

Transforming Command & Staff Training for Multi-Domain Operations

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MAK ONE & HIVE Simulation Solution... Provide Cost-Effective Tools Directly to End Users

Put the training tools in your hands

- Train whenever, wherever you want
- Train specific missions and key processes

Make them simple and effective

- Easy to learn and operate Simple terrain & scenario generation
- Unit personnel can develop & run exercises without outside assistance

Provide a cohesive and integrated Constructive and Virtual Environment

• Based on a common software platform with common terrains, models, and scenarios

Comprehensive measurement and evaluation

- Course of Action analysis
- Realtime assessment
- After Action Review



MAK ONE

A single comprehensive constructive environment for wargaming, training & experimentation



3



HIVE enhances MAK One with data analytics meeting Training Audience, Training System and Wider Defence user needs.

It can provide in-flight feedback via mentors in realtime and to support AARs, as well as provide post event access to performance data.

lt also:

- Illuminates in-flight exercise complexity and challenge management
- Provides evidence to support readiness assessment.
- Will provide evidence to support doctrine validation, lessons processes, experimentation, and evidence-based Force Development decision making.





VR Forces integration with Hive



- *Entity Level simulations
- ** Aggregate level simulations

CERVUS

MAK ONE + HIVE

- Simulated with scale, high fidelity and multi-domain representation
- Enhanced evaluation of planning;
- Automated evaluation of <u>the</u> Plan;
- Full evaluation of Execution;
- Enhanced support to Learning

	"As is"	"To be"
Subjective Evaluation of planning		
Objective evaluation of planning	×	
Assessment of Plan	×	
Subjective Evaluation of execution		\checkmark
Objective evaluation of execution	×	
Comparing planning performance with plan potential with execution outcome	×	

PLANNING PLAN EXECUTION LEARNING Automated Digitised COA Realistic, immersive environment for . Data supported learning – descriptive, development & plan LOCONs predictive and prescriptive analytics assessment evaluation Real-time performance tracking for HICON ٠ tailored and distributed to the point of Exploitation of sim speed and "jump" Enhanced Mission ٠ need Rehearsal Evaluation of BG HQ and Player Deep dive to review key DPs for Teamwork assessments Execution alternative futures Measurement of learning -





MAK ONE ARCHITECTURE: Combines Virtual & Constructive Simulations MAK ONE can be deployed locally in classrooms and labs, in a portable environment on laptops, in a distributed simulation network, on virtual machines, or in the cloud.



Supporting Brigade Level Exercises

Scalability

- From single laptop to large scale multi-user exercise
- From Squad vignette to Brigade-on-Brigade exercises
- From local exercise on a LAN to distributed Exercise in the Cloud
- From Single User to Multi-User

Realtime Scaling

- Add spare capacity
- Automated load balancing

Open Standards

- GIS Data
- HLA & WebLVC
- C2SIM









MAK Use Case

Virtual Machine w/ NVIDIA GRID

MAK Use Case:

OVR-Forces

Virtual Machine with NVIDIA GRID splitting the GPU four ways.

MAK TECHNOLOGIES

To help our customers plan for a simulation project, we configured and tested an Intel server with 48 Intel(R) Xeon(R) Platinum 8160 CPU @ 2.10GHz processors and two Tesla P40 GRID card running VMware ESXi, 6.7.0 hypervisor, with NVIDIA vGPU Manager. We configured the GRID-based system to support three vGPU per Telsa P40 using the P40-8Q Virtual GPU profile. Each vGPU presents a virtual desktop running either VR-Forces or VR-Engage to clients running VMWare Horizon Virtual Desktop Client.

VR-Engage

VR-Engage



VR-Engage

Cloud architectures take advantage of elasticity to facilitate greater scalability. Scalability can be thought of two ways.

of scalability can work with any application by moving to a more powerful (more compute, memory, storage resources) virtual machine or resizing the current VM. Scale Horizontally or Scale-Out is the provisioning of instances of the application on additional virtual machines and then dividing the load between them. Elasticity allows the redivision of resources between applications by provisioning, or by claiming back virtual machines as the need occurs. Horizontal scaling uses the infrastructure elasticity, but the application needs to be able to scale by adding more nodes and by distributing the load.

