

# Radar Systems International

**MARCONI**

No. 5

## Another 23cm ATC radar for Canadian Forces

Only months after installing an air traffic control radar at a forces base at Comox in Canada, Marconi Radar Systems Limited received a further order from the Canadian Department of Supply and Service for a similar system at Lahr in West Germany. These 23cm (L) Band ATC radar systems are to provide all-weather approach guidance and terminal area control facilities.

The new order reflects the outstanding success of the installation at Comox which is acknowledged to be one of the most difficult radar sites anywhere in the world. It has one of the highest rainfall rates in Canada and is ringed by mountainous country. The outstanding performance of this radar with its excellent clutter suppression facilities, and the short delivery time, have been a key factor in the placing of the order for Lahr where the radar conditions are also extremely difficult.

Lahr is situated in the Rhine Valley south-east of Strasbourg, and is also an extremely difficult radar site with high rainfall and mountainous terrain. With civilian airports at nearby Strasbourg and Basel and several military airfields in the area, traffic density is very high. The Combined ATC Center at Lahr is required to provide Terminal Control services at the two Canadian bases, Soellingen and Lahr, as well as high level emergency

control assistance over the German airfield at Bremgarten. The intricate pattern of airways in this combined air space will contribute to the complexity of the control function performed from the Lahr ATC Center.

### System at Lahr

As in the case of Comox, the order called for an interim aerial head, a small single-beam aerial system to be delivered within a matter of weeks, with the final radar an S654, dual-beam system to follow twelve months after. The interim radar system was installed on time and handed over to 1 Canadian Air Group on the 18th August.

Marconi has also built the tower which supports the radar aerial and has a complete turnkey responsibility for the new central operations room. The Company has supplied all communications control equipment, radar displays, polarized lighting, etc., and has

engineered the complete unit. The radar aerial is sited 600 yards away from the operations building.

### Dual Beam Aerial

The Type S654 radar described in the No. 4 edition of this journal, uses a dual beam system which combines overlapping high and low cover beams from the single aerial. This design feature reduces ground clutter and 'angels' on the radar display, at the same time maintaining a high signal strength over a wide vertical sector. Radar pulses are transmitted by the lower beam only, while upper and lower beams are used for reception.

Radar returns from short-range targets are accepted from the high beam in order to eliminate ground clutter, and for longer range targets the low beam aerial is selected. This changeover would typically occur at about 15 nautical miles.

### Good Moving Target Performance

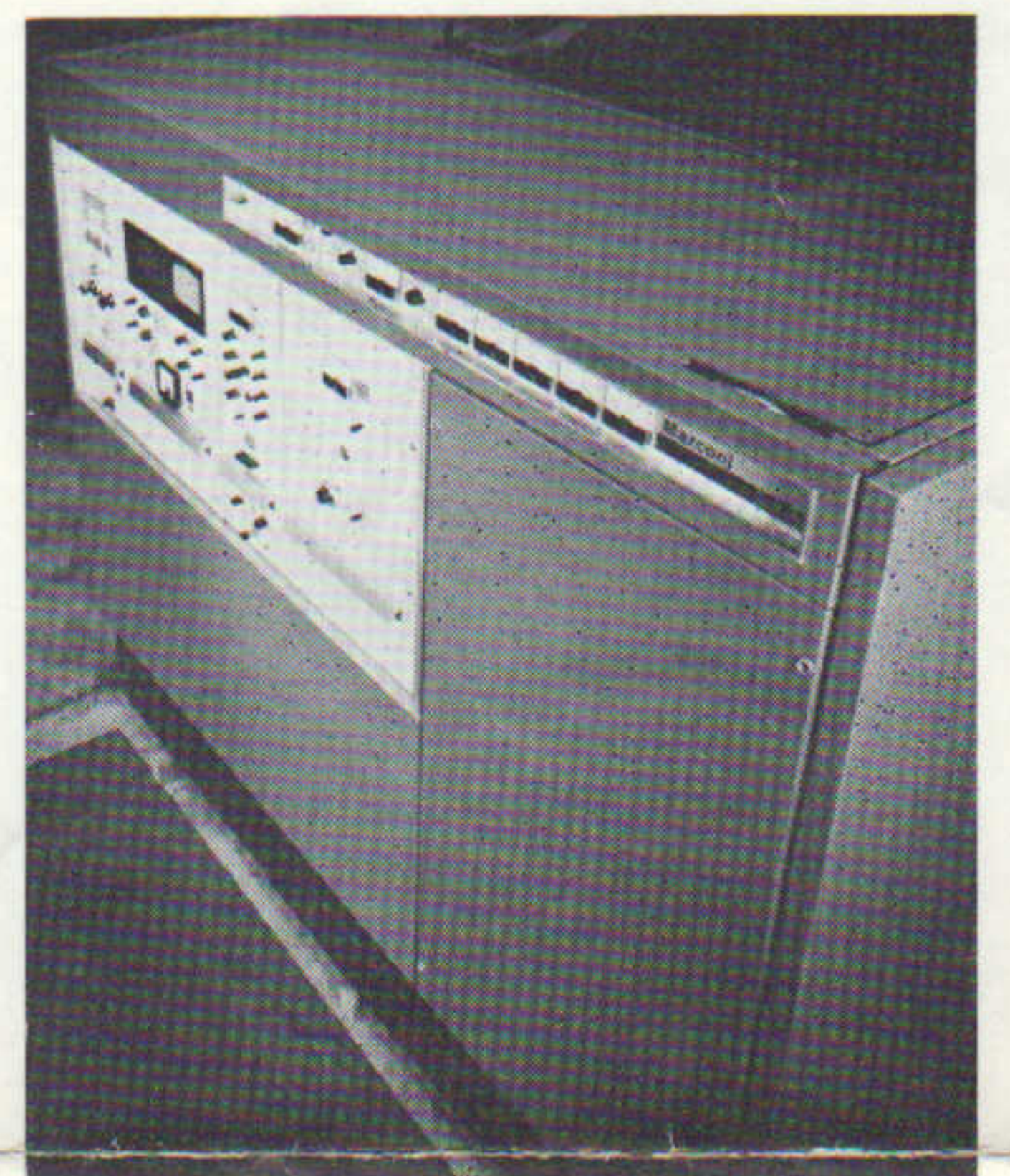
The transmitter system incorporates a number of features which lead to an exceptionally good Moving Target Indication performance. It is fully crystal referenced and the design ensures pulse-to-pulse stability. A new vapour-cooled magnetron with high mechanical stability is used and the complete transmitter is engineered to be free of mechanical vibration.

Comprehensive signal processing facilities and circular polarization of the transmitted pulses also contribute to the very 'clean' radar picture.

### Training Facilities

A number of Canadian Forces technicians have already received extensive training from Marconi in the operation and maintenance of the equipment. When the system is fully installed and operational, training will also be given on site.

