

# AN/APS-508

Imaging Radar and IFF Interrogator System (IRIS)



*Telephonics, the leader in advanced airborne surveillance systems, has produced the AN/APS-508 Integrated Radar and IFF Interrogator System (IRIS) specifically for the most demanding Maritime and Littoral MPA Missions.*

The Imaging Radar (AN/APS-508), and IFF Interrogator System (AN/UPX-505) (IRIS) sets a new standard for multi-mission airborne surveillance systems. For the first time, this P-3 system integrates into a single radar, the traditional functionality of ASW/ASUW maritime patrol and overland air-to-ground SAR/GMTI. The IRIS sensor suite is the ideal solution for aircraft upgrades or new production, where the user must meet multiple diverse mission requirements with a single aircraft.

The IRIS meets the demanding requirements of the military maritime environment of the Aurora MPA aircraft, a version of the Lockheed Martin P-3 Orion operated by forces worldwide. The IRIS is a natural fit for those forces interested in upgrading their MPA fleets to improve performance and deliver important capability.

## Operating Modes

- Wide Area Surveillance (WAS)
- Low Radar Cross Section (LRCS)
- ISAR (Seaspot)
- Stripmap SAR
- Landspot SAR
- Ground MTI (GMTI)
- Navigation (NAV)
- Weather (WX)
- Search & Rescue Transponder (SART)
- All-Mode IFF Interrogator (IFF-I)

## AN/APS-508 RADAR OVERVIEW

The radar consists of four LRUs: Antenna/Pedestal (A/P), Microwave Front End

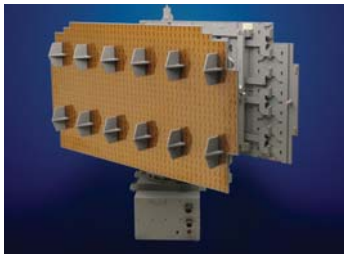
(MFE), Receiver/Transmitter (R/T), and Signal Processor (SP). In addition, the radar requires an Inertial Measurement Unit (IMU) and has a Radar Digital Data Recorder (RDDR). Each LRU is qualification tested to military specifications.

## Antenna/Pedestal (A/P)

The A/P consists of dual back-to-back antennas mounted on a single pedestal. Dual antennas provide versatility in optimizing system performance across all operating modes, and enables combined and dual mode operation. A high-speed waveguide switch



allows for switching between the two antennas in a scan-to-scan interleaved fashion or a sector-interleaved fashion within a single 360° scan. This capability facilitates simultaneous, dual mode operation on either a scan-interleaved basis or by switching between the two antennas within a single 360° scan. Performance in high-resolution maritime modes is also enhanced by illuminating the same target sector with both antennas within a single 360° scan. The primary antenna has a pencil beam, three-phase-center, flat plate radiator with HH polarization. The secondary antenna is also pencil beam with VV polarization.



Antenna/Pedestal

## Microwave Front End (MFE)

The MFE architecture simplifies the waveguide installation and minimizes RF losses prior to the LNAs. MFE functions include low noise amplification, pre-selection, receiver protection, duplexing function with receive path switching and transmit power monitoring. Included in the MFE is an optical delay line for automatic self calibration of the transmit/receive path.



Microwave Front End

## Receiver/Transmitter (R/T)

The transmitter uses an 8kw TWT with 5% duty cycle for an average power output of 400 watts. The 1 GHz bandwidth provides extremely fine resolution and frequency agility. The three-channel receiver provides for both analog and digital pulse compression, depending on mode.



Receiver/Transmitter

## Signal Processor (SP)

The SP is based on the Mercury Computer Raceway open architecture for high-speed data transfers. It is an air-cooled, 17-slot, 6U VME chassis. Features of this high throughput SP include:

- High-speed, FPGA-based signal processing for automatic detection and tracking of low radar cross section targets in open ocean and littoral environments
- Simultaneous Doppler Beam Sharpened Imaging or Target Detection/TWS processing in the GMTI modes
- Simultaneous Wide-Area Search (WAS) with Nav and Weather
- Simultaneous NAV and Weather
- SART or A-Scan Interleaved with WAS or Low RCS Search
- Simultaneous WX and NAV mode processing display together with WAS mode

- Production of multiple, high-resolution ISAR or Landspot images in a single pass of the aircraft
- Production of very wide swath imagery in the Stripmap mode in real time
- Integrated record/playback capability of time correlated raw sensor data, NAV data and control.



