Marconi
Radar Systems

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Radar Systems International

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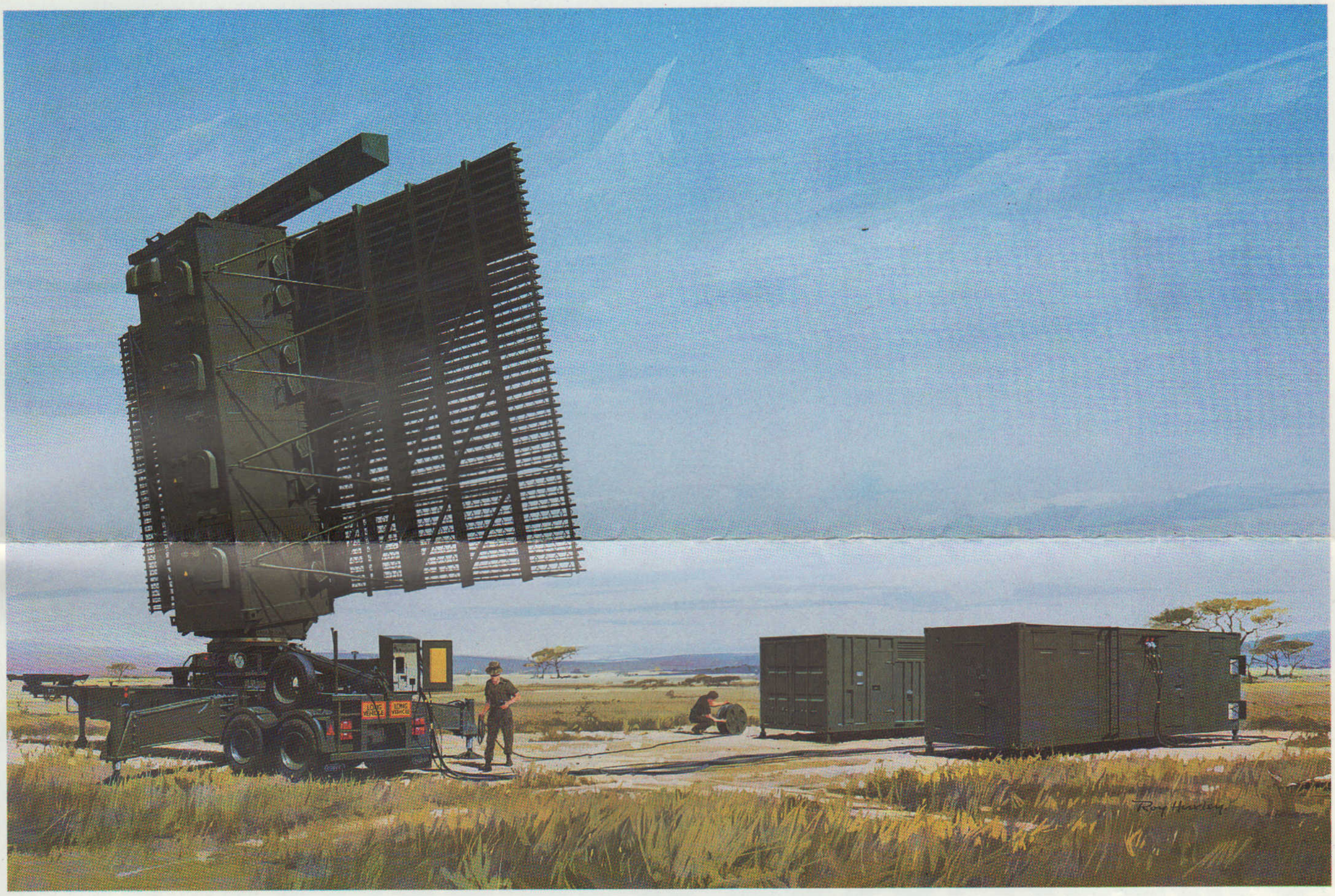
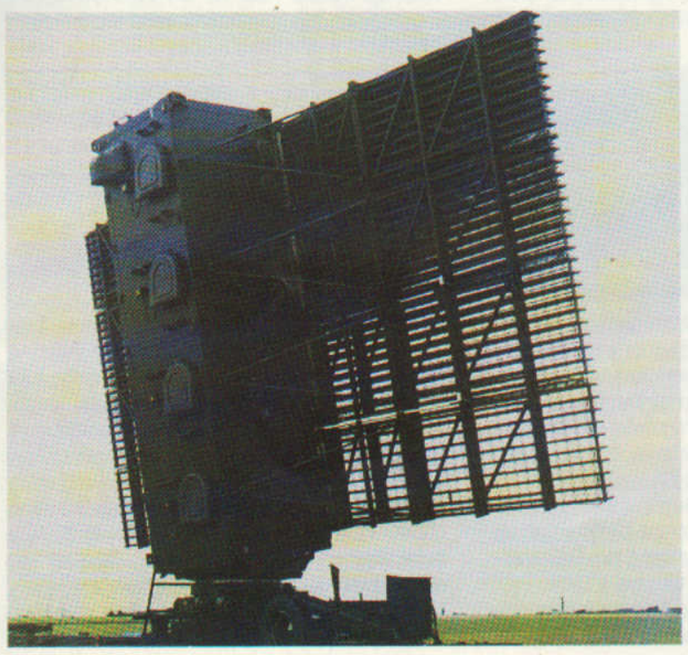
Martello S723
a new member of the Martello family





