



MM/SPS-702 search
radar and MM/SPN-703
navigation radar

MM/APO-706 airborne radar

HSS-1 coastal and harbour
surveillance radar



SMA

SEGNALAMENTO MARITTIMO ED AEREO

Radar systems for ships, aircrafts, helicopters and ground stations.

- Radars for navigation air and naval search.
- Homing and guidance radars.
- Coastal and harbour surveillance radars.
- Tactical visualization, command and control displays, missile assignment consoles.
- Graphic displays and plotting systems.
- Signal processing and data handling techniques.
- System engineering.

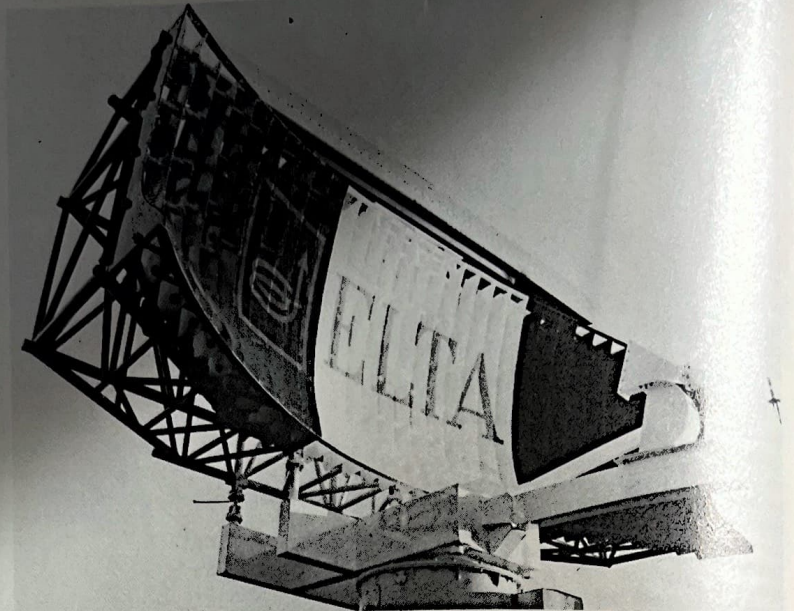
PO. BOX 200 - FIRENZE (ITALIA) - TELEPHONE: 055/27501 - TELEX: SMARAD 570622 - CABLE: SMA FIRENZE

1958.153

ELTA SURFACE RADARS

Elta Electronics Ltd produces a range of surface radars for ATC, search and acquisition, and similar applications, with fixed and land-mobile systems for surveillance roles, coastal protection, etc.

Base model for most of this equipment, which is built on a modular design concept, is the EL/M-2205, and unless otherwise stated the following text relates to this model. (The current range is now based on the EL/M-2215 (3708.153) a modernised and improved version of the EL/M-2205.) Other models are the surface and low air cover search radar, EL/M-2206, which employs the AT-102 antenna in place of the AT-103 used in the EL/M-2205, and the naval version EL/M-2207 (3264.253). All versions are constructed to conform to the MIL-E-16400 specification and are provided with BITE (built-in test equipment). Conventional PPI displays or synthetic (raster-type) displays are available for use with all models. Integrated IFF is available as an option and is used in military models. A high performance, compact, and lightweight E/F-band transceiver forms the basic building block, and two of these units may be operated together in dual diversity. Receiver models available include: linear with switchable STC, FTC, IAGC, Log-FTC-Anti Log, CFAR. There is single-knob tuning of the transmitter frequency between 3.1 and 3.2 GHz, and a stable synthesiser enabling the whole equipment to cover this band in less than 20 s, in the EL/M-2206 version.

CHARACTERISTICS:**Type:** EL/M-2205**Antenna****Dimensions:****Height:** 300 cm**Width:** 500 cm**Weight:** 600 kg**Beamwidth:** 1.4° horizontal; 5.5° vertical**Pattern:** Cosc-squared to 35°**Gain:** 34.5 dB**Sidelobes:** Better than -23 dB**Polarisation:** Linear/horizontal/circular**Rotary joints:** E/F and D bands**Transmitter****Frequency:** E/F-band. Crystal selectable in 250 MHz range**Output power:** 425 kW peak**Pulse width:** 0.4 or 1.4 μ s

Elta EL/M-2205 search radar scanner AT-103 with on-mounted IFF

Prf: Fixed, adjustable from 1000 - 1500 pps for 0.4 μ s pulse. Random variable, 1500 \pm 20% pps for 0.4 μ s pulse, 750 \pm 20% pps for 0.4 μ s pulse**Stagger ratio:** Random from pulse to pulse**SYNCH:** Periodic, Random, External**SYNCH output:** Display SYNCH, SSR pre-trigger**Receiver****Type:** Superheterodyne**Frequency control:** Single-knob manual, or automatic**IF:** 60 MHz**Noise figure:** 2.0 dB maximum (at input of parametric amplifier)**Sensitivity:** 107 dBm (at parametric amplifier input)**MTI sensitivity:** 104 dBm (at parametric amplifier input)**Gain:** 120 dB**Bandwidths:** 1.5 MHz (1.4 μ s pulse)
3 MHz (0.4 μ s pulse)**Video outputs:** Normal, MTI, Log-FTC Anti-log Processor**Digital MTI:** 3-pulse canceller with feedback**Sub-clutter visibility:** 27 dB**Blind speeds:** None below Mach 3**Prf stagger:** Pulse to pulse, random

Optional MTI extractor, 50 target memory

Transmitter/receiver**Height:** 110 cm**Width:** 60 cm**Depth:** 65 cm**Weight:** 270 kg**STATUS:**

Unspecified models of the EL/M-2200 series are stated to be in service in Israel and abroad.

CONTRACTOR:

Elta Electronics Industries Ltd, Ashdod, Israel.

ITALY

3278.153

MM/SPQ-3 COASTAL RADARS

The SPQ-3 series of radars comprises a variety of equipment combinations, centred on co-mounted I/J-band and E/F-band radars, configured to produce sets appropriate to coastal surveillance and harbour surveillance functions and related applications. The system is transportable by trucks or helicopters, and is generally intended to be integrated in larger defence control networks. The complete equipment is housed within two cabins, plus a trailer motor-generated power supply unit. The first cabin contains the two radar transmitter/receivers, and the associated antennas which are mounted on top can be folded inside for transport. The second cabin contains the operational part of the system, such as displays, processing unit, video recorder, and plotting table. The electronic recording system can be independently connected to the I/J-band or to the E/F-band radar, and is based on processing radar data (range scale, antenna speed, bearing etc) by means of a TV scan converter and connecting these to a magnetic recorder. Restitution of stored data is obtained by connecting the magnetic recorder output data to a TV-type display. Remote and local control facilities are provided.

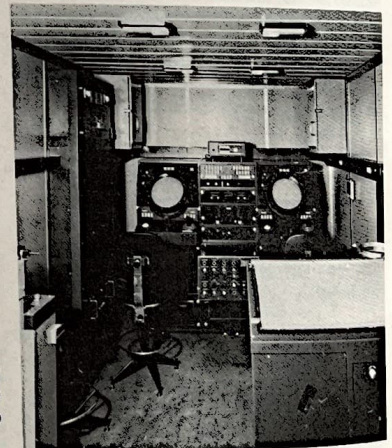
The principal operational roles are medium to long range detection of air attack or of combined air/seaborne assaults by means of the E/F-band radar; and close to medium range surface surveillance by means of the I/J-band radar to assist defence against surface craft attack, landings etc. In the SPQ-3B version, a special feature is the detection and location of the splashes caused by air-dropped mines in harbours or confined waters.

