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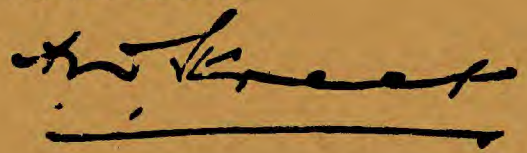
A SUMMARY OF OPERATIONAL, TECHNICAL AND GENERAL DATA CONCERNING

SHORE RADAR SERVICES

THE ATTENTION OF PLANNING STAFFS IS DRAWN PARTICULARLY TO THE FOREWORD AND INTRODUCTION

PREPARED BY DIRECTION OF THE RADAR BOARD FOR INTER-SERVICES USE

PROMULGATED FOR THE INFORMATION AND GUIDANCE OF ALL CONCERNED BY COMMAND OF THE AIR COUNCIL



AIR MINISTRY
OCT. 1944

SUMMARY OF CONTENTS

FOREWORD

The primary purpose in presenting the data contained in this book is to provide information that will give Naval Army and Air Force planning staffs, Commanding Officers and Officers-in-Charge of Units an adequate understanding of the capabilities and limitations of Shore Radar Services.

The material has been compiled to furnish a source of information to which Commanders and Commanding Officers can refer in all operations involving Shore Radar Services, and to provide a ready reference to basic equipment as used, or projected for use, by the three Services.

Reference is made to other factors not normally associated with Shore Radar, but which have a bearing on its operation.

2. DEFINITION

Radio Detection and Ranging (RaDaR) is a radio method by which information is obtained regarding the position of such objects as aircraft, ships, and distinct topographical features within a specific area.

(*a*) The term " Shore Radar Services " has been used to embrace Radar equipment capable of performing one or more of the following functions :—

(i) Detection and tracking of aircraft (air cover) ;

(ii) Detection and tracking of ships (surface cover).

(iii) Control of air interceptions.

(iv) Control of surface interceptions.

3. CAPABILITIES

(*a*) Shore Radar Services function in any condition of visibility for the purpose of :—

(i) Locating and providing visual display of the location of ships and aircraft.

(ii) Detecting, tracking, estimating numbers and character of targets.

(iii) Continuous reporting of range, bearing and elevation with an accuracy depending upon the type of Radar set used.

(iv) Control of aircraft and ship interceptions.

(v) Substitution for ships' Radar, where ships are close in shore and their Radar screened off.

organisation for fighter ops, gun ops, controlled interceptions, etc. The Radar Officer must realise that action taken on the information provided by his station will largely depend on the accuracy of that information. Radar personnel should be given training on " Capabilities, Limitations and Other Factors " as set out in paras. 3, 4 and 5, and as contained in the respective data sheets for each type of set. They should be exercised to form an efficient and resourceful team.

8. PLOTTING

To ensure speedy identification and action upon the detection of a target, and to relieve pressure on main filter and plotting rooms wherever possible, it is advisable to pre-filter information, and for this purpose almost every set is equipped with local plotting facilities. In preserving continuity of tracking, estimating numbers and character of targets, the local plot can pass on valuable information.

9. COMMUNICATIONS

The time lag from the detection of an aircraft until the receipt of information at the operations centre concerned, is one of the most serious limitations in the Radar system. It should be borne in mind that during each 60 seconds delay the range of a fast aircraft can close a further 6 miles, thus making its interception most difficult. Only by carefully planning the communicating channels, using direct links and employing intelligent personnel can the time interval be kept to the absolute minimum.

10. ANTI-AIRCRAFT AND COAST ARTILLERY RADAR

(*a*) Anti-Aircraft Operations Rooms

Areas in which the primary defence against air attack is entrusted to Anti-Aircraft Artillery are known as Gun Defended Areas (GDA's). In order to control and co-ordinate AA fire in these areas, each GDA is provided with one or more AA Operations Rooms (AAOR).

AAOR's obtain advance information of impending raids either from the early warning system provided under RAF arrangements or from the Radar equipment at each gun-site.

Cases may arise where the first information of the approach of hostile aircraft is received from AA Radar, and it is therefore important that such information should be available to other plotting and filter rooms. Provision of facilities for passing on information so obtained should be considered by the Planning Staff, and, in order to assist them, details of the various types of AA Radar equipment and their performance are included in this book.

(*b*) Coast Artillery Plotting Rooms

Plotting rooms are also provided for the control of Coast Artillery. Here again, information of shipping movements may be obtained either downwards from Naval plots or upwards from Coast Artillery Radar equipment. The possibility of such information being first obtained from Coast Artillery Radar equipment should not be overlooked, and provision of facilities for its distribution to other plotting rooms or report centres should be taken into consideration by the Planning Staff. Details of the various types of Coast Artillery Radar sets, together with their performance, are included.

4. LIMITATIONS

Inherent Limitations of Radar :—

(*a*) Inability to detect under-water targets.

(*b*) With present types of Radar, topographical features produce permanent echoes, and heavy clouds, storms and sea waves can produce unwanted echoes ; all of these may interfere with the detection and plotting of targets.

(*c*) Range is limited :—

(i) By inherent features of the set such as transmitter power, receiver sensitivity, etc.

(ii) To slightly over the visual horizon (where performance of the set allows). Greater ranges may, however, be attained under anomalous propagation conditions (*vide* Introduction 10 (ii) (*c*)).

(*d*) Incomplete air cover due to lobe characteristics in vertical radiation pattern (*vide* Introduction, 10 (ii) (*a*)).

(e) Presence of side lobes giving secondary signals (*vide* Introduction, 10 (ii) (*b*)).

(*f*) Vulnerability of some sets to jamming (*vide* Introduction, 6).

5. OTHER FACTORS

Other important factors to which special consideration must be given are :—

(*a*) Choice of location (*i.e.*, height and nature of site).

(*b*) The standard of efficiency of personnel (*vide* para. 7 below).

(*c*) Necessity for maintenance to ensure the highest standard of performance of the Radar sets.

(*d*) Linking up of filters, plots, plotting room and operational terminals.

(e) Communications and reporting channels.

(*f*) " Spurious " or unwanted signals (e.g., from flocks of birds) experienced mainly in high-powered Radar sets.