Martello S723 is the latest member of the Martello family, complementing the existing Martello S713. S723 is an advanced all solid-state 3-D air defence radar system. Based entirely on state-of-the-art electronic and mechanical techniques, this high technology radar breaks new ground in accuracy, reliability, high availability and ECCM capability.

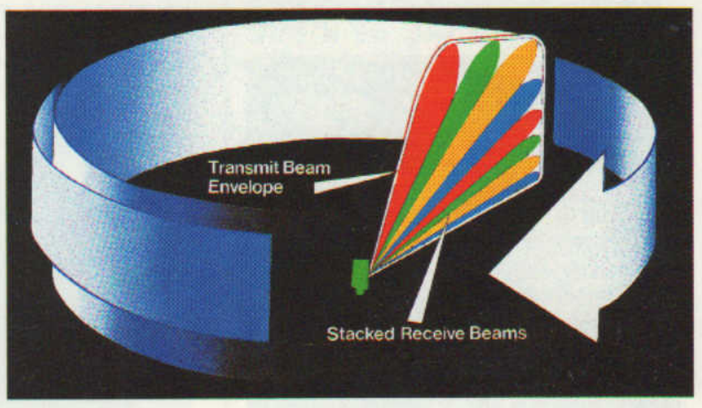
Martello S723 is a stacked beam radar, using a unique parallel receiving system for height finding. On every revolution of the antenna, bearing, range and height are produced on every target within the radar cover. The antenna of S723 is a planar array consisting of a vertical stack of horizontal linear array elements, each with its own transmit-receive module. Each array has the same shaped amplitude distribution, producing a narrow azimuth beamwidth.

Low sidelobes are produced by precise control of the amplitude and phase fed to each array. In elevation, the phase of the RF power in the transmitter modules is controlled to give cosecant squared cover. Every target is illuminated on every transmission.

All the arrays receive returns from a target. The individual receiver outputs are then combined in a simple passive beam forming network. This synthesizes eight elevation beams, matched to the required elevation cover. All eight beams have pulse compression and signal processing, under automatic control, with manual over-rides available. Target range and azimuth are extracted from a series of individual returns by the plot forming unit. Monopulse measurement of returns in adjacent elevation beams yield the corresponding height data.

Plot range, azimuth and height are correlated with extracted IFF/SSR data for onward transmission to operations centres. The system is self adaptive to the radar environment.

A radar management position is provided,



giving comprehensive facilities for monitoring system performance together with complete control of system parameters.

Features of solid-state Martello S723 include: 23cm band operation; solid-state distributed transmitter; uncommitted frequency agility; pulse compression; low sidelobe planar array antenna; distributed receiver system; adaptive signal processing; comprehensive ECCM; comprehensive monitoring and diagnosis facilities, and transportable and static use.

Marconi ~ a complete c

Command, Control, Communication and Intelligence have now been brought together under a modern systems concept known as C^3I. The principles of this concept have been understood for many years. The evolution of modern electronic sensors and intelligence gathering methods have, however, revolutionised C^3I capabilities.