Features of the E/F-band radar include: variable-frequency transmission; random prf; high directivity antenna pattern; Dicke-fix IF receiver; and linear-

logarithmic IF receiver. The I/J-band equipment has most of these features with the exception of the Dicke-fix, and two back-to-back antennas as compared with the single horn-fed parabolic reflector of the E/F-band unit. Both are essentially very high image resolution systems with low average emitting power, particularly suitable for operation (by means of frequency and polarisation decorrelation) in high traffic density environments. Sector transmission is possible.

Scan converter displays are provided and there are facilities for video recording and replay. Digital and analogue format remote data transmission outputs are available.

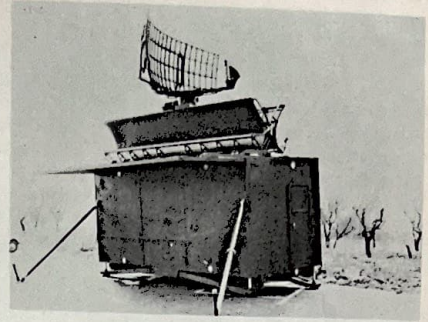
Internal view of SPQ-3 radar control cabin, showing the two identical PPI consoles, each of which can be switched independently to either of the system's two radars

**CHARACTERISTICS:**

Transmitter	E/F-band	I/J-band
Peak power	1 MW+	180 kW+
Pulse-length/prf	1.5 μ s/450 Hz	0.15 μ s/2500 Hz 1.5 μ s/450 Hz
Receiver	Superhet	Superhet
RF noise factor	<6.5 dB	<7 dB
IF	60 MHz	60 MHz
IF bandwidth	1 MHz	10 MHz
Antenna	Horn-fed parabolic	2 back-to-back with end-fed slotted wave-guide feeders. 1 antenna can vary inclination -2° to +15°
Polarisation	Horizontal/circular	Horizontal
Beamwidth	1.5° hor. \times 7° vert. Cosc ² to 28° \pm 2 dB	0.5° hor. \times 3.5° vert. Cosc ² to 45° \pm 2 dB
Rotation speed	4, 8, or 16 rpm	15, 30, or 60 rpm
Dimensions	450 \times 180 cm	440 \times 108 cm

STATUS:
Production. Italian Forces and foreign governments are believed to have been supplied.

CONTRACTOR:
SMA - Segnalamento Marittimo ed Aereo, PO Box 200, Via del Ferone Soffiano, 50100 Florence, Italy.

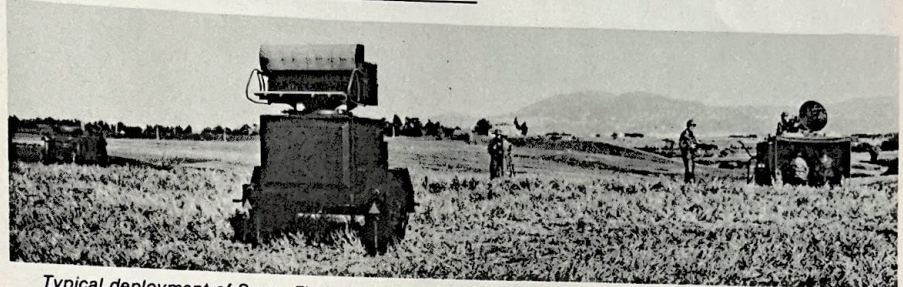


The main radar cabin of the SPQ-3 system, showing the back-to-back scanners for the I/J band spotting and tracking radar and the upper early warning E/F-band search radar scanner

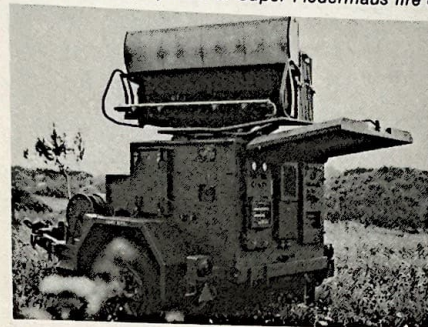
**1529-153
LPD-20 SEARCH RADAR**

The LPD-20 is a search and acquisition radar developed to counter air threats from low and very low level targets in the region below the useful coverage of other radars. Two basic versions have been realised:

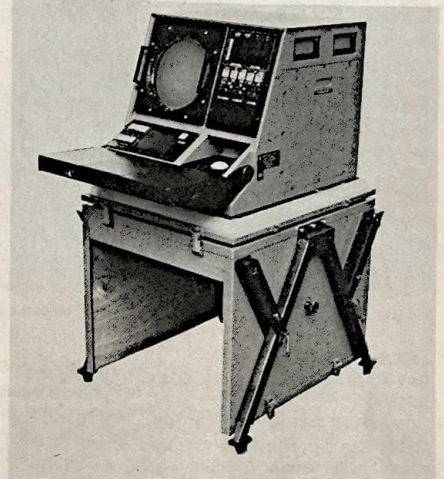
- (1) *Integrated version:* The radar can easily be fitted into the Contraves Super Fledermaus family of fire control systems. This simplest arrangement employs the PPI display as the fire control system, so that the search radar is unattended and a single operator is able to control the complete radar system for both search and tracking of targets.
- (2) *Autonomous version:* The LPD-20 used as an autonomous radar set is equipped with a separate PPI display, for alerting light AA weapons (guns or very short-range SAM) for different purposes (target designation to light unslaved AA artillery emplacements, low and very low altitude surveillance, etc).



Typical deployment of Super Fledermaus fire control system with LPD-20 radar (integrated version)



Contraves LPD-20 search and acquisition radar with Cossor IFF unit (LPD-20, autonomous version)



Display unit for LPD-20 search radar on its transport case in the operational configuration

IFF facilities are also integrated into the radar system. Contraves Italiana SpA in September 1974 concluded an agreement with Cossor Electronics Ltd by which integrated IFF facilities produced by the UK firm can be provided as a customer option for LPD-20 systems.

The main parts of the radar are:

- (1) a rotating section, comprising antenna, transmitter/receiver, signal processor, and modulator;
- (2) turning gear;
- (3) a cabin containing power supplies and operational controls, and
- (4) trailer chassis.

System weight (trailer version) is 2500 kg.

The LPD-20 is a fully coherent pulse-doppler radar. An MTI improvement factor of better than 50 dB is claimed, together with a detection range of about 20 km on targets travelling at speeds between 20 and 410 m/s at heights up to 4000 m. Angular resolution is of the order of 1-4° and range resolution about 500 m. Rapid reaction to sudden low-level threats is aided by a high data rate, the use of a common PPI for search and fire control system, accurate target range and azimuth designation data, and transfer from search radar to fire control radar in two to three seconds. Provision is made for the incorporation of

IFF Mk 10/SIF facilities into the basic LPD-20 radar. Furthermore, as an optional alternative to the autonomous version, an automatic data transmission system can be provided, which allows forwarding of target data information to other users. This system consists of a data transmission unit (DTU) built into the display unit and a data receiver unit (DRU), which is associated with the user's weapon or weapons.

Numerical data corresponding to target position and identification (polar or cartesian co-ordinates and IFF) is transmitted by the DTU (FSK modulator and buffer amplifier) through a two-wire field telephone line or radio link to the user's DRU (filter and demodulator), where it is displayed in a numerical form. A maximum of three targets can be handled simultaneously by the system. Maximum range of telephone transmission amounts to about 400 m (one reel length); DTU transmitted power, however, can cope with longer distances, of the order of some 5 km, when using longer telephone lines. The DRU is provided with autonomous supply (rechargeable DC battery). Data transmission is uni-directional (from display unit to weapons).

STATUS:

The radar has undergone rigorous field tests in Italy and elsewhere and is now in series production. Although detailed information has not been released, this system is known to be widely used in many parts of the world.

Current production of the Super Fledermaus fire control system (2376.151) incorporates modifications to enable it to be associated with the LPD-20.

