



New Navy Solutions: Developing Simulation Based C4I Applications

Practical Composability!

Command and Control Research & Technology Symposium
June 15-17, 2004
San Diego, California

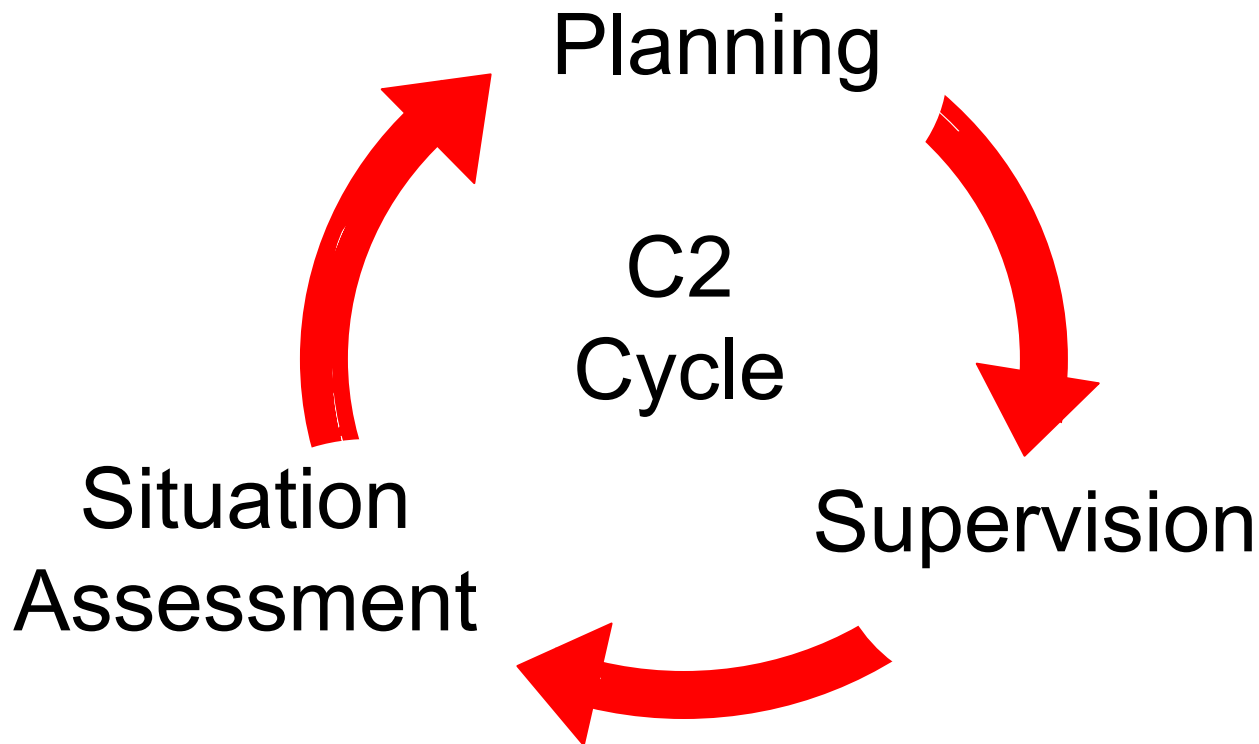
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Brief Outline

- C4I – Simulation Issues
- M&S Design Requirements
- Applications
- Composability Example

The Command and Control Cycle



C2 Systems primarily support the Situation Assessment Phase!

What is the problem?

It is fundamental.

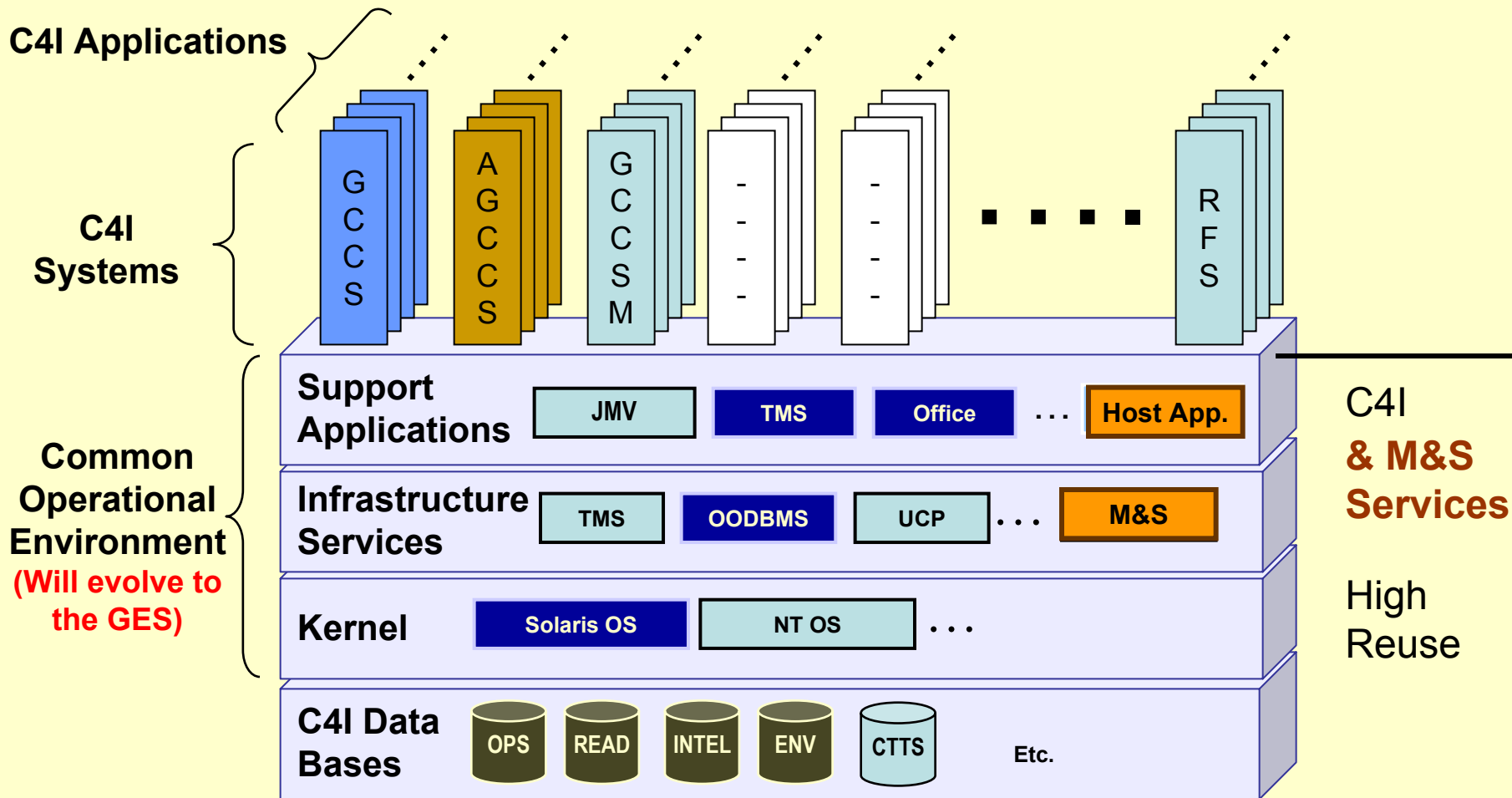
C4I Systems:

- Operate in current time with real world data.
- Present a single common operational picture.
- Communicate as global broadcast systems.

Simulation Based Applications (e.g., Planning, Course of Action Analysis) **require:**

- Variable time bases.
- Analysis of “What if?” situations.
- Local perceptions.
- Peer-to-peer collaboration.

COE Compliant C4I Systems Architecture



M&S Requirements

What is Needed?

Provide Services that:

- Link simulations to COE & C4I applications.
- Manage simulated data.
- Manage variable time bases.
- Perform format, data, protocol conversions.
- Generate scenarios.
- Provide distributed Application services.