## Unmanned S600 radars for NATO



Equipment for two unmanned radar stations, which will form part of the NADGE (NATO Air Defence Ground Environment) radar chain, is being brought together at the Marconi Test Establishment, Bushy Hill, Essex, in readiness for final system testing. As announced in the No. 1 edition of this journal, Marconi Radar Systems Limited, the British partner of NADGECO, won a contract to supply all the electronic equipment for the two stations from Hollandse Signaalapparaten, the Dutch partner in NADGECO and the main contractor for this part of the scheme.

The two stations, to be installed in Norway, will be used in the 'gap filling' role to complete low radar coverage. Being entirely unmanned in operation, the stations will be visited only once a week for brief routine maintenance. Although signals and monitoring information will be passed to a manned part of the NADGE radar chain via microwave link, the S600 transmitters employed will have no remote adjustment facilities and the high reliability and stability provided by the solid-state design is of vital importance to the scheme.

The value of the total Marconi involvement in contracts for NADGE is in the region of £10 million.



The interim aerial installation at Lahr

## Radar Systems International

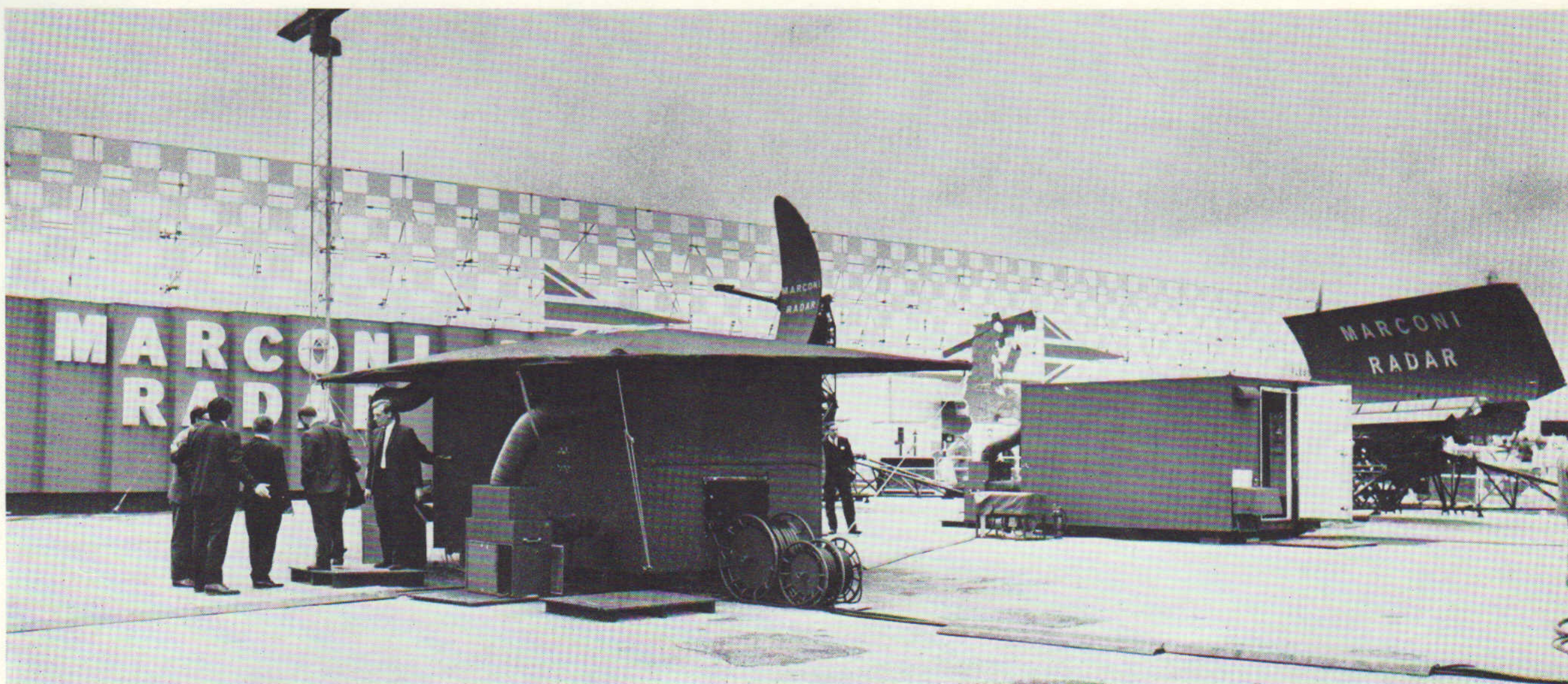
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The highly successful S600 series presentation at Farnborough '68

# Marconi Radar Spectacular at Farnborough '70

John Sutherland looks at this year's big show  
Managing Director, Marconi Radar Systems Limited



Marconi Radar Systems Limited will be putting on the most spectacular show ever at Farnborough this year. We shall be showing many exciting additions and extensions to the S600 series of modular radars for both air defence and air traffic control, the range which was so successfully launched at Farnborough '68, and which has had such an important impact on world markets. We believe firmly that Farnborough is a first class 'shop window' for defence and civil aviation ground electronics, and our efforts there in previous years have been rewarded by substantial export business directly attributable to contacts made at the show.

We shall be uncovering at Farnborough for the first time our new digital display, which is part of the data handling system designed to operate with the sensors of the S600 series. The 'wraps' will also be off the MYRIAD III computer, latest in the family of high speed on-line machines conceived for such data processing applications as air defence and air traffic con-

trol. At the 'front end' we shall be showing the latest combination of digital signal processing and extractors for use primarily with the radars of the S600 series but of course applicable to many other radar heads. One could say that this was our digital year!

Recent months have seen the consolidation of the new groupings brought about by the GEC-English Electric merger. The Marconi Company, as 'the principal operating company' of GEC-Marconi Electronics Ltd, is the nucleus for the formation of a massive 100-million-pound-plus organization which is of a size and capability to match any capital electronics business in the world. Marconi Radar Systems Limited is one of the market-oriented companies within GEC-Marconi Electronics, accounting for over a quarter of the business. The bringing together of Marconi Radar Division, AEI Radar, Aerospace and Defence Division and Elliott Air Space Control Division in Marconi Radar Systems has

resulted in a product range and system capability of immense power.

In ground air defence radar, Marconi radar capability covers every aspect of defence requirements ranging from simple primary surveillance radars to complex ground controlled interception and weapon control systems. The product range includes large stacked-beam 3D radars, plan and heightfinding radars, secondary radars (IFF), mobile and air transportable radars, signal processing systems, data utilization and display systems and radar simulation systems. In air traffic control for civil aviation, the Company's capability covers all aspects of airfield and airspace control, ranging from primary radars to sophisticated data processing systems. The product range includes Approach, TMA and long-range surveillance radar systems, secondary surveillance radar systems and data utilization and display equipment. The Company specializes in computer based systems for the handling of data in the air traffic control environment, including Flight Plan Processing, radar data processing, automated AFTN, data display and radar simulation.

