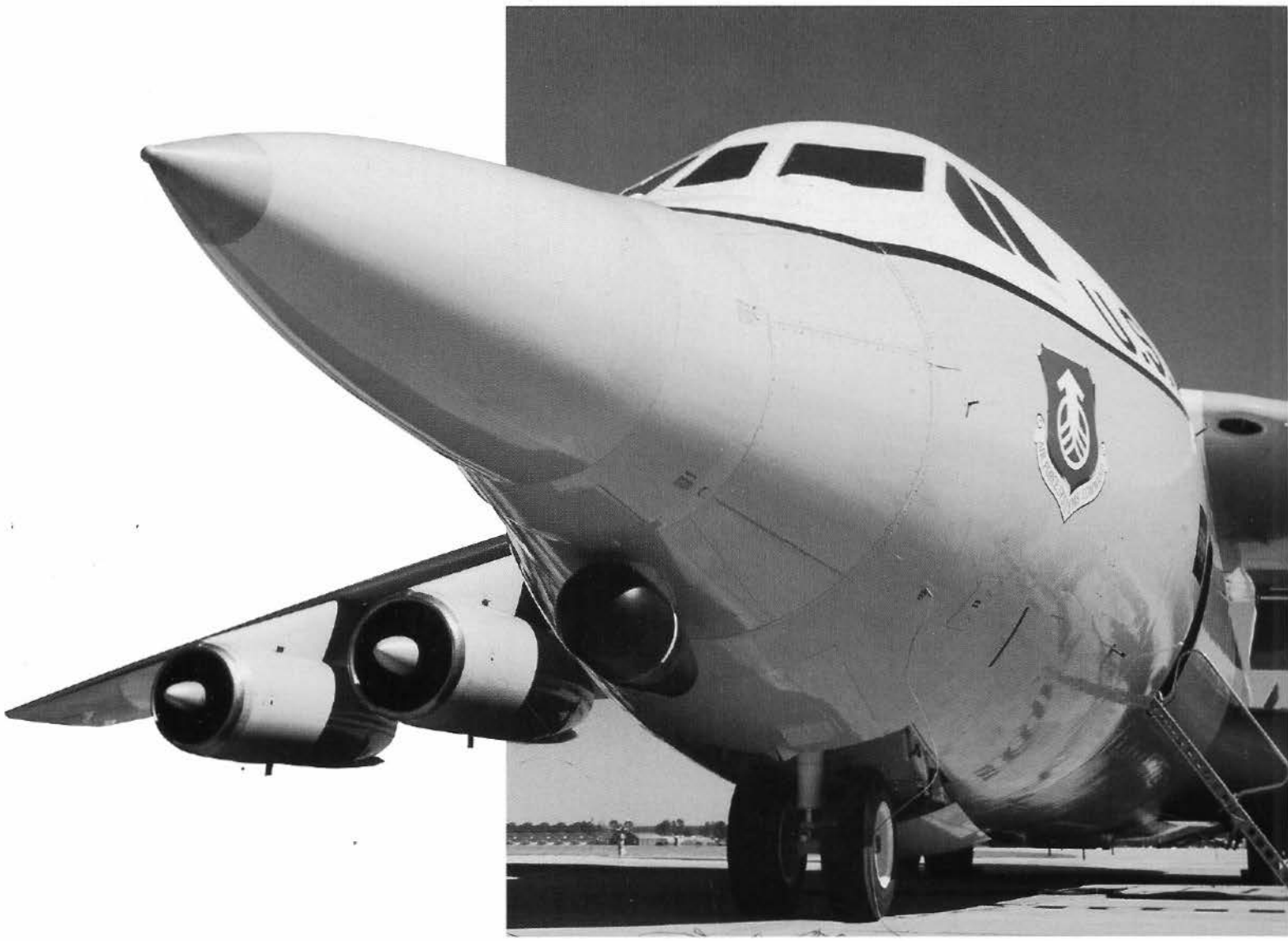
ARTB

ADVANCED RADAR TEST BED

ELECTRONIC COUNTER COUNTERMEASURES



Lockheed Aeronautical Systems Company

AND

4950th TEST WING,
AERONAUTICAL SYSTEMS DIVISION

The Advanced Radar Test Bed (ARTB) has been designed and built by the Lockheed Aeronautical Systems Company (LASC) under a contract with the Aeronautical Systems Division of the USAF. It is a modified C-141A airplane having a capability to test airborne radars in an electronic countermeasures (ECM) environment. The ARTB will be demonstrated and delivered with an APG-63 test radar installed. However, the ARTB has specific features to install the APG-70, APG-66, APG-68 or APQ-164 Radars with the host aircraft radome and features which will facilitate installing any other radars or sensors.

