



VR-Forces

Scenario Management Guide



VT MÄK
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Contents

Preface

How This Manual is Organized	xvii
VR-Forces Documentation.....	xix
MÄK Products	xx
How to Contact Us	xxii
Document Conventions	xxiii
Mouse Button Naming Conventions.....	xxiv
Third Party Licenses	xxiv
Boost License.....	xxiv
libXML and libICONV	xxv
Lua	xxv
Freefont OpenType Font Set.....	xxv
Third-Party Licenses for VR-Vantage Applications.....	xxv

Chapter 1. Creating and Running Scenarios

1.1. Creating a Scenario	1-3
1.1.1. Specifying Multiple Simulation Model Sets	1-8
1.1.2. Creating Simulation Model Set Configurations	1-9
1.1.3. Setting the Scenario Starting Date and Time	1-12
1.1.4. Merging Scenarios	1-13
1.1.5. Importing and Exporting MSDL	1-13
1.2. Loading a Scenario	1-15
1.2.1. Loading a Recently Loaded Scenario	1-16
1.2.2. Loading a Scenario from the Command Line	1-16
1.2.3. Load Balancing a Scenario	1-17
1.2.4. Displaying Scenario Information	1-19
1.2.5. Editing the Scenario Description	1-21
1.2.6. Sample Scenarios	1-21

1.3. Saving a Scenario	1-22
1.3.1. Saving an Existing Scenario	1-23
1.3.2. Saving a Scenario to a New Name	1-24
1.3.3. Saving Checkpoints	1-24
1.3.4. Deleting Checkpoints	1-26
1.4. Starting a Simulation	1-27
1.4.1. Starting or Resuming a Paused Scenario	1-27
1.4.2. Changing the Simulation Speed	1-27
1.4.3. Pausing a Scenario	1-28
1.4.4. Rewinding a Scenario	1-28
1.4.5. Closing a Scenario	1-28
1.5. Pausing a Scenario Automatically	1-29
1.5.1. Setting the Scenario End Time for a New Scenario	1-29
1.5.2. Setting the Scenario End Time for an Open Scenario	1-29
1.6. Running VR-Forces in Batch Mode	1-30
1.6.1. The Batch File	1-30
1.6.2. Creating a Batch File	1-31
1.6.3. Editing a Batch File	1-31
1.6.4. Running VR-Forces in Batch Mode	1-34
1.6.5. Recording Batch Scenarios	1-35
1.7. Recording VR-Forces Simulations with the MÄK Logger	1-35

Chapter 2. Creating and Placing Objects

2.1. Creating Objects	2-3
2.2. Selecting the Object to Create	2-4
2.2.1. Selecting the Object to Create on the Create Menu	2-4
2.2.2. Selecting the Object to Create on an Object Palette	2-5
2.2.3. Pinning an Object Palette to the Window	2-8
2.2.4. Draw Mode	2-9
2.3. Placing Objects	2-11
2.3.1. Placing an Object Using Default Values (Click to Create)	2-11
2.3.2. Specifying an Object's Properties Before You Create It (Click to Locate)	2-12
2.4. Specifying an Object's Altitude	2-14
2.4.1. Setting Altitude Dynamically	2-14
2.4.2. Setting Altitude in the Create Object or Edit Object Dialog Box	2-15
2.4.3. Specifying the Altitude for All of the Vertices in a Route	2-16
2.5. Specifying an Object's Heading Dynamically	2-17
2.6. Locking the Mouse to the Object Being Created	2-18
2.7. Moving Objects	2-19
2.7.1. Dragging an Object to a New Location	2-19
2.8. Copying and Pasting Objects	2-21
2.8.1. Copying Objects	2-21
2.8.2. Pasting Objects	2-22
2.8.3. Pasting Specific Entity Characteristics	2-23

2.9. Creating Cultural Features	2-24
2.10. Creating Props	2-25
2.11. Adding an Object to the Favorites List	2-25

Chapter 3. Creating and Managing Entities

3.1. Creating Entities	3-3
3.1.1. Default Placement of New Entities	3-3
3.1.2. Placing Entities Inside Buildings	3-4
3.1.3. Placing Entities on Other Entities	3-4
3.1.4. Entity Resources	3-4
3.1.5. Deleting Entities	3-5
3.2. Editing Entities	3-5
3.3. Embarking and Disembarking Entities	3-6
3.3.1. Embarking and Disembarking Entities Instantly	3-8
3.3.2. Disembarking Entities Using the Disembark Command	3-10
3.4. Embedded Entities	3-11
3.4.1. Configuring an Entity to Support Embedded Entities	3-11
3.4.2. Deploying Embedded Entities	3-14
3.4.3. Deploying an Entity with a Task	3-14
3.4.4. Recovering Deployed Entities	3-15
3.4.5. Assigning Tasks and Plans to Embedded Entities	3-15
3.4.6. Restoring an Entity that has Embedded Entities	3-15
3.5. Collision, Obstacle, and Feature Avoidance	3-16
3.6. Entity Movement and Soil Type	3-17
3.7. Using a Joystick to Control Entities	3-18

Chapter 4. Simulating Aggregates

4.1. Introduction to Aggregates	4-2
4.2. Creating Aggregates	4-2
4.2.1. Creating an Aggregate by Combining Existing Entities	4-2
4.2.2. Creating a Preconfigured Aggregate	4-5
4.2.3. Configuring the Aggregate Creation State	4-6
4.3. Selecting an Aggregate	4-6
4.4. Adding Entities to an Aggregate	4-7
4.5. Removing an Entity from an Aggregate	4-8
4.6. Entity-Level Aggregates and Aggregate State	4-8
4.6.1. How an Aggregate's State is Shown	4-9
4.6.2. How Changing Aggregation State Affects an Aggregate	4-10
4.7. Triggering Aggregate State Transitions	4-12
4.7.1. Aggregating and Disaggregating Entities Manually	4-12
4.7.2. Configuring Automatic Aggregation and Disaggregation	4-13
4.7.3. Using Disaggregation Areas	4-13
4.8. Writing Plans for Aggregates	4-13
4.9. Deleting an Aggregate	4-13

Chapter 5. Simulating Aggregate-Level Aggregates

5.1. The Aggregate Warfare Model	5-2
5.1.1. Aggregate Combat	5-3
5.1.2. Aggregate Footprints	5-4
5.1.3. Aggregate Posture	5-4
5.1.4. Aggregate Movement	5-6
5.1.5. Limited Munition Attack	5-7
5.1.6. Contamination Areas	5-7
5.1.7. Aggregate Sensors	5-8
5.2. Combat Engineering Objects	5-9
5.2.1. Concealed Obstacles	5-11
5.2.2. Creating Combat Engineering Objects	5-12
5.2.3. How Engineering Entities Create Engineering Objects	5-12
5.3. Logistics	5-14
5.3.1. Receiving Supplies	5-16
5.3.2. Providing Supplies	5-16
5.4. Electronic Warfare	5-17
5.4.1. Jamming Communications	5-17
5.4.2. Jamming Radar	5-18
5.4.3. Sensing Electronic Emissions	5-19

Chapter 6. Overlays and Tactical Graphics

6.1. Introduction	6-3
6.1.1. Naming Tactical Graphics	6-3
6.2. Creating and Editing Overlays	6-4
6.2.1. Creating an Overlay	6-5
6.2.2. Selecting Overlays	6-5
6.2.3. Locking an Overlay	6-5
6.2.4. Hiding the Objects on an Overlay	6-6
6.2.5. Changing an Overlay's Name	6-6
6.2.6. Deleting an Overlay	6-6
6.3. Creating Tactical Graphics	6-7
6.3.1. Creating Freehand Lines	6-7
6.3.2. Drawing Circles and Ellipses	6-8
6.3.3. Drawing Boxes	6-8
6.3.4. Adding Text to an Overlay	6-9
6.3.5. Assigning Tactical Graphics to an Overlay	6-9
6.3.6. Displaying a Terrain Profile When You Create a Line	6-10
6.3.7. Publishing Tactical Graphics	6-11
6.3.8. Creating a Computed Route	6-11
6.3.9. Creating an Intel Collection Area	6-13
6.3.10. Creating Routes for Aircraft	6-14
6.4. Deleting Tactical Graphics	6-14

6.5. Editing Tactical Graphics	6-15
6.5.1. Editing Vertices	6-16
6.5.2. Resizing Boxes and Text Objects	6-19
6.5.3. Rotating an Ellipse	6-19
6.5.4. Changing the Direction of a Line	6-20
6.5.5. Changing the Color of a Tactical Graphic	6-20
6.5.6. Changing Linear and Areal Style Properties	6-21
6.6. Saving and Loading Tactical Graphics and Overlays	6-22
6.6.1. Loading Tactical Graphics and Overlays	6-22

Chapter 7. Assigning Tasks

7.1. Assigning Tasks to Entities	7-3
7.1.1. C++ Tasks and Scripted Tasks	7-3
7.1.2. Concurrent Task Execution	7-4
7.1.3. How do I Know which Entity can Execute a Task?	7-6
7.1.4. Escaping the Task Assignment Process	7-6
7.1.5. Specifying Parameters for Tasks	7-6
7.1.6. Viewing Task Status	7-8
7.1.7. Filtering the Object Selection Lists	7-9
7.1.8. Skipping (Stopping) a Task	7-9
7.2. Assigning Tasks to Aggregates	7-10
7.2.1. Convoy Tasks	7-10
7.2.2. Independently Tasking Aggregate Members	7-11
7.3. Reactive Tasks	7-11
7.3.1. Enabling Reactive Tasks	7-13
7.3.2. Disabling Reactive Tasks	7-14
7.3.3. Setting the Priority of a Reactive Task	7-15
7.3.4. Managing Reactive Tasks	7-16
7.3.5. Cancelling a Reactive Task	7-17
7.4. Using Behavior Sets to Manage Scripted Tasks	7-18
7.4.1. Creating Behavior Sets	7-19
7.4.2. Editing Behavior Sets	7-20
7.4.3. Assigning a Behavior Set to a Force	7-20
7.5. Entity Movement On Roads and Off Roads	7-21
7.5.1. Road Driving Behavior	7-23
7.6. Fixed-Wing Entity Tasks and Behaviors	7-23
7.6.1. Placement of Newly Created Fixed-Wing Entities	7-23
7.6.2. Fly Task Behavior is Different from Move Task Behavior	7-24
7.6.3. Specifying and Maintaining Altitude for Fixed-Wing Entities	7-25
7.6.4. Fixed-Wing Entity Movement on the Ground and in the Air	7-26
7.6.5. How Fixed-Wing Entities Take Off	7-28
7.6.6. How Fixed-Wing Entities Land	7-29
7.7. Rotary-Wing Entity Tasks and Behaviors	7-30
7.7.1. Controlling Rotary-Wing Orientation	7-32

Chapter 8. Task Procedures

8.1. Task Procedures	8-4
8.2. Animated Movement	8-5
8.3. Arm Mine at Depth	8-6
8.4. Come to Stop	8-6
8.5. Convoy Along	8-7
8.6. Convoy To	8-8
8.7. Deploy Sonobuoy	8-8
8.8. Deploy Sonobuoys Along Route	8-9
8.9. Disembark	8-10
8.10. Disembark All	8-10
8.11. DI-Guy Animation	8-11
8.12. Drop Naval Depth Charge	8-12
8.13. Drop Naval Depth Charge at Location	8-12
8.14. Drop Naval Mine	8-13
8.15. Drop Naval Mines Along Route	8-14
8.16. Embark	8-15
8.17. Execute Close Air Support	8-17
8.18. Explode Charge at Depth	8-19
8.19. Fire at Target	8-19
8.20. Fire Cruise Missile	8-20
8.21. Fire for Effect Tasks	8-21
8.21.1. Firing Naval Guns	8-22
8.22. Fixed-Wing Land	8-22
8.23. Fixed Wing Takeoff	8-23
8.24. Fly Altitude	8-23
8.25. Fly Heading	8-24
8.26. Fly Heading and Altitude	8-25
8.27. Follow Entity	8-26
8.27.1. How Fixed-Wing Entities Follow Entities	8-26
8.28. Intercept and Destroy	8-27
8.29. Lase Target	8-27
8.30. Launch Anti-Submarine Missile (Vertical)	8-28
8.31. Launch Counter Measures	8-28
8.32. Launch Smoke	8-29
8.33. Launch Torpedo	8-30
8.33.1. Anti-ship (Fixed Depth)	8-30
8.33.2. Anti-Submarine	8-31
8.34. Lower Periscope	8-31
8.35. Move Along Route	8-32
8.36. Move Into Formation	8-33
8.37. Move To Altitude	8-34
8.38. Move To Depth	8-34

8.39. Move To Location (Direct)	8-35
8.39.1. Adding Multiple Move To Location (Direct) Tasks to a Plan	8-36
8.40. Move To Location (On Roads)	8-36
8.41. Move to Location (Plan Path)	8-37
8.41.1. Move to Location (Plan Path) for Ground Vehicles	8-37
8.41.2. Move to Location (Plan Path) for Ships	8-38
8.42. Move To Waypoint (Direct)	8-39
8.43. Move To Waypoint (On Roads)	8-40
8.44. Move to Waypoint (Plan Path)	8-41
8.44.1. Move to Waypoint (Plan Path) for Ground Vehicles	8-41
8.44.2. Move to Waypoint (Plan Path) for Ships	8-42
8.45. Orbit	8-43
8.46. Patrol Along Route	8-43
8.47. Patrol Between	8-44
8.48. Pattern Hold (Location)	8-44
8.49. Pattern Hold (Waypoint)	8-45
8.50. Place IED	8-46
8.51. Raise Periscope	8-47
8.52. Release Bomb Tasks	8-47
8.53. Rotary-Wing Land	8-48
8.54. Sail Heading	8-49
8.55. Send Radio Set	8-49
8.56. Send Radio Task	8-50
8.57. Send Text Message	8-50
8.58. Sonar Dip	8-51
8.59. Sweep Naval Mines	8-52
8.60. Turn To Heading	8-52
8.61. User Task	8-53
8.62. Wait Tasks	8-53
8.62.1. Wait	8-53
8.62.2. Wait Duration	8-54
8.62.3. Wait Elapsed	8-54
8.63. Reactive Tasks and Background Processes	8-55

Chapter 9. Aggregate-Level Tasks

9.1. Activate Jammer	9-3
9.2. Air-to-Ground Attack	9-3
9.3. Attack with Anti-Air Missile	9-3
9.4. Attack with Anti-Ship Missile	9-4
9.5. Attack with Land-Attack Missile	9-4
9.6. Attack with Torpedo	9-4
9.7. Automatic Air Defense	9-5
9.8. Biological Attack	9-5
9.9. Bomb Location	9-6
9.10. Breach Obstacles	9-7

9.11. Change MOPP Level	9-7
9.12. Change Posture	9-8
9.13. Chemical Attack	9-8
9.14. Construct Abatis	9-9
9.15. Construct Anti-Tank Ditch	9-9
9.16. Construct Barbed Wire	9-10
9.17. Construct Barricade	9-10
9.18. Construct Berm	9-11
9.19. Construct Booby Trap	9-11
9.20. Construct Bridge	9-12
9.21. Construct Dry Gap	9-13
9.22. Construct Fortified Area	9-13
9.23. Construct Fortified Line	9-14
9.24. Construct Minefield	9-14
9.25. Construct Strong Point	9-15
9.26. Deactivate Jammer	9-15
9.27. Destroy Bridge	9-16
9.28. Destroy Ditch	9-16
9.29. Destroy Explosive	9-16
9.30. Destroy Fortification	9-17
9.31. Destroy Obstacle	9-17
9.32. Halt Movement	9-17
9.33. Improve Booby Trap	9-18
9.34. Improve Breach	9-18
9.35. Improve Bridge	9-18
9.36. Improve Ditch	9-19
9.37. Improve Fortification	9-19
9.38. Improve Obstacle	9-20
9.39. Indirect Fire	9-20
9.40. Move Along Route Retrograde	9-21
9.41. Move to Location Retrograde	9-21
9.42. Move to Waypoint Retrograde	9-21
9.43. Nuclear Attack	9-21
9.44. Send NBC Report	9-22
9.45. Send Obstacle Report	9-22

Chapter 10. Setting Entity State

10.1. Setting Entity State and Attributes	10-3
10.2. Active Sonar Mode	10-3
10.3. Activity	10-4
10.4. Aggregate State	10-4
10.5. Altitude	10-5
10.6. Ammunition	10-5
10.7. Ammunition Pacing/Tracking	10-6
10.8. Appearance	10-6
10.9. Armed	10-7

10.10. Capabilities	10-7
10.11. Collision Avoidance Types	10-8
10.12. Concealed	10-9
10.13. Contamination	10-9
10.14. Counter Measures Auto Launch	10-9
10.15. Destroyed	10-10
10.16. Detonation Fuse Type	10-10
10.17. DI-Guy Appearance	10-11
10.18. Disembarked	10-11
10.19. Embarked	10-12
10.20. Emitter	10-13
10.21. Engagement Results	10-14
10.22. Equipment Pacing/Tracking	10-14
10.23. Food, Water, Fuel, Oil and Lubricant	10-15
10.24. Food, Water Fuel, Oil and Lubricant Pacing/Tracking	10-15
10.25. Force	10-16
10.26. Formation	10-17
10.27. Heading	10-18
10.27.1. Setting an Entity's Heading Manually	10-18
10.28. Health	10-19
10.29. IFF	10-20
10.30. Lase Autonomous	10-21
10.31. Laser Code	10-21
10.32. Location	10-22
10.33. MOPP Level	10-22
10.34. Morale	10-22
10.35. Notify Level	10-23
10.36. Ordered Speed	10-23
10.37. Posture (Aggregate)	10-24
10.38. Posture (Human)	10-25
10.39. Preferred Targets	10-26
10.40. Radar Mode	10-27
10.41. Reorganize	10-27
10.42. Resources	10-28
10.43. Resources Pacing/Tracking	10-28
10.44. Restore	10-29
10.45. Set Resupply Mode	10-30
10.46. Rules of Engagement	10-30
10.46.1. How Fire-When-Fired-Upon Works	10-31
10.47. Sector of Responsibility	10-32
10.48. Sonar Depth	10-33
10.49. Spot Reports	10-34
10.50. Supplying	10-34
10.51. Surrendered	10-35
10.52. Synchronize Laser Code	10-35
10.53. Target	10-36

10.54. Tasked by Superior	10-36
10.55. Weapons Pacing/Tracking	10-37
10.56. Weapon State	10-37

Chapter 11. Writing Plans

11.1. Introduction to Entity Plans and Global Plans	11-3
11.2. Conditional Statements	11-5
11.2.1. Specifying Names or Patterns in Conditional Statements ...	11-6
11.2.2. The If/else Statement	11-9
11.2.3. When Statements (Triggers)	11-10
11.2.4. While Statements	11-12
11.2.5. Conditional Tests	11-13
11.3. Viewing Plans	11-16
11.4. Writing Entity Plans	11-18
11.4.1. Adding an Entity Task or Set Data Request to a Plan	11-19
11.4.2. Adding a Conditional Statement to a Plan	11-20
11.4.3. Editing a Statement	11-23
11.4.4. Deleting Statements from a Plan	11-23
11.4.5. Printing Plans	11-23
11.4.6. Saving Changes to a Plan	11-24
11.5. Creating Global Plans	11-24
11.6. Adding Global Commands to a Plan	11-25
11.6.1. Adding a Global Task or Set to a Plan	11-26
11.6.2. Sending Console Messages	11-27
11.6.3. Creating Objects from Within a Plan	11-28
11.6.4. Deleting Objects from Within a Plan	11-28
11.6.5. Issuing a Plan	11-29
11.7. Writing Plans for Aggregates	11-30
11.8. Writing a Plan for Multiple Entities	11-30
11.9. Writing Plans for Remote Entities	11-30
11.10. Copying Plans and Plan Statements	11-31
11.11. Restarting a Plan	11-31
11.12. Abandoning a Plan	11-32
11.13. Considerations for Creating Plans	11-33
11.13.1. Name Changes Can Invalidate Plan Statements	11-33
11.13.2. Considerations for Using Triggers	11-33
11.13.3. Moving In Formation	11-34
11.13.4. Using the Tasked-By-Superior Request in a Plan	11-34
11.13.5. Following Entities	11-35
11.13.6. Planning Tasks for Aircraft	11-35
11.13.7. Using Non-VR-Forces Entities in Plans	11-35

Chapter 12. Scenario Events

12.1. Introduction to Scenario Events	12-2
12.2. Creating a Scenario Event	12-2
12.2.1. Adding Linked Events	12-4
12.2.2. Adding Content to a Scenario Event	12-6
12.2.3. Adding Intelligence Objects	12-7
12.2.4. Starting a Scenario Event	12-9
12.2.5. Ending a Scenario Event	12-10
12.2.6. Sorting the Event List	12-11
12.2.7. Deleting a Scenario Event	12-11
12.3. Showing and Hiding Scenario Events	12-12

Chapter 13. Target Detection and Combat Features

13.1. Displaying Entities Based on Spot Reports	13-2
13.1.1. Enabling or Disabling Spot Reports	13-3
13.1.2. Configuring the Spot Reports Viewpoint	13-4
13.1.3. Configuring the Spot Reports Certainty Level	13-8
13.1.4. Applying Spot Reports to Tactical Graphics	13-9
13.1.5. Displaying Labels for Spot Reports	13-9
13.1.6. Using Spot Reports in Tasks	13-9
13.2. Managing Force Hostility Relationships	13-10
13.2.1. Changing a Force's Hostility in a Plan	13-11
13.3. Detecting Targets	13-12
13.3.1. Target Detection and Spot Reports	13-14
13.3.2. Lasing Targets	13-14
13.4. Using Sonar	13-16
13.4.1. Propulsion Noise and Sonar	13-17
13.5. Launching Counter Measures (Chaff and Flare)	13-18
13.6. Modeling Artillery Munitions	13-20
13.7. Taking Damage from Munitions	13-21

Chapter 14. Managing Indirect Fire and Missiles

14.1. Introduction to Indirect Fire	14-2
14.1.1. Creating an Indirect Fire Event	14-3
14.1.2. Editing Indirect Fire Events	14-6
14.1.3. Deleting Indirect Fire Events	14-6
14.1.4. Configuring Indirect Fire Event Default Values	14-7
14.2. Ballistic Missiles	14-8
14.2.1. Firing Ballistic Missiles	14-8
14.2.2. Editing Missile Target Events	14-10
14.2.3. Deleting Missile Target Events	14-10

Chapter 15. Environment Conditions

15.1. Introduction to Environment Conditions	15-2
15.2. Setting the Date and Time of Day	15-2
15.2.1. Setting the Date	15-3
15.2.2. Setting the Time of Day	15-4
15.2.3. Choosing the Illumination Model	15-4
15.3. Specifying the Environment Conditions	15-5
15.3.1. Adding an Environment Condition	15-6
15.3.2. Editing an Environment Condition	15-7
15.3.3. Deleting an Environment Condition	15-7
15.4. Setting Weather Conditions	15-7
15.4.1. Setting the Wind Speed and Direction	15-8
15.4.2. Setting Visibility (Fog)	15-9
15.4.3. Specifying Precipitation Type and Intensity	15-10
15.4.4. Specifying Cloud Cover	15-10
15.5. Creating Local Weather Zones	15-11
15.5.1. Editing a Weather Zone's Environment	15-13
15.6. Configuring Marine Conditions	15-14
15.6.1. Enabling Marine Effects	15-15
15.6.2. Configuring Marine Conditions	15-15
15.7. Setting the Thermocline	15-17
15.8. Displaying Screen Splash Effects	15-18

Chapter 16. Creating Scripted Tasks

16.1. Introduction to Scripted Tasks	16-3
16.1.1. Task Type Scripted Tasks	16-4
16.1.2. The Reactive Task Type Scripted Task	16-4
16.1.3. Background Process Type Scripted Task	16-4
16.1.4. Script Metadata	16-4
16.1.5. The Lua Scripting Language	16-5
16.2. Creating a New Scripted Task	16-5
16.2.1. Specifying the Script ID	16-9
16.2.2. Specifying the Task Menu Icon	16-9
16.2.3. Specifying Task Parameters	16-10
16.2.4. Specifying the Task Menu Location	16-13
16.2.5. Specifying Action Categories	16-15
16.2.6. Configuring a Script's Availability to an Entity Type	16-16
16.2.7. Specifying the Programming Language for a Scripted Task	16-20
16.2.8. Creating Reactive Tasks	16-21
16.2.9. Creating Background Processes	16-22
16.3. Saving Scripted Tasks	16-23
16.4. Editing a Scripted Task	16-24
16.5. Filtering the List of Scripted Tasks	16-24

16.6. Organizing Scripted Tasks into Folders	16-25
16.6.1. Adding a Folder	16-25
16.6.2. Renaming a Folder	16-25
16.6.3. Deleting a Folder	16-25
16.6.4. Adding Scripted Tasks to a Folder	16-25
16.6.5. Removing a Scripted Task from a Folder	16-25
16.7. Exporting and Importing Scripted Tasks	16-26
16.7.1. Importing a Scripted Task Package	16-27
16.8. Copying a Scripted Task	16-28
16.9. Deleting a Scripted Task	16-28
16.10. Creating a System Scripted Task	16-29
16.10.1. Including System Scripted Tasks on the Task Menu	16-29
16.11. Specifying a Script Editor	16-31
16.12. Editing Lua Files	16-32

Chapter 17. Writing Scripts for Scripted Tasks

17.1. The VR-Forces Lua Interface	17-3
17.1.1. Lua Classes	17-3
17.1.2. Lua Modules	17-4
17.2. Script Loading and Execution	17-5
17.2.1. Script Entry Points	17-5
17.2.2. The Scripted Task Execution Sequence	17-7
17.2.3. Limitations for Checkpointing Scripted Tasks	17-10
17.2.4. Editing Scripted Tasks While a Scenario is Running	17-12
17.3. Tasks and Subtasks	17-13
17.3.1. Monitoring the Status of Tasks and Subtasks	17-14
17.3.2. Stopping Tasks	17-14
17.3.3. Task Parameters	17-14
17.4. Geometry	17-16
17.4.1. <i>Location3D</i>	17-16
17.4.2. <i>Vector3D</i>	17-16
17.4.3. <i>VectorOffset3D</i>	17-18
17.4.4. <i>VectorGeoc3D</i>	17-18
17.5. Reserved Words	17-19
17.6. Coding Messages for Translation	17-20
17.7. Error Detection	17-20
17.8. Interactive Scripts	17-21
17.9. A Basic Scripted Task	17-22
17.9.1. Create and Move to Waypoint Metadata	17-23
17.9.2. The Create and Move To Waypoint Lua Script	17-25
17.10. A Simple Reactive Task	17-27
17.11. Background Processes	17-28

Appendix A. Example Scenarios

A.1. The Breaching Scenario	A-2
A.1.1. Create the Scenario	A-3
A.1.2. Create the Minefield	A-4
A.1.3. Create the Opposing Forces	A-5
A.1.4. Create the Tactical Graphics	A-6
A.1.5. Create the Friendly Entities	A-8
A.1.6. Write the Plans	A-10
A.1.7. Save the Scenario	A-17
A.1.8. Running the Scenario	A-18
A.2. The Embarkexample Scenario	A-19
A.2.1. Create the Entities and Objects	A-20
A.2.2. Write the Plans for the Entities	A-30

Appendix B. Merging Scenarios

B.1. The Scenario Merge Tool	B-2
B.2. Starting Scenario Merge	B-3
B.3. Creating a Scenario Merge Project	B-4
B.3.1. Adding Scenarios to a Project	B-4
B.3.2. Removing Scenarios from a Project	B-5
B.3.3. Specifying an Ignore List File	B-5
B.3.4. Saving a Project	B-6
B.3.5. Loading a Project	B-6
B.4. Merging Scenarios	B-7
B.5. Displaying Scenario Files	B-7
B.5.1. Editing Scenario Files	B-8
B.5.2. Closing Scenario Files	B-8
B.6. Specifying the Output Notification Level	B-8
B.7. Using the Scenario Merge Command-Line Interface	B-9

Appendix C. Systems and System Usage

C.1. VR-Forces Systems	C-2

Index



Preface

This manual is written for persons who will use the VR-Forces application. The manual assumes that you are familiar with your operating system and that you know how to work in your computer's graphical window environment.

Please see release documentation for information about changes and updates to VR-Forces since this manual went to press.

How This Manual is Organized

The chapters are organized as follows:

Chapter 1, *Creating and Running Scenarios*, explains how to create and run scenarios, how to create batch scenarios and how to checkpoint scenarios.

Chapter 2, *Creating and Placing Objects*, explains describes the common procedures for creating entities, tactical graphics, and props.

Chapter 3, *Creating and Managing Entities*, explains the fine points of creating entities. It also covers embarkation and collision avoidance.

Chapter 4, *Simulating Aggregates*, explains how to create and edit aggregate entities.

Chapter 6, *Overlays and Tactical Graphics* describes the creation and use of overlays, how to create tactical graphics other than points, lines, and areas, and how to edit tactical graphics.

Chapter 7, *Assigning Tasks*, provides general information about assigning tasks and creating behavior sets.

Chapter 8, *Task Procedures*, describes the tasks provided with VR-Forces that apply to entity-level entities and to both entity-level entities and aggregate-level entities.

Chapter 9, *Aggregate-Level Tasks*, describes the tasks that apply only to aggregate-level entities.

Chapter 10, *Setting Entity State*, describes how to assign set data requests to entities.

Chapter 11, *Writing Plans* explains how to write plans for entities and how to write global plans.

Chapter 12, *Scenario Events* explains how to create and run scenario events.

Chapter 13, *Target Detection and Combat Features*, describes spot reports, laser targeting, entity hostility, and how entities take damage.

Chapter 14, *Managing Indirect Fire and Missiles*, explains how to configure and call in indirect fire.

Chapter 15, *Environment Conditions*, describes how to manipulate the date, time of day, and weather conditions.

Chapter 16, *Creating Scripted Tasks*, introduces scripted tasks and explains how to create them. It does not cover how to write scripts for scripted tasks.

Chapter 17, *Writing Scripts for Scripted Tasks*, introduces the Lua script API for VR-Forces and explains how to write scripts for scripted tasks.

Appendix A, *Example Scenarios* walks you through the process of creating two of the sample scenarios provided with VR-Forces.

Appendix B, *Merging Scenarios* explains how to use the Scenario Merge tool to merge scenarios.

Appendix C, *Systems and System Usage* lists all the systems provided with VR-Forces and provides information about them, including which entities use them.

VR-Forces Documentation

VR-Forces documentation is provided as manuals in PDF format, online help, and HTML class documentation. The PDF files are in the *.doc* directory. The VR-Forces documentation set is as follows:

- ♦ *VR-Forces Documentation Center* is your central starting point for accessing the VR-Forces manual set. It has a documentation roadmap, tables of contents for all manuals, and a master index, including the TDB Tool, to help you find references to subjects that are covered in two or more manuals or locate the manual in which a particular topic is discussed. All table of contents entries and index entries are live links to the manuals.
- ♦ *VR-Forces Getting Started Guide* is a quick introduction to VR-Forces. It covers the basics of installing VR-Forces, running a scenario, and creating a scenario. It focuses on helping new users avoid common mistakes.
- ♦ *VR-Forces Users Guide* describes how to install VR-Forces and configure license management. It explains how to use the VR-Forces graphical user interface to view simulations and how to manage aspects of VR-Forces that are not directly related to creating and running scenarios.
- ♦ *VR-Forces Scenario Management Guide* explains how to create and run scenarios.
- ♦ *VR-Forces Configuration Guide* explains advanced features for configuring performance and how to edit VR-Forces configuration files. It includes documentation of the Entity Editor, OPD Editor, and Scenario Merge tools. It also explains how to compose terrains and configure 3D models.
- ♦ *VR-Forces Migration Guide* collates API migration information for recent releases.
- ♦ Online help. The VR-Forces front-end, the OPD Editor, the Entity Editor, and the TDB Tool have online help accessible from the Help menu.
- ♦ VR-Forces Developers Guide and API documentation. Class documentation and developers guides in linked HTML pages.
- ♦ *VR-Forces Release Notes*.
- ♦ *VR-Forces First Experience Guide*. A brief introduction to the most basic features of VR-Forces. Provides less detail than *VR-Forces Getting Started Guide*.
- ♦ *VR-Forces Entity Model Catalog*. A catalog of all of the entities configured in the Entity Editor with basic parameter details and a screen capture of the model.

MÄK Products

VR-Forces is a member of the VT MÄK line of software products designed to streamline the process of developing and using networked simulated environments. The VT MÄK product line includes the following:

- ♦ VR-Link[®] Network Toolkit. VR-Link is an object-oriented library of C++ functions and definitions that implement the High Level Architecture (HLA) and the Distributed Interactive Simulation (DIS) protocol. VR-Link has built-in support for the RPR FOM and allows you to map to other FOMs. This library minimizes the time and effort required to build and maintain new HLA or DIS-compliant applications, and to integrate such compliance into existing applications.

VR-Link includes a set of sample debugging applications and their source code. The source code serves as an example of how to use the VR-Link Toolkit to write applications. The executables provide valuable debugging services such as generating a predictable stream of HLA or DIS messages, and displaying the contents of messages transmitted on the network.

- ♦ MÄK RTI. An RTI (Run-Time Infrastructure) is required to run applications using the High Level Architecture (HLA). The MÄK RTI is optimized for high performance. It has an API, RTIsby[®], that allows you to extend the RTI using plug-in modules. It also has a graphical user interface (the RTI Assistant) that helps users with configuration tasks and managing federates and federations.
- ♦ VR-Forces[®]. VR-Forces is a computer generated forces application and toolkit. It provides an application with a GUI, that gives you a 2D and 3D views of a simulated environment.

You can create and view local entities, aggregate them into hierarchical units, assign tasks, set state parameters, and create plans that have tasks, set statements, and conditional statements. VR-Forces also functions as a plan view display for viewing remote entities taking part in an exercise. Using the toolkit, you can extend the VR-Forces application or create your own application for use with another user interface.

- ♦ VR-Vantage[™]. VR-Vantage is a line of products designed to meet your simulation visualization needs. It includes three end-user applications (VR-Vantage Stealth, VR-Vantage PVD, and VR-Vantage IG) and the VR-Vantage Toolkit.
 - VR-Vantage Stealth displays a realistic, 3D view of your virtual world, a 2D plan view, and an exaggerated reality (XR) view. Together these views provide both situational awareness and the big picture of the simulated world. You can move your viewpoint to any location in the 3D world and can attach it to entities so that it moves as they do.
 - VR-Vantage IG is a configurable desktop image generator (IG) for out the window (OTW) scenes and remote camera views. It has most of the features of the Stealth, but is optimized for its IG function.
 - VR-Vantage PVD provides a 2D plan view display. It gives you the big picture of the simulated world.

- The VR-Vantage Toolkit is a 3D visual application development toolkit. Use it to customize or extend MÄK's VR-Vantage applications, or to integrate VR-Vantage capabilities into your custom applications. VR-Vantage is built on top of OpenSceneGraph (OSG). The toolkit includes the OSG version used to build VR-Vantage.
- ♦ MÄK Data Logger. The Data Logger, also called the Logger, can record HLA and DIS exercises and play them back for after-action review. You can play a recorded file at speeds above or below normal and can quickly jump to areas of interest. The Logger has a GUI and a text interface. The Logger API allows you to extend the Logger using plug-in modules or embed the Logger into your own application. The Logger editing features let you merge, trim, and offset Logger recordings.
- ♦ VR-Exchange™. VR-Exchange allows simulations that use incompatible communications protocols to interoperate. For example, within the HLA world, using VR-Exchange, federations using the HLA RPR FOM 1.0 can interoperate with simulations using RPR FOM 2.0, or federations using different RTIs can interoperate. VR-Exchange supports HLA, TENA, and DIS translation.
- ♦ VR-TheWorld™ Server. VR-TheWorld Server is a simple, yet powerful, web-based streaming terrain server, developed in conjunction with Pelican Mapping. Delivered with a global base map, you can also easily populate it with your own custom source data through a web-based interface. The server can be deployed on private, classified networks to provide streaming terrain data to a variety of simulation and visualization applications behind your firewall.
- ♦ DI-Guy™. The DI-Guy product line is a set of software tools for real-time human visualization, simulation, and artificial intelligence. Every DI-Guy software offering comes with thousands of ready-to-use characters, appearances, and motions. DI-Guy enables the easy creation of crowds and individuals who are terrain aware, autonomous, and react intelligently to ongoing events. Save time, money and create outstanding simulations with DI-Guy. The DI-Guy product line includes the following products:
 - The DI-Guy SDK. Embed the DI-Guy library in your real-time application and populate your world with lifelike human characters.
 - DI-Guy Scenario™. Author and visualize human performances in a rich, user-friendly graphical environment. Use DI-Guy Scenario as an end visualization application or save scenarios and load them into your DI-Guy SDK enabled application.
 - DI-Guy AI. Generate crowds of autonomous characters to quickly populate your worlds with hundreds and thousands of terrain-aware, collision avoiding DI-Guys. Used as a module on top of DI-Guy Scenario and DI-Guy SDK.
 - Expressive Faces Module. Enable DI-Guy characters to have faces that display emotion, eyes that look in directions and blink, and lips that sync to sound files.
 - DI-Guy Motion Editor. Create or customize motions to your particular needs in an easy-to-use graphical application.

How to Contact Us

For VR-Forces technical support, information about upgrades, and information about other MÄK products, you can contact us in the following ways:

Telephone

Call or fax us at:	Voice:	617-876-8085 (extension 3 for support)
	Fax:	617-876-9208

E-mail

Sales and upgrade information:	info@mak.com
Technical support:	support@mak.com
VR-Vantage support:	vrv-support@mak.com

Internet

MÄK web site home page:	www.mak.com
License key requests:	www.mak.com/support/get-licenses.html
Product version and platform information:	www.mak.com/support/ product-versions.html
For the free, unlicensed MÄK RTI:	www.mak.com/resources/bonus- material/cat_view/16-bonus-materials/ 24-mak-high-performance-rti.html
MÄK Community Forum:	www.mak.com/community-forum/ 1-forum.html

Post

Send postal correspondence to:	VT MÄK 150 Cambridge Park Drive, 3rd Floor Cambridge, MA, USA 02140

When requesting support, please tell us the product you are using, the version, and the platform on which you are running.

Document Conventions

This manual uses the following typographic conventions:

Monospaced	Indicates commands or values you enter.
Monospaced Bold	Indicates a key on the keyboard.
<i>Monospaced Italic</i>	Indicates command variables that you replace with appropriate values.
Blue text	A hypertext link to another location in this manual or another manual in the documentation set.
{ }	Indicates required arguments.
[]	Indicates optional arguments.
	Separates options in a command where only one option may be chosen at a time.
()	In command syntax, indicates equivalent alternatives for a command-line option, for example, (-h --help).
/	Indicates a directory. Since MÄK products run on both Linux and Windows PC platforms, we use the / (slash) for generic discussions of pathnames. If you are running on a PC, substitute a \ (backslash) when you type pathnames.
<i>Italic</i>	Indicates a file name, pathname, or a class name.
sans Serif	Indicates a parameter or argument.
➤	Indicates a one-step procedure.
Menu → Option	Indicates a menu choice. For example, an instruction to select the Save option from the File menu appears as: Choose File → Save .
	Click the icon to run a tutorial video in the default browser.
	Indicates supplemental or clarifying information.
	Indicates additional information that you must observe to ensure the success of a procedure or other task.
	Indicates that a section is valid only for entity-level simulation.
	Indicates that a section is valid only for aggregate-level simulation.

Directory names are preceded with dot and slash characters that show their position with respect to the VR-Forces home directory. For example, the directory *vrforces4.3 Early Adopter/doc* appears in the text as *./doc*.

Mouse Button Naming Conventions

An instruction to click the mouse button, refers to clicking the primary mouse button, usually the left button for right-handed mice and the right button for left-handed mice. The context-sensitive menu, also called a popup menu or right-click menu, refers to the menu displayed when you click the secondary mouse button, usually the right button on right-handed mice and the left button on left-handed mice.

Third Party Licenses

MÄK software products may use code from third parties. This section contains the license documentation required by these third parties.

Boost License

VR-Link, and all MÄK software that uses VR-Link uses some code that is distributed under the Boost License. All header files that contain Boost code are properly attributed. The Boost web site is: www.boost.org.

Boost Software License - Version 1.0 - August 17th, 2003

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libXML and libICONV

VR-Link and all MÄK software that uses VR-Link, links in libXML and libICONV. On some platforms the compiled libraries and header files are distributed with MÄK Products. MÄK has made no modifications to these libraries. For more information about these libraries please see the following web sites:

- ♦ The LGPL license is available at: <http://www.gnu.org/licenses/lgpl.html>.
- ♦ Information about IconV is at: <http://www.gnu.org/software/libiconv/>.
- ♦ Information about LibXML is at: <http://xmlsoft.org/>.

Lua

VR-Forces and DI-Guy use the Lua programming language (www.lua.org). Its license is as follows:

Copyright © 1994–2012 Lua.org, PUC-Rio.

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Freefont OpenType Font Set

VR-Vantage applications and VR-Forces use the Freefont OpenType font set from the Free Software Foundation. It is covered by the General Public License (GPL). For details, please see: <http://www.gnu.org/licenses/gpl.html>

Third-Party Licenses for VR-Vantage Applications

VR-Vantage applications use a variety of third-party libraries. Developers who want to use these libraries may be required to purchase developer's licenses. Please see section 1.2 in *VR-Forces Front-End Developers Guide* for details.



1. Creating and Running Scenarios

This chapter explains how to create, load, run, and save scenarios.

Creating a Scenario	1-3
Specifying Multiple Simulation Model Sets	1-8
Creating Simulation Model Set Configurations	1-9
Setting the Scenario Starting Date and Time	1-12
Merging Scenarios	1-13
Importing and Exporting MSDL.....	1-13
Loading a Scenario.....	1-15
Loading a Recently Loaded Scenario	1-16
Loading a Scenario from the Command Line	1-16
Load Balancing a Scenario.....	1-17
Displaying Scenario Information	1-19
Editing the Scenario Description	1-21
Sample Scenarios	1-21
Saving a Scenario	1-22
Saving an Existing Scenario	1-23
Saving a Scenario to a New Name	1-24
Saving Checkpoints	1-24
Deleting Checkpoints.....	1-26
Starting a Simulation	1-27
Starting or Resuming a Paused Scenario	1-27
Changing the Simulation Speed	1-27
Pausing a Scenario	1-28
Rewinding a Scenario	1-28
Closing a Scenario	1-28

Pausing a Scenario Automatically.....	1-29
Setting the Scenario End Time for a New Scenario	1-29
Setting the Scenario End Time for an Open Scenario.....	1-29
Running VR-Forces in Batch Mode.....	1-30
The Batch File.....	1-30
Creating a Batch File.....	1-31
Editing a Batch File.....	1-31
Running VR-Forces in Batch Mode	1-34
Recording Batch Scenarios	1-35
Recording VR-Forces Simulations with the MÄK Logger	1-35

1.1. Creating a Scenario

To use VR-Forces to simulate entities, you must load a scenario or create a new one. When you first start VR-Forces, the Startup Screen asks you if you want to create or load a scenario (unless you have disabled this feature). Thereafter, to create a scenario, use the procedure in this section. (For details about the Startup Screen, please see Section 5.1.1, “Starting VR-Forces from the VR-Forces Launcher,” in *VR-Forces Users Guide*.)

i

If you are using multiple front-ends in the same session, when one of them creates a scenario, the terrains in all other front-ends are closed (unless the terrain is the same as that for the new scenario) and the terrain for the new scenario is loaded.

To create a scenario:

1. Choose **File** → **New Scenario**, or click the New Scenario button () on the File Toolbar. The Initial Scenario Information dialog box opens (Figure 1-1). By default, it opens in *.userData/terrains*, the directory that contains the terrain files shipped with VR-Forces. (For a brief description of the databases supplied with VR-Forces, please see Section 18.10, “Terrain Databases Provided with VR-Forces,” in *VR-Forces Users Guide*. For details about terrain files, please see Section 3.11, “Terrain Databases,” in *VR-Forces Users Guide*.)

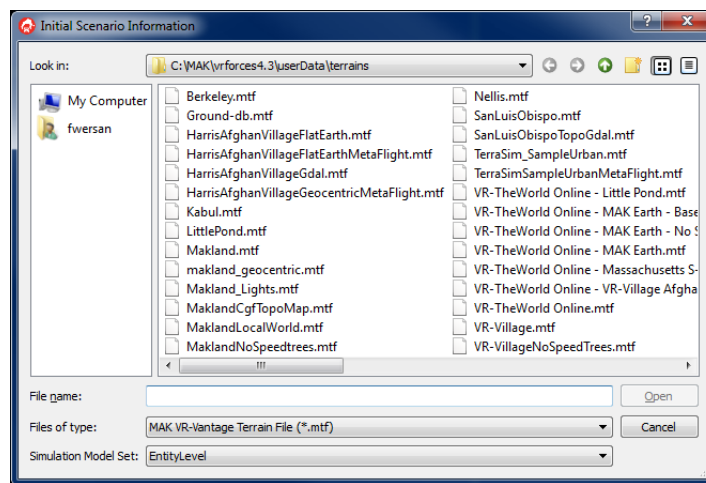


Figure 1-1. Initial Scenario Information dialog box

2. In the file list, select a terrain database. (MTF is the preferred file type.) A database must be a flat earth, geocentric, UTM, or Lambert Conformal Conic database. By default, this terrain is used for both the front-end and back-end.



If you choose an MTF file and an MTD file with the same name exists, the back-end loads the MTD file.

3. In the Simulation Model Set list, select a simulation model set or SMS configuration. (For information about SMS configurations, please see [“Creating Simulation Model Set Configurations,”](#) on page 1-9.) You can change your selection or specify additional SMSs in the New Scenario dialog box.
4. Click Open. The New Scenario dialog box opens ([Figure 1-2](#)).

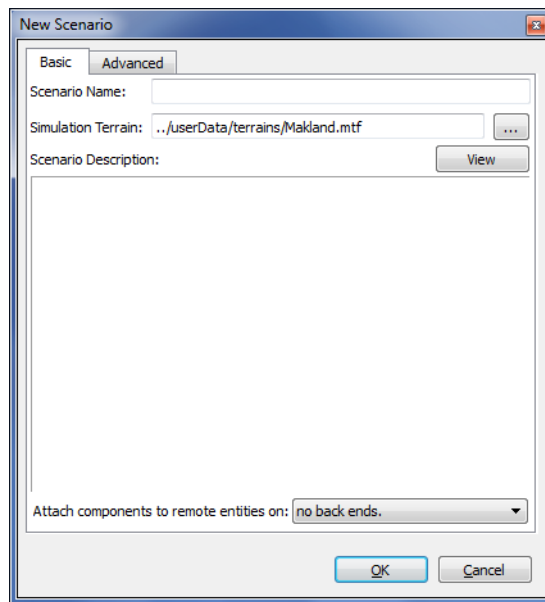


Figure 1-2. New Scenario dialog box

5. Optionally, set basic scenario parameters. [Table 1-2](#) describes the basic parameters.

Table 1-1: Basic scenario parameters

Parameter	Description
Scenario Name	Specifies the name of the scenario. This is the name used to identify the scenario when you join a session. If you do not specify a name, the scenario file name is used.
Simulation Terrain	Specifies the terrain to be used by the back-end. By default, this is the terrain you selected in the Initial Scenario Information dialog box. However, you can change it if you want to.
Scenario Description	The scenario description lets you provide a description of the scenario. This may be useful to remind you or other VR-Forces users of its purpose or special details. You can enter the description as plain text or as HTML. If you use HTML, when the description is displayed in the Scenario Information dialog box, it is displayed using the HTML formatting.
Attach Components to Remote Entities On	Specifies whether or not to attach components to remote entities, and if so, the back-ends on which to manage the components that are being attached to remote entities. Unlike other scenario parameters, you can change this value when you load a scenario. For details about configuring components for attachment to remote entities, please see Section 10.12, “ Configuring VR-Forces Components on Remote Entities ,” in <i>VR-Forces Configuration Guide</i> .
 This value is not saved in the scenario file. To attach components in future runs of the scenario, you must specify the appropriate setting each time you load the scenario.	

For more information about these parameters, please see Section 3.2.1, “[Scenario Parameters](#),” in *VR-Forces Configuration Guide*.

6. Optionally, select the Advanced tab ([Figure 1-3](#)) and set advanced scenario parameters (overriding the default settings).

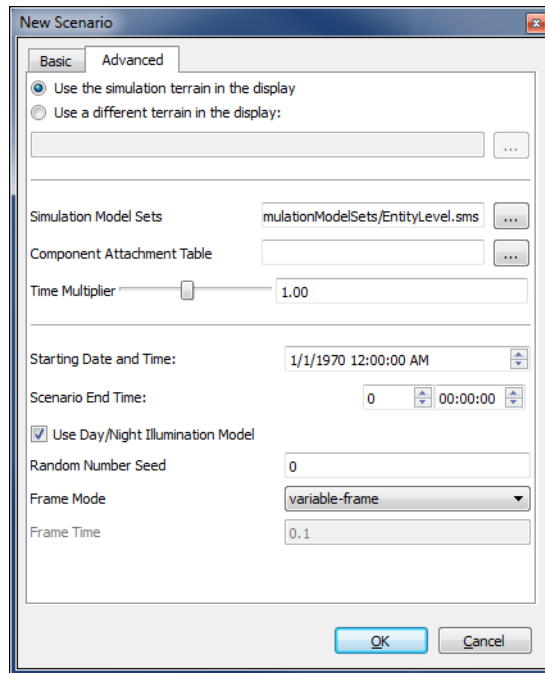


Figure 1-3. New Scenario dialog box, Advanced tab

Table 1-2 describes the parameters you can set.

Table 1-2: Advanced scenario parameters

Parameter	Description
Use the Simulation Terrain in the Display	If selected (the default), the scenario uses the same terrain for the front-end and back-end.
Use a Different Terrain for the Display	If selected, lets you specify the terrain to be used by the front-end.
Simulation Model Sets	Specify one or more simulation model sets. A scenario must specify at least one simulation model set. For more information, please see “Specifying Multiple Simulation Model Sets,” on page 1-8. Default: <i>EntityLevel.sms</i> .
Component Attachment Table	If you plan to attach components to remote entities, specify the component attachment table that you want to use. For details about configuring components for attachment to remote entities, please see Section 10.12, “Configuring VR-Forces Components on Remote Entities,” in <i>VR-Forces Configuration Guide</i> .
Time Multiplier	Specify a time multiplier for the scenario. For HLA time-managed federations, this parameter is ignored. Default: 1.0 (real-time).

Table 1-2: Advanced scenario parameters

Parameter	Description
Starting Date and Time	Specify the date and time of day at which the simulation should start. As time advances, the Environment Settings Toolbar daylight icon changes coloration. In 3D, the sky coloration also changes as time advances. This is a back-end setting. Default: current date at 10:00 A.M.
Scenario End Time	The simulation time at which to automatically pause the scenario.
Use Day/Night Illumination Model	If selected, use an ephemeris model in the back-end to calculate illumination. This affects sensors. If cleared, the entire world is fully illuminated regardless of the time of day. For more information, please see “Choosing the Illumination Model,” on page 15-4.
Random Number Seed	Specify a random number seed as an integer ≥ 0 .
Frame Mode	Select a frame mode from the list.
Frame Time	Specifies the length of a frame, in seconds. This parameter is not enabled if Frame Mode is variable-frame.

For more information about these parameters, please see:

- Section 3.13.1, [“Simulation Time,”](#) in *VR-Forces Users Guide*.
- Section 3.13.3, [“Exercise Clock Modes,”](#) in *VR-Forces Users Guide*.
- Section 3.2.1, [“Scenario Parameters,”](#) in *VR-Forces Configuration Guide*.

7. Click OK. The scenario information is displayed and the terrain is displayed in the 2D view.
8. Add the entities and graphical objects that you need for your simulation. For information about adding entities and tactical graphics, please see Chapter 2, [Creating and Placing Objects](#).
9. Save the scenario. For details about saving scenarios, please see [“Saving a Scenario,”](#) on page 1-22.

1.1.1. Specifying Multiple Simulation Model Sets

You can specify more than one simulation model set for a scenario. One strategy for extending VR-Forces is to use an SMS provided with VR-Forces for the majority of objects and to create a separate SMS for customized entities. As you upgrade to newer versions of VR-Forces, you can more easily migrate your customized SMS to the new version because your changes have not been integrated into the default SMS. (You can also include the SMSs provided by VR-Forces in your custom SMS. In that case you would just load the custom SMS and not multiple SMSs. For more information, please see Section 5.3, “[Simulation Model Sets](#),” in *VR-Forces Configuration Guide*.)

When you load multiple SMSs, if there is any overlap in the objects they specify, the last SMS loaded overrides previous SMSs.



Do not use an entity-level SMS and an aggregate-level SMS together. The entities from the two SMSs will not be able to interact.

To specify multiple simulation model sets for a scenario:

1. In the New Scenario dialog box, click the Browse button on the Simulation Model Set line. The Simulation Model Set Files dialog box opens. It lists the SMS files to be loaded for this scenario.

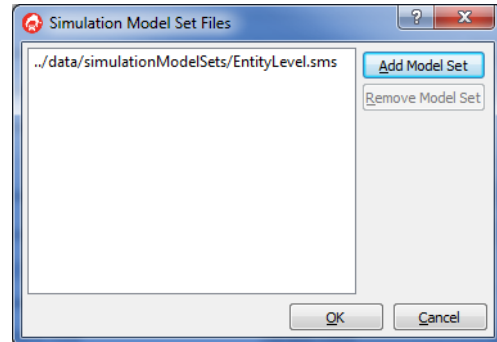


Figure 1-4. Simulation Model Set Files dialog box

2. In the The Simulation Model Set Files dialog box, click Add. A blank line is added to the window ([Figure 1-5](#)).

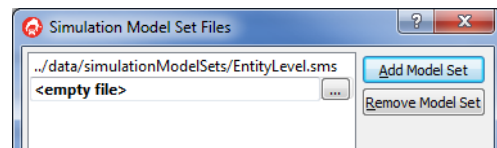


Figure 1-5. Add simulation model set

3. Click the Browse button next to the blank line. The Choose File dialog box opens.

4. Select a simulation model set and click Open. The SMS is added to the text box.
5. Click OK.
6. Complete the New Scenario dialog box.

1.1.2. Creating Simulation Model Set Configurations

When you create a new scenario, you specify an SMS in the Initial Scenario Information dialog box (see “[Creating a Scenario](#),” on page 1-3 for details). The Simulation Model Set list lists all SMSs in `./data/simulationModelSets`. The SMSs are listed in alphabetical order. If you want a particular SMS to be the default SMS you can create an SMS configuration and specify that it be the default. You can create as many SMS configurations as you want. An SMS configuration can have more than one SMS in it. So if you routinely create scenarios that use multiple SMSs, creating a configuration can save you from the necessity of always specifying the additional SMSs on the Advanced tab of the New Scenario dialog box (as described in “[Specifying Multiple Simulation Model Sets](#),” on page 1-8).



The Simulation Model Set list in the Initial Scenario Information dialog box lists all SMS configurations and all SMSs. It does not duplicate names, so if an SMS configuration has the same name as an SMS, only the SMS configuration is listed.

To create a simulation model set configuration:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Session Options page ([Figure 1-6](#)).

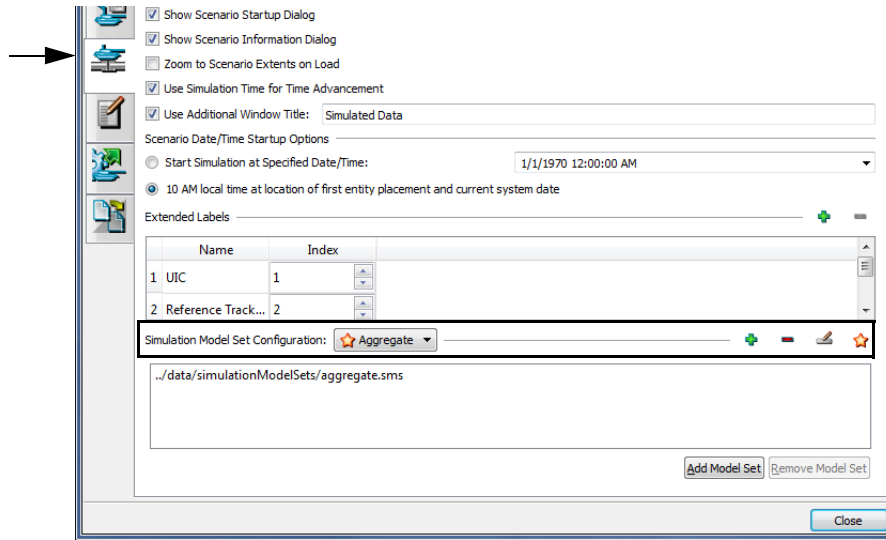


Figure 1-6. Session Options page

3. Click the Add button (+) on the Simulation Model Set Configuration line. The Configuration dialog box opens.
4. Type a name for the configuration.
5. Click OK. The new configuration is added to the list.
6. Click Add Model Set. A line is added to the window.
7. Click the Browse button at the end of the new line. A file chooser dialog box opens.
8. Select the SMS you want to put in this configuration.
9. Click Open. The SMS is added to the list.
10. Optionally, add additional SMSs to this configuration.
11. Click Close.

Specifying the Default SMS Configuration

You can specify that a particular SMS configuration be selected in the Initial Scenario Information dialog box whenever you create a new scenario.



Specifying an SMS as the default SMS automatically removes that designation from any other SMS.

To specify the default SMS configuration:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Session Options page ([Figure 1-6](#)).
3. In the Simulation Model Set Configuration list, select the configuration that you want to be the default.
4. Click the Star button (★). A star is displayed next to the configuration name in the list, indicating that it is the default configuration.

1.1.3. Setting the Scenario Starting Date and Time

By default, when you create a scenario, the starting simulation date and time is the current system date at 10:00 A.M. local time, where local time is determined based on the longitude of the first entity that gets created in the scenario.



The time zone is an approximation. It does not take into account unusual time zone boundaries or daylight savings time. The time zone is set once. If you create an entity and then delete it, the location of that entity still determines the time zone. Furthermore, if for some reason you were to create a scenario and then run it without creating any entities, if at any point you created an entity, the starting date and time would be reset to the default value based on the location of that entity.

You can change the starting date and time when you create a scenario and you can change the default time used for new scenarios.

For more information about simulation time, please see [“Setting the Date and Time of Day,”](#) on page 15-2.

To set the scenario start date and time:

1. Begin the scenario creation process, as described in [“Creating a Scenario,”](#) on page 1-3.
2. When the New Scenario dialog box opens, select the Advanced tab ([Figure 1-3](#)).
3. In the Starting Date and Time box, specify the starting date and time.
4. Continue creating the scenario.

Setting the Default Scenario Starting Date and Time

You can change the default starting date and time for scenarios.

To set the default starting date and time:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Session Options page ([Figure 1-6](#)).
3. Select the Start Simulation at Specified Date/Time option.
4. Specify the starting date and time.

1.1.4. Merging Scenarios

VR-Forces users often assign scenario development to multiple persons or teams. Then they merge the separately-developed scenarios into a master scenario. Merging scenarios by hand can be a difficult task due to the requirement to reconcile entity and object names, plans, and other scenario elements that could be duplicated, particularly if objects are named using the default conventions. VR-Forces includes an offline tool, Scenario Merge, for merging scenarios. For details, please see Appendix B, [Merging Scenarios](#).

1.1.5. Importing and Exporting MSDL

Military Scenario Definition Language (MSDL) is a SISO standard for describing military scenarios using an XML format. It allows for interchange of scenario descriptions between simulation applications and systems that use different internal formats. You can import MSDL files into a VR-Forces scenario.

VR-Forces does not import all of the information that can be in an MSDL file. It imports and exports:

- ♦ Entities and entity locations. Locations are always exported in geocentric coordinates.
- ♦ Force relationships and hostility relationships.
- ♦ Aggregate formations.
- ♦ Tactical graphics.

To import MSDL:

1. Create or load a scenario.
2. Choose **File** → **Import Scenario Laydown**. The Import Scenario File dialog box opens.
3. Select the MSDL file that you want to import.
4. Click Open.

Exporting MSDL

To export a scenario to MSDL:

1. Create or load a scenario.
2. Choose **File** → **Export Scenario Laydown**. The Export Scenario dialog box opens.
3. Type a name for the file.
4. Click Save. If VR-Forces is not sure how to export an entity type to MSDL, the Export MSDL Scenario dialog box opens (Figure 1-7).

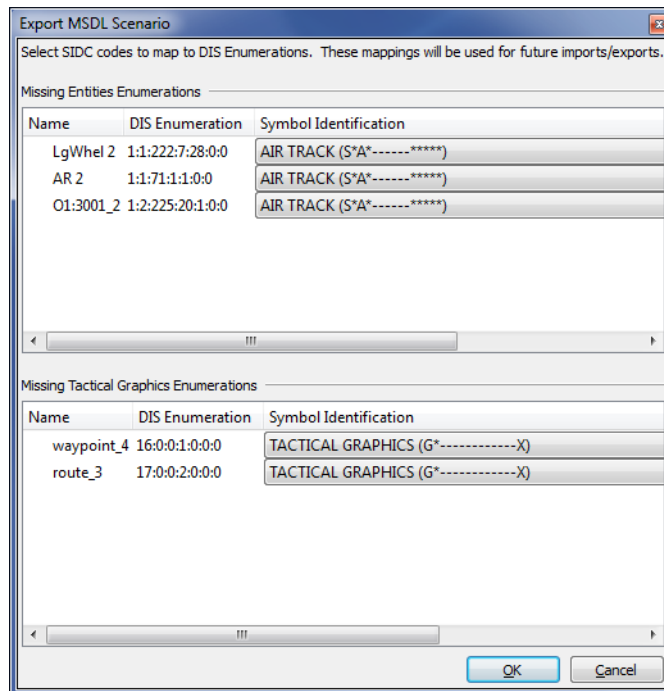


Figure 1-7. Export MSDL Scenario dialog box

5. For each entity type listed in the Export MSDL Scenario dialog box:
 - a. In the Symbol Identification column, click the value. A list of possible identification codes is displayed. (These codes are from the MSDL specification. You will need to familiarize yourself with the specification to fully understand them.)
 - b. Select the proper identification.
6. Click OK.

1.2. Loading a Scenario

After you have created and saved a scenario, you can load it and run it on any platform supported by the version of VR-Forces in which you created it. Most scenarios are forward compatible. Please see *VR-Forces Release Notes* for compatibility issues.

i

- If you are running multiple front-ends in the same session, when you load a scenario, any terrains that are open on other front-ends are closed and the terrain for the newly loaded scenario is opened.
- When you load a scenario that uses multiple back-ends, if any of the required back-ends are not running, VR-Forces prompts you to remap the objects in the scenario. The Remap Missing Back-ends dialog box lists the unavailable back-ends and the available back-ends. You can specify which back-ends to map objects to or you can select “map all to” and map all objects to one back-end. For more information about remapping back-ends, please see [Remapping Back-ends](#), under Section 3.2.5, “Working with Multiple Back-ends,” in *VR-Forces Users Guide*.

To load a scenario:

1. Choose **File** → **Load Scenario** or click the Open Scenario button (📁) on the File Toolbar. The Load Scenario dialog box opens ([Figure 1-8](#)).

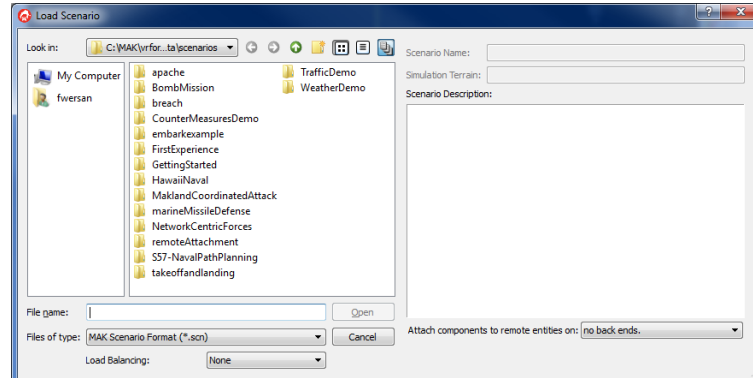


Figure 1-8. Load Scenario dialog box

2. Select a scenario to load. Basic information about the scenario is displayed ([Figure 1-9](#)). Scenarios are files with the suffix *.scn*. Sample scenarios are located in the *./userData/scenarios* directory. (Batch scenarios, described in “[Running VR-Forces in Batch Mode](#),” on page 1-30, have the suffix *.bsn*.)

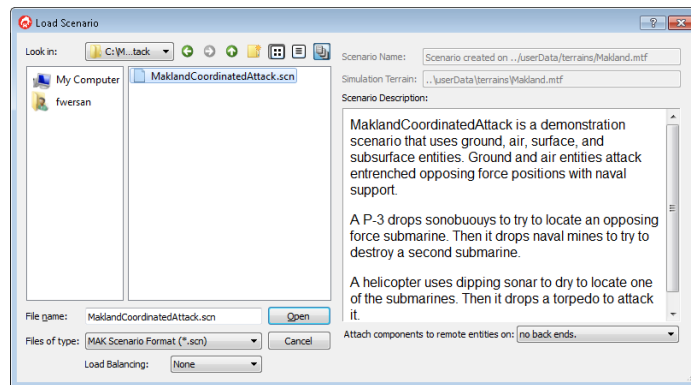


Figure 1-9. Load Scenario dialog box

3. Optionally, specify whether or not to allow management of components on remote entities by selecting an option in the Attach Components to Remote Entities On list. For details about configuring components on remote entities, please see Section 10.12, “[Configuring VR-Forces Components on Remote Entities](#),” in *VR-Forces Configuration Guide*.
4. Optionally select a load balancing option.
5. Click Open.

1.2.1. Loading a Recently Loaded Scenario

VR-Forces keeps a list of the scenarios you open. You can quickly open a scenario from the list.

- To open a recently used scenario, choose **File** → **Recent Scenarios** → *scenario_name*.

1.2.2. Loading a Scenario from the Command Line

If you start VR-Forces from the command line, you can specify a scenario to load. You can specify the scenario in the back-end or front-end. The other executable will load it as soon as it starts up.

To load a scenario when you start the back-end, use the `-L` command-line option, for example:

```
vrfsimDIS -s 1 -a 3001 -L "../userData/scenarios/myScenario.scn"
```

To load a scenario when you start the front-end, use the `--scenarioFile` command-line option, for example:

```
vrfgui --scenarioFile "../userData/scenarios/myScenario.scn" --dis -s 1 -a 3000
```


1.2.3. Load Balancing a Scenario

After you create a scenario, you may decide that you want to spread simulation of objects across more back-ends than you used to create it. You would typically increase the number of back-ends to improve performance. The process of spreading the simulation work across multiple simulation engines is called load balancing. VR-Forces supports even distribution (done automatically by VR-Forces) and manual load balancing.



If you are using interest management to support large entity counts, do not enable load balancing. It will negate the assignment of entities to specific back-ends that is part of designing a scenario for interest management.

To load-balance a scenario:

1. Choose **File** → **Load Scenario**. The Load Scenario dialog box opens.
2. In the Load Scenario dialog box, select an option from the Load Balancing list ([Figure 1-10](#)).

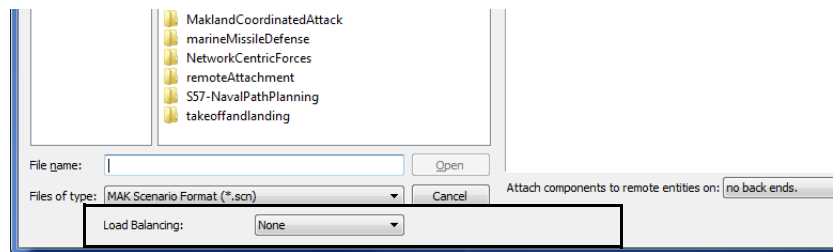


Figure 1-10. Load Balancing list

If you select Even Distribution, VR-Forces automatically distributes objects across the available back-ends. If you choose Manual load balancing, the Object Mapping dialog box opens ([Figure 1-11](#)).

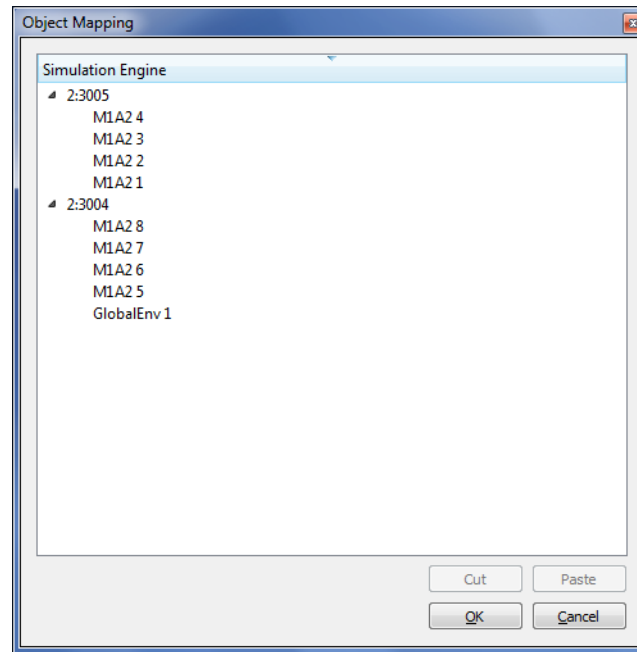


Figure 1-11. Object Mapping dialog box

3. In the Object Mapping dialog box, expand the list for the back-end from which you want to distribute objects.
4. Redistribute objects by dragging them from a source back-end to a target back-end, or by cutting them from the source back-end and pasting them onto the target back-end. You can view the new distribution of objects by expanding the list for the target back-end.
5. Click OK. The scenario loads. If you open the information dialog box for an object, the title bar displays the back-end on which it is simulated.
6. To preserve the new object mappings, save the scenario. When you save the scenario, you are prompted to save the original mappings. Click No to save the new load balanced mappings.

1.2.4. Displaying Scenario Information

When you create a scenario, you specify a variety of parameters (or accept default values) and, optionally, specify a name and description for the scenario. If a scenario has a description, when you load the scenario, the Scenario Information dialog box opens automatically. (You can disable this behavior.)

You can display scenario information at any time while a scenario is loaded. You can edit the scenario description. Other values are read only. (You can edit them directly in the scenario file. For details, please see Section 3.2, “[The Scenario File](#),” in *VR-Forces Configuration Guide*.)

To display scenario information:

1. Choose **File** → **Scenario Information**. The Scenario Information dialog box opens ([Figure 1-12](#)).

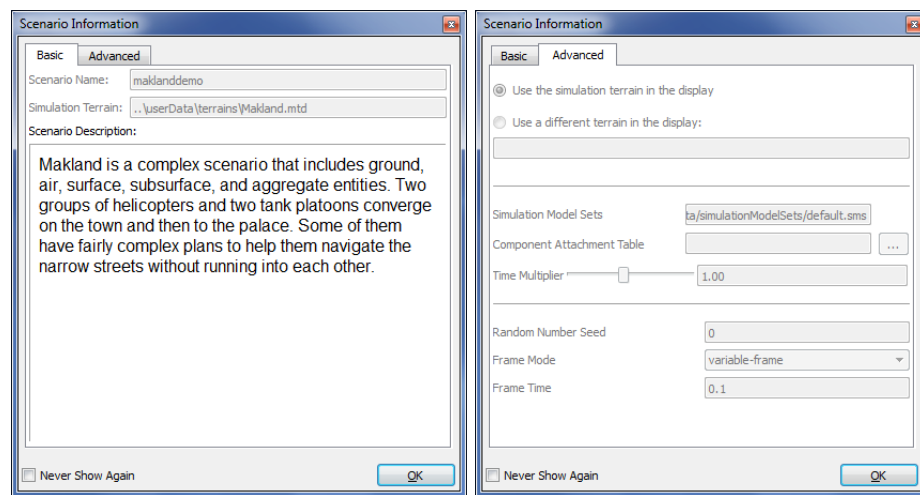


Figure 1-12. Scenario Information dialog box

2. To view advanced parameters, select the Advanced tab.

Enabling and Disabling Display of the Scenario Description

By default, the scenario description gets displayed when you open a scenario. You can turn it off in the Scenario Information window and you can enable and disable its display in the Application Settings dialog box.

To disable display of scenario information when a scenario is loaded, use one of the following methods:

- ♦ When the Scenario Information window opens, select the Never Show Again check box.
- ♦ On the Application Settings dialog box, Session Options page, clear the Show Scenario Information Dialog check box.
- To enable the Scenario Information dialog box, on the Application Settings dialog box, Session Options page, select the Show Scenario Information Dialog check box.

1.2.5. Editing the Scenario Description

You can edit a scenario's description in the Scenario Information dialog box.

To edit a scenario's description:

1. Choose **File** → **Scenario Information**. The Scenario Information dialog box opens (Figure 1-13).

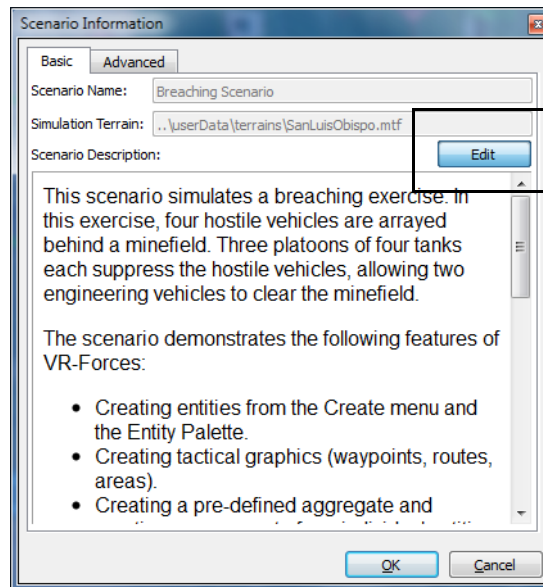


Figure 1-13. Scenario Information (editable)

2. Click Edit. The description window changes to edit mode and the button text changes to View.
3. Edit the text.
4. To see how the text will be displayed, click View.
5. Click OK.

1.2.6. Sample Scenarios

VR-Forces includes several sample scenarios. Appendix A, [Example Scenarios](#) has the step-by-step process for creating the breaching scenario and the embarkexample scenario.

1.3. Saving a Scenario

The first time you save a scenario, VR-Forces saves the path of the terrain database and other scenario configuration data to a scenario file (extension *.scn*). (Paths are saved relative to the *./bin* directory.) This information usually does not change between runs of a scenario. Every time you save a scenario, VR-Forces saves the order of battle, the plans, and object mapping information to individual files that have the same name as the scenario, but with file extensions that identify the information in the file (*.oob*, *.pln*, *.gpl*, *.xtr*, *.omp*, and so on).



- ♦ If you want to keep the initial state of a scenario (simulation time = 0 and no simulation has taken place), so that you can repeatedly run a simulation from the beginning, save the scenario when you have finished creating it, but before you run it. Then, do not save the scenario again under the same name (unless you specifically want to change the original state of the scenario).
- ♦ If you load an alternate terrain in a front-end when it joins a session, the alternate terrain is not saved as part of the scenario.

When you save a scenario, whether during the course of setting it up or during a simulation, all object state information gets saved. Essentially, every save is a checkpoint. When you run a saved simulation, all entities will resume whatever they were doing when the scenario was saved.



If entities are executing scripted tasks, some information regarding the tasks is not saved. For details, please see [“Limitations for Checkpointing Scripted Tasks,”](#) on page 17-10.

If you save a scenario after it has started (whether it is paused or running), it is not saved to the original scenario file. It is saved to a checkpoint that is named using the convention *scenario_name_at_time_time.scn*. This ensures that you cannot inadvertently overwrite the original scenario file. To overwrite the original scenario, you must use Save Scenario As. For more information about checkpoints, please see [“Saving Checkpoints,”](#) on page 1-24.

To save a new scenario:

1. Choose **File** → **Save Scenario** or click the Save button (📁) on the File Toolbar. The Save Scenario dialog box opens.
2. Select the directory in which you want to save the scenario.



If you create a folder in the Save dialog box and it has a space at the end of the name, Windows does not recognize the existence of the folder. If you try to delete it, the system may blue screen. Running scandisk can solve this problem.

3. Give the scenario a name.
4. Click Save. All scenario files are saved with the new name.



If you save a remapped scenario, you are prompted to save the scenario with the original mappings or with the remappings.

1.3.1. Saving an Existing Scenario

In most computer applications, when you save an existing file, the current version of the file simply overwrites the previously saved version. However, when VR-Forces saves a scenario, the save action depends on the status of the scenario. VR-Forces tracks the simulation time of the scenario. When you save a scenario:

- ♦ If a version of the scenario exists with the current simulation time, VR-Forces displays a message indicating that a version of the scenario at that simulation time exists and asks if you want to overwrite it.
- ♦ If there is no version with the current simulation time, VR-Forces creates a new checkpoint at the current simulation time, using the checkpoint naming convention.

This behavior ensures that if you change a scenario after you have started a simulation, you will never inadvertently overwrite the original version or another checkpoint.

- To save a previously saved scenario, choose **File** → **Save Scenario**.

1.3.2. Saving a Scenario to a New Name

To save a scenario to a new name:

1. Choose **File** → **Save Scenario As**. The Save Scenario dialog box opens.
2. Select the directory in which you want to save the scenario.
3. Give the scenario a name.
4. Click Save. The scenario is saved to the new name.

1.3.3. Saving Checkpoints

You may want to save snapshots of a simulation at various points in its life for after-action-review or to use as the starting point of a new exercise. You might also want to stop an exercise and resume it at some later point, with all entities remembering their tasks and state information. You can do this by saving a checkpoint.



If entities are executing scripted tasks, some information regarding the tasks is not saved. For details, please see [“Limitations for Checkpointing Scripted Tasks,”](#) on page 17-10.

You can save a checkpoint at any time by saving the scenario. Checkpoints are saved to the same directory. You can also configure VR-Forces to save checkpoints at regular intervals. If periodic checkpointing is enabled, the Status bar displays the time until the next checkpoint.

When you run a checkpointed scenario, entities resume the tasks that they were executing at the time the checkpoint was saved. If detonations were scheduled or if missiles were in flight, they resume their former state.

Saving an Individual Checkpoint

Whenever you save a scenario, it creates a checkpoint.

- To save an individual checkpoint, choose **File** → **Save Scenario**.

Scheduling Periodic Checkpoints

You can configure VR-Forces to save checkpoints at regular intervals. You can specify that the intervals be calculated in real time or simulation time. Saving checkpoints in simulation time may be useful if you are running a scenario at a rate greater or lesser than real time.

To schedule checkpoints:

1. Choose **File** → **Schedule Periodic Checkpointing**. The Periodic Checkpointing dialog box opens ([Figure 1-14](#)).

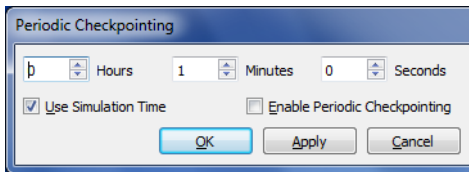


Figure 1-14. Periodic Checkpointing dialog box

2. Enter the time interval between checkpoints, in hours, minutes, and seconds.
3. Select the Enable Periodic Checkpointing check box.
4. To save checkpoints based on simulation time, check the Use Simulation Time check box. To use real time intervals, clear the check box.
5. Click OK.

Disabling Periodic Checkpointing

To disable periodic checkpointing:

1. Choose **File** → **Schedule Periodic Checkpointing**. The Periodic Checkpointing dialog box opens.
2. Clear the Enable Periodic Checkpointing check box.
3. Click OK.

1.3.4. Deleting Checkpoints

You can delete checkpoints manually in a file browser, like you can delete any other files on your computer. You can also easily delete them from the front-end.

To delete checkpoints:

1. Choose **File** → **Delete Scenario Checkpoints**. The Delete Checkpoints dialog box opens ([Figure 1-15](#)).

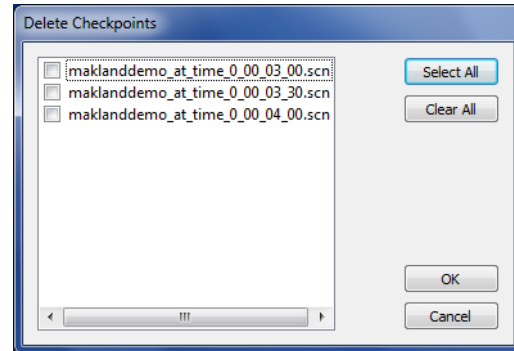


Figure 1-15. Delete Checkpoints dialog box

2. Select the checkpoints that you want to delete.
3. Click OK.

1.4. Starting a Simulation

If you want to use VR-Forces to simply observe a remote simulation, you can start it, open a terrain database, and wait for it to pick up messages from the network. However, you will probably use VR-Forces to run simulations that have locally simulated entities.

1.4.1. Starting or Resuming a Paused Scenario

When you load a scenario, it opens in the paused state unless you start with the `-L` and `-r` back-end command line options.

- To begin or resume execution of a paused scenario, choose **Simulation** → **Run Scenario**, or click the Run button on the Simulation Control Toolbar (Figure 1-16).



Always save a new scenario before you run it for the first time. If you do not save it, you will not be able to return to the starting point. Rewinding a scenario that has not been saved deletes all unsaved objects.

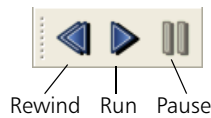


Figure 1-16. Simulation Control Toolbar

1.4.2. Changing the Simulation Speed

You can vary the speed of a simulation so that it runs at speeds faster or slower than real-time.

If you are running VR-Forces with time management, the Simulation Time Scale Toolbar has no effect on simulation speed.



If you increase the speed at which a scenario runs, the frame rate is reduced and performance of models may degrade.

- To change the speed of a simulation, drag the indicator on the Simulation Time Scale Toolbar (Figure 1-17), or type a value in the text box.

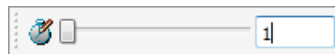


Figure 1-17. Simulation Time Scale Toolbar

1.4.3. Pausing a Scenario

When you pause a simulation, local entities stop executing plans and tasks. Display of remote entity activity continues as it is received over the network.

- To pause a simulation, choose **Simulation** → **Pause Scenario**, or click the Pause button on the Simulation Control Toolbar (Figure 1-16).

1.4.4. Rewinding a Scenario

If you are running a scenario or have completed a scenario and want to start it over again, you can rewind it. Rewinding a scenario returns it to its last saved state.



If you are working on a new scenario and have not saved it, rewind deletes all your work and returns the scenario to its original, blank state.



If you save checkpoints while a scenario is running, when you rewind, the scenario rewinds to the most recent checkpoint, not to the original scenario. To return to a version of the scenario other than the most recent checkpoint, you must load that version.

- To rewind a scenario, choose **Simulation** → **Rewind Scenario**, or click the Rewind button on the Simulation Control Toolbar (Figure 1-16).

If you do not pause a scenario before you rewind it, it starts playing again immediately.

1.4.5. Closing a Scenario

- To close a scenario, choose **File** → **Close Scenario**, or click the Close Scenario button (✕) on the File Toolbar.

1.5. Pausing a Scenario Automatically

You can specify a scenario end time (in simulation time). As the scenario progresses, the amount of time remaining is displayed in the Simulation Time Remaining Toolbar (Figure 1-18). When the scenario reaches this time it stops. You can resume the scenario by clicking the Play button.

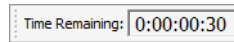


Figure 1-18. Simulation Time Remaining Toolbar

You can set the scenario end time when you create a scenario or after you have loaded it.

1.5.1. Setting the Scenario End Time for a New Scenario

The default scenario end time for new scenarios is 0 – do not pause the scenario.

To set the scenario end time for a new scenario:

1. Create a new scenario as described in “[Creating a Scenario](#),” on page 1-3.
2. In the New Scenario dialog box, select the Advanced tab.
3. Specify an end time in days, hours, minutes, and seconds.
4. Continue the scenario creation procedure.

1.5.2. Setting the Scenario End Time for an Open Scenario

You can set the scenario end time for a scenario after you open it. If you set a time that is sooner than the current elapsed time, the scenario stops immediately.

To set the scenario end time for an open scenario:

1. Choose **Simulation** → **Set Scenario End Time**. The Set Scenario End Time dialog box opens.
2. Specify how long you want the scenario to run.
3. Click OK.
4. Optionally, save the scenario. Remember that if the scenario is already running or has advanced and then paused, the end time is saved to a checkpoint, not the original scenario.

1.6. Running VR-Forces in Batch Mode

Batch mode allows you to run one or more scenarios multiple times, without direct action through the graphical user interface. A scenario run in batch mode runs with the parameters in the scenario file, except that you can override the random number seed.

Batch mode is “read only.” You cannot save a scenario, create entities or objects, pause the scenario, or otherwise change it, while a batch is running. However, you can view the Objects List Panel, Plan windows, and open informational dialog boxes. You can close a scenario that is running in batch mode and resume control of VR-Forces.

1.6.1. The Batch File

A batch mode file contains the information that VR-Forces needs to run scenarios in batch mode. Batch mode offers the following options:

- ♦ Run a particular scenario multiple times.
- ♦ Run a series of different scenarios (batches), each of which can be run multiple times.
- ♦ Run from the command line using one back-end. If a scenario was created using multiple back-ends, you cannot run it in batch mode using this method.
- ♦ Run from the VR-Forces front-end using one or more back-ends.
- ♦ Generate Logger Control messages to have the MÄK Logger record each simulation.

For each batch (one scenario run one or more times) within the batch file, you can:

- ♦ Specify the length of time the simulation is to run (in real time or simulation time).
- ♦ Specify the object parameter database to use.
- ♦ Specify that the random number seed used be the value specified in the scenario file, a value specified in the batch file, or be computer generated.

A batch file has the file extension *.bsn*.

1.6.2. Creating a Batch File

To run VR-Forces in batch mode, you create a batch file (*.bsn*). VR-Forces supplies a sample batch file. Use it as a model for creating your own batch files.

To create a batch file:

1. Create scenarios as you would any scenario. (For details, please see [“Creating a Scenario,”](#) on page 1-3.)
2. In a text editor, open the sample batch file provided with VR-Forces.
3. Save the batch file under a new name, with the file extension *.bsn*.
4. Replace the sample values with your own, as described in [“Editing a Batch File,”](#) on page 1-31.
5. Save the new batch file.

1.6.3. Editing a Batch File

A batch file is written in MÄK Technologies Lisp format (MTL). (For information about the MTL format, please see Section 2.5, [“MÄK Technologies Lisp \(MTL\) Files,”](#) in *VR-Forces Configuration Guide*.) A batch file starts with parameters that affect the entire batch. Then it has a batch list, which contains one or more batches. Each batch specifies a scenario, the number of times it is to be run, and other parameters. [Table 1-3](#) describes the parameters.

The following is an example of a batch file:

```
(scenario-batch
  (use-logger-control True)
  (logger-files-path "..\logger_tapes") ;; path is relative to Logger
  executable.
  (batch-list
    (batch
      (number-of-runs 2)
      (random-number-seed 4)
      (scenario-filename "..\data\scenarios\breach\breaching.scn")
      (parameter-filename
        "..\data\simulationModelSets\EntityLevel\vrfSim.opd")
      (simulation-run-duration 0 : 0 : 0 : 30.000000) ;; simulation time
    )
    (batch
      (number-of-runs 3)
      (scenario-filename
        "..\data\scenarios\apache\apache_groundDB.scn")
      (parameter-filename
        "..\data\simulationModelSets\EntityLevel\vrfSim.opd")
      (run-duration 0 : 0 : 0 : 20.000000) ;; real time
    )
  )
)
```

Table 1-3: Batch file parameters (Sheet 1 of 2)

Parameter	Description
Scenario-batch parameters	
use-logger-control	Specifies whether or not to generate Logger Control messages. Options: ♦ False – Do not generate messages. ♦ True – Generate messages to create Logger files for each run of each batch.
logger-files-path	If use-logger-control is True, specifies the directory in which to store Logger files. The path can be absolute or relative to the Logger executable.
Batch-list parameters	
number-of-runs	Specifies how many times to run the scenario in this batch run entry.
random-number-seed	This parameter is optional. If it is specified, it overrides the random number seed in the scenario file. It specifies a random number seed as follows: ♦ -1 – use a value generated by the computer. Values are different for each run of this batch. ♦ Any non-negative integer – use the number specified for each run of the batch.
scenario-filename	Specifies the scenario to be run in this batch run entry. The scenario can be specified as an absolute path or a path relative to the directory in which the executable is located.
parameter-filename	This parameter is optional. If it is specified, it overrides the object parameter database specified by the scenario and specifies the object parameter database file to use.

Table 1-3: Batch file parameters (Sheet 2 of 2)

Parameter	Description
simulation-run-duration	Specifies the duration in simulation time that the simulation will run. It is mutually exclusive with run-duration. If both are specified, VR-Forces uses simulation-run-duration.  Specify hours, minutes, and days as integers, for example 15. Specify seconds as real numbers, for example, 15.0.
run-duration	Specifies the duration in real time that the simulation will run. For example, if a scenario has a time scale set to 2 (twice real time), and a run-duration of 10 minutes, 20 minutes of simulation time will elapse before the batch stops running this scenario. It is mutually exclusive with simulation-run-duration.  Specify hours, minutes, and days as integers, for example 15. Specify seconds as real numbers, for example, 15.0.

1.6.4. Running VR-Forces in Batch Mode

To run VR-Forces in batch mode:

1. Start VR-Forces. If any of the scenarios you plan to run in batch mode require multiple back-ends, start the back-ends with the required site and application IDs.
2. If you are going to generate Logger control messages, start the MÄK Logger.
3. Choose **File** → **Load Batch File**, or click the Load Batch File button (📄) on the File Toolbar. The Load Batch File dialog box opens.
4. Select the batch file you want to run.
5. Click Open.

VR-Forces begins running the first scenario in the batch file. When VR-Forces finishes running the batch file, it closes the final scenario.



- ♦ When VR-Forces runs a batch file, if it cannot load a scenario specified in the file, it skips the scenario and goes to the next batch entry in the file.
- ♦ Automatic remapping is always enabled for batch mode.

Running in Batch Mode from the Command Line

If your scenarios only need one back-end, you can run a batch file from the command line.

- To run a batch from the command line, use the **-B** parameter, with the back-end in separate mode, for example:

```
vrfsimDIS -s 1 -a 3001  
-B "../userData/scenarios/batchfile.bsn"
```

The scenario begins to run automatically.

1.6.5. Recording Batch Scenarios

You can generate Logger Control messages and save scenario output to a Logger file. You must start the Logger before you run the batch scenario.

If you generate Logger Control messages, each simulation is saved individually by the Logger, with a filename in the format:

```
<batch_scenario_name>_<scenario_run_number>_<random_number_seed>.lgr
```

You can specify the directory in which you want the Logger file to be saved.

The MÄK Logger does not record batch file runs if a previous recording exists. By default, the Logger does not allow you to overwrite existing files using the remote control API. So, once you record a batch run, you cannot record a subsequent run of the same batch. You can work around this problem by editing the *lgrConfig.xml* file to permit overwriting of Logger files. Make the following edits in the configuration file for each protocol for which you want to record batch runs:

Add the following lines to the <defaults> section:

```
<var name="processRemoteControl" type="bool" value="true"/>
<var name="recordRemoteControl" type="bool" value="true"/>
<var name="allowDeleteRemoteControl" type="bool" value="true"/>
```

Add the following lines to the <commands name="startup"> section:

```
<command domain="Simulation" protocol="DIS"
  command="SetRemoteControlSettings">
  <param name="process" var="processRemoteControl"></param>
  <param name="record" var="recordRemoteControl"></param>
  <param name="allowDelete" var="allowDeleteRemoteControl"></param>
</command>
```

Use the appropriate value for the protocol attribute.

1.7. Recording VR-Forces Simulations with the MÄK Logger

You can use the MÄK Logger to record VR-Forces simulations and then play them back for review. If you want to view a Logger file in VR-Forces (as opposed to some other MÄK viewer, such as VR-Vantage Stealth), note the following considerations:

- When you view the Logger file, you must run VR-Forces with an application number that is different from the one you used when you recorded the simulation. If you use the same application number, VR-Forces may crash.
- Do not load the original scenario in VR-Forces while you view the recording. Just load the terrain database that the simulation requires.
- If you are using HLA 1516, do not record a simulation and then immediately play it back. Exit the applications and start a new federation. Trying to play back the file in the federation from which it was recorded can result in name reservation conflicts and applications may crash.



2. Creating and Placing Objects

This chapter describes generic procedures for creating and placing entities and tactical graphics. The later chapters assume that you are familiar with these procedures.

Creating Objects	2-3
Selecting the Object to Create	2-4
Selecting the Object to Create on the Create Menu	2-4
Selecting the Object to Create on an Object Palette	2-5
Pinning an Object Palette to the Window	2-8
Draw Mode	2-9
Placing Objects	2-11
Placing an Object Using Default Values (Click to Create)	2-11
Specifying an Object's Properties Before You Create It (Click to Locate)	2-12
Specifying an Object's Altitude	2-14
Setting Altitude Dynamically	2-14
Setting Altitude in the Create Object or Edit Object Dialog Box	2-15
Specifying the Altitude for All of the Vertices in a Route	2-16
Specifying an Object's Heading Dynamically	2-17
Locking the Mouse to the Object Being Created	2-18
Moving Objects	2-19
Dragging an Object to a New Location	2-19
Copying and Pasting Objects	2-21
Copying Objects	2-21
Pasting Objects	2-22
Pasting Specific Entity Characteristics	2-23
Creating Cultural Features	2-24
Creating Props	2-25

[Adding an Object to the Favorites List.....](#) 2-25

2.1. Creating Objects

VR-Forces lets you create entities, cultural features, tactical graphics, and props. You can create entities and cultural features from the Create menu or the Entities Palette. You create tactical graphics from the Create menu or the Tactical Graphics and Hazards/Obstacles palettes. (The objects on the Hazards/Obstacles Palette are tactical graphics that are use for aggregate-level simulations.) You create props from the Props Palette. The procedure for creating an object is essentially the same regardless of the type of object:

1. Select the object that you want to create.
2. Specify the location and properties of the object.

However, there are several ways to select the object you want to create and several ways to specify an object’s location and properties. This chapter describes the different generic ways to create objects. Additional procedures specific to different object types are described in later chapters.

When you create an object, VR-Forces adds a tab to the right side of the window, below the object palettes. The tab is labeled Create *object*, where *object* is whatever object you selected to create. If you click that tab, it opens a dialog box that lets you specify the properties of the object you are creating. [Table 2-1](#) lists the properties that you can set for each object type. You can also edit these same properties after you create an object.

Table 2-1: Editable object properties

	Entity	Cultural Feature	Tactical Graphic	Prop
Force	X	X	X	
Heading	X	X		
Label (and extended labels)	X	X		
Location	X	X	X	X
Name	X	X	X	
Overlay	X (Edit only)	X (Edit only)	X	
Style			X	

2.2. Selecting the Object to Create

You can select the object to create on the Create menu or on an object palette (Entities Palette, Tactical Graphics Palette, Hazards/Obstacles Palette, or Props Palette). Once you have selected the object, placing the object is the same regardless of how you started the process. For details, please see [“Placing Objects,”](#) on page 2-11.

The Create menu does not contain the full list of objects configured in VR-Forces. It only lists the entities and tactical graphics that you have marked as “Favorites”. It gives you quick access to your most frequently used objects. For details, please see [“Adding an Object to the Favorites List,”](#) on page 2-25.

2.2.1. Selecting the Object to Create on the Create Menu

Waypoints, routes, areas, and objects marked as Favorites are available on the Create menu.

To select the object to create on the Create menu:

1. If you are using multiple simulation engines, in the Selected Simulation Engine Toolbar select the simulation engine on which you want to simulate the object.
2. To create an object or graphic, choose **Create** → *category* → *object_type*, where:
 - *category* is a category of entity, such as Ground or Human, a category of cultural feature, or a category of tactical graphic.
 - *object_type* is a specific type within the category, such as M1A2 or T80.

The cursor changes to draw mode and a Create Object tab is added to the window. For details about draw mode, please see [“Draw Mode,”](#) on page 2-9.

3. Create the object, as described in [“Placing Objects,”](#) on page 2-11.

2.2.2. Selecting the Object to Create on an Object Palette

VR-Forces has the following object palettes that let you quickly choose the object that you want to create:

- ♦ Entities Palette. Create entities, cultural features, and buildings.
- ♦ Tactical Graphics Palette. Create tactical graphics, such as control objects, lines, circles, points, and text.
- ♦ Hazards/Obstacles. Lets you create weather objects, contamination areas, and various types of hazards and obstacles. (Except for weather objects, these graphics are aggregate-level only.)
- ♦ Props Palette. Create props that can be saved as part of the terrain.

Figure 2-1 shows the location of the palettes.

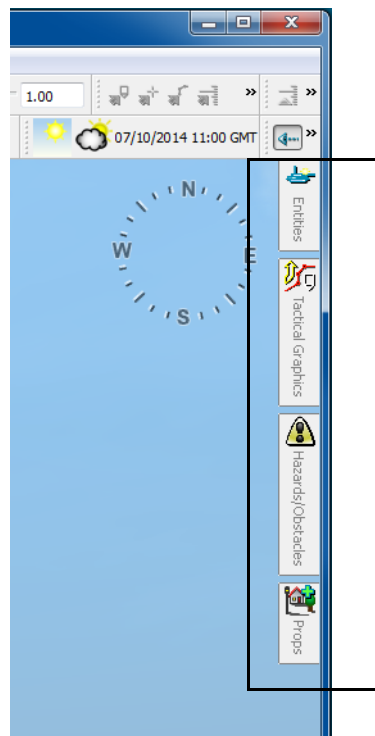


Figure 2-1. Object creation palette tabs

To select the object to create on an object palette:

1. If you are using multiple simulation engines, in the Selected Simulation Engine Toolbar select the simulation engine on which you want to simulate the object.
2. Click the tab for the palette you want to open. The palette is displayed ([Figure 2-2](#)).

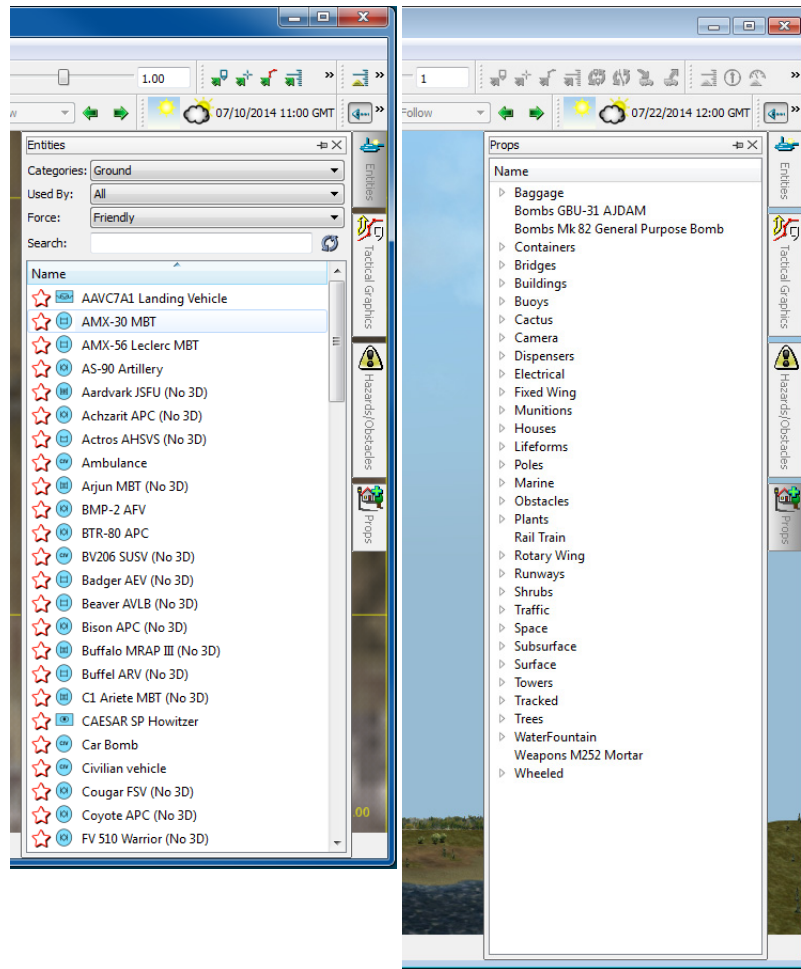


Figure 2-2. Object palettes

By default, the palettes list all objects that can be created. You can filter the Entities Palette list by category, force, and country of use. You can filter the Tactical Graphics Palette and Hazards/Obstacles Palette by category and force. The Props Palette organizes props by category in a tree list.

3. Optionally, in the Categories list, select the category for the object you want to create, such as ground or fixed-wing for entities, or control objects for tactical graphics.
4. Optionally, filter the Entities Palette by selecting a country in the Used By list.

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The Used By filter lists entities of the selected Category that are used by the specified country. VR-Forces does not provide an exhaustive list of countries or the platforms that they use. You can add additional countries and categorize entities in the Entity Editor. For details, please see Section 6.2.1, “[Editing an Entity’s Used By Countries List](#),” in *VR-Forces Configuration Guide*.

5. In the Force list, select the force for which you want to create this entity. All entity types for a given platform are listed. There is no preconceived force for any of them.
6. In the list of objects, click the object that you want to create. The cursor changes to draw mode and a Create Object tab is added to the window. For details about draw mode, please see “[Draw Mode](#),” on page 2-9.
7. Create the object, as described in “[Placing Objects](#),” on page 2-11.

2.2.3. Pinning an Object Palette to the Window

Ordinarily, after you select an object to create, the palette closes. However, you can pin the palette to keep it open so that you can select additional objects to create without needing to click the palette to reopen it. If you pin a palette, it becomes dockable and undockable and you can drag it off the window like the other panels. (For details about undocking panels, please see Section A.1, “[Dockable Panels and Toolbars](#),” in *VR-Forces Users Guide*.)

- To pin a palette so that it stays open after you select an object, click the pin button (📌) in the title bar ([Figure 2-3](#)).

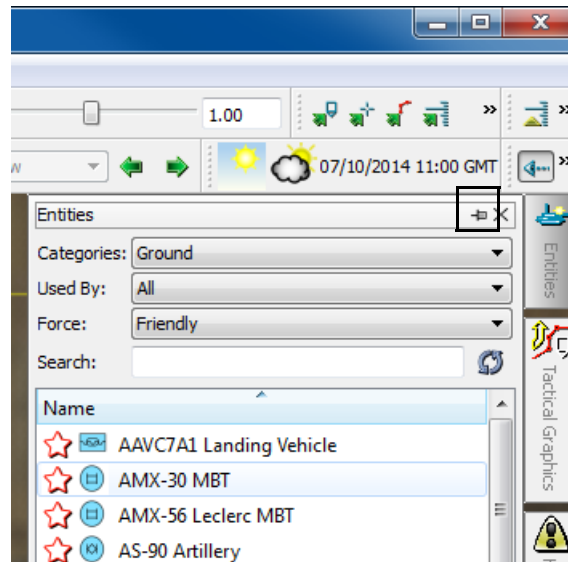


Figure 2-3. Palette pin

2.2.4. Draw Mode

When you create an object, the cursor changes to draw mode. If you are creating an entity or a cultural feature in the 2D view, the cursor changes to a 2D icon that represents the chosen entity (Figure 2-4).

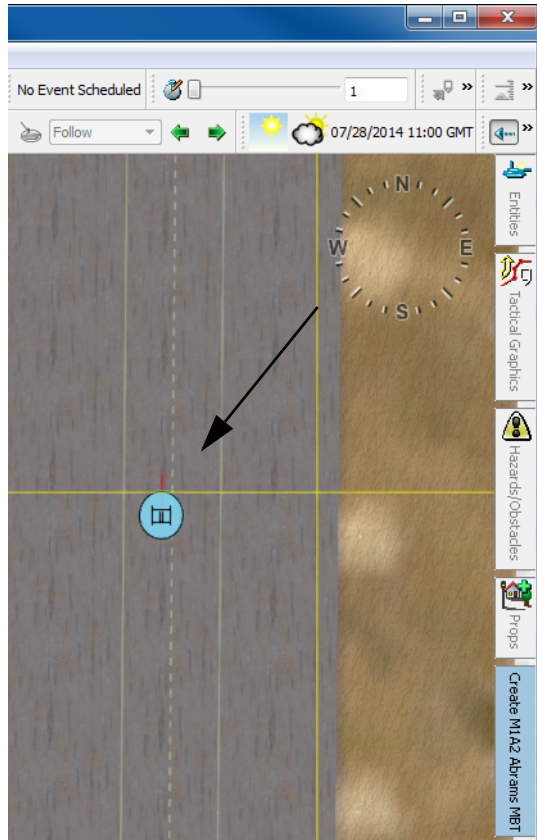


Figure 2-4. 2D entity creation and Create *object* tab

In the 3D view, the cursor changes to the 3D model for the chosen entity (Figure 2-5). If you are zoomed out, 3D models may be hard to see.

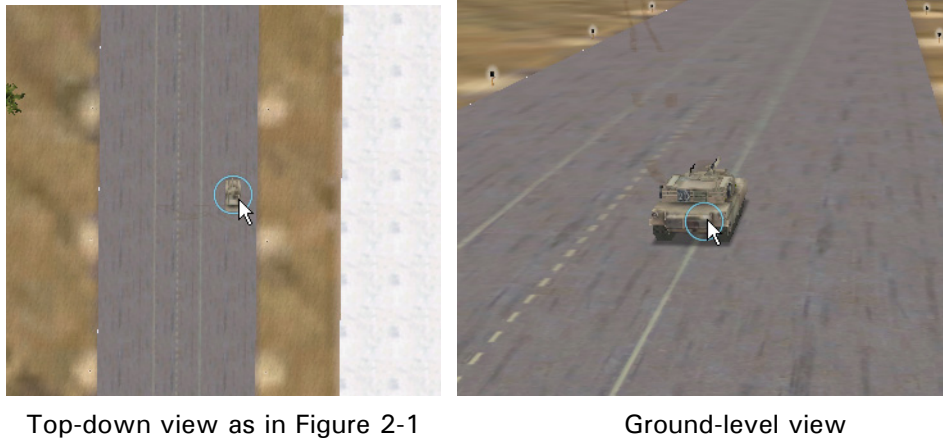


Figure 2-5. 3D entity creation

If you are creating a tactical graphic, the cursor displays the waypoint symbol when you create a point and a vertex symbol when you create any type of line or area. [Figure 2-6](#) illustrates tactical graphics draw mode cursors.

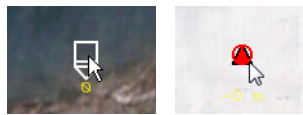


Figure 2-6. Tactical graphics cursors in draw mode

If you are creating a prop, the cursor changes to show the model for the prop. In the 2D view, the model is a top down view and is proportional to the terrain, so it may be difficult to see if you are zoomed out.

2.3. Placing Objects

After you select the object that you want to create, the Create Object tab is added to the right side of the window below the Props Palette.

There are two basic methods for placing entities, as follows:

- **Click to Create.** Each mouse click creates an instance of the selected object. For multi-vertex tactical graphics, each click specifies a vertex. Click to Create is best for rapidly creating objects using the default values for the object's properties.

The create object graphic is attached to the mouse cursor. Although you can use the Create Object dialog box to specify an object's name or other properties, as you move the cursor into the dialog box, the creation location (as represented by the object graphic) moves with it, which can be disconcerting. You can set heading and altitude dynamically, so there is no need to use the Create Object dialog box for these properties.

- **Click to Locate.** Mouse clicks specify the coordinates, but do not cause the entity to be created. The create object graphic is placed at the specified coordinates, but is not attached to the mouse cursor.

If you want to explicitly set the object's location, and particularly if you want to set the altitude relative to sea level, you must use this method. This method may also be more comfortable for persons who want to take a deliberative approach to specifying an object's properties before creating it.

2.3.1. Placing an Object Using Default Values (Click to Create)

Although you can specify an object's properties using the Click to Create method, it is best suited for quickly creating objects using default properties. Objects are placed on the default overlay.

To place an object with each mouse click:

1. Select the object that you want to create as described in [“Selecting the Object to Create,”](#) on page 2-4. A Create object tab is added to the side of the window below the Props Palette.
2. For entities and waypoints, click on the terrain for each object you want to place. You can create multiple single point objects without exiting create mode. For details about disabling this create mode, please see [“Locking the Mouse to the Object Being Created,”](#) on page 2-18.

For multi-vertex tactical graphics, click on the terrain to place each vertex. Right click to place the last vertex in a route or area. (Do not try to close areas by clicking on the starting point. Doing so only creates another vertex near the first one.)

To draw a circles, ellipses, boxes, or text, please see the sections in Chapter 6, [Overlays and Tactical Graphics](#).



- ♦ If new objects or vertices do not get displayed as you click, it is possible that Attach Object to Mouse is disabled. To restore Click to Create mode:
 1. Click the Create Object tab. The Create Object dialog box opens.
 2. Select the Attach Object to Mouse check box.
- ♦ If tactical graphics are not displayed after you create them, check to see if the display of tactical graphics has been disabled. For details, please see Section 6.4, “[Displaying Tactical Graphics](#),” in *VR-Forces Users Guide*.

3. Optionally, you can set the altitude of an object as you create it. For details, please see “[Setting Altitude Dynamically](#),” on page 2-14.
4. Optionally, you can set the heading of an object as you create it. For details, please see “[Specifying an Object’s Heading Dynamically](#),” on page 2-17.



If you want to specify any of the object’s properties in the Create Object dialog box while using Click to Create, you can do so. However, be aware that as you move the cursor into the dialog box, the object graphic will move also. Once you specify the desired properties, click on the terrain to create an object with those properties. The properties will be applied to any additional objects you create until you change them or close the dialog box.

5. Right-click or press **Esc** to exit create mode.

2.3.2. Specifying an Object’s Properties Before You Create It (Click to Locate)

In the Click to Locate method, clicking on the terrain sets the coordinates of the object, but does not create it. You can specify all of the object’s properties in the Create Object dialog box before creating it. [Table 2-1](#) lists the properties that you can set for the different types of objects.



VR-Forces remembers how you use the Create Object dialog box on a per-object basis. For example, if you create a waypoint and open the Create Waypoint dialog box to specify its properties, the next time you create a waypoint, the Create Waypoint dialog box opens automatically. If the dialog box opens and you do not want it open for this object creation or for future creations of the current object type, click the Create Object tab. The dialog box will close and VR-Forces will still be in object creation mode. The next time you create this object type, the dialog box will not open automatically.

To specify the properties of an object when you create it:

1. Select the object that you want to create as described in [“Selecting the Object to Create,”](#) on page 2-4. A Create Object tab is added to the window below the Props Palette ([Figure 2-4](#)).
2. Click the Create Object tab. A Create Object dialog box that is appropriate for the object opens ([Figure 2-9](#)).

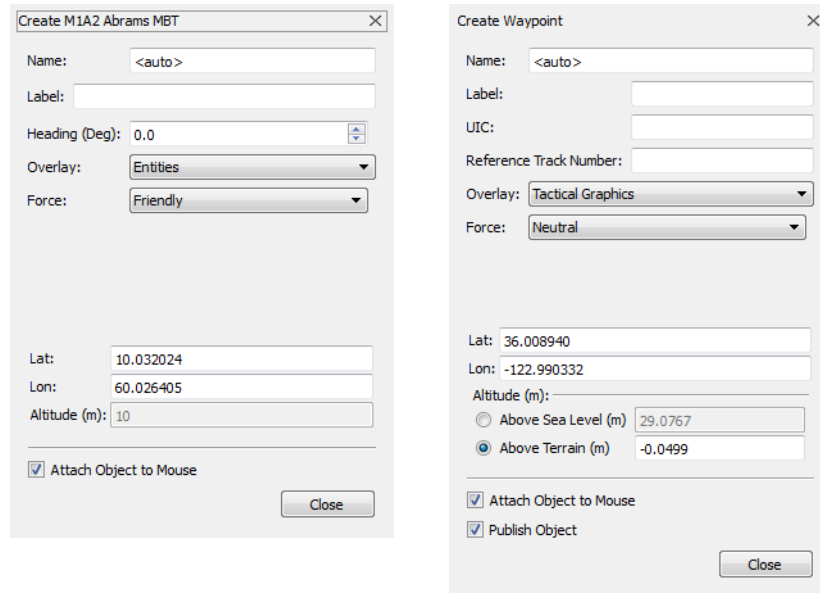


Figure 2-7. Create Object dialog boxes

3. Clear the Attach Object to Mouse check box. For details about this option, please see [“Locking the Mouse to the Object Being Created,”](#) on page 2-18.
4. To specify the object’s name, type a name in the Name box. For details about how entities are named, please see Section 3.5.1, [“How Entities are Identified,”](#) in *VR-Forces Users Guide*.
5. Optionally, specify a label.
6. Optionally, if extended labels are available, specify them. For information about extended labels, please see Section 7.2, [“Using Extended Labels,”](#) in *VR-Forces Users Guide*.
7. To specify the object’s heading, type or select a value, in degrees, in the Heading box.
8. To specify the overlay on which to place an object, select an overlay from the Overlay list.
9. Optionally, specify a force.

10. To specify an entity or point object's coordinates, click on the terrain or type coordinate values in the dialog box. To specify the altitude, follow the procedure in [“Specifying an Object's Altitude,”](#) on page 2-14.

To specify the vertices of a route or area:

- a. Click on the terrain to place the first vertex, or type the coordinates in the dialog box.
- b. Click the Add button (+) to add a vertex.
- c. Click to locate the vertex or type the coordinates.
- d. Continue adding vertices until you are finished specifying the route or area. You can insert vertices anywhere in the object by selecting an existing vertex and clicking the Add button.

To draw circles, ellipses, boxes, or text, please see Chapter 6, [Overlays and Tactical Graphics](#).

11. For tactical graphics, specify whether or not to publish the object.
12. Click Create. The object is created. You can continue to create additional objects of this type.
13. To close the dialog box, click Close.