The wide range and advanced design of the radar and associated products for air traffic control and air defence on show at Farnborough reflects the very high level of investment in Research and Development by Marconi Radar Systems Limited — a level of expenditure which is absolutely essential in order to maintain the market supremacy which we currently enjoy.

However, this expenditure must be wisely and carefully committed if it is to be really effective in augmenting and up-dating our product range, and this calls for a detailed and continuous consideration of market requirements, state of the art in technique, and the many other factors which go into product planning.

Our development objectives, again reflected in the products to be shown at Farnborough, are basically —

**Cost effectiveness**, not only in capital costs, but also in all the subsequent support costs.

**Reliability** and ease of maintenance.

**Flexibility**, to meet a wide variety of operational needs, to deal with an evolving situation and to be capable of extension and adaptation to meet new requirements.

We are confident that Farnborough '70 will consolidate the already dominant position of Marconi Radar in world markets.

## GEC-Marconi Electronics Limited The Marconi Company Limited (Principal Operating Company)

### Marconi Communication Systems Limited

Marconi Broadcasting Division  
Marconi Mercantile Marine Division  
Marconi Radio Communications Division  
Marconi Line Communications Division  
Marconi Space Communications Division  
Mobile Communications Division, GEC-AEI (Electronics) Limited Coventry  
Eddystone Radio Limited  
Marconi Specialized Components Division

### Marconi Radar Systems Limited

Marconi Radar Division  
Elliott Aerospace Control Division  
GEC-AEI (Electronics) Limited, Leicester

### Marconi Space and Defence Systems Limited

GEC-AEI (Electronics) Limited, Stanmore and Portsmouth  
Elliott Space and Weapon Automation Limited

### Marconi-Elliott Avionic Systems Limited

Marconi Aeronautical Division  
Marconi Electro-Optical Systems Division  
Elliott Flight Automation Limited  
Elliott Automation Radar Systems Limited

### Marconi Instruments Limited

### Marconi Italiana S.p.A

### Marconi (China) Limited

### Marconi (South Africa) Limited

### EASAMS

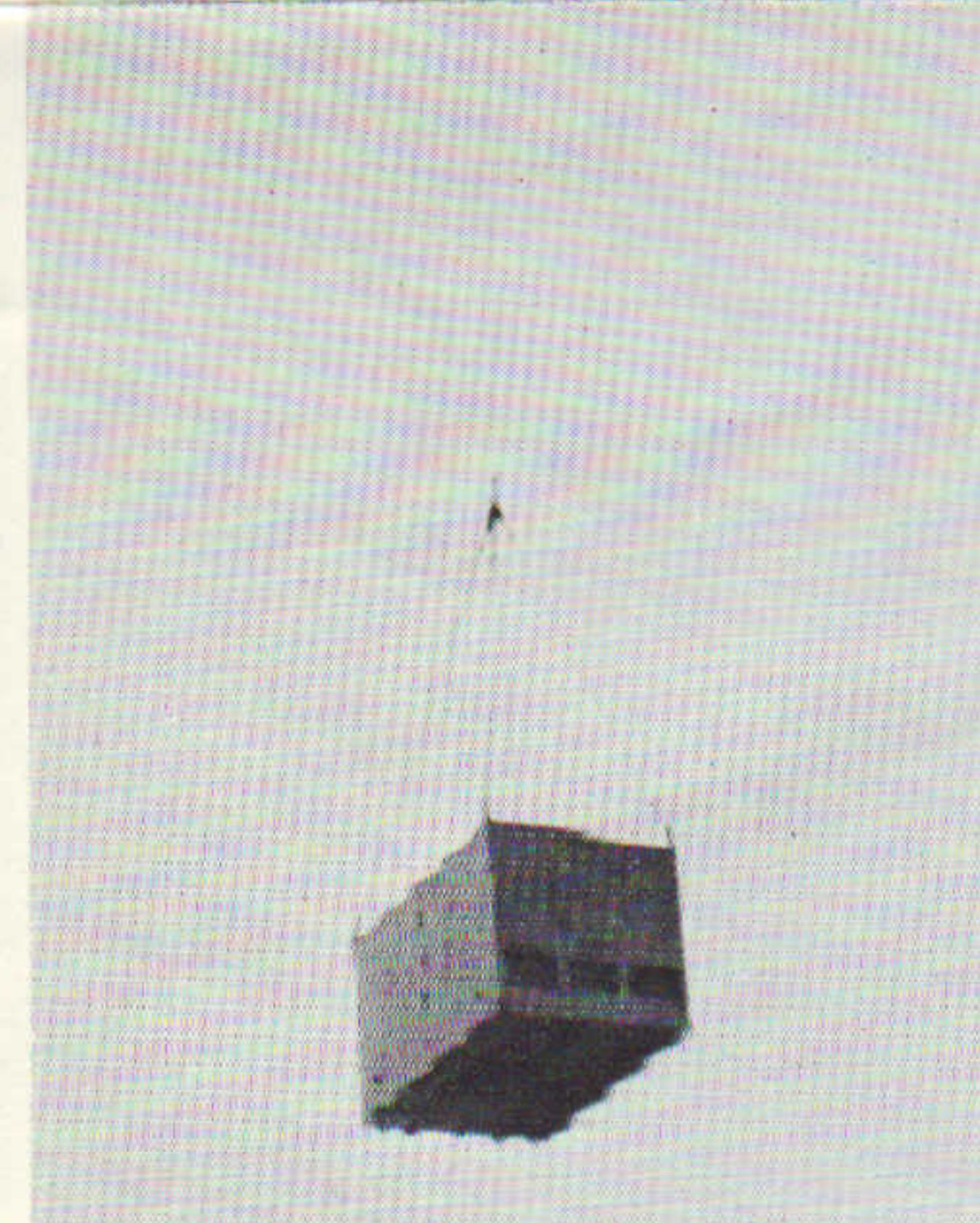
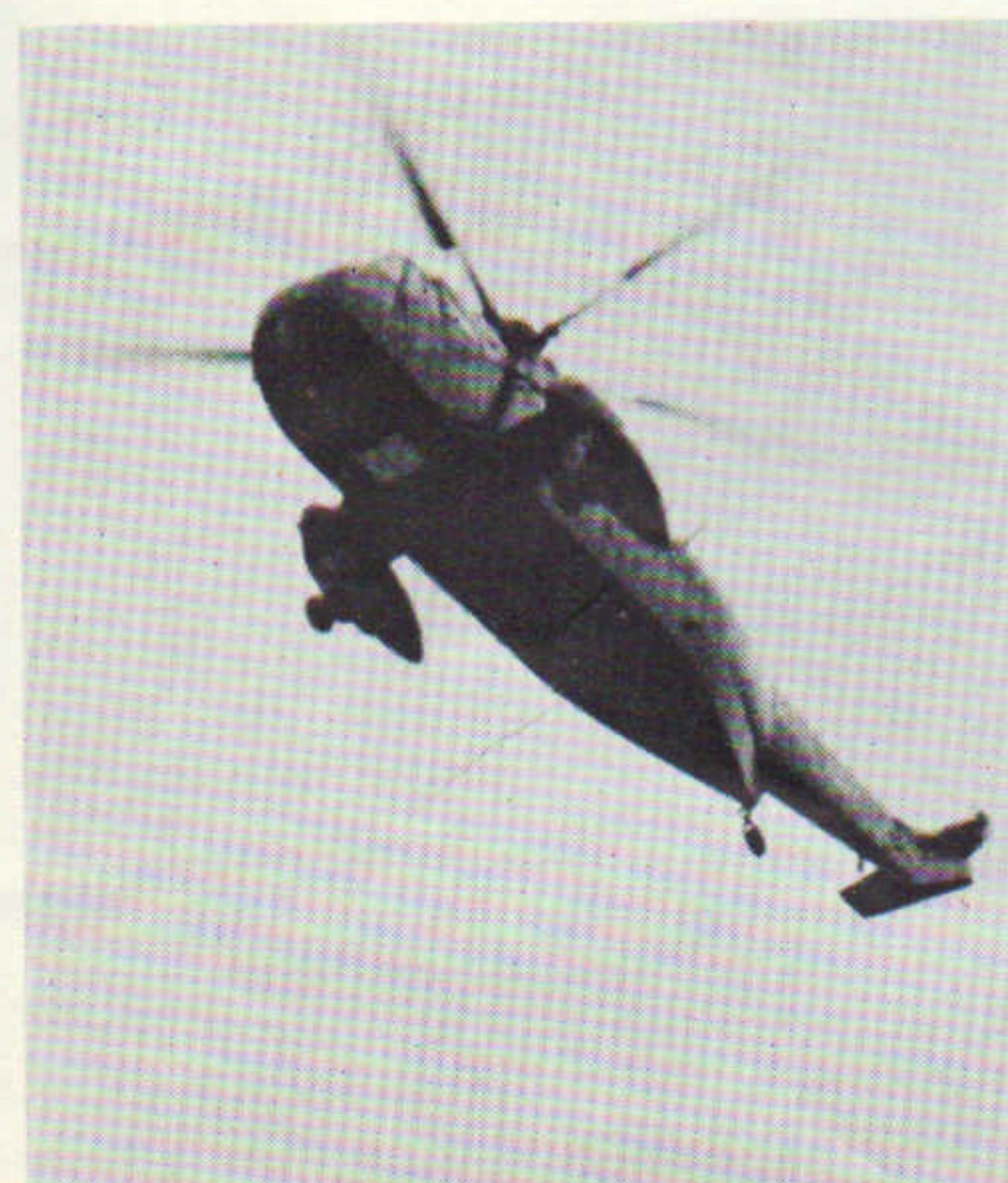


