



LEONARDO ELECTRONICS

RAT 31 D/L M DIGITAL

Digital Long-Range Mobile
New Generation Radar System



RAT 31 D/L M DIGITAL is a Deployable 3D Early Warning, Full-Digital AESA GaN L-band Radar developed by Leonardo to provide war-fighting solutions against a full spectrum of threats - including ABT, TBM, Hypersonic Cruise Missiles, Anti-Radiation Missiles, Helicopters, UAVs, chaff, and jamming-in demanding ECCM combat scenarios where rapid deployability and complementary coverage are essential to mission success.

The RAT-31 L-Band family is sold worldwide and is a mainstay of Air Defence in more than 30 countries, including many NATO member nations (with full coverage of the NATO D-band spectrum), offering continuous operation through high reliability and graceful degradation characteristics.

With a Full-Digital, L-band solid-state AESA 3D Antenna, it delivers effective long-range detection at ranges exceeding 465km.

The system is specifically designed for Surveillance and Air Defence missions, integrating a new-generation Digital Primary Sensor with Leonardo Secondary Surveillance Radar (SSR) technology. In addition to the traditional identification interrogation Modes 1,2,3/A,4,5, C, and S, the SSR is enhanced with dedicated ADS-B to enable silent identification mode capability.

Autonomous detection and track initiation for Tactical Ballistic Missiles (TBMs) have been enhanced, drawing on 25 years of experience in modern battlefields and providing demonstrated Military utility functions to operational forces.

Tracking of external cues for ABT and TBM threats is further enhanced, improving RAT 31 D/L M DIGITAL's ability to interconnect fully with other RAT 31 D/L radars within an Air Defence Network, and to deliver robust surveillance and tracking against Missile threats.

New Digital technologies reinforce Leonardo's proprietary radiation architecture based on multiple, independent, simultaneous pencil-beam technology. Each beam is independently phase-controlled and, combined with advanced signal-processing techniques, provides high scanning flexibility and effective clutter suppression.



RAT-31 DL/M-DIGITAL benefits from its AESA software-defined Antenna, which can be adapted to emerging threats by incorporating specialised operational modes for new threats of interest, such as Hypersonic Cruise Missiles. In addition, multiple simultaneous, independently phase-controlled pencil beams provide high scanning flexibility and very high data rates, making them particularly effective for clutter processing. Each beam enables monopulse altitude measurements with excellent accuracy, even in frequency-agile mode. The system's reduced peak power improves resistance to Anti-Radiation Missiles (ARM) and Electronic Countermeasures (ECM).

Fixed and adaptive-notch Moving Target Indicator (MTI) filters, supported by updated maps, enhance performance across ground and sea clutter, rainfall, chaff, and clear environments. The system delivers robust Electronic Protective Measures (EPM) and Electronic Counter-Countermeasures (ECCM).

Deployment System

RAT-31 DL/M DIGITAL is engineered for Self-Encamping operations, meaning the Radar System can deploy without the need of external tools such as cranes or lifters. The Transport configuration is optimised for road and tactical air transportation operations.

The system is composed by:

→ Antenna Pallet engineered for transport on standard trucks with an ISO 20 feet ISOFIX lock system.

→ Equipment Shelter ISO 20 feet container transportable on standard trucks with ISOFIX lock system.

Complementary, double-redundant Leonardo Power Generators ensure continuous operations in unprepared fields, granting stable energy, uninterrupted operations, and swing maintenance.

Thanks to its architecture based on multiple independent pencil beams, overall performance significantly exceeds operational requirements.

RAT 31DL-M-DIGITAL is designed for continuous 24/7 operation. Extensive use of graceful degradation concepts and hot redundancy on mission-critical items delivers reliability figures higher than those of sensors in the same class and allows operators to resolve critical failures without interrupting operations.

RAT-31-DL-M DIGITAL has a withstanding Mean Time Between Critical Failures (MTBCF).

The radar can be operated either locally via the Radar Management Console or remotely through consoles installed in new or existing Control Centres.



