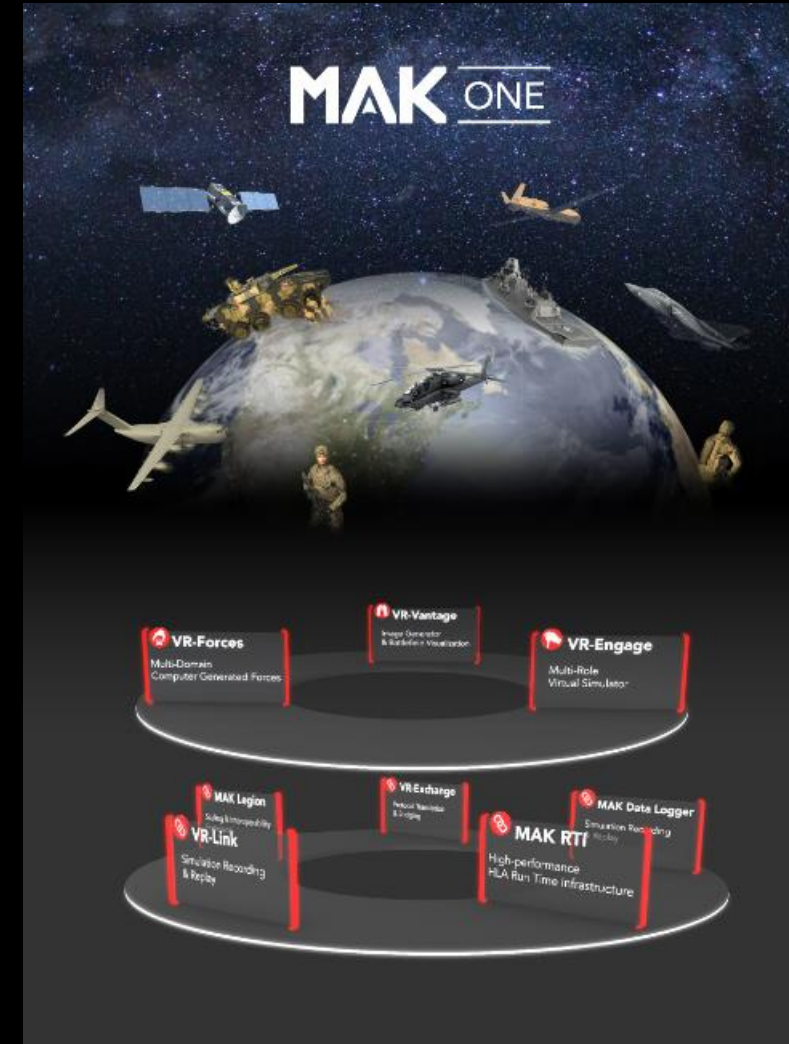




VR Forces for Analysis

Paddy Little – Technical Director
paddy.l@cervus.ai



VR Forces- Hive Case Studies

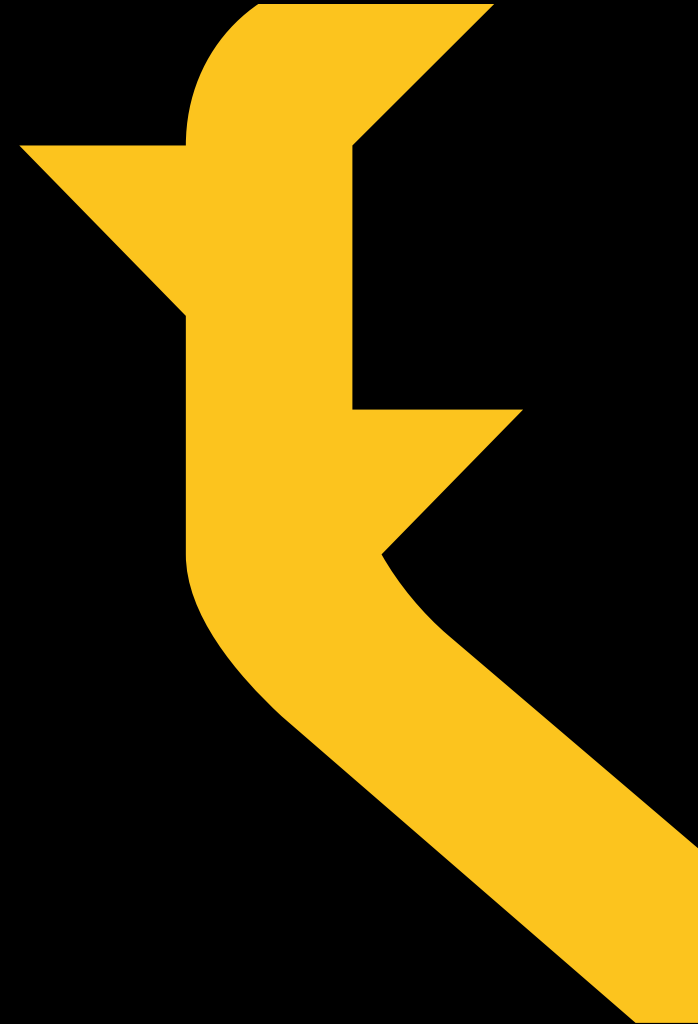
- USMC Wargaming - 2019
- British Army – Army Warfighting Experiment – 2020/21
- NATO Wargaming – 2022/23
- Pj ELDON – 2023/24
- British Army – Forge – 2022-27

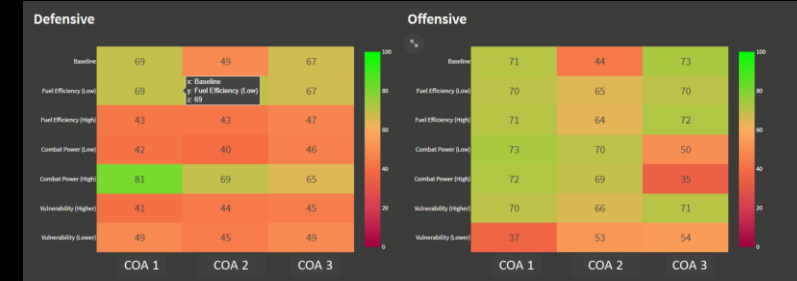
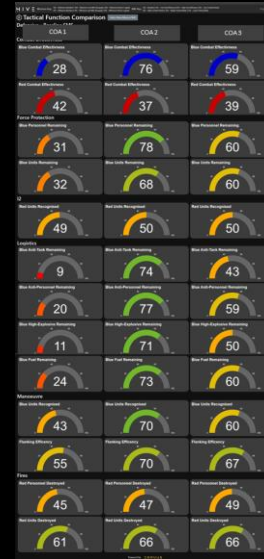
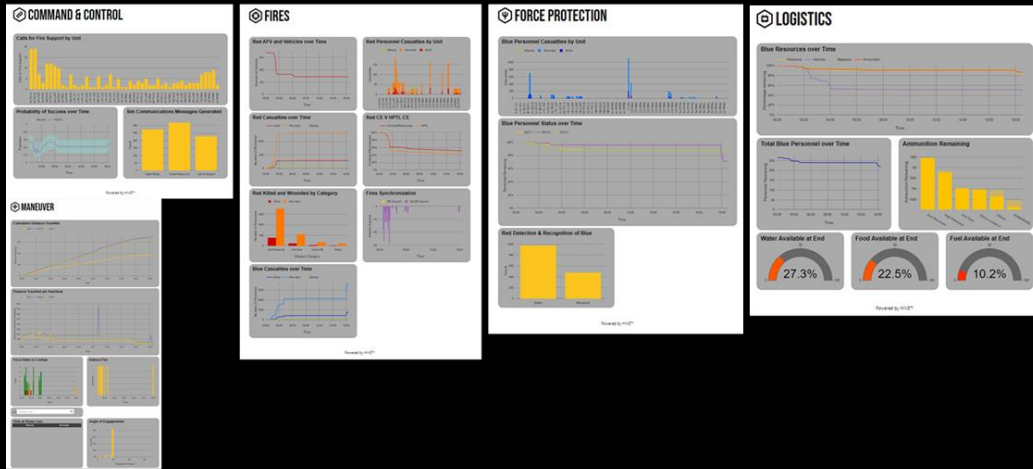


- Aggregate & Entity
- Air, Land, Joint
- Company to Corps

Agenda

- What is Hive
- Case study – Forge
- Wargaming for training, education, and op planning
- CAST/CST
- Summary





What is Hive ?



