AIR TRAFFIC MANAGEMENT

# AIRPORT & ROUTE PRIMARY SURVEILLANCE 3D RADAR

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# AIRPORT & ROUTE PRIMARY SURVEILLANCE 3D RADAR

3D PSR & MSSR Antennas

## Latest technologies for Airport & Air Route Surveillance

Indra's 3D PSR is a modular, fully solid-state 3D primary radar (PSR) that incorporates the latest technologies for airport and air route surveillance. It provides accurate aircraft position information, including flight height.

These capabilities of detection and 3D position estimation are achieved even under extreme weather conditions, ground clutter and natural or man-made interference. Both with cooperative and non-cooperative aircraft.

In this sense, the radar complements the surveillance function of the Monopulse Secondary Radar (MSSR), allowing the detection and tracking of aircraft without an operative SSR transponder.

Besides aircraft detection and tracking, the radar includes a weather processor that provides the controller with the required weather information for safe air traffic control management.

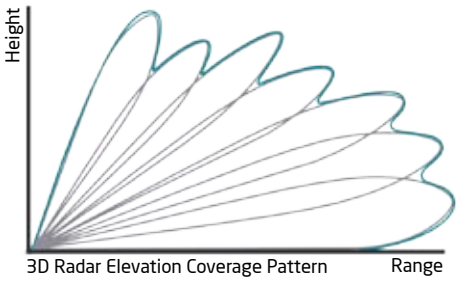
## Principal Features Summary

- Overall fulfilment of ICAO and EUROCONTROL requirements
- Operation at L Band (1250 to 1350 MHz), which provides better performance in adverse weather conditions than radars that operate at higher bands
- Planar array antenna with pencil beam antenna patterns, electronic steering in elevation and mechanical scanning in azimuth
- A modular architecture based on transmitter and receiver modules that provide graceful degradation
- Dual Chain
- Dual frequency operation
- 3D aircraft position information based on Monopulse Technique both in azimuth and elevation, and Pulse Compression in range
- Efficient use of time and energy through the suited configuration of transmitted waveforms and instrumented range for each elevation beam
- MTD/MTI processing techniques in the Doppler frequency domain for clutter cancellation
- Special techniques to avoid harmful effects of multiple-time-around signals caused for example by anomalous propagation
- Integrated Track-While-Scan Process with Kalman filters, for aircraft tracking, false alarm number reduction and suppression of detection caused by low speed objects like terrestrial vehicles
- Weather Processor providing 6 levels of intensity mapping according to ICAO standards
- Complete set of available configurations with different Instrumented Coverage / Rotation Rate for fulfilment of specific customer requirements
- Fully high-level software programmable Signal and Data Processor based on commercially-available (COTS) latest-generation multiprocessor boards
- Time stamping of targets reports based on GPS time reference
- Mechanically designed to support an LVA Secondary Radar antenna, providing required interfaces for joint PSR/MSSR operation
- Data Processor including a PSR/MSSR Combiner that merges primary radar data from 3D PSR with secondary radar data from the MSSR
- Supports remote and Local Control and Monitoring. Local control is performed from a Local Operation Workstation with radar data display capability and friendly Graphical User Interface
- Integrated built-in-test (BIT) system for automatic fault detection and isolation
- Redundancy in overall system design providing high Operational Availability
- Modular design that eases future upgrades and improvements

## High Reliability and Availability

High flexibility supported by modular, repetitive and redundant architecture providing soft-fail capability, in case of failure of any array element, and easy maintainability with a minimum number of spares.

Very reliable system: MTBCF >20.000 hours, MTTR < 30 minutes and System Availability > 99,99%.




## Operational Highlights

Radar Cabinets

### 3D Pencil Beam Technique

The 3D PSR is a "pencil beam" radar. This "pencil-type" high-gain beam is aimed with phase control to several transmit/receive pointing elevations whilst the antenna is mechanically rotated in azimuth.

Each beam can be configured with the number of pulses, pulse energy, instrumented range and processing type that are most appropriate, taking into account the required instrumented coverage and the characteristics of clutter in the elevation volume covered by the beam.

Detection is improved since it can only be affected by the clutter or interference present in the beam that points at the aircraft.

High elevation beams are virtually free of surface clutter making aircraft detection more feasible than with conventional 2D radars. This 3D radar system provides aircraft altitude data without the need of their cooperation.

### Planar Array Antenna and Distributed Solid-State Design

It is based on a planar array antenna composed of vertically stacked horizontal linear arrays.

Driven by modular solid-state transmitters and receivers that electronically synthesize a transmit/receive antenna pattern with narrow beam width, both in azimuth and elevation.

