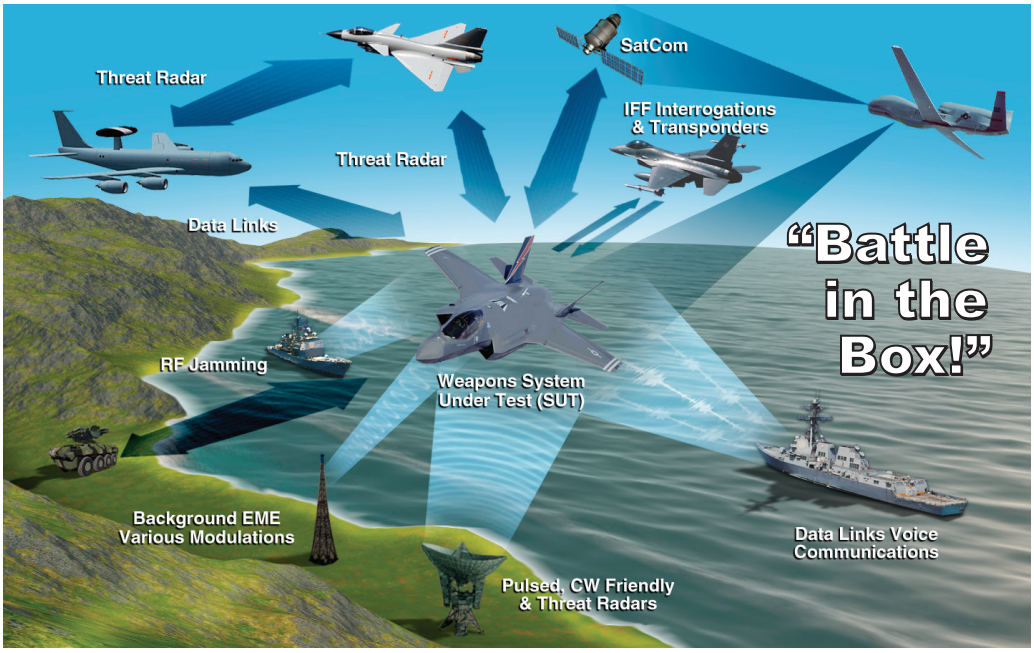
EW/IO RF THREAT SIMULATION

Benefield Anechoic Facility



The Benefield Anechoic Facility (BAF) has a highly sophisticated Combat Electromagnetic Environment Simulator (CEESIM). Virtually any RF threat system or friendly RF emitter can be generated for free-space radiation (or direct injection) - offering the most cost-effective means of testing and validating effectiveness of sophisticated Electronic Warfare (EW)/Information Operations (I/O) systems (RWR, ESM, ECM, ELINT, SIGINT, Radar and other RF systems) against today's threats and emerging threats not yet available at open-air ranges.

Our capability provides the opportunity to test these systems in a dense near real-world battle space electromagnetic environment (EME) with friendly and hostile RF emitters. Typical test applications include emitter detection, ID, response including ECM (jamming), ECM technique evaluation and optimization, direction finding, processing, prioritization, and reactive beam steering antenna characterization. This capability is also used to test integrated or stand-alone RF systems with other avionics such as a radar system and a jamming system on a platform.

We provide high-fidelity multiple, simultaneous emitters in a static or dynamic platform in simple or dense RF scenarios which model regional laydowns with typical background signals including some communication, navigation and identification (CNI) signals. The main RF free-space transmission subsytem is highly mobile within the BAF.

System threat analysts can program and radiate the frequency, power, pulse width, pulse shape, modulation, pulse repetition frequency, threat transmit antenna patterns (mechanical or electronic scanners), platform dynamics and perform complex frequency and inter-/intra-pulse modulations to meet test requirements.

A direct injection method provides up to 60 ports of phase and amplitude controlled RF injection. The system performs angle-of-arrival (AoA) antenna response modeling, which supports the testing of sensors that use amplitude-based and/or phase interferometer-based angle measurements.

The simulator may be operated in manually scripted scenarios, automated CEESIM event-driven scenarios, and scenarios built using realistic battle-space simulations from the 772 TS Digital Integrated Air Defense Simulator (DIADS). The system provides integrated operations with the Joint Communications Simulator (JCS, covered under separate fact sheet) to increase scenario density and threat signals in the CNI area. An interface is also provided for operation with the 772 TS Global Positioning System (GPS) simulator at the BAF.

In summary the BAF EW RF threat generation provides, in an installed systems environment:

- ✓ Hundreds of threat emitters, with thousands of modes currently programmed, including several which are exact reproductions of signals recorded from actual radar systems
- ✓ Complex, dynamic and dense EME delivered through direct-injection or free-space radiation
- ✓ Effective risk reduction opportunities for a wide spectrum of RF systems and tests prior to flight test or deployment

Benefield Anechoic Facility (BAF)

Electronic Warfare RF Threat Simulation

U.S. AIR FORCE

Pulse Train Generation

- 1010 moving players and 1010 emitters at a time
- 100 emitter events / sec, 1 µs resolution on events
- Pulse density (free space)
  - 1.35 million pulses per second (10 CW emitters)
  - 2.0 million pulses per second (No CW emitters)
  - ≤ 3% pulse dropout
- Pulse repetition interval: 1 µs to 600 ms
- Pulse width: 31 ns to 66 ms
- Extensive signal modulation: AM, FM, PM, Doppler, frequency agility, chirp, intra-pulse AM, FM, and PM
- Extensive scan modeling: omni, fixed, conical, sector, circular, raster, Palmer, multi-beam, electronic, others

Direct Injection

- Supports direct connection to SUT
- 6 channel 80 ports
- Provides pulse-to-pulse dynamic AOA
- Fully modeled SUT receive antenna characteristics
- Increased pulse density
  - 4.35 million pulses per second (10 CW emitters)

Direct Injection cont.