HIVE

Extracts data from VR Forces

Stores the richer data securely

Access the performance data through accessible dashboards

Reduced costs and easy to deploy with existing VR Forces

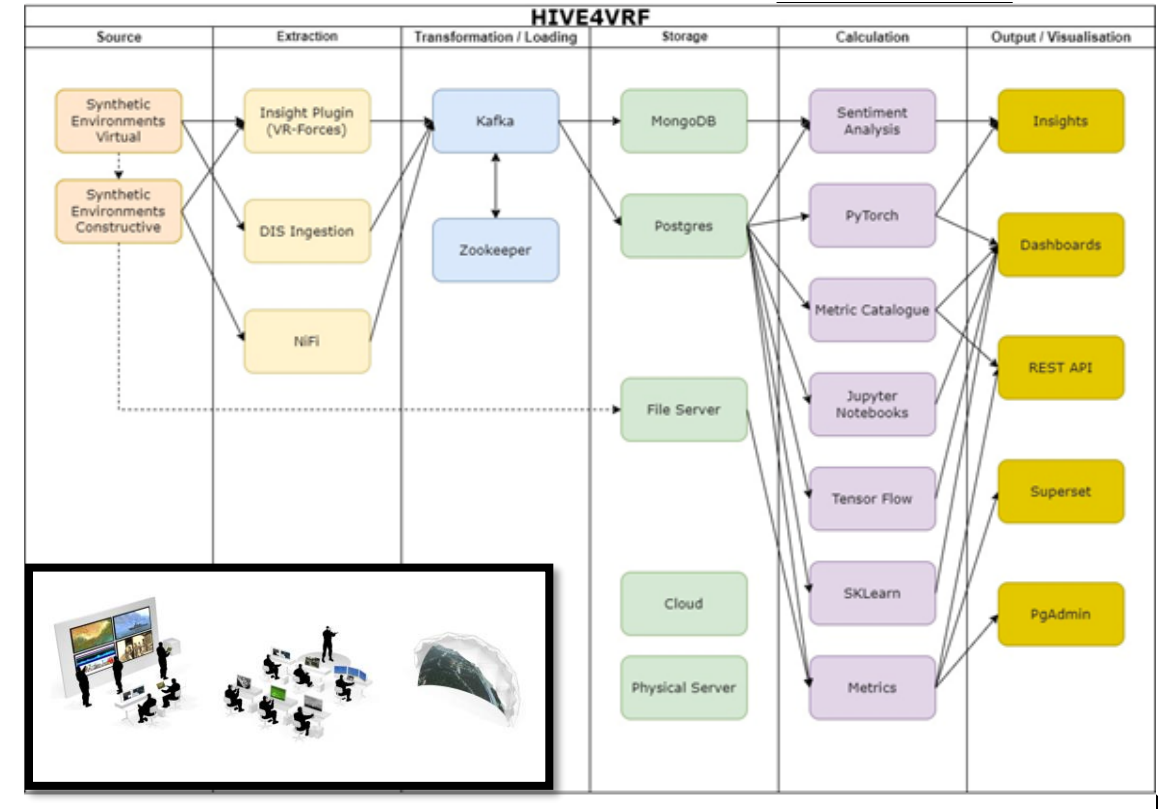
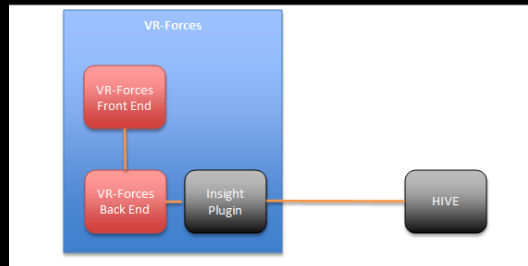
HIVE4VR-Forces came about from the requirement to capture a richer dataset from VR-Forces than would be available within open standards such as DIS.

By developing a plugin within VR-Forces it allows Hive to extract the information in a standardized format during the running of the simulation and closely couple data generation and data analysis.

The richer data that is available within VR-Forces that can be extracted by Hive means that more complex metrics can be generated that provide insights to how that specific execution.

HIVE4VR-Forces is made up of 2 products from Cervus – Hive 2.4 Core and Insight Plug In. These are provided together as a solution to complement an installation of VR-Forces to work.

This product only works with VR-Forces and requires that it is installed through a slimmed down version of Hive focused around analyzing the data from VR-Forces and the Insight plugin that gets installed within VR-Forces as a plugin within the software.

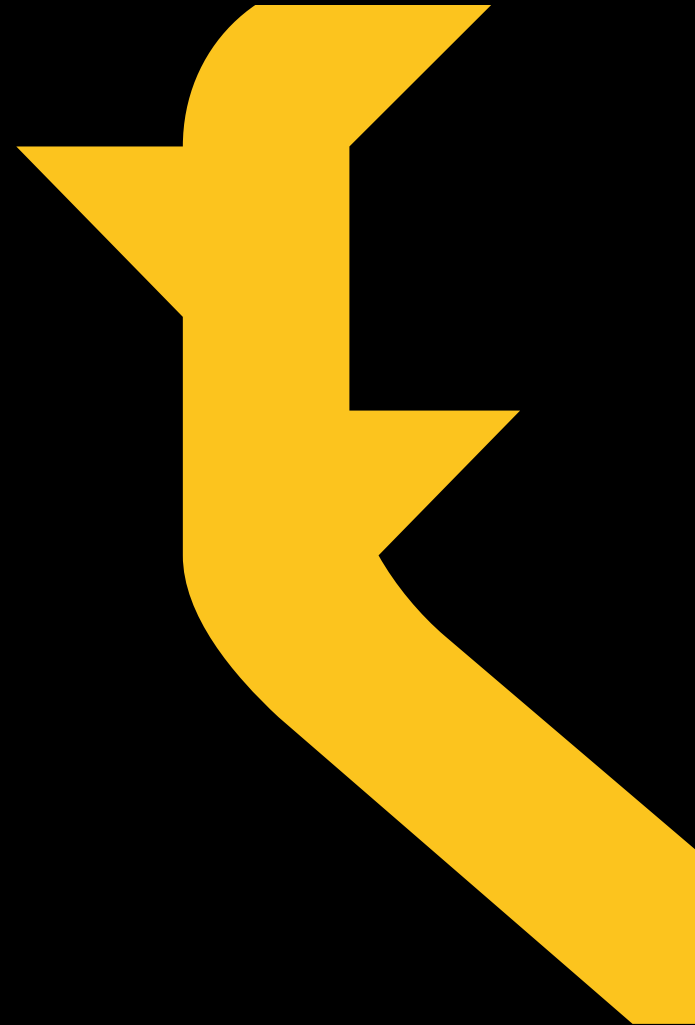


Question	Answer
Do you need to have it running all the time?	The plugin can be switched on and off through the VR-Forces GUI under the Settings tab. If you switch it off then you will need to restart VR-Forces for the change to take effect.
How will the data be tagged?	All the data within Hive will be tagged based on a Phase ID set when you start an execution within VR-Forces.
Can you run multiple instances at the same time?	A single instance of Hive will ingest the data from multiple insight plugins at the same time with them being assigned a unique ID.
What if I pause the simulation?	The plugin will remain active but will not send out more data to Hive. When you start the simulation again then it will continue to write the data.
What if VR-Forces crashes?	This will stop the data going to Hive, the next time you run VR-Forces then it will treat it as a new ingestion.
Can you see the data during execution?	Yes this data can be seen within Hive dashboards.

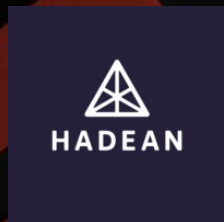
Features

- Ingestion of VR-Forces simulation data runtime
- Ability to ingest VR-Forces data at the speed of the simulation (VR-Forces allows for running between 1x and 15x speed).
- Ability to stream multiple instance of VR-Forces to the same instance of HIVE, allowing for the comparison of data sets.
- Ability to automatically tag the data in HIVE with mission name, date/time and start.
- Injecting custom events within VR-Forces scripts to send the data to HIVE.
- Ability to deploy the software on physical hardware and within a cloud environment.
- Access to a growing metrics catalog based on collaboration with customers.
- Ability to stream the data from HIVE to other applications through the HIVE API.
- Within the web interface able to:
 - To start, stop and tag the ingestion of data from VR-Forces.
 - Runtime viewing through a web interface of the metrics as the simulation is running.
 - Out of the box generic Tactical Function-based dashboards for evaluation of combined arms simulation from company to brigade level
 - Out of the box generic evaluation dashboards for Offensive, Defensive Counter Air and Surface attack missions in the Air domain
 - Provision of dashboards to compliment After Action Review (AAR) and the MAK Data Logger