CERVUS



9



Plan Customize & Add Your Content

Create ORBATs

- Multi-sided
- Import from C2/Planning Systems
- Experiment with different force structures

Customize Parameters

 Change performance / capabilities of units, sensors and weapons

Add Content

• Easily edit and add new units, weapons, munitions and sensors

Combine into

- Units & Formations
- Pre-Configured Groups

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CER



VR-Forces Supports C2SIM for:

- ORBAT Laydown
- Tactical Graphics









Plan

Fast and Simple Scenario Creation

World-Wide Terrain

• Create scenarios anywhere in the world

Dynamic Environment

- Date and Time of day
- Weather
- Dynamic Terrain

Quickly add entities to simulation

- Drag and Drop Units from ORBAT
- Pattern of Life
- Pre-Configured Groups

Easy and Intuitive Scenario UI

- Tactical Graphics
- Line of Sight Calculations
- 2D, 3D and Simulated Sensor Views



0 more (just) 20 more

Observer Views

Harner R 1 Type: US Army M Speed (an/h): 0.0 Altude (n): 33

2250022

1024120

Plan and Execute Dynamic Synthetic Environment

• Terrain

- Support for whole earth tiled terrains generated from imagery and elevation data
 - Rural, urban, coastal, maritime, space,
 - Procedurally generate 3D content from feature data
 - Land use data
 - Buildings
 - Road Networks
 - Dynamic user modifiable terrain
 - Ridgelines & Engineering Objects
 - Features & Props

Weather

- Specifiable in zones or globally
- Affects mobility, sensors

Plan Sync Matrix

- Make Phased Unit (and Entity) Coordination easy. Currently each entity needs to be planned independently.
- Offer single dialog to allow coordinated plans based on Phase/Time/Events or other conditions
- Represent your scenario or battle plan as a series of phases over time.

Unit/ Object	Sub Unit	Phase 1		Phase 2	Phase 3	Phase 4	Phase 5
A CO		Move to PL S	unrise	Collect Wounded	Move to Evac Area	Load Wounded	EVAC
B CO							
	A PLT	Move to South EVAC Area	Defend Evac Area	Defend Evac Area	Defend Evac Area	Defend Evac Area	EVAC
	B PLT	Defend Evac Area	Move to North Evac Area	Defend Evac Area	Defend Evac Area	Defend Evac Area	EVAC
FtrFW 5		Loiter		CAS	Exfil		

Common triggers include:

- Crossing a Phase Line
- Entering an Area
- Behavior Completion
- Stop Time
- Event
- Any VR-Forces condition

Each block represents a specific plan. Plans are issued to units based on phase progression



HIVE FUNCTIONAL EVALUATION OF COAs & SELECTED PLAN





Powered by HIVE?

VIIS

• Delta is later measured between strength of plan and ability to execute plan.

HIVE COA MEASUREMENT & EVALUATION





Below

Below



Above



Affordability

Cost

Execute Multi-Domain Support

Multi-domain support for the different Battlefield Operating Systems

- Intelligence
- Maneuver
- Fire Support
- Air Defense
- Mobility & Survivability
- Combat Service Support
- Command and Control

Disaster Response





Execute Roles and User Interfaces

UI specific to role

Quick Menus/controls specific to role

User Reconfigurable and saved per user

Fog of War

Instructor assigns BOS, Role and Units to a station



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Execute VR-Forces Entities

Manned

• Ground, rotary-wing, fixed-wing, surface, sub-surface, and dismounted entities

Unmanned

• Air, Ground, Surface, Subsurface

Aggregate entities into multi-force hierarchies

Embark entities onto one another

Tasking

- Automated path planning
- Mission Plans
- Dynamic assignment of tasks and set data requests
- Via communications
- Using tactical objects waypoints, routes, areas

Semi-automated behaviors

• Individuals and Units



Execute Intelligent Behaviors - Smart Entities and Units

Doctrine Engine for higher level units

Behavior trees

Weapons and systems

Aggregate level calculations

Pattern of life activity

Complex Tasks





MAKTECHNOLOGIES

Execute Unit Behaviors

MAK is significantly modifying VR-Forces to facilitate small unit formation, movement, and coordinated behaviors.

- Improvements to primitive behaviors
- Increased aggregate primitive state
- Improvements to the Behavior Language (LUA)
- A GUI for rapid behavior composition and understanding













Behavior Improvements



- Spot Reports for Units
- Subordinate Functions/Roles
- Sensor Improvements
- Artillery Chanel

MAK TECHNOLOGIES

• Coordinated Turns

Spot Reports
Spot Reports Enabled: On 🔻
Only to Front-End
○ Broadcast
Send to Specific Entities
 Superior and Peers
Filter: All
Name: AFV 1
Name
🛞 AFV 1
aR Co 1

Units can send spot reports to superiors and peers now. This is away that individual sensors can be "rolled up" to the aggregate level for processing at the unit level.



