



RSM 970 S

Monopulse Secondary Surveillance Radar/Mode S



RSM 970 S: the gate to the 21st century

Thales ATM presents the latest generation Mode S/ Monopulse Secondary Surveillance Radar System: the RSM 970 S.

Twenty years of experience in the field of MSSR/Mode S gave Thales ATM the unique capability to propose the RSM 970 S, the higher performance sensor that gives controller total support in severe Air Traffic situations.

The RSM 970 S stands as the most advanced MSSR/Mode S. Developed as part of the full Mode S system and built around validated elements that have proven their performance through extensive programmes of operational and technical tests, the RSM 970 S can be fitted as an MSSR or Mode S sensor. The Mode S functions cover the selective interrogation, the enhanced surveillance, and full data link.

Using innovative techniques and latest technologies, the RSM 970 S is a price optimized sensor designed to provide the best response to operational requirements:

- ✓ a high contribution to Air Traffic safety by ensuring a total integrity and availability of the surveillance and communication data provided to the controller
- ✓ an aid to support reduced separation standards in congested traffic areas
- ✓ a lower cost of ownership owing to an easy and flexible use, a high reliability, a reduced maintenance scheme and effective post contract services.

The RSM 970 S has been recognized by the community of customers and the full Mode S version has been site accepted by Eurocontrol within the POEMS programme.

The RSM 970 S sets a new standard in MSSR/Mode S sensor performance and best supports the Air Traffic Services.

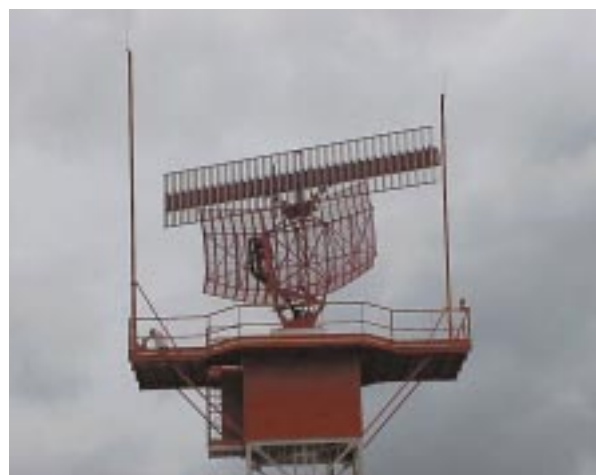




Improving ATM operations through enhanced MSSR performance and Mode S benefits

Supporting effective air traffic control with high safety level

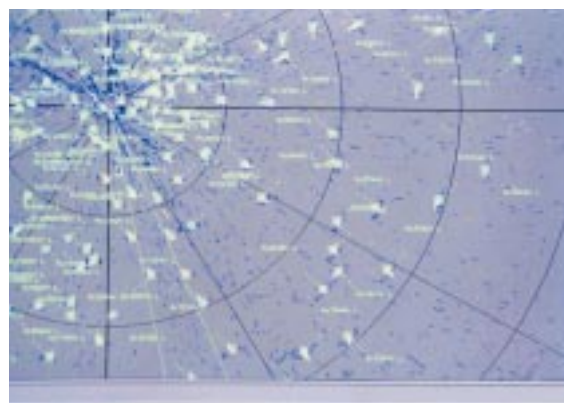
- ✓ Safety requirements integrated since start of development
- ✓ Highest MSSR performance in heavily polluted electromagnetic environment
- ✓ Detection and resolution capabilities allowing reduced separation standards
- ✓ False targets rejection: multipath, reflections, ring around, splits, fruits
- ✓ High data availability owing to redundant architecture and automatic seamless switch over
- ✓ Mode S functionalities and performance meeting the 'European Mode S Station Functional Specification' of Eurocontrol



RSM 970 S co-mounted with STAR 2000 Solid State PSR

Offering improved/new services to the controller

- ✓ Mode S basic surveillance supports the full compatibility with existing centres and offers:
 - Improved data integrity giving better code quality
 - Suppression of resolution issues thanks to selective interrogations
 - Improved Short-Term Conflict Alert (STCA) through 25 ft increment altitude reporting
 - Full compatibility with existing ATC centres thanks to standard ASTERIX format
- ✓ Mode S elementary and enhanced surveillance offer the downlinking of airborne data by using GICB (Ground Initiated Comm. B) and MSP (Mode S Specific Protocol) protocols:
 - Aircraft call-sign, facilitating flight data processing and overcoming the limitation on allocation of Mode A codes
 - State vector: heading, airspeed, vertical speed...
 - Aircraft route intentions: way points...
 - ACAS resolution advisory, selected VHF channel...
- ✓ Surveillance Coordination Function offers:
 - Optimisation of a cluster of Mode S stations



Ready for the Aeronautical Telecommunications Network (ATN)

- ✓ Supporting a two way air/ground data link dedicated mainly to air traffic services
- ✓ Allowing interconnection of ATCC and on board Flight Management System (FMS) through the Mode S subnetwork
- ✓ Providing an ISO 8208 switched virtual circuit through connection to the Mode S ground data link processor (GDLP)





Superior Design for lowest ownership cost

The RSM 970 S family: MSSR version / Mode S version

- ✓ A common product design based on the POEMS development
- ✓ Mode S version with full Mode S functionalities validated with Eurocontrol
- ✓ Lower cost MSSR version, for operational environments not yet requiring Mode S
- ✓ MSSR version is easily field-upgradable to Mode S by simple plug-in of 3 modules