Signal Processor

## Inertial Measurement Unit (IMU)

The IMU is the heart of the motion compensation subsystem. It is mounted adjacent to the antenna pedestal and enables precise measurement of the motion of the antenna phase centers relative to the aircraft flight path to ensure well-focused, high-resolution imagery at long ranges.



Inertial Measurement Unit

## Radar Digital Data Recorder (RDDR)

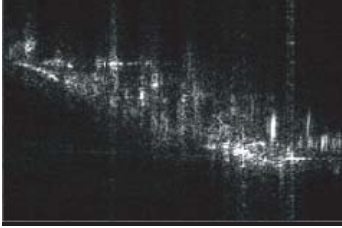
The RDDR is a commercial RAID data recorder.



Radar Digital Data Recorder

## System Features of the AN/APS-508

- **Wide Area Surveillance Mode (WAS).** Provides maritime surveillance of medium to large RCS targets out to 200nm while operating at altitudes up to 35,000 ft.
- **Low Radar Cross Section Mode (LRCS).** Performs automatic detection of small (1m<sup>2</sup>) to medium RCS targets out to 45 nm from typical altitudes of 500 ft. to 2000 ft. Two LRCS submodes are available, one optimized for periscope detection and another for search and rescue situations. Both LRCS sub-modes feature high-speed LRCS target detection in high sea states.
- **Maritime Tracking.** Automatic target detection and track initiation is provided in both WAS and LRCS modes for up to 300 detected targets. Track filters (range and speed) suppress reporting of tracks that are not of interest to the operator. Landmass rejection, based on a stored world map database, inhibits auto initiation of any tracks located over land.
- **Classification Capabilities**
  - ♦ **A-Scan Mode.** Displays the designated target's intensity vs. range. A-Scan is concurrent with WAS and LRCS modes.
  - ♦ **Seaspot (ISAR) Mode.** Seaspot relies on target ship motion (Doppler) to focus images of targets under a broad range of sea states at long stand-off ranges. Image resolutions of less than one meter are available.



Seaspot (ISAR) Mode

◆ **Target Classification Software (TCS).** Contains mensuration tools to assist the operator in measuring the length of the target, relative location and size of the dominant scatterers from either the A-Scan profile or the Seaspot image.

• **Land Imaging Modes**

◆ **Stripmap.** Produces a continuous streaming SAR image of the terrain offset from the side of the aircraft. The image can be along a track parallel to the aircraft flight path or at an angle relative to the flight path. Resolutions below one meter are available in all SAR modes.

◆ **Landspot.** While in Stripmap mode, the operator can switch to Landspot Mode for higher resolution imaging of a selected target area in a single pass of the aircraft. Multiple Landspot images can be produced during a single pass of the aircraft.

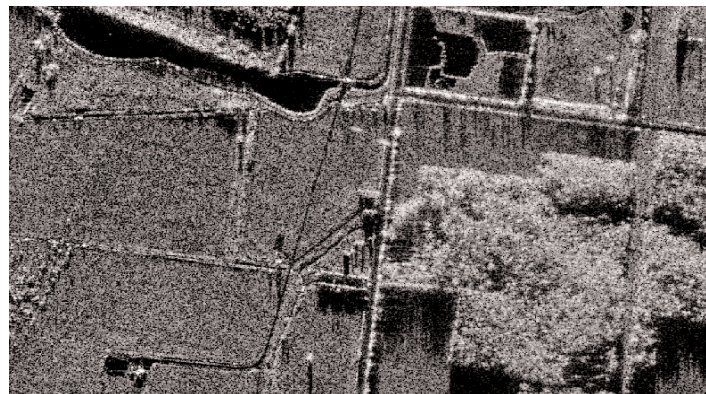
• **Ground Moving Target Indicator (GMTI).** Provides the capability to detect and track targets moving against ground clutter. Target positions and track are overlaid on a Doppler Beam Sharpened (DBS) image generated simultaneously with the GMTI data, or a map pre-loaded into the operator workstation.

• **Navigation Mode (NAV).** Performs real-beam coast-line and surface mapping. A combined WAS/NAV mode is provided and typically the NAV mode display is routed to a cockpit display and the WAS mode imagery to the radar workstation.

