

NDIA
National Test & Evaluation
Conference

Unmanned Vehicle Synthetic
Environment

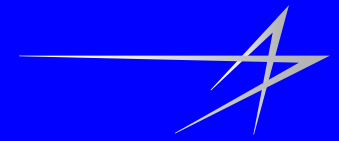
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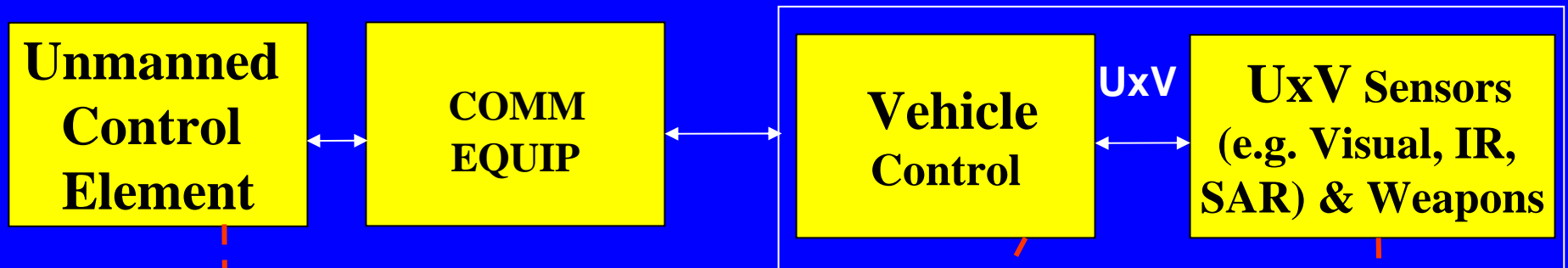
Introduction

- **Description of an Unmanned Synthetic Environment**
 - **Operational vs. Simulation Architecture**
- **Example Control Elements**
- **Video Examples of Real-time Sensor Images**
- **When a UxV Synthetic Environment (SE) could be used**
- **Corporate Research and Development Efforts**
 - **Unmanned Ground Vehicle Technology Transformation Program (TTP)**
 - **Fast Inshore Attack Craft (TTP)**
- **Conclusion**

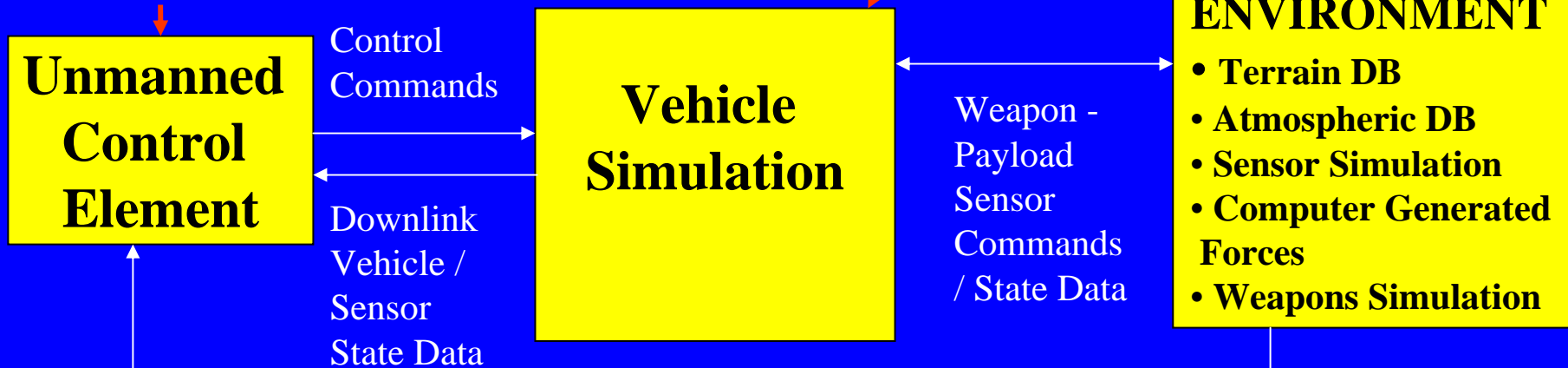


UxV Architectures

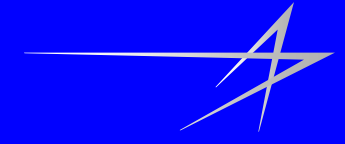
UxV Live/Operational Environment



UxV Simulation Environment



Simulated Terrain/Atmospheric Imagery (e.g. Visual, IR, SAR)