2.4. Specifying an Object's Altitude

You can specify an altitude for air platforms, sub-surface entities, the vertices of waypoints and routes, and props when you create them or edit their properties. (You can also set altitude for entities using the Location set data request, Fly Altitude tasks, and the Move to Location task. You can set altitude dynamically or in the various dialog boxes for setting object properties or actions.)

2.4.1. Setting Altitude Dynamically

You can set altitude dynamically for entities that support an altitude, for waypoints, for individual vertices of a route, and for props that have not been saved into a terrain. When you set altitude dynamically, it is set relative to the terrain.

To set altitude dynamically:

- ♦ If you are creating an object, press **Alt** and scroll the mouse wheel, or press **Alt**+left mouse button and drag the mouse.
- ♦ If you are editing an entity or vertex:
 - a. Double-click the object to make it editable.
 - b. Press **Alt** and scroll the mouse wheel, or press **Alt**+left mouse button and drag the mouse.
 - c. Click to set the new altitude.

2.4.2. Setting Altitude in the Create Object or Edit Object Dialog Box

When you set altitude in a dialog box, you have the following options:

- ♦ Above Sea Level. The distance above sea level. If the terrain is higher than the altitude entered, the entity will be below the surface of the ground.
- ♦ Above Terrain. The distance above the terrain at this location.

If you are creating or editing a route, you can adjust the altitude of all of the vertices at the same time and in the same way. For details, please see [“Specifying the Altitude for All of the Vertices in a Route,”](#) on page 2-16.

To set altitude in a dialog box:

1. If you are creating or editing an object:
 - a. Click the Create Object (or Edit Object) tab. A dialog box opens.
 - b. Clear the Attach Object to Mouse check box. The Location group box becomes enabled. (Although the entity will change its location as you move the cursor into the dialog box, it snaps back to its original location as soon as you clear the check box.)
2. In the Altitude group box, select one of the options.
3. Type an altitude in the box.

2.4.3. Specifying the Altitude for All of the Vertices in a Route

When you create a route or edit its vertices, you may want to change the altitude of all of its vertices in a similar way. VR-Forces lets you:

- ♦ Adjust all vertices by the same amount.
- ♦ Set all vertices to the same height above sea level.
- ♦ Set all vertices to the same height above the terrain.

To change the altitude for all of the vertices in a route:

1. If you are creating a route, open the Create Route dialog box. If you are editing a route:
 - a. Select the route.
 - b. Choose **Entities** → **Edit**. The Edit Route dialog box opens.
2. Click the Adjust Points button (📍). The Adjust All Points dialog box opens (Figure 2-8).

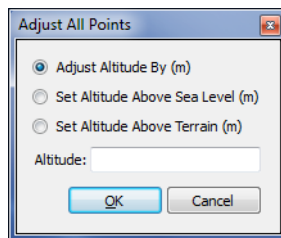


Figure 2-8. Adjust All Points dialog box

3. Select the adjustment action as follows:
 - Adjust Altitude By. Changes the altitude of each vertex by the amount specified in the Altitude box.
 - Set Altitude Above Sea Level. Sets the altitude of each vertex to the amount above sea level specified in the Altitude box. This could result in some vertices being below ground.
 - Set Altitude Above Terrain. Sets the altitude of each vertex the amount above the terrain specified in the Altitude box.
4. Type the desired altitude adjustment value in the Altitude box.
5. Click OK.

2.5. Specifying an Object's Heading Dynamically

When you create an entity, cultural feature, or prop, you can set its heading in the Create Object dialog box, or dynamically. Afterwards, you can edit an entity or cultural feature's heading directly or use the Heading set data request. (For more information, please see [“Heading,”](#) on page 10-18.)

- To set an object's heading dynamically as part of the creation process, hold down the **Shift** key and the left mouse button, and drag the mouse.

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In the 2D view, as you change the heading for an entity you can see the heading indicator change heading. However cultural features do not have heading indicators, so if you want to set the heading dynamically, you may want to switch to 3D view so that you can see the model rotate.

2.6. Locking the Mouse to the Object Being Created

By default, when you create entities or waypoints, you can create multiple objects by continuously left-clicking without exiting create mode. This is a very convenient feature if you want to create objects using default naming conventions and do not need to specify specific location coordinates or overlay assignments during the creation process. (You can always edit an object's properties after you create it.)

However, if you want to use the Create Object dialog box to specify location or other properties for each object as you create it, this feature can be inconvenient because as you move the mouse to the Create Object dialog box, the placement location changes with the mouse movement. Disabling this feature can give you greater control over the creation process, because clicking to set the location of the object or a vertex does not create it – it sets the coordinates, but lets you make further changes in the Create Object dialog box before you create the object.

If you disable an object's attachment to the mouse when you are creating objects, you create them by clicking Create in the dialog box rather than clicking on the terrain.

- To enable or disable the mouse's attachment to the creation location, in the Create Object or Edit Object dialog box, select or clear the Attach Object to Mouse check box (Figure 2-9). When you select the check box, a Create button gets added to the dialog box. The setting gets carried over to future object creations.

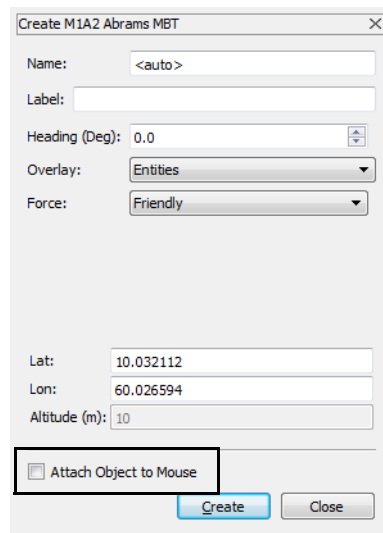


Figure 2-9. Create Object dialog box

2.7. Moving Objects

You can move an object by dragging it, changing its location in the Edit dialog box, or for entities only, sending a Location request.

For information about setting the location of an entity, please see “[Location](#),” on page 10-22.



You can only move objects simulated by VR-Forces.

2.7.1. Dragging an Object to a New Location

When you move objects, they are centered on the mouse location as follows:

- ♦ If you select an object by double-clicking, it attaches to the mouse at the location where you clicked it. (For individual entities and point objects, the objects are centered on the mouse location, but for lines or areal objects, the attachment is at the point where you clicked.)
- ♦ If you select an individual object and move it by choosing the Move command:
 - Point objects are centered on the mouse, just as when you double-click them.
 - Routes attach to the mouse cursor at the first point of the route ([Figure 2-10](#)).
 - Areas attach to the cursor at the center of mass.

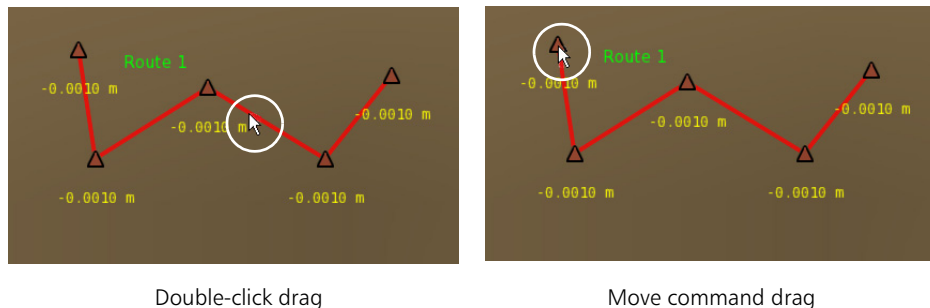


Figure 2-10. Moving individual lines

- ♦ If you select multiple objects and move them by choosing the Move command:
 - Point objects attach to the cursor at their center of mass.
 - Multipoint objects have their centers of mass averaged and the center point attaches to the cursor ([Figure 2-11](#)).

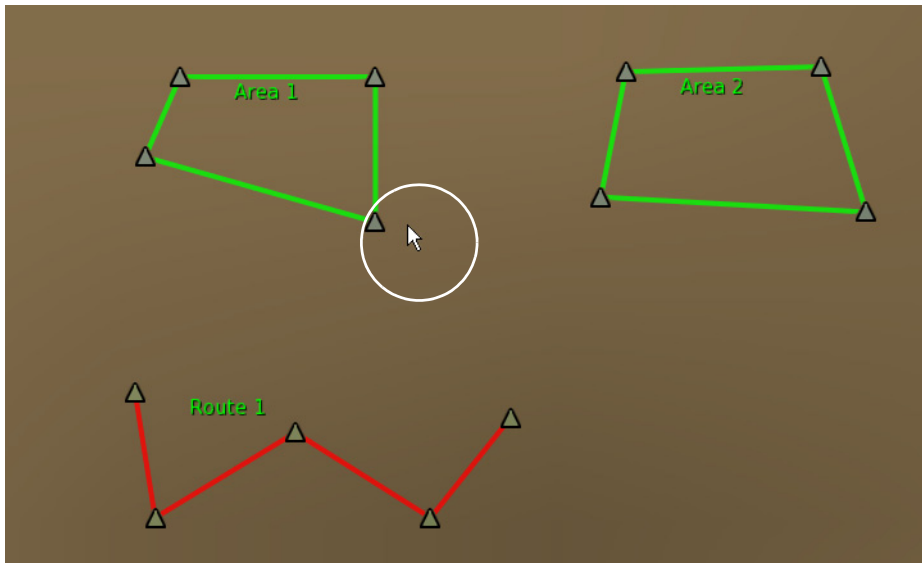


Figure 2-11. Moving multiple objects



If you click the terrain and then **Shift**-click or **Ctrl**-click an object, the terrain is selected and the Move command will not be available.

To drag an object from one point on the terrain to another:

1. Double-click the object, or select the object and choose **Entities** → **Move**.
2. Move the mouse to change the location of the object.
3. Left-click the mouse.



- ♦ You can drag multiple objects and they can be of different types.
 - ♦ To drag multiple objects, you must select the objects and choose **Entities** → **Move**.
-

Canceling a Drag-and-Drop Move

- To cancel a move made by dragging an object, press **Esc** before you click the left mouse button.

2.8. Copying and Pasting Objects

You can copy objects and paste the copies elsewhere in a scenario or even in another scenario. The Paste Special option allows you to specify which entity characteristics you paste.

VR-Forces copies the following data about an object:

- ♦ Environmental objects:
 - Original name
 - Label
 - Force
 - Color.
- ♦ Entities:
 - Original name
 - Label
 - Force
 - Heading
 - Appearance (lights, landing gear, and so on)
 - Rules of engagement
 - Plan.
- ♦ Aggregate entities copy the same information as individual entities plus the list of subordinates.

VR-Forces does not copy:

- ♦ The current task.
- ♦ State information, except as noted previously.
- ♦ Load balancing status. All objects get pasted into the currently selected back-end.
- ♦ Embarkation structures. If, for example, you copy an aircraft carrier that has planes embarked, only the carrier is copied, not the embarked entities.



The copy/paste process is resource intensive. It is primarily for use during scenario development. Use during a simulation could affect performance.

2.8.1. Copying Objects

To copy objects:

1. Select the objects you want to copy.
2. Choose **Entities** → **Copy**.

2.8.2. Pasting Objects

A simple paste pastes all of the attributes of an object that get copied. It pastes objects as follows:

- ♦ Tactical graphics are placed on the currently selected overlay. If you copied objects that were on different overlays, that differentiation is not preserved.
- ♦ Copied objects maintain the state at the time that they were copied. Therefore, if you paste objects some time after they were initially copied, the copies do not reflect any changes that may have taken place to the original entities. For example, if an entity was copied and then deleted, the copied version of the entity is still pasted.
- ♦ Embarkation structures are not copied, only the parent entity.



Pasting entity plans may have unexpected consequences, because their object references do not change when you copy them. For example, suppose the plan for Entity A refers to Waypoint 1. You copy Entity A and Waypoint 1 and paste them as Entity B and Waypoint 2. If you copy the plan, Entity B's plan will still refer to Waypoint 1. If you expected it to refer to Waypoint 2, you will not see the behavior you expected. You can choose not to paste plans. For details, please see [“Pasting Specific Entity Characteristics,”](#) on page 2-23.

To paste objects:

1. Choose **Entities** → **Paste**. The objects in the paste buffer are displayed on screen. They float as you move the cursor to show you where they will be placed when you paste them.
2. Click on the terrain where you want the objects to be pasted. They are pasted in the relative positions in which they were copied. If an object has an altitude, it is pasted using the same altitude above the terrain as the original object.
3. Optionally, continue pasting additional copies if desired.
4. Right-click to exit paste mode.

2.8.3. Pasting Specific Entity Characteristics

When you paste entities, you can specify which of the following entity characteristics you want to paste with the entity:

- ♦ Plans.
- ♦ Appearance.
- ♦ Heading.
- ♦ Rules of engagement.
- ♦ Entity name. (If you are pasting an entity in its original scenario, you must paste with a new name. However if you are copying it to another scenario, you might want to keep the same name.)
- ♦ Altitude. You can specify that the previous altitude be applied as above terrain or as above sea level.

To paste particular entity characteristics:

1. Choose **Entities** → **Paste Special**. The Paste Special dialog box opens.

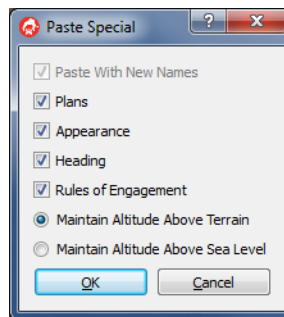


Figure 2-12. Paste Special dialog box

2. By default, all check boxes are selected. Clear the check boxes for the options you do not want to paste. If you are pasting entities into the scenario from which they were copied, you must paste with new names. Clearing that option will cause the paste to fail.
3. Choose the altitude option that you want to use.
4. Click OK. The objects in the paste buffer are displayed on screen. They float as you move the cursor to show you where they will be placed when you paste them.
5. Click on the terrain where you want the objects to be pasted. They are pasted in the relative positions in which they were copied.
6. Optionally, continue pasting additional copies if desired.
7. Right-click to exit paste mode.

Pasting Altitude

When you paste objects, if the pasted object can have an altitude value, such as a fixed-wing entity, a waypoint, or the vertices of a route, the default behavior is to replicate the original altitude above the terrain. If you use the Paste Special operation, you can choose to apply the original altitude as being above sea level. [Figure 2-13](#) illustrates these alternatives. A waypoint is placed on the terrain. It is 0 meters above the terrain. However, the terrain itself is 200m above sea level. If the waypoint is copied and pasted at point A and the altitude above the terrain is maintained, the point is placed at 0m above the terrain. If the point is pasted at point B and altitude above sea level is maintained, it is placed 200m above sea level.

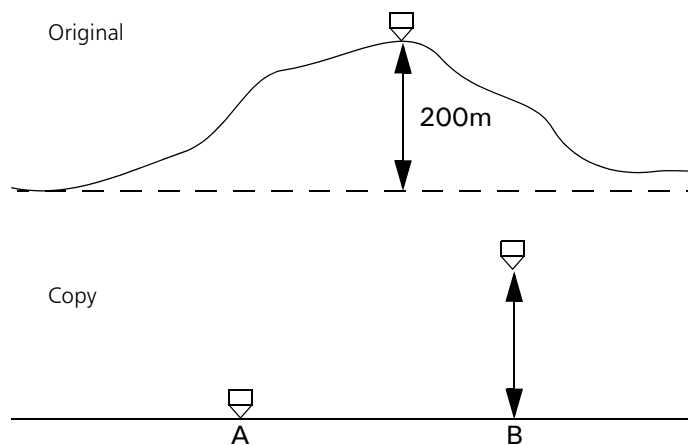


Figure 2-13. Pasting altitude

2.9. Creating Cultural Features

Cultural features are objects that you can add to a scenario to simulate human artifacts such as buildings, bridges, and so on. They are in the Building and Cultural Feature categories on the Create menu and the Entities Palette. You add them to a scenario the same way you would add an entity. Cultural features are listed in the Objects List Panel. You can apply some set data requests to them, such as Location and Heading.



Some of the choices on the cultural feature lists are the same as those available on the Props Palette. However, cultural features are not the same things as props. Props are terrain objects and can be saved as part of a terrain. Cultural features are not part of the terrain, they are a type of entity and are saved in the order of battle file.

2.10. Creating Props

Props are terrain objects that you can select independently of the terrain. Section 13.12.1, “[Extracting Props from a Terrain Patch](#),” in *VR-Forces Configuration Guide* explains how to create them by extracting them from a terrain or a feature layer. However, you can also create them from the Props Palette, similarly to how you create entities. This is a valuable feature if your terrains do not have any features that you can extract as props. However note the following important details:

- ♦ Props are not saved in a scenario. If you want to save a prop, you must save the terrain. You can save the terrain to a different name or overwrite the existing terrain. The next time you open the terrain, the prop will be part of it.
- ♦ When you create a prop, the back-end does not know anything about it, because it is a terrain object. To have the back-end take the prop into account, you must save the terrain (as mentioned in the previous paragraph) and start a new scenario that uses the terrain.
- ♦ You can also create cultural features that look exactly like the props that you can create. However cultural features are not the same things as props. Cultural features are treated like entities. They are listed with entities and tactical graphics and get saved as part of the scenario.

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The list of props that you can create from the Props Palette is based on the model definitions defined on the Model Definitions tab of the Visual Model Editors dialog box. Therefore, you can add new props to the Props Palette by adding new model definitions. For details, please see Section 15.7, “[Adding Object Models as Props](#),” in *VR-Forces Configuration Guide*.

2.11. Adding an Object to the Favorites List

As mentioned in “[Selecting the Object to Create](#),” on page 2-4, the Create menu does not include all of the objects that you can create. It just lists the objects that you have designated as “Favorites”. When you specify that an entity or tactical graphic be a favorite, it is automatically added to the Create menu.

The favorites list is specific to a simulation model set. It is saved to `./data/simulation-ModelSets/<model_set>/gui/favorites.mst`. You can copy the file to other instances of VR-Forces or future releases and your favorites list will be enabled.

To add or remove an object from the Favorites list:

1. Open the palette that has the object you want to add to the Favorites list.
2. Select the category for the object you want to add to the Favorites list.
3. Click the star to the left of the object’s name.



3. Creating and Managing Entities

This chapter explains how to create and manipulate entities. For information about working with aggregate entities, please see Chapter 4, *Simulating Aggregates*. For information about managing entity information, please see Chapter 7, *Viewing Entities and Entity Information*, in *VR-Forces Users Guide*. For information about entity hostility relationships, target detection, and target acquisition, please see Chapter 13, *Target Detection and Combat Features*. For information about assigning tasks and set data requests to entities, please see Chapter 7, *Assigning Tasks* and Chapter 10, *Setting Entity State*.

Creating Entities	3-3
Default Placement of New Entities	3-3
Placing Entities Inside Buildings	3-4
Placing Entities on Other Entities	3-4
Entity Resources	3-4
Deleting Entities	3-5
Editing Entities	3-5
Embarking and Disembarking Entities	3-6
Embarking and Disembarking Entities Instantly	3-8
Disembarking Entities Using the Disembark Command	3-10
Embedded Entities	3-11
Configuring an Entity to Support Embedded Entities	3-11
Deploying Embedded Entities	3-14
Deploying an Entity with a Task	3-14
Recovering Deployed Entities	3-15
Assigning Tasks and Plans to Embedded Entities	3-15
Restoring an Entity that has Embedded Entities	3-15
Collision, Obstacle, and Feature Avoidance	3-16

Creating and Managing Entities

Entity Movement and Soil Type	3-17
Using a Joystick to Control Entities	3-18

3.1. Creating Entities

The basic procedure for creating an entity is fairly simple:

1. On the Create menu or Entities Palette, select the entity that you want to create.
2. Click on the terrain to place the entity.
3. Optionally, specify the properties of the entity, such as name, altitude, and heading.

The generic procedures for choosing the entity to create, placing it on the terrain, and setting properties are described in Chapter 2, [Creating and Placing Objects](#). This section provides additional details about entity creation and placement.

You can also create entities by copying existing entities. For details, please see [“Copying and Pasting Objects,”](#) on page 2-21.

You can create pre-configured aggregates the same way you create individual entities. You can also create aggregates by aggregating existing entities. To learn how to create an aggregate, please see [“Creating Aggregates,”](#) on page 4-2.



When you create entities, if spot reports are enabled and a particular force is hidden, if you create an entity of the hidden force, you will not be able to see it. It is recommended that you disable spot reports or set the viewpoint to show all forces when you are creating scenarios. For details about spot reports, please see [“Displaying Entities Based on Spot Reports,”](#) on page 13-2.

The force ID of the entity is set to the type specified in the simulation model set.

3.1.1. Default Placement of New Entities

By default, ground, lifeform, rotary-wing, and fixed-wing entities get placed on the ground. Surface and subsurface entities are created at sea level.

Ground-based entities are placed at the highest possible terrain intersection at the location. If a terrain supports buildings with multiple levels, the entity is placed at the highest level. Once the entity begins moving, if the next calculated location resides in-between two levels of terrain, and if the entity is configured to respect terrain intersections when moving, and there is no terrain blocking its movement, the entity places itself at the closest elevation to the desired location.

3.1.2. Placing Entities Inside Buildings

One of the benefits of creating entities in a 3D observer mode is the ease of placing entities in the precise location and orientation that you want them to be in, particularly inside buildings. However, placing entities inside small enclosed spaces can be hindered by the location of walls relative to the observer. You can work around this problem by:

- Adjusting the near clipping plane to remove the display of walls and floors until you see the location where you want to place entities. For details about changing the clipping plane, please see Section 12.4.1, “[Setting the Clipping Planes](#),” in *VR-Forces Configuration Guide*.
- Adjusting the transparency of a building so that you can see inside of it. For details about changing transparency, please see Section 13.12.5, “[Setting the Opacity of Props](#),” in *VR-Forces Configuration Guide*.



If you enable view constraints, it may restrict your ability to move the observer into buildings. You can disable view constraints by pressing **x**.

3.1.3. Placing Entities on Other Entities

If you want to place an entity on or in another entity, such as an aircraft on an aircraft carrier or a dismounted infantry entity in a truck, then you must embark the entity. Creating an entity on top of another entity will not provide the results you want. For example, if you create a fixed-wing entity and manipulate its location and altitude so that it looks like it is on the deck of an aircraft carrier, as soon as you start the simulation, the jet will start flying at that altitude, because it is not attached to the carrier. It is just created at a particular location. For complete details about embarking entities, please see “[Embarking and Disembarking Entities](#),” on page 3-6.

3.1.4. Entity Resources

When you create an entity, it has a full complement of resources, as defined in the object parameter database. You do not have to assign resources to an entity when you create it. However, if you want an entity to start a simulation with less than a full set of resources, you could use the Resource set data request to set its resources at some amount less than 100%.

3.1.5. Deleting Entities

To delete an entity:

1. Select the entity you want to delete.
2. Choose **Entities** → **Delete** or press the **Delete** key.

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- ♦ If you delete an aggregate entity, all its subordinates also get deleted.
 - ♦ If you delete an entity that has an intervisibility object pinned to it, the intervisibility object also gets deleted. For details, please see Section 14.10, “[Deleting Intervisibility Objects](#),” in *VR-Forces Users Guide*.
-

3.2. Editing Entities

You can edit the following entity properties:

- ♦ Name.
- ♦ Label (and extended labels if available).
- ♦ Force.
- ♦ Location.
- ♦ Heading.
- ♦ Altitude.
- ♦ Overlay.

To edit an entity:

1. Select the entity.
2. Choose **Entities** → **Edit**. The Edit Entity dialog box opens ([Figure 3-1](#)).

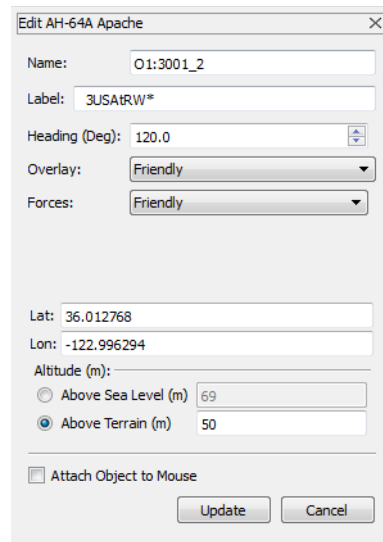


Figure 3-1. Edit Entity dialog box

3. Change the properties as desired.
4. Click OK.



You can also change the location, altitude, and heading dynamically, through a variety of movement tasks, or with set data requests. For details, please see:

- ♦ “Setting Altitude Dynamically,” on page 2-14.
 - ♦ “Specifying an Object’s Heading Dynamically,” on page 2-17.
 - ♦ “Moving Objects,” on page 2-19.
 - ♦ Chapter 8, *Task Procedures*.
 - ♦ Chapter 10, *Setting Entity State*.
-

3.3. Embarking and Disembarking Entities

Embarkation places entities into or onto other entities, for example, dismounted infantry in a truck, trucks on an LCAC, or aircraft on an aircraft carrier. While embarked, the entities travel with the entity on which they are embarked. Embarked entities are not visible in the 2D view. They are always visible in the 3D view.



If you are using HLA and want to use the embarkation feature, you must use RPR FOM 2, draft 17 or later. VR-Forces includes configurations in the Simulation Connections Configuration dialog box that start VR-Forces using the correct FED file and FOM Mapper for RPR FOM 1.0 and RPR FOM 2.

You can attach control objects to entities so that embarked entities can use them to move about on the parent entity. For example, an aircraft could taxi towards a waypoint on the flight deck of an aircraft carrier.



Attached objects are shown in the Embarkation View on the Objects List Panel.

The embarkation status of entities is displayed in the Embarkation View of the Objects List Panel (Figure 3-2).

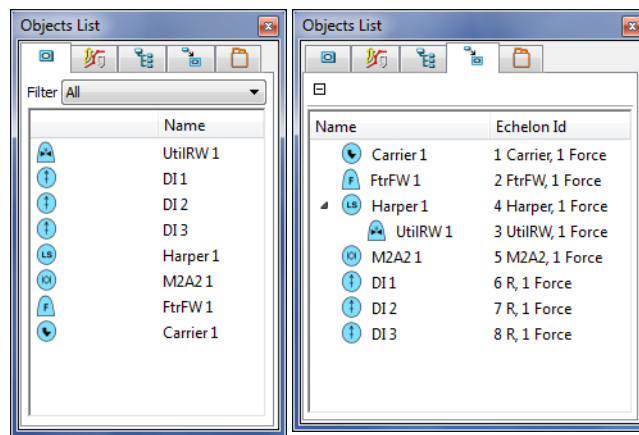


Figure 3-2. Echelon View and Embarkation View

You can embark and disembark entities instantly (described in this section), or you can have them simulate embarkation and disembarkation using the Embark and Disembark tasks, described in Chapter 8, *Task Procedures*.

When you embark an entity using the Embark task, the entity can embark only on entities that are configured to accept that type of entity. For example, LCACs are configured to accept several types of ground vehicles. You cannot give a DI an Embark task to embark on an LCAC. However, when you use the immediate embark method to embark an entity, you can use preconfigured slots (spaces) for entities or specify an override. When you specify an override you can embark an entity on any other entity at the coordinates you enter. However, it is your responsibility to know what the proper coordinates are.



Embarked entities controlled by joystick cannot disembark. For example, if you use a joystick to control a fixed-wing taking off from a carrier, the aircraft will take off, but it will remain in an embarked state.

3.3.1. Embarking and Disembarking Entities Instantly

You can embark and disembark entities instantly using commands on the Entities menu, using set data requests, or in the Embarkation View. Using set data requests lets you include immediate embarkation in plans. This may be particularly useful in a global plan, in which you may want to quickly create and embark entities without paying attention to the realism of the action. For details about using set data requests for embarkation, please see [“Embarked,”](#) on page 10-12 and [“Disembarked,”](#) on page 10-11.

Embarking Entities Instantly Using the Embark On Command

The Embark On command lets you embark entities using preconfigured embarkation spaces or using specific coordinates. If the embarkation spaces on the parent entity are full, VR-Forces sends a message to the back-end console and the entity is not embarked. To embark entities instantly from a plan, use the Embarked set data request.

To embark an entity instantly using the Embark On command:

1. Select the entity that you want to embark.
2. Choose **Entities** → **Embark On**. The Embark On dialog box opens.

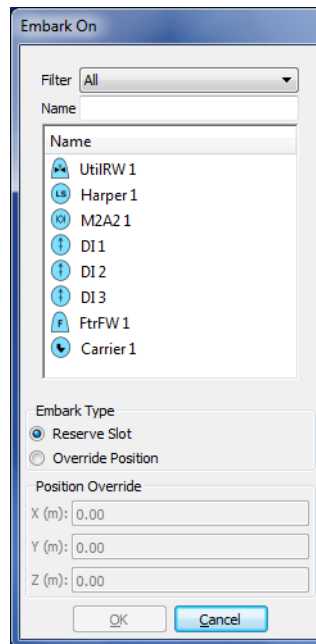


Figure 3-3. Embark On dialog box

3. Optionally, filter the list of potential parent entities.
4. Select the parent entity.
5. To embark in a configured space, select the Reserve Slot option. To specify an embarkation point, select Override Position.
6. If you chose the Override Position option, specify the coordinates on the parent, in body coordinates, for the embarkation point.
7. Click OK.

Embarking Entities in the Embarkation View

To embark an object in the Embarkation View:

1. On the Objects List Panel, select the Embarkation view.
2. Drag the entity you want to embark onto the parent entity. The Embarked dialog box opens.
3. Click OK to embark using the Reserve Slot option.
4. To specify an embarkation location, select Override Position and specify the location.
5. Click OK.

3.3.2. Disembarking Entities Using the Disembark Command

Like the Embark On command, the Disembark command is typically used as part of scenario development. To simulate disembarkation, you would use the Disembark task. To provide instant disembarkation in a plan, you would use the Disembarked set data request.



Embarked entities controlled by joystick cannot disembark. For example, if you use a joystick to control a fixed-wing taking off from a carrier, the aircraft will take off, but it will remain in an embarked state.

To disembark an entity instantly:

1. Select the entity that you want to disembark.
2. Choose **Entities** → **Disembark**. If the entity was embarked using the default embarkation point, it is disembarked next to the former parent entity. If the entity was embarked using a position override, it is disembarked in the same location as the former parent.

To disembark an entity in the Embarkation View:

1. Open the Embarkation View.
2. Drag the entity you want to disembark off of the parent entity to the force level.

Disembarking All Entities

When you disembark all entities from a parent, the placement of the entities depends on how they were embarked. If the entities were embarked with the Embark On command or the Embark task, they are disembarked to separate locations near the parent. If they were embarked with the Embarked set data request, they are all disembarked in the same location in the center of the parent entity. Since this behavior is usually not desirable, you should understand how you embarked the entities before you use this command.

To disembark all entities from a parent entity:

1. Select the parent entity.
2. Choose **Entities** → **Disembark All**.

3.4. Embedded Entities

Embedded entities are a convenient way to manage entities that are typically embarked on other entities.

Ships, planes, and vehicles often carry other platforms or personnel. You can simulate this relationship by embarking entities on other entities. However, this involves creating the embarking entities, giving them plans, embarking them, disembarking them, and otherwise managing the relationship. This can be inconvenient if you need to simulate large numbers of embarked entities, such as the airplanes and helicopters on an aircraft carrier or multiple personnel on a personnel carrier.

The embedded entity feature lets you configure entities with a set of embedded entities. You can then deploy the embedded entities and give them tasks or plans. Once deployed, there is no difference between an embedded entity and any other entity, except that a parent entity can recover a deployed entity. You do not need to manage the initial process of creating the relationship between the entities via embarkation and disembarkation.

3.4.1. Configuring an Entity to Support Embedded Entities

Embedded entities are configured in systems, which you then add to an entity in the Entity Editor. An entity can have only one embedded entity system. Therefore, if you need different configurations of embedded entities for different parent entities, you must create a system for each configuration.

Within a configuration, you must specify each embedded entity. In other words, you cannot specify a system as containing, for example, 5 helicopters and 40 F/A-18 jets. In this case the system would have to individually specify each helicopter and each jet.

A system definition file for embedded entities specifies the entities and the metadata needed to edit properties in the Entity Editor. You must give each entity a unique name.

An entity is formatted as follows (from `./data/simulationModelSets/EntityLevel/vrf/Sim/systems/other/ddg-embedded-support-craft.sysdef`):

```
(embedded-entities
  (ee-1
    (entity-name "SH-60 Seahawk Alpha")
    (entity-type 1 (1 2 225 22 3 1 0))
    (deployment-time 0.0)
    (recovery-distance 35.0)
    (relative-position $rel-pos-lamps-a)
    (relative-heading $rel-heading-lamps-a)
  )
  ...
  (ee-2
    (entity-name "RHIB Alpha")
    (entity-type 1 (1 3 225 63 8 0 0))
    (deployment-time 15)
    (recovery-distance 50.0)
    (relative-position $rel-pos-rhib-a)
    (relative-heading $rel-heading-rhib-a)
  )
  ...
)
```

The `relative-position` and `relative-heading` parameters are variables that link to the meta-data, as follows:

```
(parameter-data-list
  (vector-parameter-data
    (parameter-name "rel-pos-lamps-a")
    (variable-type "DtRwVector")
    (display-label "Seahawk Alpha's relative position")
    (display-units "meters")
    (source-units "meters")
    (default-value -75.000000 0.000000 -6.500000)
    (relative-to "")
  )
  (vector-parameter-data
    (parameter-name "rel-pos-rhib-a")
    (variable-type "DtRwVector")
    (display-label "Rigid-hull Alpha's relative position")
    (display-units "meters")
    (source-units "meters")
    (default-value -75.000000 10.000000 -6.500000)
    (relative-to "")
  )
  ...
  (real-parameter-data
    (parameter-name "rel-heading-lamps-a")
    (variable-type "DtRwReal")
    (display-label "Seahawk Alpha's relative heading")
    (display-units "degrees")
    (source-units "degrees")
    (default-value 0.000000)
  )
  (real-parameter-data
    (parameter-name "rel-heading-rhib-a")
    (variable-type "DtRwReal")
    (display-label "Rigid-hull Alpha's relative heading")
    (display-units "degrees")
  )
)
```

```
(source-units "degrees")
(default-value 90.000000)
)
...
)
```

Figure 3-4 illustrates the properties dialog box created for the system shown in previous paragraphs.

DDG Embedded Support Craft (LAMPS/RHIB) (other-3) Properties

System that allows an entity to deploy and recover Embedded Entities appropriate to a ship with supporting LAMPS units.

Seahawk Alpha's relative position

Forward (m): -75

Right (m): 0

Up (m): 6.5

Seahawk Bravo's relative position

Forward (m): -75

Right (m): 0

Up (m): 6.5

Rigid-hull Alpha's relative position

Forward (m): -24

Right (m): 12

Up (m): 0

Rigid-hull Bravo's relative position

Forward (m): -33

Right (m): 12

Up (m): 0

Seahawk Alpha's relative heading (deg): 0.0000

Seahawk Bravo's relative heading (deg): 0.0000

Rigid-hull Alpha's relative heading (deg): 0.0000

Rigid-hull Bravo's relative heading (deg): 0.0000

OK Cancel

Figure 3-4. Embedded Entity Properties dialog box

3.4.2. Deploying Embedded Entities

To add an embedded entity to a simulation, you deploy it from the parent entity. You can deploy an embedded entity explicitly or implicitly (by assigning a task to it). An embedded entity's label displays its name and the name of its parent.



There is a delay of a few seconds from the time a deployment is ordered and the time it is executed.

To deploy an embedded entity explicitly:

1. Select the parent entity.
2. Choose **Task** → **Embedded Entity** → **Deploy**. The Deploy dialog box opens.
3. Select the entity you want to deploy.
4. Click OK. The embedded entity gets deployed next to the parent entity in the relative position in its configuration.

3.4.3. Deploying an Entity with a Task

You can assign a task to a deployable entity, that is, an embedded entity that has not been deployed yet. This implicitly deploys the entity so that it can execute the task. You can assign a task to an embedded entity in the parent's plan or you can assign a task to a parent entity that requires it to deploy an embedded entity. The Sector Search example scripted task is an example of how to task a parent entity to deploy an embedded entity.



There is a delay of a few seconds from the time a deployment is ordered and the time it is executed.

To assign a task to a deployable entity in a parent's plan:

1. Select the parent entity.
2. Choose **Entities** → **Plan**. The Plan window opens.
3. Choose **Embedded Entities** → *entity* → **Task** (or **Set**) → *task* (or *set*), where *entity* is one of the entities that the parent can deploy and *task* (or *set*) is one of the tasks or sets on the Task or Set menu. An appropriate dialog box for the task or set opens.



If an entity does not have embedded entities, the Embedded Entities menu is not available.

4. Fill out the dialog box like you would for any task or set.

5. Click OK. The task is added to the plan. When you run the scenario, the embedded entity gets deployed and is assigned the task or set.

3.4.4. Recovering Deployed Entities

If you want an embedded entity that has been deployed to return to its parent, you can have the parent recover it. If you do not recover it, the deployed entity continues to function in the scenario just like any other entity.

To recover a deployed embedded entity:

1. Select the parent entity.
2. Choose **Task** → **Embedded Entity** → **Recover**. The Recover Embedded Entity dialog box opens.
3. Select the entity you want to recover.
4. Click OK. The parent sends a message to the deployed entity to return. It returns and is embedded again.

3.4.5. Assigning Tasks and Plans to Embedded Entities

Once an embedded entity is deployed, it is just like any other entity in the scenario. You can give it independent tasks or write a plan for it. Follow the standard procedures for these activities.

3.4.6. Restoring an Entity that has Embedded Entities

If you deploy an embedded entity and it gets destroyed, it is removed from the scenario and is not available to be deployed again. However, if you restore a parent entity and it had deployed entities that were subsequently destroyed, it is restored to the full complement of embedded entities. Entities that are deployed at the time the parent is restored are not affected. They are not duplicated in the parent's inventory and their relationship is not affected.

3.5. Collision, Obstacle, and Feature Avoidance

By default, in entity-level simulations, entities avoid other entities, features, and obstacle control objects. If, while carrying out a task, a ground, lifeform, or rotary-wing entity detects that it is on course to collide with another entity, a feature, or an obstacle, it alters its route to avoid the collision. Then it returns to its task.



In aggregate-level simulations, there is no collision avoidance between entities. If an aggregate encounters an obstacle, it stops, sends a message to the console, and awaits further instructions.

When an entity avoids an obstacle, it does not necessarily follow the outline of the obstacle, it avoids the obstacle's bounding volume, which is conceptually the smallest rectangle that bounds all of the points in the obstacle.

Ground entities avoid features, such as buildings and plants. By default, entities avoid other entities (some cultural features are created as entities), buildings, water, and vegetation. (LCACs do not avoid vegetation by default.)

Collision avoidance has the following qualifications:

- To specify that ground entities should not move through the terrain (for example, through a wall or through a hill), set the **check-terrain-collisions** parameter in the automotive actuator component (powertrain) to True. For performance reasons, it defaults to False, so that entities that do not care about terrain collisions do not perform the check.
- If an entity is tasked to move to a point that is inside an obstruction, or very close to one, it might never reach the point, but it will continue to try to reach the point as long as the task is in effect. This behavior also applies to entities following routes that have vertices inside an obstruction.
- If a terrain has geometric features as well as point vector features, the feature avoidance may not work because the points are placed on the terrain on “top” of the existing geometry, which means they are on top of the geometric feature.
- Do not place entities inside obstacles. Their behavior will be unpredictable.
- Although you can assign a force to an obstacle when you create it, it has no effect on entity behavior. Entities avoid all obstacles.

You can configure the objects that an entity will avoid by editing its entry in the object parameter database. For details about configuring obstacle avoidance, please see Section 10.10, “[Configuring Obstruction Avoidance](#),” in *VR-Forces Configuration Guide*.



The B-HAVE Module for VR-Forces, an extra-cost plug-in for VR-Forces provides improved collision avoidance using advanced AI techniques.

3.6. Entity Movement and Soil Type

In VR-Forces, the movement of entities is affected by the surfaces on which they are moving. The speed of movement over a given surface (as a percentage of ordered speed) is configured in the **soil-list** block in an entity's object parameter database entry.

[Table 3-1](#) lists the soil types supported for terrain databases and how they map to the roughness types that can be configured in the **soil-list** block for VR-Forces entities.

Table 3-1: Soil type/roughness type mappings

Soil type	Roughness type
ocean	deep-water
deepLake	deep-water
shallowLake	shallow-water
deepRiver	deep-water
shallowRiver	shallow-water
shallowPond	shallow-water
shallowStream	shallow-water
dryGround	hard-packed
pavedRoad	paved-road
gravelRoad	gravel
dirtRoad	gravel
asphalt	hard-packed
USRailroad	hard-packed
softSoil	sand
swamp	muck
mud	muck
forest	hard-packed
grass	hard-packed
cultivatedFields	hard-packed
orchards	hard-packed
rock	rocks
boulder	rocks
sand	sand
building	hard-packed
tree	hard-packed



3.7. Using a Joystick to Control Entities

VR-Forces supports use of joysticks to control ground, fixed-wing, and rotary-wing entities. The default joystick parameters are specified in the file `.appData/settings/vrfSim/joyParam.dat`. (For details, please see Section 10.9, “[Configuring Joysticks](#),” in *VR-Forces Configuration Guide*.) You can override the default values for specific entities by editing parameters for the joystick controller in the system definition file for an entity’s movement system.



-
- ♦ The joystick must be connected to the computer on which the entity is being simulated.
 - ♦ You cannot enable or disable joystick support for all entities at once. You can only enable joysticks for individual entities.
 - ♦ Embarked entities controlled by joystick cannot disembark. For example, if you use a joystick to control a fixed-wing taking off from a carrier, the aircraft will take off, but it will remain in an embarked state.
-

To enable or disable joystick use:

1. Select the entity for which you want to enable or disable joysticks.
2. Choose **Entities** → **Enable Joystick** or **Disable Joystick**.



4. Simulating Aggregates

This chapter explains how to create and manage aggregate entities.

Introduction to Aggregates	4-2
Creating Aggregates	4-2
Creating an Aggregate by Combining Existing Entities	4-2
Creating a Preconfigured Aggregate	4-5
Configuring the Aggregate Creation State.....	4-6
Selecting an Aggregate.....	4-6
Adding Entities to an Aggregate.....	4-7
Removing an Entity from an Aggregate.....	4-8
Entity-Level Aggregates and Aggregate State	4-8
How an Aggregate's State is Shown	4-9
How Changing Aggregation State Affects an Aggregate	4-10
Triggering Aggregate State Transitions.....	4-12
Aggregating and Disaggregating Entities Manually	4-12
Configuring Automatic Aggregation and Disaggregation.....	4-13
Using Disaggregation Areas	4-13
Writing Plans for Aggregates	4-13
Deleting an Aggregate.....	4-13

4.1. Introduction to Aggregates

VR-Forces supports two types of aggregates – entity-level aggregates, which are created in scenarios that use *EntityLevel.sms*, and aggregate-level aggregates, which are created in scenarios that use *AggregateLevel.sms*. The procedures for creating and managing these two types of aggregates are similar in many respects. This chapter describes procedures that they share and some procedures that only apply to entity-level aggregates.

4.2. Creating Aggregates

You can create an aggregate by selecting existing entities (which can be individual entities or aggregate entities) and combining them to form an aggregate entity, or by placing a preconfigured aggregate from the Entities Palette.

When you create an aggregate, it is created as a subordinate to the force level. You cannot create aggregates that are subordinates of an existing aggregate. Once you create an aggregate, you can subordinate it to another aggregate. (For details, please see [“Adding Entities to an Aggregate,”](#) on page 4-7).

By default, in entity-level scenarios, aggregates are created in a disaggregated state. However, you can change this behavior. For details, please see [“Configuring the Aggregate Creation State,”](#) on page 4-6.



Except where noted, the procedures for creating and editing aggregates apply to entity-level aggregates and aggregate-level aggregates.

4.2.1. Creating an Aggregate by Combining Existing Entities

When you create an aggregate by combining entities, you can specify the order of subordinates in the aggregate. This determines which subordinate is considered the aggregate leader and affects the assignment of echelon IDs. (It also affects the icon used to represent the aggregate.) You cannot change the subordinate order after you create the aggregate.



- When you create an aggregate entity, the members of the aggregate get new echelon IDs to reflect the new entity hierarchy.
 - If the entities that you are aggregating have plans and your aggregate setting is to aggregate new aggregates, the plans are deleted. However since entity plans get deleted whenever an aggregate enters the aggregated state, you cannot count on entities keeping their plans even if you change this setting.
-

To create an aggregate by combining existing entities:

1. Select the entities that you want to become part of an aggregate.
2. Choose **Entities** → **Aggregate As**. The Aggregate As dialog box opens (Figure 4-2).

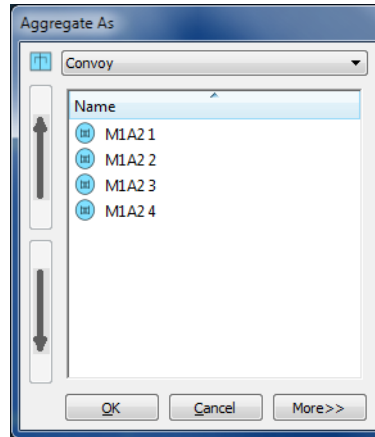


Figure 4-1. Aggregate As dialog box

3. Select an aggregate type from the list.



- ♦ The Convoy aggregate can only be assigned convoy tasks. Its only purpose is to allow you to quickly aggregate miscellaneous ground vehicles into a convoy. You cannot aggregate or disaggregate a convoy aggregate.
- ♦ The default list of aggregate types is limited and is different for entity-level scenarios and aggregate-level scenarios. You can specify the aggregate types that are on the list in the Entity Editor. For details, please see Section 7.3, “Specifying an Aggregate As Option,” in *VR-Forces Configuration Guide*.

4. Optionally, customize the entity type enumeration for the aggregate, as follows:
 - a. Click More. The dialog box expands to show the entity type enumeration for the aggregate type selected.

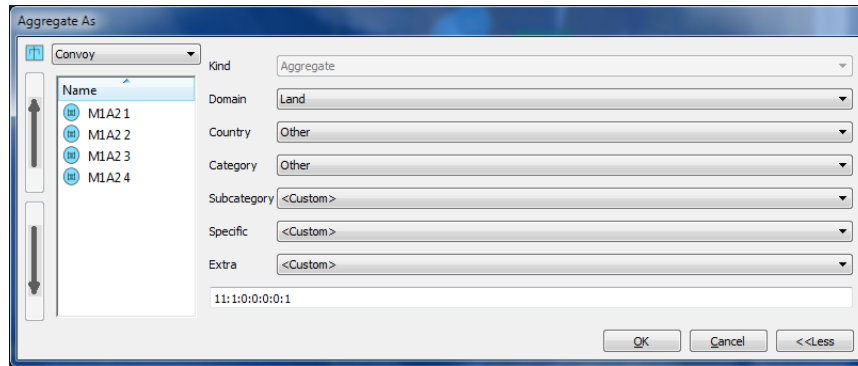


Figure 4-2. Aggregate As dialog box

- b. Edit the enumeration by selecting values from the lists, or by typing an enumeration.



If an edit to the enumeration results in an entity type that does not match the aggregate type selected in the list, the list entry does not change. However, the aggregate will be created with the entity type specified by the custom enumeration.

5. Optionally, change the order of subordinates, as follows:
 - a. Select the subordinate whose order you want to change.
 - b. Click the up or down arrow to move it to a new position in the list of subordinates.
6. Click OK.

By default, entity-level aggregates are created in a disaggregated, collapsed format. The icons for individual members are hidden. You can change the default aggregation state. For details, please see [“Configuring the Aggregate Creation State,”](#) on page 4-6. Aggregated state does not apply to aggregate-level entities. They are always created in expanded format.

4.2.2. Creating a Preconfigured Aggregate

The entity-level SMS includes preconfigured aggregates at several hierarchical levels. You can configure these entities and add additional aggregates in the Entity Editor. (For details, please see Section 7.4, “[Editing Aggregate Composition](#),” in *VR-Forces Configuration Guide*.)

You can create preconfigured aggregates by selecting them on the Entities Palette and follow the standard procedures for creating entities. The abbreviations in the aggregate names have the following meanings:

- ♦ ADA. Air defense artillery.
- ♦ COLT. Combat observation lasing team.
- ♦ CSS. Combat service support.
- ♦ FA. Field artillery.
- ♦ MI. Mechanized infantry.



You can add additional preconfigured aggregates to the Entities Palette by creating them in the Entity Editor.

4.2.3. Configuring the Aggregate Creation State

This procedure only applies to entity-level aggregates.

To configure the aggregation state used when aggregates are created:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Entity Behavior Options page ([Figure 4-3](#)).

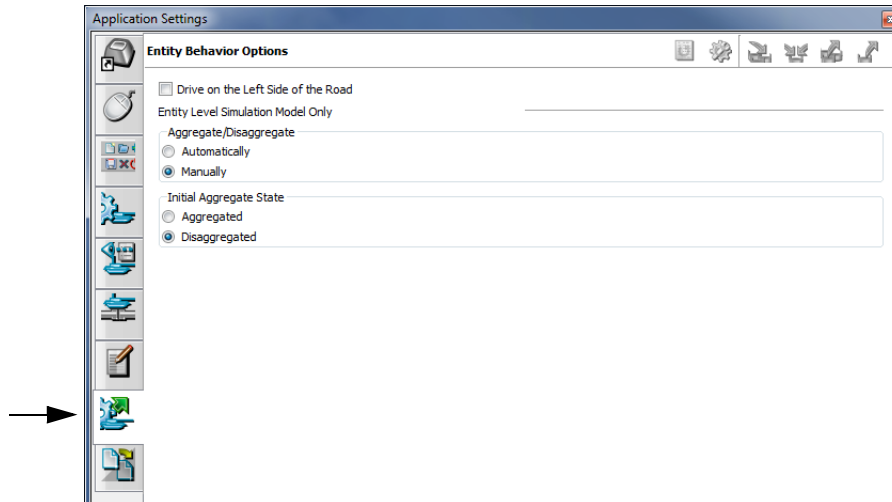


Figure 4-3. Entity Behavior Options page

3. In the Initial Aggregate State group box, select the creation option that you want.
4. Click OK.

4.3. Selecting an Aggregate

- To select an aggregate, select its icon on the terrain, or select it in one of the views on the Objects List Panel.

4.4. Adding Entities to an Aggregate

- To add an entity to an aggregate, in the Echelon View, select the entity you want to add and drag it onto the aggregate as illustrated in [Figure 4-4](#). Notice that the name of the aggregate stays the same, but its echelon ID changes.



You can add entities to an entity-level aggregate only if it is in the disaggregated state.

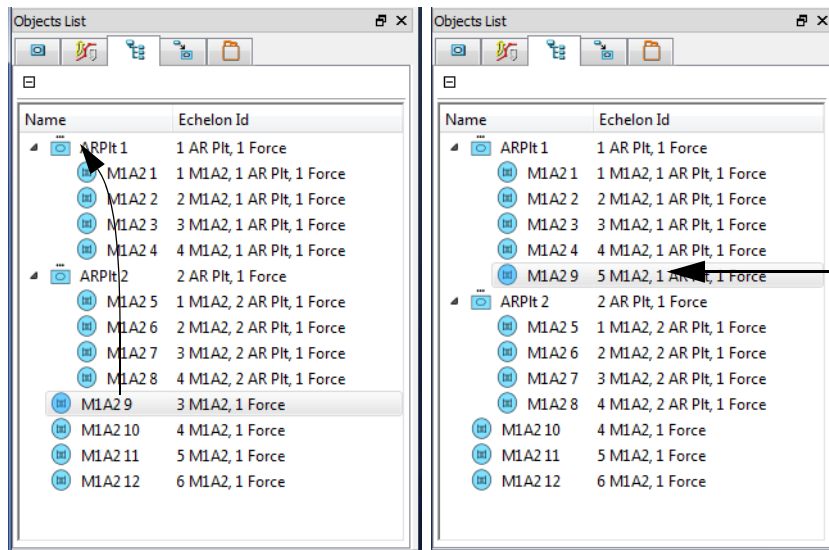


Figure 4-4. Adding an entity to an aggregate

4.5. Removing an Entity from an Aggregate

- To remove an entity from an aggregate, in the Echelon View, drag the entity from the aggregate to the force level in the window, as illustrated in [Figure 4-5](#), or into another aggregate. Notice that the name of the aggregate stays the same, but its echelon ID changes.



You can remove entities from an entity-level aggregate only if it is in the disaggregated state.

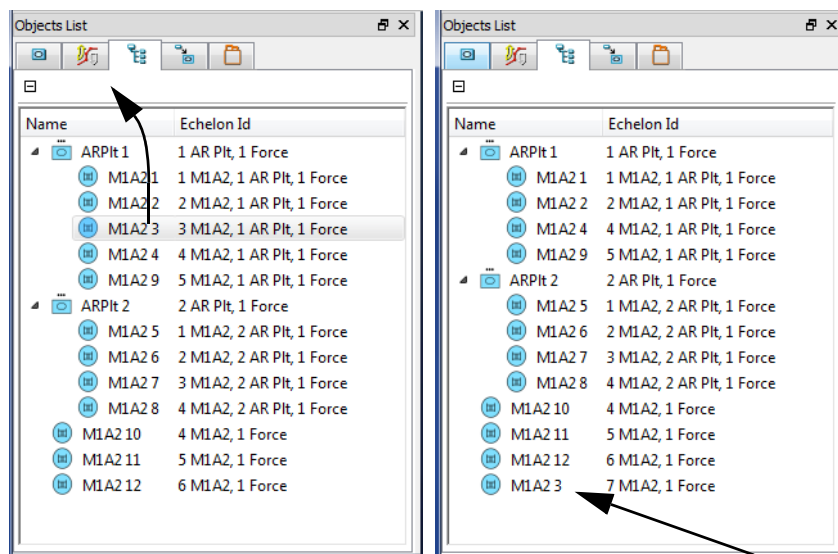


Figure 4-5. Removing an entity from an aggregate

4.6. Entity-Level Aggregates and Aggregate State

It is important to understand the differences between an aggregate entity that is in the aggregated state and one that is in the disaggregated state. The types of aggregates are introduced in Section 3.6, “[Aggregate Modeling](#),” in *VR-Forces Users Guide*. This section provides additional details about how aggregates function in the two different aggregation states.



The Convoy aggregate does not support aggregation and disaggregation.

4.6.1. How an Aggregate's State is Shown

Aggregates publish their current aggregate state using the DIS/RPR FOM aggregate state enumeration. The current value for this parameter is displayed on the Aggregate Information page in an aggregate's information dialog box (Figure 4-6). It can be accessed in the aggregate's *DiVrfAggregateStateRepository* member.

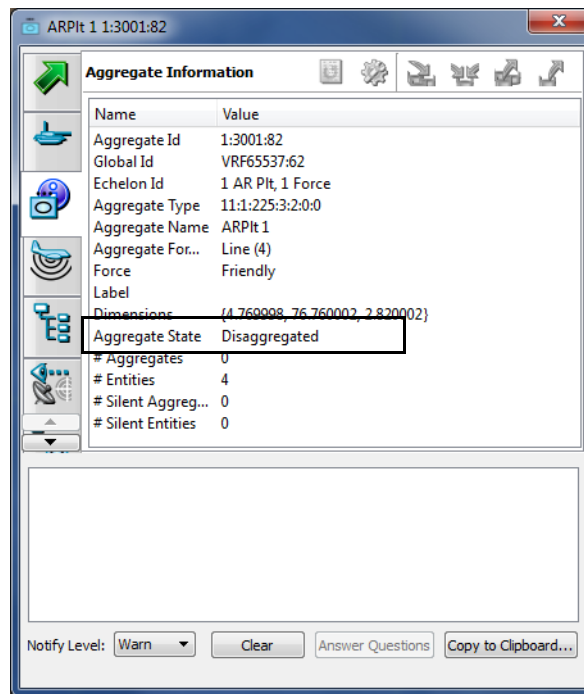


Figure 4-6. Aggregate Information page

Aggregated State

When an aggregate is in the aggregated state, its subordinates do not exist as distinct entities. It does not have any subordinates shown in the Echelon View or on the Subordinates tab of its information dialog box. It does not display ghosted icons for subordinates. You cannot expand or collapse it.

Disaggregated State

When an aggregate is in the disaggregated state, its subordinates are simulated as distinct entities. (However, it is possible to have a disaggregated aggregate with no subordinates.) Subordinates are displayed under the aggregate in the Echelon View and are listed on the Subordinates tab of its information dialog box. You can expand or collapse the aggregate view.

4.6.2. How Changing Aggregation State Affects an Aggregate

Aggregates can change their aggregation state at runtime. All state information maintained by the aggregate (for example, the current task it is executing, plan state, current resource levels) is maintained across the transition between aggregated and disaggregated states. This section describes how aggregates handle transitions for the most important activities.

Movement

All movement tasks can be executed in either aggregated or disaggregated state. Aggregates can transition between states at any time, without interrupting movement tasks. For example, suppose an aggregate in the disaggregated state, is executing a move-to-location task. While it is executing the task, you issue a `Aggregate State set data` request, indicating it should switch to the aggregated state. The aggregate transitions into the aggregated state (subordinates are deleted, and the state associated with them is mapped and stored internally in the aggregate), and continues moving toward its destination. Similarly, making a transition in the opposite direction while executing a movement task, does not interrupt the execution of that task.

Aggregates preserve their formation across aggregate state transitions.

Combat

Only disaggregated aggregates can engage in combat. However, an aggregate remembers any loss of resources or subordinates while it is aggregated. If a subordinate is destroyed while the aggregate is disaggregated, it will not be created again if the aggregate aggregates and then disaggregates again.

Resources

Resources are tracked and restored across state transitions. However, if a subordinate is destroyed while in the disaggregated state, then all of its resources are lost. They are not redistributed to other subordinates.

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When you restore an aggregate that is in the aggregated state (using Restore), the original configuration of the aggregate is recreated. If you restore an aggregate that is in the disaggregated state, then only those subordinates still present in the simulation are restored. Any destroyed subordinates that were previously removed from the simulation as result of a disaggregate-->aggregate-->disaggregate transition are not restored. To fully recover all subordinates, restore the aggregate while in the aggregated state.

Entity Plans and Tasks

While an aggregate is disaggregated, individual entities can be given tasks and plans. However, when the aggregate aggregates, all tasks and plans are discarded. If the initial aggregate creation state is set to Aggregated and you create an aggregate from existing entities, if the entities have plans, the plans are discarded. (For information about settings the initial aggregation state, please see [“Configuring the Aggregate Creation State,”](#) on page 4-6.)

4.7. Triggering Aggregate State Transitions

Aggregate state transitions can be initiated manually or automatically, as follows:

- ♦ **Manually:** You can send an Aggregate State set data request or use Aggregate and Disaggregate commands on the Entities menu. This immediately forces the aggregate to change state. As a set data request, state changes can be included in plans.
- ♦ **Automatically:** On the Entity Behavior Options page of the Application Settings dialog box, you can configure automatic aggregation and disaggregation. In automatic mode, aggregates automatically aggregate or disaggregate according to the following rules:
 - If the aggregate is within “disaggregation range” of a hostile entity or aggregate, the aggregate is in the disaggregated state. Disaggregation range is the range around an entity or aggregate in which you want to force any nearby aggregated entities to disaggregate so you can detect or engage them. This range is configurable for every type of entity and aggregate in the Entity Editor. (You must show advanced parameters to set this parameter.)
 - If the aggregate’s formation footprint (projection of its bounding extent in a topographic plane) overlaps a disaggregation area, the aggregate is in the disaggregated state. (A disaggregation area is a specific type of control object.)
 - If neither of the above conditions is in effect, the aggregate is in the aggregated state.

4.7.1. Aggregating and Disaggregating Entities Manually

To aggregate a disaggregated entity:

1. Select the aggregate.
2. Choose **Entities** → **Aggregate**.



You can also change an aggregate’s state with the Aggregate State set data request (which also means that you can change state from within a plan).

To disaggregate an aggregated entity:

1. Select the aggregate.
2. Choose **Entities** → **Disaggregate**.

4.7.2. Configuring Automatic Aggregation and Disaggregation

To configure automatic aggregation and disaggregation:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Entity Behavior Options page ([Figure 4-3](#)).
3. In the Aggregate/Disaggregate group box, select Automatically or Manually.
4. Click OK.

4.7.3. Using Disaggregation Areas

When an aggregated entity that has automatic aggregation and disaggregation enabled enters a disaggregation area, it disaggregates. When it leaves the area, it aggregates again. A disaggregation area is a control object. You create one just like any other area, as described in Chapter 2, [Creating and Placing Objects](#).

4.8. Writing Plans for Aggregates

- To write a plan for an aggregate, follow the procedures for writing a plan for an entity in Chapter 11, [Writing Plans](#).

4.9. Deleting an Aggregate



If you delete an aggregate, all its member entities get deleted.

To delete an aggregate:

1. Select the aggregate.
2. Choose **Entities** → **Delete**.



5. Simulating Aggregate-Level Aggregates

This chapter describes the aggregate warfare model and how entities created using the `AggregateLevel.sms` work.

The Aggregate Warfare Model.....	5-2
Aggregate Combat.....	5-3
Aggregate Footprints	5-4
Aggregate Posture	5-4
Aggregate Movement.....	5-6
Limited Munition Attack	5-7
Contamination Areas.....	5-7
Aggregate Sensors	5-8
Combat Engineering Objects.....	5-9
Concealed Obstacles.....	5-11
Creating Combat Engineering Objects	5-12
How Engineering Entities Create Engineering Objects.....	5-12
Logistics.....	5-14
Receiving Supplies.....	5-16
Providing Supplies.....	5-16
Electronic Warfare	5-17
Jamming Communications.....	5-17
Jamming Radar	5-18
Sensing Electronic Emissions.....	5-19

5.1. The Aggregate Warfare Model

VR-Forces supports a warfare model for aggregate-level scenarios. (For details about the difference between aggregate-level scenarios and entity-level scenarios, please see Section 3.6, “[Aggregate Modeling](#),” in *VR-Forces Users Guide*.) The aggregate warfare model requires use of *AggregateLevel.sms* and only works with HLA Evolved and the extended aggregate FOM.

The aggregate warfare model is data-driven. Entities have combat power and combat vulnerability. Their overall state is expressed as their health. These are abstract values that represent relative strengths of different aggregate entities.

When opposing force entities come into contact, they inflict damage on each other until one of the entities is destroyed or breaks off combat. An aggregate is considered killed when its health is 0.

Some of the features that distinguish aggregate-level scenarios from entity-level scenarios include:

- ♦ Footprint. The area occupied by the aggregate entity.
- ♦ Posture. The aggregate’s mode of interaction with the environment.
- ♦ Logistics. Management of personnel and materiel.
- ♦ Combat engineering objects. Tactical graphics that affect entity movement and health.
- ♦ Electronic warfare. The ability to jam communications.
- ♦ Reports. Some data tracked in a simulation is not used by the back-end. It is sent over the network to be used by command and control systems and human participants.

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AggregateLevel.sms includes some individual entities, such as surface vessels and aircraft. However, these entities also use the aggregate warfare model. They do not behave like they would if you were using the same entity types in entity-level modeling.

5.1.1. Aggregate Combat

Combat power is the ability of an entity to cause casualties and damage, and is a function of how many weapons it has, the size (destructive power) of their munitions, the rate of fire of the weapons, the accuracy of the weapons, and the effectiveness of the subordinate entities in conducting an attack (tactics, coordination, target selection, and so on).

An aggregate-level entity's ability to engage in combat is expressed as a strength value in one or more of the following five domains:

- ♦ Anti-air
- ♦ Anti-tank
- ♦ High explosive
- ♦ Anti-personnel
- ♦ Anti-ship.

The strength value describes the attrition rate per second imposed on the target by the attacking entity. A combat domain has a range. When an opposing force entity is within the range of a combat domain for which an entity has strength, it attacks the entity.

Health is a function of the amount of equipment, personnel, or both in the entity, and the difficulty in destroying them. For example, an entity with 10 tanks would have twice the health of an entity with 5 of the same kind of tank.

Entities also have a vulnerability in each of these domains. Base vulnerability describes how susceptible an entity is to a given category of weapon. In particular, it describes how easy it is to hit and kill the equipment in the entity with the given category of weapon. For example, infantry is very susceptible to high explosive munitions, light armor fairly susceptible, and heavy armor not very susceptible.

Vulnerability is expressed as a modifier of the combat power (attrition rate) of the attacker. It is multiplied by the attrition rate to calculate the actual damage. For example, a Mech Inf CO US has an Anti-personnel strength of 78. A Mech Inf CO RU has an Anti-personnel vulnerability of .1. If the US company attacks the Russian company, the actual damage for personnel will be $78 * 0.1 = 7.8$ per second.

Both combat power and vulnerability are modified by a variety of factors, including posture, MOPP level, sector, and morale. The combination of all modifiers results in the final attrition rate.

The attrition across all domains is applied to the entity's health. If health declines to 0, the entity is killed.

5.1.2. Aggregate Footprints

An aggregate footprint is an abstract representation of the area the aggregate occupies with vehicles, personnel, and equipment. An aggregate will take damage from events that occur within its physical footprint, such as explosions or other entities firing into that area.

The physical footprint has four sectors: front, rear, left flank, and right flank. The interactions of the aggregate with other entities in the scenario varies based on which sector another entity is encountered on. For example, an aggregate is typically much more vulnerable to attack on the rear and flank sectors.

Both the physical footprint size and the size of the sectors for an aggregate are configured with a base value, but can then change during the scenario depending on actions of the entity.



The footprint is always circular. The footprint parameter describes the radius.

5.1.3. Aggregate Posture

Posture refers to an aggregate's overall mode of interaction with its environment. It is an abstraction of the positioning of the equipment and personnel of the aggregate within the physical footprint, and the state of readiness of the aggregate for various activities.

The supported postures are:

- ♦ Deliberate-Defense. Planned, prepared. Lower mobility, lower vulnerability, moderate attack power. Can be mobile defense or area defense.
- ♦ Hasty-Defense. Reactionary. Moderate mobility, moderate vulnerability, lower attack power. Happens when you first make contact with the enemy.
- ♦ Deliberate-Attack. Planned, prepared. Moderate mobility, moderate vulnerability, higher attack power.
- ♦ Hasty-Attack. Reactionary. Higher mobility, higher vulnerability, lower attack power. Happens when you first make contact with the enemy.
- ♦ Reconnaissance. Mobile maneuver, locate and report on enemy, avoid detection, avoid engagement (if you can).
- ♦ Travel. Very high mobility, but very vulnerable to attack and low attack power. Useful when the aggregate is moving from one location to another in a safe area.
- ♦ Rout. Health is less than 50% and entity is under attack. It cannot change to another posture until its health exceeds 50%.

An aggregate's posture affects:

- ♦ Footprint. The amount of space that the aggregate occupies.
- ♦ Sensing. For example, in reconnaissance posture the aggregate detects objects more quickly and at a greater distance than in a defensive posture.

- ♦ Sensor signature. The ability of other aggregates to detect an aggregate is affected.
- ♦ Movement speed.
- ♦ Sector sizes.
- ♦ Combat power. Many weapon systems can only be used in certain postures. In particular, most cannot be used in Travel posture (which is the posture an entity is in when it is created).
- ♦ Vulnerability.

When an aggregate transitions between postures, it does so over time. Transitions may take up to several hours. The transition delay models the planning and preparation necessary to perform the task expected in the new posture. For example, deliberate defense is a well prepared defense that assumes planning fires, digging fighting positions, and so on. It significantly reduces the vulnerability of the defender. However, it may require 3 hours to transition to this posture. Hasty attack is the only posture that does not require a long transition time, as it is the posture for quick actions on contact, meeting engagements, pursuits, and so on. Transition times between each posture are configured in the Entity Editor.

Defense postures assume stationary defense.

Aircraft and ships generally do not distinguish postures, except that they are not battle-ready in Travel.

5.1.4. Aggregate Movement

Aggregates try to move at their ordered speed. The movement speed of an aggregate over the terrain depends on many factors, including the following:

- ♦ The slope of the terrain and the broad categories of the terrain underneath the aggregates, alter the maximum possible travel speed.
- ♦ Roads allow aggregates to move more quickly, while restricted areas like forests or cities slow them down.
- ♦ Rivers and water bodies may stop an aggregate completely, although bridges allow them to cross.
- ♦ Overlapping footprints cause aggregates to slow down.



The movement speed modifiers for slope, terrain, footprint overlap, MOPP, posture, and so on only affect maximum speed. If ordered speed is less than the net modified max speed, you will not see a change in speed due to these factors.

For movement speed calculations, the center point of the aggregate is used to determine what type of terrain the aggregate is on.

If the footprints of two aggregates overlap, their movement is slowed based on their Max Speed Modifier When Overlapping Another Unit parameter. This parameter is set on the Movement tab for an aggregate in the Entity Editor. The lower the value, the greater the movement penalty. When aggregate footprints overlap, the lowest modifier among all overlapping aggregates is applied to all of them.



Aggregate-level simulations do not support collision avoidance among entities.

The effect of terrain features on movement is configured in an aggregate's movement system. For details, please see Section I.8, “[Configuring Aggregate-Level Movement Restrictions](#),” in *VR-Forces Configuration Guide*.

VR-Forces supports a variety of combat engineering objects that affect entity movement. They may cause an aggregate to go more slowly or they may damage the aggregate. For information about combat engineering objects, please see “[Combat Engineering Objects](#),” on page 5-9.

5.1.5. Limited Munition Attack

Most aggregate-level combat is automated and continues until a combatant is killed or combatants run out of ammunition. There are no specific fire or detonation interactions involved and combat essentially takes place in the background. The aggregate warfare model also supports limited munition attacks, in which a limited amount of munitions are used and the attack then ends. In the case of artillery, this is a specified number of rounds from a battery, delivered over a short time. In the case of large munitions such as missiles and bombs, the attack for each munition is generally instantaneous. VR-Forces does not model the time it takes for a munition to reach its target.

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Not all missile attacks are modeled as limited munition attacks. Anti-tank missiles in ground aggregates, for example, are launched by multiple launchers in the entity against multiple targets in the defender, and are modeled with normal combat power.

Individual missile attacks typically make use of a hit factor from the attacker and a defense factor from the defender to determine a hit probability. The missile must hit before its combat power is applied in an attack.

5.1.6. Contamination Areas

The aggregate warfare model supports nuclear, biological, and chemical contamination areas (NBC areas) that may damage or impede an aggregate. You can create contamination areas as tactical graphics, or entities with nuclear, biological, or chemical weapon systems can create them as a result of attacking with these weapons.

Contamination areas have parameters that are similar to other areal tactical graphics, plus the following parameters:

- ♦ Agent type. The type of contamination. It determines the configuration used for damage calculations.
- ♦ Terrain type. Informational only; not used by VR-Forces.
- ♦ Topography type. Informational only; not used by VR-Forces.
- ♦ Vegetation type. Informational only; not used by VR-Forces.

The terrain, topography, and vegetation types are published by VR-Forces, but do not affect aggregate modeling or interaction. They may be useful to other applications that interact with VR-Forces.

By default, NBC hazard areas are placed on the Contamination Areas overlay.

Contamination (NBC) Areas and MOPP Level

VR-Forces supports nuclear, biological, and chemical (NBC) contamination areas.

When an aggregate is attacked by NBC weapons or enters an NBC area, it suffers attrition. It stops its current task and increases its mission oriented protective posture (MOPP) level until it stops suffering attrition. Then it resumes its task. However, any contamination that took place persists.

If an aggregate is moving and it detects an NBC hazard area in its path, it stops moving and increases its MOPP level to a point that will allow it to pass through the hazard area without suffering attrition.

Increasing MOPP level affects an aggregate's speed, combat effectiveness, sensor sensitivity, posture transition time, and vulnerability.

5.1.7. Aggregate Sensors

Aggregate-level entities use the same sensor signature mechanism as entity-level entities. Sensor systems allow them to detect other entities in various domains. Sensor signatures indicate how detectable they are by other entities in the applicable domains. The main difference between aggregate-level entities and entity-level entities is in the detection checks. Entity level entities do a line-of-sight check from the center of the entity. Aggregate-level entities do three checks – from the center of the outer ring of the footprint and from the edges of the circumference of the footprint, as illustrated in [Figure 5-1](#).

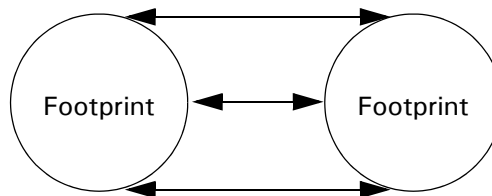


Figure 5-1. Aggregate level sensing

5.2. Combat Engineering Objects

VR-Forces supports a variety of combat engineering objects that affect aggregate movement. They may cause an aggregate to go more slowly or they may damage the aggregate. Combat engineering objects (CEOs), such as fortifications, can also protect an aggregate, in that they affect the effectiveness of opposing forces.

CEOs are displayed as tactical graphics. You can create combat engineering objects from the Hazard/Obstacles Palette. Also, aggregates can create combat engineering objects in response to combat engineering object tasks.

Aggregates can counter the presence of combat engineering objects by breaching them, bridging them, defusing them, or destroying them.

Combat engineering objects can have the following effects on aggregates:

- ♦ **Mobility.** CEOs can decrease entity mobility. Mobility modifiers are configured by mobility type. For instance, an object might affect the mobility of soldiers on foot more than tanks. When an entity comes in contact with an engineering object, it checks the object type's mobility modifier against the entity's mobility type. The entity slows down based on the modifier value.

The modifier is scaled based on the completion percentage of the object. Modifiers only affect the maximum speed, so speed will be affected only if the modified maximum speed is less than the current speed of the entity.

If an aggregate encounters an obstacle that obstructs its movement or may cause damage, it stops moving and sends a message to the console indicating that it is obstructed ([Figure 5-2](#)). The user must then tell it what to do. The console message may use the question and answer capability. (For information about console questions, please see [Section 7.12.3, "Answering Questions from Scripted Tasks"](#), in *VR-Forces Users Guide*.)

i

The entity may not be able to move until you respond to the question.

If an obstacle is concealed, the entity does not stop. For information about concealed obstacles, please see ["Concealed Obstacles,"](#) on page 5-11.

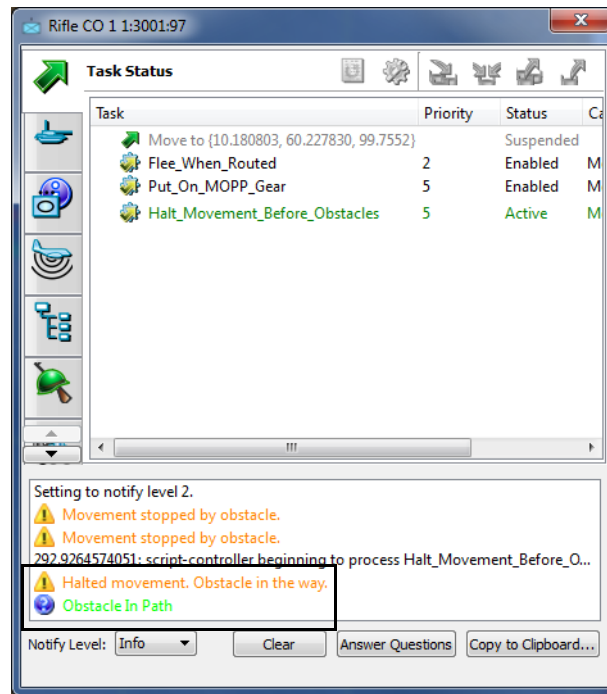


Figure 5-2. Question in entity console

- ♦ Mobility enabling. Certain types of engineering objects are treated as terrain features by a moving entity. For instance, an entity may determine that an engineering object represents a road or bridge, giving it additional path planning options. This capability is either on or off.
- ♦ Vulnerability. Vulnerability modifiers are configured by weapon type. For instance, a fortification might do very well at stopping anti-personnel weapons, but may do little or nothing to stop high explosives. When an entity under fire comes in contact with an engineering object, it checks the object type's vulnerability modifier against the attacking weapon's category. This may reduce the amount of damage the entity takes from that weapon.

The modifier is scaled based on the completion percentage of the object.

- ♦ Visibility. When an entity comes in contact with an engineering object with a visibility modifier, its visibility to opposing entities is increased or decreased accordingly.

The modifier is scaled based on the completion percentage of the object.

- ♦ Attrition over time. When an entity comes in contact with an engineering object that causes damage (for example a minefield), that entity continues taking damage over time as long as it remains in contact. The damage is configured as one of the existing damage/weapon categories, for example, high-explosive. Entities with more or less vulnerability to that damage type take more or less damage accordingly.

The attrition is scaled based on the completion percentage of the object.

- ♦ Immediate attrition. Some engineering objects cause one-time, immediate damage to any entity that comes in contact with them. For instance, an entity might trigger a hidden IED. Usually the engineering object is destroyed in the process.

The modifier is scaled based on the completion percentage of the object.

The various modifiers are configured for each CEO in the Entity Editor.

5.2.1. Concealed Obstacles

By default, minefields, booby traps and unexploded ordnance objects are concealed. (This attribute is configurable in the Entity Editor, so you can set it for other objects if you want to.) The engineering object sensor does not automatically detect concealed objects within its sensing radius. The sensor has a random (configurable) chance of detecting the object each sensor cycle that the object is within range.

If a sensor detects a concealed minefield, the Mark Minefield reactive task marks it as detected. Thereafter, the minefield is always 100% detectable. (The Mark Minefield reactive task is enabled by default.)

Aggregate movement systems check the concealed flag for obstacles. For non-friendly obstacles that are concealed, the “stop and ask” behavior is suppressed unless the object has been specifically detected by the sensor. Therefore, if the sensor has not detected the object, the entity enters it without first stopping and alerting you to the presence of the object.

Concealed objects are always discovered if they are causing damage to an entity.

5.2.2. Creating Combat Engineering Objects

You can create combat engineering objects directly from the Hazards/Obstacles Palette or you can task entities with the appropriate systems, such as combat engineering entities, to create them.

Combat engineering objects are implemented as points, lines, and areas, so you can create them the same way that you would create tactical graphics. Most areal CEOs are fixed size, which is configurable in the Entity Editor. You just have to specify the lower left corner of the area.

When you create a CEO from the Hazards/Obstacles Palette, you can give it a name, specify a layer and set all the parameters you would expect for that type of object. When you task an entity to create a CEO, it is given a default name and you can only specify its location.

Many tactical graphics have the same default names as CEOs, for example, fortified lines and minefields. They may also look the same on the map. However tactical graphics do not affect aggregate movement and combat the way that CEOs do. To help distinguish tactical graphics from CEOs, CEOs created by entities are placed on the Combat Engineering Object layer. It is recommended that if you create CEOs from the Hazards/Obstacles Palette, that you place them on the CEO layer.

5.2.3. How Engineering Entities Create Engineering Objects

When an entity with engineering capabilities creates a CEO, it expends construction material at a rate specified in the object's model (configured in the Entity Editor). Depending on the type of objects, the process can take hours of simulation time.

While an object is partially complete, its effectiveness is reduced. Some effects, such as enabling mobility over previously impassable terrain (for example by using bridges), do not take effect until the object is complete.



You can follow the progress of object construction in two ways. You can view the engineering entity's use of construction material on the Supplies page of its Information dialog box. You can view the percent of the object's completion on the Engineering Object Information page of the Information dialog box for the object ([Figure 5-3](#)).

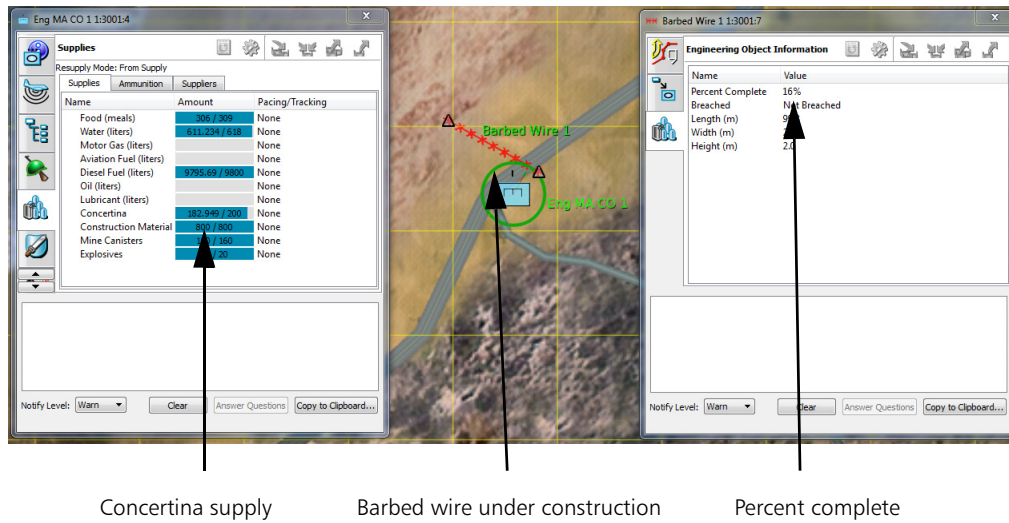


Figure 5-3. Road under construction

Aggregate entities create combat engineering objects as follows:

1. The entity moves within range of the location to create the object.
2. The entity creates a new object that is 0% complete. The object is displayed on the terrain.
3. The entity begins constructing the object. As it does so, its supply of construction material decreases.
4. When the object is complete or the entity runs out of construction material, it ends the task.

If a creating entity is interrupted and must halt construction, it notifies that object that construction has stopped. The object stays at its current level of completion, which may or may not be useful, depending on the object type. A constructing entity might also reduce its rate of construction if it takes damage.

If the constructing entity is able to resume construction or another entity is tasked to improve the object, it moves within range of the object and construction starts again.

Multiple entities with construction capability can work together. In order to task a second entity to assist the first, task it to improve the object under construction.

5.3. Logistics

Aggregates have resources, such as fuel, ammunition, and food. Over time, and particularly during combat, these resources are consumed. Logistics is the process by which an aggregate resupplies itself.

Aggregates can resupply the following resources:

- ♦ Health
- ♦ Food
- ♦ Water
- ♦ Motor Gas
- ♦ Aviation fuel
- ♦ Diesel fuel
- ♦ Oil
- ♦ Lubricant
- ♦ Anti-Tank
- ♦ High-Explosive
- ♦ Anti-Personnel
- ♦ Anti-Air
- ♦ Anti-Ship
- ♦ Large-Munition
- ♦ Other.

Anti-Tank, High-Explosive, Anti-Personnel, Anti-Air, and Anti-Ship refer to ammunition in that category. There is no distinction made between different ammunition names within a category. Large-munition covers all other categories of ammunition, such as indirect fire munitions, bombs, and missiles. Other supplies covers any other type of supply, including engineering materials.

The Supplies page on the Information dialog box indicates when an entity is receiving or providing supplies. You can display supply lines that show when a supply unit is supplying another unit ([Figure 5-4](#)). In [Figure 5-5](#), green arrows show the supplies that the entity is receiving.

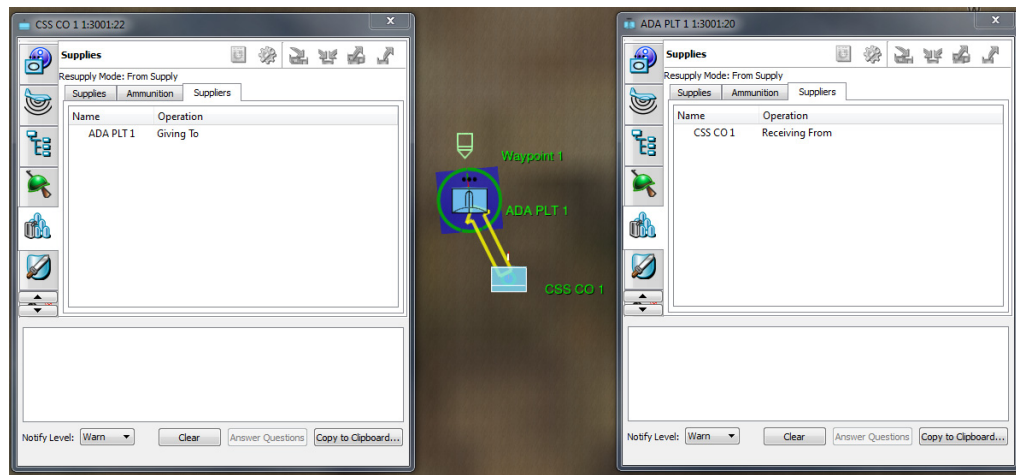


Figure 5-4. Supply information and supply lines

Name	Amount	Pacing/Tracking
Food (meals)	87 / 87	None
Water (liters)	173.796 / 174	None
Motor Gas (liters)	569.066 / 570	None
Aviation Fuel (liters)		None
Diesel Fuel (liters)		None
Oil (liters)		None
Lubricant (liters)		None

Figure 5-5. Supplies being received

5.3.1. Receiving Supplies

Aggregates can receive supplies in the following ways:

- Take supplies from a supply entity. Aggregates take supplies from a friendly supply entity that is within range and has notified them that it can provide supplies.
- Auto Resupply Continuously. Supplies increase continuously at a configurable rate.
- Auto Resupply Periodically. Entities refill all supplies at specified intervals. The interval is configurable.

The ability to resupply can be restricted if an entity is moving, attacking, or defending. This is configured in the Entity Editor on the Supplies tab. You can change how an entity receives supplies using the Set Resupply Mode task. If they are configured for airborne refueling (Can Receive Fuel While Airborne parameter), airplanes can receive fuel while they are flying, but must be on the ground to receive any other type of supply.

5.3.2. Providing Supplies

Entities can provide supplies to other entities if they have a resupply system (*resupplier.sysdef*). A resupply entity can be configured to provide any of the supplies that are supported. A resupply entity can provide supplies to any number of other entities. It is assumed to have its own supply source, so it never runs out. You can change a supply entity's status with the Change Supplying Command task.

A resupply entity runs a background process that tests for friendly entities in its area and notifies them that it is available to provide supplies. It checks for conditions that might prevent an entity from receiving supplies. It stops providing supplies to entities that move out of range.

5.4. Electronic Warfare

The aggregate warfare model supports three types of electronic warfare – communications jamming, radar jamming, and sensing electronic emissions.

5.4.1. Jamming Communications

Each aggregate has an EW-Comms-Dependence and an EW-Defense-Strength property. The dependence property indicates how much it can be affected if its communications are jammed. The defense factor indicates how well its technology and practices protect it from communications jamming. Aggregates also have, in their state properties, a list of jamming attacks being made against them (type and strength) and a net EW-Comms-Degradation-Percentage.

When an entity attacks another entity with jamming, it sends EW attack information to the target.



Entities jam all enemy entities in range; there is no target selection. Friendly entities are not affected.

When an entity suffers communications jamming attacks, the strengths of all attacks are added together and compared to the defensive strength. The ratio determines a modifier between 0 and 1, which is multiplied by the EW-Comms-Dependence. The result is a degradation percentage. This degradation percentage is applied to reduce combat power, and increase vulnerability and posture change time (by a maximum factor of 2.0).

Aggregates can have a system called an aggregate-comms-jammer. This system is parameterized with a strength, maximum range, and set of allowed postures. Strength falls off with $1/r^2$ (r is range in kilometers). This system can trigger EW attacks using the Make EW Attack background scripted task. It has a jammer controller that can publish an emitter.

You can enable or disable the emitter using the Emitter set data request. Turning it on activates jamming, and turning it off deactivates jamming. If the emitter is turned on while the entity is not in an allowed posture for jamming, a warning is printed to the console. In this case the emitter is on, but it is not used for jamming attacks.

When jamming is enabled the Make EW Attack script determines which jamming systems on the entity are on, and then uses them to attack all targets within range. It updates (new) EW-Attacks and Jamming-Strength-On state properties on the entity. The Jamming-Strength-On property summarizes the strength from all jammers the entity has turned on, and is used for emissions sensing. The Update_EW_Degradation background script computes the effects of EW attacks on an entity.

The MI PLT (military intelligence platoon) aggregate is configured to have an aggregate-comms-jammer.

5.4.2. Jamming Radar

Each aggregate has a state property Radar-Jamming-Strength-Receiving, which is updated by the Update_EW_Degradation background script. This is the total radar jamming strength being received.

Radar jamming can have the following effects:

- ♦ Reduce the sensitivity of radar sensors so they cannot detect targets.
- ♦ Reduce the hit factor of radar-homing missiles so they have a smaller hit probability.

The active-radar-sensor system has a parameter called **jamming-defense-factor**. This factor reflects the technology of the radar (not power) and is used with the jamming strength received to compute a sensitivity modifier for the sensor. The modifier varies from 0 to 1.

The weapons systems that use a controller that uses an `aggregateReleaseBombControllerDescriptor` have parameters **can-be-radar-jammed** and **jamming-defense-factor**. This includes the following weapon systems:

- ♦ aggregate-antiair-missile
- ♦ aggregate-antiship-missile
- ♦ aggregate-land-attack-missile
- ♦ aggregate-release-bomb
- ♦ aggregate-unguided-bomb.

If **can-be-radar-jammed** is true, then **jamming-defense-factor** is used with jamming strength received to calculate a modifier for the hit factor of the weapon.

Weapons systems are configured with either a constant or variable for **can-be-radar-jammed**, to provide examples of different guidance systems:

- ♦ Anti-air missiles use a variable, to allow modeling of IR or radar-homing missiles.
- ♦ Anti-ship missiles set **can-be-radar-jammed** true, thus assuming radar guidance.
- ♦ Land attack missiles use a variable.
- ♦ Release-bomb omits the parameter (default is false), to simulate optical guidance.
- ♦ Unguided bomb omits the parameter (default is false).

The aggregate-radar-jammer system can publish an emitter and can be turned on and off using Emitter set data request. It enables the EW_Attack script.

The radar jammer strength falls off with $1/r^2$ (r is range in kilometers).

The EA-18G entity is configured with a radar jamming system.

5.4.3. Sensing Electronic Emissions

The emission sensor domain allows entities to sense RF electromagnetic emissions from entities. Each entity has an emissions signature, which is a parameter for each entity type. This can be detected by the SIGINT sensor. This is the “normal background signature”.

There is a sensor signature modifier for emissions. VR-Forces determines if specific emitters are turned on, thus adding to the normal background signature for the entity.

The emissions signature modifier has a parameter, **jam-strength-factor**, that converts jamming strength to a signature value. It is set in the platform files.

There is a sensor system emissions-sensor for emissions. It is called a SIGINT (signals intelligence) sensor. The MI PLT entity is configured with a SIGINT Sensor.



6. Overlays and Tactical Graphics

This chapter explains how to create and edit overlays and tactical graphics.

Introduction	6-3
Naming Tactical Graphics	6-3
Creating and Editing Overlays	6-4
Creating an Overlay	6-5
Selecting Overlays	6-5
Locking an Overlay	6-5
Hiding the Objects on an Overlay	6-6
Changing an Overlay's Name	6-6
Deleting an Overlay	6-6
Creating Tactical Graphics	6-7
Creating Freehand Lines	6-7
Drawing Circles and Ellipses	6-8
Drawing Boxes	6-8
Adding Text to an Overlay	6-9
Assigning Tactical Graphics to an Overlay	6-9
Displaying a Terrain Profile When You Create a Line	6-10
Publishing Tactical Graphics	6-11
Creating a Computed Route	6-11
Creating an Intel Collection Area	6-13
Creating Routes for Aircraft	6-14
Deleting Tactical Graphics	6-14
Editing Tactical Graphics	6-15
Editing Vertices	6-16
Resizing Boxes and Text Objects	6-19

Overlays and Tactical Graphics

Rotating an Ellipse	6-19
Changing the Direction of a Line	6-20
Changing the Color of a Tactical Graphic	6-20
Changing Linear and Areal Style Properties	6-21
Saving and Loading Tactical Graphics and Overlays	6-22
Loading Tactical Graphics and Overlays	6-22

6.1. Introduction

Tactical graphics are graphical objects, such as lines, points, and areas, that you can draw on the terrain, or which are drawn by VR-Forces or remote applications. Control objects are a special kind of tactical graphic. Entities are aware of control objects and most lines and points and can interact with them. For example, an entity can follow a route, move to a point, or avoid an obstacle. VR-Forces can test to determine if an entity is in an area or to either side of a phase line. In aggregate-level scenarios, entities are aware of hazard and obstacle tactical graphics.

All tactical graphics and entities are placed on overlays. By default, they are placed on overlays that have the same name as the palette from which they are created, except that weather objects are placed on the Weather overlay and contamination areas are placed on the Contamination Areas overlay.

You can create additional overlays and assign objects to them.

For conceptual information about tactical graphics, please see Section 3.7, “[Tactical Graphics](#),” in *VR-Forces Users Guide*.

6.1.1. Naming Tactical Graphics

The names you assign to graphics must be unique among all objects. Names are case sensitive, for example you can create three points called Waypoint Alpha, waypoint alpha, and Waypoint alpha, but you cannot create an area called Area 1 and a disaggregation area called Area 1. Object names can be up to 255 characters long.



Some character sets require multiple ASCII characters to represent a displayed character. If you use one of these character sets, the maximum length of object names in visible characters may vary.

6.2. Creating and Editing Overlays

Overlays allow you to add graphic objects to the VR-Forces window as if you were adding clear plastic overlays to a physical map and drawing on them. They provide a convenient way to organize and manage the tactical graphics in a simulation. You can add any number of overlays. You can rename them. You can enable or disable editing of the objects they contain.

When you create an object, if you do not explicitly assign it to an overlay, it gets placed on a default overlay. If the default overlay does not exist, it gets created. The default overlay for an object type is configured in the Entity Editor.

Overlays and their contents are displayed in the Overlays tab of the Objects List Panel. The Overlay Bar has a label for each overlay that lets you show and hide the objects on that overlay (Figure 6-1).

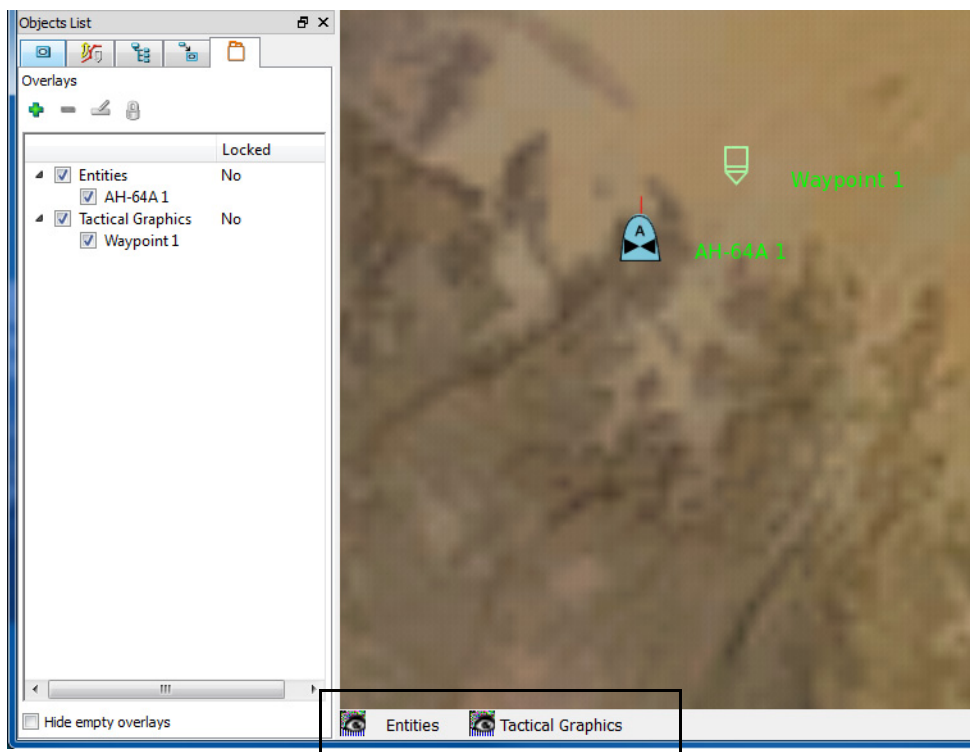


Figure 6-1. Overlays tab and Overlay Bar

6.2.1. Creating an Overlay

To create an overlay:

1. On the Objects List Panel, select the Overlays tab (Figure 6-2).

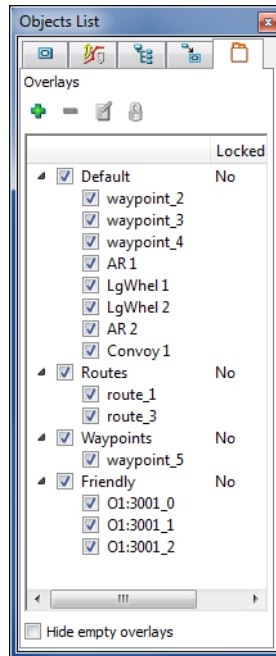


Figure 6-2. Overlays tab

2. Click the Add button (+). An overlay is added to the list with a default name.
3. Optionally, change the name as described in “Changing an Overlay’s Name,” on page 6-6.

6.2.2. Selecting Overlays

- To select an overlay, click its name on the Overlays tab.

6.2.3. Locking an Overlay

When an overlay is locked, you cannot edit the objects on it. You can still add and delete objects.

To lock or unlock an overlay:

1. On the Objects List Panel, select the Overlays tab.
2. Select the overlay you want to lock or unlock.
3. Click the Lock/Unlock button (🔒), or double-click the entry in the Locked column. It will toggle between Yes and No.

6.2.4. Hiding the Objects on an Overlay

You can hide the objects on an overlay. This may be convenient if you want to focus on a particular set of entities or objects while you are editing or observing a scenario. You can hide all of the objects on an overlay or individual objects.

To hide all of the objects on an overlay, do one of the following:

- ♦ Click the overlay label on the Overlay Bar.
- ♦ On the Objects List Panel, Overlay tab, clear the check box for the overlay that you want to hide.
- To hide individual objects on an overlay, on the Objects List Panel, Overlay tab, clear the check box for the object.

6.2.5. Changing an Overlay's Name

You can change the name of a default overlay, such as Entities or Tactical Graphics. However, the next time you create an object that gets assigned to a default overlay, unless you assign it to the renamed overlay, a new overlay with the default name gets created.

To change an overlay's name:

1. On the Objects List Panel, select the Overlays tab.
2. Select the overlay that you want to rename and click the Rename button () , or double-click the overlay whose name you want to change. The name becomes editable.
3. Type a new name.
4. Press **Enter**.

6.2.6. Deleting an Overlay

To delete an overlay:

1. On the Objects List Panel, select the Overlays tab.
2. Select the overlay you want to delete.



When you delete an overlay, all of the tactical graphics on it are also deleted.

3. Click the Delete button ().

6.3. Creating Tactical Graphics

The generic procedures for creating tactical graphics are described in Chapter 2, *Creating and Placing Objects*. This section provides additional details about tactical graphic creation and placement.

6.3.1. Creating Freehand Lines

A freehand line is essentially many short line segments. After you create a freehand line you can change the sampling rate used to determine how many segments it has. The fewer the segments, the less fluid the line is.

Unlike other lines, the individual vertices of a freehand line do not have vertex markers. You cannot select them individually on the map. However, you can edit them in the Edit Freehand Line dialog box.

The Freehand Line With Arrow automatically puts an arrow at the end of the line. However, you can also add an arrow to a freehand line that is created without one.



If you reduce the sampling rate, resulting in fewer segments and a less fluid line, once you save the line you cannot automatically increase the number of segments to increase the fluidity of the line. You would have to add vertices by hand.

To create a freehand line:

1. Click the Tactical Graphics Palette.
2. Select the Shapes category.
3. Select Freehand line or Freehand Line with Arrow.
4. Click where you want the line to start, and while holding down the left mouse button, draw a line on the screen.
5. Release the mouse button. The Create Freehand dialog box opens.
6. Edit the properties as desired.

6.3.2. Drawing Circles and Ellipses

Entities do not interact with circles and ellipses. They are strictly for use as graphics.

To draw a circle:

1. Click the Tactical Graphics Palette.
2. Select the Shapes category.
3. Select Circle. The cursor changes to draw mode and shows a vertex icon.
4. Click to place the center of the circle. A center point is placed on the terrain and a circle is drawn. There is now a vertex icon on the circumference of the circle.
5. Drag the mouse to set the radius of the circle.
6. Click to complete the circle.

To draw an ellipse:

1. Click the Tactical Graphics Palette.
2. Select the Shapes category.
3. Select Ellipse. The cursor changes to draw mode and shows a vertex icon.
4. Click to set the center of the ellipse. A center point is set and a small circle is displayed with a vertex indicator at the bottom of the circle.
5. Drag the mouse up or down and click to set the height of the ellipse. A vertex indicator is added to the left side of the circle.
6. Drag the mouse left and right and click to set the width of the ellipse.

6.3.3. Drawing Boxes

Boxes are constrained to be parallelograms. Entities do not interact with boxes. (In other words, they are not areas.)

To draw a box:

1. Click the Tactical Graphics Palette.
2. Select the Shapes category.
3. Select Box. A box is attached to the cursor
4. Click to place the box in the approximate location that you want.
5. Double-click any vertex. The vertex changes to show it is editable.
6. Drag the vertex to reshape the box.

6.3.4. Adding Text to an Overlay

You can add text to an overlay. The maximum width of the text object is fixed.

To add text to an overlay:

1. Click the Tactical Graphics Palette.
2. Select the Shapes category. (Text is also in the Logistics, Intel, and Symbols categories.)
3. Select Text. The text “Text” is attached to the cursor.
4. Click to set the bottom center of the text. The Create Text dialog box opens.
5. Type the text you want in the Text box.
6. Edit any other properties as desired.
7. Click Create.

6.3.5. Assigning Tactical Graphics to an Overlay

By default, when you create a tactical graphic, it gets assigned to an overlay with the same name as the palette from which it is created. (You can change the default overlay in the Entity Editor.) If no overlay exists, the overlay is created and the graphic is assigned to it. You can assign a tactical graphic to a different overlay when you create it or edit it. To assign a tactical graphic to an overlay when you create it, set this property as described in [“Specifying an Object’s Properties Before You Create It \(Click to Locate\),”](#) on page 2-12. To move a tactical graphic to a different overlay, follow the procedure in [“Moving a Tactical Graphic to a Different Overlay,”](#) on page 6-9.

Moving a Tactical Graphic to a Different Overlay

To move a tactical graphic to a different overlay:

1. Select the object you want to move.
2. Choose **Entities** → **Edit**. The Edit Object dialog box opens.
3. If Attach Object to Mouse is selected, clear the check box.
4. In the Overlay list, select the overlay that you want the object to move to.
5. Click Update.



You can also move a tactical graphic to a different overlay by dragging it to the new overlay on the Overlays tab of the Objects List panel.

6.3.6. Displaying a Terrain Profile When You Create a Line

You can display a terrain profile window while you create a line. You can configure terrain profiles to automatically display a terrain profile when a line is created (Section 13.1.2, “[Configuring Terrain Profiles](#),” in *VR-Forces Users Guide*), or you can display the window manually.

To open a terrain profile window while you are creating a line:

1. Select the object that you want to create as described in “[Selecting the Object to Create](#),” on page 2-4. A Create Object tab is added to the window below the Props Palette ([Figure 2-4](#)).
2. Click the Create Object tab. A Create Object dialog box that is appropriate for the object opens ([Figure 6-3](#)).

	Lat	Lon	Alt(m)
1	36.008361	-122.988168	-0.000016
2	36.010590	-123.002091	0.000042
3	36.010997	-122.989221	-0.050016

Figure 6-3. Terrain Profile button

3. Click to place the first vertex. The Terrain Profile button is activated.
4. Click Terrain Profile.

6.3.7. Publishing Tactical Graphics

By default, all tactical graphics are published. That is, they are sent out over the network and are visible to other participants in an exercise. You can choose to not publish a tactical graphic. In that case, it is visible only in the front-end on which it was created.

Published tactical graphics get saved to the order of battle file. Unpublished tactical graphics get saved to the overlays file that gets created as part of the scenario. You can also manually save tactical graphics to an overlay file separate from the one stored with the scenario.

To publish or unpublish a tactical graphic:

1. Select the graphic you want to edit.
2. Choose **Entities** → **Edit**. The Edit Object dialog box opens.
3. To publish the object, select the Publish Object check box. To unpublish it, clear the check box.

6.3.8. Creating a Computed Route

VR-Forces can create routes between two points and take into account criteria such as avoiding buildings, using roads, and avoiding water. Unlike the temporary routes that VR-Forces creates for movement tasks, a computed route is a tactical graphic that is saved with the scenario and can be used by any entity.

When you create a computed route, you specify rules that VR-Forces should use when creating the route. VR-Forces includes preconfigured rule sets for ships and ground vehicles. You can add additional preconfigured rule sets. You can also add additional rules. The rules and rule sets are configured in *./data/simulationModel-Sets/<sms>/gui/computedRouteRulesTypes.xml*.

To create a computed route:

1. Choose **Create** → **Computed Route**. The Create Computed Route dialog box opens (Figure 6-4).

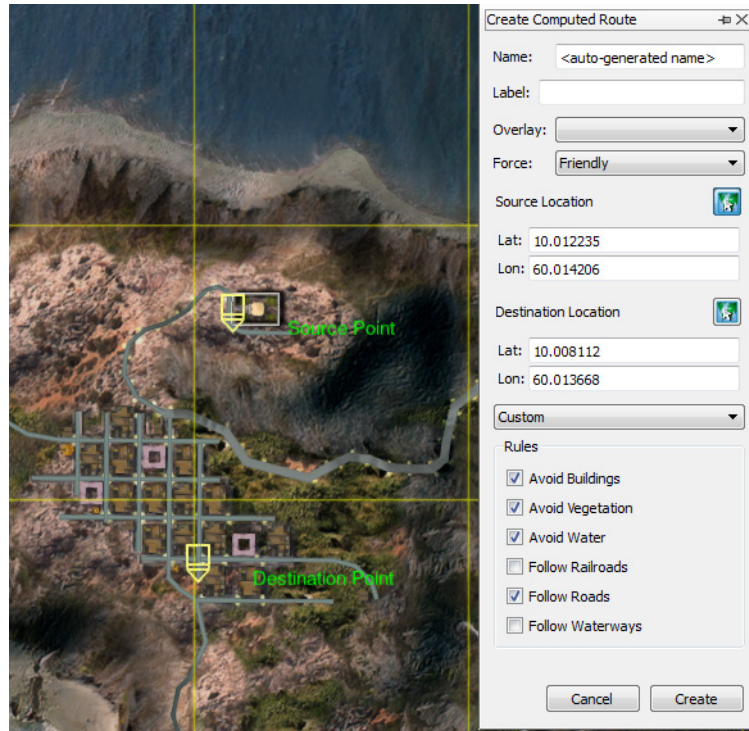


Figure 6-4. Creating a computed route

2. Optionally, specify a name, label, and overlay.
3. Select the force for the route.
4. Click to place the starting point of the route, or enter a value for the Source Location.
5. Click to place the end point of the route, or enter a value for the Destination Location.
6. Select the type of vehicle. Ground vehicles and ships have a preconfigured set of rules. Select custom to choose a different set of rules.
7. If you select Custom, select the rules that you want to be enforced for the route. Clear those you do not want to use.
8. Click Create.

6.3.9. Creating an Intel Collection Area

Intel Collection Areas modify the sensor signatures of entities within their boundaries. This affects the ability of other entities to detect them. Intel Collection Areas are created just like other areas. The difference is specification of area modifiers. Area modifiers are set per force. A modifier greater than 1.0 increases the sensor signature for members of that force, making them easier to detect. A modifier less than 1.0 reduces their signature, making them harder to detect.

To create an intel collection area:

1. On the Tactical Graphics Palette, select the Intel category.
2. Click Intel Collection Area.
3. Draw an area on the map as you would for any other tactical graphic area.
4. In the Create Intel Collection Area dialog box, click the Add button (+) next to the Area Modifiers label. The Choose Force dialog box opens ([Figure 6-5](#)).

Figure 6-5 shows the 'Create Intel Collection Area' dialog box. It contains the following fields and controls:

- Name:** <auto-generated name>
- Label:** (empty text box)
- UIC:** (empty text box)
- Reference Track Number:** (empty text box)
- Overlay:** (dropdown menu)
- Forces:** (dropdown menu, currently set to 'Friendly')
- Area Modifiers:** A section with a '+' icon and a table.

Force	Modifier
Friendly	.5
Opposing	.25

Figure 6-5. Create Intel Collection Area dialog box

5. Select the force for which you want to add a modifier.
6. Click OK. The force gets listed in the Area Modifiers window.
7. Double-click the Modifier column to make it editable.

8. Type the modifier value you want to apply to this force.
9. Optionally, add additional force entries to the list.
10. Click Create.

6.3.10. Creating Routes for Aircraft

When you create a route for a fixed-wing entity, remember that as an aircraft flies between the vertices of a route, it starts at the altitude of the first vertex and immediately rises or falls to the altitude of the next vertex as shown in the trajectory in (Figure 6-6). (It does not change altitude smoothly between the vertices.) If a terrain feature in-between the two vertices is higher than the trajectory followed by the aircraft, the aircraft will fly into the terrain, even though a line between the two vertices would not pass through the terrain. There is no terrain following built into the route following process for fixed-wing entities.

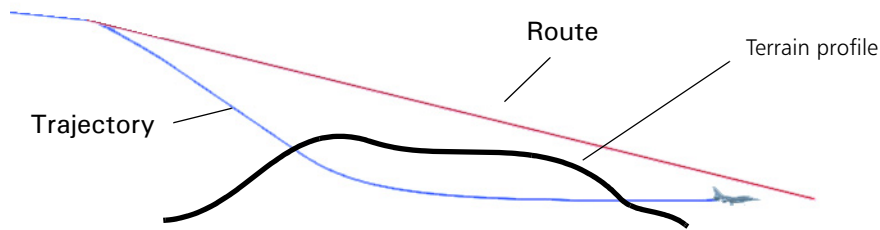


Figure 6-6. Fixed-wing trajectory between vertices

This caution applies to rotary-wing entities if there are abrupt changes in elevation in the terrain. Rotary-wing entities can follow the terrain, but they only look down, not ahead, so abrupt changes in terrain could cause a crash.

6.4. Deleting Tactical Graphics

To delete a graphical object:

1. Select the object you want to delete.
2. Choose **Entities** → **Delete**, or press the **Delete** key.

6.5. Editing Tactical Graphics

You can edit a tactical graphic's properties. The properties that you can edit vary depending on the type of graphic and can include some or all of the following:

- ♦ Add, delete, and edit vertices ([“Editing Vertices,”](#) on page 6-16).
- ♦ Change its name.
- ♦ Change the altitude reference ([“Setting Altitude in the Create Object or Edit Object Dialog Box,”](#) on page 2-15), [“Specifying the Altitude for All of the Vertices in a Route,”](#) on page 2-16.
- ♦ Change the direction of a line ([“Changing the Direction of a Line,”](#) on page 6-20).
- ♦ Edit linear and areal styles:
 - Change the pen style and width.
 - Change the line style.
 - Add or remove arrows.
 - Change the fill of an area.([“Changing Linear and Areal Style Properties,”](#) on page 6-21.)
- ♦ Move it to a different location ([“Dragging an Object to a New Location,”](#) on page 2-19).
- ♦ Move it to a different overlay ([“Moving a Tactical Graphic to a Different Overlay,”](#) on page 6-9).
- ♦ Change the color ([“Changing the Color of a Tactical Graphic,”](#) on page 6-20).
- ♦ Resize boxes and text objects ([“Resizing Boxes and Text Objects,”](#) on page 6-19).
- ♦ Rotate an ellipse ([“Rotating an Ellipse,”](#) on page 6-19).

i

To edit a tactical graphic, its overlay must be unlocked.

6.5.1. Editing Vertices

You can edit the vertices of routes and areas. You can edit them dynamically or in the Edit Object dialog box.

Adding a Vertex

You can add vertices to a route or area directly on the terrain or in the Edit Object dialog box.

To add a vertex to an object dynamically:

1. Right-click the vertex next to which you want to add a new vertex. A menu is displayed.
2. Choose **Add Point After** or **Add Point Before**. A point is added midway between the selected vertex and the next or previous vertex, based on the command you chose.
3. Optionally, edit the new point as described in [“Editing a Vertex,”](#) on page 6-18.

To add a vertex in the Edit Object dialog box:

1. Select the object you want to edit.
2. Choose **Entities** → **Edit**. The Edit Object dialog box opens (Figure 6-7).

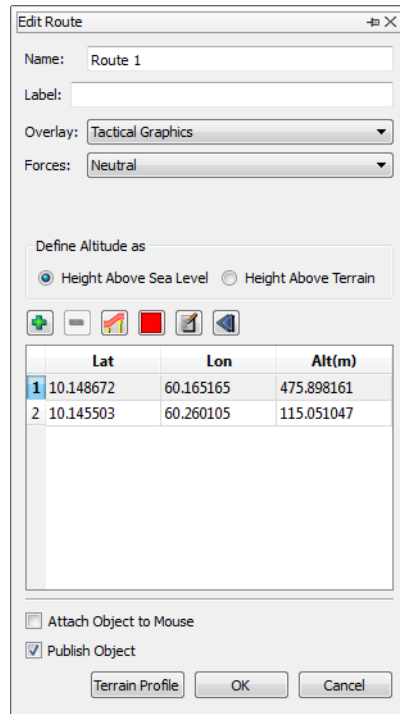


Figure 6-7. Edit Route dialog box

3. If Attach Object to Mouse is selected, clear the check box.
4. In the list of vertices, select the vertex after which you want to add the new vertex.
5. Click the Add button (+). A vertex is added midway between the selected vertex and the next vertex. If you selected the last vertex, a new vertex is added to the end of the route.
6. Optionally, edit the new point as described in “Editing a Vertex,” on page 6-18.
7. Click Update.

Editing a Vertex

You can edit a vertex dynamically or in the Edit Object dialog box.

To edit a vertex dynamically:

1. Double-click the vertex.
2. Move the mouse to change the vertex's location.
3. Use **Alt**+mouse wheel or **Alt**+left mouse button+drag to change the altitude.
4. Click to place the vertex.