Decision Support for WARDEV & CAPDEV



FORGE



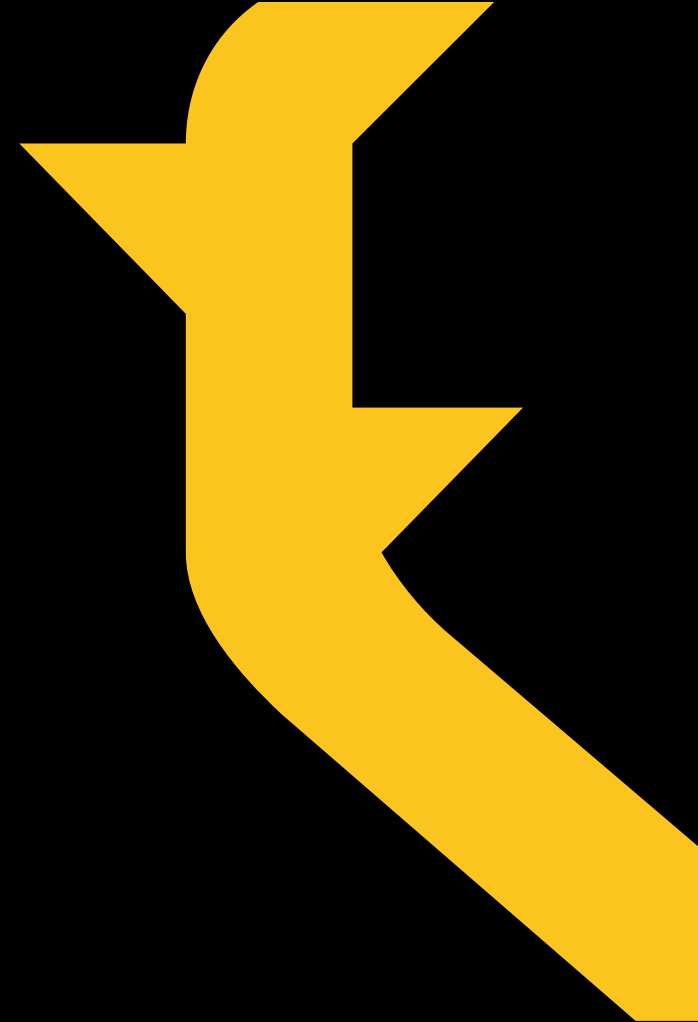
ST ENGINEERING ANTICIP

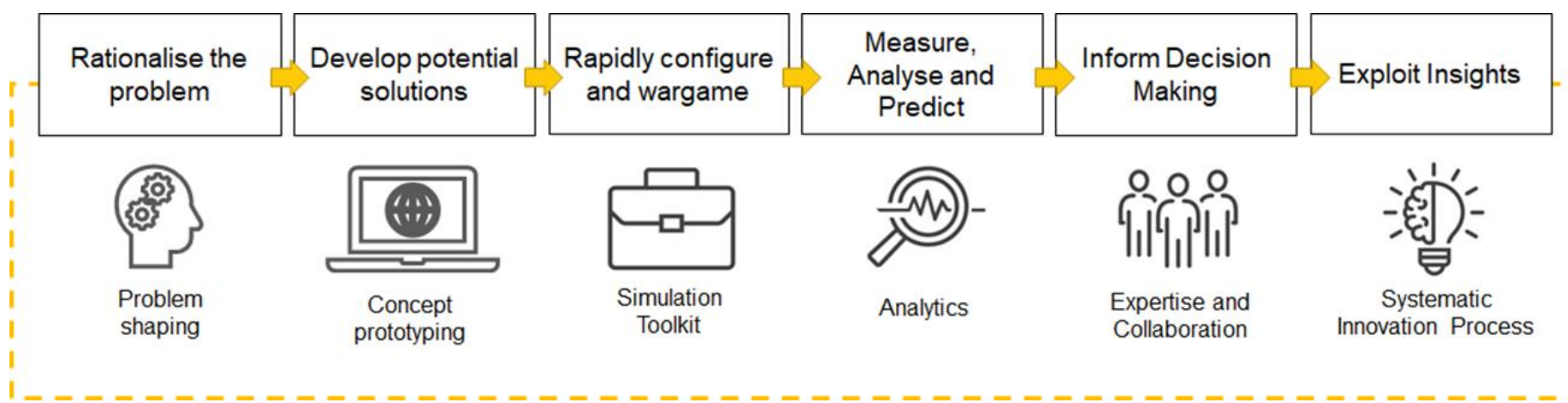
CERVUS



FORGE

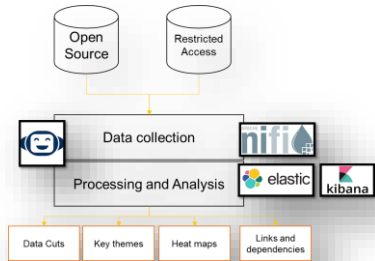
- Forge is a combination of process, technology and SME support
- A key element is the simulation component
 - A specific application for VR Forces & Hive
 - Cloud orchestration technologies to run multiple instances at hi speed
 - Hive evaluating cloud-scale datasets
 - Hive also being used to “task”





1. Knowledge Extractor

Information search and Problem Analytics



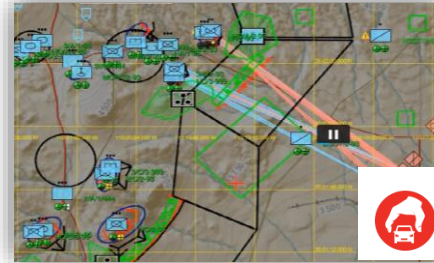
2. Solution Experimentation

Definition and Prototyping



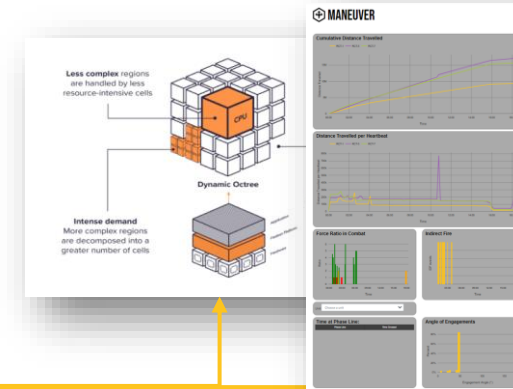
3. Simulation

COTS Simulations and Environments



4. Measurement

Hive and distributed, low cost, hyper processing

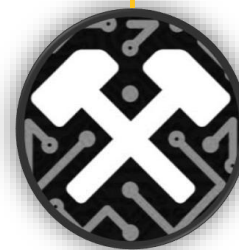


5. Insights

Collaborative Analysis and Insight Reporting



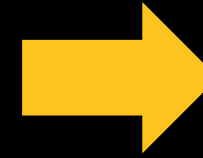
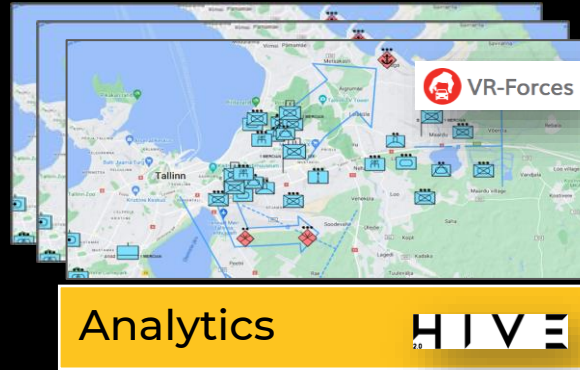
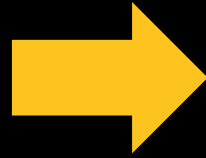
Digital War Room
GUI and VR Immersion



Army Forge

What we would **normally** do

Single
Variables

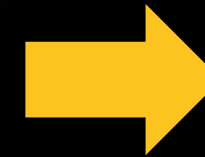
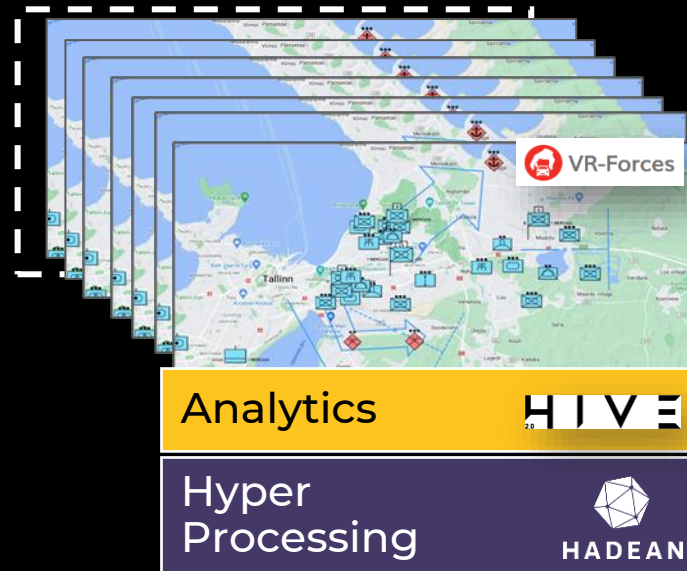
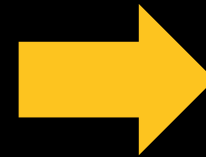


Limited
Exploration
(Cost and Time)

*What is the optimal
concept for operating
our future force in
Urban environments?*