6. PLANNING

Inter-Service planning staffs and Commanders should consider carefully how best to utilise available Radar equipment in all phases of a combined operation. Radar cover against possible sustained sea or air attack must be planned from the earliest stages of an occupation and with due regard to difficulties of communicating information so obtained, identifying targets, and possible enemy efforts to disorganise Radar services by jamming.

7. OPERATION

The largest contributing factor in the operation of Shore Radar Services is the degree of manning and maintenance efficiency. Capabilities can be stepped up and limitations minimised if the Officer-in-Charge of Shore Radar Operations is resourceful, skilful and well informed, the crews experienced and competent in their duties and standard performance of the equipment is maintained.

Officers should be well acquainted with all linking channels, *i.e.*, the Radar Officer should be conversant with the filter and plotting organisation, plotting room terminals, liaison staff and their adjoining operational units, *e.g.* : the

II. SHORE RADAR SETS AND ASSOCIATED EQUIPMENT

A summary of useful technical, operational, and general data covering equipment as used in Shore Radar Services is set out in the data sheets. These are prefaced by an Introduction which gives simple explanations of the headings and terminology used.

More detailed information for maintenance personnel can be obtained from the instructional manuals relevant to the respective Radar sets.

INTRODUCTION

EXPLANATION AND EXPANSION OF HEADINGS AND TERMINOLOGY USED IN DATA SHEETS

1. Title of Set

The abbreviation AMES stands for Air Ministry Experimental Station. Wherever an Army (e.g., AA No. 4 Mark II) or a Naval (e.g., NT277T) title exists this is also indicated.

2. Status

As far as possible, an indication of the state of development and present availability of each set is given. Amendments will from time to time be issued to bring this document up to date.

3. Function

The normal functions of the set in accordance with modern technique are quoted together with an indication of possible extensions.

4. Description

An indication of the portability of the station together with a brief account of its main features is given.

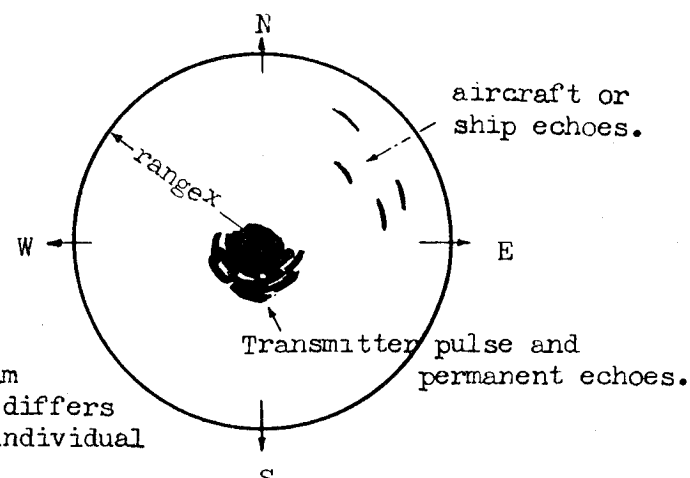
In the majority of sets a telephone switchboard (AD1240) and a number of head sets are provided, and the term "Standard Telephone Facilities" is used to cover these. Wherever more restricted facilities are provided these are indicated. Local plotting facilities are included in most sets to preserve continuity in tracking, and wherever possible to pre-filter information in order to relieve pressure on filter and plotting rooms.

5. Frequency

There are four main frequency bands used by Shore Radar stations covered in this book. These are centred around the following :—

Frequency	*Wavelength*	*Designation*
43 mc/s.	7 metres	Metric
200 mc/s.	1.5 metres	Metric
600 mc/s.	50 cms.	Decimetric
3,000 mc/s.	10 cms.	Centimetric

Signals increase the intensity of parts of this rotating line with the result that echoes appear as bright arcs whose inner centres correspond to the position of the target. With some equipments having fine range and bearing discrimination the echoes reduce to spots on the tube face. These bright arcs persist for a period, and thus a complete picture of all detectable targets in an area can be seen on the tube face. A gridded mask can be placed over the tube face, thus enabling the positions of the echoes to be read off directly as grid references, and to be pinpointed with regard to the surrounding country—hence the term " plan position indicator." The range and bearing of an echo can be estimated separately if desired.



x Maximum range differs with individual sets.

FIG.2. Typical PPI display, showing transmitter pulse, permanent echoes, and target responses.

6. Anti-Jamming Properties

Deliberate jamming is experienced in two forms :—

(i) Jamming signals, of the same frequency as the Radar set, which make it very difficult to pick out target echoes on the display equipment.

(ii) *Window*. This is the term used to describe metallised paper strips sown in the vicinity of an attacking force of enemy aircraft. These lead to a mass of static echoes on the display equipment, thus making it extremely difficult to resolve aircraft responses.

7. Personnel required to Operate and Maintain on a 3½-watch basis

The term 3½-watch basis implies in practice a 3-watch basis with a ½-watch reserve in addition to allow for sickness, leave, etc. Wherever the manpower situation permits or in intemperate climates a four-watch basis is recommended.

8. Presentation

(i) *Range Tube* (or " A " scope)

In this type of display signals appear as perpendicular deflections (echoes) along a bright horizontal trace on the cathode ray tube face. The transmitter pulse is usually visible at the commencement of the trace at zero range, and the trace is scaled to enable the *range* of an echo to be read off. Accurate *bearing* can be obtained with radar sets having beamed radiation, by noting the direction in which the aerial points to give maximum echo amplitude on the range tube.

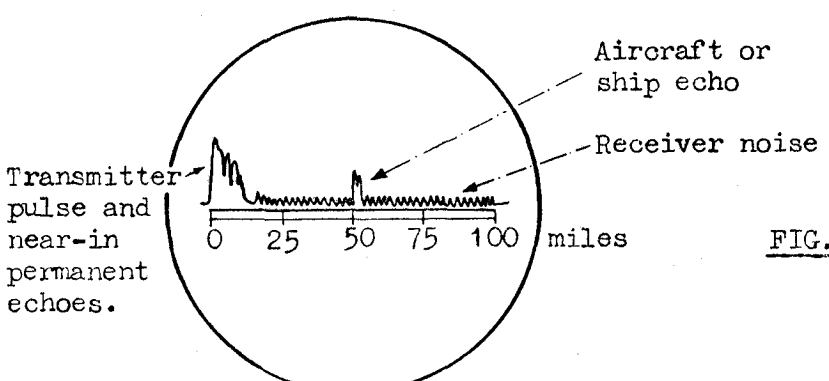


FIG.1 Range tube display showing transmitter pulse and permanent echoes, echo at 50 miles range, and trace noise.