To edit a vertex in the Edit Object dialog box:

1. Select the object you want to edit.
2. Choose **Entities** → **Edit**. The Edit Object dialog box opens.
3. If Attach Object to Mouse is selected, clear the check box.
4. If you are editing a waypoint, click on the terrain to specify a new location or edit the coordinates and altitude in the Edit Waypoint dialog box.

If you are editing a phase line, route, or area, you can:

- a. Double-click the coordinate value you want to change to make it editable.
- b. Type a new value and press Enter or click someplace outside of the value.

Alternatively, you can click on the map to change the coordinates of the selected vertex. To set the altitude, you must edit the value by hand.

5. Click Update.

Deleting a Vertex

You can delete vertices directly or in the Edit Object dialog box.

To delete a vertex directly:

1. Right-click the vertex you want to delete. A menu is displayed.
2. Choose **Delete Point**. The point is deleted. (There is no confirmation prompt.)

To delete a vertex in the Edit Object dialog box:

1. Select the object you want to edit.
2. Choose **Entities** → **Edit**. The Edit Object dialog box opens.
3. If Attach Object to Mouse is selected, clear the check box.
4. In the list of vertices, select the vertex you want to delete.
5. Click the Delete button (■).
6. Click Update.

6.5.2. Resizing Boxes and Text Objects

You cannot edit the individual vertices of a box or a text object, you can only resize them.

- To resize a box or text object, grab one of its vertices and drag it to create the new object size.

6.5.3. Rotating an Ellipse

In addition to changing the width and height of an ellipse, you can rotate it around its center point. You can undo and redo ellipse rotation.

To rotate an ellipse:

1. Select the ellipse.
2. Choose **Entities** → **Edit**. The Edit *object* dialog box opens.
3. Select the Free Rotate check box.
4. Click OK.
5. Grab one of the points on the ellipse and drag it in a circular direction.

6.5.4. Changing the Direction of a Line

All lines have a direction. The direction affects how an entity moves along it and the direction that arrows face, if present. If you draw a line and then decide you want to reverse its direction, you can do so.

To change the direction of a line:

1. Select the line.
2. Choose **Entities** → **Edit**. The Edit *object* dialog box opens.
3. Click the Reverse Direction button ().
4. Click OK.

6.5.5. Changing the Color of a Tactical Graphic

You can change the color of a tactical graphic.

To change the color of an tactical graphic:

1. Select the graphic whose color you want to change.
2. Choose **Entities** → **Edit**. The Edit *object* dialog box opens.
3. Click the Color button (). A color picker dialog box opens.
4. Click a color button or click the Custom Color button to choose a new color from the Color Picker.
5. Click OK.

6.5.6. Changing Linear and Areal Style Properties

Lines and areas have a variety of properties that can be set in the Edit Style dialog box. The procedure is essentially the same for all of these properties. The properties you might be able to change are as follows:

- ♦ Line width. The width of the lines that make up a tactical graphic, either the actual line or the boundary of an area.
- ♦ Pen style. How the line or outline is drawn – solid line, no line, or as dashed and dotted lines. This property does not apply to lines that use a texture, such as Line of Contact.
- ♦ Fill style. The fill style for areal objects. Fill styles include degrees of solid fill and various types of line and grid fills.
- ♦ Line style. The different types of special lines, such as Main Axis.
- ♦ Arrow. You can add arrows to the end of a line or at the end of each segment of the line.

To change a style property:

1. Select the graphic you want to edit.
2. Choose **Entities** → **Edit**. The Edit object dialog box opens.
3. Click the Edit Style button (🔧). The Edit Style dialog box opens ([Figure 6-8](#)).

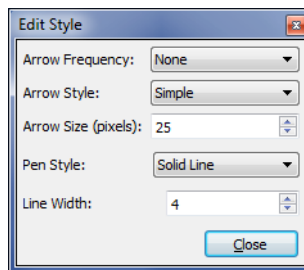


Figure 6-8. Edit Style dialog box

4. Change the properties by selecting options from the appropriate list or typing new values.
5. Click OK.

6.6. Saving and Loading Tactical Graphics and Overlays

If you publish a tactical graphic, it is automatically saved to the order of battle file (.*oob*). If you do not publish a tactical graphic, it is automatically saved to the overlay file (.*ovl*). There may be cases where you want to create a set of overlays for use in multiple scenarios. You can save them to an overlay file independently of the scenario, or even save the overlays and not save the scenario at all.



When you save overlay objects, only unpublished tactical graphics get saved.

To save overlays and tactical graphics:

1. Choose **File** → **Save Overlay**. The Save Overlay dialog box opens.
2. Type a name for the overlay file.
3. Click Save.

6.6.1. Loading Tactical Graphics and Overlays

You can load overlays that you have saved from a previous session.

To load overlays:

1. Choose **File** → **Load Overlay**. The Load Overlay dialog box opens.
2. Select the overlay file you want to load.
3. Click Open.



When you load overlay objects, you must use the same terrain database you created them on, or a terrain database that includes the area they were created in.



7. Assigning Tasks

This chapter provides general details about how to assign tasks to entities. For descriptions of specific tasks and how to assign them, please see Chapter 8, *Task Procedures* and Chapter 9, *Aggregate-Level Tasks*.

Assigning Tasks to Entities	7-3
C++ Tasks and Scripted Tasks.....	7-3
Concurrent Task Execution	7-4
How do I Know which Entity can Execute a Task?	7-6
Escaping the Task Assignment Process	7-6
Specifying Parameters for Tasks	7-6
Viewing Task Status.....	7-8
Filtering the Object Selection Lists	7-9
Skipping (Stopping) a Task.....	7-9
Assigning Tasks to Aggregates	7-10
Convoy Tasks	7-10
Independently Tasking Aggregate Members.....	7-11
Reactive Tasks	7-11
Enabling Reactive Tasks.....	7-13
Disabling Reactive Tasks.....	7-14
Setting the Priority of a Reactive Task.....	7-15
Managing Reactive Tasks	7-16
Cancelling a Reactive Task.....	7-17
Using Behavior Sets to Manage Scripted Tasks.....	7-18
Creating Behavior Sets.....	7-19
Editing Behavior Sets	7-20
Assigning a Behavior Set to a Force.....	7-20
Entity Movement On Roads and Off Roads	7-21

Road Driving Behavior.....	7-23
Fixed-Wing Entity Tasks and Behaviors	7-23
Placement of Newly Created Fixed-Wing Entities	7-23
Fly Task Behavior is Different from Move Task Behavior	7-24
Specifying and Maintaining Altitude for Fixed-Wing Entities	7-25
Fixed-Wing Entity Movement on the Ground and in the Air	7-26
How Fixed-Wing Entities Take Off.....	7-28
How Fixed-Wing Entities Land.....	7-29
Rotary-Wing Entity Tasks and Behaviors	7-30
Controlling Rotary-Wing Orientation.....	7-32

7.1. Assigning Tasks to Entities

You can assign tasks to an entity as part of its plan, as part of a global plan, and independently of any plan. For conceptual information about tasks, please see Section 3.8, “Tasks,” in *VR-Forces Users Guide*. For information about how to add a task to a plan, please see “[Adding an Entity Task or Set Data Request to a Plan](#),” on page 11-19. For the procedures for assigning tasks, please see Chapter 8, *Task Procedures* and Chapter 9, *Aggregate-Level Tasks*.

You cannot assign tasks to non-VR-Forces entities. However, you can use a remote entity as a parameter in a task, for example, following a remote entity, or targeting a remote entity. For more information, please see “[Using Non-VR-Forces Entities in Plans](#),” on page 11-35.

7.1.1. C++ Tasks and Scripted Tasks

The VR-Forces application includes a basic set of entity tasks for movement, weapons fire and other actions, that were developed using the VR-Forces Toolkit and the C++ API. System integrators often add additional tasks before delivering VR-Forces to their customers. These tasks are called C++ tasks to distinguish them from another type of task – the scripted task. Scripted tasks, written in the Lua programming language, use the lower-level C++ tasks and the VR-Forces Lua API to build higher-order tasks for entities.

To the VR-Forces end user, these tasks, most of which are listed on the Task menu, are indistinguishable. However, you can write new scripted tasks and edit existing tasks. Therefore, where necessary, when discussing a task, this manual will indicate which type of task it is discussing. For information about scripted tasks, please see Chapter 16, *Creating Scripted Tasks*.

VR-Forces also supports two special categories of scripted tasks called reactive tasks and background processes. These tasks are not on the Task menu. Reactive tasks execute when a condition becomes true. For details, please see “[Reactive Tasks](#),” on page 7-11. Background processes run continuously. They only apply to aggregate-level scenarios. (For details, please see “[Reactive Tasks and Background Processes](#),” on page 8-55.)

7.1.2. Concurrent Task Execution

Some tasks can execute at the same time. Some are mutually exclusive. If you assign an entity a task that is mutually exclusive with its current task, the current task is abandoned. If you assign a task that is not mutually exclusive with the current task, an entity executes the new task while continuing to execute the previous task.



When you assign a mutually exclusive independent task, VR-Forces displays a prompt that asks you to confirm interruption of the current task. You can disable this prompt if you always want a new task to interrupt the current task. For details, please see [“Enabling and Disabling the Task Confirmation Prompt,”](#) on page 7-4.

C++ tasks are organized into the following groups:

- ♦ Weapon
- ♦ Movement
- ♦ Radio
- ♦ Depth control.

All tasks within a group are mutually exclusive among themselves. For example, all movement tasks are mutually exclusive. Entities that are moving can usually execute a task from one of the other groups at the same time. For example, entities can execute the various Send tasks while they are executing movement tasks. When you create a scripted task, you can specify which groups it conflicts with. For information about how to configure mutually exclusive tasks, please see Section 10.8, [“Configuring Task Execution Rules,”](#) in *VR-Forces Configuration Guide*. For information about scripted tasks, please see Chapter 16, [Creating Scripted Tasks](#).

Enabling and Disabling the Task Confirmation Prompt

When you give an entity an independent task, if it is executing a task or a plan, VR-Forces informs you that the new task will override the task or plan and asks you to confirm the action. You can enable and disable the confirmation prompt.

To enable or disable the task override confirmation prompt:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page ([Figure 7-1](#)).

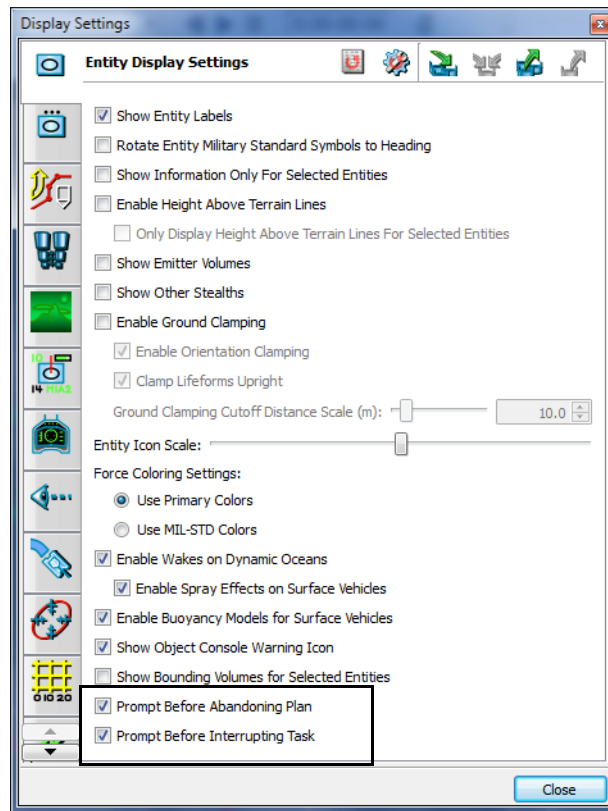


Figure 7-1. Entity Display Settings page

3. To enable or disable the prompt for interrupting a task, select or clear the Prompt Before Interrupting Task check box.
4. To enable or disable the prompt for abandoning a plan, select or clear the Prompt Before Abandoning Plan check box.

7.1.3. How do I Know which Entity can Execute a Task?

Some VR-Forces tasks apply to almost all entities, such as Radio tasks and some movement tasks. Others are valid only for particular platforms or even particular entity types. Sometimes it is obvious which entity types can execute a task. For example, you would expect that Fixed-Wing Land only applies to fixed-wing entities. Similarly, Raise Periscope applies to submarines. However, for other tasks, it is not always evident which entity can execute a task.

Entities can execute tasks for which they have an appropriate controller. Since most task controllers are embodied in systems, this means that entities can execute the tasks supported by their various movement, weapons, sensors, and other systems. For example, to deploy naval mines, an entity needs a Naval Mine Deployment system.

To see which systems an entity has, and thereby infer which tasks it can execute, you can examine the entity's systems in the Entity Editor. You can also refer to *VR-Forces Entity Model Catalog*, which lists the systems for each entity configured in the Entity Editor.

Appendix C, *Systems and System Usage* lists each system provided with VR-Forces, the types of entities it supports, and its description. It also lists each system and the entities that are configured to use it.

7.1.4. Escaping the Task Assignment Process

You can escape the task assignment process at any point before you complete it.

- To escape the task assignment process, in the task dialog box, click Cancel.

7.1.5. Specifying Parameters for Tasks

VR-Forces lets you specify task parameters in dialog boxes or by selecting them on the terrain. Many tasks require you to select an object or entity.

If you select the appropriate object, the selection is reflected in the task dialog box.

If you prefer, you can specify all parameters in the task dialog box. Depending on the zoom level of the terrain and the number of entities and tactical graphics you have created, it may be easier to select an object from a list than to select it from a densely packed group of icons.

Selecting Objects in Multiple List Dialog Boxes

Some task dialog boxes, such as Patrol Between, require you to select multiple objects, each of which is selected from a different list.

You can select the objects in the list window or in the display window. At any given moment, one of the lists is the active list and a selection in the display window is reflected in that list. The active list is indicated by the button next to the Filter list (Figure 7-2).

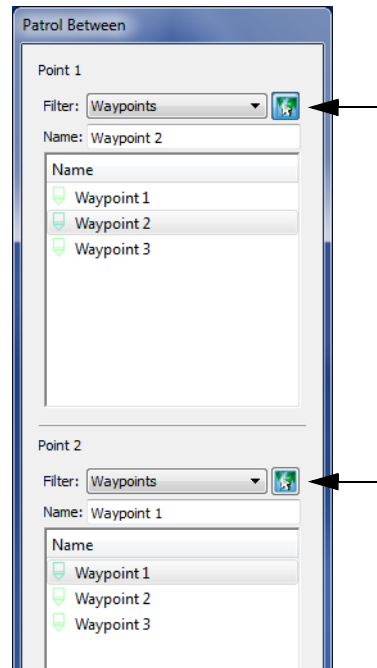


Figure 7-2. Multiple list dialog box

The active list is determined as follows:

- When you first open the dialog box, the first list window is automatically active. If you select an object in the display, it is selected in the first list window. Then the second list window automatically becomes active and the next object you select in the display is selected in the second list window. This sequence continues until all list windows have a selection. Then the last window stays as the active list.
- Selecting an object in a list window makes it active.
- Clicking the Filter button (🔍) next to the Filter list makes that list window active. It will stay active until you click the button to inactivate it or click in another list window.
- If all lists are inactive (by clicking the Filter button to put it into the unselected state), you can click objects in the display without affecting the selections in the list windows.

7.1.6. Viewing Task Status

The Entity Information dialog box for an entity lists its current task on the Task Status page. It also lists the state of the reactive tasks that are enabled for the entity. If an entity is executing a task as part of its plan, you can also see which task it is executing by opening its Plan window (Figure 7-3).

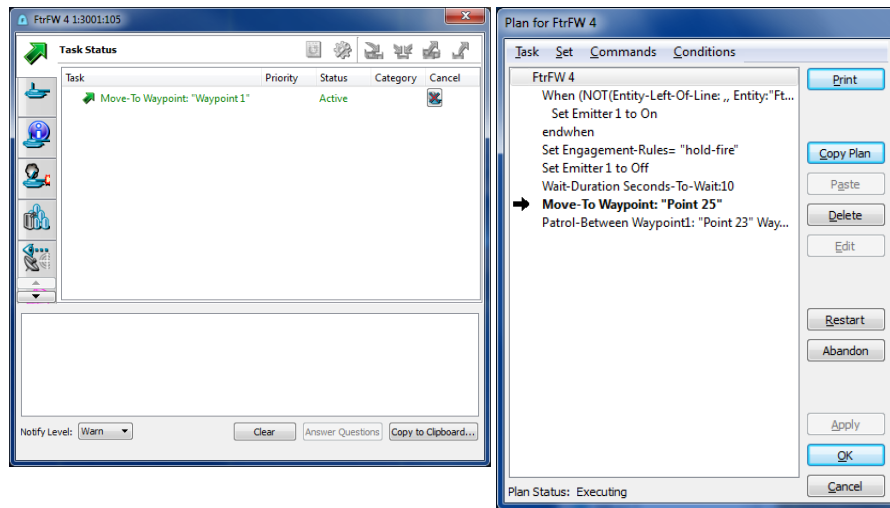


Figure 7-3. Display of entity task status

7.1.7. Filtering the Object Selection Lists

If a task requires you to select objects, you can filter the object selection list to make it easier to find the particular objects you need to select (Figure 7-4). If you are selecting entities, for example in a Follow Entity task, you can display all entities, individual entities only, or aggregate entities only. Within the latter two groups, you can display friendly or opposing entities. In a Move To task, you can filter for waypoints, friendly entities, or opposing entities.

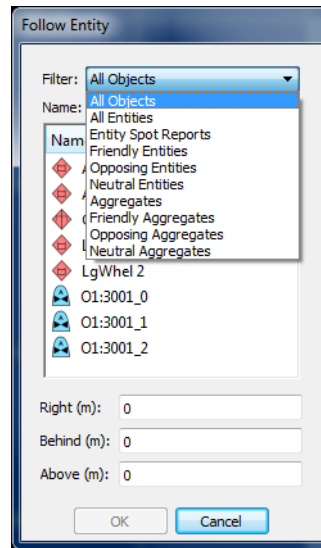


Figure 7-4. Entity filter list

- To filter an entity list, in a task or set data request dialog box, choose the filter type from the list.

7.1.8. Skipping (Stopping) a Task

You can instruct an entity to stop executing its current task. If the entity is executing a plan, it moves to the next task in its plan. If there are no further tasks, the entity waits for further orders.

- To order an entity to skip a task, choose **Entities** → **Skip Task**.

i

- ♦ Skip Task does not apply to members of an aggregate that are executing tasks assigned to them by the aggregate leader.
- ♦ You can also stop tasks from the Task Status page of the Entity Information dialog box. For details, please see [“Cancelling a Reactive Task,”](#) on page 7-17.

7.2. Assigning Tasks to Aggregates

- To assign a task to an aggregate, select the aggregate, then assign it a task as you would any individual entity.

7.2.1. Convoy Tasks

VR-Forces has two tasks for moving in convoys – Convoy Along and Convoy To. These tasks can only be assigned to aggregate entities made up of ground vehicles. When an aggregate receives a convoy task, it organizes itself into a column based on the echelon IDs. Then it executes the task.

Once the task begins, the members of the aggregate try to maintain a consistent distance apart from each other. You can configure this distance by editing the Ground Convoy Movement system in the OPD Editor. The distance is specified by the **separation-distance** parameter. You can also specify an amount by which the separation distance can vary using the **separation-tolerance** parameter.



If VR-Forces can determine that a convoy task is not appropriate for a given aggregate, for example a rotary wing aggregate, the convoy tasks will not be available on the Task menu. However, in other cases, such as mixed aggregates or if you aggregate disparate entities as Ground Aggregate, it is up to you to know whether or not an aggregate consists only of ground vehicles or contains platforms that do not support convoy tasks.

7.2.2. Independently Tasking Aggregate Members

Members of a disaggregated aggregate can have individual plans or be assigned tasks independently of the aggregate. If a member of an aggregate entity is independently tasked, when it completes its task it automatically becomes tasked by its superior. You do not need to give it a Tasked by Superior set data request. You can override this behavior by setting an object's **tasked-by-superior-upon-task-complete** parameter in the object parameter database to False.

If a Skip Task command is given to an independently tasked subordinate, it remains in the independently tasked state until it either completes a task or it is given a Set Tasked by Superior set data request.

When an entity becomes tasked by its superior, it does not execute the task that the aggregate is currently executing. It receives the next task that is sent out by the aggregate.



When a disaggregated aggregate changes to the aggregated state, the individual subordinates cease to exist. Therefore, if a subordinate is executing an independent task, when the aggregate changes state, the task activity ends immediately.

7.3. Reactive Tasks

Reactive tasks are a special category of scripted tasks. Unlike other tasks (whether scripted or built-in), reactive tasks do not begin to execute as soon as they are assigned. They monitor events in a simulation and execute in response to conditions specified in the script. In this way they are similar to collision avoidance, which takes over entity movement in response to an imminent collision, or **When** statements in plans, which get triggered when a condition becomes true.

Because reactive tasks are scripted tasks, you are not restricted to the few conditions available in plans. You have the full VR-Forces Lua API available to script the conditions and the resulting behaviors. Like other scripted tasks, reactive tasks are either scenario-specific or system reactive tasks.

Reactive tasks have the following behaviors and characteristics:

- ♦ Reactive tasks can be automatically enabled for a category of entity. They can also be individually enabled and disabled.
- ♦ When a reactive task is activated, the current task is suspended. When the reactive task concludes, the entity resumes the previous task, if possible. There may be cases where the previous task is no longer valid. For example, if an entity was executing a Move to Waypoint (Use Roads) task and the result of the reactive task was that the entity is no longer near the road network, it will not be able to resume the Move to Waypoint (Use Roads) task.
- ♦ Reactive tasks support task concurrency.

- ♦ Reactive tasks can be interrupted by other reactive tasks. Precedence among reactive tasks is based on a task's priority. If a reactive task is executing and a reactive task with a higher priority gets triggered, it suspends the current reactive task. When the higher priority task completes, the lower priority task resumes. When it completes, the original task resumes. Multiple nesting of tasks in this way is permitted. Reactive tasks with the same or lower priority do not interrupt the active task.
- ♦ Reactive tasks can have parameters, just like any other task. If a reactive task is enabled and the parameters are not set, it may not work as expected. A well-written reactive task should have default values for parameters, but VR-Forces does not enforce this.
- ♦ Users can change the priority of a reactive task while a scenario is running. This affects the next activation of the task.
- ♦ If a reactive task is interrupted by a nonconcurrent independent task assignment, from the Task menu or a global plan, the reactive task and all suspended tasks are cancelled and the new task is executed. However, it is still possible that the new task could be interrupted by the same or a different reactive task.
- ♦ Active reactive tasks can be cancelled by a VR-Forces user.
- ♦ After a reactive task is complete, it enters the enabled state and can become triggered again.
- ♦ The status of reactive tasks is displayed on the Task Status page of the Entity Information dialog box, along with the status of the current or suspended task.

The following sections describe how to manage reactive tasks in a scenario. For information about how to write and configure reactive tasks, please see Chapter 17, [*Writing Scripts for Scripted Tasks*](#).

7.3.1. Enabling Reactive Tasks

Like other scripted tasks, when a reactive task is written, it is specified as being valid for one or more entity types. It can also be configured to be enabled by default. If a reactive task is not enabled by default, you can enable it for individual entities.



This procedure applies to the currently selected entity. If you have multiple Entity Information windows open, selecting a reactive task on the Task Status page of an entity does not select the entity and does not make it the task affected by this procedure.

To enable a reactive task:

1. Select the entity for which you want to enable the task.
2. Choose **Set** → **Reactive Tasks** → **Enable**. The Enable Reactive Task dialog box opens (Figure 7-5). If there are no reactive tasks available, the dialog box states this. This condition occurs if all appropriate reactive tasks are already enabled or there are no reactive tasks for this entity type.

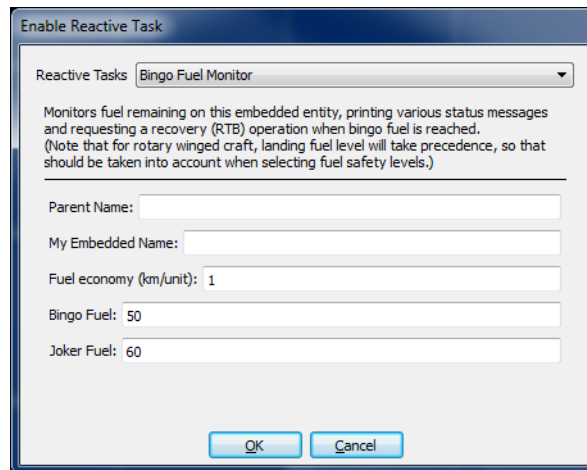


Figure 7-5. Enable Reactive Task dialog box

3. In the Reactive Tasks list, select the task you want to enable. If the task requires parameters, the dialog box redisplay and lists the parameters.
4. If necessary, specify the parameters.
5. Click OK.



You can also enable reactive tasks in the Manage Reactive Tasks dialog box. For details, please see “[Managing Reactive Tasks](#),” on page 7-16.

7.3.2. Disabling Reactive Tasks

You can disable reactive tasks on a per-entity basis. When you disable a reactive task, any active tasks continue to execute. However, no new instances of the disabled task will be activated.



This procedure applies to the currently selected entity. If you have multiple Entity Information windows open, selecting a reactive task on the Task Status page of an entity does not select the entity and does not make it the task affected by this procedure.

To disable a reactive task for an entity:

1. Select the entity for which you want to disable a reactive task.
2. Choose **Set** → **Reactive Tasks** → **Disable**. The Disable Reactive Task dialog box opens. If there are no reactive tasks available, the dialog box states this. This condition occurs if all appropriate reactive tasks are already disabled or there are no reactive tasks for this entity type.
3. In the Reactive Tasks list, select the task you want to disable.
4. Click OK.



You can also disable reactive tasks in the Manage Reactive Tasks dialog box. For details, please see [“Managing Reactive Tasks,”](#) on page 7-16.

7.3.3. Setting the Priority of a Reactive Task

When a reactive task is created, it is assigned a priority. The priority determines which reactive tasks it can override or be overridden by. Priorities are expressed as integers, with 1 being the highest priority. You can change the priority of a reactive task on a per-entity basis.



This procedure applies to the currently selected entity. If you have multiple Entity Information windows open, selecting a reactive task on the Task Status page of an entity does not select the entity and does not make it the task affected by this procedure.

To change the priority of a reactive task:

1. Select the entity for which you want to change a reactive task's priority.
2. Choose **Set** → **Reactive Tasks** → **Priority**. The Reactive Task Priority dialog box opens. If there are no reactive tasks available, the dialog box states this.
3. In the Reactive Tasks list, select the task whose priority you want to change.
4. Select a priority in the box. The lower the number, the higher its priority.
5. Click OK.



You can also change priority in the Manage Reactive Tasks dialog box. For details, please see [“Managing Reactive Tasks,”](#) on page 7-16.

7.3.4. Managing Reactive Tasks

You can enable, disable, and change priority for all the reactive tasks that apply to an entity from the Manage Reactive Task dialog box.

To manage multiple reactive tasks for an entity:

1. Select the entity for which you want to manage reactive tasks.
2. Choose **Set** → **Reactive Tasks** → **Manage** or choose **Entities** → **Manage Reactive Tasks**. The Manage Reactive Task dialog box opens (Figure 7-6). It lists each reactive task configured for this entity type, its status, and its priority. If a task requires parameters, you can set them.

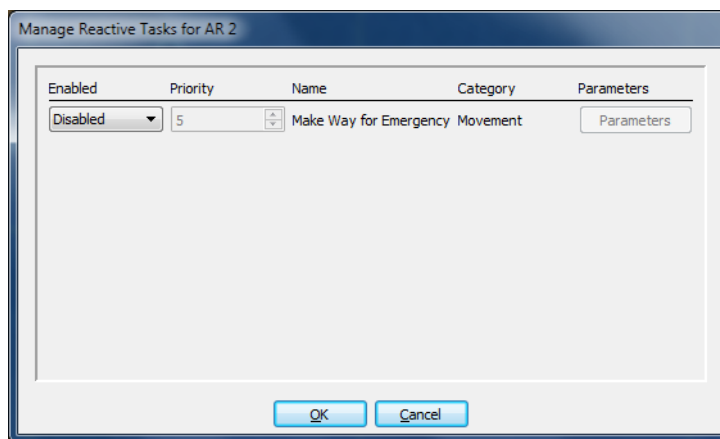


Figure 7-6. Manage Reactive Task dialog box

3. For each task, to enable or disable, select an option from the list in the Enabled column.
4. For each task, change the priority by selecting an option in the box in the Priority column.
5. For each task that has parameters, click Parameters and set its parameters. (A task must be enabled to set its parameters.)
6. Click OK.

7.3.5. Cancelling a Reactive Task

You can cancel a reactive task while it is executing. When you cancel a reactive task, the entity resumes the suspended task. However, if the condition that caused the reactive task to activate is still true, when you cancel a reactive task, it will usually immediately activate again.



You can also use this procedure to cancel (skip) a regular task.

To cancel a reactive task:

1. Select the entity whose task you want to cancel.
2. Choose **Entities** → **Information**, or press **i**. The Entity Information dialog box opens.
3. Select the Task Status page. If a reactive task is active, it has a button in the Cancel column (Figure 7-7).

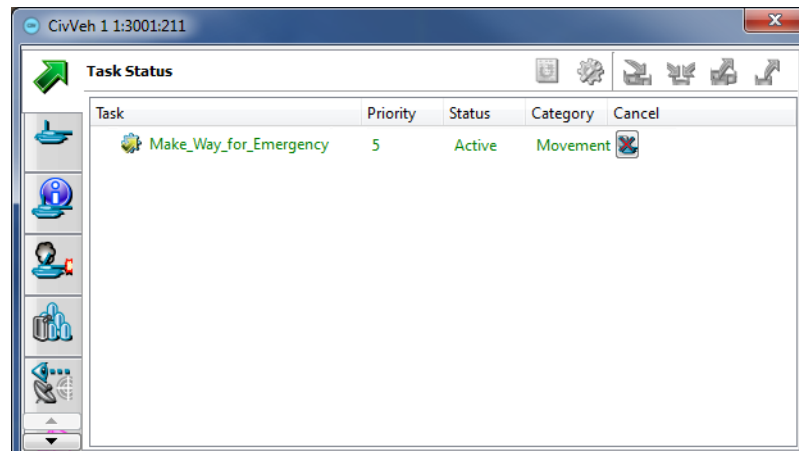


Figure 7-7. Active reactive task

4. Right-click the active task and choose **Cancel Reactive Task**, or click the button in the Cancel column.

7.4. Using Behavior Sets to Manage Scripted Tasks

Behavior Sets let you organize scripted tasks so that a set of related tasks can be enabled or disabled at the force level.

If a scripted task is not assigned to a Behavior Set, its availability to an entity is determined by the following settings:

- ♦ The Valid for Entity Types list for the task.
- ♦ For tasks specific to systems, configuration of that system on an entity.
- ♦ For reactive tasks, the Enable/Disable setting in the Manage Reactive Tasks dialog box for the entity.

If a scripted task is assigned to a Behavior Set, then in addition to the requirements in the previous list, it is available to entities only if the Behavior Set is assigned to a force and only to entities of that force. (You can assign a Behavior Set to more than one force.)

As an example of how you might use Behavior Sets, suppose that dismounted infantry react differently to an attack depending on whether they are operating in rural terrain or in urban terrain. You have a set of scripted tasks that you have written for reacting to attack in each of these two situations. If you are not using Behavior Sets, then at a minimum, to manage which tasks would get used when the entities are under attack, you would have to tell users not to use the inappropriate tasks. Or, you could enable and disable the correct set of tasks in the Scripted Tasks dialog box before the start of the scenario. Or, you would have to enable and disable the tasks on a per entity basis in the Manage Reactive Tasks dialog box. Shifting back and forth between simulations in different terrains might become a management problem.

Using Behavior Sets, you could create a Behavior Set for rural terrain operations and one for urban operations. You would assign the relevant scripted tasks to each Behavior Set. Then before you ran a scenario, you would assign the Behavior Set you want to use to the force. The tasks in the Behavior Set would be enabled and those in the unused Behavior Set would be disabled. There would be no further configuration required.

7.4.1. Creating Behavior Sets

To create a Behavior Set:

1. Choose **Simulation** → **Behavior Sets**. The Edit Behavior Sets dialog box opens (Figure 7-8).

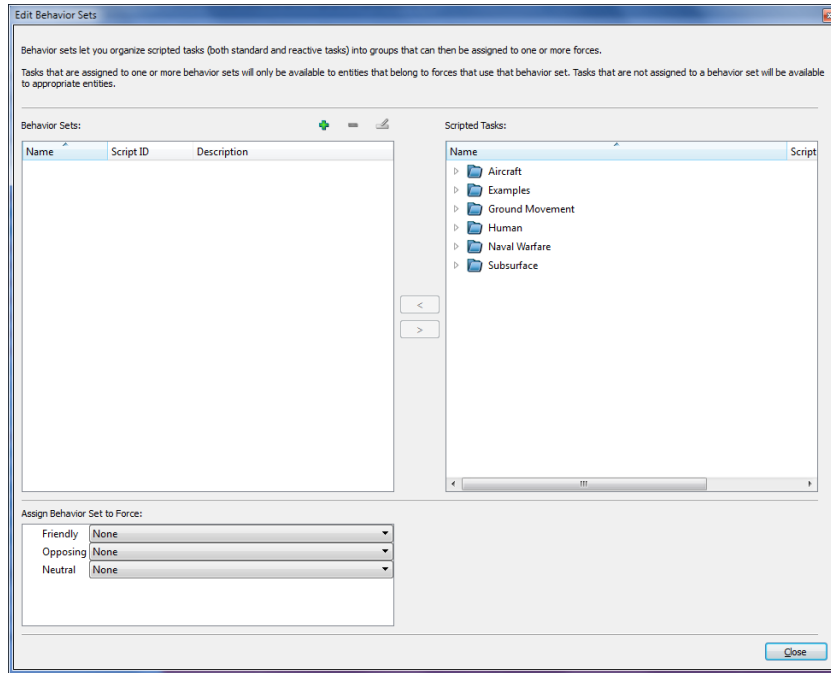


Figure 7-8. Edit Behavior Sets dialog box

2. Click the Add button (+). The New Behavior Set Name dialog box opens.
3. Type a name for the Behavior Set.
4. Click OK.
5. In the Scripted Tasks list, select the scripted tasks that you want to assign to this Behavior Set. Click the left-facing arrow. The scripted tasks are added to the Behavior Set. If you select a folder, all tasks in the folder get added to the Behavior Set. (You can also assign tasks to Behavior Sets in the Edit Scripted Task dialog box. For details, please see “Creating a New Scripted Task,” on page 16-5.)
6. Optionally, assign the Behavior Set to a force.

7.4.2. Editing Behavior Sets

You can edit Behavior Sets, rename them, and delete them.

To edit Behavior Sets:

1. Choose **Simulation** → **Behavior Sets**. The Edit Behavior Sets dialog box opens (Figure 7-8).
2. Expand the Behavior Set that you want to edit.
3. Add and remove scripted tasks by selecting them and clicking the appropriate arrow button.
 - To rename a Behavior Set, select it in the Behavior Sets list, click the Rename button (✎), and type a new name.
 - To delete a Behavior Set, select it in the Behavior Sets list and click the Delete button (✖).

7.4.3. Assigning a Behavior Set to a Force

You can only assign one Behavior Set to a force at any given time.

To assign a Behavior Set to a force:

1. Choose **Simulation** → **Behavior Sets**. The Edit Behavior Sets dialog box opens (Figure 7-8).
2. In the Assign Behavior Set to Force window, click the list for the force to which you want to assign a Behavior Set.
3. Select the Behavior Set that you want to assign. If you do not want any Behavior Sets assigned, select the blank line in the list.

7.5. Entity Movement On Roads and Off Roads

Some terrains have vector road networks. Ground vehicle entities can use these networks to move precisely through the terrain. The tasks for moving on roads are distinct from the tasks for moving without respect to road networks. (For a description of how entities move when they use road driving, please see [“Road Driving Behavior,”](#) on page 7-23.) If you want entities to move both on and off roads, you need to understand how these tasks interact.

The road driving tasks are Move to Waypoint (On Roads) and Move To Location (On Roads). The generic movement tasks are Move to Location (Direct) and Move to Waypoint (Direct).



Road driving tasks are valid only for ground vehicles. If you give a road driving task (including Move To (On Roads), Treat Route as Road, and Use Roads in B-HAVE default plans) to any other type of entity, it will fail.

When you give an entity a generic Move To (Direct) task, it moves directly towards its destination. It will avoid obstacles. It will not pay attention to the terrain except to the extent that it cannot move on certain soil types or terrains that are too steep.

When you give an entity a Move (On Roads) task, it must be within 10 meters of the edge of the road (this is configurable) or the task fails. It will move along the road network to the point nearest the destination and then will stop. If the destination is not on the road, the entity does not leave the road to move to it.

Given these behaviors, if you want an entity to move from an off-road location to another location, but use roads if it can, you will have to give it three tasks:

1. Move to Waypoint (Direct) or Move to Location (Direct), where the waypoint or location is on the road network.
2. Move to Waypoint (On Roads) or Move To Location (On Roads), where the waypoint or location is the final destination or some point on the road network where you want the entity to leave the network.
3. Move to Waypoint (Direct) or Move to Location (Direct), where the waypoint or location is the final off road destination.

VR-Forces has a pair of tasks that combine direct movement and road driving – Move to Waypoint (Plan Path) and Move To Location (Plan Path). If you give an entity one of these tasks, it moves directly to the nearest point on the nearest road, drives along the road to the nearest point to the destination, then drives directly to the destination.

Using one of these tasks saves you from assigning three tasks as in the sequence in the previous paragraphs. However, using a path planning task may not result in the most efficient plan. For example, consider the entity and waypoint in [Figure 7-9](#). The quickest way to get to the waypoint is to drive directly to it across the terrain. Alternatively, it could drive to the road, drive a short distance, and then exit the road. [Figure 7-10](#) shows the path (bold red) that VR-Forces plans when given the Move To Waypoint (Plan Path) task. As you can see, it uses the road network, but not in the most direct way.

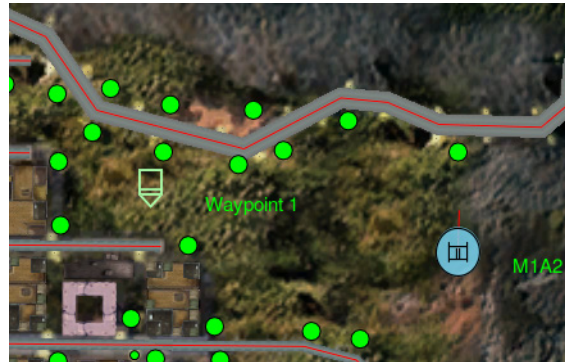


Figure 7-9. Entity and waypoint



Figure 7-10. Result of Move To Waypoint (Plan Path)



The road driving feature in VR-Forces requires that the road vectors making the network be connected at their edges. Some data does not have accurate positions for road ends, which will cause them to be disconnected, and the road driving unable to plan a path along those roads.

7.5.1. Road Driving Behavior

The Move (On Roads) tasks use road driving behaviors intended to provide realistic behavior of multiple cars on a road network. When an entity is given one of these tasks:

- ♦ It clamps to the road and does not deviate from it.
- ♦ It goes around corners accurately.
- ♦ It ignores any obstacles that are near to the road and which would ordinarily trigger obstacle avoidance. The vehicle only responds to obstacles that block the road.
- ♦ If a vehicle is blocking its progress and there is an adjacent lane in the road that is clear, the entity passes the blocking vehicle.

In the Move Along Route task, you can specify that VR-Forces treat the route as a road. The entity would then use the road driving system to follow the route.

7.6. Fixed-Wing Entity Tasks and Behaviors

This section describes the behaviors of fixed-wing entities supplied with VR-Forces and the issues you should keep in mind when assigning tasks and set data requests.

7.6.1. Placement of Newly Created Fixed-Wing Entities

When you create a fixed-wing entity, it is placed on the ground. If you want a fixed-wing entity to start a scenario in the air, you must set its altitude at the beginning of the scenario. It will loiter at the specified altitude.

7.6.2. Fly Task Behavior is Different from Move Task Behavior

Fixed-wing entities can move in response to Fly tasks (Fly Altitude, Fly Heading, and so on) and Move tasks (Move to Waypoint (Direct), Move Along Route, and so on). There are important differences between how fixed-wing entities respond to the different classes of movement tasks. Fixed-wing entities can move on the ground (taxi), in which case they move like ground vehicles.

For Move and Patrol tasks, if a fixed-wing entity is in the air:

- ♦ When a fixed-wing entity moves to a point or between the vertices in a route, it immediately ascends or descends to the altitude of the target point. This is illustrated in [“Fixed-Wing Movement Between Vertices,”](#) on page 7-27.
- ♦ When an entity arrives at a point or the end point of a route, it loiters.

Fly tasks are only for entities that are in the air. You cannot use them to cause an entity to take off or land. For Fly tasks:

- ♦ Entities move to a new altitude at the specified heading, at the specified climb or descent rate.
- ♦ When they reach the new altitude, they continue flying at their current heading.

Given these differences, if you want to change heading, altitude, or both for an entity that is in the air and not executing a Move or Patrol task, use a Fly task. These tasks are not designed to have an entity move to a particular location or along a route. To have an entity move to a particular location or along a route, use a Move or Patrol task. In most cases, Fly Altitude will be preferable to Move to Altitude.

7.6.3. Specifying and Maintaining Altitude for Fixed-Wing Entities

You can explicitly change a fixed-wing entity's altitude in the following ways:

- ♦ The Altitude set data request moves an entity immediately to the specified altitude.
- ♦ The Move to Altitude task causes an entity to spiral to the specified altitude at the same coordinates that it had when it received the task.
- ♦ The Fly Altitude and Fly Heading and Altitude tasks cause the entity to move smoothly to the new altitude while continuing to fly at its current or newly specified heading.

An entity's altitude changes implicitly if it is given a Move or Patrol task in which the altitude of the target point or vertex is different from the entity's current altitude. In this case the entity immediately moves to the new altitude and then proceeds to the target point.



When you assign a task that includes a location and you specify the location by clicking on the terrain, the default altitude is zero. If you do not specify a non-zero altitude in the task dialog box, VR-Forces uses the altitude of the entity at the time the task is assigned. This prevents you from inadvertently specifying a location that would cause the entity to crash.

7.6.4. Fixed-Wing Entity Movement on the Ground and in the Air

Fixed-wing aircraft support takeoff and landing. Since they can move on the ground and in the air, you need to understand their behavior in these different environments. [Table 7-1](#) and [Table 7-2](#) describe how fixed-wing entities respond to Move To, Move Along Route, and Patrol Route tasks depending on their current location. The rest of this section provides additional details about take-off and landing.

Table 7-1: Fixed-wing entity Move To behavior

If entity is on/in the:	and waypoint is on/in the:	the entity:
Ground	Ground	taxis to point.
Ground	Air	takes off towards the point.
Air	Air	flies to point.
Air	Ground	crashes.

Table 7-2: Fixed-wing entity route-following behavior

If entity is on/in the:	and next vertex is on/in the:	the entity:
Ground	Ground	taxis to vertex.
Ground	Air	takes off toward the vertex.
Air	Air	flies to the vertex.
Air	Ground	tries to land at the vertex.

Fixed-wing entities do not support terrain-following. Therefore, when you task a fixed-wing entity to move to a point or follow a route, you must be certain that there are no points in the terrain that are higher than the altitude of the entity's flight path, or the entity will crash. For example, if you assign a fixed-wing entity to follow a route whose vertices are set at 3000 meters above sea level, if the terrain rises above 3000 meters at some point in between two vertices of the route, the entity will crash into the terrain at that point ([Figure 7-11](#)). You can view the terrain profile of the route to check for intersections with the terrain. (For details, please see Section 13.1.1, "[Displaying a Line's Terrain Profile](#)," in *VR-Forces Users Guide*.)

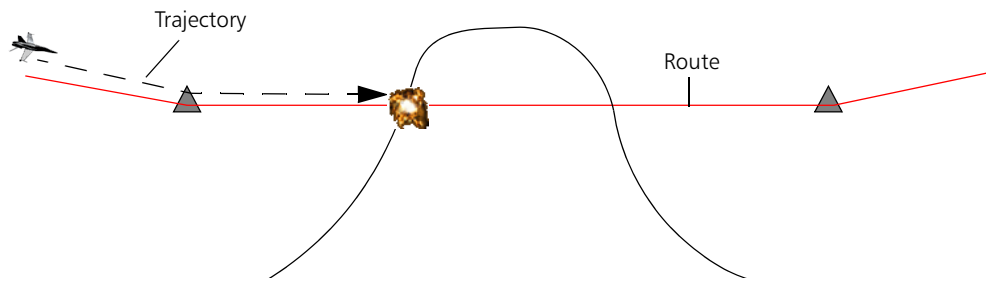


Figure 7-11. Fixed-wing route following

Fixed-Wing Movement Between Vertices

If two vertices in a route are not at the same altitude, a fixed-wing entity does not fly from the first vertex to the second in a smooth gradient. As soon as it passes the first vertex, it immediately descends to the altitude of the next vertex and then continues to fly towards it at that altitude. Therefore, it is possible that you could create a route that does not intersect the terrain, but an entity flying along that route could crash because a location in the terrain exceeds the altitude of a destination point, as illustrated in (Figure 7-12).

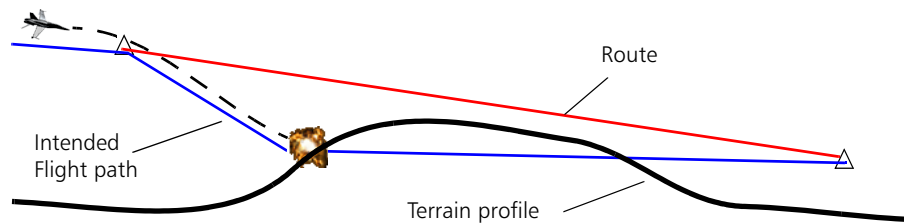


Figure 7-12. Fixed-wing trajectory between vertices



If you want a plane to change altitude using a smooth gradient, use one of the Fly Altitude tasks. However, these tasks do not let you follow a route.

7.6.5. How Fixed-Wing Entities Take Off

You can have fixed-wing aircraft take off using the Fixed Wing Takeoff task (for details, please see “Fixed Wing Takeoff,” on page 8-23) or by using innate behavior. This section describes take-off using innate behavior.

Fixed-wing entities take off by moving to a waypoint that is above ground level or by following a route that has a vertex above ground level.

When you task a fixed-wing entity to move to a waypoint that is above ground level, the entity orients itself directly towards that point and accelerates in the direction of the point. When it reaches its minimum lift speed, it takes off and rises to the altitude of the point it is moving to. You can control the distance required to take off by setting the **max-thrust** parameter.

When a fixed-wing entity takes off, it does not take into account the soil type or terrain, except that if the slope of the terrain along which the entity must move to take off is greater than the **max-slope** parameter, the entity halts.

Fixed-wing entities do not know anything about runways that may be part of a terrain database. When you create a waypoint towards which an entity will take off, or create a route along which an entity will take off, you are responsible for ensuring that the entity is properly oriented towards the runway.

If an entity takes off as part of route following, you can define a runway with two points on the ground. If an entity detects that the point in the route after the one it is moving towards is in the air, it uses the current point as the take-off direction, but takes off as soon as possible and flies to the point in the air. [Figure 7-13](#) illustrates this behavior.

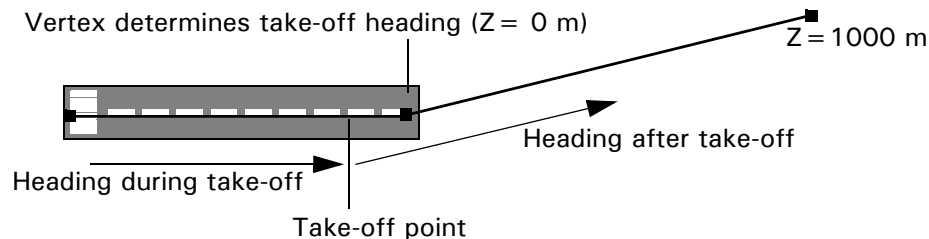


Figure 7-13. Defining a runway for take-off

7.6.6. How Fixed-Wing Entities Land

You can have aircraft land using the Fixed Wing Land task (please see “[Fixed-Wing Land](#),” on page 8-22), or as described in this section. The underlying behavior of the Fixed Wing Land task is the same as in this section. Using the Fixed Wing Land task automates the process of setting up the approach route.

A fixed-wing entity can land only in the context of following or patrolling a route. When a fixed-wing entity follows a route and determines that the next vertex in the route is on the ground, it decelerates as it reduces altitude towards that vertex. If it does not have enough distance from the previous vertex to decelerate sufficiently, it may crash. To ensure adequate deceleration, you may want to create a trigger that sets the entity’s speed when it approaches the runway.

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Any time an entity is within 10 meters of the terrain and it is moving within 10 percent of its minimum lift speed, it will try to land.

To orient an entity for landing, you may have to create several vertices prior to the runway to get the entity properly lined up. [Figure 7-13](#) shows two different routes ending at an airport (the routes have been edited to improve visibility). The first route has vertices that line up the entity with the runway. The second route curves in towards the runway, so the entity does not approach the runway in a straight line. Therefore, as it reaches the landing point, it is not lined up with the runway and it lands on the taxiway.



Entity lands on runway



Entity lands to left of runway

Figure 7-14. Landing fixed-wing entities

7.7. Rotary-Wing Entity Tasks and Behaviors

This section describes the behaviors of rotary-wing entities supplied with VR-Forces and the issues you should keep in mind when assigning tasks and set data requests.

Rotary-wing entities get created on the ground unless you specify an altitude at creation. (For details about specifying an altitude when you create an air platform, please see [“Specifying an Object’s Altitude,”](#) on page 2-14.)

If a rotary-wing entity is airborne and it is not assigned a task, it hovers at the specified location and altitude. When it completes a task, it hovers in the location where it completed the task.

The **terrain-check** parameter determines how a rotary-wing entity interacts with the terrain. If **terrain-check** is False, a rotary-wing entity ignores the terrain. It could appear to fly below ground. However, when **terrain-check** is set to True, VR-Forces does not have to check ground points, so performance may improve.

When **terrain-check** is True, rotary-wing entities interact with the terrain. If a rotary-wing entity approaches a ground point at three meters per second or less, it lands. If it approaches the ground at a greater speed, it crashes.

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- When you assign a task that includes a location and you specify the location by clicking on the terrain, the default altitude is zero. If you do not specify a non-zero altitude in the task dialog box, VR-Forces uses the altitude of the entity at the time the task is assigned. This prevents you from inadvertently specifying a location that would cause the entity to crash.
- Rotary-wing entities are not able to reach moving waypoints or land on moving ships. A rotary-wing entity will approach a given waypoint or landing point, but will never completely reach the goal.

Helicopters have a basic terrain avoidance algorithm that helps prevent crashing if they are sent to waypoints or follow routes that do not have an altitude. The terrain avoidance logic maintains a distance above the ground; it does not look ahead. So, a helicopter could crash if the terrain rises suddenly ([Figure 7-15](#)). You can view the terrain profile of the route to check for intersections with the terrain. (For details, please see [Section 13.1.1](#), “[Displaying a Line’s Terrain Profile](#),” in *VR-Forces Users Guide*.)

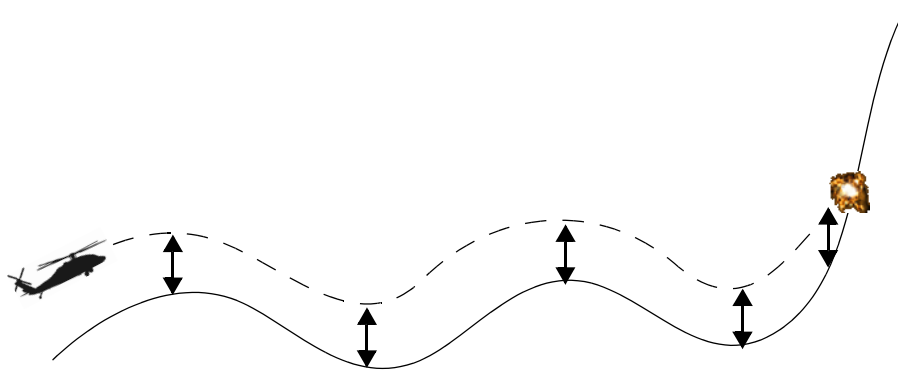


Figure 7-15. Helicopter terrain avoidance

7.7.1. Controlling Rotary-Wing Orientation

A rotary-wing entity can move laterally (sideways) without changing its orientation. In other words, it does not have to face in the direction it is moving. Rotary-wing entity movement controllers have two parameters that configure the speed at which a rotary-wing entity can move laterally. Rotary-wing entities rotate to try to align themselves with their velocity vector under the following circumstances:

- ♦ If the current speed is greater than the speed specified by **vel-to-align-actual**.
- ♦ If the speed of the entity is not greater than **vel-to-align-actual**, but the desired speed of the entity (the velocity it is attempting to achieve as a result of position or velocity commands) is greater than **vel-to-align-desired**.

If you do not want a rotary-wing entity to align itself with its direction of travel, set **vel-to-align-actual** and **vel-to-align-desired** to speeds that are greater than the speed at which you expect the entity to travel. You can set these parameters in the OPD Editor.



8. Task Procedures

This chapter describes the tasks supplied with VR-Forces that apply to entity-level simulations. Some tasks also apply to aggregate-level simulations.

Task Procedures	8-4
Animated Movement	8-5
Arm Mine at Depth	8-6
Come to Stop.....	8-6
Convoy Along.....	8-7
Convoy To	8-8
Deploy Sonobuoy	8-8
Deploy Sonobuoys Along Route	8-9
Disembark	8-10
Disembark All.....	8-10
DI-Guy Animation	8-11
Drop Naval Depth Charge.....	8-12
Drop Naval Depth Charge at Location	8-12
Drop Naval Mine.....	8-13
Drop Naval Mines Along Route.....	8-14
Embark	8-15
Execute Close Air Support	8-17
Explode Charge at Depth.....	8-19
Fire at Target.....	8-19
Fire Cruise Missile	8-20
Fire for Effect Tasks.....	8-21

Firing Naval Guns	8-22
Fixed-Wing Land	8-22
Fixed Wing Takeoff	8-23
Fly Altitude	8-23
Fly Heading	8-24
Fly Heading and Altitude	8-25
Follow Entity	8-26
How Fixed-Wing Entities Follow Entities	8-26
Intercept and Destroy	8-27
Lase Target	8-27
Launch Anti-Submarine Missile (Vertical)	8-28
Launch Counter Measures	8-28
Launch Smoke	8-29
Launch Torpedo	8-30
Anti-ship (Fixed Depth)	8-30
Anti-Submarine	8-31
Lower Periscope	8-31
Move Along Route	8-32
Move Into Formation	8-33
Move To Altitude	8-34
Move To Depth	8-34
Move To Location (Direct)	8-35
Adding Multiple Move To Location (Direct) Tasks to a Plan	8-36
Move To Location (On Roads)	8-36
Move to Location (Plan Path)	8-37
Move to Location (Plan Path) for Ground Vehicles	8-37
Move to Location (Plan Path) for Ships	8-38
Move To Waypoint (Direct)	8-39
Move To Waypoint (On Roads)	8-40
Move to Waypoint (Plan Path)	8-41
Move to Waypoint (Plan Path) for Ground Vehicles	8-41
Move to Waypoint (Plan Path) for Ships	8-42
Orbit	8-43
Patrol Along Route	8-43
Patrol Between	8-44
Pattern Hold (Location)	8-44

Pattern Hold (Waypoint)	8-45
Place IED	8-46
Raise Periscope.....	8-47
Release Bomb Tasks	8-47
Rotary-Wing Land.....	8-48
Sail Heading	8-49
Send Radio Set.....	8-49
Send Radio Task	8-50
Send Text Message	8-50
Sonar Dip	8-51
Sweep Naval Mines	8-52
Turn To Heading	8-52
User Task	8-53
Wait Tasks.....	8-53
Wait	8-53
Wait Duration	8-54
Wait Elapsed	8-54
Reactive Tasks and Background Processes.....	8-55

8.1. Task Procedures

This chapter describes the procedures for the tasks supplied with VR-Forces. Unless noted, they apply to both entity-level simulations and aggregate-level simulations. If a task only applies to entity-level simulations, it has an entity icon () in the margin. Tasks that only apply to aggregate-level simulations are described in Chapter 9, [Aggregate-Level Tasks](#).

If your installation uses the VR-Forces API to add additional tasks, consult with your software engineers for local procedural information. Please see “[Fixed-Wing Entity Tasks and Behaviors](#),” on page 7-23 and “[Rotary-Wing Entity Tasks and Behaviors](#),” on page 7-30, for additional information about assigning tasks to these entity types.

The instructions for creating tasks direct you to use options on the Task menu. However, all the options available on the main menu are also available on context-sensitive menus. A limited number of tasks are available on the Tasks Toolbar.



8.2. Animated Movement

The Animated Movement task lets you assign a scripted behavior to an entity. This task is a generalized version of firing ballistic missiles, which is described in “[Ballistic Missiles](#),” on page 14-8. To use this task, you must first create a file that describes the movements that you want an entity to make. Animated movement files can be in comma-separated values (CSV) format or 3DS ASCII Export (ASE) format. You configure animated movement tasks in the Entity Editor. For details, please see Section 6.5.2, “[Configuring Animated Movement](#),” in *VR-Forces Configuration Guide*.

To assign an animated movement task:

1. Select the entity to task.
2. Choose **Task** → **Movement** → **Animated Movement**. The Animated Movement dialog box opens ([Figure 8-1](#)).

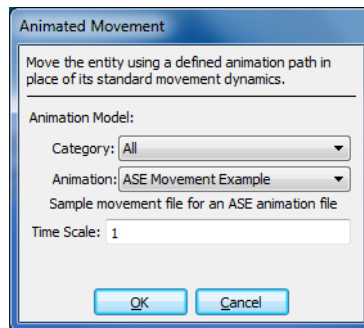


Figure 8-1. Animated Movement dialog box

3. Optionally, filter the animation list by selecting a category in the Category list.
4. Select an animation in the Animation list. You are responsible for knowing that the animation is appropriate to the entity you selected.
5. Optionally, specify a time scale. By changing the time scale you can make the animation run faster or slower than specified in the animation file.
6. Click OK.



8.3. Arm Mine at Depth

If a naval mine has been deployed, Arm Mine at Depth lets you change the mine's parameters.

Arm Mine at Depth is a system scripted task. It is disabled by default.

 To arm a mine:

1. Select the mine.
2. Choose **Task** → **Arm Mine at Depth**. The Arm Mine at Depth dialog box opens.
3. Specify the depth at which to arm the mine.
4. Specify the radius within which target entities will detonate the mine.
5. Optionally, specify a time when the mine will be armed, in days and hours:minutes:seconds.
6. In the Targets list, add the types of entities that can trigger the mine, as follows:
 - a. Click the Add button (). The Entity Type dialog box opens.
 - b. Build an entity type by selecting options from the lists for each enumeration component or type an enumeration.
 - c. Click OK.
7. To specify that only hostile entities will set off the mine, select Hostile Only. If this setting is cleared, any entity will set off the mine.
8. Click OK.



8.4. Come to Stop

The Come to Stop task stops a surface entity using a normal stop, an emergency stop, or a slow drift.

 To assign a Come to Stop task:

1. Select the entity.
2. Choose **Task** → **Movement** → **Come to Stop**. The Come to Stop dialog box opens.
3. Select an option for how to stop.
4. Click OK.



8.5. Convoy Along

The Convoy Along task commands an aggregate to move along a route in a convoy. When the task starts, the lead entity moves far enough along the route for the rest of the aggregate to create a column that ends approximately at the beginning of the route. Then the aggregate begins moving along the route.



The Convoy Along task is valid only for ground-vehicle aggregates.

For more details about convoys, please see [“Convoy Tasks,”](#) on page 7-10.

To assign a Convoy Along task:

1. Select the aggregate that you want to send in a convoy.
2. Choose **Task** → **Movement** → **Convoy Along**. The Convoy Along dialog box opens.
3. Specify the route to convoy along.
4. Click OK.



8.6. Convoy To

The Convoy To task commands an aggregate to move to a waypoint in a convoy. If you specify use of roads, VR-Forces uses the information in the road network to plan the convoy's movement. If you do not specify use of roads, the convoy moves directly across the terrain as an individual entity would move in a Move To task.



The Convoy To task is valid only for ground-vehicle aggregates.

For more details about convoys, please see “[Convoy Tasks](#),” on page 7-10.

To assign a Convoy To task:

1. Select the aggregate that you want to send in a convoy.
2. Choose **Task** → **Movement** → **Convoy To**. The Convoy To dialog box opens.
3. Specify the waypoint to convoy to.



When you specify use of roads, VR-Forces looks for roads over a fairly wide area and if one is found, will try to use them even if this results in an indirect approach to the waypoint. If there are no roads close to the route you would expect the aggregate to take to reach the waypoint, do not select this option.

4. Click OK.



8.7. Deploy Sonobuoy

The Deploy Sonobuoy task lets an aircraft deploy a sonobuoy for taking sonar readings. A sonobuoy is deployed as an entity. This task is available to entities that have a Sonobuoy Deployer system configured. Deploy Sonobuoy is a system scripted task.



RPR FOM 1.0 does not support active sonar. You will not be able to create sonobuoys if they have an active sonar system.

To deploy a sonobuoy:

1. Select the entity.
2. Choose **Task** → **Deploy Sonobuoy**. The Deploy Sonobuoy dialog box opens.
3. Select the type of sonar to use – Active or Passive.
4. Specify the depth at which to deploy the sonobuoy.
5. Click OK.



8.8. Deploy Sonobuoys Along Route

The Deploy Sonobuoys Along Route task lets an aircraft deploy sonobuoys as it moves along a route. A sonobuoy is deployed as an entity. This task is available to entities that have a Sonobuoy Deployer system configured. Deploy Sonobuoys Along Route is a system scripted task.



RPR FOM 1.0 does not support active sonar. You will not be able to create sonobuoys if they have an active sonar system.

To deploy sonobuoys along a route:

1. Select the entity.
2. Choose **Task** → **Deploy Sonobuoys Along Route**. The Deploy Sonobuoys Along Route dialog box opens.
3. Select the route to use.
4. Specify the distance between each sonobuoy.
5. Select the type of sonar to use – Active or Passive.
6. Specify the depth at which to deploy the sonobuoys.
7. Click OK.

8.9. Disembark

The Disembark task causes an entity to move to the parent entity's egress (exit) point and disembark. If the selected entity is an aggregate (disaggregated), the disembark task is given to all embarked subordinates. The task is considered complete when all subordinates are disembarked. To disembark entities immediately, that is, without using a task, please see [“Embarking and Disembarking Entities,”](#) on page 3-6.



- ♦ When an entity disembarks, it simply goes to the disembarkation location. If you plan to disembark several entities from the same parent by giving them disembark tasks, you are responsible for making sure that each entity moves from the disembarkation point before the next entity disembarks.
- ♦ Aggregate entities in the aggregated state cannot embark or disembark. If a disaggregated entity is embarked, you cannot aggregate it either manually, or as a result of automated aggregation conditions.

To disembark an entity:

1. Select the entity you want to disembark.
2. Choose **Task** → **Embarkation** → **Disembark**, or click the Disembark button () on the Tasks Toolbar.

8.10. Disembark All

The Disembark All task is given to a parent entity. It gives a Disembark task to all embarked entities except aggregates. When you issue a Disembark All task, VR-Forces tries to disembark the entities sequentially and have them move to sufficiently dispersed locations to avoid collision problems.

To disembark all entities from a parent entity:

1. Select the parent entity.
2. Choose **Task** → **Embarkation** → **Disembark All**.



8.11. DI-Guy Animation

VR-Forces can specify the movements and appearance of DI-Guy models used in the Stealth observer mode and in 3D visualization programs such as VR-Vantage Stealth. The DI-Guy Animation task directs the 3D model to engage in a one-time or repeated series of motions. VR-Forces does not simulate the actions that the 3D model performs; it just adjusts the location and orientation of the VR-Forces entity to synchronize it with the 3D model's animated behavior. To change a 3D model's appearance, use the DI-Guy Appearance set data request. For details, please see “[DI-Guy Appearance](#),” on page 10-11.



The DI-Guy Animation task applies only to lifeform entities.

To specify a DI-Guy animation:

1. Select the lifeform entity whose behavior you want to animate.
2. Choose **Task** → **DI-Guy** → **DI-Guy Animation**. The DI-Guy Animation dialog box opens ([Figure 8-2](#)).

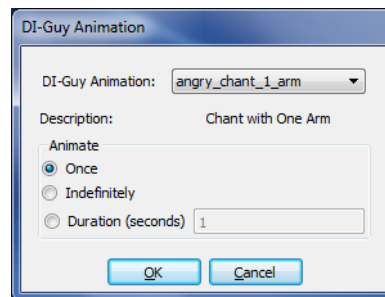


Figure 8-2. DI-Guy Task Animation dialog box

3. In the Animation list, select an animation. The names of animation options do not always clearly describe the animation. The Description is a friendlier description of what the animation is.



You can edit the animation description. Descriptions are in `./appData/settings/vrfSim/character_animations_table.mtl`.

4. In the Animate group box, specify the duration of the animation.
5. Click OK.



8.12. Drop Naval Depth Charge

The Drop Naval Depth Charge task drops a depth charge at the current location of the entity. To execute this task, an entity must have a Naval Depth Charge Deployment weapons system. Drop Naval Depth Charge is a system scripted task.

To drop a naval depth charge:

1. Select the entity.
2. Choose **Task** → **Engagement** → **Drop Naval Depth Charge**. The Drop Naval Depth Charge dialog box opens.
3. In the Naval Depth Charge list, select the type of depth charge to drop.
4. Specify the depth at which you want the depth charge to explode.
5. Click OK.



8.13. Drop Naval Depth Charge at Location

The Drop Naval Depth Charge at Location task drops a depth charge at a specified location. To execute this task, an entity must have a Naval Depth Charge Deployment weapons system. Drop Naval Depth Charge at Location is a system scripted task.



In this task, the location is the location of the entity when it drops the depth charge. Since the entity is flying, the location must include a reasonable altitude.

To drop a naval depth charge at a location:

1. Select the entity.
2. Choose **Task** → **Engagement** → **Drop Naval Depth Charge at Location**. The Drop Naval Depth Charge At Location dialog box opens.
3. In the Naval Depth Charge list, select the type of depth charge to drop.
4. Specify the depth at which you want the depth charge to explode.
5. Specify the location where you want to drop the depth charge.

By default, this task uses the altitude of the entity at the time the task is assigned as the altitude for the drop location. (Use Current Altitude check box.) If you specify an altitude and the check box is selected, VR-Forces ignores the altitude you entered and uses the current entity altitude. If you want to specify the altitude, clear the check box and make sure that you specify the altitude in the Altitude group box. If you click on the terrain to specify the X, Y location, the altitude gets set to 0, so be sure to enter the altitude you want after clicking on the terrain.

6. Click OK.



8.14. Drop Naval Mine

The Drop Naval Mine task allows entities with a Naval Mine Deployment system to drop naval (underwater) mines at their current location. Drop Naval Mine is a system scripted task.

To drop a naval mine:

1. Select the entity.
2. Choose **Task** → **Engagement** → **Drop Naval Mine**. The Drop Naval Mine dialog box opens.
3. In the Naval Mine list, select the type of mine to drop.
4. In the Mine Depth field, set the depth to drop the mine. Positive numbers are below sea level.
5. In the Arming Delay fields, set the time to elapse before the mine becomes armed. The first field is days. The second field is Hours:Minutes:Seconds.
6. In the Detonate Proximity field, set the distance from the mine within which a target entity will detonate the mine.
7. In the Trigger Entity Types list, add the types of entities that can trigger the mine, as follows:
 - a. Click the Add button (🔍). The Entity Type dialog box opens.
 - b. Build an entity type by selecting options from the lists for each enumeration component or type an enumeration.
 - c. Click OK.
8. To specify that only hostile entities will set off the mine, select Hostile Only. If this setting is cleared, any entity will set off the mine.
9. Click OK.



8.15. Drop Naval Mines Along Route

The Drop Naval Mines Along Route task allows entities with a Naval Mine Deployment system to drop naval (underwater) mines while they travel along a route. Drop Naval Mines Along Route is a system scripted task.

To drop naval mines along a route:

1. Select the entity.
2. Choose **Task** → **Engagement** → **Drop Naval Mine**. The Drop Naval Mines Along Route dialog box opens.
3. Select the route to follow.
4. In the Mine Spacing field, specify the distance between each mine.
5. In the Naval Mine list, select the type of mine to drop.
6. In the Mine Depth field, set the depth to drop the mine. Positive numbers are below sea level.
7. In the Arming Delay fields, set the time to elapse before the mine becomes armed. The first field is days. The second field is Hours:Minutes:Seconds.
8. In the Detonate Proximity field, set the distance from the mine within which a target entity will detonate the mine.
9. In the Trigger Entity Types list, add the types of entities that can trigger the mine, as follows:
 - a. Click the Add button (📁). The Entity Type dialog box opens.
 - b. Build an entity type by selecting options from the lists for each enumeration component or type an enumeration.
 - c. Click OK.
10. To specify that only hostile entities will set off the mine, select Hostile Only. If this setting is cleared, any entity will set off the mine.
11. Click OK.

8.16. Embark

The Embark task causes an entity to move to the ingress (entry) point of the parent entity and embark on it. If the embarking entity is an aggregate, each available taskable subordinate is given an embark task. When all subordinates have embarked, the aggregate task is considered complete.



Aggregate entities in the aggregated state cannot embark or disembark.

The Embark task is valid only if the specified parent entity is configured to accept the entity that wants to embark on it. If you task an entity to embark on an entity that is not configured to receive it, for example, you task a DI to embark on an M1A2, the entity will not respond to the task. If you want to embark an entity on an entity that is not configured to receive it, you can use the immediate embarkation process. For details, please see [“Embarking and Disembarking Entities,”](#) on page 3-6.

[Table 8-1](#) lists the entities that support embarkation that have slots configured and the number and type of embarked entities they can hold. (Other entities may support embarkation, but not have slots configured.) High fidelity entities (HF column) have polygonal models of the entity and embarkation slots defined in such a way that the embarking entities can smoothly embark on the host entity when viewed in the 3D view or VR-Vantage.

Table 8-1: Embarkation support

Entity	Can Carry	HF
M2A2 Bradley IFV	6 DI	
M113 Armored Utility Vehicle	11 DI	
M-939A2 5-Ton Truck	14 DI	x
MT-LB Multipurpose Armored Vehicle	11 DI	
BTR-80 Armored Personnel Carrier	11 DI	
BMP-2 AVF	7 DI	
C-130 Hercules	92 DI or 3 ground vehicles	
CH-46E Sea Knight	11 DI	
CH-53E Super Stallion	55 DI	
UH-60 Blackhawk	11 DI	
OH-58 Kiowa	6 DI	
Mi-2 Hoplite	11 DI	
LCAC Landing Craft Air Cushion	12 HMMWVs or 4 trucks or 1 M1A2 or 1 generic ground vehicle	x
LSD-49 Harpers Ferry	2 LCACs and 2 helicopters	x

Table 8-1: Embarkation support

Entity	Can Carry	HF
Guided Missile Destroyer	2 helicopters	
Aircraft Carrier	12 fighters or 9 fighters and 2 cargo planes. Three helicopters. 70 planes below deck.	x

The aircraft carrier can carry both fixed-wing and rotary-wing aircraft. After the deck positions are used, additional entities embarked are stored below deck, as in a low-fidelity model.



- ♦ If you are using HLA and want to use the embarkation feature, you must use RPR FOM 2, draft 17 or later. VR-Forces includes entries on the Simulation Connections Configuration dialog box that start VR-Forces using the correct FED file and FOM Mapper for RPR FOM 1.0, and RPR FOM 2.
- ♦ If the embarkation spaces on the parent entity are full, VR-Forces sends a message to the back-end console and the entity does not try to embark.
- ♦ If you give multiple entities embark tasks for the same parent, you are responsible for spreading the tasks over time so that the entities do not all converge on the parent at the same time, which would result in problems due to collision avoidance.

To embark an entity:

1. Select the entity.
2. Choose **Task** → **Embarkation** → **Embark**, or click the Embark button (🚢) on the Tasks Toolbar. The Embark On dialog box opens.



Unlike the Embark On dialog box that opens when you choose **Entities** → **Embark**, the Embark On dialog box for the Embark task does not allow you to choose the embarkation point.

3. Select the parent entity (the entity to embark on) or type its name in the Name box.
4. Click OK.



8.17. Execute Close Air Support

The Execute Close Air Support task assigns a fixed-wing fighter or bomber a close air support (CAS) task based on a 9-Line Briefing. The entity being tasked must be in the air to execute this task. This is a system scripted task.



A 9-Line Briefing is a format used by U.S. armed forces to call in CAS. The Execute Close Air Support dialog box explicitly or implicitly requests all of the information in a 9-Line Briefing. However, the scripted task does not use all of this information to simulate CAS. (The procedure notes which fields are not used.) The task has parameters for all 9 lines to provide simulation authenticity. Since this is a scripted task, you could modify it to use all of the parameters.

To execute close air support:

1. Select the entity you want to fire.
2. Choose **Task** → **Engagement** → **Execute Close Air Support**. The Execute Close Air Support dialog box opens ([Figure 8-3](#)).
3. In the Initial Point section, specify the location from which the aircraft should line up with the target by entering location values or clicking on the terrain.
4. In the Heading box, specify the approach heading. Optionally, specify an offset if you want the entity to favor a particular side of the line of approach.
5. In the Distance box, specify the distance from the initial point to the target. This information is not used by the task.
6. Select the target. Target selection satisfies lines 4, 5, and 6 of a 9-Line briefing, because it provides the location, altitude, and name of the target.
7. In the Mark Type box, specify how the target is marked. This information is not used by the task.

Execute Close Air Support

Execute a call for Close Air Support (CAS) to engage a named target.

9-Line

1. Initial Point:

X: 0.00

Y: 0.00

Altitude: use current

2. Heading: (Rad): 0.0000

Offset: none

3. Distance (m): 0

4-6. Target:

Filter: All Entities

Name:

Name

- Sailbt 1
- Dstryr 1
- Cvln 1
- A320 1
- CivRW 1
- AR 1
- FtrFW 1

7. Mark Type:

Laser Code 0

8. Friendlies:

9. Egress Heading: (Rad): 0.0000

Attack Information

Ordinance: weapon-3/GBU-31A-JDAM

OK Cancel

Figure 8-3. Execute Close Air Support dialog box

8. If you are using a laser designator to mark the target, enter the laser code. (If you specify a laser code, an entity in the simulation must be lasing the target for the CAS to work.)
9. In the Friendlies box, specify the distance and direction of friendly forces from the target. This information is not used by the task.
10. In the Egress Heading box, specify the heading by which the attacking entity should leave after parting the target. It will continue on this heading until it is given another task.
11. In the Ordinance list, select the type of bomb to drop.
12. Click OK.



8.18. Explode Charge at Depth

The Explode Charge at Depth task explodes a depth charge at the specified depth. You can use this task to explode a depth charge that has been deployed, but has not yet exploded.

Explode Charge at Depth is a system scripted task. It is disabled by default.

To explode a depth charge:

1. Select the depth charge.
2. Choose **Task** → **Explode Charge at Depth**. The Explode Charge at Depth dialog box opens.
3. Specify the depth.
4. Click OK.



8.19. Fire at Target

The Fire at Target task commands an entity to fire at a specific target. You can specify which weapon system to use and how many rounds to fire.

When you issue this task, the entity ignores its rules of engagement and force types. Entities will fire at their own force if told to do so. The shooter must have line-of-sight to the target and have an appropriate weapons system and ammunition for the target.

To order an entity to fire at a target:

1. Select the entity you want to fire.
2. Choose **Task** → **Engagement** → **Fire at Target**. The Fire at Target dialog box opens.
3. Select the target entity.
4. In the Weapon Selection group box, select an option as follows:
 - To let VR-Forces choose the weapon, select Automatic.
 - To choose the weapon yourself, select Manual and select a weapon from the list.
5. In the Maximum Rounds to Fire box, enter the number of rounds you want the entity to fire. (The entity will stop firing when the target is destroyed or when the maximum number of rounds has been fired, whichever comes first.)



8.20. Fire Cruise Missile

A cruise missile can fly directly to a target or follow a route.

To fire a cruise missile:

1. Select an entity that has cruise missile resources.
2. Choose **Task** → **Engagement** → **Fire Cruise Missile**. The Fire Cruise Missile dialog box opens (Figure 8-4).

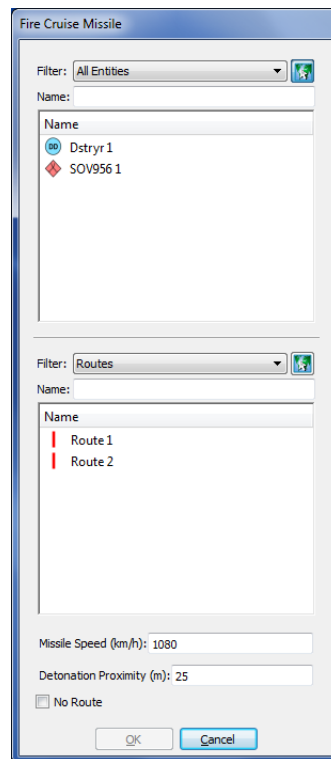


Figure 8-4. Fire Cruise Missile dialog box

3. Select the target from the list or on the terrain, or type its name in the Name box. Targets can be entities or points.
4. Select a route for the missile to follow or select the No Route check box. If no route is selected, the missile flies directly to the target.
5. Specify the ordered speed for the missile.
6. Specify the detonation proximity for the warhead. It will detonate within this range of the selected target.
7. Click OK.



8.21. Fire for Effect Tasks

You can task artillery entities and surface vessels that have naval guns to fire for effect. The three options are:

- ♦ Fire-for-Effect on Entity.
- ♦ Fire-for-Effect on Location, where location is a point on the terrain.
- ♦ Fire-for-Effect on Target, where a target is a waypoint.

If an entity has more than one weapon, you can select multiple weapons to fire. However, they will all fire on the same target. You cannot target them independently.

To assign a Fire-for-Effect task:

1. Select the entity to which you want to assign the task. (It must be an artillery entity.)
2. Choose **Task** → **Engagement** → **Fire-for-Effect on Entity** (or Location or Target). The appropriate dialog box opens.
3. Identify the target as follows:
 - For FFE Entity, select the target entity in the list, select it on the terrain, or type its name in the Name box.
 - For FFE Location, click a location on the terrain, or enter the coordinates.
 - For FFE Target, select a point from the list, or select it on the terrain.



For FFE Entity and FFE Target, you can filter the target list.

5. In the Select Weapons list, select the weapons that you want to fire.
6. Specify the number of rounds.
7. Optionally, specify the height above the terrain at which rounds should detonate.
8. Click OK.



- ♦ The Fire-for-Effect tasks are only meaningful when assigned to artillery entities or surface vessels that have naval guns.
- ♦ When you choose Fire-for-Effect on Entity, VR-Forces notes the location of the entity and fires at that spot. If the targeted entity moves, the artillery does not change the location at which it is firing.
- ♦ Artillery entities have maximum and minimum ranges. To see these ranges, enable range rings for the entity. (For details, please see Section 7.9, “[Displaying Threat and Sensor Range Rings](#),” in *VR-Forces Users Guide*.) The back-end console window prints messages when you select targets that are outside of the entity’s range.



8.21.1. Firing Naval Guns

Ordinarily, naval guns fire their munitions in a parabola, similar to artillery. However, they can also fire directly at a target if the following conditions are true:

- ♦ The target's range is greater than the weapon's minimum range, but less than the first value in its range list.
- ♦ The **capable-of-direct-alignment** parameter for the weapon system's naval-gun-controller is set to True.
- ♦ The firing entity has line-of-sight to the target.



8.22. Fixed-Wing Land

[“How Fixed-Wing Entities Take Off,”](#) on page 7-28, describes how fixed-wing entities land and the steps to design a landing approach. The Fixed Wing Land task automates the process of landing a fixed-wing aircraft. However, you must still specify a route to serve as the runway. Fixed-Wing Land is a system scripted task.

When the task is invoked, VR-Forces defines an approach route for the plane to move along. The length of this route is either the plane's altitude or the length needed to slow the plane down to landing speed, whichever is greater. The route is created and the plane moves along the route, coming to landing speed. At the end of the approach route, the plane is tasked to move along the runway.



Although it is possible to land an entity on another entity, such as an aircraft carrier, if you want to embark an entity, you must use the Embark task, not a landing task.

To land a fixed-wing aircraft:

1. Select the entity.
2. Choose **Task** → **Movement** → **Fixed Wing Land**. The Fixed Wing Land dialog box opens.
3. In the Name box, type the name of the route you want it to land on, or select the route in the list or on the terrain.
4. Click OK.



8.23. Fixed Wing Takeoff

You can explicitly task a fixed-wing entity to take off. (For details about implicit take-off, please see [“How Fixed-Wing Entities Take Off,”](#) on page 7-28.) In a Fixed Wing Takeoff task, the entity moves along the specified route, reaches takeoff speed (30% of minimum lift), and then moves to a point defined by the controller some distance up and away from the end of the route. Fixed-Wing Takeoff is a system scripted task.

To assign a Fixed Wing Takeoff task:

1. Select the entity.
2. Choose **Task** → **Movement** → **Fixed Wing Takeoff**. The Fixed Wing Takeoff dialog box opens.
3. Select the route to take off on or type its name in the Name box.
4. Click OK.



8.24. Fly Altitude

The Fly Altitude task commands a fixed-wing or rotary-wing entity to fly to the specified altitude at a specified ascent or descent rate, using its current heading and ordered speed. When it reaches the altitude it continues to fly at that altitude at the current heading until it receives other commands. The entity will not exceed the limits for altitude or ascent/descent rate set in the OPD for the entity type.

You cannot use a Fly Altitude task to cause a fixed-wing entity to take off. A fixed-wing entity that is on the ground ignores this task.

If a rotary-wing entity is on the ground and is given this task, it rises to the specified altitude as it moves forward at its current heading. If a rotary-wing entity is in the air and is given this task with an altitude of zero, it descends to approximately 33 M and continues flying at that altitude at its current heading.

To assign a Fly Altitude task:

1. Select a fixed-wing or rotary-wing entity.
2. Choose **Task** → **Movement** → **Fly Altitude**. The Fly Altitude dialog box opens.
3. In the Altitude box, specify the altitude above sea level to fly to.
4. In the Climb/Descent Rate box, specify the rate.
5. Click OK.



8.25. Fly Heading

The Fly Heading task commands a fixed-wing or rotary-wing entity to turn to the specified heading at the specified turn rate. It maintains its current altitude and speed. When it is finished turning to the new heading, it continues to fly at this heading until it receives other commands. The entity will not exceed the turn rate specified in the OPD.

A fixed-wing entity that is on the ground ignores this task.

If a rotary-wing entity is on the ground and is given this task, it rises to approximately 60 M and then drops down to approximately 33 M while simultaneously moving forward and turning to the specified heading. After turning to the new heading, it continues moving forward. Its altitude varies somewhat as it follows the terrain.

To assign a Fly Heading task:

1. Select a fixed-wing or rotary-wing entity.
2. Choose **Task** → **Movement** → **Fly Heading**. The Fly Heading dialog box opens.
3. In the Heading box, specify the heading to fly to.
4. In the Turn Rate box, specify the rate.
5. Click OK.



8.26. Fly Heading and Altitude

The Fly Heading and Altitude task commands a fixed-wing or rotary-wing entity to fly to a specified altitude, at a specified ascent or descent rate, while turning to a specified heading at a specified turn rate. If you do not specify a heading or altitude, the entity continues to use the current value for that parameter.

While executing this task, the entity maintains its current speed. When it completes the command, it continues to fly at the new altitude and heading until given other commands. The entity will not exceed the limits on altitude, turn rate, and ascent/descent rate set in the OPD.

You cannot use a Fly Heading and Altitude task to cause a fixed-wing entity to take off. A fixed-wing entity that is on the ground ignores this task.

If a rotary-wing entity is on the ground and is given this task, it takes off and moves forward while it rises to the specified altitude and turns to the specified heading. If a rotary-wing entity is in the air and is given this task with an altitude of zero, it moves forward and turns to the new heading while it descends to approximately 33 M and continues flying at that altitude on the new heading.

To assign a Fly Heading task:

1. Select a fixed-wing or rotary-wing entity.
2. Choose **Task** → **Movement** → **Fly Heading and Altitude**. The Fly Heading and Altitude dialog box opens.
3. In the Heading box, specify the heading to fly to.
4. In the Altitude box, specify the altitude above sea level to fly to.
5. In the Turn Rate box, specify the rate.
6. In the Climb/Descent Rate box, specify the rate.
7. Click OK.



8.27. Follow Entity

You can order an entity to follow another entity. You can specify a distance and offset between the entities. If you tell two or more entities to follow the same entity, make sure that you do not give them the same offset (please see [“Following Entities,”](#) on page 11-35).

An entity continues to follow its target entity until:

- ♦ The task is overridden.
- ♦ The followed entity is destroyed.

If entity A is assigned to follow entity B, but it cannot find entity B, entity A continues to look for entity B until entity B becomes available, or until entity A is assigned another task.

The following entity tries to match the speed of the followed entity unless it has to hold back or catch up to accommodate changes in direction or terrain effects.

To order an entity to follow another entity:

1. Select the entity.
2. Choose **Task** → **Movement** → **Follow Entity**. The Follow Entity dialog box opens.
3. Optionally, filter the entity list.
4. In the Name box, type the name of the entity to follow, or select it from the list or on the terrain.
5. Optionally, type an offset in the Behind, Right, and Above text boxes. If you want an entity to follow in front, to the left, or below, put a minus sign (-) in front of the value.
6. Click OK.

8.27.1. How Fixed-Wing Entities Follow Entities

A fixed-wing entity can follow an entity that is on the ground, or might be on the ground, for example if it is following a fixed-wing entity that lands. To ensure that the follower does not crash, make sure that it is following above the followed entity and that the distance above is high enough to account for changes in the terrain.



8.28. Intercept and Destroy

The Intercept and Destroy task tells an entity to move towards the target entity and engage it in any way that is appropriate.



Intercept and Destroy turns off collision avoidance for the tasked entity. Its primary purpose is to allow entities such as car bombs and suicide bombers to approach a target entity and detonate its munition. If you give this task to an entity that does not have any offensive capability, such as a truck, it will ram the target. However, since VR-Forces does not model the effects of two entities colliding, there will be no damage to either entity and the tasked entity may end up circling the target. Therefore, you should be careful about which entities you assign this task to or the results may not be what you expect.

To assign the Intercept and Destroy task:

1. Select the entity to which you want to assign the task.
2. Choose **Task** → **Engagement** → **Intercept and Destroy**. The Intercept and Destroy dialog box opens.
3. Select the entity that is to be the target of the assault.
4. Optionally, specify a standoff distance. The entity will not go closer to the target than this distance.
5. Click OK.



8.29. Lase Target

The Lase Target task simulates aiming a laser beam at a target to guide a laser guided weapon. By default, entities with laser capability lase autonomously. Use this task if you want to lase a specific target. An entity can lase a target while it is executing a movement task.

To lase a target, an entity must have a Laser Designator system.

To lase a target:

1. Select the entity that will aim the laser.
2. Choose **Task** → **Engagement** → **Lase Target**. The Lase Target dialog box opens.
3. Select the entity that you want to lase.
4. Click OK.



8.30. Launch Anti-Submarine Missile (Vertical)

The Launch Anti-Submarine Missile (Vertical) task lets a surface entity launch a missile that flies to the vicinity of the target and then drops a homing torpedo. To execute this task, an entity needs an Anti-Submarine Missile (Vertically Launched) weapon system. This is a system scripted task.

To launch an anti-submarine missile:

1. Select the surface entity.
2. Choose **Task** → **Engagement** → **Launch Anti-Submarine Missile (Vertical)**. The Launch Anti-Submarine Missile (Vertical) dialog box opens.
3. Select the target entity.
4. Specify the location at which to drop the homing torpedo.
5. Click OK.



8.31. Launch Counter Measures

Fixed-wing and rotary-wing entities can launch counter measures, such as chaff and flares. Launch Counter Measures is not an exclusive task. It does not interrupt an entity's current task. (For more information, please see [“Launching Counter Measures \(Chaff and Flare\),”](#) on page 13-18.)

To launch counter measures:

1. Select the entity that you want to launch counter measures.
2. Choose **Task** → **Engagement** → **Launch Counter Measures**. The Launch Counter Measures dialog box opens.
3. In the Counter Measure Types list, select the type of counter measures you want to launch.
4. In the Number To Fire box, specify the number of counter measures to launch.
5. In the Time Between Fires box, specify the amount of time, in seconds, between each counter measure launch.
6. Click OK.



8.32. Launch Smoke

The Launch Smoke task causes an entity to create a smoke cloud. The cloud is created as an environmental object. It grows over time.

An entity can launch a smoke cloud towards a threat or in a specific direction. Smoke clouds affect sensors. They do not affect entity movement.



Tactical smoke is delivered by the M250 smoke grenade launcher. An entity must have this system to execute this task.

To launch a smoke cloud:

1. Select the entity that you want to launch smoke.
2. Choose **Task** → **Engagement** → **Launch Smoke**. The Launch Smoke dialog box opens.
3. Select At Nearest Threat or Toward Compass Heading.
4. If you selected Toward Compass Heading, specify a compass heading, in degrees.
5. Click OK.



8.33. Launch Torpedo

Subsurface entities can launch two types of anti-ship torpedoes. One moves at a fixed depth; one homes in on the center of the target. In both cases, the torpedo travels at an initial bearing for a fixed distance before it homes in on the target. The Launch Torpedo tasks are system scripted tasks.



Torpedoes rise to target depth at a fixed rate. If a submarine is quite close to a target when it fires, the torpedo might not be able to rise to target depth in the distance from the submarine to the target. If this happens, it will circle until it reaches target depth.



8.33.1. Anti-ship (Fixed Depth)

To launch a torpedo that moves at a fixed depth:

1. Select a subsurface entity.
2. Choose **Task** → **Engagement** → **Launch Torpedo** → **Anti-ship (Fixed Depth)**. The Anti-ship (Fixed Depth) dialog box opens.
3. Optionally, filter the entity list.
4. Select the target entity.
5. In the Homing Start Delay box, enter the amount of time that the torpedo should travel on its initial bearing.
6. In the Cruise Depth box, specify the depth the torpedo should travel at. It will remain at this depth.
7. In the Initial Bearing box, specify the bearing the torpedo should travel at until it begins homing in on the target.
8. In the Proximity Trigger Distance box, set the distance from a target at which the torpedo will detonate.
9. Click OK.



8.33.2. Anti-Submarine

The anti-submarine torpedo homes in on the center of the target.

To launch an anti-submarine torpedo:

1. Select a subsurface entity.
2. Choose **Task** → **Engagement** → **Launch Torpedo** → **Anti-submarine**. The Anti-Submarine dialog box opens.
3. Optionally, filter the entity list.
4. Select the target entity.
5. In the Homing Start Delay box, enter the amount of time that the torpedo should travel on its initial bearing.
6. In the Initial Bearing box, specify the bearing the torpedo should travel at until it begins homing in on the target.
7. In the Proximity Trigger Distance box, set the distance from a target at which the torpedo will detonate.
8. Click OK.



8.34. Lower Periscope

The Lower Periscope task lowers the periscope of a subsurface entity. The periscope is an articulated part that is visible in the Stealth view. Lower Periscope is a system scripted task.

To lower a submarine's periscope:

1. Select the entity.
2. Choose **Task** → **Other** → **Lower Periscope**.

8.35. Move Along Route

By default, an entity moves along a route from its nearest vertex to its end point.



- ♦ If you edit a route while an entity is moving to the starting point of that route as part of a Move Along Route task, the entity will move to the nearest vertex, whether it is the starting point, or not.
- ♦ If you want an entity to repeatedly move along the same route from beginning to end (for example, to follow a circular route), be sure to clear the Start at Closest Vertex check box. If you do not, after the first time the entity moves along the route, it will keep going to the end vertex, because that will be the closest vertex to where it is starting the new Move Along Route task.
- ♦ When you task an air platform entity to follow a route, be sure to take into account the altitude of the route's vertices and the terrain the entity has to pass over to complete the task. (For more information, please see “[Fixed-Wing Movement Between Vertices](#),” on page 7-27 and “[Rotary-Wing Entity Tasks and Behaviors](#),” on page 7-30.)
- ♦ Aggregates do not generate subordinate routes until they reach the beginning of the route.
- ♦ An aggregate starts moving along a route when the leading edge of its formation is at the first point of the route. It is considered finished when the leading edge reaches the last point of the route.

To direct an entity to move along a route:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move Along Route**, or click the Move Along Route button () on the Tasks Toolbar. The Move Along Route dialog box opens.
3. In the Name box, type the name of the route you want the entity to follow, or select a route in the list or on the terrain.
4. To have the entity move from the end of the route to the beginning, select Reverse Direction.
5. To have the entity use the road driving movement strategy, select the Treat Route as Road check box. The route is treated as a two-lane bidirectional road.



If you select Treat Route as Road, the entity must be within 10 meters of the route or the task will fail. The task is treated just like a Move To Waypoint/Location (On Roads) task.

6. To have the entity start the route at the beginning, clear the Start at Closest Vertex check box.

7. Click OK.



8.36. Move Into Formation

You can order a disaggregated aggregate to move to a formation at a specified location. Moving to a formation is not the same as setting formation. Setting formation changes the formation instantly. Moving to a formation causes the members of the aggregate to simulate traveling through the terrain into the new formation.

For aggregated aggregates, Move Into Formation has the same effect as a Formation set data request.

To direct an aggregate to move to a formation:

1. Select the aggregate.
2. Choose **Task** → **Movement** → **Move Into Formation**. The Move Into Formation dialog box opens.
3. Select the desired formation from the list.
4. Specify the location at which the aggregate is to move into formation by entering coordinates, or by clicking on the terrain.
5. If you specify the location by clicking and the task is for an air platform that is in the air, change the altitude to a height that will prevent the entity from crashing.
6. Specify the heading the aggregate is to assume at the target location.
7. Click OK.



8.37. Move To Altitude

You can order an aircraft entity to move to an altitude. When you assign this task, the entity moves to the new altitude at the same coordinates. Fixed-wing aircraft spiral to the new coordinates. Rotary-wing and subsurface entities rise or fall. Moving to an altitude is not the same as setting altitude. Setting altitude moves an entity instantaneously. It is also not the same thing as Fly Altitude. At the conclusion of Move to Altitude, an aircraft circles or hovers at the new altitude. At the conclusion of Fly Altitude, an aircraft continues moving at its current heading.



Fixed-wing entities that are on the ground cannot respond to a Move to Altitude task. If they are given this task, a message is printed to the object console and the task is ignored.

To send an entity to an altitude:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move to Altitude**, or click the Move to Altitude button () on the Tasks Toolbar. The Move To Altitude dialog box opens.
3. Type the altitude that you want the entity to move to.
4. Click OK.



8.38. Move To Depth

The Move To Depth task lets you specify the depth for subsurface entities. When an entity moves to a depth, it continues any horizontal movement that was in effect prior to starting the task.

To assign a move to depth task:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move to Depth**. The Move To Depth dialog box opens.
3. Select an option for the depth. If you choose a specific depth, type a depth in the Target Depth box.
4. Specify the ascent/descent rate.
5. Click OK.

8.39. Move To Location (Direct)

You can order an entity to move directly to a location on the terrain without regard to road networks. If you add Move to Location (Direct) tasks to a plan, you have more options than when you give an independent task.

Moving to a location is not the same as setting location. Setting location moves an entity instantaneously. Moving to a location causes an entity to simulate traveling through the terrain.

If you want an entity to use the road network to move to a location, use the Move To Location (On Roads) task. If you want to move both on and off road, use Move To Location (Plan Path). For details about road movement, please see [“Entity Movement On Roads and Off Roads,”](#) on page 7-21.

To direct an entity to move to a location as an independent task:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move to Location (Direct)**, or click the Move to Location (Direct) button () on the Tasks Toolbar. The Move to Location (Direct) dialog box opens.
3. Click on the terrain where you want the entity to move, or enter the coordinates of the location in the Move to Location (Direct) dialog box.
4. Optionally, set the altitude, as described in [“Specifying an Object’s Altitude,”](#) on page 2-14.



If you specify the location by clicking and the task is for an air platform that is in the air, be sure to change the altitude to a height that will prevent the entity from crashing.

5. Click OK.

8.39.1. Adding Multiple Move To Location (Direct) Tasks to a Plan

When you add a Move to Location (Direct) task to a plan, you can add multiple locations without clicking OK and selecting the task again from the menu. Also, since in this method you cannot specify the altitude for each location, you can specify a height above the terrain for the altitude of the succeeding points.

To add multiple Move to Location (Direct) tasks to a plan:

1. In the Plan Editor for an entity, choose **Task** → **Movement** → **Move to Location (Direct)**. The Move to Location (Direct) dialog box opens.
2. Select Each Click Generates A Task.
3. If you want to specify an altitude for the locations, specify an altitude, as described in [“Specifying an Object’s Altitude,”](#) on page 2-14.
4. Click a point on the terrain for each location that you want the entity to move to. A Move To Location (Direct) task is added to the plan for each location.
5. Click OK.



8.40. Move To Location (On Roads)

The Move To Location (On Roads) task causes an entity to move along the road network to the nearest point on the road to the specified location. If the location is not on the road, the entity does not leave the road to move to the location.

The entity must be within 10 meters of the edge of the road at the start of the task or it will fail. (The distance is configurable in the **allowable-distance** parameter in the **rail-path-movement** controller in the entity’s movement system definition file.)

If you want an entity to move directly to a location without using the road network, use the Move To Location (Direct) task. If you want to move both on and off road, use Move To Location (Plan Path). For details about road movement, please see [“Entity Movement On Roads and Off Roads,”](#) on page 7-21.



Move To Location (On Roads) is valid only for ground vehicles. If you give it to any other type of entity, it fails.

To direct an entity to move to a location along roads:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move To Location (On Roads)**. The Move To Location (On Roads) dialog box opens.
3. Click on the terrain where you want the entity to move, or enter the coordinates of the location in the dialog box.
4. Click OK.



8.41. Move to Location (Plan Path)

VR-Forces has two versions of the Move to Location (Plan Path) task. One is for ground vehicles; one is for surface and subsurface entities.

8.41.1. Move to Location (Plan Path) for Ground Vehicles

The Move to Location (Plan Path) task combines the Move to Location (Direct) and Move to Location (On Roads) tasks to let you send an entity to a location without the need to create multiple individual Move to Location (Direct) and Move to Location (On Roads) tasks. Move to Location (Plan Path) is a system scripted task.

When an entity receives this task, it determines if there is a road network near by. If there is, it moves directly to the nearest point on the road network. Then it moves along the roads using road driving behavior until it gets to the point on the road that is closest to the destination. Then the entity moves off the road directly to the destination.

For more information about road driving and how the path planning tasks work, please see [“Entity Movement On Roads and Off Roads,”](#) on page 7-21.

To move a ground vehicle to a location with path planning:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move To Location (Plan Path)**. The Move To Location (Plan Path) dialog box opens.
3. Click on the terrain where you want the entity to move, or enter the coordinates of the location in the dialog box.
4. Click OK.

8.41.2. Move to Location (Plan Path) for Ships

The Move to Location (Plan Path) task plots a route to the destination location based on the depth of water between the starting point and ending point. You specify the minimum depth required for the ship to maneuver. You can specify that the depth be based on the ship's draft or you can enter a specific depth value. The ship's draft is determined by calculating the distance its bounding box extends below its origin, as set in the Entity Editor.



The formula for calculating the draft is:

$\text{draft} = \text{height}/2 - \text{offset (Up)}$

where height and offset are set in the Size group box in the Entity Editor.

If you give this task to a submarine, VR-Forces assumes that it is moving on the surface.



For this task to work, your terrain must include S-57 data or depth information provided in a similar way.

This task is a system scripted task.

To move a surface or subsurface vehicle to a location with path planning:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move To Location (Plan Path)**. The Move To Location (Plan Path) dialog box opens.
3. Click on the terrain where you want the entity to move, or enter the coordinates of the location in the dialog box.
4. Specify how you want VR-Forces to determine the minimum depth of water for the route.
5. If you want to see the path displayed, select Display Route.
6. Click OK.

8.42. Move To Waypoint (Direct)

You can order an entity to move to a point or another entity. Moving to an object is not the same as setting location. Setting location moves an entity instantaneously. Moving to an object simulates an entity traveling through the terrain.

If you want an entity to use the road network to move to a waypoint, use the Move To Waypoint (On Roads) task. If you want to move both on and off road, use Move To Waypoint (Plan Path). For details about road movement, please see “[Entity Movement On Roads and Off Roads](#),” on page 7-21.



Rotary-wing entities are not able to reach moving waypoints or land on moving ships. A rotary-wing entity will approach a given waypoint or landing point, but will never completely reach the goal.

To send an entity to an object:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move to Waypoint (Direct)**, or click the Move to Waypoint (Direct) button () on the Tasks Toolbar. The Move To Waypoint (Direct) dialog box opens.
3. Optionally, filter the object selection list.
4. In the Name box, type the name of the object to move to, or select the object in the list or on the terrain.
5. Click OK.



When you task an air platform entity to move to an object, be sure to take into account the altitude setting for the object and the terrain the entity has to pass over to complete the task.



8.43. Move To Waypoint (On Roads)

The Move To Waypoint (On Roads) task causes an entity to move along the road network to the nearest point on the road to the specified waypoint. If the waypoint is not on the road, the entity does not leave the road to move to it.

The entity must be within 10 meters of the edge of the road at the start of the task or it will fail. (The distance is configurable in the **allowable-distance** parameter in the **rail-path-movement** controller in the entity's movement system definition file.)

If you want an entity to move directly to a waypoint without using the road network, use the Move To Waypoint (Direct) task. If you want to move both on and off road, use Move To Waypoint (Plan Path). For details about road movement, please see [“Entity Movement On Roads and Off Roads,”](#) on page 7-21.



Move To Waypoint (On Roads) is valid only for ground vehicles. If you give it to any other type of entity, it will fail.

To direct an entity to move along roads to a waypoint:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move To Waypoint (On Roads)**. The Move To Waypoint (On Roads) dialog box opens.
3. Select the waypoint.
4. Click OK.



8.44. Move to Waypoint (Plan Path)

Move to Waypoint (Plan Path) has two versions, one for ground vehicles and one for surface and subsurface entities.

8.44.1. Move to Waypoint (Plan Path) for Ground Vehicles

The Move to Waypoint (Plan Path) task combines the Move to Waypoint (Direct) and Move to Waypoint (On Roads) behaviors to let you send an entity to a waypoint without the need to create multiple individual Move to Waypoint (Direct) and Move to Waypoint (On Roads) tasks. Move to Waypoint (Plan Path) is a system scripted task.

When an entity receives this task, it determines if there is a road network near by. If there is, it moves directly to the nearest point on the road network. Then it moves along the roads using road driving behavior until it gets to the point on the road that is closest to the destination. Then the entity moves off the road directly to the destination.

For more information about road driving and how the path planning tasks work, please see [“Entity Movement On Roads and Off Roads,”](#) on page 7-21.

To direct an entity to move to a waypoint with path planning:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move To Waypoint (Plan Path)**. The Move To Waypoint (Plan Path) dialog box opens.
3. Select the waypoint.
4. Click OK.

8.44.2. Move to Waypoint (Plan Path) for Ships

The Move to Waypoint (Plan Path) task plots a route to the waypoint based on the depth of water between the starting point and ending point. You specify the minimum depth required for the ship to maneuver. You can specify that the depth be based on the ship's draft or you can enter a specific depth value. The ship's draft is determined based by calculating the distance its bounding box extends below its origin, as set in the Entity Editor.



The formula for calculating the draft is:

$\text{draft} = \text{height}/2 - \text{offset (Up)}$

where height and offset are set in the Size group box in the Entity Editor.

If you give this task to a submarine, VR-Forces assumes that it is moving on the surface.



For this task to work, your terrain must include S-57 data or depth information provided in a similar way.

This task is a system scripted task.

To move a surface or subsurface vehicle to a waypoint with path planning:

1. Select the entity.
2. Choose **Task** → **Movement** → **Move To Waypoint (Plan Path)**. The Move To Waypoint (Plan Path) dialog box opens.
3. Select the waypoint to move to.
4. Specify how you want VR-Forces to determine the minimum depth of water for the route.
5. If you want to see the path displayed, select Display Route.
6. Click OK.



8.45. Orbit

The Orbit task allows a fixed-wing aircraft to circle around a point without needing to create a route for it to follow.

To specify an orbit task:

1. Select the entity that you want to orbit.
2. Choose **Task** → **Movement** → **Orbit**. The Orbit dialog box opens.
3. Specify the coordinates of a point on the terrain around which the entity should orbit. You can click on the terrain to specify the points.
4. Specify the altitude at which to fly.
5. Specify the radius of the circle.
6. Select or clear the Clockwise option to specify the direction of travel.
7. Click OK.

8.46. Patrol Along Route

When an entity patrols along a route, it moves to the nearest vertex of the route, to the end point, back to the beginning of the route, and then continues going back and forth along the route until given another command.

To order an entity to patrol along a route:

1. Select the entity.
2. Choose **Task** → **Movement** → **Patrol Along Route**, or click the Patrol Along Route button () on the Tasks Toolbar. The Patrol Along Route dialog box opens.
3. In the Name box, type the name of the route to patrol along, or select the route in the list or on the terrain.
4. Click OK.



When you task an air platform entity to follow a route, be sure to take into account the altitude of the vertices and the terrain the entity has to pass over to complete the task.

8.47. Patrol Between

An entity can patrol between two point objects, entity objects, or both. When an entity patrols between two objects, it goes to the starting object, then moves back and forth between the two objects.

To order an entity to patrol between two objects:

1. Select the entity.
2. Choose **Task** → **Movement** → **Patrol Between**, or click the Patrol Between Points button (📍) on the Tasks Toolbar. The Patrol Between dialog box opens.
3. In the Name box for Point 1, type the name of the first object to patrol between, or select an object in the list or on the terrain.
4. In the Name box for Point 2, type the name of the second object to patrol between, or select an object in the list or on the terrain.
5. Click OK.



When you task an air platform entity to patrol between objects, be sure to take into account the altitude of the objects and the terrain the entity has to pass over to complete the task.



8.48. Pattern Hold (Location)

The Pattern Hold (Location) task assigns a fixed-wing or rotary-wing entity to execute a standard hold pattern at the specified location. This is a system scripted task.

To assign a pattern hold (location) task:

1. Select a fixed-wing or rotary-wing entity.
2. Choose **Task** → **Movement** → **Pattern Hold (Location)**. The Pattern Hold (Location) dialog box opens.
3. Enter the location or select it on the terrain.
4. Specify the heading, speed, and altitude for the hold pattern.
5. Specify the turn direction for the hold pattern.
6. Click OK.



8.49. Pattern Hold (Waypoint)

The Pattern Hold (Waypoint) task assigns a fixed-wing or rotary-wing entity to execute a standard hold pattern at the specified waypoint. This is a system scripted task.

To assign a pattern hold (waypoint) task:

1. Select a fixed-wing or rotary-wing entity.
2. Choose **Task** → **Movement** → **Pattern Hold (Waypoint)**. The Pattern Hold (Waypoint) dialog box opens.
3. Select the waypoint.
4. Specify the heading, speed, and altitude for the hold pattern.
5. Specify the turn direction for the hold pattern.
6. Click OK.



8.50. Place IED

The Place IED task lets a human entity place an improvised explosive device (IED) at a particular location and move to a post-placement location. This task also sets the parameters for how the IED will be armed. Place IED is a system scripted task.

To assign a place IED task to a human entity:

1. Select the entity.
2. Choose **Task** → **Engagement** → **Place IED**. The Place IED dialog box opens (Figure 8-5).

Place IED

Tasks an entity to move to a location, place an IED and then move away to another location.

Placement Location

X: 0.00

Y: 0.00

Alt (m):

☐ Above Sea Level (m) 0.000

☒ Above Terrain (m) 0.000

Placement Duration 10

Fuse Type proximity

Time Delay 30

Proximity 10

Post Placement Location

X: 0.00

Y: 0.00

Alt (m):

☐ Above Sea Level (m) 0.000

☒ Above Terrain (m) 0.000

Arming Location arm at post placement location

OK Cancel

Figure 8-5. Place IED dialog box

3. Enter the location where the IED should be placed, or click on the terrain to specify the location.
4. In the Placement Duration box, enter the amount of time it takes to place the IED.
5. Select a fuse type from the Fuse Type list.
6. For a timed delay fuse, specify the time to delay in the Time Delay box.
7. For a proximity fuse, specify the distance from the IED within which another entity will trigger the IED.
8. Enter the location where the entity should move to after it places the IED, or click on the terrain to specify the location.

9. In the Arming Location list select Arm at Placement Location to arm the IED as soon as it is placed, or Arm at Post Placement Location to arm it when the entity reaches the post-placement location.
10. Click OK.



8.51. Raise Periscope

The Raise Periscope task raises the periscope of a subsurface entity. The periscope is an articulated part that is visible in the Stealth observer mode. Raise Periscope is a system scripted task.

To raise a submarine's periscope:

1. Select the entity.
2. Choose **Task** → **Other** → **Raise Periscope**.



8.52. Release Bomb Tasks

Fixed-wing entities can release bombs targeted to a laser spot, a location, or an entity. The Release Bomb on Laser Spot task requires that another entity lase the target. You must synchronize the laser code for the bomber with the laser code for the lasing entity. Use of lasers is described in:

- ♦ [“Lasing Targets,”](#) on page 13-14.
- ♦ [“Lase Target,”](#) on page 8-27.
- ♦ [“Laser Code,”](#) on page 10-21.
- ♦ [“Synchronize Laser Code,”](#) on page 10-35.

The Release Bomb on Target and Release Bomb on Location tasks cause a bomb to be immediately dropped. The task assumes that the target is in front of the aircraft. The targetable area is a circle whose radius is defined by the altitude of the airplane and its maximum range.

The bomb navigates toward its target based on **max-range** and **max-range-altitude** parameters (configurable in the Entity Editor). A bomb can navigate **max-range** meters laterally if it is at **max-range-altitude** meters above the target. As the altitude changes, the distance it can travel changes accordingly, so at half of **max-range-altitude** it can travel half of **max-range**.

The bomb follows a straight line path from its launch to the point it is navigating to, assuming it can reach it. If its target point is out of range, it gets as close to the target as it can. If the target point moves, the bomb changes course and heads for the new target point.



Use of a Release Bomb task requires that you determine if the airplane is in range of the target. The Execute Close Air Support task ensures that the airplane is within range of the target before it drops its bomb. Therefore, we recommend using that task rather than one of the Release Bomb tasks.

The Release Bomb on Laser Spot task steers the bomb towards the laser point.

To assign a release bomb task:

1. Select the entity that will release the bomb.
2. Choose **Task** → **Engagement** → *task*, where *task* is Release Bomb on Laser Spot, Release Bomb on Location, or Release Bomb on Target. The appropriate dialog box opens.
3. In the Bomb Types list, select the type of bomb you want to drop.
4. In the Detonation Proximity box, enter the distance from the target at which the bomb should detonate.
5. For Release Bomb on Location, specify the location.
For Release Bomb on Target, select the target.
6. Click OK.



8.53. Rotary-Wing Land

The Rotary Wing Land task automates the process of landing a rotary-wing aircraft. Rotary-wing aircraft can land on points.



Although it is possible to land an entity on another entity, such as an aircraft carrier, if you want to embark an entity, you must use the Embark task, not a landing task.

To land a rotary-wing aircraft:

1. Select the entity.
2. Choose **Task** → **Movement** → **Rotary Wing Land**. The Rotary Wing Land dialog box opens.
3. In the Name box, type the name of the waypoint on which you want the entity to land, or select the waypoint in the list or on the terrain.
4. Click OK.



8.54. Sail Heading

The Sail Heading task causes a surface entity to sail towards the specified heading. After turning to the heading, the entity moves at its ordered speed indefinitely.

To assign a sail heading task:

1. Select the entity.
2. Choose **Task** → **Movement** → **Sail Heading**. The Sail Heading dialog box opens.
3. Specify a heading in the indicated units (radians or degrees).
4. Specify the diameter of the turn.
5. Specify the direction of the turn, as follows:
 - Toward Heading. Chooses the most direct turn.
 - Port. Turns to port until it reaches the heading.
 - Starboard. Turns to starboard until it reaches the heading.
6. Click OK.

8.55. Send Radio Set

The Send Radio Set task lets you send a set data request to an entity using a VR-Forces radio message. The receiving entity executes the set data request as if you had issued it directly to the entity from the Set menu or a set data request in a plan.

To send a set data request radio message:

1. Select the entity that will send the message.
2. Choose **Task** → **Radio** → **Send Radio Set** → *category* → *set_data_request*, where *category* is one of the categories of set data requests and *set_data_request* is one of the set data requests for that category. A dialog box for the set data request opens.
3. In the Name text box, type the name of the entity that will receive the set data request message, or select the entity in the list or on the terrain.
4. If the selected set data request requires input, complete the dialog box as described in Chapter 10, [Setting Entity State](#).
5. To send the message to all entities configured to receive messages from this entity's radio, select the Broadcast check box. (For details about configuring the radio model, please see Section 2.4, [“Configuring Communication Models,”](#) in *VR-Forces Configuration Guide*.)
6. Click OK.

8.56. Send Radio Task

The Send Radio Task task lets you send a task to an entity using a VR-Forces radio message. The receiving entity executes the task as an independent task.