Sharable M&S Software Components

M&S Services

- Common Operational Picture (COP) Capture
- Mission Editor
- Time Line Display / Editor
- Virtual Track Manager
- Plan Preview
- Dynamic Run (Time base Management)
- Exercise Track Management System (XTMS)
- Archive
- Replay
- Debrief Editor

- Event Manager
- HLA/RTI Ambassador
- ATO Parser
- DIS Server
- Training TUTOR

Plug-in Models

- Visibility Manager
- Mobile Sensor Model
- Visual LOS Model

Development Tools

- C4I Simulator/Stimulator
- Training AUTHOR
- Host Applications



C4I Developments using M&S Host Applications

- ⇒ 1. C4I Team Training (CTTS)
- 2. GCCS/M Training Author & Tutor
- ⇒ 3. Weapons of Mass Destruction Defense
- 4. Range Fusion System
- 5. Transit Training
- ⇒ 6. Predator Down Link Trainer
- 7. ATO Plan Analysis
- 8. Mission Editor 4.2
- 9. Multi-Ship Synchronization
- 10. Archive, Reconstruction, Debrief

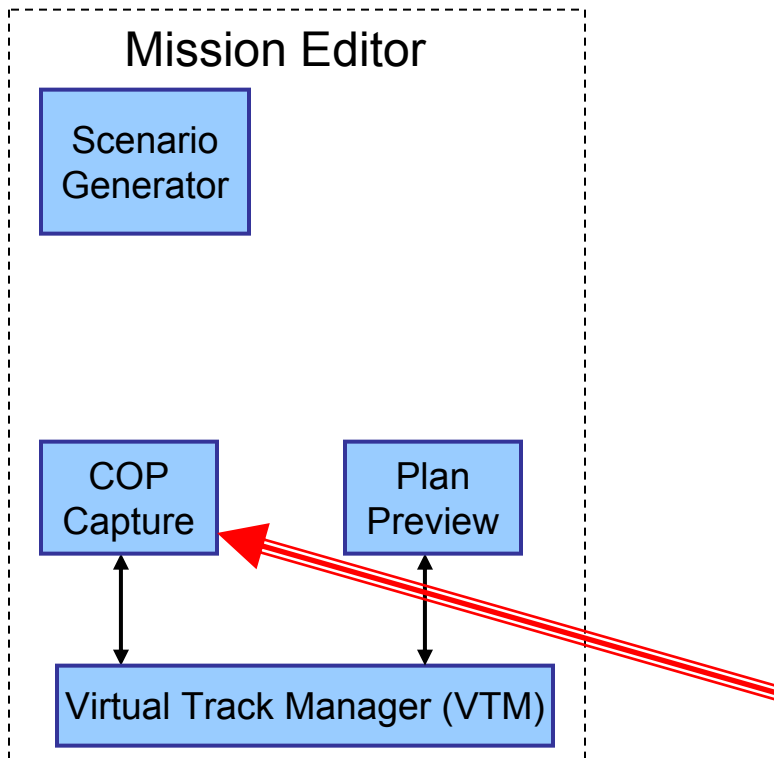


Example Development: C4I Team Training System (CTTS) ← click to play video

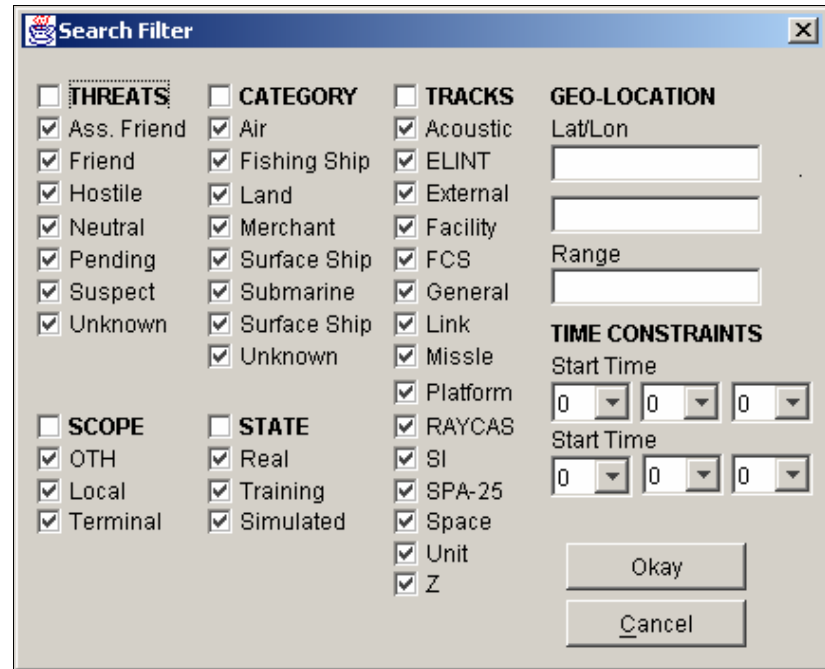
- Global Command and Control System Maritime (GCCS-M) Application
- Fully embedded
- Contains the Cruise Missile Training (CMT) Simulation

Composability Example: CTTS

Start with the Mission Editor (COP Capture)



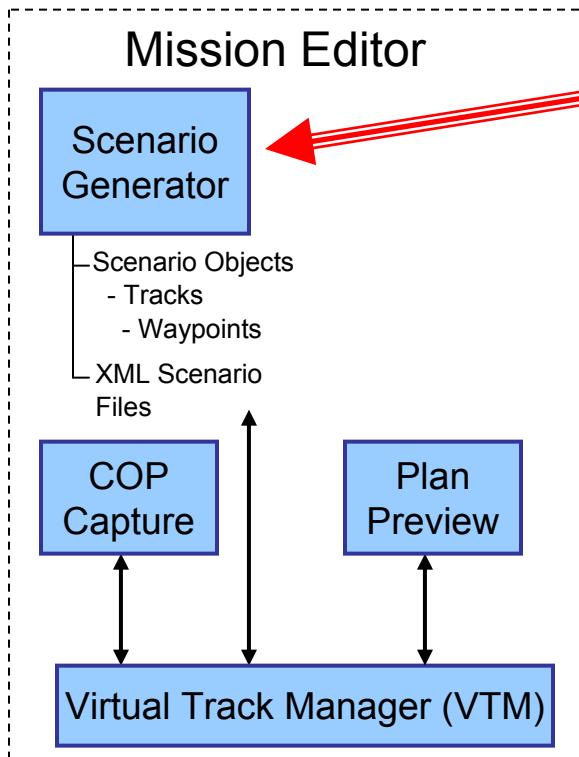
Create the Mission



COP Capture provides current real world data for simulation initialization and time projection analysis.

Composability Example: CTTS

Add the Scenario Generator



The **Scenario Generator** is a common component used in a wide range of C4I planning, training & analytical applications.

The screenshot shows the "Embedded Simulation Infrastructure" application window. The "Track" tab is active, displaying a table of track data and a list of actions on the right.

