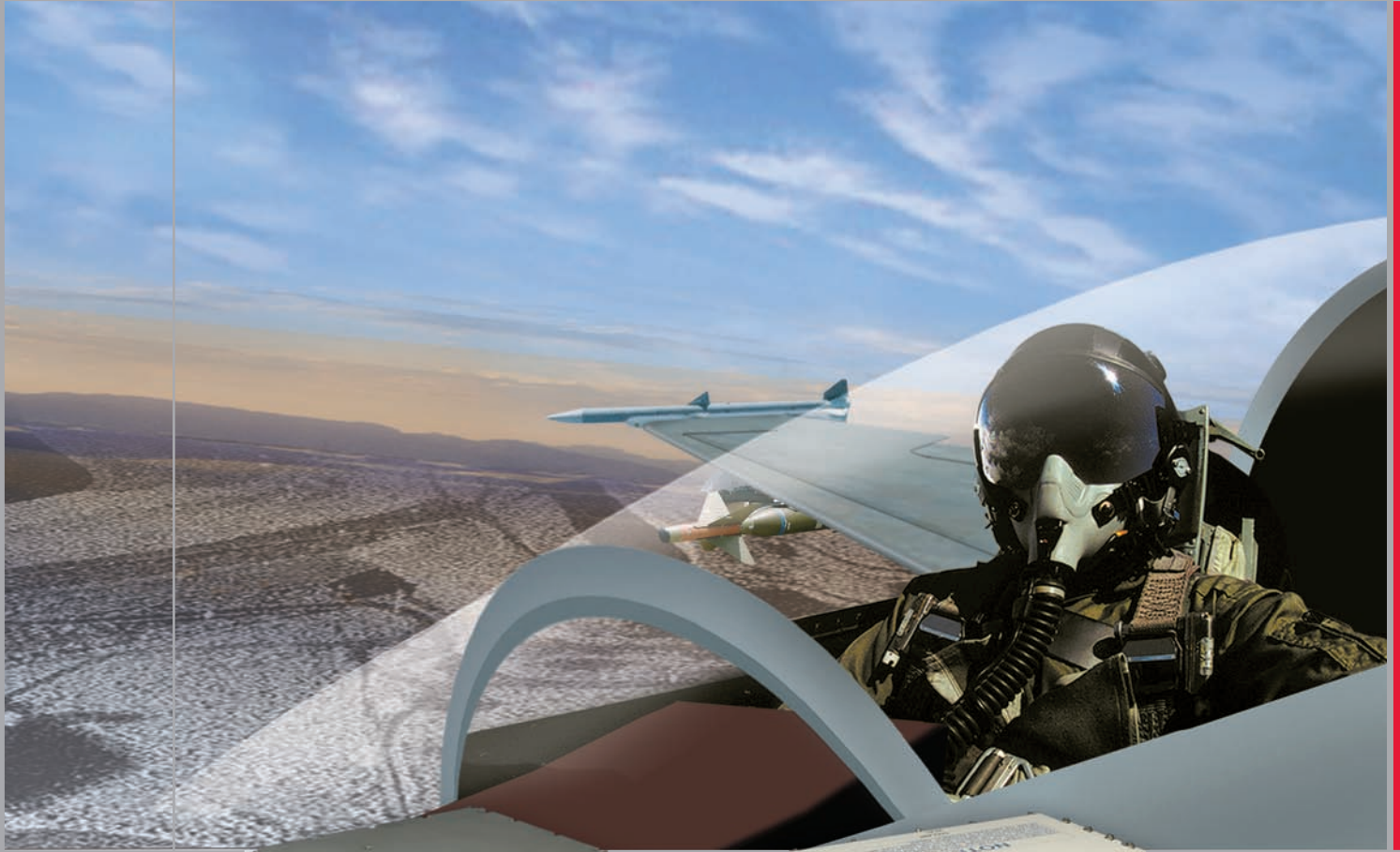


# Digital Anti-Jam Receiver (DAR)

Customized Military GPS Solutions for Severe Requirements



**Raytheon**

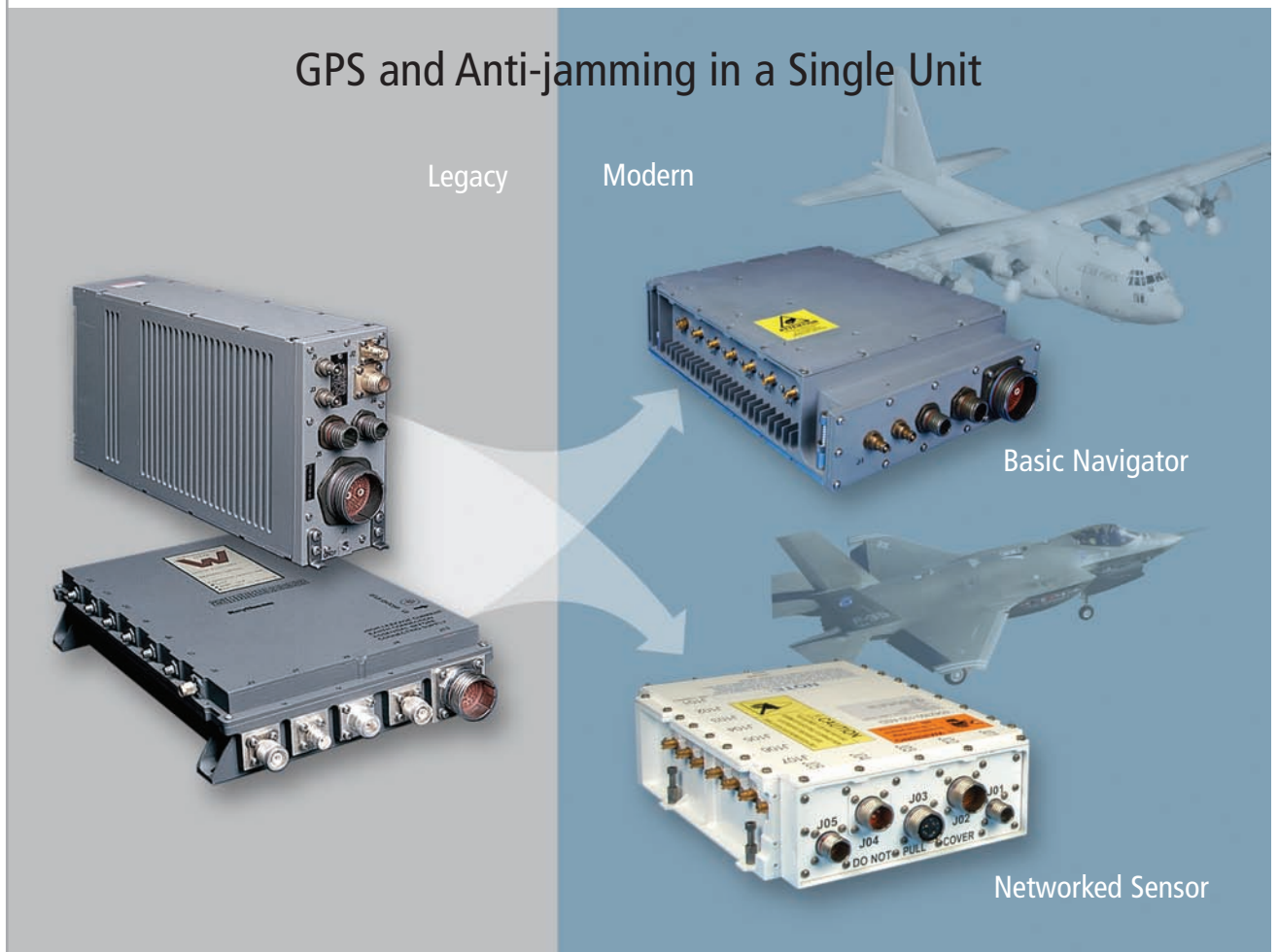
## **Compact. Multifunctional. Upgradable.**

Raytheon's Digital Anti-jam Receiver (DAR) provides the highest possible GPS accuracy and jamming resistance for all combat aviation missions.

