



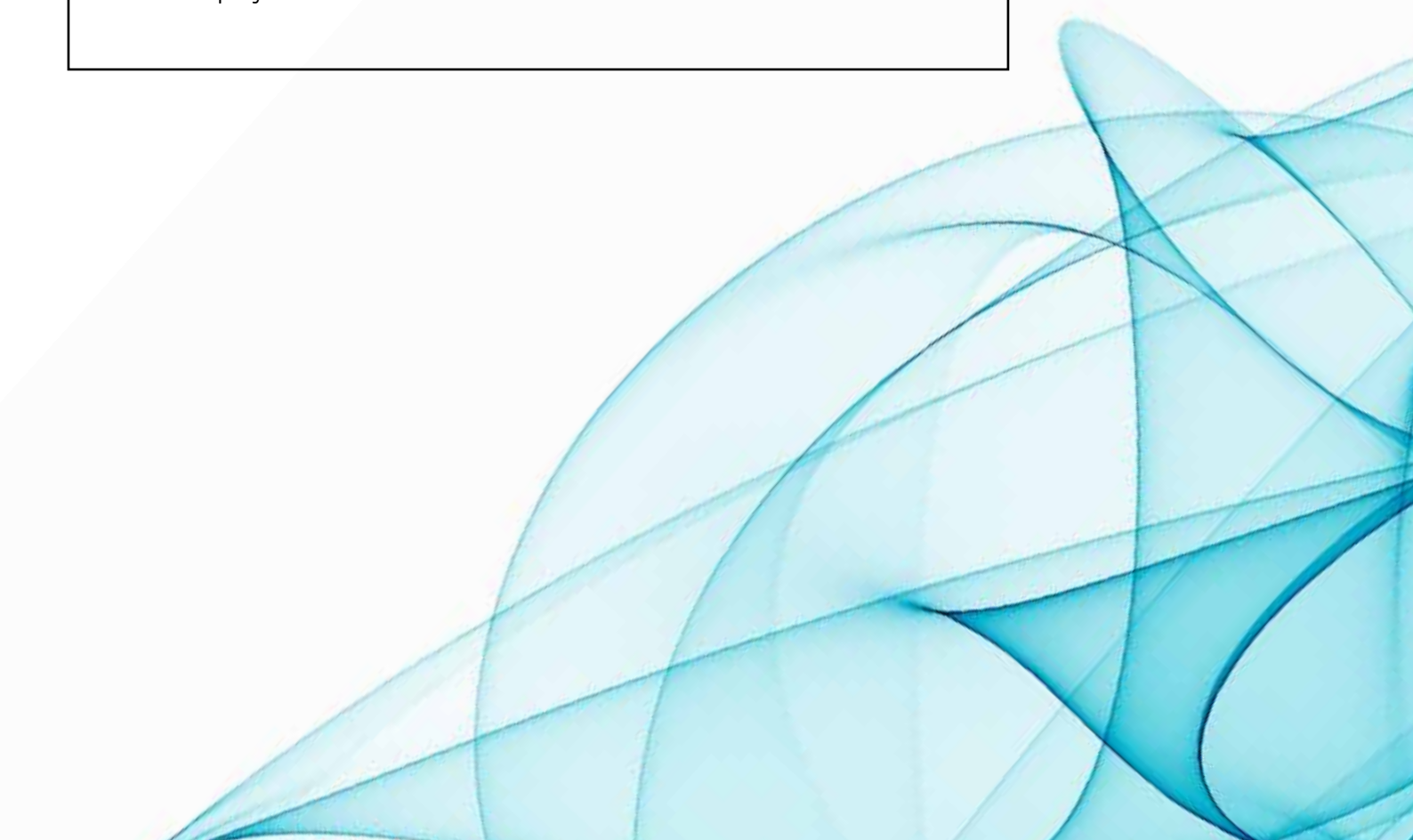
**indra**

AIR TRAFFIC MANAGEMENT

# **MONOPULSE SECONDARY SURVEILLANCE MODE-S RADAR**

Supplying ATM systems around the world for more than 90 years

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# MONOPULSE SECONDARY SURVEILLANCE MODE-S RADAR



Mongolia Munk Ulzit MSSR mode-S Site

## High performance mode-S radar

The current MSSR radar is the fourth significant generation of MSSR radars in Indra. It complies with the requirements stated by the International Civil Aviation Organization (ICAO) and with the performance demanded by EUROCONTROL to the surveillance and navigation mode S systems.

This mode S system means a low cost and high radar performance solution which offers great flexibility to adapt to the client necessities.

The MSSR radar includes full international capabilities as enhanced surveillance performances.

The MSSR-S radar assembly corresponds to a modern station architecture, unmanned with a user-friendly latest-generation interface allowing full local and remote management.