To send a task radio message:

1. Select the entity that will send the message.
2. Choose **Task** → **Radio** → **Send Radio Task** → *category* → *task*, where *category* is one of the categories of tasks and *task* is one of the tasks in that category. A dialog box for the task opens.
3. In the Name text box, type the name of the entity that will receive the task message, or select the entity in the list or on the terrain.
4. If the selected task requires input, complete the dialog box as described in “[Specifying Parameters for Tasks](#),” on page 7-6.
5. To send the message to all entities configured to receive messages from this entity’s radio, select the Broadcast check box. (For details about configuring the radio model, please see Section 2.4, “[Configuring Communication Models](#),” in *VR-Forces Configuration Guide*.)
6. Click OK.

8.57. Send Text Message

The Send Text Message task lets you send a text message to an entity using a VR-Forces simulated radio message. The receiving entity must be on the same network as the sending entity. Usually this means the same aggregate or same force. The receiving entity can test for receipt of the message in a conditional statement in its plan. (For details, please see “[Receive Text Message](#),” on page 11-16.)

To send a text message:

1. Select the entity that will send the message.
2. Choose **Task** → **Radio** → **Send Text Message**. The Send Text dialog box opens.
3. In the Name text box, type the name of the entity that will receive the text message, or select the entity in the list or on the terrain.
4. In the Message Text box, type the message.
5. To send the message to all entities configured to receive messages from this entity’s radio, select the Broadcast check box. (For details about configuring the radio model, please see Section 2.4, “[Configuring Communication Models](#),” in *VR-Forces Configuration Guide*.)
6. Click OK.



8.58. Sonar Dip

Rotary-wing entities that have sonar can dip the sonar into water at a specified depth. Dipped sonar is not visualized in the Stealth view. The sonar is just simulated at the specified depth. Entities cannot dip sonar if they are moving faster than a set speed. Sonar Dip is a system scripted task.

To dip sonar:

1. Select the entity.
2. Choose **Task** → **Sonar Dip**. The Sonar Dip dialog box opens.
3. Specify the location at which to dip the sonar.
4. Specify how long the sonar should stay dipped.
5. Select the type of sonar to dip – Active or Passive.



RPR FOM 1.0 does not support active sonar.

6. Specify the depth for the sonar.
7. Click OK.



8.59. Sweep Naval Mines

The Sweep Naval Mines task causes an entity to look for and disable naval mines along a route. It looks within a specified distance from the route. An error rate specifies a percentage chance that the entity will detect a mine, but not disable it. The Sweep Naval Mines task is available to surface entities that have a Naval Mine Sweep system. Sweep Naval Mines is a system scripted task.

To assign the Sweep Naval Mines task:

1. Select the entity.
2. Choose **Task** → **Movement** → **Sweep Naval Mines**. The Sweep Naval Mines dialog box opens.
3. Select the route to follow.
4. Specify the sensing range. The default is 300 meters.
5. Optionally, specify the disarm failure probability. This is the percentage chance that a mine will be found, but not disabled.
6. Click OK.



8.60. Turn To Heading

The Turn to Heading task provides a realistic way for ground vehicles to turn to a new heading. Rather than turning instantly, as happens with the Heading request, a vehicle pivots or makes a K-turn to the new heading. The turning behavior for an entity is controlled by its **can-pivot** parameter in the object parameter database.

To order an entity to turn to a heading:

1. Select the entity.
2. Choose **Task** → **Movement** → **Turn to Heading**. The Turn to Heading dialog box opens.
3. Type a heading.
4. Click OK.

8.61. User Task

User tasks are tasks that have been added to VR-Forces using the VR-Forces toolkit. To assign a user task, you must know the name of the task and the required values for up to four parameters.



The User Task command is not available on the Task menu unless a developer adds a controller that accepts a user task.

To assign a user task:

1. Select the entity that you want to execute the task.
2. Choose **Task** → **Other** → **User Task**. The User Task dialog box opens.
3. Type the name of the task.
4. Type any required parameters.
5. Click OK.

8.62. Wait Tasks

You can order an entity to wait indefinitely, for a specified period of time, or until a specified elapsed simulation time.



The Wait task is not equivalent to an immediate stop task. If an entity is moving and you give it a Wait task, it might not stop immediately, particularly if a controller such as the collision avoidance controller is controlling its movement.

8.62.1. Wait

To order an entity to wait indefinitely:

1. Select the entity.
2. Choose **Task** → **Wait** → **Wait**.



If you put an indefinite wait in a plan, the entity does not progress through its plan until it receives another command, either as the result of a **When** statement being triggered or an independent task.

8.62.2. Wait Duration

To order an entity to wait a specific amount of time:

1. Select the entity.
2. Choose **Task** → **Wait** → **Wait Duration**. The Wait Duration dialog box opens.
3. Specify the duration of the wait in hours, minutes, and seconds.
4. Click OK.

8.62.3. Wait Elapsed

To order an entity to wait until a specific elapsed simulation time:

1. Select the entity.
2. Choose **Task** → **Wait** → **Wait Elapsed**. The Wait Elapsed dialog box opens.
3. Specify the elapsed time from the start of the simulation, in hours, minutes, and seconds.
4. Click OK.

For information about simulation time and simulated exercise time, please see Section 3.13.1, “[Simulation Time](#),” in *VR-Forces Users Guide*.

8.63. Reactive Tasks and Background Processes

Reactive tasks and background processes are not described in this chapter because they run automatically; no user action is required to execute them. This section describes the reactive tasks and background processes included with VR-Forces.

VR-Forces includes one reactive task – Make Way for Emergency. This task applies to ground vehicles. If an emergency vehicle that has its lights on approaches a ground vehicle that is driving on a road, the vehicle pulls over to the side of the road.

Table 8-2 lists the background tasks provided. These tasks are only available for aggregate entities in *AggregateLevel.sms*.

Table 8-2: Background processes (*AggregateLevel.sms*)

Background Process	Description
Attack Enemies	Determines when to begin and stop attacking enemies.
Calculate Maximum Speed Modifier	Calculates a modifier that is applied to the maximum possible speed of an aggregate to modify its movement rate.
Halt When Engaged	Stop moving when attacking a hostile entity.
Make EW Attack	If a jammer system is turned on, attack all non-friendly entities within range of the jammer. The entity attacks continuously.
Manage Sensors	Manages the state of an entity's sensors.
Perform Attrition	Determines when an aggregate is being attacked and modifies its health based on the current attrition rate.
Put on MOPP Gear	If an entity has MOPP gear, when it enters a hazardous area, it stops and changes to MOPP level 4.
Receive Construction	Allows an engineering object to receive construction from other entities.
Resize Footprints	Updates the size of an entity's physical and sensor footprints.
Update Combat Effectiveness	Updates the combat effectiveness state of an entity.
Update EW Degradation	Processes jamming interactions and computes the level of degradation in communications and radar from these attacks.
Use Supplies	Uses supplies based on the entity's current activities.



9. Aggregate-Level Tasks

This chapter describes tasks that only apply to aggregate-level simulations

Activate Jammer	9-3
Air-to-Ground Attack	9-3
Attack with Anti-Air Missile	9-3
Attack with Anti-Ship Missile	9-4
Attack with Land-Attack Missile	9-4
Attack with Torpedo	9-4
Automatic Air Defense	9-5
Biological Attack	9-5
Bomb Location	9-6
Breach Obstacles	9-7
Change MOPP Level	9-7
Change Posture	9-8
Chemical Attack	9-8
Construct Abatis	9-9
Construct Anti-Tank Ditch	9-9
Construct Barbed Wire	9-10
Construct Barricade	9-10
Construct Berm	9-11
Construct Booby Trap	9-11
Construct Bridge	9-12
Construct Dry Gap	9-13
Construct Fortified Area	9-13

Aggregate-Level Tasks

Construct Fortified Line	9-14
Construct Minefield	9-14
Construct Strong Point	9-15
Deactivate Jammer	9-15
Destroy Bridge	9-16
Destroy Ditch	9-16
Destroy Explosive	9-16
Destroy Fortification	9-17
Destroy Obstacle	9-17
Halt Movement	9-17
Improve Booby Trap	9-18
Improve Breach	9-18
Improve Bridge	9-18
Improve Ditch	9-19
Improve Fortification	9-19
Improve Obstacle	9-20
Indirect Fire	9-20
Move Along Route Retrograde	9-21
Move to Location Retrograde	9-21
Move to Waypoint Retrograde	9-21
Nuclear Attack	9-21
Send NBC Report	9-22
Send Obstacle Report	9-22

9.1. Activate Jammer

The Activate Jammer task turns on jamming for an entity equipped with a jamming emitter. This task has the same effect as Set Emitter - On.

- To activate an entity's jammer, choose **Task** → **Jamming** → **Activate Jammer**.

9.2. Air-to-Ground Attack

The Air-to-Ground Attack task requires an attack (ingress) route, an exit (egress) route, and a target point.

When the aircraft reaches the target point, it attacks with each type of HE ammunition it has. It expends all ammunition of each type. There is a 30 second delay between attacks with each ammunition type.

To specify an air-to-ground attack:

1. Select the entity that will attack.
2. Choose **Task** → **Engagement** → **Air-to-Ground Attack**. The Air-to-Ground Attack dialog box opens.
3. Select a target point.
4. Select an ingress route.
5. Select an egress route.



This is a multiple list dialog box. For details about how to control which list has focus, please see [“Selecting Objects in Multiple List Dialog Boxes,”](#) on page 7-7.

6. Click OK.

9.3. Attack with Anti-Air Missile

This task is available to any entity that has anti-air missiles.

To attack an entity with an anti-air missile:

1. Select the entity that will attack.
2. Choose **Task** → **Engagement** → **Attack with Anti-Air Missile**. The Attack with Anti-Air Missile dialog box opens.
3. Select a target.
4. Specify the number of missiles to fire.
5. Click OK.

9.4. Attack with Anti-Ship Missile

This task is available to any entity that has anti-ship missiles.

To attack an entity with an anti-ship missile:

1. Select the entity that will attack.
2. Choose **Task** → **Engagement** → **Attack with Anti-ship Missile**. The Attack with Anti-ship Missile dialog box opens.
3. Select a target.
4. Specify the number of missiles to fire.
5. Click OK.

9.5. Attack with Land-Attack Missile

This task is available to entities that have land-attack missiles, such as the Arleigh Burke DDG.

To attack an entity with a land-attack missile:

1. Select the entity that will attack.
2. Choose **Task** → **Engagement** → **Attack with Land-Attack Missile**. The Attack with Land-Attack Missile dialog box opens.
3. Select a target.
4. Specify the number of missiles to fire.
5. Click OK.

9.6. Attack with Torpedo

This task is available to entities that have torpedoes, such as the Arleigh Burke DDG.

To attack an entity with a torpedo:

1. Select the entity that will attack.
2. Choose **Task** → **Engagement** → **Attack with Torpedo**. The Attack with Torpedo dialog box opens.
3. Select a target.
4. Specify the number of torpedoes to fire.
5. Click OK.

9.7. Automatic Air Defense

When an entity has the Automatic Air Defense task, it automatically fires at enemy aircraft that enter the specified area. An entity must have an anti-air weapon, such as air-to-air missile to execute this task.

To enable automatic air defense:

1. Select an entity that has anti-air capability.
2. Choose **Task** → **Engagement** → **Automatic Air Defense**. The Automatic Air Defense dialog box opens.
3. Select the area in which the entity should automatically fire anti-air weapons.
4. Click OK.

9.8. Biological Attack

The Biological Attack task lets an entity create an area contaminated with biological agents.

When you assign a Biological Attack task, you specify the center of the area in which it will take place. The size of the area and the allowed range from the entity is specified in the biological weapon weapons system. You can edit these values in the Entity Editor.

To execute a biological attack:

1. Select the entity that will make the attack.
2. Choose **Task** → **Engagement** → **Biological Attack**. The Biological Attack dialog box opens.
3. Click a location for the center of the area of attack or specify the coordinates.
4. In the Agent Type list, select the type of biological agent.
5. Click OK.

9.9. Bomb Location

You can specify that an entity bomb a location. When you choose a weapon, the Bomb Location dialog box displays information about the chosen weapon ([Figure 9-1](#)).

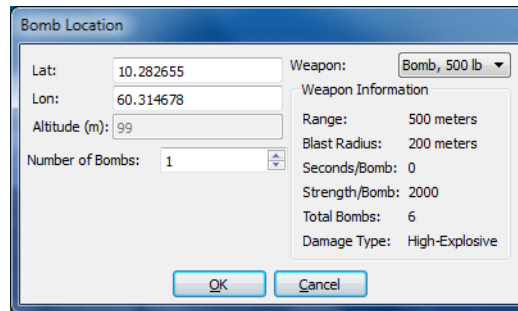


Figure 9-1. Bomb Location dialog box

To bomb a location:

1. Select the air aggregate that will attack.
2. Choose **Task** → **Engagement** → **Bomb Location**. The Bomb Location dialog box opens.
3. Click the location to bomb or enter the coordinates.
4. Specify the number of bombs to drop.
5. In the Weapon list, select the type of bomb to drop.
6. Click OK.

9.10. Breach Obstacles

The Breach Obstacles task lets an engineering entity breach an obstacle so that entities can pass through it. Depending on the breaching system an entity has, it may be able to breach fortifications, minefields, or ditches.

A breach line is specified with two points.

To breach an obstacle:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Breach Obstacles**. The Breach Obstacles dialog box opens.
3. Click Define. The cursor changes to draw mode and the Create Breach dialog box opens or becomes available.
4. Draw a two-point line to specify where to create the breach.
5. Right-click to finish the breach lane, or click Create in the Create Breach dialog box. (The line is not displayed until the CE entity starts to build it.)
6. Click OK.

9.11. Change MOPP Level

Aggregates automatically raise their mission oriented protective posture (MOPP) level when they encounter a contamination area. However, you can manually change an aggregate's MOPP level. Supported MOPP levels are as follows:

- ♦ MOPP Level 0 — Protective mask carried. Suit, gloves, and boots accessible/available.
- ♦ MOPP Level 1 — Suit worn. Mask, gloves and boots carried.
- ♦ MOPP Level 2 — Suit and boots worn. Gloves and mask carried.
- ♦ MOPP Level 3 — Suit, boots and mask worn. Gloves carried.
- ♦ MOPP Level 4 — All protection worn.

Changes to MOPP level do not take place immediately. (To change the MOPP level immediately, use Set MOPP Level.) Increasing the MOPP level degrades an entity's speed and combat effectiveness. Increasing the MOPP level does not remove existing contamination, but prevents NBC contamination from harming the entity.

To change an aggregate's MOPP level:

1. Select the aggregate.
2. Choose **Task** → **Change MOPP Level**. The Change MOPP Level dialog box opens.
3. Specify a new MOPP level.
4. Click OK.

9.12. Change Posture

You can set an entity's posture to one of the following:

- ♦ Travel
- ♦ Reconnaissance
- ♦ Hasty attack
- ♦ Deliberate attack
- ♦ Hasty defense
- ♦ Deliberate defense.

Changes to posture take place over time. To change posture immediately, use Set Posture.

To change an entity's posture:

1. Select the entity.
2. Choose **Task** → **Change Posture**. The Change Posture dialog box opens.
3. Specify a new posture.
4. Click OK.

9.13. Chemical Attack

The Chemical Attack task lets an entity create an area contaminated with chemical agents.

When you assign a Chemical Attack task, you specify the center of the area in which it will take place. The size of the area and the allowed range from the entity is specified in the chemical weapon weapons system. You can edit this value in the Entity Editor.

To execute a chemical attack:

1. Select the entity that will make the attack.
2. Choose **Task** → **Engagement** → **Chemical Attack**. The Chemical Attack dialog box opens.
3. Click a location for the center of the area of attack or specify the coordinates.
4. In the Agent Type list, select the type of chemical agent.
5. Click OK.

9.14. Construct Abatis

Combat engineering entities can construct abatises. An abatis is specified as a point.



You can create abatises directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this obstacle.

To construct an abatis:

1. Select an entity with combat engineering capability.
2. Choose **Task** → **Combat Engineering** → **Construct Abatis**. The Construct Abatis dialog box opens.
3. Click Define. The Create Abatis dialog box opens.
4. Click where you want to locate the abatis
5. In the Create Abatis dialog box, click OK.
6. In the Construct Abatis dialog box, click OK.

9.15. Construct Anti-Tank Ditch

An anti-tank ditch is a linear object. The Construct Anti-Tank Ditch task lets an aggregate dig a ditch. This task takes place over time.



You can create anti-tank ditches directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this obstacle.

To construct an anti-tank ditch:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Anti-Tank Ditch**. The Construct Anti-Tank Ditch dialog box opens.
3. Click Define. The Create Anti-Tank Ditch dialog box opens and the cursor changes to draw mode.
4. Click to specify the vertexes of the line as you would when creating any linear object, or add points in the dialog box and click Create.
5. Click OK.

9.16. Construct Barbed Wire

Combat engineering units can construct barbed wire. Barbed wire is specified as a line.



You can create barbed wire directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this obstacle.

To construct barbed wire:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Barbed Wire**. The Construct Barbed Wire dialog box opens.
3. Click Define. The Create Barbed Wire dialog box opens.
4. Click to specify the vertexes of the line as you would when creating any linear object.
5. In the Construct Barbed Wire dialog box, click OK.

9.17. Construct Barricade

Combat engineering units can construct barricades. A barricade is specified as a line.



You can create barricades directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this obstacle.

To construct a barricade:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Barricade**. The Construct Barricade dialog box opens.
3. Click Define. The Create Barricade dialog box opens.
4. Click to specify the vertexes of the line as you would when creating any linear object.
5. In the Construct Barricade dialog box, click OK.

9.18. Construct Berm

Combat engineering units can construct berms. A berm is specified as a line.



You can create berms directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this obstacle.

To construct a berm:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Berm**. The Construct Berm dialog box opens.
3. Click Define. The Create Berm dialog box opens.
4. Click to specify the vertexes of the line as you would when creating any linear object.
5. In the Construct Berm dialog box, click OK.

9.19. Construct Booby Trap

The Construct Booby Trap task lets you specify a location where explosives will detonate if triggered by the presence of an entity. Booby traps cause some level of attrition on the affected entity. To create a booby trap, an entity must have explosive resources.



You can create booby traps directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this object.

To construct a booby trap:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Booby Trap**. The Construct Booby Trap dialog box opens.
3. Click Define. The Create Booby Trap dialog box opens.
4. Click where you want to locate the booby trap or type the coordinates in the dialog box and click OK.
5. Click OK.

9.20. Construct Bridge

Combat engineering units can construct bridges. A bridge is specified as a two-point line.



You can create bridges directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this object.

To construct a bridge:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Construct Bridge**. The Construct Bridge dialog box opens. The location is marked as Not defined.
3. Click Define. The Create Bridge dialog box opens and the cursor changes to draw mode.
4. Click on the terrain to specify the start and end vertices of the bridge.
5. Right-click to finish the bridge, or click Create in the Create Bridge dialog box. (The bridge is not displayed until the CE entity starts to build it.)
6. Click OK.

9.21. Construct Dry Gap

The Construct Dry Gap task lets an engineering unit create a dry gap, which is a type of ditch. (Use Improve Ditch and Destroy Ditch to continue building a dry gap or destroy it.)



You can create dry gaps directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this object.

To construct a dry gap:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Dry Gap**. The Construct Dry Gap dialog box opens.
3. Click Define. The Create Dry Gap dialog box opens and the cursor changes to draw mode.
4. Click to specify the vertices of the dry gap.
5. Right-click to finish the dry gap, or click Create in the Create Dry Gap dialog box. (The dry gap is not displayed until the CE entity starts to build it.)
6. Click OK.

9.22. Construct Fortified Area

The Construct Fortified Area task allows an aggregate to construct a fortified area. A fortified area is defined as a box. You specify the southwest corner of the area. Construction of a fortified area takes place over time.



You can create fortifications directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this object.

To construct a fortified area:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Fortified Area**. The Construct Fortified Area dialog box opens.
3. Click Define. The Create Fortified Area dialog box opens and the cursor changes to show an area.
4. Click where you want to locate the southwest corner of the area or type the coordinates in the dialog box and click Create.
5. Click OK.

9.23. Construct Fortified Line

The Construct Fortified Line task lets an aggregate construct a fortified line. Construction of a fortified line takes place over time.



You can create fortifications directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this object.

To construct a fortified line:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Fortified Line**. The Construct Fortified Line dialog box opens.
3. Click Define. The Create Fortified Line dialog box opens and the cursor changes to draw mode.
4. Click to specify the vertexes of the line as you would when creating any linear object, or add points in the dialog box and click Create.
5. Click OK.

9.24. Construct Minefield

Combat engineering entities can create volcano minefields. Minefields are fixed size rectangles.



You can create minefields directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this obstacle.

To construct a mindefield:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Minefield**. The Construct Minefield dialog box opens.
3. Click Define. The Create Minefield (Volcano) dialog box opens and the cursor changes to show a minefield.
4. Click where you want to locate the southwest corner of the minefield or type the coordinates in the Create Minefield (Volcano) dialog box and click Create.
5. In the Construct Minefield dialog box, click OK.

9.25. Construct Strong Point

The Construct Strong Point task lets an aggregate construct a strong point. A strong point is defined as a box. You specify the southwest corner. Construction of a strong point takes place over time.



You can create strong points directly from the Hazards/Obstacles Palette. This task is used when you want an entity to construct this object.

To construct a strong point:

1. Select the entity.
2. Choose **Task** → **Combat Engineering** → **Construct Strong Point**. The Construct Strong Point dialog box opens.
3. Click Define. The Create Strong Point dialog box opens and the cursor changes to show a box.
4. Click where you want to locate the southwest corner of the box or type the coordinates in the dialog box and click Create.
5. Click OK.

9.26. Deactivate Jammer

The Deactivate Jammer task turns off jamming for an entity equipped with a jamming emitter. This task has the same effect as Set Emitter - Off.

- To activate an entity's jammer, choose **Task** → **Jamming** → **Activate Jammer**.

9.27. Destroy Bridge

When you task an engineering entity to destroy a bridge, it consumes its Explosives resource. As the entity attacks the bridge, the bridge's completeness percentage decreases. When the completion percentage reaches zero, the bridge is removed from the scenario.

To destroy a bridge:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Destroy Bridge**. The Destroy Bridge dialog box opens.
3. Select the bridge you want to destroy.
4. Click OK.

9.28. Destroy Ditch

When you task an engineering entity to destroy a ditch, it consumes its Explosives resource. As the entity attacks the ditch, the ditch's completeness percentage decreases. When the completion percentage reaches zero, the ditch is removed from the scenario.

To destroy a ditch:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Destroy Ditch**. The Destroy Ditch dialog box opens.
3. Select the ditch you want to destroy.
4. Click OK.

9.29. Destroy Explosive

The Destroy Explosive task lets an entity destroy a booby trap or unexploded ordnance.

To destroy explosives:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Destroy Explosive**. The Destroy Explosive dialog box opens.
3. Select the booby trap or unexploded ordnance you want to destroy.
4. Click OK.

9.30. Destroy Fortification

When you task an engineering entity to destroy a fortification, it consumes its Explosives resource. As the entity attacks the fortification, the fortification's completeness percentage decreases. When the completion percentage reaches zero, the fortification is removed from the scenario.

To destroy a fortification:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Destroy Fortification**. The Destroy Fortification dialog box opens.
3. Select the fortification you want to destroy.
4. Click OK.

9.31. Destroy Obstacle

The Destroy Obstacle task lets an entity destroy obstacles (such as berms, barricades, and barbed wire) that do not have a specific destroy task, such as Destroy Fortification or Destroy Explosive.

To destroy an obstacle:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Destroy Obstacle**. The Destroy Obstacle dialog box opens.
3. Select the obstacle you want to destroy.
4. Click OK.

9.32. Halt Movement

The Halt Movement task causes an entity to stop moving.

To halt an entity's movement:

1. Select the entity.
2. Choose **Tasks** → **Movement** → **Halt Movement**. Movement stop immediately.

9.33. Improve Booby Trap

The Improve Booby Trap task lets an aggregate complete an incomplete booby trap. When you improve a booby trap it gets improved to as complete a level of strength as the entity can bring it to. This task can be assigned to an entity to assist another entity that is creating a booby trap.

To improve a booby trap:

1. Select the entity that will improve the booby trap.
2. Choose **Task** → **Combat Engineering** → **Improve Booby Trap**. The Improve Booby Trap dialog box opens.
3. Select the booby trap that you want to improve.
4. Click OK.

9.34. Improve Breach

The Improve Breach task tells an entity to complete an incomplete breach. When you improve a breach it gets improved to as complete a level of strength as the entity can bring it to. This task can be assigned to an entity to assist another entity that is breaching an obstacle.

To improve a breach:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Improve Breach**. The Improve Breach dialog box opens.
3. Select the breach you want to improve.
4. Click OK.

9.35. Improve Bridge

The Improve Bridge task tells an entity to complete an incomplete bridge. When you improve a bridge it gets improved to as complete a strength level as the entity can bring it to. This task can be assigned to an entity to assist another entity that is creating a bridge.

To improve a bridge:

1. Select a combat engineering entity.
2. Choose **Tasks** → **Combat Engineering** → **Improve Bridge**. The Improve Bridge dialog box opens.
3. Select the bridge you want to improve.
4. Click OK.

9.36. Improve Ditch

The Improve Ditch task lets an aggregate improve an incomplete anti-tank ditch. When you improve a ditch it gets improved to as complete a strength level as the entity can bring it to. This task can be assigned to an entity to assist another entity that is creating a ditch.

To improve a ditch:

1. Select the entity that will improve the ditch.
2. Choose **Task** → **Combat Engineering** → **Improve Ditch**. The Improve Ditch dialog box opens.
3. Select the ditch that you want to improve.
4. Click OK.

9.37. Improve Fortification

The Improve Fortification task lets an aggregate improve an incomplete fortification area, line, or strong point. When you improve a fortification it gets improved to as complete a strength level as the entity can bring it to. This task can be assigned to an entity to assist another entity that is creating a fortification.

To improve a fortification:

1. Select the entity that will improve the fortification.
2. Choose **Task** → **Combat Engineering** → **Improve Fortification**. The Improve Fortification dialog box opens.
3. Select the fortification that you want to improve.
4. Click OK.

9.38. Improve Obstacle

The Improve Obstacle task lets an entity improve an incomplete obstacle (such as berms, barricades, and barbed wire) that does not have a dedicated improve task, such as Improve Breach or Improve Bridge. When you improve an obstacle it gets improved to as complete a strength level as the entity can bring it to. This task can be assigned to an entity to assist another entity that is constructing an obstacle.

To improve an obstacle:

1. Select the entity that will improve the obstacle.
2. Choose **Task** → **Combat Engineering** → **Improve Obstacle**. The Improve Obstacle dialog box opens.
3. Select the obstacle that you want to improve.
4. Click OK.

9.39. Indirect Fire

The Indirect Fire task allows an entity to fire on a point. The indirect fire scatters bursts within a sheaf radius, which is a circle around the target point.

If multiple units are within the radius, they are all attacked. Attack strength is applied fully to each attacked entity. It is not divided among them. For example, if there are four units in the sheaf radius and the attack strength is 100, an attack strength of 100 is applied to each of the units.

If the blast effect radius of the munitions being fired is less than the sheaf radius, the attack strength is reduced by the ratio of the areas of the blast circle to the sheaf circle. For example, if the sheaf radius is 100 and the blast effect radius is 50, the ratio of the areas is 1:4, so the attack strength would be 25% of the full value.

To specify indirect fire for an aggregate:

1. Select the entity.
2. Choose **Task** → **Engagement** → **Indirect Fire**. The Indirect Fire dialog box opens.
3. Select the point on which you want to center the indirect fire.
4. In the Weapon list, select the weapon you want to use. Its characteristics are displayed.
5. In the Number of Attacks box, specify how many attacks to make.
6. In the Sheaf Radius box, specify the radius, in meters around which to scatter indirect fire. This value must be equal to or less than the Max Sheaf Radius value shown in the Weapon Information group box for the selected weapon.
7. Click OK.

9.40. Move Along Route Retrograde

Move Along Route Retrograde is the same as Move Along Route, except that the aggregate does not change its heading to the direction of movement. It maintains the heading at the start of movement or a heading necessary for defensive operations. See the Move Along Route task for the procedure for this task.

9.41. Move to Location Retrograde

Move to Location Retrograde is the same as Move to Location, except that the aggregate does not change its heading to the direction of movement. It maintains the heading at the start of movement or a heading necessary for defensive operations. See the Move to Location task for the procedure for this task.

9.42. Move to Waypoint Retrograde

Move to Waypoint Retrograde is the same as Move to Waypoint, except that the aggregate does not change its heading to the direction of movement. It maintains the heading at the start of movement or a heading necessary for defensive operations. See the Move to Waypoint task for the procedure for this task.

9.43. Nuclear Attack

The Nuclear Attack task lets an entity create an area contaminated with nuclear radiation.

When you assign a Nuclear Attack task, you specify the center of the area in which it will take place. The size of the area and the allowed range from the entity is specified in the nuclear weapon weapons system. You can edit this value in the Entity Editor.

To execute a nuclear attack:

1. Select the entity that will make the attack.
2. Choose **Task** → **Engagement** → **Nuclear Attack**. The Nuclear Attack dialog box opens.
3. Click a location for the center of the attack area or specify the coordinates.
4. In the Agent Type list, select the type of radiation.
5. Click OK.

9.44. Send NBC Report

An NBC report is the equivalent of sending a spot report when an NBC area is found. NBC reports are sent automatically if an entity has an NBC sensor. However, this task allows you to send a report manually.

To send an NBC report:

1. Select the entity.
2. Choose **Task** → **Send NBC Report**. The Send NBC Report dialog box opens.
3. Select the contamination area for which to send a report.
4. Specify the engagement result. This is any text that you want to accompany the report.
5. Click OK.

9.45. Send Obstacle Report

An obstacle report is the equivalent of sending a spot report when an obstacle area is found. Obstacle reports are sent automatically if an entity has an engineering object sensor. However, this task allows you to send a report manually.

To send an obstacle report:

1. Select the entity.
2. Choose **Task** → **Send Obstacle Report**. The Send Obstacle Report dialog box opens.
3. Select the obstacle for which to send a report.
4. Specify the Engagement Result. This is any text that you want to accompany the report.
5. Click OK.



10. Setting Entity State

This chapter explains how to set entity state, such as speed, force, and target.

Setting Entity State and Attributes	10-3
Active Sonar Mode.....	10-3
Activity	10-4
Aggregate State.....	10-4
Altitude.....	10-5
Ammunition	10-5
Ammunition Pacing/Tracking	10-6
Appearance	10-6
Armed.....	10-7
Capabilities	10-7
Collision Avoidance Types	10-8
Concealed.....	10-9
Contamination	10-9
Counter Measures Auto Launch.....	10-9
Destroyed	10-10
Detonation Fuse Type.....	10-10
DI-Guy Appearance.....	10-11
Disembarked.....	10-11
Embarked	10-12
Emitter	10-13
Engagement Results.....	10-14
Equipment Pacing/Tracking.....	10-14

Food, Water, Fuel, Oil and Lubricant	10-15
Food, Water Fuel, Oil and Lubricant Pacing/Tracking	10-15
Force.....	10-16
Formation.....	10-17
Heading.....	10-18
Setting an Entity's Heading Manually	10-18
Health	10-19
IFF	10-20
Lase Autonomous	10-21
Laser Code.....	10-21
Location	10-22
MOPP Level.....	10-22
Morale	10-22
Notify Level.....	10-23
Ordered Speed	10-23
Posture (Aggregate)	10-24
Posture (Human)	10-25
Preferred Targets	10-26
Radar Mode.....	10-27
Reorganize	10-27
Resources	10-28
Resources Pacing/Tracking	10-28
Restore.....	10-29
Set Resupply Mode.....	10-30
Rules of Engagement	10-30
How Fire-When-Fired-Upon Works.....	10-31
Sector of Responsibility.....	10-32
Sonar Depth	10-33
Spot Reports	10-34
Supplying	10-34
Surrendered	10-35
Synchronize Laser Code.....	10-35
Target	10-36
Tasked by Superior.....	10-36
Weapons Pacing/Tracking	10-37
Weapon State.....	10-37

10.1. Setting Entity State and Attributes

Some set data requests only apply to entity-level simulations. Others only apply to aggregate-level simulations. These set data requests indicate the applicable simulation type with an entity () or aggregate () icon in the margin.

The Set menu is context sensitive. It only shows the options that apply to the selected entity.

The graphical user interface does not necessarily know about the state of an entity. When you open a dialog box for a Set command, any data in the dialog box represents either default values or the most recently used value, except for the Altitude, Location, and Heading dialog boxes, which show the current values for the selected entity.

You can filter entity selection lists. For details, please see “[Filtering the Object Selection Lists](#),” on page 7-9.



10.2. Active Sonar Mode

If an entity has an active sonar system, you can set the sonar mode.



RPR FOM 1.0 does not support active sonar.

To set the active sonar mode:

1. Select the entity.
2. Choose **Set** → **Sensors** → **Active Sonar Mode**. The Active Sonar Mode dialog box opens.
3. In the System ID list, select the sonar system that you are setting. The entities provided with VR-Forces just have one active sonar system.
4. In the Mode list, select a sonar mode or select Off to disable active sonar.
5. Click OK.



10.3. Activity

You can give an aggregate-level entity an activity. Activities are configured by entity type, so they may vary from one entity to another. Some of the available activities include the following:

- ♦ Unknown
- ♦ Attacking
- ♦ Bivouacking
- ♦ Emplacing obstacle
- ♦ Indirect fire
- ♦ Jamming
- ♦ Other
- ♦ Patrolling
- ♦ Probing
- ♦ Retreating.

 **To specify an aggregate's activity:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Activity**. The Activity dialog box opens.
3. Select an activity from the list.
4. Click OK.



10.4. Aggregate State

The Aggregate State request lets you change an aggregate from the aggregated state to the disaggregated state and vice versa.

To set an aggregate's aggregation state:

1. Select the aggregate.
2. Choose **Set** → **Aggregate** → **Aggregate State**. The Aggregate State dialog box opens.
3. Select the desired state from the list.
4. Click OK.

10.5. Altitude

The Altitude request changes the altitude of entities immediately. If you want a fixed-wing or rotary-wing entity to move to an altitude, use the Move to Altitude or Fly Altitude task. You can set the altitude manually or place an entity at a specific level in a multi-level terrain feature, such as a building.

To set an entity's altitude:

1. Select the entity.
2. Choose **Set** → **Position** → **Altitude**, or click the Altitude button () on the Sets Toolbar. The Altitude dialog box opens. It displays the entity's current altitude.
3. Select MSL (mean sea level) or AGL (above ground level) to specify the base for the altitude value.
4. Type the new altitude.
5. Click OK.



10.6. Ammunition

You can specify the amount of each type of ammunition that an aggregate has.

To set the ammunition level:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Ammunition**. The Ammunition dialog box opens.
3. Select the check box for each type of ammunition that you want to set.
4. For each selected type of ammunition, adjust the slider or type a value.
5. Click OK.



10.7. Ammunition Pacing/Tracking

Ammunition Pacing/Tracking lets you specify that a particular ammunition type be marked as pacing, tracking, or neither. Pacing indicates that the status of this item is critical to the mission. Tracking indicates that the commander is interested in the status of this item. These designations do not affect the simulation. They are reported for use by external systems.

 **To specify pacing or tracking for an aggregate's ammunition:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Ammunition Pacing/Tracking**. The Ammunition Pacing/Tracking dialog box opens.
3. Select the check box for each type of ammunition for which you want to specify pacing or tracking.
4. For each selected ammunition type, select an option from the list.
5. Click OK.

10.8. Appearance

You can set appearance attributes for entities. The appearance attributes that are available for an entity are determined by its entry in `./appData/settings/vrfGui/SISO-REF-010-2010-RC1.xml`. The default list of appearance attributes is based on the DIS standard.

The Lifeform State field of the Appearance dialog box sets the posture for an entity. If VR-Forces does not support a selected posture, it simulates the entity using the closest similar posture. If a posture involves walking or running, VR-Forces chooses the posture to use based on the entity's speed. For more information about setting posture, please see [“Posture \(Human\),”](#) on page 10-25.

To set appearance values:

1. Select the entity.
2. Choose **Set** → **Appearance** → **Appearance**. The Appearance dialog box opens. The settings displayed are the current settings for the entity.
3. Change appearance settings as desired.
4. Click OK.



10.9. Armed

IEDs, car bombs, and suicide bombers must be armed to detonate. They are all armed by default. You can disarm them and re-arm them.



IEDs, car bombs, and suicide bombers have radios. Therefore, you can arm and disarm them using the Send Radio Set task.

To arm or disarm an explosive device:

1. Select the IED.
2. Choose **Set** → **Engagement** → **Armed**. The Armed dialog box opens.
3. Select an option from the list.
4. Click OK.

10.10. Capabilities

You can set capabilities for entities. The capabilities that are available for an entity are determined by its entry in *./appData/settings/vrfGui/SISO-REF-010-2010-RC1.xml*. The default list of capabilities is based on the DIS standard.

To set entity capabilities:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Capabilities**. The Capabilities dialog box opens. It displays the current settings for the entity.
3. Change the settings you want to change.
4. Click OK.



10.11. Collision Avoidance Types

Sometimes entities exhibit undesired collision avoidance behavior because they try to avoid objects that are close to their line of travel, but not necessarily blocking it. You can enable and disable avoidance of entities, buildings, and trees on a per-entity basis. This option overrides the collision avoidance settings in the object parameter database entry for the entity.



- ♦ Collision avoidance settings are saved in an entity's process state repository. However, there is no indication in the GUI what these settings are. Therefore, we recommend that you not change collision avoidance settings through the GUI indiscriminately because you may lose track of which entities are avoiding which types of objects. To permanently set collision avoidance for an entity, edit its components in the object parameter database.
- ♦ When the Collision Avoidance Types dialog box opens, it does not reflect the settings for the selected entities. It only provides a default setting. Make sure that you review all the settings in the dialog box to be sure you do not inadvertently enable or disable a setting that you do not want to change.
- ♦ The Collision Avoidance Types set data request lets you specify collision avoidance only for broad categories of objects. You can set collision avoidance more specifically in the object parameter database.

To change collision avoidance for specific object types:

1. Select the entity.
2. Choose **Set** → **Action** → **Collision Avoidance Types**. The Collision Avoidance Types dialog box opens.
3. Select the check boxes for object types to avoid and clear the check boxes for the object types that the entity should not try to avoid.
4. Click OK.

10.12. Concealed

The Concealed request sets an entity's concealment attribute to True or False. For entity-level simulations, this only affects the DIS or RPR FOM data sent over the network. It does not affect the simulation. For aggregate-level simulations, when an entity is concealed, its sensor signature is changed so that it is harder to detect.

To set the concealment attribute for an entity:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Concealed**. The Concealed dialog box opens.
3. Select an option from the list.
4. Click OK.



10.13. Contamination

The Contamination set data request lets you set the contamination type for an entity.

 **To set contamination:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Contamination**. The Contamination dialog box opens.
3. Select a contamination type from the list.
4. Click OK.



10.14. Counter Measures Auto Launch

The Counter Measures Auto Launch set data request lets you enable and disable automatic launching of counter measures. If you disable automatic counter measures, you can still launch them manually using the Launch Counter Measures task.

To enable or disable automatic launch of counter measures:

1. Select the entity.
2. Choose **Set** → **Engagement** → **Counter Measures Auto Launch**. The Auto Launch dialog box opens.
3. Select an option from the list.
4. Click OK.

10.15. Destroyed

You can set an entity's state to be destroyed. This can be helpful when you want an entity to be destroyed without having to first simulate its destruction by another entity.

To set an entity's state to destroyed:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Destroyed**. The entity is immediately destroyed.



10.16. Detonation Fuse Type

The Detonation Fuse Type set data request lets you configure detonation of improvised explosive devices (roadside IED entity), suicide bombers, and car bombs. You can set them to detonate immediately, at a certain time delay, or based on the proximity of a target entity. If you specify proximity detonation, you can set the radius of the proximate area. If you specify time, you must set the time in seconds until detonation. Detonation Fuse Type implicitly arms the device. (For details about arming devices, please see “Armed,” on page 10-7.)



IEDs, car bombs, and suicide bombers have radios. Therefore, you can detonate them using the Send Radio Set task.

To configure detonation fuse type:

1. Select the object that you want to configure.
2. Choose **Set** → **Engagement** → **Detonation Fuse Type**. The Detonation Fuse Type dialog box opens.
3. In the Fuse Type list, select the fuse type (Timed, Immediate, or Proximity).
4. If you selected a Timed fuse, in the Time box, specify the elapsed time, in seconds, at which the IED should detonate.

If you selected a Proximity fuse, in the Proximity box, specify the radius of the area in which an entity will trigger the detonation.

5. Click OK.



10.17. DI-Guy Appearance

The DI-Guy Appearance set data request determines the clothing and physical characteristics of a lifeform when it is displayed in a 3D simulation that uses DI-Guy characters.



The DI-Guy Appearance set data request applies only to lifeform entities.

To set an entity's DI-Guy appearance:

1. Select the entity.
2. Choose **Set** → **Appearance** → **DI-Guy Appearance**, or click the DI-Guy Appearance button (👤) on the Sets Toolbar. The DI-Guy Appearance dialog box opens.
3. Select an appearance from the list.
4. Optionally, in the 3D view only, select the Apply Selected Appearance Immediately check box. This displays the selected entity with the new appearance so that you can see what the appearance looks like before you apply the change.
5. Click OK.

10.18. Disembarked

The Disembarked set data request immediately disembarks an entity (as opposed to simulating disembarkation, as done by the Disembark task). It is the equivalent of the **Entities** → **Disembark** command. However, Disembarked allows you to include immediate disembarkation in a plan.

To set an entity to be disembarked:

1. Select the entity. (If you are using the 2D icon model, set embarked entities are not displayed, so you have to select it in the Objects List Panel.)
2. Choose **Set** → **Embarkation** → **Disembarked**.

10.19. Embarked

The Embarked set data request immediately embarks an entity (as opposed to simulating embarkation, as done by the Embark task). It is the equivalent of the **Entities** → **Embark On** command. However, Embarked allows you to include immediate embarkation in a plan.



If you are using HLA and want to use the embarkation feature, you must use RPR FOM 2, draft 17 or later.

To set an entity to be embarked:

1. Select the entity to be embarked.
2. Choose **Set** → **Embarkation** → **Embarked**. The Embarked dialog box opens.
3. Select the entity to embark on.
4. Optionally, specify a embarkation offset. The default, 0,0,0, puts the entity at the center of the parent entity.
5. Click OK.

10.20. Emitter

The radar sensor has an emitter component that models basic electromagnetic emissions. An entity can have multiple emitter components. Each emitter component can have a list of modes and each mode can have multiple beams.

Emission properties (azimuth, elevation, effective radiated power, and so on) for each beam are specified in the emitter component descriptor in the object parameter database. Emission properties are published by the emitter component.

An emitter component can publish itself as a standard beam type or a tracking beam type. The type is determined by the setting for the **targeting-capable** parameter in the object parameter database. It applies to all beams emitted by the specific component. If **targeting-capable** is False, the beam is a standard beam. If **targeting-capable** is True, it is a tracking beam.

If an emitter component has **targeting-capable** set to True, it registers for set-target messages. If you set a target for the entity on which the emitter is mounted, it publishes the target entity as its tracking target for all of the components beams.

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- Setting a target does not cause the beam to actually track the target. The beam's behavior is determined by the parameters in its description in the object parameter database.
- The emitter will continue to publish the targeted entity as its tracking target until you set another target, regardless of the status of that entity in the exercise. There is no way to set the target to “none”.
- Please see Section 10.5, “[Configuring Emitters](#),” in *VR-Forces Configuration Guide*, for an explanation of how to configure individual and multiple emitters in the object parameter database.
- Please see the online help for the OPD Editor for a description of emitter parameters.

Each emitter has an ID that is assigned automatically, starting with 0. Unless you change the system definition files, all default fixed-wing aircraft have one emitter with ID 0.

To turn on electromagnetic emissions:

1. Select the entity.
2. Choose **Set** → **Sensors** → **Emitter**. The Emitter dialog box opens.
3. Type the emitter ID. If the entity only has one emitter, its ID is 0. If it has more than one emitter, IDs get incremented by 1 for each additional emitter. There is no way to identify the emitter ID for a particular emitter, so you will have to use a trial-and-error approach to identify the correct emitter ID to use.
4. In the Emitter list, select On.



10.21. Engagement Results

An engagement result is a text string that gets included in entity state update messages that get sent over the network. The purpose is for a human participant to comment on the current state of an entity as a simulation progresses. Once specified, the text string continues to get sent until the expiration time is reached or a new engagement result is set.

To set engagement results:

1. Select the entity.
2. Choose **Set** → **Engagement** → **Engagement Results**. The Engagement Results dialog box opens.
3. Specify the engagement result. This can be any text you want to enter.
4. Set the expiration time in days and hours:minutes:seconds.
5. Click OK.



10.22. Equipment Pacing/Tracking

Equipment Pacing/Tracking lets you specify that a particular type of equipment be marked as pacing, tracking, or neither. Pacing indicates that the status of this item is critical to the mission. Tracking indicates that the commander is interested in the status of this item. These designations do not affect the simulation. They are reported for use by external systems.

To specify pacing or tracking for an aggregate's equipment:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Equipment Pacing/Tracking**. The Equipment Pacing/Tracking dialog box opens.
3. Select the check box for each type of equipment for which you want to specify pacing or tracking.
4. For each selected ammunition type, select an option from the list.
5. Click OK.



10.23. Food, Water, Fuel, Oil and Lubricant

You can set the current level of an aggregate's resources.

 **To set the level of food, water, fuels, and lubricants:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Food, Water, Fuel, Oil and Lubricant**. The Food, Water, Motor-Gas, Aviation-Fuel, Diesel Fuel, Oil, Lubricant dialog box opens.
3. Select the check box for each type of resource you want to specify.
4. For each selected resource type a value.
5. Click OK.



10.24. Food, Water Fuel, Oil and Lubricant Pacing/Tracking

Food, Water, Fuel, Oil, and Lubricant Pacing/Tracking lets you specify that a particular resource be marked as pacing, tracking, or neither. Pacing indicates that the status of this item is critical to the mission. Tracking indicates that the commander is interested in the status of this item. These designations do not affect the simulation. They are reported for use by external systems.

 **To set pacing and tracking for food, water, and fuels, and lubricants:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Food, Water, Fuel, Oil and Lubricant Pacing/Tracking**. The Food, Water, Motor-Gas, Aviation-Fuel, Diesel Fuel, Oil, Lubricant Pacing/Tracking dialog box opens.
3. Select the check box for each type of resource for which you want to specify pacing or tracking.
4. For each selected resource select an option from the list.
5. Click OK.

10.25. Force

You can change an entity's force during runtime. This might be useful in a simulation in which neutral forces begin assisting one force or another, or in which opposing forces capture friendly force weaponry and begin using it.

When you change an entity's force, its:

- ♦ Echelon ID changes to reflect the new force.
- ♦ Icon changes to the appropriate force color and type.
- ♦ Force ID changes.

Its entity enumeration does not change. So, for example, if you change the force of an M1A2, which has the country code 225 (United States), it still has the same country code, even though it might now be functioning as part of a force that is opposing United States forces.

To set the force of an entity:

1. Choose **Set** → **Disposition** → **Force**. The Force dialog box opens.
2. Select a force from the list.
3. Click OK.



10.26. Formation

VR-Forces supports the following formations:

- ♦ Column (default)
- ♦ Line
- ♦ Wedge
- ♦ Vee
- ♦ User-defined formations.

Formations are defined in formation files in the directory *./data/simulationModel-Sets/<model_set>/vrfSim/formation*. Formation files have the extension *.frm*. In addition to the named formations provided by MÄK, VR-Forces supports user-defined formations. If you create a new formation in the Entity Editor, it automatically gets added to the formation list for the aggregate types that support it.



The vee and wedge formations provided with VR-Forces place the aggregate leader at the end of one of the arms of the formation. If an aggregate has fewer than seven or eight members, it will not be symmetrical.

When you set the formation for a disaggregated aggregate, the entities that make up the aggregate snap to formation immediately. If you want entities to simulate moving into formation, rather than snapping to formation, use the Move Into Formation task.

If you set the formation for an aggregated aggregate, the aggregate remembers the formation and uses it the next time it disaggregates.

To set an aggregate's formation:

1. Select the aggregate whose formation you want to set.
2. Choose **Set** → **Aggregate** → **Formation**. The Formation dialog box opens.
3. In the Formation list, select the formation that you want the aggregate to use.
4. Click OK.

For information about configuring formations and about how to create user-defined formations, please see Section 10.4, “[Configuring Formations](#),” in *VR-Forces Configuration Guide*.

10.27. Heading

The Heading request instantly sets an entity's heading. If you want an entity to move to a new heading by pivoting or executing a K-turn, use the Turn To Heading task.

To set an entity's heading:

1. Select the entity.
2. Choose **Set** → **Position** → **Heading**, or click the Heading button (①) on the Sets Toolbar. The Heading dialog box opens. It displays the entity's current heading.
3. In the Heading text box, type a heading, in degrees.
4. Click OK.

10.27.1. Setting an Entity's Heading Manually

You can set an entity's heading by directly manipulating the entity.

To set an entity's heading manually:

1. Double-click the entity.
2. **Shift**+left mouse button+drag the mouse to change the heading. In the 3D view, you can see the entity rotate to the new heading. In the 2D view, the heading indicator rotates.
3. Release the **Shift** key.
4. Release the mouse button. If you have enabled rotation of icons to the heading, the entity icon rotates. For information about rotating icons to a heading, please see Section 7.3.2, “[Rotating 2D Icons to an Entity's Heading](#),” in *VR-Forces Users Guide*.



10.28. Health

Health is a value based on an entity's total personnel, equipment, and weapons. The Health set data request lets you restore personnel to their full values and set the overall health of the entity. For details about entity health, please see [“The Aggregate Warfare Model,”](#) on page 5-2.

To set an entity's health:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Health**. The Health dialog box opens. It displays the current state of personnel, equipment, and weapons.
3. To restore all personnel, select Reset Kill, Captured, Wounded, Missing.
4. To specify the overall health of the entity, adjust the Health slider or type a number in the Health box. As you move the slider to the left, the amount of personnel, equipment, and weapons decreases.
5. Click OK.

10.29. IFF

Friendly fixed-wing entities can model a NATO Identification Friend from Foe (IFF) transponder.



- Mode 5 and mode C are equivalent.
- The dialog box does not force you to enter valid codes. It truncates invalid entries to the correct length (but not necessarily valid data).
- When you open the dialog box, it reflects the current IFF settings for the entity, if any.
- You can view an entity's IFF settings on the IFF tab of its Information dialog box.

To set the IFF transponder for a fixed-wing entity that is configured with an IFF controller:

1. Select the entity.
2. Choose **Set** → **Sensors** → **IFF**. The IFF dialog box opens ([Figure 10-1](#)).

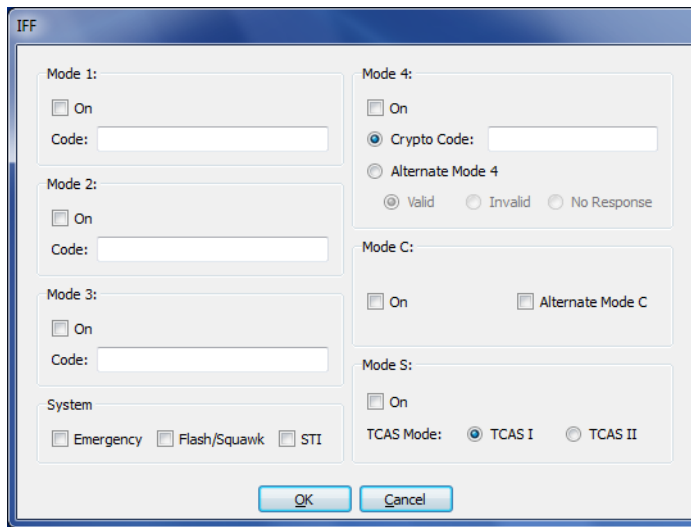


Figure 10-1. IFF dialog box

3. Complete the IFF dialog box.



10.30. Lase Autonomous

By default, entities with laser capability lase targets autonomously as part of the built-in target acquisition and firing process. You can specifically enable and disable autonomous lasing.

To enable or disable autonomous lasing:

1. Select the entity.
2. Choose **Set** → **Laser Designator** → **Lase Autonomous**. The Lase Autonomous dialog box opens.



The Lase Autonomous dialog box does not show the current lasing state of the entity.

3. Select an option from the list (Off or On).
4. Click OK.



10.31. Laser Code

The Laser Code set data request sets the code for laser beams sent by an entity and the code that the entity's missiles seek when they fire. By default, VR-Forces calculates a laser code for each laser-capable entity when it is created. You can change the laser code to a code of your choice. For information about the consequences of setting laser codes, please see [“Lasing Targets,”](#) on page 13-14.

To specify an entity's laser code:

1. Select the entity.
2. Choose **Set** → **Laser Designator** → **Laser Code**. The Laser Code dialog box opens.
3. Type a number between 111 and 8888, using only the digits 1-8.
4. Click OK.

10.32. Location

To move an entity instantly from one place to another, you can set its location or you can drag it to a new location. For information about dragging entities, please see [“Dragging an Object to a New Location,”](#) on page 2-19. For ground entities, specifying an altitude lets you place an entity at different levels (floors) in building features.

To set the location for an entity:

1. Select the entity.
2. Choose **Set** → **Position** → **Location**. The Location dialog box opens. It displays the entity’s current location. The cursor changes to input mode.
3. Click on the terrain where you want to move the entity, or enter the coordinates of the location in the Location dialog box.
4. Optionally, set the altitude, as described in [“Specifying an Object’s Altitude,”](#) on page 2-14.
5. Click OK.



10.33. MOPP Level

You can set an aggregate’s MOPP Level. The MOPP level changes instantly. To change MOPP level over time, use the Change MOPP Level task.

 **To set the MOPP level:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **MOPP Level**. The MOPP Level dialog box opens.
3. Select an option from the list.
4. Click OK.



10.34. Morale

You can set an aggregate’s morale.

 **To set an aggregate’s morale:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Morale**. The Morale dialog box opens.
3. Adjust the slider or type a value from 0 through 100.
4. Click OK.

10.35. Notify Level

You can set the notification level for entity console messages without opening the Entity Information dialog box.

To set the notification level:

1. Choose **Set** → **Other** → **Notify Level**. The Notify Level dialog box opens.
2. Select a notification level in the list.
3. Click OK.

10.36. Ordered Speed

When you set an entity's speed, you are setting its ordered speed, the speed at which you want it to move. It may not move at that actual speed due to soil type, slope, and so on. In aggregate level scenarios, speed may be affected by modifiers. If you set the speed while an entity is moving, it accelerates or decelerates from the current speed to the new ordered speed, if it can.



- ♦ Regardless of the speed that you enter, an entity's speed cannot exceed the value set by the **max-speed** parameter in the object parameter database.
- ♦ The Speed request sets the ordered speed of a fixed-wing entity in its current context – air or ground. The entity will not exceed the maximum speed for that context. However, if the maximum allowable ground speed is greater than the lift speed of the entity, and you assign an ordered speed greater than the lift speed, when the entity reaches that speed, it will take off.

To set the ordered speed of an entity:

1. Select the entity.
2. Choose **Set** → **Action** → **Ordered Speed**. The Ordered Speed dialog box opens.
3. In the Ordered Speed text box, set the speed.
4. Click OK.



10.37. Posture (Aggregate)

You can set the posture of an aggregate. The posture changes instantly. To change posture over time, use the Change Posture task.

 **To set an aggregate's posture:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Posture**. The Posture dialog box opens.
3. Select an option from the list.
4. Click OK.



10.38. Posture (Human)

A human entity (civilian or dismounted infantry) has a posture that determines its position when it is not moving and its type of movement when it is moving. Table 10-1 lists the position and movement relationships for each posture.

Table 10-1: Posture relationships

Posture	When it is not moving, it is:	When it is moving, it is:
standing	standing	walking or running
kneeling	kneeling	crawling
prone	prone	crawling
running	standing	walking or running
walking	standing	walking or running
crawling	prone	crawling
parachuting	standing	walking or running
jumping	standing	walking or running
sitting	standing	walking
squatting	prone	crawling
crouching	prone	crawling
wading	standing	walking or running

i

- ♦ For those postures listed as “walking or running”, VR-Forces sets the movement posture based on the entity’s speed.
- ♦ If an entity does not support a particular posture, it is set to the closest supported posture.
- ♦ Setting posture in the Lifeform State field of the Appearance dialog box has the same effect as setting the posture using the Posture set data request.

To set a lifeform’s posture:

1. Select the lifeform.
2. Choose **Set** → **Appearance** → **Posture**. The Posture dialog box opens.
3. Select a posture from the list.
4. Click OK.



10.39. Preferred Targets

Aggregate entities can target up to three entities. By default, they target the three entities that are most vulnerable to attack. If you want an entity to target specific entities that it might not choose automatically, the Preferred Targets set data request lets you specify them as preferred targets.

 **To specify preferred targets:**

1. Select an entity.
2. Choose **Set** → **Engagement** → **Preferred Targets**. The Preferred Targets dialog box opens.
3. Select up to three entities.
4. Click OK.

10.40. Radar Mode

The Radar Mode set data request lets you change the type of beam that an entity emitter publishes. By default, each fixed-wing aircraft has one emitter that has two beam types, search and track.

Figure 10-2 illustrates the difference in appearance between the beams for the two radar modes, in the 2D view. (The beams are not displayed unless you set emitters to be on.)

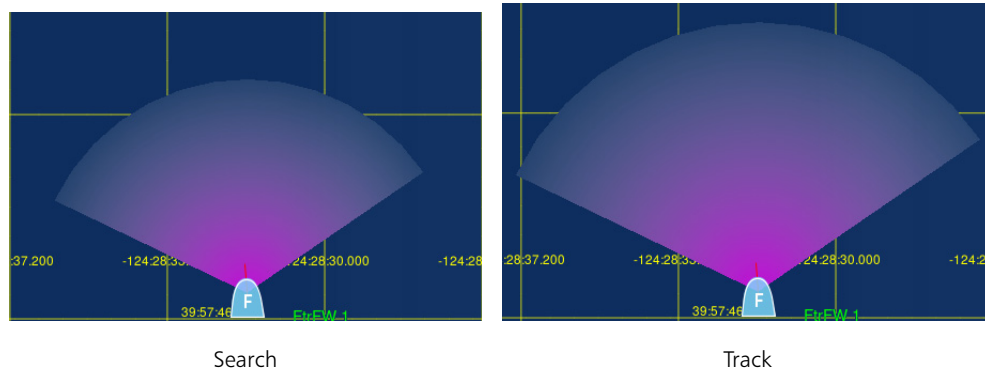


Figure 10-2. Radar mode beams

For more information about emitter beams, please see “[Emitter](#),” on page 10-13 and Section 10.5, “[Configuring Emitters](#),” in *VR-Forces Configuration Guide*.

To set an entity’s radar mode:

1. Select the entity whose radar mode you want to set.
2. Choose **Set** → **Sensors** → **Radar Mode**. The Radar Mode dialog box opens.
3. If the entity has more than one emitter, select the emitter ID you want to set in the Emitter ID list.
4. Select the mode in the Mode list.



10.41. Reorganize

If automatic reorganization is not enabled, you can reorganize an aggregate by issuing the Reorganize set data request.

To reorganize an aggregate:

1. Select the aggregate that you want to reorganize.
2. Choose **Set** → **Aggregate** → **Reorganize**.

The change takes place immediately. For more information about reorganization, please see [Reorganizing Aggregates](#), under “[How Aggregates Are Organized](#)” in *VR-Forces Users Guide*.

10.42. Resources

You can specify the value to assign to a resource. In entity-level scenarios, the resources provided with VR-Forces that you can set are fuel and ammunition. The object parameter database lists the ammunition types available for each type of entity. In aggregate-level scenarios an entity might not have any resources, depending on how it is configured in the Entity Editor.

To specify a resource value:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Resources**. The Resources dialog box opens.
3. Select a resource from the Resource list. The dialog box displays the maximum amount of the resource allowed, as configured in the object parameter database.
4. Specify a value for the resource.
5. Click OK.



10.43. Resources Pacing/Tracking

Resources Pacing/Tracking lets you specify that a resource type be marked as pacing, tracking, or neither. Pacing indicates that the status of this item is critical to the mission. Tracking indicates that the commander is interested in the status of this item. These designations do not affect the simulation. They are reported for use by external systems.

To set pacing and tracking for a resource:

1. Choose **Set** → **Disposition** → **Resource Pacing/Tracking**. The Resources Pacing/Tracking dialog box opens.
2. Select Resources.
3. Click OK.

10.44. Restore

Restoring an entity returns its resources to the values specified in the object parameter database. If the entity is destroyed, it returns it to life.



When you restore an entity-level aggregate that is in the aggregated state (using Restore), the original configuration of the aggregate is recreated. If you restore an aggregate that is in the disaggregated state, then only those subordinates still present in the simulation are restored. Any destroyed subordinates that were previously removed from the simulation as result of a disaggregate-->aggregate-->disaggregate transition are not restored. To fully recover all subordinates, restore the aggregate while in the aggregated state.

To restore an entity:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Restore**.

The change takes place immediately.



10.45. Set Resupply Mode

Set Resupply Mode specifies one of the following resupply modes for aggregates:

- ♦ None. The entity does not resupply itself.
- ♦ From Supply Units. When a resupply entity is in range, the aggregate gets supplies from it.
- ♦ From Self-Continuous. The aggregate resupplies itself continuously based on its resupply rate parameters. For details, please see “[Logistics](#),” on page 5-14.
- ♦ From Self-Periodic. The aggregate periodically resets all of its supplies, except health, to the base level. This level is reduced by health losses.

 **To specify the resupply mode:**

1. Select the aggregate.
2. Choose **Set** → **Logistics** → **Set Resupply Mode**. The Resupply Mode dialog box opens.
3. Select a resupply mode from the Resupply Mode list.
4. If you select From Self-Periodic, specify the resupply period in the Periodic Resupply Period boxes.
5. Click OK.

10.46. Rules of Engagement

Rules of engagement specify the conditions under which an entity will fire at the enemy.



The rules of engagement for a fixed-wing entity are in effect whether it is on the ground or in the air. If you do not want fixed-wing entities to fire missiles while they are on the ground, you must change the rules of engagement.

To specify the rules of engagement for an entity:

1. Select the entity.
2. Choose **Set** → **Engagement** → **Rules of Engagement**, or click the Rules of Engagement button () on the Sets Toolbar. The Rules of Engagement dialog box opens.
3. In the Rules of Engagement list, select the rule you want to apply.
4. Click OK.

10.46.1. How Fire-When-Fired-Upon Works

An entity considers itself under fire if either of the following is true:

- ♦ An “Entity Impact” detonation interaction that targeted this entity has recently (within **underFireTime** seconds (default 120)) been received.
- ♦ Any detonation has happened within **underFireDistance** (default 1000 meters) of this entity.

There is no attempt to return fire specifically at the attacking entity. If an entity thinks that it is under fire, it will fire at any enemies that it can target.



The **underFireTime** and **underFireDistance** parameters are part of the under-fire-determination-sensor component in an entity's platform (OPE) file.

10.47. Sector of Responsibility

An entity's sector of responsibility is used with detection tables to determine the priority of targets. Normally, the priority of targets that are outside an entity's sector of responsibility is lower than the priority of targets in its sector of responsibility. For information about the target detection tables, please see Section 10.2, “[Detection Tables](#),” in *VR-Forces Configuration Guide*.

You must specify a sector center and a sector size. Sector center is the center of the area you wish to designate, and sector size is the size of the area, both in degrees. Degrees are measured as 0 to the front (based on the heading), increasing clockwise. If the Turret Scan Controller is mounted on an entity with an articulating turret, then the turret scans the sector of responsibility specified. Sector center is the midpoint of the area. [Figure 10-3](#) illustrates these parameters. The sector size is approximately 140 degrees, a bit less than half the circle. The sector center is at 0 degrees.



The default sector of responsibility is 90 degrees, centered at zero degrees.

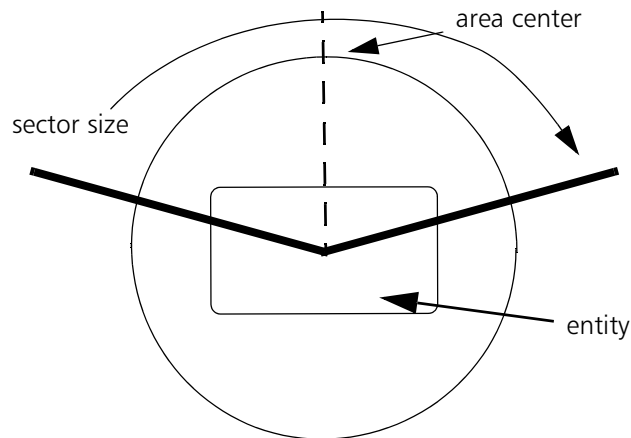


Figure 10-3. Sector of responsibility parameters

To set an entity's sector of responsibility:

1. Select the entity.
2. Choose **Set** → **Engagement** → **Sector of Responsibility**. The Sector of Responsibility dialog box opens.
3. In the Size text box, set the size of the area to be scanned, in degrees.
4. In the Center text box, set the center of the scan area, in degrees.
5. Click OK.



10.48. Sonar Depth

The Sonar Depth set data request lets you set the depth at which an entity's sonar operates. This allows you to simulate a helicopter dipping a sonar sensor into the water or a vessel dipping a sensor to a lower depth. Since sonar only works when the sensor is in the water, setting the sonar depth is the only way for helicopter-born sonar to work.

The sonar stays at this depth regardless of the altitude or depth of the entity. If you set the depth to be the depth of the entity with the Use Entity Depth option, it has the effect of retracting the sonar. If you simply set the sonar to the depth of the entity and the entity changes depth, the sonar will stay at the assigned depth.

To set sonar depth:

1. Select the entity.
2. Choose **Set** → **Sensors** → **Sonar Depth**. The Sonar Depth dialog box opens.
3. Specify the depth.
4. Optionally, select Use Entity Depth to set a dipped sonar to the depth of the entity.
5. Click OK.

10.49. Spot Reports

You can set spot reports on or off for all entities (global setting) from the Spot Reports page of the Application Settings dialog box. You can also set them for individual entities. When you set spot reports on, it means that the entity sends them. Visualization of spot reports is enabled or disabled for the GUI as a whole on the Spot Reports page. For more information about spot reports, including setting them globally, please see [“Displaying Entities Based on Spot Reports,”](#) on page 13-2.



You cannot set an entity-level aggregate entity to send spot reports; you can only set spot reports for individual entities. However, you can select multiple individual entities and set spot reports for all of them at the same time.

To set spot reports on or off for an entity:

1. Select the entity.
2. Choose **Set** → **Sensors** → **Spot Reports**. The Spot Reports dialog box opens. If you are turning spot reports off, skip to step 5.
3. Select one of the following options:
 - Only to Front End. Do not send spot reports to other back-ends. This option can improve performance.
 - Broadcast. Send spot reports to all entities.
 - Send to Specific Entities. Sends to specific entities.
4. If you selected Send to Specific Entities, the entity list is enabled. Select the entities to which you want this entity to send sport reports.
5. Select an option from the Spot Reports Enabled list. If you choose On or Off, the setting persists regardless of the global spot report setting. If you want the entity to use the global spot report setting, choose Use Global Setting.
6. Click OK.



10.50. Supplying

The Supplying set data request sets a supply entity to stop providing supplies or to start providing supplies.

To stop or start a supply entity providing supplies:

1. Choose **Set** → **Logistics** → **Supplying**. The Supplying dialog box opens.
2. Select Stop or Start.
3. Click OK.



10.51. *Surrendered*

The Surrendered set data request only applies to lifeforms. When a lifeform is in the surrendered state, it does not fire at other entities and other entities do not fire at it.

To set an entity to be surrendered:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Surrendered**. The Surrendered dialog box opens.
3. Select an option from the list.
4. Click OK.



10.52. *Synchronize Laser Code*

The Synchronize Laser Code set data request lets an entity with laser-guided weapons easily synchronize its laser code with the laser code of the lasing entity. The alternative to this command would be to use Laser Code to set the code for the lasing entity and the firing entity.

To synchronize laser codes:

1. Select the entity that has a laser-guide weapon.
2. Choose **Set** → **Laser Designator** → **Synchronize Laser Code**. The Synchronize Laser Code dialog box opens.
3. Select the lasing entity that you want this entity to synchronize with.
4. Click OK. The laser code for the selected entity is changed to match that of the lasing entity.



10.53. Target

You can command an entity to specifically target another entity. For this set data request to be effective, the target must be visible to the targeting entity. When you set a target, you override the priorities set by the target selection controller. If the specified target is in the list of candidate targets, it gets the highest priority as a target. However, if the specified target is not visible as a target to the targeting entity, the entity fires at the other available targets. It does not keep looking for the specified target. (You could achieve this behavior by putting a Target statement inside a While statement in a plan.)

To set an entity's target:

1. Select the entity.
2. Choose **Set** → **Engagement** → **Target**. The Target dialog box opens.
3. Optionally, filter the entity selection list.
4. In the Target list, or on the terrain, select the entity to target.
5. Click OK.

10.54. Tasked by Superior

You can order an entity that is part of an aggregate, and which is executing its own plan or is conducting an independent task, to stop executing those tasks and take commands from its aggregate. When you order an entity to be tasked by its superior, it stops conducting independent tasks and waits for the next order from the aggregate. (It does not execute the aggregate's current task, if any.) For more information about being tasked by superior, please see [“Independently Tasking Aggregate Members,”](#) on page 7-11.

To order an entity to be tasked by its superior:

1. Select the entity.
2. Choose **Set** → **Other** → **Tasked by Superior**.

The change takes place immediately.



10.55. Weapons Pacing/Tracking

Weapons Pacing/Tracking lets you specify that weapons a weaponbe marked as pacing, tracking, or neither. Pacing indicates that the status of this item is critical to the mission. Tracking indicates that the commander is interested in the status of this item. These designations do not affect the simulation. They are reported for use by external systems.

 **To set pacing or tracking for an aggregate's weapons:**

1. Select the entity.
2. Choose **Set** → **Disposition** → **Weapons Pacing/Tracking**. The Weapons Pacing/Tracking dialog box opens.
3. Select the check box for each weapon for which you want to specify pacing or tracking.
4. For each selected weapon type, select an option from the list.
5. Click OK.



10.56. Weapon State

You can set the weapon state for dismounted infantry entities. The options are stowed, deployed, and in-fire-position.



If an entity has an appearance for a weapon state, it uses it in the 3D view. However, some weapon states are not supported for some entities.

To set the weapon state:

1. Select the entity.
2. Choose **Set** → **Disposition** → **Weapon State**. The Weapon State dialog box opens.
3. Choose a weapon state from the list.
4. Click OK.



11. Writing Plans

This chapter explains how to combine tasks, set data requests, global commands, and conditions into plans.

Introduction to Entity Plans and Global Plans	11-3
Conditional Statements.....	11-5
Specifying Names or Patterns in Conditional Statements.....	11-6
The If/else Statement.....	11-9
When Statements (Triggers)	11-10
While Statements	11-12
Conditional Tests	11-13
Viewing Plans	11-16
Writing Entity Plans	11-18
Adding an Entity Task or Set Data Request to a Plan	11-19
Adding a Conditional Statement to a Plan.....	11-20
Editing a Statement	11-23
Deleting Statements from a Plan	11-23
Printing Plans.....	11-23
Saving Changes to a Plan.....	11-24
Creating Global Plans	11-24
Adding Global Commands to a Plan.....	11-25
Adding a Global Task or Set to a Plan	11-26
Sending Console Messages.....	11-27
Creating Objects from Within a Plan	11-28
Deleting Objects from Within a Plan	11-28
Issuing a Plan	11-29
Writing Plans for Aggregates	11-30

Writing a Plan for Multiple Entities	11-30
Writing Plans for Remote Entities.....	11-30
Copying Plans and Plan Statements	11-31
Restarting a Plan	11-31
Abandoning a Plan	11-32
Considerations for Creating Plans.....	11-33
Name Changes Can Invalidate Plan Statements	11-33
Considerations for Using Triggers	11-33
Moving In Formation.....	11-34
Using the Tasked-By-Superior Request in a Plan	11-34
Following Entities	11-35
Planning Tasks for Aircraft	11-35
Using Non-VR-Forces Entities in Plans.....	11-35

11.1. Introduction to Entity Plans and Global Plans

A plan contains one or more statements that get executed by VR-Forces without human intervention. You build these statements in dialog boxes. VR-Forces writes the statement to the plan, so you do not have to worry about syntax errors in your statements when you first create them. However, you must understand the meaning of individual commands and parameters and the implications of how you order them, to make sure that a plan does what you want it to do.

VR-Forces supports two types of plans – entity plans and global plans. They have the following characteristics:

- ♦ Entity plans apply to a specific entity. They contain tasks and set data requests that are specific to the entity and which get executed sequentially. The sequence of task execution can be interrupted by receipt of a task from an external actor (a global plan command or independent task). The task sequence can also be interrupted if a trigger (a form of conditional statement) or a reactive task is activated.



Entity plans can include global commands (which are described later in this section). However, you must be careful not to target global commands, tasks, or sets to an entity in its own plan when you really want entity-specific tasks or sets. Entity tasks are executed sequentially. Sending an entity a global command, even from within its own plan, terminates its plan.

- ♦ Global plans are independent of any entity. The statements in a global plan affect the scenario as a whole (create and delete object commands) or a specific entity (task and set commands). Tasks sent to an entity from a global plan have the same effect on the entity as independent tasks assigned by a human player. They interrupt any task that the entity is engaged in and terminate its plan. Furthermore, if a global plan has a series of tasks for the same entity, they get sent in order without regard to completion of the previous task (as if you issued a series of commands from the Task menu, one immediately after another). In such a case, only the last command sent is likely to be completed.

For an example of how to write a “good” global plan, please see [Global Plans](#), in Chapter 6, [Writing Plans](#), in *VR-Forces Getting Started Guide*.

In [Figure 11-1](#), note that the entity plan window (on the right) is tied to a particular entity (shown in the title bar). It has the same menus as the global plan, plus additional Task and Set menus. The commands on the Task and Set menus in the entity plan apply implicitly to the entity for which you are writing the plan.

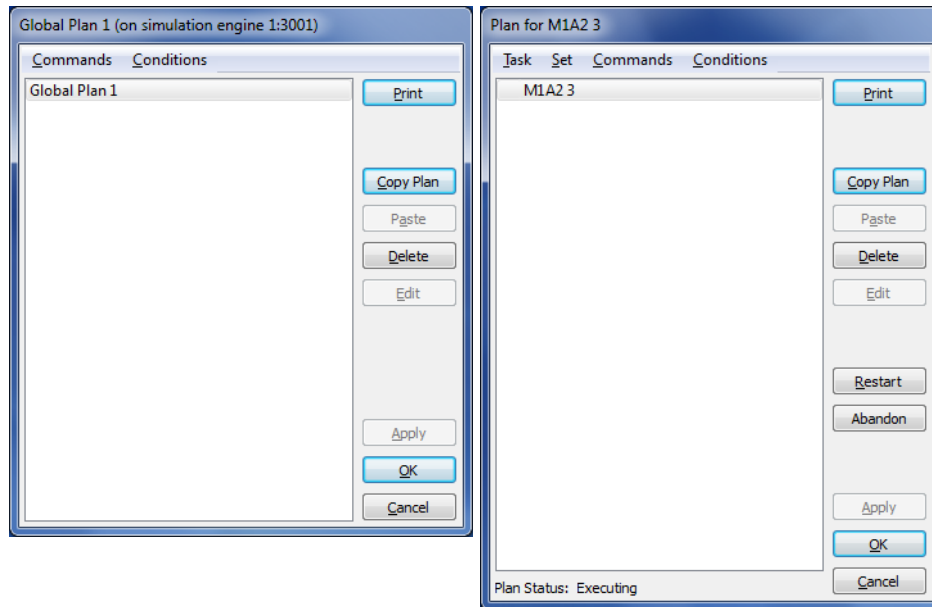


Figure 11-1. Global plan and entity plan

The Commands menu, which is common to both types of plans, contains global commands. These commands allow you to:

- ♦ Create and delete objects.
- ♦ Assign tasks and set data requests to entities.
- ♦ Send console messages.
- ♦ Change hostility.
- ♦ Issue plans to entities.
- ♦ Abandon and restart plans.
- ♦ Change time of day and weather settings.

Global commands must explicitly state the entity to which they apply.

11.2. Conditional Statements

Many of the statements used in plans set a parameter or direct an entity to perform a specific task unconditionally. However, the plan language also includes the conditional statements, `If`, `When`, and `While`. A conditional statement specifies a condition and a block of plan statements.

- ♦ An `If` statement is evaluated once, when the plan arrives at the statement. If the condition is true at that point, VR-Forces executes the statements in the `If` block.
- ♦ A `When` statement is also called a trigger. It specifies a condition that is evaluated periodically by VR-Forces. If the condition becomes true, VR-Forces executes the statements in the trigger block. A trigger statement lets you plan for a condition without knowing in advance when the condition will occur.
- ♦ A `While` statement executes a block of statements repeatedly while the condition remains true. VR-Forces evaluates the condition when the plan first arrives at the `While` statement. If the condition is true, it executes the statements in the block. When it completes the statements, it evaluates the condition again. If it is still true, VR-Forces executes the statements again. It continues to do so as long as the `While` condition is true.

The conditions supported by VR-Forces are:

- ♦ Is an entity in a given area? (Entity In Area)
- ♦ Is an entity to the left of a phase line? (Entity Left of Line)
- ♦ Is an entity destroyed? (Entity Destroyed)
- ♦ Is an entity under fire? (Entity Under Fire)
- ♦ Has an entity located a target? (Entity Has Target)
- ♦ Has an entity's embarkation state changed? (Entity Embarked)
- ♦ Is an entity above or below a specified altitude? (Entity Altitude)
- ♦ Has an entity detected another entity? (Entity Detected)
- ♦ Has an entity received a radio message? (Receive Text Message)
- ♦ Has an engineering object been breached? (Engineering Object Breached)
- ♦ Has a missile approach warning been received? (Missile Approach Warning)
- ♦ Is a scenario event in process or concluded? (Scenario Event)
- ♦ Has a lifeform surrendered? (Lifeform Surrendered)
- ♦ Does a lifeform have a particular DI-Guy animation? (Entity Di-Guy Animation Check)
- ♦ Does a lifeform have a particular DI-Guy appearance? (Entity Di-Guy Appearance Check)
- ♦ Is a random probability true? (Random)
- ♦ Is an entity resource at a certain level? (Resource)
- ♦ Is the simulation time greater than or less than a specific elapsed time? (Sim Time)
- ♦ Is the simulation date and time a certain value? (Simulation Date/Time)

Conditional statements can include the boolean operators True and False, and the logical operators AND, OR, and NOT.

11.2.1. Specifying Names or Patterns in Conditional Statements

When you add a conditional statement to a plan, you must specify the entity or entities for which the condition will be tested. You can specify:

- ♦ A specific named entity, for example, When entity M1A2 1 is in Area 1.
- ♦ That the condition applies to “Self”, for example, When “I” am in Area 1. Specifying a condition for one’s self makes it easy to copy plans or plan statements and paste them into the plans of other entities without doing any editing.
- ♦ An entity enumeration, for example, any entity with enumeration 1:1:225:1:1:3:0 (any M1A2).
- ♦ The inverse of the selection, for example, any entity but myself, or any entity except an M1A2.
- ♦ That for aggregates, the entire aggregate must satisfy the condition (the default), or that any subordinate member of an aggregate satisfies the condition. For example, the default behavior when Entity Is Destroyed is applied to an aggregate is that all members of the aggregate must be destroyed for the condition to be true. The alternative is that the condition is true if any member of the aggregate is destroyed.

The Name and Pattern specifications are mutually exclusive. You cannot specify a name and a pattern. The tab in the Condition dialog box that is visible when you click OK is the specification that gets applied.

Specifying a Name in a Conditional Statement

To specify a named entity in a condition statement:

1. In a conditional statement dialog box, select the Name tab (Figure 11-2).

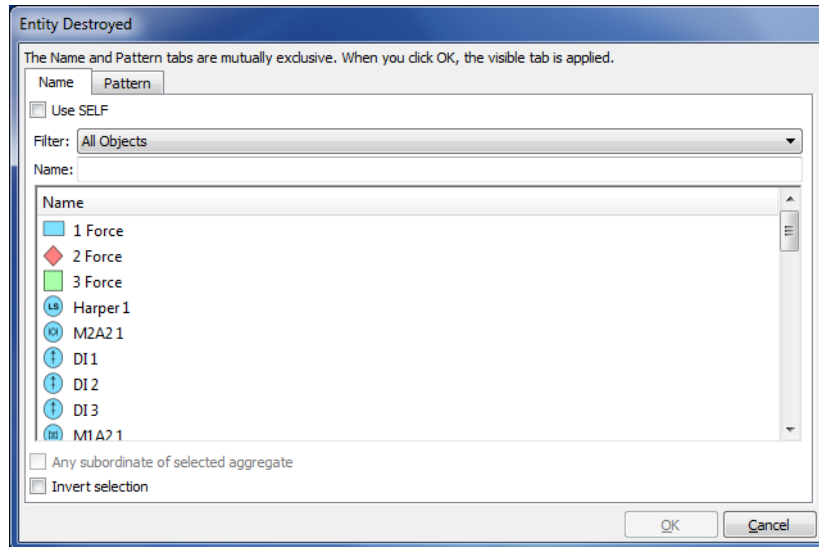


Figure 11-2. Name tab in condition dialog box

2. Do one of the following:
 - To specify the entity whose plan this is as the entity in the condition, select the Use SELF check box.
 - To specify an entity by name, select the entity in the list or type its name in the Name text box.
3. If you select an aggregate entity in the list, the Any Subordinate of Selected Aggregate check box is enabled. If you want the condition to be satisfied when any entity in the aggregate meets the condition, select the check box.
4. To specify the inverse of the name, that is, any entity except the selected one, select the Invert Selection check box.
5. Click OK.

Specifying an Entity Pattern in a Conditional Statement

The enumerations used in the lists on the Pattern tab are loaded from the file `.\appData\settings\vrfGui\condition-entity-types.csv`. They represent a subset of the enumerations typically used for entities in simulations. However, you can enter any numeric value you want in the enumeration value box.

If you expect that you will consistently need to specify enumeration values that are not part of `condition-entity-types.csv`, such as a particular country code, you can edit it to add the patterns you need.

To specify an entity pattern in a condition statement:



1. In a conditional statement dialog box, select the Pattern tab (Figure 11-3).

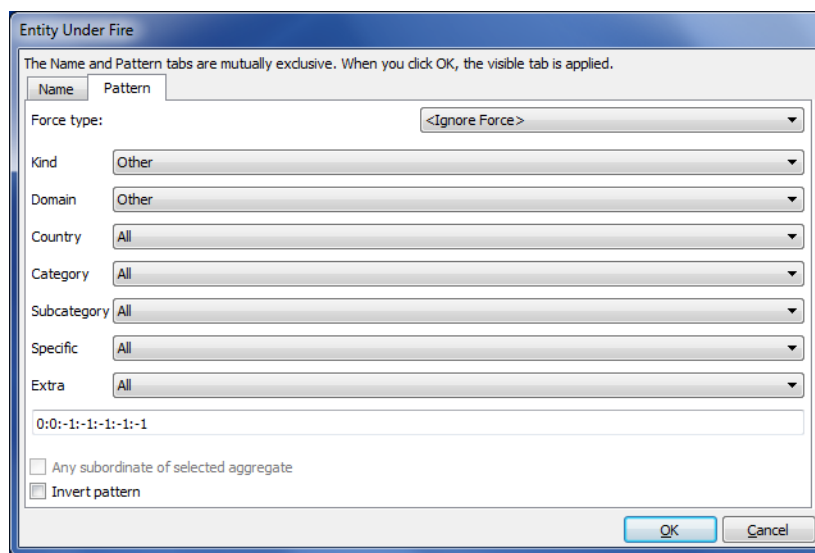


Figure 11-3. Pattern tab in condition dialog box

2. Optionally, specify a force to test for.
3. For each element of the enumeration, select an option from the list, or type an enumeration in the text box.
4. If the enumeration you enter is for an aggregate entity, the Any Subordinate Of Selected Aggregate check box is enabled. If you want the condition to be satisfied when any entity in the aggregate meets the condition, select the check box.
5. To specify the inverse of the name, that is, any entity except the selected one, select the Invert Pattern check box.
6. Click OK.

11.2.2. The If/else Statement

An `If/else` statement tests a condition. It only tests the condition once.



Do not use an `If` statement to test for receipt of a message or some other circumstance that does not represent an entity's state. VR-Forces does not keep a record of events and such a test will almost always evaluate to false. Use a `When` statement to test for conditions that do not evaluate entity state.

An `If/else` statement consists of:

- ♦ The word `If`.
- ♦ A condition to be evaluated.
- ♦ A block of statements.
- ♦ An `else` statement.
- ♦ Optionally, statements for the `else` condition.

If the condition is true at the moment the `If` statement is evaluated, control passes to the first statement of the `If` block. If the condition is false, control passes to the first statement in the `else` block, if you have one, or to the first statement after the complete `If/else` block if you do not have an `else` block. You can nest `If/else` statements within `If/else` statements. The syntax is as follows:

```
If (condition) then
    zero_one_or_more_statements
else
    zero_one_or_more_statements
endif
```

When VR-Forces reaches the end of the block of `If` or `else` statements, control passes to the first statement after the `If/else` statement.

The Add Conditional Expression dialog box ensures that you have the correct syntax. It does not ensure that your `If/else` block makes logical sense.

11.2.3. When Statements (Triggers)

A trigger consists of a **When** statement followed by a block of statements that are executed only if the condition in the **When** statement is true.

When VR-Forces reads a **When** statement, it registers the trigger and checks the condition. If the condition is true, control passes to the first statement in the **When** block. Task execution proceeds as follows:

- If the **When** block contains any tasks that are mutually exclusive with the currently executing task, the current task is discarded and the statements in the **When** block are executed.
- If the tasks in the **When** block are not mutually exclusive with the current task, or if the **When** block only has set data request statements, the **When** statements are executed and the current task continues. For more information about this case, please see [“Using Triggers That Do Not Have Mutually Exclusive Tasks,”](#) on page 11-34.
- After the tasks in the **When** statement block are completed, control returns to the next statement in the entity’s plan.



The location of a **when** statement in a plan has an important affect on its functioning. For a discussion about where to place triggers, please see [“Deciding Where to Put Trigger Statements,”](#) on page 11-33.)

If the condition is false, VR-Forces continues to the next statement in the plan. It continues to check the trigger condition periodically. If at any point, the condition evaluates as true, control passes to the block of statements associated with the trigger. Task execution proceeds as described in the previous paragraph.

[Figure 11-4](#) illustrates the process when a trigger has a task that is mutually exclusive with the current task. After the tasks in the **When** statement block are completed, control returns to the next statement in the entity’s plan. If the entity was in a **While** loop when the trigger fired, it returns to the next statement in the **While** block.

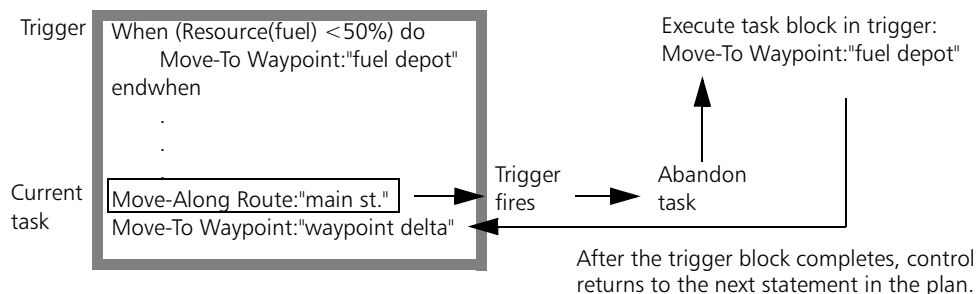


Figure 11-4. Flow of control for triggers

After a trigger fires, it is removed from the list of registered triggers. If you want to continue to test for the same condition, you need to execute another **When** statement for that condition.

Unregistering Triggers

You cannot unregister triggers while a scenario is running. If you do not want a trigger to be executed, you have the following options:

- ♦ Before you start the scenario, remove the trigger from the plan.
- ♦ During a simulation, abandon the plan.
- ♦ During the simulation, remove the trigger from the plan and save the plan. The new plan will erase the old one. However, the plan will begin executing at the first statement, which may not be the behavior you want.

11.2.4. While Statements

A `While` statement consists of:

- ♦ The word `While`.
- ♦ A condition to be evaluated.
- ♦ A block of statements.

If the condition is true at the moment the `While` statement is reached, control passes to the first statement of the `While` block. If the condition is false, control passes to the first statement after the complete `While` block. You can nest `While` statements within `If`, `When`, and `While` statements.

When VR-Forces reaches the end of the `While` block, it evaluates the condition again. If the condition is still true, VR-Forces executes the statements again. If it is false, control passes to the first statement after the `While` block.

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- ♦ VR-Forces re-evaluates a `while` condition only after it has executed all of the statements in the block. If the condition becomes false while VR-Forces is executing statements in the block, VR-Forces continues to execute all statements because it does not re-evaluate the condition until it completes the `While` block.
 - ♦ If you put a continuous task such as `Wait` or a `Patrol Between` in a `While` block, it is possible that the condition will never be re-evaluated, because the tasks in the block will never be completed.
-

11.2.5. Conditional Tests

This section describes each of the conditions that VR-Forces can test. When you set up conditions, keep in mind the following:

- ♦ If there is no entity with the specified name, the result is always false.
- ♦ If the specified entity is destroyed, the condition might never be satisfied. Your plan should take this possibility into account.

Altitude

Altitude returns true if the entity (or member of an aggregate) is at a higher or lower altitude than the one specified.

Detect Entity

The Detect Entity condition tests to see if an entity has been detected at a particular identification level. The identification levels are Detected, Classified, Identified, and Full Knowledge. Identification levels are determined by the detection probability configuration files, based on the distance between the detecting entity and the target and for how long the entity has been detected. For details about the detection probability files, please see Section 10.2, “[Detection Tables](#),” in *VR-Forces Configuration Guide*.



Engineering Object Breached

The Engineering Object Breached condition returns true if the specified engineering object has been breached. (Aggregate-level scenarios only.)

Entity Destroyed

Entity Destroyed returns true if the specified entity or aggregate is destroyed.



The definition of destruction for an aggregate is implementation specific. The aggregates supplied by MÄK for VR-Forces report that they are destroyed if every member of the aggregate is destroyed. An aggregated aggregate is destroyed if the aggregate is destroyed. If you have implemented aggregates locally using the VR-Forces Toolkit, they could have a different definition of destroyed.



Entity Di-Guy Animation Check

The Entity Di-Guy Animation Check condition tests the current DI-Guy animation for a lifeform. This condition may be useful if you are scripting a series of animations. For example, if a particular entity is using a threatening or hostile animation, you might want to have other entities respond a certain way.



Entity Di-Guy Appearance Check

The Entity Di-Guy Appearance Check condition tests the current DI-Guy appearance for a lifeform. This condition may be useful if you are scripting a lifeform's interaction with another lifeform based on ethnicity or how they are dressed.

Entity Embarked

Entity Embarked returns true if the named entity is embarked.

Entity Has Target

Entity Has Target returns true if the entity specified in the condition identifies a target. For example, consider the entities in [Figure 11-5](#). The condition in M1A2 1's plan is true when BMP 1 has a target, not when M1A2 1 targets BMP 1.

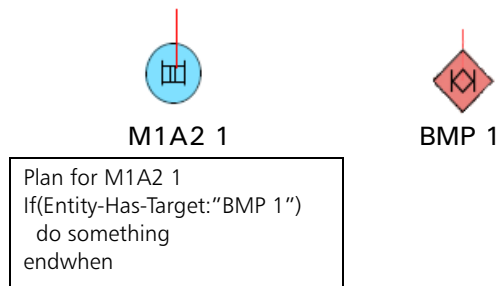


Figure 11-5. Entity Has Target condition



If an entity's rules of engagement prevent it from firing, this condition does not return true when the entity identifies a target.

Entity In Area

Entity In Area returns true if the entity (or member of an aggregate) reports that it is in the named area. You can use the NOT boolean operator, to test whether an entity is outside the area.

Entity Left of Line

Entity Left of Line returns true if the entity (or member of an aggregate) reports that it is to the left of the specified phase line.

An entity is considered to be to the left of a phase line if it is on the left side of an infinite extension of the phase line as viewed from a point on the line facing in the direction of the line. For a description of phase line direction, please see Section 3.7.2, “Phase Lines,” in *VR-Forces Users Guide*.

Entity Under Fire

Entity Under Fire returns true if the entity (or member of an aggregate) is under fire.

**Lifeform Surrendered**

The Lifeform Surrendered condition tests to see if a lifeform entity has surrendered (using the Surrendered set data request).

Missile Approach Warning

The Missile Approach Warning condition returns true if a hostile missile is within the specified distance.

Random

You can use the Random condition to randomly decide an entity's behavior at run time.

Percentage – A floating point probability percentage value between 0% (zero) and 100%. Random returns true if a random number between zero and 100 is less than or equal to the specified value.

If you use the Random condition, consider the following issues:

- ♦ Random is not very useful in triggers, since triggers may evaluate their condition expressions as often as once per tick. This means that a trigger expression of “Random Probability:50%” is likely to fire within the first couple of times it is evaluated. Therefore, we recommend that you not create triggers that are based on a random condition.
- ♦ If you use a random condition in a cascading sequence of **If/else** statements, and you want to ensure the correct probability distribution, be careful how you specify the percentage value. For example, randomly selecting one of three paths with equal probability would be done like this:

```
If (Random Probability:33.33%) then
  Move-Along Route:"1"
Else
  If (Random Probability:50%) then
    Move-Along Route:"2"
  Else
    Move-Along Route:"3"
  Endif
Endif
```

Resource

The Resource condition tests the amount of a specified resource using comparison operators.

Receive Text Message

The Receive Text Message condition tests to see if an entity has received a text message (sent by the Send Text Message task) that contains the text specified in the Receive Text Message dialog box.

Scenario Event

The Scenario Event condition returns true if the specified scenario event is in process or has completed.

Simulation Time

The Sim Time condition returns true if the elapsed simulation time is greater than (Sim Time >) or less than (Sim Time <) the time specified in the statement. Sim Time is the elapsed simulation time in days, hours, minutes, and seconds.

Simulation Date/Time

The Simulation Date/Time condition returns true if the simulation date and time matches the specified value.

Boolean and Logical Operators

You can use the following boolean and logical operators in conditional expressions:

- ♦ True.
- ♦ False.
- ♦ AND (*expression*, *expression*) – evaluates as true if both conditional expressions are true.
- ♦ OR (*expression*, *expression*) – evaluates as true if either of the expressions are true.
- ♦ NOT (*expression*) - evaluates as true if the conditional expression is false.

You can nest and combine conditional expressions.

11.3. Viewing Plans

You can view an entity's plan and observe its progress through the plan. You can view the plans for as many entities at a time as you want. In addition to viewing plan status in the Plan window, you can view the current task on the Task Status page of the Entity Information dialog box.

To view an entity's plan:

1. Select the entity whose plan you want to view.
2. Choose **Entities** → **Plan**, or press **p**. The Plan window opens.

The task that an entity is executing is highlighted in the Plan window. When the entity completes its plan, a message is displayed in the status area at the bottom of the Plan window.

11.4. Writing Entity Plans

This section explains how to write entity plans. For conceptual information about plans, please see Section 3.9, “Plans,” in *VR-Forces Users Guide*, and the previous sections in this chapter.

When you write a plan, keep the following considerations in mind:

- ♦ If you edit a plan during a simulation, when you apply the changes, the entity whose plan has been changed begins executing it from the beginning. This might mean its activities are no longer synchronized with those of the other entities, unless the updated plan only includes statements that you want to execute starting at the current point of the simulation. Therefore, we recommend that you edit plans when you first load a scenario, before you start running the simulation.
- ♦ If you have two or more Plan windows open at the same time, and you open a dialog box, such as Move To, but do not complete the command, you cannot open that same dialog box from another Plan window until you complete the one that is open.

To edit an entity's plan:

1. Select an entity.
2. Choose **Entities** → **Plan**, or press **p**. The Plan window opens. The entity's plan is displayed.

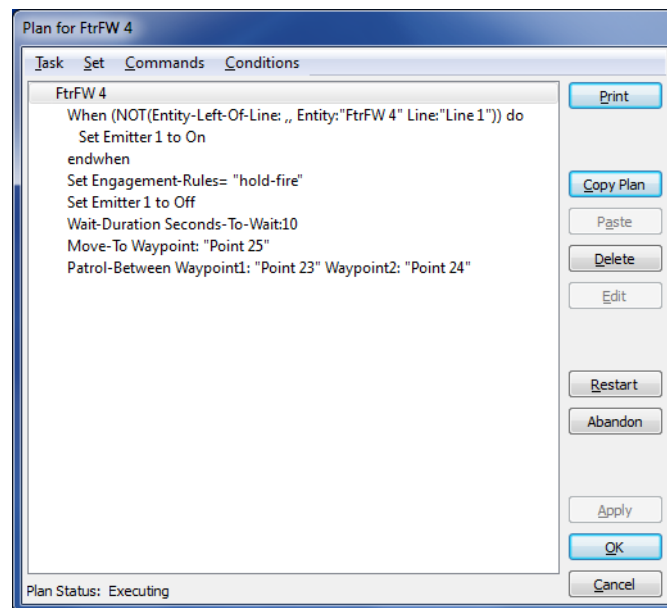


Figure 11-6. Plan window

3. Add new statements, edit statements, or delete statements as described in the following sections.

11.4.1. Adding an Entity Task or Set Data Request to a Plan

When you add statements to an entity plan, you add them after the currently selected statement. (For details about adding tasks to a global plan, please see [“Adding Global Commands to a Plan,”](#) on page 11-25.)

To add a task to a plan:

1. Open the Plan window for an entity.
 2. In the Plan window, select the statement immediately above where you want to insert a new statement. If the plan does not have any statements yet, the plan root – “*Entity_name*” is already selected.
 3. Choose **Task** → *category* → *Task*, where *category* is one of the categories on the Task menu and *Task* is a task listed for the selected category. A dialog box appropriate to the task opens. The procedures for filling out each type of task dialog box are described in Chapter 7, [Assigning Tasks](#).
 4. Complete the required parameter information.
 5. Click OK in the task dialog box to add the statement. You can click Cancel at any time to exit a task dialog box.
- To add a set data request to a plan, follow the same procedure as for adding a task, except choose **Set** → *category* → *Set Data Request*.

The procedures for filling out Set statement dialog boxes are in Chapter 10, [Setting Entity State](#).



Some task and set statements, such as Wait, or Reorganize, do not require you to specify any values. They are added immediately to the plan without any intermediate dialog boxes.

11.4.2. Adding a Conditional Statement to a Plan

To add a conditional statement to a plan:

1. Open the Plan window for an entity.
2. In the Plan window, select the statement immediately above where you want to insert a new statement. If the plan does not have any statements yet, the plan root – *Entity_name* is already selected.
3. Choose **Conditions** → *condition*. The conditional expression dialog box opens.
4. Complete the conditional expression dialog box as described in [“Building Statements in the Conditional Expression Dialog Box,”](#) on page 11-20.



Once you make a selection from a list, you cannot change it. If you make an error building a conditional expression, you will have to Cancel out of the dialog box and start over again.

5. Click OK. A conditional statement block is added to the plan, with the syntax (the condition plus an “end” statement) that defines the bounds of the block of tasks that are executed if the condition is true. You need to add the task statements that you want to have executed. To add the task statements, follow the procedure in [“Adding an Entity Task or Set Data Request to a Plan,”](#) on page 11-19.

Building Statements in the Conditional Expression Dialog Box

The conditional expression dialog box is a dynamic dialog box that lets you build a conditional statement. It contains lists that have the permissible options for each step of a condition. As you select options, the dialog box redisplay, adding additional fields. You can build conditional statements using comparison operators, logical operators, and tests of entity status.

Using Prefix Notation to Establish Grouping and Precedence

To specify grouping, the Conditional Expression dialog box uses prefix notation, in which the operator comes first, followed by the operands. For example, a condition that you might verbalize as, “If entity 1 is in area A and entity 2 is in area B,” is expressed in prefix notation as:

```
AND(entity 1 in area A, entity 2 in area B)
```

(For simplicity, this example does not use complete VR-Forces statement syntax.)

If you are not familiar with prefix notation, you might want to write out your conditional expressions before you begin entering them in the Conditional Expression dialog box.

Figure 11-7 illustrates how the Conditional Expression dialog box might redraw as you successively add the components of a condition statement. It creates the following conditional expression:



```
If(AND(Entity-In-Area Entity:"M1A2 2" Area:"base camp",
      resource(fuel)<25%))then
else
endif
```



The conditional expression dialog box resizes as you add conditions.

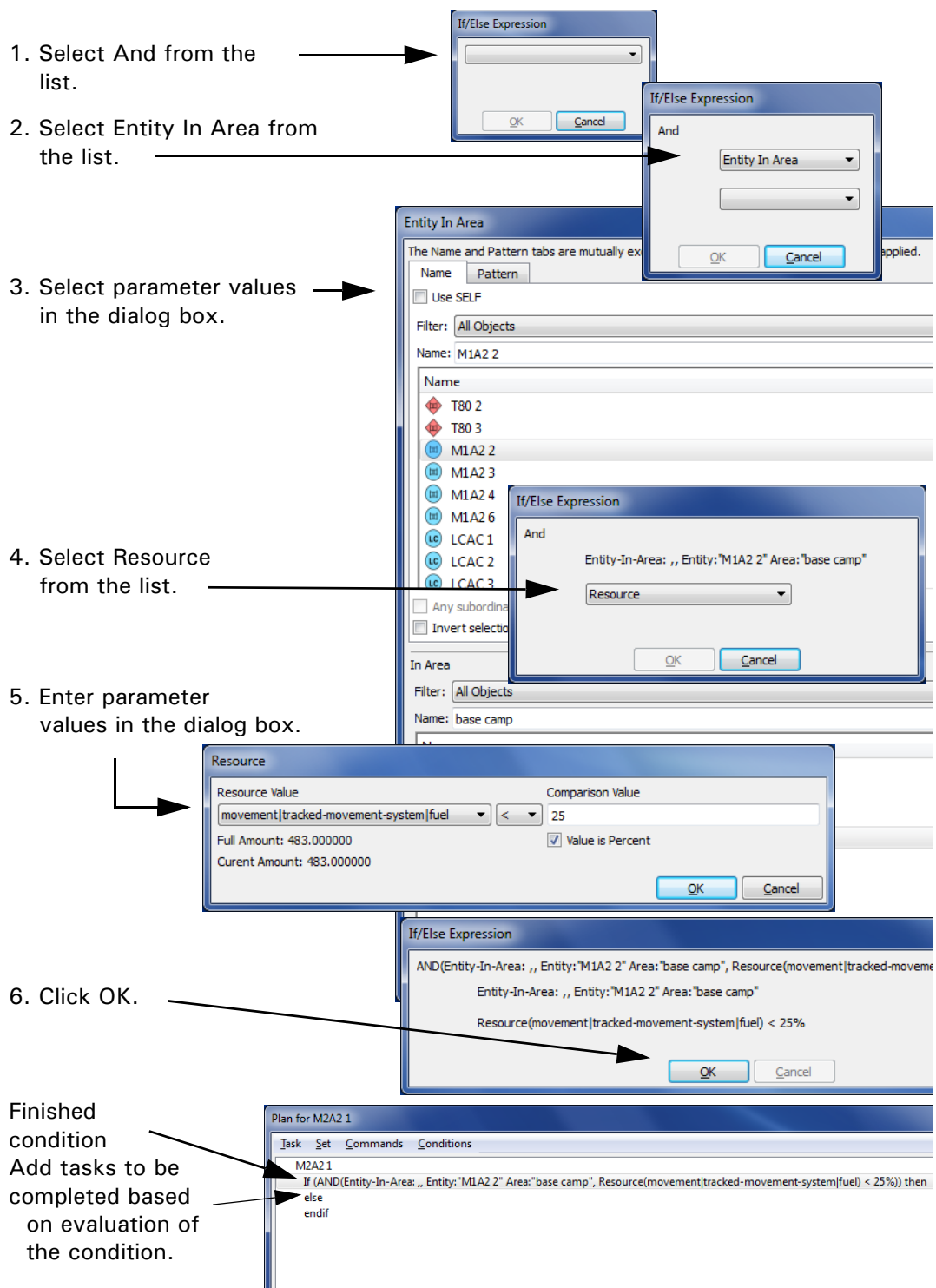


Figure 11-7. Example of building a conditional statement

11.4.3. Editing a Statement

You can edit simple statements in the Plan window. If you want to change a complex conditional statement, you must delete it and re-enter it.

To edit a plan statement:

1. Double-click the statement or select the statement and click Edit. An edit dialog box for the particular statement type opens.
2. Enter the changes you want to make.
3. Click OK in the edit dialog box.
4. Click OK or Apply in the Plan window.

11.4.4. Deleting Statements from a Plan

You can delete statements from a plan individually, or all at once. You can delete the individual statements in the statement block of a conditional statement. If you delete the conditional statement itself, all substatements are also deleted.

To delete a statement from a plan:

1. Select the statement you want to delete.
2. Click Delete or press **Delete**.

Deleting All Statements From a Plan

To delete all statements in a plan:

1. Select the top line in the plan.
2. Click Delete or press **Delete**.

11.4.5. Printing Plans

You can print plans. The printout lists the name of the scenario, the entity's name, and the plan statements.

To print a plan:

1. Open a global plan or the Plan window for the entity whose plan you want to print.
2. Click Print. A standard print dialog box for your operating system opens.
3. Complete the dialog box as you normally would.

11.4.6. Saving Changes to a Plan

You can save changes to a plan and continue editing, or save changes and exit the Plan window. The plan is saved to the scenario plan file. You do not specify a file to save it to.

- To save changes to a plan, in the Plan window click Apply or OK.

11.5. Creating Global Plans

Global plans are not tied to a specific entity. However, since they must be executed by a simulation engine, they are assigned to a specific back-end, just like objects are.

To create a global plan:

1. Choose **Simulation** → **Global Plans**. The Global Plans window opens (Figure 11-8). It lists each global plan and the simulation engine on which it is executed.

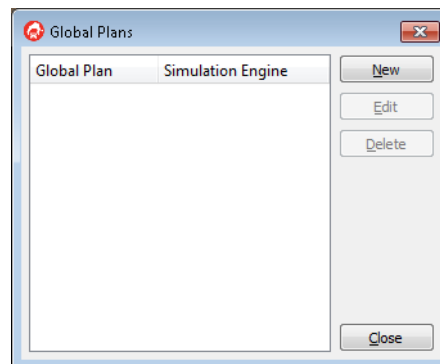


Figure 11-8. Global Plans window

2. Click New. The New Global Plan Information dialog box opens.
3. In the Plan Name box, type a name for the plan.
4. If your scenario has more than one back-end, select the back-end on which you want to run the global plan.
5. Click OK. The Global Plan window opens (Figure 11-9).

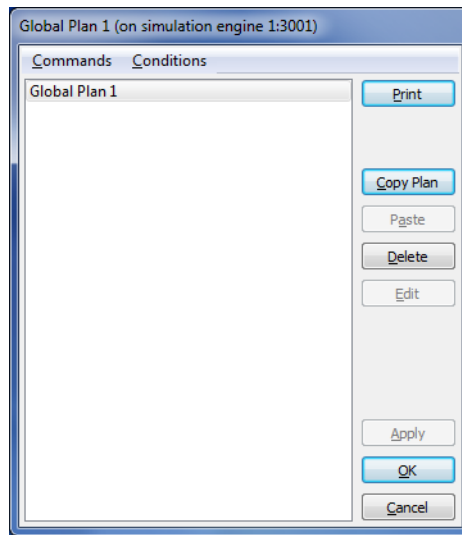


Figure 11-9. Edit Global Plan window

6. Add commands as described in [“Adding Global Commands to a Plan,”](#) on page 11-25.

11.6. Adding Global Commands to a Plan

The global command submenus mimic the Task and Set menus on the VR-Forces menu bar and the options on the Entities Palette, Tactical Graphics Palette, and Hazards/Obstacles Palette. There are also several global commands that are only available on the Commands menu. Except as noted in this section, the procedures for adding global commands and conditional statements to a global plan are the same as the procedures for adding them to entity plans.

11.6.1. Adding a Global Task or Set to a Plan

The commands on the Task and Set menus in an entity plan apply implicitly to the entity for whom you are writing a plan. Global commands must be assigned explicitly to a target entity. Therefore, even though the list of tasks and sets on the commands menu look the same as those in an entity plan or the main VR-Forces menu bar, the dialog boxes they use are different.

Figure 11-10 shows the Follow Entity dialog box displayed if you choose **Commands** → **Task** → **Movement** → **Follow Entity** in a global plan, and the Follow Entity dialog box displayed if you choose **Task** → **Movement** → **Follow Entity** in an entity plan. The right pane in the global command requires the same information as the local command. The difference is that in the global command dialog box you must specify the entity to which the command will apply. You can specify an existing entity or you can specify the name of an entity that does not yet exist, but which you expect to be created during the lifetime of the scenario, perhaps as the result of a Create command in a global plan.

Other than the requirement to specify the target entity, adding a global task or set command to a plan uses the same procedure as adding any task or set to an entity plan.

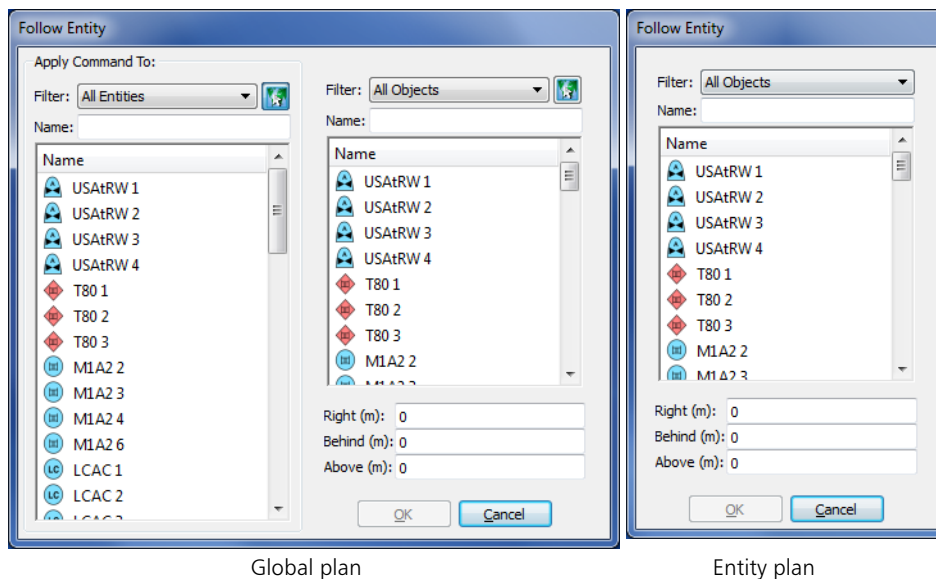


Figure 11-10. Global command task dialog box and entity plan task dialog box

To assign a global command:

1. In a Plan window or Global Plan window, choose one of the commands on the commands menu or a submenu. The appropriate dialog box opens for the command.
2. If the dialog box requires you to specify the entity that will execute the command (in other words, if there is an Apply Command To panel in the dialog box), select an entity from the list or type its name in the Name box. The entity does not have to exist in the scenario at the time you add the command, but you should be sure that it will be created before the command is run.

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Remember that a global task command affects an entity like an independent task. It interrupts the current task and causes the entity to abandon its plan. If you are adding a global task command to an entity plan, be sure that you are assigning it to some other entity and not the entity for whom you are writing the plan. (Unless you want the entity to abandon its plan.)

3. In the command-specific panel of the dialog box, complete the command parameters. Please see Chapter 7, *Assigning Tasks* and Chapter 10, *Setting Entity State* for the details of assigning specific tasks and sets.

11.6.2. Sending Console Messages

You can send messages to be displayed in the console on an object's information dialog box and to the back-end console. Messages sent by global plans go to the back-end console. Messages sent from an entity's plan go to the console in its Entity Information dialog box.

If the notification level for a console message is lower than the notification level configured for the back-end or the target entity, the message is not displayed. For example, if an entity's notification level is set to Info, it receives Error, Warn, and Info messages, but not messages set to Verbose or Debug.

To send a console message from a plan:

1. In an Entity Plan or Global Plan window, choose **Commands** → **Console Message**. The Console Message dialog box opens.
2. Select the notify level from the list.
3. Type the message you want to send.
4. Click OK.

11.6.3. Creating Objects from Within a Plan

You can create any of the objects on the entity, tactical graphics, and hazards/obstacles palettes from within a plan.

To create an object from a plan:

1. In an Entity Plan or Global Plan window, choose **Commands** → **Create** → *object*, where *object* is an object listed on one of the submenus.
2. Create the desired object as you would if you were creating it directly from the main Entities Palette. When you are finished creating the object, a create command is added to the plan and the object itself disappears. (The object disappears because you are not actually creating the object right now, you are just creating the command that will create it later when the plan executes.)

11.6.4. Deleting Objects from Within a Plan

You can delete any object in a scenario from a plan.

To delete an object from a plan:

1. In the Entity Plan or Global Plan window, choose **Commands** → **Delete Object**. The Delete Object dialog box opens.
2. Type the name of the object you want to delete or select the object in the list or on the terrain.
3. Click OK.

Deleting One's Self from the Scenario

The Delete Object global command lets you delete any specified object. If you just want to delete the entity whose plan you are editing, you can use the Delete Self command. Like the Use Self option in some conditions, Delete Self provides a non-entity-specific command that is useful for plans that you want to assign to multiple entities.

- To assign the Delete Self command, choose **Commands** → **Delete Self**.

11.6.5. Issuing a Plan

The Issue Plan global command lets you assign a plan to an entity. When you issue a plan, the new plan replaces whatever plan or task the entity is executing. Although you can issue a plan to any entity, this command is particularly useful for when you create an entity after a scenario has started.

