SCOTTISH AND OCEANIC AIR TRAFFIC CONTROL CENTRES

National Air Traffic Services

NATS

SCOTTISH AND OCEANIC AIR TRAFFIC CONTROL CENTRES

Air traffic in United Kingdom airspace is managed by the National Air Traffic Services (NATS), an organisation jointly responsible to the Civil Aviation Authority and the Ministry of Defence. NATS is responsible for air traffic services to civil and military air traffic, and for the planning, provision and maintenance of radars, navigational aids, and communications.

The aim of NATS is to ensure the safe, orderly and expeditious flow of air traffic within UK airspace, which extends over the land mass and the seas and oceans surrounding it. NATS also provide services over the eastern part of the North Atlantic – a responsibility assigned to the UK by the International Civil Aviation Organisation.

Air traffic in UK airspace is varied, ranging from public transport flights of the airlines to military aircraft on operational training; from the private pilot flying for pleasure to helicopters plying their way between oil rigs and the mainland; from island-hopping passenger services in the Scottish Highlands and Islands to agricultural crop-spraying aircraft; balloons and gliders.

Airspace is divided into ***Flight Information Regions*** *(FIRs) of which the United Kingdom has responsibility for three, each with its own Control Centre:*

LONDON — *covering England, up to 55°N, Wales, the Isle of Man, and the immediately surrounding seas. Its Control Centre is at West Drayton near London's Heathrow Airport, and there is a sub-centre at Manchester.*

SCOTTISH — *covering the whole of Scotland, Northern Ireland and the immediately surrounding seas. Its Control Centre is at Prestwick.*

OCEANIC — *covering the eastern part of the North Atlantic. Its Control Centre is also at Prestwick.*

This booklet describes the services provided by the Scottish and Oceanic Air Traffic Control Centre at Atlantic House, Prestwick in Ayrshire.

Cover picture:
The exterior of Atlantic House showing the radio aerial linking ScATCC with Lowther Hill and Rhu Stafnish

HOW AIR TRAFFIC CONTROL IS ORGANISED

As far as possible, public transport, military, business, sporting and leisure aircraft are allowed to fly when, where and how they wish. Within the Flight Information Regions are two categories of airspace – 'controlled' and 'uncontrolled'.

In uncontrolled airspace, aircraft may fly when and where they like, subject to a set of simple rules. To operate in controlled airspace, aircraft must be suitably equipped and their pilots appropriately qualified.

Controlled airspace is divided into three parts:

Control Zones surrounding and protecting major airports

Terminal Control Areas normally established at the confluence of airways in the vicinity of one or more major aerodromes

Airways connecting the Terminal Control Areas, and linking up with the airways of adjacent countries

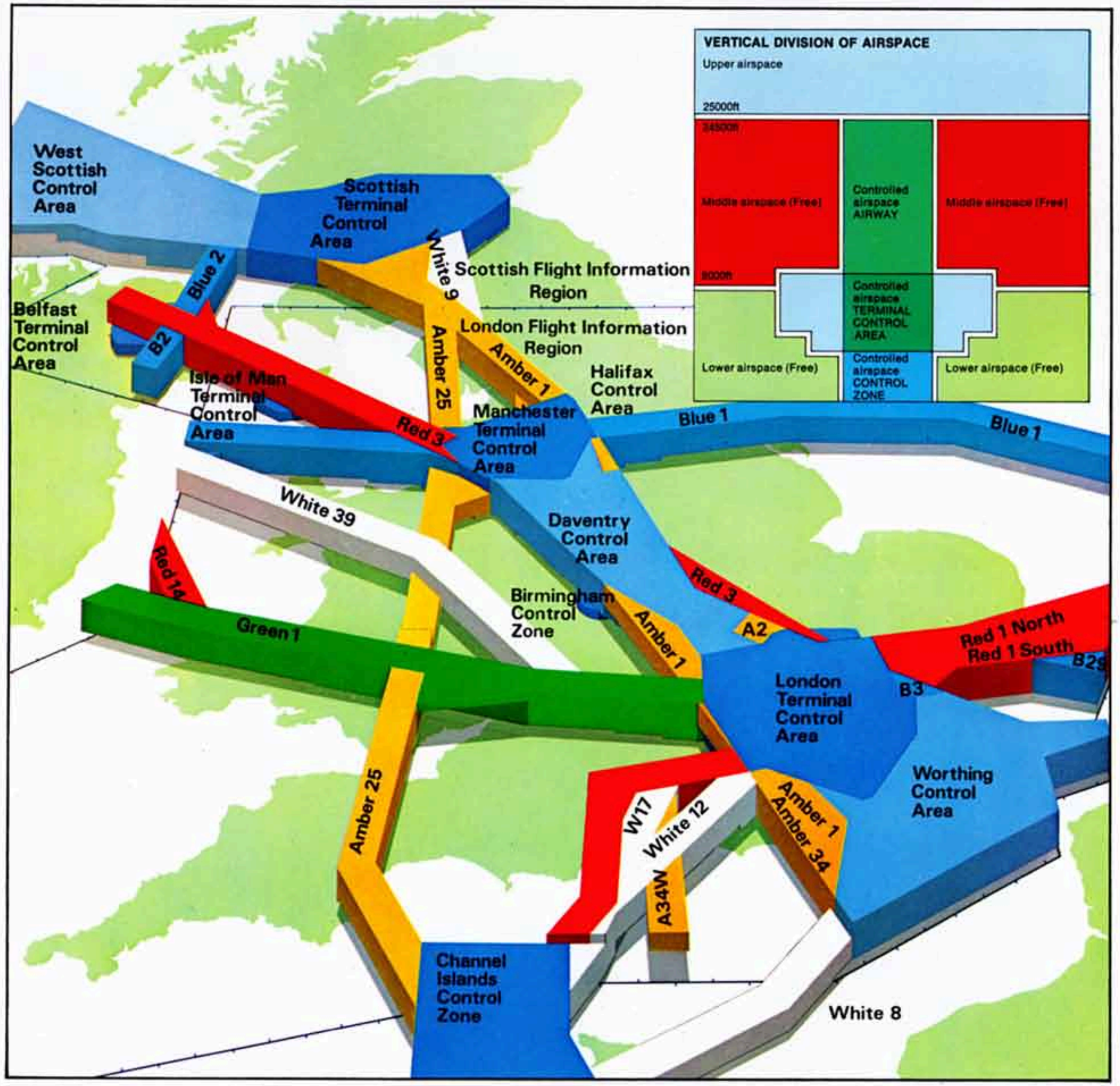
The airways are corridors of airspace ten miles wide, usually from a base of between 5000 and 7000 ft up to a height of 24,500 ft. Above 24,500 ft civil and military aircraft, many of which are overflying the UK, are subject to a full and mandatory ATC service.