KEY FEATURE

- GaN (Gallium Nitride) technology
- Full digital architecture with a Software Defined AESA Antenna
- Digital Transmit/Receive Modules (TRMs) with direct Radio-Frequency generation and sampling
- Digital beamforming (redundant)
- Reduced Line Replaceable Units (LRUs) quantity
- Compliance with Asterix Categories:
 - Category 21 (ADS-B)
 - Categories 34/48 (Plot and Tracks)

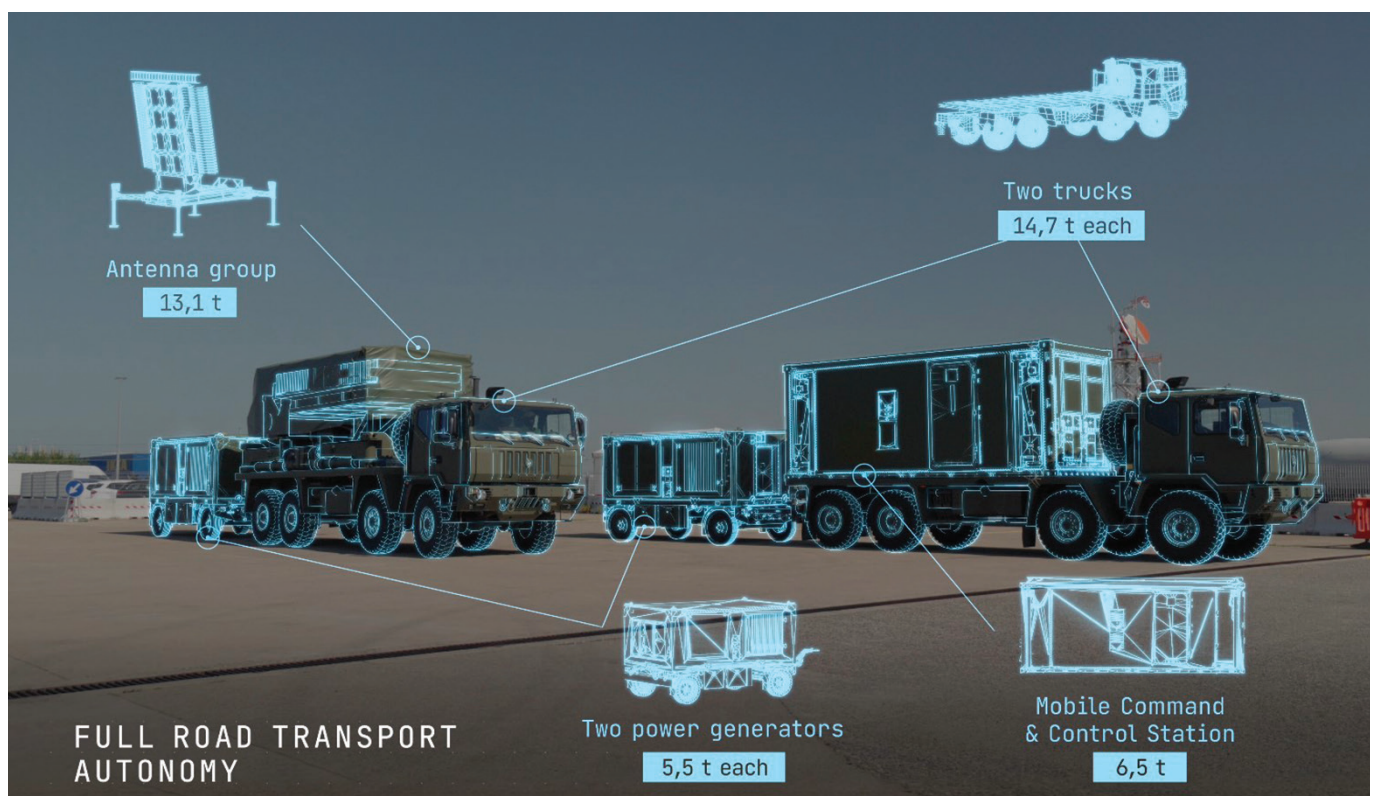
In addition, Tx/Rx Digitalisation at single radiating-row level enables:

- Full control of each Tx/Rx element, ensuring maximum versatility in antenna-beam synthesis
- Digital beam definition, allowing Unlimited Growth Capability for additional beam shapes
- Entire radar chain, from Tx signal generation to Rx signal sampling, is fully distributed on D-TRMs: no single point of failure in the system and a significant improvement in system availability

Software suite and simulation capabilities

The system is complemented by a Digital Radar Environmental Simulator (D-RES), capable of generating highly realistic simulation scenarios for testing and training, including:

- Multiple Air-Breathing Target (ABT) models: including fighters, bombers, and helicopters, each with distinct Radar-Cross Section (RCS) profiles, manoeuvrability parameters, and applicable jammers/weapons
- ARM and TBM missile simulations based on physical parameters
- A wide variety of jammer types (from ACCS): Repeater, Continuous Wave (CW), CW pulse, Spot, Barrage, Click, and Swept jammers
- Surface-clutter modelling for both ground and sea environments
- Fluctuation models: Swerling types 1–2 (for ABTs) and 3–4 (for TBM's)
- Advanced propagation models



KEY BENEFITS

- Self-encampable
- Easy transportable via land, sea, and air
- Both local and remote operability via the Radar Management Console or through consoles installed in new or existing Control Centres
- Mechanical design optimised for rapid deployment (2 hours), supporting relocation needs
- 24/7 continuous operation even when deployed in unprepared sites
- Exceptional reliability due to solid-state design and graceful-degradation features
- Modular architecture ensures high fault tolerance
- Multiple waveform options for optimised coverage
- Excellent detection performance across all clutter conditions
- ECM monitoring across the full operational bandwidth
- Automatic frequency selection for minimal jamming vulnerability
- Jam strobe extraction capabilities

↓ Rat 31 D/L M Digital C-130 Loading



TECHNICAL INFORMATION

SYSTEM	Digital 3D Aesa Antenna Equipment	
	Operating Band:	L-Band
	Probability of Detection:	90%
	Coverage:	<ul style="list-style-type: none"> • Instrumented Range: <ul style="list-style-type: none"> > 265 km • Elevation: <ul style="list-style-type: none"> - Up to 20° (Air-Breathing Targets - ABT) - Up to 60° (Tactical Ballistic Missiles - TBM)
		<ul style="list-style-type: none"> • Maximum Height: <ul style="list-style-type: none"> - 100,000 ft (ABT) - Not limited (TBM) • Azimuth: 0° – 360°
	Target Types:	<ul style="list-style-type: none"> • Air-Breathing Targets (ABTs and UAVs) • Missiles, including Anti-Radiation Missiles (ARM) and Tactical Ballistic Missiles (TBM)
	Antenna Rotation Rate/ Data Update Rate:	≥ 5 RPM
MTBCF:	> 3 times of sensor of the same class	
PRIMARY ANTENNA	Active array with elevation phase scanning	
	32 Tx/Rx modules + 2 modules dedicated to Side-Lobe Blanking (SLB) and Side-Lobe Cancellation (SLC) functionalities	
	Electronic Elevation Scan:	<ul style="list-style-type: none"> • 0°–20° in ABT mode • 0°–60° in TBM mode
	Simultaneous Pencil Beams	
	Polarisation:	Linear horizontal
	Elevation Measurement:	Monopulse with enhanced low-angle technique
AUXILIARY ANTENNAS	Side-Lobe Blanking (SLB)	
	Side-Lobe Cancellation (SLC)	
RECEIVER	Direct Radio-Frequency (RF) sampling	
	Dedicated ECM data-analysis channel	
	Digital Pulse Compression	
	Digital Down-Conversion	
	Digital Beam Forming (DBF) on detection channels plus one ECM analysis channel	
	Frequency Selection:	<ul style="list-style-type: none"> • Manual • Random • Automatic (based on real-time environmental interference analysis)

TECHNICAL INFORMATION

SIGNAL PROCESSOR	Type	Coherent signal processing
	Anti-Clutter Filters:	<ul style="list-style-type: none"> • Adaptive-notch MTI cancellers • Fixed filters • Real-time automatic clutter mapping
	Azimuth Correlator:	Moving-window type
	Amplitude Detection:	Digital modulus extractor
	SLB and SLC processing integrated	
INTERFACE	Open Integration Architecture	
	Programmable and control-flexible interface	
	Fully compatible with remote control and command inputs from remote control centres	



For more information:
infomarketing@leonardo.com

Leonardo Electronics
Via Tiburtina, Km 12,400 - 00131 Rome - Italy
T +39 06 41501, F +39 06 4131133

This publication is issued to provide outline information only and is supplied without liability for errors or omissions. No part of it may be reproduced or used unless authorised in writing.
We reserve the right to modify or revise all or part of this document without notice.

EL00049 12-25
2025 © Leonardo S.p.A.