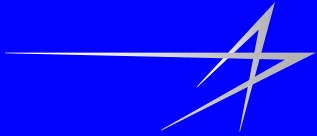


Example Control Element: Universal Controller Prototype (UCP)

The screenshot displays the FalconView software interface, titled "FalconView - LIMITED DISTRIBUTION - HRI-1.ugv". The main window shows a 3D terrain map with a grid overlay and various navigation tools. On the left side, there are three video feeds, each with a title bar and a play button. The bottom of the interface features a control panel with several sections:

- Channel Selection:** Buttons for "Select Chan. 1", "Select Chan. 2", and "Select Chan. 3".
- Query and Misc.:** A "Query" button and a "Misc." button.
- ESTOP:** A large red "ESTOP" button.
- Vehicle Information:** A table with columns for "Selected", "VID", "Vehicle Type", and "Mode". The current selection is "1" with VID "41" and Vehicle Type "SMSS".
- Sensor and Camera Controls:** Buttons for "Select Sensor1", "Select Sensor2", "Select Sensor3", "Select Sensor4", "Adjust Sensor", "Turn On Sensor", "Turn Off Sensor", "Set Mast Height", "PackBot Video", and "Set Cam Pose".
- Engine and Command Controls:** Buttons for "Stop Engine", "Start Engine", "Disable Cmd/Ctrl", and "Enable Cmd/Ctrl".
- Association List:** A dropdown menu showing "41 SMSS".
- System Status:** A "Log" button and a "CAUTION: Handgrips Activated!" message.

The Windows taskbar at the bottom shows the start button and several open windows, including "FalconView - LIMITED..." and the system clock showing "11:23 AM".



Example Control Element: Generic Unmanned-Vehicle Supervisory Segment (GUSS)

ANLAS Job Bar
Manager Comms Configuration System UAV Window Help
Weapon-Control UAV-Mission Control UAV-Sensor Control Prompts Screen Shot Ownship

UAV Mission Control
Go to Map Point
Follow Footprint
Execute Handoff
Execute Recovery
Threat Avoid: On/Off
Controlling: UAV-229, UAV-2, UAV-108
Teamed: UAV-229, UAV-2, UAV-108

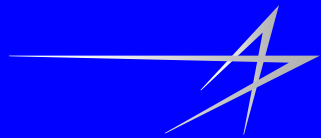
UAV 108 - Status Overlay
Mission Time Remaining: 1:54:46
Reserved Recovery Time: 0:10:54
Current Action Time-To-Go: N/A
Current UAV Action: Orbiting - Idle
UAV Location: 34:37:17N 43:40:32E
FOV Slant Range / Zoom: 2548m / 75%
UAV Comms Status: 100%
UAV Altitude (AGL/MSL): 8234ft / 8600ft
UAV Velocity (Air/Grnd): 75kt / 75kt

UAV Sensor Control - UAV 229
FOV Control: In, Out, Center, Slew
Burst Correct
Size Ref.: On/Off
Sensor Mod: EO, IR, Radar
Controlling: UAV-229, UAV-2, UAV-108
Arm Laser