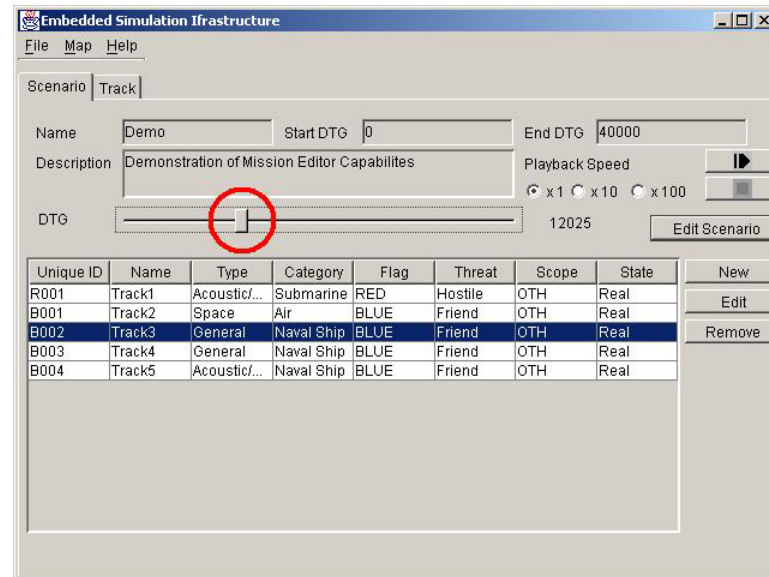
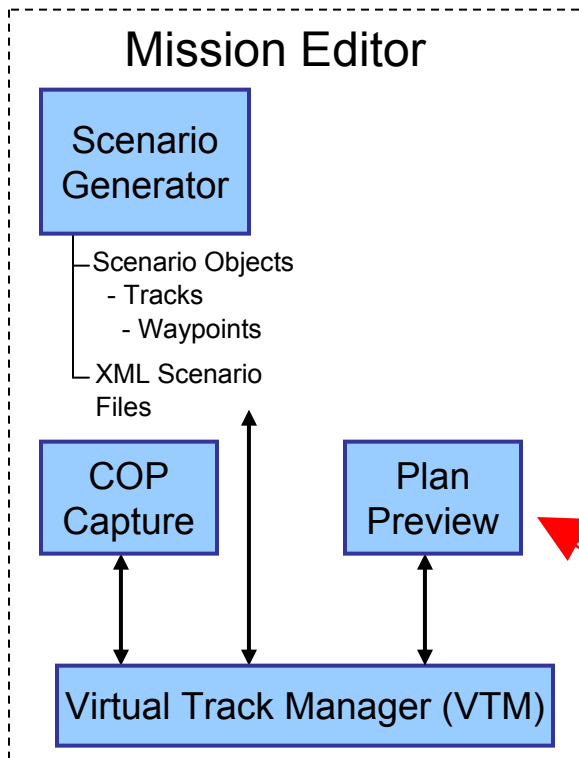
Source	DTG	Latitude	Longitude	Altitude	Course	Speed
Norfolk, VA	0	360154N	0762918W	0.0	90.6000407...	30.0
	6729	360119N	0751958W	0.0	37.0830446...	30.0
	15807	370140N	0742312W	0.0	18.1409498...	30.0
	27124	383117N	0734602W	0.0	14.5600134...	30.0
	38237	400056N	0731558W	0.0	57.6689768...	30.0
	46116	403603N	0720312W	0.0	41.7642616...	30.0
	53104	411929N	0711150W	0.0	9.03094057...	30.0
Groton, RI	56545	414749N	0710549W	0.0	37.7775759...	30.0

On the right side of the window, there is a vertical list of buttons: "Edit Track", "New", "Edit", "Delete", "Insert", "Up", and "Down".

Create the Mission

Composability Example: CTTS

Add the Plan Preview & VTM to the Mission Editor



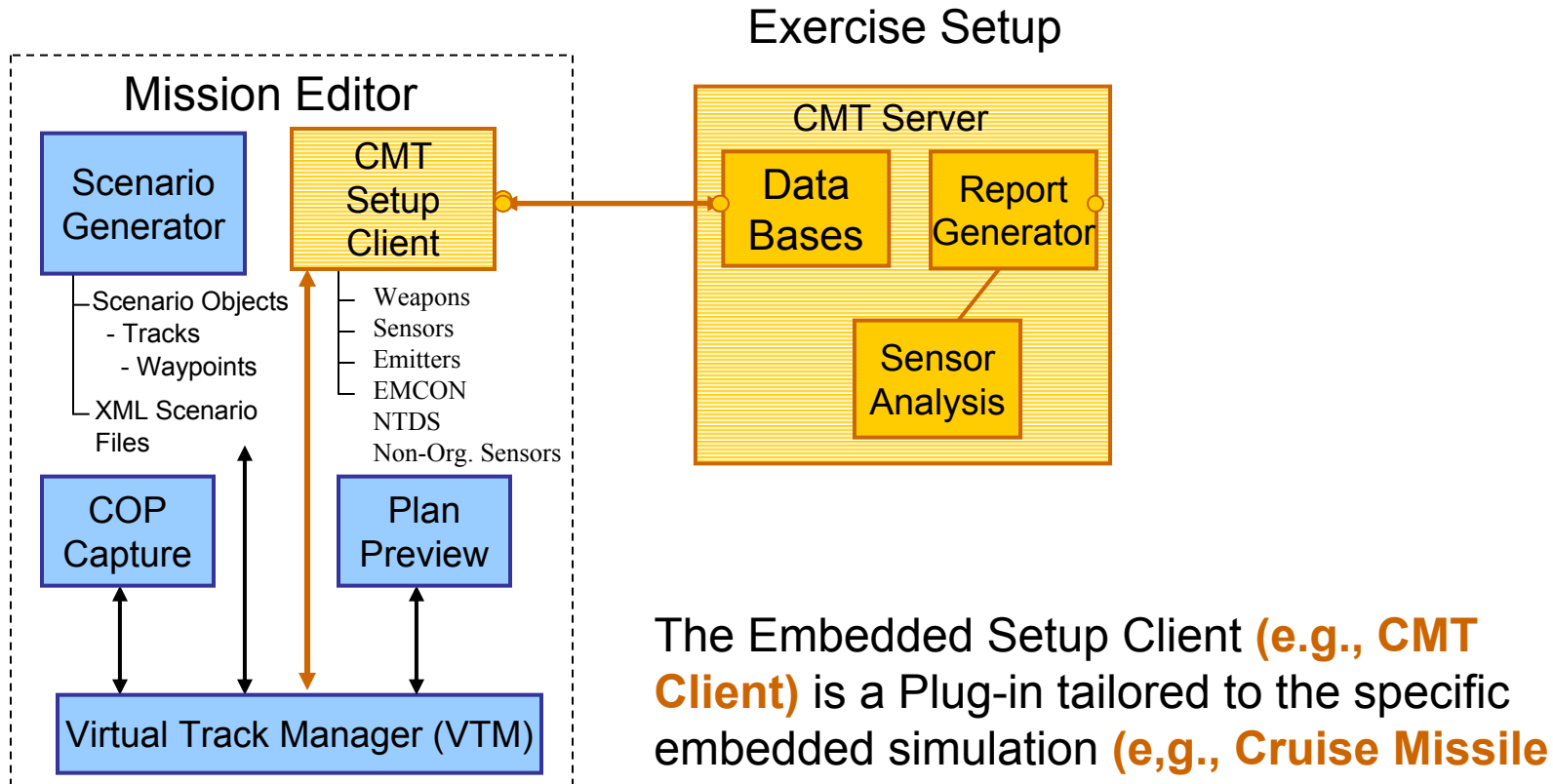
Plan Preview allows the user to play and preview the scenario.

The **Virtual Track Manager** is used to store and manipulate scenarios.

