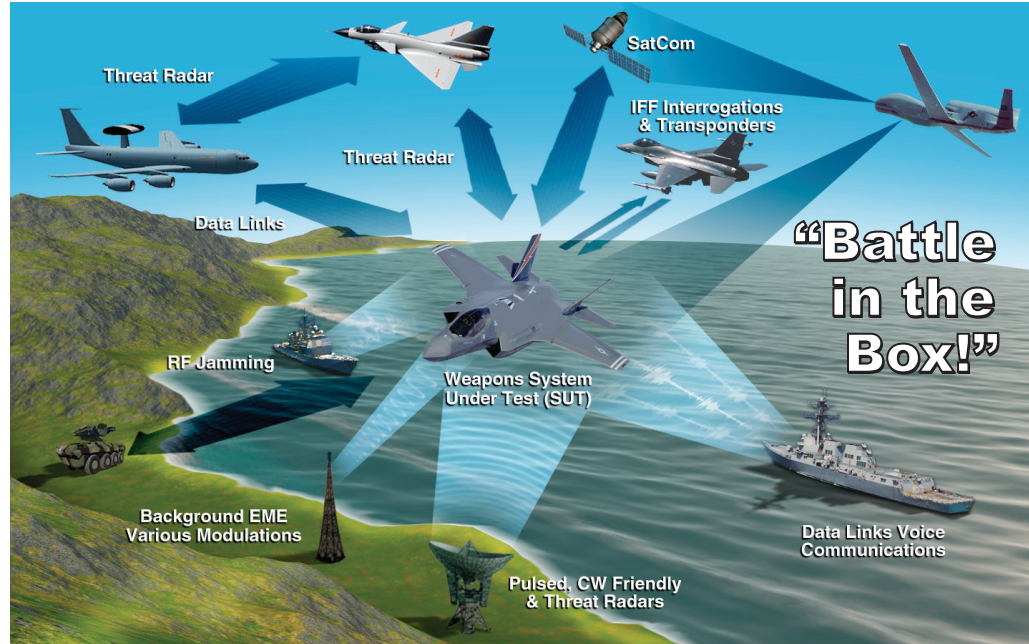


# EW/IO RF THREAT SIMULATION

## 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 - offering the most cost-effective means of testing and validating effectiveness and suitability 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 at full transmitter power), 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 subsystem 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 the test requirement.

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. Direct injection of the threats into a system under test is also available with the BAF's threat simulation architecture.

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

- ✓ Hundreds of threat emitters, with thousands of modes currently programmed, including several which are exact reproductions of signals recorded from actual radar systems
- ✓ Threat densities and signals not available at open-air ranges
- ✓ Complex, dynamic and dense EME delivered through free-space radiation to the system-under-test's antennas
- ✓ 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  $\mu$ s resolution on events
- Pulse density (free-space) with one DGS\* and 36 independent RF channels
  - 2.45 million pulses per second for a typical EW scenario without CW emitters
  - 1.80 million pulses per second for a typical EW scenario with 10 CW emitters
- Much higher densities are achievable for strictly generic pulse density tests
  - $\leq 3\%$  pulse dropout
- Pulse repetition interval: 1  $\mu$ s 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

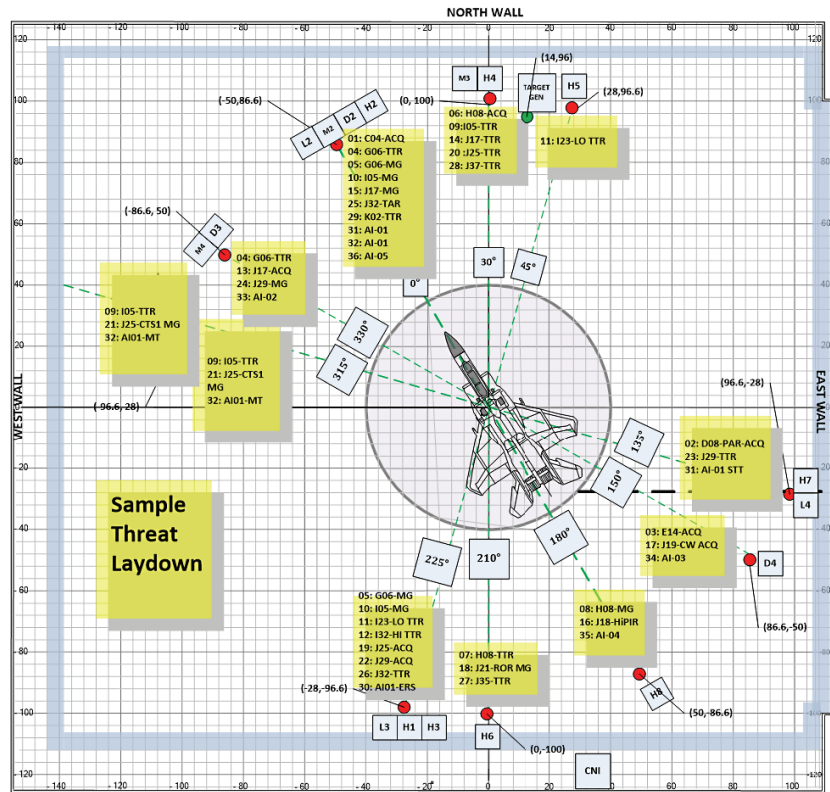
- Supports direct connection to SUT

### 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
- 26 Free space portable locations - Tests all quadrants/sectors of an aircraft
- 36 Source channels
  - 12 High band (6-18 GHz)
  - 20 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 threatpulse. 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 1.8 million pulses per second with a dropout rate of  $\leq 3\%$  (2.45 million pulses per second without any CWs). 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 26 transmit carts are mobile and 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 ~ 50 ft or on the 80 ft diameter, 170-ton capacity turntable (360°)
- SUT rotated on turntable or hoist
- Threat height adjustable 7 – 35 ft
- 36 channels at 26 highly mobile locations providing 360° flexibility + SUT rotation
- Channels are in 3 bands
  - H: 6 to 18 GHz
  - M: 2 to 6 GHz
  - L: .1 to 2 GHz
  - D: Dual channel H + M
- Threats are assigned to channel location
  - Selected based on threat reqm'ts
  - Dedicated or multiplexed for density
  - Dynamically reassigned as required
- Additional CNI simulators are available for threat and friendly CNI emitters
- Threat timing controlled by test conditions
  - Scripted or manual
  - 1 v. 1, 1 v. many
  - All at once or in custom sequence
- All transmit signals verifiable with pulse monitoring & recording (at RF and digitally)
- All chamber emission free space is monitored and recorded as required



Sample Threat Laydown (BAF)

Chamber is 264 ft L x 250 ft W x 70 ft H



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