What we think we can do
now might be **unlimited**

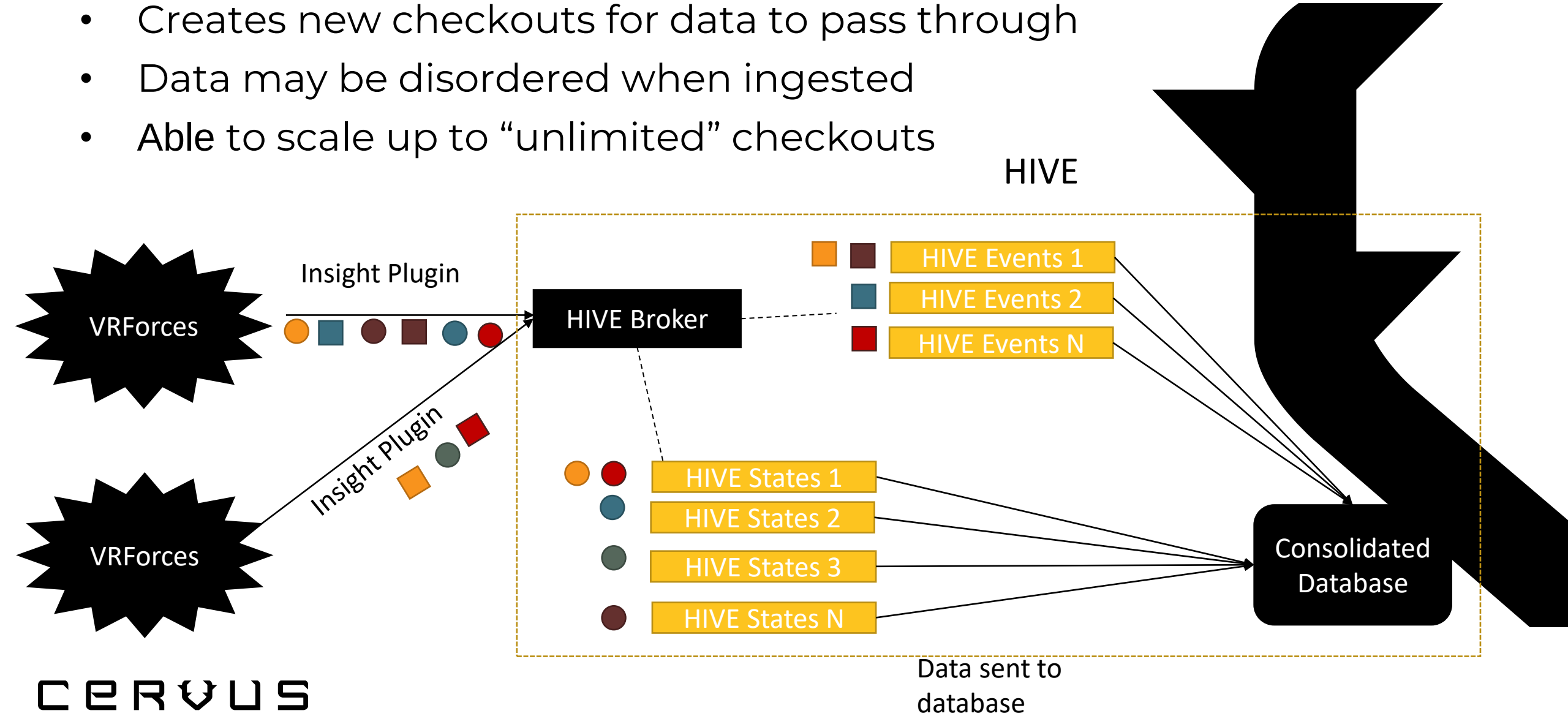
Multiple
Variables



Testing all the concepts,
simulations and variables
(Optimal decision faster
with more objective
evidence)

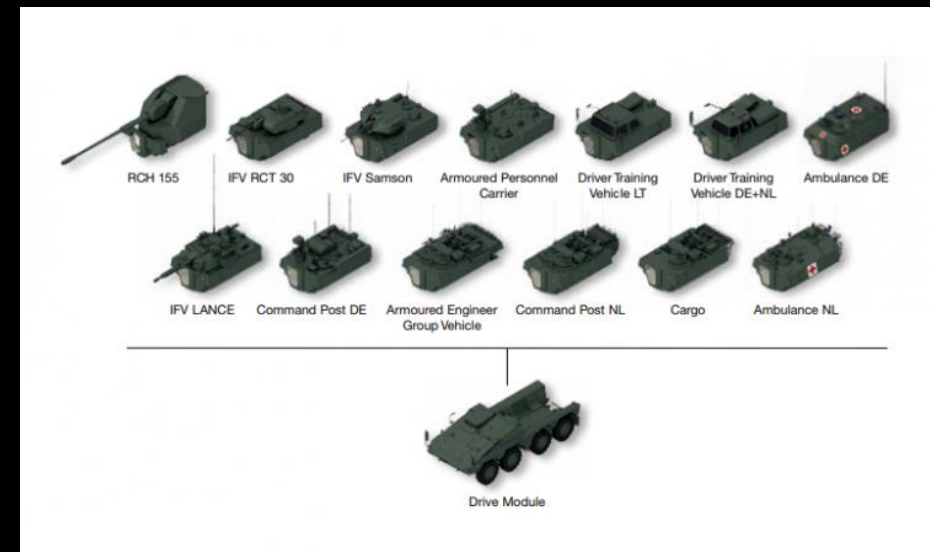
Parallel Ingesting

- Creates new checkouts for data to pass through
- Data may be disordered when ingested
- Able to scale up to “unlimited” checkouts

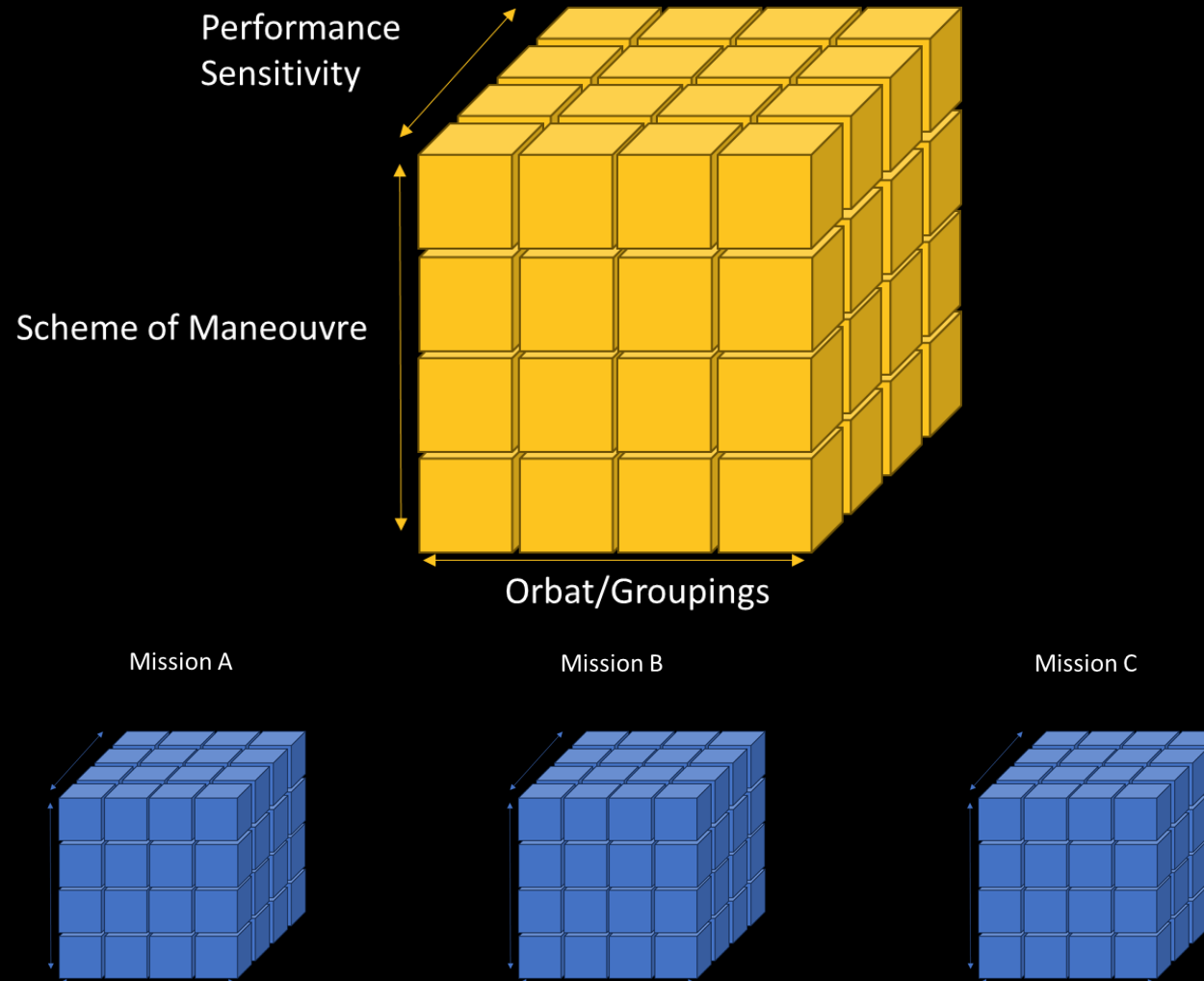


Potential Experimentation areas

- 2024
 - Complement existing Analysis & Experimentation Campaign on Armoured Brigade Combat Team Optimisation
- 2025/27
 - Deep Fires ?
 - Deep Recce Strike ?
 - Bde & Divisional Logistics ?
 - SHORAD ?