The LPD-20 is in full production, and is being supplied in substantial numbers - in both integrated and autonomous versions - to several countries in various parts of the world.

DEVELOPMENT:

Contraves Italiana SpA, Via Affile 102 (Km 13, 150 Via Tiburtina) 00131, Rome, Italy.

**4018.153
ALERTER RADAR**

The Contraves Alerter advanced search and acquisition radar system was designed by Contraves to serve as a combined mobile or stationary low-level air surveillance radar station and command post. It is mounted on an M548/C tracked vehicle in the present version for use in a fixed deployment or on the move. In the former role the shelter may be off-loaded and located up to 100 m from the antenna site..

Operational facilities include:

- (1) Air surveillance down to very low altitudes.
- (2) Automatic threat evaluation, and up to 12 targets can be processed simultaneously.
- (3) Automatic target designation to the most appropriate weapon system available.
- (4) Control of associated AA weapon systems (up to 12).
- (5) Easy integration into a higher-level air defence system.

The radar antenna is housed in a protective radome

carried on a telescopic mast which is elevated (up to 10 m) in use to ensure maximum range. The shelter is air-conditioned and contains control consoles and operators' facilities, and remote control of radar operation is possible.

CHARACTERISTICS:

- Frequency:** I-band, frequency-agile
- Type:** Coherent, pulse doppler, pulse compression
- Detection range:** Up to 23 km
- Processing:** Track-while-scan, automatic threat evaluation
- Presentation:** CRI (computer radar indicator)

STATUS:

Prototype completed and extensive field trials carried out.

CONTRACTOR:

Contraves Italiana SpA, Via Affile 102 (Km 13,150 Via Tiburtina) 00131 Rome, Italy.

Artist's impression of Contraves Alerter advanced search and acquisition radar system



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the AT-101, which is claimed to require a reflector area 66 per cent of that required by a conventionally designed antenna to achieve the same performance characteristics.

Operational roles include air early warning surface surveillance, target indication, and navigation. Other features are operator selection of transmitter pulse width, single knob frequency tuning, true motion display, and integrated IFF.

One or two IP-33 41 cm diameter PPI display consoles are normally fitted. Antenna polarisation is switchable linear/circular and there is remote control of antenna elevation angle.

CHARACTERISTICS:

Transmitter

Peak power: 425 kW typical
Average power: 425 W typical
Frequency: 3.1 - 3.3 GHz tunable
PRF: 500 - 700 pps, long pulse
 1000 - 1500 pps, short pulse

Pulse length: 1.4 or 0.4 μ s

Receiver

Type: Linear, with switchable STC, FTC, IAGC, Log-FTC-A Log, CFAR

Noise: 2 dB

IF frequency: 60 MHz

IF bandwidth: 1.4 MHz, long pulse; 3 MHz, short pulse

Antenna

Gain: 28 dB (F-band); 17 dB (IFF)

Beamwidth: 3-3° azimuth (3 dB)

10° elevation (3 dB), cosec² to 30°

Rotation rate: 12 or 24 rpm, selectable

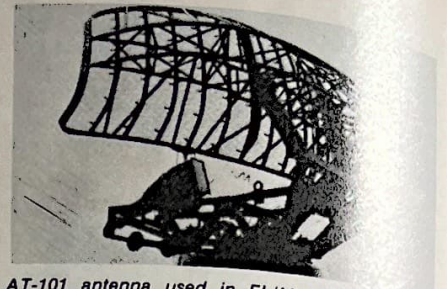
Stabilisation: $\pm 15^\circ$

Dimensions: 2.4 x 1.0 m (reflector)

Performance

Detection range: 55 km, against fighter aircraft size target

Resolution: <75 m, short pulse; <230 m, long pulse



AT-101 antenna used in EL/M-2207 radar system

STATUS:

No details of ship fittings have been released for publication.

CONTRACTOR:

Elta Electronics Industries Ltd, Ashdod, Israel.

ITALY

1364.253

RAN-3L NAVAL RADAR (MM/SPS-768)

The Selenia RAN-3L (Italian Navy MM/SPS-768) is a long range, early warning radar, specifically designed for service in naval vessels in the frigate/destroyer/cruiser class.

The radar is of advanced design and provides air/surface warning and target identification for a modern shipborne defence system. A double curvature reflector with double channel IFF/radar feed is used (G11) and scanner stabilisation can be provided (G12). A new concept in radar design is the use of a composite coded waveform. This offers the following main advantages:

- (1) Ability to obtain great range accuracy and discrimination together with long range detection and a good overall reliability.
- (2) Ability to maintain an adequate target visibility in the presence of either deliberate or natural interference, through the codification of information.
- (2) Ability to take advantage of the diversified information contained in each packet of RF energy in order to extract the doppler components within a single repetition period. This provides the improved capability for cancelling clutter echoes while performing an RF agile transmission.
- (4) Ability to ensure a CFAR condition and SCV in a clutter environment (also against clutter received through antenna sidelobes when the ship is underway).

Digital techniques are used extensively and

applications of this include: transfer of functions, coping with weather and clutter returns, verifying false alarms, mode change-over etc. The RF generation and amplification process is entirely compatible because of a fully coherent transmitter/receiver chain. Therefore, changes in radar waveform, repetition interval, transmission frequency, pulse phase, and gain level are accomplished in real time thereby giving greatly enhanced performance. A multi-pulse coded radiation in frequency agile operation is used in transmission. Code-matched filtering and pulse compression is performed in reception together with doppler discrimination to enhance echoes from genuine targets relative to noise or jamming.

CHARACTERISTICS:

Frequency: D-band

Antenna: 3.6 x 7.6 m

Rotation: 6 rpm

Polarisation: Linear

Range: Approx 280 km

Range accuracy: 70 m

Angular accuracy: 0.4°

Outputs: Main video to air plots

Normal video to surface plots

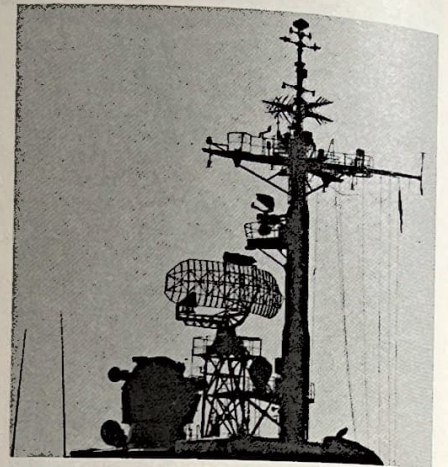
Synthetic video to computer

DEVELOPMENT:

Development was started in 1968 under Italian Navy contract.

STATUS:

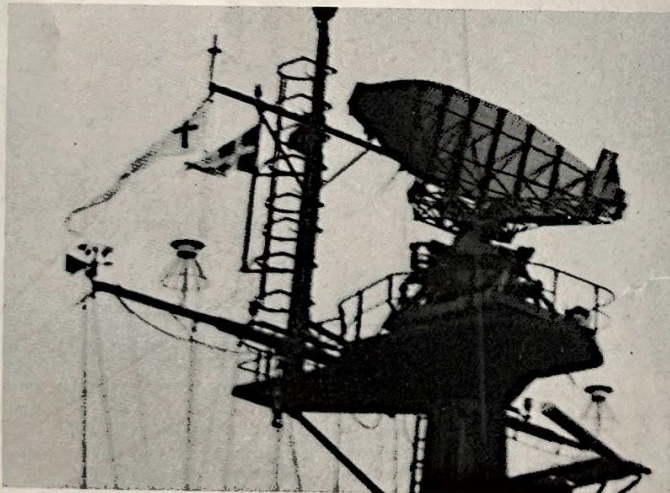
In current production, and a number of systems are being supplied to the Italian Navy and to foreign navies.



