

# Communication, Navigation and Identification (CNI)

## Benefield Anechoic Facility



BAF CNI systems provide the test capability and visibility to understand a system's utility and performance in dense, system-of-systems (SoS), family-of-systems (FoS) operationally representative free-space (for true end-to-end test) RF environments with coherent, secure (supports all program classifications), known, and repeatable test conditions. The CNI suite consists of the Joint Communications Simulator (JCS) for friendly and hostile RF signals, the Commander's Tactical Terminal (CTT) for friendly situational awareness information, a Link-16 Simulation and Stimulation Suite for high fidelity Link-16 network testing, and the Global Positioning System Simulator (GPSS). A Global System for Mobile (GSM) Cell network is also available. The Link-16 suite, the KU-Band SatCom Link and Digital Integrated Air Defense System (DIADS) systems enable, respectively, network-centric, external, and threat-based distributed test operations.

The JCS system provides customers with a programmable, scenario-based, complex signal, information coherent RF generation system capable of creating a dense and realistic CNI RF environment. Pulsed signals such as IFF signals can be time shared providing RF emitter densities well in excess of 100's of signals and both interrogations and replies are available. It also provides FRUIT (friendly replies unsynchronized in time) for a SUT interrogator to experience an even more realistic or stressing environment. The JCS has a portable capability and AIMS certification is expected in 2014. AIMS-certified portable test sets augment the environment. Most importantly, the data content of SUT IFF interrogations and transponder responses can be decoded and deciphered by the JCS' SUT Data Capture capability.

The CTT provides a scenario-based, computer controlled radio/simulator with operational multi-channel UHF radios providing real world broadcasts of selected line-of-sight or satellite communications tactical data links. This creates a realistic joint battlefield environment for evaluation of system performance, interoperability, off-platform cueing, and situational awareness. Presently, the unit provides the Tactical Information Broadcast System (TIBS) or Integrated Broadcast Service – Interactive (IBS-I).

The suite used to generate, monitor, test, assess, and document Link-16 equipment, platforms, and networks for interoperability or performance in dense environments is the Advanced Communication Environment (ACE) / Faithful Timeslot Messaging (FTM). It renders a high-fidelity, operationally representative Link-16 network test environment with precise timeslot by timeslot signal time of arrival, signal strength, and message content per the network design and scenario. It delays signal arrival based on separation distance and attenuates the signal based upon sender's transmitter power, separation distance, and antenna patterns of the SUT and sender. Line of Sight (LOS) terrain occlusion or below the horizon conditions are programmable.

The Multi-Link System Test Training Tool (MLST<sup>3</sup>) presents a comprehensive RF rest-of-the-world simulation for testing Link-16 terminals and their platforms in fully populated, dynamic L-Band RF environments. The MLST<sup>3</sup> and ACE-FTM may operate together as an actual network and have the ability to interactively exchange Link 16 messages in a distributed environment and also introduce Link 16 message errors.

The Link Environment Gateway Simulator (LEGS) provides an additional Link-16 simulation capability as well as providing Link 16 terminal operational insight and recording. A Link-16 Management System (LMS-16) provides independent data capture of Link-16 RF transmissions.

The BAF's near-real world electromagnetic environment (EME) is used to characterize and test the system to enhance flight test or operational efficiency. Full up SoS and FoS tests with friendly and hostile scenarios are possible.



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## Communication, Navigation and Identification (CNI) Interactive Simulation



U.S. AIR FORCE

### Joint Communications Simulator (JCS)

- 72 simultaneous RF emitters (pulsed signals timeshared)
- 2000 emitters in a scenario
- Large gaming area - Simulates threats from 20 to 200+ miles
- IFF:
  - Interrogations: Modes 1, 2, 3/A, C, Mode S (all uplink formats), Mode 5 (Levels 1 & 2)
  - Interactive Replies: Modes 1, 2, 3/A, C, and 4
  - AIMS Certification (JCS): 2014
- Extensive waveforms & modulations: AM, FM, PM, PSK, FSK, MSK, frequency hopping Doppler, frequency agility, chirp,
- Antenna modeling: omnidirectional, dipole, fixed, conical, sector, circular,

### Other Radios and Test Sets

- IFF (AIMS Cert): IFF-45TS, AN/USM-719, (all modes interrogation and replies) T-47G (SIF Only)
- Military/Civil: ARC-210, PRC-117 available