In **controlled airspace** the function of air traffic control is to keep aircraft safely separated from each other by using internationally agreed standards. This is done either by allocating different heights to aircraft or by arranging certain minimum horizontal distances between them. The separation distances vary. For example, an aircraft flying along the airways under radar surveillance may not pass within five nautical miles of another if it is at the same height: on the other hand, if two aircraft are less than five nautical miles apart horizontally, they must be at least 1000 ft apart vertically. Above 29,000 ft this separation is increased to 2000 ft.

Above 24,500 ft is a **Special Rules Area** in which all civil aircraft are controlled. Most of this airspace is also a military Mandatory Radar Service Area in which all military aircraft are required to receive a radar control service. In some places Special Rules Airspace has been provided below 24,500 ft. This is done where there is a need to protect public transport aircraft without interfering with other aircraft movements. Pilots flying in this airspace need radio equipment to be able to communicate with air traffic control, and must obey ATC instructions.

Outside controlled and Special Rules Airspace NATS provide ATC services to aircraft on request. On certain routes which are well-used but not busy enough to classify as airways, NATS has established Advisory Routes where pilots can receive an ATC service to ensure their separation from other participating aircraft.

Below 8000 ft certain co-opted Ministry of Defence units provide a **Lower Airspace Radar Service.** The service supplements NATS services and is available to all aircraft flying between 3000 ft above mean sea level and Flight Level 80, within approximately 30 nautical miles of each listed aerodrome.



Airways in United Kingdom airspace

Military services

The military element of NATS provides four main radar services to aircraft operating within radar cover:

- Aid to all aircraft in distress
- Radar service to military aircraft flying between 25,000 ft and 66,000 ft, and to military aircraft crossing the national airways
- Radar service to aircraft descending into or climbing out of selected military airfields
- Radar service to aircraft both civil and military on transit flights below 25,000 ft outside the airways system

The emergency service is available to all military and civil aircraft capable of communicating by radio on the VHF or UHF international aeronautical emergency frequencies. The Scottish Air Traffic Control Centre (ScATCC) maintains a continuous listening watch on these frequencies and is able to fix the position of an aircraft in distress through a country-wide network of direction-finding stations.

Military controllers in the ScATCC operations room

For aircraft on the UHF emergency frequency, the bearings received at the direction-finding stations are relayed to ScATCC and displayed automatically on a large screen in the Distress and Diversion (D&D) cell. The D&D controller can then 'fix' the position of an aircraft in distress almost instantaneously and provide the required assistance. When handling an emergency, the D&D controller can summon assistance from outside bodies such as RNLI, HM Coastguard, search and rescue units, helicopters, mountain rescue teams and the police.

The military Distress and Diversion Cell at ScATCC

Radars

There are about a hundred radar displays at the London, Manchester and Scottish centres which provide information on air traffic. These displays receive signals from a network of primary and secondary radar stations. Secondary radars give position, height, identity and on-board-emergency information for aircraft fitted with a 'transponder' The services from the Centres are supplemented by Joint Air Traffic Control Radar Units manned by military and civil controllers, who provide a radar control service in areas outside the radar coverage available to the London and Scottish centres.

Navigational aids

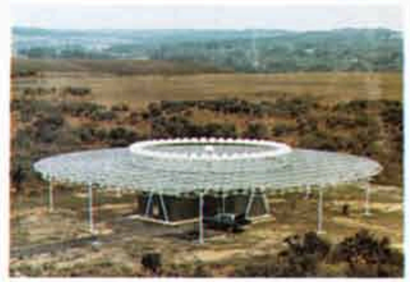
A network of some hundred navigational aid stations provides radio signals which aircraft use for en-route flying, determining position and locating aerodromes. The main aids used are VHF omni-directional ranges (VOR and DVOR); distance measuring equipment (DME), and non-directional beacons (NDB).

Automation

NATS use computer-based systems extensively for three main purposes – the automatic processing, distribution and display of flight plan and radar-derived position information on aircraft controlled by operational units; the training of controllers; and the evaluation of air traffic service system developments.

The London Air Traffic Control Centre uses the IBM 9020D computer. In Prestwick the Scottish Air Traffic Control Centre processes radar data using Marconi "Locus 16" processors which are described more fully later in this book, on page 14. The Oceanic Area Control Centre at present uses the Apollo system to process flight plan information on aircraft flying across the Atlantic Ocean. This system will be replaced in a few years' time by a new flight data processing system with a greater potential for future development.