### Monopulse Technique

Another specific feature of 3D PSR is the achievement of high accuracy and resolution of aircraft in azimuth by the use of Monopulse technique.

This technique, based on simultaneous reception of signals through two antenna patterns, sum-type and difference-type patterns, is also used for estimation of aircraft elevation, which is the first step for aircraft height calculation.

Range accuracy and resolution is obtained by digital pulse compression by using phase modulated waveforms and very low side lobe level filter response.

### Frequency Diversity

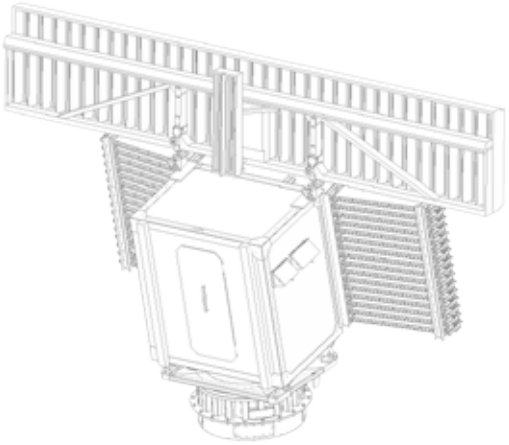
The 3D PSR is a dual frequency radar simultaneously operating with two frequency channels. This feature provides better detection and accuracy performance, especially for small aircraft and interference conditions.

### Anti-Clutter Capabilities

Detection of aircraft immersed in terrain or weather clutter is achieved by the use of MTD or MTI processing.

Aircraft with low radial velocities can also be detected by the clutter-free high elevation beams or by the low elevation beams which provide superclutter visibility based on Clutter Map detection techniques.

# ATM



| TECHNICAL CHARACTERISTICS | |
|---|---|
| **GENERAL CHARACTERISTICS** | |
| **Frequency Operating Band** | 1250 to 1350 MHz |
| **Frequency Modes** | 2 Frequency channels<br>More than 70 selectable frequency codes<br>Dual frequency code operation mode |
| **Power amplifier modules** | 16 (graceful degradation) |
| **RF Tx and blanking** | Up to 16 sectors in azimuth |
| **Tx waveforms** | Complex waveform scheduling with long length (high energy)LFM pulses: Up to 500 us |
| **Duty Cycle** | 11 % mean, 15% peak |
| **PRF** | Complex staggered interpulse period scheme |
| **MTI improvement factor** | 60 dB |
| **COVERAGE** | |
| **Range** | 70, 100, 110, 120 or 180 NM |
| **Heigth** | Up to 80000 feet |
| **Elevation** | > 30° |
| **RELIABILITY** | |
| **Availability** | 99.99% |
| **MTBCF** | > 20000 hours |
| **MTTR** | < 30 minutes |
| **RESOLUTION** | |
| **Range** | 200 m |
| **Azimuth** | 3° |
| **ACCURACY** | |
| **Range** | 50 m |
| **Azimuth** | 0.2° |
| **Height** | 2500 feet up to 60 NM |
| **RECEIVER** | |
| **Architecture** | Distributed front-end elements |
| **Sensitivity** | -115 dBm |
| **Dynamic Range** | > 80 dB |
| **STC** | > 60 dB |
| **ANTENNA** | |
| **Architecture** | Planar array with 16 row antennas. Digitally controllable beamforming |
| **Patterns** | Tx pattern<br>3 simultaneous Rx patterns (Sum, Diff Azim, Diff Elev) |
| **Gain** | Tx: 33.3 dBi<br>Rx: 33 dBi |
| **Azimuth beamwidth** | 2.8° |
| **Elevation Beamwidth** | 6° |
| **Rotation Speed** | From 5 rpm to 15 rpm in relation to range coverage |
| **Polarization** | Linear |
| **Receiving channels** | Sum-F1, Sum-F2, Diff Az-F1, Diff Az-F2, Diff Elev-F1, Diff Elev-F2 |
| **SIGNAL & DATA PROCESSOR** | |
| **Architecture** | COTS multiprocessor boards<br>Configurable processes: MTI, MTD, Non-Coherent Integration |
| **Processing channels** | Adaptive clutter suppression by coherent processing |
| **Detection Process** | Based on combination of range CFAR and clutter maps |
| **Coordinate estimation** | Monopulse in azimuth and elevation (target height) |
| **Weather Channel** | US-NWS / ICAO 6 level detection |
| **Capacity** | 1000 plots per scan<br>500 tracks per scan |

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Wb RCG
Rb AAA
Ab JTM
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