(ii) *PPI Tube* (Plan Position Indicator)

This type of display gives a complete Radar picture of the area under surveillance and is only used with sets having reasonably directional aerials rotating in azimuth. The trace differs from that on the range tube in that it is not stationary but rotates about the tube face centre, being synchronised with the aerial system, and appears as a barely visible line.

(*b*) Height finding facilities where available.

(*c*) Range and bearing discrimination and accuracy. The figures quoted in the data sheets are dependent upon a number of factors, including the size and range of the target, and should be taken as a general guide and not as absolute.

(*d*) Liability to masking by permanent echoes.

(*e*) Dependence of performance on site.

(*f*) IFF performance and limitations.

(ii) *Factors affecting performance*

The following factors must be considered in assessing the performance that it is possible to obtain from a Radar set :—

(*a*) *Height of site* (*including vertical polar diagram*). In general, detection ranges of aircraft and surface vessels for Radar of any frequency increase with the height of the Radar, but in the case of aircraft, detection ranges also depend on the height of the aircraft in relation to the vertical polar diagram (VPD) of the set.

For centimetric sets, detection ranges on surface vessels and very low flying aircraft are normally (*i.e.*, in the absence of anomalous propagation) limited to slightly over the visual horizon. Thus high sites give the best low cover. Reference should be made to the chart preceding the data sheets (p. 3.0). This shows the effect of site height upon detection ranges for representative types of 10 cm. sets.

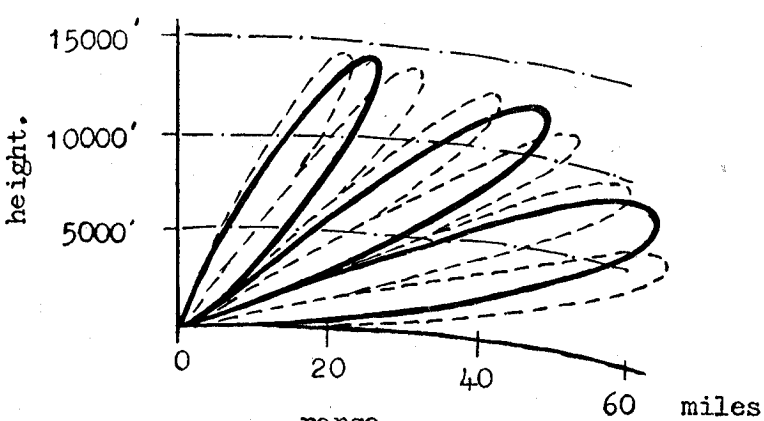


FIG.4. Typical vertical polar diagram (full lines) Broken lines indicate effect of doubling height of site.

(iii) *AMES Type 13 height display*

This height finding display takes the form of a vertical section of sky with lines of constant height approximately horizontal. The echoes appear as short bright lines from which range and height are read off directly.

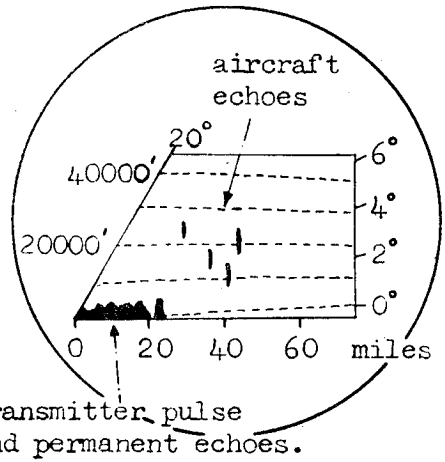


FIG.3. A.M.E.S. Type 13 height display

(iv) *Display Unit Type 5*

The *Display Unit Type 5* is a standard display unit for ground AMES. It consists of two or three units (consoles), one or two of which will contain PPI displays. The remaining one can be used for a range tube or AMES type 13 form of height display. Where there are two PPIs one may be used to direct the height finding equipment on to a selected aircraft target.

9. Power Supply

The usual source of supply is quoted. It is advisable that a standby duplicate power supply be provided ; this policy is adopted for all AMES.

10. Performance

(i) In the majority of cases the information presented under this heading includes :—

(*a*) A brief summary of general performance, figures for detection ranges (in land miles) of a medium sized twin-engined aircraft at various heights and/or representative sizes of surface vessels (e.g., destroyers and M.T.B.), whichever is applicable. For 10 cm. sets the figures quoted for detection ranges on surface vessels are for sets giving standard performance and may not be realised in practice. The terms high, medium, low and very low flying aircraft used in this memorandum refer to aircraft at the following heights :—

HIGH	Above 20,000 ft.
MEDIUM	2,000 ft.—20,000 ft.
LOW...	200 ft.—2,000 ft.
VERY LOW	Below 200 ft.

It should be borne in mind that for size estimation it is necessary to stop the aerial for several periods of up to 30 seconds. Such pauses might impair air cover if made too frequently when the set is employed in a dual air reporting and surface watching role.

Finally it is stressed that reliable size estimation is only possible within the optical horizon and cannot be expected on long range targets under conditions of anomalous propagation.

(iv) *IFF Mark III (Identification of Friend or Foe)*

(*a*) *Outline of System*

Friendly aircraft and ships carry a small combined receiver/transmitter known as a TRANSPONDOR. Ground Radar Stations are provided with a separate transmitter (INTERROGATOR), and a receiver (RESPONSOR). The transponder is triggered by a signal from the interrogator, and automatically returns a signal to the responsor which is displayed on the indicating unit in the Radar set. This signal can, if required, be coded for special identification or distress purposes.