High Level analysis design



New Hive components

HIVE

Experiments

New Experiment

Name	Created	Dimensions	Problem Space	
Event 1_Maximal	20/11/2023, 14:45:18	4	180	i 👁 📊 🗑
Event 1_BCT_Advance to Contact	20/11/2023, 14:42:39	3	45	i 👁 📊 🗑
Event 1_BCT_Mobile Defence	20/11/2023, 14:40:02	3	48	i 👁 📊 🗑
Event 1_BCT_Obstacle Xing	20/11/2023, 14:37:40	3	45	i 👁 📊 🗑

Event 1_BCT_Mobile Defence

Event 1_BCT_Advance to Contact

Event 1_BCT_Obstacle Xing

Dimensions: 3

Total Problem Space: 45

BLUE SoM

Baseline A B

Number of variants: 3

BLUE Orbit Concepts

Baseline US ABCD E F

Number of variants: 5

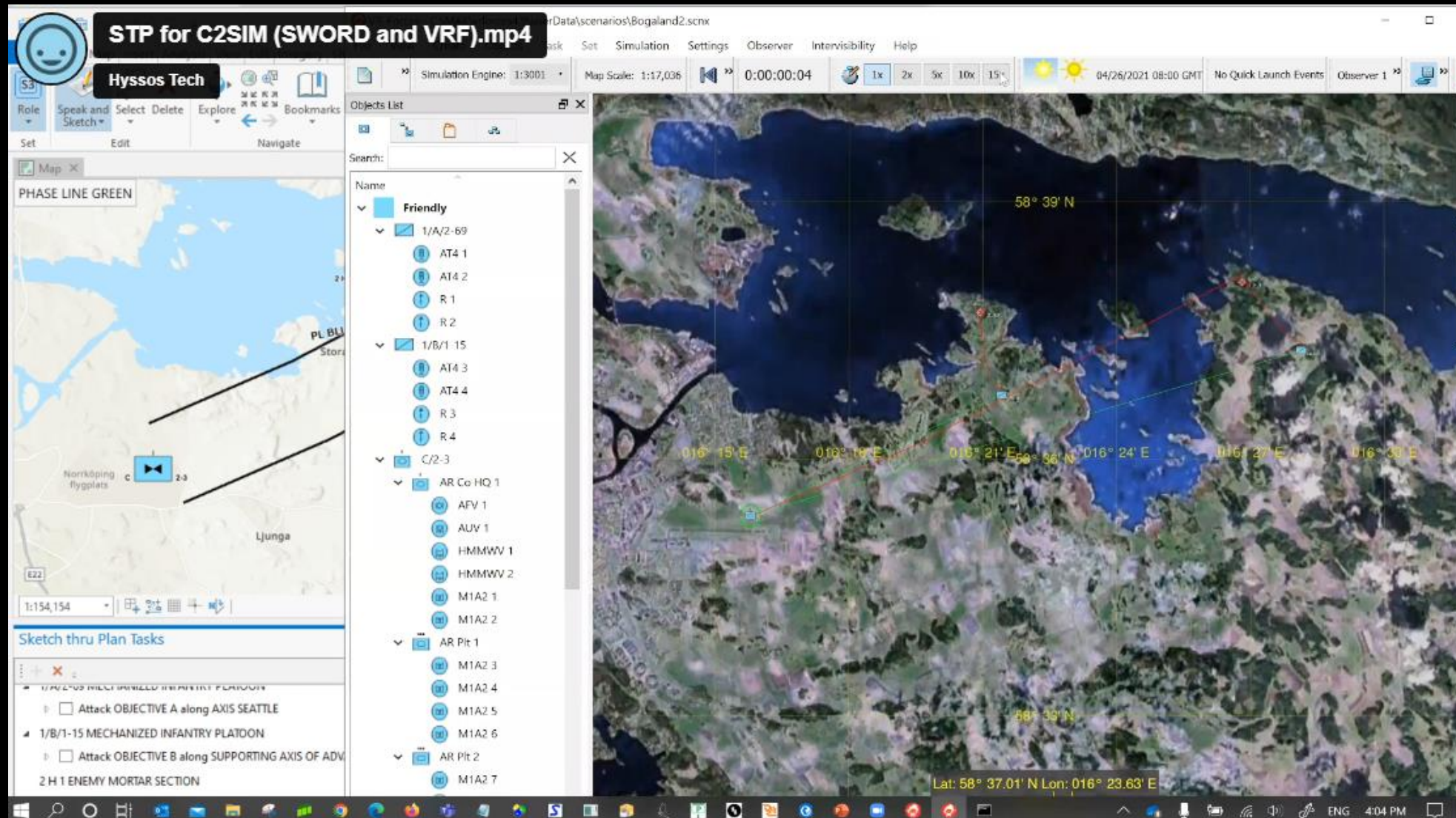
Performance Variables

Lethality SMS Vulnerability SMS Consumption SMS

Number of variants: 3

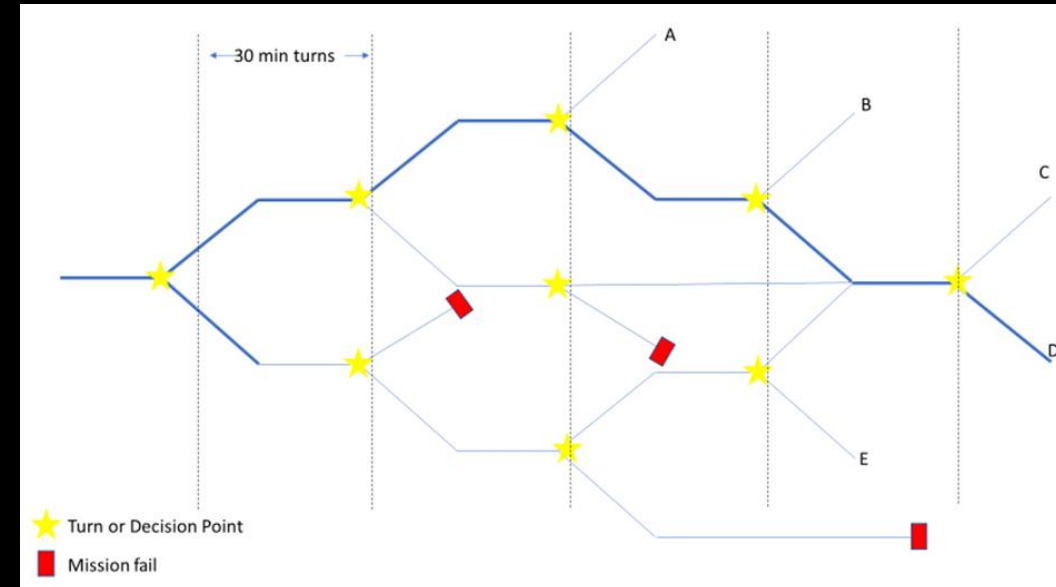
HIVE

Phase ID	Status	BLUE SoM	BLUE Orbit Concepts	Performance Variables	Manage
acGsgJluqgVvAyyK	None	Baseline	2	Consumption SMS	🗑
acKOkEgUsQmFyJK	None	A	Baseline	Lethality SMS	🗑
blvbbzmrlwkFwEvV	None	A	3	Vulnerability SMS	🗑
bPLvDxsxtLLnVQW	None	B	Baseline	Vulnerability SMS	🗑
CekUwUJYtkbzKGu	None	B	Baseline	Consumption SMS	🗑
dzNXCXkwEJijJF	None	A	1	Consumption SMS	🗑
eMmiCTpfjPHpQA	None	Baseline	2	Vulnerability SMS	🗑
eXMoCnKFFcZpckE	None	A	2	Vulnerability SMS	🗑
fTDeUVVAdEgJzc	None	Baseline	3	Lethality SMS	🗑
FvdKsLrwZgkPYyIt	None	Baseline	1	Vulnerability SMS	🗑
GTVikuZOGzzeBUz	None	Baseline	3	Consumption SMS	🗑
hrPgBMQRQRVDWuri	None	Baseline	1	Lethality SMS	🗑
HTxqnZYXIRHnslcS	None	B	1	Vulnerability SMS	🗑