Create the Mission

Composability Example: CTTS

Develop the Simulation **Setup** Interface

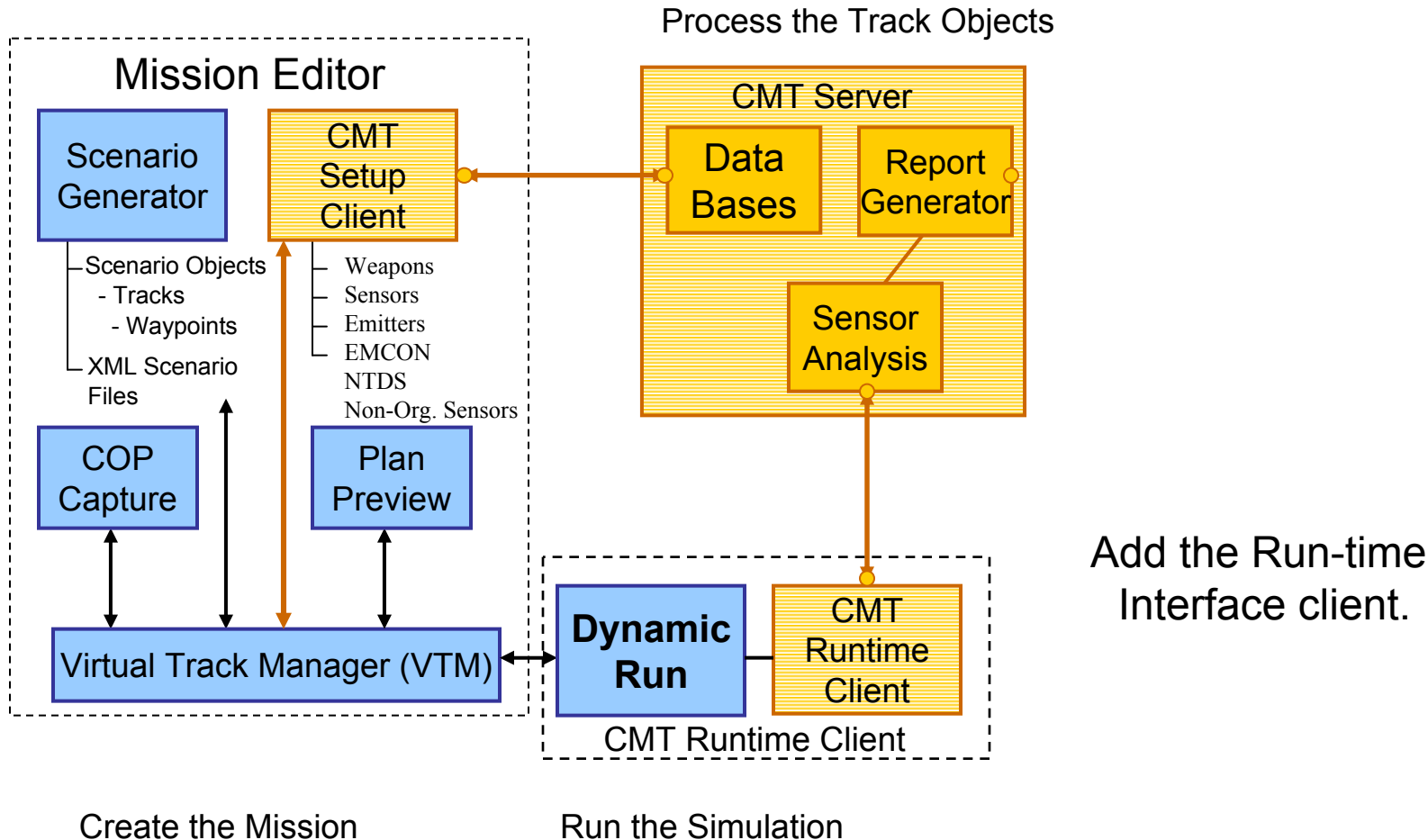


Create the Mission

The Embedded Setup Client (e.g., **CMT Client**) is a Plug-in tailored to the specific embedded simulation (e.g., **Cruise Missile Trainer**) to provide parametric inputs, user interface and runtime controls.