The requirement to possess good command, control, communication and intelligence facilities in order to co-ordinate a nation's defences in the most effective manner has been understood for a very long time. Indeed the results of long years of warfare have been analysed thoroughly and almost invariably wars have been won - and lost - because of the victor's superior C^3I facilities.

Modern warfare has ephasised the extreme importance of integrated C^3I systems. Critical elements of the opposing forces such as tactical headquarters and similar facilities can be quickly located by modern intelligence gathering methods, while current weapons with their vastly increased aiming accuracy and weapon yield possess the capabilities to effectively find and destroy.

To achieve such results, intelligence gathered from numerous sources must be quickly collated and analysed for decision making, weapon systems selected and activated and the enemy forces destroyed before protective measures such as redeployment can take place. Modern technology and an integrated approach to C^3I can achieve these results, which are in effect a force multiplier.

Marconi Radar C^3I capabilities

Marconi Radar C^3I capabilities range from the provision of strategic war headquarters to tactical transportable operations centres. The Company's business has been to provide systems to meet these requirements for the past 35 years. The gradual shift in emphasis from real-time raw radar displays to modern computer driven CCIS work stations has placed software in an increasingly dominant position. Marconi Radar possesses one of the largest air defence software houses in Europe. Operational specialists, system analysts and software programmers are constantly working on the application of advanced techniques to current and future system requirements, including: Ada and the support environment; operating systems database management and software security; digitised voice communications under ADP control; multi-processor operating systems, and Raster graphic colour display systems.

Marconi Radar has the reservoir of experience, specialists and resources to provide cost-effective solutions to all C^3I system requirements.

805 Seawolf

an effective defence against anti-ship missiles

The 805 Seawolf system, chosen by the United Kingdom Royal Navy and entering service in 1984 on current frigates, will also be fitted to the new-build Type 23 Frigates.

805 Seawolf, the only proven point defence missile system in the world, is available for use with 4 or 6 barrel missile launchers, or, in the latest development, with vertical launch Seawolf.

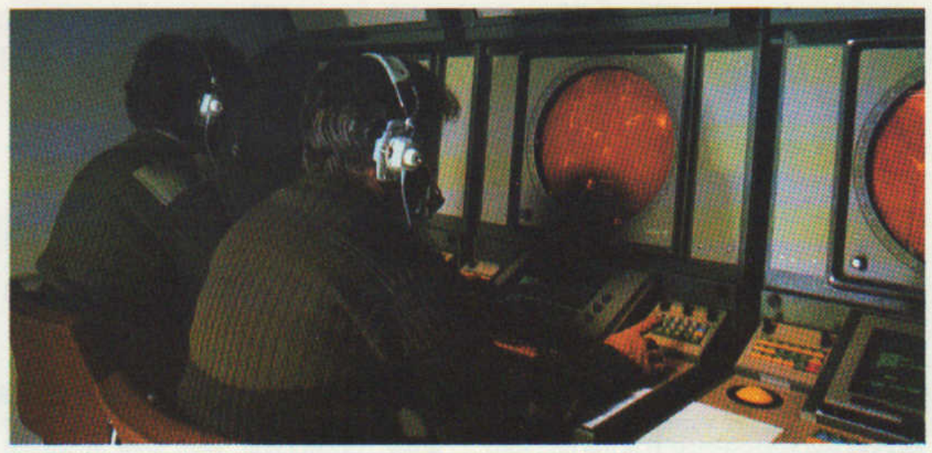
The 805 Seawolf tracker is a dual-beam differential tracking radar, designed specifically to match the engagement envelope of the Seawolf missile.