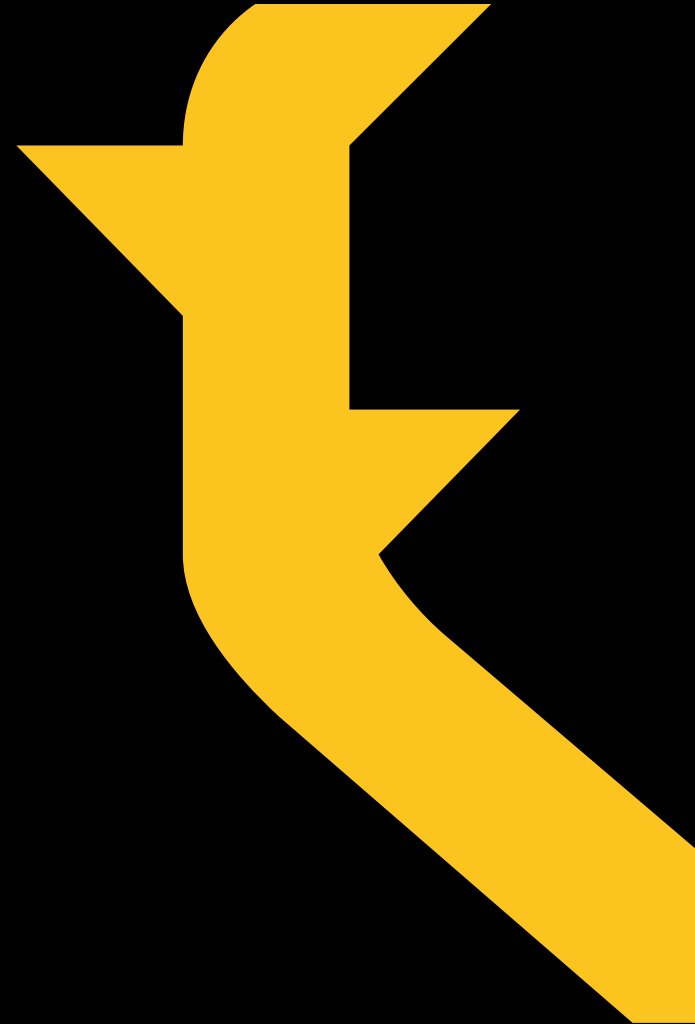


Future developments

- Better AI-driven behaviours
- User-driven baseline scenario generation
 - Solo – build RED/BLUE COAs and run headless
 - Turn-based 1 v 1 – RED vs BLUE players
 - Turn-based Tm v Tm – RED vs BLUE teams
- Training Data Exploitation
 - Huge untapped potential
 - Requires new policy and processes
- Branching and Sequelling

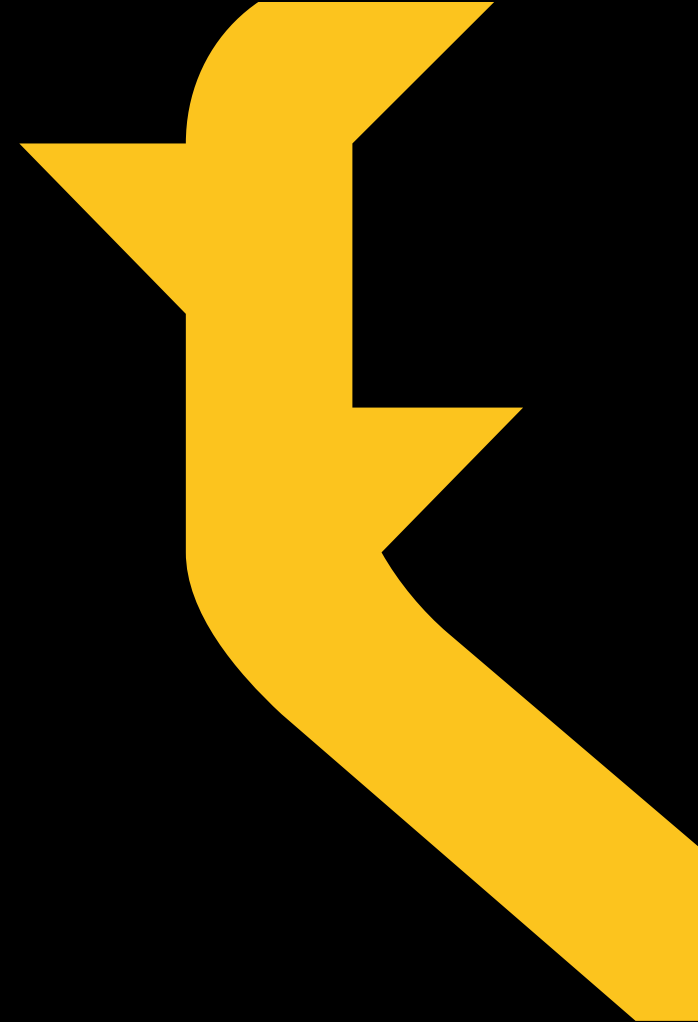


Wargaming for education, training and op planning - VR Forces and analysis



Supporting Training & Education

- Complement not replace existing methods
- Bring doctrine to life
- Support both training in the process and effectiveness of the outcome:
 - “Was a good appreciation conducted?”
 - “Did it produce a good plan/good decision” ?
- Participants to see and evaluate consequences
- Treat all planning activities as the opportunity to develop digital tactical artefacts for exploitation by others





