



AIR TRAFFIC CONTROL RADARS

23cm (L) Band Approach and Terminal Area Radar

The S 654 23cm (L) Band radar has been designed to combine approach and terminal area functions so that one radar may be used for simultaneous application. Very high standards of reliability and MTI performance have been achieved and the development of extremely stable circuits has resulted in very low levels of system jitter, thereby eliminating the performance limitations encountered with previous generations.

The S 654 uses a double-beam aerial system of special design aimed at reducing angle and ground clutter whilst maintaining the wanted signal strength, thus enhancing the system sub-clutter visibility. These advantages are achieved by receiving two overlapping beams from the aerial's single reflector. These two beams are displaced in the vertical plane and have the same line of sight in the horizontal plane. They are produced by two separate horns mounted one above the other. The lower of the two beams is used for transmission and reception, and the upper beam for reception only.

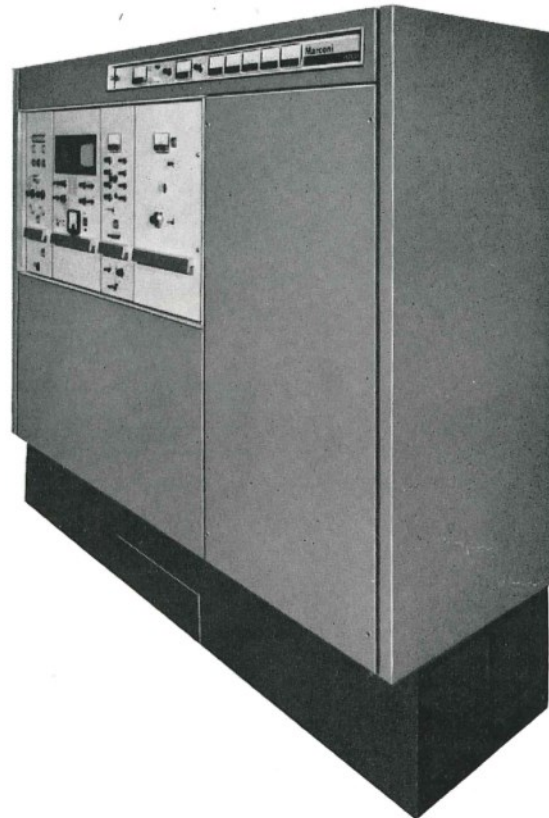
The aerial array has circular polarizing elements to combat weather clutter signals. Further rejection of very heavy weather returns from storms is achieved by the MTI and Pulse Length Discrimination (PLD) circuits of the Signal Processing Equipment.

The aerial reflector is 9.74m (32ft) wide and has a 5.79m (19ft) vertical aperture producing a horizontal beamwidth of 1.7°. The aerial assembly rotates at 15 r.p.m giving a data renewal rate of once every 4 seconds. Other turning rates can be provided if required.

The transmitter/receiver used in the S 654 is the Type S 2011 2MW 23cm (L) Band Transmitter/Receiver which is described on page 260. The associated Signal Processing System is the Type S 7005 or S 7008 which are described on page 262.

Features

- High data rate for efficient Approach Control.
- Long range for full Terminal Area cover.



Transmitter/Receiver
Type S 2011

Double-beam Aerial System for enhanced target-to-clutter ratio.

Vapour-cooled crystal-referenced Magnetron for exceptional MTI performance.

Comprehensive signal processing for improved auto-extraction.

All solid-state for exceptional reliability.

Frequency Diversity can be used for extra range performance.

Data summary

Aerial System

Horizontal Aperture: 9.74m (32ft).

Vertical Aperture: 5.79m (19ft).

Horizontal beam width: 1.7° at -3dB relative to peak.

Turning speed: 15 r.p.m. Other speeds available.

Polarization: Circular for both High and Main beams. Optional in-out switching.

Operational Wind Speeds:

- 50 knots mean hourly.
- 70 knots for 10sec gusts.
- 90 knots for 1sec gusts.

Survival Wind Speed: 120 knots (Radomes can be supplied, see page 266.)

Transmitter/Receiver Type S 2011

Frequency range: 1250 to 1365MHz—range covered by 2 magnetrons, each continuously tunable over 60MHz.

Transmitter power output:

- Mean 3kW.
- Peak 2MW.

Pulse length: 2.5 to 5μsec.

PRF: 200 to 600 p.p.s.

Receiver (R.F.): Parametric amplifier noise figure 2.5dB (typical).

Pre-set gain: 20dB.

Bandwidth: 17–35MHz.



Receiver (I.F and Video): Linear and logarithmic i.f amplifiers are included. PLD processing is applied to log video.

I.F output: 45MHz.

Power input: 380V or 415V 3-phase 50-60Hz. 12kVA.