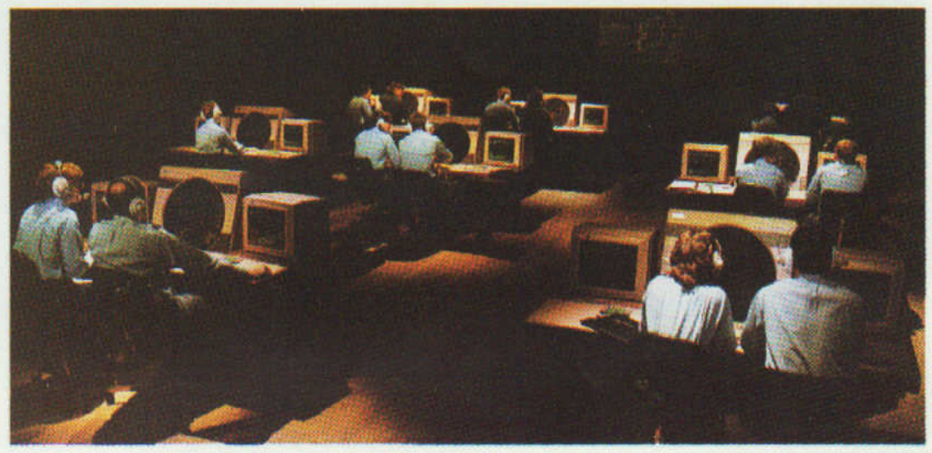
Excellent clutter rejection is provided to give a good system performance when operating either in open or enclosed waters. Special facilities are provided to enable the system to operate in hostile electronic environments.

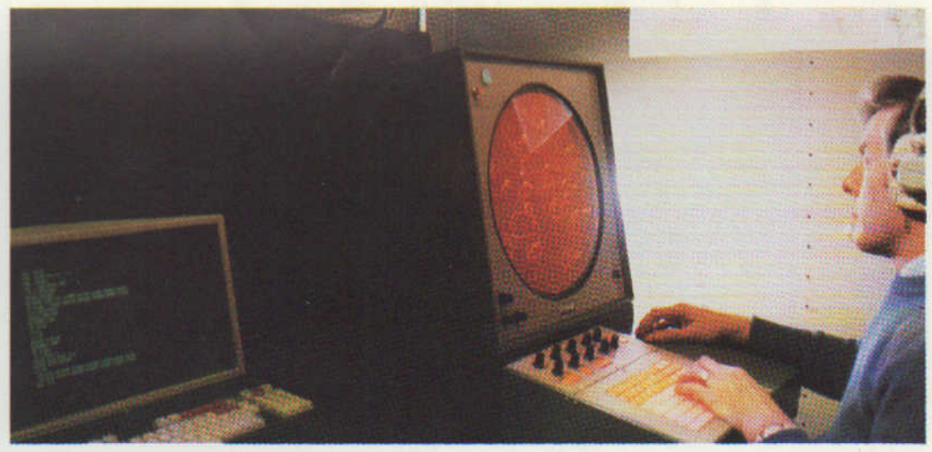
The 805 Seawolf weapon control system provides full blindfire capability against small, fast targets with attack profiles varying from high diving to sea skimming. 805 SW is suitable for fitting into ships with displacements down to 1000 tons.

Features of 805 Seawolf include: dual-frequency using independent radars; full use of the Seawolf missile performance; fast reaction time - fully automatic from target indication data; full blindfire control of Seawolf against missiles with high or low attack profiles; auto-selection of tracking radar; good performance in clutter and ECM; easy installation; lightweight; fast surveillance and sector search for autonomous acquisition; independently optimised search profiles; also suitable for gunfire control

capability in C³I







700 Series Low Level Radars

The Marconi 700 Series low level radar systems have been introduced to provide a total capability in low level and gap filling applications. The series at present comprises three systems; S706, a tactical-coastwatching radar; S711, a tactical 'pop-up' radar; and S712, a tactical-point defence radar. All are based upon a standardised electronics module, the antennas, software and deployment features being configured to suit each specific operational role.

The standardised electronics modules provide the following features: 10cm S-band operation; high stability coherent (driven) transmitter; optimised pulse compression; cathode modulated travelling wave tube using fail-soft switching modules; wideband frequency agility and PRF stagger with multiple operating modes; adaptive signal processing; integrated primary and secondary plot extraction; dual operator's positions with automatic data processing; solid state electronics; high reliability; intelligent BITE covering all sub-systems.

S712 Battlefield Defence-Point Defence Radar

S712 is a single vehicle system, offering the ultimate in tactical availability and suitable for trailer or flat-bed vehicle applications. Compatible with SHORAD SAM and AAA systems, the S712 radar system provides real capability in battlefield defence and point defence applications and features high mobility and off-road capability.