When you create a scenario, you cannot create an entity plan for an entity that does not exist. Therefore, if you create an entity after the scenario starts (using the Create global command), it is difficult to send it a sequence of tasks because global commands are not executed in sequence (as discussed in “Introduction to Entity Plans and Global Plans,” on page 11-3 and Chapter 6, *Writing Plans*, in *VR-Forces Getting Started Guide*). The Issue Plan command solves this problem.

Issue Plan is a concurrent task. Including it in an entity plan does not affect the current task that the entity is executing or the sequencing of tasks in its plan.

To issue a plan to an entity:

1. In a global plan or an entity plan, choose **Commands** → **Issue Plan**. The Issue Plan dialog box opens (Figure 11-11).

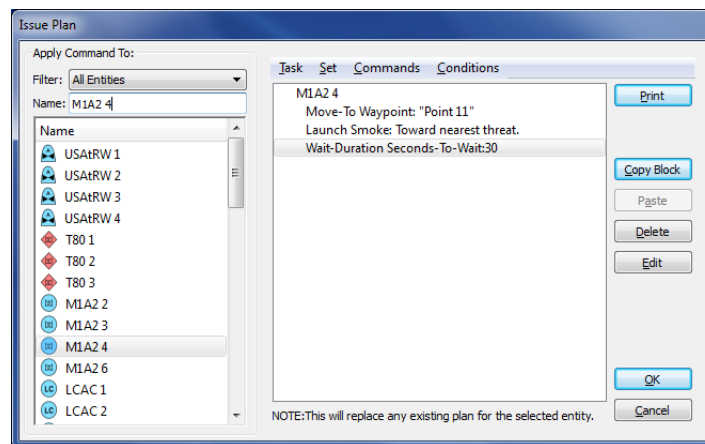


Figure 11-11. Issue Plan dialog box

2. In the Apply command To: group box, select the entity to which you want to assign this plan or type the name of the entity in the Name text box. If this is an entity that does not yet exist (because you plan to create it from a plan after the scenario starts), you must type the name and you are responsible for ensuring that the name you type matches the name of the entity that will be created.
3. Use the right side of the dialog box to write an entity plan. It has the exact same set of menus and commands as the Entity Plan dialog box. Follow the procedures described elsewhere in this chapter to write the plan.
4. Click OK.

11.7. Writing Plans for Aggregates

To write a plan for an aggregate:

1. Select the aggregate.
2. Follow the procedures for writing a plan for an individual entity.



Please see “[Independently Tasking Aggregate Members](#),” on page 7-11 for notes about how entities that are members of aggregates respond to individual plans and independent tasks.

11.8. Writing a Plan for Multiple Entities

You can write a plan and assign it to multiple entities at the same time. If any of the entities already has a plan, it is overwritten by the new plan. After you assign a plan using this procedure, you can individually edit the plans for any entity and the changes do not affect the other entities.



If you select several entities and they all have the exact same plan, the plan window displays that plan. If any of the entities have different plans, you are given the option to continue or cancel. If you continue, VR-Forces displays an empty Plan window and the new plan replaces the whatever plans the entities previously had.

To write a plan for multiple entities:

1. Select the entities to which you want to assign the same plan.
2. Choose **Entities** → **Plan**. The Plan window opens.
3. Add statements to the plan as you would if you were writing a plan for an individual entity.
4. Click OK. The plan is assigned to the selected entities.

11.9. Writing Plans for Remote Entities

If you attach components to remote entities, you can write plans for those entities. To assign plans, the entities must exist in the exercise, must have attached components, and must be present in the exercise when VR-Forces saves the scenario. The plans must be appropriate for the attached components. Movements tasks are not appropriate, because VR-Forces cannot control the location of a remote entity. Appropriate plan statements might be to enable spot reporting, or to send a radio message. For details about how to attach components to remote entities, please see Section 10.12, “[Configuring VR-Forces Components on Remote Entities](#),” in *VR-Forces Configuration Guide*.

11.10. Copying Plans and Plan Statements

You can copy plans and individual plan statements and paste them into another entity's plan.

To copy plans and plan statements:

1. Open the Plan window for the plan that you want to copy.
2. To copy the entire plan, select the top line in the plan (*Entity_name*). To copy a statement, select the statement. If you select a conditional statement, the entire statement block is selected.
3. Click Copy. If you selected the top line, it reads Copy Plan. If you select a statement, it reads Copy Block.
4. Open the Plan window for the entity you want to copy the plan to.
5. Select the line just above where you want to insert the copied plan.
6. Click Paste.
7. Continue editing the plan.
8. Save the plan.

11.11. Restarting a Plan

There may be occasions when you want to restart an entity's plan without restarting a scenario. You can restart a plan interactively or by placing a Restart Plan command in a plan.

When you restart a plan, VR-Forces processes the statements in the plan, starting from the first statement. However, the entity executes tasks starting from its current location, not the location it had at the start of the scenario (unless it has not moved since the start of the scenario).

To restart a plan interactively:

1. Select the entity whose plan you want to restart.
2. Choose **Entities** → **Restart Plan**.

To restart a plan from within a plan:

1. Open an entity's plan or a global plan.
2. Choose **Commands** → **Restart Plan**. The Restart Plan dialog box opens.
3. Select the entity whose plan you want to restart.
4. Click OK.
5. Save the plan.

To restart a plan from the Plan window:

1. Open an entity's plan.
2. Click Restart.

11.12. Abandoning a Plan

If you give an entity that is executing a plan an independent task, it abandons the plan. You can also order an entity to stop executing its plan. When you abandon a plan, the following things happen:

- ♦ The entity stops whatever task it is working on, even if it is an independent task.
- ♦ The plan is marked as complete.
- ♦ All registered triggers are deleted.
- ♦ The statement indicator skips to the end of the plan.
- ♦ The entity enters a wait state.



If you give an entity that is executing a plan an independent task, VR-Forces prompts you before it abandons the plan. (There is no prompt for the Abandon Plan command.) You can disable the prompt. For details, please see [“Enabling and Disabling the Task Confirmation Prompt,”](#) on page 7-4.

You can abandon a plan interactively or by sending an Abandon Plan command in an entity or global plan.

To abandon a plan interactively:

1. Select the entity whose plan you want to abandon.
2. Choose **Entities** → **Abandon Plan**.

To abandon a plan from within a plan:

1. Open an entity's plan or a global plan.
2. Choose **Commands** → **Abandon Plan**. The Abandon Plan dialog box opens.
3. Select the entity whose plan you want to abandon.
4. Click OK.
5. Save the plan.

To abandon a plan from the Plan window:

1. Open an entity's plan.
2. Click Abandon.

11.13. Considerations for Creating Plans

This section has tips for constructing plans including how to avoid problems that are hard to debug and how statements affect each other, with implications for how to organize the statements in a plan.

11.13.1. Name Changes Can Invalidate Plan Statements

Plan statements can reference named objects, such as tactical graphics and entities. For example, a Follow Entity task specifies the name of the entity to follow. If someone changes the name of an entity or tactical graphic after you create a plan, VR-Forces will not be able to find the object referenced in the plan statement. If this happens in a task statement, the plan skips the task and moves to the next task. If a renamed object is in a conditional statement, the condition may never become true.

11.13.2. Considerations for Using Triggers

Triggers are a versatile part of plans and you should have a good understanding of their intricacies before you use them.

Deciding Where to Put Trigger Statements

VR-Forces does not evaluate a trigger condition until it executes a **When** statement and registers the trigger. If you want to ensure that a **When** statement always gets read by VR-Forces, put it at the beginning of a plan before any non-trigger statements. If you put a trigger later in a plan, it is possible that it will never be registered. This could occur if a plan is abandoned. Of course, you might decide that you do not want a trigger to be registered unless a set of preceding tasks have been completed. In that case, placing it later in the plan may be exactly what you want to do.

You can also place a trigger inside a conditional block so that it gets registered only if a particular condition is true at a particular time.

For example, if you always want entity 1 to respond to entry of hostile forces into an area, put a trigger at the beginning of the plan. If you want entity 1 to respond to a hostile entity in an area only after the simulation has progressed for 15 minutes, nest the trigger inside another trigger that fires when `Sim Time > 15 minutes`.

Using Triggers That Do Not Have Mutually Exclusive Tasks

A trigger does not have to have any task statements in its statement block. It could just have Set statements. Or, it could have sets and concurrent tasks. If a trigger block just has Set statements, it does not interrupt the task that the entity is executing when the trigger gets executed. The Set statements get executed while the entity is performing its task. This has the same effect as if you manually set the entity's state while it was performing a task.

Using a trigger that just has Set statements can be useful if you want to change an entity's state under certain conditions, but do not know in advance when those conditions might exist.

Reregistering Triggers

A trigger can only fire once. It does not stay in effect for a reoccurrence of the triggering event. Under limited circumstances it is possible to work around this limitation. If an entity's plan only contains **When** statements, you could put a Restart Plan command at the end of each **When** block. In this way, after a trigger fires, it executes the commands in the trigger block and then it restarts the plan. This reregisters all of the **When** statements in the plan.

If a plan has commands outside of a trigger, then restarting the plan would also cause the entity to execute those commands, which might not be desirable. You might be able to work around this issue by putting these commands in a **When** block related to the simulation time.

As an alternative to using triggers, you can write reactive tasks, which work similarly to triggers or you can write a regular scripted task that is designed to repeatedly test a condition.

11.13.3. Moving In Formation

If you want an aggregate to move in a certain formation, add a Formation statement to the plan before the task that requires the aggregate to move. The default formation is a column.

11.13.4. Using the Tasked-By-Superior Request in a Plan

If you put the Tasked-By-Superior request in the body of a plan, it has no real effect. This is because, as soon as it is set, the plan goes to the next task and overrides the superior. The only way that the Tasked-By-Superior command gets implemented as part of a plan is if it is the last statement in a plan or the last statement in a trigger that happens to get executed after all the statements in an entity's plan have been executed.

11.13.5. Following Entities

If you tell two or more entities to follow another entity, do not give them the same offset values. If the followed entity stops, one follower will arrive at the specified offset position and stop, while the others will circle the location because they cannot all occupy the same space.

11.13.6. Planning Tasks for Aircraft

When you plan tasks for aircraft, the most important thing to remember is to pay attention to the terrain. Fixed-wing aircraft do not have terrain following capabilities. Rotary-wing aircraft have some terrain-following capacity, but it has some limitations. So if you assign aircraft an altitude that is lower than the terrain at some point along a route or the path they must follow to reach a waypoint, they will crash into the terrain. View the terrain profile for a route to see if it intersects the terrain.

You should also bear in mind that the turning radius and speed of fixed-wing aircraft affect how closely they can follow a route.

11.13.7. Using Non-VR-Forces Entities in Plans

You can use a non-VR-Forces entity as a parameter in a plan, for example, following a remote entity, or testing to see if a remote entity is in an area.

To identify non-VR-Forces entities, VR-Forces uses their marking text. If a non-VR-Forces entity does not have marking text, VR-Forces uses its entity identifier as its name.

VR-Forces does not recognize remote aggregates as aggregates, so it cannot check their children. Remote aggregates are ignored by the simulation engine.



- ♦ Referring to remote entities by their marking text may have unpredictable results if there is more than one remote entity with the same marking text.
 - ♦ If you include a non-VR-Forces entity in a plan you must ensure that the remote simulator uses the same name for the entity in future runs.
-



12. Scenario Events

Scenario events let you provide non-simulated input to scenario participants.

Introduction to Scenario Events	12-2
Creating a Scenario Event	12-2
Adding Linked Events	12-4
Adding Content to a Scenario Event.....	12-6
Adding Intelligence Objects.....	12-7
Starting a Scenario Event.....	12-9
Ending a Scenario Event.....	12-10
Sorting the Event List.....	12-11
Deleting a Scenario Event.....	12-11
Showing and Hiding Scenario Events.....	12-12

12.1. Introduction to Scenario Events

A scenario event represents an incident or condition that exercise participants can respond to, for example a political event, a natural disaster, or some other novel event that might require a participant to respond. VR-Forces does not simulate scenario events. Objects in a simulation do not interact with scenario events and scenario events do not affect simulated objects. Scenario events are placeholders that allow you to provide a richer simulation experience.

Events can include rich text, audio files (WAV), video (AVI) and raster files (JPG, PNG, SVG, or BMP). Use of these media allow you to expand the scope and quality of a training experience without needing to build a complicated simulation to support it. The flexibility of scenario events allows you to use them in any way that adds value to an exercise, for example, mission briefings, and video teaching points.

Unless you disable it, when an event gets triggered, VR-Forces displays a dialog box that displays the event information. If a scenario has events that are triggered by simulation time or time of day, the Scenario Event Toolbar displays the amount of time until the next event ([Figure 12-1](#)).

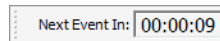


Figure 12-1. Scenario Event Toolbar

12.2. Creating a Scenario Event

To create a scenario event:

1. Choose **Simulation** → **Scenario Events**. The Scenario Event Manager opens ([Figure 12-2](#)).

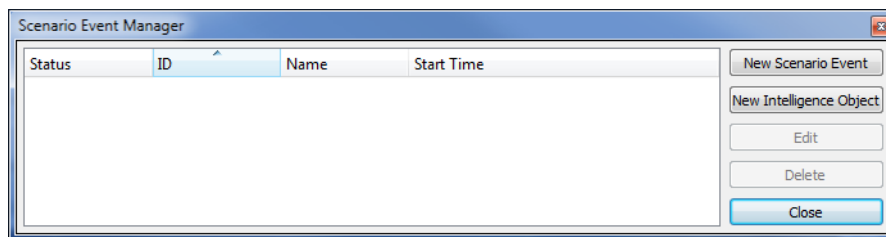


Figure 12-2. Scenario Event Manager

2. Click New Scenario Event. The Create Scenario Event dialog box opens ([Figure 12-3](#)).

Figure 12-3. Create Scenario Event dialog box

3. Fill out the dialog box as follows:
 - ♦ Event Title. A short descriptive name for the event.
 - ♦ Label. The label to be displayed.
 - ♦ Extended labels. If present, fill out extended labels.
 - ♦ Overlay. The overlay to which the event is assigned. Default: Events.
 - ♦ Use Location (optional). You can specify a location for an event icon to appear when the event is triggered. You can click on the map where you want the event to occur or enter a location in any of the location formats.
 - ♦ Ordinal. Events are numbered in the sequence they are created. You can change the numbers to suit your purposes.
 - ♦ Event Icon (optional). Select an appropriate icon to appear on the map at the location and time of the event.
 - ♦ Forces. Select the forces you want to get the event when it occurs. You can select multiple forces.

- ♦ Start. Specify one of the options for how the event gets triggered:
 - Manual. Event will be triggered manually by the scenario administrator.
 - Time of Day. Specify the time of day.
 - Linked. Specify the linking events as described in [“Adding Linked Events,”](#) on page 12-4.
 - Simulation Time. Specify the simulation time.
 - Immediate. The event starts as soon as it is created.



If you trigger an event by time and the specified time is prior to the start time of the scenario, the event will be triggered when the scenario starts.

- ♦ End. Specify how the end of the event is triggered, as follows:
 - Manual. Ended by the scenario administrator.
 - Time of Day. Specify the time of day.
 - Duration. Specify how long the event lasts.
 - ♦ Event Content. Add content as described in [“Adding Content to a Scenario Event,”](#) on page 12-6.
4. Your new event appears in the event list. Events may be sorted by any of the column headings.
 5. Click Create.

12.2.1. Adding Linked Events

You can link multiple events to a single preceding event (many to one) or link one event to another linked event if your scenario requires it (one to one). (You cannot link one to many.) You can create a linked event to trigger at any time after the preceding event it is linked to. For example, an event of a bridge being washed away could be linked to a preceding event such as reporting heavy rains, flooding, or rising river levels.

To add a link to a scenario event:

1. Create an event as described in [“Creating a Scenario Event,”](#) on page 12-2.
2. For the Start trigger, select Linked.
3. Click Edit Links. The Edit Links dialog box opens ([Figure 12-4](#)).

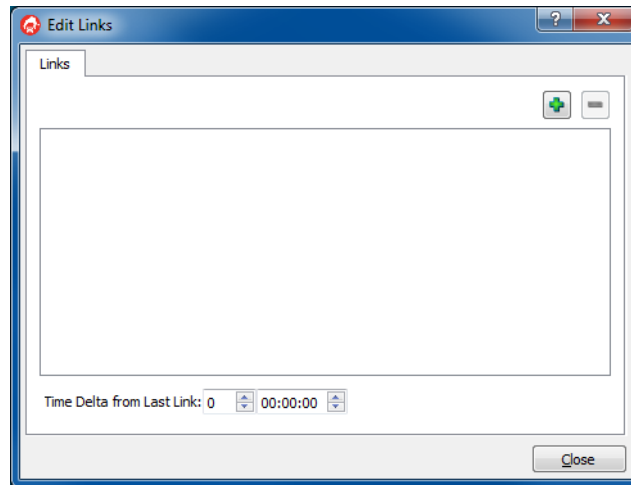


Figure 12-4. Edit Links dialog box

4. Click the Add button (+). The Link to Scenario Event dialog box opens (Figure 12-5).

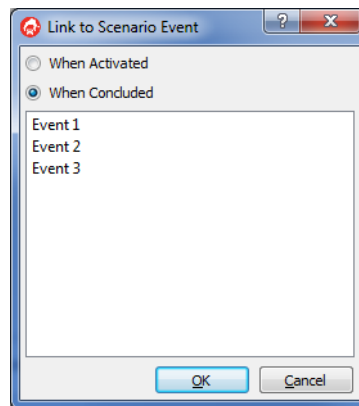


Figure 12-5. Link to Scenario Event dialog box

5. Select When Activated or When Concluded to indicate the relationship of the event to its linked event.
6. Select the event you want to link to.
7. Enter the time delta. This is the amount of time to wait after the preceding event before triggering the linked event.
8. Click OK.

12.2.2. Adding Content to a Scenario Event

The content for a scenario event can be text, can attach audio, video, and graphics (in BMP, JPG, SVG, or PNG).

For sound and video files, you can specify files in any format that your computer supports.

To add content to a scenario event:

1. Create an event as described in “[Creating a Scenario Event](#),” on page 12-2.
2. In the Create Scenario Event dialog box, click Event Content. The Event Contents dialog box opens ([Figure 12-6](#)).

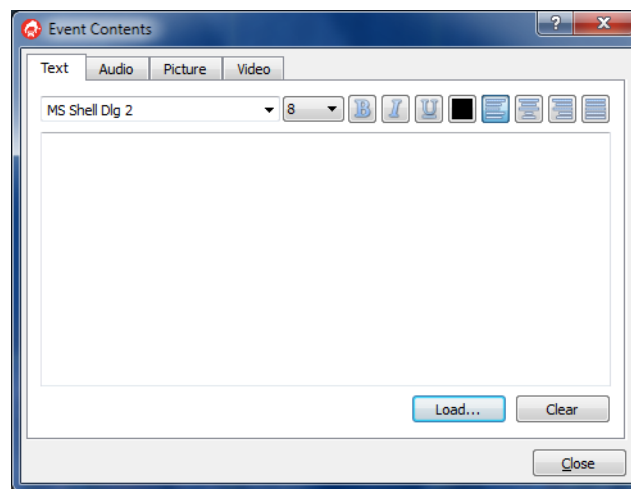


Figure 12-6. Event Contents dialog box

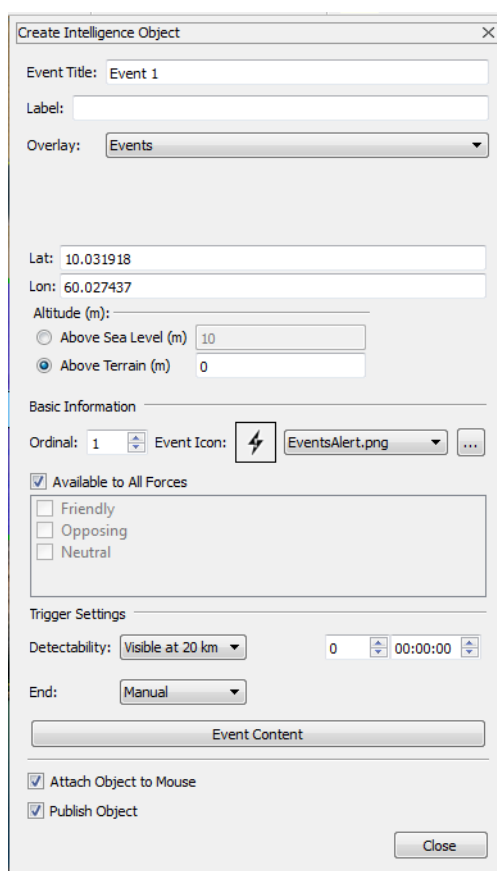
3. Select the tab for the content type that you want for this event. You can have more than one type of content.
 4. For video, picture, or audio:
 - a. Click Choose. A file selection dialog box opens.
 - b. Select the file you want to add.
 - c. Click Open.
- For text:
- a. Type the text you want in the dialog box or click Load and select a text file to load.
 - b. Format the text as desired.
5. Optionally, test video and audio files by clicking the Play button.
 6. Click Close.

12.2.3. Adding Intelligence Objects

Intelligence objects are tactical graphics that trigger scenario events when they are detected by an entity. By default, intelligence objects are detected by visual sensors. However, you can configure them to be detectable by other sensors.

To add an intelligence object:

1. Choose **Simulation** → **Scenario Events**. The Scenario Event Manager opens (Figure 12-2).
2. Click New Intelligence Object. The cursor changes to draw mode and the Create Intelligence Object dialog box opens (Figure 12-7).



The 'Create Intelligence Object' dialog box contains the following fields and controls:

- Event Title:** Text field with 'Event 1'.
- Label:** Empty text field.
- Overlay:** Dropdown menu set to 'Events'.
- Lat:** Text field with '10.031918'.
- Lon:** Text field with '60.027437'.
- Altitude (m):**
 - ☐ Above Sea Level (m) 10
 - ☒ Above Terrain (m) 0
- Basic Information:**
 - Ordinal:** Spin box set to 1.
 - Event Icon:** Icon of a lightning bolt.
 - File:** Text field with 'EventsAlert.png' and a browse button (...).
 - ☒ Available to All Forces
 - ☐ Friendly
 - ☐ Opposing
 - ☐ Neutral
- Trigger Settings:**
 - Detectability:** Dropdown menu set to 'Visible at 20 km'.
 - Value:** Spin box set to 0.
 - Time:** Time field set to 00:00:00.
 - End:** Dropdown menu set to 'Manual'.
 - Event Content:** Large empty text area.
- Checkboxes:**
 - ☒ Attach Object to Mouse
 - ☒ Publish Object
- Close:** Button at the bottom right.

Figure 12-7. Create Intelligence Object dialog box

3. Click where you want the intelligence object to be located, or type its location in the dialog box.

4. Specify basic information and trigger settings as you would for a scenario event (“[Creating a Scenario Event](#),” on page 12-2), except that instead of configuring a start event, you specify detectability.

To use only a visual sensor for detectability, select a distance in the Detectability list.

To use other sensors, specify detectability as follows:

- a. In the Detectability list, select User Defined. The Edit Detectability button is added to the dialog box.
- b. Click Edit Detectability. The Set Sensor Signatures dialog box opens ([Figure 12-8](#)).

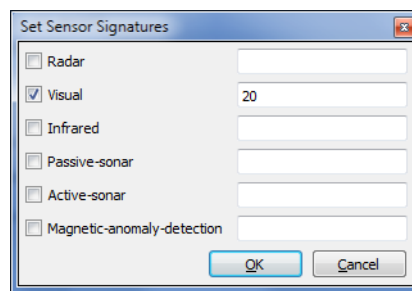


Figure 12-8. Set Sensor Signatures

- c. Select each sensor that you want to use to detect the intelligence object.
- d. For each sensor specify the sensor signature. (Although sensor signatures are technically unit-less, as a practical matter the sensor signature represents the distance in kilometers at which the object can be sensed.)
- e. Click OK.
- f. Click Create.

12.2.4. Starting a Scenario Event

A scenario event starts based on the Start Event trigger, by a command in a plan, or manually. Regardless of how a scenario event's trigger is set up, you can manually start an event at any time.

To start a scenario event:

1. Choose **Simulation** → **Scenario Events**. The Scenario Event Manager opens ([Figure 12-9](#)).

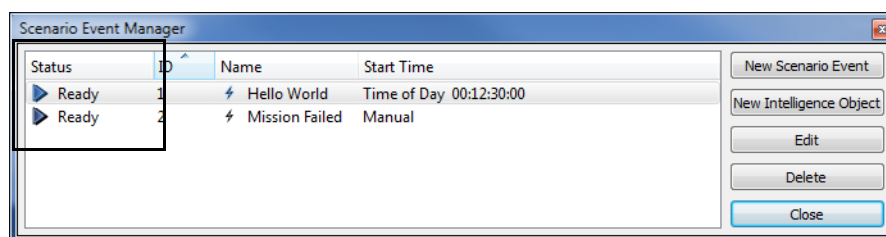


Figure 12-9. Scenario Event Manager, Play button

2. In the Status column, click the Play button (▶) for the event you want to start ([Figure 12-9](#)). The Event window opens ([Figure 12-10](#)).

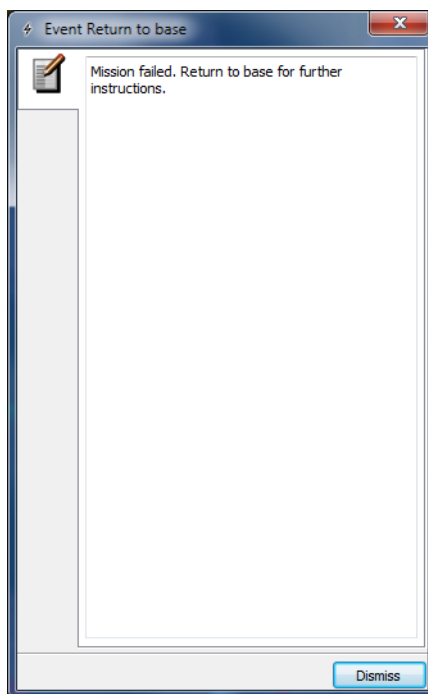


Figure 12-10. Event window

Starting a Scenario Event from a Plan

You can include scenario events in plans. For example, an entity's plan could have an Entity In Area condition and when that condition is satisfied, you could trigger an event such as, "The enemy has seized your headquarters!" or "Congratulations, you have seized the enemy headquarters!"

To send a scenario event in a plan:

1. In a plan window, choose **Commands** → **Scenario Event**. The Scenario Event dialog box opens.
2. Select the event you want to send.
3. In the Operation list, select Start or Stop.
4. Click OK.

12.2.5. Ending a Scenario Event

An event ends based on the End Event trigger setting, by a command in a plan, or manually.



When a scenario event ends, the Event window does not close automatically. The title bar indicates that the event is over by changing the text from Active to Inactive. You must close the window manually.

To end a scenario event manually:

1. Choose **Simulation** → **Scenario Events**. The Scenario Event Manager opens.
2. In the Status column, click the Stop (■) button for the event you want to stop (Figure 12-11).

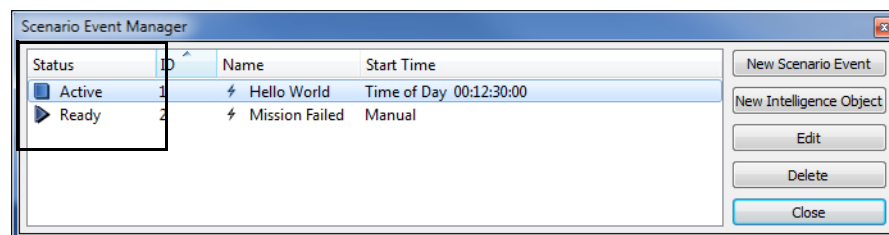


Figure 12-11. Scenario Event Manager, Stop button

3. Click Close.

12.2.6. Sorting the Event List

Scenario events have ID numbers. The numbers have no effect on when events get sent. They are simply a convenience for instructors and players. You can sort the list by number or by any other column listed.

- To change the sort order of scenario events, click the heading of the column that you want to sort on.

12.2.7. Deleting a Scenario Event

To delete a scenario event:

1. Choose **Simulation** → **Scenario Events**. The Scenario Event Manager opens ([Figure 12-11](#)).
2. Select the event you want to delete.
3. Click Delete.

12.3. Showing and Hiding Scenario Events

You can specify which events, if any, are displayed and whether or not the Event dialog box is displayed when an event gets triggered. The visibility to force settings refer to visibility according to spot report settings and are based on the force availability specified when a scenario event is created or edited.

To show or hide scenario events:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Scenario Event Settings page (Figure 12-12).



Figure 12-12. Scenario Event Settings page

3. Select an option for viewing events.



13. Target Detection and Combat Features

This chapter describes VR-Forces features related to target detection and acquisition – spot reports, hostility relationships, lasing, and munition damage.

Displaying Entities Based on Spot Reports.....	13-2
Enabling or Disabling Spot Reports.....	13-3
Configuring the Spot Reports Viewpoint	13-4
Configuring the Spot Reports Certainty Level	13-8
Applying Spot Reports to Tactical Graphics.....	13-9
Displaying Labels for Spot Reports.....	13-9
Using Spot Reports in Tasks	13-9
Managing Force Hostility Relationships.....	13-10
Changing a Force's Hostility in a Plan	13-11
Detecting Targets	13-12
Target Detection and Spot Reports.....	13-14
Lasing Targets.....	13-14
Using Sonar	13-16
Propulsion Noise and Sonar	13-17
Launching Counter Measures (Chaff and Flare).....	13-18
Modeling Artillery Munitions	13-20
Taking Damage from Munitions.....	13-21

13.1. Displaying Entities Based on Spot Reports

A spot report is a report by an entity to members of its force that it has detected a member of another force.

By default, VR-Forces displays entities based on complete ground truth. That is, it shows all entities in their exact location. However in real-world combat and training situations, participants rarely know where all other entities are, including those in their own force. This is called the fog-of-war. VR-Forces can simulate a semblance of the fog-of-war by displaying entities based on spot reports, rather than ground truth.

When you display entities based on spot reports, you do not see all members of forces other than your own. You only see spot reports for other-force entities that have been detected by members of your force. Spot reports are represented by icons that are similar to entity icons, but they do not move as entity icons do. Furthermore, since spot reports lose value over time as entities move to different locations, VR-Forces maintains a certainty level for the location of other forces. If a detected entity is not detected again for a period of time, its certainty decreases and its icon becomes increasingly transparent to show that it is less certain that the entity is at the reported location.

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- ♦ Generating spot reports can reduce the performance of the simulation engine.
 - ♦ When spot reports are enabled, VR-Forces does not display icons for dead entities.
 - ♦ When you rewind a scenario, the global spot report setting persists. Spot report settings for individual entities revert to the settings saved with the scenario.
-

You can view a video that demonstrates entity classification and spot reports at [./doc/vrforces_tutorialvideos.htm](/doc/vrforces_tutorialvideos.htm).

13.1.1. Enabling or Disabling Spot Reports

You can enable or disable spot reports globally or per entity. To set spot reports for an entity, use the Spot Reports set data request, as described in “[Spot Reports](#),” on page 10-34.

Enabling or Disabling Spot Reports Globally

When you enable or disable spot reports globally, the setting is applied to all entities that have not explicitly set spot reports on or off with the Spot Reports set data request. The setting persists, which allows you to set an entity to use the global spot report setting.

To enable or disable spot reports for all entities:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Spot Report Options page.
3. Select the Enable/Disable Spot Reports tab ([Figure 13-1](#)).

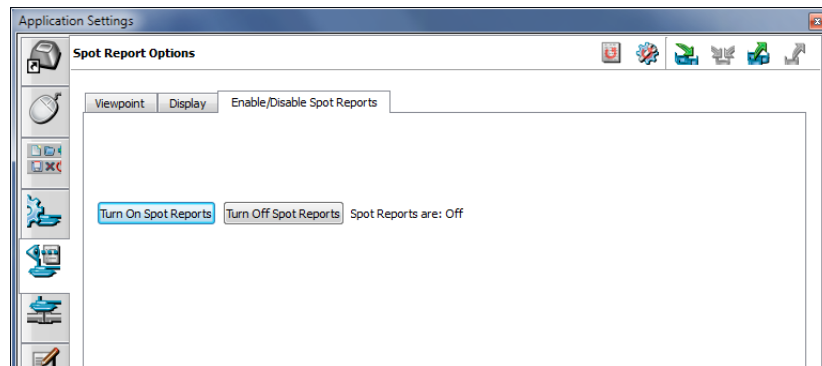


Figure 13-1. Spot Report Options page, Enable/Disable Spot Reports tab

4. Click Turn on Spot Reports or Turn Off Spot Reports. The change takes effect immediately.

13.1.2. Configuring the Spot Reports Viewpoint

The spot report viewpoint determines which entities and objects are shown using ground truth and which are shown using only spot reports. You can select preconfigured viewpoints or create custom viewpoints.



- ♦ If you create an entity for a force that is not visible based on the viewpoint setting, after you create the entity, it will disappear. Therefore, it is recommended that you show ground truth for all forces when you are creating entities and tactical graphics.
- ♦ When you rewind a scenario, the viewpoint configuration stays the same as in the previous run of the scenario. The global spot report setting stays the same. Entity-specific spot report settings revert to the settings saved with the scenario.

Selecting a Preconfigured Spot Report Viewpoint

VR-Forces provides viewpoints for the friendly, opposing, and neutral forces. In each of these viewpoints, VR-Forces displays ground truth for the viewpoint force and spot reports for the other forces. For example, if you select the Friendly force viewpoint, all entities in Force 1 are displayed showing ground truth. All other entities are displayed only if they have been detected by a friendly entity that is configured to send spot reports.

When you select a preconfigured viewpoint, the check boxes in the windows in the Map View group box are automatically set to match the selected viewpoint.

To configure spot reports:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Spot Report Options page.
3. Select the Viewpoint tab (Figure 13-2).

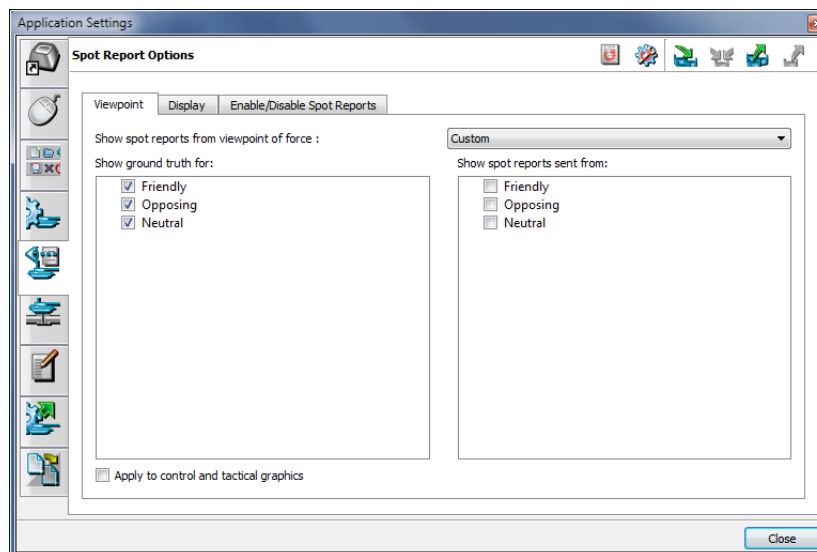


Figure 13-2. Spot Report Options page, Viewpoint tab

4. Select an option in the Show Spot Reports from Viewpoint of Force list.

Configuring Custom Spot Report Viewpoints

If you do not want to use a preconfigured viewpoint, you can create a custom viewpoint. This option allows you to see ground truth and spot reports from a mix of forces. When you create a custom viewpoint, the Show Spot Reports from Viewpoint of Force list displays the viewpoint that you have created (usually Custom).

It is possible to create a custom configuration in which no objects are displayed, so think carefully about your choices.

To configure a custom viewpoint:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Spot Report Options page.
3. Select the Viewpoint tab (Figure 13-2).
4. In the Show Ground Truth For window, select the forces for whom you want ground truth to be displayed. You would usually select the same forces as the ones selected in the Show Spot Reports Sent From window.
5. In the Show Spot Reports Sent From window, select the forces whose spot reports you want to display. In other words, if you are not showing ground truth for the opposing force and only want to see the opposing force entities that are detected by friendly and neutral entities, then select the Friendly and Neutral check boxes.

Configuring Same-Side Fog-of-War

There may be cases when you want to simulate same-side fog-of-war. That is, members of a force do not know where other members of their force are unless detected by an entity and reported using a spot report.

To simulate same-side fog-of-war, you must edit the *spot-report-generator.sysdef* file. You might want to create a customized file that you can assign only to the entities that you want to simulate same-side fog-of-war. (You can use the Entity Editor to change the spot report systems that entities use.) In the system definition file change the **send-spot-reports-on-own-force** parameter to **True**, as follows:

```
(spot-report-generator-system
  (controllers
    (spot-report-generator
      (component-descriptor-type
        "spot-report-generator-controller-descriptor")
      ...
      (object-types-to-spot-report
        (object-type 1 (1 -1 -1 -1 -1 -1 -1))
        (object-type 1 (3 -1 -1 -1 -1 -1 -1))
        (object-type 1 (5 -1 -1 -1 -1 -1 -1))
      )
      (send-spot-reports True)
      (send-spot-reports-on-own-force True)
      (send-spot-reports-on-hostile-forces True)
      (send-spot-reports-on-neutral-forces True)
    )
  )
  ...
)
```



You can edit the system definition file by hand or in the OPD Editor. For details about the OPD Editor and the Entity Editor, please see *VR-Forces Configuration Guide*.

13.1.3. Configuring the Spot Reports Certainty Level

It is assumed that as time passes the validity, or certainty, of a spot report declines. To simulate this decline in certainty, VR-Forces can display the icons that represent spot reports at increasing levels of transparency. Once the initial validity period has expired, the spot report degrades over a configurable amount of time. The icon's transparency decreases in four steps, with each step being 25% of the total time allotted for degradation.



The validity period is specified by the `report-resend-period` parameter in the `spot-report-generator.sysdef` file in the SMS you are using. The default is 60 seconds.

To configure the amount of time, in seconds, over which a spot report degrades:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Spot Report Options page.
3. Select the Display tab (Figure 13-3).
4. Specify a value, in seconds, in the Time After Spot Report Expiration Before Spot Report Is Removed box.

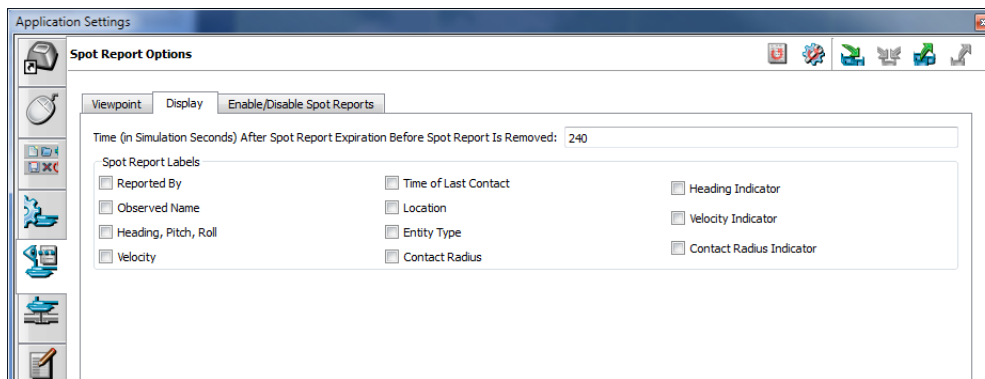


Figure 13-3. Spot Reports dialog box, Display tab

13.1.4. Applying Spot Reports to Tactical Graphics

You can display tactical graphics based on spot reports rather than ground truth. The same criteria are applied to their display as are applied to the display of entities. For information about how to assign objects to a force, please see “[Creating Tactical Graphics](#),” on page 6-7.

To apply spot reports to tactical graphics:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Spot Report Options page.
3. Select the Viewpoint tab ([Figure 13-2](#)).
4. Select the Apply to Control and Overlay Objects check box.

13.1.5. Displaying Labels for Spot Reports

You can display labels (symbol decorations) for spot reports with information similar to that for entity icons.

To display spot report labels:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Spot Report Options page.
3. Select the Display tab ([Figure 13-3](#)).
4. In the Spot Report Labels group box, select the labels that you want to display.



You can also enable labels for spot reports on the Display Settings dialog box, Symbol Decoration Settings page.

13.1.6. Using Spot Reports in Tasks

Spot reports are listed in the Objects List Panel and other entity lists. Although the spot report icon in the display window may not show information about a spot report if it has not been identified, the entry in the list includes the object name. You can filter the list to only show spot reports.

You can select a spot report as a parameter in tasks that require you to select an entity. If you use a spot report in a task, VR-Forces carries out the task based on the ground truth of the reported entity, not the location of the spot report. For example, if you specify a spot report in the Follow Entity task, and the target entity moves after the spot report was received, the following entity will follow the actual location of the reported entity, not its location when the spot report was made.

13.2. Managing Force Hostility Relationships

VR-Forces categorizes entities as members of a force, such as friendly, opposing, or neutral. By default, friendly forces and opposing forces are hostile to each other. Neither is hostile towards neutral forces. You can change force hostility relationships dynamically. This may be particularly useful if you are simulating an environment in which civilian populations become hostile to a particular force, or in which armed militias, for example, switch allegiances to other forces.

You can add new forces in the Entity Editor. For details, please see Section 6.12, “Managing the Forces List,” in *VR-Forces Configuration Guide*. You can change a force’s hostility in a global or entity plan. For details, please see “Changing a Force’s Hostility in a Plan,” on page 13-11.

You can change the default hostility relationships by editing the *forceHostility.mtl* file for the simulation model set you are using (for example, *./data/simulationModel-Sets/<model_set>/forceHostility.mtl*).

When you change force hostility at runtime, the changes are saved as part of the scenario. The hostility relationships loaded with a scenario overrides the hostility loaded by the simulation model set's hostility file.



Hostility relationships are not reciprocal. For example if you set neutral force entities to be hostile to friendly force entities, that does not mean that friendly force entities are hostile to neutral force entities.

To change the force hostility matrix:

1. Choose **Simulation** → **Hostility Matrix**. The Hostility Matrix opens (Figure 13-4). Each row in the matrix lists the hostility relationships between that row’s force and all of the other forces (represented by color-coded columns).

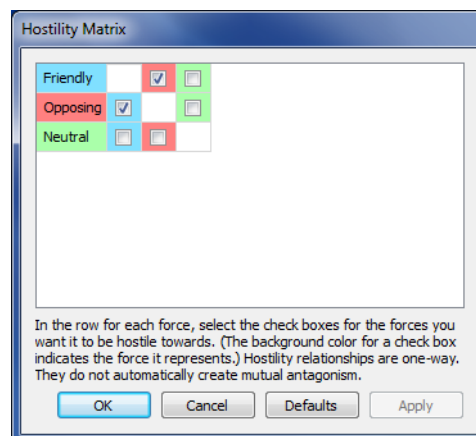


Figure 13-4. Hostility Matrix

2. For each row in the matrix, select the check boxes in the columns for the forces that you want this force to be hostile towards. Clear the check boxes for forces that you do not want it to be hostile towards.
3. Click OK.

13.2.1. Changing a Force's Hostility in a Plan

To change a force's hostility in a global or local plan:

1. Open a global plan or an entity's plan.
2. Choose **Commands** → **Change Hostility**. The Change Hostility dialog box opens ([Figure 13-5](#)).

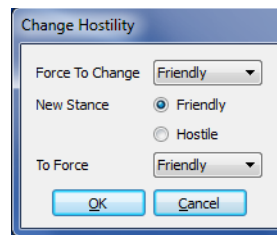


Figure 13-5. Change Hostility dialog box

3. In the Force to Change list, select the force whose hostility you want to change.
4. In the To Force list, select the force towards which you want to change hostility.
5. Select the new force relationship (New Stance), either Friendly or Hostile.
6. Click OK. The command is added to the plan.

13.3. Detecting Targets

Entities can have one or more sensors, for example, visual, sonar, or radar, for detecting and identifying other entities. When an entity detects another entity, it assigns it a combat identification (CID) level. If it continues to maintain contact with the entity, it upgrades the CID level as follows:

- CID Level 0 – not detected.
- CID Level 1 – Detected: the entity is detected, but only its platform is known, for example, ground.
- CID Level 2 – Classified: the entity’s category is known, for example, tank.
- CID Level 3 – Identified: the entity’s category and subcategory are known, for example M1A2.
- CID Level 4 – Full Knowledge: all visible information about the entity is known.



CID levels are assigned based on the distance to the detected entity and the length of time that the entity has been in contact. You can configure these values in the detection tables (`./data/simulationModelSets/<model_set>/vrSim/detection/*.csv`). For details about these configuration files, please see Section 10.2, “Detection Tables,” in *VR-Forces Configuration Guide*.

By default, entities do not fire at a detected hostile entity until it achieves the Identified level. You can configure this behavior by changing the `detection-level-to-set-hostility` parameter in the entity’s sensor system. For details about editing entity parameters, please see *VR-Forces Configuration Guide*.

Figure 13-6 shows a series of screen captures of an entity as its CID level is advanced from Detected through Identified. In this scenario, spot reports are enabled. Therefore, when an entity is detected, it is displayed with a yellow icon, rather than the normal color for the force. It is not given the correct force color until the detected entity is CID level Identified.



You can view videos that demonstrates entity classification and spot reports at [./doc/vrforces_tutorialvideos.htm](#), or click the camera icons in previous paragraphs.

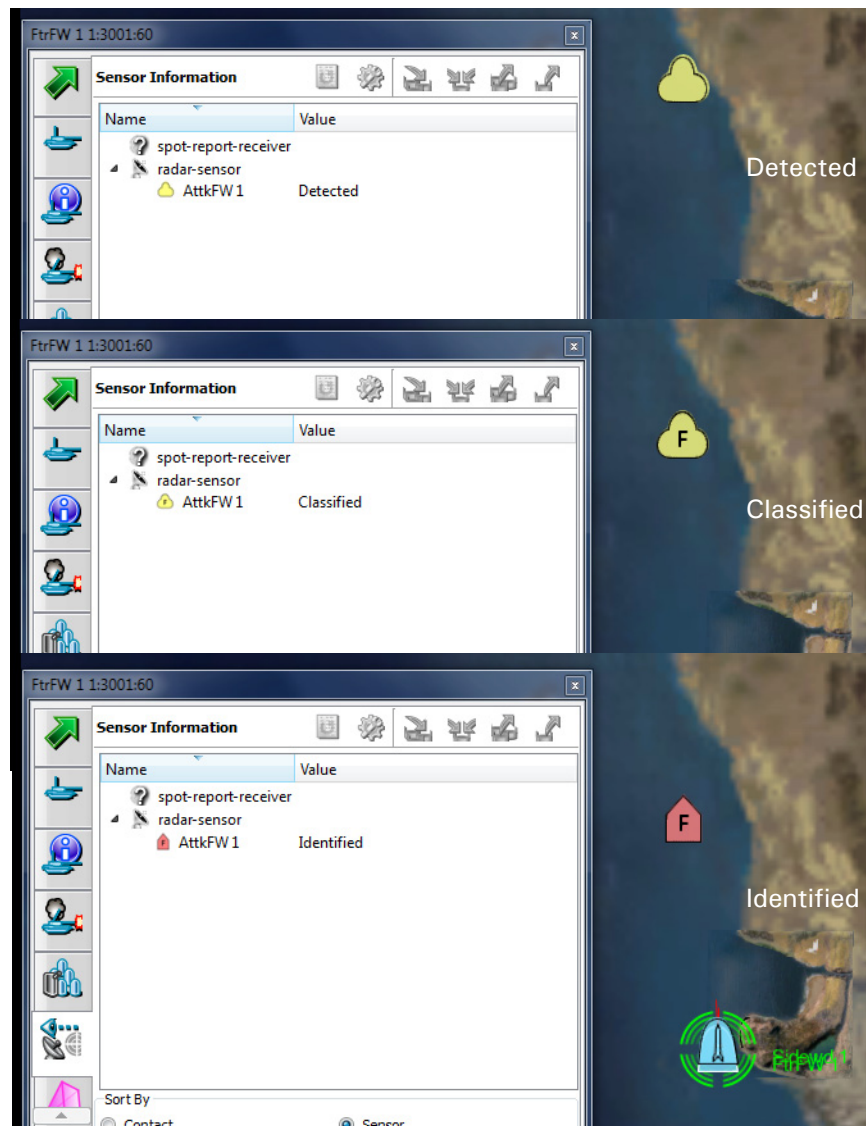


Figure 13-6. Entity classification and display when spot reports are enabled

13.3.1. Target Detection and Spot Reports

Entity detection and classification can be enhanced by enabling spot reports. Detected entities are assigned CID levels based on length of contact and distance from the detecting entity. In some cases, such as a fixed-wing aircraft flying quickly over a battle-field, or an entity that is at the farthest point of its range from a target, contact might not be sufficient to advance to the Identified CID level. In such cases, even though the entity is technically capable of firing on the target, it might not do so because the CID level is not high enough.

If spot reports are enabled, the classification of entities in the spot reports that an entity receives is combined with the directly sensed information. Therefore, if an entity classifies a target at a low CID level, but it receives a spot report that classifies the target at a high CID level, it can fire on the target based on the CID level in the spot report. For example, as noted in the previous paragraph, a fixed-wing aircraft is unlikely to maintain contact with a ground-based entity long enough to elevate its CID level to Identified. However, if a member of its force on the ground identifies the target and sends out a spot report indicating CID level 3 or 4, when the fixed-wing aircraft receives the spot report, it can add the target to its target list.

13.3.2. Lasing Targets

Some entities, such as DI Lasing, have laser-targeting capability. Others, such as attack helicopters, have laser targeting capability and carry laser-guided missiles. Laser-guided missiles do not use the standard VR-Forces targeting mechanisms. They only fire on targets that are identified by laser beams that have the same laser code as the laser-guided missile launcher. The laser beam could be generated by a laser designator on the same entity (autonomous lasing), or could be generated by another entity.

Laser codes are numbers in the range of 111-8888, using only the digits 1-8. By default, VR-Forces calculates a unique laser code for each entity when it is created. When you assign a laser code to an entity, any laser beams sent by that entity use the assigned laser code and the missiles carried by that entity (if applicable) use the same code. Therefore, for example, the default behavior for attack helicopters would be to fire their laser-targeted missiles only at targets that they have lased.



A laser-guided missile launcher must be able to see a laser spot and an appropriate target before it fires. If the missile loses the laser spot before it hits the target, it tracks to the last known laser spot.

Autonomous Lasing

By default, entities that have laser-guided missiles are configured for autonomous lasing. This means that they can lase targets and fire at them without outside intervention (for example, using the Lase Target task). Entities with autonomous lasing enabled identify and fire at targets independently, just like entities that use conventional munitions.

Synchronizing Laser Codes

There are cases in which you will want more than one entity to use the same laser code. For example, you might want one entity to lase targets (the designator), and another one to fire on them (the shooter). In this case you would assign both entities the same laser code. The designator would be given the hold-fire rule of engagement or not have any missile resources. The shooter would be configured to not lase targets (Lase Autonomous would be set to Off). It would just fire on the targets identified by the designator's laser.

You can synchronize the laser codes of the lasing entity and the firing entity by setting them for each entity with the Laser Code set data request, or you can let VR-Forces synchronize the codes with the Synchronize Laser Code set data request. For details, please see [“Laser Code,”](#) on page 10-21 and [“Synchronize Laser Code,”](#) on page 10-35.



13.4. Using Sonar

VR-Forces simulates active and passive sonar. Entities can be configured with three types of sonar sensor systems: Active Sonar, Passive Sonar, and Sonar. The Sonar system includes both active and passive sonar. Both types of sonar use the VR-Forces sensor signature mechanism. The signatures are different, reflecting the different chances of detecting entities using the two types of sonar.

Passive sonar has the following characteristics:

- Sonar can be dipped at a depth other than that of the entity.
- If an entity is moving faster than a specified speed, passive sonar does not work.
- Sonar takes into account thermocline data. Thermoclines are layers of water that have different temperatures and, therefore, different density. Sound transmission varies as it passes through the thermocline. In VR-Forces sonar effectiveness is reduced as it passes through thermocline boundaries. For more information, please see [“Setting the Thermocline,”](#) on page 15-17.
- Passive sonar ignores line-of-sight. It does not take into account underwater terrain or the presence of islands.
- If an entity is publishing propulsion noise, it can affect its detectability by passive sonar.

Active sonar has the following characteristics:

- Active sonar should acquire targets more quickly than passive sonar.
- If an entity has an active sonar system enabled, it is more easily detected by passive sonar systems.
- Entities with an active sonar that is enabled publish Underwater Acoustics PDUs.
- Entities can have multiple active sonar modes, similar to radar modes, using emitter beams. For details about configuring emitters, please see Section 10.5, [“Configuring Emitters,”](#) in *VR-Forces Configuration Guide*.
- Active sonar detects targets within the range of its emitter beams, but without regard to the direction of the beams.
- Active sonar ignores propulsion noise and the presence of active sonar on the target.



RPR FOM 1.0 does not support active sonar. If you try to create an entity that has an active sonar system, the entity will not be created and a warning will be sent to the console. If you try to load a scenario that has such an entity, it will not be created.

Sonar only works in water. Therefore rotary-wing entities with sonar systems must set their depth in order to sense anything.

13.4.1. Propulsion Noise and Sonar

If an entity is generating propulsion noise, it is easier to detect using passive sonar. VR-Forces publishes propulsion noise for surface and subsurface entities. If the power plant for an entity is turned off, it does not publish propulsion noise. To turn propulsion noise on or off, change the power plant appearance (for details, please see [“Appearance,”](#) on page 10-6) or set the **power-plant-active** parameter in the propulsion-noise-generator component of the entity’s movement system in the OPD Editor.

VR-Forces publishes three propulsion noise values:

- ♦ Current Shaft RPM, calculated as `current speed * speed-to-rpm-factor`.
- ♦ Ordered Shaft RPM, calculated as `ordered speed * speed-to-rpm-factor`.
- ♦ Shaft RPM Rate of Change, calculated as `current acceleration * acceleration-to-rpm-factor`.

The values for current speed, ordered speed, and current acceleration are the current values for the entity. The values for `speed-to-rpm-factor` and `acceleration-to-rpm-factor` are taken from the **speed-to-rpm-factor** and **acceleration-to-rpm-factor** parameters in the propulsion-noise-generator component of the entity’s movement system.

When a target is being detected by passive sonar, if it is publishing propulsion noise, its calculated RPM is compared to a nominal RPM (default 100) to generate a sensor signature modifier. For example, if an entity is publishing an RPM of 80, its signature is scaled by 0.8. If its RPM is 150, the signature is scaled by 1.5.



RPR FOM 1.0 does not support propulsion noise. If you try to create an entity that has propulsion noise enabled, the entity will not be created and a warning will be sent to the console. If you try to load a scenario that has such an entity, it will not be created.

13.5. Launching Counter Measures (Chaff and Flare)

Fixed-wing and rotary-wing entities can launch counter measures (chaff and flare) when they are targeted by air-to-air and ground-to-air missiles. By default, entities launch counter measures automatically based on settings in the *countermeasures.sysdef* file. When an aircraft detects a hostile missile within a specified range, it determines the type of missile and looks up the type of counter measures to use in the *USCounterMeasuresTable.asl* or *CISCounterMeasuresTable.asl* table.

Figure 13-7 shows a friendly force fighter launching counter measures against an aphid missile.



Figure 13-7. Counter measures (flare)

You can disable automatic counter-measures with the Counter Measures Auto Launch set data request. You can also launch counter-measures with the Launch Counter Measures task. The Launch Counter Measures task is not an exclusive task, so it does not interfere with the entity's current task. For details about the task and set data request, please see [“Launch Counter Measures,”](#) on page 8-28 and [“Counter Measures Auto Launch,”](#) on page 10-9.

You can configure the behavior of automatic counter measures in the *counter-measures-launcher.sysdef* and *cis-counter-measures-launcher.sysdef* files (in *./data/simulationModel-Sets/EntityLevel/vrfSim/systems/other*). [Table 13-1](#) describes the parameters that you might want to change.

Table 13-1: Counter measure launcher parameters

Parameter	Description
auto-launch-enabled True	Enables or disables automatic launching of counter measures.
auto-launch-range	The range within which an entity will detect missiles against which to launch counter measures.
auto-launch-reset-time	The amount of time, in seconds, an entity will wait before launching additional counter measures.
auto-launch-default-resource	The default counter measure to use.
auto-launch-number-of-resources	The number of counter measures to launch for each launch sequence.
counter-measures-select-table-file	The counter measures selection table to use to determine which counter measures to fire for a particular missile.



13.6. Modeling Artillery Munitions

VR-Forces models artillery in two ways – direct fire and indirect fire. Artillery entities, such as howitzers use a direct fire model. The artillery entity is modeled and the munitions it fires are modeled. Indirect fire simply models artillery barrages within an area. For details about indirect fire, please see Chapter 14, [Managing Indirect Fire and Missiles](#).

By default, when an artillery entity fires, VR-Forces models the munition. Munitions are not affected by wind speed or friction. VR-Forces can also model artillery without modeling the munition. In this case, it just publishes a fire event and detonation event. Modeling munitions requires more computer resources than not doing so. Therefore, in large simulations you may want to disable modeling of munitions.

To disable modeling munitions, in the indirect-fire-actuator, set the **simulate-munition** parameter to false. For example, in the OPD Editor:

1. Select the Systems List tab.
2. Select the M284 155mm Cannon.
3. Select the Components tab.
4. Expand the Actuators list.
5. Select M284-cannon.
6. Change the value for the **simulate-munition** parameter.



13.7. Taking Damage from Munitions

Entities can be damaged by munitions fired by other entities. They can be damaged by direct fire – a munition that hits the entity or within a configurable distance of the entity, and by indirect fire – a munition that explodes within a configurable distance of the entity. An entity can also suffer collateral damage. This can occur if an entity is hit by direct fire of sufficient power to damage nearby entities.

The types of munitions to which an entity is vulnerable are determined by its damage system. Each damage system has a damage actuator, which specifies damage files. These damage files specify how entities are damaged by direct and indirect fire from specific munitions. *VR-Forces Configuration Guide* describes damage systems and damage files. The important point to remember as a VR-Forces user is that an entity will not be harmed by a munition unless it has a damage system that knows about that munition. And, if you introduce a new munition type, it will not harm any entities unless their damage systems have a damage file for the new munition.



The default radar signature for ground vehicles is 500 meters. This is too short a distance for most fixed-wing aircraft to detect and fire on a ground vehicle. To make ground vehicles vulnerable to aircraft, increase the radar signature to a distance that is appropriate for the aircraft in your simulation.



14. Managing Indirect Fire and Missiles

This chapter explains how to create and edit indirect fire events and ballistic missiles.

Introduction to Indirect Fire	14-2
Creating an Indirect Fire Event.....	14-3
Editing Indirect Fire Events	14-6
Deleting Indirect Fire Events	14-6
Configuring Indirect Fire Event Default Values	14-7
Ballistic Missiles	14-8
Firing Ballistic Missiles	14-8
Editing Missile Target Events	14-10
Deleting Missile Target Events.....	14-10



14.1. Introduction to Indirect Fire

The indirect fire feature allows you to create, configure, and schedule indirect fire events. Indirect fire events are not associated with a particular entity. VR-Forces does not model the launcher or trajectory of the munitions. Indirect fire results in one or more salvos of one or more rounds in or near a designated area of the terrain. Entities do not take damage from indirect fire unless they are configured to do so. [Figure 14-1](#) illustrates indirect fire within an indirect fire area.

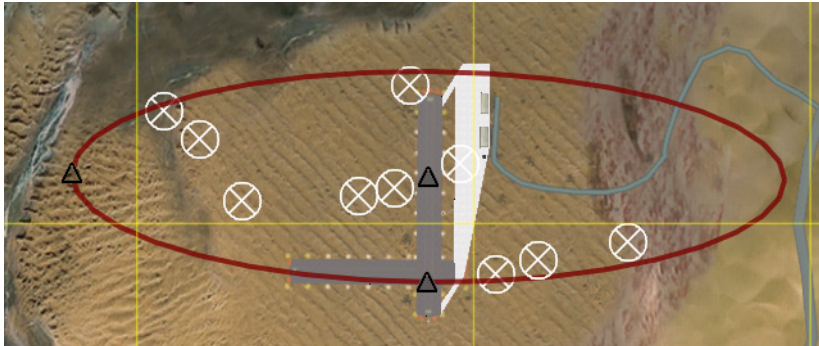


Figure 14-1. Indirect fire event

Indirect fire types are configured in `./data/simulationModelSets/EntityLevel/indirectFire-Types.mtl`.

14.1.1. Creating an Indirect Fire Event

When you create an indirect fire event, you specify an area in which the event is to take place, the parameters of the event, and a starting time. The area in which an indirect fire event takes place is a tactical graphic and is listed on the Environmentals tab of the Objects List Panel.

By default, indirect fire areas are placed on the Indirect Fire layer (which is created for the first indirect fire object). You can put other objects on this layer. You can put indirect fire objects on other layers by selecting a layer in the Create Indirect Fire dialog box or by dragging them on the Overlay tab of the Objects List Panel.

To create an indirect fire event:

1. Choose **Simulation** → **Munition Targets**. The Munition Target Settings dialog box opens (Figure 14-2).

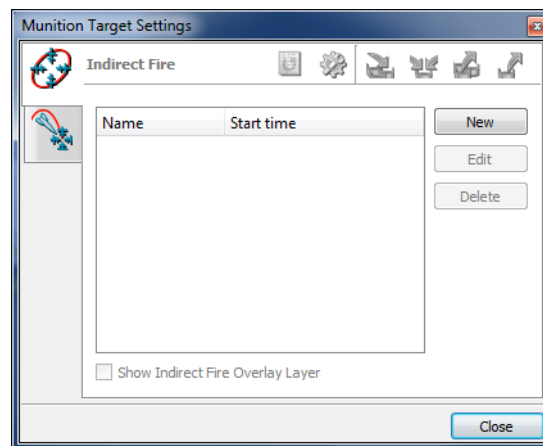


Figure 14-2. Munition Target Settings dialog box, Indirect Fire page

2. Select the Indirect Fire page.
3. Click New. The cursor changes to create mode and a tab for the Create Indirect Fire dialog box is added to the window.
4. Draw an ellipse on the map to specify the area of the fire event:
 - a. Click to set the center of the ellipse. A center point is set and a small circle is displayed with a vertex indicator at the bottom of the circle.
 - b. Drag the mouse up or down and click to set the height of the ellipse. A vertex indicator is added to the left side of the circle.
 - c. Drag the mouse left and right and click to set the width of the ellipse (Figure 14-3).

Optionally, you can specify the properties of the ellipse in the Create Indirect Fire dialog box.

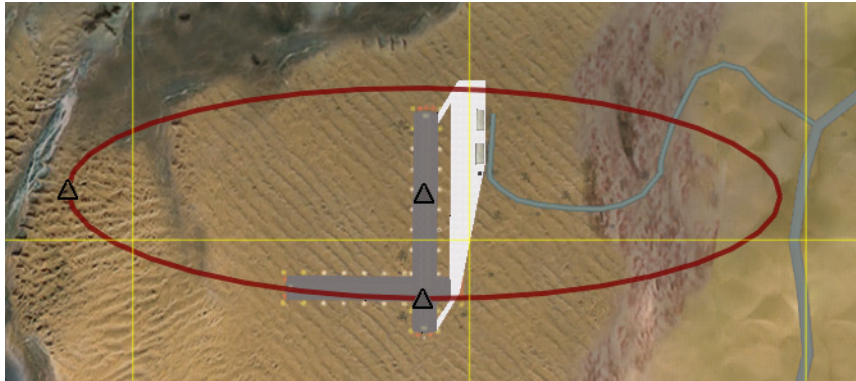


Figure 14-3. Indirect fire event area

5. Click the tab to display the Create Indirect Fire dialog box (Figure 14-4).

Create Indirect Fire

Name: <auto-generated name>

Label:

Heading (deg): 0.0

X Radius (m): 0.0

Y Radius (m): 0.0

Overlay: Indirect Fire

Force: Friendly

☐ ☐

Lat: 10.031826

Lon: 60.026575

Altitude (m): 10

Detonation Start Time:

☒ Immediate

☐ At Simulation Time: 0 00:00:00

Number Of Salvos: 5

Rounds Per Salvo: 10

Scatter Time (s): 1.00

Time Between Salvos (HH:MM:SS): 0:00:15

Altitude Above Terrain(m): 0

Munition Type: 76 mm M319

☒ Publish Object

Close

Figure 14-4. Create Indirect Fire dialog box

6. Type a name for the event in the Name text box, or accept the default name (Indirect Fire *n*).

7. Optionally, specify a layer for the event. (If there are no tactical graphics in the scenario, there might not be any layers to select. A layer will be created when you click Create to create this indirect fire event.)
8. Configure the parameters of the fire event, as follows:
 - Select the detonation start time. The options are Immediate or At Simulation Time. If you select At Simulation Time, enter the simulation time at which you want the munition to start firing.
 - In the Number of Salvos box, enter the number of salvos you want to fire.
 - In the Rounds Per Salvo box, enter the number of rounds you want to fire for each salvo.
 - In the Scatter Time box, enter the length of time for each salvo. The rounds in each salvo will be detonated at random times within this time period.
 - If you specified more than one salvo, in the Time Between Salvos box enter the amount of time you want to pass between each salvo.
 - Optionally, specify an altitude above the terrain that the rounds should detonate at.
 - Select the munition type in the Munition Type list.
9. Click Create. The Indirect Fire event is added to the list ([Figure 14-5](#)). The area is added as an object on the Indirect Fire layer on the Overlays tab of the Objects List Panel (unless you chose a different layer).

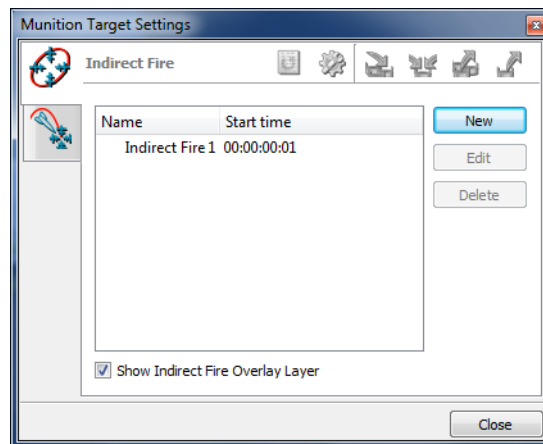


Figure 14-5. Indirect Fire page with indirect fire event

14.1.2. Editing Indirect Fire Events

You can edit the properties of an indirect fire event. You can also directly manipulate the area that specifies the event.

To edit an indirect fire event:

1. Choose **Simulation** → **Munition Targets**. The Munition Target Settings dialog box opens.
2. Select the Indirect Fire page ([Figure 14-5](#)).
3. Select the indirect fire event that you want to edit.
4. Click Edit. The Edit Indirect Fire dialog box opens.
5. Change the properties that you want to change.
6. Click OK.

14.1.3. Deleting Indirect Fire Events

To delete an indirect fire event:

1. Choose **Simulation** → **Munition Targets**. The Munition Target Settings dialog box opens ([Figure 14-2](#)).
2. Select the Indirect Fire page ([Figure 14-5](#)).
3. Select the indirect fire event that you want to delete.
4. Click Delete.
5. Click Close.

14.1.4. Configuring Indirect Fire Event Default Values

You can configure a set of default values that get applied to the Create Indirect Fire dialog box.

To configure default values for indirect fire events:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Indirect Fire Settings page (Figure 14-6).

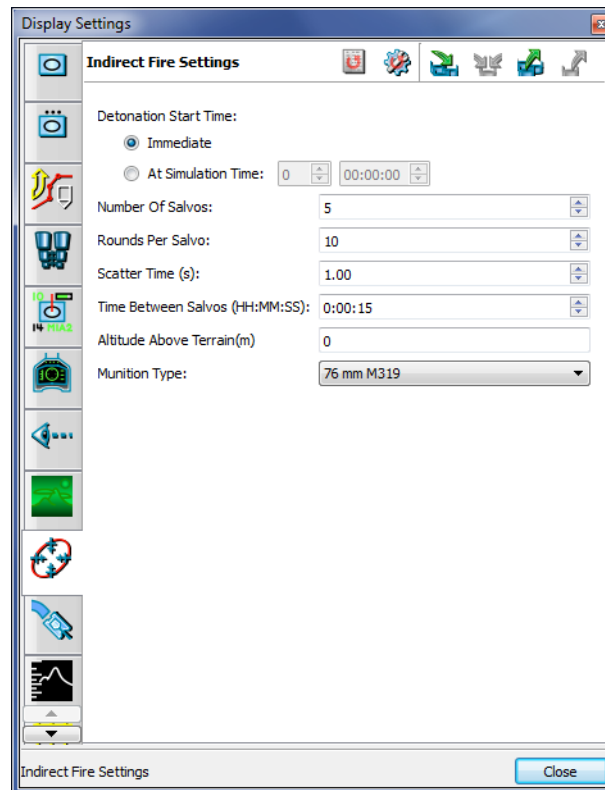


Figure 14-6. Indirect Fire Settings page

3. Set the parameters to the desired default values.
4. Click Close.



14.2. Ballistic Missiles

VR-Forces supports firing of ballistic missiles, including multistage missiles. The trajectory of a missile is determined by a series of coordinates in a comma-separated values (CSV) file. VR-Forces includes some sample CSV files. VR-Forces users are responsible for creating their own files if they want missiles to fly with different characteristics.

You fire a ballistic missile by specifying a target and choosing a missile type. The characteristics of the missile type are specified in the Entity Editor. A missile launches at the same altitude as the target point at a distance determined by the CSV file. Therefore, if a target point is placed at or near the ground, it is possible that due to variations in the terrain, the launch location could be underground. Once the missile launches, it follows the trajectory contained in the CSV that it is configured with. It detonates when it reaches the target point. For details about configuring missiles, please see Section 6.5.1, “[Configuring Ballistic Missile Movement](#),” in *VR-Forces Configuration Guide*.

14.2.1. Firing Ballistic Missiles

To fire a ballistic missile:

1. Choose **Simulation** → **Munition Targets**. The Munition Target Settings dialog box opens ([Figure 14-2](#)).
2. Select the Missile Target page ([Figure 14-7](#)).

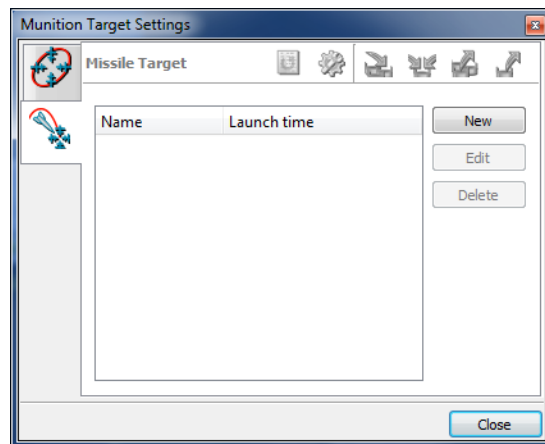
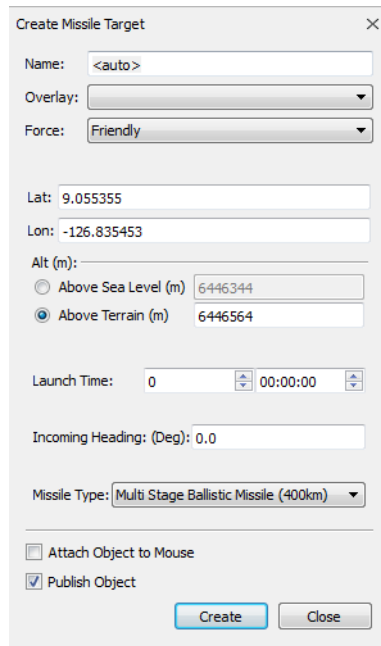


Figure 14-7. Munition Target Settings dialog box, Missile Target page

3. Click New. The cursor changes to a cross-hair.
4. Click the location where you want the missile to hit. The Create Missile Target dialog box opens ([Figure 14-8](#)).



The image shows a 'Create Missile Target' dialog box with the following fields and options:

- Name:** <auto>
- Overlay:** (dropdown menu)
- Force:** Friendly (dropdown menu)
- Lat:** 9.055355
- Lon:** -126.835453
- Alt (m):**
 - ☐ Above Sea Level (m) 6446344
 - ☒ Above Terrain (m) 6446564
- Launch Time:** 0 (with time selection buttons) 00:00:00 (with time selection buttons)
- Incoming Heading: (Deg):** 0.0
- Missile Type:** Multi Stage Ballistic Missile (400km) (dropdown menu)
- ☐ Attach Object to Mouse
- ☒ Publish Object
- Create** (button)
- Close** (button)

Figure 14-8. Create Missile Target dialog box

5. Optionally, specify the parameters for the target. In particular, set the following parameters:
 - Name. The name of the target point.
 - Launch Time. The simulation time at which the missile will be launched.
 - Incoming Heading. The heading, relative to the target, from which the missile will be launched.
 - Missile Type. An option from the list.
6. Click Create. The missile event is listed in the Missile Target window.

14.2.2. Editing Missile Target Events

You can edit the properties of a missile target event. You can also directly manipulate the target point.

To edit a missile target event:

1. Choose **Simulation** → **Munition Targets**. The Munition Target Settings dialog box opens ([Figure 14-2](#)).
2. Select the Missile Target page ([Figure 14-7](#)).
3. Select the missile fire event that you want to edit.
4. Click Edit. The Edit Missile Target dialog box opens.
5. Change the properties that you want to change.
6. Click Update.

14.2.3. Deleting Missile Target Events

To delete a missile target event:

1. Choose **Simulation** → **Munition Targets**. The Munition Target Settings dialog box opens ([Figure 14-2](#)).
2. Select the Missile Target page ([Figure 14-7](#)).
3. Select the missile fire event that you want to delete.
4. Click Delete.
5. Click Close.



You can also simply delete the target point from the terrain.



15. Environment Conditions

This chapter explains how to set the time of day and weather conditions.

Introduction to Environment Conditions	15-2
Setting the Date and Time of Day	15-2
Setting the Date	15-3
Setting the Time of Day	15-4
Choosing the Illumination Model	15-4
Specifying the Environment Conditions	15-5
Adding an Environment Condition.....	15-6
Editing an Environment Condition.....	15-7
Deleting an Environment Condition.....	15-7
Setting Weather Conditions	15-7
Setting the Wind Speed and Direction	15-8
Setting Visibility (Fog)	15-9
Specifying Precipitation Type and Intensity	15-10
Specifying Cloud Cover.....	15-10
Creating Local Weather Zones	15-11
Editing a Weather Zone's Environment	15-13
Configuring Marine Conditions	15-14
Enabling Marine Effects	15-15
Configuring Marine Conditions.....	15-15
Setting the Thermocline.....	15-17
Displaying Screen Splash Effects	15-18

15.1. Introduction to Environment Conditions

You can set the date, time of day, weather, and marine conditions from the front-end and in plans. The date, time of day, and weather conditions are back-end settings, not merely front-end display effects. They affect entity sensors and line-of-sight. For example, if visibility is set to 4 kilometers, an entity will not see an entity that is 5 km away. If the time of day changes from daytime to nighttime, lighting conditions in the 3D view change accordingly.

The time of day advances as simulation time advances. However, they are not directly tied to each other. For example, if at the start of a simulation (simulation time 0:00:00:00), you set the time of day to 10:00 AM, after eight hours of simulation time passes, the time of day will be 6:00 PM. However, you could just as easily set the initial time of day to some other time or change it at will during the course of the simulation. These changes would not affect the elapsed simulation time in any way. They would just change the starting point for the advance of the time of day.

Date and Time and Weather are options on the commands menu in global plans and entity plans.

15.2. Setting the Date and Time of Day

VR-Forces uses an ephemeris model to calculate illumination based on the date and time of day. The amount of light affects visual sensors. Simulation illumination is always calculated based on Greenwich Mean Time (GMT) offset by the time zone where an entity is located (based on longitude). Since you can change the time zone used for the Environment Settings Toolbar, it is possible for the display of illumination in Stealth mode to be different from what you expect. This is explained as follows:

The default display in the Environment Settings Toolbar is GMT. The time displayed is offset from the time zone used in the starting date and time. For example a starting time of 10:00 A.M. Eastern Standard Time (EST) is 15:00 GMT. So if you create a scenario with an entity in Boston, Massachusetts, USA, the Environment Settings Toolbar will display 15:00 GMT. For details about setting the starting date and time, please see [“Setting the Scenario Starting Date and Time,”](#) on page 1-12.

If you change the time zone in the Environment Conditions dialog box, the time displayed in the Environment Settings Toolbar changes to the current time for that time zone. Using the example in the previous paragraph, if you change the time zone to EST, the Environment Settings Toolbar will read 10:00 EST. However, the illumination in the Stealth mode does not change to the new time zone. It continues to represent the illumination in GMT. If you change the time to 5:00 P.M. EST, the display will be dark, because 5:00 P.M. EST is 10:00 P.M. GMT and illumination is based on GMT.

15.2.1. Setting the Date

To set the date:

1. Choose **Simulation** → **Environment Settings**, or click the date on the Environment Settings Toolbar. The Environment Settings dialog box opens.
2. Select the Date and Time page (Figure 15-1).

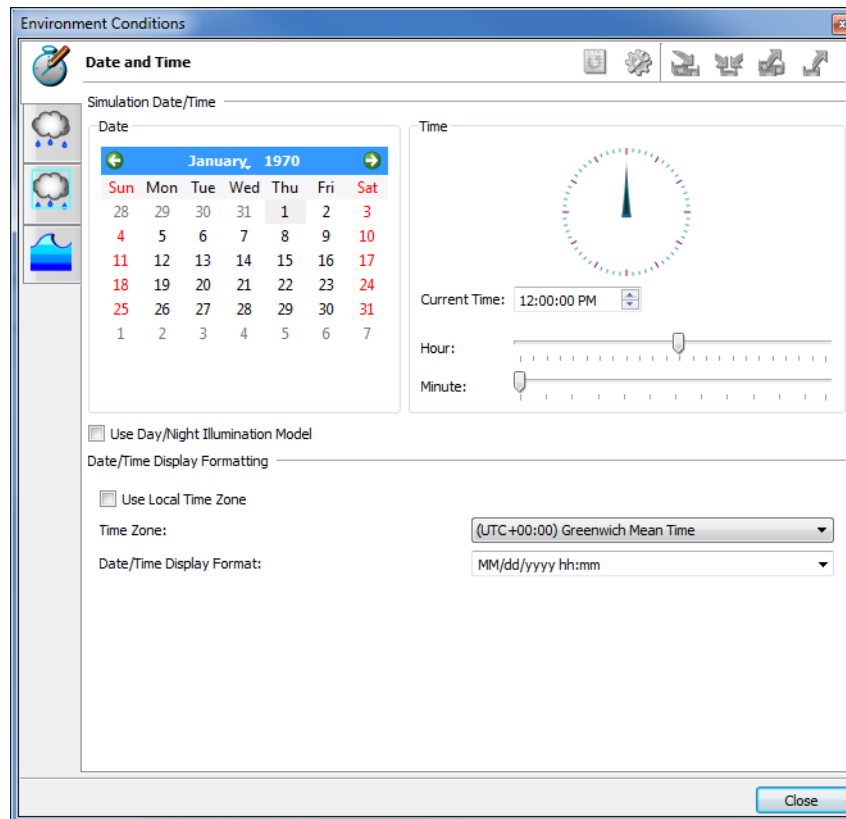


Figure 15-1. Date and Time page

3. To change the month, click the right or left arrows, or click the month and select a month from the list.
4. To change the year, click the right or left arrows, or click the year and type in a year or use the spin controls to select a value.
5. To specify the date, click on the date in the calendar.

15.2.2. Setting the Time of Day

As time advances, the time displayed on the Environment Settings Toolbar changes. The time of day setting is independent of simulation time. The default time zone is Greenwich Mean Time. You can change the time zone to the local zone or any of the zones in the Time Zone list.

To set the time of day:

1. Choose **Simulation** → **Environment Settings**, or click the date on the Environment Settings Toolbar. The Environment Settings dialog box opens.
2. Select the Date and Time page ([Figure 15-1](#)).
3. Set the time of day by changing the value in the Current Time box or by adjusting the Hour and Minute sliders.
4. Select the time zone in one of the following ways:
 - Select a time zone in the Time Zone list.
 - Select Use Local Time Zone. The time zone set for your computer is used.
5. Optionally, select a date/time display format. This changes the format used in the Environmental Settings Toolbar.

15.2.3. Choosing the Illumination Model

Illumination affects visual sensors. Illumination can be on all of the time or it can be affected by the time of day. The illumination setting does not affect the front-end. It only affects back-end calculations. If the day/night illumination model is active, the back-end calculates illumination based on an entity's location given current Greenwich Mean Time, offset by the time zone where the entity is located (based on longitude). This calculation does not take into account daylight savings time or localized time zone variations.

To specify the illumination model:

1. Choose **Simulation** → **Environment Settings**, or click the date on the Environment Settings Toolbar. The Environment Settings dialog box opens.
2. Select the Date and Time page ([Figure 15-1](#)).
3. Select or clear the Use Day/Night Illumination Model check box.

15.3. Specifying the Environment Conditions

VR-Forces has a set of preconfigured environment conditions. Each environment condition has settings for:

- ♦ Weather:
 - Wind speed and direction.
 - Cloud cover.
 - Visibility.
 - Precipitation type and intensity.
 - Fog height and color.
- ♦ Marine:
 - Sea swell.
 - Sea state.
 - Surface transparency.
 - Underwater visibility.
 - Choppiness.
 - Surge depth.

Conditions range from clear to stormy and let you quickly set the weather without needing to adjust all the various weather parameters. However, if you want to, you can change any of the individual weather parameters. Changing a weather or marine setting does not affect the saved settings unless you specifically overwrite them.

You can save and import environment settings. Environment settings support the standard VR-Forces settings behaviors, as described in [“Managing VR-Vantage Settings,”](#) on page 3-20.

You can add your own environment conditions.

To specify a weather condition:

1. Choose **Simulation** → **Environment Conditions** or click the weather icon on the Environment Settings toolbar. The Environment Conditions dialog box opens.
2. Select the Weather page ([Figure 15-2](#)).

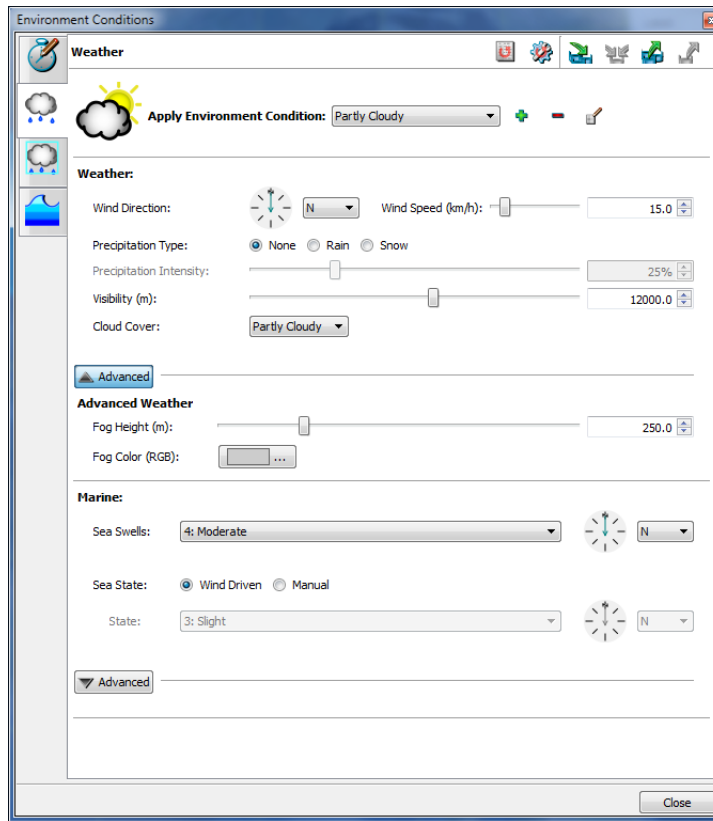


Figure 15-2. Weather page

3. In the Apply Environment Condition list, select the condition you want.

15.3.1. Adding an Environment Condition

If you add an environment condition, it gets added to the Apply Environment Condition list.

To add an environment condition:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).
3. Change the weather settings to the ones you want for the new condition.
4. Click the Add button (+). The Name an Environment Condition dialog box opens.
5. Type a name for the new condition.
6. Click OK.

15.3.2. Editing an Environment Condition

You can change the settings for an environment condition. Editing a condition essentially means overwriting a condition with the current set of weather and marine conditions.

To edit an environment condition:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).
3. Optionally, in the Apply Environment Condition list, select a condition you want to use as your starting point.
4. Change whatever conditions you want.
5. Click the Edit button (✎). The Select an Environment Condition dialog box opens.
6. In the Select Name list, select the condition you want to overwrite.
7. Click OK.

15.3.3. Deleting an Environment Condition

If you delete one of the built-in environment conditions, you can restore it from the factory settings.

To delete an environment condition:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).
3. Click the Delete button (✖). The Select an Environment Condition dialog box opens.
4. In the Select Name list, select the condition you want to delete.
5. Click OK.

15.4. Setting Weather Conditions

You can set the following weather conditions:

- ♦ Cloud cover
- ♦ Visibility
- ♦ Precipitation
- ♦ Wind speed and direction.

When you specify weather, the back-end sends out state updates with these conditions. Entities respond to them only if their model has the ability to do so.

15.4.1. Setting the Wind Speed and Direction

You can set the wind speed and direction. If you do not specify the sea state manually, it is set based on the wind conditions. The maximum wind speed that you can set is 360 km/h.) The wind direction affects the angle at which precipitation falls.

To set wind speed and direction:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).

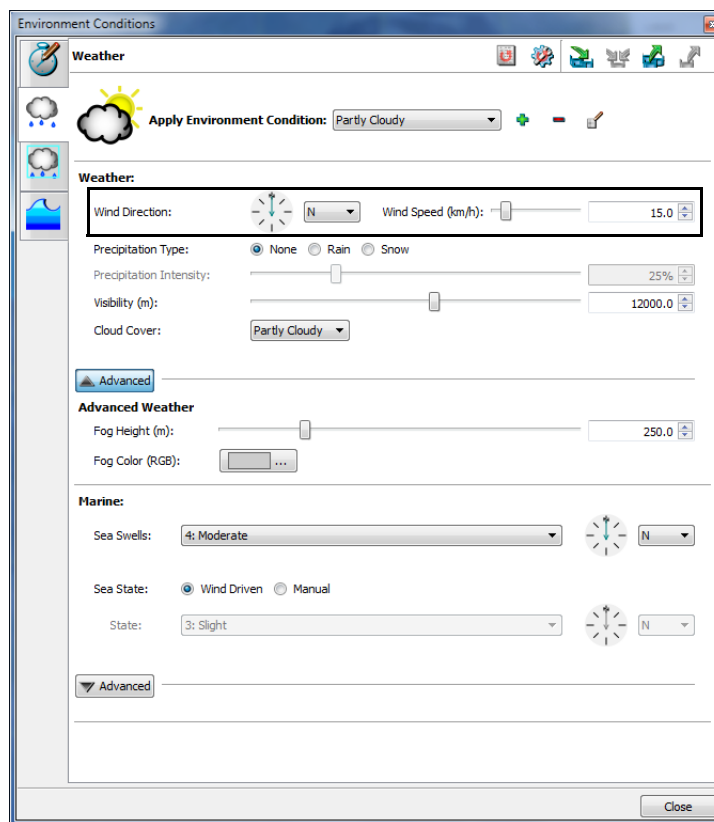


Figure 15-3. Weather page

3. Drag the Wind Direction indicator to the desired compass point or select an option from the list.
4. Drag the Wind Speed slider or enter a value in the box.

15.4.2. Setting Visibility (Fog)

The visibility setting determines the denseness of the fog effect, which determines how far you can see.

To set visibility:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).
3. Adjust the Visibility slider or enter a value in the box.

Configuring Fog

You can set the fog height and color. The fog height affects how much sky the observer can see when looking up from ground level. For example, if you set the fog height to 50m and look up, you will see some amount of sky above you, and to the sides it will be very gray. If you then set it to 10m and look up, you will see mostly blue sky above you, but still quite a bit of gray to the sides.



Fog settings are not modeled in the back-end. Therefore, they are not available when you set weather conditions in a plan.

To configure fog:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).
3. In the Weather section of the page, click Advanced. The dialog box expands to show options for fog.
4. To set the fog height, adjust the slider or enter a value in the box.
5. To set the fog color:
 - a. Click the color swatch. A color picker dialog box opens.
 - b. Select the color you want to apply to the fog. It is applied immediately, so you can easily see the effect of the new color and change it if you want to.
 - c. Click OK.

15.4.3. Specifying Precipitation Type and Intensity

VR-Forces supports display of rain and snow. You can configure the intensity of precipitation.

To specify the precipitation type and intensity:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page ([Figure 15-3](#)).
3. Select a Precipitation Type. If you select rain or snow, the Precipitation Intensity setting becomes editable.
4. Adjust the Precipitation Intensity slider or enter a value in the box. The range is 0% through 100%.

15.4.4. Specifying Cloud Cover

VR-Forces simulated varying amounts and types of cloud cover, from clear, to cloudy, to thunderstorm. When you choose an environment condition, it includes an appropriate degree of cloud cover. You can also change the cloud cover at any time.

To specify the cloud cover:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page ([Figure 15-3](#)).
3. Select an option from the Cloud Cover list.

15.5. Creating Local Weather Zones

You can create local weather zones. Each zone can have different weather conditions and entities can respond to those conditions as they move from zone to zone.

Weather zones have a priority. If two zones overlap and one has a higher priority than the other, an entity in the overlapping area responds to the weather conditions in the higher priority zone. If overlapping zones have the same priority, the one that gets discovered first on the network is used.

Weather zones are rectangular areas on the terrain. By default, they are placed on the Weather overlay. Weather zones display a graphic that represents the weather conditions. [Figure 15-4](#) illustrates a weather zone set to the Thunderstorm environmental condition. You can move and resize them just as you can move and resize other tactical graphics.

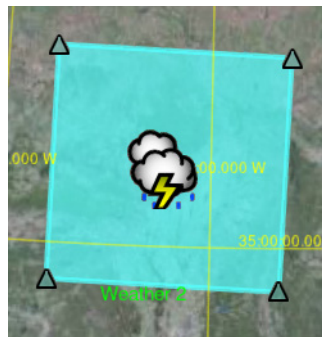


Figure 15-4. Weather zone

To create a local weather zone:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Local Weather Zones page ([Figure 15-5](#)).

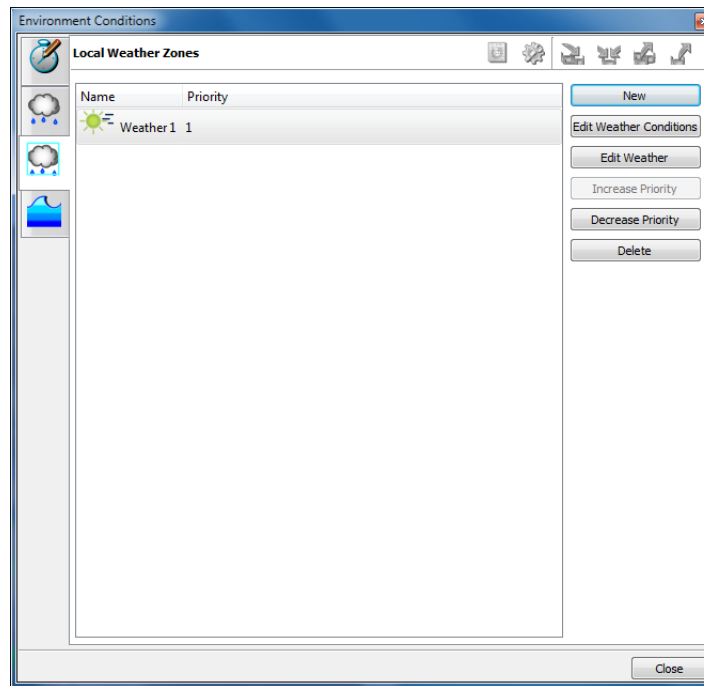


Figure 15-5. Local Weather Zones page

3. Click New. A weather zone is added to the scenario and the Create Weather dialog box opens.

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The default size for a weather zone is 100,000 meters per side, so on small terrains, the zone might cover the terrain. If this is a problem, edit the Length and Width in the Create Weather dialog box to reduce it to a manageable size.

4. Optionally, edit the various parameters for the weather zone. In particular, select an environmental condition or edit the environment to specify the conditions you want to apply to this weather zone. For details about editing the environment, please see [“Editing a Weather Zone’s Environment,”](#) on page 15-13.
5. Click Create.

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You can also create a weather zone by selecting Weather on the Hazard/Obstacles Palette.

15.5.1. Editing a Weather Zone's Environment

You can edit a weather zone's environment when you create it or after you create it. You can assign it one of the preconfigured environmental conditions or change individual environment settings. For details about preconfigured environmental conditions, please see [“Specifying the Environment Conditions,”](#) on page 15-5.

To edit a weather zone's environment:

1. Do one of the following:
 - In the Create Weather dialog box, click Edit Environment. The Weather dialog box opens ([Figure 15-6](#)).
 - On the Local Weather Zones page of the Environment Conditions dialog box, select the weather zone you want to edit and click Edit Weather Conditions. The Set Weather dialog box opens.

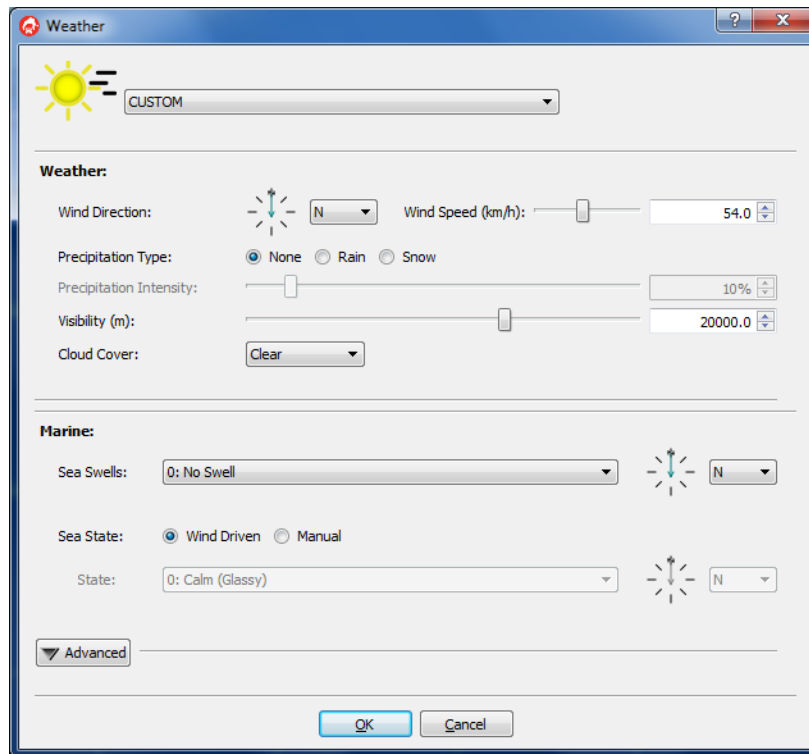


Figure 15-6. Set Weather dialog box

2. Change weather conditions as desired. They are the same as those on the Weather page of the Environment Conditions dialog box. For details, please see [“Setting Weather Conditions,”](#) on page 15-7.
3. Click OK.

15.6. Configuring Marine Conditions

VR-Forces supports a variety of dynamic ocean effects (Figure 15-7), including:

- ♦ Douglas Sea State. This includes wind waves (wind sea), swell character, and the directions of each. VR-Forces allows each to be separately configured.
- ♦ Wave chop.
- ♦ Surface transparency. The ability to see through the water from above sea level.
- ♦ Underwater visibility. The ability to see underwater.
- ♦ Swell.
- ♦ Surge depth. When bathymetry data is present, this is the depth of the water at which full storm effects take place. As the water gets shallower, it gets calmer.



Figure 15-7. Fishing boat



Enabling dynamic ocean effects can affect performance.

15.6.1. Enabling Marine Effects

Marine effects can reduce performance. Therefore, they are disabled by default.

- To enable marine effects, choose **Observer** → **Dynamic Ocean**, or click the Dynamic Ocean button (🌊) on the Observer Settings toolbar.

15.6.2. Configuring Marine Conditions

The preconfigured environment conditions include marine conditions. You can also customize the marine settings at any time.

To configure marine effects:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Weather page (Figure 15-3).

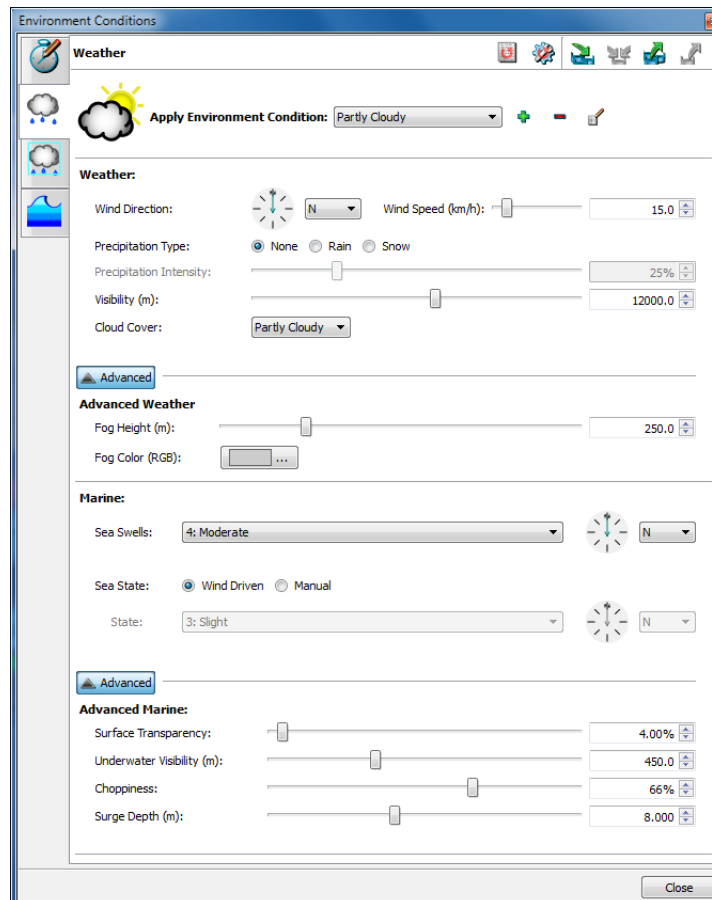


Figure 15-8. Weather page

3. Change settings as desired. The settings are described in [Table 15-1](#).

Table 15-1: Advanced marine settings

Parameter	Description
Sea Swells	The amount of rise and fall of waves independent of wind. Choose from 10 fixed swell states. You can also set the compass direction from which swells originate.
Sea (wind) state	Determined by the wind direction and speed or set manually. If manual, one of the swell states for the Douglas sea state scale. You can also set the compass direction from which sea state originates.
Advanced Parameters	
Surface Transparency	The depth at which VR-Forces begins to apply transparency to the water surface if the terrain has bathymetry or underwater polygons. This setting helps reduce Z-fighting along the shoreline. It does not mean that you can see some distance into the water when the observer is over deep water. The maximum value represents transparency to 500 meters.
Underwater visibility	The distance you can see underwater if the observer is underwater.
Choppiness	The percentage of turbulence on the water.
Surge depth	When bathymetry data is present, this is the depth of the water at which full storm effects take place. As the water gets shallower, it gets calmer.

15.7. Setting the Thermocline

Thermoclines are layers of water that have different temperatures and, therefore, different density. Sound transmission varies as it passes through the thermocline. In VR-Forces, sonar effectiveness is reduced as it passes through thermocline boundaries. By default, VR-Forces does not set any thermoclines. You can specify the depth of up to five thermoclines.

To specify a thermocline:

1. Choose **Simulation** → **Environment Conditions**. The Environment Conditions dialog box opens.
2. Select the Thermoclines page ([Figure 15-9](#)).

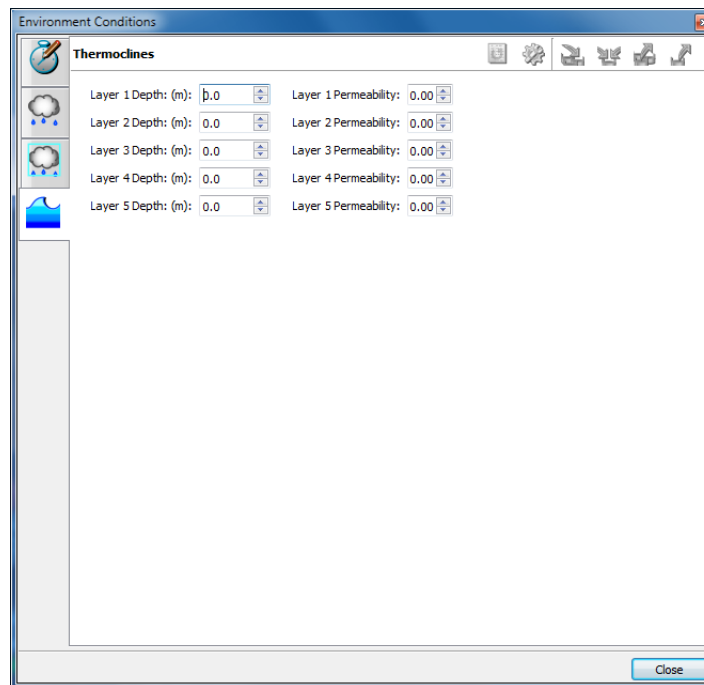


Figure 15-9. Thermoclines page

3. For each thermocline that you want to specify, type or select a value in the depth box and the permeability box.

15.8. Displaying Screen Splash Effects

When it is raining, VR-Forces can simulate raindrops hitting the observer's camera lens. If the observer is close to the surface of the ocean (as if a periscope were being raised or lowered), VR-Forces can simulate the effect of waves and water droplets splashing on the observer's camera (Figure 15-10).



Figure 15-10. Rain effect

To enable or disable screen splash effects:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 15-11).

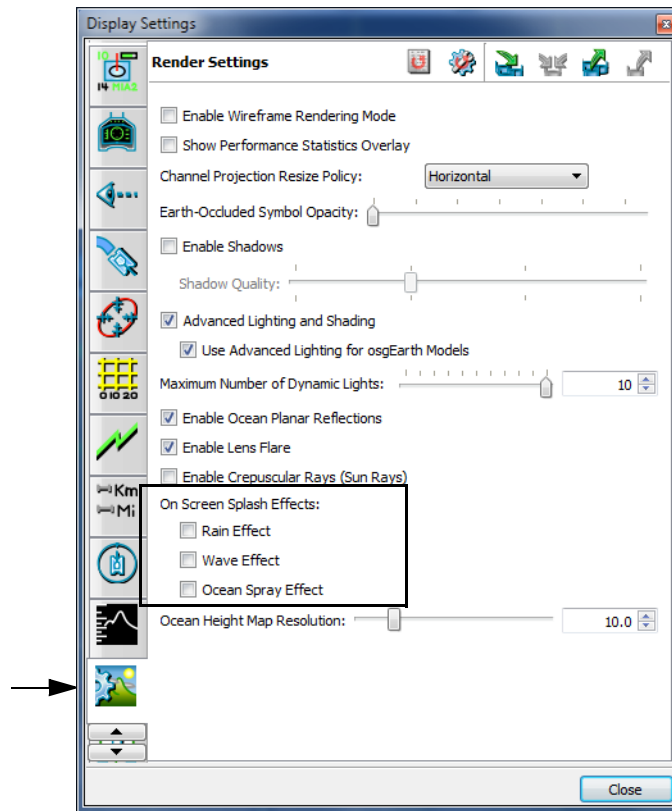


Figure 15-11. Render Settings page

3. Select or clear the Rain Effect, Wave Effect, or Ocean Spray effect check boxes.



16. Creating Scripted Tasks

VR-Forces lets you create new tasks by writing scripts. You do not need to know C++ or have a developers license to write these scripts. This chapter explains how to create scripted tasks. Chapter 17, *Writing Scripts for Scripted Tasks* explains how to write scripts for scripted tasks.

Introduction to Scripted Tasks	16-3
Task Type Scripted Tasks	16-4
The Reactive Task Type Scripted Task	16-4
Background Process Type Scripted Task	16-4
Script Metadata	16-4
The Lua Scripting Language	16-5
Creating a New Scripted Task	16-5
Specifying the Script ID	16-9
Specifying the Task Menu Icon	16-9
Specifying Task Parameters	16-10
Specifying the Task Menu Location	16-13
Specifying Action Categories	16-15
Configuring a Script's Availability to an Entity Type	16-16
Specifying the Programming Language for a Scripted Task	16-20
Creating Reactive Tasks	16-21
Creating Background Processes	16-22
Saving Scripted Tasks	16-23
Editing a Scripted Task	16-24
Filtering the List of Scripted Tasks	16-24
Organizing Scripted Tasks into Folders	16-25
Adding a Folder	16-25
Renaming a Folder	16-25

Creating Scripted Tasks

Deleting a Folder.....	16-25
Adding Scripted Tasks to a Folder	16-25
Removing a Scripted Task from a Folder	16-25
Exporting and Importing Scripted Tasks.....	16-26
Importing a Scripted Task Package	16-27
Copying a Scripted Task	16-28
Deleting a Scripted Task	16-28
Creating a System Scripted Task	16-29
Including System Scripted Tasks on the Task Menu	16-29
Specifying a Script Editor	16-31
Editing Lua Files.....	16-32

16.1. Introduction to Scripted Tasks

The scripted task feature in VR-Forces allows you to create new tasks for entities without using the VR-Forces Toolkit and C++ API. Scripted tasks use the Lua programming language. The actions that entities can carry out are still limited to the basic C++ tasks provided by VR-Forces. However, since Lua is a full-featured scripting language, it is far more powerful than the plan language used to create entity plans and you can be much more creative in how you use the basic tasks. In addition to functions for tasks and sets, Lua scripts can make many types of calls to the simulation engine to get entity status or other simulation data. Scripts can also set some simulation data.

Scripted tasks are classified as system scripts or as scenario scripts. System scripted tasks are saved as part of the SMS and are available to all scenarios that use that SMS. Scenario scripted tasks are available only in the scenario for which the script was created. However, you can save a scenario script as a system script if you want to and, just as with other data used by VR-Forces, there are ways of copying scripted tasks from one VR-Forces installation to another.

VR-Forces supports three types of scripted tasks, as follows:

- ♦ Task. Task scripted tasks are listed on the Task menu and are used as independent tasks or in plans just like C++ tasks.
- ♦ Reactive task. A reactive task monitors the simulation and gets activated when the conditions set in the script become true. Reactive tasks are enabled or disabled for entities through the GUI.
- ♦ Background process. A background process runs continuously from the time an entity is created. There is no user interface for assigning background processes to entities. Their use is based entirely on the scripting process.

Although creation of scripts requires that you have some programming skills, you do not need to know C++, use a compiler, or use the VR-Forces APIs to write these scripts.

From a Lua script you can:

- ♦ Create and delete simulation objects (entities, waypoints, and so on).
- ♦ Set weather and environment state.
- ♦ Get entity state, such as:
 - Aggregation
 - Location
 - Embarkation
 - Type
 - Force
 - Damage state
 - Velocity.

- ♦ Monitor and set entity resources.
- ♦ Get entity sensor contacts.
- ♦ Task other entities.
- ♦ Subtask self.
- ♦ Send Set Data Request messages.
- ♦ Test terrain:
 - Get terrain height.
 - Check line of sight.
 - Find feature data.

VR-Forces includes a text editor (SciTE) to use as the default script editor. You can configure VR-Forces to use a different editor if you want to. For details, please see [“Specifying a Script Editor,”](#) on page 16-31.

16.1.1. Task Type Scripted Tasks

Scripted tasks get added to the Task menu and are treated just like the tasks that are built into VR-Forces.

When you create a scripted task, you can specify input parameters. When you assign the task to an entity, either from the Task menu or in a plan, VR-Forces builds a dialog box for the task that includes all of the parameters specified for the script.

16.1.2. The Reactive Task Type Scripted Task

Reactive tasks are a special category of scripted tasks. Once enabled they monitor a simulation and get activated when the conditions set in the script become true. Reactive tasks are not added to the Task menu. In most respects the process for creating and writing reactive tasks is the same as creating and writing all scripted tasks. Assume that all details about scripted tasks apply to reactive tasks unless noted otherwise. For conceptual details about reactive tasks, please see [“Reactive Tasks,”](#) on page 7-11.

16.1.3. Background Process Type Scripted Task

The background process is a script that runs in the background for the entity types for which it was written. Strictly speaking it is not a task, but background processes are created and managed through the scripted task interface. Since a background task has no user interface, it does not have any input parameters. When you create a background process, you specify the entity types for which it is available and you write the script.

16.1.4. Script Metadata

A script has two major components, the script code, and the script metadata. The metadata provides all of the information that VR-Forces needs to store the script, add it to the Task menu, and generate the task dialog box.

16.1.5. The Lua Scripting Language

Lua is a lightweight scripting language used by VR-Forces to implement the scripted tasks feature. VR-Forces includes a set of Lua functions that map the built-in tasks and set data requests as well as the ability to obtain entity state information. You use these functions as the starting point for building new tasks. For details about the Lua language, please see the Lua web site (www.Lua.org).

16.2. Creating a New Scripted Task

To create a new scripted task, you specify the metadata for the script and write the script code. A scripted task's metadata specifies the script's name, where it will be placed on the Task menu, and its parameters, if any. Specifying metadata may be an iterative process, particularly the parameters, which may change as you write the code for the script. However, the minimum first step in creating a scripted task is to specify a name for the script and add it to the list of scripted tasks. Once you do this, you can edit the metadata and the code as needed until you have completed the scripted task to your satisfaction.

All new scripted tasks are created as scenario tasks. If you want to create a new system scripted task, you save the scenario scripted task as a system scripted task. For details, please see [“Creating a System Scripted Task,”](#) on page 16-29.

To create a new scripted task:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks dialog box opens ([Figure 16-1](#)).

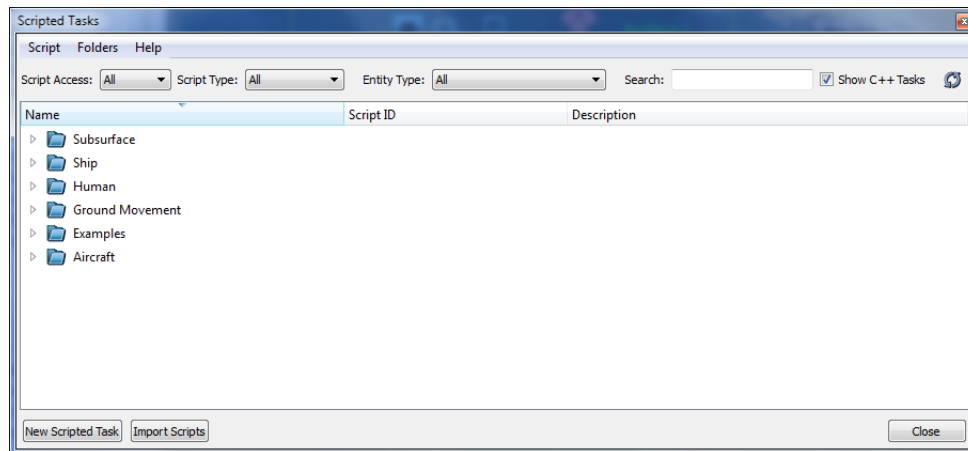


Figure 16-1. Scripted Tasks dialog box

2. If you have a folder hierarchy and want to create the script in a particular folder, select the folder. (For more information, please see [“Organizing Scripted Tasks into Folders,”](#) on page 16-25.)

3. Choose **Script** → **New Scripted Task**. The New Scripted Task dialog box opens (Figure 16-2).

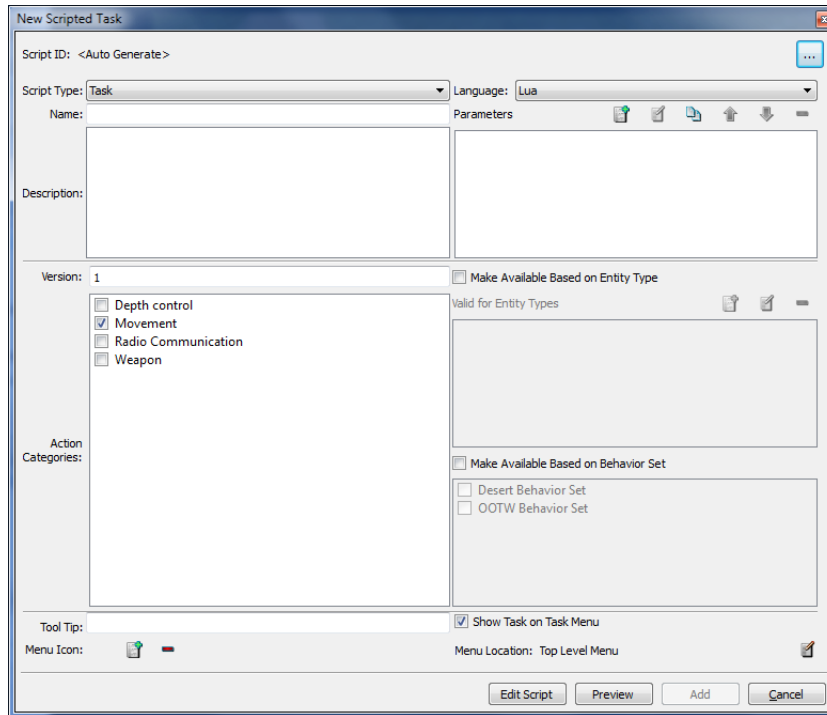


Figure 16-2. New Scripted Task dialog box

4. In the Script Type list, select the type of scripted task you are creating (Task, Reactive Task, or Background Process). The dialog box displays the correct set of meta-data for the type of task you chose.

