The Marconi Types S1010 and S1015 are two of three mobile surveillance aerial modules individually covering S and L Bands and using common techniques and components. The modules comprise a single-curvature reflector, a squintless linear feed, a turning gear with data take-off elements, a high-power rotating joint and associated slip-ring unit mounted on a combined gantry/chassis. They are suitable for transport by helicopter, aircraft or rail and running gear may be fitted for movement on roads or across country.

Both modules operate at S band. The reflector of the Type S1010 is shaped to give cosec^2 vertical cover while that of the S1015 is parabolic in profile.

Gantry/Chassis

The gantry/chassis of each module consists of a centre section and three legs. The centre section is a welded tubular steel space-frame which provides support for the turning gear. The top of the frame is basically triangular with the corners turned in to form the mounting points for the gear-box, which is enclosed by the three sides of the frame. Below the gear-box is another triangular frame, turned through 60° relative to the upper one. The centre section is completed by triangular frames between the upper and lower triangles.

The tripod gantry is completed by three legs, also of welded tubular steel space-frame construction and triangular in section, which fit onto the triangular sides of the centre section. The lower main member of each leg is horizontal and the legs taper towards the outer end where jacks are fitted for levelling. The jack feet are 432mm (1ft 5 in)in diameter and rest on a pitch circle radius of 3·66m (12ft) when deployed. Two of the legs are removable and in the normal transport condition are stowed alongside the fixed leg.

Running gear is attached by locating two tines on each set of wheels into tunnels fixed to the chassis gantry. The forward tine tunnels are carried on a transverse pintle mounted beam 610mm (2ft) from the end of the fixed leg. The locating points for the rear set of wheels are directly below two corners of the lower triangle of the centre section. The roading loads are therefore transmitted through three points on the chassis, reducing torsional stresses to a minimum.

In the roading condition the overall dimensions of the module are 7·14m (23ft 5in) long (towbar stowed) by 2·52m (8ft 3in) wide by 2·79m (9ft 2in) high with a wheelbase of 5·69m (18ft 8in).

Reflector and Support Structure

The single-curvature reflector is 5·49m (18ft) wide by 1·83m (6ft) high and is carried on a stiff fabricated box structure 3·05m (10ft) long by 534mm (1ft 9in) wide by 203mm (8in) deep which is bolted to the output flange of the turning gear. At each end of this box is a triangular box, the top corners of which house the pivots on which the reflector is mounted. Pivoting on the same axis are two L-shaped beams, one at each end, which project forward underneath the reflector and carry the feed. When the reflector is up in the deployed position it is clamped to the beams and is automatically fixed in the correct position relative to the feed. By pivoting the beams (and thus the reflector) the tilt angle of the aerial may be adjusted. The range of adjustment is from −2 to +3 degrees relative to the normal setting and is set manually by screw-jacks.

For transportation the reflector is unclamped and folded forward so that it is lying flat. It is also necessary to fold the aerial in winds which exceed 129km/h (70 knots) when it is deployed normally on its gantry. Folding of the aerial is also achieved by screw-jacks which can be driven by a small electric motor.

The reflector itself is a box structure to give the best strength-to-depth ratio. It consists of two stressed aluminium skins, one of which is the reflecting surface, spaced by profile ribs and completely enclosed. The reflector is shaped to give a cosec^2 type of vertical cover on the S1010 module and the S1015 is a section of a parabolic cylinder.

Mounting points are provided at the top of the reflector for a secondary radar aerial 4·27m (14ft) long.

Turning Gear

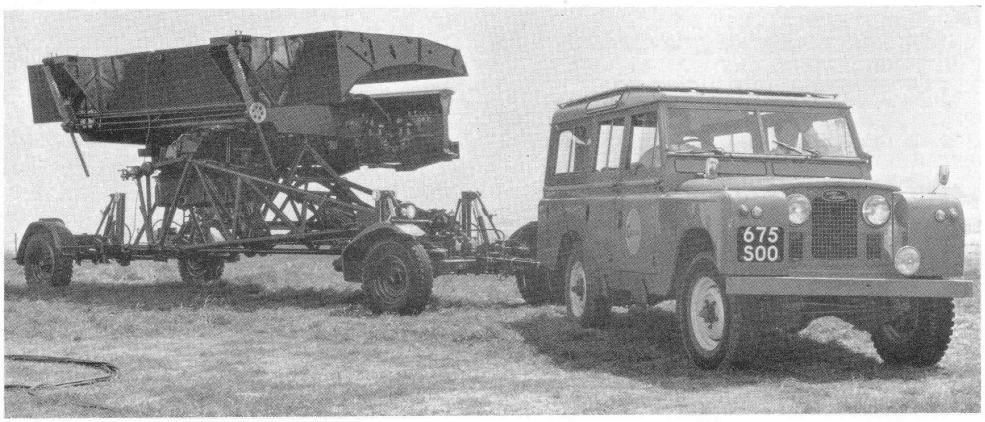
The turning gear is capable of driving the reflector and support structure at speeds up to 15 rev/min in winds up to 129km/h (70 knots). Four basic versions are available :

i) Fixed 6 rev/min
ii) Fixed 15 rev/min
iii) Variable 0–6 rev/min
iv) Variable 0–15 rev/min

The fixed-speed turning gears use a.c motors at a nominal 1500 rev/min in conjunction with 250 :1 or 100 :1 primary gear-boxes ; the variable-speed turning gears use d.c motors and the same gear-boxes. One motor is used for speeds up to 6 rev/min while two motors are normally fitted for higher speeds. The main casing is a welded fabrication in the form of three box section arms radiating from a central drum. Each arm carries a tapered socket which mates with a plug on the gantry. The plug is free to move on a large diameter ball and thus takes up tolerances in alignment.