A secondary radar station with a primary radar in the background



A DVOR radio beacon

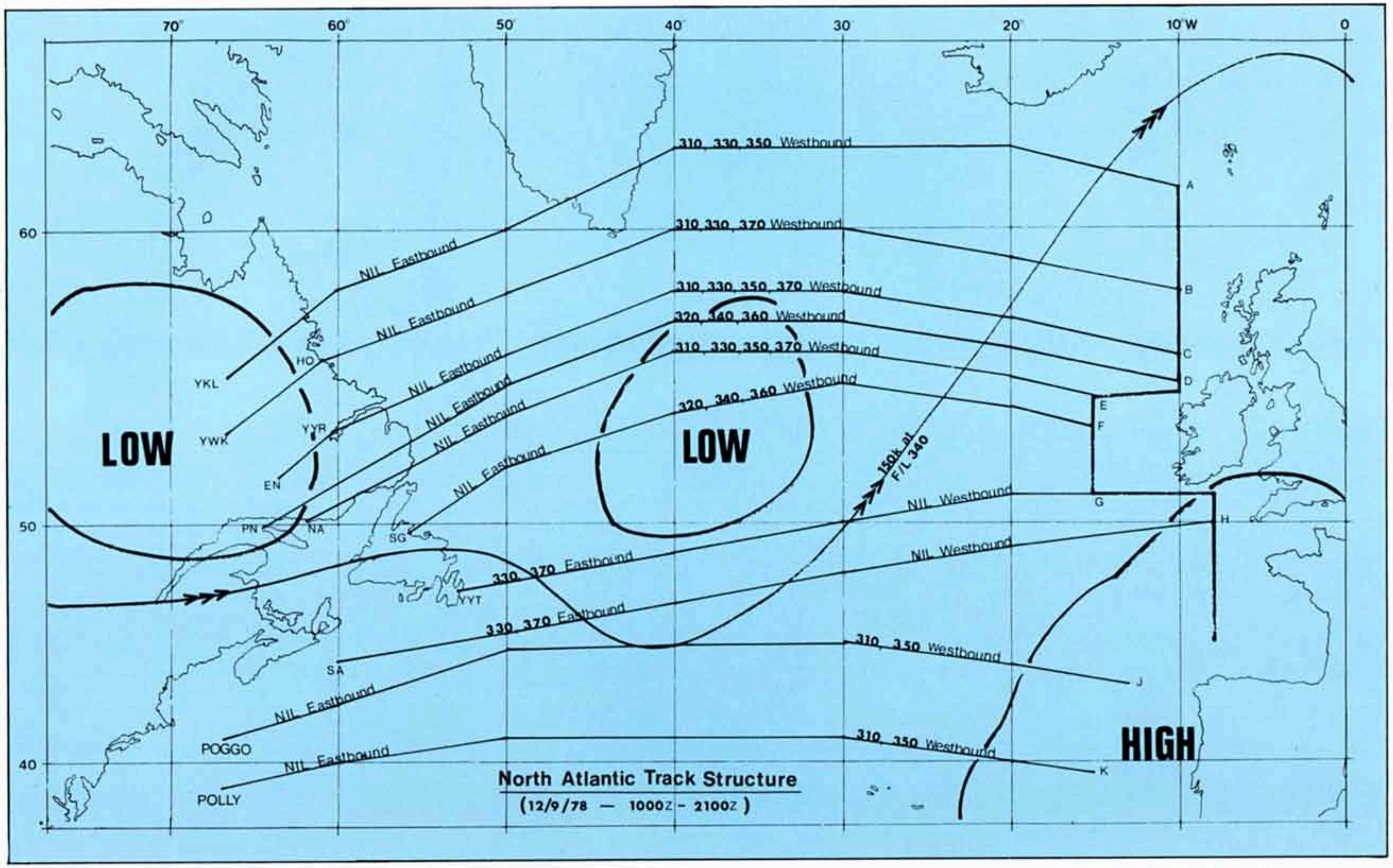
NORTH ATLANTIC OCEANIC AIR TRAFFIC CONTROL

Responsibility for the provision of air traffic control services within the North Atlantic Region is delegated by the International Civil Aviation Organisation to five States: Iceland, Canada, USA, Portugal and the United Kingdom. The Region is divided into five Oceanic Control Areas and air traffic in each area is controlled by the relevant Oceanic Area Control Centres (OACC) at Reykjavik, Gander, New York, Santa Maria and Prestwick. The Oceanic Control Centre at Prestwick is responsible for providing ATC services to traffic operating in the eastern portion of the North Atlantic region.

This traffic is controlled by using position reports and estimates passed by the aircraft through a high frequency radio communications station at Ballygirreen, near Shannon in Ireland. All communications received at Ballygirreen are transmitted to Prestwick Oceanic Centre by teleprinter. When an ATC reply is required, it is teletyped back to Ballygirreen for onward transmission through high frequency to the aircraft.

ATC clearances to enter the oceanic area are issued well in advance, normally by direct radio contact with the aircraft through one or two extended range VHF radio stations at Dundonald Hill in Scotland and Davidstow Moor in Cornwall. The two stations give VHF coverage over most of the UK FIRs: outside this area aircraft may request clearance, on high frequency, through Ballygirreen or through a domestic ATC agency.

As a result of passenger demands, time zone differences and airport noise restrictions, much of the North Atlantic air traffic contributes to one of two flows – westbound in the morning, eastbound in the evening. Because of the concentration of the flows and the limited vertical height band which is economic for turbo-jet operations, the airspace is comparatively congested. In order to provide the best service to the bulk of the traffic, a system of organised tracks is constructed by the relevant OACC every 12 hours to accommodate as many aircraft as possible on their most economic flight paths.



The North Atlantic track structure between 10am and 9pm on 12 September 1978. A typical daytime track system showing the tracks, flight level availability and significant weather characteristics

Prestwick OACC is responsible for the day track system and Gander for the night track system. In each case, planners on either side of the ocean consult with each other and co-ordinate as necessary with adjacent OACCs, as well as with domestic ATC agencies, to ensure that the system provides sufficient tracks and flight level profiles to satisfy anticipated traffic demands.

When negotations are complete, the organised track system is published by the OACC concerned by signal to all interested units in Europe and North America. The daytime system is usually published by Prestwick between midnight and 1 am; Gander usually publishes its night system between noon and 1 pm. In the case of the daytime system, a tape is made giving details of track co-ordinates for continuous broadcast during the period of validity.

Each oceanic flight plan received from the departure airport includes the track, flight level and cruise Mach number requested and this information is used to produce a planning flight progress strip.

When the pilot requests clearance, the planning controller attempts to fit the flight into the requested slot according to the aircraft's requested level, Mach number and boundary estimate. Once the clearance is accepted by the pilot, the information is relayed to the relevant ATC centre and, where necessary, to adjacent OACCs. Then the clearance is fed into the Apollo computer which prints the necessary en-route flight progress strip and passes the information to the computer in Gander OACC. The en-route flight progress strip produced by the computer gives all relevant flight details and computed times of arrival at specific reporting points along the track, normally at intervals of 10° of longitude. This en-route flight progress strip is used by the controller to monitor the progress of the flight through the Oceanic Control Area. Most flights across the North Atlantic are handled in this way, but some aircraft wish to operate outside the organised track system; for example, on flights between Europe and the Caribbean, or between Europe and the west coast of North America. Some of these flights, together with those operating at much lower altitudes and slower speeds, are not handled by the Apollo computer. Although in these cases flight progress strips are produced manually, the same service is provided and the same degree of care exercised to ensure safe operation.

Transatlantic flights by Concorde are also controlled from the Oceanic Centre. These flights operate along fixed tracks, normally between 50-60,000 ft. Because of the extremely small number of aircraft flying within this height band, it is usually possible for the OACC to issue a clearance before take-off which allows Concorde to operate on a supersonic 'cruise-climb profile' which is the best in terms of fuel economy.

Controllers and their assistants at work in the Oceanic Area Control Centre

SCOTTISH AIR TRAFFIC CONTROL CENTRE

ScATCC looks after about 137,000 square miles of United Kingdom airspace. The area extends from 61°N, near the Faroe Islands, southwards to the boundary of the London FIR at 55°N, on a line running roughly through Carlisle and Newcastle. To the east it reaches 250 miles from the UK mainland to the Norwegian and Danish FIRs; westward to the Oceanic Control Area, 150 miles from the mainland, taking in the airspace over Northern Ireland.