The DAR ensures robust GPS navigation for the full spectrum of military aviation missions, from precision attack and tactical airlift to unmanned reconnaissance and strike. It represents the most advanced GPS technology available today, combining the latest selective availability anti-spoofing module (SAASM) receiver with the ultimate in digital anti-jam (A/J) technology.

To prevent obsolescence during the host aircraft's service life, the DAR has an upgrade roadmap that includes all anticipated GPS modernization requirements, including M-code, the joint precision approach and landing system (JPALS), and civil airspace compliance.

## GPS and Anti-jamming in a Single Unit



The DAR provides GPS and anti-jamming functions in a single unit. Customized GPS solutions support legacy platforms that have system data bus architecture, or modern platforms with a fibre channel network.

### DAR Benefits

**Compact:** Combination of GPS receiver and anti-jam antenna controller in a single line replaceable unit (LRU)

**Survivable:** GPS navigation at double the jamming level allowed by current analog anti-jam systems

**Accurate:** High-precision position/velocity/time (PVT) outputs and line-of-sight measurements (pseudo-range, delta-range, and carrier phase) under severe aircraft dynamics

**Flexible:** Interface and packaging options for both new installations and retrofits

**Assured Integrity:** Receiver autonomous integrity monitoring (RAIM) and fault detection and exclusion (FDE) per RTCA documents TSO-C129a and DO-229a, as modified by MSO-C145

**Roadmap to Future:** Compliance with JCS SAASM mandate, with path to M-code; JPALS upgrade will be available on fibre channel networked platforms

# Customized anti-jam GPS solutions for multiple platforms and navigation

## Supports Multiple Navigation System Architectures

The DAR is compatible with several navigation system architectures, functioning alternatively as:

- Standalone navigation unit, with PVT outputs to mission computer, flight management function, or flight instrumentation
- GPS sensor, tightly coupled to an inertial navigation system, with pseudo-range and delta-range (PR/DR) outputs
- Measurement engine, providing carrier phase measurements for precision applications such as JPALS or sensor motion compensation (modern platforms)

In addition to conventional INS/GPS aiding functions, the DAR offers Direct Measurement Processing (DMP), a patented Raytheon implementation of ultra-tight INS coupling. DMP provides anti-jamming beyond that afforded by the adaptive antenna, and also supports high-accuracy velocity measurement.

## The Lightning Strike™ SAASM GPS Receiver

The heart of the DAR is the Lightning Strike, the smallest P/(Y)-code GPS SAASM approved by the U. S. government. True all-in-view, 24-channel, simultaneous L1/L2 tracking provides the most precise autonomous position/velocity/time (PVT) measurements possible. Carrier phase velocity accuracy of 1 cm/sec offers major sensor motion compensation improvements for target location and tracking.

Position accuracy in the GPS sensor configuration is further enhanced by wide area GPS enhancement (WAGE) and support for differential GPS (DGPS) modes. DAR is compatible with the aviation DGPS requirements of JPALS, including shipboard relative GPS (SRGPS).

The DAR incorporates receiver autonomous integrity monitoring (RAIM) and fault detection and exclusion (FDE) (as specified in RTCA documents TSO-C129a and DO-229a, respectively, and as modified by MSO-C145). These features provide the level of integrity necessary to permit using the DAR as a primary navigation reference. Although intended for use as a precise positioning system (PPS) P/(Y)-code GPS receiver, the DAR can provide outputs based on C/A code standard positioning system measurements, without loss of PPS keys or function on