- 7.35 million pulses per second (no CW emitters)

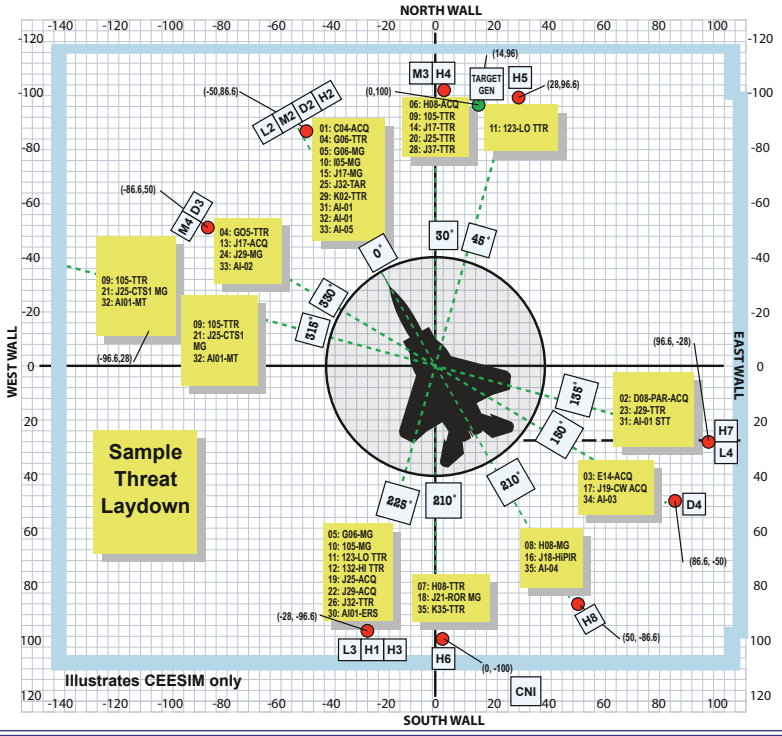
Free Space signal generation

- Frequency range: 100 MHz to 18 GHz
- ERP: up +47 dBm (low band) to +68 dBm (mid and high band)
- Power levels to represent a 120 dBm threat @ 20 NM
- Adjustable antenna height: 7 to 35 feet
- Aircraft Position: up to approximately 50 feet above floor on hoist or on turntable
- 20 Free space portable locations - Tests all quadrants/ sectors of an aircraft
- 24 Source channels (36 in CY2016)
  - 12 High band (6-18 GHz)
  - 8 Mid band (2-6 GHz)
  - 4 Low band (100 MHz - 2 GHz)
- 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

The BAF has two Digital Generation Subsystems (DGSs). A DGS generates the pulse descriptor words (PDWs) that define each threat pulse. The DGSs can generate up to 1010 simultaneous emitters. For a typical maximum pulse density free-space scenario 269 pulsed emitters (256 low PRF, 7 medium PRF, and 6 PDs) and 5 CWs can be generated. Pulse densities achieved can be as high as 1.35 million pulses per second with a dropout rate of ≤ 3% (2.0 million pulses per second without any CWs). Much higher densities are achievable in the direct injection (non-radiating) mode. The PDWs are fiber optically sent to the remote RF channels. Signals are modulated, filtered and transmitted through the appropriate transmit antenna to the SUT. The transmit carts are positioned in the chamber as required by the test requirement/scenario. The number of simultaneous threats depends on the duty cycle of the chosen emitters and the desired fidelity of the simulation. Pulse dropouts are directly related to the pulse width and PRI/PRF (resultant duty cycle) of the chosen signals. With two DGSs an extremely high number (1010) of beams can be generated.

- Aircraft hoisted to desired height - up to ~ 55 ft or on the 80 ft turnable
- Threat height adjustable 7-35 ft.
- 24 channels at 20 locations
  - Determines AoA (360˚) (aircraft rotation is also possible)
- Channels are in 3 bands
  - H - 6 GHz to 18 GHz
  - M - 2 GHz to 6 GHz
  - L - 100 MHz to 2 GHz
  - D - Dual channel H+M

- Threats are assigned to channel location
  - Selected based on threat requirements
  - Dedicated or multiplexed for density
  - Dyamically reassigned as required
- Threat timing controlled by test conditions
  - Scripted or manual
  - 1v. 1, 1 v. many
  - All at once or in sequence
- All transmit signals verifiable with pulse monitoring & recording (RF and digitally)
- All chamber free space emission is monitored



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