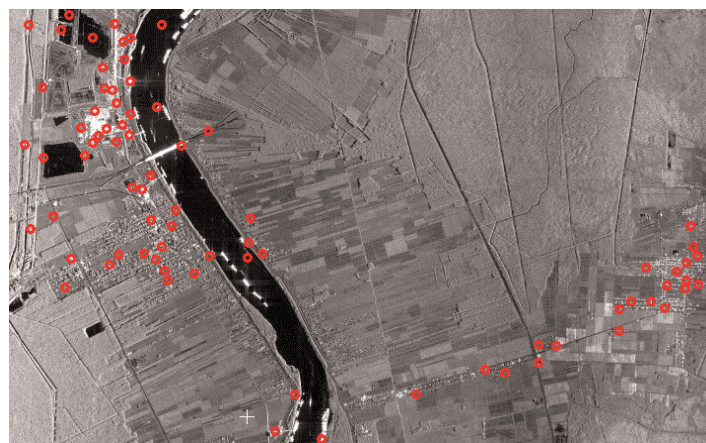
• **Weather Mode (WX).** Provides four-color weather presentation based on Rain-fall reflectivity measurements out to 200 nm. A combined WAS/WX mode is provided with the WX mode display routed to the cockpit and the WAS imagery routed to the radar workstation.



Wide Area Surveillance Mode



Land Imaging Mode Stripmap



Ground Moving Target Indicator (GMTI)

**AN/UPX-505 IFF Interrogator (IFF-I)**

The AN/UPX-505 IFF Interrogator (IFF-I) equipment is an integral part of the AN/APS-508 multi-mode radar. The unique design of the IFF required for multi-mode radars enables this sensor to provide IFF reply video and target reports in all radar modes, if commanded, or independently in Radar Standby. The equipment is a Mark XIIA Interrogator with Mode S. Operation in Modes 1, 2, 3, C, 4, 5 Level 1 and Level 2, and Mode S Level 1 and Level 2, is provided in such a way as to maximize automation and transaction management to ease operator workload. (Military modes are export controlled). In the IRIS, the IFF antenna shares a common aperture with the radar and is linked to the particular radar mode functionality thus providing exceptional performance. The difficult task of correlating IFF and radar data, normally part of the Integrated Mission system software, is accomplished within the IRIS. This approach, of a single integrated radar and IFF, eliminates the cost and risks associated with procuring separate radar and IFF interrogator sensors.



IFF Interrogator

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## System Specifications

### AN/APS-508 Physical Characteristics

WRA Name	Wt. (Lbs.)	Dimensions (inches)			Power		Heat Diss. Watts
		L	W	H	Type	Consumption	
Antenna Pedestal LN-251 (A/P)	106 13	46.0	46.00	39.1	Powered from MFE	–	500
Receiver/Transmitter (R/T)	90	23.6	15.35	9.9	115 Vac. 3Φ, 400 Hz	5.3 Amps	1300
Signal Processor (SP)	79	23.1	15.35	11.8	115 Vac. 3Φ, 400 Hz	2.3 Amps	760
Microwave Front End (MFE)	46	20.3	15.00	7.3	115 Vac. 3Φ, 400 Hz	1.8 Amps	105
Total System Weight	334						

Environment	Radome Mounted Equipment	Cabin Mounted Equipment
Operating Temperature	-55 to +55°C	-25 to +55°C
Humidity	95%	95%
Altitude	35,000 ft.	15,000 ft.
Operating Vibration	0.1g <sup>2</sup> /Hz	0.1g <sup>2</sup> /Hz (SP @ 0.3g <sup>2</sup> /Hz)
Functional Shock	6g	6g
Crash Safety	15g	30g
EMI/EMC	MIL-STD-461D	MIL-STD-461D
Power	MIL-STD-461A	MIL-STD-461A

## System Interfaces

### CP-140 IRS Interfaces Requirements

- 115/208 VAC, 400 Hz – 3-phase, 3500 VA
- Weight on Wheels Switch
- 1553 Bus – Platform NAV Data and Control
- Dual Operator RGB Video
- Ethernet – Track Data & A-Scan
- Gigabit Ethernet – Image Exploitation
- ESM Blanking
- Dry Air

### Logistics

- Comprehensive BIT
- > 900 Hr. MTBF (AIC)
- < 25 Min. MTTR

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