Dual electronics housed in EMC cabinets

Advanced techniques and technologies

- ✓ Modern technology for improved reliability:
 - Last generation RF power transistors
 - New digital monopulse receiver
 - VLSI and DSP circuits for signal processing
 - COTS PowerPC™ board for data processing
- ✓ High sampling and processing rate (50 ns) allowing unique degarbling capabilities
- ✓ Decoding validation performed in three steps
- ✓ Field proven performance validated by Civil Aviation Administrations worldwide



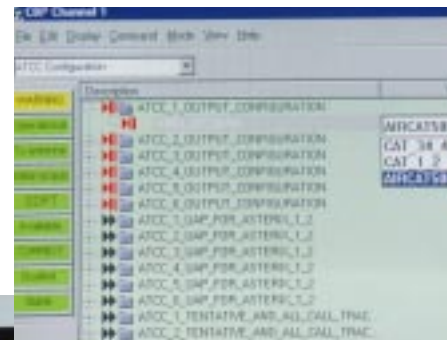
High duty cycle
transmitter capable
of full Data Link operation

Designed to standards

- ✓ Compliant with ICAO standards and Eurocontrol 'European Mode S Station Functional Specification' (EMS)
- ✓ Designed to the European Directives and International Standards for electromagnetic compatibility and safety
- ✓ Asterix formatted output data (other formats available)
- ✓ Open architecture : Ethernet, VME, ISO protocols

Low ownership cost

- ✓ Easy to use and to maintain
- ✓ Unmanned operation through efficient RCMS
- ✓ On line testing at LRU level
- ✓ On site repair by safe and easy replacement
- ✓ No specific test equipment required, no periodic adjustment
- ✓ High reliability, high availability
- ✓ Long life equipment supporting extreme weather conditions
- ✓ Wide range of support services:
 - Repair service
 - Standard exchange service
 - Dedicated support service





POEMS - European Mode S Programme

In 1997, Eurocontrol has selected Thales ATM for the development and validation of POEMS (Pre-Operational Mode S) systems on the basis of its large experience and capabilities in Mode S.

The POEMS requirements include full Mode S Data Link Operation and stations Networking. The Thales ATM POEMS station was site accepted in 2001.

Thales ATM Mode S product is based on the latest EUROCONTROL specifications, the "European Mode S Station Functional Specification" (EMS).

An experienced team

Thales ATM experience and competence in Monopulse Secondary Radars and Mode S has been widely demonstrated:

- ✓ 20 years of development and production of MSSR products
- ✓ Over 300 MSSR radars sold all over the world, including Austria, Azerbaijan, Belgium, Brazil, Cambodia, China, Cyprus, Denmark, Egypt, France, Greece, Kuwait, Laos, Mexico, South Africa, South Korea, Turkmenistan, Uzbekistan
- ✓ Active member of ICAO SICASP panel for Mode S
- ✓ Collaboration with French STNA and EUROCONTROL for implementation of future Mode S operational concepts



RSM 970 S Technical characteristics

Functional characteristics		SSR	Mod
LVA Antenna			
Scan rate	up to 15 RPM	4	4
Maximum gain	> 27 dBi	4	4
Azimuth beamwidth	2.4j	4	4
Interrogator / Receiver			
SSR Modes	1, 2, 3/A, C	4	4
Mode S surveillance modes	Intermodes, All-call, Roll-call		4
Mode S datalink modes	SLM, ELM		4
Mode S peak duty cycle	65% over 2 ms		4
Mode S average duty cycle	5%		4
Interrogator sidelobe suppression		4	4
Receiver sidelobe suppression		4	4
Improved interrogator sidelobe suppression		4	4
Signal and Data processor			
Maximum range	up to 256 nmi	4	4
Fruit density in the mainlobe	up to 11.000 per sec	4	4
Mode S elementary/enhanced surveillance			4
Mode S surveillance coordination (cluster)			4
Target load:			
- per scan	800	4	4
- per 45j sector	200	4	4
- per 3.5j sector	40	4	4
Output formats	Aircat, Asterix cat 1/2/34/48	4	4
Performance figures			
Probability of detection (Pd)	> 99%	4	4
False target reports ratio	< 0.1%	4	4
Multiple target reports	< 1 per scan	4	4
Code validation (Pv)	> 99%	4	4
Validated false code ratio	< 0.1%	4	4
Resolution according to Eurocontrol areas			
- area 1: 0.6 < Dq < 4.8j, DR < 2 nmi	Pd > 98% Pv > 98%	4	4
- area 2: 0.6 Dq < 0.6j, 0.05 < DR < 2 nmi	Pd > 98% Pv > 90%	4	4
- area 3: Dq < 0.6j, DR < 0.05 nmi	Pd > 60% Pv > 30%	4	4
Azimuth accuracy	< 0.07j	4	4
Range accuracy (SSR)	< 30 m	4	4
Range accuracy (Mode S)	< 15 m		4
Reliability, Availability, Maintainability			
Fully duplicated electronics		4	4
MTBF	> 1400 h	4	4
MTBCF	> 50 000 h	4	4
MTTR	< 0.5 h	4	4
Availability (Ai)	99.999 %	4	4
Bite coverage	> 90 %	4	4