An additional facility afforded by the *IFF Mark III system* and known as *IFF Mark IIIG* is available for use during ground control of interceptions (GCI) between the intercepting fighter and the ground Radar station. By manipulation of a switch in the aircraft, a second channel can be brought into operation in the transpondor, which is directly triggered by means of the Radar pulse received from the GCI operating on 209 mc/s. The returned signals being of the same frequency as the Radar channel are displayed in conjunction with the Radar signal at the ground station, and greatly facilitate identification in the closing stages of an interception.

(*b*) *Limitations*

The principal difficulty in operation of the *IFF Mark III* system is to obtain positive correlation of each *IFF* signal with its own Radar echo. It is generally impracticable to provide sufficient discrimination in range and bearing for this purpose, and this limitation becomes particularly serious in conditions of high traffic density.

(*b*) *Horizontal Polar Diagram*

Modern Radar aerial systems are designed as far as possible to concentrate their radiation in one narrow beam (main lobe). In addition, unwanted weaker side lobes are always present.

Figure 5 illustrates a typical horizontal polar diagram showing main lobe and side lobes. A small target in the main lobe at (A) may thus be obscured by echoes from large objects (particularly land masses) at the same range either in a side lobe as at (B) or in the weaker part of the main lobe. Thus :

(i) the wider the main lobe,

(ii) the stronger the side lobes, the worse is the bearing discrimination and the greater the masking effect of unwanted echoes.

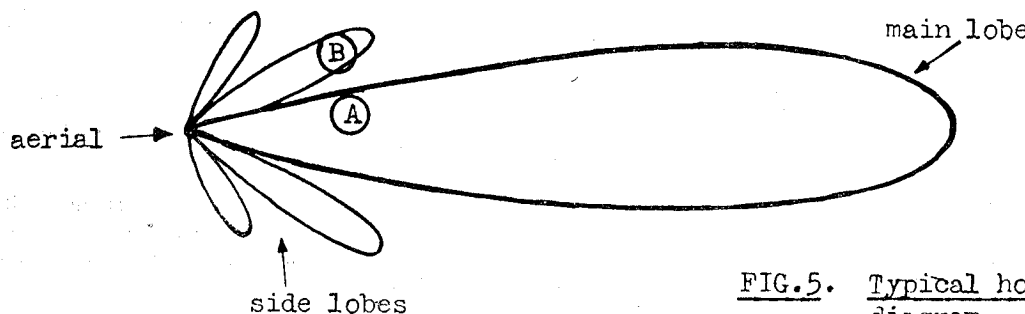


FIG.5. Typical horizontal polar diagram.

(*c*) *Anomalous Propagation (Anoprop)*

Under certain meteorological conditions, more prevalent in tropical climates and during summer months in temperate latitudes, Radar sets will give increased ranges at low angles of sight.

Charts showing the distribution of areas in which anomalous propagation is likely to occur, together with seasonal variations, have been prepared (*vide* TRE report T.1484).

(iii) *Use of Shore Radar for Estimating the size of Surface Vessels*

The average performance of various types of centimetric Radar sets on surface vessels has been carefully charted (*vide* AORG Report No. 155). The performance of any particular set can be checked from day to day and any deviation from standard, under conditions of normal propagation, can be observed. Charts are available which indicate the signal strength to be expected on various types of vessel at all ranges within the optical horizon (*vide* AORG Report " Performance Checks and Estimation of Vessel Size on Shore Based 10 cm. Radar Sets " dated 30th March, 1944). Knowing the measure of efficiency of the set, and the range of the vessel, the operator can estimate its size by the use of these charts.

Regular performance checks to determine efficiency are recommended for all 10 cm. Shore Radar sets, but accurate estimation of vessel size should only be expected from fully trained crews who have had practice on ships of known type.