5. Complete the fields in the dialog box. They are described in [Table 16-1](#) and in following sections.

Table 16-1: Script metadata

Input Field	Description
Script ID	A unique name for the scripted task. VR-Forces generates a default name, but you will probably want to change it to something meaningful. It is your responsibility to make sure that it is unique. Please see “Specifying the Script ID,” on page 16-9 for details.
Script Type	One of the following: ♦ Task. A scripted task that would typically be accessed through the Task menu. ♦ Reactive Task. A task that executes in response to specific conditions. ♦ Background Process. A task that executes continuously in the background. The fields on the New Scripted Task dialog box vary based on which type of task is being created.
Language	Specify Lua if you are writing a Lua script for this task. Specify C++ if you have written a new task controller and want to use the scripted task interface to create the GUI portion of the task. (Does not apply to reactive tasks and background processes.) For more information, please see “Specifying the Programming Language for a Scripted Task,” on page 16-20.
Name	The text that will be added to the Task menu for this script.
Description	A description of what the task does. This text is displayed on the task’s dialog box. (Optional)
Tool Tip	Text for a tooltip when the task is selected on the Task menu. (Optional) (Does not apply to reactive tasks and background processes.)
Menu Icon	The icon to display next to the task name on the Task menu. Please see “Specifying the Task Menu Icon,” on page 16-9 for details. (Optional) (Does not apply to reactive tasks and background processes.)
Version	Script version. Available as a parameter to a Lua script. For use by script writers who want to have different versions of a script.
Action Categories	Specifies the categories of tasks that this scripted task will interrupt. (In other words, action categories manage task concurrency. For details about concurrent tasks, please see “Concurrent Task Execution,” on page 7-4.) (Does not apply to background processes.)

Table 16-1: Script metadata

Input Field	Description
Behavior Sets	Select each Behavior Set that you want this script to be part of. You can also assign scripts to Behavior Sets in the Edit Behavior Sets dialog box. For details about Behavior Sets, please see “Using Behavior Sets to Manage Scripted Tasks,” on page 7-18.
Parameters	The input parameters that the task requires. Please see “Specifying Task Parameters,” on page 16-10 for details. (Optional) (Does not apply to background processes.)
Show Scripted Task on Task Menu	Select to show the scripted task on the Task menu. Clear to hide the task. (You might want to write a scripted task that will be used by other scripted tasks, but which you do not want a user to assign directly to an entity.) (Does not apply to reactive tasks and background processes.)
Menu Location	The location on the Task menu where this scripted task will be listed. Please see “Specifying the Task Menu Location,” on page 16-13 for details. (Does not apply to reactive tasks and background processes.)
Valid for Entity Types	The entity types that can use this task. This entry affects the context sensitivity of the Task menu. Please see “Specifying the Valid Entity Types for a Task,” on page 16-17 for details.
Enabled by Default	Reactive tasks only. If selected, the reactive task is automatically enabled for all supported entity types.
Default Priority	Reactive tasks only. The priority for this task. For information about the effect of reactive task priority, please see “Reactive Tasks,” on page 7-11.
View Like Priorities	Reactive tasks only. Displays a list of the reactive tasks that are valid for this task’s entity types and action categories. This helps you decide what priority you want to give to the reactive task you are creating or editing.

6. Optionally, click Preview to see the dialog box that the scripted task will create.
7. Optionally, click Edit Script to begin writing the code for this scripted task.
8. Click Add. The script is added to the list in the Scripted Tasks window.
9. To save the script task as part of the scenario, save the scenario.
10. Write the code for the scripted task. For details, please see Chapter 17, [Writing Scripts for Scripted Tasks](#).

16.2.1. Specifying the Script ID

Each script must have a unique ID. VR-Forces generates a default ID, but it does not contain meaningful text. Therefore, you may want to change the ID.



The script ID is used internally by VR-Forces to manage how a scripted task is executed. If a scripted task is used in a plan, it is referenced by its script ID. If you change the ID, you must ensure that it is unique. You cannot edit the ID of a system scripted task.

To specify the script ID:

1. In the New Scripted Task (or Edit Scripted Task) dialog box, click the button to the right of the Script ID. The New Script ID dialog box opens.
2. Type the ID you want to use.
3. Click OK.

16.2.2. Specifying the Task Menu Icon

If you want to put an icon on the Task menu next to the menu text, you can specify one. (Does not apply to reactive tasks and background tasks.)

To specify a Task menu icon:

1. Click the Add button (📁) next to the Menu Icon label. The Select Menu Icon dialog box opens.
 2. Browse the directory structure and select the icon that you want to use.
 3. Click Open.
- To remove the Task Menu icon for a script, click the Remove button (➖) next to the Menu Icon label.

16.2.3. Specifying Task Parameters

Scripted tasks can take input parameters. When you specify parameters for a scripted task, VR-Forces automatically builds a dialog box that lets the user enter the parameter values. The parameter types that you can specify for a scripted task are as follows:

- ♦ Aggregate Formation. Provides a list of formations for aggregate entities.
- ♦ Altitude MSL. Altitude above mean sea level.
- ♦ Bomb Resource. Creates a list of bomb resources.
- ♦ Boolean. Creates a check box.
- ♦ Choice (List). Specifies choices presented in a drop-down list.
- ♦ Choice (Option Button). Specifies choices presented as a option (radio) buttons.
- ♦ DI-Guy Animation. Lets you select a DI-Guy animation.
- ♦ DI-Guy Appearance. Lets you select a DI-Guy appearance.
- ♦ Distance. Specifies a distance.
- ♦ Emitter. Entity emitter ID.
- ♦ Entity Type. Entity type enumeration.
- ♦ Force.
- ♦ Heading. Heading, in degrees.
- ♦ Integer. A whole number.
- ♦ Location (with altitude). Vector description of a location, in geocentric, including altitude.
- ♦ Location (without altitude). Vector description of a location, in geocentric, altitude not included.
- ♦ Munition Resource. Creates a list of munitions.
- ♦ Offset Location. Specifies an offset to the side, behind, and above, as in the Follow Entity task.
- ♦ Real. A floating point decimal number.
- ♦ Resource. Creates a list of available resources.
- ♦ Separator. Lets you put a separator in the generated dialog box. This is just for formatting purposes
- ♦ Simulation Object (Single). Lets you select one simulation object in a list window.
- ♦ Simulation Object (Multiple). Lets you select multiple simulation objects in a list window.
- ♦ Speed. Any kind of rate, such as speed, climb rate, and so on.
- ♦ String. An alphanumeric string.
- ♦ Time. Time in days:hours:minutes:seconds.
- ♦ Turn Rate. Turn rate in radians/second.

If a scripted task does not have any input parameters, it executes as soon as it is assigned to an entity, like the Wait command does.

To specify a parameter for a script:

1. Click the Add button (📄) above the Parameters list. The Add Parameter dialog box opens (Figure 16-3).

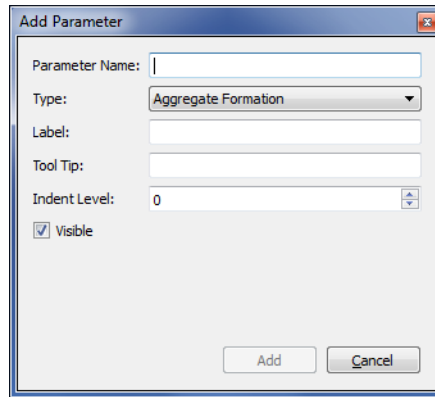


Figure 16-3. Add Parameter dialog box

2. Select the type of parameter from the Type list. If appropriate, the dialog box redisplay to request the details required for the variable type you selected.
3. Fill out the fields as follows:

All of the parameters have the following fields:

- Parameter Name. The name to be used by the Lua script for this parameter. For example, if you give a parameter the name **taskDestination**, in the Lua code for the scripted task, the parameter will be accessed as **taskParameters.taskDestination**.
- Label. This is the text used on the dialog box that is generated for the task. If you leave this field blank, the parameter name is used.
- Tool Tip. Optional text for a tool tip.
- Indent Level. The number of pixels to indent the parameter on the task dialog box. This allows you to apply some formatting to the dialog box.

- Visible check box. Specifies that the parameter be included on the scripted task dialog box. (You might want a parameter to be available in the code, but not have it set by a user when the scripted task is assigned.)

Many parameters let you specify a default value or state.

Some parameters let you specify a range for the acceptable values:

- Range Bottom. The lowest acceptable value for this parameter.
- Range Top. The highest acceptable value for this parameter.

The Boolean parameter type lets you create a check box. You can specify that the default be checked or unchecked.

For details about adding choices to a Choice parameter, please see [“Specifying Choices for the Choice Parameters,”](#) on page 16-12. For details about adding categories to a filtered list, please see [“Specifying Categories for a Simulation Object,”](#) on page 16-12.

Specifying Choices for the Choice Parameters

The Choice parameters require a list of choices, which get added to the dialog box as option buttons or as a list. You can add choices, edit them, and delete them.

To add a choice:

1. Click the Add Parameter button () on the Choice Box Values line. The New Choice dialog box opens.
2. Type the text for the choice.
3. Click OK.
4. Repeat this procedure for each choice that you want to have available. (The last choice added becomes the default choice.)

Specifying Categories for a Simulation Object

The Simulation Object parameter lets you build a list of categories on which to filter the display of entity types in a dialog box.

To add a category to the simulation object list:

1. Click the Add Parameter button () on the Filters line. The Choose Filter dialog box opens.
2. Select a filter from the Filters list.
3. Click OK.
4. Repeat the procedure to add as many filters as you want.

Editing the Category List for a Simulation Object Parameter

You can edit the list of filter categories for a Simulation Object parameter. The edit operation is essentially a replacement of the current category with a new one. You can achieve the same effect by deleting the current category and adding a new one.

To edit the list of filter categories in a Simulation Object parameter:

1. Select the parameter you want to edit in the Parameters list on the New Scripted Task dialog box.
2. Click the Edit button (✎). The Script Variable dialog box opens.
3. In the Filters list, select the filter that you want to edit.
4. Click the Edit button (✎). The Choose Filter dialog box opens.
5. Select the filter category that you want to use.
6. Click OK. The original category is removed and the new one is added.

To delete a category from a Simulation Object parameter:

1. Select the parameter you want to edit in the Parameters list on the New Scripted Task dialog box.
2. Click the Edit button (✎). The Script Variable dialog box opens.
3. In the Filters list, select the filter that you want to delete.
4. Click the Delete button (✖). The category is removed from the list.

16.2.4. Specifying the Task Menu Location

Scripted tasks get added to the Task menu, unless you specify that they not be shown (by clearing the Show Task on Task Menu check box). The default location is the top level of the menu. However, you will probably want to organize your tasks using the submenus provided by VR-Forces or in newly created submenus. The New Scripted Task dialog box displays the menu under which the scripted task is placed. It does not show the full path from the top level menu.



When you add a scripted task to a menu, it does not appear on the menu until you reload the scenario.

To specify a Task menu location for a scripted task:

1. Click the Edit button (✎). The Select Location on Task Menu dialog box opens (Figure 16-1).

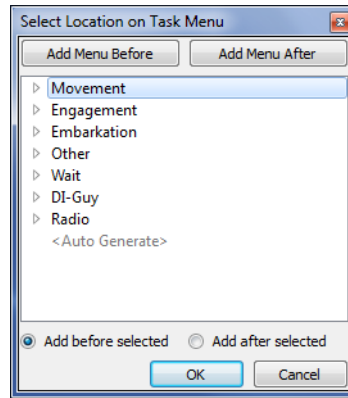


Figure 16-4. Select Location on Task Menu dialog box

2. To add the scripted task to an existing submenu:
 - a. Expand the submenu on which you want to put the task.
 - b. Select the task that you want the new task to be next to.
 - c. To put the new task above the selected menu item, select the Add Item Before Selected option. To put the new task below the selected menu item, select the Add Item After Selected option.
 - d. Click OK.
3. To create a new submenu for the scripted task:
 - a. Select the submenu next to where you want to add the new submenu.
 - b. To add the new menu before the selected submenu, click Add Menu Before. To add the new menu after the selected submenu, click Add Menu After. The New Menu Name dialog box opens.
 - c. Type a name for the new submenu.
 - d. Click OK.
 - e. Add the scripted task to the new submenu using the procedure in step 2.

16.2.5. Specifying Action Categories

Some VR-Forces tasks can run at the same time as other tasks, while some are mutually exclusive. This is called task concurrency. (For details about concurrent tasks, please see [“Concurrent Task Execution,”](#) on page 7-4.) The C++ tasks provided with VR-Forces are organized in groups to help manage concurrency. They are configured in `./data/simulationModelSets/<model_set>/vrfSim/taskRules/default-task-rules.task`.

In the New Scripted Task dialog box, these groups are represented as action categories. The action categories displayed in the Scripted Tasks dialog box are configured in `./data/simulationModelSets/<model_set>/vrfSim/taskRules/actionCategories.task`. (For details about configuring action categories, please see Section 10.8.1, [“Configuring Action Categories,”](#) in *VR-Forces Configuration Guide*.)

When you create or edit a scripted task you can specify which groups of tasks the new task can run concurrently with and which it will interrupt. By default, the Movement category is selected, which means that if you do not change the setting, the new task will interrupt movement tasks.

- To specify which tasks a scripted task will interrupt, in the Action Categories list, select the categories to interrupt. For example, if the new task involves movement, you probably want it to interrupt other movement tasks, so you would select the Movement category check box. If it is a new type of message task, you probably want to let it run concurrently with movement tasks, so you would clear the Movement category check box.

16.2.6. Configuring a Script’s Availability to an Entity Type

Scripted tasks can be available to an entity based on the following criteria:

- The task is available for certain entity types. For details, please see “[Specifying the Valid Entity Types for a Task](#),” on page 16-17.
- The task is part of a Behavior Set. For details, please see “[Specifying Availability by Behavior Set](#),” on page 16-18.
- The task is specified in a system definition. (For example, the Naval Mine Sweep task is available to entities with a Naval Mine Sweep system.) This state is not shown in the Edit Scripted Task dialog box. For details, please see “[Specifying a Scripted Task in a System Definition](#),” on page 16-18.

Availability by entity type and by Behavior Set is configured in the New Scripted Task and Edit Scripted Task dialog boxes. [Table 16-2](#) shows the interaction of these settings.

Table 16-2: Scripted task availability

Available by Entity Type	Available by Behavior Set	Availability
☒	☐	The script is available only to those entity types listed.
☐	☒	The script is available to all entities, but only if one of the selected behavior sets is applied to the entity’s force.
☒	☒	The script is available to the specified entity types, but only if one of the selected behavior sets is applied to the entity’s force.

Specifying the Valid Entity Types for a Task

You can restrict a scripted task to specific entity types. If you do this, the task will not appear on the Task menu when you select an entity for which it is not valid. Just as with built-in VR-Forces tasks, there are cases, such as for global plans, where VR-Forces cannot determine the entity context and the task will be available on the Task menu even though it is not appropriate to the entity that you are tasking. In those cases it is up to you to know that a task is valid.

To specify the valid entity types for a scripted task:

1. Select the Make Available Based on Entity Type check box.
2. Click the Add button (🔧) on the Valid for Entity Types line. The Entity Type dialog box opens (Figure 16-5). You can build an entity type enumeration by selecting options from the enumeration field lists or you can type in the enumeration directly.

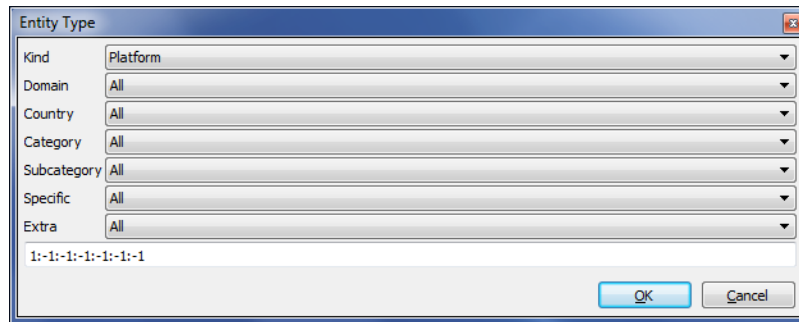


Figure 16-5. Entity Type dialog box

3. For each field of the entity type (Kind, Domain, Country, and so on), select an option from the list.

The options are drawn from the DIS Enumerations document. As you select an option, the enumeration at the bottom of the dialog box changes to reflect your choice. You do not have to make a selection for each field. VR-Forces uses wild carding to match entities against the final enumeration.

4. If appropriate, add additional enumerations for each entity type that is valid for the scripted task.

Specifying Availability by Behavior Set

You can restrict a scripted task to specific Behavior Sets. If you do this, the task will not appear on the Task menu when you select an entity whose force does not have the Behavior Set assigned to it.

To specify that a scripted task is available by Behavior Set:

1. Select the Make Available Based on Behavior Set check box.
2. Select each Behavior Set for which you want this scripted task to be available.



You must create the Behavior Sets before you can assign scripts to them. All available Behavior Sets are automatically listed in the dialog box window.

Specifying a Scripted Task in a System Definition

Some scripted tasks are available to entities because they are specified in a system that the entity uses. These tasks are not assigned to entity types as part of the scripted task meta data.



This method is used for many of the system scripted tasks supplied with VR-Forces.

Scripted tasks are specified in a system definition by their script IDs in the **script-ids** parameter. (In *AggregateLevel.sms*, some scripted tasks for combat engineering objects are specified in the **create-script-id**, **improve-script-id**, and **destroy-script-id** parameters.) Script IDs can be specified in a script-enable-controller and in controllers derived from it.

The following example is from *ground-aggregate-movement.sysdef* in *AggregateLevel.sms*. Any entity with this system definition can use the Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, and Move_To_Waypoint_Plan_Path scripted tasks. The variables described in the script-variables block are accessible to the script through the `vrf:getScriptAttribute()` function.

```
(script-enable-controller
  (component-descriptor-type "script-enable-controller-descriptor")
  ...
  (script-ids "Maximum_Speed_Modifier" "Halt_Movement"
    "Move_To_Location_Plan_Path" "Move_To_Waypoint_Plan_Path")
  (script-variables
    (maximum-speed-modifier-variables
      (script-id "Maximum_Speed_Modifier")
      (variables
        (DtRwReal Rain-Modifier-By-Intensity
          $rain-modifier-by-intensity)
        (DtRwReal Snow-Modifier-By-Intensity
          $snow-modifier-by-intensity)))))
```

```

        (DtRwReal Visibility-Degrades-When-Below
         $visibility-degrades-when-below)
        (DtRwReal Visibility-Can-Degrade-Speed-Up-To
         $visibility-can-degrade-speed-up-to)
    )
)
(move-to-location-variables
 (script-id "Move_To_Location_Plan_Path")
 (variables
  (DtRwString Obstacle-Feature-Query "MAK_OBSTACLE")
  (DtRwString Path-Feature-Query "MAK_ROAD")
 )
)
...
)
)

```

The following example is from the *aggregate-5-inch-gun.sysdef* in *AggregateLevel.sms*. It adds the **script-ids** parameter to the aggregate-indirect-fire-controller, which is derived from the script-enable-controller. Any entity with this system can use the Indirect Fire and Limited Munition Attack scripted tasks.

```

(weapon-indirect-fire
 (systems )
 (sensors )
 (controllers
  (aggregate-indirect-fire-controller
   (component-descriptor-type "aggregate-indirect-fire-controller-
descriptor")
   (component-type "aggregate-indirect-fire-controller")
   (min-tick-period -1.000000)
   (min-tick-period-variance -1.000000)
   (process-state-repository-name "aggregate-indirect-fire-
controller-process-state-repository-default")
   (process-state-repository-type "aggregate-indirect-fire-
controller-process-state-repository")
   (is-enabled True)
   (script-ids "Indirect_Fire" "Limited_Munition_Attack")
   (weapon-name "5 inch shell")
   ...
  )
 )
)

```

The following example is from *obstacle-builder.sysdef* and shows the **create-script-id** and **improve-script-id** parameter:

```

(creatable-objects
 (affectable-object
  (object-type 1 (16 1 0 62 3 0 0))
  (time-to-complete $time-to-create-abatis)
  (range $creation-range-abatis)
  (create-script-id "Construct_Abatis")
  (improve-script-id "Improve_Obstacle")
 )
 ...
)

```

16.2.7. Specifying the Programming Language for a Scripted Task

The Language list in the New Scripted Task dialog box has two options, Lua and C++. In most cases you will choose Lua and write a script to implement the scripted task. However, since the scripted task interface automatically generates task dialog boxes and updates the Task menu, it can be a convenient way to add the GUI component for new tasks that developers have written in C++ with the VR-Forces Toolkit. Developers who take this approach do not have to rebuild the VR-Forces front-end or write a plug-in to add their new task to the menu and code a task dialog box.



The Language option only applies to Task type scripted tasks. Reactive tasks and background processes are always written in Lua.

If a developer adds a new C++ task controller using this approach, it looks for the script ID of the scripted task. The Move (On Roads) tasks use the scripted task interface to create their dialog boxes. The addTask example in the VR-Forces Toolkit demonstrates this method of adding tasks. For more information, please see *VR-Forces Developers Guide*.

You can display C++ tasks in the Scripted Tasks dialog box by selecting the Show C++ Tasks check box (Figure 16-6).

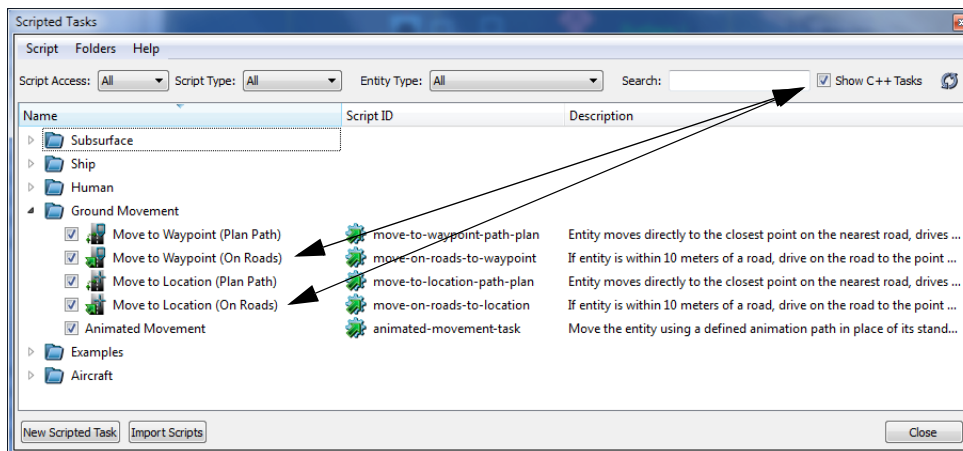


Figure 16-6. C + + tasks

16.2.8. Creating Reactive Tasks

The process for creating a reactive task is largely the same as for creating other scripted tasks. This procedure focuses on the differences.

To create a reactive task:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks dialog box opens (Figure 16-1).
2. If you have a folder hierarchy and want to create the script in a particular folder, select the folder. (For more information, please see “Organizing Scripted Tasks into Folders,” on page 16-25.)
3. Choose **Script** → **New Scripted Task**. The New Scripted Task dialog box opens (Figure 16-2).
4. In Script Type list, select Reactive Task. The New Scripted Task dialog box redisplay to show the metadata fields for a reactive task (Figure 16-7).

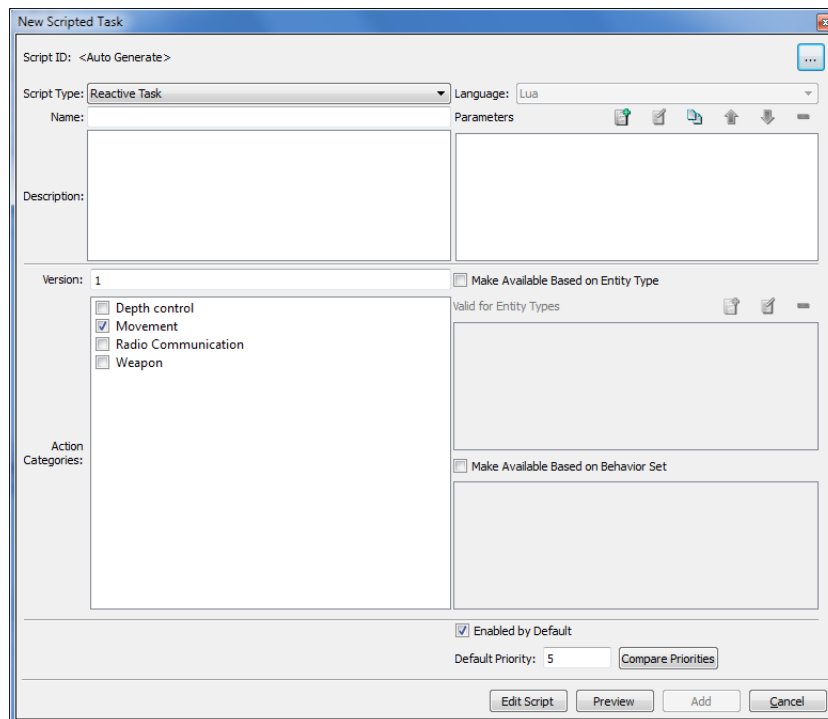


Figure 16-7. New Scripted Task dialog box, reactive task

5. Complete the fields in the dialog box. Fields that are common to all scripted tasks are described in Table 16-1.
6. To make this reactive task enabled by default, select the Enabled By Default check box.

7. In the Default Priority box, type the priority for this task. The lower the number, the higher the priority. To help you set the priority, you can view a list of all reactive tasks that are valid for the entity types of this task so that you can consider their relative importance and set an appropriate priority.
8. Optionally, click Compare Priorities to see a list of reactive tasks and their priorities.
9. Click Add.

16.2.9. Creating Background Processes

The procedure for creating a background process is essentially the same as for other scripted task types. The main difference is that there are fewer fields to complete in the New Scripted Task dialog box. For details about writing a background process script, please see “[Background Processes](#),” on page 17-28.

To create a background process:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks dialog box opens ([Figure 16-1](#)).
2. If you have a folder hierarchy and want to create the script in a particular folder, select the folder. (For more information, please see “[Organizing Scripted Tasks into Folders](#),” on page 16-25.)
3. Choose **Script** → **New Scripted Task**. The New Scripted Task dialog box opens ([Figure 16-2](#)).
4. In Script Type list, select Background Process. The New Scripted Task dialog box redisplay to show the metadata fields for a background process ([Figure 16-7](#)).
5. Complete the fields in the dialog box. Fields that are common to all scripted tasks are described in [Table 16-1](#).

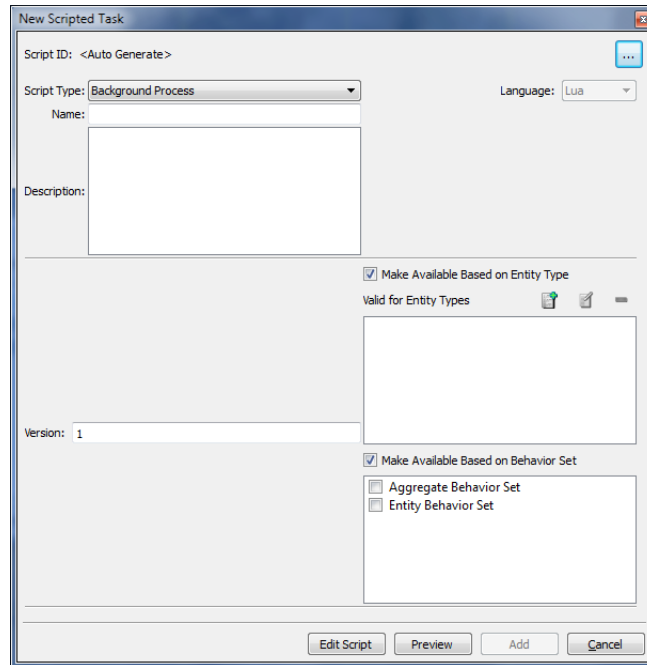


Figure 16-8. New Scripted Task dialog box, background process

6. Click Add.

16.3. Saving Scripted Tasks

When you create or edit a scripted task, its listing in the Scripted Tasks window is in italics, prefaced by an asterisk. When you save the scenario, or promote a scripted task to a system script, the scripted task gets saved and the italics and asterisk get removed.

It is likely that you will test scripted tasks by running a scenario and you will want to edit the scripted task as you find problems. If you create or edit a scripted task while a scenario is running and you decide to rewind the scenario without saving it (which would be normal behavior for rewinding a scenario), you are prompted to preserve the changes to the scripted task after the scenario rewinds. The scripted task is still not saved and you will, therefore, receive the standard “scenario modified” prompt when you start the scenario again. You do not have to save the scenario if the only thing that changed is the scripted task. You can continue to run the scenario and rewind while you are working on the scripted task. Eventually you will have to save the scenario if you want to save your changes to the scripted task.

- To save a scenario scripted task, save the scenario.
- To save a system scripted task, after updating the task in the Edit Scripted Task dialog box, click Update.

16.4. Editing a Scripted Task

You can edit scripted tasks.



If you edit a system scripted task, the changes will affect all scenarios that use the scripted task. You are responsible for ensuring that any changes have the intended results for all scenarios that are affected.

To edit the metadata for a scenario script:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the scripted task that you want to edit.



In the Script ID column the icon indicates the type of scripted task, Task () , Reactive Task () , or Background Process () .

3. Choose **Script** → **Scripted Task**, or double-click the script name. The Edit Scripted Task dialog box opens. (If you are editing a system scripted task, you are prompted to confirm that you want to edit it.)
4. Edit the metadata as desired.
5. Click Update.

16.5. Filtering the List of Scripted Tasks

You can filter the tasks listed in the Scripted Tasks dialog box by selecting options from the lists below the menu bar, as follows:

- Script Access: Show system scripts, scenario scripts, or all scripts.
- Script Type: Show scripted tasks, reactive tasks, or all scripted tasks.
- Entity Type: Show scripts that apply to the selected entity type.



This filter is based on the Valid for Entity Types list for each scripted task. Some scripted tasks do not have any entity types listed. These tasks, such as Drop Naval Depth Charge, become available to entities based on the systems that they have configured. Therefore, this list may be somewhat misleading in terms of the overall applicability of scripted tasks to the different platforms.

- Show C++ Tasks: Toggles the display of tasks that are written in C++, but whose GUIs are created using the scripted task mechanism.

16.6. Organizing Scripted Tasks into Folders

You can create folders and organize scripted tasks by folder.

16.6.1. Adding a Folder

To add a folder:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Choose **Folders** → **Add Folder**. The Folder Name dialog box opens.
3. Type a name for the folder.
4. Click OK.

16.6.2. Renaming a Folder

To rename a folder:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the folder that you want to rename.
3. Choose **Folders** → **Rename Folder**. The Folder Name dialog box opens.
4. Type a new name for the folder.
5. Click OK.

16.6.3. Deleting a Folder

You cannot delete a folder that has scripts in it.

To delete a folder:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the folder that you want to delete.
3. Choose **Folders** → **Delete Folder**.

16.6.4. Adding Scripted Tasks to a Folder

- To add a scripted task to a folder, drag it onto the folder.

16.6.5. Removing a Scripted Task from a Folder

- To remove a scripted task from a folder, drag it away from the folder.

16.7. Exporting and Importing Scripted Tasks

Scenario scripts are saved in a scenario's SPT file, not as individual scripts. If you want to make a scenario script available to other scenarios, but you do not want to save it as a system script, you can export the script from the scenario in which you created it and import it into any other scenario. You can export multiple scripts to one file as a script “package”.



You cannot add or remove scripted tasks from a script package. To change the contents you would have to create a new package.

If scripted tasks are organized in folders, when you save them the folder structure is also saved.

To export scripted tasks:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the scripts that you want to export. (The window supports typical methods for selecting multiple entries in a list.)
3. Choose **Script** → **Export Script Package**. The Choose Script File dialog box opens. By default it opens in *./userData/taskScripts*.
4. Type a name for the scripts file.
5. Click Save. The scripts gets saved to a file with the extension *.spt*. The file contains the metadata and the script code.

16.7.1. Importing a Scripted Task Package

If you import a script package that has multiple scripted tasks, you can choose which scripted tasks to import. Scripts get imported with the folder hierarchy that they were saved in.

To import scenario scripted tasks:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens (Figure 16-1).
2. Choose **Script** → **Import Script Package** or click Import Scripts. The Choose Script File dialog box opens.
3. Select the script file that you want to import.
4. Click Open. The Import dialog box opens (Figure 16-9). It lists the scripted tasks saved in the script file.

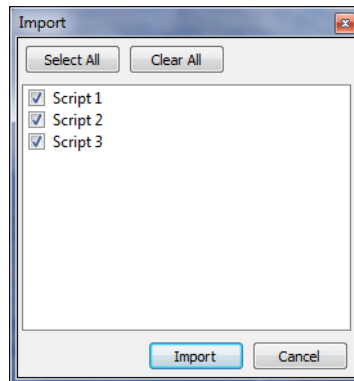


Figure 16-9. Import dialog box

5. Select the scripted tasks that you want to import.
6. Click Import.

16.8. Copying a Scripted Task

If you want to create a new script that is similar to an existing one, you can copy an existing script and then edit it for its new purpose.

To copy a scripted task:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the scripted task that you want to copy.
3. Choose **Script** → **Duplicate**. The New Scripted Task dialog box opens. If you copied a scenario scripted task, the duplicate script is assigned a new script ID. If you copied a system script, the script ID is not changed. You will have to change the script ID manually.



If you do not change the script ID for a copied system scripted task, the system scripted task gets removed from the list of scripted tasks for this scenario and the new scripted task is added as a scenario scripted task. This lets you experiment with changes to a system scripted task without actually changing it. The original system scripted task will still be available to other scenarios.

4. Edit the script.
5. Click Duplicate. The script is added to the list.

16.9. Deleting a Scripted Task

If you delete a scripted task that is assigned to an entity in the scenario, the task assignment, whether as an independent task or as part of a plan, will fail. If the scripted task is used as a subtask in another scripted task, that scripted task will fail. VR-Forces does not warn you if either of these cases exist. It is your responsibility to consider the effects of deleting a scripted task.

To delete a scripted task:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the scripted task that you want to delete.
3. Choose **Script** → **Delete Scripted Task**.

16.10. Creating a System Scripted Task

To create a system scripted task, you create a scenario scripted task and then save it as a system scripted task. System scripted tasks are saved in `./data/simulationModelSet/<model_set>/scripts`. A system scripted task has two files. The metadata is saved in a file ending with the extension `.xml`. The code is saved in a file with the extension `.lua`.

To save a scenario scripted task as a system scripted task:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Select the scripted task that you want to save as a system scripted task.
3. Choose **Script** → **Promote to System Scripted Task**. You are prompted to confirm the change.
4. Click Yes.

16.10.1. Including System Scripted Tasks on the Task Menu

Most of the system scripted tasks included with VR-Forces are listed on the Task menu. The scripted tasks in the Examples folder and a few other tasks are not listed. You can specify whether or not particular scripted tasks are listed. You might want to do this to reduce clutter on the Task menu. Or you might want to limit the tasks available to players in a particular deployment of VR-Forces.

A system scripted task's inclusion on the Task menu is controlled by the following settings:

- ♦ The Show Scripted Task on Task Menu check box on the New Scripted Task and Edited Scripted Task dialog boxes.
- ♦ The check box next to the scripted tasks entry on the Scripted Tasks dialog box ([Figure 16-10](#)).
- ♦ Its membership in a behavior set. The effect of behavior sets on task availability is additive to the configuration discussed in this section. For details about using behavior sets, please see [“Using Behavior Sets to Manage Scripted Tasks,”](#) on page 7-18.

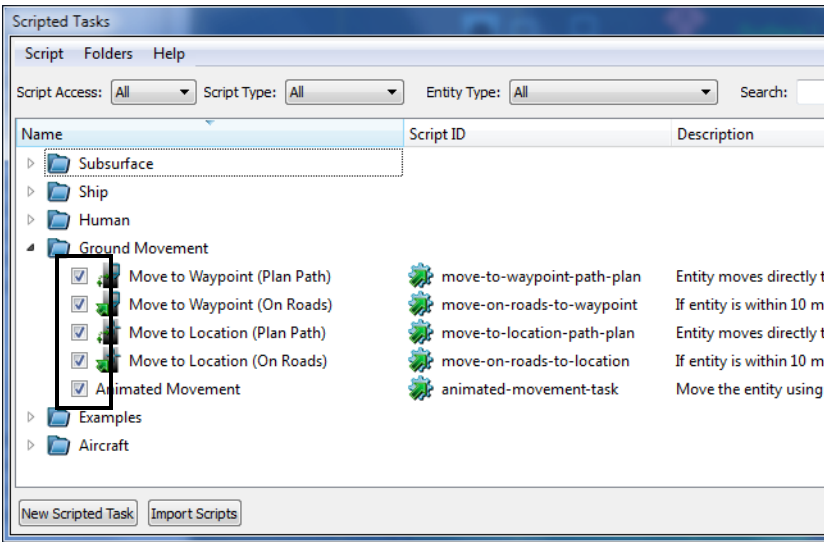


Figure 16-10. Show scripted task on Task menu check box

Table 16-3 shows when a scripted task is listed on the Task menu based on the configuration check boxes selected.

Table 16-3: System scripted task inclusion on Task menu

Show Scripted Task on Task Menu check box	System scripted task list check box	Task included on Task menu
☒	☒	Yes
☒	☐	No
☐	☒	Yes, for this scenario.
☐	☐	No

To specify the availability of a system scripted task on the Task menu:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens (Figure 16-1).
2. In the list of system scripted tasks, select the scripted task whose availability you want to change. Use Table 16-3 to determine which check box configuration you need for your desired Task menu status.
3. Choose **Script** → **Scripted Task**. The System Script Editing prompt opens. (If you have disabled this prompt, the Edit Scripted Task dialog box opens. Skip to step 5.)
4. In the System Script Editing prompt, click Yes. The Edit Scripted Task dialog box opens.
5. Select or clear the Show Scripted Task on Task Menu check box.

6. Click Update.
7. In the list of scripted tasks, select the check box next to the system scripted task you are editing to make it available. Clear the check box to make it unavailable.

16.11. Specifying a Script Editor

VR-Forces installs SciTE as the default script editor for scripted tasks. However, you can use any text editor that you want.

To specify the editor to use for scripts:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the Scripted Task Options page ([Figure 16-11](#)).

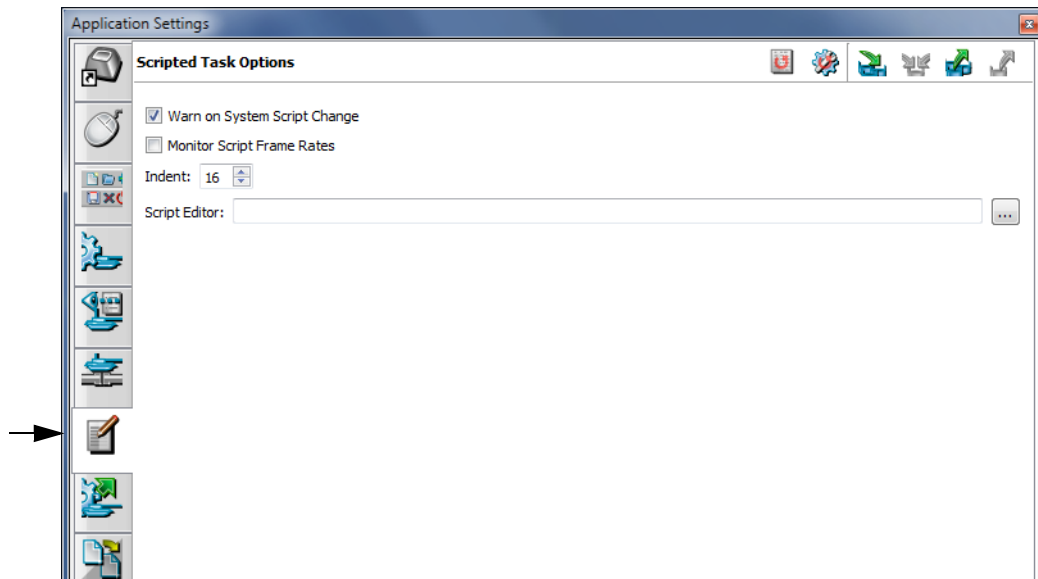


Figure 16-11. Scripted Task Option page

3. Click the Browse button (...) next to the Script Editor box. The Choose Script Editor dialog box opens.
4. Select the application that you want to use as the editor.
5. Click Open.

16.12. Editing Lua Files

To edit the scripts for scenario scripted tasks you need to work through the Scripted task GUI because the scripts are embedded in the scenario scripts file rather than being saved as individual Lua files. System scripts are saved as Lua files, but even in this case it is better to edit them in the context of the entire scripted task rather than by editing the Lua file. However, VR-Forces includes some libraries of Lua functions that are independent of any of the scripted tasks. They are available to be included in your scripted tasks. If you want to edit the functions in these libraries or add to them, you need to edit the individual Lua files. The function libraries are in *./userData/scripts*. You can open them in any editor, or access them through the Scripted Tasks dialog box.

To edit a Lua file from the Scripted Task dialog box:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks window opens ([Figure 16-1](#)).
2. Choose **Script** → **Edit External Script**. A file chooser dialog box opens.
3. Select the script that you want to edit. The file opens in a text editor.
4. Edit the file.
5. Save the file.



17. Writing Scripts for Scripted Tasks

This chapter explains how to write Lua scripts for scripted tasks.

The VR-Forces Lua Interface	17-3
Lua Classes	17-3
Lua Modules	17-4
Script Loading and Execution	17-5
Script Entry Points	17-5
The Scripted Task Execution Sequence.....	17-7
Limitations for Checkpointing Scripted Tasks	17-10
Editing Scripted Tasks While a Scenario is Running.....	17-12
Tasks and Subtasks.....	17-13
Monitoring the Status of Tasks and Subtasks	17-14
Stopping Tasks	17-14
Task Parameters.....	17-14
Geometry.....	17-16
Location3D	17-16
Vector3D.....	17-16
VectorOffset3D	17-18
VectorGeoc3D	17-18
Reserved Words	17-19
Coding Messages for Translation.....	17-20
Error Detection.....	17-20
Interactive Scripts	17-21
A Basic Scripted Task.....	17-22
Create and Move to Waypoint Metadata	17-23
The Create and Move To Waypoint Lua Script.....	17-25

Writing Scripts for Scripted Tasks

A Simple Reactive Task	17-27
Background Processes	17-28

17.1. The VR-Forces Lua Interface

The VR-Forces Lua interface provides pre-defined elements that you can use to create scripts. These elements include object classes that represent the simulation, simulated objects, and geometric objects, plus Lua modules that provide tools for common tasks.

The classes and functions in the Lua interface are documented in the VR-Forces Lua API Documentation. This is a set of HTML files similar to the VR-Forces Toolkit documentation. It is accessible from the Windows Start menu or in `./doc/luadoc/index.html`.

17.1.1. Lua Classes

The Lua interface defines classes for common objects and functions. The classes in the interface are not fully featured classes as in the C++ language, but they do abstract the representation of information associated with an object and collect a set of methods related to the object. In Lua, to call a method `fn` on object `obj`, write:

```
obj:fn()
```

Several of the classes defined in the interface do not have constructors, because their objects are pre-defined or created only as return values to other functions. The classes and pre-defined objects in the interface are as follows:

- ♦ *vrf*. *vrf* is defined as a global object for all Lua scripts. It is an instance of a class that represents the Lua interface; other instances cannot be created in a script. The *vrf* object provides functions that control and access information in the VR-Forces simulation.
- ♦ *SimObject*. *SimObject* is a class that represents simulation objects in VR-Forces. There is no constructor for *SimObjects* in the interface, but there are *vrf* functions that create objects, that get objects by name, that get nearby objects, and so on. *SimObject* methods are provided for getting information about the object such as location, force type, and embarkation status.
- ♦ *this*. *this* is an object of class *SimObject* that is defined for all Lua scripts. It represents the entity running the script, also known as “ownship”. It is not possible to construct a *this* object in a script. In addition to being able to use all of the *SimObject* methods, a Lua script can change the location and heading of *this*, manipulate its resources, and examine the contacts detected by the entity’s sensors.
- ♦ *Location3D*, *Vector3D*, *VectorGeoc3D*, *VectorOffset3D*. These classes represent geometric objects. For more information, please see “Geometry,” on page 17-16.
- ♦ *FeatureSet*. This class represents a set of features obtained from a query to the terrain database. A *FeatureSet* is created with a *vrf* query function. *FeatureSet* methods allow a script to examine the features to determine their attribute values, vertex locations, and so on.



In Lua, variables assigned to objects actually just hold a reference to an object, so that if one variable is assigned to another they will both hold a reference to the same object. In the following example, `firstObj` and `secondObj` refer to the same object.

```
firstObj = getObjectByName("APC 1")
secondObj = firstObj
```

In most cases this is what a Lua programmer wants. However, for the geometric objects, a Lua programmer may sometimes want to make a copy of an object. A simple assignment does not make a copy in Lua, so the geometric objects have `makeCopy()` methods to provide copies.

17.1.2. Lua Modules

The Lua interface includes Lua modules for use in Lua scripts. A module `stuff` can be accessed in a Lua script by writing

```
require "stuff"
```

The modules available in the interface are as follows:

- ♦ *vrfutil*. Technically, *vrfutil* is not a Lua module. (It is not defined with a module function.) It is just a set of global utility functions. The Lua script template that opens when a new script is created contains:

```
require "vrfutil"
```

so that these functions are available to the script by default.
- ♦ *fsm*. The *fsm* module defines a class that implements finite state machine logic. There is one function in this module, `new()`, which creates an *fsm* object.
- ♦ *exectool*. The *exectool* module is a package of functions that supports the use of a single Lua function to describe the control flow of a scripted task. To use this tool, the task logic is described in a function we call a `scriptFunction`. This function is written as if it will execute up to a subtask invocation, and then wait until that subtask is completed before continuing.

The *.lua* module files are located in *./userData/scripts*. You can add user-created modules to this directory and then import them into scripts with a `require` statement.

17.2. Script Loading and Execution

This section describes script entry point functions and the execution sequence for scripted tasks. It also describes how VR-Forces checkpoints scripted tasks and executes them when a checkpointed scenario is run.

17.2.1. Script Entry Points

The Lua API includes functions that we call “entry points” to a scripted task. When you create a new script, they are included in the default script template. Unlike the Lua functions that you might write as part of a script, you do not have to call entry point functions from within the script. They are called by the simulation engine. (However, if an entry point function is not defined in a script, it does not get called.)

- ♦ `init()`. Use `init()` to set up the initial state of your scripted task’s environment. The `init()` function is the first function called when a scripted task is executed. It is called when a task is assigned to an entity, even if the scenario is paused. It is never called again for the life of the scripted task.
- ♦ `tick()`. The `tick()` function is the heart of every scripted task. It is called at every tick of the simulation engine once the entity has completed its initialization. Most of a scripted task’s logic should be written into the `tick()` function as it is the only entry point function consistently called in the script.
- ♦ `suspend()`. The `suspend()` function gets executed when a reactive task is triggered for an entity and the reactive task cannot run concurrently with the current task. The typical behavior, as embodied in the scripted task template, is to stop all tasks and subtasks.
- ♦ `resume()`. The `resume()` function gets executed when a reactive task completes. The typical behavior is to reinitialize the suspended task.

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As you can see from their descriptions, the `suspend()` and `resume()` functions do not exactly suspend and resume tasks as those terms are commonly understood. In most cases (this is task dependent), VR-Forces does not preserve the state of an entity's tasks when they are suspended, it stops the tasks. Nor does it resume the previous task from the point at which it was suspended, it restarts the task from the current state of the entity. However, VR-Forces always saves the lua state of scripted tasks, so when a scripted task resumes, its variables may need to be reset in `init()` or `checkInit()`.

- ♦ `saveState()`. If a script is running, the `saveState()` function is called just before a scenario is about to be saved. VR-Forces automatically saves the state of script execution. (For details, please see [“Limitations for Checkpointing Scripted Tasks,”](#) on page 17-10.) This function lets you do any additional processing to save the state of your scripted task. Most scripts do not use this function.
- ♦ `loadState()`. If a script was running when a scenario was saved, the `loadState()` function is called just after a scenario is loaded or rewound. VR-Forces automatically restores the state of a scripted task that was running when a scenario was saved. This function lets you do any additional processing required to restore the state of the script. If your script uses the `saveState()` function, you probably want to include complementary processing in `loadState()`. Most scripts do not use this function.

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If your `loadState()` function assumes the presence of other entities, you must take into account that other entities might not have loaded yet when the function is called.

- ♦ `shutdown()`. The `shutdown()` function is called when the task is ending for any reason. You will not typically need to write any code in this function, however it is available if there is a case in which you want to do anything before the task ends.
- ♦ `receiveTextMessage()`. The `receiveTextMessage()` function is called when the entity executing this task receives a text message. The function provides some data to determine what the text message is and which entity the text message came from.

The following script entry points are only used in reactive tasks:

- ♦ `check()`. The `check()` function defines the condition under which the reactive task gets triggered. It keeps checking the condition until it becomes true, at which point it starts the reactive task.
- ♦ `checkInit()`. The `checkInit()` function initializes the reactive task when it is enabled. It sets the initial conditions for the `check()` function. `checkInit()` runs when a reactive task is first enabled and runs again after the reactive task completes so that it can begin checking the condition again.

17.2.2. The Scripted Task Execution Sequence

A Lua script has several distinct sections, including the entry points described in “[Script Entry Points](#),” on page 17-5 and the global commands in the script. When a scripted task is assigned to an entity, the following actions happen, even if the scenario is paused:

1. The script environment is initialized. This step defines the *vrf* and *this* objects and all of the class functions in the Lua API.
2. The script text is loaded. All Lua statements in the global scope are executed. Normally, the script defines (assigns initial values to) global variables here.
3. The `init()` function is called.

This sequence is followed whenever a scripted task is assigned, including the following situations:

- ♦ A scripted task is assigned while the scenario is running.
- ♦ An entity has a script assigned at the beginning of a scenario and the scenario is loaded or rewound.
- ♦ You modify the script or script metadata while the script is running.

If the simulation is running, after the `init()` function is called VR-Forces begins calling the `tick()` function at the period specified by the `setTickPeriod()` function (default: 0.5 seconds).

Suppose a script “test” contains the following code:

```
print("Global statements")
t = {}
function init()
    print("Init function")
    vrf:setTickPeriod(0.5)
    t[1] = 0
end
function tick()
    table.insert(t, vrf:getExerciseTime())
    print("Tick ", #t)
end
```

If script is assigned to an entity and then the scenario runs for a short time, the console output would be as follows:

```
Global statements
Init function
DtCgfDispatcher::controlScenario: run
Tick 2
Tick 3
Tick 4
DtCgfDispatcher::controlScenario: pause
```

[Figure 17-1](#) illustrates the control flow for a scripted task.

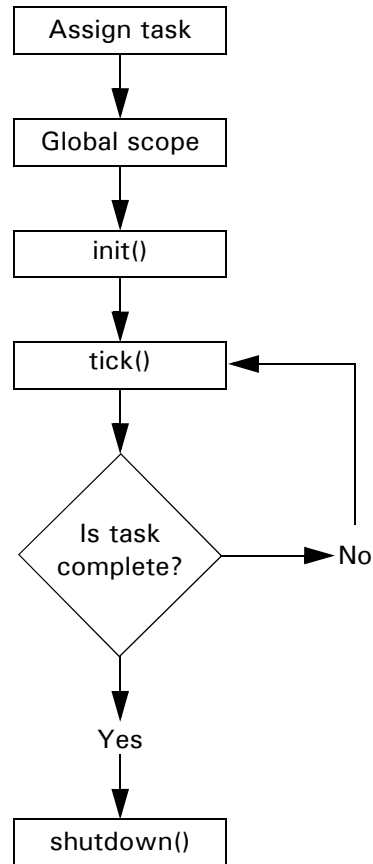


Figure 17-1. Scripted task control flow

The Script Execution Sequence for Reactive Tasks

[Figure 17-2](#) illustrates the script execution sequence for reactive tasks. It is distinguished from that for scripted tasks by the addition of the checking process.

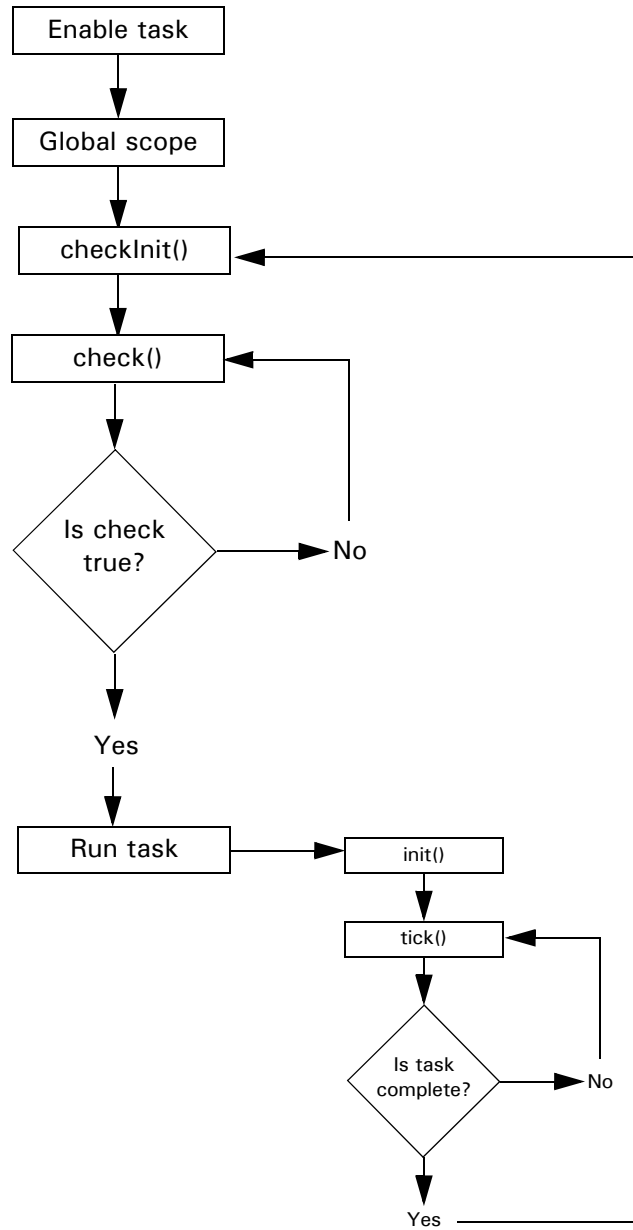


Figure 17-2. Reactive task control flow

The Script Execution Sequence for Saved Scenarios

When a scenario is saved (checkpointed), VR-Forces first runs `saveState()` and then saves the Lua state in the scenario file. (Checkpointing a scripted task has some limitations. For details, please see [“Limitations for Checkpointing Scripted Tasks,”](#) on page 17-10. For general details about checkpointing, please see [“Saving a Scenario,”](#) on page 1-22.) When a saved scenario is loaded, the following steps are taken to restore the scripted task:

1. The script environment is initialized. This step defines the *vrf* and *this* objects and all of the class functions in the Lua API.
2. The script text is loaded. All Lua statements in the global scope are executed. Global variables defined and initialized in this part of the script are re-initialized.
3. VR-Forces restores the values of global variables to the saved values. These values replace the initial values assigned in step 2.
4. The `loadState()` function is called.



The `init()` function is not run when a scenario is reloaded.

Assume that the “test” scripted task described in the previous section is saved at the point shown in the sample code (`t = 4`). When the scenario is run from the checkpoint, the console output will be as follows:

```
DtCgfdDispatcher::controlScenario: run
Tick 5
Tick 6
DtCgfdDispatcher::controlScenario: pause
```

17.2.3. Limitations for Checkpointing Scripted Tasks

When VR-Forces saves (or checkpoints) a scenario, it saves the following aspects of the Lua state in the checkpoint:

- The values of global variables that contain strings, numbers, and objects (of the classes listed in [“Lua Classes,”](#) on page 17-3).
- Tables, but only table values that contain strings, numbers, objects, and tables. Tables cannot contain values that refer to the same table, either directly or indirectly through another table.

The following aspects of the Lua state do not get saved in a checkpoint:

- Variables containing functions or threads.
- Variables declared in the global scope with the keyword `local` preceding the declaration.
- Table entries that do not use numbers or strings as keys.

Lua scripts that contain elements that do not get saved can still be restored after a checkpoint if the global statements in the script reset the elements. For example, a variable containing a function will not be saved in the scenario file, but if this variable is initialized in the global Lua statements, it will be reset when those statements are loaded. However, if the value of this variable was changed during script execution (in the `init()` or `tick()` functions), then its value will not be restored correctly.

Tables that reference themselves in the table do not get saved properly.

To demonstrate how scripted tasks get saved, assume the following script:

```
print("Global statements")
a = 0
t = {foo = 0, bar = 1}
f = function () print("hello") end
function init()
    print("Init function")
    vrf:setTickPeriod(0.5)
    a = 100 -- change a
    t.foo= 10 -- change t.foo
    t.bar = nil -- remove t.bar
    f = function () print("world") end -- change f
end
function tick()
    print ("Tick. a = ",a, "t.foo = ", t.foo, "t.bar = ", t.bar)
    f()
    print()
end
```

The output the first time the scripted task runs is as follows:

```
Global statements
Init function
DtCgfDispatcher::controlScenario: run
Tick. a = 100      t.foo = 10      t.bar = nil
world
```

When the scenario is saved and then reloaded, and the simulation is run again, the following is printed:

```
DtCgfDispatcher::controlScenario: run
Tick. a = 100      t.foo = 10      t.bar = 1
hello
```

A comparison of the outputs reveals that variable `a` and table entry `t.foo` were restored to the correct values. However, table entry `t.bar` and function `f` were re-initialized in the global statements, but were not restored to the values they had when the scenario was saved.

17.2.4. Editing Scripted Tasks While a Scenario is Running

You can add, remove, and edit scripted tasks during scenario creation or while a scenario is running. If a scripted task is not being used by any entities, editing or deleting it has no effect on the scenario. If you change a scripted task that is being executed by an entity, when you save the change the scripted task may be stopped, restarted, or continue to execute depending on what has changed.

[Table 17-1](#) lists the effect on scripted tasks and scripted tasks running as subtasks if you edit the code or metadata:

Table 17-1: Side effects of editing scripted tasks

Change to scripted task	Result
Change code or any metadata except the script ID. Entity type is still supported.	The task restarts. Changes to the Action Category take effect when scenario restarts.
Entity types supported changes.	The task stops for entities that no longer support it.
Script ID changes.	The task continues to execute. Any other script that uses this scripted task (as a subtask) will fail until its code is updated to use the new script ID.

If you changed the entity types that can use the scripted task, then it will be added to or removed from the Task menu for the appropriate entity types. (This change takes place immediately.)

17.3. Tasks and Subtasks

The primary way that a scripted task carries out actions is through starting subtasks for the entity running it or sending tasks to other entities. All C++ tasks and other scripted tasks are available for sending as subtasks or tasks.

If a scripted task needs to give a task to the entity that is running it, it does so as a subtask. (The entity's current task is the scripted task itself, so any action that it needs to take is a subtask to the scripted task.) Subtasks are started using the `vrf:startSubtask()` function.

If a scripted task needs to give a task to an entity other than the one running it, it uses the `vrf:sendTask()` function.

A `startSubtask()` or `sendTask()` function specifies the task name and task parameters, if any. The name must be the name of one of the C++ tasks, as listed in the Task page of the Lua API Documentation, or the script ID of another scripted task.

The task parameters are passed as a Lua table, with parameter names as the indices and the parameter values as the values. The valid parameters for C++ tasks are also listed in the Task page. For scripted tasks, the parameter names are the parameter names defined for that task. You can view them by opening a scripted task in the Edit Scripted Task dialog box. Any parameters that are not specified when starting the task use their default values.

The following example subtask gives a Move To Waypoint task to the entity running the scripted task:

```
vrf:startSubtask("move-to", {destination = "Waypoint 1"})
```

i

If a task does not have any parameters, `startSubtask()` must represent the parameters as `{}`. For example:

```
vrf:startSubtask("wait", {})
```

The following example task sends a Patrol Between Waypoints task to the entity named "someEntity":

```
vrf:sendTask(someEntity, "patrol-two-points",  
  {first_control_point="Waypoint 1", second_control_point="Waypoint 2"})
```

If a task is started with an invalid name or invalid parameters, a runtime error will occur in the script.

Whenever a task or subtask is started, a task ID integer is returned. This task ID is used to monitor or stop the task.

i

If a task is started on an entity that cannot execute it, the task will enter the Complete (failed) state shortly after the start call is made. This may not happen until a subsequent tick of the scripted task.

17.3.1. Monitoring the Status of Tasks and Subtasks

Once a task is started, the scripted task that started it can monitor it using its task ID. A task can be in one of three states: Running, Complete, or Canceled, as follows:

- ♦ Running. The task was started, but has not completed or been canceled.
- ♦ Complete (success). The task has completed, and called `endTask(true)` to end itself.
- ♦ Complete (failure):
 - The task has ended itself by calling `endTask(false)`.
 - The task failed to start because the entity was incapable of executing this task.
- ♦ Canceled:
 - The task was explicitly canceled using `stopTask()`.
 - The task was replaced by a conflicting task.
 - The user issued a Skip Task.



The success or failure of task completion is defined by the task being executed, and may not be consistent between task types.

Subtasks are monitored with the functions:

- ♦ `isSubtaskComplete(taskID)`
- ♦ `subtaskResult(taskID)`
- ♦ `isSubtaskRunning(taskID)`
- ♦ `isSubtaskCanceled(taskID)`.

Tasks are monitored with the functions:

- ♦ `isTaskComplete(taskID)`
- ♦ `taskResult(taskID)`
- ♦ `isTaskRunning(taskID)`
- ♦ `isTaskCanceled(taskID)`.

17.3.2. Stopping Tasks

Any task or subtask that has been started from a scripted task can be stopped by that task before it has completed. This is done using `stopTask(taskID)` or `stopSubtask(taskID)`.

17.3.3. Task Parameters

Task parameters are the parameters that are gathered from the user, or set by a parent task, when a task is started. They are passed into the new task when it starts.

For scripted tasks, the task parameters are available in a Lua table named `taskParameters` available in the global scope. The table contains items named using the parameter names specified in the parameters section of the Scripted Task dialog box when the task was created. The types of these parameters depend on the parameter types selected by the user in this dialog box. [Table 17-2](#) lists the parameter types you can specify when you create a scripted task and the corresponding Lua types in the `taskParameters` table.

Table 17-2: Task parameters and Lua types

Parameter Type	Lua Type
Aggregate Formation	String
Altitude MSL	Number (meters)
Bomb Resource	String (resource name)
Boolean	Boolean
Choice (List)	Number (Index of the option chosen)
Choice (Option Button)	Number (Index of option chosen)
DI-Guy Animation	String
DI-Guy Appearance	String
Distance	Number (meters)
Emitter	Number (Index of the emitter system)
Entity Type	String (DIS type enumeration, colon separated)
Force	String
Heading	Number (radians)
Integer	Number
Location (with altitude)	Location3D
Location (without altitude)	Location3D
Munition Resource	String (resource name)
Offset Location	VectorOffset3D
Real	Number
Resource	String (resource name)
Simulation Object (Single)	SimObject
Simulation Objects (Multiple)	Table of SimObjects
Speed	Number (meters / second)
String	String
Time	Number (seconds)
Turn Rate	Number (radians / second)

17.4. Geometry

The Lua interface includes classes representing geometric objects. The classes represent locations and vectors in three dimensional space. Different classes are defined for vectors in different contexts so that functions that manipulate them know what their context is and can convert between contexts automatically. Therefore, a script does not have to, for example, create rotation matrices to perform coordinate transformations between vectors that are in an entity-body context and vectors that are in a world context.

17.4.1. *Location3D*

A *Location3D* represents a point in three-dimensional (3D) space. Scripts can access the three components of the location as latitude, longitude, and altitude. There is no other access to components in any other coordinate system. Methods are available to construct a *Location3D*, to create a vector from the difference between two locations, and to generate a new point by adding a vector to a location.

17.4.2. *Vector3D*

A *Vector3D* is a direction in a north-east-down coordinate system. Scripts can access these three components of a *Vector3D*, or access bearing-inclination-range (Figure 17-4). This is the type of vector that scripts will use most often to find directions between locations, to create new locations relative to other locations, and so on.

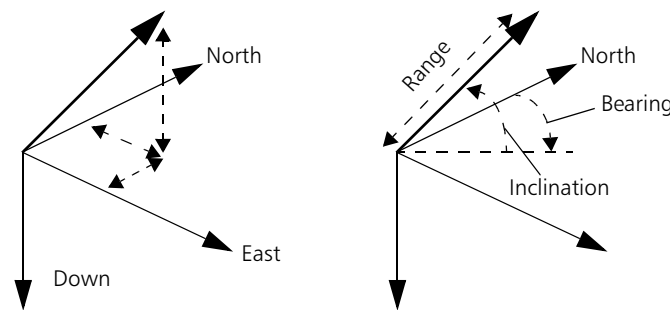


Figure 17-3. Vector3D: North-East-Down, or Bearing-Inclination-Range

When viewed from the perspective of a 3D Cartesian coordinate system that is fixed to the earth, there is no single north-east-down coordinate system. This is because “north” and “east” directions vary depending on where the observer is located on the earth. The *Vector3D* is therefore similar to a vector in topographic coordinates. At higher latitudes, “north” for two different entities may not be the same direction (for example, two planes near the north pole, but at different longitudes, that are both flying “north,” are not on parallel courses).

Figure 17-3 shows two north-east-down coordinate systems with origins at different locations on the earth. The coordinate systems have different orientations with respect to a coordinate system fixed to the earth.

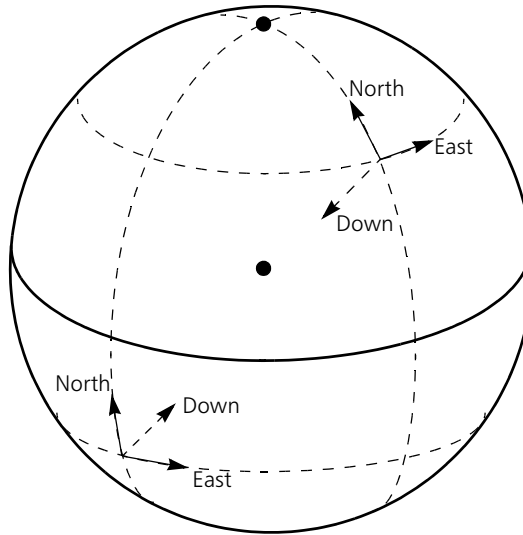


Figure 17-4. Coordinate systems with different origins

A *Vector3D* is not strictly a vector, in that it is not a straight line in a Cartesian coordinate system fixed to the earth. Just as the direction “east” changes (viewed in the Cartesian coordinate system) to follow the curvature of the earth, so does a *Vector3D*. This definition is different from topographic coordinates, which are Cartesian coordinates fixed to a point on the surface of the earth. Implications of this definition include the following:

- ♦ The heading of a *Vector3D* from one location to another is the heading of the shortest route around the earth (the great circle route) between the locations. The length is the great circle distance.
- ♦ The inclination of a *Vector3D* between two locations with the same altitude is 0.0, even when one location is over the horizon from the other.
- ♦ A *Vector3D* with length equal to the circumference of the earth, and inclination 0.0, when added to a location on the surface of the earth will produce a location coincident with the first location.

17.4.3. *VectorOffset3D*

A *VectorOffset3D* is a set of three values that define an offset from some reference direction defined by a *Vector3D*. The three values represent *right-forward-up*, where:

- ♦ *forward* is in the same direction as the reference.
- ♦ *right* is to the right in a horizontal plane. Horizontal means the plane defined by an inclination of zero; this definition implies that the “roll” component of the reference direction is assumed to be zero.
- ♦ *up* is perpendicular to *forward* and *right*, that is, *right* X *forward*.

A *VectorOffset3D* is appropriate to use, for example, to define the offsets of entity formation positions from a central location. Actual formation positions could be generated by transforming the offsets to *Vector3Ds* using the direction vector of the entity, and then adding the *Vector3Ds* to the entity location.

17.4.4. *VectorGeoc3D*

A *VectorGeoc3D* is a vector in a Cartesian coordinate system fixed to the earth (geocentric coordinates). The actual coordinate meanings and values are not accessible to the script, because they are considered to be abstract. A *VectorGeoc3D* can be generated only by taking the difference of two locations, or by transforming a *Vector3D* at a particular location.

A *VectorGeoc3D* between two locations is the line-of-sight vector between the locations. Therefore:

- ♦ A *VectorGeoc3D* between two points on opposite sides of the earth, at the same altitude, will go through the earth. (A *Vector3D*, by contrast, will go around the earth parallel to the surface.)
- ♦ The angle between two *VectorGeoc3D* vectors corresponding to north for two entities near the north pole will be the difference in their longitudes. (The angle between their *Vector3Ds* for north, by contrast, will be zero.)

The Lua interface does not have any simulation functions that require *VectorGeoc3Ds*. However, they may be manipulated to compute angles and so forth.

17.5. Reserved Words

Table 17-3 lists reserved words (in addition to those reserved by Lua), which should not be used except for their intended purpose.

Table 17-3: Reserved words

Name	Module	Function
vrf	vrf	Module singleton
this	SimObject	Ownership name
ScriptVrfObject	SimObject	Class name
Location3D	Location3D	Class name
Vector3D	Vector3D	Class name
VectorGeoc3D	VectorGeoc3D	Class name
VectorOffset3D	VectorOffset3D	Class name
ScriptFeatureSet	FeatureSet	Class name
vrfprint	vrfutil	Global function
printDebug	vrfutil	Global function
printVerbose	vrfutil	Global function
printInfo	vrfutil	Global function
printWarn	vrfutil	Global function
printError	vrfutil	Global function
EntityType	vrfutil	Global table of functions
bhaveLoaded	vrfutil	Global function
new	fsm	Function name

17.6. Coding Messages for Translation

VR-Forces has a utility, `translationFileCreate`, that can extract the user-visible text in a scripted task dialog box and make it available for translation. (For details, please see Section 2.5, “[Localizing the Graphical User Interface](#)”, in *VR-Forces Users Guide*.) If a script contains messages such as `printWarn`, `printInfo`, and so on, you can code these messages so that they are also extracted to the translation file.

To code messages for translation, use the following syntax:

```
printWarn(vrf:trUtf8("Text message."))
```

You can include variable data in the message, as follows:

```
printWarn(vrf:trUtf8("Some text %1. Some more text  
%2"):arg(variable1):arg(variable2))
```

where an argument can be a string or number.

17.7. Error Detection

The VR-Forces Lua implementation can detect syntax errors and runtime errors.

When you save the script for a scripted task, it is checked for syntax errors. If an error is found, it is reported in an error message. In [Figure 17-5](#), the `if` statement in line 7 is missing the `then` keyword.

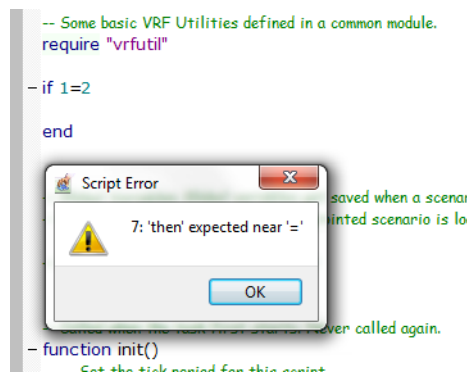


Figure 17-5. Lua syntax error



Detection of a syntax error does not prevent the script from being saved. If you do not fix the error and try to use the scripted task, the back-end will generate an error.

When you run a scripted task, the back-end can detect errors due to incorrect use of user functions and the Lua API functions, such as calling an object that does not exist, or trying to access feature data before it is paged in. When a runtime error is detected, the back-end generates an error message. When the back-end generates an error, the script that caused the error is displayed in bold, red type in the Scripted Tasks dialog box (Figure 17-6). Therefore, you may want to keep the dialog box open while you are testing new or edited scripts.

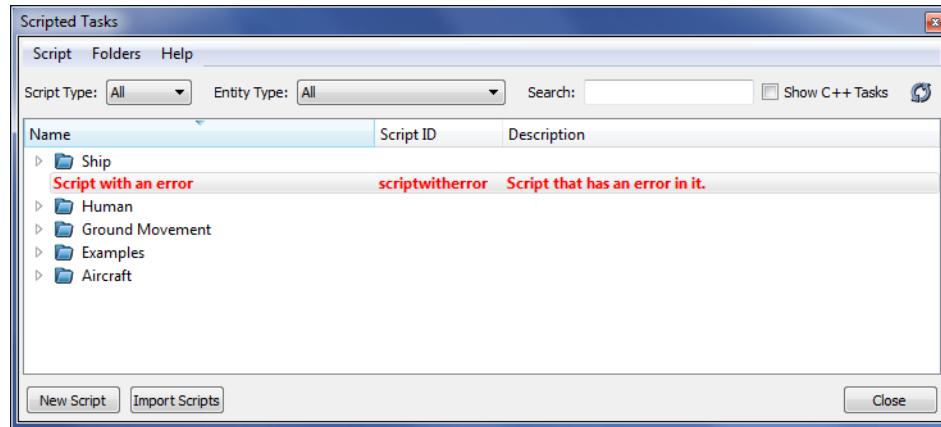


Figure 17-6. Lua error message

To view an error message:

1. In the Scripted Tasks dialog box, select the script that has generated an error.
2. Choose **Script** → **View Script Error**. An error message is displayed.



Script errors are also sent to the console in the Entity Information dialog box.

17.8. Interactive Scripts

You can write scripts that request input from the VR-Forces user. Script questions are sent to the entity's object console and to the Object Console Summary Panel. Users can answer questions from the Object Console Summary Panel.

To create interactivity in a script, use the `vrf:askUserQuestion()` Lua function. When a script sends a question to the console, the Answer Questions button becomes active. When the user clicks the button, a set of choices is displayed. The choices can be presented as buttons, as option buttons, or as a drop-down list.

The script can do whatever it wants with the user input.

17.9. A Basic Scripted Task

VR-Forces includes many scripted tasks, all of which can serve as examples of how to write one. The Create and Move to Waypoint scripted task is intended is a basic example that shows you how to:

- ♦ Set up metadata.
- ♦ Include the VRF Utilities module.
- ♦ Initialize a subtask ID.
- ♦ Use the `init()` function.
- ♦ Create a waypoint using input from the task's dialog box.
- ♦ Send a set data request to an entity, using input from the task's dialog box.
- ♦ Use the `tick()` function.
- ♦ Send a subtask and get the subtask ID.
- ♦ Check for completion of the task.
- ♦ Stop the task.

The Lua code is comprehensively commented. This section supplements the comments.

17.9.1. Create and Move to Waypoint Metadata

Figure 17-7 shows the metadata for the Create and Move to Waypoint scripted task.

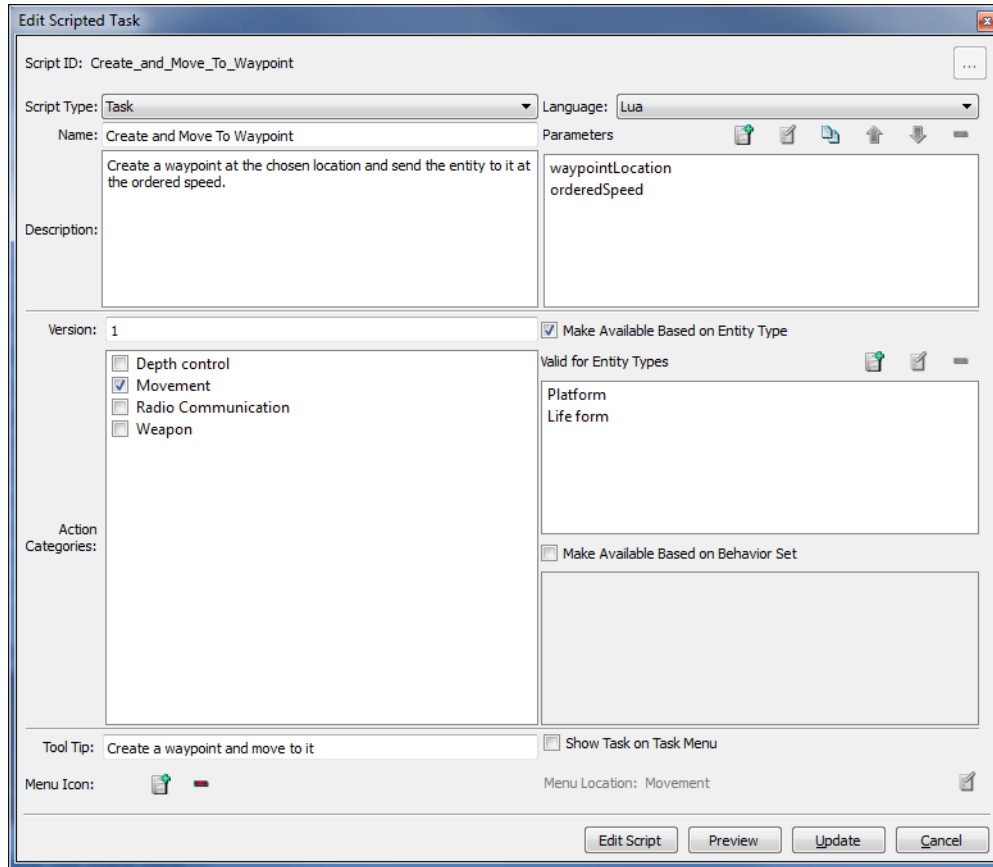


Figure 17-7. Create and Move to Waypoint scripted task

To view the metadata:

1. Choose **Simulation** → **Scripted Tasks**. The Scripted Tasks dialog box opens.
2. Expand the Examples folder (Figure 17-8).

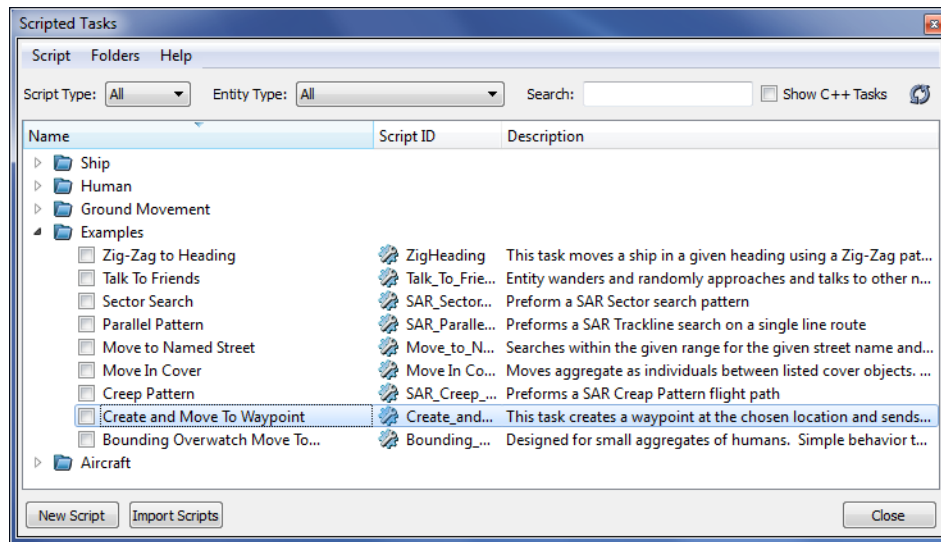


Figure 17-8. Scripted Tasks dialog box

3. Select Create and Move to Waypoint.
4. Choose **Script** → **Scripted Task**. The Edit Scripted Task dialog box opens (Figure 17-7).

Note how the Name column of the Create and Move To Waypoint entry in the Scripted Tasks dialog box matches the Menu Text in the Edit Scripted Task dialog box. The Script ID and Description fields are also drawn from the scripted tasks metadata.

Now let's look at the parameters. This scripted task has two parameters, waypointLocation and orderedSpeed. To see the definition of a parameter, select it and click the Edit button (✎). Figure 17-9 shows the dialog boxes that specify the parameters.

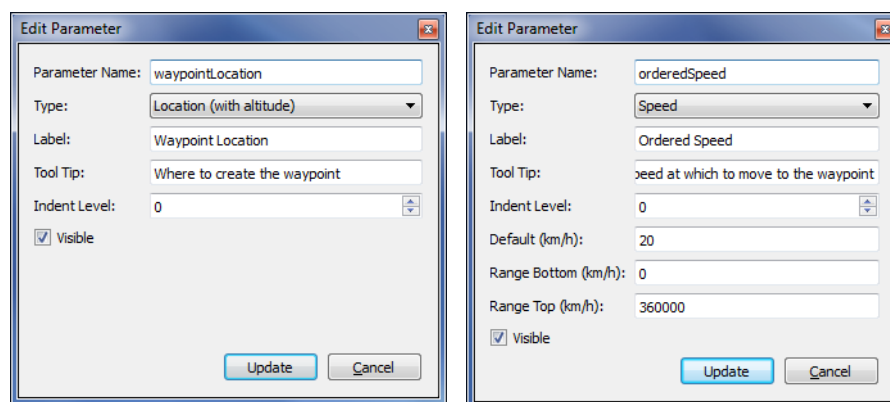


Figure 17-9. Parameter definitions

Figure 17-10 shows the dialog box that is displayed when you assign an entity this task. Note that the description of the task on the dialog box matches the description in the metadata. The parameter labels in the dialog box match the labels specified for the two parameters. The labels are not the same thing as the parameter name. The parameter name is the name used in the Lua script for this scripted task.

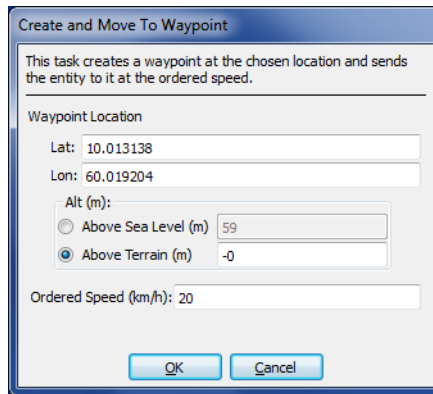


Figure 17-10. Create and Move to Waypoint dialog box

When this scripted task is assigned to an entity, the user will specify the waypoint and the ordered speed. Then the scripted task will be executed. Now we will look at the Lua script to see what happens.

17.9.2. The Create and Move To Waypoint Lua Script

The entire Lua script for this scripted task (without comments) is as follows:

```
require "vrfutil"
moveToWaypointSubtaskId = -1
function init()
    vrf:setTickPeriod(0.5)

    waypoint =
        vrf:createWaypoint({location=taskParameters.waypointLocation,
            force=this:getForceType()})

    vrf:sendSetData(this, "set-speed",
        {speed=taskParameters.orderedSpeed})
end
function tick()
    if moveToWaypointSubtaskId == -1 then
        moveToWaypointSubtaskId = vrf:startSubtask("move-to",
            {control_point=waypoint:getName()})
    end
    if vrf:isSubtaskComplete(moveToWaypointSubtaskId) then
        vrf:endTask(true)
    end
end
function shutdown()
    vrf:deleteObject(waypoint)
end
```

The comments in the script describe the control flow. The essence is that using the input from the task dialog box, the waypoint gets created and the speed gets set in `init()`. The first time the task is ticked, it sends the Move to Waypoint subtask. Thereafter, each time the task is ticked, it checks to see if the subtask is complete. When the subtask is complete, the task is ended and the waypoint is removed.

The functions in this script are all in the `vrf` class, which is described in “[Lua Classes](#),” on page 17-3. The `createWaypoint()` function takes its location from the `waypointLocation` parameter that was defined in the scripted task metadata and whose value was provided in the Create and Move To Waypoint dialog box when the task was assigned. Similarly, the ordered speed is set with the `sendSetData()` function and the value is taken from the `orderedSpeed` parameter for the task. The script gets the parameter values with the `taskParameters.parameter` syntax.

This script uses three of the entry point functions – `init()`, `tick()`, and `shutdown()`. If you were to checkpoint the scenario while the script was executing, the standard save actions would take place, but no script-specific actions would be taken, because there is no `saveState()` function in the script. Similarly, no special action would be taken when the scenario was loaded again because `loadState()` is not used.

For details about the parameters and return values of the functions, please see the VR-Forces Lua API documentation. Similarly, the tasks and set data requests that you can assign with the `startSubtask()` and `sendSetData()` functions are described on the Task and Set pages of the Lua API documentation. You should review the lists of functions to see what you can do in a scripted task.

17.10. A Simple Reactive Task

The difference between a scripted task and a reactive task is the use of the `check()` and `checkInit()` functions in the reactive task. The `check()` function tests a condition at whatever tick rate you specify. If the condition returns true, the task runs.

The simple reactive task in this section monitors the speed of an entity. When it exceeds 15 meters per second, the entity is destroyed. The script works as follows:

1. The `checkInit()` function sets the tick rate to 1.0 second.
2. In `check()`, VR-Forces gets the speed of the entity and prints it to the console.
3. It tests to see if the speed is greater than 15 meters per second. If the condition is met, the function returns true.
4. If the function returns true, the script executes `init()` and begins to tick().
5. In the `tick()` function, the entity is destroyed and the task is complete. Note that in the `executeSetData()` function, `set-destroy` does not have parameters, but the command must include empty braces.

```
function checkInit()
    vrf:setTickPeriod(1.0)
end

function check()
    currentSpeed = this:getSpeed()
    print("speed is:", currentSpeed)
    if currentSpeed > 15 then
        return true
    end

    return false
end

function init()
    vrf:setTickPeriod(0.5)
end

function tick()
    vrf:executeSetData("set-destroy", {})
    vrf:endTask(true)
end
```

17.11. Background Processes

Background processes are scripts that run continuously in the background. When you create a background process, you specify which entity types it is valid for. Thereafter, whenever you create those entity types the background process initializes as soon as the entity is created. The supported entity type can be as general or as specific as you want it to be, based on the entity type enumeration that you specify.

Background processes are used for entity actions that happen continuously in a scenario, such as consuming or receiving supplies, calculating the entity's footprint, and automatically attacking opposing forces.

Background processes have one important restriction - they cannot issue tasks to entities or stop their tasks.

There is no indication in the GUI that a background process is running. The only way to know which background processes are available and which entities they might be affecting is to examine them in the Scripted Tasks dialog box.

The following code is a very simple background process that checks an entity's speed every five seconds. If the speed exceeds three meters/second, it prints a message to the console. The script's metadata specifies that it applies to lifeforms. Therefore, this background process will run for each lifeform entity in the scenario.

```
require "vrfutil"
function init()
    vrf:setTickPeriod(5.0)
end

function tick()
    currentSpeed = this:getSpeed()
    if currentSpeed > 3 then
        print("speed is:", currentSpeed, ". Going too fast.")
    else
        print ("Speed is OK.")
    end
end
```



A. Example Scenarios

VR-Forces includes several sample scenarios. This appendix explains how to create the breaching scenario and the embarkexample scenario. It assumes some basic knowledge of VR-Forces concepts and the VR-Forces interface, such as how to select objects, how to pan and zoom the terrain, and so on. If you have not yet reviewed the sample tutorial in *VR-Forces Getting Started Guide*, you may want to try that tutorial before trying these example scenarios.

The Breaching Scenario	A-2
Create the Scenario.....	A-3
Create the Minefield.....	A-4
Create the Opposing Forces.....	A-5
Create the Tactical Graphics	A-6
Create the Friendly Entities	A-8
Write the Plans	A-10
Save the Scenario.....	A-17
Running the Scenario	A-18
The Embarkexample Scenario.....	A-19
Create the Entities and Objects	A-20
Write the Plans for the Entities.....	A-30

A.1. The Breaching Scenario

This scenario simulates a breaching exercise. In this exercise, four hostile vehicles are arrayed behind a minefield. Three platoons of four tanks each suppress the hostile vehicles, allowing two engineering vehicles to clear the minefield. This scenario uses *EntityLevel.sms*.

Figure A-1 illustrates the order of battle and tactical graphics in the scenario.

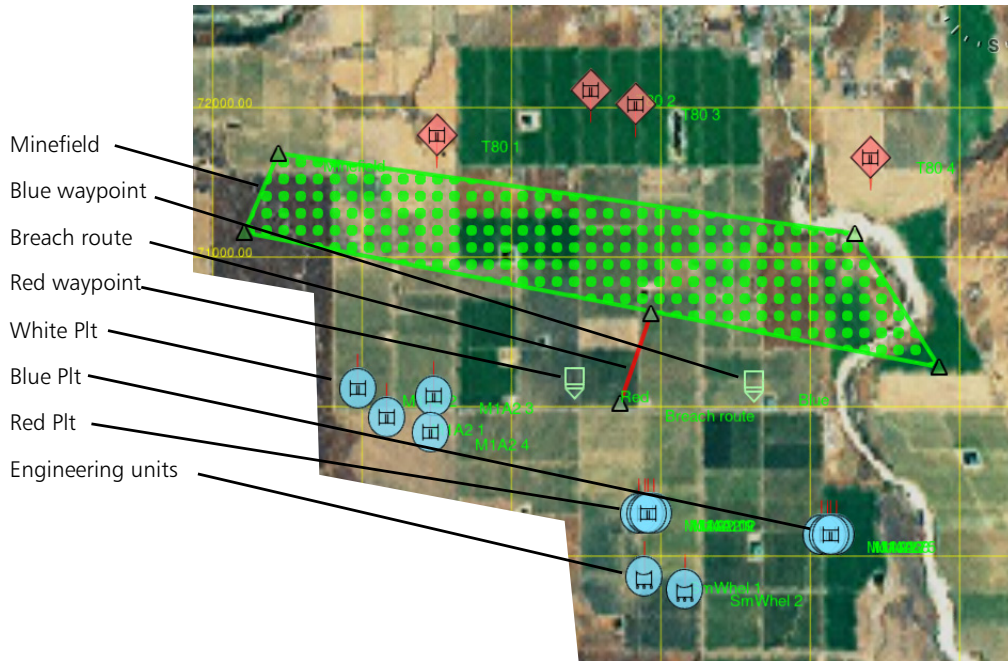


Figure A-1. Breaching scenario order of battle

The scenario demonstrates the following features of VR-Forces:

- ♦ Creating entities.
- ♦ Creating tactical graphics (waypoints, routes, areas).
- ♦ Creating a pre-defined aggregate and creating an aggregate from individual entities.
- ♦ Creating plans, using:
 - Move To.
 - Follow Entity.
 - Follow Route.
 - Conditions.

The scenario plays out as follows for the Blue force entities:

- ♦ White Platoon stays in position and fires on hostile forces.
- ♦ Red Platoon advances to waypoint red and provides cover for the engineers.
- ♦ Blue Platoon advances to waypoint blue and provides cover for the engineers.
- ♦ When the hostile forces are destroyed, the engineering entities advance on the minefield to clear it.



The scenario has entities that represent engineering entities, but *EntityLevel.sms* does not actually have models for engineering entities.

You can view videos that demonstrate this tutorial at [./doc/vrforces_tutorialvideos.htm](/doc/vrforces_tutorialvideos.htm).

A.1.1. Create the Scenario

To create the scenario:



1. Start VR-Forces. The VR-Forces window opens.
2. Choose **File** → **New Scenario**. The Select Simulation Database dialog box opens.
3. Select a terrain database. We used the *SanLuisObispo.mtf* database.
4. Click Open. The New Scenario dialog box opens.
5. Type a name in the Scenario Name box, such as myBreachingScenario. Accept all of the default values for the scenario parameters.
6. Click OK. The San Luis Obispo database is displayed. This database covers a portion of California, U.S.A.

Save the Scenario

Save the scenario periodically as you work on it.

To save the scenario:

1. Choose **File** → **Save Scenario**. The Save Scenario dialog box opens. By default, the name you gave to the scenario when you created it is automatically entered.
2. Click the New Folder button. A new folder is added to the window.
3. Type a name for the new folder, such as myBreaching.
4. Select the folder.
5. Accept the default name or type a name of your choice.
6. Click OK.

A.1.2. Create the Minefield

We will create the minefield first, since it becomes a good reference around which to create the entities and other objects.

To create the minefield:



1. Zoom in on a relatively flat portion of the terrain. This is to minimize the impact of hilly terrain and intervisibility issues on how the simulation runs. For this scenario, we used an area just to the northeast of the center of the terrain ([Figure A-2](#)).



Figure A-2. San Luis Obispo terrain

2. Click the Tactical Graphics tab on the right side of the window. The Tactical Graphics Palette opens.
3. In the Categories list, select Engineering.
4. In the list of tactical graphics, select Minefield. The Create Minefield tab gets added to the window and the cursor changes to a vertex marker.
5. Click the Create Minefield tab. The Create Minefield dialog box opens ([Figure A-3](#)).
6. In the Name box, type Minefield.

7. Draw an oblong area to define a minefield (Figure A-3). Click to define the first three vertices. Right-click to define the last vertex.

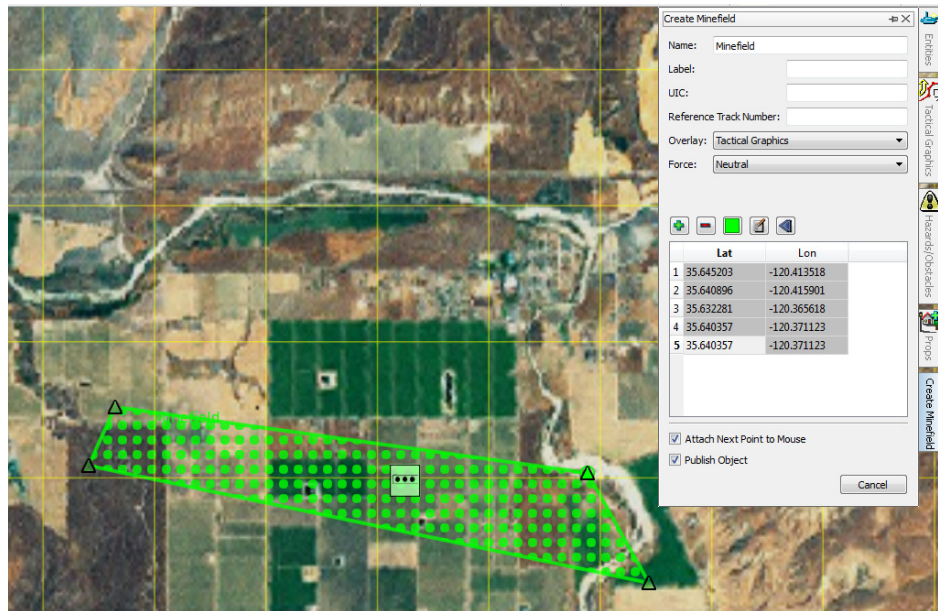


Figure A-3. Create the minefield

A.1.3. Create the Opposing Forces

Now that we have the minefield as a reference point, we can create the hostile entities.

To create the opposing forces:

1. Click the Entities Palette (on the right margin of the window).
2. In the Category list, select Ground.
3. In the Force list, select Opposing.
4. In the list of entities, select T-80 Main Battle Tank.
5. Click on the map north of the minefield four times, as indicated in Figure A-1, to place the T-80s.
6. Right-click to exit create mode.



Aggregate the Opposing Forces

We will want to test for when all of the opposing forces are destroyed. This will be easier to do if they are in an aggregate.

To aggregate the opposing forces:

1. Select the four T-80 tanks.
2. Choose **Entities** → **Aggregates As**. The Aggregate As dialog box opens ([Figure A-4](#)).

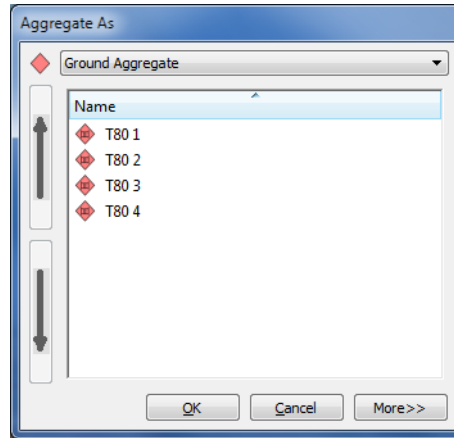


Figure A-4. Aggregate As dialog box

3. In the list, select Ground Aggregate.
4. Click OK. The tanks are aggregated into a platoon.
5. In the Echelon View tab on the Object tab, expand the aggregate ([Figure A-5](#)).

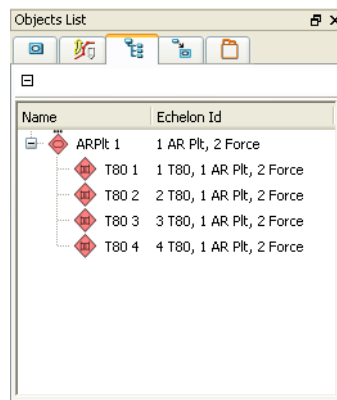


Figure A-5. Echelon View

A.1.4. Create the Tactical Graphics

We need to create two waypoints and a route for the Blue Force.

Create the Waypoints

To create the waypoints:



1. Click the Tactical Graphics Palette (on the right margin of the window).
2. In the Category list, select Control Objects.
3. In the list of control objects, select Waypoint. The Create Waypoint tab is added to the window.
4. Click the Create Waypoint tab. The Create Waypoint dialog box opens.
5. Type a name for the waypoint, such as Red.
6. Using [Figure A-1](#) as a guide, click on the map where you want to place the waypoint for Red platoon.
7. In the Create Waypoint dialog box, type a name for the second waypoint, such as Blue.
8. Click on the terrain where you want to place the waypoint.
9. Right-click to exit draw mode.

Create the Route

The route will guide the engineers as they swing past the Red Platoon and move to the minefield. The route is shown as Breach route in [Figure A-1](#).

To create the route:

1. Click the Tactical Graphics Palette.
2. In the list of control objects, select Route. The Create Route tab is added to the window.
3. Click the Create Route tab. The Create Route dialog box opens.
4. Type a name for the route, such as “Breach route”.
5. Click on a point just east of waypoint Red.
6. Move the mouse cursor to the edge of the minefield.
7. Right-click to place the end point in the route.
8. Save the scenario.

At this point, the scenario should look something like [Figure A-6](#).

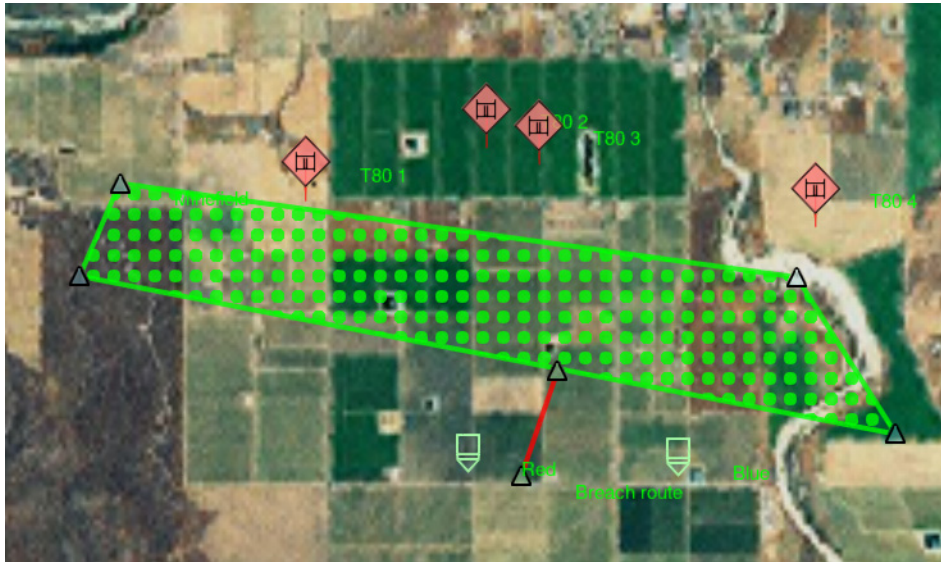


Figure A-6. Breaching scenario progress

A.1.5. Create the Friendly Entities

Using [Figure A-1](#) as a guide to location, create the friendly entities. We will create one platoon from individual entities, and the other two using pre-configured platoons.

To create the friendly entities:



1. Click the Entities Palette.
2. In the Categories list, select Aggregate.
3. In the Force list, select Friendly.
4. In the list of entities displayed, select Armor Plt(US).
5. Click on the map to place the red platoon and blue platoon as shown in [Figure A-1](#). Right-click to exit create mode. The aggregates are created with default names (ARPlt 2 and ARPlt 3). They are disaggregated and expanded, so you can see the individual entities.
6. Select one of the platoons. To select a platoon, you must select the platoon icon, not one of its subordinates. The easiest place to do that is on the Echelon View tab of the Object Lists panel ([Figure A-7](#)).

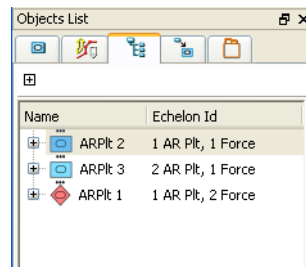


Figure A-7. Echelon View tab

7. Choose **Entities** → **Edit**. The Edit Armor Plt (US) dialog box opens.
8. In the name text box, replace the default name with Red Plt or Blue Plt, depending on which platoon you selected.
9. Click Update.
10. Rename the other platoon that you created.
11. Click the Entities Palette.
12. In the Categories list, select Ground.
13. In the list of entities, click M1A2 Tank. The cursor changes to draw mode.
14. Click on the map where White Platoon should be. An entity icon is displayed.
15. Click three more times to create the rest of the tanks in White Platoon. Right-click to exit create mode. (We will create the aggregate from these entities in the next section.)
16. Open the Entities Palette.
17. In the Ground/Friendly category, select M58 MICLIC.
18. Click twice on the map to the South of Red Plt to create two MICLIC entities.
19. Right-click to exit create mode.
20. Save the scenario.

Create White Platoon

To create the white platoon:

1. Select the four members of White Platoon.
2. Choose **Entities** → **Aggregates As**. The Aggregate As dialog box opens.
3. Select Ground Aggregate from the list.
4. Click OK.
5. Select the new platoon.
6. Choose **Entities** → **Edit**. The Edit Scene Object dialog box opens.

7. Change the name to White Plt.
8. Save the scenario.

A.1.6. Write the Plans

The plans tell the entities how to carry out their roles in the scenario. The White platoon just stays in place. We do not give it a plan. It will just respond to any opposing force entities that it detects.

Write the Plan for Blue Platoon

Blue Platoon will move to a waypoint. As it moves it responds to any opposing force entities that it detects. The plan is quite simple to write.

To write the plan for Blue Platoon:

1. Select Blue Platoon.
2. Choose **Entities** → **Plan**. The Plan window opens ([Figure A-8](#)).

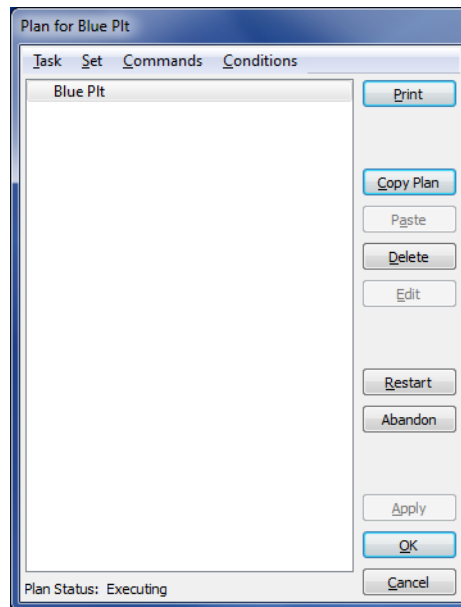


Figure A-8. Blue Platoon plan

3. In the Plan window, choose **Task** → **Movement** → **Move To Waypoint (Direct)**. The Move To Waypoint (Direct) dialog box opens (Figure A-9).

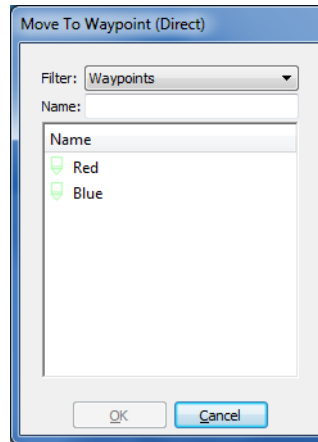


Figure A-9. Move To Waypoint (Direct) dialog box

4. In the Move To Waypoint (Direct) dialog box, or on the map, select the Blue waypoint.
5. Click OK. The task is added to the plan. The plan is now complete (Figure A-10).

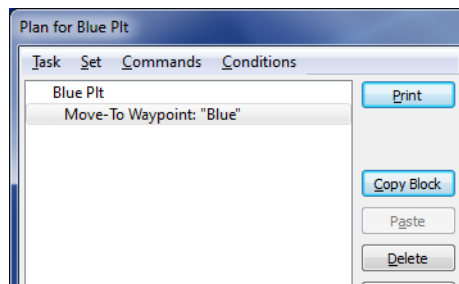


Figure A-10. Blue plan - complete

6. In the Plan window, click OK.

Write the Plan for Red Platoon

The Red Platoon moves to the Red waypoint. It has another job to do. When all the opposing forces are destroyed, it sends a message on the radio network. The MICLICs are listening for the message. They will not try to clear the minefield until they receive it.

To write the plan for red platoon:

1. Select Red Platoon.
2. Press **p**. The Plan window opens.

3. In the Plan window, choose **Task** → **Movement** → **Move To Waypoint (Direct)**. The Move To Waypoint (Direct) dialog box opens (Figure A-9).
4. In the Move To Waypoint (Direct) dialog box, or on the map, select the Red waypoint.
5. Click OK. The task is added to the plan (Figure A-11).

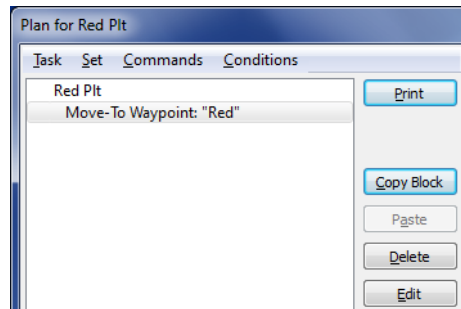


Figure A-11. Plan for Red Platoon - move to waypoint

6. Select the top line in the plan.
7. In the Plan window, choose **Conditions** → **When**. The When Expression dialog box opens (Figure A-12).

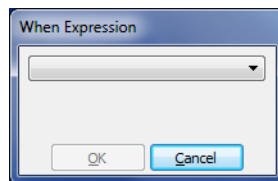


Figure A-12. When Expression dialog box

8. In the list, select Entity Destroyed. The Entity Destroyed dialog box opens.

9. In the list of entities, select ARPlt 1 (Figure A-13).

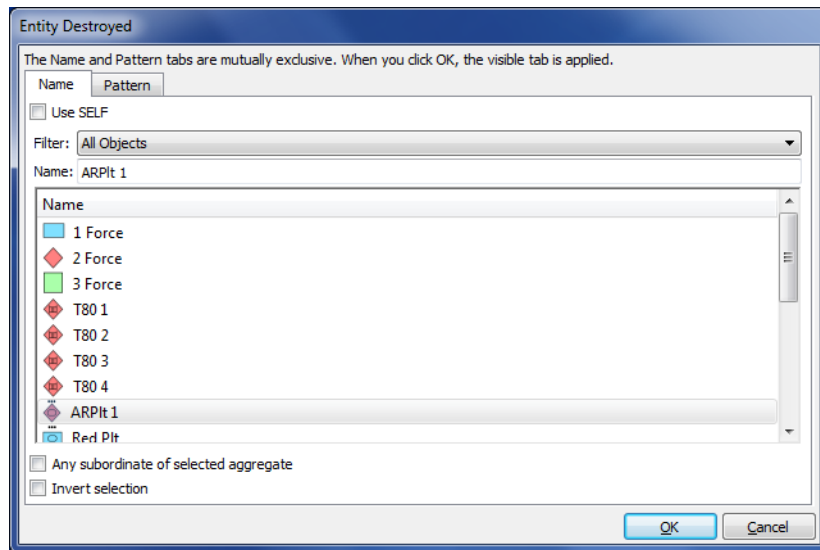


Figure A-13. Entity Destroyed dialog box

10. Click OK. The expression is added to the When Expression dialog box (Figure A-14).

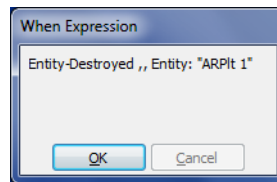


Figure A-14. Completed When Expression dialog box

11. In the When Expression dialog box, click OK. The When expression is added to the plan (Figure A-15). Now we need to add tasks to execute when the expression becomes true.

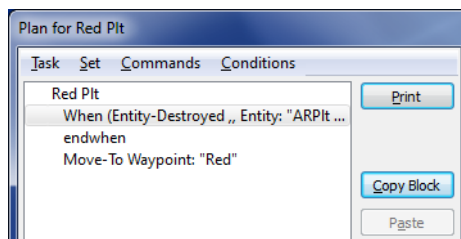


Figure A-15. Red Plan with incomplete When expression

12. The When expression should be selected. If not, select it.

13. Choose **Task** → **Radio** → **Send Text Message**. The Send Text dialog box opens.
14. In the Send Text dialog box, select the Broadcast check box. This means the message will be sent to all entities.
15. In the Message Text box, type Opposing Force Destroyed (Figure A-16).

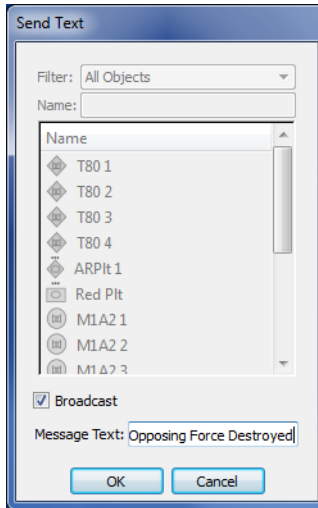


Figure A-16. Send Text dialog box

16. Click OK. The plan for Red Platoon is finished (Figure A-17).

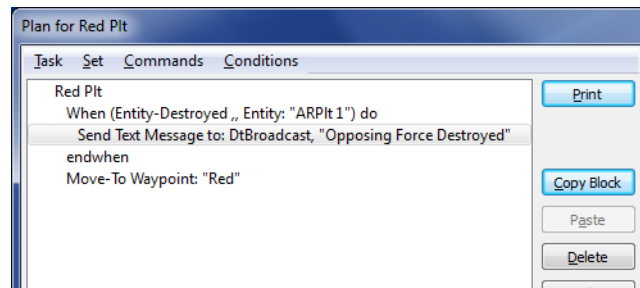


Figure A-17. Completed plan for Red Platoon

17. Click OK.
18. Save the scenario.

Write the Plans for the Engineering entities

When the MICLICs are notified that the opposing force has been destroyed, they move along a route to the edge of the minefield. Then they clear it.

The MICLICs provided with VR-Forces do not actually have the ability to simulate clearing a minefield. We are going to provide some visual interest by using global commands to remove the original minefield and replace it with two minefields with a space between them.

We will start with the plan for SmWhel 1:



1. Select SmWhel 1.
2. Press **p**. The Plan window opens.
3. In the Plan window, choose **Conditions** → **When**. The When Expression dialog box opens.
4. In the list, select Receive Text Message. The Receive Text Message dialog box opens.
5. Type the message that we are waiting for (Opposing Force Destroyed) ([Figure A-18](#)).

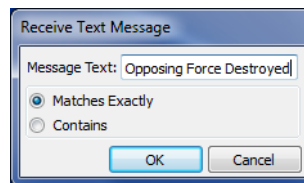


Figure A-18. Receive Text Message dialog box

6. Click OK.
7. In the When Expression dialog box, click OK. The empty expression is added to the plan window ([Figure A-19](#)). Now we need to tell the entity what to do when it gets this message (move along the route, then redraw the minefield).

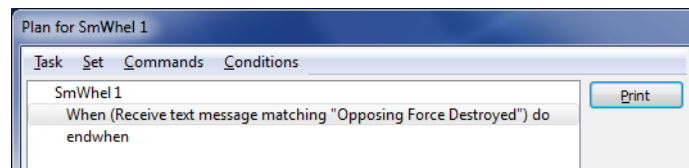


Figure A-19. Plan for SmWhel 1

8. In the Plan window, choose **Task** → **Movement** → **Move Along Route**. The Move Along Route dialog box opens.

9. Select Breach route, then click OK. The task is added to the plan.
 As we said earlier, *EntityLevel.sms* does not actually model minefields or the types of entities that could clear one. To provide the visual illusion of clearing a corridor through the minefield, after the MICLICs arrive at the end of the route, we will delete the minefield and create two new minefields that occupy most of the space of the original one, but leaves a corridor for entities to travel through.
10. Choose **Commands** → **Delete**. The Delete dialog box opens.
11. In the list, select Minefield.
12. Click OK.
13. Choose **Commands** → **Create** → **Tactical Graphics** → **Engineering** → **Minefield**. The Create Minefield dialog box opens.
14. Type Minefield-left in the Name box.
15. Draw an area over most of the minefield to the left of where the breach route intersects the minefield.
16. Click OK. You will not see this new area, because it does not exist in the simulation yet. It will not exist until the command gets executed.
17. Repeat steps 13 through 16, but this time draw the minefield to the right of the route. Call it Minefield-right. The plan should now be similar to [Figure A-20](#).

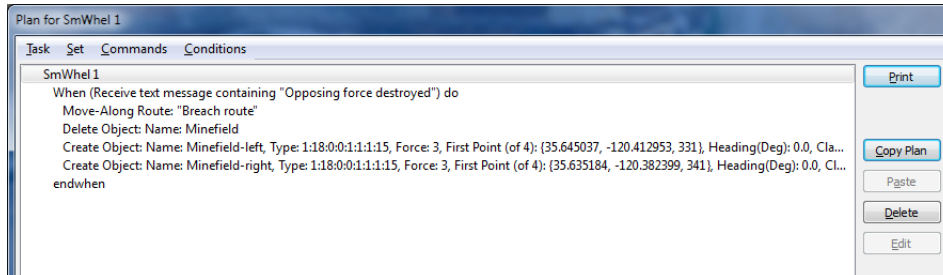


Figure A-20. Plan for SmWhel 1 after When expression complete

18. Click OK. The plan is now complete.
19. Save the scenario.

Write the Plan for SmWhel2 2

The plan for SmWhel 2 is a bit simpler than that of SmWhel 1. It follows SmWhel 1, offset to the right, so that it arrives at the minefield next to the other entity. Try creating the plan yourself. It should look like ([Figure A-21](#)).