ScATCC's operations room, on the first floor of Atlantic House, is a spacious area with operational units arranged in four rows. The outer rows consist of control suites, each containing a Planning position equipped for flight progress strips and a Radar position containing two Locus 16 radar displays. Associated controls, radio channel selectors, telephone keyboard, and closed

The operations room at ScATCC

circuit television displays are grouped closely around each unit.

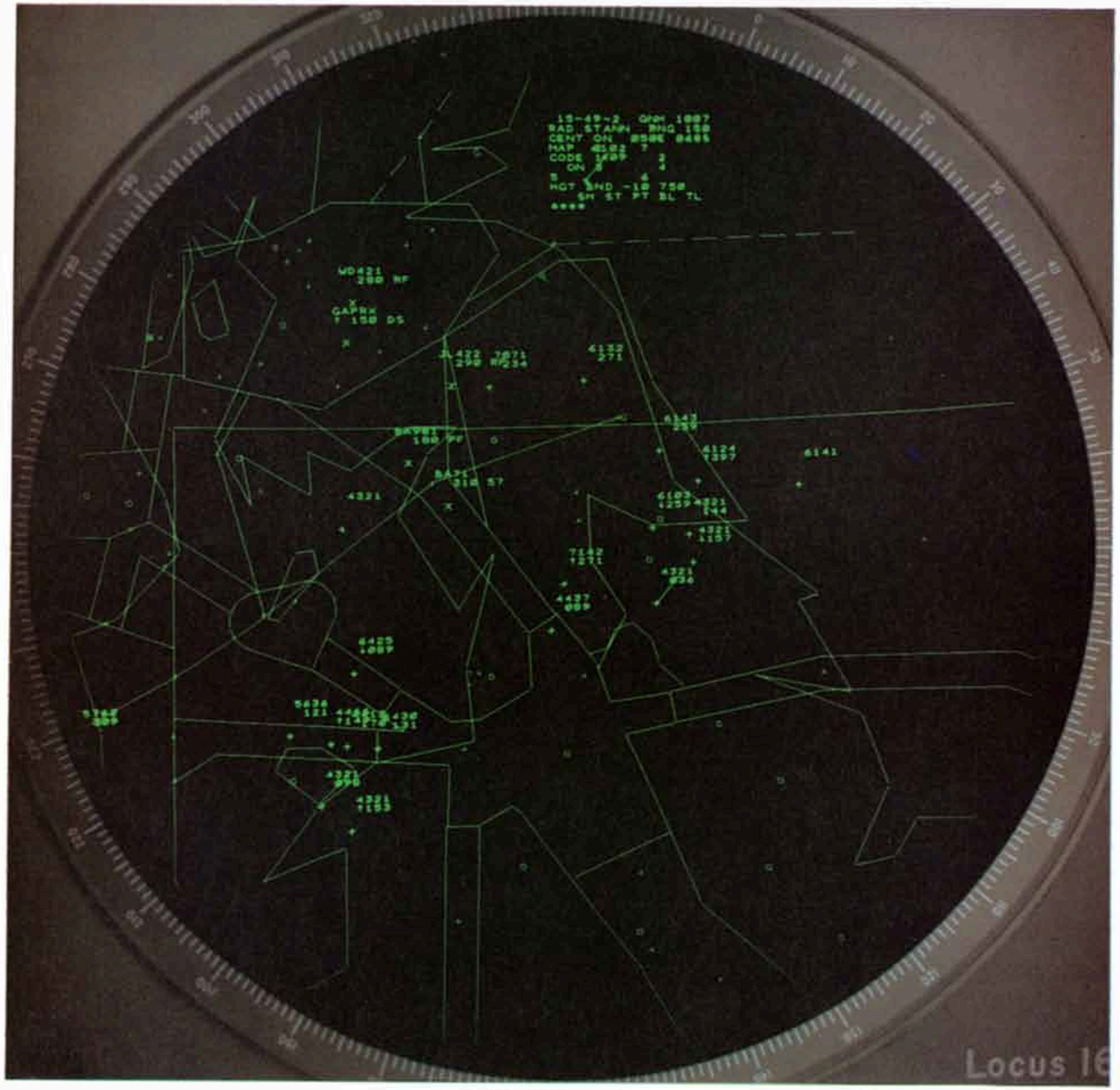
The units down the centre of the room provide the Flight Data Processing, Code/Callsign Conversion units, and the FIR sector. The west side of the Operations Room handles all traffic in Controlled and Advisory airspace below 24,500ft, while the east side attends to the upper airspace where joint civil/military control is provided.

At one end of the operations room is the Watch Supervisor's desk, while at the other are large windows with venetian blinds. In the past it has been necessary for air traffic controllers to work in artificial light but the new sharply-defined, green radar displays at ScATCC allow work to be carried out in subdued daylight.

The new consoles have two computer-driven processed radar displays. Each aircraft is identified on the display by a symbol giving its callsign, height and destination, and indicating whether the aircraft is climbing or descending.

Controllers have a number of radio telephone channels that they can use to communicate with pilots under their control. There is also a computerized telephone network for rapid consultation with controllers in other centres and airports as well as with those in ScATCC. Up-dated aeronautical information is shown on closed circuit television screens set in the consoles.

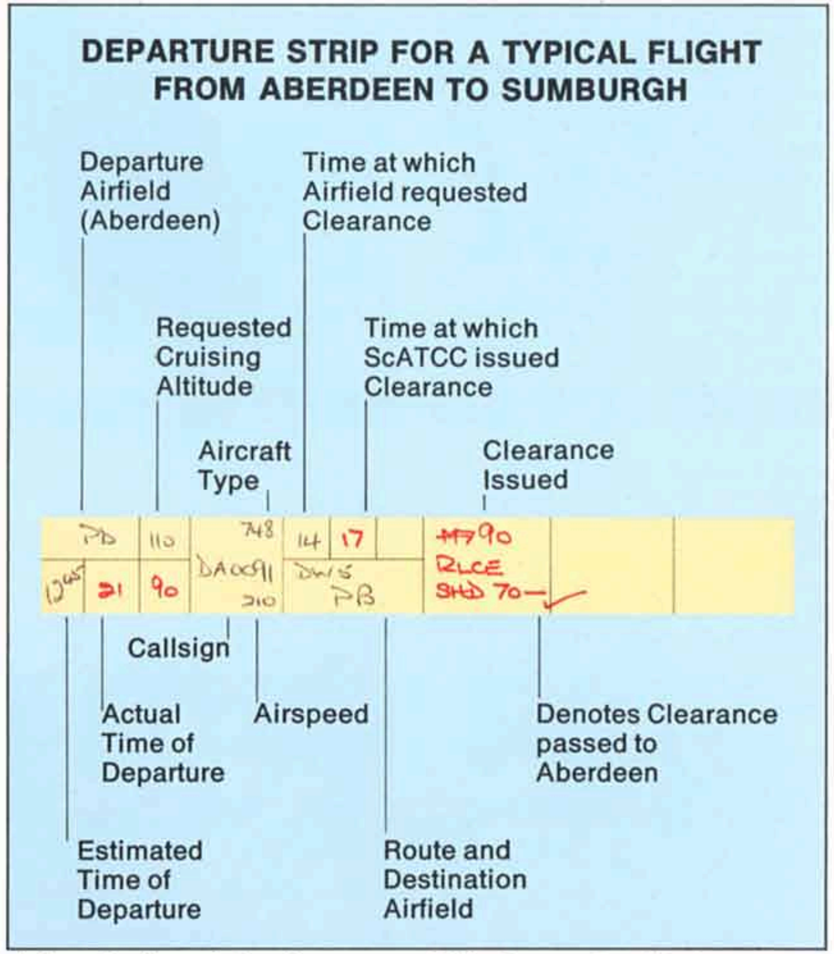
The air traffic controllers at ScATCC work a five-watch system to keep the centre operating 24 hours a day, seven days a week. A watch consists of about 18 controllers and 18 assistants. The Oceanic Area Control Centre uses the same system but here a watch consists of seven controllers and eight assistants.