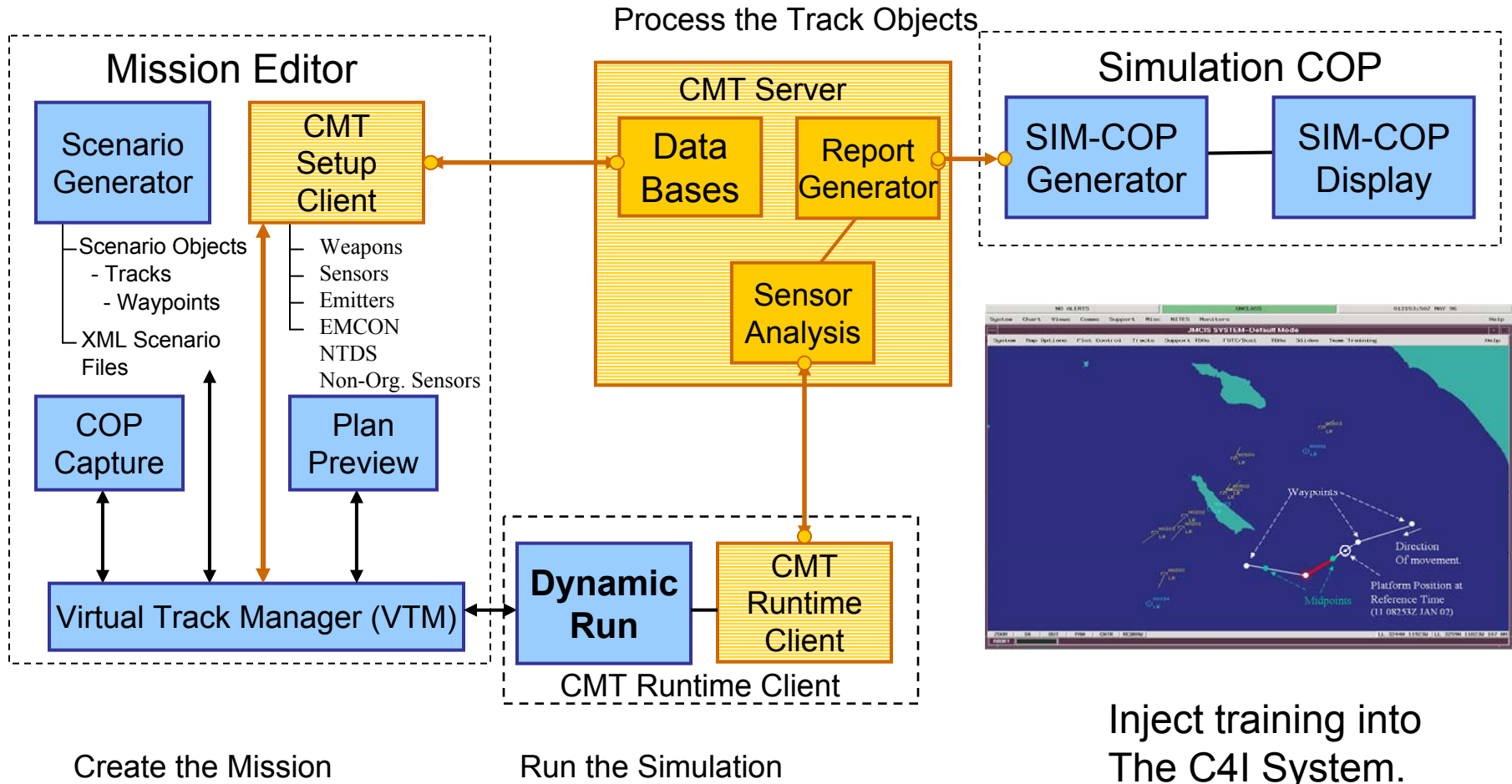
Composability Example: CTTS

Develop the Simulation Runtime Interface



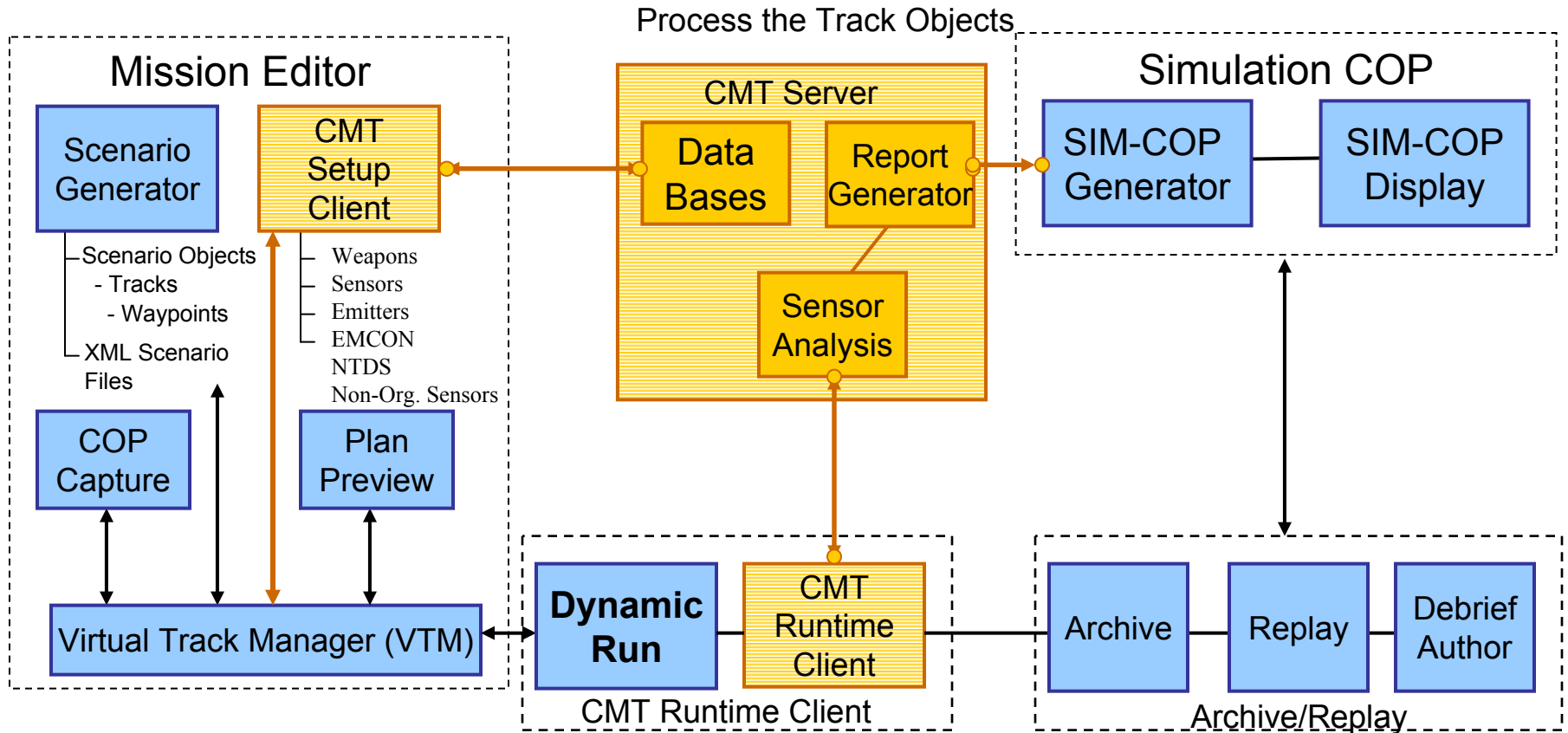
Composability Example: CTTS

Develop the Simulation **Output** Interface



Composability Example: CTTS

Add Archive, Replay & Debrief Plug-ins



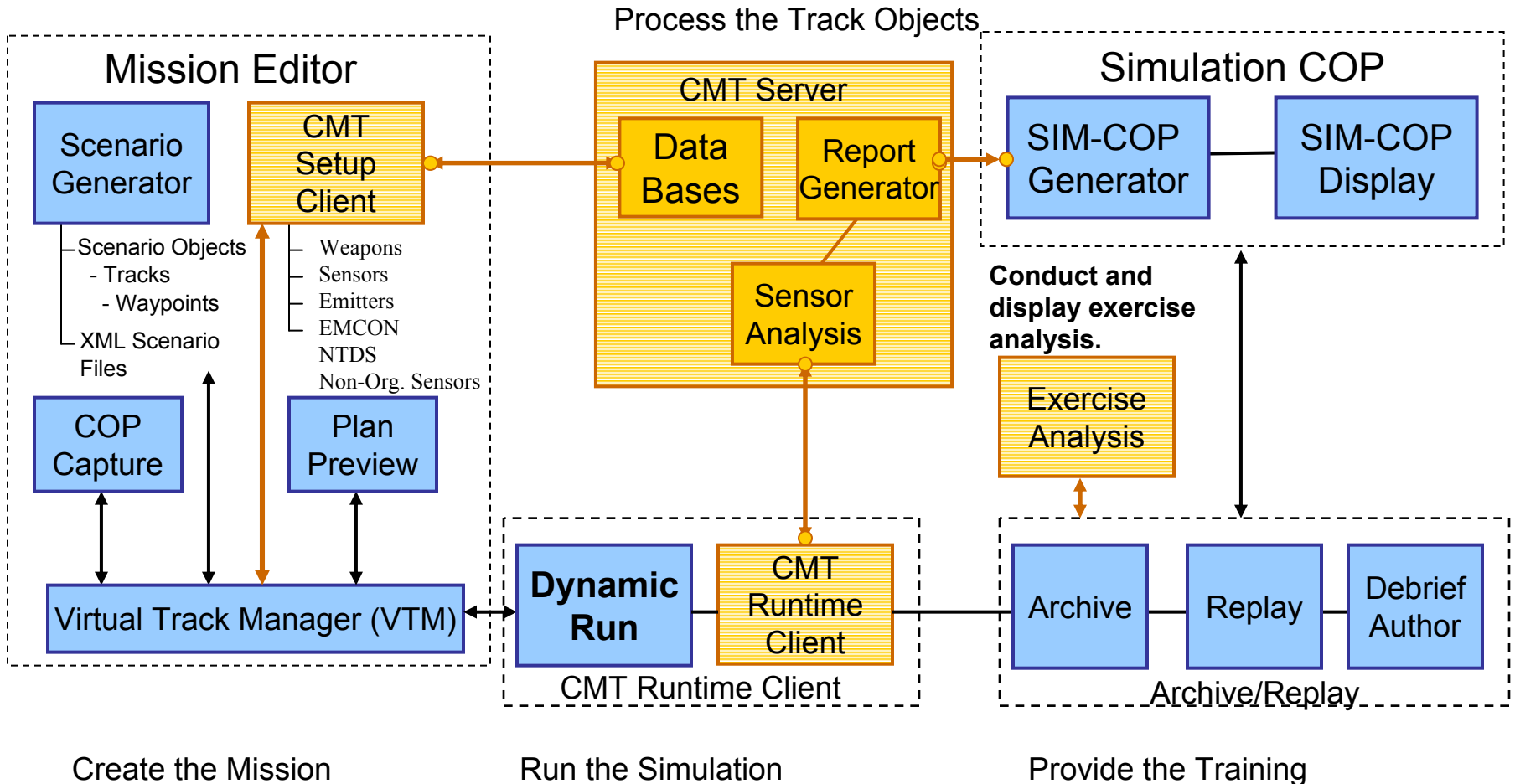
Create the Mission

Run the Simulation

Provide Archiving and Replay

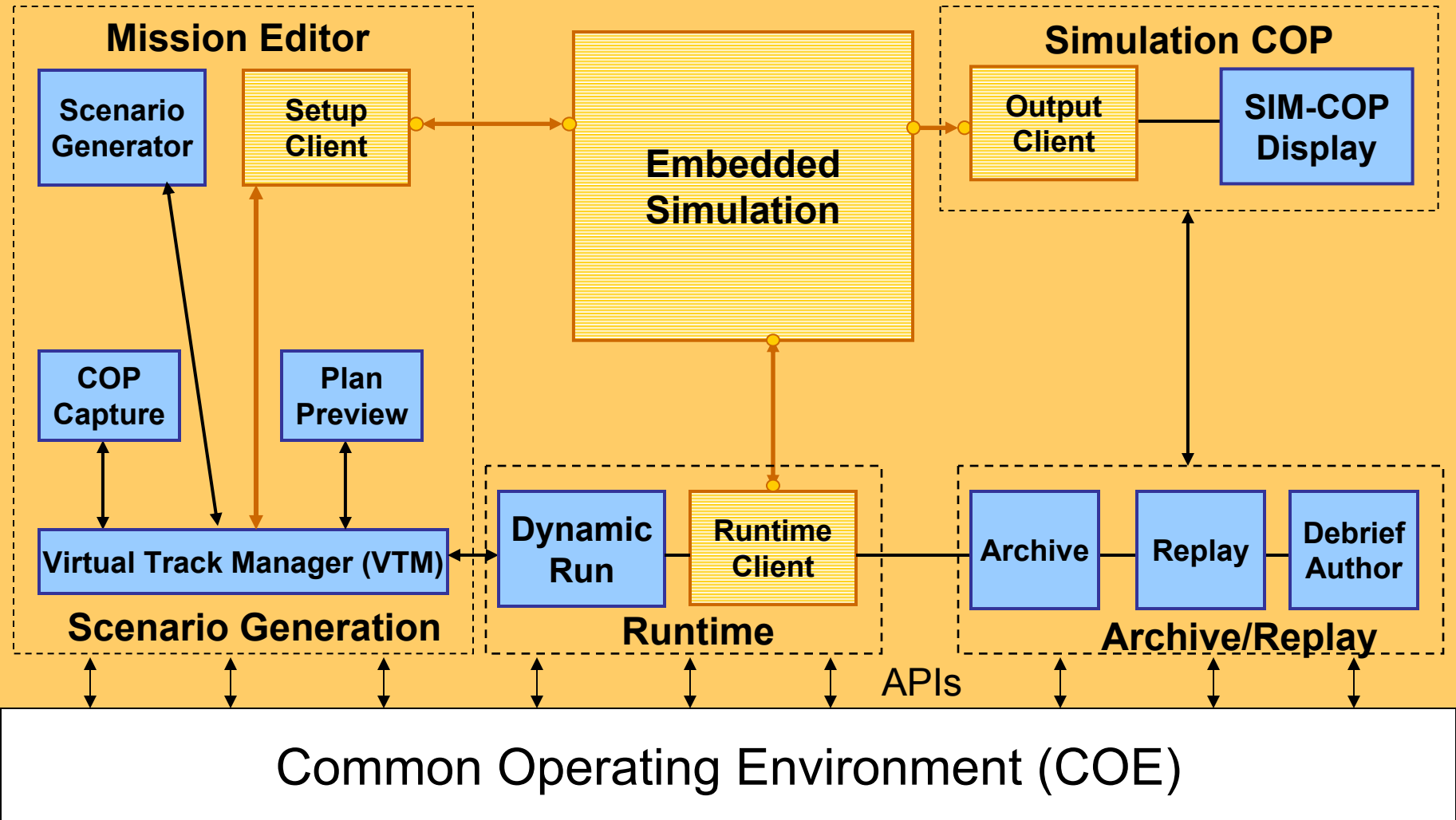
Composability Example: CTTS

Develop any **Unique Functions**



C4I M&S Host Application

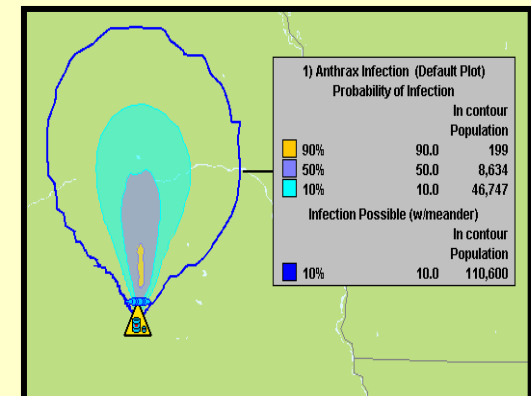
Generic Architecture for Scenario Based Applications

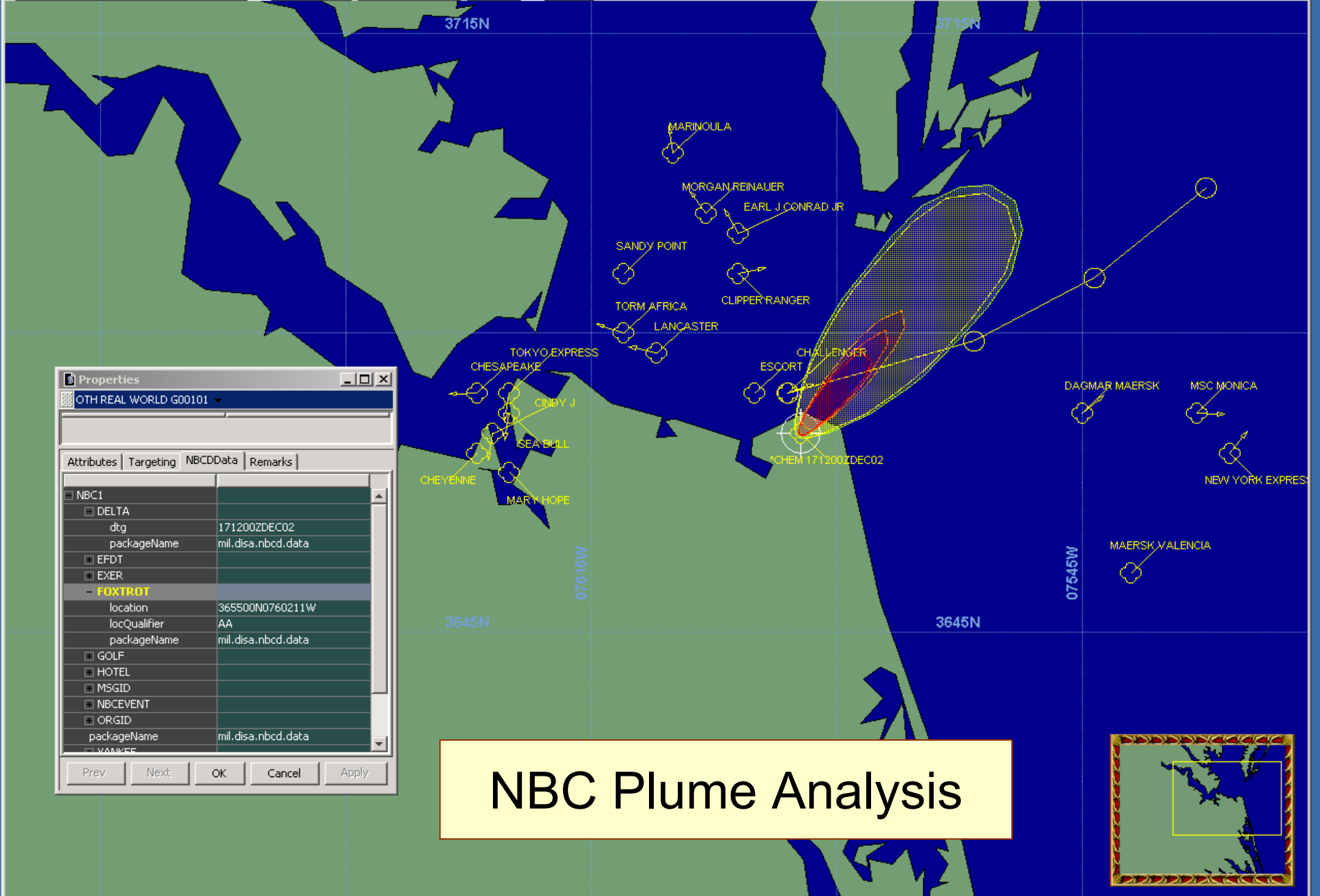


Weapons of Mass Destruction Defense Host Mission Application.

Provide C4I an on-site situational awareness of nuclear, biological, and chemical (NBC) weapon information and processes that are beyond human cognition in “raw” state.

Initial Capability: Use an embedded HPAC server to predict hazardous down wind effects of simulated or occurring NBC weapon attacks or attacks on NBC facilities.





Properties

OTH REAL WORLD G00101

Attributes Targeting NBCDData Remarks

NBC1	
DELTA	
dtg	171200ZDEC02
packageName	mil.disa.nbcd.data
EFDT	
EXER	
FOXTROT	
location	365500N0760211W
locQualifier	AA
packageName	mil.disa.nbcd.data
GOLF	
HOTEL	
MSGID	
NBCEVENT	
ORGID	
packageName	mil.disa.nbcd.data
YANKEE	

