AIR TRAFFIC MANAGEMENT

# MONOPULSE SECONDARY SURVEILLANCE MODE S RADAR

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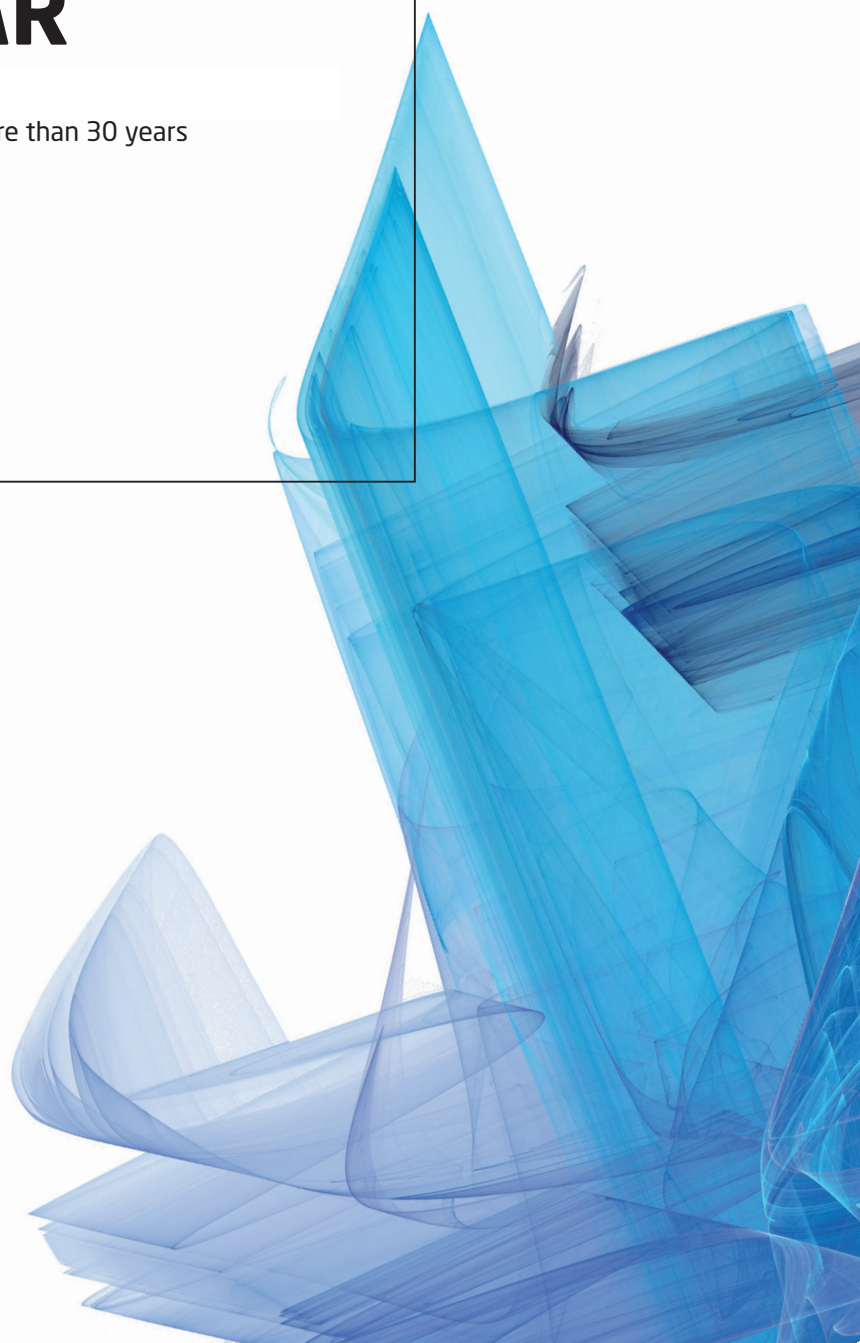