A radar display showing the positions of aircraft by their callsigns, height and destination symbols

A TYPICAL FLIGHT UNDER SCOTTISH AIR TRAFFIC CONTROL

Before taking off, the pilot of every public transport aircraft (defined as one that carries passengers and/or freight) intending to fly within regulated airspace has to "file" a flight plan which is transmitted to the control centre. This information, in coded form, is transmitted ahead of the flight not only to its destination airport, but also to all FIRs that it will pass through on its route. For regular flights, the basic information about the flight plan may be filed some weeks or even months previously and is stored until it is needed.



At least 30 minutes before the expected departure time, information is taken from the flight plan by the Data Extraction Cell at ScATCC which then makes up a departure flight progress strip indicating the aircraft's callsign, type, speed, expected departure time, route destination, and desired flight level. This is forwarded to the sector's Flight Progress Board Assistant (FPBA) who makes up further flight progress strips for use along the route, including one for the transfer point into the next area.

The ScATCC operations room

When the flight is nearly ready to depart, Aerodrome Control, situated in the airport's Control Tower, passes a departure warning to the Sector's FPBA, who allocates a secondary surveillance radar (SSR) code and enters it, together with flight callsign, into the computer. The departure strip is transferred to the Planning Controller, who is then in a position to regulate the flow of departures according to the traffic situation.

The departure time is telephoned to the sector and the Planning Controller allocates a cruising flight level. The cruising flight level and estimated time of arrival at the transfer point into the next sector or FIR are added to the flight progress strip, and the details are telephoned to the next unit. The transfer strip is then forwarded to the Planning Controller. Meanwhile the aircraft has taken off and the pilot has contacted the Executive Controller of the first sector, who is busy supervising the climb under radar control to the allocated cruising level. In due course the aircraft will be integrated into the traffic pattern and its cruising level and, as it reaches a pre-determined point, responsibility for the flight is handed over to the next sector.

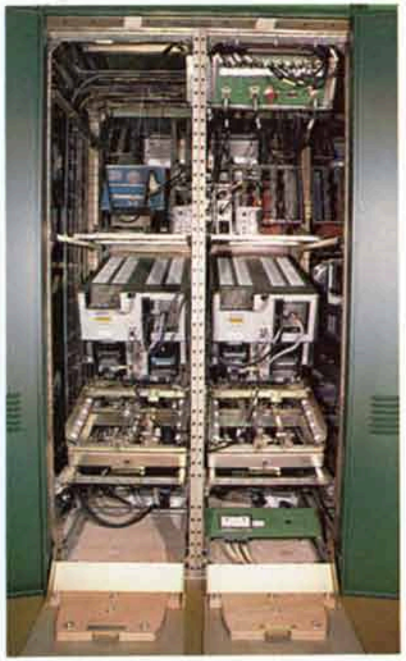
The visual control room in the control tower at Prestwick Airport

TECHNICAL DETAILS OF THE TELECOMMUNICATIONS SERVICES AT ScATCC

The technical services at ScATCC are provided by modern highly sophisticated and reliable equipment. Each system and the Centre as a whole has been engineered to allow re-arrangement and additions to services to be carried out easily and without interruption to the operational services. Maintenance is carried out by a watch-keeping staff on a 24-hour basis.

The air traffic controllers maintain contact with the aircraft crews through the radio telephone service and this is the most vital link in the overall air traffic service. Consequently, this system is engineered to an exceptional degree of performance and reliability. It is backed up by the latest stored programme controlled telephone system enabling the controllers to speak to each other within the Centre and with airports and air traffic units both within the UK and overseas.

Control of aircraft movements is achieved largely through radar surveillance and this uses a modern synthetic picture, bright display viewing system. It presents a very clear uncluttered picture to the controllers and allows them individually a high degree of selection of the actual information displayed on their particular viewing units. ScATCC is the first centre in the UK to be entirely equipped with synthetic radar. In addition, each control position is equipped with centrally-driven digital clocks and closed circuit television (CCTV) for the display of supporting information. All radio messages, both in and out, together with some telephone calls are recorded.



The front and back of a ScATCC control position

To ensure against interruption from power failure and mains interference, a power-conditioning system (PCS) is interposed between the outside supply mains and the essential services. This is backed by a standby power generator to cover other than momentary mains failures.

These engineering services are all monitored at System Control, where the System Controller directs investigation and any necessary remedial action. He is generally aware of any major troubles developing before they are noticed by ATC and he can take prompt action to maintain a full service.

Left: The System Controller monitoring the telecommunications services
Below: The Software Cell where computer programs are maintained and developed

Workshops are provided where the equipment can be maintained, repaired and modified. A Software Cell provides for the maintenance and development of the computer programs and uses its own radar processing facilities to assist in this work.

The accommodation consists of the original Atlantic House together with the new two-storey operational/technical extension at the eastern end. The original building houses the administrative services, the Oceanic Control Centre (OACC), and the teleprinter mains terminal. The OACC is to be transferred to a further extension nearing completion to the north of the operational block, when it will be completely re-equipped, including a purpose-designed Flight Data Processing System.

The Building

The new specialised technical block has been designed and built to provide an integrated system with flexibility and scope for expansion.

The ground floor serves as a service void and accommodates the cable distribution system, power conditioning system, workshops and storage room. There is a minimum height of 2 metres below trunking and cable racking and the area has fresh air ventilation and is heated.