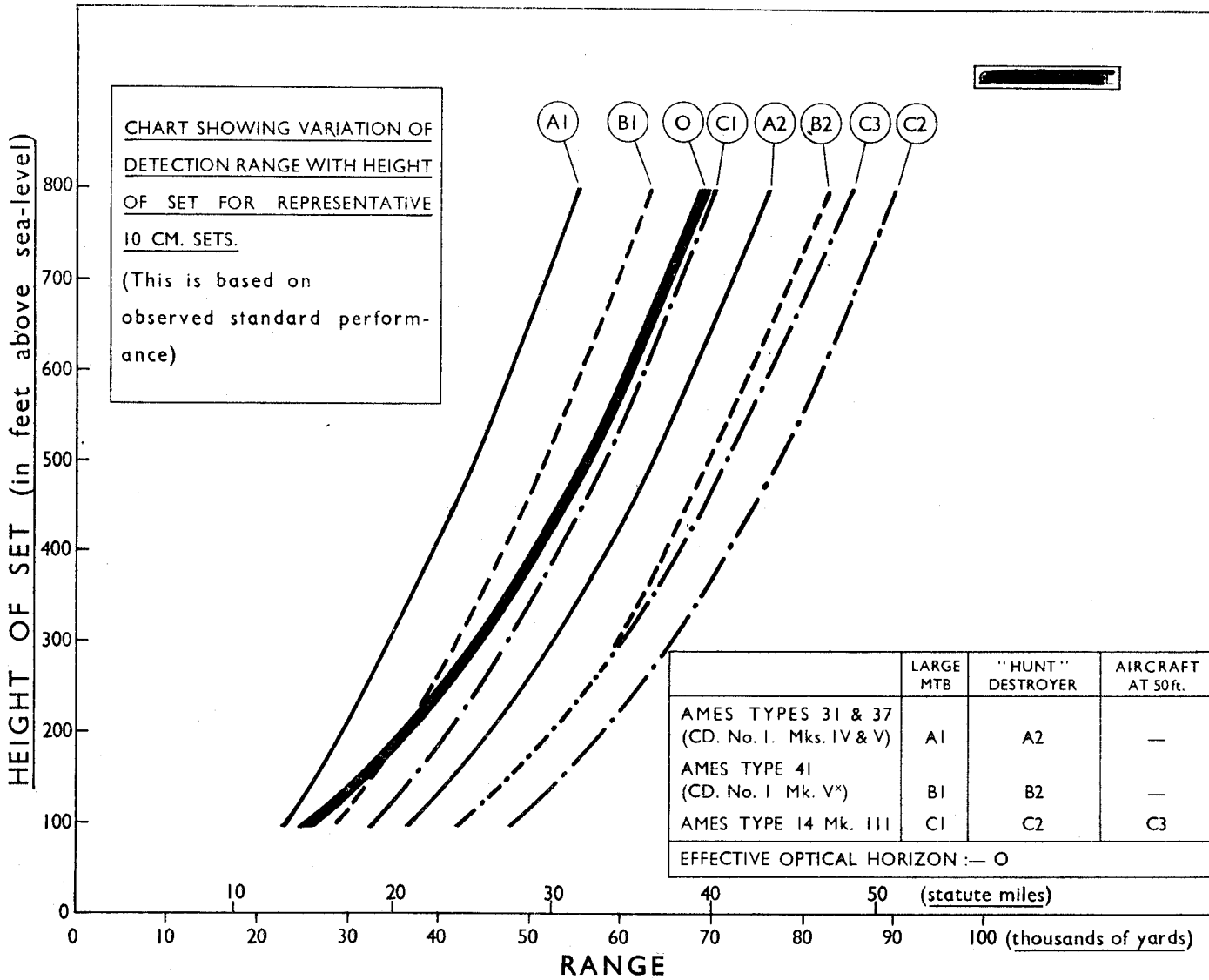
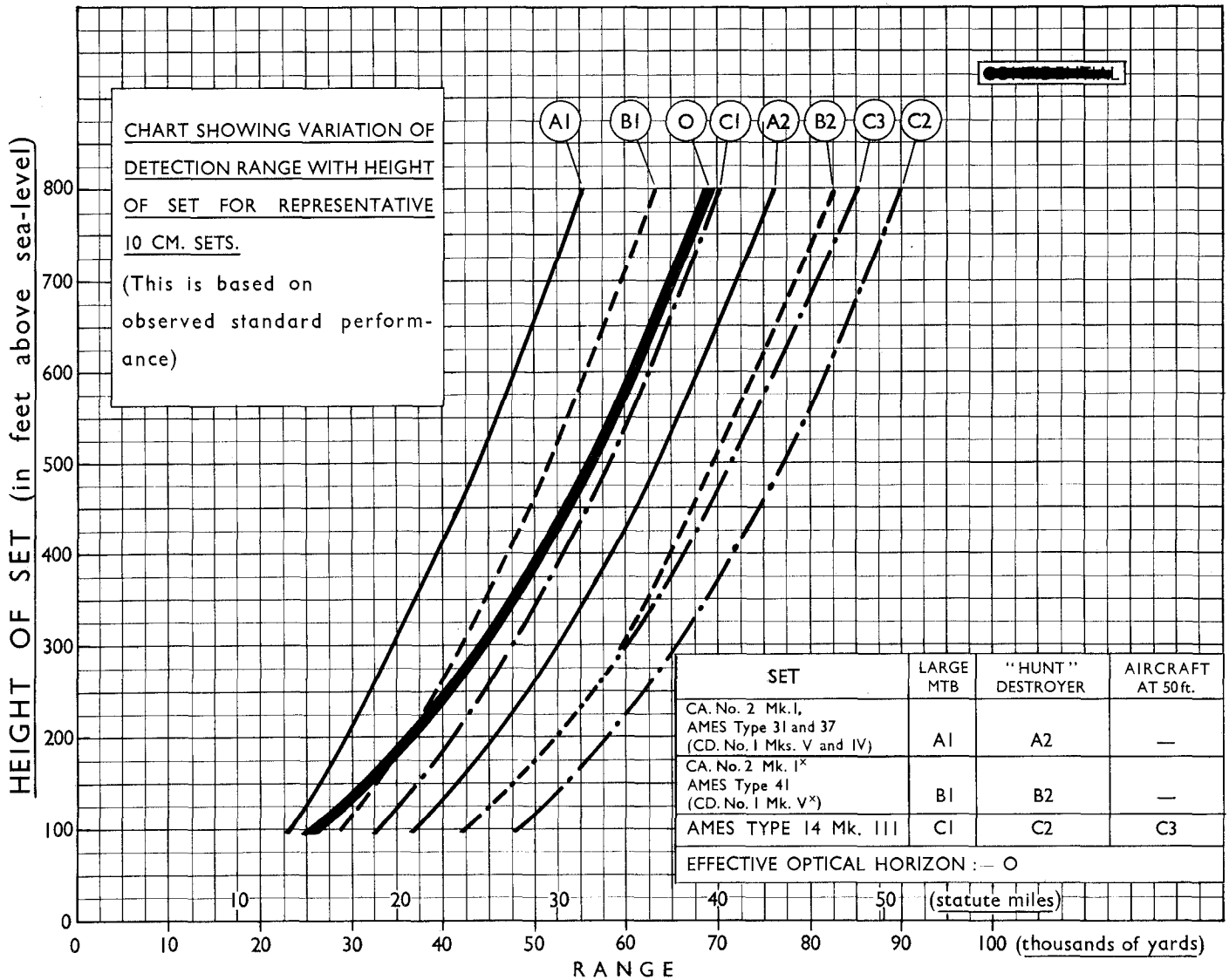


CHART SHOWING VARIATION OF DETECTION RANGE WITH HEIGHT OF SET FOR REPRESENTATIVE 10 CM. SETS.
(This is based on observed standard performance)
A1
B1
O
C1
A2
B2
C3
C2
HEIGHT OF SET (in feet above sea-level)
0
100
200
300
400
500
600
700
800
10
20
30
40
50 (statute miles)
0
10
20
30
40
50
60
70
80
90
100 (thousands of yards)
RANGE
LARGE MTB
"HUNT" DESTROYER
AIRCRAFT AT 50ft.
AMES TYPES 31 & 37 (CD. No. 1. Mks. IV & V)
A1
A2
—
AMES TYPE 41 (CD. No. 1 Mk. V^x)
B1
B2
—
AMES TYPE 14 Mk. III
C1
C2
C3
EFFECTIVE OPTICAL HORIZON :— O



SET	LARGE MTB	"HUNT" DESTROYER	AIRCRAFT AT 50 ft.
CA. No. 2 Mk. I, AMES Type 31 and 37 (CD. No. 1 Mks. V and IV)	A1	A2	—
CA. No. 2 Mk. I^{X} AMES Type 41 (CD. No. 1 Mk. V^{X})	B1	B2	—
AMES TYPE 14 Mk. III	C1	C2	C3
EFFECTIVE OPTICAL HORIZON :– O			

FUNCTIONAL INDEX TO SETS DESCRIBED IN DATA SHEETS

General Search

Light-weight Mobile

Aircraft and Surface Vessels	...	AMES type 6 ... ...