Hive - Assess

Realtime assessment

• Dashboards to monitor progress & facilitate dynamic challenge level adjustment

Recording

• HLA data, CNR & BMS data

Bookmarks, notes

• Instructor interface to mark up recording

Scoring

- Detailed assessment of performance
- Immersive LOCON play creates opportunity for meaningful C2 Effectiveness measurement

Replay

• Replay for AAR







HIVE EXECUTION MEASUREMENT & EVALUATION



		CP3
Mission Outcome		Succeed
Identify the scale and scope of risk to force and mission	Can we execute the plan without incurring unacceptable damage to critical assets?	Yes
	Can we protect critical assets in specific battlespace?	Yes
Identify ways of employing concepts	Function Score	98
and capabilities to win	Planning and Execution	Above
	Fires	Above
	Intelligence	Above
	Protect	Above
	Sustain	Above
	Enable C2	Above
Cost	Affordability	Above



- High fidelity Measurement & Performance
 - Battalion performance ability to execute plan
 - Coy/PI performance drill down
 - Functional performance drill down
 - Comparisons to Battalion-level Rolling Average Baselines



27.3%

22.5%

10.2%





Combat Net Radio Analysis Tool (C-NAT) Module

Net Connectivity	C/S Conr	nectiv	ity	C/S R	anges N	dess	ige Duratio	n Mess	age Cor	tent Me	ssage Purpos	e Playback	
		Bde	Comd	BG Co	omd A Co	γ	B Coy	C Coy	Engrs	Fires	ISR		
		67	67.0%		0% 48.6	%	75.0%	71.0%	61.0%	85.0%	71.0%		
				Company Headquarters									
			1	0	91.7%								
			10	AC	88.2%		108	49.79	6	100	39.2%		
			11	IA	74.3%		12A	38.39	6	13A	12.6%		
			11B 66.7%	12B	35.69	6	13B	46.6%					
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			11	IG	42.6%		12G	71.49	6	13G	67.3%		
			11	IH	55.3%		12H	42.89	6	13H	7.8%		



- Voice recognition layer
- Voice to text layer
- Information Taxonomy-based ML tagging layer

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	114	12.8	12.0	101	12.8	12.8	- 1	12.0	2.3	11.1	210	1	11	0.4	11.2	414	0.1	1.1	22	1	其道	44	23	12.0	24	10.3	1.118	2.4
Engrs	116	0.1	1.2	12.50	2.1	2.4	1	-	24	11	42.1	2.4	6.5	6.3	2.4	111	6.4	12.8	1	114	13.W	2.8	64	12.8	6.4	61	E.R.	8.2
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	246	0.7	2.4	-	100	24	-2.6	12.36	2.4	1.1	6.3	2.5	100	12.8	14.2	EF	-	12.4	12.8	4.1	12.8		1	14.6	83	5.8	10.0	2.3
ISR	243	0.0	1	6.11.1	4.1	27.	8.1	0.8	SA.	104	6.1	2.6	-8.4	0.4	12.16	44	100	12.8	2.4	0.4	8.5		5.4	100	2.0	6.1	11.2	1
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	185	12.18	12.2	31.1	12.18	45	5.4	12.4	1	53	8.7	#2.	24		12.8	111	2.8	-	2.3	111	100	23	2.8	12.2	4.4		1.4	12.8
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MAK TECHNOLOGIES

t Connectivity	C/S Connectivity	C/S Ranges	Message Duration	Message Content	Message Purpose	Playback	L
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Future/Next Steps

- Decision Support Assistance
- Running VR Forces instances at H + 15, H + 30 and H + 60 intervals to anticipate operational eventualities
- Consequential Learning:
- We believe that a very powerful aspect of future CAST is the ability to test and explore every Decision Point made during Execution for the consequences of choosing different alternatives. VR Forces with its snapshot function already has some capability to support this, assuming clever management by Game Controllers/HICON/White Cell etc and the ability to launch additional back ends.
- Combined with Hive analytics this offers powerful new ways of experiential learning.
- New AAR Paradigms

MAK TECHNOLOGIES

• Advanced simulation replay combined with or even lead by advanced analytics will likely evolve new AAR paradigms to best exploit these new forms.





