

Project SLAAM: Lessons Learned in Live, Virtual, and Constructive (LVC) Integration with Common Range Integrated Instrumentation System (CRIIS)

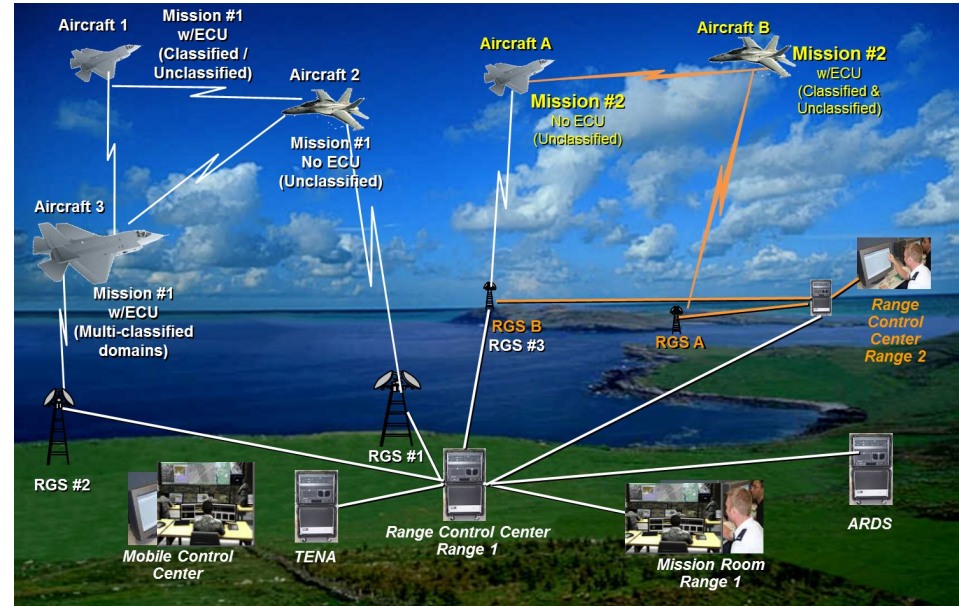
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Presented by Robert “Paco” Wolterman

Common Range Integrated Instrumentation System (CRIIS) High Level Overview

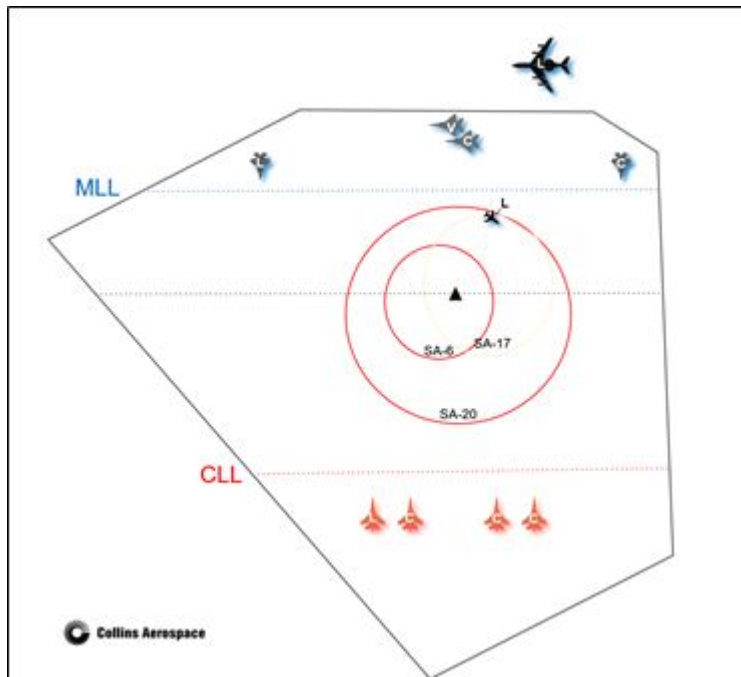
- Multiple Independent Levels of Security capable Test/Training System
- High Accuracy Time Space Position Information
- Aircraft Bus Connectivity
- 3 Different Aircraft Subsystems
 - External Pod
 - Internal Air Cooled
 - Internal Liquid Cooled
- Connections to existing infrastructure



