

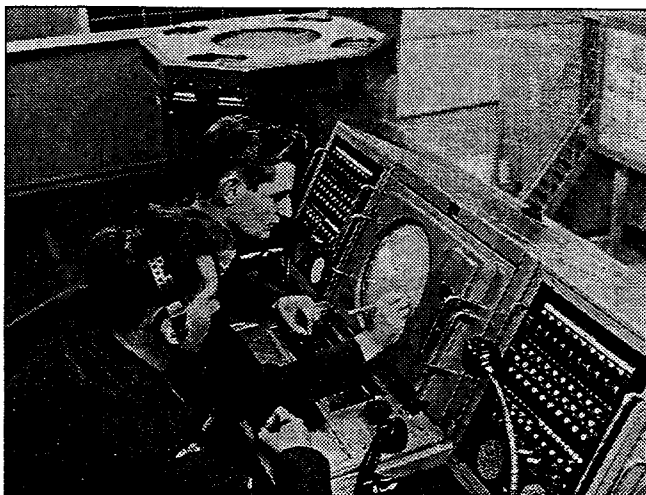
# A British Success - The Console Type 64

by Wing Commander John M Brown OBE

**I**n 1948, the worsening international situation led the Air Ministry to decide upon urgent action to bring back a number of radar stations into operational use.

In parallel with this action, Marconi's Wireless Telegraph Company Limited (MWT) was approached by the Ministry of Supply to undertake a study of the complete radar defence of this country and to make recommendations for its improvement. Such a request had never before been given to a commercial organisation, as, until then, this type of work had been the prerogative of the Government's Research Establishments.

The study was undertaken by Dr Eric Eastwood, Chief of MWT's Baddow Research Laboratories, who had formerly been on the Headquarters staff of No 60 Group during the war. He was assisted by a team of experts and they used Trimley Heath GCI Station for experimental purposes. The recommendations made in the Radar Defence Study covered the lines of future research including the design and development of transmitters of higher power, Moving Target Indication (MTI) for clutter reduction, and (of interest to us in this article) a completely new display system which would meet the needs of the Services for some years to come – Fixed Coil.



Console 64, with Console 4476 in background  
Photograph courtesy of RAF Air Defence Radar Museum, Neatishead

## Development of the Console Type 64

Formerly, ppi radar displays had used rotating deflection coils around the neck of the CRT, connected to the radar head through an electro-mechanical link. Fixed coil, as its name implies, uses static deflection coils, but fed with suitable X and Y waveforms to produce the rotating trace on the tube face. This now facilitated the presentation of additional information and symbols such as identification markers, area maps, multiple head selection, sector sweeping, trace expansion, and inter-console marking. This latter facility enabled operators to work together and to allocate positively and pass plots from one another.

MWT embarked on the development of the fixed coil system in 1950. The

concept was to keep the display console as compact as possible, to enable consoles to be grouped together, and to feed them from centralised back-up cabinets housed in the Radar Office. The ability to easily service the console involved the mounting of sub-chassis on sliding runners or being hinged. The design of the circuitry was very sophisticated to ensure that the radar display accuracy was of a high order. This was of great importance since passing rotating waveforms

through deflection coils can introduce distortion which can vary in different sectors. The deflection waveform was also complex since it now included inter-trace markers, so named as they were inserted during the flyback and deadtime period between the main radar scans.

The design of the new 12" CRT was entrusted to the English Electric Valve Company, and, in service, it proved to be a superb display tube with extremely high resolution and excellent afterglow characteristics giving good track continuity. The advanced characteristics of the CRT necessitated comprehensive protection circuitry within the console to include trace dimming in the event of scan failure, and octagonal blanking to limit the excursion of the scanning beam towards the edges of the tube (to prevent tube puncturing).

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On the initial version of the Console Type 64, the control desk included a knob from which a Type 13 nodding height-finder could be positioned and a 'slaved' azimuthation inter-trace line marker would confirm its direction. Even allowing for the reduction in the physical size of the Console 64, compared with its predecessors, being valved, it required a good flow of cooling air, which, when installed at a radar station, was supplied from the centralised equipment cooling system.

