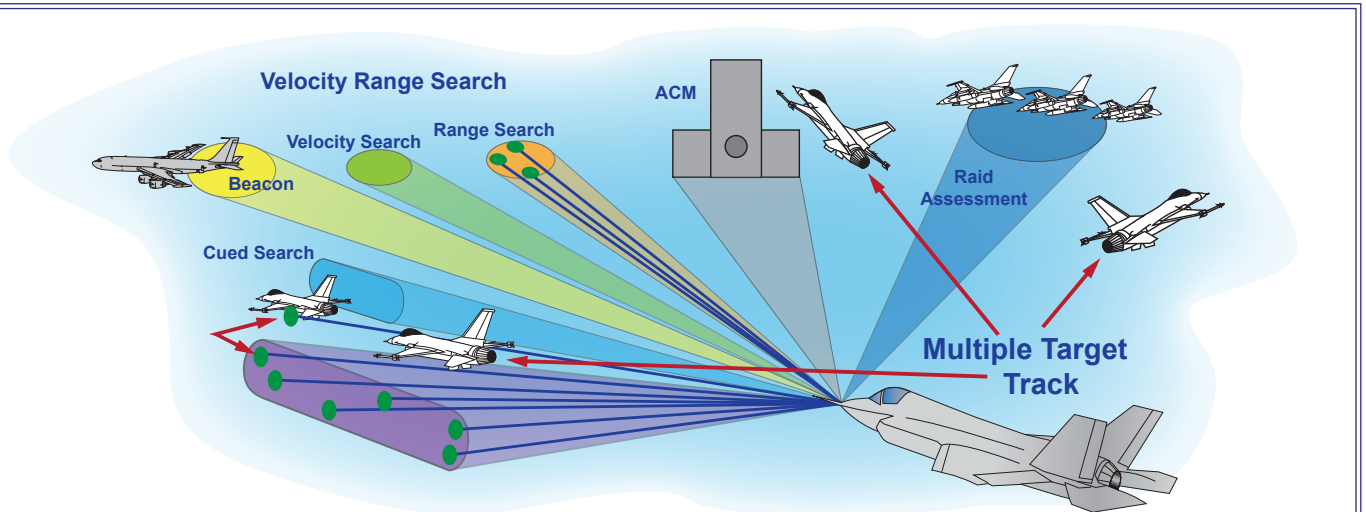


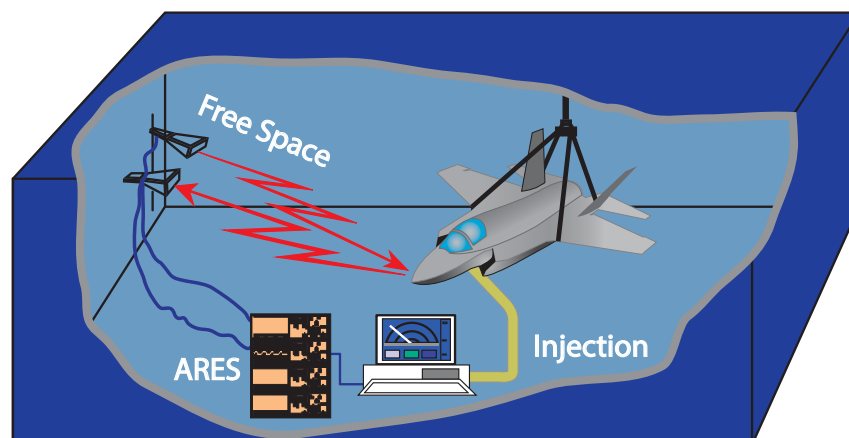
Radar Target and ECM Generation



At the BAF, a tester can evaluate their radar's performance in an installed configuration either individually or in conjunction with the operation of other aircraft systems in the presence of Electronic Warfare (EW) systems (RF threats) and Electronic Counter Measurement (ECM) jamming (both on-board and off-board) for normal operational performance as well as systems' interoperability testing. In order to accomplish this the BAF operates programmable radar target generators (RTGs) and an ECM radiating system capable of generating synthesized radar targets (SUT radar signal returns) which can be detected and observed by a SUT's radar system as it would be in flight.

The Advanced Radar Environment Simulator (ARES) capability is a RTG system which is capable of simulating and presenting up to four radar targets to a SUT radar system complete with correctly simulated range (distance and direction), location (accuracy and resolution), range rate (velocity and acceleration), radar cross-section (size and aspect angle), and (\pm) Doppler shifts (approaching and departing velocities) in response to the radar's emission. The ARES DRFM-based RF generation system can provide a radar target return range that is programmable out to 240 nmi and in to approximately 1/4 nautical mile. Additionally, the radar targets generated by ARES can have multiple additional programmable features (characteristics) that can include non-cooperative target recognition (NCTR)-related identification data and onboard ECM characteristics. The ARES system is also an ECM radiation system capable of producing ECM signals and techniques (reactive and non-reactive) in conjunction with the target return utilizing an external jammer. This is beneficial when testing a SUT radar with an electronic counter-countermeasures (ECCM) capability or an ECM system's effectiveness on that radar.

In addition to all of the above, the ARES system has the capability to capture, record, and then playback incoming SUT radar signals. The heart of the ARES system's capture and playback capability to digitize an incoming waveform, view it, store it, and then download the data to a database for further analysis involves a DRFM; an incorporated digital RF memory. The signal's waveform data can then be downloaded to a storage system where it can be viewed with analytical software and/or manipulated. Waveform data may also be uploaded from the storage computer back into the memory and played back to the SUT radar as a customized RF signal. This captured signal can be up to seven seconds in length and generated as a single seven second duration or be generated end-to-end in a continuous loop back mode.