## Preplanned DAR upgrades keep customers abreast of changing technology

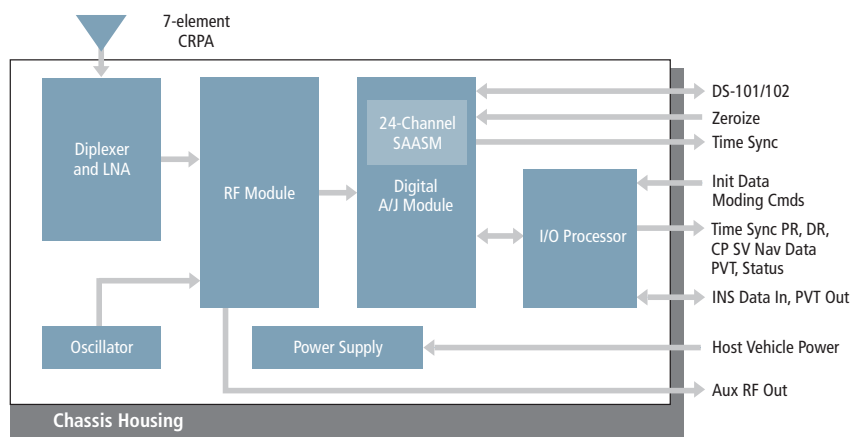
### Needs

Improved accuracy  
 Robust anti-jamming  
 GPS precision navigation and timing  
 SAASM capability  
 M-code (prevention interoperability)  
 Civil interoperability and JPALS military/civil operations  
 Future enhancements to UE (2010+)

### Raytheon GPS Product Features

1 cm/sec velocity for all missions during jamming  
 Digital nulling and beamforming  
 24-channel L1/L2, P, V, T and PR, DR, CP measurements, 25 nsec time accuracy  
 NSA-approved SAASM fully integrated  
 RF and anti-jam system fully compatible, M-code receiver available during tech refresh (2008–2010)  
 Raytheon solution integrates GATM/JPALS accuracy and integrity requirements with certifiable software/hardware  
 Participant in GPS modernization and M-code UE programs

# architectures



DAR Functional Components and Interfaces

legacy platforms. Software modifications can make this feature available to modern platforms as well.

Lightning Strike includes a proprietary signal processing technique that enables direct (Y)-code acquisition performance equivalent to that of a 9000 correlator bank. This guarantees extremely rapid time to first fix, and reacquisition, in stressful mission scenarios.

## Digital Adaptive Anti-jam Capability

The DAR uses inputs from a standard 7-element controlled reception pattern antenna (CRPA) to counter the effects of all types of GPS interference and jamming. Through the space frequency adaptive processing (SFAP) technique, the DAR forms spatial nulls to suppress jammers, while forming beams to amplify valid signals from GPS satellites. This combination of digital nulling and multiple beamforming yields the highest GPS anti-jam (A/J) performance



available from an adaptive antenna. SFAP is the result of 20 years of Raytheon development and production of integrated A/J GPS systems for aircraft, unmanned vehicles, and missiles.

## Optional Interfaces and Packaging

The DAR is designed for adaptation to both modern and legacy military aircraft:

- Standard system input/output buses per MIL-STD-1553B and ARINC 429 or Fibre Channel and 1394B avionics network interfaces for modern aircraft
- Host vehicle input power at 28 VDC, 270 VDC, or 115 VAC, 400 Hz
- Standard convection air cooled chassis, with active liquid cooling optional for very high-temperature environments

Adaptable for legacy or modern vehicle installation

	 Basic GPS Navigator	 Network GPS Sensor
<b>I/O</b>	1553 Bus Compatible with ICD-GPS-169 RS-422 Serial (test)	1394B Fibre channel RS-422 Serial (test)
<b>Anti-jam</b>	SFAP 7-channel nulling 1L1/1L2 Vertical beam	SFAP 7-channel nulling 8L1/8L2* Beam on satellite
<b>Cooling</b>	Air convection	Liquid polyalphaolefin (PAO)
<b>Power</b>	32 W nominal (28 VDC)	95 W (270 VDC)
<b>Predicted MTBF</b>	>12,500 hrs	>15,000 hrs
<b>Time to First Fix (TFFF)</b>	< 60 sec	< 45 sec
<b>Key Load</b>	DS-102	DS-101
<b>Functional Outputs</b>	Position/Velocity/ Time	Position/Velocity/ Time  Pseudo-range Delta-range Carrier phase*

\* Required for JPALS operations

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