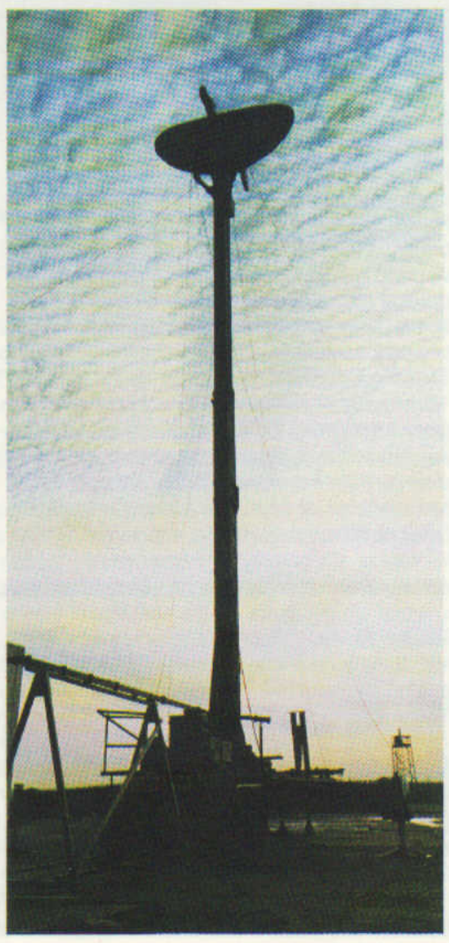
The system consists of a single container, housing the electronics modules, and with the antenna mounted on the roof. The antenna, a smaller version of the S711 antenna, uses similar construction techniques and incorporates the secondary (IFF) system.

For transportation purposes, the antenna is dismounted and stowed within the electronics container. The antenna is lightweight and can be removed by two men.

In real crashdown situations, the antenna may be left in position, stowed fore-and-aft, enabling the vehicle to be moved with utmost despatch.

Features unique to the S712 include: rapid deployment and crashdown; on or off road capability; 3 degree horizontal beamwidth; performance ideally suited to tactical systems; 66 nautical mile detection of small targets; excellent ECCM.

The S712 radar uses the same electronics/operator configuration as the S706 and S711 radars.



S711 Radar, Tactical in Difficult Terrain

The S711 radar is for tactical applications where the terrain includes mountainous, forested or urban areas, where normal radars are difficult to deploy. To supply unrestricted operation in such conditions, the S711 antenna is mounted on an elevating mast. This method of mounting the radar antenna also allows easy concealment of the radar system, generally more difficult in normal open country radar sites.

The S711 antenna is supplied mounted on a special purpose-built trailer, which incorporates the hinged mast and also integral stabilising legs. Elevation of the mast is provided by a built-in electrically driven hydraulic system. The antenna can be operated at 12 metre and 19 metre heights.

S711 features include the following:

1.5 degree horizontal beamwidth and 34dB gain; small targets detected at 64 nautical miles instrumented range; excellent MTI performance; variable antenna tilt; short deployment and crashdown; transportable by road, rail, sea or air.

The S711 radar system uses the same electronics/operator container as the S706 radar.

S706 Coast Defence-Tactical Radar

S706 is the ideal solution for coastal defence-tactical radar applications. Incorporating a trailer mounted antenna with a single curvature reflector and a linear squintless feed, S706 offers unmatched resolution, good sidelobe performance and high gain. The one degree azimuth beamwidth, allied to the 0.625 microsecond compressed receive pulse, provides the MTI and system resolution performance so essential when searching for small low flying targets in sea clutter environments.

The electronics units and operator positions are housed in a special container, which is suitable for either ground/deployment or trailer/flat-bed vehicle mounting.

The two-vehicle S706 radar can be used unmanned in a radar plot reporting role, feeding data via land line or built-in UHF LOS data link, or manned, when two operators provide a real capability to fulfil track reporting or weapon control functions.

HIGH TECHNOLOGY IN THE SERVICE OF AIR SAFETY

MESSENGER

The Marconi Radar monopulse radar system, incorporating the S1095 new technology antenna with superior performance, proven during field trials by the UK CAA.

