SPIE DEFENSE & SECURITY SYMPOSIUM 2005

Technical Challenges & Solutions In Merging GIESim and JSAF

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Enabling Technologies for Simulation Science IX

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Motivations & Challenges

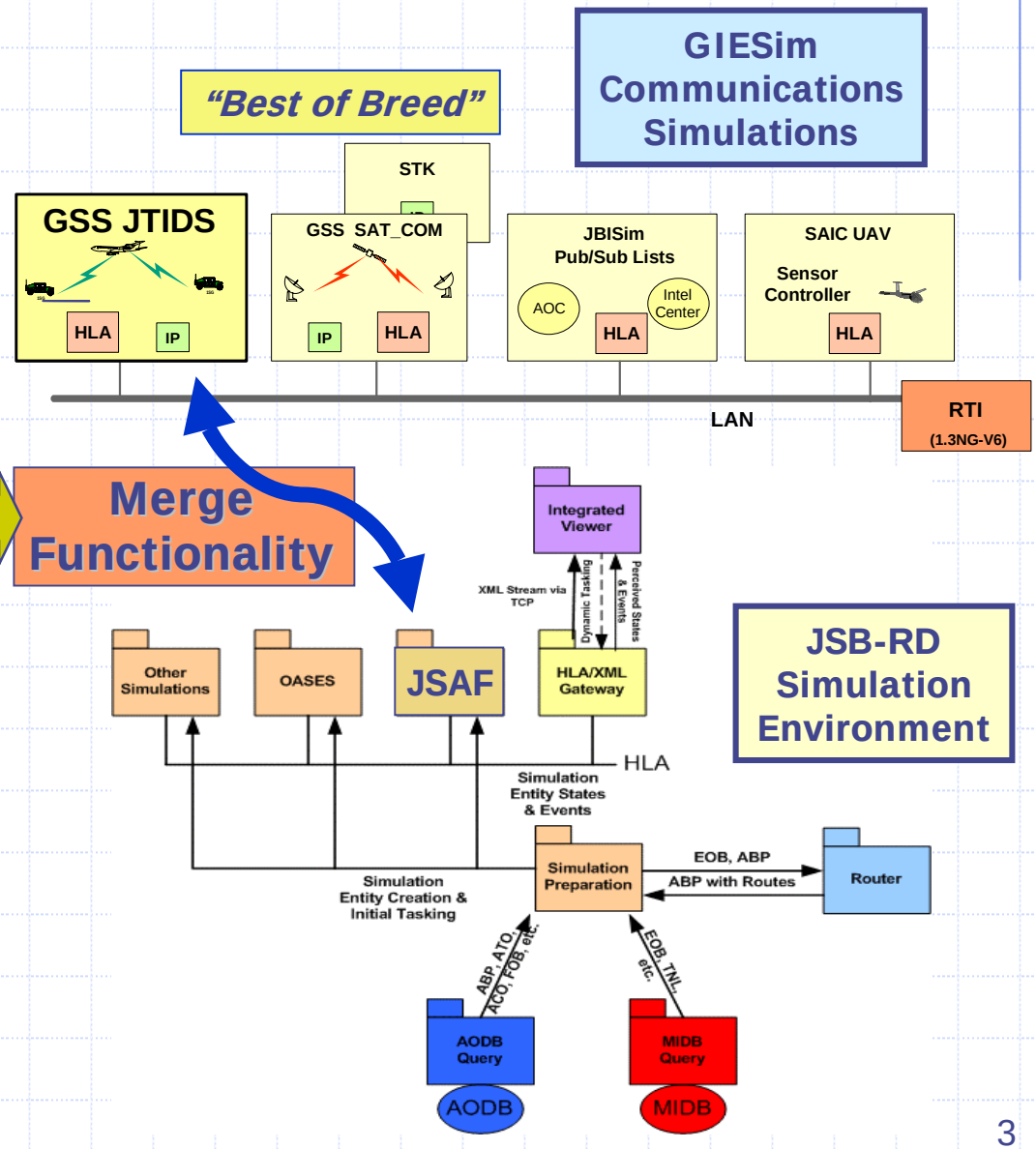
- **Goal:** Add Tactical Communications to the Joint Semi-Automated Forces (JSAF) Simulation.
- **Why?**
  - JSAF is used for large war gaming of Command & Control (C2) systems/operations – **has "no" comm modeling.**
  - Comm is *essential* to actual operations and to emerging Network Centric Warfare (NCW).
- **Challenges:**
  - Create interface between JTIDS and JSAF.
  - Enhance JTIDS Simulation to take updates and transmission requests.
  - Enhance JSAF to support comm logic and comm hooks.
  - Create a compelling, short demonstration scenario.