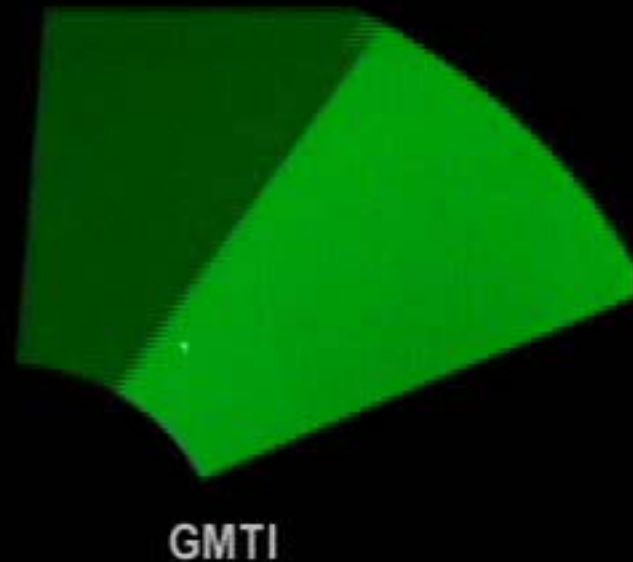
UAV 229 - Sensor Status Overlay
FOV Slant Range/Zoom: 3053m / 54%
UAV Orbit Offset / Ref. Object: Right / TEL (11m)
FOV Size: Width: 492m, Height: 504m
Burst/Correction: Add/Drop: n/a, Left/Right: n/a
Target Position: Location: N/A, Elevation: N/A, SampleCount: N/A, Est. Location Error: N/A
Reset

Search Control
Preplanned Execute
Pause/Resume
FOV Clutter: None, Low, Medium, High
Detect Mode: Auto, Manual, Remote
Targeting: Track, ATT, Payload, Id Aid, Report

UAV Sensor Control - UAV 229 (Video)
Video: Freeze, Zoom, Full, Invert
Aimpoint Coordinates: 34:39:57.80N 43:39:59.41E
Elevation: 105.5m
Close

