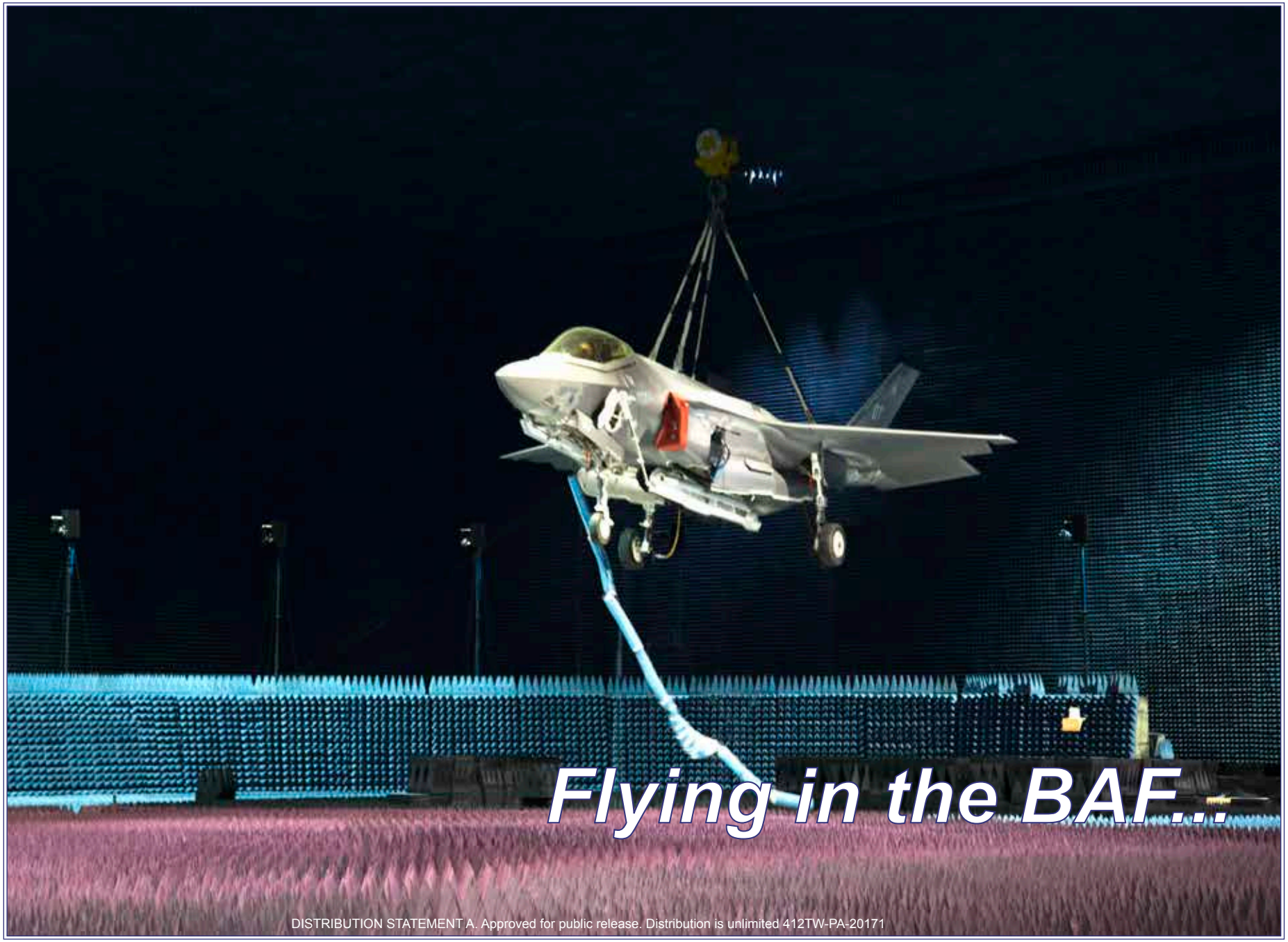
Electromagnetic Spectrum (EMS) Systems Test

Benefield Anechoic Facility



Benefield Anechoic Facility (BAF)

Electromagnetic Spectrum (EMS) Systems Test

U.S. AIR FORCE

The BAF, located at Edwards Air Force Base, California, is a large anechoic chamber test facility, providing an indoor, virtual open-air range – *A battle in a box*. It can support a majority of the current and planned Department of Defense (DoD) aircraft, with very few exceptions, to test their radio frequency (RF) systems for wide-ranging installed systems test. The primary purpose of the BAF is to test and integrate avionics systems in a secure, controlled, and repeatable electromagnetically isolated free-space environment, using state-of-the-art simulation and stimulation technology, that closely replicates the real combat mission environment.

At the BAF, the 772 Test Squadron applies comprehensive systems and test engineering principles to developmental and operational test and evaluation (T&E) of military and commercial RF systems. With the increased demand posed by integrated, EW/IO and net-centric RF systems and their required interoperability and compatibility, the BAF is *a valuable tool* to test highly integrated weapons systems.