GIESim/JSB-RD Team

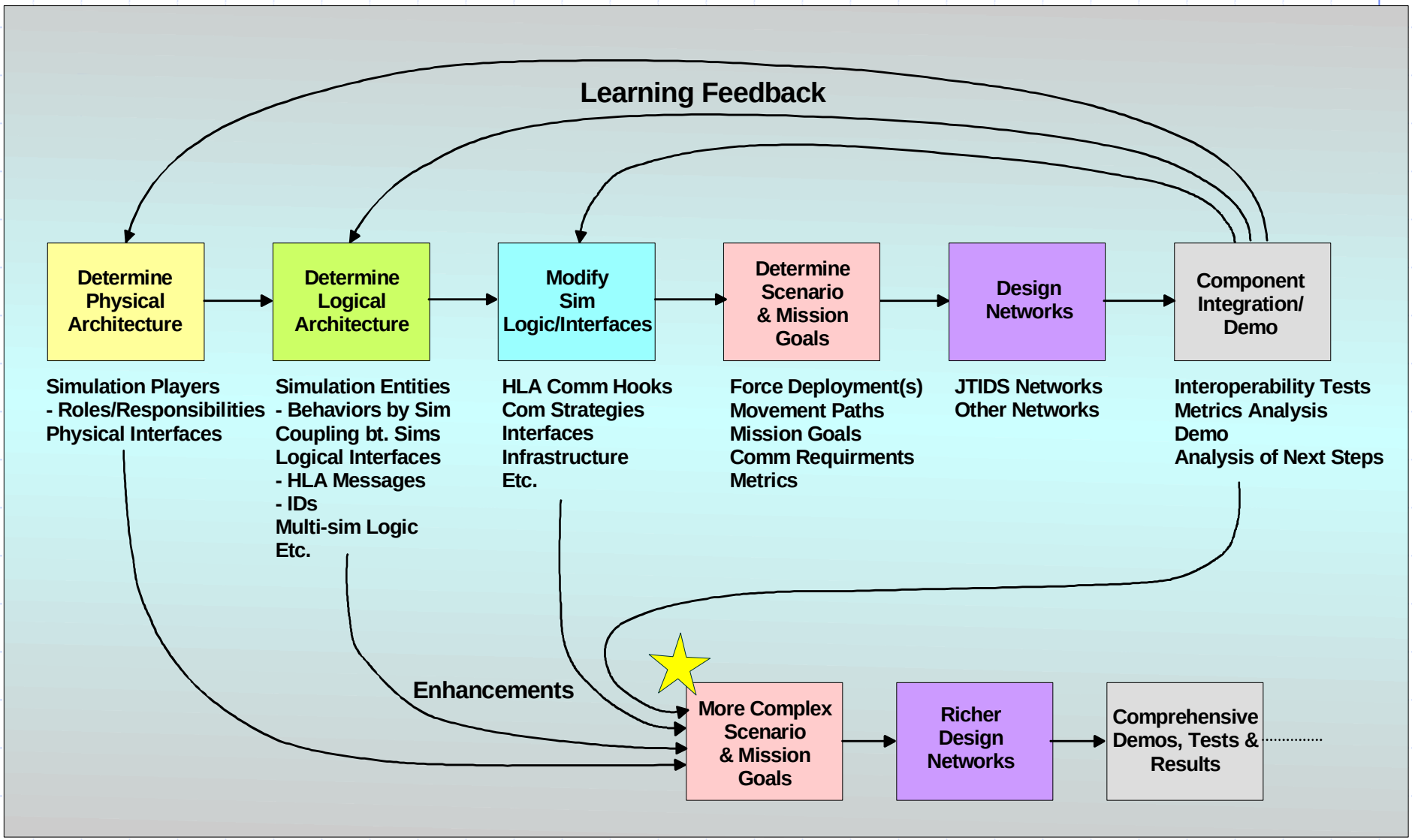
GIESim Team
(Global Information Enterprise Simulation)

High Performance Team
Combined Expertise
Combined Capabilities

JSB-RD Team
(Joint Synthetic Battle Space – R&D)