### Data Link Capabilities

- Link-11/16 Multi-Link System Test & Training Tool (MLST3) – includes error message generation
- Link-16 Advanced Communications Environment – Faithful Timeslot Messaging (ACE-FTM)
- Link-16 Management System (LMS-16) - includes data capture of RF transmissions
- Commander's Tactical Terminal (CTT) Integrated Broadcast Service – Interactive (IBS-I)

### Data Link Capabilities (cont'd)

- Link-16 Environment Gateway Simulator (LEGS)

### JCS Free-space RF signal generation

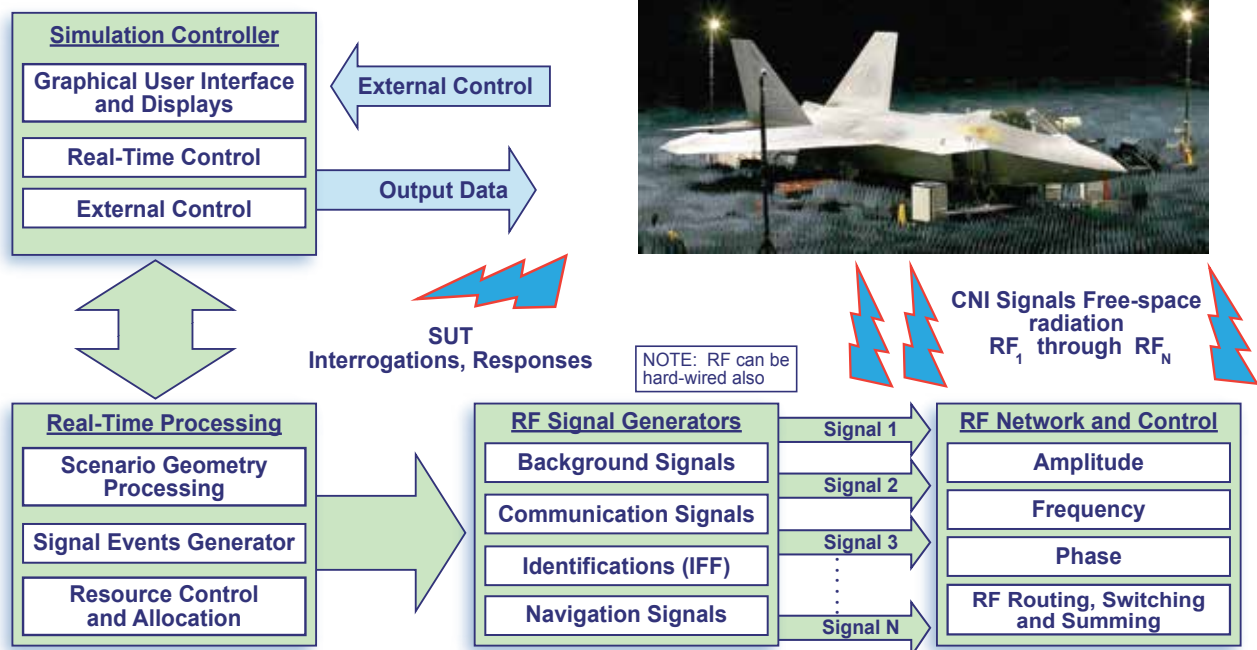
- Frequency range: 500 KHz – 18GHz
- ERP: 0 to -20 dBm (simulator output)
- Power levels to represent 50 dBm signal @ 30 NM
- Adjustable antenna height: 7 to 35 feet
- Aircraft Position: up to ~50 feet above floor on hoist or on turntable
- 18 Free-space locations - Tests all quadrants/sectors of an aircraft
- 72 Source channels – 3 Mixer bands
  - 4 High band (2-18 GHz)
  - 10 Mid band (400MHz - 2 GHz)
  - 4 Low band (500 KHz – 400 MHz)
- Dynamic range: 60 dB for both high and low power sources
- Spurious signals better than -60 dBc
- Minimum SNR: 60 dB (1 MHz bandwidth at rated power)
- Inter-pulse noise floor: -100 dBm/MHz

### JCS Phase Angle of Arrival Available

- Frequency range: 20 MHz – 2 GHz
- Directly connects to SUT antenna connections
- 16 channels (simultaneous), 32 ports
- Max ERP: -40 dBm (simulator output)
- Provides dynamic AOA (10 ms, framebased)
- SUT receive antenna characteristics
- All 72 free-space signals can be added as background

### JCS - One of the key CNI Interactive Simulators at the BAF

### System Under Test (SUT)



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