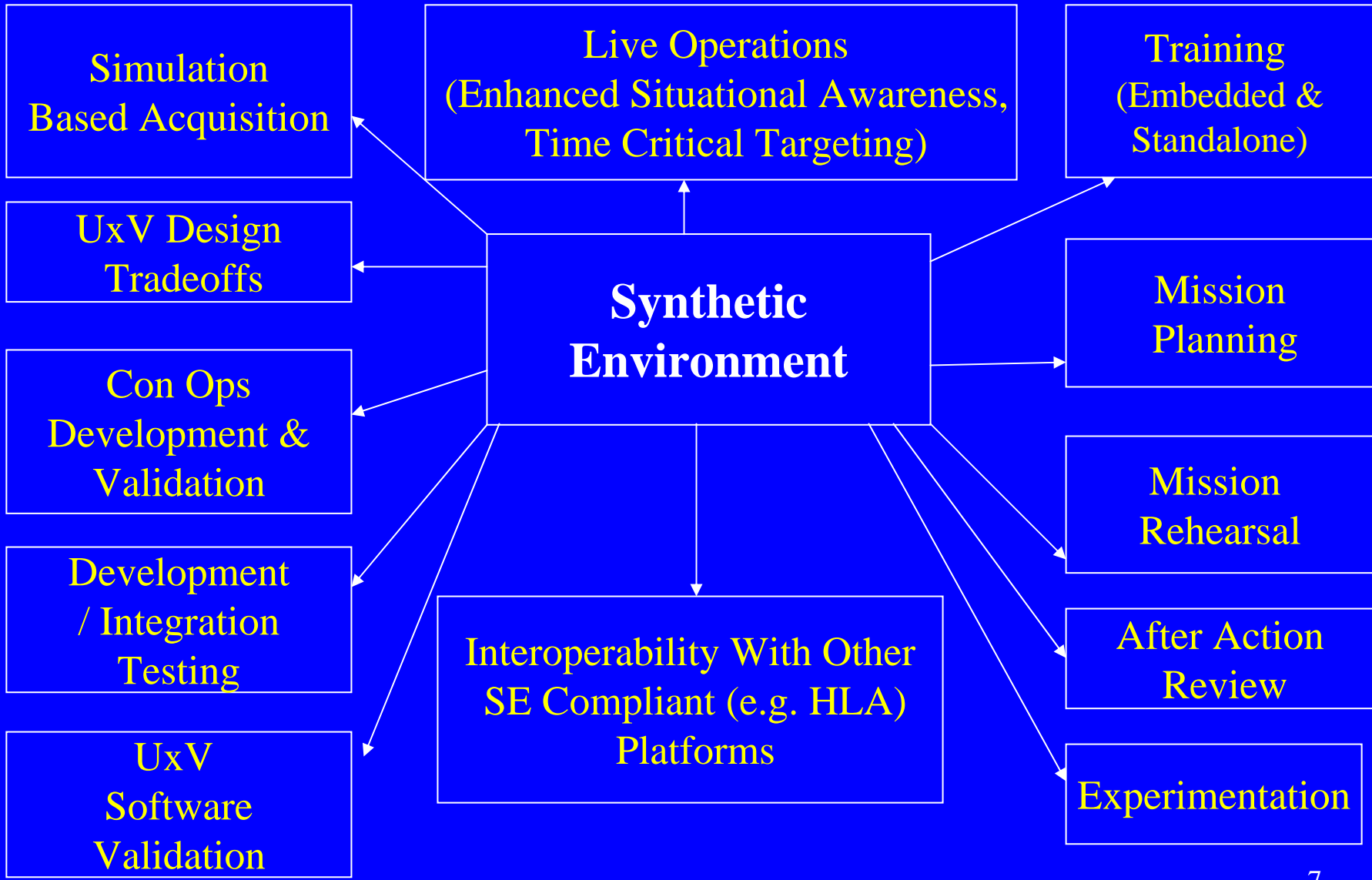


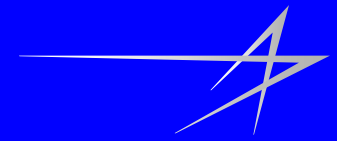
Video Example of UxV Sensor Simulation





When a UxV Synthetic Environment (SE) could be Used





Unmanned Ground Vehicle Technology Transformation Program (TTP)

Objectives:

- **Develop an Unmanned Vehicle (UxV) Simulation Test-bed to evaluate the impact of unmanned systems on combat effectiveness, lethality and survivability of the platoon**
- **Provide Tool for deriving unmanned systems requirements, CONOPS, and Tactics Techniques and Procedures**
- **Simulate a Light Infantry Platoon conducting operations in complex urban scenarios**

Key ideas to examine:

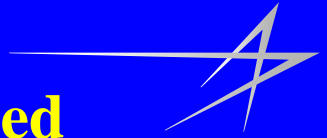
- **“Rules”/Logic For Multi-vehicle/Multi-controller Use**
- **Autonomy, Situation Awareness, Collaboration & Role De-confliction**
- **Control Hand-off At The Unit Level**
- **Element “Out Of Fight” Taking control Of Unmanned Systems**

Synthetic Environment Includes:

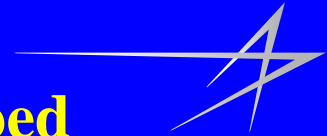
- **4 Simulated Video Channels: Multi-vehicle, Dynamically Selectable**
- **“Build-a-Bot”, Scalable, Unmanned Vehicle Simulation (UGV and VTOL UAV)**
- **Universal Controller Prototype with simultaneous control of multiple types of UxVs**
- **Joint Semi-Automated Forces (JSAF) for Manned Ground Vehicle and Dismounted Infantry Simulation**

Unmanned Vehicle (UxV) Simulation Test-bed

Demonstration System Layout



Unmanned Vehicle (UxV) Simulation Test-bed



Controller and Stealth Displays



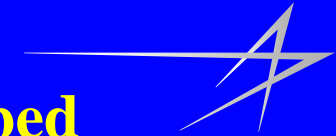
Unmanned Vehicles (UxV) Simulation Test-bed

Live Vehicle Static Displays



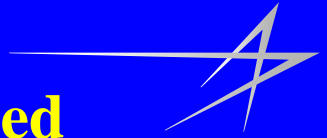
Unmanned Vehicle (UxV) Simulation Test-bed

Live Vehicle Static Displays

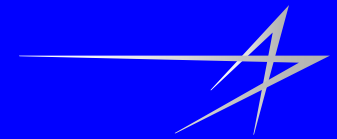


Unmanned Vehicle (UxV) Simulation Test-bed

Customer Demonstrations



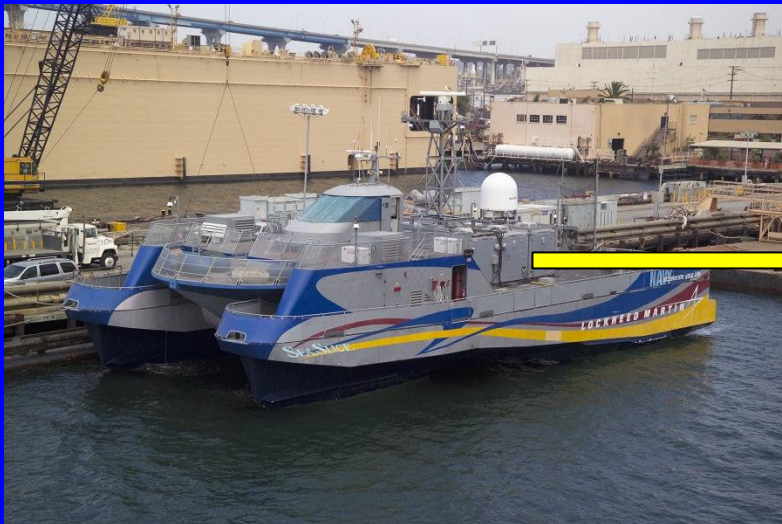
Corporate IR&Ds (Cont)



Fast Inshore Attack Craft (FIAC) TTP

- **Experimental platform used to demonstrate ship protection within 5 NM radius**
- **Uses LM Sea Slice vessel, Hellfire Missiles, Radar, EO/IR sensors and UAVs**
- **Live and simulated experiment performed on Sea Slice vessel operating in vicinity of Channel Islands and San Diego**
- **Synthetic Environment includes:**
 - **Embedded simulation capability – 10 simulated video channels**
 - **Santa Cruz / Santa Rosa Channel Islands / San Diego coastline DBs for exercise area**
 - **Radar Track and sensor simulation provided to onboard C4I devices**
 - **Hellfire simulation**
 - **Joint Semi-Automated Forces (JSAF) used to generate naval insurgent attack scenarios**

Operational Simulation & Visualization



Simulation Capabilities

- Full Fidelity Synthetic Environment
 - Natural representation of geo-specific operating areas
- Robust Semi-Automated Computer Generated Forces (CGF)
 - Hostile target boats, friendly and neutral clutter
 - Scenario Generation functionality
- Real-time Sensor Simulation
 - EO, IR, and Radar simulation at Combat Management Operator stations
- Realistic Weapons Engagement
 - Hellfire fly-out and engagement of CGF
- Embedded in Tactical Systems
 - Distributed environment driving situational awareness at each operator station

Operational Value

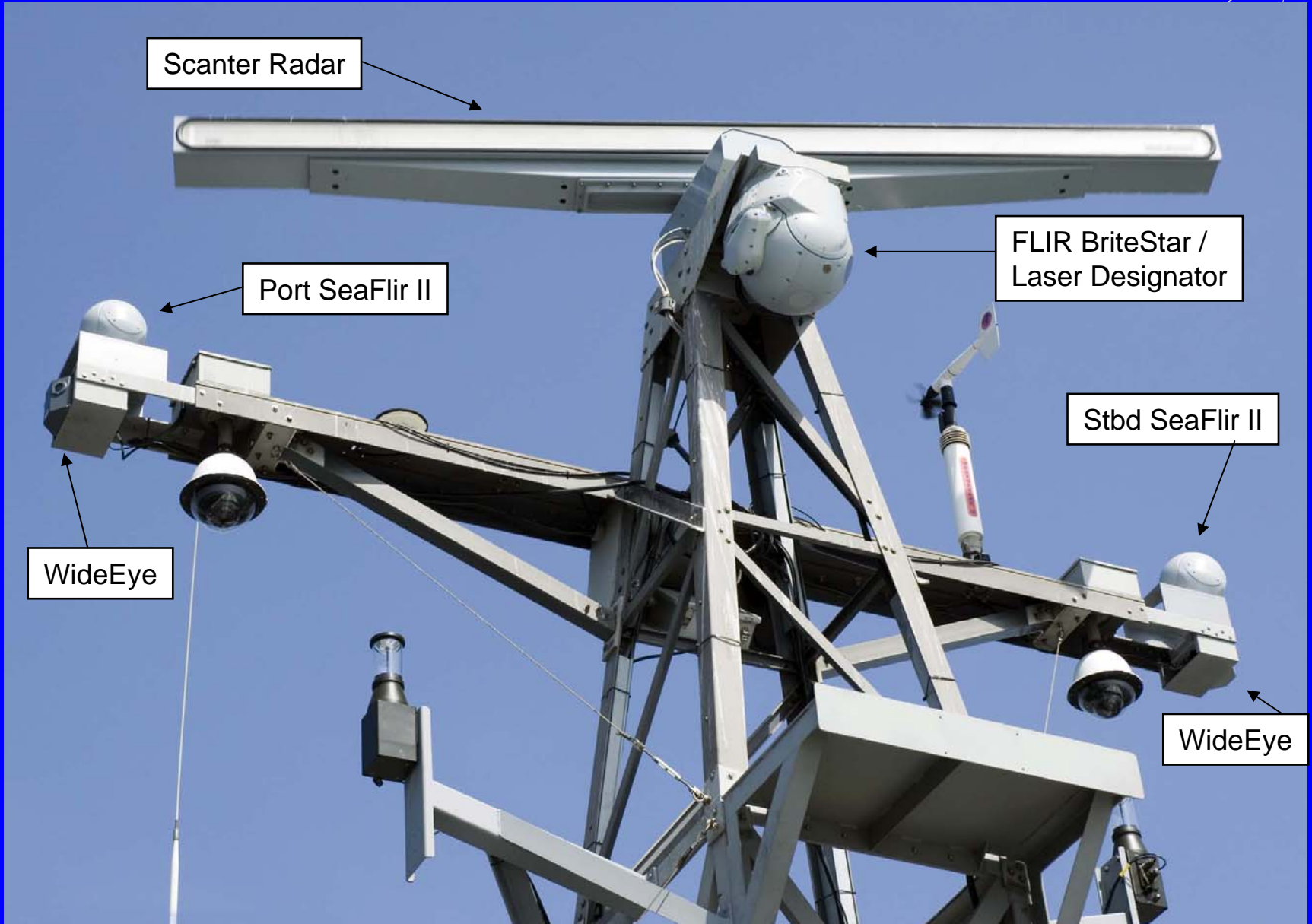
- Initial Team Training through Mission Rehearsal
- Concept Development and Experimentation
- Tactics and Doctrine Development