# S600 series forges ahead

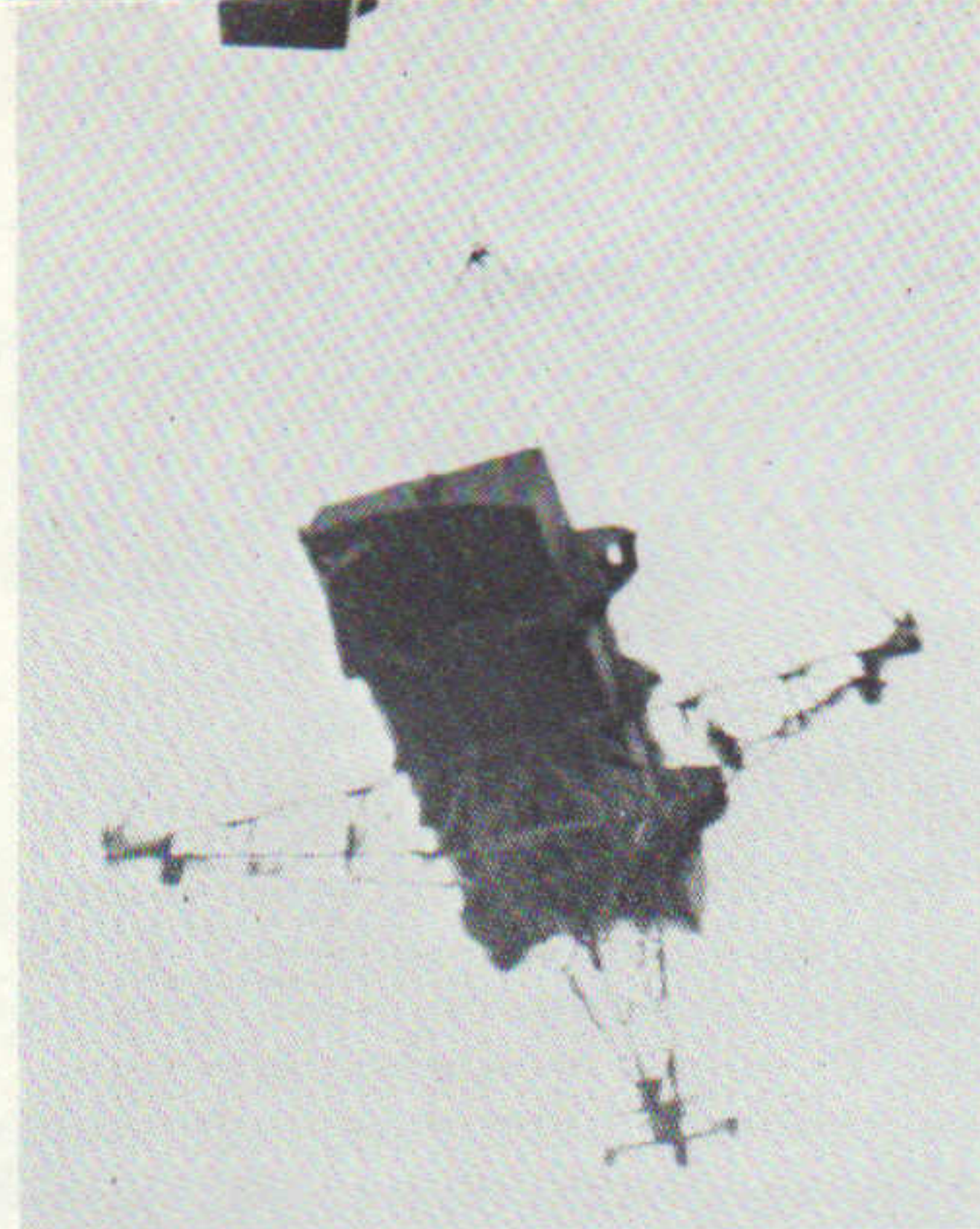
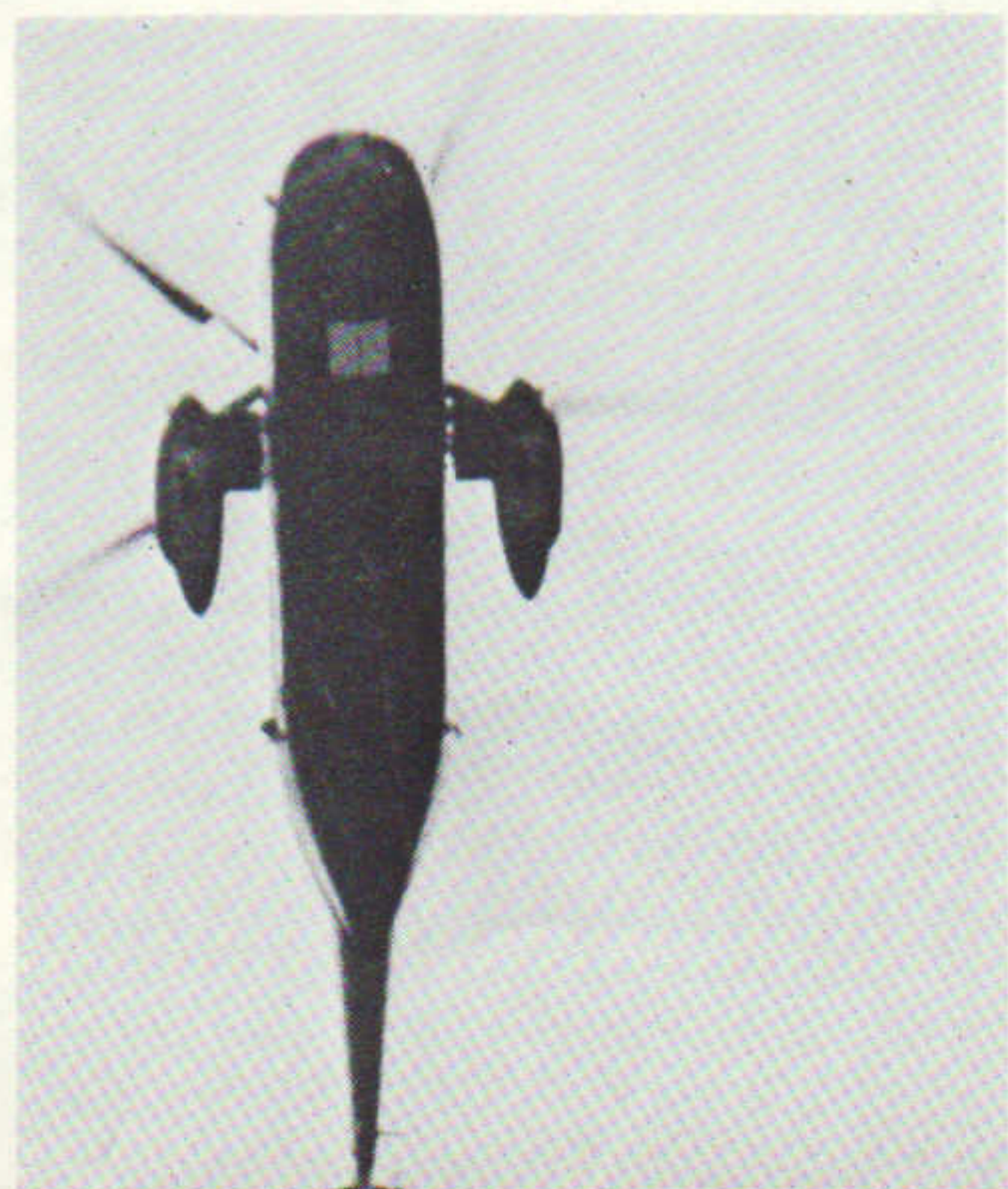
## THE NEW CONCEPT IN RADAR THAT HAS PROVED ITSELF



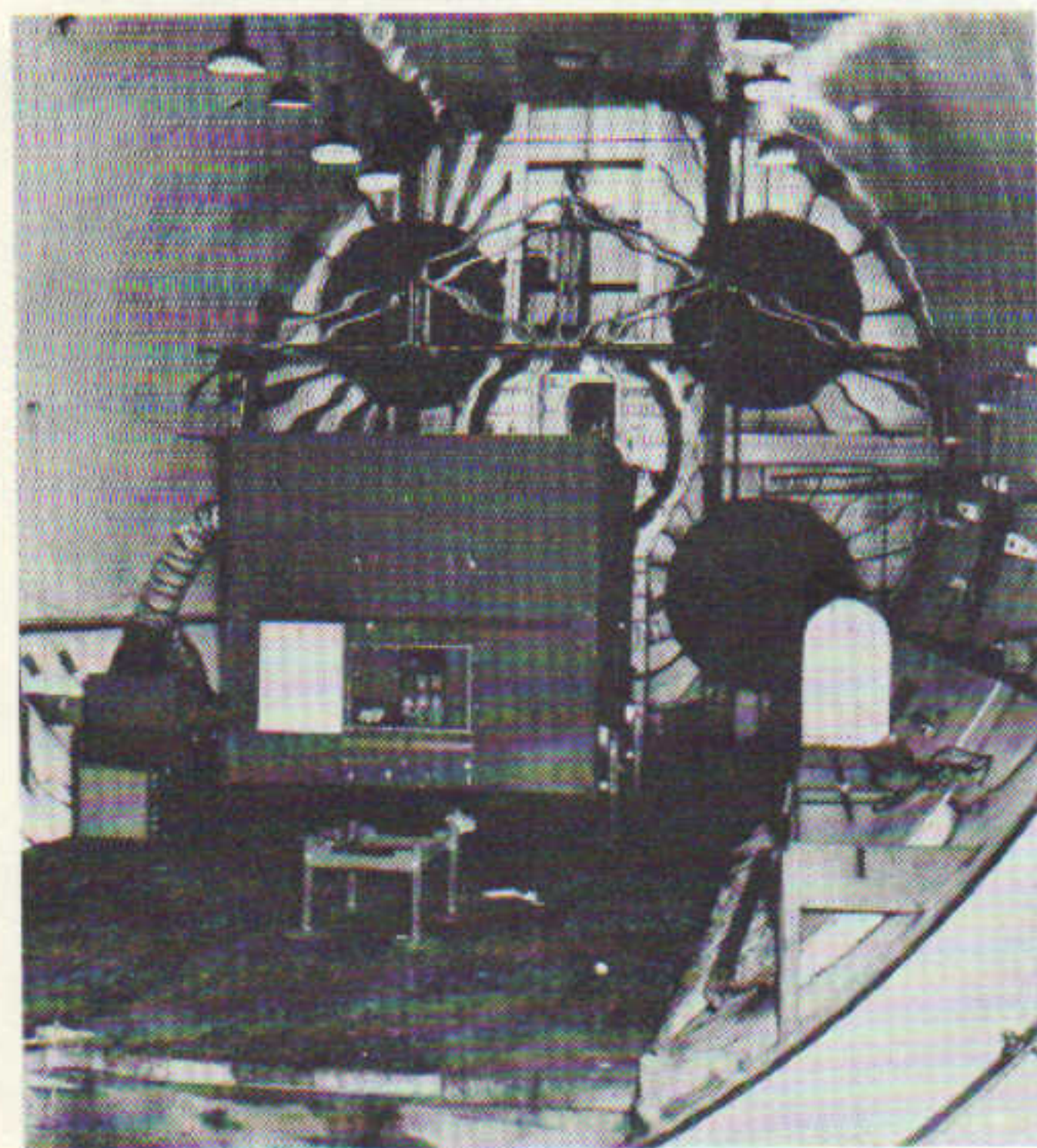
S600 series radar system deployed at Bushey Hill, Essex, England, comprising 10cm (S) Band Surveillance and 5.5cm (C) Band Heightfinder radars, with their Electronics Cabins and an Operations Cabin (left)