Merger Requirements



Scenario Considerations

Geography / Terrain

Dynamic Scenario

Equipment Deployments
Mission Deployments
Dynamic Movement Paths

Network Design

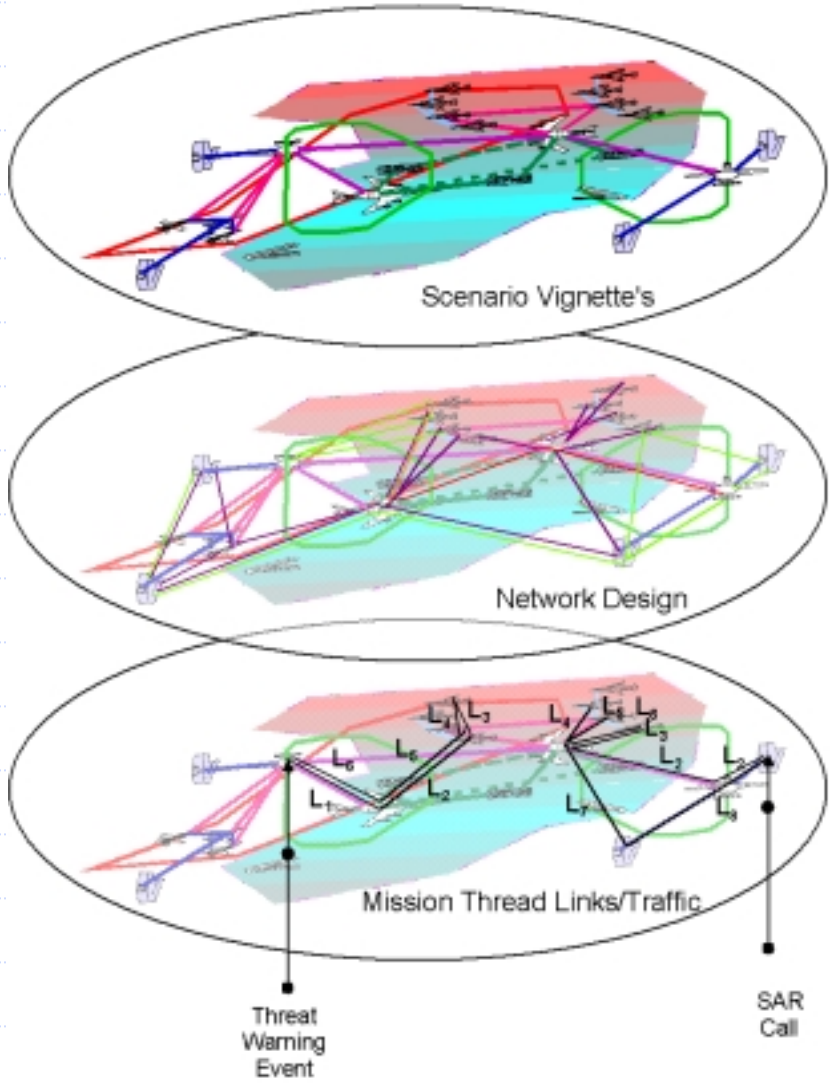
Define Network Requirements
Allocation of Time Slots and Protocols to support all Mission and Communications requirements within a Scenario

Mission Threads

Define Flow of Comm Messages Associated with a particular Mission
Threads consist of multiple Links
Example: Time Critical Target

Dynamic Mission Events

Trigger the Flow of Tactical Comms
At Specific Times / Places
E.g., Pop-up Threats



“Wow” Scenario

Scenario Set-Up

A tactical F-15 STRIKER aircraft receives a target message from Special Operations Forces (SOF) and follows terrain during ingress to target. Later on, the SOF on the ground detects a mobile SAM site. The SOF is now separated from the STRIKER by a mountain ridge.

Variation 1 – JSAF Only: The SOF “notifies” the STRIKER who evades the SAM.

Lesson: The STRIKER survives, but the simulation is unrealistic. Worse, it erroneously predicts **the STRIKER gets away.** ***Would actually get killed! Not acceptable for realistic simulation.***

Variation 2 - JSAF w/ Comms: *The original Scenario without smart “fixes”*

The SOF uses JTIDS to send a threat warning to the STRIKER but the mountain range blocks direct radio contact. **The STRIKER gets hit.**