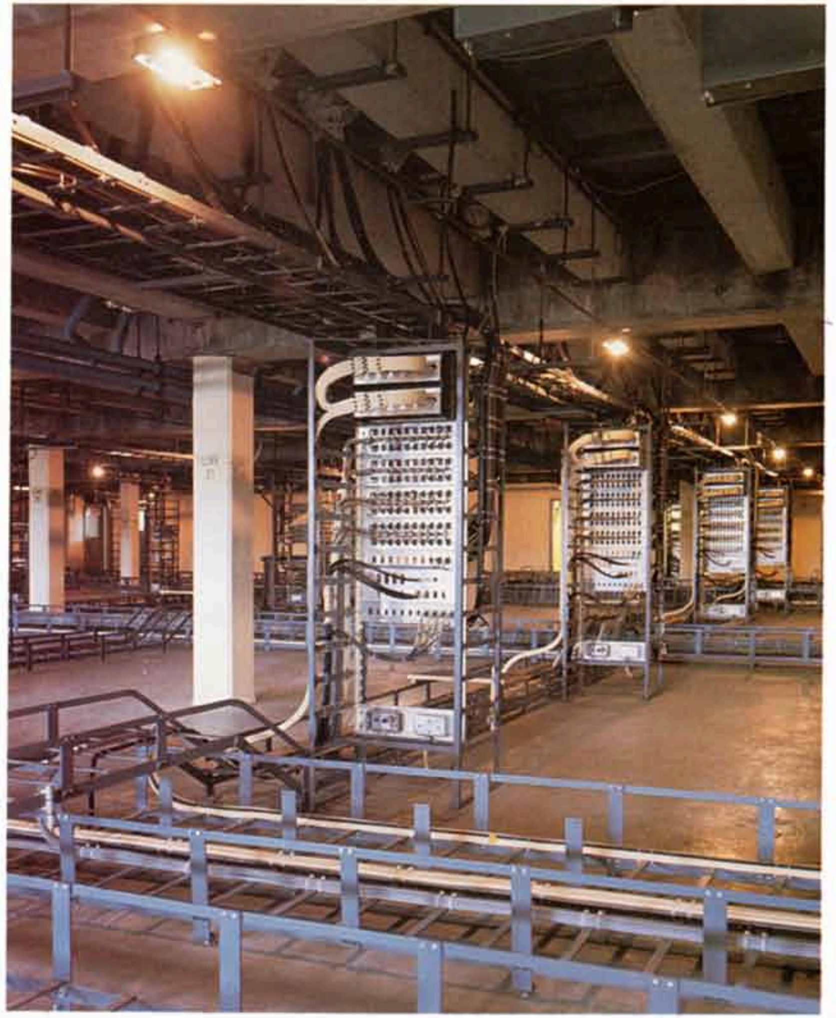
The first floor accommodates the ScATCC domestic and en-route operations room, the Distress and Diversion Cell, System Control, workshops and telecommunications equipment rooms.

The technical equipment required to provide the services to the operations rooms is contained in the Telecommunications Equipment Room.

Between the Operations Room and the Equipment Room is the System Control, a technical facilities control and management point. The whole of the first floor is air conditioned to maintain a temperature of 20° ±1 °C and humidity of 50% RH ±5%. Should there be an air conditioning failure, fresh air is circulated to maintain a reasonable working environment.

The operations room lighting has been designed to eliminate light reflections on radar and other screens and can be dimmed to suit local requirements. Emergency lighting is provided automatically in the event of loss of main lighting supply.

The building incorporates an underground wire mesh area earthing mat connected to buried electrodes. The inside of some walls have been screened to reduce, to tolerable levels, outside interference which may adversely effect the computer equipment. Fire/smoke detection, with visual and aural alarm indications, is provided, in System Control and the foyer of Atlantic House, in addition to the normal break-glass fire alarm system. All installation cabling between sub-system equipments and operational suites is routed on cable racking in the service void on the ground floor.



The cable distribution area below the operations room

Technical Furniture
The technical furniture used in the Centre was designed and manufactured by CAA with ergonomic and medical aspects considered in the design. The furniture for the operational suites is to a design named ATCON and is of metal construction, while that for supervisors and system control is of wood. Each operational console consists of a main frame to which is bolted a selection of facia. The facia are metal shells, each with a front aperture into which are mounted the various modular facility panels required at that position. Behind the front mounted panels are related interface panels on which plug/socket facilities are mounted. These permit quick replacement of faulty items and allow flexibility. In addition to the facility panels the various facia that may be fitted to the main frame include overhead spot lamps, map units, radar display mountings, closed circuit television and flight progress boards. Any console can be readily transformed by replacing its various facia, as changed requirements dictate. The Supervisor's and System Controller's suites, although made of wood, are designed to use the same metal fittings, for facia panels etc, as the standard ATCON metal consoles. Cables enter the consoles through holes in the modular floor panels. The openings are fitted with fire-resistant cable gaiters, additional cables can easily be accommodated.

Communication Facilities
The communications facilities provided at Atlantic House can be divided into three groups:

Ground to Ground
Telephone system consisting of PABX and TDCE
AFTN

Air to Ground
MSRCE
RDCE
Radio links

Miscellaneous
Audio Recording
CCTV
Clock System

The telephone equipment room at Atlantic House housing the IBM 3750

Telephone System
The telephone system at Atlantic House consists of two main equipments providing facilities throughout the Centre:

Private Automatic Branch Exchange (PABX), an electronic switching system with stored programme control, and multi-frequency signalling which has full Post Office approval.

Telephone Distribution and Control Equipment (TDCE), which provides an interface between the PABX and the operating positions.

The PABX, IBM 3750 switching system is the modal point in Scotland for the NATS Operational Switched Telephone Network (OSTN) and the Administrative Telephone Network (ATN). The system, which has a capacity of over 900 extensions, 104 private wire centres or external discrete telephones and connections to the public switching network, has a manned switchboard to assist extensions or network users. The system gives each extension a combination of facilities selectable from a pre-arranged programme including:

- A means of breaking into an otherwise engaged call by priority users.
- A means of indicating to an otherwise engaged call that another extension requires communication.
- The ability to connect extensions for conference.
- Extension hunting.
- Single-key dialling.
- Non-dial connections.
- Abbreviated address dialling.
- Barring and freeing a phone on a 'per extension' basis.
- Flexible extension numbering.

The TDCE, which has its own power supply, consists of a central apparatus in the equipment room with desk-mounted key and lamp panels at the various operating positions. The installation of this CAA-designed equipment was implemented by the CAA's Telecommunications Engineering Establishment to schedules prepared by Tels, and includes fifteen cabinets and two distribution frames with nearly 50,000 connection cables, 1600 km of cable with 250,000 terminations.