The global system architecture makes use of the experience gained by Indra Sistemas S.A. in developing and installing surveillance radar networks for clients world-wide. This is a very open and flexible architecture, configurable according to the client's requirements and the needs of the different sites, such as its communications architecture and maintenance network.



MSSR mode-S Antenna

## Characteristics

### Functions

- Detecting targets with enhanced surveillance using selective interrogations
- Video processing
- Data processing
- Data link operation capability
- Surveillance coordination function
- Code management: II/SI according to ICAO
- Automatic reporting of aircraft identification
- Transponder capability report
- Altitude reporting in 25 ft intervals
- Flight status
- DAPs supported
  - » Magnetic heading
  - » Air speed
  - » Selected altitude
  - » Vertical rate
  - » Track angle rate
  - » Roll angle
  - » Ground speed
  - » True track angle

### System features and radar parameters

- Double redundant channel for the transmitter/receiver/processor with automatic reconfiguration in the event of a fault
- Solid-state transmitter
- Use of latest-generation signal and data processors for processing and tracking the signal
- Compliance with international standards (EUROCONTROL / ICAO / RTCAA)
- Local and remote control and supervision system with maximum efficiency man-machine interface, using a colour display, executed in workstations
- Intelligent BIT, built-in test, with remote control and performance supervision
- Ease configurable to adapt it to customers needs
- High coverage volume due to range reached and small cone of silence.

### Control and monitoring system

- Full redundancy
- Hieratical configuration for avoiding control conflicts
- Keeps historical data. Create/manages files by user access
- Color key for the state of the modules
- Print and restore files
- Help in case of incompatible options
- Configuration set for each channel and by zones
- More than 90% faults detected

### Local display

- Presentation of data over maps
- Filtering by interesting areas
- Zoom capability
- Presentation of data link
- Recording
- Saving data into files
- Display managing (2D / 3D presentation available)

# ATM

## Features

### High technology used

- A completely solid state radar, including the transmitter
- Fault resistant
- Dual Tx/Rx and extractor architecture
- The MSSR-S radar assembly corresponds to a modern station architecture, unmanned, with a user-friendly latest generation, full local and remote management
- SME, bus VME, VDSLI-DSP circuits, power PC
- Latest-generation digital signal processors and the latest proven technology for detection techniques ensuring that data are acquired with high reliability

### Reliability and low life-cycle cost

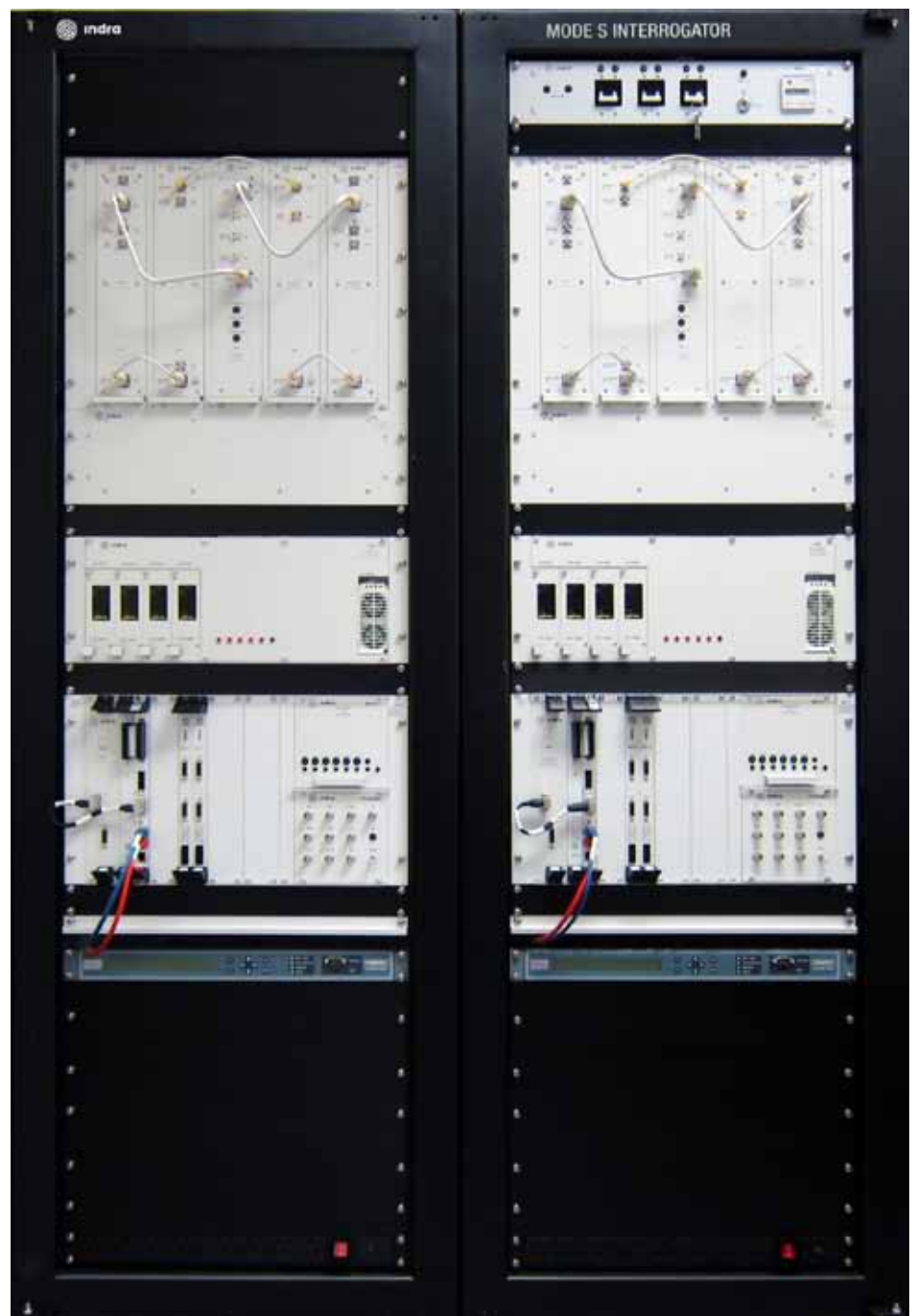
- High MTBCF and MTBF values
- Simple maintenance and adjustment tasks
- Lower annual cost in servicing time and spares which greatly reduces the life-cycle cost
- Integrated test and supervision unit that checks the performances of the system from the remote site
- Modular BITE at LRU level that continually controls the correct operation of each and every module, both for radiofrequency and digital processing