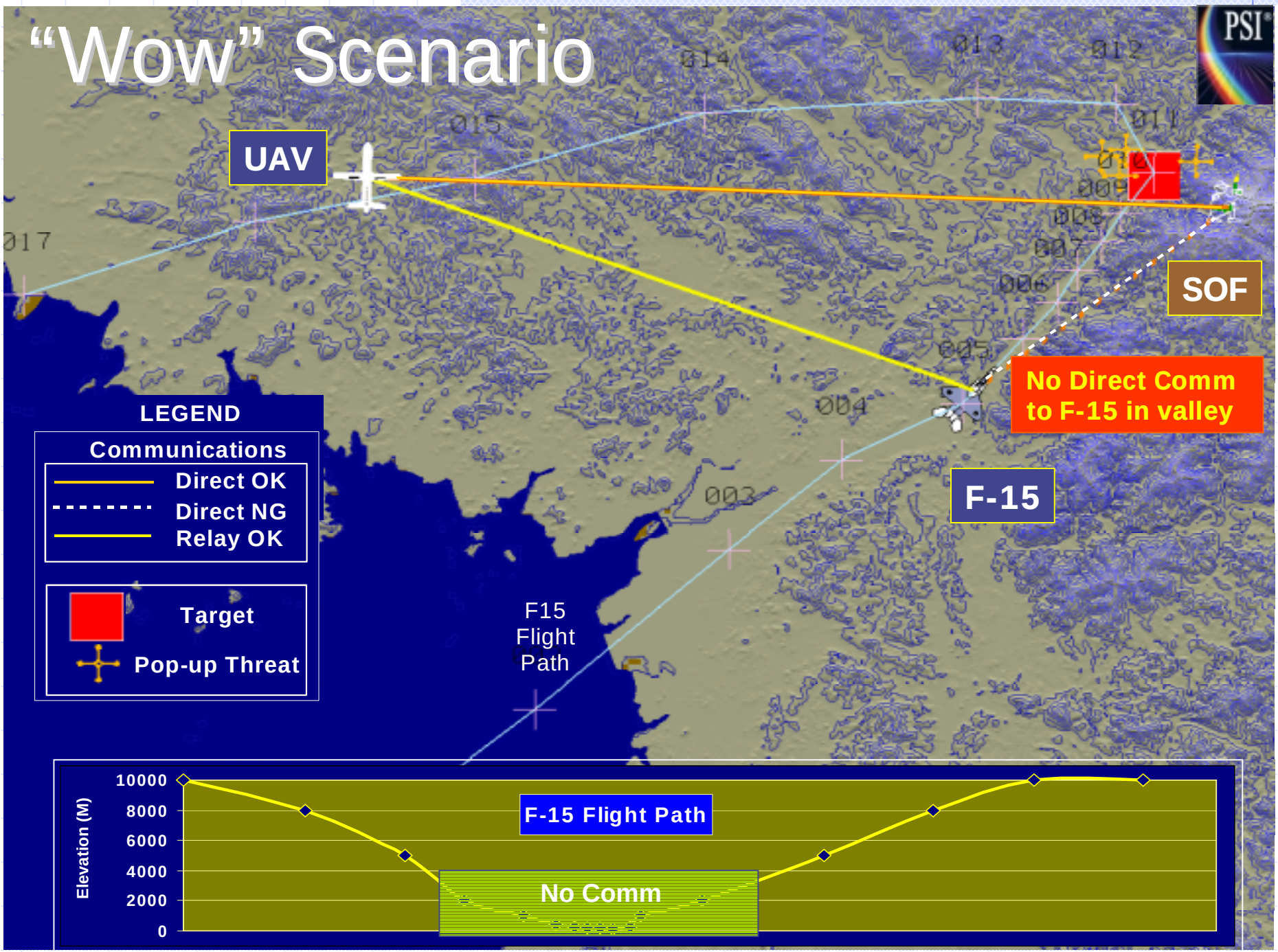
Lesson: We need to account for distance, terrain and network design in realistic mission planning; advanced communications planning in support of operations is critically important

Variation 3 - JSAF w/ Comms and Relay: *In essence, perfect Comm as in Variation 1*

To facilitate perfect communications, we turn on a JTIDS relay – maybe a UAV. The STRIKER gets the relayed threat warning and evades!! **The STRIKER gets away.**

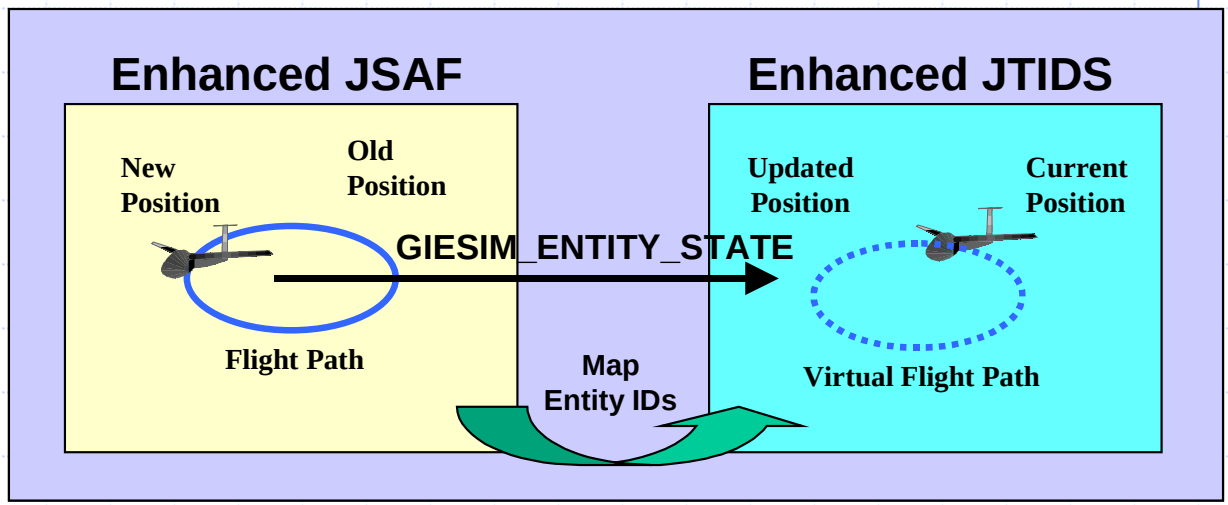
Lesson: Correct communications modeling can replicate any set of assumptions.

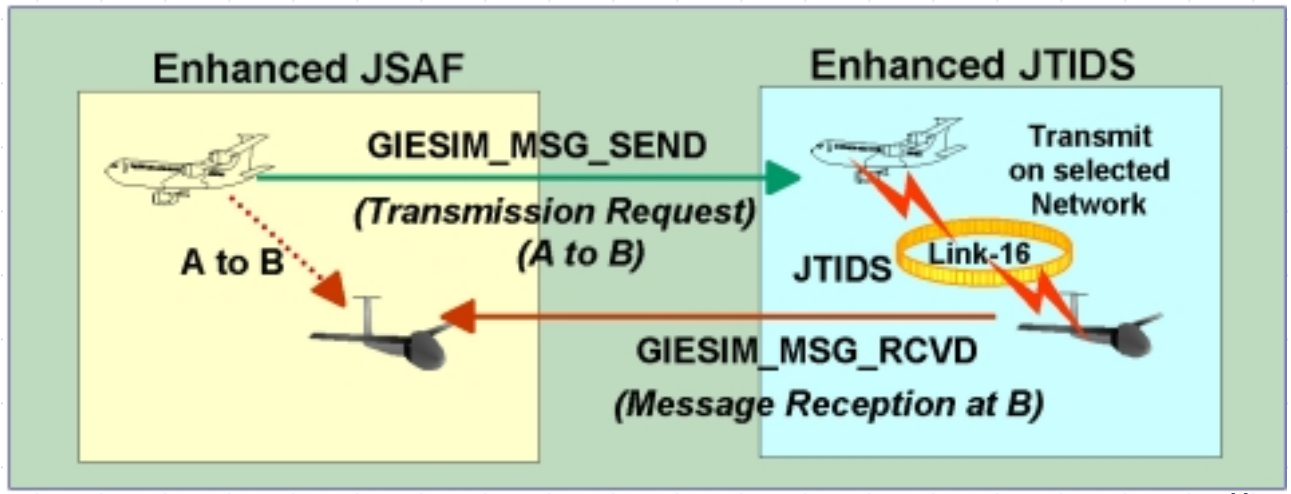
“Wow” Scenario



GIESim JTIDS Enhancements

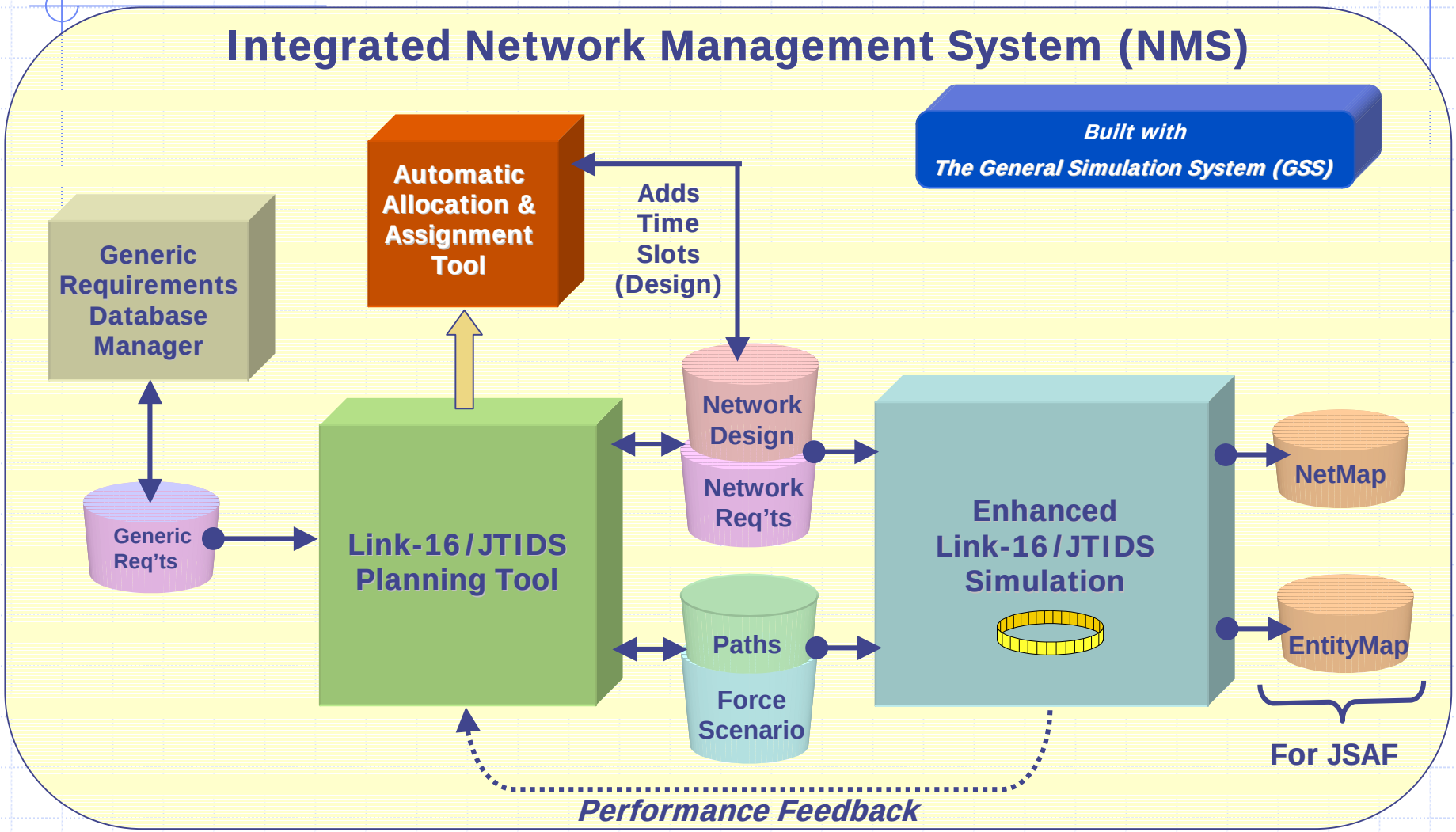
- HLA Interactions
- Position Updates
- Entity IDs
- Transmission Requests
- Transmission Responses
- Entity IDs
- Net Types
- Network Selection
- JSAF Payload:
  - MSG ID & Size
  - Destination
  - Latency



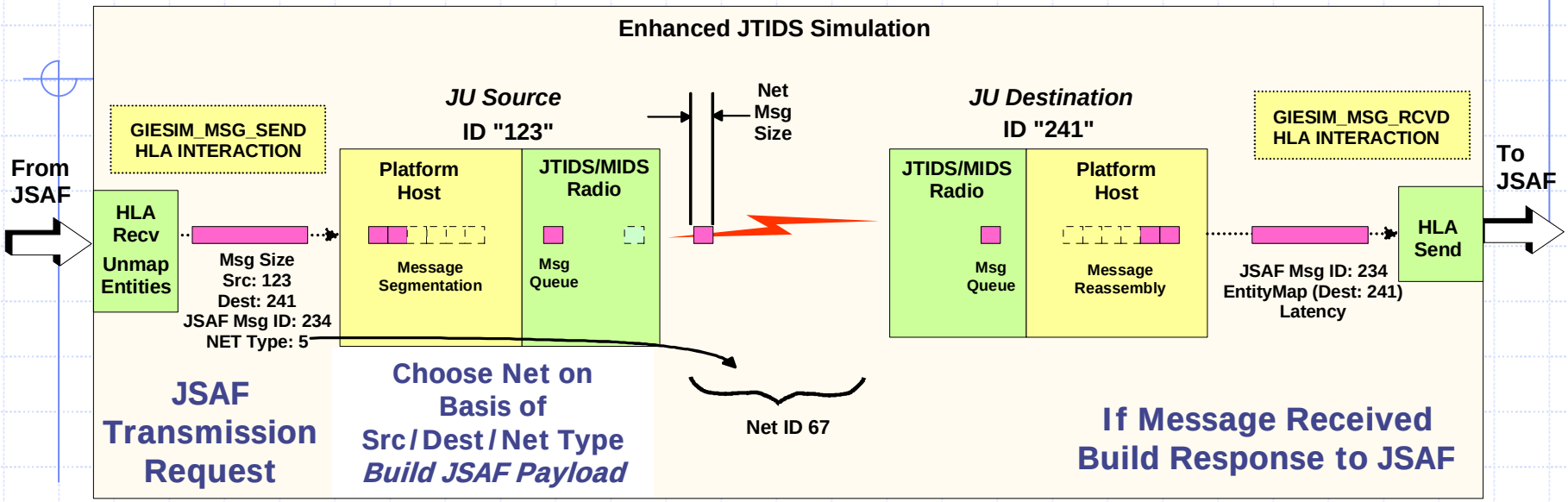


Link-16 Network Management System

Scenario & Network Design, Simulation



Enhanced JTIDS Message Handling

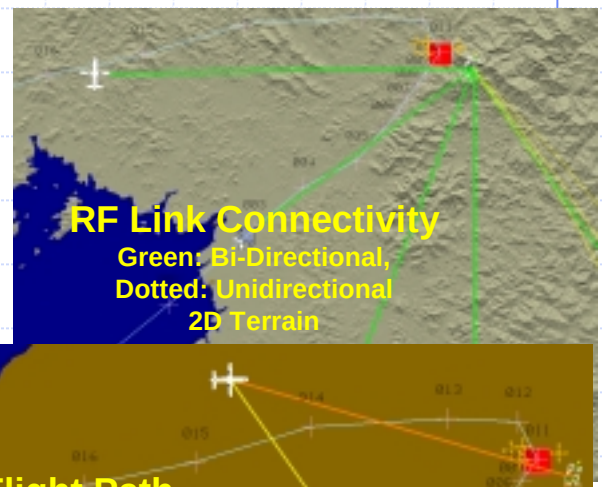


"Wow" Scenario JTIDS Networks

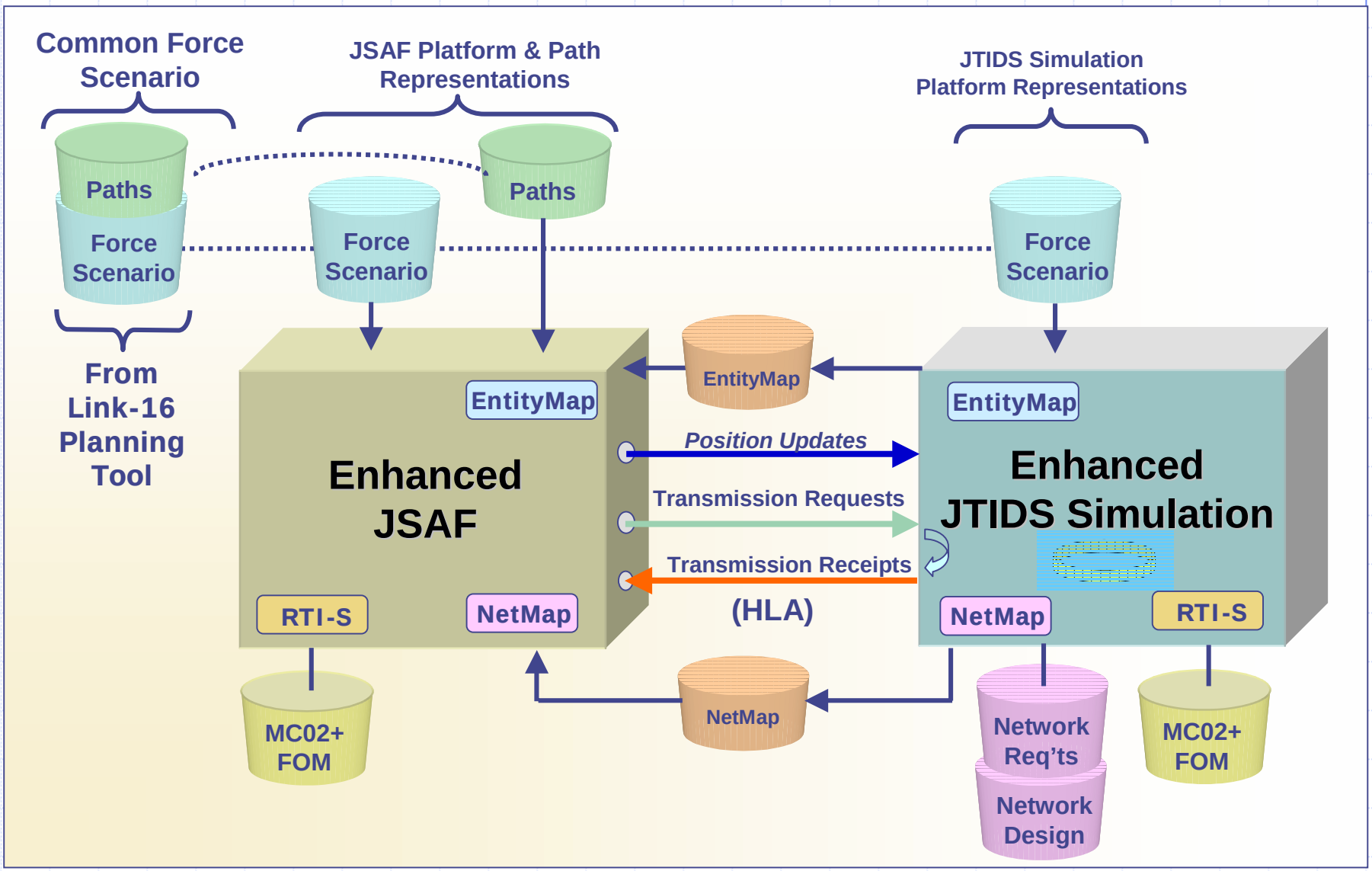
Net Purpose/Label	Net Type #	Link-16 Msg	Source	Destination	Access Mode	Response Time
Threat Warning	14	J15.0	SOF	F-15	Dedicated	1 Sec
Mission Control	15	J12.7	SOF	F-15	Dedicated	2 Sec
Engagement Status	16	J12.6	F-15	SOF	Contention	2 Sec

GIESim Link-16 Simulation Capabilities

- **Accurate & Fast Radio Propagation:**
  - Effects of 3D Terrain
  - Effects of Transmitter Power Levels & Antennas
  - Dynamic Calculation of Mutual Interference & Noise
- **Visualization:**
  - 2D Terrain & Contours, Political Areas
  - Platform Icons (Air, Sea, Ground)
  - RF Link Connectivity
  - Network Requirements including Relays
    - In tabular form
    - Dynamically between platforms over the terrain
  - Dynamic Position Updates
- **Dynamically Assess Network Performance**
- **Enhanced Interface to JSAF:**
  - Take external platform position updates
  - Handle network transmission requests & notify if resolved
- **Part of PSI Link-16 Network Management System (NMS)**



Component Integration



Results & Benefits

Before Merger

JSAF

- Realistic mission execution
- Realistic movement & weapons modeling
- No communication modeling

GIESim JTIDS

- Realistic network management
- Realistic tactical communications modeling
- No mission behaviors

After Merger

Enhanced JSAF

- **Who needs to talk to who**
- **Moves the platform**
- **Initiates communications**

Enhanced JTIDS

- **Builds tactical networks**
- **Updates communication links**
- **Resolves communications**

Unifies mission & communications simulation within common force scenario

Enables Network Centric Operations in JSAF

Future Plans

GIESim/JSB-RD Team

- **Experimentation:**
  - Larger Scenarios
  - Higher Traffic
  - Mission Threads
  - Computing Architectures
- **New Comm Models**
- **New Applications**
- **Transition to Advanced Technology Demonstration**
- **Adoption by large simulation Command**