The TDCE supplies an emergency standby in the event of a complete PBAX failure, by automatically connecting selected private wires to a central control keyboard, which can extend calls to and from selected operational positions to the network.

The multi-frequency key pad panels, designed by the CAA to use the 3750 PABX system, are located at operating positions. In addition to visual call indications each ATC position has a call indicator which may be set to one of eight output tones. From the key pad panels two extensions to the PABX may be accessed, and at least twenty line selection keys are available for private wire and non-dial connections. Headset and handset facilities are available and each position has alert facilities.

Aeronautical Fixed Telecommunications Network (AFTN). This is an international network used for the interchange of telegraph messages pertinent to air traffic control. The main AFTN centre for the UK is the CACC at Heathrow and the telegraphic traffic is exchanged between CACC and Atlantic House on a CAA-operated Multi-Channel Voice Frequency Telegraph (MCVFT) Network over Post Office rented lines. The various types of AFTN messages are distributed to pertinent operating positions either in the form of hard copy (paper) or via message-routeing equipment to designated teleprinters at selected locations within Atlantic House. The teleprinters used in noise sensitive areas are of the electronic termal variety.

Radio Links Two main radio link systems at Atlantic House connect ScATCC with Lowther Hill and Rhu Stafnish, via a repeater station at Brown Carrick. The radio link equipment at ScATCC is in the Equipment Room and the aerials are on a tower at the north-east end of the building.

Air to Ground Communication This is achieved by utilising remote transmitter and receiver stations including new stations at Saxa Vord (Shetlands) and the BP Forties production platform in the North Sea. Signals to and from these remote stations are fed over Post Office-rented lines and NATS-owned radio link systems using MSRCE. These 13 strategically placed remote stations, using 16 VHF and 8 UHF channels provide a radio telephony coverage over the whole of the ScATCC areas of responsibility.

Multicarrier Station Remote Control Equipment (MSRCE). The MSRCE provides a highly reliable service from the remote transmitter and receiver stations. The facility enables remote station parameters including outside electricity and DC supply.

Radio Distribution and Control Equipment (RDCE). At Atlantic House the RDCE permits individual controllers to access up to seven pre-selected VHF/UHF channels from the 24 available. In addition to access to the RT this system also provides for controller access to the telephone system using a common headset.

Audio Recording ScATCC is equipped with three 32-track recorders with a maximum recording period of 24 hours per tape.

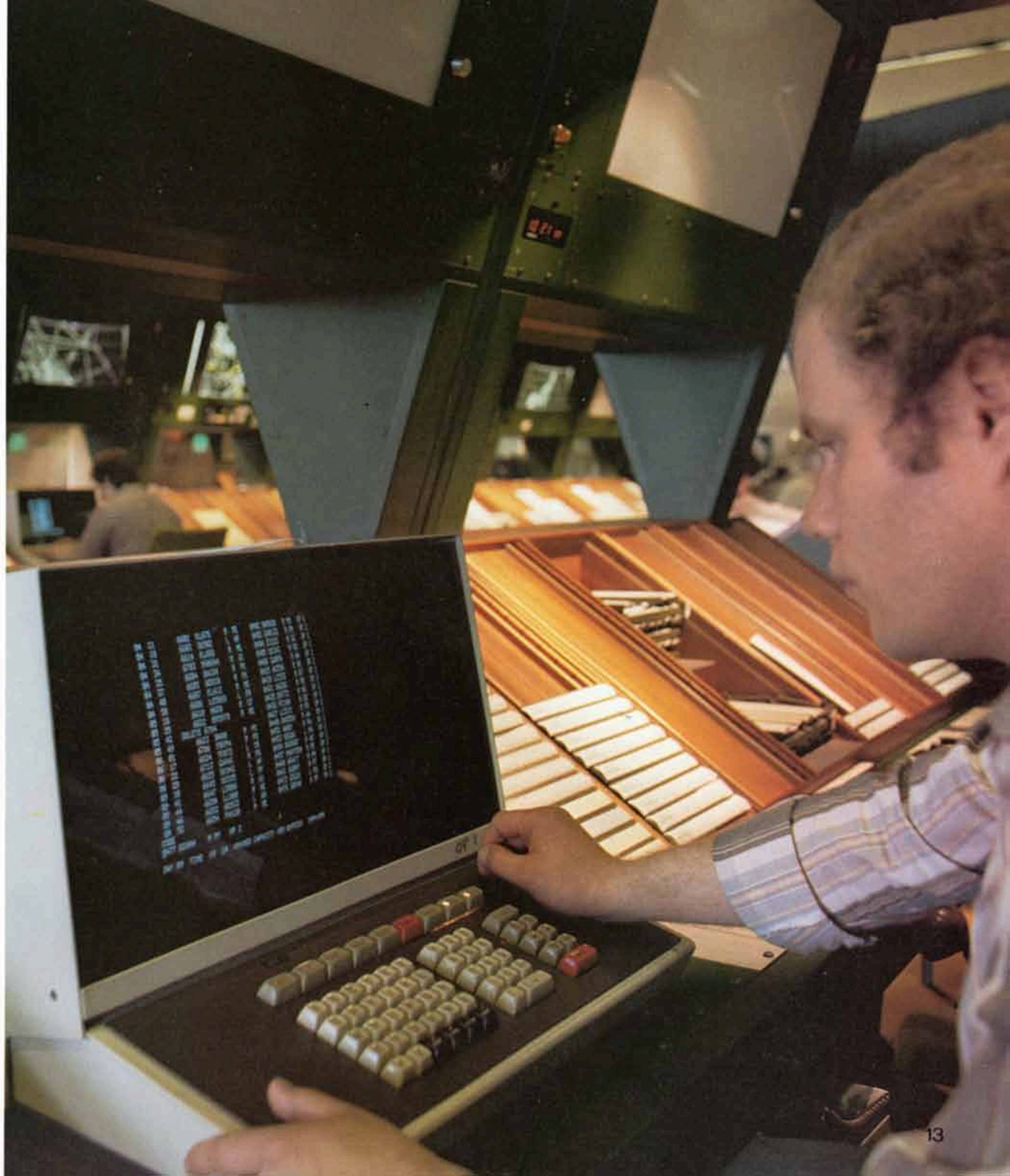
Clock System Time coding is supplied from a Timeon Cinque Master Time Source feeding digital clocks throughout the Centre. This time coding system differs from some others in that each 15-second interval is uniquely coded so that, even in the event of a failure or interruption, all the clocks will be reset automatically to within 15 seconds. The time source is also used to provide time injection for the RT recording.