Antenna complex (large antenna on lattice structure) of the early warning search radar MM/SPS-768 (Selenia type RAN-3L) installed on board the Italian Navy cruiser Doria. The same equipment will replace AN/SPS-40 and AN/SPS-12 radars on Veneto and Audace/Ardito.

CONTRACTOR:

Selenia-Industrie Eletttroniche Associated SpA, Via Tiburtina Km 12400, 00131 Rome, Italy.



Forward search radar of the Royal Danish Navy frigate Peder Skram, a Selenia RAN-14S. The aft search radar is a Selenia SF-1 (Stefan Terzibaschtsch)



Selenia SF-1 search radar antenna on the Royal Danish Navy 'Falster' class minelayer, Sjelland. Bottom right can be seen the Contraves Sea Hunter FCS radar group. (Stefan Terzibaschtsch)

1699.253

RAN-10S NAVAL RADAR (MM/SPS-774)

The RAN-10S (Italian Navy designation, MM/SPS-774) is an advanced E/F-band coded radar for combined air and surface surveillance. The radar

design philosophy is the same as that of the RAN-3L early warning radar (1364.253), and a number of items are common to both systems. Basic characteristics that the two radars share include:

- (1) Improved accuracy and resolution due to time compression of the radiated waveform.
- (2) Good sub-clutter visibility in natural or man-made interference.

- (3) Clutter cancellation simultaneous with RF agility.
 (4) Advanced CFAR under varying environmental conditions.

The antenna assembly provides for simultaneous air and surface search and is a pitch and roll stabilised reflector with double channel radar/IFF feed. The transmitter is medium powered coherent equipment, and the receiver incorporates a parametric amplifier, frequency programmer, quadrature IF channels, and digital processing.

The MM/SPS-774 is intended for fitting in vessels of medium tonnage such as corvettes, frigates, or fast destroyers. Typical operational roles include air warning, tactical air control, helicopter direction, surface surveillance, navigation, and anti-ship missile direction.

The radar is optimised for target designation to gun and/or missile weapon control systems and for interfacing with automatic or semi-automatic command and control systems. Use of a coded waveform and digital processing of returns gives excellent clutter and jamming rejection performance.

Frequency agility operation is available.

CHARACTERISTICS:

Frequency: E/F-band
Antenna: 3.2 x 4.5 m
Rotation: 15 and 30 rpm
Polarisation: Linear and circular
Range: Approx 75 km
Range accuracy: 20 m
Angular accuracy: 0.35°

DEVELOPMENT:

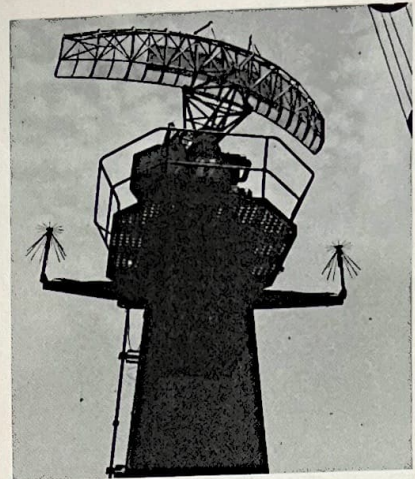
Development began in early 1969.

In current production on behalf of the Italian, Peruvian and Venezuelan Navies who are fitting the MM/SPS-774 in 'Lupo' class frigates.

CONTRACTOR:

Selenia-Industrie Elettroniche Associate SpA, Via Tiburtina Km 12400, 00131 Rome, Italy.

RAN-10S antenna installation aboard a 'Lupo' class frigate



1365.253

RAN-11 L/X INTEGRATED NAVAL RADAR SYSTEM

The RAN-11 L/X is an integrated D- and I/J-band (formerly the L- and X-bands) radar system jointly developed by the companies Selenia and SMA. It has been specifically designed for application as primary radar on board fast patrol craft, hydrofoils, missile boats, and corvettes, or as secondary radar for larger warships. The D-band portion fulfils the air detection role whereas the I/J-band portion ensures long range surface detection and possibly, air warning facilities.

The system benefits from modern signal processing techniques in addition to traditional facilities such as STC, FTC, and a circular polariser. The I/J-band transceiver is an improved version of the search and navigation radar MM/SPQ-2 (1703.253). The D-band transceiver is a very modern pulse doppler radar which uses doppler filtering and pulse compression to provide an extremely high sub-clutter visibility together with a CFAR characteristic. The processing is performed by digital hardware, and the transmitter section is fully solid state. The D-band processed video is suitable for mixing with another video signal without degradation of performance due to collapsing losses. The two radars may therefore

simultaneously feed the same display, thus allowing a significant improvement in operational effectiveness.

The radar system is fitted with a common, roll and pitch stabilised antenna, which includes IFF facilities. The stabilisation platform can also accept a second antenna system for other requirements. The equipment has been designed and tested in accordance with MIL-E-16400F (Am.4).

The detection range is about 28 km for the D-band radar, while the surface coverage of the I/J band extends to 80 km.

DEVELOPMENT:

Development was started in 1969.

STATUS:

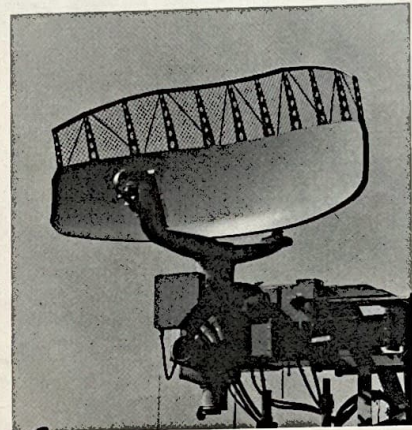
In production and being installed on board the CNR 2400 t fast frigates for the Peruvian and Venezuelan Navies, and also CNR 600 t corvettes. Expected to become operational by end of 1977.

CONTRACTORS:

Selenia Industrie Elettroniche Associate SpA, Via Tiburtina Km 12400, 00131 Rome, Italy.

Eisag - Elettronica San Giorgio SpA, Via Hermada 6, Genoa, Italy.

SMA - Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano 50100 Florence, Italy.



Roll and pitch stabilised antenna complex of the RAN-11 L/X search radar produced by Selenia and SMA. The upper portion of the reflector operates only for the D-band

1368.253

ORION RTN-10X NAVAL TRACKING RADAR

The Orion RTN-10X is a conical-scan pulse radar operating in the I/J-band. It has been especially developed for one man operation, and installation with gun or missile fire control systems in naval vessels. Specifically, the Orion is used in conjunction with Selenia equipment (see Albatros system) or with other equipment (El San Giorgio, Ferranti, Galileo etc). Operational range is about 40 km.

The antenna system consists of a slatted parabolic reflector and feed, with integral trunnion box, mounted on an elevation over train director. Elevation coverage is plus 90 to minus 30°. The trunnion box contains the feed drive motor for high-speed conical scanning, and the assembly which performs the target acquisition scanning mode. The unit is fitted to accept a CCTV camera and camera control unit.

The equipment is, with the exception of CRTs and a few special tubes, of solid-state design. The range tracking and timing system employs digital techniques, resulting in a greatly improved dynamic response, together with high accuracy and stability. Controls and monitoring instruments for the complete system are located in the operating console. This arrangement allows the operator to monitor the functioning of the apparatus and simultaneously observe the signals displayed on the CRTs.

Acquisition of a target is initiated by external designating input sources. The radar then switches to the acquisition phase and upon detection of the

target, automatic tracking is started. As an alternative, the radar can perform an autonomous search programme, in this way further complementing the surveillance system with the low altitude detection capability inherent to the Orion equipment.

Much consideration has been given in design to the reliability of the radar and to the rapid location of faults, and the equipment is provided with built-in monitoring instruments and quick connection plugs and sockets. An optional performance monitor unit is also available which further extends quick checking capabilities.