Transportable Surveillance Aerial and Electronics Cabin being lifted by helicopter during the S600 series proving trials



S600 series Transportable Surveillance Aerial being loaded aboard a C130 transport aircraft



S600 series Transportable Cabin and its equipment undergoing extreme climatic tests in the BAC Stratosphere Chamber

With the highly successful launching at Farnborough '68, the Marconi S600 series rapidly established itself as the most advanced range of modular radar equipment in the world that would meet almost any radar requirement. The S600 concept of a family of compatible radar units, which could be built up to form various systems capable of satisfying almost any air defence or air traffic control need, has proved itself as the most effective means of satisfying radar requirements over the next decade. The high degree of flexibility and cost effectiveness, together with the exceptionally high standards of reliability, compactness and ease of operation, achieved with the S600 series, have been the foundation of its unparalleled success. World orders now exceed £10,000,000 and call for systems to cover a wide variety of applications and to satisfy almost every conceivable air traffic control and air defence requirement, in locations from arctic regions to the tropics.

During the past two years the S600 series development and production programme has been one of intense activity, with the successful completion of the proving trials, both climatic and air transportation, the build-up of comprehensive production lines and the development of new equipments to supplement and extend the already extensive range of radar equipment.

The successful completion of the trans-

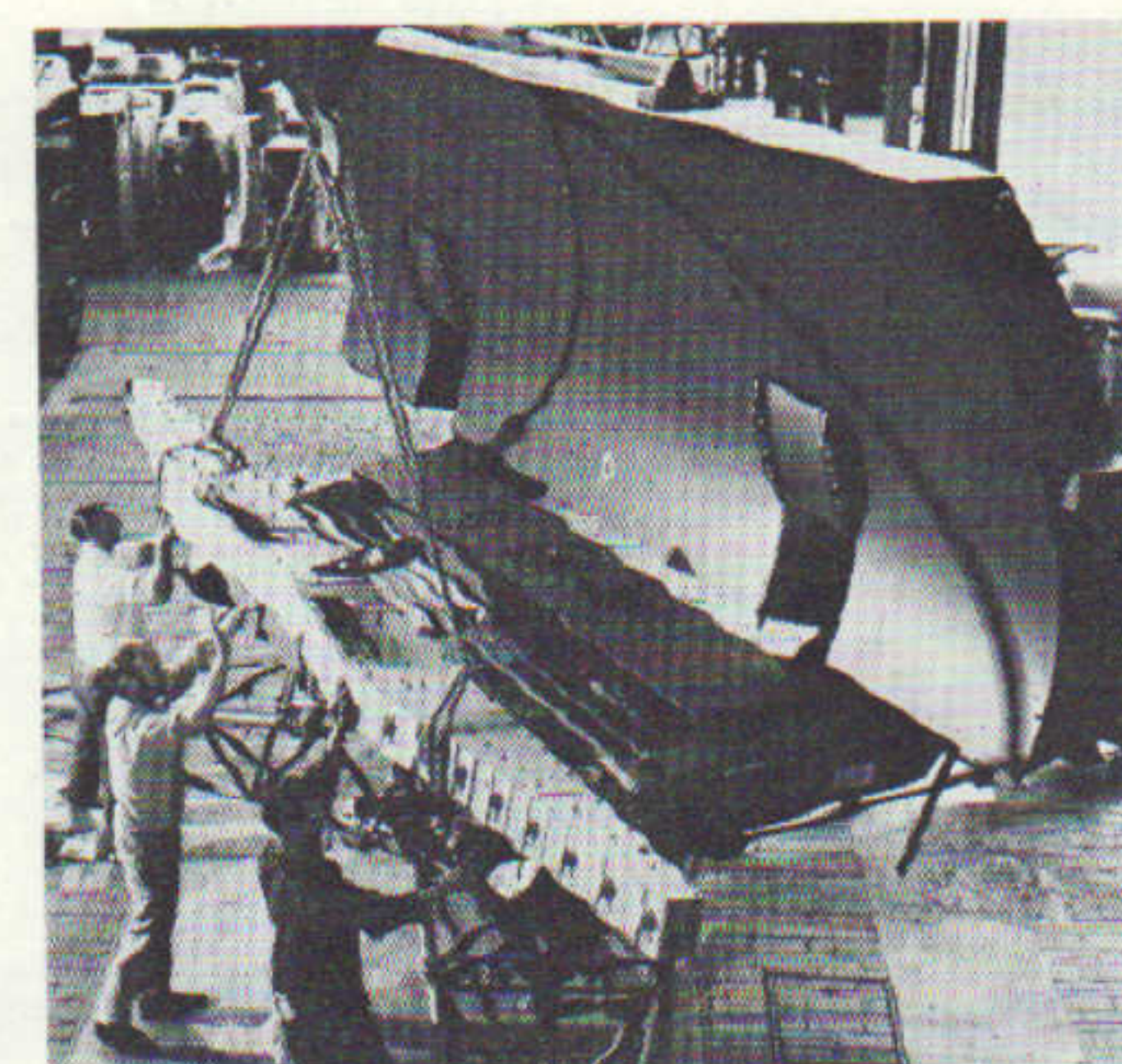
portable equipment proving trials assured the full mobility capability of the S600 series equipment which offers complete freedom in the choice of operational sites with the ability to redeploy rapidly to meet changing tactical situations, and its ability to withstand any climatic condition likely to be encountered in the world. The transportable elements comprise aerial assemblies and standard cabins, housing transmitter/receivers, display, data handling and communications equipment, which can be lifted by helicopter, carried in transport aircraft such as the C130 or towed by a light vehicle such as a landrover. The flexibility and transportability of the S600 series were firmly established in 1969 when the British Board of Trade used an S600 series system, comprising 10cm (S) Band surveillance and 5.5cm (C) Band heightfinder radars and an operations cabin, to carry out studies at three different locations of aircraft patterns around the four possible sites for London's third airport.