Sample BAF Radar Test Setup



U.S. AIR FORCE

Benefield Anechoic Facility (BAF) Radar Target and ECM Generation



Target Generation

Operational band width (0.3 to 40 GHz)

- Low band: 300 MHz to 18 GHz, 2 Targets,
- X-band: 8 GHz to 12 GHz, 4 targets,
- High band: 18 GHz to 40 GHz, 1 Target

Target:

- Minimum range: 1500 ft.
- Maximum range: 240 nmi
- Range resolution: < 1 ft.
- Range accuracy: 1 ft. RMS
- Range rate accuracy: 0.1 ft./sec RMS
- Range jitter: 1 ft. RMS

Doppler:

- Doppler range: -500 kHz to +500 kHz
- Doppler accuracy: ±5 Hz
- Doppler resolution: 1 Hz

Signal characteristics :

- Pulse widths: 100 nsec to CW
- PRF: 100 Hz to CW

Spurious responses (with ± 5 Hz accuracy)

- 5 MHz: -65 dBc in-band
- 50 MHz: -50 dBc in-band
- 850 MHz: -40 dBc in-band
- Out of Band -40 dBc

Noise floor at TX port

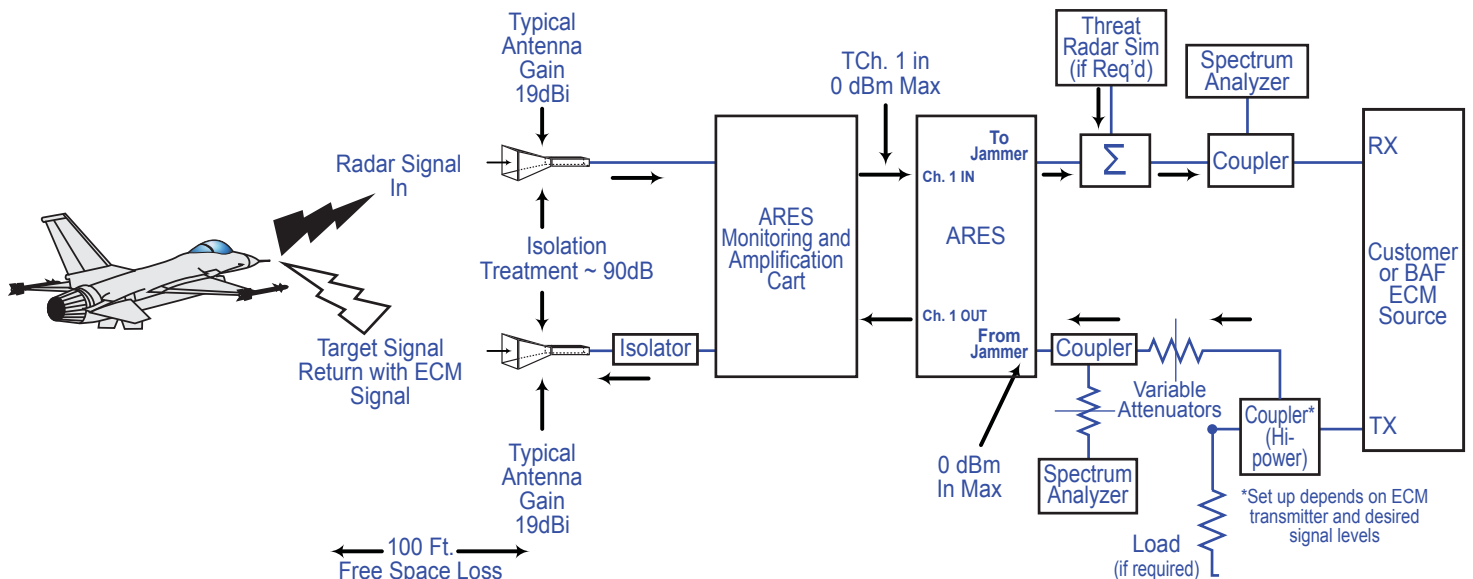
- At 0 dBm TX out: < -108 dBm/Hz
- At < -45 dBm TX out: -150 dBm/Hz

ECM Capability (Reactive & Non-Reactive)

- Operational band width: 0.3 to 18 GHz
- Reactive mode:
 - One target available overlaid with ECM (jammer) signal
 - The incoming radar transmit signal is down converted and stored in the DRFM. The signal is delayed in range (two-way range delay). Doppler modulated, and one-way beam-shaped before being sent to the external jammer
 - The external jammer (e.g. ECM pod) generates coherent techniques such as VGPO, RGPO, VFTs (MFTs), RGPO/VGPO
 - The signal received from the external jammer is one-way beam-shaped and then combined with the ARES RF target skin return to be sent back to the SUT radar
 - Demonstrates ARES ability to generate the required reactive jammer capabilities for testing radar system under test susceptibility to a variety of jamming techniques
- Non-reactive mode:
 - Two targets/channels available for target generation w/ one overlaid with the jammer source
 - Operates w/ only Ch-1 receiving the jammer non-coherent signal
 - Each channel capable of generating ECM noise in 1 or both of the target generating channels such as fixed spot noise, responsive spot noise, swept noise, amplitude modulated noise, custom noise

RF Record/Playback

- Operational band width: .3 to 18 GHz
- Storage: 1 terabyte
- Captures up to 7 seconds of waveform data
- Data recorded with a 10-Bit resolution at 2200 MHz sample rate
- Data flatness : ± 4 dB w/ spurious response -65 dBc at max output
- Data stored as a binary file with exporting capability
- Viewable as amplitude vs. time, frequency vs. time, and amplitude vs. frequency
- Data available via functions of PRI, PW & Frequency



Sample BAF Radar Test Setup



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