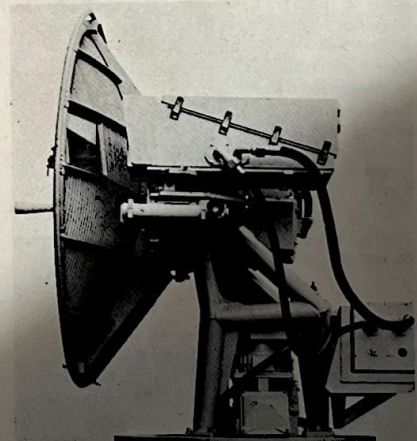
The equipment is supplied either in its basic configuration or in an improved version, in order to provide a scaled performance to meet specific operational, environmental, and installation requirements.

The basic version, as well as the radars already in service, can be given, when deemed necessary, the more advanced capabilities of the improved version by the adoption of modification kits. The additional facilities can be selected from among the following:

- (1) Frequency agility
- (2) Pulse doppler processing
- (3) Special ECCM processing

DEVELOPMENT:

The development of the Orion series started in the early 1960s on behalf of the Italian Navy. Significant improvement in technology and design has been successfully introduced into the original project. The last series, which is named Orion-10X, was developed in 1970 and series production began in 1972.



Orion RTN-10X radar antenna director

STATUS:

The radar has been extensively supplied to the Italian Navy and to many foreign navies. In series production.

CONTRACTOR:

Selenia-Industrie Elettroniche Associate SpA, Via Tiburtina Km 12400, 00131 Rome, Italy.

1935.253

ORION RTN-20X NAVAL RADAR

The Orion RTN-20X is another of the family of I/J-band tracking radars that has evolved from the

Orion 10X. It has been developed particularly for use in the Dardo ship's close-in weapon system (1920.281). In this application it is used for the automatic acquisition of air targets and spotting of

rounds. It is a digital coherent monopulse radar, featuring high ECCM, sub-clutter visibility, and tracking performance.

Autonomous, automatic acquisition occurs at

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ranges from 5 to 12 km depending on target size and relative altitude of the radar antenna and target. Fully automatic, self-adaptive target tracking takes place thereafter, using monopulse techniques. Among its main features that should be mentioned are:

- (1) Nodding free operation during tracking
- (2) Automatic spotting of the rounds
- (3) Automatic acquisition and tracking of a missile launched by the tracked platform.

Much consideration has been given in design to the reliability of the radar and to the rapid location of faults.

DEVELOPMENT:

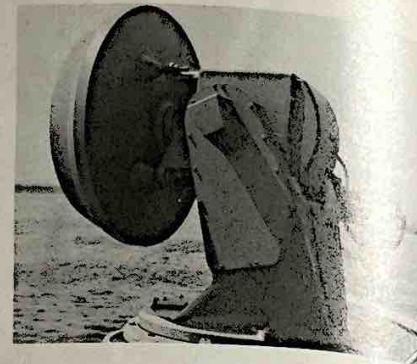
Development was started in 1973 as a private venture.

STATUS:

Operational. The equipment is in production for installation on board 'Lupo' class frigates of the Italian, Peruvian and Venezuelan Navies.

CONTRACTOR:

Selenia-Industria Eletttroniche Associate SpA, Via Tiburtina Km 12400, 00131 Rome, Italy.



Orion RTN-20X tracking radar

1936.253

ORION RTN-30X NAVAL RADAR

The Orion RTN-30X is a monopulse acquisition and tracking radar operating in the I/J-band. Its performance specifications have been dictated by the requirement of integration with advanced weapon systems having an intercept capability up to 15 km and particularly optimised to counter the low and very low altitude threat in an environment characterised by rain, sea, and land clutter, and dense electronic countermeasures.

The RTN-30X employs a coherent chain for RF generation and operates in frequency agility with simultaneous MTI processing. This gives the radar an excellent anti-clutter capability, denying the jamming threat and improving the tracking accuracy. Independent search and acquisition patterns are automatically performed according to computer programs. After radar lock-on, the radar switches to automatic tracking, in which regeneration is provided by the computer.

This radar is particularly designed for integration

with the Albatros Mk 2 missile and gun fire control system.

DEVELOPMENT:

Its research and development programme has been commissioned by the Italian Defence Technical Scientific Committee within a wider development programme for a new GFCS.

CONTRACTOR:

Selenia-Industria Eletttroniche Associate SpA, Via Tiburtina Km 12400, 00131 Rome, Italy.

3483.253

MM/BPS-704 SUBMARINE RADAR

The MM/BPS-704 is a naval search and navigation radar for use aboard submarines, and is a version of the 3RM series of naval radars (1702.253). The general characteristics are similar to the MM/SPN-703 surface ship version (3482.253), using the same

20 kW transmitter and with the same pulse length/prf combinations. The principal differences are indicated in the following table.

CHARACTERISTICS:

Antenna span: 1 m
Beamwidth: 2.2° horizontal; 11° vertical
Gain: At least 27 dB

Noise figure: Better than 11 dB

STATUS:

Italian Navy 'Sauro' class submarines are fitted with the BPS-704.

CONTRACTOR:

SMA-Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano, PO Box 200, 50100 Florence, Italy.

1702.253

3RM SERIES NAVAL RADARS

The 3RM Series are I-band navigation and surface warning radars, with some air target capability. The equipment has been tested and qualified in full accordance with MIL-E-16400F specifications. The antennas used are of the slotted waveguide type and provide horizontal beamwidths from 0.8 to 2.0°, depending upon the antenna length, and a vertical beam pattern of 26°, shaped to 40°. Scanner rotation rate is 25 rpm. Two transmitters are available, with outputs of 7 kW or 20 kW. The display unit has a 9 in (23 cm) diameter PPI.

CHARACTERISTICS:

Frequency: 9375 MHz
Peak power: 7 kW or 20 kW
Antenna: Slotted waveguide
Rotation rate: 25 rpm
Pulse length/PRF: 0.05 μ s/6000 Hz
0.15 μ s/3000 Hz
0.5 μ s/1500 Hz
1.5 μ s/750 Hz

Receiver: Linear, lin-log

Display: 23 cm PPI; 8 ranges 0.25 - 40 nm

True motion unit: On request.

STATUS:

In production and fitted to ships of a number of navies, and notably those of the Italian Navy, and on the West German fast patrol boats of the 143 and 148 classes. The 3TM20-H version of the 3RM radar is the selected standard navigation radar for the PHM NATO hydrofoil. The US Navy has officially approved introduction of this equipment into its inventory under the military nomenclature AN/SPS-63. The Italian Navy missile hydrofoil, P420-Swordfish, is fitted with the 3RM 7-250 version, which has a different antenna and a second 250 kW transmitter. A submarine version (3RM20-SMG/MM-BPS-704) is a standard production item.

Other variants include the 3RM20-B (MM/SPN-703) for the Italian Navy; the helicopter models MM/APS-705 and MM/APS-707; and the Marte system radar MM/APQ-706.

CONTRACTOR:

SMA-Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano, PO Box 200, 50100 Florence, Italy.



3RM antenna group

3482.253

MM/SPN-703 NAVIGATION RADAR

The Italian Navy MM/SPN-703 is the latest version of the 3RM navigation radar (1702.253), incorporating the latest state-of-the-art developments in electronic design. Most characteristics are similar or identical to those of the 3RM, above; known differences are listed in the following table.

CHARACTERISTICS:

Peak power: 20 kW
Antenna: Low profile slotted waveguide with cylindrical-paraboloid depolarising reflector
Beamwidth: 1.2° azimuth; 25° vertical

Pulse length/PRF: 0.5 μ s/5200 Hz

0.15 μ s/2600 Hz

0.5 μ s/1300 Hz

1.5 μ s/650 Hz

Noise figure: 9 dB

DEVELOPMENT:

Evolved from the 3RM series as the 3RM20B for the Italian Navy.