# MONOPULSE SECONDARY SURVEILLANCE MODE S RADAR

## Low cost and high performance mode S radar

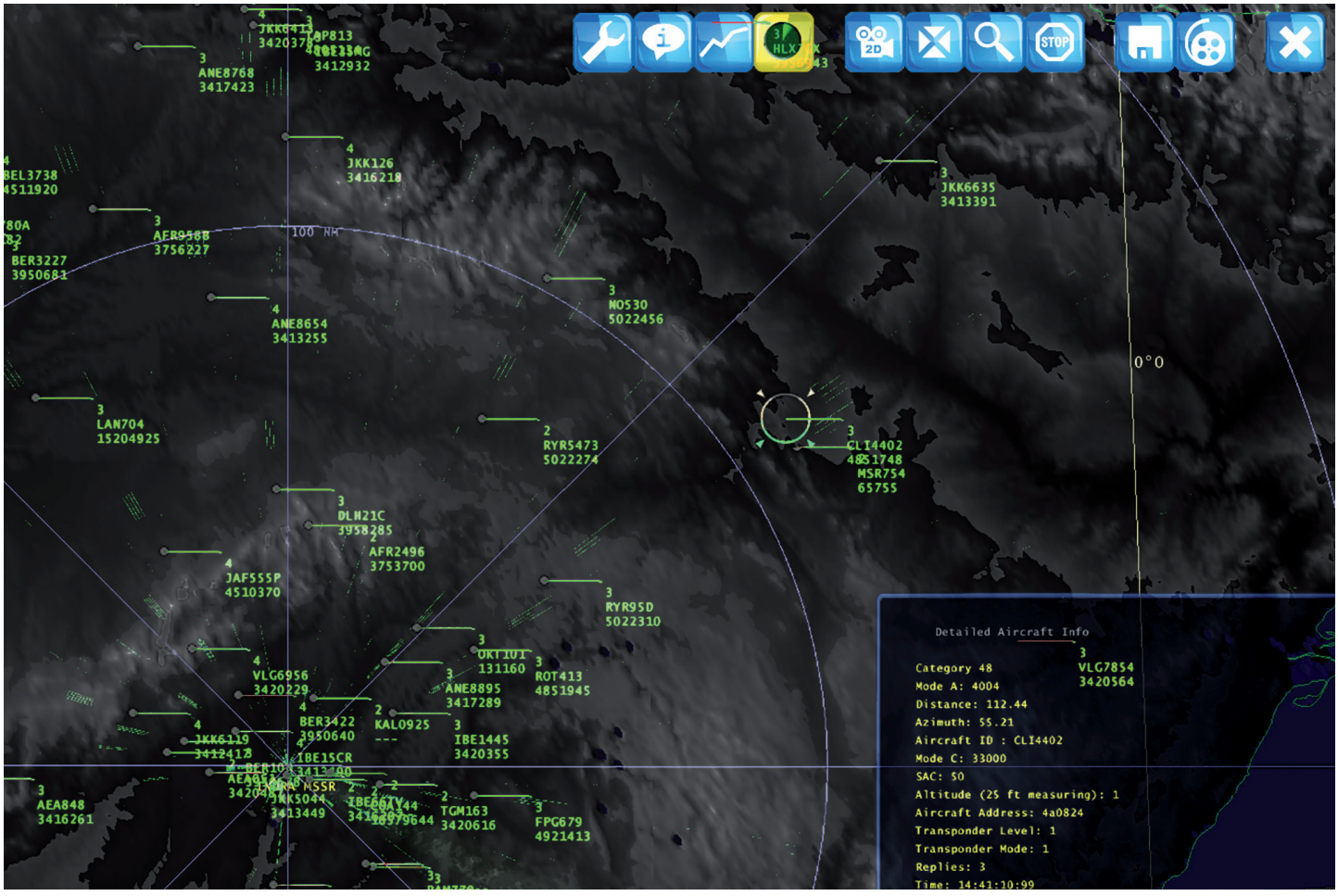
### Introduction

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 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.




Screen from the side local central and monitory position showing mod S Asterix data and raw video in 3D view

MSSR mode S radar station

## Characteristics

### Functions

- Detecting targets with enhanced surveillance using selective interrogations
- Video processing
- Data processing
- Data link
- Station coordination
- Code management: II/SI and ICAO
- Display
- Automatic reporting of aircraft identification
- Transponder capability report
- Altitude reporting in 25 ft intervals
- Flight status
- SI code capability
- DAPs
  - 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 as EUROCONTROL and ICAO
- Local and remote control and supervision system with maximum efficiency man-machine interface, using a colour display, executed in workstations
- Intelligent BITE, built-in test equipment, with diagnostic remote control and performance supervision
- Ease configurable to adapt it to customers needs

### Control and monitoring

- 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
- Presentation of data link
- Recording
- Saving data into files
- Display managing

## Features

### High technology

- 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
- 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 mode S upgrade solution
- The mode S radar station also shares significant components with them (power supply and process modules, control and supervision workstations, communications management components...)

### Operative capability

- High data reliability and probability of detection for future ATC applications
- High processing velocity which allows high capacity of degarbling

## Main technical features

| | |
|---|---|
| **Radar coverage** | 256 NM range<br>66000ft height |
| **Probability of dtection (Pd)** | SSR: [3] 97%<br>Mode S: [3] 99% |
| **Probability of code validation** | Mode 3/A: ≥ 98%<br>Mode C: ≥ 96%<br>Mode S: ≥ 99% |
| **Code detecion** | Mode 3/A, C<br>Codes 7500, 7600, 7700<br>Military emergency replay train<br>Military identity replay train<br>Error detection and correction for mode S repiles |
| **False codes validated** | Mode 3/A: < 0.1%<br>Mode C: < 0.1% |
| **False targets** | < 0.1% and less than one per scan on average |
| **Validated Comm-B or Comm-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: 1σ≤ 15 m<br>SSR: 1σ≤ 30 m |
| **Azimuth accuracy (systematic errors)** | 0<Φ<6°: ≤ 0.022°<br>6<Φ<10°: £0.033° |
| **Azimuth accuracy (random errors)** | 1σ≤ 0.068° |
| **Precision** | Range: ≤ 1/128 NM<br>Azimuth: ≤ 0.022° |
| **Overall jump rate** | < 0.05% |
| **GARBLING TARGET PROCESSING** | |
| **No. overlapping replies** | Four SSR, rejecting all phantoms<br>Two Mode S |
| **Probability detection two SSR targets** | ≤ 60% (<0.05 NM range, < 0.6° azimuth<br>≤ 98% (0.5 to < 2 NM range, ≤ 0.6° azimuth)<br>≤ 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)<br>≥ 90% (0.5 to < 2 NM range, ≤ 0.6° azimuth)<br>≥ 98% (< 2NM range, > 0.6° and < 4.8° azimuth) |
| **TARGET LOAD** | |
| **Per scan** | ≥ 900 |
| **Per 45° sector** | ≥ 225 = 25% total aircraft |
| **Per 3,5° sector** | ≥ 54 = 6% total aircarft |
| **Additional tracking capability** | Tracks up to 12 targets simultaneously through "cone silence" |
| **Processing delays** | ≤ 120° of LVA rotation<br>≤ 2 sec. independent of turning rate |
| **Re-interrogation** | In absence of reply to a selective interrogation a re-interrogation will be performed in the next selective period. |
| **MTBCF** | > 40.000 hours |
| **MTTR** | ≤ 30 m for interrogator |


ISO 9001:2000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