Messenger is an entirely new monopulse SSR system, designed to fulfil ICAO and STANAG 5017 requirements and providing exceptional performance improvements. The MESSENGER system is a direct replacement for existing ground based equipments and can be used without changes in existing ICAO SSR systems or to airborne transponders.

Monopulse MESSENGER is the first step towards the new SSR system now being planned by ICAO and known as Mode S. This new system introduces selective addressing and a ground-to-air data link and will convert SSR into a combined sensor and communications system. Mode S involves a new airborne transponder which will be compatible with the existing SSR system.

MESSENGER has been designed to be easily updated to the full Mode S system with no redundant equipment.

The monopulse SSR technique accurately determines target azimuth on each pulse of a transponder reply. Not only does this provide improved plot position accuracy and smoother tracking, it also provides much better data recovery from garbled and corrupted replies. Because a lower PRF can be used, less fruit is generated and in particular less transponder overload and 'lock-up' occurs.

Coupled with the efficient Marconi S1095 large vertical aperture antenna, which reduces cover gaps and site reflections, the MESSENGER system makes good most of the shortcomings which have so far prevented SSR from realising its full potential.

S1095 antenna

The new S1095 antenna is a large vertical aperture (LVA) antenna of open planar array construction, both light in weight and with low wind resistance. The antenna can either be used on its own turning gear and tower, or co-mounted with a primary radar antenna.

The S1095 antenna is unique in having a very high efficiency. Designed using a new CAD facility known as SYNFF, the antenna has a gain of 29dB, at least 2dB higher than can be achieved using the conventional Woodward method.

The vertical radiation pattern of the antenna has a sharp bottom edge to reduce the amount of ground incident energy and therefore to minimise reflections from buildings and other structures, the cause of false targets with the conventional 'hogtrough' antenna. Tests have shown a ten to one improvement in this respect. Lobes and gaps in the cover, which also cause operational problems, are also markedly reduced.

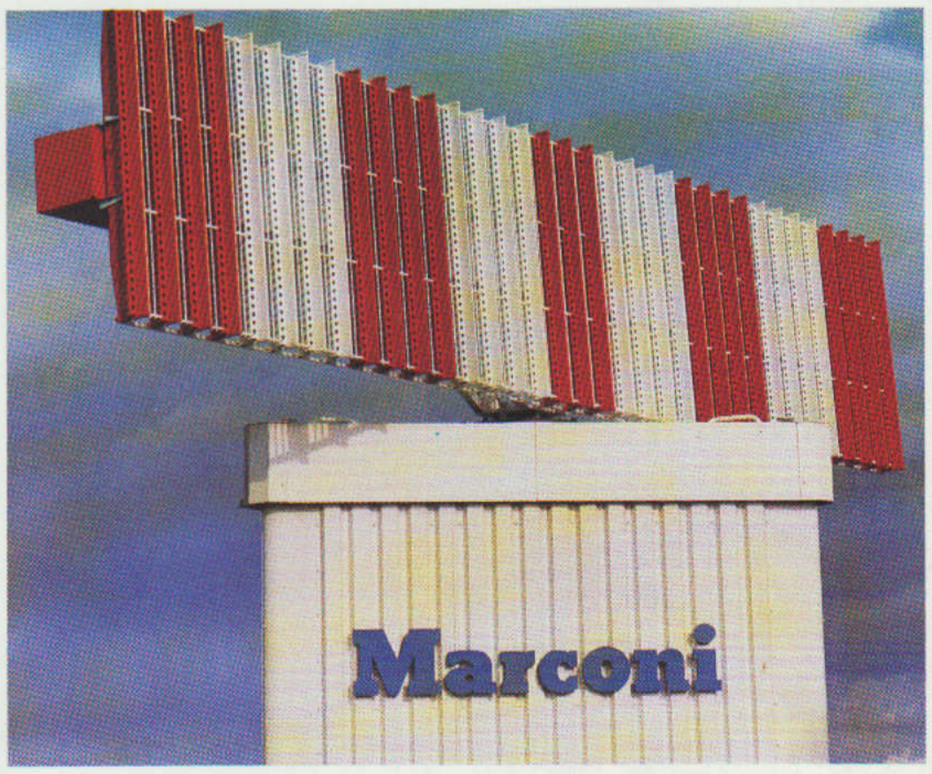
Antenna S1095 can be used to advantage with any traditional non-monopulse SSR system, particularly where reflections are a problem. The reduction in ground incident radiation from the antenna also means less gaps in the vertical cover and the high gain can be used either for additional range or for increasing the MTBF of the interrogator by running it at a lower power output.