STATUS:

Adopted by Italian Navy and probably others.

CONTRACTOR:

SMA - Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano, PO Box 200, 50100 Florence, Italy.



SMA MM/SPN-703 radar antenna

1703.253

SPQ-2D NAVAL RADAR

The SPQ-2D is a medium power I/J-band radar whose principle of operation is based on time shared transmission of long and short pulses to achieve

simultaneous video signals with high sensitivity for surface search and short-range air search, or with high resolution for navigation and close-in control. The last feature is particularly appropriate for rescue operations and the direction of ASW helicopters.

The SPQ-2D equipment is currently integrated as the target designation radar in various electronic combat systems. A later model is the SPQ-2F.

Two control units which include all the operational controls of the radar permit use of remote or local

controlling facilities by either CIC or EW operators. The SPQ-2D is designed for IFF compatibility and there is provision for 'Beacon' operation in conjunction with an I/J-band transponder. Among the optional additional facilities which are available are: track-while-scan operation at an antenna rotation rate of 40 rpm; frequency agility; MTI D-band transceiving section integrated with the I/J-band (and with a common SPQ-2 type antenna group) and with a common SPQ-2 type antenna group) for off-flying target detection; and varying modes of operation.

The antenna assembly is produced in both roll and pitch stabilised and non-stabilised forms. The reflector is a double-curvature lattice and mesh

structure of about 3 m span, and is illuminated by a feed horn carried by an underslung support boom.

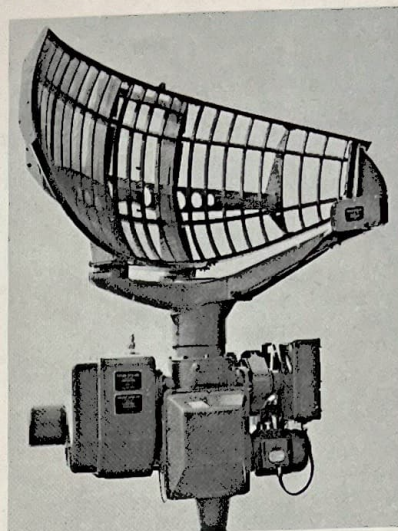
The sensor's output signals can be processed for different types of plot extraction and displayed on SMA-designed and manufactured weapons management consoles.

STATUS:

The SPQ-2D has been in production for several years and is fitted on ships of several navies including the Italian Navy, Canadian Navy (DDH 280 frigates), and the Venezuelan Navy.

CONTRACTOR:

SMA - Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano, PO Box 200, 50100 Florence, Italy.



SPQ-2D antenna group with stabilised mount

3262.253

MM/SPQ-701 NAVAL RADAR

The SMA MM/SPQ-701 naval radar is an I-band equipment designed for surface and air target detection and primarily intended for fitting in small vessels such as hydrofoils and fast patrol boats. It is essentially a combined system that includes

navigational and search components, and the roll-stabilised mount carries both antennas.

Reportedly of advanced design, the MM/SPQ-701 employs frequency agility and is provided with digital MTI. Good performance is claimed, including long and short range target detection in ECM. Provisions

include an antenna and appropriate rotary joints etc.

STATUS:

No details obtained.

CONTRACTOR:

SMA - Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano, PO Box 200, 50100 Florence, Italy.

3263.253

MM/SPS-702 NAVAL RADAR

The SMA MM/SPS-702 naval radar is derived from the MM/SPQ-701 described above (3262.253), and is essentially comprised of the search components of

that equipment. An I-band system, it provides assistance in missile guidance, supplying data for TWS (track-while-scan) processing and also providing a mount for the command guidance antenna. IFF facilities are incorporated.

STATUS:

No details obtained.

CONTRACTOR:

SMA - Segnalamento Marittimo ed Aereo, Via del Ferrone Soffiano, PO Box 200, 50100 Florence, Italy.

NETHERLANDS

1973.253

LW.08 NAVAL EARLY WARNING AND WEAPON DIRECTION RADAR

The LW.08 is a new high-power D-band synthesiser-driven travelling-wave tube radar with pulse-to-pulse coherence, designed to fulfil the following functions:

- (1) Long-range air warning with high definition
- (2) Long-range surface surveillance
- (3) Target designation for weapon control radars and systems

It is used in both naval and land-based applications.

Long-range performance is aided by use of a high mean-power TWT in the transmitter. A pulse-compression receiver with MTI provides for good performance in rain and in the presence of ground clutter. For naval use, the antenna is mounted on a platform which is stabilised in roll and pitch against ship's motion. As is general practice with Signaal radars, a stainless steel antenna reflector is used to counteract the effects of the salt atmosphere and corrosive exhaust gases. The electronics are solid-

state. Other technical features include: frequency agility over a wide band; horizontal and circular polarisation; synthesiser-controlled coherent transmitter; MTI with digital canceller; digital video processor, and provision for integration of IFF. Range performance against a 2 m² air target is 145 nautical miles.

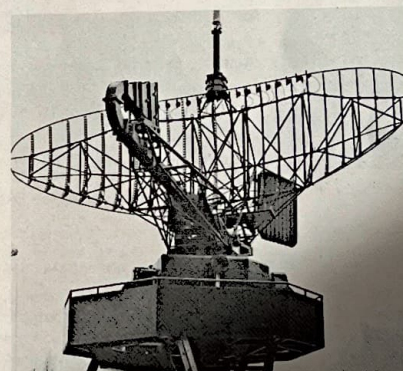
STATUS:

Contracts have been placed for LW.08 systems for fitting in Royal Netherlands Navy S-type frigates and for the RN anti-submarine cruisers and Type 42 frigates as well as the Argentinian aircraft carrier *25 de Mayo*. In the RN installation a Marconi antenna will be employed, and the radar will be designated Type 1022.

LW.08/3 systems (land-based) are employed at Changi Airport in Singapore and at two airfields in Paraguay.

CONTRACTOR:

Hollandse Signaalapparaten BV, PO Box 42, Hengelo, Netherlands.



LW.08/2S early warning and weapon direction radar

3484.253

SIGNAAL STIR

The Signaal STIR tracking radar is a lightweight two-axis tracker capable of rapid and accurate target tracking down to sea-skimmer missile heights, without the aid of television. The initials STIR denote Signaal track and illuminating radar. The modular tracker system with its electric servo drives was originally developed as a short/medium-range I-band monopulse tracker with J-band illumination for the Seasparrow missile. A later version has a concentric I/K-band monopulse radar with J-band illumination

for improved tracking. Another variant exists for Seawolf missile (2442.231) blind fire control featuring I/K-band radar and CLOS equipment. A variety of MTI and ESM/ECCM features are incorporated.

STATUS:

By December 1979, 30 sets had been ordered by the Royal Netherlands Navy and Federal Republic of Germany, and other, unspecified navies, and at that time about six systems were operational.

CONTRACTOR:

Hollandse Signaalapparaten BV, PO Box 42, Hengelo, Netherlands.



Signaal STIR, VM40 naval tracking and illumination radar

3306.353

EL/M-2021 RADAR

The Elta EL/M-2021 multi-role combat radar was revealed at the 1977 Paris Air Show. Operating in the I/J-band of the radar spectrum, it provides facilities for a variety of air-to-air and air-to-ground missions. These include air interception, close-in combat, air-to-ground bombing and gunnery, terrain following, avoidance and mapping.

In the air-to-air mode, it performs search and automatic tracking, and in the air-to-ground mode it supplies ranging information to the bombing computer (both CCIP and CCRP weapon delivery modes are available). Head-up and head-down displays provide the pilot with data for interception of targets and provide fire control for guns. A stabilised radar picture is produced which is of value in the navigation mode using radar mapping.