Mobile or Transportable

Aircraft and Surface Vessels	...	AMES type 11 ... ...
Aircraft and Surface Vessels	...	AMES type 14 ... ...
Aircraft and Surface Vessels	...	AMES type 57 (14 Mk. II) ... ...
Surface Vessels		AMES type 31 ... ...
Surface Vessels		AMES type 37 ... ...
Surface Vessels		AMES type 41 ... ...
Aircraft (with height finding)	...	AMES type 9 ... ...

Static

Aircraft and Surface Vessels	...	AMES type 5 ... ...
Aircraft and Surface Vessels	...	AMES type 50 ... ...
Aircraft and Surface Vessels	...	AMES types 52, 56 ... ...

Aircraft Interception and General Search with Height Finding

Mobile

Primarily for aircraft but all can give information on Surface Vessels	AMES type 13 ... ...
	AMES type 15 ... ...
	AMES type 21 ... ...
	AMES type 22 ... ...

Anti-Aircraft and Coast Artillery

Mobile	AA No. 3 ... ...
Static	CA No. 1 ... ...
Static	CA No. 2 ... ...

TITLE OF SET :

AMES Type 5, Mark II

Chain Overseas Low (COL)

Status

Many stations in use in overseas theatres.

Function

Early warning against medium and low flying aircraft. Surface watching when no 10 cm. equipment available.

Description

A fixed installation with a power turned broadside common T & R array mounted on a 20′ gantry (Type 5 Mk. IIA), or 184′ tower (Type 5 Mk. IIB). Power turning gives rotation at selected speeds up to 3.3 r.p.m. with slowest speed for inching. An obsolete Mk. I hand-turned version exists.

Local Plotting Facilities

One or more plotting boards.

Communications

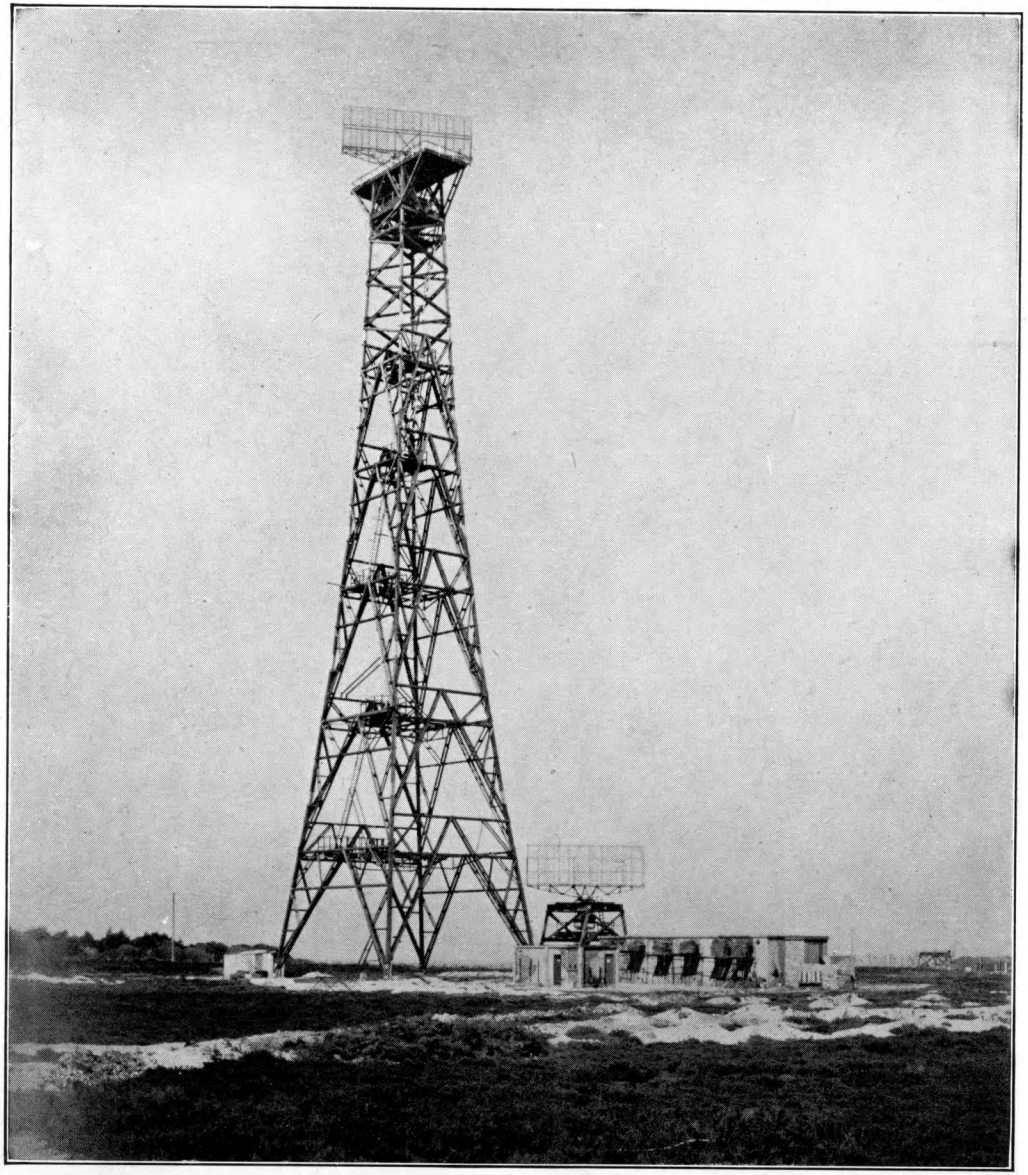
Standard telephone facilities are provided.

Ventilation

Forced air with filters. Heating facilities.