Interrogator/Responser

S2101, the interrogator-responser used in the MESSENGER system, is a single rack mounted unit which includes the off-boresight azimuth measurement system. The interrogator section uses solid state devices throughout, including the output stages. The latter are modular in format, each module having a peak power output of 500 Watts. Up to 4 modules may be used in an interrogator, the choice depending upon the required range performance and the length of coaxial cable between the antenna and the interrogator. The modules have been designed to provide the full duty cycle required by Mode S operation.

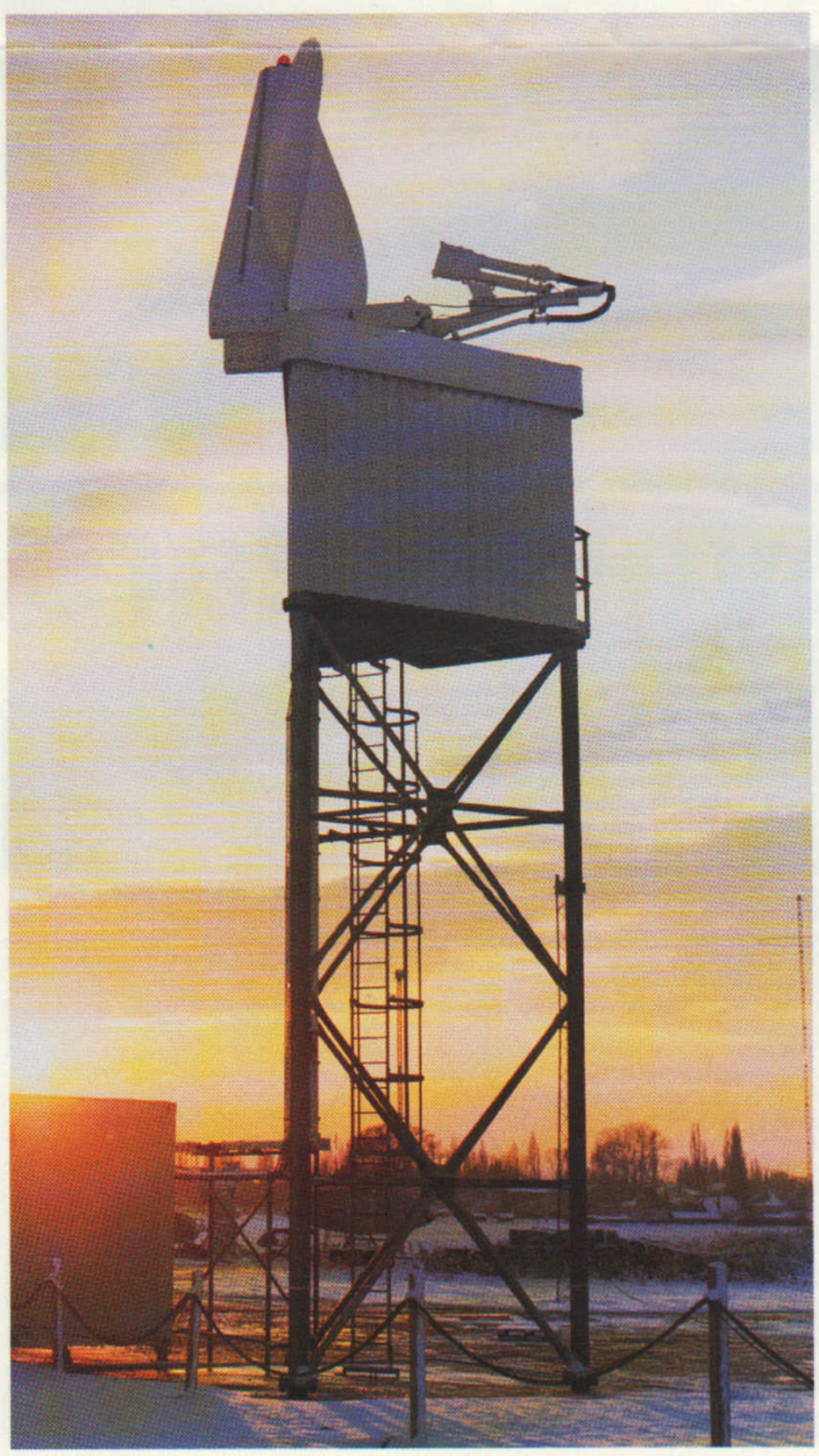
Decoder-Extractor

The decoder-extractor S7204 used in MESSENGER employs a number of advanced processing techniques to achieve a high decoding and plot forming capability. The decoder is a hybrid hardware/firmware design which not only cannot be overloaded but also provides



considerable functional flexibility. The hardware element provides the basic real-time decoder, the firmware dealing with more complex corrupted replies. The amount of hardware involved has been reduced by employing very fast processors and speed is further enhanced by use of the bit-slice processing technique.

Terminal Area Radar S512



Radar S512 is a high power 10cm band air traffic control sensor. With a range of over 100 nautical miles on a light aircraft, the radar provides full cover of the terminal area and also advance warning of approaching airways traffic. The excellent top cover, in excess of 50,000 feet, allows TMA overfliers to be seen out to full range. At short range, all approach control functions are supplied, including a minimum range of 1/2mile (0.8 kilometre), a data rate of 4 seconds and the detection of small aircraft targets in the presence of heavy ground and moving rain clutter.

Radar S512 can be supplied in a variety of different system configurations such as single channel, main-standby and dual channel frequency diversity, the advantages of the latter being the fail-soft reliability and the additional performance due to the diversity effect.

S512 can be integrated with the Marconi monopulse MESSENGER SSR, in either an on-mounted or off-mounted role. The combination of S512 and MESSENGER provides all three air traffic control sensor functions; enroute to 200 miles, terminal area and approach control, including surveillance radar approaches, within a single system.

Antenna