Closed Circuit Television (CCTV) is used at ScATCC to provide immediate transfer of static intelligence from the Supervisor to controllers and assistants. Seventeen TV monitors each with push button selection of the four discrete channels are provided.

Radar Data Processing and Display System

The Radar Data Processing System (RDP) is based on a 'distributed intelligence' concept. Instead of one large centralised computer complex, with processing and storage capacity for all activities, the RDP at ScATCC has several processors, each operating independently from distributed information. The adoption of the distributed intelligence concept, using hardware identical computers, means that the failure of any one processor will not affect others, with the obvious overall improvement in reliability. Being independent, failure of one processor will not jeopardise the whole system, and each may be isolated completely for maintenance, repair or modification. Being hardware identical,

A video data terminal in the operations room which gives the Air Traffic Control Assistant information on aircraft codes and callsigns



the spares, test equipment, documentation and training requirements are simplified. The system has been designed to be capable of expansion without re-programming or taking the whole system out of operational service.

Radar information is received from five remote radar stations which are situated at Stornoway, Glasgow, Lowther Hill, St Annes and Bishops Court. Each radar is equipped with plot extractors which convert the radar information into a digital form suitable for transmission via Racal-Milgo modems over high quality telephone circuits to ScATCC for further processing as described below. To ensure high reliability two alternately routed circuits are provided between each station and ScATCC.

The RDP uses 36 Marconi Locus 16 processors, each with its own magnetic disc store. These are divided into two types, four of them being configured as radar processors and the remainder being configured as display processors. The radar processors receive the incoming radar signals and process them for transmission via Head Data Highways (HDH) to the display processors which drive individual displays and enable a controller to select the required radar and to optimise the picture details.

Each radar processor can accept and process the information from two radar sites. It selects the better link to the remote station and prepares the incoming data for final processing by the display processors. Its functions include the formation of SSR tracks, suppression of stationary targets, and the conversion of SSR codes into aircraft callsigns. Each radar processor has its own code/callsign file which can be updated by an Air Traffic Control Assistant from one of two Video Data Terminals (VDT) in the operations room. Each VDT comprises a 12″ display and keyboard and an entry made at either VDT is repeated to each radar processor code/callsign file.

The fact that each radar display is driven via an individual display processor allows the controller a large degree of autonomy over his displayed picture. For example, he may select any of the five radars, adjust the range and off-set of the picture, filter the SSR responses, select and change maps and select tracking mode and heading line information.

In the event of a radar processor failure the display processor may operate direct from the incoming radar signals but with the loss of some facilities such as tracking and code/callsign conversion.

The Central Control and Monitoring System

Display positions
Each control position uses identical types of equipment and the associated display processor(s) are located directly behind the position.

A typical ATC console consists of:

EMERGENCY R/T HANDSET

RADAR HEAD SELECT PANEL

CCTV

RADAR DISPLAY FUNCTION KEYBOARDS

INFORMATION BOARDS

RADAR DISPLAYS

R/T FACILITIES

ROLLING BALL KEYBOARD

ROLLING BALLS

FLIGHT PROGRESS BOARDS

The radar display uses a 16″ CRT with P31 phosphor and green filter, and is designed for high ambient light working. The functional keyboard together with the rolling ball and its associated keyboard are the means by which the controller arranges the information to be displayed. The rolling ball permits the controller to point to a specific item on the display and thence to modify the displayed information relating to that item. The communications and CCTV facilities are described on pages 12 and 13.

The CCMS is a computer-based facility providing information and status monitoring and remote control of sub-systems at both ScATCC and out-stations. These remotely sited out-stations include en-route navigational aids and transmitter/receiver sites in addition to the radar stations at Lowther Hill, Stornoway and Glasgow. A real-time recording of facility status is made through CCMS. In Systems Control a radar display of the type used in the operations room is installed and, backed by its own display processor, is able to monitor any radar facility available in the operations room.

PRIME CONTRACTORS ENGAGED ON THE ScATCC PROJECT

In addition to the considerable manufacturing and installation programme undertaken by the NATS Telecommunications Engineering Establishment located at Gatwick the following organisations were contracted to provide the service listed. Other sub-contractors too numerous to list have contributed in their own fields.

Applied Data System Ltd Carshalton	Telephone Distribution and Control Equipment
BICC/Burndy St Helens	Miniature Multiway Electrical Cable Connectors
BICC London	Cables
Cable & Wireless London	Message Routeing Equipment
Cayson Electrics Ltd Watford	Battery Charger Systems
Cossor Electronics Harlow	Secondary Surveillance Radar Pri/Sec Radar Processors (Plot Extractors) UHF Transmitters
C & S Antennas Ltd Rochester	VHF Aerials
Electrical Research Association Leatherhead	Interference Investigation
Electrocraft Consultants Ltd Haslemere	CCTV
GEC Telecommunications Ltd Coventry	Channel Multiplex Equipment
Harmer & Simmons Hainault	Battery Charger Systems
Industrial Instruments Ltd Bromley	Battery Charger Systems
IBM (UK) Ltd Chiswick	PABX
Marconi Company Ltd Chelmsford	Primary Radars Display Processing Radar Displays
Microflow-Pathfinder Fleet	Clean Air Units
Park Air Electronics Ltd Peterborough	VHF and UHF Receivers
Plessey Co Ltd London	Primary and Secondary Radar Processing
Plessey Co Ltd Poole	MSRCE
Post Office Corporation	Telephones and Landlines
Property Services Agency Edinburgh	Buildings and Works Services
Pye Telecommunications Ltd Cambridge	SHF Radio Link Equipment
Pye-TMC Dulwich	MCVFT Equipment
Racal-Amplivox Wembley	Lightweight Headsets
Racal-Milgo Reading	Radar Data Transmission
Racal-Thermostatics Ltd Southampton	Multichannel Recoding Equipment
Southern Microwave Laboratories Ltd Hayling Island	UHF Aerials
Timeon Cinque Rickmansworth	Clocks and Time Recording Equipment
Vanderhoff-Communications Ltd Nuneaton	Telephone Equipment

The photographs on the cover and pages 2, 6, 7, 10 (right), 13, 14 and 15 are reproduced by kind permission of Marconi Radar Systems Ltd.

CAA Document No. 187
Designed for Information and Publicity Division of the Civil Aviation Authority by Leslie McCombie & Co. Ltd.
Printed by John Brown (Printers) Limited Nottingham.
Distributed by Civil Aviation Authority, Greville House, 37 Gratton Road, Cheltenham.