Frequency (Wavelength)

200 mc/s. (1.5 metres).



AMES Type 5, showing typical Tower and Gantry Installations

Typical Detection Ranges on Surface Vessels :—

Vessel	*Detection Range for 200 ft. Site*
Large M.T.B.	15,000 yds.
" Hunt " destroyer	35,000 yds.

Range Accuracy ± 1 mile.

Bearing Accuracy ± 1°.

Range Discrimination (for two targets on same bearing) ½ mile.

Bearing Discrimination (for two targets at same range) 10°.

Very susceptible to permanent echoes, partly owing to side lobes, and sites have to be carefully chosen to give a free area of coverage.

The *IFF Mk. III* system does not permit of bearing discrimination as a fixed omni-directional aerial system is used. Range correlation is possible, but in general there is considerable clutter, and identification is difficult except in conditions of low density.

American Equivalent

SCR 588 and SCR 627 nearest counterpart (also GCI).

Relevant Instruction Manual

C.D.0878, Chap. 4, Air Ministry Issue.

Anti-Jamming Properties

This equipment is capable of frequency variation over a few megacycles as an emergency A-J measure. A-J devices are not fitted. . These stations are extremely vulnerable to a concentrated jamming attack.

Seriously affected by *Window*.

Personnel Required to Operate and Maintain (on a 3½-watch basis)

1 Flying Officer (Technical).

Mechanics	*Operators*
3 N.C.O.s	4 N.C.O.s
2 Other Ranks	8 Other Ranks

Presentation

As the aerial beam rotates, illuminated targets give echoes which are displayed on a range tube, and also on a PPI tube on which signals appear as bright arcs, and to which is fitted a gridded mask enabling plots to be read off directly as grid references. *IFF* signals are displayed on the range tube on the same trace as the Radar signals, the *IFF* transmitter being fired in synchronism with the Radar transmitter.

Power Supply

230v. 50 cycles 3 phase, usually supplied by 20 KVA Mk. II Lister Generator.

Performance

Theoretically, complete 360° azimuthal coverage is available, but this is usually restricted by the nature of the site. Low cover is very much dependent on the site, high sites giving improved performance due to the fact that the lobe system is depressed, giving increased range on low flying aircraft and surface vessels. Cover at high angles of elevation (above 20°) is not good.

Typical Detection Ranges on Aircraft for Two Sites :—

	Detection Range (statute miles)	
Height of Aircraft in ft.	*50 ft. Site*	*400 ft. Site*
50	—	17½
100	—	23
500	15	35
5,000	70	90
20,000	150	150

There are no direct height finding facilities. At low sites, an estimate of heights can be obtained by using vertical polar diagrams and noting detection and fade ranges. This can be sufficiently accurate to enable interceptions to be made.

TITLE OF SET :

AMES Type 6

Mark II (AA No. 4 Mark II)

Mark III (AA No. 4 Mark III)

Mark IV

Light Warning Set (L/W)

Status

Relatively few Mk. II sets still in use. Several hundred Mk. III sets deployed in overseas theatres. Only a small quantity of Mk IV sets have been produced and are held in U.K. as an A-J reserve.

Function

Light transportable or mobile equipment for general early warning of aircraft and surface vessels, particularly in assault operations. Provides limited warning until heavier, longer range and more accurate equipment can be installed.

Description

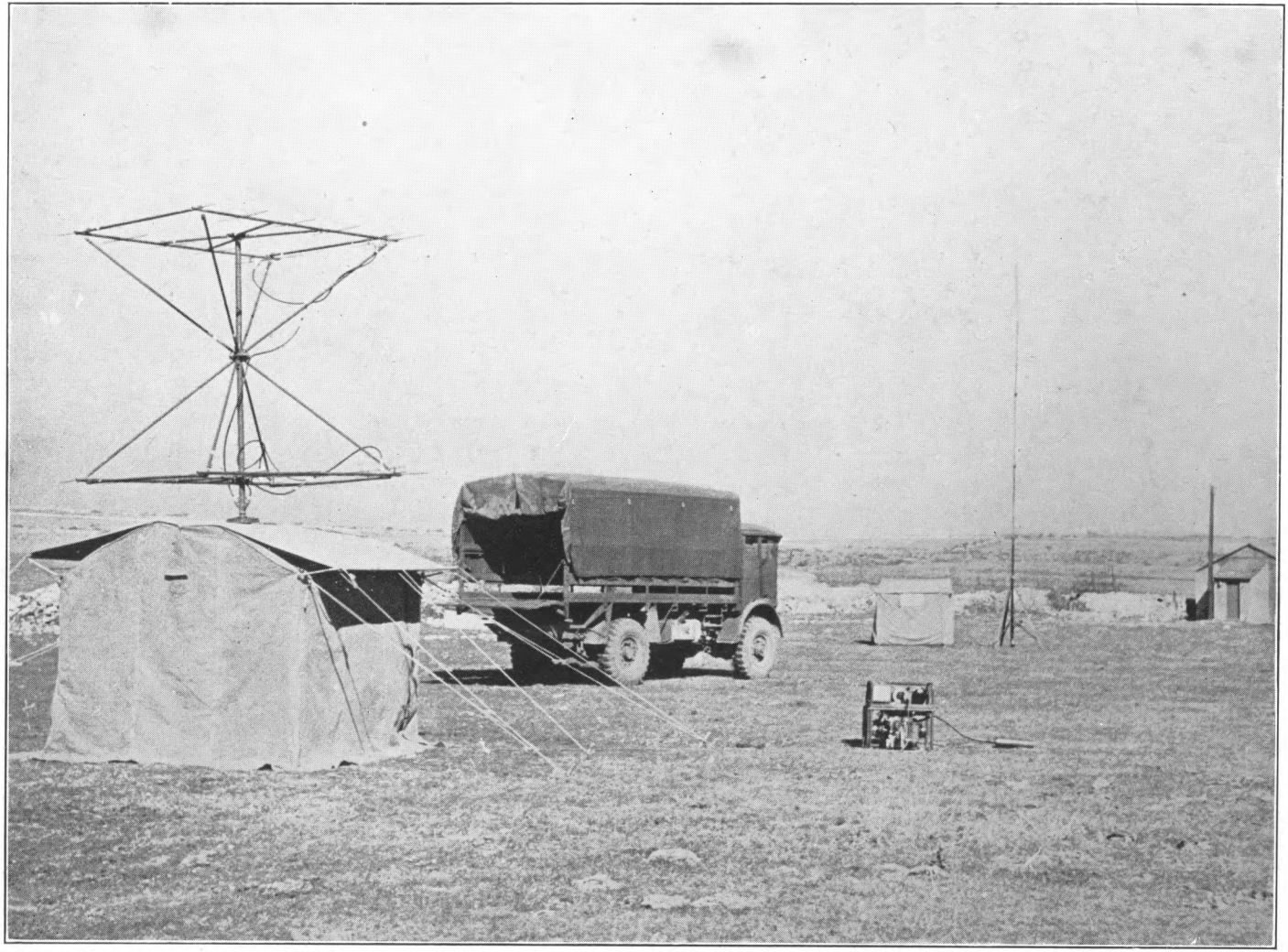
The Radar equipment is mounted in a frame-work and either housed in a tent or fitted in a 15 cwt. truck. In the first instance it is collapsible, and transported in a 3-ton lorry. The aerial system can be either continuously rotated by an electric motor at 4 r.p.m. or hand operated. The aerial system consists of two pairs of Yagi arrays separated vertically by about 1½ wavelengths. The vehicle set requires 10 minutes and the tent set 2 hours to bring into operation.