Farnborough '70 will see the introduction of new equipments that supplement and extend the present range of equipment, including digital signal processing systems and a digital extractor designed primarily for operation with the S600 series radars, the S3014 series of digital displays and the Myriad III computer, designed for use in the S600 series data handling systems.

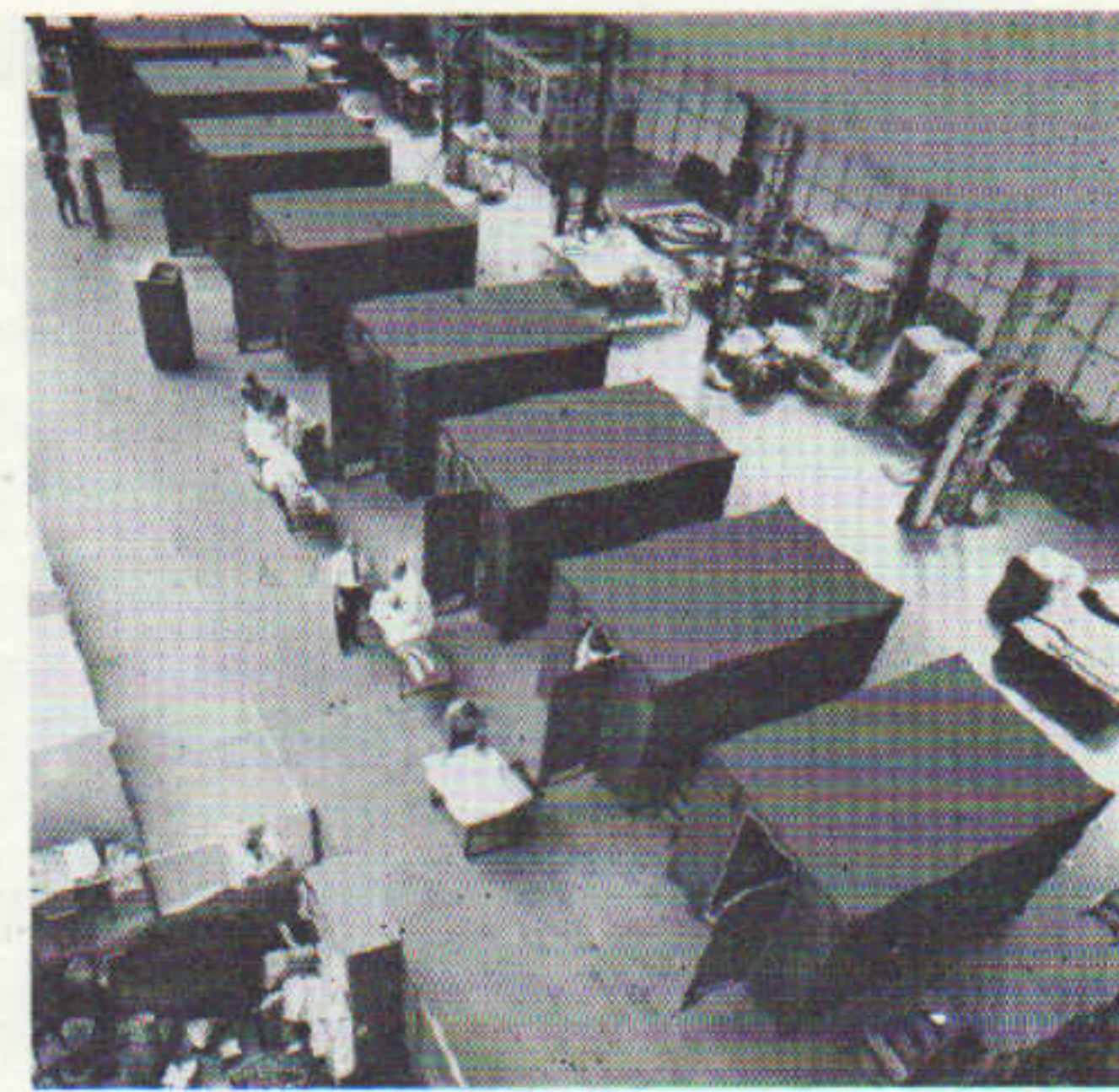
### S600 series production



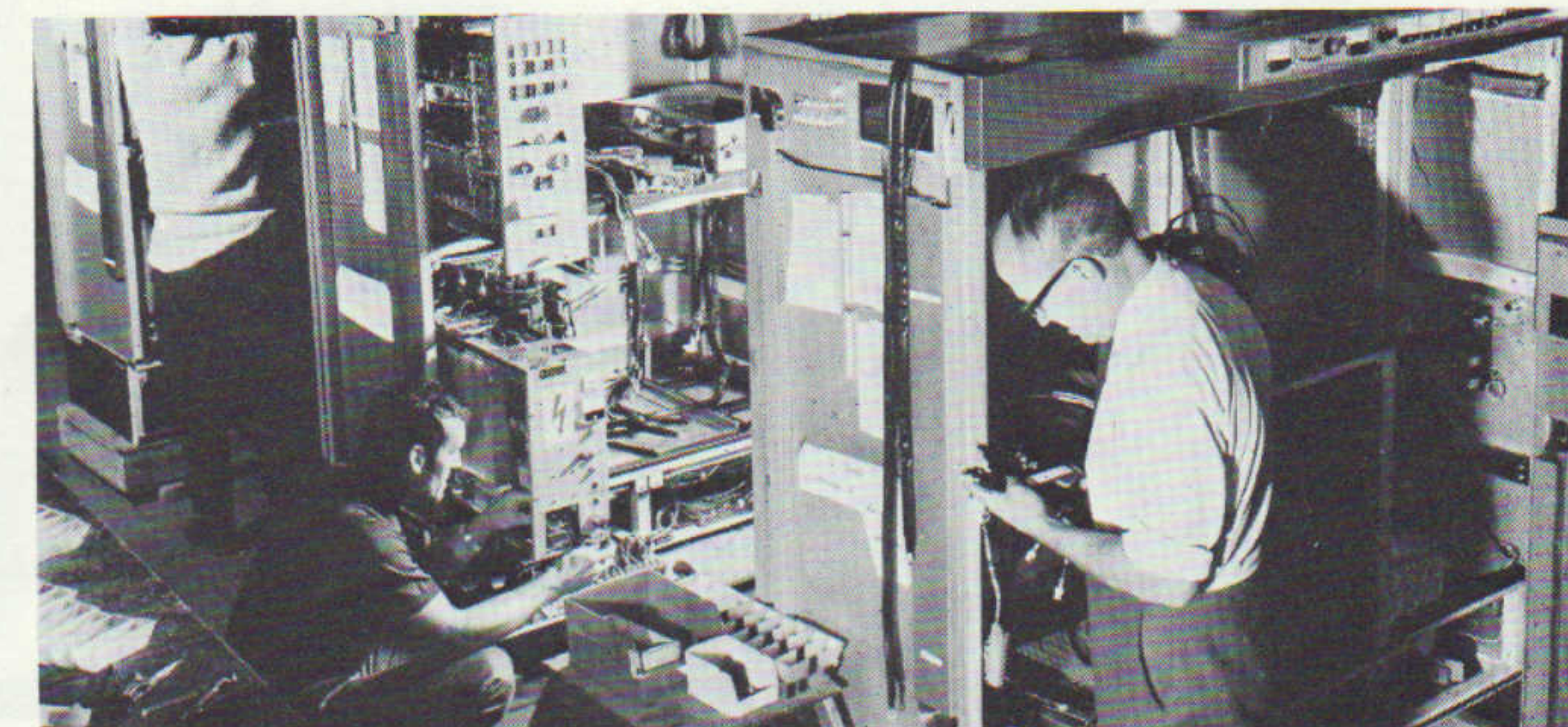
Transportable Heightfinder Aerial being assembled at Gateshead Works