The equipment is constructed of about a dozen line replaceable units (LRUs) which include transmitter, processor, modulator, missile illumination unit, RF head, weapon delivery unit, receiver, RF exciter, servo amplifier unit, power supply, interface computer unit, and missile delivery computer. An inverse cassegrain antenna is employed and solid-state circuitry is used.

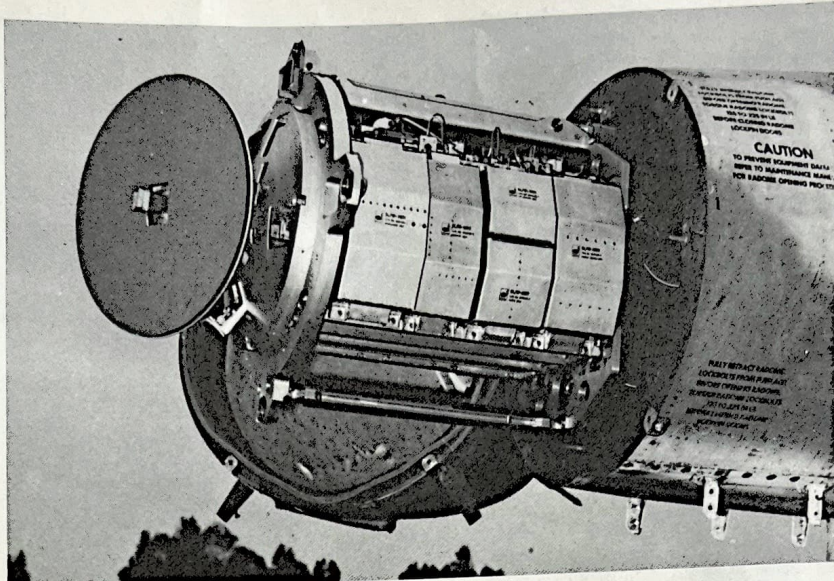
Coherent processing, using digital techniques is relied upon, and both look-up and look-down waveforms are understood to be provided

CHARACTERISTICS:

Transmitter
Frequency: Probably I/J-band
Bandwidth: 500 MHz
Peak power: 3 kW
Average power: 200 W
Receiver noise: -5 dB

Antenna: Inverse cassegrain
Scan Tracking Search/AI Dogfight
Azimuth ±70° ±45° ±10°
Elevation +80 to -40° ±5° -0 to +60°
Range tracking accuracy: 10 m ± 10%
Processor: CCD processor for signal extraction;
 digital data processor for avionics interface
Dimensions: (less antenna)

Maximum diameter: 74 cm
Minimum diameter: 44 cm
Height: 1.295 m
Weight: 120 kg (including antenna)
STATUS: Development.
CONTRACTOR: Elta Electronics Industries Ltd, Ashdod, Israel.



EL/M-2021 multi-role combat radar

3307.353

MM/APS-705 RADAR

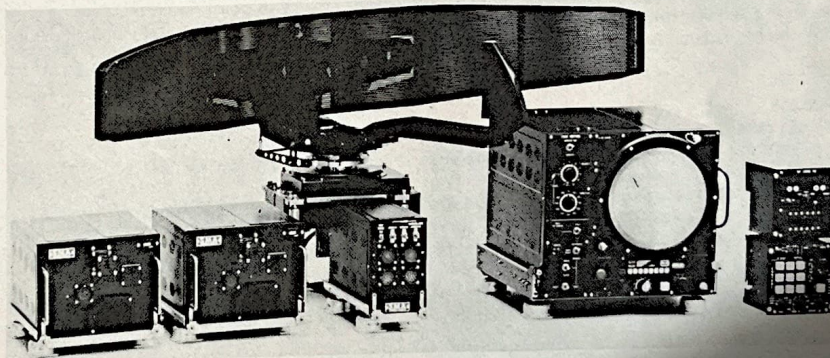
The MM/APS-705 is an airborne search and navigation radar designed specifically for naval helicopters, in particular the AB.212 and SH-3D types, providing for ASW, mapping, SAR, and similar operations. The operating frequencies are in the I-band and two transmitter/receivers are used for frequency diversity operation providing clutter decorrelation and enhancing reliability. There are four pulse length/prf combinations and eight range settings matched to bearing/range discrimination.

Antenna groups for either ventral or dorsal mounting are produced and there are also size variations, that for the SH-3D having a wider aperture than that for the AB.212 (1.6 m compared with 1.2 m). Line-of-sight stabilisation is provided in both cases, and there are alternative, selectable antenna rotation rates, 20 or 40 rpm. Manually controlled antenna tilt provides for ±20° of movement. An alternative back-to-back antenna is another option for use where higher data rates are required, for instance.

The display unit incorporates a 23 cm diameter CRT PPI with digital true motion presentation facilities, electronic and mechanical cursors, markers, and complemented by a separate digital readout X-Y reference display.

There is an expanded micro-B display for chaff or multi-target detection, and the radar provides outputs for other displays and extractor units. Other facilities include sector transmissions and blanking; interfaces for Beacon receiver, IFF, ASW and ESM systems; built-in test; data link; track-while-scan and dense-environment tracker. Equipment options, in addition

ITALY



MM/APS-705 airborne radar installation

to the back-to-back antenna already mentioned, include a 75 kW frequency-agile transmitter/receiver, a pilot's bright display, and the auto-tracker with ECCM provisions and micro-B display.

CHARACTERISTICS:

Transmitter/receiver: Dual, I-band
Peak power: 25 kW each
Pulse length/prf: 0.05 μs/1600 Hz
 0.15 μs/1300 Hz
 0.5 μs/1300 Hz
 1.5 μs/650 Hz

Noise figure: 8.5 dB
Receiver characteristics: Linear; Log up to 80 dB
Anti-clutter: STC, FTC, log-averaging
Antenna: Cylindrical-paraboloid segment. Horn feed

Polarisation: Horizontal
Beamwidth: 2° az × 7° elev (AB.212, 1.2 m aperture)
 1.5° az × 10° elev (SH-3D, 1.6 m aperture)
Rotation rate: 20 and 40 rpm
Stabilisation: ±20° pitch and roll
Manual tilt: ±20°
Display: P33 phosphor, 9 in (23 cm)
Range settings: 0.5, 1, 2, 5, 10, 20, 40, 80 nm
System weight: 87 kg
STATUS: Standard equipment in Italian Navy AB.212 and SH-3D helicopters, and procured by foreign navies.
CONTRACTOR: SMA-Segnalamento Marittimo ed Aereo, PO Box 200, Via del Ferrone Soffiano, 50100 Florence, Italy.

3308.353

MM/APS-707 RADAR

The MM/APS-707 is essentially a simpler version of the MM/APS-705 (3307.353), with a single 20 kW transmitter/receiver for fixed frequency operation (I-band), and suitable for airborne applications where reduced weight, lower power consumption, and cost

considerations call for a less sophisticated equipment.

In most other respects the two systems are the same and the APS-707 is designed to provide for helicopter requirements associated with navigation, surface search, tracking, mapping, rescue, ASW etc.

Similar additional options are available, such as 1.2 m or 1.6 m aperture antenna and mounting on top or beneath the helicopter fuselage.

CONTRACTOR: SMA - Segnalamento Marittimo ed Aereo, PO Box 200, Via del Ferrone Soffiano, 50100 Florence, Italy.

3309.353

MM/APQ-706 RADAR

The MM/APQ-706 search and attack radar is used in the Italian Navy Marte helicopter-launched anti-ship missile system (1651.321). It consists of two

I-band transmitter/receiver channels operating in frequency diversity, with frequency agility facilities on one channel, and is provided with a data processing and extraction system and tactical display console. The MM/APQ-706 can fulfil typical naval

helicopter roles such as surface search, navigation, ASW etc in addition to providing target detection, acquisition and missile guidance facilities for the Marte system.