The tent set is transported in a 3-ton General Purpose vehicle, the equipment itself weighing 1 ton 17 cwt.

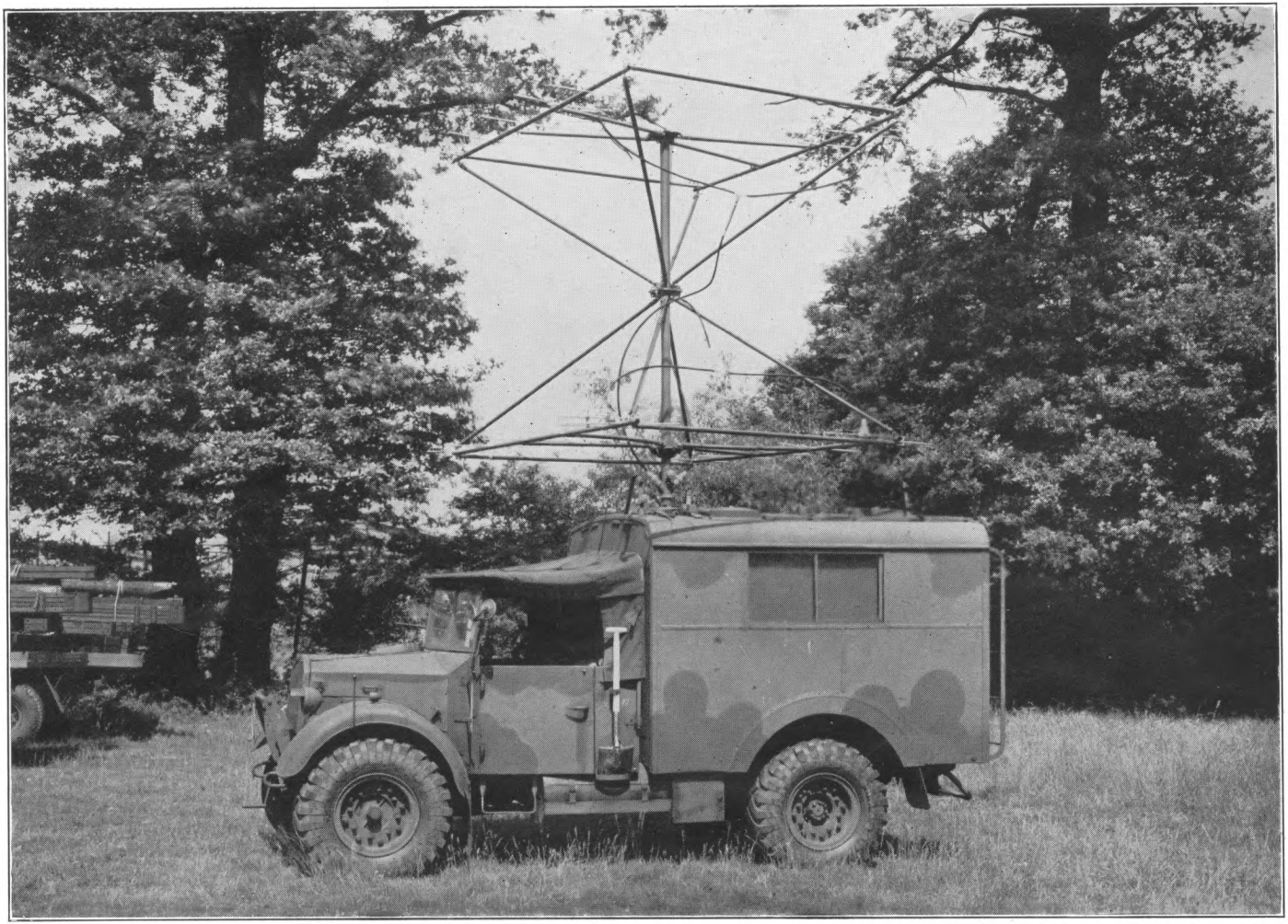
Details of the truck-mounted set are as follows :—

Vehicle	*Weight*		*Dimensions (travelling)*		
	tons	*cwt.*	*Length*	*Width*	*Height*
RV430	2	19	15′ 2″	6′ 9″	9′ 0″

For both types of convoy a 3 ton General Purpose vehicle is required as a load carrier.



AMES Type 6 Mk. III (tented version)



AMES Type 6 Mk. III. Truck-mounted version

Performance

Affected by site. The lower aerial system can be switched so as to fill the gaps in the vertical cover on a flat site. The performance is poor against low flying aircraft. On high sites this is improved. Aircraft above 30,000′ are first picked up in the gap filling lobe.

Typical Detection Ranges on Aircraft for Two Sites :—

Height of Aircraft in ft.	*Detection Range (statute miles)*	
	Flat Site	*400 ft. