

Conducting a Live-Virtual-Constructive Demonstration Using a Live-Virtual-Constructive Interoperability Portal

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Objectives

- Demonstrate the capability and training value of bringing virtual and constructive components into the Live Training Range environment via a Raytheon developed Interoperability Portal (IP)
- Cost Avoidance by reducing duplication: weapons models, threat systems, display and debrief systems, cross-domain solutions and information assurance strategies
- LVC = Not Live *or* Synthetic – Live *with* Virtual and/or Constructive assets



Distributed Simulation Protocols

- **Distributed Interactive Simulation (DIS)**
 - Used by USAF Distributed Mission Operations Network (DMON)
 - IBAR simulations in the Demo use DIS
- **High Level Architecture (HLA)**
 - Navy Aviation Simulator Master Plan (NASMP) and Navy Continuous Training Environment (NCTE) Standard
 - Joint Strike Fighter simulators will be HLA
- **Test and Training Enabling Network (TENA)**
 - Requirement for Tactical Combat Training System (TCTS)
 - Integrating Testing, Training, Simulation Across Distributed Facilities
 - Enables integration and interoperability among live range systems, facilities, simulations, and C4ISR.



LVC-Interoperability Portal (IP)

- **Portal Versus Gateway**
 - Gateway
 - **Typically translate data between two training protocols (one to one)**
 - **Interfaces are tightly coupled and communicate directly to each other**
 - Changing one interface usually necessitates a change to the other
 - **Can also translate data between different versions of a training protocol (Bridge)**



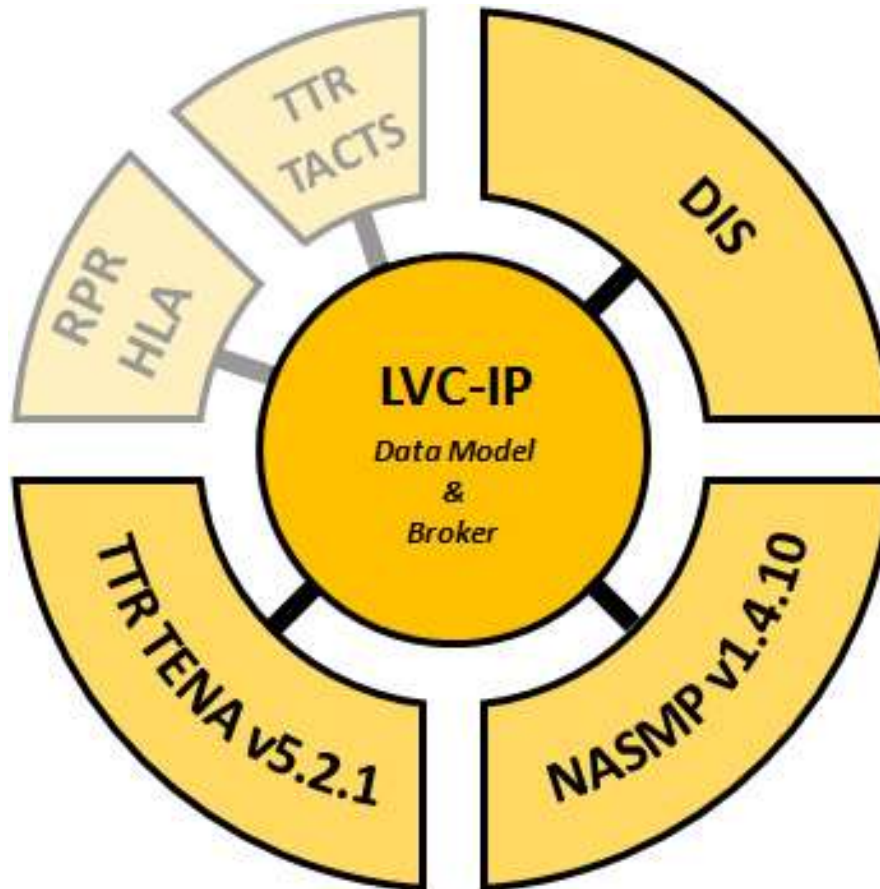
LVC-Interoperability Portal (IP)

- **Portal Versus Gateway**
 - Portal
 - **Can translate data between many training protocols (many to many)**
 - **Interfaces designed to be loosely coupled and do not communicate directly to each other**
 - Changing one interface does not affect other interfaces
 - **Can also translate data between different versions of a simulation protocol (Bridge)**



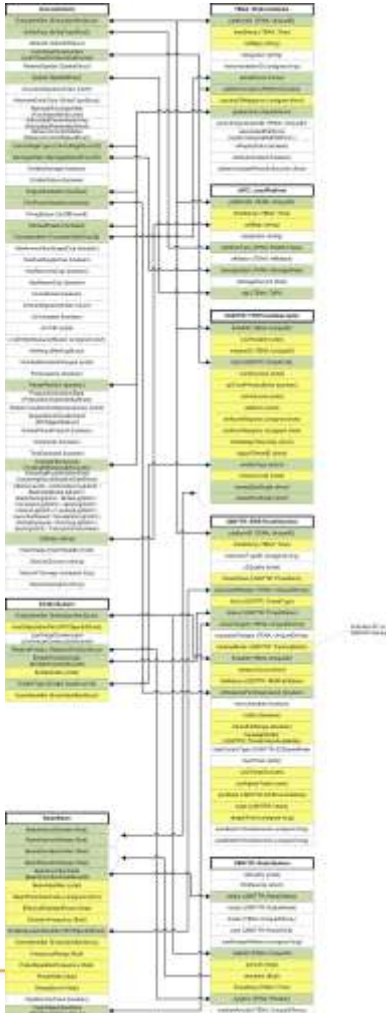
LVC-Interoperability Portal

Notional View



Data Element Alignment Issues

- Perceived by the TTR as ground based threats that are used to track and engage aircraft.



- Represented in NCTE HLA by the GroundVehicle, EmitterSystem, and RadarBeam objects.
- Represented in TTR TENA by the PlatformDetails, LandPlatform, TTRThreatDescriptor, EWSThreatInterface, and RadarSystem SDOs.
- Bidirectional transformation.
- Update rate of Threats from TTR is 10Hz.
- Update from NCTE to TTR will require heartbeat.
- Yellow represents non-optional attributes for which there does not exist a direct correlation.



Systems in Demonstration

Thompson Lab (TARIF) Systems

- Live Monitor (LM)
- Joint Display System (JDS)
- EW Server (EWS)
- Logical Range Object Model (LROM)
- TCTS recorded mission data

Michelson Lab (IBAR) Systems

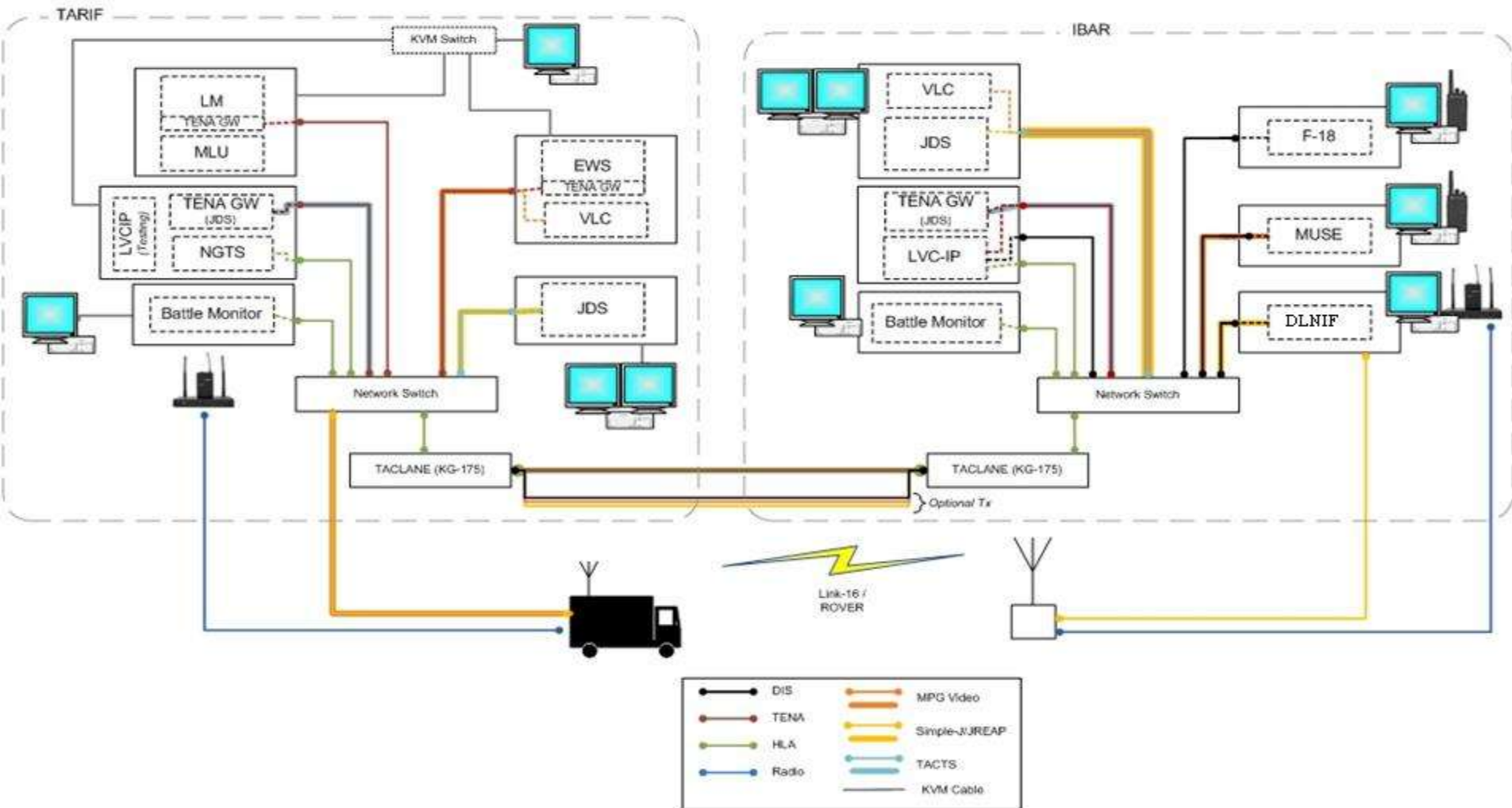
- Multiple Unified Simulation Environment (MUSE)
 - UAV Simulations
- Virtual Prototype Facility (VPF)
 - F-18 Simulator
- Data Link Network Integration Facility (DLNIF)
 - LINK 16 Van
 - ROVER

Next Generation Threat System

LVC-Interoperability Portal



LVC Demo Architecture



Execution and Lessons Learned

- **IA/Security**
 - Start early
 - Always takes longer and is more trouble than expected
- **Network connections**
 - Multi-cast vs. Uni-cast
 - Need to know what kind of signal you want to pass through the network and ensure your hardware is compatible with your plans
- **Data publication rates**
 - Ensure all your joined systems are either tolerant of varying data publication rates or force your systems to publish/update at a rate acceptable to all
- **Entity control determination**
 - Need to plan up front, which simulation will generate/control entities within the simulation and how does that simulation publish those entities? If this is done wrong, you may end up with dropped entities or ghosts

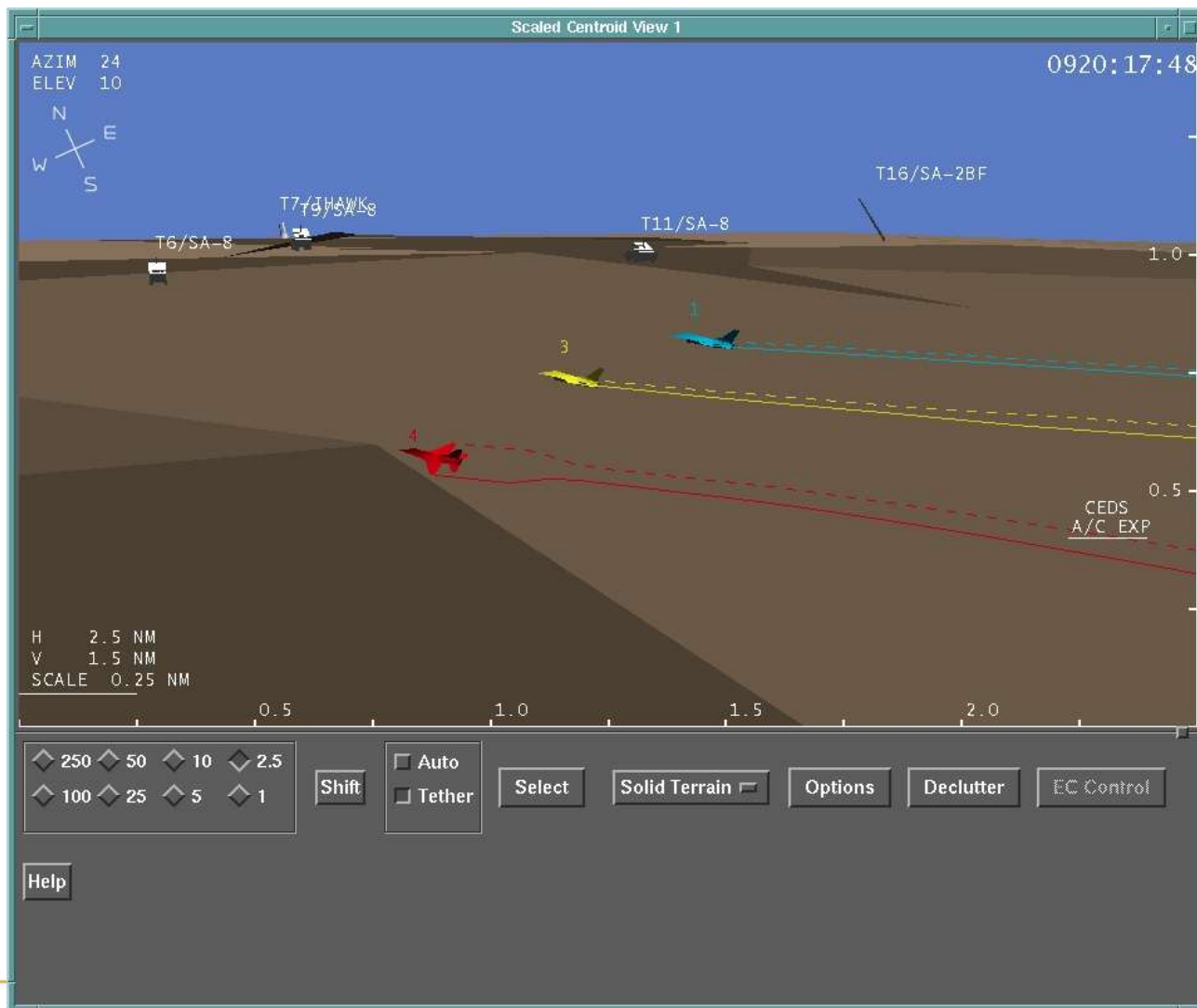




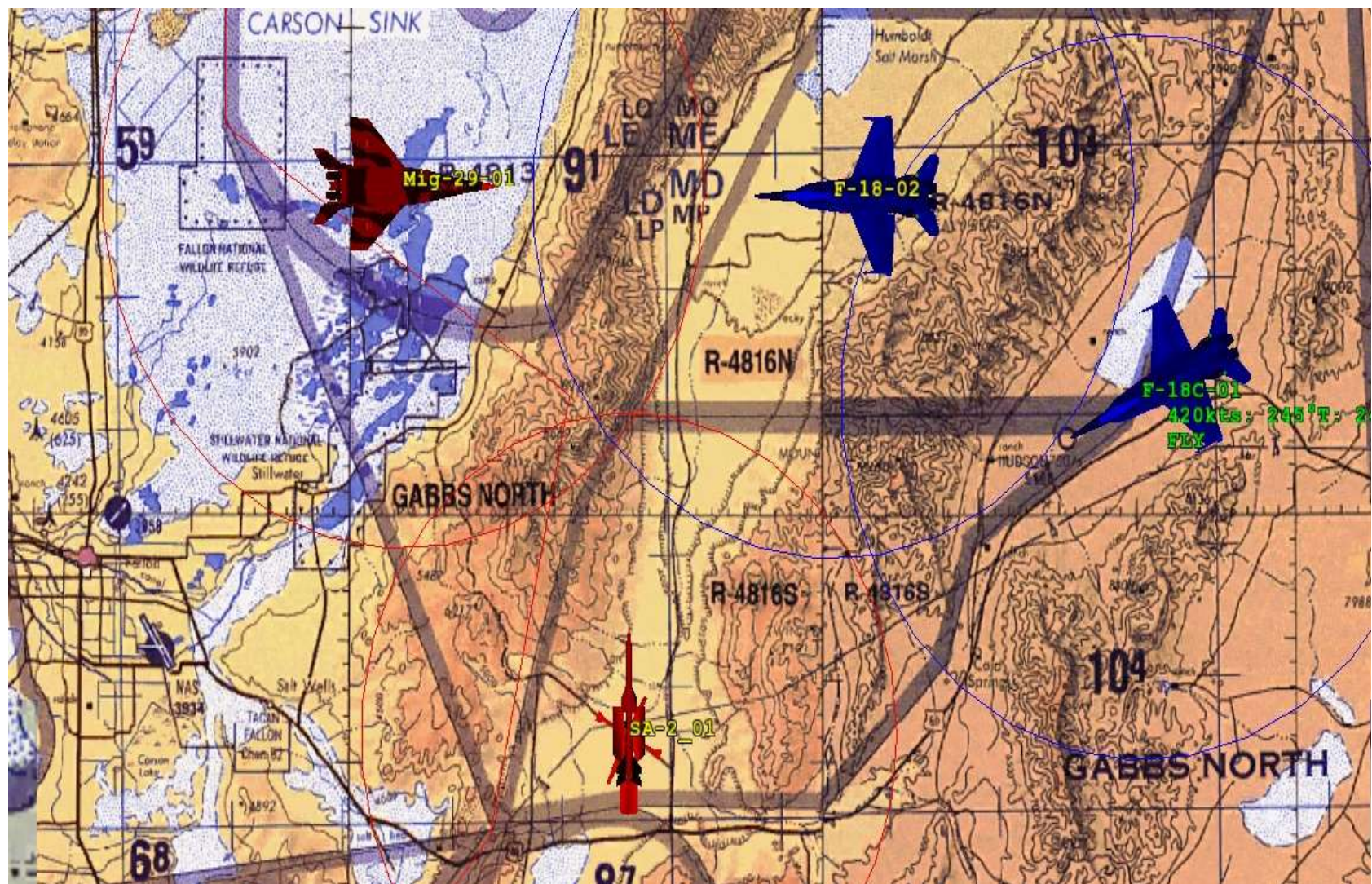
BACK-UP



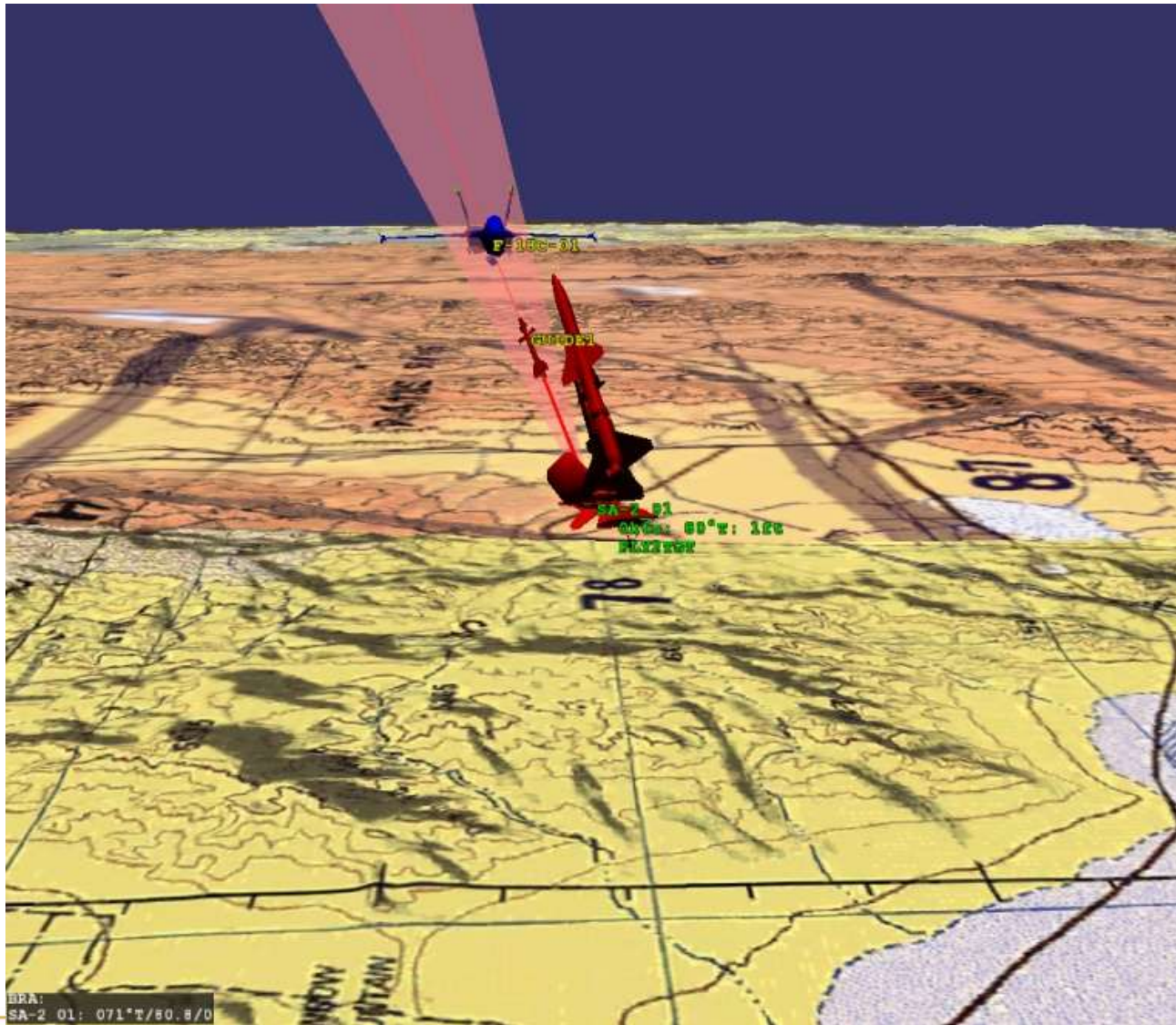
Joint Display System



NGTS Overview



NGTS Engagement



Unmanned Air Systems