The need for the ARTB was generated by the increasing tactical emphasis on airborne electronic warfare and the associated ECM threats to U.S. airborne radars. It was determined that a DoD test bed was needed to quantify radar operational effectiveness for air-to-air and air-to-ground missions in realistic ECM environments.

Radar System Test Bench

Universal Nose

Weather Radar Pod

Target Generator/APTEC Computer Rack

The ARTB concept evolved through actions of the Air Force Systems Command (AFSC) to develop this test bed which will:

- Capture with an airborne laboratory the external electro-magnetic environment dynamically impacting the radar test article.
- Record the state data of the radar test article and of the test bed airplane.
- Provide a quick-look and self-contained post-flight data reduction and analysis capability.
- Provide the environment and facilities necessary for engineers and observers to evaluate ECCM technologies.
- Be capable of worldwide operation, on or off established test ranges.
- Provide adaptability to accommodate a wide range of test radars.

Video Subsystem Rack

Control Computers and Digital Recorders

Test Director an
Instrumentation
Engineer Consol

Telemetry Subsystem Rack

Radar Operator and Instrumentation Engineer Console

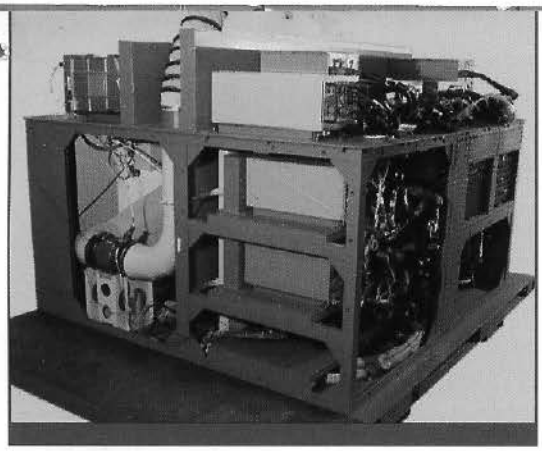
ESM/Engineer and Computer Operator Console

The conversion of the C-141A airplane to a radar test bed includes the installation of an APG-63 radar for test demonstration purposes. The conversion also involves changes to the aircraft's electrical, structural, avionics, hydraulics, and environmental control systems to accommodate the test radar and laboratory equipment.

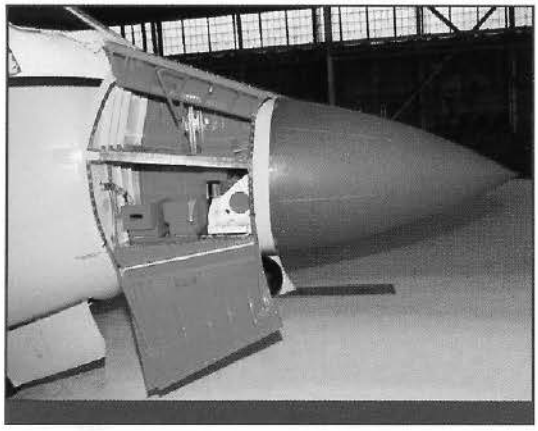
While the airplane modifications are significant, by far the largest challenge centers on the design, engineering and production of the laboratory capability provided by the Radar Test Instrumentation System (RTIS) which evolved as a requirement from the early USAF system definition studies.

The 4950th Test Wing at WPAFB, Ohio, is responsible for the management of the ARTB Program and for the operation, maintenance, and effective use of this new test facility.

Observer Consoles



Radar System Test Bench



Facilities for Nose-Radar Mounting

Radar Operator

Control Computer and
Digital Recorder Console

Radar Test Instrumentation System (RTIS)

The RTIS serves as the ARTB laboratory. It captures, records, reduces, analyzes, and displays a wide range of data from the external magnetic environment, the test article state, the airplane state, and telemetered data from ground stations, other test aircraft, or both. The RTIS also performs avionics interface simulation functions. Major RTIS subsystems include computer, timing, telemetry, video, space positioning, graphics, recording, target generator, operator station, and Electronic Support Measures (ESM) elements.

Significant LASC design features for the Radar Test Instrumentation System are:

- A ruggedized computer system with two 650 MicroVAXs and an Aptec I/O computer using supercomputer principles to vastly enhance overall VAX performance.

- A computer system that uses standard busses for flexibility and adaptability with Ethernet, RS 232, IEEE 488 and MIL-STD-1553B.

- Computer software that is modular, menu driven, designed for customer compatibility, modifiable by table entries, transportable to any VAX system, and delivered with necessary development tools.

- Operator Stations with programmable plasma touch screens for alphanumeric and graphics display in lieu of discrete function buttons.

- Generic Interface Boards that are electrically reconfigurable for different radars using a development system and data delivered by LASC.