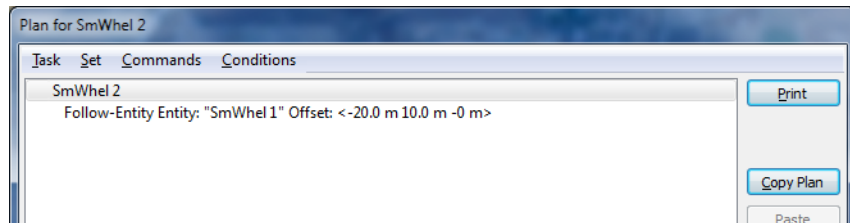


Figure A-21. Plan for SmWhel 2

A.1.7. Save the Scenario

Be sure to save the scenario before you run the simulation. If you want to save it in its starting state, do not save it after you run the simulation.

A.1.8. Running the Scenario

Once you have created the scenario and saved it, click the Run button and watch the simulation run. Open the plan windows for the MICLICs and observe the progression of tasks through the plan.

If hostile entities do not get destroyed, it may be that the blue entities cannot see them. If they cannot see them, they cannot shoot each other. Use the intervisibility feature to test line-of-sight. Move the entities around, or find a flatter section of the terrain until you get the results you want.

You can run the breaching scenario included with VR-Forces and see how it compares to the one that you created.

Figure A-22 shows the breaching scenario after the MICLICs have completed their plans. All of the aggregates are expanded so that you can see the individual entities.

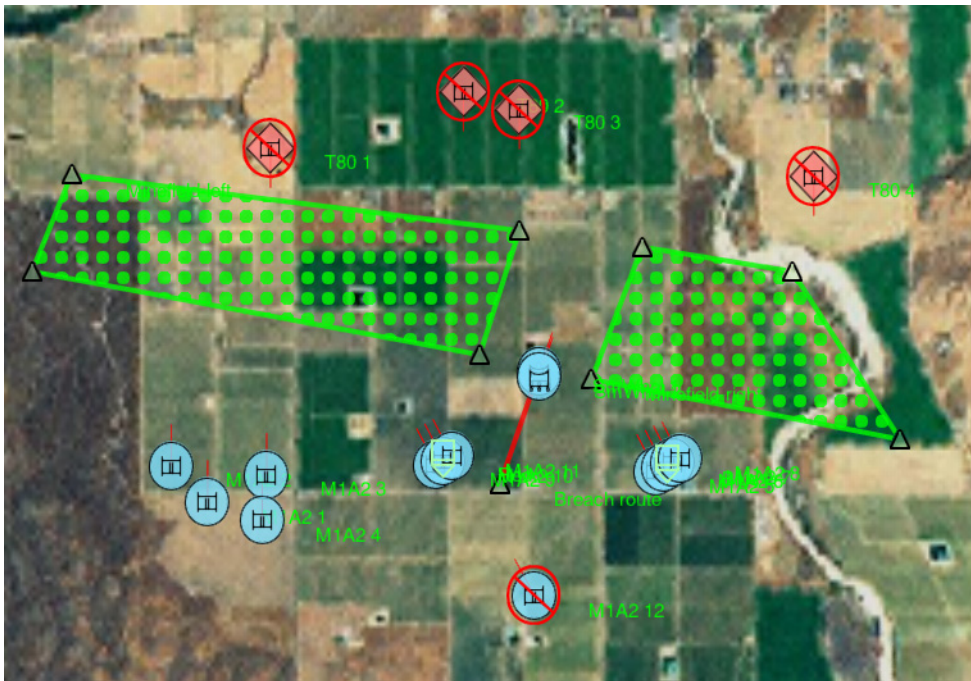


Figure A-22. Breaching scenario after minefield cleared

A.2. The Embarkexample Scenario

The embarkexample scenario (Figure A-23) demonstrates the embarkation feature. It shows the following:

- Embarking and disembarking DIs to and from a Bradley vehicle.
- Embarking and disembarking a helicopter to and from a Harpers Ferry ship and an aircraft carrier.
- Embarking a fixed-wing aircraft on the aircraft carrier.
- Embarking DIs onto a helicopter and disembarking one of them onto the aircraft carrier.
- Directly embarking a DI on an aircraft carrier and walking on the flight deck.

The scenario uses immediate embarkation and the embark and disembark tasks. It also demonstrates various types of conditional statements, including nested conditional statements.

A completed scenario is included with VR-Forces in `./userData/scenarios/embarkexample`. This section is a step-by-step explanation of how to create the scenario. It assumes that you have completed the breaching scenario example and does not provide quite as much detail for how to create entities and tactical graphics. This scenario uses *EntityLevel.sms*.



If you are using HLA, you must use RPR FOM 2 draft 17 or later for scenarios that use embarkation.



Figure A-23. Embark scenario

A.2.1. Create the Entities and Objects

The scenario has the following entities:

- ♦ A fixed-wing aircraft on the airport runway.
- ♦ A helicopter embarked on an LSD-49 Harpers Ferry ship.
- ♦ A dismounted infantry entity (DI) embarked on an aircraft carrier.
- ♦ A DI standing behind a Bradley vehicle in the town.
- ♦ A DI standing in the courtyard of the palace.

The scenario has the following tactical graphics:

- ♦ A route for the fixed-wing plane to follow to take off.
- ♦ A waypoint in front of the palace for the Bradley vehicle to drive to.
- ♦ A waypoint in front of the palace for the helicopter to land at.
- ♦ A waypoint on the carrier deck for the DI to walk to.

Create the Surface Entities

To create the surface entities:

1. Start VR-Forces.
2. Choose **File** → **New Scenario**. The Initial Scenario Information dialog box opens.
3. Select *Makland.mtf*.
4. Click Open. The New Scenario dialog box opens.
5. Click OK. The Makland database is displayed.
6. Navigate to the Makland peninsula, the bay and the airport.
7. On the Entities Palette, select the Surface category and the Friendly force.
8. In the entity list, select CVN-75 Harry S. Truman
9. Click in Makland Bay midway to the left of the peninsula.
10. Right click to exit create entity mode.
11. Place a LSD- 49 Harpers Ferry Class Ship in the middle of Makland Bay ([Figure A-24](#)).



Figure A-24. Surface entities

12. Save the scenario.

Create the Aircraft

To create the aircraft:

1. Zoom in on the airport, located northeast of the bay.
2. On the Entities Palette, select the Fixed Wing category.
3. Select force Friendly.
4. Select an F/A 18 Hornet entity.
5. Click the northern end of the north/south runway.
6. Right-click to exit create entity mode.
7. Select the entity.
8. Choose **Set** → **Position** → **Heading**. The Heading dialog box opens.
9. Type 180 and click OK.
10. Zoom out to see a larger area of the map.
11. On the Entities Palette, select the Rotary Wing category.
12. Select a CH46E Sea Knight entity.
13. Click anyplace on the map.
14. Right-click to exit create mode.
15. Select the helicopter.
16. Choose **Entities** → **Embark On**. The Embark On dialog box opens.
17. In the list window, select the LSD 49 (Harper 1).
18. Click OK. The helicopter is immediately embarked on the LSD 49. If you select the Embarkation View on the Objects List Panel, you can see that the helicopter is listed as being embarked on the LSD 49 ([Figure A-25](#)).

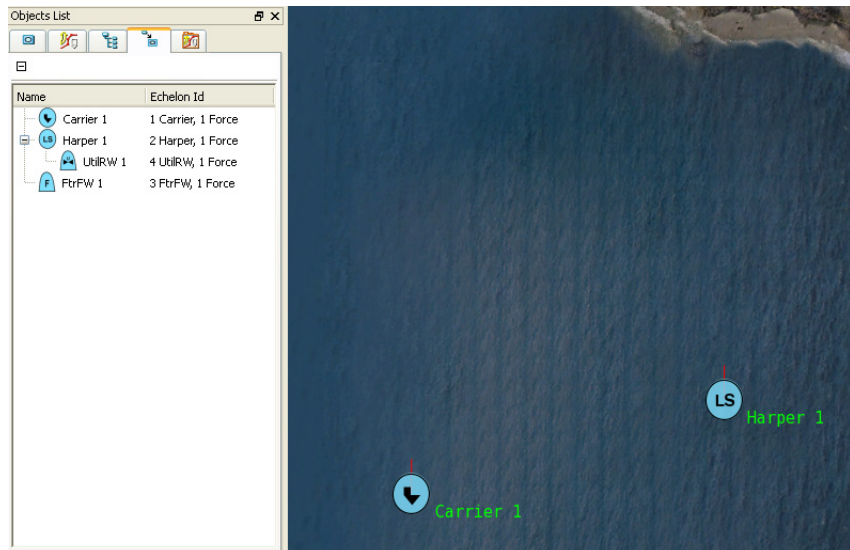


Figure A-25. Helicopter embarked on LSD 49 Harpers Ferry

19. Save the scenario.

Create the Bradley Vehicle

To create the Bradley Vehicle:

1. Zoom in on the town on the peninsula.
2. On the Entities Palette, change the category to Ground.
3. Select force Friendly.
4. Select an M2A2 Bradley IFV entity.
5. Place the Bradley vehicle where the road to the palace intersects a north/south street, as shown in [Figure A-26](#).



Figure A-26. Bradley vehicle

6. Save the scenario.

Create Dismounted Infantry

The scenario has two dismounted infantry that ride in the helicopter, and one that is embarked on the aircraft carrier. Embarking the DI on the carrier requires a bit of discussion.

There are two ways to embark an entity – immediate embarkation and the embarkation task. If you want to use the Embark task, the receiving entity must be configured to accept the embarking entity. We will use the Embark task a little later in this example.

We want to embark one of the DI entities on the aircraft carrier. However, aircraft carriers are not configured to accept DI entities, so we cannot use an Embark task to do this. However, we can use the immediate embark feature to embark an entity on any other entity. To do this, we must specify the coordinates at which to place the entity. In this example, we want to place a DI on the carrier deck and make it look good in the 3D view. Through experimentation, we know that using the model supplied with VR-Forces, the altitude offset to place an entity on the carrier deck is 21 meters. We also offset the location to move the entity to the side of the deck.

To create the dismounted infantry:

1. On the Entities Palette, change the category to Human.
2. Select a Dismounted-Infantry entity.
3. Select force Friendly.
4. Place one DI directly behind (south of) the Bradley vehicle.
5. Place one DI in the courtyard area of the palace at the top of the hill in Makland (Figure A-27).



Figure A-27. DI at palace

6. Place a third DI anywhere in town. This is just a temporary location. In a moment you will embark this entity on the aircraft carrier.
7. Double-click the DI in the palace to make its position editable. Hold down the Shift key and drag the mouse to change the heading indicator to 270 degrees (Figure A-28).



Figure A-28. DI at palace after setting heading

8. Select the DI that you placed temporarily in town.
9. Choose **Entities** → **Embark On**. The Embark On dialog box opens.
10. In the entity list, select the carrier.
11. Select the Override Position option.

12. In the Position Override group box, set the X value to 15 and the altitude value to 21. This places the DI at the deck level of the carrier ([Figure A-29](#)).

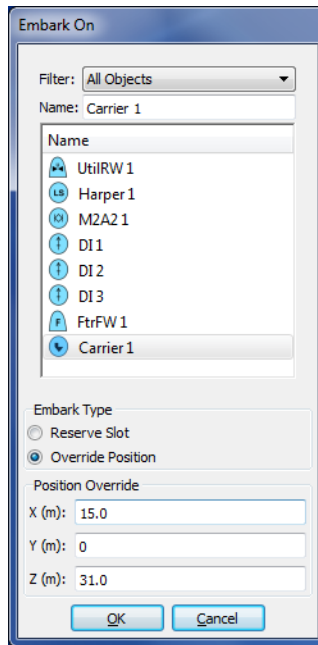


Figure A-29. Embark On dialog box

13. Click OK. The DI is embarked on the carrier.
14. Save the scenario.

Create the Tactical Graphics

We need a few tactical graphics to specify the movement tasks for the entities.

Create a Runway at the Airport

At the airport, create a route from North to South along the runway. Call it Runway (Figure A-30).

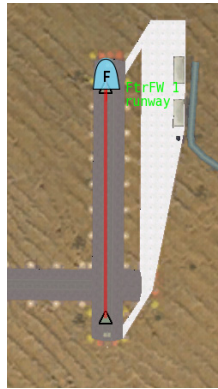


Figure A-30. Runway

Create Waypoints at the Palace

To create the waypoints at the palace:

1. Zoom in on the palace at the top of the hill near the town.
2. Place a waypoint on the edge of the road just before the palace entryway. Call it “palace”.
3. Place a waypoint on the ground in front of the palace between the trees. Call is “helipad” (Figure A-31).



Figure A-31. DI and waypoints at palace

Attach a Waypoint to the Carrier

We want to attach a waypoint to the carrier. However, in the 2D view, there is no way to figure out where to place the waypoint because the carrier is shown as a 2D icon. So, we will switch to the 3D view.

To attach a waypoint to the carrier:

1. Move the observer so that you are looking at the 2D icon for the aircraft carrier.
2. Check the Attachment button (🔗) on the Attach Object Toolbar to make sure that you are not attached to an entity. If it is depressed, click it to unattach the observer.
3. In the Observer list on the Observer Toolbar, select Stealth. The view changes to 3D. However we are still looking down on the terrain, so we have a nice top-down view of the aircraft carrier (Figure A-32).



Figure A-32. Aerial view of carrier in 3D

4. Zoom in on the aircraft carrier.
5. Choose **Create** → **Waypoint**.
6. Expand the Create Waypoint dialog box.
7. Clear the Attach Object to Mouse check box.
8. Type a name for the waypoint, such as Carrier.
9. For the Altitude option, select Above Sea Level.
10. Type a value of 21 (to put the waypoint on the carrier deck).
11. Select the Attach Object to Mouse check box.
12. Click on the deck of the carrier toward the lower right (Figure A-33).

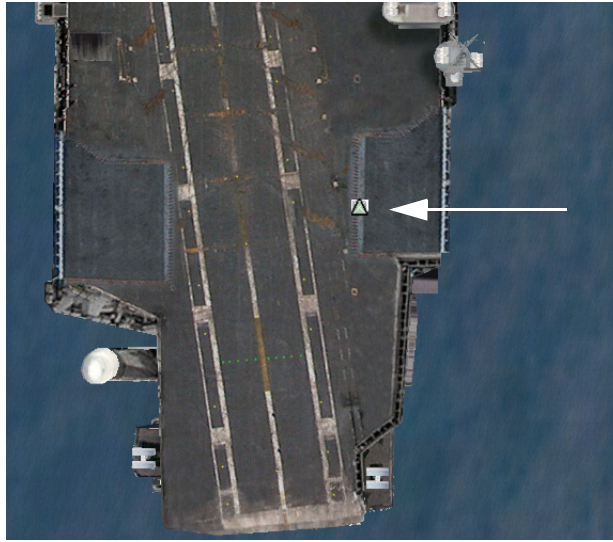


Figure A-33. Waypoint on carrier

13. Right-click.

Now we will attach the waypoint to the aircraft carrier. When you attach a tactical graphic to an entity, it moves with the entity. Even though the aircraft carrier is not moving in this scenario, this extra step teaches you about this procedure.

14. Select the waypoint.

15. Choose **Entities** → **Attach Object To**. The Attach Object To dialog box opens.

16. Select Carrier 1.

17. Save the scenario.

A.2.2. Write the Plans for the Entities

We need to write plans for the entities to do the following:

- ♦ The jet will take off from the airport and embark on the carrier (land and taxi to a parking place).
- ♦ The helicopter will disembark from the LSD-49 and fly to the palace, where it will land. Two DIs will embark on it. Then it will take off and embark on the carrier, disembark, and embark back on the LSD-49.
- ♦ The DI in town will embark on the Bradley and ride with it to the palace. It will then disembark from the Bradley and embark on the helicopter.
- ♦ The DI in the palace courtyard will embark on the helicopter.
- ♦ The DI on the carrier will walk to the waypoint.

Write the Fixed-Wing Aircraft's Plan

To write the fixed-wing aircraft's plan:

1. Select the fixed-wing entity.
2. Choose **Entities** → **Plan**. The Plan window opens.
3. In the Plan window, choose **Task** → **Movement** → **Fixed Wing Takeoff**. The Fixed Wing Takeoff dialog box opens.
4. In the Fixed Wing Takeoff dialog box, select Runway from the list of routes.
5. Click OK. The task is added to the plan.
6. Choose **Task** → **Embarkation** → **Embark**. The Embark On dialog box opens.
7. In the Embark On dialog box, select Carrier 1 from the list and click OK.
8. In the Plan window, click OK. The plan for the fixed-wing entity is finished (Figure A-34).

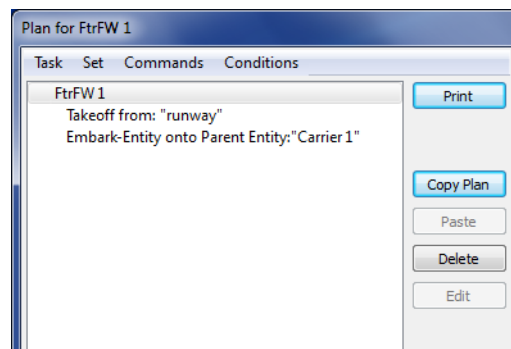


Figure A-34. Fixed-wing entity plan

Write the Helicopter's Plan

To write the helicopter's plan:

1. If you are in the 2D view, on the Objects List Panel, Entity List view, select the helicopter entity. (Since the helicopter is embarked, it is not visible on the map, so you cannot select it there.) If you are in the 3D view, you can select the copter in the Objects List Panel or by clicking the model.
2. Choose **Entities** → **Plan**. The Plan window opens.
3. Choose **Task** → **Disembark**.
4. Choose **Task** → **Move To Altitude**. The helicopter is going to fly to the palace, which is on top of a hill with steep cliffs. Sometimes the terrain following feature of the helicopter cannot handle steep cliffs well, causing the helicopter to crash, so we want to get it up to a good altitude to avoid crashing.
5. Set the altitude to 200 meters and click OK.

6. Choose **Task** → **Rotary Wing Land**. The Rotary Wing Landing dialog box opens.
7. In the list of waypoints, select helipad and click OK.

When the helicopter lands, it sends a message to the DIs to tell them that it is OK to embark.
8. Choose **Task** → **Send Text Message**. The Send Text dialog box opens.
9. Select DI 1. This will direct the message just to this entity.
10. In the Message Text box, type Load up.
11. Click OK. When the helicopter lands, it will tell DI 1 to load up, so that it knows it is time to embark on the helicopter.

After the helicopter lands at the palace, it needs to wait until the two DI have embarked before it takes off. So we use a When statement with an Entity Embarked condition. The helicopter doesn't need to watch for this entity to be embarked until it lands at the palace, so we can put the When statement in the middle of the plan rather than at the beginning as we might with other conditions.
12. Choose **Conditions** → **When**. The When Expression dialog box opens.
13. Select Entity Embarked. The Entity Embarked dialog box opens.
14. On the Name tab, in the top list, select DI 2. This is the entity whose embarkation status we want the helicopter to monitor.
15. In the bottom list, select UtilRW1. This is the name of the helicopter. We want to test the condition that DI 2 is embarked on UtilRW 1.
16. In the Entity Embarked dialog box, click OK. Then, click OK in the When Expression dialog box. The condition is added to the plan. Now we need to specify what the helicopter should do when the condition is true.
17. The line in the plan window that starts "When (Entity-Embarked)" should already be selected. If it is not, select it now.
18. In the Plan window, choose **Task** → **Embark**.
19. Specify that the helicopter embark on Carrier 1.
20. In the Plan window, choose **Task** → **Wait Duration**.
21. Specify a duration of 1 minute. This is how long the helicopter will wait on the carrier deck after it embarks.
22. In the Plan window, choose **Task** → **Disembark**. This disembarks the helicopter from the carrier.
23. In the Plan window, choose **Task** → **Embark**.
24. Specify that the helicopter is to embark on the LSD-49 Harpers Ferry. The plan is complete (Figure A-35).

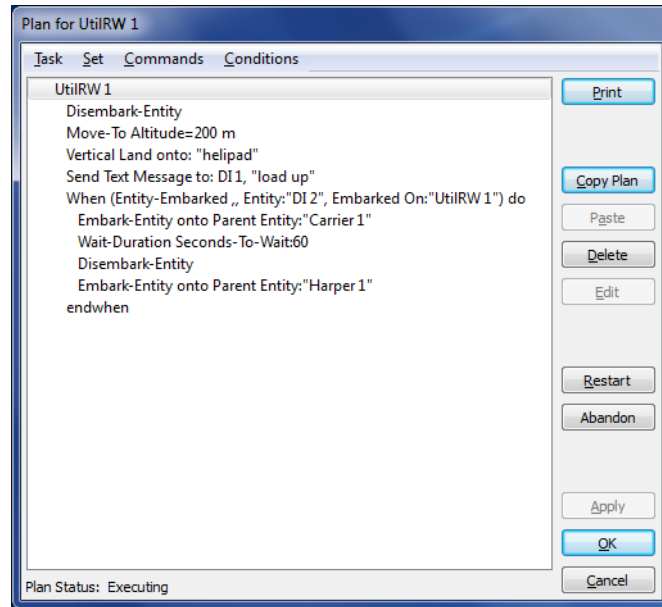


Figure A-35. Rotary-wing entity plan

25. Click OK.

Write the Plan for the DI on the Carrier

By now you should have a pretty good feel for the mechanics of adding tasks to a plan, so we will just tell you which tasks to add to the plans for the DI entities. To view the plans for the entities, load the supplied example scenario and open the Plan window for the entity you are interested in.

Give the DI on the carrier a task to Move to Waypoint "carrier".

Write the Plan for the DI in Town

To write the plan for the DI in the town:

1. Task this entity to embark on the Bradley vehicle.
The DI will have to disembark from the Bradley to embark on the helicopter. We will do this by having the helicopter send a message to the DI when it lands. That will trigger the disembarkation task.
2. Select the top line in the plan window. (The line that says *entity_name*.) We want this condition to be at the top of the plan so it gets registered immediately because we do not know when it will come true.
3. Choose **Conditions** → **When**.
4. In the When Expression dialog box, select Receive Text Message.
5. In the Receive Text Message dialog box, type the message text **Load up**.
6. Click OK to back out of the dialog boxes.
7. In the When block, add a Disembark task.
8. Send a text message to DI2 that says **Let's go**.
9. Set the speed to 10.0 km/h. This is fast enough so that the DI will run to the helicopter instead of walking.
10. Add a task to embark on the UtilRW1.
11. Add another When condition. Select the Entity Embarked condition and specify the helicopter embarked on the carrier.
12. In the When block, add a Wait Duration, 30 seconds task. This task means that when the helicopter embarks on the carrier, the DI entity waits 30 seconds.
13. Add a Disembark task. This disembarks the DI from the helicopter. Since the helicopter is embarked on the carrier, the DI is automatically embarked on the carrier.
14. Add a Move To task and specify Waypoint "carrier". After the DI disembarks from the helicopter, it walks across the deck to the waypoint.
15. Save the plan.

Write the Plan for the DI in the Courtyard

The DI in the courtyard (DI 2) waits until DI 1 sends a “Let’s go” message, then it embarks on the helicopter.

To write the plan for the DI in the courtyard:

1. Open the Plan window for DI 2.
2. Add a When condition that tests for receipt of the **Let ’ s go** message from DI1.
3. In the When block, set the speed to 10.0 km/h and add an Embark task for DI 2 to embark on the helicopter.
4. Save the plan.

Write the Bradley Vehicle’s Plan

We want the Bradley to wait until DI 1 embarks on it, then drive to the palace.

To write the plan for the Bradley vehicle:

1. Add a When statement that tests for DI 1 being embarked on the Bradley.
2. Within the When block, add a Move To Waypoint (On Roads) task for the Bradley to move to waypoint “palace”.
3. Save the plan.



B. Merging Scenarios

This appendix explains how to merge scenarios with the Scenario Merge tool.

The Scenario Merge Tool.....	B-2
Starting Scenario Merge	B-3
Creating a Scenario Merge Project.....	B-4
Adding Scenarios to a Project	B-4
Removing Scenarios from a Project.....	B-5
Specifying an Ignore List File.....	B-5
Saving a Project	B-6
Loading a Project.....	B-6
Merging Scenarios.....	B-7
Displaying Scenario Files	B-7
Editing Scenario Files	B-8
Closing Scenario Files.....	B-8
Specifying the Output Notification Level.....	B-8
Using the Scenario Merge Command-Line Interface.....	B-9

B.1. The Scenario Merge Tool

VR-Forces users often assign scenario development to multiple persons or teams. Then they merge the separately-developed scenarios into a master scenario. Merging scenarios by hand can be a difficult task due to the requirement to reconcile entity and object names, plans, and other scenario elements that could be duplicated, particularly if objects are named using the default conventions.

The Scenario Merge tool allows you to combine two or more VR-Forces scenarios into a single scenario. Scenario Merge detects and resolves conflicts so that the simulated objects can co-exist in a single scenario, without losing their unique identity. Likewise, references to conflicting names are resolved, so that the plans from both scenarios work properly.

Scenario Merge has a graphical user interface and a command-line interface. It is an off-line tool for combining existing scenarios.

Scenario Merge has an API that lets you merge scenarios programmatically. For details, please see the *DtScenarioMergeDirector* class (*scenarioMergeDirector.h*) in the class documentation.

i

Scenario Merge does not merge scripted tasks, selection groups, or observer views.

To merge scripted tasks, export the tasks for each scenario and import them into the merged scenario. For details, please see [“Exporting and Importing Scripted Tasks,”](#) on page 16-26.

To merge observer views, export the observer views from the original scenarios and import them into the merged scenario. For details, please see Section 11.11, [“Saving and Recalling Views,”](#) in *VR-Forces Users Guide*.

There is no way to save and merge in selection groups. However, you could use the selection groups file from the original base scenario.

B.2. Starting Scenario Merge

The graphical user interface is the primary way to use the Scenario Merge tool.

- To start Scenario Merge in Windows, on the Start menu, choose **Programs** → **MAK Technologies** → **VR-Forces 4.3 Early Adopter** → **Tools** → **Scenario Merge**.

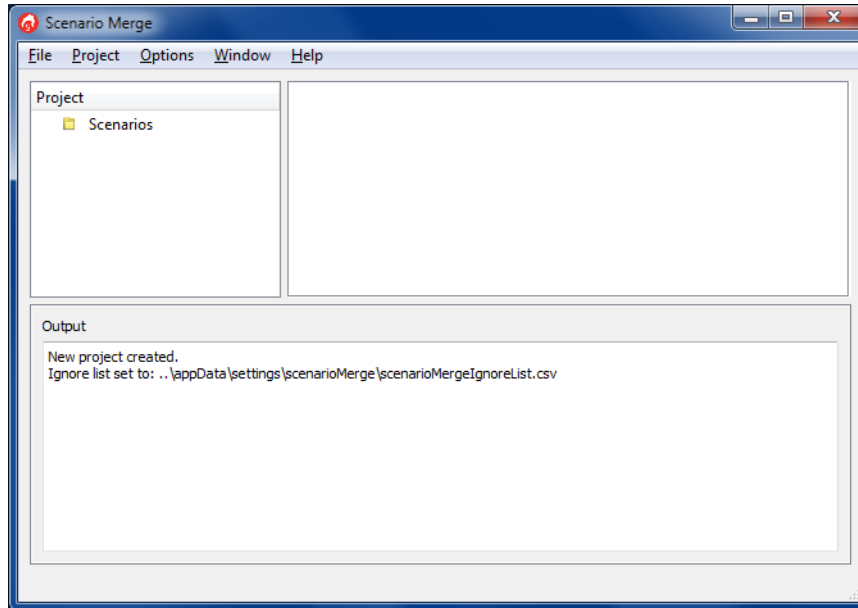


Figure B-1. Scenario Merge window at startup

- To start the Scenario Merge from the command line, enter the following:
`./bin/scenarioMerge [projectFile]`

If you start Scenario Merge from the command line and specify *projectFile*, Scenario Merge loads the project file. Otherwise, it opens a new project. command-line syntax is described in [“Using the Scenario Merge Command-Line Interface,”](#) on page B-9.

B.3. Creating a Scenario Merge Project

Before you can merge scenarios, you must create a Scenario Merge project. A project identifies the scenarios to merge, where to write the merged scenario, and optionally, a list of attributes to ignore during the merge process.



All of the scenarios in a project should be created with the same version of VR-Forces. If you have a scenario that you created with a previous version of VR-Forces and you want to merge it with a newer scenario, open it in the latest version of VR-Forces and save it.

When you start Scenario Merge, it automatically creates a new, empty project. However, you can also start a new project manually.

➤ To open a new project, choose **File** → **New Project**.

B.3.1. Adding Scenarios to a Project

You can add as many scenarios as you want to a project. However, the first scenario you add is the key scenario. It determines the parameters of the final scenario, including, terrain database, simulation model set, exercise start time, and so on. If any of the scenarios that you merge into the first scenario have different scenario parameters, they are ignored and a diagnostic message is recorded in the project log file.

If you add scenarios from different terrains, Scenario Merge uses only geocentric coordinates for entity position data. This is accomplished using the Ignore List File, which is explained in “[Specifying an Ignore List File](#),” on page B-5.



Before you add a scenario created in VR-Forces 3.10.x or earlier to a project, open it in the current version of VR-Forces and save it.

To add a scenario to a project, use one of the following methods:

- Choose **Project** → **Add Scenario**, and select a scenario to add.
- Drag a scenario file (.scn) from Windows Explorer to the Scenario Merge Project tree view.
- Drag a scenario folder from Windows Explorer to the Scenario Merge Project tree view. If you drag a folder, Scenario Merge adds all scenario files in the folder to the project.

B.3.2. Removing Scenarios from a Project

To remove a scenario from a project:

1. In the Project window, select the scenario that you want to remove.
2. Choose **Project** → **Remove Scenario**.

B.3.3. Specifying an Ignore List File

Sometimes it is useful to suppress values when writing to the final scenario. For example, Scenario Merge suppresses any reference to a local coordinate system in the Order of Battle file (*.oob*) file. You can specify values to ignore in an ignore list file. The ignore list file is a comma-delimited text file, for example:

```
local-kinematics-state,IGNORE  
local-vertices,IGNORE
```

The first value is the string to search for during a merge operation. The second value is a text string that will replace the key in the merged scenario.

If a substitution is specified in the ignore list, it is applied to the following files in the scenario:

- ♦ Order of Battle (*.oob*)
- ♦ Plan (*.pln*)
- ♦ Global Plan (*.gpl*)
- ♦ Object Map (*.omp*).

To create an ignore list file, you must use a text editor. Scenario Merge just lets you specify which file to use. You must include the following lines from the default ignore list:

```
local-kinematics-state,IGNORE  
local-vertices,IGNORE
```

These entries are needed when merging scenarios that use different terrains.

To specify the Ignore List file:

1. Choose **Project** → **Specify Ignore List**. The Specify Ignore File dialog box opens.
2. Type a filename or click Browse and select the Ignore List file.
3. Click OK.

B.3.4. Saving a Project

When you save a project, Scenario Merge creates a project file. You can load the project at a later date to merge the scenario again or change which scenarios you want to merge. You can also use a project file to merge files from the command-line. For details about running from the command-line, please see [“Using the Scenario Merge Command-Line Interface,”](#) on page B-9.

To save a project:

1. Choose **File** → **Save Project**. The Scenario Merge dialog box opens.
2. Select a directory and type a name for the project.
3. Click Save. The project gets saved with the extension *.smp*.

The Scenario Merge Project File

A merge project is a comma-delimited text file that lists the scenarios to merge, the desired location for the final result, and merge options. The following is an example of a Scenario Merge project file:

```
OUT,..\\data\\scenarios\\demoMerge
IGN,..\\config\\scenarioMergeIgnoreList.csv
SCN,..\\data\\scenarios\\scenarioOne\\scenarioOne.scn
SCN,..\\data\\scenarios\\scenarioTwo\\scenarioTwo.scn
SCN,..\\data\\scenarios\\scenarioThree\\scenarioThree.scn
SCN,..\\data\\scenarios\\scenarioFlour\\scenarioFlour.scn
```

Each line starts with one of the following keywords:

- OUT specifies the location for the output scenario files.
- IGN specifies an Ignore List file. For details, please see [“Specifying an Ignore List File,”](#) on page B-5.
- SCN specifies the path of a scenario to merge in.



Paths are relative to the location of *scenarioMerge.exe*.

B.3.5. Loading a Project

If you have saved a project, you can load it, edit it as necessary, and regenerate the merged scenario.

To load a project:

1. Choose **File** → **Load Project**. An Open dialog box opens.
2. Select the Scenario Merge project file that you want to load.
3. Click Open.

B.4. Merging Scenarios

- To merge the scenarios in a project, choose **Project** → **Merge**. The scenarios are merged and informational messages are displayed in the console.

B.5. Displaying Scenario Files

You can display the text of one or more of the scenario files in a project.

- To display a scenario file, in the Project window, double click the file. It is displayed to the right of the Project window.

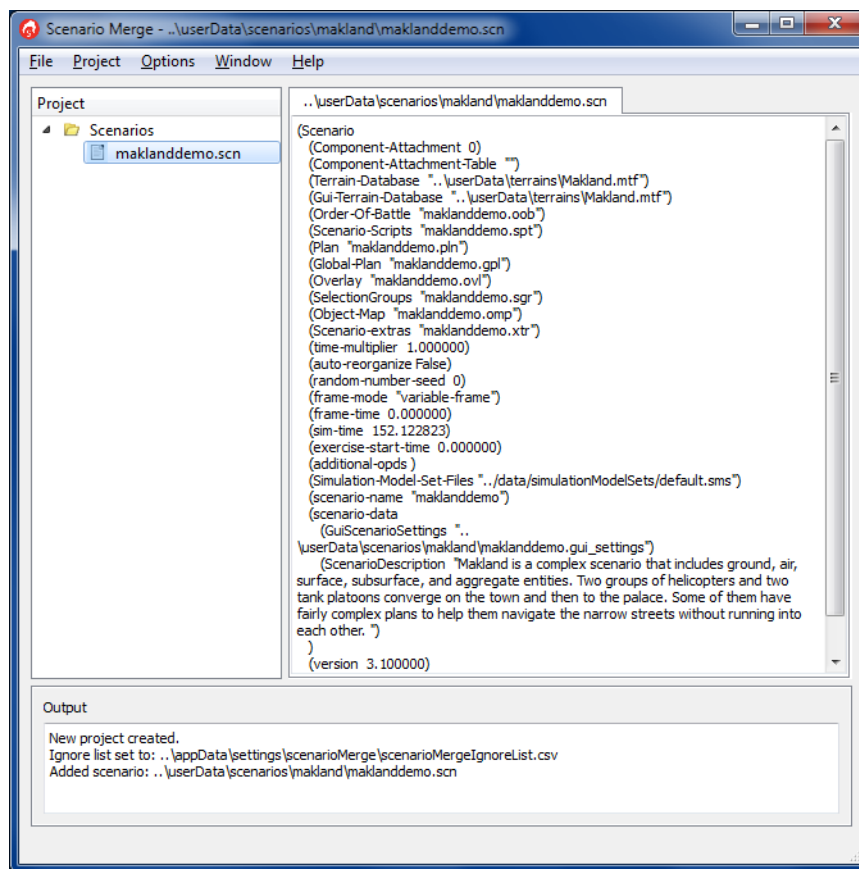


Figure B-2. Scenario file display

B.5.1. Editing Scenario Files

If you display a scenario file, you can edit it. Any edits you make are saved back to the original scenario. You cannot edit the scenario file that gets created when you merge scenarios.



Editing scenario files is risky to scenarios and is advisable only for experienced VR-Forces users. Be sure you fully understand the contents of the file.

To edit a scenario file:

1. In the scenario file display window, make any edits desired.
2. Choose **File** → **Save Scenario** or **Save All**.

B.5.2. Closing Scenario Files

To close a scenario file that is displayed by Scenario Merge, use one of the following methods:

- ♦ Choose **Window** → **Close**. If multiple files are open, this closes the most recently opened one.
- ♦ Choose **Window** → **Close All**.
- ♦ Choose **File** → **Close Scenario**.

B.6. Specifying the Output Notification Level

You can specify the notification level used for sending messages to the output console. The notification levels correspond to the notification levels used throughout MÄK products and described in Chapter 2, *VR-Forces Configuration Files*.

- To set the notification level, choose **Options** → **Set Notify Level** → *level*, where *level* is one of the following:
 - ♦ Fatal
 - ♦ Warning
 - ♦ Info
 - ♦ Verbose
 - ♦ Debug.

B.7. Using the Scenario Merge Command-Line Interface

To run the Scenario Merge tool from the command line, use the following syntax:

```
scenarioMerge -c projectFile
```

where:

-c specifies that Scenario Merge should run in command-line mode.

projectFile specifies a Scenario Merge project file to load. For details about creating project files, please see [“Adding Scenarios to a Project,”](#) on page B-4.



C. Systems and System Usage

The tables in this appendix provide information about the systems provided with VR-Forces and list the entities that use them.

VR-Forces Systems	C-2

C.1. VR-Forces Systems

Table C-1 lists all of the systems provided with the *EntityLevel.sms* and provides information about them. Table C-2 lists each system and the entity types that use it. Table C-3 lists systems and the scripted tasks configured in them for *EntityLevel.sms*. Table C-4 lists the systems for *AggregateLevel.sms*. Table C-5 lists the system and entity types for *AggregateLevel.sms*. Table C-6 lists systems and the scripted tasks configured in them for *AggregateLevel.sms*.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
120mm Gun	weapon	ground	Turreted 120mm gun, typical of tanks such as the M1A2. Fires M829A1-AP and M830-HEAT rounds. Targets ground vehicles.
125mm Gun	weapon	ground	Turreted 125mm gun, typical of tanks such as the T-80. Fires both BM-9-AP and BM-14m-HEAT rounds. Targets ground vehicles.
ADA Quad 14.5mm Machine Gun	weapon	ground	ADA Quad Machine Gun , multi-barreled machine gun used for ADA. Found on ZPU-4. 14.5mm rounds. Targets Air entities.
25mm Gun	weapon	ground	Turreted 25mm gun. Fires M791-AP 25mm rounds. Targets ground vehicles.
30mm Gun	weapon	ground	Turreted 30mm gun. Fires AT-30mm rounds. Targets ground vehicles.
Active RADAR Sensor	sensor	all	Allows an entity to detect other objects through RADAR. Also publishes emitter beams that represent the emissions from the sensor.
Active SONAR Sensor	sensor	all	Allows an entity to detect other objects through SONAR.
Air Aggregate	movement	aggregate	Basic movement capabilities for any air-based aggregate, fixed wing or rotary wing.
Air Cushion	movement	ground	Air cushion movement; allows entity to cross both land and water.
Airborne Targeting RADAR	sensor	fixed-wing, rotary-wing	RADAR used by aircraft to detect targets. Publishes an emitter beam.
Anti-Submarine Missile (Vertically Launched)	weapon	surface	Missile launched from deck of ship, flies out to submarine target and drops a homing torpedo.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
Building Default Damage	damage	cultural-feature	Default damage system for a building.
CIS Air Defense Missile Package	weapon	fixed-wing	Missile launcher with loadout for CIS air defense entity. Fires Aphid AA-8 missiles against air targets and Kedge AS-14 missiles against ground targets.
CIS Attack Helicopter Missile Package	weapon	rotary-wing	Missile launcher with loadout for CIS attack helicopter. Fires Archer AA-11 missiles against air targets and Spiral AT-6 missiles against ground targets.
CIS Attack/Strike Missile Package	weapon	fixed-wing	Missile launcher with loadout for CIS attack/strike entity. Fires Aphid AA-8 missiles against air targets and Kerry AS-7 missiles against ground targets.
CIS Counter Measures Launcher	other	all	Allows an entity to launch counter measures for self defense. Configured with CIS flares and chaff.
CIS Fighter Bomber Bomb Bay	weapon	fixed-wing, rotary-wing	Releases bombs in response to Release Bomb on Target, Location and Laser Spot tasks. Configured to launch bombs manufactured in the Commonwealth of Independent States.
CIS Heavy Bomber Bomb Bay	weapon	fixed-wing, rotary-wing	Releases bombs in response to Release Bomb on Target, Location and Laser Spot tasks. Configured to launch bombs manufactured in the Commonwealth of Independent States.
Counter Measures Launcher	other	all	Allows an entity to launch counter measures for self defense.
Cruise Missile	movement	fixed-wing	Cruise missile flight dynamics. Fast and maneuverable, but with limited tasking capabilities.
DDG Embedded Support Craft (LAMPS/RHB)	other	all	System that allows an entity to deploy and recover Embedded Entities appropriate to a ship with supporting LAMPS units.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
DI Laser Designator	other	all	A laser designator, which can aim a laser at targets. For use with a laser guided missile delivery system. This laser designator can be explicitly tasked to designate particular targets, or set to autonomous lasing mode. In autonomous lasing mode, the laser will automatically designate hostile ground vehicles.
Exocet Cruise Missile Launcher (Forward Launched)	weapon	fixed-wing	Launcher for Exocet anti-ship cruise missiles. Launches missiles forward of the entity, appropriate for aircraft.
Exocet Cruise Missile Launcher (Vertically Launched)	weapon	surface, ground	Launcher for Exocet anti-ship cruise missiles. Launches missiles at an upward angle, appropriate for ships.
Explosive Device	weapon	all	Explosive device system. Allows 3 types of detonations -- instant, time-delayed, and proximity.
Fall From Sky Dynamics	movement	all	Movement dynamics for based on gravity and drag of object.
Maverick Missile Launcher	weapon	fixed-wing	Fixed Maverick Missile Launcher. Fires Air-To-Ground missiles at ground targets. Fixed to the entity (no turret) and always fires forward.
Sidewinder Missile Launcher	weapon	fixed-wing, rotary-wing	Fixed Maverick Missile Launcher. Fires Air-To-Air missiles at air targets. Fixed to the entity (no turret) and always fires forward.
Fixed Wing Default Armor	damage	fixed-wing	Basic armor for a fixed-wing aircraft.
Fighter Jet	movement	fixed-wing	Fighter jet, such as the A-10.
Heavy Plane	movement	fixed-wing	Heavy plane flight dynamics, such as a cargo plane.
High Maneuverability Fighter	movement	fixed-wing	Highly maneuverable fighter jet, such as the F-16.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
Frictionless Gravity Dynamics	movement	all	Movement dynamics solely based on gravity.
Ground Aggregated Movement	aggregated	aggregate	Basic movement capabilities for any ground-based aggregated unit, both vehicle and DI.
Ground Convoy Movement	disaggregated	aggregate	Basic movement capabilities for any ground-based convoy unit.
Ground Disaggregated Movement	disaggregated	aggregate	Basic movement capabilities for any ground-based disaggregated unit, both vehicle and DI.
Heavy Armor	damage	ground	Heavy armored ground vehicle, such as a tank.
Light Armor damage model	damage	ground	Component that computes damage for lightly armored ground vehicles. Maps munition types to damage tables.
Tracks	movement	ground	Movement model for ground entities with tracks.
Tracks/Amphibious	movement	ground	Amphibious tracked vehicles that can move over land and water.
No Armor	damage	ground, vrf object	Unarmored ground vehicle, such as a civilian vehicle.
Wheels (off road)	movement	ground	Wheeled vehicle designed for off road use, such as a HMMWV. Can switch into road following mode.
Wheels (road)	movement	ground	Wheeled vehicle designed for on-road use, such as a civilian car.
AK-47	weapon	human	Handheld AK-47 rifle. Targets human entities.
AT4	weapon	human	Handheld AT4 Anti-Tank weapon. Targets ground vehicles and helicopters.
M16 rifle	weapon	human	Handheld M16 rifle. Targets human entities.
M240B Machine Gun	weapon	human	Hand carried M240B 7.62mm Machine Gun. Targets lifeforms.
M249 SAW	weapon	human	M249 Squad Automatic Weapon, 5.56mm fully automatic rifle. Targets lifeforms.
M60 Machine Gun	weapon	human	Hand carried M60 7.62mm Machine Gun. Targets lifeforms.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
RPG Launcher	weapon	human	Handheld RPG Launcher. Targets ground vehicles and helicopters.
Handheld UAV	movement	fixed-wing	Handheld / hand-launched UAV such as the RQ-11 Raven
Homing Torpedo Capability (Forward Launched)	weapon	subsurface, surface, rotary-wing, fixed-wing	Homing torpedo capability. Launched from forward tubes.
Human Disaggregated Movement	disaggregated	aggregate	Basic movement capabilities for any human disaggregated unit, both vehicle and DI.
Suicide Vest	weapon	human	Explosive device system that is worn by a lifeform.
Human Default	movement	human	Default movement dynamics for human entities. Manages movement and posture.
IFF Transponder	other	all	Sends IFF data, when turned on. IFF is off by default.
IR Sensor	sensor	all	Allows an entity to detect other objects through Infrared.
Laser Designator	other	all	A laser designator, which can aim a laser at targets. For use with a laser guided missile delivery system. This laser designator can be explicitly tasked to designate particular targets, or set to autonomous lasing mode. In autonomous lasing mode, the laser will automatically designate hostile ground vehicles.
Laser Guided Hellfire Missile Launcher	weapon	fixed-wing, rotary-wing	Launches Hellfire missiles at targets that are lased with the laser code matching the one set in the launcher. Can only fire on targets designated with a laser.
Laser Guided Missile Dynamics	movement	missile	Movement dynamics for a laser guided missile. A missile using this type will require a laser on its target.
Default Armor	damage	human	Basic damage model for lifeform entities.
Limit Entity Existence	other	all	Used to control the life span of the object this system is attached to. Once it's life span is up the object is removed from the simulation.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
M2HB Machine Gun	weapon	ground	Turreted M2 .50 Caliber Machine Gun, typical of the secondary gun on tanks such as the M1A2. M2 12.7mm rounds. Targets lifeforms.
M230 Chain Gun	weapon	ground, rotary-wing	M230 chain gun, mounted on the AH-64 Apache. Fires High Explosive Dual Purpose rounds that can penetrate 2 inches of armor, and that fragment to kill soft targets.
M240 Machine Gun	weapon	ground, rotary-wing	Vehicle mounted M240 7.62mm Machine Gun. Typical secondary gun on tanks such as the M1A2. Targets lifeforms and unarmored vehicles.
M250 smoke grenade launcher	other	all	Allows an entity to launch thermal obscuring white phosphorous (WP) smoke.
M252 81mm mortar	weapon	human	
M270 MLRS Launcher	weapon	ground	Turreted indirect fire weapon. Fires M26 rockets on command. Targets must be at least 2km away.
M284 155mm Cannon	weapon	ground	Turreted indirect fire weapon. Fires 155mm M107 rounds on command. Targets must be at least 2km away.
M60 Machine Gun	weapon	ground, rotary-wing	M60 7.62mm Machine Gun, typical vehicle machine gun. Replaced by M240. Targets lifeforms and unarmored vehicles.
MAD Sensor	sensor	all	Allows an entity to detect Subsurface entities using Magnetic Anomaly Detection.
Missile Default Armor	damage	missile, fixed-wing, scripted-movement	Basic armor for a missile.
Guided Missile Dynamics	movement	missile	Movement dynamics for a basic guided missile.
Missile Warhead	weapon	fixed-wing, subsurface, surface	Missile warhead. It explodes as soon as it hits another entity, the ground, or the surface of the water.
MK 45 Naval Gun	weapon	surface	Turreted indirect fire weapon. Fires 127mm rounds on command.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
Naval Depth Charge Deployment	weapon	fixed-wing	Depth charge release system for naval depth charges.
Naval Mine Deployment	weapon	fixed-wing, subsurface, surface	Mine release system for naval (under-water) mines.
Naval Mine Dynamics	movement	all	Movement dynamics based on gravity and drag of object. Will also allow the object to stop at a certain altitude.
Naval Mine Explosive Device	weapon	bomb	Naval Mine device system. Allows 3 types of detonations -- instant, time-delayed, and proximity.
Naval Mine Sweep	other	surface	Execute task to sweep and disable naval mines.
Passive RADAR Sensor	sensor	all	Allows an entity to detect other objects through RADAR. No emitters are published for this sensor.
Passive SONAR Sensor	sensor	all	Allows an entity to detect other objects through SONAR.
Patriot Missile Launcher	weapon	ground	Turreted Patriot Missile Launcher. Targets air vehicles.
Periscope	other	subsurface	System that will allow modeling of a periscope.
Rotary Wing Attack	movement	rotary-wing	Attack Helicopter, such as the A-64.
Rotary Wing Default Armor	damage	rotary-wing	Basic armor for a rotary wing aircraft.
Cargo	movement	rotary-wing	General Cargo helicopter, such as the CH-53 Super Stallion.
Dipping SONAR Sensor	sensor	rotary-wing	Allows an entity to detect other objects through SONAR.
Utility	movement	rotary-wing	General utility helicopter, such as the UH-60 Blackhawk.
VTUAV	movement	rotary-wing	General Vertical Takeoff Unmanned Aerial Vehicle such as the Dragon Warrior
SA-9 SAM Missile Launcher	weapon	ground	Turreted surface-to-air missile launcher which fires SA-9 missiles. Targets air vehicles.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
Scripted Movement	scripted-movement	scripted-movement	System that will allow for scripted movements.
Small boat	movement	surface	Movement dynamics for small boats.
Bomb Dynamics	movement	bomb	Movement dynamics for a guided smart bomb.
SONAR Sensor	sensor	all	Allows an entity to detect other objects through SONAR.
Sonobuoy Deployer	other	all	System that allows an entity to deploy sonobuoys.
Space Shuttle	movement	fixed-wing	Based on the heavy plane flight dynamics.
Spot Report Generator	other	all	Allows the entity to send spot reports through its radio when its sensors detect other entities in the scenario.
Spot Report Receiver	other	all	Allows an entity to receive spot reports from other entities over the radio, and add these contacts to its list of known entities. By default, spot reports expire after 5 minutes.
Stinger Missile Launcher	weapon	ground	Turreted Stinger Missile Launcher. Targets air vehicles between 1km and 8km away, and fires guided stinger missiles at them.
Subsurface Entity Default	damage	subsurface	Basic damage model for subsurface entities.
Subsurface	movement	subsurface	Movement dynamics for a subsurface vessel.
Surface Entity Default	damage	surface	Basic damage model for a surface vessel
Surface Disaggregated Movement	disaggregated	aggregate	Basic movement capabilities for any surface-entity-based disaggregated unit.
Large Ship	movement	surface	Movement dynamics for a large ship.
Surface Multiple Hit Damage	damage	surface	Hit point based surface damage model
Small Surface Ships	damage	surface	Damage model for small boats such as inflatables, sailboats, or small patrol boats.

Table C-1: System descriptions, EntityLevel.sms

System	Category	Entity Types	Description
Torpedo Warhead	weapon	subsurface, surface	Torpedo warhead. It explodes as soon as it hits another entity, the ground, but not the surface of the water. Can also explode proximal to entity.
TOW Missile Launcher	weapon	ground	Turreted TOW Missile Launcher. Targets ground vehicles.
US Fighter Bomber Bomb Bay	weapon	fixed-wing, rotary-wing	Releases bombs in response to Release Bomb on Target, Location and Laser Spot tasks. Configured to launch bombs manufactured in the United States of America.
US Heavy Bomber Bomb Bay	weapon	fixed-wing, rotary-wing	Releases bombs in response to Release Bomb on Target, Location and Laser Spot tasks. Configured to launch bombs manufactured in the United States of America.
Vertical SAM Missile Launcher	weapon	ground, surface	surface-to-air missile launcher which fires SM-2 missiles. Targets cruise missiles.
Visual Sensor	sensor	all	Allows an entity to detect other objects through visible light.

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
120mm Gun	AMX-30 MBT, AMX-56 Leclerc MBT, Arjun MBT (No 3D), C1 Ariete MBT (No 3D), FV4030/4 Challenger MBT (No 3D), FV4034 Challenger 2 MBT (No 3D), K1A1 MBT (No 3D), Leopard 2 Tank, M1A2 Abrams MBT, Merkava III MBT (No 3D), Merkava IV MBT (No 3D), PT-91 Twardy MBT (No 3D), Type 10 MBT (No 3D), Type 90 Kyu-maru MBT (No 3D)
125mm Gun	MBT 2000 (No 3D), T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Type 99 MBT (No 3D)
ADA Quad 14.5mm Machine Gun	ZPU-4 AA Gun, ZSU-23-4 Shilka
25mm Gun	AAVC7A1 Landing Vehicle, FV101 Scorpion CVR, M2A2 Bradley IFV, M3A2 Bradley CFV, MBT 2000 (No 3D), T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Type 99 MBT (No 3D), XM7 FIST-Bradley
30mm Gun	BMP-2 AFV, FV 510 Warrior (No 3D), FV107 Scimitar (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Active RADAR Sensor	Aircraft Carrier, Arleigh Burke-class Destroyer, Bay-class DLS (No 3D), Sentinel R1 (No 3D), Dabur-class Patrol Boat (No 3D), Durand de la Penne-class Destroyer (No 3D), Echo-class Survey Ship (No 3D), Fridtjof Nansen-class (No 3D), Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Henry J Kaiser-class Oiler (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), Invincible-class Carrier (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), L-class Frigate (No 3D), M-class Frigate (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), LPH01 Ocean (No 3D), Harpers Ferry-class LSD, MIM-104 Patriot Launcher, Osprey-class Mine CMS (No 3D), Nimitz-class Carrier, Oksoy-class Minehunter (No 3D), Queen Elizabeth-class Carrier (No 3D), River-class Patrol Vessel (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), Sandown-class Minehunter (No 3D), Skjold-class Patrol (No 3D), Sovremenny-class Destroyer, Super Dvora Mark II (No 3D), Tiger-class Fast Attack Craft (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D)
Active SONAR Sensor	Alta-class Minehunter (No 3D), Fridtjof Nansen-class (No 3D), L-class Frigate (No 3D), M-class Frigate (No 3D), Oksoy-class Minehunter (No 3D), Sonobuoy (Passive)
Air Aggregate	
Air Cushion	LCAC
Airborne Targeting RADAR	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AV-8B Harrier II, B-2 Spirit, BAE CT-155 Hawk (No 3D), C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), Cypher VTUAV, Dragon Warrior VTUAV, E-3 Sentry, EA-6B Prowler, Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Hermes 450 (No 3D), Maveric UAS (No 3D), MiG-27 Flogger, MiG-29 Fulcrum, Mirage 2000, Mirage F1, MQ-9 Reaper UAV, P-3 Orion, MQ-1 Predator, RQ-11 Raven UAV, RQ-4 Global Hawk UAV (No 3D), RQ-7 Shadow UAV (No 3D), ScanEagle UAV (No 3D), SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Tornado ADV
Anti-Submarine Missile (Vertically Launched)	Arleigh Burke-class Destroyer, Type 23 Frigate (No 3D)
Building Default Damage	POL Storage Tank, Tower Radio
CIS Air Defense Missile Package	MiG-29 Fulcrum, SU-27 Flanker

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
CIS Attack Helicopter Missile Package	KA-50 Hokum, Mi-24 Hind, Mi-28 Havoc
CIS Attack/Strike Missile Package	MiG-27 Flogger, SU-25 Frogfoot, Su-37 Flanker
CIS Counter Measures Launcher	KA-50 Hokum, Mi-24 Hind, Mi-28 Havoc, MiG-27 Flogger, MiG-29 Fulcrum, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker
CIS Fighter Bomber Bomb Bay	MiG-27 Flogger, MiG-29 Fulcrum, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker
CIS Heavy Bomber Bomb Bay	
Counter Measures Launcher	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), AV-8B Harrier II, BAE CT-155 Hawk (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), CH-148 Cyclone (No 3D), CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, EA-6B Prowler, EC145 (No 3D), EH101 Merlin (No 3D), Eurofighter Typhoon, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, HH-65 Dolphin (No 3D), KA-50 Hokum, MD 500 (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, MiG-27 Flogger, MiG-29 Fulcrum, Mirage 2000, Mirage F1, OH-58 Kiowa, P-3 Orion, RAH-66 Comanche, SA 330 Puma (No 3D), SH-3 Sea King (No 3D), SH-60 Seahawk, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Tornado ADV, UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), V-22 Osprey (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D)
Cruise Missile	Exocet Cruise Missile, RUR-5 ASROC (No 3D)
DDG Embedded Support Craft (LAMPS/RHIB)	Arleigh Burke-class Destroyer
DI Laser Designator	DI Lasing (CIS), DI Lasing (US)
Exocet Cruise Missile Launcher (Forward Launched)	MiG-27 Flogger, Mirage 2000, SU-25 Frogfoot, Su-37 Flanker

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Exocet Cruise Missile Launcher (Vertically Launched)	Arleigh Burke-class Destroyer, Durand de la Penne-class Destroyer (No 3D), Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Horizon-class Destroyer (No 3D), Iroquois-class Destroyer (No 3D), KD-III-class Destroyer (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), Skjold-class Patrol (No 3D), Sovremenny-class Destroyer, Tiger-class Fast Attack Craft (No 3D), Type 42 Destroyer (No 3D), Type 22 Frigate (No 3D), Udaloy-class Destroyer (No 3D)
Explosive Device	Car Bomb, Duffle Bag, Naval Mine, Quickstrike Mk 65, Roadside IED, Sea Lance ASW, Suicide Bomber
Fall From Sky Dynamics	CIS Chaff, CIS Flare, US Chaff, US Flare
Maverick Missile Launcher	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AV-8B Harrier II, EA-6B Prowler, Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Mirage F1, P-3 Orion, MQ-1 Predator, Tornado ADV
Sidewinder Missile Launcher	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AV-8B Harrier II, BAE CT-155 Hawk (No 3D), Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Mirage F1, Tornado ADV
Fixed Wing Default Armor	A-10 Thunderbolt, A-4 Skyhawk (No 3D), Airbus 310, Airbus 320, Airbus 380 (No 3D), AT-802 (No 3D), AV-8B Harrier II, B-2 Spirit, Beechcraft 36 Bonanza (No 3D), Beechcraft C-12 Super King (No 3D), Beechcraft T-6 (No 3D), BN-2 Islander (No 3D), Boeing 707, Boeing 737 British Midland, Boeing 747-400, Boeing 757 (No 3D), Boeing 767 (No 3D), Boeing 777 (No 3D), Boeing 787 (No 3D), Bombardier CL-600 (No 3D), Bombardier DHC-8 (No 3D), Sentinel R1 (No 3D), Bombardier CRJ100 Conrad Air, Bombardier CRJ200 Air France, C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), Dornier DO 228-200 LGW, E-3 Sentry, EA-6B Prowler, Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Gulfstream G550 (No 3D), Hermes 450 (No 3D), IAI 1124 Sea Scan (No 3D), Lockheed L-1011 (No 3D), Maveric UAS (No 3D), MiG-27 Flogger, MiG-29 Fulcrum, Mirage 2000, Mirage F1, MQ-9 Reaper UAV, P-3 Orion, MQ-1 Predator, RQ-11 Raven UAV, RQ-4 Global Hawk UAV (No 3D), RQ-7 Shadow UAV (No 3D), ScanEagle UAV (No 3D), Space Shuttle, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Tornado ADV
Fighter Jet	A-10 Thunderbolt, AV-8B Harrier II, B-2 Spirit, F-117A Nighthawk, MiG-27 Flogger, SU-25 Frogfoot, Su-37 Flanker

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Heavy Plane	Airbus 310, Airbus 320, Airbus 380 (No 3D), AT-802 (No 3D), Beechcraft 36 Bonanza (No 3D), Beechcraft C-12 Super King (No 3D), Beechcraft T-6 (No 3D), BN-2 Islander (No 3D), Boeing 707, Boeing 737 British Midland, Boeing 747-400, Boeing 757 (No 3D), Boeing 767 (No 3D), Boeing 777 (No 3D), Boeing 787 (No 3D), Bombardier CL-600 (No 3D), Bombardier DHC-8 (No 3D), Sentinel R1 (No 3D), Bombardier CRJ100 Conrad Air, Bombardier CRJ200 Air France, C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), Dornier DO 228-200 LGW, E-3 Sentry, EA-6B Prowler, Gulfstream G550 (No 3D), IAI 1124 Sea Scan (No 3D), Lockheed L-1011 (No 3D), P-3 Orion
High Maneuverability Fighter	A-4 Skyhawk (No 3D), BAE CT-155 Hawk (No 3D), Canadair CT-114 (No 3D), Eurofighter Typhoon, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Hermes 450 (No 3D), MiG-29 Fulcrum, Mirage 2000, Mirage F1, MQ-9 Reaper UAV, MQ-1 Predator, RQ-4 Global Hawk UAV (No 3D), SU-27 Flanker, Tornado ADV
Frictionless Gravity Dynamics	M107 155mm, M26 Rocket, M374A2 81mm
Ground Aggregated Movement	ADA Plt (CIS), ADA Plt (US), Armor Co (CIS), Armor Co (US), Armor Co HQ (CIS), Armor Co HQ (US), Armor Plt (CIS), Armor Plt (US), COLT Team (CIS), COLT Team (US), CSS Plt (CIS), CSS Plt (US), DI Plt (CIS), DI Squad (CIS), DI Squad (US), FA Battery (US), Ground Aggregate, MI Plt (CIS), MI Plt with IFV (US), USMC FT, USMC SQD, US Army LtInf FT, US Army LtInf SQD, US Army Mech FT A (Javelin), US Army Mech FT B, US Army Mech SQD
Ground Convoy Movement	Convoy
Ground Disaggregated Movement	ADA Plt (CIS), ADA Plt (US), Armor Co (CIS), Armor Co (US), Armor Co HQ (CIS), Armor Co HQ (US), Armor Plt (CIS), Armor Plt (US), CSS Plt (CIS), CSS Plt (US), DI Squad (US), FA Battery (US), Ground Aggregate, MI Plt (CIS), MI Plt with IFV (US)
Heavy Armor	AMX-30 MBT, AMX-56 Leclerc MBT, Arjun MBT (No 3D), Badger AEV (No 3D), Beaver AVLB (No 3D), Buffalo MRAP III (No 3D), Buffel ARV (No 3D), C1 Ariete MBT (No 3D), FV4030/4 Challenger MBT (No 3D), FV4034 Challenger 2 MBT (No 3D), K1A1 MBT (No 3D), Leopard 2 Tank, M1A2 Abrams MBT, MBT 2000 (No 3D), Merkava III MBT (No 3D), Merkava IV MBT (No 3D), MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), PT-91 Twardy MBT (No 3D), T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Taurus ARV (No 3D), Type 10 MBT (No 3D), Type 90 Kyu-maru MBT (No 3D), Type 99 MBT (No 3D), VM 90 LSVW (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Light Armor damage model	Aardvark JSFU (No 3D), AAVC7A1 Landing Vehicle, Achzarit APC (No 3D), AS-90 Artillery, Bison APC (No 3D), BMP-2 AFV, BTR-80 APC, CAESAR SP Howitzer, Cougar FSV (No 3D), Coyote APC (No 3D), FV 510 Warrior (No 3D), FV101 Scorpion CVR, FV107 Scimitar (No 3D), FV432 APC (No 3D), Grizzly APC (No 3D), Husky ARV (No 3D), L-118 Howitzer (No 3D), LAV III APC (No 3D), LG1 Howitzer (No 3D), M-71 Howitzer (No 3D), M109 Howitzer, M1126 Stryker ICV, M113 APC, M252 Mortar (No 3D), M2A2 Bradley IFV, M3A2 Bradley CFV, M577A2 Command Post, M777 Howitzer (No 3D), M88 Medium Recovery Vehicle, M993 MLRS, M9 ACE, Mamba APC (No 3D), MT-LB APC, Namer APC (No 3D), Puma CEV (No 3D), Rapier SAM (No 3D), SA-15 Gauntlet SAM, SA-19 Grison, SA-6 Gainful SAM, SA-9 Gaskin SAM System, VAB APC, VBL ATV, XM7 FIST-Bradley, ZPU-4 AA Gun, ZSU-23-4 Shilka
Tracks	Aardvark JSFU (No 3D), Achzarit APC (No 3D), AMX-30 MBT, AMX-56 Leclerc MBT, Arjun MBT (No 3D), AS-90 Artillery, Badger AEV (No 3D), Beaver AVLB (No 3D), Bison APC (No 3D), BMP-2 AFV, BTR-80 APC, Buffel ARV (No 3D), C1 Ariete MBT (No 3D), Cougar FSV (No 3D), Coyote APC (No 3D), FV 510 Warrior (No 3D), FV101 Scorpion CVR, FV107 Scimitar (No 3D), FV4030/4 Challenger MBT (No 3D), FV4034 Challenger 2 MBT (No 3D), FV432 APC (No 3D), Grizzly APC (No 3D), Husky ARV (No 3D), K1A1 MBT (No 3D), LAV III APC (No 3D), Leopard 2 Tank, LG1 Howitzer (No 3D), M-71 Howitzer (No 3D), M109 Howitzer, M1A2 Abrams MBT, M252 Mortar (No 3D), M2A2 Bradley IFV, M3A2 Bradley CFV, M577A2 Command Post, M777 Howitzer (No 3D), M88 Medium Recovery Vehicle, M993 MLRS, M9 ACE, Mamba APC (No 3D), MBT 2000 (No 3D), Merkava III MBT (No 3D), Merkava IV MBT (No 3D), MT-LB APC, Namer APC (No 3D), PT-91 Twardy MBT (No 3D), Puma CEV (No 3D), Rapier SAM (No 3D), SA-15 Gauntlet SAM, SA-19 Grison, SA-6 Gainful SAM, T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Taurus ARV (No 3D), Type 10 MBT (No 3D), Type 90 Kyu-maru MBT (No 3D), Type 99 MBT (No 3D), VAB APC, VBL ATV, XM7 FIST-Bradley, ZSU-23-4 Shilka
Tracks/Amphibious	AAVC7A1 Landing Vehicle

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
No Armor	Actros AHSVS (No 3D), Ambulance, BV206 SUSV (No 3D), Car Bomb, Civilian vehicle, Cow, Defense Satellite, Duffle Bag, Female On Bike, Fire Engine, Fuel Tanker Trailer, G-Wagen (No 3D), GAZ-69 Utility Vehicle, Goat, HMMWV Utility Vehicle, HMMWV with Avenger, HMMWV with M2, HMMWV with Shelter, HMMWV with TOW launcher, Horse, Horse with Rider, Iveco LMV (No 3D), Jackal MWMIK (No 3D), Jet Ski, Land Rover Wolf (No 3D), LCAC, M-Gator ATV (No 3D), M35 Truck, M58 MICLIC, M939A2 5-Ton Truck, M977 HEMTT Cargo Truck, M978 HEMTT Fuel Truck, Male On Bike, MILCOTTS Silverado (No 3D), MIM-104 Patriot Launcher, Mule, Navistar 7000 (No 3D), Police Car, Rigid-Hulled Inflatable Boat, Rigid-Hulled Inflatable Boat - Civilian, Roadside IED, Sailboat, Sheep, Speedboat, Technical Truck, Tractor Trailer Cab, Tractor Trailer with Cab, Water Buffalo, ZIL-135 8x8 Truck
Wheels (off road)	Actros AHSVS (No 3D), Buffalo MRAP III (No 3D), CAESAR SP Howitzer, Cow, Female On Bike, Fire Engine, GAZ-69 Utility Vehicle, Goat, HMMWV Utility Vehicle, HMMWV with Avenger, HMMWV with M2, HMMWV with Shelter, HMMWV with TOW launcher, Horse, Horse with Rider, Iveco LMV (No 3D), Jackal MWMIK (No 3D), Land Rover Wolf (No 3D), M1126 Stryker ICV, M113 APC, M35 Truck, M58 MICLIC, M939A2 5-Ton Truck, M977 HEMTT Cargo Truck, M978 HEMTT Fuel Truck, Male On Bike, MIM-104 Patriot Launcher, MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), Mule, Navistar 7000 (No 3D), SA-9 Gaskin SAM System, Sheep, Technical Truck, VM 90 LSVW (No 3D), Water Buffalo, ZIL-135 8x8 Truck
Wheels (road)	Ambulance, BV206 SUSV (No 3D), Car Bomb, Civilian vehicle, Fuel Tanker Trailer, G-Wagen (No 3D), M-Gator ATV (No 3D), MILCOTTS Silverado (No 3D), Police Car, Tractor Trailer Cab, Tractor Trailer with Cab
AK-47	DI AK-47, DI Lasing (CIS), Mideast Combatant, Taliban
AT4	Chilean AT4, US Army AT4
M16 rifle	Chilean IMI Galil, Chilean M16-M203, Chilean M16, Chilean M4, DI Lasing (US), DI SMAW And Rifle, Police Officer, Sergeant M16, Suspect, USMC M16-M203, USMC M16, USMC M4, US Army M16-M203, US Army M16, US Army M4, US Army M9
M240B Machine Gun	Chilean M240, USMC M240, US Army M240
M249 SAW	Chilean M249, USMC M249, US Army M249
M60 Machine Gun	Chilean M60, US Army M60
RPG Launcher	DI RPG, , Mideast Combatant with RPG, US Army Javelin

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Handheld UAV	Maveric UAS (No 3D), RQ-11 Raven UAV, RQ-7 Shadow UAV (No 3D), ScanEagle UAV (No 3D)
Homing Torpedo Capability (Forward Launched)	Arleigh Burke-class Destroyer, Astute-class Submarine (No 3D), Dolphin-class Submarine (No 3D), Durand de la Penne-class Destroyer (No 3D), Fridtjof Nansen-class (No 3D), Guided Missile Destroyer, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Iroquois-class Destroyer (No 3D), M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), Los Angeles-Class Submarine, Ohio-class Submarine, Romeo-class Submarine, RUR-5 ASROC (No 3D), Scorpene-class Submarine (No 3D), SH-60 Seahawk, Song-class Submarine, Sovremenny-class Destroyer, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D), Ula-class Submarine (No 3D), Vanguard-class Submarine (No 3D), Victoria-class (No 3D), Walrus-class submarine (No 3D)
Human Disaggregated Movement	COLT Team (CIS), COLT Team (US), DI Plt (CIS), DI Squad (CIS), USMC FT, USMC SQD, US Army LtInf FT, US Army LtInf SQD, US Army Mech FT A (Javelin), US Army Mech FT B, US Army Mech SQD
Suicide Vest	Suicide Bomber
Human Default	Cameraman, Chicken, Child, Child (Crowd Behavior), Chilean AT4, Chilean IMI Galil, Chilean M16-M203, Chilean M16, Chilean M240, Chilean M249, Chilean M4, Chilean M60, Civilian (Chem/Bio Behavior), Civilian Female, Civilian Male, DI AK-47, DI Lasing (CIS), DI Lasing (US), DI RPG, DI SMAW And Rifle, Factory Worker, Female Civilian (Crowd Behavior), Female Dancer, Fireman (Extinguisher), Fireman (Hose), Flight Deck Crew, Flight Deck Crewman, Flight Deck Crew (Chock And Chains), Flight Deck Crew (Grounding Cable), Flight Deck Crew (Pallet Handler), Flight Deck Worker, Male Civilian (Crowd Behavior), Man in Wheelchair, Mideast Combatant, Mideast Combatant with RPG, Mideast Female, Mideast Female (Crowd Behavior), Mideast Male, Mideast Male (Crowd Behavior), Mother, Police Officer, Sergeant M16, Suicide Bomber, Suspect, Taliban, US Army Medic, US EOD, USMC M16-M203, USMC M16, USMC M240, USMC M249, USMC M4, US Army AT4, US Army Javelin, US Army M16-M203, US Army M16, US Army M240, US Army M249, US Army M4, US Army M60, US Army M9, Western Teen

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
IFF Transponder	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), Airbus 310, Airbus 320, Airbus 380 (No 3D), AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), Astute-class Submarine (No 3D), AT-802 (No 3D), AV-8B Harrier II, B-2 Spirit, BAE CT-155 Hawk (No 3D), Bay-class DLS (No 3D), Beechcraft 36 Bonanza (No 3D), Beechcraft C-12 Super King (No 3D), Beechcraft T-6 (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), BN-2 Islander (No 3D), Boeing 707, Boeing 737 British Midland, Boeing 747-400, Boeing 757 (No 3D), Boeing 767 (No 3D), Boeing 777 (No 3D), Boeing 787 (No 3D), Bombardier CL-600 (No 3D), Bombardier DHC-8 (No 3D), Sentinel R1 (No 3D), Bombardier CRJ100 Conrad Air, Bombardier CRJ200 Air France, C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), Canadair CT-114 (No 3D), CH-148 Cyclone (No 3D), CH-149 Cormorant, CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, Cypher VTUAV, Dabur-class Patrol Boat (No 3D), Dornier DO 228-200 LGW, Dragon Warrior VTUAV, Durand de la Penne-class Destroyer (No 3D), E-3 Sentry, EA-6B Prowler, EC145 (No 3D), Echo-class Survey Ship (No 3D), EH101 Merlin (No 3D), Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Gulfstream G550 (No 3D), Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), HH-65 Dolphin (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), IAI 1124 Sea Scan (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), KA-50 Hokum, KD-III-class Destroyer (No 3D), L 14 Albion (No 3D), Lockheed L-1011 (No 3D), LPH01 Ocean (No 3D), MD 500 (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, MiG-27 Flogger, MiG-29 Fulcrum, Mirage 2000, Mirage F1, Nimitz-class Carrier, OH-58 Kiowa, P-3 Orion, RAH-66 Comanche, River-class Patrol Vessel (No 3D), SA 330 Puma (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), SH-3 Sea King (No 3D), SH-60 Seahawk, Sovremenny-class Destroyer, Space Shuttle, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Tornado ADV, Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D), UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), V-22 Osprey (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
IFF Transponder (continued)	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), Airbus 310, Airbus 320, Airbus 380 (No 3D), AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), Astute-class Submarine (No 3D), AT-802 (No 3D), AV-8B Harrier II, B-2 Spirit, BAE CT-155 Hawk (No 3D), Bay-class DLS (No 3D), Beechcraft 36 Bonanza (No 3D), Beechcraft C-12 Super King (No 3D), Beechcraft T-6 (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), BN-2 Islander (No 3D), Boeing 707, Boeing 737 British Midland, Boeing 747-400, Boeing 757 (No 3D), Boeing 767 (No 3D), Boeing 777 (No 3D), Boeing 787 (No 3D), Bombardier CL-600 (No 3D), Bombardier DHC-8 (No 3D), Sentinel R1 (No 3D), Bombardier CRJ100 Conrad Air, Bombardier CRJ200 Air France, C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), Canadair CT-114 (No 3D), CH-148 Cyclone (No 3D), CH-149 Cormorant, CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, Cypher VTUAV, Dabur-class Patrol Boat (No 3D), Dornier DO 228-200 LGW, Dragon Warrior VTUAV, Durand de la Penne-class Destroyer (No 3D), E-3 Sentry, EA-6B Prowler, EC145 (No 3D), Echo-class Survey Ship (No 3D), EH101 Merlin (No 3D), Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Gulfstream G550 (No 3D), Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), HH-65 Dolphin (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), IAI 1124 Sea Scan (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), KA-50 Hokum, KD-III-class Destroyer (No 3D), L 14 Albion (No 3D), Lockheed L-1011 (No 3D), LPH01 Ocean (No 3D), MD 500 (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, MiG-27 Flogger, MiG-29 Fulcrum, Mirage 2000, Mirage F1, Nimitz-class Carrier, OH-58 Kiowa, P-3 Orion, RAH-66 Comanche, River-class Patrol Vessel (No 3D), SA 330 Puma (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), SH-3 Sea King (No 3D), SH-60 Seahawk, Sovremenny-class Destroyer, Space Shuttle, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Tornado ADV, Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D), UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), V-22 Osprey (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
IR Sensor	AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), Arleigh Burke-class Destroyer, AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), CH-148 Cyclone (No 3D), CH-149 Cormorant, CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, Dabur-class Patrol Boat (No 3D), EC145 (No 3D), Echo-class Survey Ship (No 3D), EH101 Merlin (No 3D), Hermes 450 (No 3D), HH-65 Dolphin (No 3D), HMMWV with Avenger, Island-class Patrol Vessel (No 3D), KA-50 Hokum, Maveric UAS (No 3D), MD 500 (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, MQ-9 Reaper UAV, OH-58 Kiowa, MQ-1 Predator, RAH-66 Comanche, River-class Patrol Vessel (No 3D), RQ-11 Raven UAV, RQ-4 Global Hawk UAV (No 3D), RQ-7 Shadow UAV (No 3D), SA 330 Puma (No 3D), Sandown-class Minehunter (No 3D), ScanEagle UAV (No 3D), SH-3 Sea King (No 3D), SH-60 Seahawk, Type 42 Destroyer (No 3D), UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), V-22 Osprey (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D)
Laser Designator	DI Lasing (CIS), DI Lasing (US)
Laser Guided Hellfire Missile Launcher	AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MQ-9 Reaper UAV, RAH-66 Comanche
Laser Guided Missile Dynamics	Laser Guided Hellfire Missile
Default Armor	Cameraman, Chicken, Child, Child (Crowd Behavior), Child (Injured), Chilean AT4, Chilean IMI Galil, Chilean M16-M203, Chilean M16, Chilean M240, Chilean M249, Chilean M4, Chilean M60, Civilian (Chem/Bio Behavior), Civilian Female, Civilian Male, DI AK-47, DI Lasing (CIS), DI Lasing (US), DI RPG, DI SMAW And Rifle, Factory Worker, Female Civilian (Crowd Behavior), Female Dancer, Fireman (Extinguisher), Fireman (Hose), Flight Deck Crew, Flight Deck Crewman, Flight Deck Crew (Chock And Chains), Flight Deck Crew (Grounding Cable), Flight Deck Crew (Pallet Handler), Flight Deck Worker, Male Civilian (Crowd Behavior), Man in Wheelchair, Mideast Combatant, Mideast Combatant with RPG, Mideast Female, Mideast Female (Crowd Behavior), Mideast Male, Mideast Male (Crowd Behavior), Mother, Police Officer, Sergeant M16, Suicide Bomber, Suspect, Taliban, US Army Medic, US EOD, USMC M16-M203, USMC M16, USMC M240, USMC M249, USMC M4, US Army AT4, US Army Javelin, US Army M16-M203, US Army M16, US Army M240, US Army M249, US Army M4, US Army M60, US Army M9, Western Teen
Limit Entity Existence	CIS Chaff, CIS Flare, Mk-46 MOD 5 Torpedo (No 3D), Mk-48 ADCAP Torpedo, RUR-5 ASROC (No 3D), US Chaff, US Flare

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
M2HB Machine Gun	Achzarit APC (No 3D), Badger AEV (No 3D), BTR-80 APC, Buffel ARV (No 3D), HMMWV with M2, Leopard 2 Tank, M1126 Stryker ICV, M113 APC, MT-LB APC, Namer APC (No 3D), Rigid-Hulled Inflatable Boat, Taurus ARV (No 3D), Technical Truck, Type 10 MBT (No 3D), Type 90 Kyu-maru MBT (No 3D), VAB APC
M230 Chain Gun	AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), MH-60L Black Hawk DAP (No 3D), RAH-66 Comanche, Westland Lynx (No 3D)
M240 Machine Gun	Arjun MBT (No 3D), Bison APC (No 3D), C1 Ariete MBT (No 3D), Cougar FSV (No 3D), Coyote APC (No 3D), FV4034 Challenger 2 MBT (No 3D), FV432 APC (No 3D), Grizzly APC (No 3D), HH-65 Dolphin (No 3D), Husky ARV (No 3D), Iveco LMV (No 3D), Jackal MWMIK (No 3D), LAV III APC (No 3D), M1A2 Abrams MBT, Mamba APC (No 3D), MBT 2000 (No 3D), MH-47 Chinook (No 3D), MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), PT-91 Twardy MBT (No 3D), T-84 MBT (No 3D), T90A MBT (No 3D), Type 99 MBT (No 3D), USMC M240, V-22 Osprey (No 3D), VM 90 LSVW (No 3D)
M250 smoke grenade launcher	Achzarit APC (No 3D), Arjun MBT (No 3D), Badger AEV (No 3D), Buffel ARV (No 3D), M1A2 Abrams MBT, Merkava III MBT (No 3D), Merkava IV MBT (No 3D), Namer APC (No 3D), Puma CEV (No 3D), Taurus ARV (No 3D), Type 10 MBT (No 3D)
M252 81mm mortar	M252 Mortar (No 3D)
M270 MLRS Launcher	M993 MLRS
M284 155mm Cannon	AS-90 Artillery, CAESAR SP Howitzer, L-118 Howitzer (No 3D), LG1 Howitzer (No 3D), M-71 Howitzer (No 3D), M109 Howitzer, M777 Howitzer (No 3D)
M60 Machine Gun	CH-148 Cyclone (No 3D), CH-47 Chinook (No 3D), MH-60 Black Hawk, SH-3 Sea King (No 3D)
MAD Sensor	CH-46E Sea Knight, P-3 Orion, SH-60 Seahawk
Missile Default Armor	AA-11 Archer Missile, AA-8 Aphid Missile, AGM-65 Maverick Missile, AIM-9 Sidewinder Missile, AS-12 Kegler Missile, AS-14 Kedge Missile, AS-7 Kerry Missile, AT-6 Spiral Missile, BGM-71 TOW Missile, Exocet Cruise Missile, FIM-92 Stinger Missile, Hellfire Missile, Laser Guided Hellfire Missile, M39 Missile, MIM004 Patriot Missile, RUR-5 ASROC (No 3D), SA-9 Missile, Scud-B Missile, SM-2 Standard Missile, SS-24 Scalpel Missile, SS-24 Scalpel Stage

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Guided Missile Dynamics	AA-11 Archer Missile, AA-8 Aphid Missile, AGM-65 Maverick Missile, AIM-9 Sidewinder Missile, AS-12 Kegler Missile, AS-14 Kedge Missile, AS-7 Kerry Missile, AT-6 Spiral Missile, BGM-71 TOW Missile, Exocet Cruise Missile, FIM-92 Stinger Missile, Hellfire Missile, Laser Guided Hellfire Missile, MIM004 Patriot Missile, RUR-5 ASROC (No 3D), SA-9 Missile, SM-2 Standard Missile
Missile Warhead	Exocet Cruise Missile, M107 155mm, M26 Rocket, M374A2 81mm, SM-2 Standard Missile
MK 45 Naval Gun	Arleigh Burke-class Destroyer, Bay-class DLS (No 3D), Dabur-class Patrol Boat (No 3D), Durand de la Penne-class Destroyer (No 3D), Echo-class Survey Ship (No 3D), Guided Missile Destroyer, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Hunt-class Minehunter (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), L-class Frigate (No 3D), M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), LPH01 Ocean (No 3D), Oksoy-class Minehunter (No 3D), River-class Patrol Vessel (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Skjold-class Patrol (No 3D), Sovremenny-class Destroyer, Super Dvora Mark II (No 3D), Tiger-class Fast Attack Craft (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloj-class Destroyer (No 3D)
Naval Depth Charge Deployment	B-2 Spirit, P-3 Orion
Naval Mine Deployment	B-2 Spirit, Durand de la Penne-class Destroyer (No 3D), Halifax-class Frigate (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), Osprey-class Mine CMS (No 3D), P-3 Orion, Sandown-class Minehunter (No 3D), Skjold-class Patrol (No 3D), Sovremenny-class Destroyer, Tiger-class Fast Attack Craft (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D)
Naval Mine Dynamics	Naval Mine, Quickstrike Mk 65, Sea Lance ASW
Naval Mine Explosive Device	Naval Mine, Quickstrike Mk 65, Sea Lance ASW
Naval Mine Sweep	Alta-class Minehunter (No 3D), Hunt-class Minehunter (No 3D), Kingston-class Patrol vessel (No 3D), Osprey-class Mine CMS (No 3D), Oksoy-class Minehunter (No 3D), Sandown-class Minehunter (No 3D), Tiger-class Fast Attack Craft (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Passive RADAR Sensor	Arleigh Burke-class Destroyer, Dabur-class Patrol Boat (No 3D), Echo-class Survey Ship (No 3D), Fridtjof Nansen-class (No 3D), Hunt-class Minehunter (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Rapier SAM (No 3D), River-class Patrol Vessel (No 3D), SA-15 Gauntlet SAM, SA-19 Grison, SA-6 Gainful SAM, SA-9 Gaskin SAM System, Sandown-class Minehunter (No 3D), Scorpene-class Submarine (No 3D), Super Tanker (No 3D), Type 209 Submarine (No 3D), Type 23 Frigate (No 3D), Vanguard-class Submarine (No 3D), Victoria-class (No 3D)
Passive SONAR Sensor	Fridtjof Nansen-class (No 3D), L-class Frigate (No 3D), M-class Frigate (No 3D), Oksoy-class Minehunter (No 3D), Sonobuoy (Passive)
Patriot Missile Launcher	MIM-104 Patriot Launcher
Periscope	Astute-class Submarine (No 3D), Dolphin-class Submarine (No 3D), Los Angeles-Class Submarine, Ohio-class Submarine, Romeo-class Submarine, Scorpene-class Submarine (No 3D), Song-class Submarine, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Ula-class Submarine (No 3D), Vanguard-class Submarine (No 3D), Victoria-class (No 3D), Walrus-class submarine (No 3D)
Rotary Wing Attack	AH-1W SuperCobra, AH-64A Apache, AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), HH-65 Dolphin (No 3D), KA-50 Hokum, Mi-24 Hind, Mi-28 Havoc, RAH-66 Comanche
Rotary Wing Default Armor	AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), CH-148 Cyclone (No 3D), CH-149 Cormorant, CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, Cypher VTUAV, Dragon Warrior VTUAV, EC145 (No 3D), EH101 Merlin (No 3D), HH-65 Dolphin (No 3D), KA-50 Hokum, MD 500 (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, OH-58 Kiowa, RAH-66 Comanche, SA 330 Puma (No 3D), SH-3 Sea King (No 3D), SH-60 Seahawk, UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), V-22 Osprey (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D)
Cargo	CH-148 Cyclone (No 3D), CH-47 Chinook (No 3D), CH-53E Super Stallion, EH101 Merlin (No 3D), MH-47 Chinook (No 3D), SA 330 Puma (No 3D), SH-3 Sea King (No 3D), V-22 Osprey (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D)
Dipping SONAR Sensor	CH-46E Sea Knight, SH-3 Sea King (No 3D), SH-60 Seahawk

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Utility	AH-6 Little Bird (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), CH-149 Cormorant, CH-46E Sea Knight, EC145 (No 3D), MD 500 (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-2 Hoplite, OH-58 Kiowa, SH-60 Seahawk, UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D)
VTUAV	Cypher VTUAV, Dragon Warrior VTUAV
SA-9 SAM Missile Launcher	Rapier SAM (No 3D), SA-15 Gauntlet SAM, SA-19 Grison, SA-6 Gainful SAM, SA-9 Gaskin SAM System
Scripted Movement	M39 Missile, Scud-B Missile, SS-24 Scalpel Missile, SS-24 Scalpel Stage
Small boat	Dabur-class Patrol Boat (No 3D), Echo-class Survey Ship (No 3D), Hauk-class Fast Attack (No 3D), Island-class Patrol Vessel (No 3D), Jet Ski, Rigid-Hulled Inflatable Boat, Rigid-Hulled Inflatable Boat - Civilian, River-class Patrol Vessel (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), Sailboat, Skjold-class Patrol (No 3D), Speedboat, Super Dvora Mark II (No 3D), Tiger-class Fast Attack Craft (No 3D)
Bomb Dynamics	CBU-105 SFW, GBU-31A JDAM, KAB-500N Bomb
SONAR Sensor	Aircraft Carrier, Alta-class Minehunter (No 3D), AN/BLQ-11 UUV (No 3D), Arleigh Burke-class Destroyer, Astute-class Submarine (No 3D), Bay-class DLS (No 3D), CH-46E Sea Knight, Dolphin-class Submarine (No 3D), Durand de la Penne-class Destroyer (No 3D), Fridtjof Nansen-class (No 3D), , Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), Iroquois-class Destroyer (No 3D), L-class Frigate (No 3D), M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), Los Angeles-Class Submarine, LPH01 Ocean (No 3D), Harpers Ferry-class LSD, Osprey-class Mine CMS (No 3D), Mk-46 MOD 5 Torpedo (No 3D), Mk-48 ADCAP Torpedo, Nimitz-class Carrier, Ohio-class Submarine, Oksoy-class Minehunter (No 3D), REMUS UUV (No 3D), Romeo-class Submarine, Saar 5-class Corvette (No 3D), Sandown-class Minehunter (No 3D), Scorpene-class Submarine (No 3D), SH-3 Sea King (No 3D), SH-60 Seahawk, Skjold-class Patrol (No 3D), Song-class Submarine, Sonobuoy (Passive), Sovremenny-class Destroyer, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D), Ula-class Submarine (No 3D), Victoria-class (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Sonobuoy Deployer	Bay-class DLS (No 3D), Dabur-class Patrol Boat (No 3D), Echo-class Survey Ship (No 3D), Halifax-class Frigate (No 3D), Horizon-class Destroyer (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), L 14 Albion (No 3D), LPH01 Ocean (No 3D), P-3 Orion, River-class Patrol Vessel (No 3D), Tiger-class Fast Attack Craft (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D)
Space Shuttle	Space Shuttle
Spot Report Generator	A-10 Thunderbolt, A-4 Skyhawk (No 3D), Aardvark JSFU (No 3D), AAVC7A1 Landing Vehicle, Achzarit APC (No 3D), Actros AHSVS (No 3D), AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), Aircraft Carrier, AMX-30 MBT, AMX-56 Leclerc MBT, AN/BLQ-11 UUV (No 3D), Arjun MBT (No 3D), Arleigh Burke-class Destroyer, AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), AS-90 Artillery, AV-8B Harrier II, B-2 Spirit, Badger AEV (No 3D), BAE CT-155 Hawk (No 3D), Bay-class DLS (No 3D), Beaver AVLB (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), Bison APC (No 3D), BMP-2 AFV, BN-2 Islander (No 3D), BTR-80 APC, Buffalo MRAP III (No 3D), Buffel ARV (No 3D), C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), C1 Ariete MBT (No 3D), CAESAR SP Howitzer, Canadair CT-114 (No 3D), CH-148 Cyclone (No 3D), CH-149 Cormorant, CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, Chilean AT4, Chilean IMI Galil, Chilean M16-M203, Chilean M16, Chilean M240, Chilean M249, Chilean M4, Chilean M60, Cougar FSV (No 3D), Coyote APC (No 3D), Cypher VTUAV, Dabur-class Patrol Boat (No 3D), Defense Satellite, DI AK-47, DI Lasing (CIS), DI Lasing (US), DI RPG, DI SMAW And Rifle, Dolphin-class Submarine (No 3D), Dragon Warrior VTUAV, E-3 Sentry, EA-6B Prowler, EC145 (No 3D), Echo-class Survey Ship (No 3D), EH101 Merlin (No 3D), Euro-fighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, Fridtjof Nansen-class (No 3D), FV 510 Warrior (No 3D), FV101 Scorpion CVR, FV107 Scimitar (No 3D), FV4030/4 Challenger MBT (No 3D), FV4034 Challenger 2 MBT (No 3D), FV432 APC (No 3D), F/A-18 Hornet, GAZ-69 Utility Vehicle, Grizzly APC (No 3D), Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Hermes 450 (No 3D), HH-65 Dolphin (No 3D), HMMWV Utility Vehicle, HMMWV with Avenger, HMMWV with M2, HMMWV with Shelter, HMMWV with TOW launcher, Husky ARV (No 3D), Invincible-class Carrier (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), Iveco LMV (No 3D), Jackal MWMIK (No 3D), L-class Frigate (No 3D), K1A1 MBT (No 3D), KA-50 Hokum, M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), L-118 Howitzer (No 3D), Land Rover Wolf (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Spot Report Generator	LAV III APC (No 3D), , LCAC, Leopard 2 Tank, LG1 Howitzer (No 3D), Lockheed L-1011 (No 3D), Los Angeles-Class Submarine, LPH01 Ocean (No 3D), Harpers Ferry-class LSD, M-71 Howitzer (No 3D), M109 Howitzer, M1126 Stryker ICV, M113 APC, M1A2 Abrams MBT, M2A2 Bradley IFV, M35 Truck, M3A2 Bradley CFV, M577A2 Command Post, M58 MICLIC, M777 Howitzer (No 3D), M88 Medium Recovery Vehicle, M939A2 5-Ton Truck, M977 HEMTT Cargo Truck, M978 HEMTT Fuel Truck, M993 MLRS, M9 ACE, Mamba APC (No 3D), Maveric UAS (No 3D), MBT 2000 (No 3D), MD 500 (No 3D), Merkava III MBT (No 3D), Merkava IV MBT (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, Mideast Combatant, Mideast Combatant with RPG, MiG-27 Flogger, MiG-29 Fulcrum, MIM-104 Patriot Launcher, Mirage 2000, Mirage F1, MQ-9 Reaper UAV, MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), MT-LB APC, Namer APC (No 3D), Navistar 7000 (No 3D), Nimitz-class Carrier, OH-58 Kiowa, Ohio-class Submarine, Oksoy-class Minehunter (No 3D), P-3 Orion, Police Officer, MQ-1 Predator, PT-91 Twardy MBT (No 3D), Puma CEV (No 3D), Queen Elizabeth-class Carrier (No 3D), RAH-66 Comanche, Rapier SAM (No 3D), REMUS UUV (No 3D), Rigid-Hulled Inflatable Boat, River-class Patrol Vessel (No 3D), Romeo-class Submarine, RQ-11 Raven UAV, RQ-4 Global Hawk UAV (No 3D), RQ-7 Shadow UAV (No 3D), SA 330 Puma (No 3D), SA-15 Gauntlet SAM, SA-19 Grison, SA-6 Gainful SAM, SA-9 Gaskin SAM System, Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), ScanEagle UAV (No 3D), Scorpene-class Submarine (No 3D), Sergeant M16, SH-3 Sea King (No 3D), SH-60 Seahawk, Skjold-class Patrol (No 3D), Song-class Submarine, Sonobuoy (Passive), Sovremenny-class Destroyer, Space Shuttle, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Super Dvora Mark II (No 3D), Suspect, T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Taurus ARV (No 3D), Technical Truck, Tiger-class Fast Attack Craft (No 3D), Tornado ADV, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 10 MBT (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Type 90 Kyu-maru MBT (No 3D), Type 99 MBT (No 3D), Udaloy-class Destroyer (No 3D), UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), Ula-class Submarine (No 3D), US Army Medic, US EOD, USMC M16-M203, USMC M16

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Spot Report Generator (continued)	USMC M240, USMC M249, USMC M4, US Army AT4, US Army Javelin, US Army M16-M203, US Army M16, US Army M240, US Army M249, US Army M4, US Army M60, US Army M9, V-22 Osprey (No 3D), VAB APC, Vanguard-class Submarine (No 3D), VBL ATV, Victoria-class (No 3D), VM 90 LSVW (No 3D), Walrus-class submarine (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D), XM7 FIST-Bradley, ZIL-135 8x8 Truck, ZPU-4 AA Gun, ZSU-23-4 Shilka
Spot Report Receiver	A-10 Thunderbolt, A-4 Skyhawk (No 3D), Aardvark JSFU (No 3D), AAVC7A1 Landing Vehicle, Achzarit APC (No 3D), Actros AHSVS (No 3D), AH-1W SuperCobra, AH-64A Apache, AH-6 Little Bird (No 3D), Aircraft Carrier, AMX-30 MBT, AMX-56 Leclerc MBT, AN/BLQ-11 UUV (No 3D), Arjun MBT (No 3D), Arleigh Burke-class Destroyer, AS-365 Dauphin (No 3D), AS-565 Panther (No 3D), AS-90 Artillery, AV-8B Harrier II, B-2 Spirit, Badger AEV (No 3D), BAE CT-155 Hawk (No 3D), Bay-class DLS (No 3D), Beaver AVLB (No 3D), Bell 412 (No 3D), Bell 206 JetRanger (No 3D), Bell 406 (No 3D), Bison APC (No 3D), BMP-2 AFV, BN-2 Islander (No 3D), BTR-80 APC, Buffalo MRAP III (No 3D), Buffel ARV (No 3D), C-130 Hercules, C-17 Globemaster III (No 3D), C-5 Galaxy (No 3D), C1 Ariete MBT (No 3D), CAESAR SP Howitzer, Canadair CT-114 (No 3D), CH-148 Cyclone (No 3D), CH-149 Cormorant, CH-46E Sea Knight, CH-47 Chinook (No 3D), CH-53E Super Stallion, Chilean AT4, Chilean IMI Galil, Chilean M16-M203, Chilean M16, Chilean M240, Chilean M249, Chilean M4, Chilean M60, Cougar FSV (No 3D), Coyote APC (No 3D), Dabur-class Patrol Boat (No 3D), Defense Satellite, DI AK-47, DI Lasing (CIS), DI Lasing (US), DI RPG, DI SMAW And Rifle, Dolphin-class Submarine (No 3D), E-3 Sentry, EA-6B Prowler, EC145 (No 3D), Echo-class Survey Ship (No 3D), EH101 Merlin (No 3D), Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, Fridtjof Nansen-class (No 3D), FV 510 Warrior (No 3D), FV101 Scorpion CVR, FV107 Scimitar (No 3D), FV4030/4 Challenger MBT (No 3D), FV4034 Challenger 2 MBT (No 3D), FV432 APC (No 3D), F/A-18 Hornet, GAZ-69 Utility Vehicle, Grizzly APC (No 3D), Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Hauk-class Fast Attack (No 3D), Hermes 450 (No 3D), HH-65 Dolphin (No 3D), HMMWV Utility Vehicle, HMMWV with Avenger, HMMWV with M2, HMMWV with Shelter, HMMWV with TOW launcher, Husky ARV (No 3D), Invincible-class Carrier (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), Iveco LMV (No 3D), Jackal MWMIK (No 3D), L-class Frigate (No 3D), K1A1 MBT (No 3D), KA-50 Hokum, M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), L-118 Howitzer (No 3D), Land Rover Wolf (No 3D), LAV III APC (No 3D), LCAC

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Spot Report Receiver	Leopard 2 Tank, LG1 Howitzer (No 3D), Lockheed L-1011 (No 3D), Los Angeles-Class Submarine, LPH01 Ocean (No 3D), Harpers Ferry-class LSD, M-71 Howitzer (No 3D), M109 Howitzer, M1126 Stryker ICV, M113 APC, M1A2 Abrams MBT, M2A2 Bradley IFV, M35 Truck, M3A2 Bradley CFV, M577A2 Command Post, M58 MICLIC, M777 Howitzer (No 3D), M88 Medium Recovery Vehicle, M939A2 5-Ton Truck, M977 HEMTT Cargo Truck, M978 HEMTT Fuel Truck, M993 MLRS, M9 ACE, Mamba APC (No 3D), Maveric UAS (No 3D), MBT 2000 (No 3D), MD 500 (No 3D), Merkava III MBT (No 3D), Merkava IV MBT (No 3D), MH-47 Chinook (No 3D), MH-60L Black Hawk DAP (No 3D), MH-60 Black Hawk, MH-6 Little Bird (No 3D), Mi-24 Hind, Mi-28 Havoc, Mi-2 Hoplite, Mideast Combatant, Mideast Combatant with RPG, MiG-27 Flogger, MiG-29 Fulcrum, MIM-104 Patriot Launcher, Mirage 2000, Mirage F1, MQ-9 Reaper UAV, MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), MT-LB APC, Namer APC (No 3D), Navistar 7000 (No 3D), Nimitz-class Carrier, OH-58 Kiowa, Ohio-class Submarine, Oksoy-class Minehunter (No 3D), P-3 Orion, Police Officer, MQ-1 Predator, PT-91 Twardy MBT (No 3D), Puma CEV (No 3D), Queen Elizabeth-class Carrier (No 3D), RAH-66 Comanche, Rapier SAM (No 3D), REMUS UUV (No 3D), Rigid-Hulled Inflatable Boat, River-class Patrol Vessel (No 3D), Romeo-class Submarine, RQ-11 Raven UAV, RQ-4 Global Hawk UAV (No 3D), RQ-7 Shadow UAV (No 3D), SA 330 Puma (No 3D), SA-15 Gauntlet SAM, SA-19 Grison, SA-6 Gainful SAM, SA-9 Gaskin SAM System, ScanEagle UAV (No 3D), Scorpene-class Submarine (No 3D), Sergeant M16, SH-3 Sea King (No 3D), SH-60 Seahawk, Skjold-class Patrol (No 3D), Song-class Submarine, Sovremenny-class Destroyer, Space Shuttle, SU-25 Frogfoot, SU-27 Flanker, Su-37 Flanker, Super Dvora Mark II (No 3D), Suspect, T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Taurus ARV (No 3D), Technical Truck, Tiger-class Fast Attack Craft (No 3D), Tornado ADV, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 10 MBT (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Type 90 Kyu-maru MBT (No 3D), Type 99 MBT (No 3D), Udaloy-class Destroyer (No 3D), UH-1N Twin Huey (No 3D), UH-60 Blackhawk, UH-72 Lakota (No 3D), Ula-class Submarine (No 3D), US Army Medic, US EOD, USMC M16-M203, USMC M16, USMC M240, USMC M249, USMC M4, US Army AT4, US Army Javelin, US Army M16-M203, US Army M16, US Army M240
Spot Report Receiver (continued)	US Army M249, US Army M4, US Army M60, US Army M9, V-22 Osprey (No 3D), VAB APC, Vanguard-class Submarine (No 3D), VBL ATV, Victoria-class (No 3D), VM 90 LSVW (No 3D), Walrus-class submarine (No 3D), Westland Lynx (No 3D), WS-61 Sea King (No 3D), XM7 FIST-Bradley, ZIL-135 8x8 Truck, ZPU-4 AA Gun, ZSU-23-4 Shilka

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Stinger Missile Launcher	HMMWV with Avenger
Subsurface Entity Default	AN/BLQ-11 UUV (No 3D), Astute-class Submarine (No 3D), Dolphin-class Submarine (No 3D), Los Angeles-Class Submarine, Mk-46 MOD 5 Torpedo (No 3D), Mk-48 ADCAP Torpedo, Ohio-class Submarine, REMUS UUV (No 3D), Romeo-class Submarine, Scorpene-class Submarine (No 3D), Song-class Submarine, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Ula-class Submarine (No 3D), Vanguard-class Submarine (No 3D), Victoria-class (No 3D), Walrus-class submarine (No 3D)
Subsurface	AN/BLQ-11 UUV (No 3D), Astute-class Submarine (No 3D), Dolphin-class Submarine (No 3D), Los Angeles-Class Submarine, Mk-46 MOD 5 Torpedo (No 3D), Mk-48 ADCAP Torpedo, Ohio-class Submarine, REMUS UUV (No 3D), Romeo-class Submarine, Scorpene-class Submarine (No 3D), Song-class Submarine, Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Ula-class Submarine (No 3D), Vanguard-class Submarine (No 3D), Victoria-class (No 3D), Walrus-class submarine (No 3D)
Surface Entity Default	Aircraft Carrier, Alta-class Minehunter (No 3D), AN/BLQ-11 UUV (No 3D), Arleigh Burke-class Destroyer, Astute-class Submarine (No 3D), Bay-class DLS (No 3D), Container Ship, Container Ship Loaded, Cruise Ship (No 3D), Dabur-class Patrol Boat (No 3D), Dolphin-class Submarine (No 3D), Durand de la Penne-class Destroyer (No 3D), Echo-class Survey Ship (No 3D), Fishing Boat, Guided Missile Destroyer, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Henry J Kaiser-class Oiler (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), Iroquois-class Destroyer (No 3D), Island-class Patrol Vessel (No 3D), L-class Frigate (No 3D), Jet Ski, M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), Los Angeles-Class Submarine, LPH01 Ocean (No 3D), Harpers Ferry-class LSD, Osprey-class Mine CMS (No 3D), Mk-46 MOD 5 Torpedo (No 3D), Mk-48 ADCAP Torpedo, Nimitz-class Carrier, Ohio-class Submarine, Oksoy-class Minehunter (No 3D), Queen Elizabeth-class Carrier (No 3D), REMUS UUV (No 3D), Rigid-Hulled Inflatable Boat, Rigid-Hulled Inflatable Boat - Civilian, River-class Patrol Vessel (No 3D), Romeo-class Submarine, Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), Sailboat, Sandown-class Minehunter (No 3D), Scorpene-class Submarine (No 3D), Skjold-class Patrol (No 3D), Song-class Submarine, Sovremenny-class Destroyer, Speedboat, Super Dvora Mark II (No 3D), Super Tanker (No 3D), Trafalgar-class Submarine (No 3D), Type 209 Submarine (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D), Ula-class Submarine (No 3D), Vanguard-class Submarine (No 3D), Victoria-class (No 3D), Walrus-class submarine (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Surface Disaggregated Movement	
Large Ship	Aircraft Carrier, Alta-class Minehunter (No 3D), Arleigh Burke-class Destroyer, Bay-class DLS (No 3D), Container Ship, Container Ship Loaded, Cruise Ship (No 3D), Durand de la Penne-class Destroyer (No 3D), Fishing Boat, Fridtjof Nansen-class (No 3D), Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Henry J Kaiser-class Oiler (No 3D), Horizon-class Destroyer (No 3D), Hunt-class Minehunter (No 3D), Invincible-class Carrier (No 3D), Iroquois-class Destroyer (No 3D), L-class Frigate (No 3D), M-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Kingston-class Patrol vessel (No 3D), L 14 Albion (No 3D), LPH01 Ocean (No 3D), Harpers Ferry-class LSD, Osprey-class Mine CMS (No 3D), Nimitz-class Carrier, Oksoy-class Minehunter (No 3D), Queen Elizabeth-class Carrier (No 3D), Sandown-class Minehunter (No 3D), Sovremenny-class Destroyer, Super Tanker (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D)
Surface Multiple Hit Damage	Guided Missile Frigate
Small Surface Ships	
Torpedo Warhead	Mk-46 MOD 5 Torpedo (No 3D), Mk-48 ADCAP Torpedo
TOW Missile Launcher	HMMWV with TOW launcher, MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), VM 90 LSVW (No 3D)
US Fighter Bomber Bomb Bay	A-10 Thunderbolt, A-4 Skyhawk (No 3D), AV-8B Harrier II, Eurofighter Typhoon, F-117A Nighthawk, F-15 Eagle, F-16A Fighting Falcon, F-22 Raptor (No 3D), F-35 Lightning II, F/A-18 Hornet, Mirage 2000, Mirage F1, Tornado ADV
US Heavy Bomber Bomb Bay	B-2 Spirit, P-3 Orion
Vertical SAM Missile Launcher	Alta-class Minehunter (No 3D), Arleigh Burke-class Destroyer, Durand de la Penne-class Destroyer (No 3D), Guided Missile Destroyer, Guided Missile Frigate, Halifax-class Frigate (No 3D), Hawk-class Fast Attack (No 3D), Horizon-class Destroyer (No 3D), Iroquois-class Destroyer (No 3D), L-class Frigate (No 3D), KD-III-class Destroyer (No 3D), Oksoy-class Minehunter (No 3D), Saar 4-class Missile Boat (No 3D), Saar 4.5-class Missile Boat (No 3D), Saar 5-class Corvette (No 3D), Skjold-class Patrol (No 3D), Sovremenny-class Destroyer, Tiger-class Fast Attack Craft (No 3D), Type 42 Destroyer (No 3D), Type 45 Destroyer (No 3D), Type 22 Frigate (No 3D), Type 23 Frigate (No 3D), Udaloy-class Destroyer (No 3D)

Table C-2: System usage, EntityLevel.sms

System	Entities that Use System
Visual Sensor	Aardvark JSFU (No 3D), AAVC7A1 Landing Vehicle, Achzarit APC (No 3D), Actros AHSVS (No 3D), AMX-30 MBT, AMX-56 Leclerc MBT, Arjun MBT (No 3D), AS-90 Artillery, Badger AEV (No 3D), Beaver AVLB (No 3D), Bison APC (No 3D), BMP-2 AFV, BTR-80 APC, Buffalo MRAP III (No 3D), Buffel ARV (No 3D), C1 Ariete MBT (No 3D), CAESAR SP Howitzer, Car Bomb, CH-46E Sea Knight, Chilean AT4, Chilean IMI Galil, Chilean M16-M203, Chilean M16, Chilean M240, Chilean M249, Chilean M4, Chilean M60, Container Ship, Container Ship Loaded, Cougar FSV (No 3D), Coyote APC (No 3D), Cruise Ship (No 3D), DI AK-47, DI Lasing (CIS), DI Lasing (US), DI RPG, DI SMAW And Rifle, Durand de la Penne-class Destroyer (No 3D), Fishing Boat, FV 510 Warrior (No 3D), FV101 Scorpion CVR, FV107 Scimitar (No 3D), FV4030/4 Challenger MBT (No 3D), FV4034 Challenger 2 MBT (No 3D), FV432 APC (No 3D), GAZ-69 Utility Vehicle, Grizzly APC (No 3D), HMMWV Utility Vehicle, HMMWV with M2, HMMWV with Shelter, HMMWV with TOW launcher, Husky ARV (No 3D), Invincible-class Carrier (No 3D), Iveco LMV (No 3D), Jackal MWMIK (No 3D), L-class Frigate (No 3D), Jet Ski, K1A1 MBT (No 3D), M-class Frigate (No 3D), Land Rover Wolf (No 3D), LAV III APC (No 3D), LCAC, Leopard 2 Tank, M109 Howitzer, M1126 Stryker ICV, M113 APC, M1A2 Abrams MBT, M2A2 Bradley IFV, M35 Truck, M3A2 Bradley CFV, M577A2 Command Post, M58 MICLIC, M88 Medium Recovery Vehicle, M939A2 5-Ton Truck, M977 HEMTT Cargo Truck, M978 HEMTT Fuel Truck, M993 MLRS, M9 ACE, Mamba APC (No 3D), Maveric UAS (No 3D), MBT 2000 (No 3D), Merkava III MBT (No 3D), Merkava IV MBT (No 3D), Mideast Combatant, Mideast Combatant with RPG, MRAP-ATV (No 3D), MRAP-CAT II Cougar (No 3D), MRAP-CAT I MaxxPro (No 3D), MT-LB APC, Namer APC (No 3D), Navistar 7000 (No 3D), Police Officer, PT-91 Twardy MBT (No 3D), Puma CEV (No 3D), Rigid-Hulled Inflatable Boat, Rigid-Hulled Inflatable Boat - Civilian, Roadside IED, RQ-11 Raven UAV, RQ-7 Shadow UAV (No 3D), Sailboat, ScanEagle UAV (No 3D), Sergeant M16, Speedboat, Suicide Bomber, Super Dvora Mark II (No 3D), Super Tanker (No 3D), Suspect, T-69 MBT, T-72 MBT, T-80 MBT, T-84 MBT (No 3D), T90A MBT (No 3D), Taliban, Taurus ARV (No 3D), Technical Truck, Type 10 MBT (No 3D), Type 90 Kyu-maru MBT (No 3D), Type 99 MBT (No 3D), US Army Medic, US EOD, USMC M16-M203
Visual Sensor (continued)	USMC M16, USMC M240, USMC M249, USMC M4, US Army AT4, US Army Javelin, US Army M16-M203, US Army M16, US Army M240, US Army M249, US Army M4, US Army M60, US Army M9, VAB APC, VBL ATV, VM 90 LSVW (No 3D), XM7 FIST-Bradley, ZIL-135 8x8 Truck, ZPU-4 AA Gun, ZSU-23-4 Shilka

Table C-3: Systems and Configured Scripted Tasks, EntityLevel.sms

System	Scripted Tasks
120mm Gun	
125mm Gun	
ADA Quad	
14.5mm Machine Gun	
25mm Gun	
30mm Gun	
Active RADAR Sensor	
Active SONAR Sensor	
Air Aggregate	
Air Cushion	
Airborne Targeting RADAR	
Anti-Submarine Missile (Vertically Launched)	Launch_ASW_Missile
Building Default Damage	
CIS Air Defense Missile Package	
CIS Attack Helicopter Missile Package	
CIS Attack/Strike Missile Package	
CIS Counter Measures Launcher	
CIS Fighter Bomber Bomb Bay	
CIS Heavy Bomber Bomb Bay	
Counter Measures Launcher	
Cruise Missile	

Table C-3: Systems and Configured Scripted Tasks, EntityLevel.sms

System	Scripted Tasks
DDG Embedded Support Craft (LAMPS/RHIB)	Embedded_Sector_SAR
DI Laser Designator	
Exocet Cruise Missile Launcher (Forward Launched)	
Exocet Cruise Missile Launcher (Vertically Launched)	
Explosive Device	
Fall From Sky Dynamics	
Maverick Missile Launcher	
Sidewinder Missile Launcher	
Fixed Wing Default Armor	
Fighter Jet	Fixed_Wing_Takeoff, Fixed_Wing_Land
Heavy Plane	Fixed_Wing_Takeoff, Fixed_Wing_Land
High Maneuverability Fighter	Fixed_Wing_Takeoff, Fixed_Wing_Land
Frictionless Gravity Dynamics	
Ground Aggregated Movement	
Ground Convoy Movement	
Ground Disaggregated Movement	
Heavy Armor	
Light Armor damage model	
Tracks	
Tracks/Amphibious	

Table C-3: Systems and Configured Scripted Tasks, EntityLevel.sms

System	Scripted Tasks
No Armor	
Wheels (off road)	
Wheels (road)	
AK-47	
AT4	
M16 rifle	
M240B Machine Gun	
M249 SAW	
M60 Machine Gun	
RPG Launcher	
Handheld UAV	
Homing Torpedo Capability (Forward Launched)	Delayed_homing, Delayed_homing_ASW, Launch_Torpedo_Salvo
Human Disaggregated Movement	
Suicide Vest	
Human Default	
IFF Transponder	
IR Sensor	
Laser Designator	
Laser Guided Hell-fire Missile Launcher	
Laser Guided Missile Dynamics	
Default Armor	
Limit Entity Existence	
M2HB Machine Gun	
M230 Chain Gun	
M240 Machine Gun	

Table C-3: Systems and Configured Scripted Tasks, EntityLevel.sms

System	Scripted Tasks
M250 smoke grenade launcher	
M252 81mm mortar	
M270 MLRS Launcher	
M284 155mm Cannon	
M60 Machine Gun	
MAD Sensor	
Missile Default Armor	
Guided Missile Dynamics	
Missile Warhead	
MK 45 Naval Gun	
Naval Depth Charge Deploy- ment	Drop_Naval_Depth_Charge, Drop_Naval_Depth_Charge_At_Location
Naval Mine Deployment	Drop_Naval_Mine, Drop_Naval_Mines_Along_Route
Naval Mine Dynamics	
Naval Mine Explo- sive Device	
Naval Mine Sweep	Naval_Mine_Sweep
Passive RADAR Sensor	
Passive SONAR Sensor	
Patriot Missile Launcher	
Periscope	Raise_Periscope, Lower_Periscope
Rotary Wing Attack	
Rotary Wing Default Armor	

Table C-3: Systems and Configured Scripted Tasks, EntityLevel.sms

System	Scripted Tasks
Cargo	
Dipping SONAR Sensor	Sonar_Dip
Utility	
VTUAV	
SA-9 SAM Missile Launcher	
Scripted Movement	
Small boat	
Bomb Dynamics	
SONAR Sensor	
Sonobuoy Deployer	Deploy_Sonobuoy, Deploy_Sonobuoys_Along_Route
Space Shuttle	
Spot Report Generator	
Spot Report Receiver	
Stinger Missile Launcher	
Subsurface Entity Default	
Subsurface	
Surface Entity Default	
Surface Disaggregated Movement	
Large Ship	
Surface Multiple Hit Damage	
Small Surface Ships	
Torpedo Warhead	
TOW Missile Launcher	

Table C-3: Systems and Configured Scripted Tasks, EntityLevel.sms

System	Scripted Tasks
US Fighter Bomber Bomb Bay	
US Heavy Bomber Bomb Bay	
Vertical SAM Missile Launcher	
Visual Sensor	

Table C-4: System descriptions, AggregateLevel.sms

System	Category	Entity Types	Description
Mortar, 120mm	weapon	aggregate, assemblies	A single 120mm mortar tube. Capable of indirect fire missions.
Active RADAR Sensor	sensor	all	Allows an entity to detect other objects through RADAR. Also publishes emitter beams that represent the emissions from the sensor.
Aerial Refueling Resupply	other	all	Gives the unit the capability to resupply aviation fuel to airborne units from an airborne unit.
122mm Howitzer	weapon	aggregate, assemblies	Artillery piece capable of indirect fire missions.
152mm Howitzer Auto	weapon	aggregate, assemblies	Artillery piece capable of indirect fire missions. Uses auto-loader.
155mm Howitzer	weapon	aggregate, assemblies	Artillery piece capable of indirect fire missions.
Bomb, 2000lb JDAM	weapon	aggregate, assemblies	A precision guided bomb. Uses GPS
Mk 45 5-inch Gun	weapon	aggregate, assemblies	A naval gun capable of indirect fire operations.
9K330 Surface-to-Air Missile Launcher	weapon	aggregate, assemblies	An anti-air missile. Uses radar guidance.
AIM-120 AMRAAM Missile	weapon	aggregate, assemblies	A medium range anti-air missile. Uses radar guidance.