AWE21 – MAK ONE + HIVE

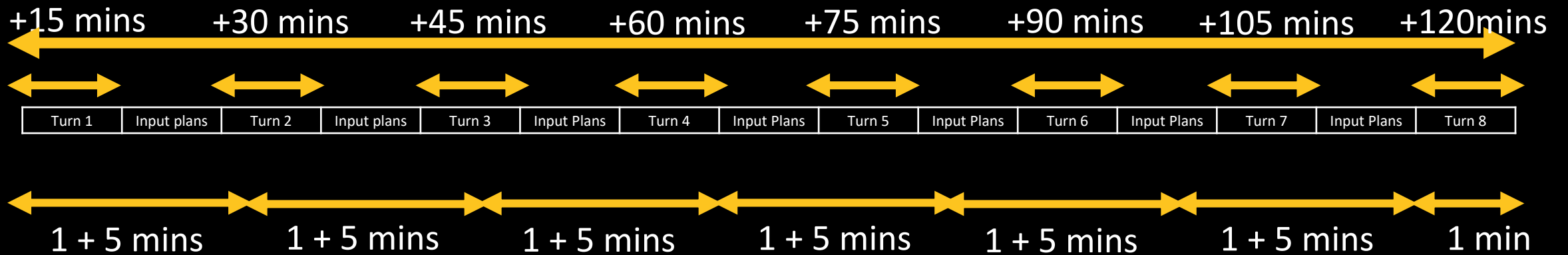


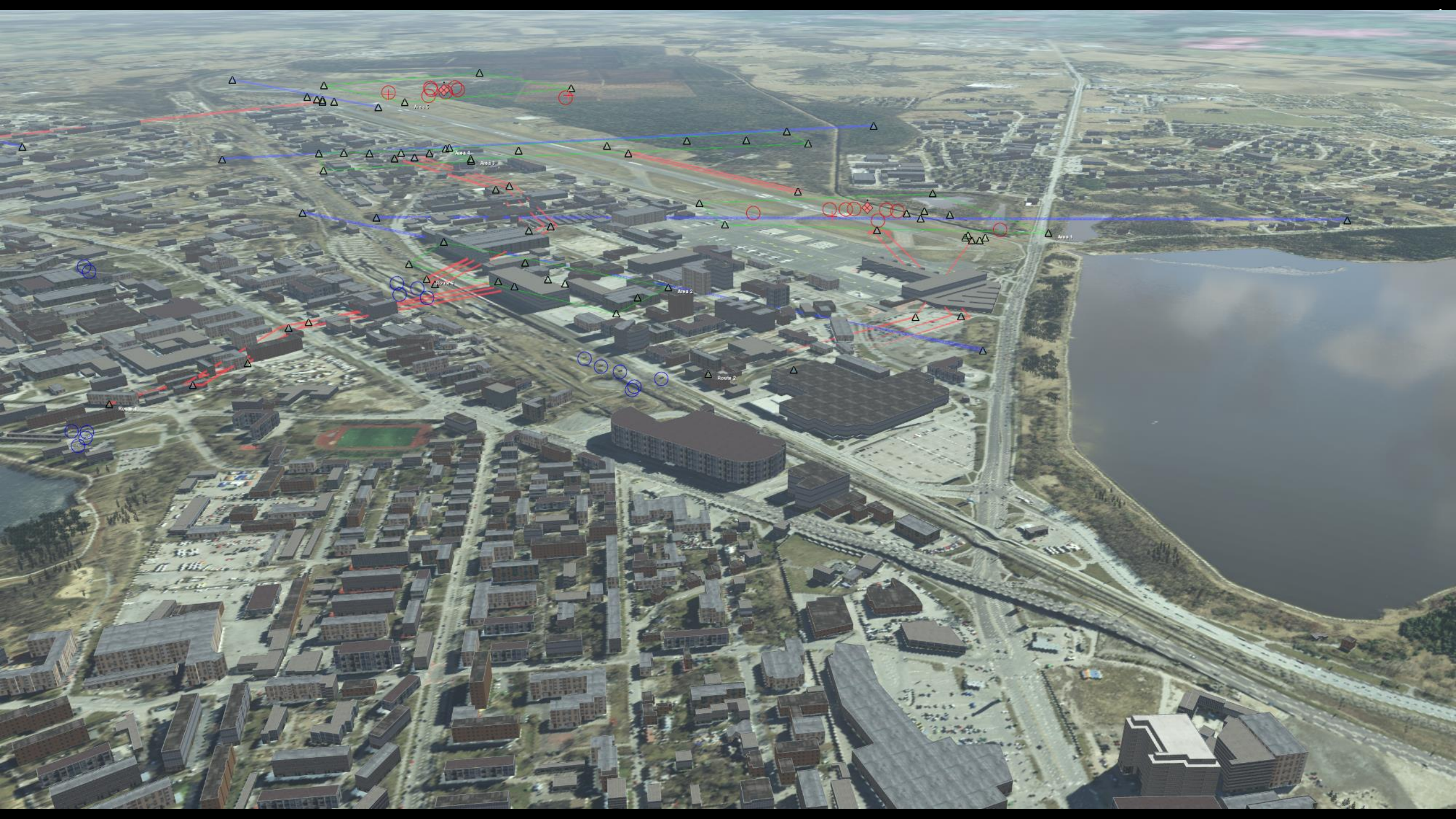
HOW: THINK – FIGHT – LEARN - REPEAT

- AM Session
 - Training/Familiarisation
 - Run 1
 - Turn based - 15 minute turns @x15 speed
 - RED & BLUE inherit scripted orders
 - At Turn 2 RED & BLUE can cancel/amend/replace orders
 - 8 x turns = 120 mins of battle
 - 37 mins per Run
 - Run 2
 - Repeat – BLUE & RED can adjust starting dispositions and allocation of forces within boundaries
 - Run 3
 - Repeat
 - Run 4
 - Switch sides
- PM Session
 - Repeat above

Wargaming Plan (detail)

- Umpire polices 1 min @x15 run time and 5 minute for plan inputs
- Variation on “you-go-I-go” style games
- Requires for each session 2 x SO3/SO2 from BG HQ + 1 x Umpire/Controller
- Mirror image sessions over 2 days
- Or – use data from 1st day to support contrived BG Planning Session on Day 2





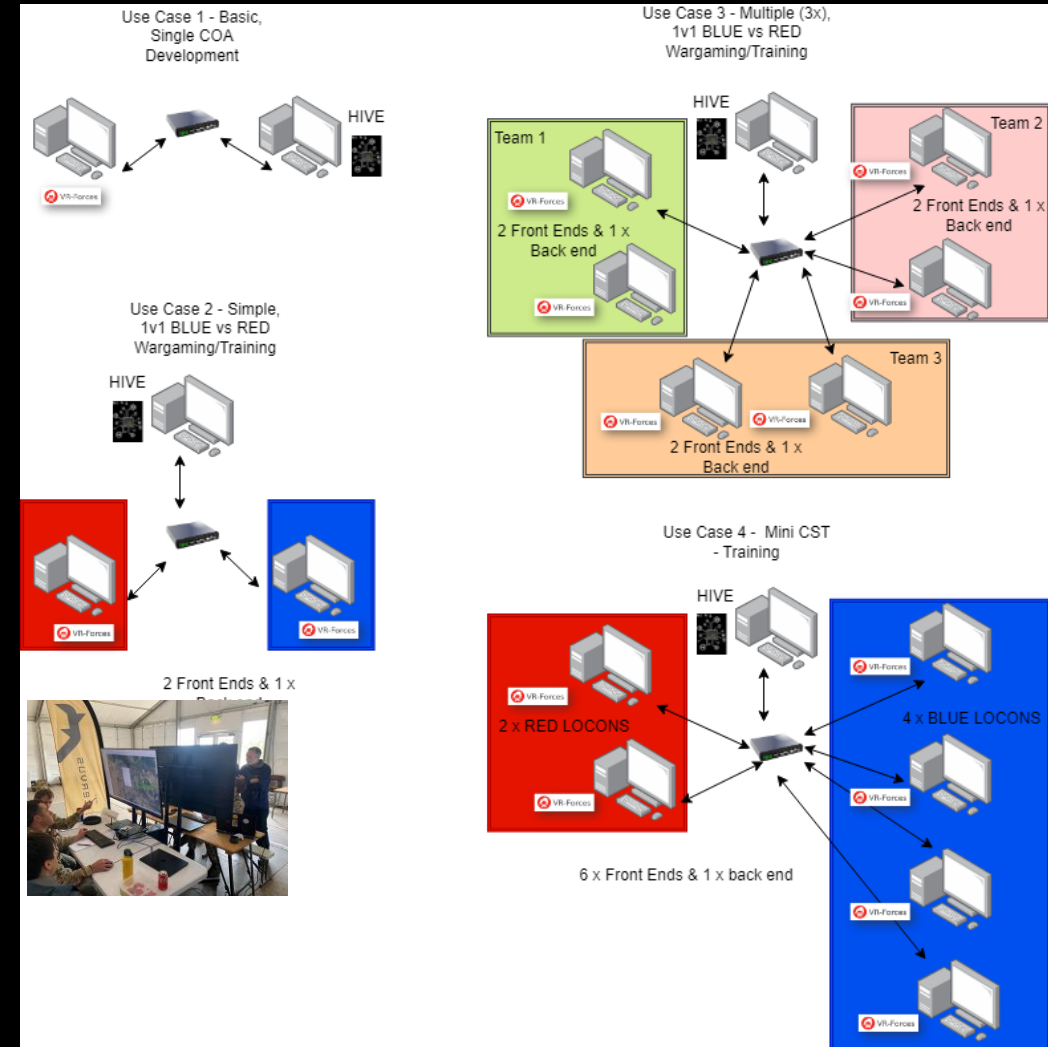
Tactical Exercise Without Troops/ Tactical Decision Game Support Options

- Option1 - Pre-TEWT
 - Pre-run selected student COAs at Bde/Bn aggregate mode in VR Forces
 - Measure selected COAs and identify challenge areas for discussion the real terrain
 - Allow students to replan prior to the TEWT if Simulation testing produces issues their existing planning had not solved
- Option 2 - Post-TEWT
 - Conduct TEWT in conventional fashion
 - Identify areas of interest/significance in the TEWT stands for subsequent simulation
 - Use Entity-level to simulate and evaluate Company level tactical problems
 - Use Aggregate-level to simulate and evaluate Bn and Bde level issues

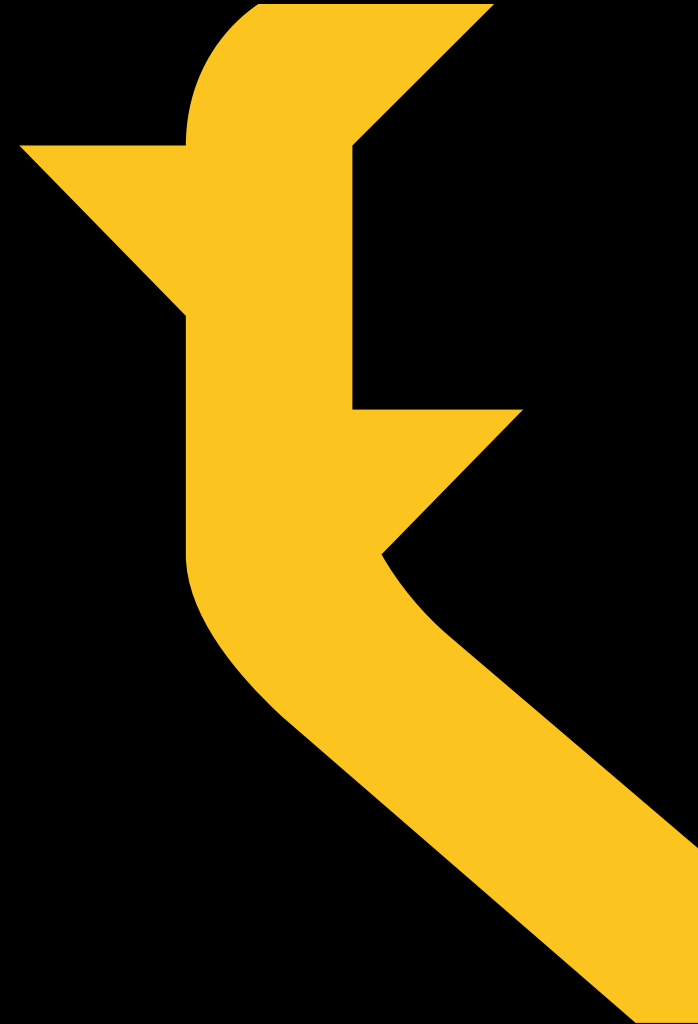


Example Organising options

- Use Case 1 –COA development
 - Iterative development of BLUE COAs run **headless** vs RED COA
- Use Case 2 – Simple 1v1
 - Competitive adversarial BLUE v RED in real time and/or time jumps
- Use Case 3 – Multiple 1v1s
 - Multiple staff teams training against each other
 - Or simulating different staff cells
- Use Case 4 – Mini Command & Staff Trainer (CST)
 - Operate as mini-CST to culminate junior staff officer training



Command and Staff Training (CAST/CST) and analysis



Computer Generated Forces have advanced significantly over the last few years – but CAST’s use of a previous generation of CGF is constraining, lacking the ability to simulate scale with any fidelity, difficulty with simulating multi-domain, and acute difficulty simulating the complexity of urban operations.

CAST as a training milestone traditionally emphasises procedural practice of HQs planning processes, with the execution phase usually not emphasised as strongly, not least because of the points made above.

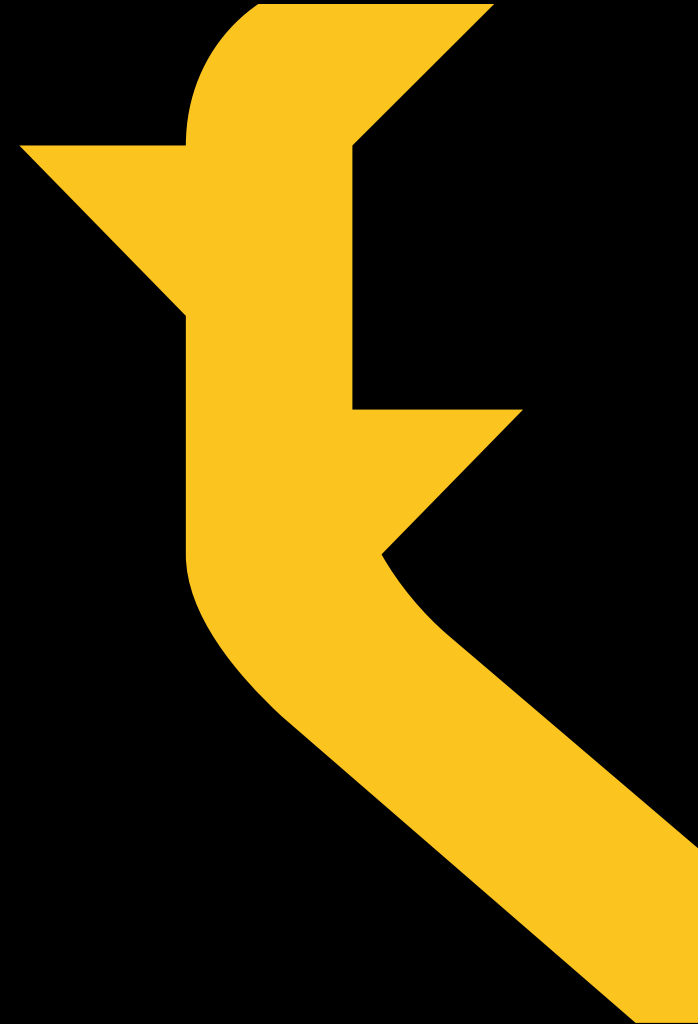
In turn this has tended to mean the emphasis on training evaluation has been placed largely on evaluating the planning process, in some respects the most difficult part of the cycle to apply objective, data-based evaluation on.

Evaluation is manpower intensive, requires significant SQEP, is largely based on detailed checklist evaluations derived from a disaggregation of Collective Training Objectives, and cannot easily allow for comparisons into other environments.

Command and Staff Training (CAST) “As is”

“As is” consequences

- Difficulty objectively evaluating the planning.
- Difficulty objectively evaluating the selected plan.
- Limited scope to objectively evaluate the conduct or execution of the plan.
- Consequently no ability to generate contrasts between **(1) planning performance**, **(2) plan effectiveness**, and **(3) ability to execute** a selected plan.
- Low fidelity, typically aggregate level CGF means that LOCONS derive significantly less training value than the primary training audience
- Poor fidelity at the LOCON component means the ability to assess the effectiveness of plan execution is diminished.
- Little of what is created at CAST could be consistently stored, exploited, and re-used as a digital artefact of worth to the whole enterprise.

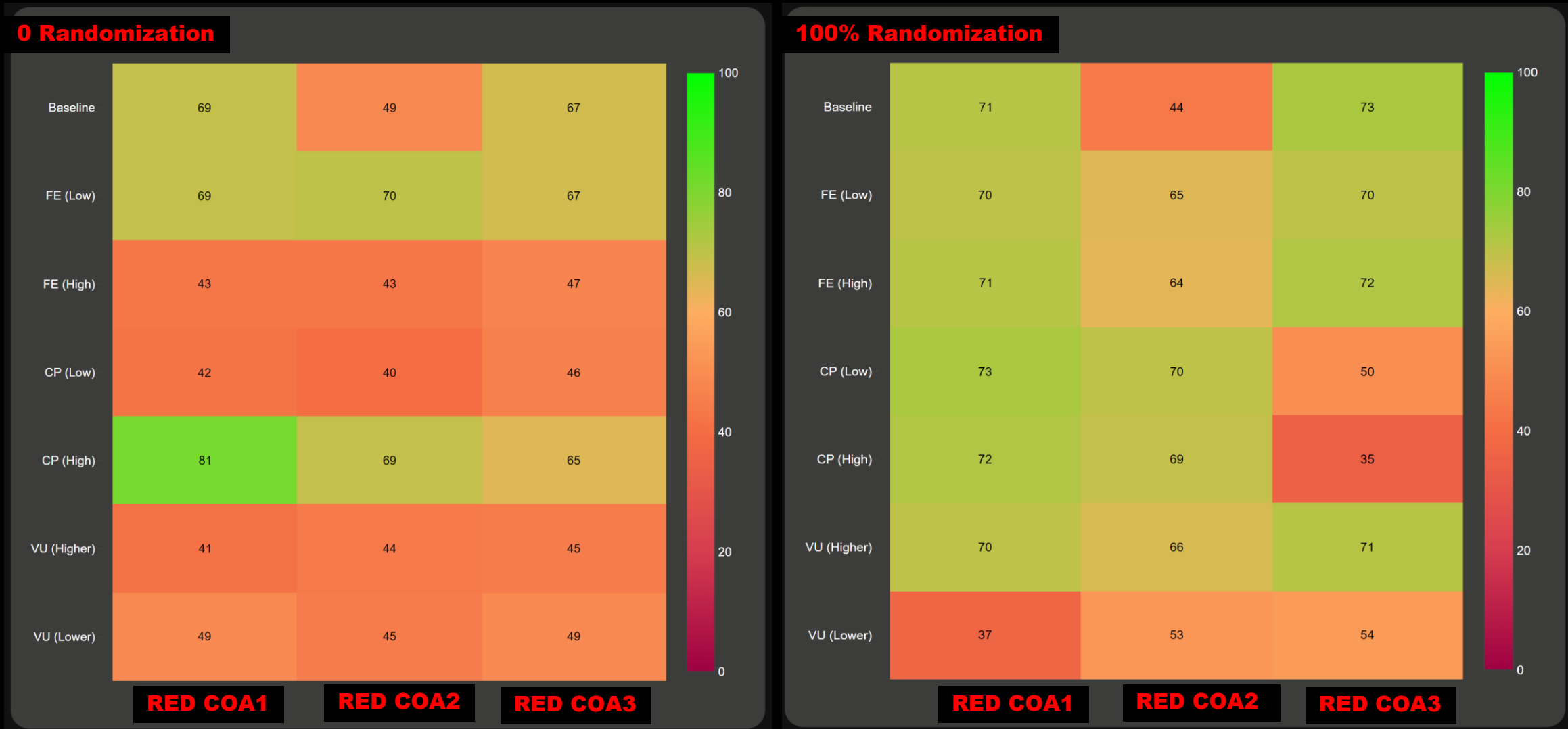


A solution – “to be”

We believe there are then four critical requirements for Next Generation CAST as part of a flexible LVC construct:

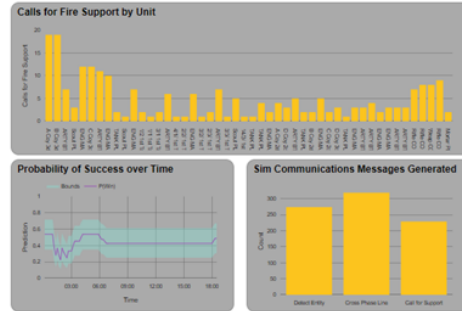
- Enhanced **evaluation** of **planning**
- Automated **evaluation** of the selected **plan**
- Full objective **evaluation** of a high-fidelity **execution** of the plan
- A substantially enhanced approach to the AAR and to **learning**





HIVE FUNCTIONAL EVALUATION OF EXECUTION

COMMAND & CONTROL



Powered by HIVE™

MANEUVER



FIRES



Powered by HIVE™

FORCE PROTECTION



Powered by HIVE™

LOGISTICS



Powered by HIVE™

Summary

- Critical interactions between analysis, analytical capability, and simulation
- More/better analytics required for training and wargaming whether MDMP, Tactics, or experimentation/decision support
- Treating all training, education, wargaming as opportunities to create digital artefacts for exploitation
- Hive is purpose built - by users for users
 - State and Event data ingestion makes for more powerful and more insightful analytical approach
 - Extensive metrics library
 - Core Coy, Bn & Bde metrics out of the box
 - Additional metrics added as part of initial installation
 - Flexible architecture for data ingestion, data visualization and re-use (REST API)
- Hive and VR Forces make for a powerful combination !