The fixed coil display system was developed and produced in three years, an astonishing achievement bearing in mind its complexity. Its production was shared between MWT and Plessey; some 600 display consoles were produced, as well as all the back-up equipment. The first ROTOR GCI to be equipped was Bawdsey in December 1953, and up to ten stations were being worked on within the ROTOR plan at any one time. By the middle of 1955, ROTOR had been installed, but, subsequently, because of the success of the fixed coil system, the CEW ROTOR sites were re-built to take the Console 64 in place of the previously installed moving coil Console 60. The Console 64 System was also installed in France and Germany.

## Signals Plan 1958 – ROTOR Phase 1A

The Radar Defence Study of 1948/49, referred to earlier, had foreseen the evolution of the fixed coil system, as well as the development of the new generation of higher powered surveillance radars, the Radar Type 80 being the first. This radar, through its excellent operational performance, reduced the necessity for the number of over-lapping ROTOR stations. Under the 1958 Signals Plan, a number of GCI stations were to be designated Master Radar Stations (MRSs) and, in 1956, MWT was tasked with re-designing the fixed coil system to exploit more fully the inter-trace capabilities.

This involved a major re-development of the back-up equipment and introduced a Dekatron 10:1 timing system, whereby the station prf of 250 was divided down to produce 10 inter-

trace sequences. The opportunity was also taken to introduce automatic zero control circuitry to negate the need for setting up controls, whilst achieving optimum registration between the main radar trace and the individual inter-trace sequences. Changes were also made to the Console 64 to introduce a joystick to give position and velocity control to inter-trace markers, as well as the ability to 'dial up' (using a GPO-type dial) an individual console and route a marker or symbol to the selected console. The additional inter-trace marker facilities enabled inter-station marking to be possible as well as the ability to transmit co-ordinates to ground-to-air missile sites. Furthermore, with the addition of active and passive selective IFF equipment, the interrogation of selected aircraft (by laying a marker over a target) was now introduced.

Two further operational requirements arose: the first, for a 21" CRT horizontal font-type console and this became designated the 4476. This console was designed to take up to four joysticks, enabling four supervisors to monitor operations at any time. Apart from more powerful deflection drive amplifiers, it shared similar units as fitted in the Console 64. The second requirement was for a fixed coil height/range display system to replace the Console 61 in ROTOR. This had been a re-engineered version of the wartime DU6, but was unstable and was incompatible with ROTOR Phase 1A; additionally, the new height/range system needed to work with both the Radar T13 and the recently introduced American FPS-6. ROTOR Phase 1A system was introduced into the Services in 1959.

## Raid Analysis Displays

With the added flexibility of the fixed coil system, under Phase 1A, MWT was tasked with the development of Type A and Type B scope presentations for raid analysis on the Console 64. In the case of the B-scope, a joystick controlled 'bucket' marker was placed enclosing a designated target (a gated area of 20 miles by 20°). On the B-scope display, the bucket sector appeared as a rectangle, with the individual targets shown as squares.

A joystick-controlled marker on the B-scope display was then positioned to encircle the 'square response'.

On the A-scope, the responses were staggered (slightly displaced by introducing some azimuth scan into the range scan). An even more successful A-scope presentation was achieved by accident! Whilst working with a colleague at Baddow, who was buried under the console plinth re-connecting cables to the console, he, in error, reversed two cables which meant we had a range and azimuth scan reversal. It so happened, that just as I was switching on, the Section Chief walked in, looked at the Console and said, "It looks like a magic carpet". It did; the single range base line had now turned into a lozenge shape, and sprouting out of the 'carpet' were the perfect spectrums of two targets. It combined the best features of the A and B scopes in one presentation. The ease of target analysis were self-evident. Thereafter, it was always known as 'Magic Carpet' and it was sold to several Air Forces overseas.

## Conclusion

The Console 64 remained with the Royal Air Force for nearly 40 years; it started with ROTOR, continued with Linesman/Mediator, and was only removed with the introduction of the latest system: Improved UKADGE. The quality of the display picture of the Console 64 was a by-word in the Fighter Control Branch of the RAF; it was rarely bettered for sharpness and consistency. It pioneered the introduction of fixed coil, a system on which all future displays was based.

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