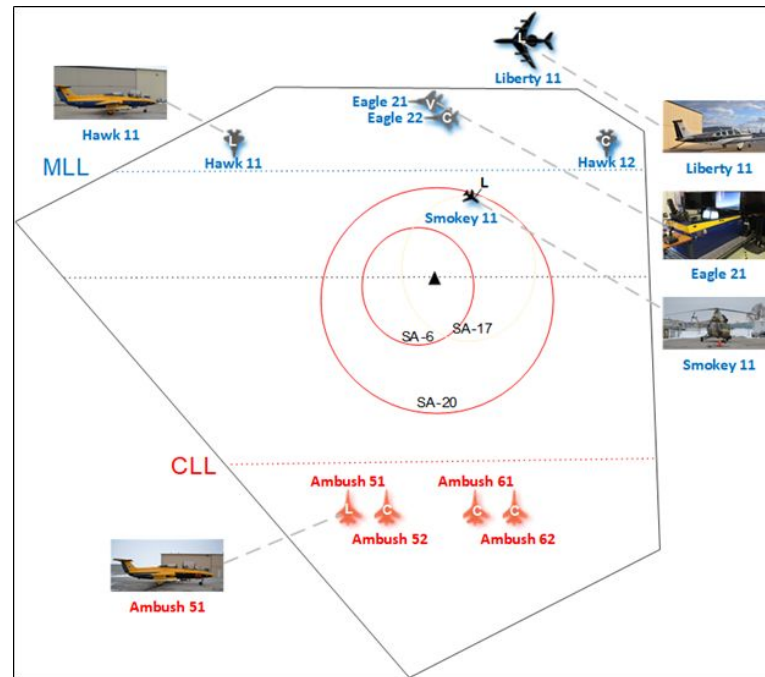
Project SLAAM

- Secure Live Air-to-Air Mission (SLAAM)
 - Live Virtual Constructive (LVC) exercise leveraging CRIIS Build 34 Baseline with modifications to enhance the Mission Room
- Conducted with the help of the Operators Performance Laboratory (OPL) at the University of Iowa
 - Aircraft Used
 - 2x L-29
 - 1x Mi-2
 - 1x Beechcraft A-36
 - Bathtub Simulator hooked into network as Virtual Player
- Demonstration Firsts
 - CRIIS Participant flown on a Helicopter
 - Build 34 State Based Messaging
 - Adaptation to a non US Tactical Aircraft
 - First use over the air

Project SLAAM: Scenario



SEAD Mission 4v4 with SA Threat



Live Asset Roles

Project SLAAM: LVC Players

Live	Virtual	Constructive
HAWK11: L-29 (BLUE)		HAWK12 (BLUE)
	EAGLE21: Bathtub SIm (BLUE)	EAGLE22 (BLUE)
AMBUSH51: L-29 (RED)		AMBUSH52 (RED)
LIBERTY: A-36 (BLUE Airborne Relay)		AMBUSH61/AMBUSH62 (RED)
SMOKEY: Mi-2 (BLUE UAS)		Surface to Air Threats (RED)

Demonstration Architecture

- OPL LVC Infrastructure
 - Provides Situational Awareness and “Sensor” feeds for Sensor-less Aircraft
 - Leverages QNT-200 datalink to push DIS to drive computers on L-29 aircraft
 - This is the surrogate for actual aircraft sensor package + tactical datalinks
- CRIIS
 - Build 34 Baseline
 - MIL-STD 1553 Connection from Participant Subsystem to Aircraft

LVC Infrastructure was segregated from CRIIS interfaces

CRIIS Configuration

- Minimal set of CRIIS Control Center (CCC) equipment mounted in Transportable Cases
 - 2 Ground Guard Drawers
 - Encryption Drawer
 - Recorder
 - Datalink Controller
 - Single Mission Room
 - 2 Minimal Remote Ground Stations
 - Datalink Only
- 3 CRIIS Configurations
 - 2x Light Pod with Encryption
 - 1x Air Cooled Internal Mount with Bypass
- 2 Datalink Relays
 - Helped with ramp connectivity to the RGS at the OPL Hanger
 - 1 Airborne
 - 1 Stationary



Mission Room Updates

- Mission Room Ground Guard was updated to enable CRIIS traffic to the Mission Room Subnet
- Link to OPL LVC Infrastructure (VR Exchange)
 - Required to populate “sensors” on sensor-less aircraft
- Added Network Switch
- Build 34 Uplink Generation

Mission Room Computers

OPCON-TCC	Constructive Scenario Master CRIIS to DIS Gateway SA Threat Control	Constructive Red Air Control	Constructive Blue Air Control	Stand-In Weapon Server
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Mission Room was Operated at Simulated System High

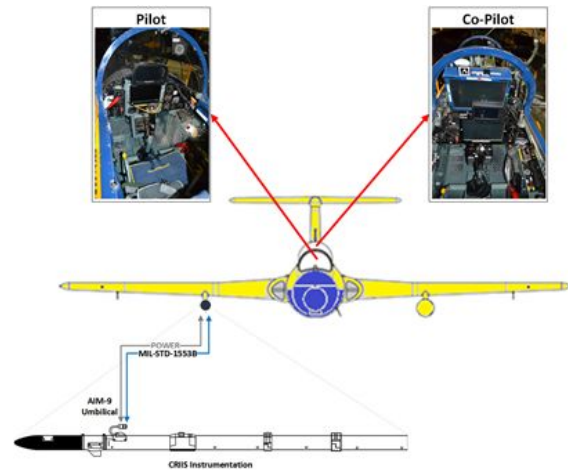
Mi-2 Updates

- Mounting Plate + Power for Air Cooled Internal Mount
- L-Band Antenna Mounts
- GPS Antenna Mount



L-29 Updates

- Aircraft has flown many missions with CRIIS Pods
 - Verified previously unused MIL-STD 1553 wiring to aircraft hardpoint
- Added MIL-STD 1553 capability to aircraft computers
 - Aircraft runs Collins Aerospace CoreSIM product
 - Created a basic 1553 ICD to understand specific aircraft states



Build 34 L-29 Configuration

- Hooks into simple 1553 messages on Aircraft to enable data flows to CRIIS Pod
- State Based Messaging (SBM) configuration created for Pods boot image
 - Look for specific bus state and downlink appropriate message
 - 4 Supported States
 - 2 Generic messages
- Handle push (from Ground) of Range Operator Controlled State Update
 - Enables Operator to affect training by supplying augmented state information

SBM allows ranges to push/pull from many 1553 messages at once

What about CRIIS Custom Messaging?

- Custom Messaging only works on one bus message at a time
- Cannot group multiple bus messages into a single message
 - TSPI is able to be interleaved with bus data for downlink only
- Can be used to push data to aircraft to affect the training scenario

CRIIS to DIS Gateway

- Convert CRIIS TSPI Solution to DIS Entity State PDU for display on DIS capable Moving Map
 - Enabled presenting Live assets as something else
- Convert received Build 34 State messages to DIS Data PDU for the Stand In Weapon Server
- Handle DIS Detonation PDU and correlate Entity ID to CRIIS PPID for Build 34 Uplink
 - Detonation PDU from Weapon Server and/or Constructive Force Controllers

Demonstration Execution

- Demo was performed on a very cold Iowa January day
- CRIIS Pods worked as expected
 - Build 34 messages were exchanged across the system
 - Ran at Simulated System High with KOV-74 inline
- CRIIS Air Cooled Internal Mount in Mi-2 worked as expected
 - Third ever CRIIS flight on a helicopter
 - Ran as Unclassified in a No ECU configuration
 - Had anomaly where track looked to be in Missouri
 - Low altitude flight due to clouds
 - No Airborne relay in the southern part of the operating area for part of the exercise
 - Helo had to land due to warning light
- Virtual player seamlessly integrated into the exercise
- Mission Room showed both levels of data highlighting the MILS capability of CRIIS

Takeaways

- CRIIS Ground Infrastructure is extensible to do the work required by Test/Training Ranges
- CRIIS (as JSAS v1.0) proved an extremely adaptable test and training system with secure, user-defined Live, Virtual, and/or Constructive interoperability
- Build 34 State Based Messaging exercised to prove capabilities for adoption to non objective CRIIS aircraft
- -10F day in January wasn't the best choice for weather
 - Proved actual operations of Pod and Air Cooled Internal Mount in those temperatures

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Backup

Abstract

This briefing will cover LVC integration with an unclassified 1553 interface on a test aircraft to exercise inherent capabilities in Common Range Integrated Instrumentation System (CRIIS). In addition, it will cover integration of potential upgrades to Mission Room Equipment that can improve capabilities at customer ranges while keeping the system MILS certified.

SLAAM System Architecture