### Communality

- Conceived with the same concepts that have provided optimum results for the radar stations supplied by Indra. The system provides the best mode S upgrade solution for conventional SSR systems
- The mode S radar station also shares significant components with other Indra's equipments (power supply and process modules, control and supervision workstations, communications management components...)

### Operative capability

- High data reliability and probability of detection
- High degarbling capability



MSSR Mode-S Equipment

Main technical features	
Radar coverage	256 NM range 66000ft height
Probability of detection (Pd)	≥ 99%
Probability of code validation	≥ 99%
Code detection	mode 3/A, C Codes 7500, 7600, 7700 Military emergency replay train Military identity replay train Error detection and correction for mode-S replies
False codes validated	mode 3/A: < 0.1% mode C: < 0.1%
False targets	< 0.1% and less than one per scan on average
Validated Comm-B/-D replay false data	Not more than 1 segment in 107 messages
Multiple target processing	Discriminating capabilities
Fruit environment supported	≥ 11.000 fruit/second in antenna main beam
Range accuracy (systematic errors)	≤ 14 m
Range accuracy (random errors)	mode S: ≤ 15 m 1σ SSR: ≤ 30 m 1σ
Azimuth accuracy (systematic errors)	0 < φ < 6°: ≤ 0.022° 6 < φ < 10°: ≤ 0.033°
Azimuth accuracy (random errors)	≤ 0.068° 1σ
Resolution	Range: ≤ 1/128 NM Azimuth: ≤ 0.022°
Overall jump rate	< 0.05%
GARBLING TARGET PROCESSING	
No. overlapping replies	Four SSR, rejecting all phantoms Two mode S
Probability detection two SSR targets	≤ 60% (< 0.05 NM range, < 0.6° azimuth) ≤ 98% (0.5 to < 2 NM range, ≤ 0.6° azimuth) ≤ 98% (2 NM range, > 0.6° and < 4.8 azimuth)
Probability detection two SSR targets (mode 3/A, mode C codes)	≥ 30% (< 0.05 NM range, ≤ 0.6° azimuth) ≥ 90% (0.5 to < 2 NM range, ≤ 0.6° azimuth) ≥ 98% (< 2 NM range, > 0.6° and < 4.8° azimuth)
TARGET LOAD	
Per scan	≥ 1080
Per 45° sector	≥ 266 = 25% total aircraft
Per 3,5° sector	≥ 65 = 6% total aircraft
Additional tracking capability	Tracks up to 24 targets simultaneously through "cone silence"
Processing delays	≤ 120° of LVA rotation ≤ 2 sec. independent of turning rate
Re-interrogation	In absence of reply to a selective interrogation a reinterrogation will be performed in the next selective period.
MTBCF	> 150.000 hours
MTTR	≤ 30 m for interrogator



ISO 9001:2000



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