Transportable Surveillance Aerials being constructed at Crompton Works



Transportable Electronics Cabins being fitted out prior to system test at Crompton Works



S600 series Transmitter assembly at New Street Works



# Marconi Displays in Computerized Tactical Trainer for British Navy

One of Europe's most sophisticated military tactical trainers, recently brought into service at HMS Dryad, Southwick, incorporates more than £½ million worth of electronic data displays supplied by Marconi Radar Systems Limited, Leicester. The trainer, designed and manufactured by Ferranti Ltd. working in close collaboration with ASWE, includes three Ferranti computers and more than 100 displays of various sizes. The displays are used to present simulated tactical information in both plan and tabular form, an application which involves the generation of a total of more than two hundred thousand characters on the display system screens.

The action speed trainer will be used to train naval officers in tactics, manoeuvres in action and the use of the most modern weapon systems. It is capable of simulating ships, submarines, aircraft and weapons and will also realistically present the interactions of radar, sonar and data handling and communications equipment.

## The Action Speed Tactical Trainer

The exercise controllers at Dryad are housed in a large control room, seated at consoles which incorporate three different size displays. From here they can run a particular exercise, feed new data to the computers with keyboards and other controls and generally monitor the performance of the students. They can also refer to two special high-definition displays which show the overall state of the exercise and which are filmed and projected onto large screens in front of them.

Students are accommodated in a number of

cubicles, each containing at least two plan displays, one of which is a 12-inch diameter plan position indicator, and the other a horizontally-mounted 24-inch conference display over which transparent charts can be laid. A 21-inch tabular display is also installed.

Each cubicle represents a vehicle in the simulated situation, perhaps a ship or a helicopter, moving through the exercise area and responding realistically to commands given by the students. The students, by using the displays and voice communications, get a constant picture of the situation and must plan their own tactics accordingly. Any changes they make in course or speed, for example, are fed to the computers and all displays are updated immediately.

The instructors also control a large number of additional vehicles and can inject new circumstances into the exercise at any time.

A complete photographic record of the exercise is taken and can be shown afterwards to illustrate significant stages in the program.

## Display System

The display system is built up from the AEI Type 1400 range of displays and back-up facilities. No less than fourteen back-up systems are used to cope with the large number of displays and the vast quantity of data being presented to them.

Each back-up system has four basically similar channels which share a common character generator with a capacity of 54 symbols. This latter equipment, digital-analogue



The displays installed in the Control Room at HMS Dryad

convertors and line generators are all under computer control.

The c.r.t. displays 'write' extremely quickly and are very flexible in operation. These characteristics are achieved by the use of a single deflection coil system which permits major deflection, location and writing signals to be superimposed and transmitted on the same set of cables. Data is fed to the back-up system from a high-capacity drum which makes a display refresh rate of approximately twelve times per second possible.

With the exception of the cathode ray tubes, the entire system is solid-state. The displays all use identical printed circuit boards and are electrically similar. This considerably simplifies the problem of maintenance and spares holding.

## Who's who in Radar



**Nigel Ellis-Robinson**, born in Buckinghamshire in 1924, joined The Marconi Company in 1949 following wartime service in the Royal Air Force and the completion of his education at Southampton University. During his Royal Air Force service he spent 3 years on radar navigational aid research for the Telecommunications Research Establishment (now RRE) and the United States Air Force, and a year as Radar Instructor at No. 2 Radio School, Yatesbury. Since joining The Marconi Company, he has been continuously associated with Radar Development, starting with the development of the radar transmitters for the VAST and ROTOR projects. Subsequently he became responsible for the development of radar transmitters, receivers and signal processors. In 1965 he was appointed Engineering Manager, in charge of the development of radar data generation equipment for the Radar Division of The Marconi Company. Upon the formation of Marconi Radar Systems Limited all equipment development was centralized within an Engineering Division with Mr. Ellis-Robinson as Divisional Manager.

# MULTI-MILLION POUND AIR DEFENCE SYSTEM FOR IRAN

The Imperial Iranian Air Force has placed a multi-million pound contract with Marconi Radar Systems Limited for a number of fully mobile air defence radar and communications systems, the most powerful of their kind ever produced.

The use of very advanced data processing

facilities, based on the Myriad computer, enables each air defence system to track a large number of high and low flying aircraft simultaneously and to handle ground controlled supersonic interception with great precision. Each convoy contains both self-propelled vehicles and equipment trailers,

including high power surveillance and height-finding radars, all remotely controlled centrally from mobile operations vehicles.

The latest transistorized displays for plan position, for data presentation and general data handling equipment centrally controlled by the Myriad computer, are contained in the operations vehicles. Ground-to-ground and ground-to-air radio communications are provided to give each system the necessary links with Air Defence Operations Centres, Sector Operations Centres, Fighter airfields, and other radar stations in the air defence network.

All parts of the mobile air defence systems are supported by mobile power generators, workshop vehicles, spares vehicles, personnel carriers, etc., making the system truly self-contained. All the system elements are ruggedized and have been proved during arduous trials to ensure that real cross-country mobility is possible and all equipment is air-conditioned to allow panclimatic operation.

Included in the contract are full spares backing, full support on site and training. Already seventy officers and airmen from the Imperial Iranian Air Force have been trained by the Company in digital techniques, transistorized equipment computers, servicing and maintenance. A number of specialists have been trained on programming to enable the Imperial Iranian Air Force continually to up-date the data handling facilities.

A mobile operations vehicle

