THALES AIR TRAFFIC MANAGEMENT



RSM 970 S

Monopulse Secondary Surveillance Radar/Mode S

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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

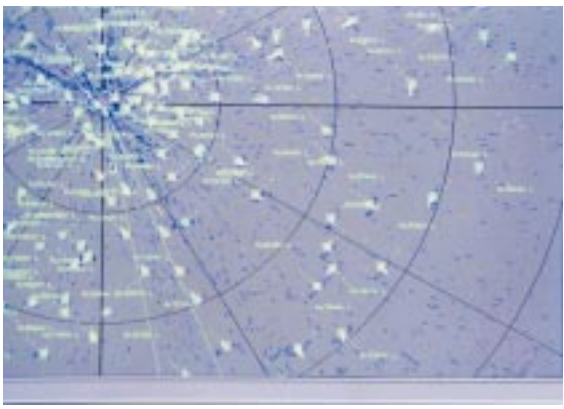
Supporting effective air traffic control with high safety level

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

- ✔ 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

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

Dual electronics housed in EMC cabinets

- ✔ 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

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 worlwide

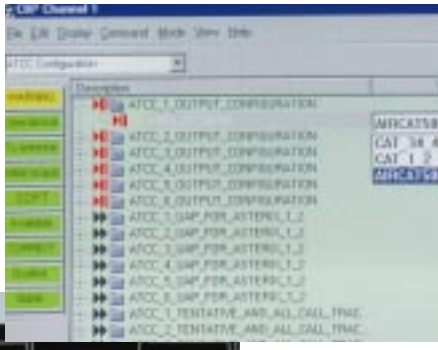
High duty cycle transmitter capable of full Data Link operation

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.

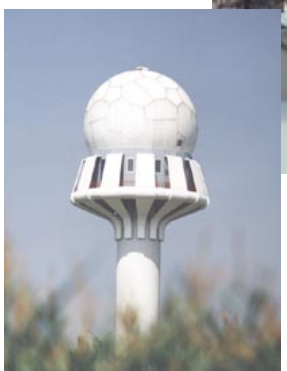
The POEMS requirements include full Mode S Data Link Operation and stations Networking. The Thales ATM POEMS station was site accepted in 2001.

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

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