Prev Next OK Cancel Apply

NBC Plume Analysis



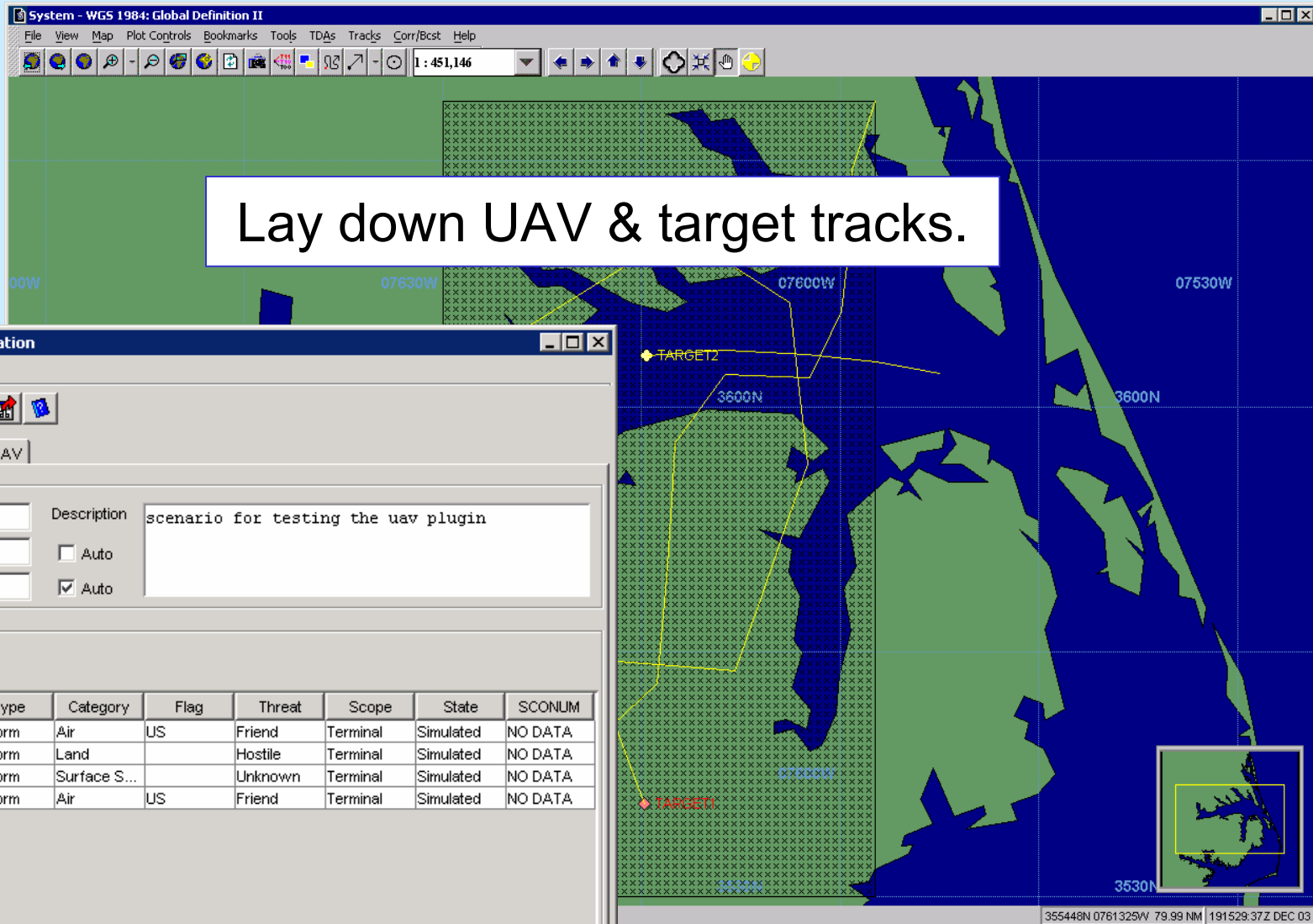
WMDD* Host Application Prototype

- Estimates down wind contamination, propagation and lethality. (Concentration contours & casualties).
- Layers NBC information into operational picture.
 - Operates with C4I tactical databases.
 - Displays fallout/ contamination clouds & time projections vis-a-vis force movements and populations.
- Interacts with mission planning & operational scenarios.
- Distributes results to other C4I Systems.

* **“Weapons of Mass Destruction Defense – A C4I Host Application”** Paper 03S-SIW-090, Simulation Interoperability Workshop, Spring 2003; Orlando, FL., G. Layman, J. Weatherly.

Predator Downlink Trainer

Stimulate the UAV Downlink

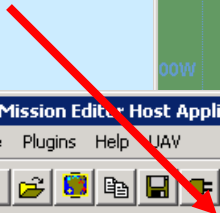


Scenario Loaded (uav test 3)

Predator Downlink Trainer

Stimulate the UAV Downlink

UAV
Plug-in



UAV Simulator Setup

Mission Editor Host Application

File Plugins Help UAV

Scenario Track Simulation UAV

Selected Track

Name: uav2

UID: 4

Category: Air

Position: 361.016N 0761.253W

Assign to Channel: 1 2 3 4 5

Channel Assignment

Ch#	Track	UID	IP	Port	Range (m)	Active
1	uav1	1	225.0.0.225	8005	30000.0	<input checked="" type="checkbox"/>
2	uav2	4	225.0.0.226	8005	30000.0	<input type="checkbox"/>
3						<input type="checkbox"/>
4						<input type="checkbox"/>