The antenna group utilises a pair of back-to-back

572 AIRBORNE RADAR/Italy-Sweden

mounted parabolic antennas, line-of-sight stabilised, housed in a chin radome, in the case of Italian Navy SH-3D helicopters. High accuracy and acquisition capability against small surface targets in the presence of severe sea clutter and/or intense EW opposition are among the main features of this radar.

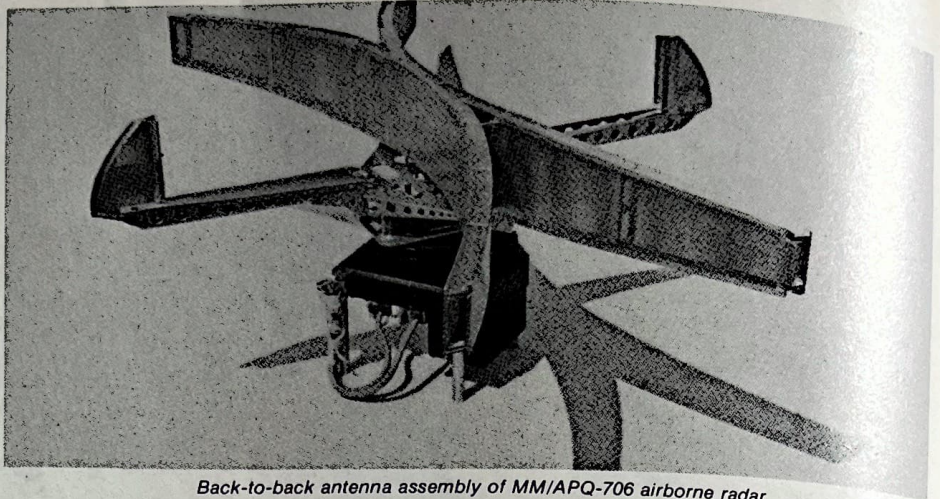
Many details of the MM/APQ-706 are classified but it belongs to the SMA APS/APQ-700 series of airborne radars and is probably closest to the MM/APS-705 version (3307.353) with the addition of known enhancements such as the back-to-back antenna, 75 kW frequency-agile transmitter/receiver, auto-tracker/ECCM package, and certain other unspecified additions.

STATUS:

Installed on Italian Navy SH-3D helicopters for Marte anti-ship missile system.

CONTRACTOR:

SMA - Segnalamento Marittimo ed Aereo, PO Box 200, Via del Ferrone Soffiano, 50100 Florence, Italy.



Back-to-back antenna assembly of MM/APQ-706 airborne radar

3488.353

SIT 432 (AN/APX-104) AIRBORNE INTERROGATOR

The SIT 432 (AN/APX-104) is a lightweight airborne IFF interrogator equipment suitable for installation on helicopters or fixed-wing aircraft to provide air-to-air and air-to-ship identification facilities.

The system provides for operation in Modes 1, 2, 3/A, and 4 when the appropriate interface equipment is available. Normal operating ranges of 180 to 270 km are provided and the design incorporates interrogation sidelobe suppression (ISLS) and receiver sidelobe suppression (RSLs) circuits, in conjunction with special antennas having sum (main lobe) and difference (sidelobe suppression) patterns. This gives a narrow effective beamwidth, even with the small antenna apertures associated with airborne fire control radars. Bracket decoded video and

discrete code decoded video are displayed on the radar PPI to provide unambiguous correlation between IFF and primary radar returns.

CHARACTERISTICS:

Frequency: 1090 \pm 0.2 MHz (receiver); 1030 \pm 0.2 MHz (transmitter)

Sensitivity: -83 dBm

Peak power: 2000 W

Duty cycle: 1.0% max

Dynamic range: 50 dB

Weight: 6.5 kg

STATUS:

Production. Co-development with Hazeltine in USA.

CONTRACTOR:

Italtel, Societa' Italiana Telecomunicazioni, 12 Piazzale Zavattari, 20149 Milan, Italy.



SIT 432 (AN/APX-104) airborne interrogator

3489.353

SIT 421 (MM/UPX-709) TRANSPONDER

The SIT 421 (MM/UPX-709) is a 'one-box' airborne IFF transponder, suitable for fitting in fixed-wing aircraft or helicopters. It operates in Modes 1, 2, 3/A, 4 and C. The receiver/transmitter includes a 500 W solid-state transmitter, dual-channel receiver and RF interface module. The first of these comprises a delay line oscillator, modulator, driver and power amplifier.

The controls for operation of the transponder, code and mode selection, etc, are mounted on the front of the equipment (which is designed for cockpit mounting) but versions are produced in which remote control facilities are provided.

CHARACTERISTICS:

Frequency: 1030 MHz (receiver); 1090 MHz (transmitter)

Sensitivity: -77 dBm (adjustable 69 - 77)

Dynamic range: 50 dBW

Output power: 27 \pm 3 dBW at 1% duty cycle

Weight: 3.5 kg

STATUS:

Production. Co-development with Hazeltine in USA.

CONTRACTOR:

Italtel, Societa' Italiana Telecomunicazioni, 12 Piazzale Zavattari, 20149 Milan, Italy.



SIT 421 (MM/UPX-709) IFF transponder

SWEDEN

1210.353

UAP 1011 (PS-37/A) AIRBORNE ATTACK RADAR

This is a multi-mode airborne attack radar, operating in the I/J-band, and using the monopulse technique. High output power is employed to provide long range performance. Cassegrain or parabolic dish scanners with fixed feed have been developed for this radar, but the latter is the preferred antenna system.

The UAP 1101 is an important element in the attack system of the Saab Viggen aircraft, and its design provides for considerable integration with the navigation, display, and the digital computer-based data processing sub-systems.

The radar is comprised of two main units, the electronics package and the scanner assembly. The former is made up of 13 replaceable units housed in a main assembly which carries the interconnecting cable looms. The division of electronic functions between the individual replaceable units has been arranged so that, as far as possible, related functions are housed within one unit, enabling the replacement of units to be effected without the need for subsequent trimming or adjustment. Each of the replaceable units contains between three and eight

sub-units, which provide further facility for servicing.

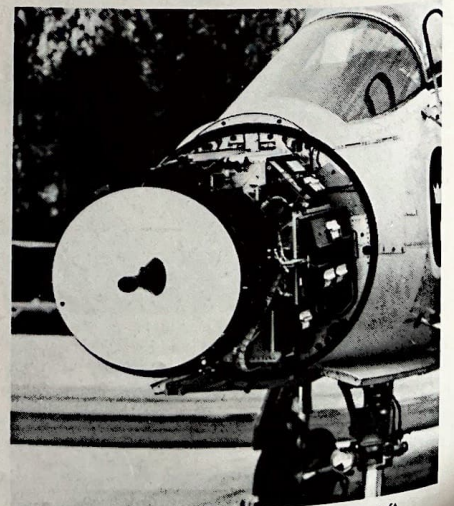
With the exception of certain high-frequency devices, the UAP 1011 is a completely solid-state equipment. The mechanical design incorporates an hydraulic drive for the antenna scanning and stabilisation system, providing accurate and rapid movement over wide angles.

In the interest of high performance and optimum operational flexibility, including conditions of high interference (natural or ECM), elaborate signal processing facilities at both the radio-frequency and video levels are provided in the UAP 1011. Another technique employed to increase accuracy and resolution is lobe-shaping, which synthetically produces the effect of increased antenna aperture and reduced sidelobes.

In the Viggen installation both head-up and head-down display of radar information is provided, the data presented varying in accordance with the operational mode employed.

OPERATION:

To comply with the requirements of operation of the Viggen by a single crew member (pilot), the UAP 1011 is designed for semi-automatic operation to reduce cockpit work-load. Facilities provided include:



UAP 1011 radar in the 37 Viggen aircraft