Physical Characteristics and Support

- 264 ft. L x 250 ft. W x 70 ft. H
- 175-ton, 80 ft. diameter turntable
- Two (2) 40-ton hoists

Upgrade In work: one (1) 120-ton hoist

Anechoic Chamber RF Characteristics

- RF shielding from external environment: ≥ 100 dB (0.1 – 18 GHz)
- Typical quiet zone isolation
  - 0.5 GHz* ≥ 72 dB
  - 1.0 GHz ≥ 84 dB
  - 2.0 GHz ≥ 96 dB
  - 3.0 – 18 GHz ≥ 100 dB

*Below 0.5 GHz desirable quiet zones are achieved with case-by-case configurations and special techniques.

Chamber Applications and Functionality

- Complete end-to-end installed systems test in a free-space RF environment
- Dense, high fidelity RF threat simulation and verification
- Electronic countermeasures collection, measurement and analysis
- Radar target return and ECM simulation for FCR and ECCM tests
- Antenna characterization and pattern measurement
- Electromagnetic environmental effects (E^3) measurements
- Intra- and Inter-Systems Electromagnetic (EM) Interference and Compatibility (EMI/EMC)
- Global positioning system (GPS) signal simulation and test
- Expert RF and EW systems test engineering expertise and know-how

Security

The BAF is designed to meet the classification levels and security requirements of most test programs. Appropriate security measures are implemented when the test program has special security requirements.

Typical Manned and Un-manned Vehicle Systems Tested

- SIGINT and ELINT systems
- Network centric systems of systems
- Communications and navigation and identification (CNI) and data links
- GPS (including anti-jam and CRPA)
- Airborne radar systems, seekers
- Radar warning receivers (RWRs)
- Electronic Countermeasures (ECM) (On-board and off-board)

EW RF Threat Simulation and Generation

- Frequency range: 100 MHz – 18 GHZ
- High fidelity, high density* Combat Electronic Environment Simulator (CEESIM) based

  *The number of simultaneous threats depends on the chosen emitters' duty cycles and the desired simulation fidelity (e.g. 1.8 million pulses per second with 5 CW emitters and a dropout of ≤ 3%, 2.45 million pulses per second without CWs.)
- Direct Injection or free-space radiation to the SUT
- 36 channels (dedicated or multiplexed) - 360° azimuth coverage
- Variable elevations based on SUT-Chamber geometry
- Dynamic user-defined scenarios
- SUT receive antenna characteristics

Upgrade In work: Next-Gen EW Emitter Generator (NEWEG) and BAF free-space radiation upgrades with Advanced Dynamic Transmit Array (ADTRA), a 28-channel AESA-based threat emitter system.

Radar Target Generation and ECM Generation

- Programmable air-to-air radar return (echo) generation
- Operational band width (0.3 to 40 GHz)
- Electronic countermeasures (ECM) for radar operational evaluation

Upgrade in work: expanded air-to-air capabilities plus air-to-ground

Communication, Navigation and Identification

- Frequency Range: 20 MHz – 2 GHz
- Direct Injection or free-space radiation at the SUT
- High fidelity, high density Joint Communications Simulator (JCS)
  - 72 simultaneous RF emitters (pulsed signals timeshared)
  - IFF: Interrogations and replies - modes 1, 2, 3A, 4, 5, and S
- All 72 free-space signals can be added as background
- Additional NAVAIDS test equipment available on CNI

Data Link Capabilities

- Ku-Band SATCOM Link provides remote monitoring and control of UAVs or RPVs from customer mission control centers
- Link-11/16 Multi-Link System Test & Training Tool (MLST3)
- Battlespace Operations Support System (BOSS)
- Link-16 Environment Gateway Simulator (LEGS)
- Link-16 Management System (LMS-16) data capture of RF transmissions
- Link 16 real-world connectivity

Electromagnetic Interference/Electromagnetic Compatibility

- Source – Victim scenarios (antenna isolation or coupling)
- High Intensity Radiated Fields (HIRF), Radiated Susceptibility, Electromagnetic Vulnerability (EMV), Hazards of Electromagnetic Radiation to Ordnance (HERO)
- Radiated and conducted emissions (intended and unintended), EMCON

Antenna Characterization and Pattern Measurement

- Stand-alone and installed antenna measurements
- Characterizes antenna system performance in an installed configuration with vehicle influence
- Large or fighter-sized aircraft on turntable or hoisted
- Rapid automated amplitude, phase and polarization collection – up to 16 antennas simultaneously
- Antenna positioners available up to 90,000 lbs vertical load

State-of-the-art Data Processing & Instrumentation Resources

- Instrumented RF, digital, and video infrastructure
- Real-time chamber video and SUT data systems
  - Monitor and display tests in the test control room
  - Measure/record PCM, RS422, RS232 and Mil-Std-1553B sources
- RF emitter generation activity files for CEESIM and other simulators
- Time correlated data files, data formats and media as requested
- Customer instrumentation hosted as requested

Support Utilities Systems

- Aircraft Electrical Power:
  - AC: 400 Hz AC – 115 VAC or 230 VAC
  - DC: 28 VDC, 270 VDC (Supports F-22 and JSF)
- Ground support equipment power:
  - AC: 115 VAC, 208 VAC, 480 VAC (60 Hz), 380 VAC (50 Hz)
  - DC: 28 VDC
- Liquid cooling: Coolanol, PAO, EGW and chilled water
- Air cooling: Large capacity
- Hydraulics: Two hydraulic systems

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