-DIS Entity Type

Kind: Platform

Domain: Air

Country: US

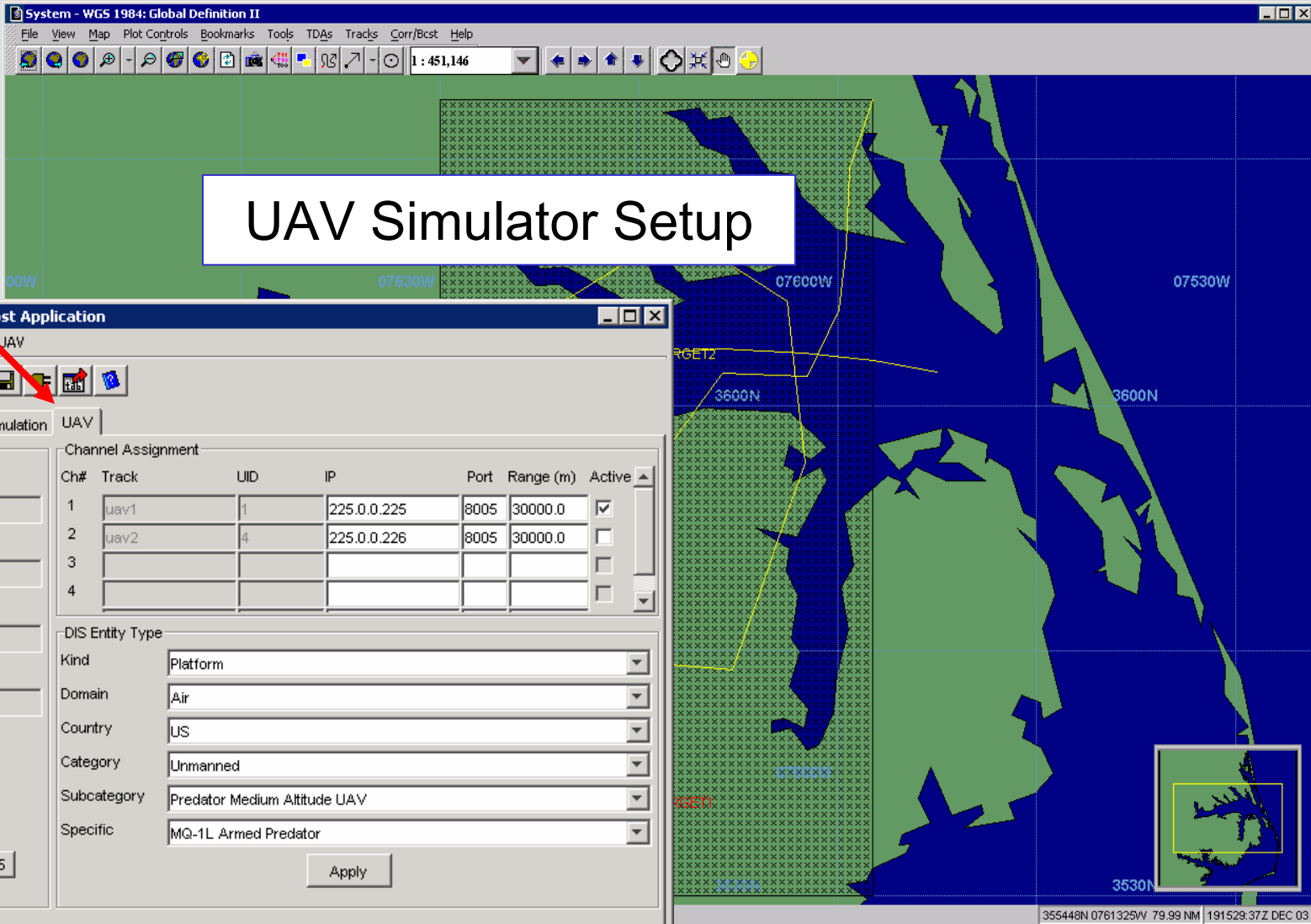
Category: Unmanned

Subcategory: Predator Medium Altitude UAV

Specific: MQ-1L Armed Predator

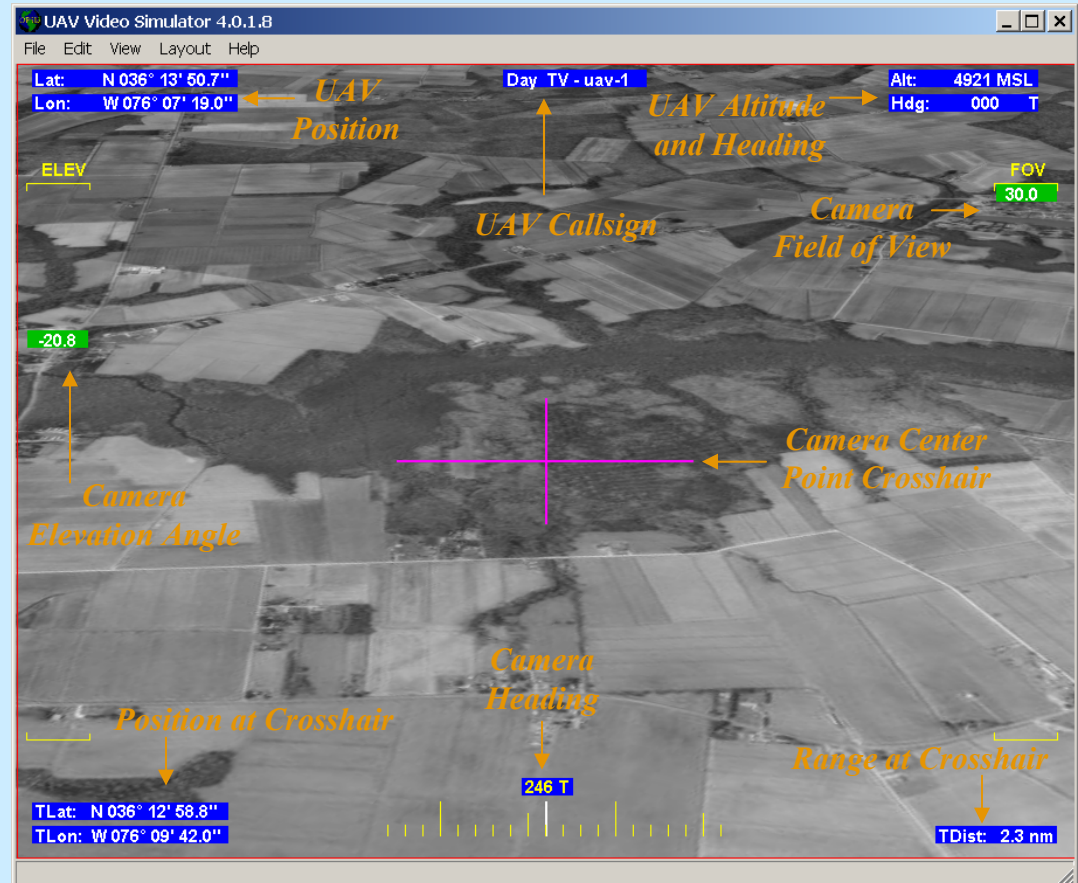
Apply

Scenario Loaded (uav test 3)



Control the Camera

Simulated Video Downlink Display



M&S Host Application Advantages

Performance, Reliability & Cost

- Provides > 85% of software needed.
 - **COE/GES:** Network Communication, Map servers, Data Fusion, Sensor Interfaces, Data Base Management, etc.
 - **M&S Services:** Host Application, Mission Editor, COP Capture, Dynamic Run, etc.
- Much easier development environment.
 - Less complex.
 - More reliable.
- Self Integration with all other M&S Applications.
- Embedded Training is included.



The Host Application and M&S Services described in this paper and brief will be available to developers in July, 2004.

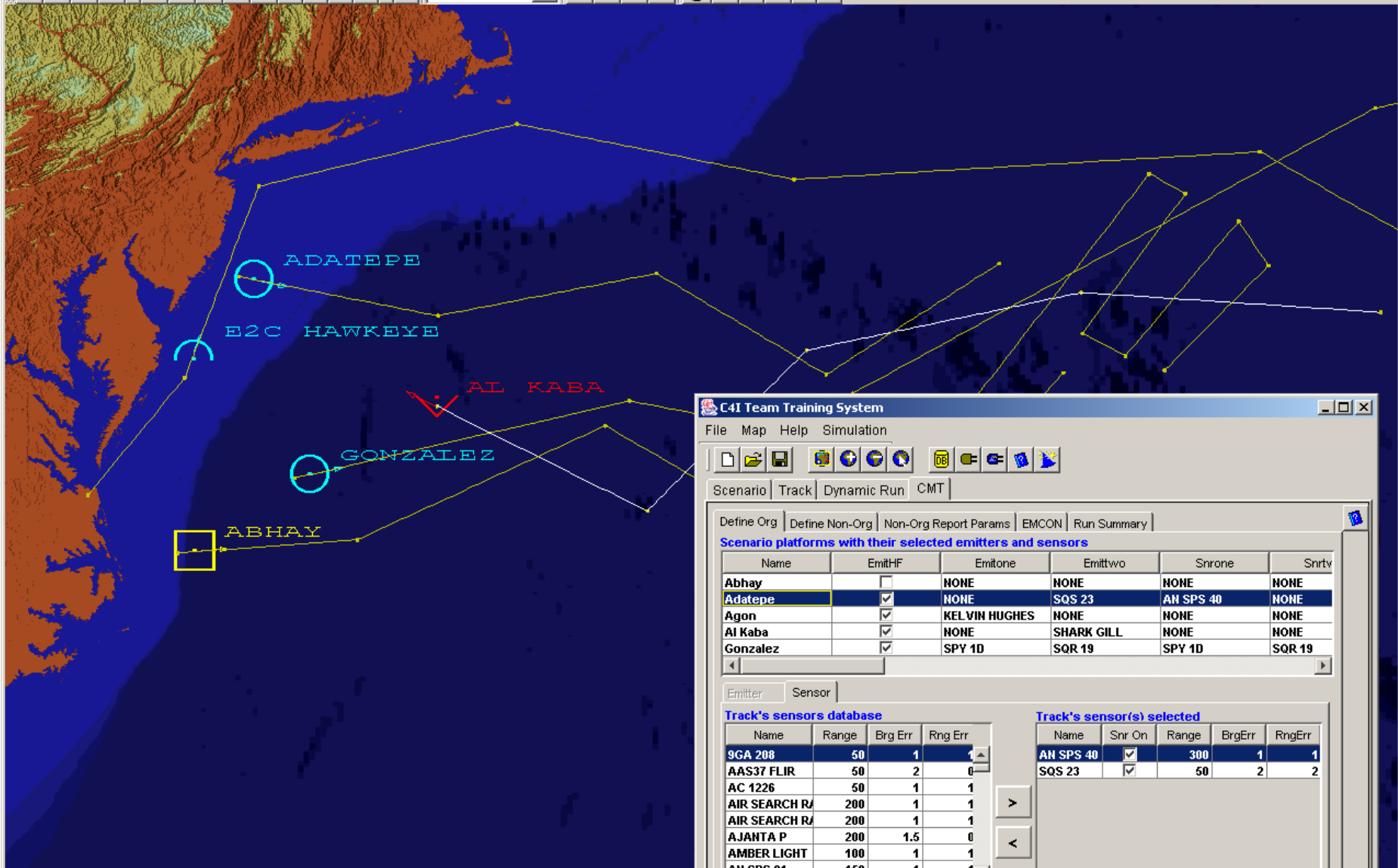
Backup

Command and Control

Definition

Command and Control is a continuous, **cyclical process** by which a commander **makes decisions** and **exercises authority** over subordinate commanders in accomplishing an assigned mission.

(US) Naval Doctrine Publication 6 – Command and Control



C4I Team Training System

File Map Help Simulation

Scenario Track Dynamic Run CMT

Define Org Define Non-Org Non-Org Report Params EMCON Run Summary

Scenario platforms with their selected emitters and sensors

Name	EmitHF	Emitone	Emittwo	Snrone	Snrtv
Abhay	<input type="checkbox"/>	NONE	NONE	NONE	NONE
Adatepe	<input checked="" type="checkbox"/>	NONE	SQS 23	AN SPS 40	NONE
Agon	<input checked="" type="checkbox"/>	KELVIN HUGHES	NONE	NONE	NONE
Al Kaba	<input checked="" type="checkbox"/>	NONE	SHARK GILL	NONE	NONE
Gonzalez	<input checked="" type="checkbox"/>	SPY 1D	SQR 19	SPY 1D	SQR 19

Emitter Sensor

Track's sensors database

Name	Range	Brg Err	Rng Err
9GA 208	50	1	1
AAS37 FLIR	50	2	0
AC 1226	50	1	1
AIR SEARCH R	200	1	1
AIR SEARCH R	200	1	1
AJANTA P	200	1.5	0
AMBER LIGHT	100	1	1
AN SPS 01	150	1	1

Track's sensor(s) selected

Name	Snr On	Range	BrgErr	RngErr
AN SPS 40	<input checked="" type="checkbox"/>	300	1	1
SQS 23	<input checked="" type="checkbox"/>	50	2	2

Apply Reset

C4I Team Training System (CTTS)