The base of the casing forms a stiff platform which carries the drive motors above (on the outside) and the primary gear-boxes below (within the sump). The sump is a fibre-glass moulding bolted to the underside of the casing, enclosing the primary gear-boxes and the main drive gear so that all the gears run in oil. The main gear is connected to the output drive flange by a stiff tube which passes up through the central drum and is supported by a pair of pre-loaded taper roller bearings which are packed in grease. Heaters are provided within the sump and controlled by thermostats to keep the oil at optimum temperature in a cold ambient.

Two of the spaces between the arms are allocated to drive motors ; the third space houses the data take-off and gear-box. The basic data take-off is an accurate 1 :1 shaft suitable for a 13-bit digital shaft encoder. Additional output shafts can be provided as follows :



S600 transportable aerial ready for road transit 78928

i) 1 : 1 for (a) Auto-align, north marker and sector blanking and/or
(b) a digital encoder, or a sine/cosine potentiometer, or a 3in magslip, or a size 23 synchro.
ii) 16 : 1 for a size 23 synchro.
iii) 30 : 1 for a type 1813 Selsyn.

The aerial may be locked on any azimuth by means of a hand operated brake, and it may be manually 'inched' over a small arc either side of this position.

Feed

The reflector is illuminated by an offset linear waveguide feed. It is well known that linear feeds and reflectors can provide a much lower side-lobe level than centre-fed double-curvature aerials, because of the accurate power distribution that can be achieved. The normal linear feed, however, suffers from the disadvantage of 'squint' and the angle between the radar beam and the normal to the reflector varies with frequency, making frequency diversity impossible and frequency changing complicated.

The linear feed used on this aerial is one of several made to a new patented Marconi design which retains the virtues of the linear feed but does not suffer from squint. This is achieved by arranging that the power distribution couplers produce a co-planar phase front at the output flare.

The feed is composed of four modules each of which comprises a stepped taper section which directs power in the correct ratios into a series of side arms. Each side arm is a critical length and ends in a radiating horn. The horns are in a line extending the full width of the reflector and feed out via a flare and a fibreglass window which seals the assembly. The window is normally fitted with quarter-wave plates to provide a circular polarization facility.

Rotating Joint and Slip-ring Unit

The waveguide rotating joint is mounted in the reflector support box and the drive tube in the turning gear and may be withdrawn from the top. The six-way slip-ring unit is mounted below the rotating joint and may be withdrawn from the bottom of the turning gear.

The joint can be fitted with an I.F.F. coaxial rotating joint.

Data Summary

Frequency band: 2700–3100MHz.
Horizontal beamwidth: 1·4°.
Vertical cover (S1010): Cosec^2 up to 45°.
Vertical beamwidth (S1015): 4·5°.
Side-lobe level: −28dB.
Gain: (S1010): 34dB ; **(S1015):** 37dB.
Polarization: Horizontal or circular.
Tilt: −2° to +3°.
Deployment: Ground slope must not exceed 1 in 20.
Ground bearing pressure: 196kg/cm^2 (2800lb/ft^2).
Environment
Operating temperature : −30° to +50°C.
Storage temperature : −40° to +65°C.
Relative humidity : 100 per cent below 30°C, 53 per cent at 40°C, 32 per cent at 50°C.
Operating wind speed : Gusting to 129km/h (70 knots) without tethering.
Survival wind speed : Gusting to 227km/h (120 knots) with tethering.
Ice coating : 6mm (0·25in) max.
Dimensions
Reflector size :
Height : 1·83m (6ft).
Width : 5·49m (18ft).
Module deployed :
Overall height : 3·92m (12ft 10½in).
Overall height (including I.F.F aerial) : (S1010)

4·66m (15ft 3½in) ; (S1015) 4·51m (14ft 9½in) ±152·5mm (6in) jacking on level ground.
Pitch circle radius : 3·66m (12ft) (jack centres at 120°).
Jack feet diameter : 432mm (1ft 5in).
Module stowed :
Overall height : (S1010) 2·79m (9ft 2in) ; (S1015) 2·69m (8ft 10 in).
Overall width 2·51m (8ft 3in).
Overall length (towbar stowed) : 7·14m (23ft 5in).
Overall length (towbar extended) : 8·48m (27ft 10in).
Wheelbase : 5·69m (18ft 8in).

Weight

Road or air transport trim : (S1010) 3590kg (7901lb) ; (S1015) 3610kg (7951lb).
Helicopter trim : (S1010) 2710kg (5969lb) ; (S1015) 2735kg (6091lb).

The information given herein is subject to confirmation at the time of ordering.

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A1