- Transmit and receive Telemetry System that has a tuneable transmitter, and two receive channels, one with an autotrack antenna.

- A uniquely developed Target Generator using digital radio frequency memory (DRFM) technology. The Target Generator is designed to adapt to any of five radars and provide either two moving targets or one moving with ground clutter, with or without the transmitter on. The generator also incorporates Futurejam.

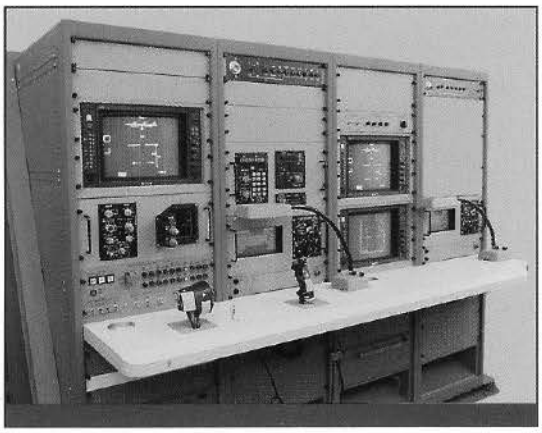
- A Space Position System that uses USAF inventory Self Contained Navigation System (SCNS) components for supportability. The system is designed to provide 16 meters position accuracy with GPS.

- All RTIS equipment is contained in eight palletized consoles with custom designed steel racks for reduced EMI.

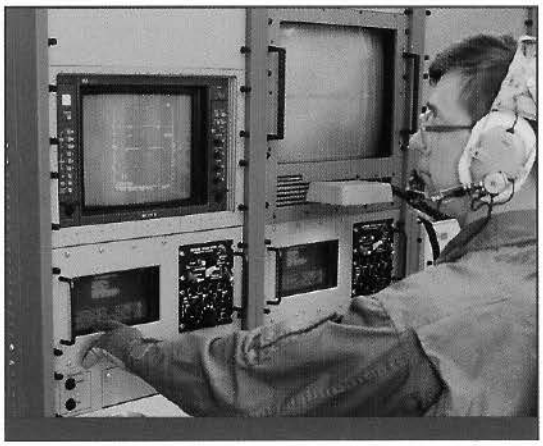
An essential support element to the complete Advanced Radar Test Bed facility is:

- A stand-alone Software Development and Verification Station (SDVS) to permit off-aircraft software development and limited data reduction. The SDVS represents a small lab version of the RTIS with all RTIS interfaces and uses the same software. Many SDVS components are ruggedized to permit interchangeability with airborne equipment.

Telemetry Console



Radar Operator and Instrumentation Engineer Console



Observer Console

Significant LASC design features for the Radar Test Article System are:

- A choice of bench and/or nose installation for test article LRUs allowing ready access in flight (bench installation) or greater installation fidelity (nose installation).

- A palletized universal Radar System Test Bench providing mounting provisions for up to 16 radar LRUs weighing 1,000 pounds. The bench also centralizes utility and interface connections for convenience and encloses cooling system components for noise reduction. The bench permits the use of interchangeable tops for adaptability to any radar.

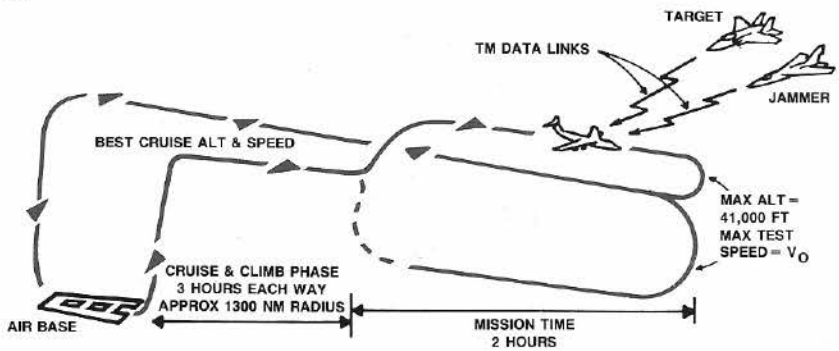
- A cooling air flow rate of 45 pounds per minute and a liquid cooling capacity of 12 kilowatts that can meet requirements of system growth.

- Generic/universal cabling, cooling lines, cooling ducts and waveguides between the bench and the nose that are sized for system growth and preclude the need for changeout with each test article.

- Four universal runs of semi-rigid helical elliptic x-band waveguide that permit bench and nose installations with extremely low transmission losses compared to rigid waveguide.

- A Radar Operator Station, adaptable to each test article, that can accommodate radar controls and displays in an operating scenario which simulates the host aircraft.

Typical Autonomous Mission



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