Table C-4: System descriptions, AggregateLevel.sms

System	Category	Entity Types	Description
Communications Jammer	electron-icwarfare	all	Jamming system for radios, cell phones, satellite phones, UAVs, etc.
Harpoon Antiship Missile	weapon	aggregate, assemblies	A long range anti-ship missile. Radar guided.
Torpedo, Mark 54	weapon	aggregate, assemblies	An anti-ship and anti-submarine torpedo. Can be air-dropped.
Radar Jammer	electron-icwarfare	all	Jamming system for acquisition and tracking/guidance radars.
Guided Bomb	weapon	aggregate, assemblies	A precision guided bomb. Uses optical or other non-radar guidance.
RIM-66 SAM	weapon	aggregate, assemblies	A surface to air missile. Uses radar guidance.
Sidewinder Anti-Air Missile	weapon	aggregate, assemblies	A short range anti-air missile. Uses IR guidance.
Stinger Anti-Air Missile	weapon	aggregate, assemblies	An anti-air missile with limited altitude. Uses IR guidance.
Tomahawk Cruise Missile	weapon	aggregate, assemblies	A long range guided land attack missile. Uses primarily GPS and optical guidance.
Unguided Bomb	weapon	aggregate, assemblies	A bomb intended to have effects in an area.
Torpedo, Type 40 (RPK-6 Vodopad SUBROC)	weapon	aggregate, assemblies	An anti-ship and anti-submarine torpedo with SUBROC configuration. Can be deck-launched.
Air-Drop Supply	other	all	Gives the unit the capability to resupply ground units from the air.
Active RADAR Sensor	sensor	all	Allows an entity to detect other objects through RADAR. Also publishes emitter beams that represent the emissions from the sensor.
Aircraft Aggregated Movement	aggregated	aggregate	Aircraft aggregated movement
Biological Weapon	weapon	aggregate, assemblies	A weapon system that create biological contamination areas.

Table C-4: System descriptions, AggregateLevel.sms

System	Category	Entity Types	Description
Booby Trap Setter	engi- neering- object- creation	aggregate, assemblies	A system which provides the capability to create booby traps.
Bridge Builder	engi- neering- object- creation	aggregate, assemblies	A system which provides the capability to create bridges.
Chemical Weapon	weapon	aggregate, assemblies	A weapon system that create chemical contamination areas.
Ditch Digger	engi- neering- object- creation	aggregate, assemblies	A system which provides the capability to create a ditch.
SIGINT Sensor	sensor	all	Allows an entity to detect other entities by their radio and RADAR emissions.
Engagement Report Generator	other	all	Allows the entity to send engagement reports through its radio when it is attacking an enemy.
Engineering Object Sensor	sensor	all	Allows an entity to detect engineering objects.
Engineering Obstacle Destroyer	obstacle- destruc- tion	aggregate, assemblies	A system which provides the capability to destroy/breach engineering obstacles. Meant to be used by units with specialized equipment.
Explosive Hazard and Simple Obstacle Destroyer	obstacle- destruc- tion	aggregate, assemblies	A system which provides the capability to destroy explosive hazards as well as destroy/breach simple obstacles.
FASCAM	weapon	aggregate, assemblies	Artillery used to deploy minefields.
Fortification Builder	engi- neering- object- creation	aggregate, assemblies	A system which provides the capability to construct fortifications.
Ground Aggregated Movement	aggre- gated	aggregate	Basic movement capabilities for any ground-based aggregated unit, both vehicle and DI.
Ground Combat Behaviors	other	all	Enables behaviors appropriate for ground combat units.

Table C-4: System descriptions, AggregateLevel.sms

System	Category	Entity Types	Description
IFF Transponder	other	all	Sends IFF data, when turned on. IFF is off by default.
Infantry Aggregated Movement	aggregated	aggregate	Infantry aggregated movement
IR Sensor	sensor	all	Allows an entity to detect other objects through Infrared.
Limit Entity Existence	other	all	Used to control the life span of the object this system is attached to. Once it's life span is up the object is removed from the simulation.
Mechanized Aggregated Movement	aggregated	aggregate	Mechanized aggregated movement
Mine Dispenser	engineering-object-creation	aggregate, assemblies	A system which provides the capability to create minefields.
MOPP Gear	other	aggregate, assemblies	Equips the unit with MOPP gear which allows MOPP level transitions.
Motorized Aggregated Movement	aggregated	aggregate	Motorized aggregated movement
NBC Sensor	sensor	all	Allows an entity to detect areas contaminated with nuclear, biological, or chemical agents.
Nuclear Weapon	weapon	aggregate, assemblies	A weapon system that create nuclear contamination areas.
Obstacle Builder	engineering-object-creation	aggregate, assemblies	A system which provides the capability to construct basic obstacles.
Passive RADAR Sensor	sensor	all	Allows an entity to detect other objects through RADAR. No emitters are published for this sensor.
Ground Resupply	other	all	Gives the unit the capability to resupply units on the ground.
Riverine Aggregated Movement	aggregated	aggregate	Riverine movement system for aggregate of one light patrol craft.
Ship Aggregated Movement	aggregated	aggregate	Ship movement system for aggregate of one type ships.

Table C-4: System descriptions, AggregateLevel.sms

System	Category	Entity Types	Description
Simple Obstacle Destroyer	obstacle-destruction	aggregate, assemblies	A system which provides the capability to destroy/breach simple obstacles. Meant to be used by units without specialized equipment.
SONAR Sensor	sensor	all	Allows an entity to detect other objects through SONAR.
Spot Report Generator	other	all	Allows the entity to send spot reports through its radio when its sensors detect other entities in the scenario.
Spot Report Receiver	other	all	Allows an entity to receive spot reports from other entities over the radio, and add these contacts to its list of known entities. By default, spot reports expire after 5 minutes.
Subsurface Aggregated Movement	aggregated	aggregate	Subsurface movement system for AggregateSMS submarines.
Tank Aggregated Movement	aggregated	aggregate	Tank aggregated movement
Visual Sensor	sensor	all	Allows an entity to detect other objects through visible light.

Table C-5: System usage, AggregateLevel.sms

System	Entities that Use System
Mortar, 120mm	AR CAV TRP US, Mortar PLT US, Mortar SP PLT US
Active RADAR Sensor	EA-18G Growler, F-16C (Air Superiority), F/A-18 (Ground Attack), F/A-18 (Ship Attack), SAM BTY RU, Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, Sub, RU SSP, Lada
Aerial Refueling Resupply	
122mm Howitzer	Artillery BTY RU
152mm Howitzer Auto	Artillery SP BTY RU
155mm Howitzer	Artillery SP BTY US, Artillery BTY US
Bomb, 2000lb JDAM	F/A-18 (Ground Attack)
Mk 45 5-inch Gun	Ship, US DDG, Arleigh Burke

Table C-5: System usage, AggregateLevel.sms

System	Entities that Use System
9K330 Surface-to-Air Missile Launcher	SAM BTY RU
AIM-120 AMRAAM Missile	F-16C (Air Superiority), F/A-18 (Ground Attack)
Communications Jammer	MI PLT US
Harpoon Antiship Missile	F/A-18 (Ship Attack), Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry
Torpedo, Mark 54	Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry
Radar Jammer	EA-18G Growler
Guided Bomb	
RIM-66 SAM	Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry
Sidewinder Anti-Air Missile	EA-18G Growler, F-16C (Air Superiority), F/A-18 (Ground Attack), F/A-18 (Ship Attack)
Stinger Anti-Air Missile	ADA PLT US
Tomahawk Cruise Missile	Ship, US DDG, Arleigh Burke
Unguided Bomb	
Torpedo, Type 40 (RPK-6 Vodopad SUBROC)	Sub, RU SSP, Lada
Air-Drop Supply	
Active RADAR Sensor	F-16C (Air Superiority), F/A-18 (Ground Attack), F/A-18 (Ship Attack)
Aircraft Aggregated Movement	Air Assault CO US, Air Attack CO US, Air Cav TRP US, EA-18G Growler, F-16C (Air Superiority), F/A-18 (Ground Attack), F/A-18 (Ship Attack), _Air FW template, _Air RW template
Biological Weapon	
Booby Trap Setter	Eng Mob Aug CO
Bridge Builder	Eng Mob Aug CO
Chemical Weapon	Artillery SP BTY RU
Ditch Digger	Eng Mob Aug CO, Mech Inf CO US
SIGINT Sensor	MI PLT US

Table C-5: System usage, AggregateLevel.sms

System	Entities that Use System
Engagement Report Generator	ADA PLT US, Air Assault CO US, Air Attack CO US, Air Cav TRP US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, CSS CO, EA-18G Growler, Eng Clearance CO, Eng Mob Aug CO, F-16C (Air Superiority), Artillery BTY US, F/A-18 (Ground Attack), F/A-18 (Ship Attack), Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, MI PLT US, Sub, RU SSP, Lada, Tank CO RU, Tank CO US, Weapons CO US, _Air FW template, _Air RW template, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
Engineering Object Sensor	ADA PLT US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, CSS CO, Eng Clearance CO, Eng Mob Aug CO, Artillery BTY US, Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, MI PLT US, Sub, RU SSP, Lada, Tank CO RU, Tank CO US, Weapons CO US, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
Engineering Obstacle Destroyer	Eng Mob Aug CO
Explosive Hazard and Simple Obstacle Destroyer	Eng Clearance CO
FASCAM	Artillery BTY RU, Artillery SP BTY US, Artillery BTY US
Fortification Builder	Eng Mob Aug CO
Ground Aggregated Movement	
Ground Combat Behaviors	
IFF Transponder	Air Assault CO US, Air Attack CO US, Air Cav TRP US, EA-18G Growler, F/A-18 (Ground Attack), F/A-18 (Ship Attack), _Air FW template
Infantry Aggregated Movement	Mortar PLT US, Rifle CO RU, Rifle CO US, _Unarmored foot template
IR Sensor	ADA PLT US, Air Attack CO US, Air Cav TRP US, AR CAV TRP US, Tank CO US

Table C-5: System usage, AggregateLevel.sms

System	Entities that Use System
Limit Entity Existence	
Mechanized Aggregated Movement	Artillery SP BTY RU, Artillery SP BTY US, Eng Clearance CO, Eng Mob Aug CO, Mech Inf CO RU, Mech Inf CO US, Mortar SP PLT US, SAM BTY RU, Scout Hvy PLT US, _Light armor template, _Mechanized template, _SPA template
Mine Dispenser	Eng Mob Aug CO
MOPP Gear	ADA PLT US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, CSS CO, Eng Clearance CO, Eng Mob Aug CO, Artillery BTY US, Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, MI PLT US, Tank CO RU, Tank CO US, Weapons CO US, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
Motorized Aggregated Movement	ADA PLT US, Artillery BTY RU, CSS CO, Artillery BTY US, Scout Motorized PLT US, MI PLT US, Weapons CO US, _Towed arty template, _Unarmored wheeled template
NBC Sensor	ADA PLT US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, CSS CO, Eng Clearance CO, Eng Mob Aug CO, Artillery BTY US, Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, MI PLT US, Tank CO RU, Tank CO US, Weapons CO US, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
Nuclear Weapon	
Obstacle Builder	Eng Mob Aug CO
Passive RADAR Sensor	
Ground Resupply	CSS CO
Riverine Aggregated Movement	
Ship Aggregated Movement	Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry

Table C-5: System usage, AggregateLevel.sms

System	Entities that Use System
Simple Obstacle Destroyer	ADA PLT US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, Artillery BTY US, Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, MI PLT US, Tank CO RU, Tank CO US, Weapons CO US, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
SONAR Sensor	Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, Sub, RU SSP, Lada
Spot Report Generator	ADA PLT US, Air Assault CO US, Air Attack CO US, Air Cav TRP US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, CSS CO, EA-18G Growler, Eng Clearance CO, Eng Mob Aug CO, F-16C (Air Superiority), Artillery BTY US, F/A-18 (Ground Attack), F/A-18 (Ship Attack), Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, MI PLT US, Sub, RU SSP, Lada, Tank CO RU, Tank CO US, Weapons CO US, _Air FW template, _Air RW template, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
Spot Report Receiver	ADA PLT US, Air Assault CO US, Air Attack CO US, Air Cav TRP US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, EA-18G Growler, Eng Clearance CO, Eng Mob Aug CO, F-16C (Air Superiority), Artillery BTY US, F/A-18 (Ground Attack), F/A-18 (Ship Attack), Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, MI PLT US, Sub, RU SSP, Lada, Tank CO RU, Tank CO US, Weapons CO US, _Air FW template, _Air RW template, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template
Subsurface Aggregated Movement	Sub, RU SSP, Lada

Table C-5: System usage, AggregateLevel.sms

System	Entities that Use System
Tank Aggregated Movement	AR CAV TRP US, Tank CO RU, Tank CO US, _Tank unit template
Visual Sensor	ADA PLT US, Air Assault CO US, Air Attack CO US, Air Cav TRP US, AR CAV TRP US, Artillery BTY RU, Artillery SP BTY RU, Artillery SP BTY US, CSS CO, EA-18G Growler, Eng Clearance CO, Eng Mob Aug CO, F-16C (Air Superiority), Artillery BTY US, F/A-18 (Ground Attack), F/A-18 (Ship Attack), Mech Inf CO RU, Mech Inf CO US, Mortar PLT US, Mortar SP PLT US, Rifle CO RU, Rifle CO US, SAM BTY RU, Scout Hvy PLT US, Scout Motorized PLT US, Ship, US DDG, Arleigh Burke, Ship, US FFG, Perry, MI PLT US, Sub, RU SSP, Lada, Tank CO RU, Tank CO US, Weapons CO US, _Air FW template, _Air RW template, _Ground master template, _Light armor template, _Mechanized template, _SPA template, _Tank unit template, _Towed arty template, _Unarmored foot template, _Unarmored wheeled template

Table C-6: Systems and Configured Scripted Tasks, AggregateLevel.sms

System	Scripted Tasks
Mortar, 120mm	Indirect_Fire, Limited_Munition_Attack
Active RADAR Sensor	
Aerial Refueling Resupply	Provide_Supplies, Change_Supplying_Command
122mm Howitzer	Indirect_Fire, Limited_Munition_Attack
152mm Howitzer Auto	Indirect_Fire, Limited_Munition_Attack
155mm Howitzer	Indirect_Fire, Limited_Munition_Attack
Bomb, 2000lb JDAM	Bomb_Location, Limited_Munition_Attack, Ground_Attack
Mk 45 5-inch Gun	Indirect_Fire, Limited_Munition_Attack
9K330 Surface-to-Air Missile Launcher	Limited_Munition_Attack, Attack_with_AntiAir_Missile, Automatic_Air_Defense, React_To_Air_Threats
AIM-120 AMRAAM Missile	Limited_Munition_Attack, Attack_with_AntiAir_Missile, Automatic_Air_Defense, React_To_Air_Threats
Communications Jammer	EW_Attack, Activate_Jammer, Deactivate_Jammer

Table C-6: Systems and Configured Scripted Tasks, AggregateLevel.sms

System	Scripted Tasks
Harpoon Antiship Missile	Limited_Munition_Attack, Attack_with_Antiship_Missile, React_To_Naval_Threats_Missile
Torpedo, Mark 54	Limited_Munition_Attack, Attack_with_Torpedo, React_To_Naval_Threats_Torpedo
Radar Jammer	EW_Attack, Activate_Jammer, Deactivate_Jammer
Guided Bomb	Bomb_Location, Limited_Munition_Attack, Ground_Attack
RIM-66 SAM	Limited_Munition_Attack, Attack_with_AntiAir_Missile, Automatic_Air_Defense, React_To_Air_Threats
Sidewinder Anti-Air Missile	Limited_Munition_Attack, Attack_with_AntiAir_Missile, React_To_Air_Threats
Stinger Anti-Air Missile	Limited_Munition_Attack, Attack_with_AntiAir_Missile, Automatic_Air_Defense, React_To_Air_Threats
Tomahawk Cruise Missile	Limited_Munition_Attack, Attack_with_Land-Attack_Missile
Unguided Bomb	Bomb_Location, Limited_Munition_Attack, Ground_Attack
Torpedo, Type 40 (RPK-6 Vodopad SUBROC)	Limited_Munition_Attack, Attack_with_Torpedo, React_To_Naval_Threats_Torpedo
Air-Drop Supply	Provide_Supplies, Change_Supplying_Command
Active RADAR Sensor	
Aircraft Aggregated Movement	Maximum_Speed_Modifier
Biological Weapon	Biological_Attack, NBC_Attack
Booby Trap Setter	Create_Booby_Trap, Improve_Booby_Trap
Bridge Builder	Construct_Bridge, Improve_Bridge
Chemical Weapon	Chemical_Attack, NBC_Attack
Ditch Digger	Create_Anti-Tank_Ditch, Improve_Ditch, Create_Dry_Gap
SIGINT Sensor	

Table C-6: Systems and Configured Scripted Tasks, AggregateLevel.sms

System	Scripted Tasks
Engagement Report Generator	
Engineering Object Sensor	
Engineering Obstacle Destroyer	Destroy_Obstacle, Destroy_Fortification, Destroy_Ditch, Destroy_Bridge, Destroy_Explosive, Breach_Obstacles, Improve_Breach
Explosive Hazard and Simple Obstacle Destroyer	Destroy_Explosive_Hazard, Destroy_Obstacle, Breach_Obstacles, Improve_Breach
FASCAM	FASCAM
Fortification Builder	Construct_Barricade, Improve_Fortification, Construct_Fortified_Line, Construct_Fortified_Area, Construct_Strong_Point
Ground Aggre- gated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
Ground Combat Behaviors	Attack_Target
IFF Transponder	
Infantry Aggre- gated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
IR Sensor	
Limit Entity Exis- tence	
Mechanized Aggregated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
Mine Dispenser	Create_Minefield
MOPP Gear	Change_MOPP_Level
Motorized Aggre- gated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
NBC Sensor	
Nuclear Weapon	Nuclear_Attack, NBC_Attack
Obstacle Builder	Construct_Abatis, Improve_Obstacle, Construct_Barbed_Wire, Construct_Berm

Table C-6: Systems and Configured Scripted Tasks, AggregateLevel.sms

System	Scripted Tasks
Passive RADAR Sensor	
Ground Resupply	Provide_Supplies, Change_Supplying_Command
Riverine Aggregated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
Ship Aggregated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
Simple Obstacle Destroyer	Destroy_Obstacle, Breach_Obstacles, Improve_Breach
SONAR Sensor	
Spot Report Generator	
Spot Report Receiver	
Subsurface Aggregated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
Tank Aggregated Movement	Maximum_Speed_Modifier, Halt_Movement, Move_To_Location_Plan_Path, Move_To_Waypoint_Plan_Path
Visual Sensor	



Index

Numerics

- 2D, icon 2-9
- 3D
 - model 2-9
 - DI-Guy 8-11
- 3D Cartesian, coordinate system 17-16
- 3DS, ASE 8-5
- 9-Line briefing 8-17

A

- Abandon Plan command 11-32
- abandoning, plan 11-32
- abandoning plan, confirmation prompt 7-4
- abatis, constructing 9-9
- acceleartion-to-rpm-factor parameter 13-17
- action category 16-7, 16-15
- actionCategories.task 16-15
- Activate Jammer task 9-3
- activating
 - jammer 9-3
 - scenario event 12-9
 - scenario event from plan 12-10
- active sonar 13-16
- Active Sonar Mode, set data request 10-3
- Active Sonar Mode dialog box 10-3
- active-radar-sensor system 5-18
- activity, aggregate 10-4
- Activity dialog box 10-4
- actuator, damage 13-21
- Add Conditional Expression dialog box 11-9
- adding
 - conditional expression to plan 11-20
 - entity to aggregate 4-7
- adding (continued)
 - environment condition 15-6
 - global commands to plan 11-26
 - linked event 12-4
 - media to scenario event 12-6
 - object, to Favorites list 2-25
 - scenarios to Scenario Merge project B-4
 - text object 6-9
 - vertex 6-16
- agent, contamination 5-7
- aggregate
 - activity 10-4
 - adding entity to 4-7
 - aggregated state 4-9
 - artillery 9-20
 - assigning tasks 7-10
 - attrition 5-11
 - from combat engineering object 5-11
 - changing state manually 4-12
 - convoy 8-7, 8-8
 - behavior 7-10
 - creating 4-2
 - preconfigured 4-5
 - deleting 4-13
 - disaggregated state 4-9
 - disaggregation area 4-13
 - embark task 8-15
 - entity, individual tasks and plans 4-11
 - footprint 5-4
 - formation 10-17
 - introduction 4-8
 - movement 5-6
 - affected by combat engineering objects 5-9
 - moving to formation 8-33
 - posture 5-4

- aggregate (continued)
 - preconfigured 4-5
 - removing entity from 4-8
 - reorganizing 10-27
 - restoring 4-11, 10-29
 - sector 5-4
 - selecting 4-6
 - sensor 5-8
 - setting formation in plan 11-34
 - state
 - affect on combat 4-10
 - affect on resource tracking 4-11
 - changing at runtime 4-10
 - initiating change 4-12
 - setting 10-4
 - showing in GUI 4-9
 - state at creation 4-6
 - state change, affect on movement task 4-10
 - subordinate, in condition 11-6
 - target, preferred 10-26
 - warfare model 5-2
 - writing plan for 4-13, 11-30
- Aggregate State dialog box 10-4
- Aggregate State set data request 10-4
- aggregate-comms-jammer, system 5-17
- aggregated state 4-9
- aggregate-level combat 5-7
- AggregateLevel.sms 5-2
- aggregate-radar-jammer system 5-18
- aggregation
 - automatic 4-13
 - manual 4-12
 - state 4-6
- air defense 9-5
- aircraft
 - See also Fixed-Wing entity and Rotary-Wing entity
 - setting speed 10-23
- Air-to-Ground Attack dialog box 9-3
- Air-to-Ground Attack task 9-3
- allowable-distance** parameter 8-36, 8-40
- Altitude
 - condition 11-13
 - set data request 7-25
- altitude 17-16
 - fixed-wing entity 7-23
 - flying to 8-23, 8-25
 - object, changing 3-5, 6-16
 - ordering entity to 8-34
 - pasted object 2-24
- altitude (continued)
 - route, setting 2-16
 - setting 2-14, 2-16, 10-5
 - fixed-wing entity 7-25
 - in dialog box 2-15
 - manually 2-14
 - testing entity for 11-13
 - vertex, changing 6-18
- Altitude dialog box 10-5
- Altitude set data request 7-25, 10-5
- ammo select table, counter measure 13-18
- ammunition 5-14, 10-5
 - pacing and tracking 10-6, 10-14
 - specifying amount 10-28
- Ammunition dialog box 10-5
- Ammunition Pacing/Tracking, set data request 10-6
- Ammunition Pacing/Tracking dialog box 10-6
- amount 10-5
- Animated Movement, task 8-5
- Animated Movement dialog box 8-5
- animation
 - DI-Guy 8-11
 - entity 8-5
 - testing DI-Guy 11-13
- Answer Questions button 17-21
- anti-air 5-14
- anti-air missile 9-3
- anti-air weapon 9-5
- anti-personnel 5-14
- anti-ship 5-14
- Anti-ship (Fixed Depth), task 8-30
- anti-ship missile 9-4
- anti-submarine, missile 8-28
- anti-tank 5-14
- anti-tank ditch
 - digging 9-9
 - improving 9-19
- Any, as condition parameter 11-6
- Any Subordinate of Selected Aggregate check box 11-7
- API, Scenario Merge B-2
- appearance
 - pasting 2-23
 - power plant 13-16
 - setting 10-6
 - testing DI-Guy 11-14
- Appearance dialog box 10-6
- Appearance set data request 10-6
- application number 1-35

- Application Settings dialog box 1-20, 4-12
 - Scripted Task Options page 16-31
 - Session Options page 1-9, 1-11, 1-12, 1-20
 - Spot Report Options page 13-3, 13-5, 13-6, 13-8, 13-9
 - Spot Reports page 10-34
 - area
 - disaggregation 4-13
 - fill style 6-21
 - fortified, constructing 9-13
 - hazard 5-8
 - NBC 5-7
 - Arm Mine at Depth, task 8-6
 - Armed dialog box 10-7
 - Armed set data request 10-7
 - arming
 - IED 10-7
 - mine, naval 8-6
 - arrow
 - adding to line 6-21
 - freehand line 6-7
 - artillery
 - aggregate 9-20
 - Fire-for-Effect task 8-21
 - ASE 8-5
 - assigning, plan to multiple entities 11-30
 - Attach Components to Remote Entities On, parameter 1-5
 - Attach Object to Mouse check box 2-18
 - attack
 - air-to-ground 9-3
 - anti-air missile 9-3
 - limited munition 5-7
 - missile 5-7
 - Attack with Anti-Air Missile dialog box 9-3
 - Attack with Anti-Air Missile task 9-3
 - Attack with Anti-ship Missile dialog box 9-4
 - Attack with Anti-Ship Missile task 9-4
 - Attack with Land-Attack Missile dialog box 9-4
 - Attack with Land-Attack Missile task 9-4
 - Attack with Torpedo dialog box 9-4
 - Attack with Torpedo task 9-4
 - attack_with anti-ship missile 9-4
 - attribute, setting entity 10-6
 - attrition, aggregate 5-11
 - attrition rate 5-3
 - audio, adding to scenario event 12-6
 - Auto Launch dialog box 10-9
 - automatic
 - aggregation 4-12
 - automatic (continued)
 - aggregation and disaggregation 4-13
 - counter measures 13-18
 - laser 10-21
 - reorganization 10-27
 - running of scenarios 1-30
 - Automatic Air Defense task 9-5
 - autonomous lasing 13-15
 - avoidance, collision 10-8
 - avoiding, collisions, obstacles, and features 3-16
- ## B
- B command-line option 1-34
 - back-end
 - balancing load 1-17
 - remapping, in batch mode 1-34
 - background process 8-55, 16-4, 17-28
 - balancing, object load 1-17
 - ballistic
 - missile 14-8
 - firing 14-8
 - target event 14-10
 - barbed wire, constructing 9-10
 - barricade, constructing 9-10
 - batch file 1-30
 - editing 1-31
 - batch mode 1-30, 1-31
 - remapping 1-34
 - starting from command line 1-34
 - beam 10-27
 - emitter 10-13, 13-16
 - standard and tracking 10-13
 - behavior, scripted 8-5
 - Behavior Set 16-8
 - assigning to force 7-20
 - creating 7-19
 - scripted task availability 16-16, 16-18
 - berm, constructing 9-11
 - biological, contamination 5-7
 - Biological Attack dialog box 9-5
 - Biological Attack task 9-5
 - biological contamination 5-8, 9-5
 - bitmap, adding to scenario event 12-6
 - bomb
 - dropping 8-47
 - laser guided 8-47
 - Bomb Location dialog box 9-6
 - Bomb Location task 9-6

- booby trap
 - creating
 - creating, booby trap 9-11
 - destroying 9-16
 - improving 9-18
- boolean, operator 11-16
- bounding volume 3-16
- box
 - drawing 6-8
 - resizing 6-19
- breach, improving 9-18
- Breach Obstacles dialog box 9-7
- Breach Obstacles task 9-7
- breaching
 - fortification 9-7
 - obstacle 9-7
- bridge 2-24
 - building 9-12
 - destroying 9-16
 - improving 9-18
- building 2-24
 - avoiding 3-16
 - bridge 9-12
 - conditional statement 11-20
 - creating entity in 3-4
 - ditch 9-13
 - dry gap 9-13
 - fortified area 9-13
 - setting avoidance 10-8
- button, Answer Questions 17-21

C

- C++
 - scripted task 16-20
 - task 16-3, 17-13
- can-be-radar-jammed** parameter 5-18
- cancelling, reactive task 7-17
- can-pivot** parameter 8-52
- Capabilities dialog box 10-7
- Capabilities set data request 10-7
- capability, setting 10-7
- car bomb, detonating 10-10
- carrier, placing entity on 3-4
- Cartesian, coordinate system 17-16, 17-18
- CAS 8-17
- category, action 16-7, 16-15
- CEO. See combat engineering object
- certainty level for spot reports 13-8

- chaff 8-28
 - launching 13-18
- Change Hostility dialog box 13-11
- Change MOPP Level dialog box 9-7
- Change MOPP Level task 9-7, 10-22
- Change Posture dialog box 9-8
- Change Posture task 9-8, 10-24
- changing
 - aggregate state 4-12
 - runtime 4-10
 - altitude, vertex 6-18
 - color, tactical graphics 6-20
 - control object 6-15
 - force hostility 13-10
 - line, direction 6-20
 - MOPP level 9-7
 - name, tactical graphic 3-5
 - overlay name 6-6
 - posture 9-8, 10-24
 - width of line 6-21
- check() function 17-6
- checkInit() function 17-6
- checkpoint 1-22, 1-24
 - deleting 1-26
 - disabling periodic 1-25
 - periodic, scheduling 1-25
 - status 1-24
- chemical, contamination 5-7
- Chemical Attack dialog box 9-8
- Chemical Attack task 9-8
- chemical contamination 5-8, 9-8
- chop, wave 15-14
- choppiness, ocean 15-16
- CID level 13-12
 - for firing at target 13-14
 - icon, color 13-12
- circling, point 8-43
- class
 - DtScenarioMergeDirector* B-2
 - DtVrfAggregateStateRepository* 4-9
 - FeatureSet* 17-3
 - Location3D* 17-16
 - Lua 17-3
 - SimObject* 17-3
 - Vector3D* 17-16
 - VectorGeoc3D* 17-18
 - VectorOffset3D* 17-18
 - vrf* 17-3
- Classified CID level 13-12
- Click to Create 2-11

-
- Click to Locate 2-11, 2-12
 - climb rate 8-25
 - clipping plane, adjusting when creating entities 3-4
 - close air support 8-17, 9-3
 - closing
 - Create Object dialog box 2-12
 - scenario file in Scenario Merge B-8
 - simulation 1-28
 - cloud
 - cover 15-5, 15-7, 15-10
 - smoke 8-29
 - code
 - laser 10-21
 - assigning 13-14
 - collateral damage 13-21
 - collision avoidance 3-16
 - specifying for entity 10-8
 - Collision Avoidance Types dialog box 10-8
 - Collision Avoidance Types set data request 10-8
 - color
 - fog 15-5, 15-9
 - partially identified entities 13-12
 - tactical graphics, changing 6-20
 - combat 5-2
 - aggregate 4-10
 - aggregate-level 5-7
 - power 5-3
 - combat engineering object 5-9
 - creating 5-12
 - partial completion 5-12
 - rate of creation 5-12
 - status 5-12
 - combat identification level 13-12
 - Come to Stop, task 8-6
 - command
 - Abandon Plan 11-32
 - Disembark 3-10
 - Embark On 3-9
 - global, adding to plan 11-26
 - Issue Plan 11-29
 - Restart Plan 11-31
 - command line
 - loading scenario from 1-16
 - running Scenario Merge from B-9
 - comma-separated values file 14-8
 - communications, jamming 5-17
 - company, pre-configured 4-5
 - comparison operator 11-15
 - component
 - attaching to remote entities 1-5
 - component (continued)
 - emitter 10-13
 - Component Attachment Table, parameter 1-6
 - computed route, creating 6-11
 - Concealed dialog box 10-9
 - Concealed set data request 10-9
 - concealment, setting 10-9
 - concurrent task 7-4, 16-15
 - condition
 - considerations for using 11-13
 - Detect Entity 11-13
 - Engineering Object Breached 11-13
 - Entity Altitude 11-13
 - Entity Destroyed 11-13
 - Entity Di-Guy Animation Check 11-13
 - Entity Di-Guy Appearance Check 11-14
 - Entity Embarked 11-14
 - Entity Has Target 11-14
 - Entity In Area 11-14
 - Entity Left of Line 11-14
 - Entity Under Fire 11-15
 - Lifeform Surrendered 11-15
 - Missile Approach Warning 11-15
 - name 11-7
 - name condition, pattern 11-6
 - pattern 11-8
 - editing csv file 11-8
 - Random 11-15
 - Receive Text Message 11-16
 - Resource 11-15
 - Scenario Event 11-16
 - Simulation Date/Time 11-16
 - Simulation Time 11-16
 - While 11-12
 - conditional expression, dialog box 11-20
 - conditional statement 11-5
 - adding to plan 11-20
 - building 11-20
 - filtering entity list 7-9
 - prefix notation 11-21
 - trigger 11-10
 - condition-entity-types.csv* file 11-8
 - configuration, simulation model set 1-9
 - configuration file, *condition-entity-types.csv* 11-8
 - configuring
 - condition pattern enumerations 11-8
 - counter measures 13-18
 - Create Object dialog box 2-12
 - detection tables 13-12
 - embedded entity 3-11

- configuring (continued)
 - hostility 13-10
 - IED 10-10
 - rotary-wing lateral movement 7-32
- confirmation prompt
 - plan, enabling or disabling 7-4
 - task, enabling or disabling 7-4
- console
 - messages, sending 11-27
 - setting notification level 10-23
- Construct Abatis dialog box 9-9
- Construct Abatis task 9-9
- Construct Anti-Tank Ditch dialog box 9-9
- Construct Anti-Tank Ditch task 9-9
- Construct Barbed Wire dialog box 9-10
- Construct Barbed Wire task 9-10
- Construct Barricade dialog box 9-10
- Construct Barricade task 9-10
- Construct Berm dialog box 9-11
- Construct Berm task 9-11
- Construct Booby Trap dialog box 9-11
- Construct Booby Trap task 9-11
- Construct Bridge dialog box 9-12
- Construct Bridge task 9-12
- Construct Dry Gap dialog box 9-13
- Construct Dry Gap task 9-13
- Construct Fortified Area dialog box 9-13
- Construct Fortified Area task 9-13
- Construct Fortified Line dialog box 9-14
- Construct Fortified Line task 9-14
- Construct Minefield dialog box 9-14
- Construct Minefield task 9-14
- Construct Strong Point dialog box 9-15
- Construct Strong Point task 9-15
- constructing
 - abatis 9-9
 - barbed wire 9-10
 - barricade 9-10
 - berm 9-11
 - fortified line 9-14
 - strong point 9-15
- Contamination, set data request 10-9
- contamination
 - agent 5-7
 - biological 9-5
 - chemical 9-8
 - nuclear 9-21
 - nuclear, biological, chemical 5-7, 5-8
 - type, setting 10-9
- Contamination dialog box 10-9
- control object
 - copying 2-21
 - creating 2-3
 - editing 6-15
 - introduction 6-3
 - pasting 2-21
 - spot report 13-9
- controller, rail-path-movement 8-36, 8-40
- convoy 8-7, 8-8
 - behavior 7-10
- Convoy Along task 7-10, 8-7
- Convoy To task 7-10, 8-8
- coordinate system
 - 3D Cartesian 17-16
 - Cartesian 17-16, 17-18
- copying
 - objects 2-21
 - performance and 2-21
 - plan statements 11-31
 - scripted task 16-28
- counter measure 8-28
 - ammo select table 13-18
 - launching 13-18
- Counter Measures Auto Launch, set data request 13-18
- Counter Measures Auto Launch set data request 10-9
- crawling 10-25
- Create Anti-Tank Ditch dialog box 9-9
- Create Barbed Wire dialog box 9-10
- Create Barricade dialog box 9-10
- Create Berm dialog box 9-11
- Create Booby Trap dialog box 9-11
- Create Bridge dialog box 9-12
- Create Dry Gap dialog box 9-13
- Create Fortified Area dialog box 9-13
- Create Fortified Line dialog box 9-14
- Create global command 11-28
- Create Indirect Artillery dialog box 14-3
- Create Intelligence Object dialog box 12-7
- Create menu 2-3
 - selecting object 2-4
- Create Minefield (Volcano) dialog box 9-14
- Create Object
 - dialog box 2-3, 2-12
 - Attach Mouse to Object 2-18
 - configuring 2-12
 - tab 2-11
- Create Route dialog box 2-16
- Create Scenario Event dialog box 12-2

Create Strong Point dialog box 9-15
create-script-id parameter 16-18
 creating 2-9

- aggregate 4-2
 - aggregation state 4-6
 - entity 4-2
- batch file 1-31
- Behavior Set 7-19
- combat engineering object 5-12
- computed route 6-11
- control object 2-3
- cultural feature 2-24
- embedded entity 3-14
- entity 2-9, 3-3, 6-7
 - adjusting clipping plane 3-4
 - in buildings 3-4
- fixed-wing entity 7-23
- fortified area 9-13
- fortified line 9-14
- freehand line 6-7
- global plan 11-24
- indirect artillery event 14-3
- minefield 9-14
- new scenario 1-3
- object 2-3, 2-4, 2-5, 2-11
 - in plan 11-28
 - mouse with 2-18
 - setting properties 2-12
- objects 2-4
- overlay 6-5
- plans 11-18
- prop 2-9, 2-25
- reactive task 16-21
- scenario event 12-2
- Scenario Merge project B-4
- scripted task 16-5
- strong point 9-15
- tactical graphics 2-9
- text object 6-9

 crouching 10-25
 cruise missile, firing 8-20
 CSV 8-5
 CSV file 14-8
 cultural feature 2-24

- creating 2-3, 2-4, 2-5, 2-11
- heading, setting 2-17

 cursor 2-9, 2-10

D

damage

- actuator 13-21
- collateral 13-21
- file 13-21
- system 13-21

 dashed line 6-21
 date

- setting 15-2, 15-3
- setting in new scenario 1-7
- simulation 1-12
 - default 1-12

 Date and Time page 15-3, 15-4
 Deactivate Jammer task 9-15
 deactivating, jammer 9-15
 decay rate for spot reports 13-8
 default

- name 2-11
- Set commands 10-3
- simulation model set configuration 1-9, 1-11
- starting date and time 1-12

 default-task-rules.tsk 16-15
 defensive measure 8-29
 defensive movement 9-21
 Delete Checkpoints dialog box 1-26
 Delete Object global command 11-28
 Delete Self global command 11-28
 deleting

- aggregate 4-13
- checkpoints 1-26
- entity 3-5
 - in plan 11-28
- environment condition 15-7
- object in plan 11-28
- overlay 6-6
 - object 6-14
- plan statement 11-23
- scenario event 12-11
- scripted task 16-28
- trigger 11-11
- vertex 6-19

 Deliberate-Attack, posture 5-4
 Deliberate-Defense, posture 5-4
 Deploy Sonobuoy, task 8-8
 Deploy Sonobuoys Along Route, task 8-9
 deploying

- embedded entity 3-14
 - with task 3-14
- sonobuoy 8-8, 8-9

- depth
 - moving to 8-34
 - sonar 10-33
- depth charge 8-12, 8-19
- descent rate 8-25
- designator, laser beam 13-14
- Destroy Bridge dialog box 9-16
- Destroy Bridge task 9-16
- Destroy Ditch dialog box 9-16
- Destroy Ditch task 9-16
- Destroy Explosive dialog box 9-16
- Destroy Explosive task 9-16
- Destroy Fortification dialog box 9-17
- Destroy Fortification task 9-17
- Destroy Obstacle dialog box 9-17
- Destroy Obstacle task 9-17
- destroyed, setting entity to 10-10
- Destroyed set data request 10-10
- destroying
 - booby trap 9-16
 - bridge 9-16
 - ditch 9-16
 - fortification 9-17
 - obstacle 9-17
 - unexploded ordnance 9-16
- destroy-script-id** parameter 16-18
- Detect Entity condition 11-13
- Detected CID level 13-12
- detecting, targets 13-12
- detection table 13-12
- detonating, IED and car bomb 10-10
- Detonation Fuse Type dialog box 10-10
- Detonation Fuse Type set data request 10-10
- dialog box
 - Active Sonar Mode 10-3
 - Activity 10-4
 - Add Conditional Expression 11-9
 - Aggregate State 10-4
 - Air-to-Ground Attack 9-3
 - Altitude 10-5
 - Ammunition 10-5
 - Ammunition Pacing/Tracking 10-6
 - Animated Movement 8-5
 - Appearance 10-6
 - Application Settings 1-20, 4-12
 - Scripted Task Options page 16-31
 - Session Options page 1-9, 1-11, 1-12, 1-20
 - Spot Report Options page 13-3, 13-5, 13-6, 13-8, 13-9
 - Spot Reports page 10-34
 - dialog box (continued)
 - Armed 10-7
 - Attack with Anti-Air Missile 9-3
 - Attack with Anti-ship Missile 9-4
 - Attack with Land-Attack Missile 9-4
 - Attack with Torpedo 9-4
 - Auto Launch 10-9
 - Biological Attack 9-5
 - Bomb Location 9-6
 - Breach Obstacles 9-7
 - capabilities 10-7
 - Change Hostility 13-11
 - Change MOPP Level 9-7
 - Change Posture 9-8
 - Chemical Attack 9-8
 - Collision Avoidance Types 10-8
 - Concealed 10-9
 - conditional statement 11-7, 11-20
 - Construct Abatis 9-9
 - Construct Anti-Tank Ditch 9-9
 - Construct Barbed Wire 9-10
 - Construct Barricade 9-10
 - Construct Berm 9-11
 - Construct Booby Trap 9-11
 - Construct Bridge 9-12
 - Construct Dry Gap 9-13
 - Construct Fortified Area 9-13
 - Construct Fortified Line 9-14
 - Construct Minefield 9-14
 - Construct Strong Point 9-15
 - Contamination 10-9
 - Create Anti-Tank Ditch 9-9
 - Create Barbed Wire 9-10
 - Create Barricade 9-10
 - Create Berm 9-11
 - Create Booby Trap 9-11
 - Create Bridge 9-12
 - Create Dry Gap 9-13
 - Create Fortified Area 9-13
 - Create Fortified Line 9-14
 - Create Indirect Artillery 14-3
 - Create Intelligence Object 12-7
 - Create Minefield (Volcano) 9-14
 - Create Object 2-3
 - configuring 2-12
 - Create Route 2-16
 - Create Scenario Event 12-2
 - Create Strong Point 9-15
 - Delete Checkpoints 1-26
 - Destroy Bridge 9-16

-
- dialog box (continued)
 - Destroy Ditch 9-16
 - Destroy Explosive 9-16
 - Destroy Fortification 9-17
 - Destroy Obstacle 9-17
 - Detonation Fuse Type 10-10
 - DI-Guy Appearance 10-11
 - Display Settings
 - Entity Display Settings page 7-4
 - Indirect Fire Settings page 14-7
 - Render Settings page 15-18
 - Edit Behavior Sets 7-19, 7-20
 - Embark On 3-9, 8-16
 - Embarked 10-12
 - Emitter 10-13
 - Engagement Results 10-14
 - Environment Conditions 15-11
 - Environment Settings 15-3, 15-4
 - Equipment Pacing/Tracking 10-14
 - Execute Close Air Support 8-17
 - Fire Cruise Missile 8-20
 - Fixed Wing Land 8-22
 - Fixed Wing Takeoff 8-23
 - Follow Entity 8-26
 - Food, Water, Motor-Gas, Aviation-Fuel, Diesel
 - Fuel, Oil, Lubricant 10-15
 - Food, Water, Motor-Gas, Aviation-Fuel, Diesel
 - Fuel, Oil, Lubricant
 - Pacing/Tracking 10-15
 - Force 10-16
 - Formation 10-17
 - Heading 10-18
 - Health 10-19
 - IFF 10-20
 - Improve Booby Trap 9-18
 - Improve Breach 9-18
 - Improve Bridge 9-18
 - Improve Ditch 9-19
 - Improve Fortification 9-19
 - Improve Obstacle 9-20
 - Indirect Fire 9-20
 - Initial Scenario Information 1-3, 1-11
 - Lase Autonomous 10-21
 - Laser Code 10-21
 - Load Batch File 1-34
 - Load Overlays 6-22
 - Location 10-22
 - Manage Reactive Task 7-16
 - MOPP Level 10-22
 - Morale 10-22
 - dialog box (continued)
 - Move Along Route 8-32
 - Move Into Formation 8-33
 - Move To Altitude 8-34
 - Move To Depth 8-34
 - Move To Location (Direct) 8-35
 - Move To Waypoint (Direct) 8-39
 - Munition Target Settings 14-3, 14-6, 14-8, 14-10
 - New Scenario 1-29
 - Notify Level 10-23
 - Nuclear Attack 9-21
 - Ordered Speed 10-23
 - Patrol Along Route 8-43
 - Patrol Between 8-44
 - Pattern Hold (Location) 8-44
 - Pattern Hold (Waypoint) 8-45
 - Periodic Checkpointing 1-25
 - Place IED 8-46
 - Posture 10-24, 10-25
 - Preferred Targets 10-26
 - Radar Mode 10-27
 - Resources 10-28
 - Resources Pacing/Tracking 10-28
 - Resupply Mode 10-30
 - Rotary Wing Land 8-48
 - Rules of Engagement 10-30
 - Sail Heading 8-49
 - Save Scenario 1-23
 - Scenario Event 12-10
 - Scenario Information 1-21
 - Sector of Responsibility 10-32
 - Send NBC Report 9-22
 - Send Obstacle Report 9-22
 - Set Scenario End Time 1-29
 - Set Sensor Signatures 12-8
 - Sonar Depth 10-33
 - Spot Reports 10-34
 - Supplying 10-34
 - Surrendered 10-35
 - Synchronize Laser Code 10-35
 - Target 10-36
 - Turn to Heading 8-52
 - User Task 8-53
 - Wait Duration 8-54
 - Wait Elapsed 8-54
 - Weapon State 10-37
 - Weapons Pacing/Tracking 10-37
 - Weather 15-13
 - digging, anti-tank ditch 9-9

- DI-Guy
 - animation, testing for 11-13
 - appearance, testing for 11-14
 - integration with VR-Forces 8-11
- DI-Guy Animation task 8-11
- DI-Guy Appearance dialog box 10-11
- DI-Guy Appearance set data request 10-11
- dipping, sonar 8-51
- direction
 - line, changing 6-20
 - Lua 17-16
 - wind 15-8
- disabling
 - editing of overlay 6-5
 - joystick use 3-18
 - periodic checkpointing 1-25
 - reactive task 7-14
 - spot report 13-3
 - spot report for entity 10-34
 - view constraint 3-4
- disaggregated state, aggregate 4-9
- disaggregation
 - area 4-13
 - automatic 4-13
 - manual 4-12
- Disembark, command 3-10
- disembark 3-10
 - in echelon view 3-10
- disembark all 3-11
- Disembark All task 8-10
- Disembark task 8-10
- Disembarked set data request 3-10, 10-11
- disembarked status, testing for 11-14
- disembarking
 - entities 3-6
 - entity 10-11, 10-12
 - instantly 3-10
- display
 - time, format 15-4
- Display Settings dialog box
 - Entity Display Settings page 7-4
 - Indirect Fire Settings page 14-7
 - Render Settings page 15-18
- Display Terrain, parameter 1-6
- displaying
 - scenario file in Scenario Merge B-7
 - scenario information 1-19
 - terrain profile, creating line 6-10
- ditch
 - anti-tank, digging 9-9
 - ditch (continued)
 - building 9-13
 - destroying 9-16
 - improving 9-19
- dotted line 6-21
- Douglas, sea state 15-14
- Douglas sea state 15-16
- drag-and-drop, cancelling 2-20
- dragging
 - cancelling move 2-20
 - object to new location 2-19
 - objects 10-22
- drawing, box 6-8
- driving, on and off roads 7-21
- Drop Naval Depth Charge, task 8-12
- Drop Naval Depth Charge at Location, task 8-12
- Drop Naval Mine, task 8-13
- Drop Naval Mines Along Route, task 8-14
- dropping, mine 8-13, 8-14
- dropping bomb 8-47
- dry gap, building 9-13
- DtScenarioMergeDirector* class B-2
- DtVrfAggregateStateRepository* class 4-9
- dynamic ocean 15-14
 - enabling and disabling 15-15

E

- Echelon View 4-7, 4-8
 - aggregated aggregate 4-9
 - disaggregated aggregate 4-9
 - disembarking 3-10
- Edit Behavior Sets dialog box 7-19, 7-20
- editing 15-13
 - batch file 1-31
 - control object 6-15
 - ellipse 6-19
 - environment condition 15-7
 - fill style 6-21
 - force hostility 13-10
 - indirect artillery event 14-6
 - line 6-21
 - Lua scripts 16-32
 - object
 - location, heading, altitude 3-5
 - scene, location, heading, altitude 6-16
 - overlay and overlay object 6-5
 - plan 11-18
 - statements 11-23
 - plans 11-18

-
- editing (continued)
 - scenario description 1-21
 - scenario file, in Scenario Merge B-8
 - scripted task 16-24
 - tactical graphics 6-15
 - vertex 6-18
 - weather zone, environment 15-13
 - effect, ocean 15-14
 - electromagnetic emission 5-19
 - electromagnetic emissions 10-13
 - electronic emission, sensong 5-17
 - electronic warfare 5-17, 5-18, 5-19
 - ellipse
 - rotating 6-19
 - undoing and redoing rotation 6-19
 - Embark On, command 3-9
 - Embark On dialog box 3-9, 8-16
 - Embark task 3-7, 8-15
 - embarkation
 - condition 11-14
 - embedded entity alternative 3-11
 - Embarkation View 3-7, 3-8, 3-10
 - embarking objects in 3-10
 - Embarked dialog box 10-12
 - Embarked set data request 3-9, 10-12
 - embarking
 - entities 3-4, 3-6
 - in Embarkation View 3-10
 - instantly 3-9
 - embedded entity 3-11
 - assigning tasks to 3-15
 - configuring 3-11
 - deploying 3-14
 - deploying with task 3-14
 - Entity Editor 3-11
 - recovering 3-15
 - restoring parent 3-15
 - system 3-11
 - emission sensor 5-19
 - emissions-sensor system 5-19
 - emitter 10-27
 - beam 10-13, 13-16
 - component 10-13
 - ID 10-13
 - setting 10-13
 - Emitter dialog box 10-13
 - Emitter set data request 9-3, 9-15, 10-13
 - Enable/Disable Spot Reports tab 13-3
 - enabling
 - editing of overlay 6-5
 - enabling (continued)
 - joystick use 3-18
 - marine effects 15-15
 - reactive task 7-13
 - spot report 13-3
 - entity 10-34
 - ending
 - scenario 1-28
 - scenario event 12-10
 - endTask() function 17-14
 - Engagement Results, set data request 10-14
 - Engagement Results dialog box 10-14
 - engagement rules 10-31
 - Engineering Object Breached condition 11-13
 - Engineering Object Information page 5-12
 - Entities Palette 2-4
 - Entitiesy Palette 2-5
 - entity
 - adding to, aggregate 4-7
 - adding to Props Palette 2-25
 - aggregate 4-2
 - altitude, testing 11-13
 - animation 8-5
 - assigning plan to multiple 11-30
 - avoiding obstacles, features, and collisions 3-16
 - console, setting notification level 10-23
 - console message, sending 11-27
 - controlling with joystick 3-18
 - copying 2-21
 - creating 2-3, 2-4, 2-5, 2-9, 2-11, 3-3, 6-7
 - creating in plan 11-28
 - damaging 13-21
 - deleting 3-5
 - in plan 11-28
 - deleting in plan 11-28
 - destroyed 10-10
 - disembarking 3-6, 10-11, 10-12
 - all 3-11
 - dragging 2-19
 - to new location 10-22
 - embarkation, testing 11-14
 - embarking 3-4, 3-6
 - embedded 3-11
 - enumeration
 - in condition 11-6
 - in plan 11-8
 - filtering list of 7-9
 - firing at target 13-12
 - fixed-wing 7-23
 - route following 7-27

- entity (continued)
 - following
 - entity 8-26
 - route 8-32
 - ground, road driving 7-21
 - heading 10-18
 - setting 2-17
 - hiding 13-2
 - hostility 13-10
 - icon
 - color, CID level 13-12
 - list, spot report 13-9
 - moving 2-19
 - on roads 8-36, 8-40
 - moving to
 - altitude 8-34
 - location 8-35
 - object or entity 8-39
 - name, pasting 2-23
 - pasting 2-21
 - control object 2-22, 2-23
 - patrolling between 8-44
 - patrolling route 8-43
 - placing 2-11
 - new 3-3
 - on entity 3-4
 - plan 15-2
 - issuing to 11-29
 - viewing 11-16
 - properties, specifying at creation 2-12
 - remote
 - in task 7-3
 - plans 11-30
 - removing, from aggregate 4-8
 - resource, at creation 3-4
 - restoring health and stores 10-29
 - routes for aircraft 6-14
 - setting
 - appearance 10-6
 - collision avoidance types 10-8
 - location 10-22
 - state and parameters 10-3
 - target 10-36
 - specifying resource 10-28
 - spot report, enabling or disabling 10-34
 - state 10-3
 - target detection 13-12
 - target in global command 11-26
 - tasking by superior 10-36
 - waiting 8-53

- entity (continued)
 - writing plan 11-18
- Entity Altitude condition 11-13
- Entity Behavior Options page 4-6, 4-12
- Entity Destroyed condition 11-13
- Entity Di-Guy Animation Check condition 11-13
- Entity Di-Guy Appearance Check condition 11-14
- Entity Display Settings page 7-4
- Entity Editor, embedded entity 3-11
- Entity Embarked condition 11-14
- Entity Has Target condition 11-14
- Entity In Area condition 11-14
- Entity Left of Line condition 11-14
- entity plan 11-3
- entity type
 - scripted task availability 16-16
 - scripted task validity 16-17
- Entity Under Fire condition 11-15
- Entityies Palette 2-3
- entry point, scripted task 17-5
- enumeration
 - for condition patterns 11-8
 - in condition 11-6
- environment
 - weather zone 15-13
 - editing 15-13
- environment condition 15-5
 - adding 15-6
 - deleting 15-7
 - editing 15-7
- environment conditions
 - marine, setting 15-15
- Environment Conditions dialog box 15-11
- Environment Settings dialog box 15-3, 15-4
- Environment Settings toolbar 15-3, 15-4, 15-5
- Environmental Settings toolbar 15-4
- ephemeris 1-7
- ephemeris model 15-2
- Equipment Pacing/Tracking, set data request 10-14
- Equipment Pacing/Tracking dialog box 10-14
- escaping
 - plan 11-32
 - task assignment 7-6
- event
 - linked, adding 12-4
 - scenario 12-2
- event list, numbering 12-11
- Event window 12-9, 12-10

EW-Comms-Degradation-Percentage 5-17
 EW-Comms-Dependence 5-17
 EW-Defense-Strength 5-17
 exectool, module 17-4
 Execute Close Air Support dialog box 8-17
 Execute Close Air Support task 8-17
 exercise, starting 1-27
 exiting
 plan 11-32
 scenario 1-28
 Explode Charge at Depth, task 8-19
 explosive device, arming 10-7
 exporting, scripted task 16-26
 external script, editing 16-32

F

favorite 2-4
 adding or removing from list 2-25
 favorites.mst 2-25
 feature, avoiding 3-16
FeatureSet class 17-3
 file, batch 1-30, 1-31
 fill style 6-21
 filtering
 entity list 7-9
 scripted task list 16-24
 fire
 indirect 14-2
 target 8-19
 Fire at Target, task 8-19
 Fire Cruise Missile dialog box 8-20
 Fire Cruise Missile task 8-20
 Fire-for-Effect task 8-21
 fire-when-fired-upon 10-31
 firing
 at target 8-19
 ballistic missile 14-8
 cruise missile 8-20
 target at 13-12
 spot report 13-14
 Fixed Wing Land dialog box 8-22
 Fixed Wing Land task 7-29, 8-22
 Fixed Wing Takeoff dialog box 8-23
 Fixed Wing Takeoff task 7-28, 8-23
 fixed-wing
 altitude 8-25
 holding pattern 8-44, 8-45
 fixed-wing entity, dropping bombs 8-47
 fixed-wing entity
 altitude 8-23
 circling a point 8-43
 counter measures 8-28
 creating 7-23
 creating routes for 6-14
 follow entity behavior 8-26
 heading 8-24, 8-25
 landing 7-29, 8-22
 route following 7-27
 routes for 6-14
 setting altitude 7-25
 setting IFF transponder 10-20
 setting speed 10-23
 takeoff 7-28
 takeoff and landing 7-26
 taking off 8-23
 terrain following 7-26
 writing plans for 11-35
 flare 8-28
 launching 13-18
 Fly Altitude task 8-23
 Fly Heading and Altitude task 8-25
 Fly Heading task 8-24
 flying
 altitude to 8-23, 8-25
 heading to 8-24, 8-25
 fog 15-5
 denseness of 15-9
 height and color 15-9
 fog-of-war 13-2
 same side 13-7
 folder
 adding scripted task to 16-25
 removing scripted task from 16-25
 scripted task 16-25
 adding 16-25
 deleting 16-25
 renaming 16-25
 follow entity, fixed-wing entity behavior 8-26
 Follow Entity dialog box 8-26
 Follow Entity task 8-26
 in plan 11-35
 follow route task 8-32
 following
 entities 8-26
 route 8-32
 food 5-14
 pacing and tracking 10-15
 setting 10-15

- Food, Water, Fuel, Oil, and Lubricant
 - Pacing/Tracking, set data request 10-15
- Food, Water, Motor-Gas, Aviation-Fuel, Diesel
 - Fuel, Oil, Lubricant, set data request 10-15
- Food, Water, Motor-Gas, Aviation-Fuel, Diesel
 - Fuel, Oil, Lubricant dialog box 10-15
- Food, Water, Motor-Gas, Aviation-Fuel, Diesel
 - Fuel, Oil, Lubricant Pacing/Tracking dialog box 10-15
- footprint
 - affect of posture 5-5
 - aggregate 5-4
 - sensor 5-8
- force
 - Behavior Set, assigning to 7-20
 - default ID 3-3
 - hostility
 - changing in plan 13-11
 - matrix 13-10
 - setting at runtime 10-16
- Force dialog box 10-16
- Force set data request 10-16
- forceHostilty.mtl 13-10
- format, time display 15-4
- formation
 - moving to 8-33
 - setting 10-17
 - in plan 11-34
 - supported 10-17
- Formation dialog box 10-17
- Formation set data request 10-17
 - in plan 11-34
- fortification
 - breaching 9-7
 - destroying 9-17
 - improving 9-19
- fortified area, constructing 9-13
- fortified line, constructing 9-14
- Frame Mode, parameter 1-7
- Frame Time, parameter 1-7
- freehand line 6-7
 - sampling rate 6-7
- front-end, selecting database 1-3
- fsm, module 17-4
- fuel 5-14, 10-7
 - pacing and tracking 10-15
 - setting 10-15
 - specifying amount 10-28
- Full Knowledge CID level 13-12

- function
 - check() 17-6
 - checkInit() 17-6
 - endTask() 17-14
 - getScriptAttribute() 16-18
 - init() 17-5
 - loadState() 17-6
 - makeCopy() 17-4
 - receiveTextMessage() 17-6
 - resume() 17-5
 - saveState() 17-6
 - sendTask() 17-13
 - shutdown() 17-6
 - startSubtask() 17-13
 - stopSubtask() 17-14
 - stopTask() 17-14
 - subtaskCanceled() 17-14
 - subtaskComplete() 17-14
 - subtaskResult() 17-14
 - subtaskRunning() 17-14
 - suspend() 17-5
 - taskCanceled() 17-14
 - taskComplete() 17-14
 - taskResult() 17-14
 - taskRunning() 17-14
 - tick() 17-5

G

- gasoline 5-14
- geocentric
 - coordinate system, vector 17-18
- geometric, objects 17-16
- getScriptAttribute() function 16-18
- global command
 - adding to plan 11-26
 - Create 11-28
 - Delete Object 11-28
 - Delete Self 11-28
 - Issue Plan 11-29
- global plan 11-3, 15-2
 - creating 11-24
- graphic, adding to scenario event 12-6
- graphical object
 - changing, line width 6-21
 - deleting 6-14
 - naming 6-3
 - spot report 13-9
- ground, attacking from air 9-3
- ground truth 13-2, 13-4

ground vehicle, road driving 7-21

H

Halt Movement task 9-17
 Hasty-Attack, posture 5-4
 Hasty-Defense, posture 5-4
 hazard, area 5-8
 Hazard/Obstacles Palette 5-9
 Hazard/Obstacles palette 15-12
 Hazards/Obstacles, palette 2-4
 Hazards/Obstacles Palette 2-5
 header file, *scenarioMergeDirector.h* B-2
 heading
 flying to 8-24, 8-25
 object, changing 3-5, 6-16
 pasting 2-23
 setting 2-3, 10-18
 manually 2-17, 10-18
 turning to 8-52
 Heading dialog box 10-18
 heading indicator 2-17
 Heading set data request 10-18
 health 5-2, 5-3
 restoring entity 10-29
 Health dialog box 10-19
 height, fog 15-9
 helicopter, terrain avoidance 7-31
 hiding
 entities 13-2
 overlay objects 6-6
 high-explosive 5-14
 HLA
 1516
 troubleshooting 1-35
 holding pattern
 fixed-wing 8-44, 8-45
 rotary-wing 8-44, 8-45
 hostility
 changing, plan in 13-11
 matrix, force 13-10

I

icon
 2D 2-9
 Task menu 16-9
 yellow 13-12
 ID
 emitter 10-27

ID (continued)
 script 16-7, 16-9, 16-18, 17-13
 task 17-13, 17-14
 Identification Friend from Foe 10-20
 IED
 arming 10-7
 detonating 10-10
 placing 8-46
 If statement 11-5, 11-9
 adding to plan 11-20
 building 11-20
 IFF 10-20
 IFF dialog box 10-20
 IFF set data request 10-20
 ignore list B-5
 illumination
 model 15-4
 setting 15-2
 illumination model 1-7
 importing
 MSDL 1-13
 scripted task 16-26, 16-27
 Improve Booby Trap dialog box 9-18
 Improve Booby Trap task 9-18
 Improve Breach dialog box 9-18
 Improve Breach task 9-18
 Improve Bridge dialog box 9-18
 Improve Bridge task 9-18
 Improve Ditch dialog box 9-19
 Improve Ditch task 9-19
 Improve Fortification dialog box 9-19
 Improve Fortification task 9-19
 Improve Obstacle dialog box 9-20
 Improve Obstacle task 9-20
improve-script-id parameter 16-18
 improving
 anti-tank ditch 9-19
 booby trap 9-18
 breach 9-18
 bridge 9-18
 ditch 9-19
 fortification 9-19
 obstacle 9-20
 strong point 9-19
 improvised explosive device, placing 8-46
 independent task 7-3
 indirect artillery
 creating 14-3
 editing 14-6
 Indirect Fire, page 14-3, 14-6

- indirect fire 14-2
- Indirect Fire dialog box 9-20
- Indirect Fire Settings page 14-7
- Indirect Fire task 9-20
- information
 - scenario, displaying 1-19
- init() function 17-5
- Initial Aggregate State 4-6
- Initial Scenario Information dialog box 1-3, 1-11
- Intel Collection Area 6-13
- intelligence object 12-7
- intensity, rain and snow 15-10
- interactive script 17-21
- Intercept and Destroy, task 8-27
- interface, Lua 17-3
- invert pattern 11-6
- Invert Selection check box 11-7
- inverting condition parameter 11-6
- Issue Plan, command 11-29

J

- jammer
 - activating 9-3
 - deactivating 9-15
- jamming
 - communications 5-17
 - radar 5-17, 5-18
- jamming-defense-factor parameter 5-18
- jam-strength-factor parameter 5-19
- joystick 3-18
- jumping 10-25

K

- kneeling 10-25

L

- L command-line option 1-16
- label
 - overlay 6-6
 - spot report 13-9
- land attack, missile 9-4
- landing
 - fixed-wing entity 7-26, 7-29, 8-22
 - rotary-wing entity 8-48
- language, scripted task 16-20
- Lase Autonomous dialog box 10-21

- Lase Autonomous set data request 10-21, 13-15
- Lase Target task 8-27, 13-15
- laser
 - autonomous 10-21
 - bomb 8-47
 - code 10-21
 - range 13-14
 - using 13-14
 - targeting 8-27
- laser code, synchronizing between entities 10-35, 13-15
- Laser Code dialog box 10-21
- Laser Code set data request 10-21, 13-14, 13-15
- lasing, autonomous 13-15
- latitude 17-16
- Launch Anti-Submarine Missile (Vertical), task 8-28
- Launch Counter Measures, task 13-18
- Launch Smoke task 8-29
- launching
 - counter measures 13-18
 - torpedo 8-30
- lifeform 11-15
 - setting
 - posture 10-25
 - weapon state 10-37
- Lifeform Surrendered condition 11-15
- limited munition attack 5-7
- line
 - arrow, editing 6-21
 - changing width 6-21
 - creating, displaying terrain profile 6-10
 - direction, changing 6-20
 - dotted and dashed 6-21
 - editing 6-21
 - fortified, constructing 9-14
 - freehand 6-7
 - style 6-21
- line-of-sight, aggregate versus entity 5-8
- linked event, adding 12-4
- list, spot report 13-9
- load balancing 1-17
- Load Batch File dialog box 1-34
- Load Overlays dialog box 6-22
- Load Scenario dialog box 1-15, 1-17
- loading
 - entities on entities 3-6
 - scenario 1-15
 - at startup 1-16
 - recently used 1-16

- loading (continued)
 - Scenario Merge project B-6
 - tactical graphics 6-22
- loadState() function 17-6
- Local Weather Zones page 15-11
- location
 - fixed-wing at creation 7-23
 - moving to 8-35
 - new entity 3-3
 - object, changing 3-5, 6-16
 - ordering entity to 8-35
 - setting 2-3, 10-22
 - by dragging 2-19
- Location dialog box 10-22
- Location set data request 10-22
- Location3D* class 17-16
- locking, overlay 6-5
- Logger, recording to 1-35
- Logger Control message 1-35
- logical, operator 11-16
- logistics 5-14
 - resupply, starting or stopping 10-34
 - resupply modes 10-30
- longitude 17-16
- Lower Periscope, task 8-31
- Lua 16-3, 16-5
 - classes 17-3
 - direction vector 17-16
 - interface 17-3
 - locations and vectors 17-16
 - method 17-3
 - module 17-4
 - object 17-3
 - location of 17-16
 - parameter 17-15
 - as table 17-13
 - require 17-4
 - table 17-13
 - tasks and subtasks 17-13
 - utility functions 17-4
 - vector
 - geocentric 17-18
 - offset 17-18
- lua, background process 17-28
- Lua API Documentation 17-3, 17-13
- lubricant 5-14
 - setting 10-15
- lubricants, pacing and tracking 10-15

M

- makeCopy() function 17-4
- Manage Reactive Task dialog box 7-16
- manual
 - aggregation 4-12
 - aggregation and disaggregation 4-12
- marine
 - conditions, setting 15-15
- marine effects, enabling and disabling 15-15
- marking, remote entity 11-35
- Max Sheaf Radius 9-20
- max-range** parameter 8-47
- max-range-altitude** parameter 8-47
- max-slope** parameter 7-28
- max-speed** parameter 10-23
- max-thrust** parameter 7-28
- media, adding to scenario event 12-6
- menu, Task 16-4
- merging, scenarios B-2, B-7
- message
 - notification for Scenario Merge B-8
 - object console, sending 11-27
 - radio 8-49, 8-50
 - sending, text 8-50
- metadata, script 16-4
- method, Lua 17-3
- Military Scenario Definition Language, importing 1-13
- mine
 - dropping 8-13, 8-14
 - naval, arming 8-6
 - sweeping for 8-52
- minefield, creating 9-14
- minimum lift speed 7-28
- missile
 - anti-air 9-3
 - anti-ship 9-4
 - anti-submarine 8-28
 - ballistic 14-8
 - firing 14-8
 - target event 14-10
 - cruise 8-20
 - land attack 9-4
- Missile Approach Warning condition 11-15
- missile attack 5-7
- Missile Target, page 14-8, 14-10
- missile target event 14-10
- Mission Oriented Protective Posture. See MOPP
- mobility, modifier 5-9

- mode
 - batch 1-30
 - C and 5 in IFF 10-20
 - model
 - 3D 2-9
 - DI-Guy 8-11
 - illumination 15-4
 - modifier 5-3
 - combat engineering object 5-9
 - mobility 5-9
 - visibility 5-10
 - vulnerability 5-10
 - modifying
 - control object 6-15
 - sensor signature 6-13
 - module
 - exectool 17-4
 - fsm, finite state machine 17-4
 - location of 17-4
 - Lua 17-4
 - MOPP Level, setting 10-22
 - MOPP level 5-8
 - changing 9-7
 - MOPP Level dialog box 10-22
 - morale, setting 10-22
 - Morale dialog box 10-22
 - mouse, locking to object 2-18
 - Move Along Route dialog box 8-32
 - Move Along Route Retrograde, task 9-21
 - Move Along Route task 8-32
 - Move Into Formation dialog box 8-33
 - Move Into Formation task 8-33
 - Move To Altitude dialog box 8-34
 - Move To Altitude task 8-34
 - Move To Depth dialog box 8-34
 - Move To Depth task 8-34
 - Move To Location (Direct) dialog box 8-35
 - Move To Location (On Roads) task 7-21, 8-36
 - Move To Location (Plan Path) task 7-21, 8-37
 - Move to Location Retrograde, task 9-21
 - Move To Location task 7-21, 8-35
 - Move to Location task, in plan 8-36
 - Move To Waypoint (Direct) dialog box 8-39
 - Move To Waypoint (Direct) task 8-39
 - Move To Waypoint (On Roads) task 7-21, 8-40
 - Move To Waypoint (Plan Path) task 7-21, 8-41
 - Move to Waypoint Retrograde, task 9-21
 - Move To Waypoint task 7-21
 - movement
 - aggregate 5-6
 - movement (continued)
 - DI-Guy 8-11
 - lifeform 10-25
 - path planning 7-21
 - retreat 9-21
 - scripted 8-5
 - speed, affect of posture 5-5
 - stopping 9-17
 - task, affect of aggregation and disaggregation 4-10
 - moving
 - along a route 8-32
 - in formation 11-34
 - object 2-19
 - objects 2-19, 10-22
 - between overlays 6-9
 - to altitude 8-34
 - to location 8-35
 - to points or entities 8-39
 - vertex 6-18
 - MSDL, importing 1-13
 - multimedia, adding to scenario event 12-6
 - multiple, simulation model set 1-8
 - munition, damaging entity 13-21
 - Munition Target Settings dialog box 14-3, 14-6, 14-8, 14-10
 - mutually exclusive task 7-4, 11-10
- ## N
- name
 - changing, tactical graphic 3-5
 - changing overlay 6-6
 - default 2-11
 - in condition 11-6, 11-7
 - object, in plan 11-33
 - setting 2-3
 - naming, tactical graphics 6-3
 - Naval Depth Charge Deployment, system 8-12
 - Naval Mine Deployment, system 8-13, 8-14
 - NBC, report 9-22
 - NBC area 5-7, 5-8
 - NBC report, sending 9-22
 - network, vector 7-21
 - New Scenario dialog box 1-29
 - noise
 - propulsion, RPM 13-17
 - non-VR-Forces, entity 11-35
 - NOT operator 11-14
 - notation, prefix 11-21

- notification level
 - Scenario Merge B-8
 - setting 10-23
- Notify Level, set data request 10-23
- Notify Level dialog box 10-23
- nuclear, contamination 5-7
- Nuclear Attack dialog box 9-21
- Nuclear Attack task 9-21
- nuclear contamination 5-8, 9-21
- numbering, events 12-11

O

- object
 - adding, to Props Palette 2-25
 - altitude, changing 3-5, 6-16
 - changing
 - line width 6-21
 - name 3-5
 - combat engineering 5-9
 - copying 2-21
 - creating 2-3, 2-4, 2-5, 2-9, 2-11
 - in plan 11-28
 - creation, mouse locking 2-18
 - cultural feature 2-24
 - deleting, from plan 11-28
 - disembarking 10-11, 10-12
 - dragging 2-19
 - to new location 10-22
 - editing 6-15
 - embarking in Embarkation View 3-10
 - fill style 6-21
 - geometric 17-16
 - heading, changing 3-5, 6-16
 - hiding 6-6, 13-2
 - intelligence 12-7
 - location, changing 3-5, 6-16
 - locking mouse to 2-18
 - Lua 17-3
 - moving 2-19
 - moving to 8-39
 - palette 2-4
 - pasting 2-21, 2-22, 2-23
 - altitude 2-24
 - placing 2-11
 - properties
 - setting 2-3
 - specifying 2-12
 - selecting, for creation 2-4
- object (continued)
 - vertex
 - adding 6-16
 - deleting 6-19
 - editing 6-18
- Object Console Summary Panel 17-21
- objects 2-9, 2-11
- Objects List Panel 3-7, 3-10, 4-6
 - Embarkation View 3-7
- observer
 - rain and wave effects 15-18
 - visibility 15-5
- obstacle
 - avoidance 3-16
 - breaching 9-7
 - destroying 9-17
 - fill style 6-21
 - improving 9-20
 - report 9-22
- obstacle report, sending 9-22
- ocean
 - choppiness 15-16
 - dynamic, enabling and disabling 15-15
 - effect 15-14
 - swell 15-16
- off road driving 7-21
- oil 5-14
 - pacing and tracking 10-15
 - setting 10-15
- opening, Create Object dialog box 2-12
- operator
 - boolean 11-16
 - comparison 11-15
 - logical 11-16
- orbit, task 8-43
- order of battle, file 6-22
- ordered speed, setting 10-23
- Ordered Speed dialog box 10-23
- Ordered Speed set data request 10-23
 - fixed-wing for 10-23
- ordnance
 - unexploded, destroying 9-16
- overlay
 - changing name 6-6
 - creating 6-5
 - deleting 6-6
 - editing, enabling and disabling 6-5
 - file 6-11, 6-22
 - hiding 6-6
 - introduction to 6-4

- overlay (continued)
 - label 6-6
 - locking and unlocking 6-5
 - moving objects between 6-9
 - setting 2-3
 - tab 6-6
 - text, adding 6-9
- overlay object
 - copying 2-21
 - deleting 6-14
 - disaggregation area 4-13
 - moving, to different overlay 6-9
 - naming 6-3
 - pasting 2-21, 2-22, 2-23
 - spot report 13-9
- Override Position 3-9
- overriding
 - default scenario parameters 1-5
 - plan 11-32

P

- padding
 - ammunition 10-6, 10-14
 - resource 10-28
 - weapon 10-37
- package, scripted task 16-26
- page
 - Date and Time 15-3, 15-4
 - Engineering Object Information 5-12
 - Entity Behavior Options 4-6, 4-12
 - Indirect Fire 14-3, 14-6
 - Local Weather Zones 15-11
 - Missile Target 14-8, 14-10
 - Scenario Event Settings 12-12
 - Supplies 5-12
- palette
 - entity 2-3
 - Hazard/Obstacles 5-9, 15-12
 - Hazards/Obstacles 2-4, 2-5
 - object creation 2-4
 - prop 2-3
 - Tactical Graphics 2-5
- parachuting 10-25
- parameter
 - acceleartion-to-rpm-factor 13-17
 - allowable-distance 8-36, 8-40
 - Attach Components to Remote Entities On 1-5
 - can-be-radar-jammed 5-18
 - can-pivot 8-52

- parameter (continued)
 - Component Attachment Table 1-6
 - create-script-id 16-18
 - destroy-script-id 16-18
 - Display Terrain 1-6
 - Frame Mode 1-7
 - Frame Time 1-7
 - improve-script-id 16-18
 - jamming-defense-factor 5-18
 - jam-strength-factor 5-19
 - Lua, table 17-13
 - max-range 8-47
 - max-range-altitude 8-47
 - max-slope 7-28
 - max-speed 10-23
 - max-thrust 7-28
 - power-plant-active 13-17
 - Radio Button Choice 16-12
 - Random Number Seed 1-7
 - relative-heading 3-12
 - relative-position 3-12
 - scenario, setting 1-5
 - Scenario Name 1-5
 - scripted task 16-10
 - script-ids 16-18
 - send-spot-reports-on-own-force 13-7
 - separation-distance 7-10
 - separation-tolerance 7-10
 - setting entity 10-3
 - Simulation Model Sets 1-6
 - Simulation Object 16-12, 16-13
 - Simulation Terrain 1-5
 - soil-list 3-17
 - specifying for task 7-6
 - speed-to-rpm-factor 13-17
 - targeting-capable 10-13
 - task, Lua 17-15
 - terrain-check 7-31
 - Time Multiplier 1-6
 - underFireDistance 10-31
 - underFireTime 10-31
 - using remote entities as 11-35
 - vel-to-align-actual 7-32
 - vel-to-align-desired 7-32
- parent, disembarking from 3-11
- passive sonar 13-16
- paste
 - special, altitude 2-24
- Paste Special 2-23

- pasting
 - appearance 2-23
 - objects 2-21, 2-22, 2-23
 - performance and 2-21
 - plans 2-22
- path, planning 7-21, 8-37, 8-41
- Patrol Along Route dialog box 8-43
- Patrol Along Route task 8-43
- Patrol Between dialog box 8-44
- Patrol Between task 8-44
- patrolling
 - between objects 8-44
 - route 8-43
- pattern
 - editing condition 11-8
 - in condition 11-6, 11-8
- Pattern Hold (Location) dialog box 8-44
- Pattern Hold (Location) task 8-44
- Pattern Hold (Waypoint) dialog box 8-45
- Pattern Hold (Waypoint) task 8-45
- Pattern tab 11-8
- pause
 - scenario, automatically 1-7
- pausing
 - scenario, automatically 1-29
 - simulation 1-28
- PDU, Underwater Acoustics 13-16
- pen style 6-21
- performance
 - affected by copy and paste 2-21
 - load balancing 1-17
- periodic checkpointing
 - disabling 1-25
 - scheduling 1-25
- Periodic Checkpointing dialog box 1-25
- periscope
 - lowering 8-31
 - raising 8-47
- phase line, Entity Left of Line 11-14
- Place IED dialog box 8-46
- Place IED task 8-46
- placing 2-11
 - entities 2-11
 - IED 8-46
 - new entity 3-3
 - props 2-11
 - tactical graphics 2-11
- plan
 - abandoning 11-32
 - confirmation prompt 7-4
 - from a plan 11-32
 - adding
 - condition 11-20
 - statement 11-19
 - task 11-19
 - aggregate, for 4-13, 11-30
 - aircraft 11-35
 - altitude condition 11-13
 - assigning to multiple entities 11-30
 - conditional statement 11-5
 - considerations for creating 11-18
 - console message, sending 11-27
 - copying 11-31
 - creating object 11-28
 - deleting
 - entity 11-28
 - object 11-28
 - statement 11-23
 - deleting statement 11-23
 - editing 11-18
 - statement in 11-23
 - effect of name changes 11-33
 - entity 11-3, 15-2
 - when aggregated 4-11
 - Follow Entity task 11-35
 - force hostility 13-11
 - global 11-3, 15-2
 - target entity 11-26
 - writing 11-24
 - global command, adding 11-26
 - including scenario events 12-10
 - inverting condition parameter 11-6
 - issuing 11-29
 - Move to Location task 8-36
 - name in condition 11-7
 - pasting 2-22, 2-23
 - pattern in condition 11-8
 - printing 11-23
 - remote entity 11-30, 11-35
 - restarting 11-31
 - saving 11-24
 - simulation time condition 11-16
 - Tasked by Superior 11-34
 - trigger 11-10
 - viewing 11-16
 - When statement 11-10
 - While condition 11-12

- plan (continued)
 - writing 11-18
- Plan window 11-16, 11-18, 11-19, 11-20, 11-23, 11-24, 11-31
- planning, path 7-21, 8-37, 8-41
- plant, avoiding 3-16
- platoon, preconfigured 4-5
- playing, scenario event 12-9
- point
 - moving to 8-39
 - patrolling between 8-44
 - reversing 6-20
 - strong, constructing 9-15
- Posture, set data request 10-24
- posture
 - affect on footprint, sensing, sensor signature, speed 5-5
 - aggregate 5-4
 - changing 9-8, 10-24
 - Deliberate-Attack 5-4
 - Deliberate-Defense 5-4
 - Hasty-Attack 5-4
 - Hasty-Defense 5-4
 - Reconnaissance 5-4
 - Rout 5-4
 - setting 10-25
 - Travel 5-4
- Posture dialog box 10-24, 10-25
- Posture set data request 10-25
- power, combat 5-3
- power-plant-active** parameter 13-17
- precipitation 15-5, 15-7
 - intensity 15-10
 - type 15-10
- preconfigured aggregate 4-5
- Preferred Targets dialog box 10-26
- prefix notation 11-21
- printing, plan 11-23
- priority, weather zone 15-11
- prisoner-of-war 10-35
- process, background 17-28
- project
 - adding scenarios to B-4
 - creating Scenario Merge B-4
 - file B-6
 - Scenario Merge B-3
 - loading Scenario Merge B-6
 - removing scenarios from B-5
 - saving Scenario Merge B-6
 - specifying ignore list for B-5

- prompt
 - confirmation, abandoning plan 7-4
 - task confirmation, enabling or disabling 7-4
- prone 10-25
- prop 2-10
 - adding, to Props Palette 2-25
 - creating 2-3, 2-4, 2-5, 2-9, 2-11, 2-25
 - heading, setting 2-17
 - placing 2-11
 - saving 2-25
- property
 - object, setting 2-3
- Props Palette 2-3, 2-4, 2-5, 2-11
 - adding objects to 2-25
- propulsion noise 13-16, 13-17
- providing, supplies 5-16
- proximity fuse 10-10
- publishing, tactical graphics 6-11

Q

- question, asking from script 17-21
- quitting
 - plan 11-32
 - retask procedure 7-6

R

- radar 10-27
 - jamming 5-17, 5-18
 - sensor 10-13
- radar mode
 - search 10-27
 - track 10-27
- Radar Mode dialog box 10-27
- Radar Mode set data request 10-27
- Radar-Jamming-Strength-Receiving 5-18
- radio 10-7, 10-10
 - message
 - set data request 8-49
 - task 8-50
- Radio Button Choice, parameter 16-12
- radius, sheaf 9-20
- rail-path-movement, controller 8-36, 8-40
- rain 15-5
 - intensity 15-10
 - splash effect 15-18
- rain and snow 15-7
- Raise Periscope, task 8-47
- Random condition 11-15

- Random Number Seed, parameter 1-7
- range, laser codes 13-14
- rate, turn 8-24
- reactive task 7-11, 8-55, 16-4, 17-6, 17-27
 - cancelling 7-17
 - creating 16-21
 - disabling 7-14
 - enabling 7-13
- real time, checkpointing in 1-25
- Receive Text Message condition 11-16
- receiveTextMessage() function 17-6
- receiving, supplies 5-16
- recently used scenario 1-16
- Reconnaissance, posture 5-4
- recording, to Logger 1-35
- recovering, embedded entity 3-15
- recovery 10-7
- redo, ellipse rotation 6-19
- register, trigger 11-11
- relative-heading** parameter 3-12
- relative-position** parameter 3-12
- Release Bomb on Laser Spot, task 8-47
- Release Bomb on Location, task 8-48
- Release Bomb on Target, task 8-48
- remapping, batch mode 1-34
- remote
 - entity 7-3
 - attaching components to 1-5
 - markings 11-35
 - plan 11-30
 - use in plans 11-35
- removing
 - entity from aggregate 4-8
 - object from Favorites list 2-25
 - scenarios from Scenario Merge project B-5
- renaming
 - overlay 6-6
 - scenario 1-24
- Render Settings page 15-18
- Reorganize set data request 10-27
- reorganizing, aggregate 10-27
- repair 10-7
- report
 - NBC 9-22
 - obstacle 9-22
- require statement, Lua 17-4
- reregistering, trigger 11-34
- Reserve Space 3-9
- resizing, boxes and text overlay objects 6-19
- resource
 - pacing and tracking 10-28
 - specifying 10-28
 - status at creation 3-4
 - tracking aggregate 4-11
- Resource condition 11-15
- Resources dialog box 10-28
- Resources Pacing/Tracking, set data request 10-28
- Resources Pacing/Tracking dialog box 10-28
- Resources set data request 10-28
- Restart Plan command 11-31
- restarting, plan 11-31
- Restore set data request 10-29
- restoring
 - aggregate 4-11, 10-29
 - embedded entity parent 3-15
 - entity health and stores 10-29
- resume() function 17-5
- resuming, simulation 1-27
- resupply 5-16, 10-7
 - modes 10-30
- Resupply Mode dialog box 10-30
- Resupply Mode set data request 10-30
- retreat 9-21
- retrograde movement 9-21
- Reverse Direction 8-32
- reversing, line direction 6-20
- rewinding
 - scenario 1-28
 - scripted task 16-23
- road
 - driving on 7-23
 - moving on 8-36, 8-40
 - network 7-21
 - using route as 8-32
- Rotary Wing Land dialog box 8-48
- Rotary Wing Land task 8-48
- rotary-wing, holding pattern 8-44, 8-45
- rotary-wing entity
 - altitude 8-23, 8-25
 - creating, routes for 6-14
 - heading 8-24, 8-25
 - landing 8-48
 - lateral movement, configuring 7-32
 - routes for 6-14
 - terrain avoidance 7-31
 - writing plans for 11-35
- rotating, ellipse 6-19
- roughness type, mapped to soil type 3-17
- round 14-2

Rout, posture 5-4
route
 altitude, setting 2-16
 computed, creating 6-11
 evaluating for aircraft 6-14
 following 8-32
 fixed-wing 7-27
 for aircraft 6-14
 patrolling 8-43
 using as road 8-32
Rules of Engagement, dialog box 10-30
rules of engagement
 pasting 2-23
 setting 10-30
Rules of Engagement dialog box 10-30
Rules of Engagement set data request 10-30
running 10-25
 batch scenario 1-32, 1-33, 1-34
 simulation 1-27
runway 7-28

S

Sail Heading dialog box 8-49
Sail Heading task 8-49
salvo 14-2
sample, scenario 1-21
sampling rate, freehand line 6-7
Save Scenario dialog box 1-23
saveState() function 17-6
saving
 plan 11-24
 prop 2-25
 scenario 1-22
 existing 1-23
 under new name 1-24
 Scenario Merge project B-6
 scripted tasks 16-23
 tactical graphics 6-22
scenario
 adding to Scenario Merge project B-4
 batch 1-31
 checkpointing 1-24
 closing 1-28
 in Scenario Merge B-8
 component attachment table 1-6
 creating new 1-3
 date, setting 1-7
 description, editing 1-21
 displaying scenario file in Scenario Merge B-7

scenario (continued)
 editing B-8
 end time 1-7, 1-29
 new scenario 1-29
 frame mode 1-7
 frame time 1-7
 information, displaying 1-19
 loading 1-15
 recently used 1-16
 merging B-2, B-7
 MSDL, importing 1-13
 name 1-5
 parameter, setting 1-5
 random number seed 1-7
 removing from Scenario Merge project B-5
 resuming 1-27
 rewinding 1-28
 scripted task 16-23
 running 1-27
 sample 1-21
 saving 1-22
 existing 1-23
 under new name 1-24
 simulation model set 1-6
 SMS, multiple 1-8
 starting 1-27
 starting date and time 1-12
 default 1-12
 terrain
 display 1-6
 simulation 1-5
 time, setting 1-7
 time multiplier 1-6
scenario event 12-2
 adding audio, video, and graphics 12-6
 creating 12-2
 deleting 12-11
 ending 12-10
 intelligence object 12-7
 sending 12-9
 sending from plan 12-10
Scenario Event condition 11-16
Scenario Event dialog box 12-10
Scenario Event Manager 12-2, 12-7, 12-9, 12-10,
 12-11
Scenario Event Settings page 12-12
Scenario Event Toolbar 12-2
Scenario Information dialog box 1-21
Scenario Merge B-2
 API B-2

-
- Scenario Merge (continued)
 - closing scenario file B-8
 - command line syntax B-9
 - console output B-8
 - creating project B-4
 - displaying scenario file B-7
 - editing scenario file B-8
 - ignore list B-5
 - loading project B-6
 - project file B-3, B-6
 - saving project B-6
 - Scenario Name, parameter 1-5
 - scenario script 16-3
 - scenarioMergeDirector.h* header file B-2
 - scheduling, periodic checkpoint 1-25
 - SciTE 16-4
 - script
 - ID 16-7, 16-9, 17-13
 - interactive 17-21
 - location, object 17-16
 - metadata 16-4
 - system and scenario 16-3
 - Update_EW_Degradation 5-18
 - script ID 16-18
 - scripted
 - behavior 8-5
 - task 16-4
 - scripted task 16-3
 - adding to folder 16-25
 - availability, by entity type or Behavior Set 16-16
 - background process 17-28
 - copying 16-28
 - creating 16-5
 - deleting 16-28
 - editing 16-24
 - entity type supported 16-17
 - entry point 17-5
 - execution flow 17-7
 - exporting and importing 16-26
 - filtering list 16-24
 - folder
 - adding 16-25
 - deleting 16-25
 - renaming 16-25
 - importing 16-27
 - in system definition 16-18
 - language 16-20
 - making available by Behavior Set 16-18
 - organizing 16-25
 - package 16-26
 - scripted task (continued)
 - parameter types 16-10
 - previewing dialog box 16-8
 - reactive 17-6
 - reactive task 7-11, 17-27
 - removing from folder 16-25
 - rewinding 16-23
 - saving 16-23
 - script, editing 16-32
 - script storage location 16-26
 - system
 - creating 16-29
 - making available on Task menu 16-29
 - storage location 16-29
 - Task menu location 16-13
 - text editor, specifying 16-31
 - Scripted Task Options page 16-31
 - script-ids** parameter 16-18
 - sea
 - choppiness 15-5
 - state 15-5, 15-16
 - swell 15-5
 - sea state, Douglas 15-14
 - sea swell 15-16
 - search, radar mode 10-27
 - sector, aggregate 5-4
 - sector of responsibility, setting 10-32
 - Sector of Responsibility dialog box 10-32
 - Sector of Responsibility set data request 10-32
 - Selected Simulation Engine toolbar 2-4, 2-5
 - selecting
 - aggregate 4-6
 - database for front-end 1-3
 - object, to create 2-4
 - self, as condition parameter 11-6
 - Send NBC Report dialog box 9-22
 - Send Obstacle Report dialog box 9-22
 - Send Radio Set task 8-49
 - Send Radio Task task 8-50
 - Send Text Message task 8-50
 - sending
 - console message 11-27
 - NBC report 9-22
 - obstacle report 9-22
 - scenario events 12-9
 - scenario events from plan 12-10
 - set data request via radio message 8-49
 - task via radio message 8-50
 - text message 8-50
 - send-spot-reports-on-own-force** parameter 13-7

- sendTask() function 17-13
- sensong, electronic emission 5-17
- sensor 13-12
 - affect of posture 5-5
 - aggregate 5-8
 - emission 5-19
 - footprint 5-8
 - radar 10-13
 - SIGINT 5-19
 - signature 13-16
- sensor signature
 - affect of posture 5-5
 - modifying 6-13
- separation-distance** parameter 7-10
- separation-tolerance** parameter 7-10
- Session Options page 1-9, 1-11, 1-12, 1-20
- Set Ammunition 10-5
- Set command, default 10-3
- set data request
 - Active Sonar Mode 10-3
 - Aggregate State 10-4
 - Altitude 7-25, 10-5
 - Ammunition Pacing/Tracking 10-6
 - Appearance 10-6
 - Armed 10-7
 - Capabilities 10-7
 - Collision Avoidance Types 10-8
 - Concealed 10-9
 - Contamination 10-9
 - Counter Measures Auto Launch 10-9, 13-18
 - Destroyed 10-10
 - Detonation Fuse Type 10-10
 - DI-Guy Appearance 10-11
 - Disembarked 3-10, 10-11
 - Embarked 3-9, 10-12
 - Emitter 9-3, 9-15, 10-13
 - Engagement Results 10-14
 - Equipment Pacing/Tracking 10-14
 - Food, Water, Fuel, Oil, and Lubricant Pacing/Tracking 10-15
 - Food, Water, Motor-Gas, Aviation-Fuel, Diesel Fuel, Oil, Lubricant 10-15
 - Force 10-16
 - Formation 10-17
 - in plan 11-34
 - Heading 10-18
 - IFF 10-20
 - Lase Autonomous 10-21, 13-15
 - Laser Code 10-21, 13-14, 13-15
 - Location 10-22
 - set data request (continued)
 - Notify Level 10-23
 - Ordered Speed 10-23
 - Posture 10-24, 10-25
 - Radar mode 10-27
 - Reorganize 10-27
 - Resources 10-28
 - Resources Pacing/Tracking 10-28
 - Restore 10-29
 - Resupply Mode 10-30
 - Rules of Engagement 10-30
 - Sector of Responsibility 10-32
 - sending by radio 8-49
 - Sonar Depth 10-33
 - Spot Reports 10-34
 - Supplying 10-34
 - Surrendered 10-35
 - surrendered 10-35
 - Synchronize Laser Code 10-35, 13-15
 - Target 10-36
 - Tasked by Superior 7-11, 10-36
 - Weapon State 10-37
 - Weapons Pacing/Tracking 10-37
- Set MOPP Level 10-22
- Set Morale 10-22
- Set Scenario End Time dialog box 1-29
- Set Sensor Signatures dialog box 12-8
- setting
 - altitude 2-14, 10-5
 - dialog box 2-15
 - fixed-wing entity 7-25
 - manually 2-14
 - route 2-16
 - appearance 10-6
 - autonomous lasing 10-21
 - capabilities 10-7
 - collision avoidance types 10-8
 - concealment 10-9
 - date 15-3
 - emitter 10-13
 - entity 10-3
 - parameters 10-3
 - to be destroyed 10-10
 - formation 10-17
 - heading 2-3, 10-18
 - manually 2-17, 10-18
 - IFF 10-20
 - laser code 10-21
 - location 2-3, 10-22
 - MOPP Level 10-22

- setting (continued)
 - morale 10-22
 - name 2-3
 - notification level 10-23
 - ordered speed 10-23
 - overlay 2-3
 - posture 10-25
 - precipitation
 - intensity 15-10
 - type 15-10
 - properties, object 2-3
 - resources 10-15
 - rules of engagement 10-30
 - sector of responsibility 10-32
 - simulation speed with time management 1-27
 - target 10-36
 - time zone 15-4
 - visibility 15-9
 - weapon state 10-37
 - weather 15-7
- sheaf radius 9-20
- shooter, laser 13-14
- Show Ground Truth For 13-6
- Show Spot Reports from Viewpoint of Force 13-5, 13-6
- Show Spot Reports Sent By 13-6
- shutdown() function 17-6
- SIGINT sensor 5-19
- signature, sensor 13-16
- SimObject* class 17-3
- simulation
 - closing 1-28
 - date 1-12
 - pausing 1-28
 - resuming 1-27
 - rewinding 1-28
 - running 1-27
 - automatically 1-30
 - speed, with time management 1-27
 - starting 1-27
 - time 1-12
 - checkpointing in 1-25
 - evaluating in plan 11-16
- Simulation Control toolbar 1-27, 1-28
- Simulation Date/Time condition 11-16
- simulation engine, specifying 2-4, 2-5
- simulation model set
 - AggregateLevel.sms 5-2
 - configuration 1-9
 - hostility file 13-10
 - simulation model set (continued)
 - multiple 1-8
 - simulation model set configuration, default 1-9, 1-11
 - Simulation Model Sets, parameter 1-6
 - Simulation Object, parameter 16-12, 16-13
 - Simulation Terrain, parameter 1-5
 - Simulation Time condition 11-16
 - Simulation Time Scale, toolbar 1-27
 - sitting 10-25
 - Skip Task, task 7-11
 - skipping task 7-9
 - smoke, creating 8-29
 - snow 15-5
 - intensity 15-10
 - soil type, mapped to roughness type 3-17
 - soil-list** parameter 3-17
 - solid line 6-21
 - sonar
 - active, mode 10-3
 - active and passive 13-16
 - depth 10-33
 - dipping 8-51
 - sonobuoy 8-8
 - thermocline 13-16, 15-17
 - Sonar Depth, set data request 10-33
 - Sonar Depth dialog box 10-33
 - Sonar Dip, task 8-51
 - sonobuoy, deploying 8-8, 8-9
 - specifying
 - aggregate target 10-26
 - resource 10-28
 - target entity in global command 11-26
 - speed
 - setting 10-23
 - wind 15-7, 15-8
 - speed-to-rpm-factor** parameter 13-17
 - splash effect 15-18
 - spot report 9-22, 13-2
 - custom viewpoint 13-6
 - decay rate 13-8
 - enabling and disabling 13-3
 - enabling or disabling, for entity 10-34
 - label 13-9
 - role in target detection 13-14
 - tactical graphics, for 13-9
 - using in task 13-9
 - viewpoint 13-4, 13-5
 - Spot Report Options page 13-3, 13-5, 13-6, 13-8, 13-9

- Spot Reports dialog box 10-34
- Spot Reports page 10-34
- Spot Reports set data request 10-34
- squatting 10-25
- standard beam 10-13
- standing 10-25
- starting
 - scenario event 12-9
 - Scenario Merge tool B-3
 - simulation 1-27
- startSubtask() function 17-13
- state, sea 15-16
- statement
 - adding to plan 11-19
 - conditional 11-20
 - deleting 11-23
 - editing in plan 11-23
- status
 - combat engineering object 5-12
 - subtask 17-14
 - task 17-14
- Status bar 1-24
- stopping
 - movement 9-17
 - scenario event 12-10
 - subtask 17-14
 - task 7-9, 17-14
- stopSubtask() function 17-14
- stopTask() function 17-14
- stores, restoring entity 10-29
- strength 5-3
- strong point
 - creating 9-15
 - improving 9-19
- style
 - fill 6-21
 - line 6-21
 - pen 6-21
- submarine
 - lowering periscope 8-31
 - moving to depth 8-34
 - raising periscope 8-47
- subordinate
 - aggregate, aggregated state 4-9
 - disaggregated state 4-9
 - in condition 11-6
- Subordinates tab, aggregate 4-9
- subsurface, moving to depth 8-34
- subsurface entity, RPM 13-17
- subtask
 - Lua 17-13
 - state
 - canceled 17-14
 - complete 17-14
 - running 17-14
 - status 17-14
 - stopping 17-14
- subtaskCanceled() function 17-14
- subtaskComplete() function 17-14
- subtaskResult() function 17-14
- subtaskRunning() function 17-14
- superior, tasking entity 10-36
- supplies 5-14
 - providing 5-16
 - receiving 5-16
- Supplies page 5-12
- supply, starting or stopping 10-34
- Supplying dialog box 10-34
- Supplying set data request 10-34
- surface, transparency 15-16
- surface entity, RPM 13-17
- surface transparency 15-14
- surface type, mapped to roughness type 3-17
- surge depth 15-5, 15-14, 15-16
- surrender
 - lifeform, testing 11-15
- surrendered 11-15
 - set data request 10-35
- Surrendered dialog box 10-35
- Surrendered set data request 10-35
- suspend() function 17-5
- swell 15-5, 15-14
 - sea 15-16
- Synchronize Laser Code dialog box 10-35
- Synchronize Laser Code set data request 10-35, 13-15
- synchronizing, laser codes 10-35
- system
 - active-radar-sensor 5-18
 - aggregate-comms-jammer 5-17
 - aggregate-radar-jammer 5-18
 - damage 13-21
 - embedded entity 3-11
 - emissions-sensor 5-19
 - Naval Depth Charge Deployment 8-12
 - Naval Mine Deployment 8-13, 8-14
 - script 16-3
- system definition, scripted task 16-18

system scripted task
 creating 16-29
 making available on Task menu 16-29

T

tab
 Create Object 2-11
 overlay 6-6

table
 detection 13-12
 Lua 17-13
 taskParameters 17-15

tactical graphic
 box, drawing 6-8
 changing name 3-5
 color, changing 6-20
 compared to combat engineering object 5-12
 creating 2-3, 2-4, 2-5, 2-9, 2-11
 editing 6-15
 loading 6-22
 moving, to different overlay 6-9
 placing 2-11
 property, setting at creation 2-12
 publishing 6-11
 saving 6-22
 vertex
 adding 6-16
 deleting 6-19

Tactical Graphics Palette 2-4, 2-5

takeoff, fixed-wing entity 7-26, 7-28

taking off 8-23

target
 aggregate, preferred 10-26
 detection 13-12
 spot reports 13-14
 firing at 8-19, 13-12
 identifying with laser beam 13-14
 setting 10-36
 specifying using laser 8-27

Target dialog box 10-36

Target set data request 10-36

targeting-capable parameter 10-13

task 7-3
 Activate Jammer 9-3
 adding to plan 11-19
 Air-to-Ground Attack 9-3
 Animated Movement 8-5
 Anti-ship (Fixed Depth) 8-30
 Arm Mine at Depth 8-6

task (continued)
 assigning to aggregate 7-10
 Attack with Anti-Air Missile 9-3
 Attack with Anti-Ship Missile 9-4
 Attack with Land-Attack Missile 9-4
 Attack with Torpedo 9-4
 Automatic Air Defense 9-5
 background 8-55
 background process 17-28
 Biological Attack 9-5
 Bomb Location 9-6
 Breach Obstacles 9-7
 by superior 10-36
 C++ 16-3, 17-13
 Change MOPP Level 9-7, 10-22
 Change Posture 9-8, 10-24
 Chemical Attack 9-8
 Come to Stop 8-6
 concurrent 7-4, 16-7, 16-15
 confirmation prompt, enabling or disabling 7-4
 Construct Abatis 9-9
 Construct Anti-Tank Ditch 9-9
 Construct Barbed Wire 9-10
 Construct Barricade 9-10
 Construct Berm 9-11
 Construct Booby Trap 9-11
 Construct Bridge 9-12
 Construct Dry Gap 9-13
 Construct Fortified Area 9-13
 Construct Fortified Line 9-14
 Construct Minefield 9-14
 Construct Strong Point 9-15
 Convoy Along 7-10, 8-7
 Convoy To 7-10, 8-8
 Deactivate Jammer 9-15
 Deploy Sonobuoy 8-8
 Deploy Sonobuoys Along Route 8-9
 Destroy Bridge 9-16
 Destroy Ditch 9-16
 Destroy Explosive 9-16
 Destroy Fortification 9-17
 Destroy Obstacle 9-17
 DI-Guy Animation 8-11
 Disembark 8-10
 Disembark All 8-10
 Drop Naval Depth Charge 8-12
 Drop Naval Depth Charge at Location 8-12
 Drop Naval Mine 8-13
 Drop Naval Mines Along Route 8-14
 Embark 3-7, 8-15

task (continued)

- escaping retask procedure 7-6
- Execute Close Air Support 8-17
- Explode Charge at Depth 8-19
- filtering entity list 7-9
- Fire at Target 8-19
- Fire Cruise Missile 8-20
- Fire-for-Effect 8-21
- Fixed Wing Land 7-29, 8-22
- Fixed Wing Takeoff 7-28, 8-23
- Fly Altitude 8-23
- Fly Heading 8-24
- Fly Heading and Altitude 8-25
- Follow Entity 8-26
- Halt Movement 9-17
- ID 17-13, 17-14
- Improve Booby Trap 9-18
- Improve Breach 9-18
- Improve Bridge 9-18
- Improve Ditch 9-19
- Improve Fortification 9-19
- Improve Obstacle 9-20
- Indirect Fire 9-20
- Intercept and Destroy 8-27
- Lase Target 8-27, 13-15
- Launch Anti-Submarine Missile (Vertical) 8-28
- Launch Counter Measures 13-18
- Launch Smoke 8-29
- Lower Periscope 8-31
- Lua 17-13
 - parameter 17-15
- Move Along Route 8-32
- Move Along Route Retrograde 9-21
- Move Into Formation 8-33
- Move To Altitude 8-34
- Move To Depth 8-34
- Move To Location 7-21, 8-35
- Move to Location, for plan 8-36
- Move To Location (On Roads) 7-21, 8-36
- Move To Location (Plan Path) 7-21, 8-37
- Move to Location Retrograde 9-21
- Move To Waypoint 7-21
- Move To Waypoint (Direct) 8-39
- Move To Waypoint (On Roads) 7-21, 8-40
- Move To Waypoint (Plan Path) 7-21, 8-41
- Move to Waypoint Retrograde 9-21
- movement, affect of aggregation state change 4-10
- mutually exclusive 7-4, 11-10
- Nuclear Attack 9-21

task (continued)

- orbit 8-43
- parameters 7-6
- Patrol Along Route 8-43
- Patrol Between 8-44
- Pattern Hold (Location) 8-44
- Pattern Hold (Waypoint) 8-45
- Place IED 8-46
- procedures, introduction 8-4
- Raise Periscope 8-47
- reactive 7-11, 8-55, 16-4, 17-6, 17-27
- Release Bomb on Laser Spot 8-47
- Release Bomb on Location 8-48
- Release Bomb on Target 8-48
- retask 7-3
- Rotary Wing Land 8-48
- Sail Heading 8-49
- scripted 16-3, 16-4
 - available by Behavior Set 16-18
 - execution flow 17-7
 - filtering list 16-24
- Send Radio Set 8-49
- Send Radio Task 8-50
- Send Text Message 8-50
- Skip Task 7-11
- skipping 7-9
- Sonar Dip 8-51
- spot report, using in 13-9
- state
 - canceled 17-14
 - complete 17-14
 - running 17-14
- status 17-14
- stopping 7-9, 17-14
- Turn to Heading 8-52
- user 8-53
- viewing current 11-16
- Wait 8-53
- Wait Duration 8-54
- Wait Elapsed 8-54
- who can execute 7-6

Task menu 16-4

- icon 16-9
- location for scripted task 16-13
- system scripted task, hiding 16-29

taskCanceled() function 17-14

taskComplete() function 17-14

Tasked by Superior

- set data request 7-11
- using in plans 11-34

- Tasked by Superior set data request 10-36
 - tasking, by superior 10-36
 - taskParameters, table 17-15
 - taskResult() function 17-14
 - taskRunning() function 17-14
 - terrain
 - avoidance 7-31
 - following 6-14
 - placement of new entities 3-3
 - terrain profile
 - displaying, line creation 6-10
 - terrain-check** parameter 7-31
 - terrain-following, fixed-wing entity 7-26
 - testing, amount of resources 11-15
 - text
 - creating 6-9
 - object, resizing 6-19
 - sending 8-50
 - text editor 16-4
 - scripted task, specifying 16-31
 - thermocline, sonar 13-16, 15-17
 - this, Lua object 17-3
 - tick() function 17-5
 - time
 - evaluating in plan 11-16
 - scenario
 - end 1-29
 - ending 1-7
 - setting 15-2
 - setting, time of day 15-4
 - setting in new scenario 1-7
 - simulation 1-12
 - default 1-12
 - zone 1-12
 - setting 15-4
 - time management, setting simulation speed 1-27
 - Time Multiplier, parameter 1-6
 - time zone 15-2, 15-4
 - timed fuse 10-10
 - toolbar, Environment Settings 15-3, 15-4, 15-5
 - toolbar
 - Entities Palette 2-5
 - Environmental Settings 15-4
 - Objects 3-7, 3-10, 4-6
 - Scenario Event 12-2
 - Simulation Control 1-27, 1-28
 - Simulation Time Scale 1-27
 - torpedo 9-4
 - anti-submarine 8-28
 - launching 8-30
 - track, radar mode 10-27
 - tracking
 - ammunition 10-6, 10-14
 - resource 10-28
 - weapon 10-37
 - tracking beam 10-13
 - transparency, surface 15-5, 15-14, 15-16
 - transponder, IFF 10-20
 - trap, creating 9-11
 - Travel, posture 5-4
 - tree, setting avoidance 10-8
 - trigger 11-10
 - adding to plan 11-20
 - deciding order in plan 11-33
 - reactive task 7-11
 - registration 11-11
 - reregistering 11-34
 - taskless 11-34
 - unregister 11-11
 - turn rate 8-24
 - rate, climb, turn, and descent 8-25
 - Turn to Heading dialog box 8-52
 - Turn to Heading task 8-52
- ## U
- underFireDistance** parameter 10-31
 - underFireTime** parameter 10-31
 - underwater, visibility 15-16
 - Underwater Acoustics PDU 13-16
 - underwater visibility 15-14
 - undo, ellipse rotation 6-19
 - unexploded ordnance, destroying 9-16
 - unloading, entities from entities 3-6
 - unlocking, overlay 6-5
 - unpublishing, tactical graphics 6-11
 - unregistering, trigger 11-11
 - Update_EW_Degradation, script 5-18
 - user, task 8-53
 - User Task dialog box 8-53
 - UTM, database 1-3
- ## V
- vector
 - geocentric 17-18
 - Lua 17-16, 17-18
 - network 7-21
 - Vector3D* class 17-16
 - VectorGeoc3D* class 17-18

- VectorOffset3D* class 17-18
- vel-to-align-actual** parameter 7-32
- vel-to-align-desired** parameter 7-32
- vertex
 - adding 6-16
 - deleting 6-19
 - editing 6-18
- video, adding to scenario event 12-6
- view constraint, disabling 3-4
- viewing
 - current task 11-16
 - Logger files 1-35
 - plan 11-16
- viewpoint
 - spot report 13-4, 13-5
 - custom 13-6
- visibility 15-7, 15-9
 - observer 15-5
 - underwater 15-5, 15-14, 15-16
- visibility modifier 5-10
- vrf* class 17-3
- VR-Forces window 1-7
- vrfutil, functions 17-4
- vulnerability 5-3
- vulnerability modifier 5-10

W

- wading 10-25
- Wait Duration dialog box 8-54
- Wait Duration task 8-54
- Wait Elapsed dialog box 8-54
- Wait Elapsed task 8-54
- Wait task 8-53
- walking 10-25
- warfare, electronic 5-17, 5-18, 5-19
- warfare model, aggregate 5-2
- water
 - pacing and tracking 10-15
 - splash 15-18
- wave, chopiness 15-14
- wave effect 15-18
- waypoint
 - moving to 8-36, 8-40
 - ordering entity to 8-39
 - patrolling between 8-44
- weapon
 - anti-air 9-5
 - deployed 10-37
 - in fire position 10-37

- weapon (continued)
 - laser guided 8-27
 - pacing and tracking 10-37
 - state, setting 10-37
 - stowed 10-37
- Weapon State dialog box 10-37
- Weapon State set data request 10-37
- Weapons Pacing/Tracking dialog box 10-37
- Weapons Pacing/Tracking set data request 10-37
- weather 15-5
 - setting 15-7
- Weather dialog box 15-13
- weather zone 15-11
 - priority 15-11
- When statement 11-5, 11-10
 - adding to plan 11-20
 - building 11-20
- While statement 11-5, 11-12
- width, changing for line 6-21
- wind
 - direction 15-5
 - offset 14-2
 - speed 15-5
 - speed and direction 15-7, 15-8
- window, Event 12-9, 12-10
- writing
 - entity plan 11-18
 - global plan 11-24
 - plan
 - for aggregate 4-13
 - for multiple entities 11-30
 - plans, remote entities 11-30

X-Y-Z

- yellow icon 13-12
- zone
 - time 1-12
 - weather 15-11



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