Sea Slice Dockside

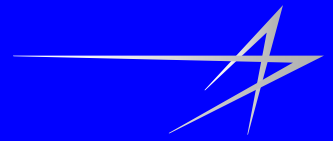


Lockheed Martin

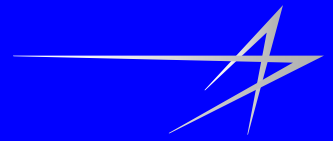
Sea Slice Mast Sensors



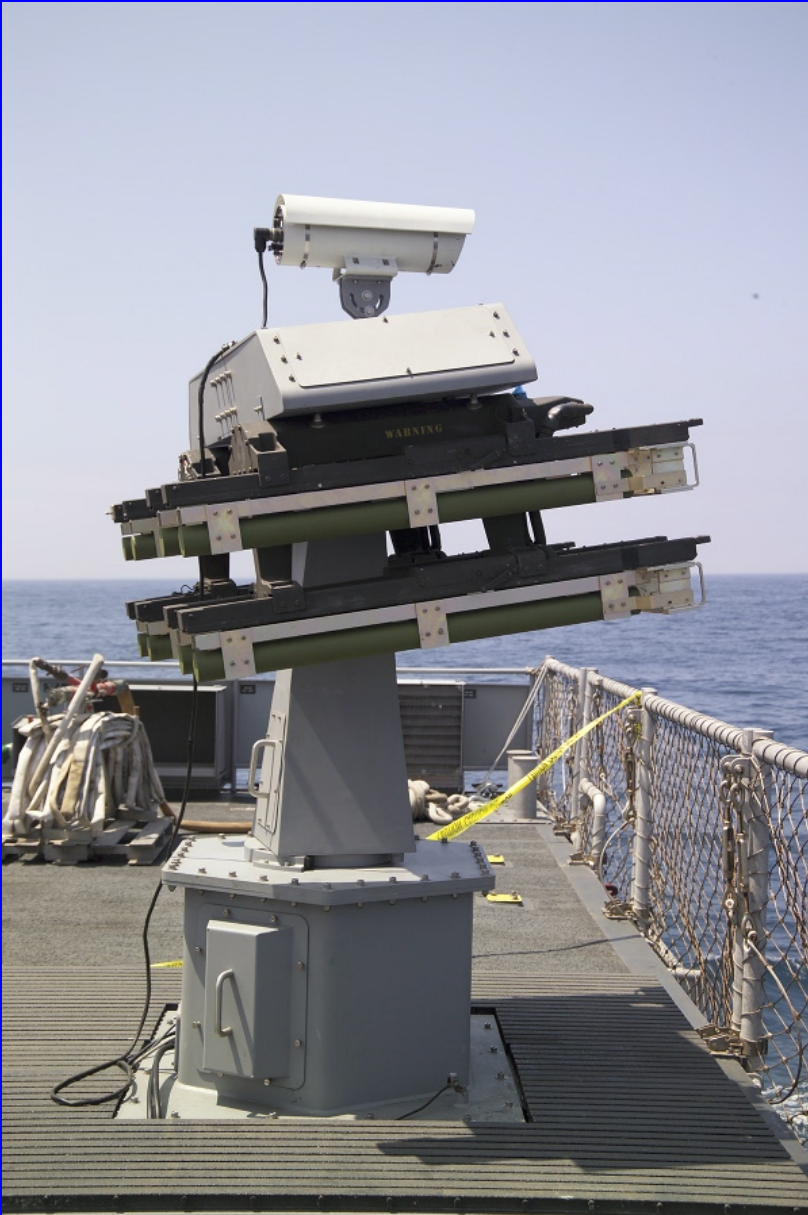
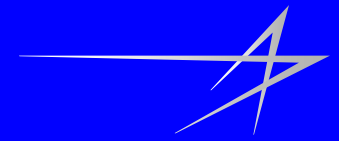
Simulated Attack

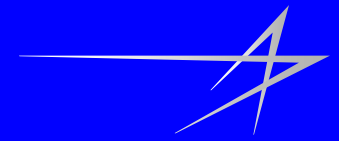


UAV Capture



Hellfire Launch Pedestal





Conclusion

- Transparency in HMI operations whether performing live or in simulation is the goal
- Embedded simulation provides extremely cost effective method to maintain team readiness
 - Required only 15 minutes on Sea Slice to transition from simulated to live operations
 - Enables disparate C4I devices to operate collectively on same Training and Mission Rehearsal scenarios
- A representative suite of equipment incorporating the described capabilities has been brought to the conference. The UxV configuration is available for demonstration and further discussion in the NDIA Display area. Please feel free to stop by.