Radar S512 uses the same well proven 2-beam antenna which has been so successfully used on Approach Control Radar S511. This advanced design, combining high gain with exceptionally low vertical and horizontal sidelobes, is unique in the use of moulded carbon fibre composite throughout the reflector and support structure.

The Radar S512 antenna is rotated at 15rpm by a simple and robust turning gear, designed for a 100,000 hours working life without replacement of major elements. Either a standard 'hogtrough' SSR antenna or a Marconi monopulse LVA SSR antenna may be co-mounted on top of the S512 antenna. The 14-bit data take-off required for monopulse SSR is a standard fit on Radar S512.

Transmitter-Receiver

The transmitter-receiver used with Radar S512 is the Type S2062, a driven system with a liquid cooled travelling wave tube as the output stage. Pulse compression is used, not only to provide good range resolution but also to avoid a high peak power output and the need for waveguide pressurisation, both features which reduce reliability.

A fail-soft low voltage (250V) solid state modulator consisting of 40 identical modules operating in parallel drives the cathode of the travelling wave tube. Not only is there no EHT supply but the only high voltage in the transmitter is the connection from the modulator to the travelling wave tube cathode.

To ensure the maximum radar performance over a range of different operational requirements, two pulse width/PRF combinations are available.

Signal Processing

Radar S512 uses an improved version of the adaptive signal processor first used in Radar S511. This signal processor sets new standards in the reduction of residual clutter and the provision of sub-moving clutter visibility.

The S512 signal processing system uses 3 parallel processing channels. The fixed clutter channel has a 4 pulse canceller with time varying weights which provides a zero radial velocity notch filter of optimum shape. The moving clutter channel has a similar filter, which is self adaptive to the mean radial velocity of moving clutter in any of 65,000 separate range-bearing cells. The non-coherent channel provides visibility of targets in the clear and is free from tangential fades. Each channel has its own adaptive temporal threshold integrator which eliminates

residual clutter and reduces false alarms. The outputs from the 3 channels are combined in a logical OR gate which ensures that the optimum signals always reach the displays. To exploit the very high stability of the transmitter-receiver, the signal processor uses 12-bit quantisation. This results in the overall system MTI improvement factor against fixed clutter being better than 53dB.

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