Dimensions:

Height 167.75cm (5ft 6in.)
 Depth 64.8cm (2ft 1.5in.)
 Width 190.5cm (6ft 3in.)
 Weight 1210kg (2267lb)

Signal Processing System Type S7006 (or S7008 where SSR is fitted)

MTI: Double cancellation by recirculation around quartz delay line.

Static suppression: 40dB.

Overall dynamic cancellation ratio: (p.r.f.=600 and aerial speed=10 r.p.m.) 38dB.

Processing facilities:

PRFS
 PRFD
 Log/PLD

Signal inputs: i.f. signals at 45MHz.

Full details are given in Marconi Radar Data Sheet C2.

50cm Terminal Area Radar

The S 650 50cm Surveillance Radar has been designed for Terminal Area and Approach Control Applications. It has a high data rate and first-class clutter rejection performance together with the ability to provide a clean clear picture at very short ranges.

The S 650 has a power of 500kW, a range of approximately 150-160 nautical miles and a normal turning speed of 10 r.p.m with a 16m (52ft) aerial. Two versions of this aerial are available, one provides additional high angle cover at the expense of some forward range.

The Transmitter/Receiver uses a fully coherent crystal controlled system with the same Klystron (K347A) output stages as used in the previous S264A radar. This tube has a typical life of 30,000 hours and is a highly reliable device. The whole Transmitter/Receiver is fully transistorized with the exception of the output klystron, a travelling wave tube driver stage and a thyatron modulator valve.

The signal processing consists of an extremely stable double cancellation MTI system with clutter gating, pulse repetition frequency stagger, pulse repetition frequency discrimination and pulse length discrimination.

The S 650 and the S 670 (described on page 258) are deliberately designed in such a way that the major elements are interchangeable with the earlier S264 and S264A radars. The latter equipments may be, therefore, updated and modernized by the addition of these new elements.

Features

Long wavelength for inherent weather clutter protection.

Crystal controlled driven transmitter for MTI stability.

Klystron output stage with travelling wave tube drive for 'fail-soft' performance.

Comprehensive signal processing for efficient clutter rejection.

All solid-state system for exceptional reliability.

High turning rate for TMA use.

Data summary

Aerial System

Horizontal aperture: 16m (52.5ft).

Vertical aperture: standard 3.65m (12ft), high cover 3.96m (13ft).

Horizontal beamwidth: 2.1° at 3dB relative to peak.

Sidelobes: -24dB relative to peak.

Back-to-front ratio: Better than 30dB.

Polarization: Horizontal.

Tilt adjustment: +1 to +12°.

Rotation speeds: 10, 15, 7.5 r.p.m.

Operational wind speeds: 15 r.p.m:

- 35 knots mean hourly.
- 45 knots for 10sec. gusts.
- 55 knots for 1sec. gusts.
- Other speeds: 50 knots mean hourly.
- 70 knots for 10sec. gusts.
- 90 knots for 1sec. gusts.

Survival wind speeds: 120 knots. (Radome can be supplied see page 266)

Transmitter/Receiver Type S 2020

Radio frequency: Any crystal-controlled frequency in the range: 580MHz to 610MHz.

Transmitter peak power:

- (a) p.r.f.s up to 550 p.p.s: 500kW.
- (b) p.r.f.s above 550 p.p.s: 500kW de-rated dependent upon p.r.f e.g 350kW at 650 p.p.s.

Pulse repetition frequency: 250 p.p.s to 650 p.p.s dependent upon operational requirements.

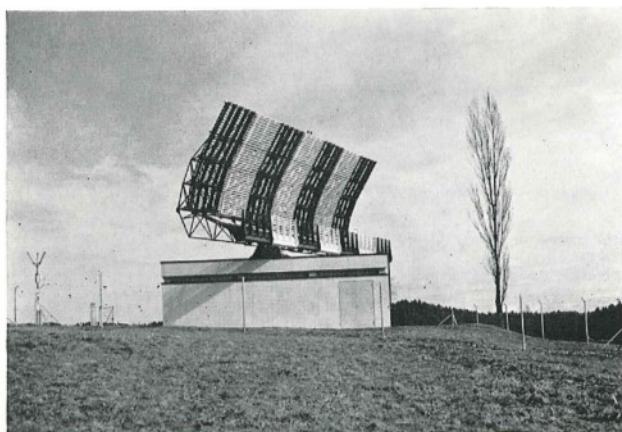
Pulse duration: 3 to 4 microseconds dependent upon p.r.f.

Receiver noise factor: > 3.5dB.

Receiver intermediate frequency: 45MHz.

Input power requirements:

- Approx. 7-8kVA 3 phase.
- 46-65Hz 380-415V a.c ±10%.



The S 650 aerial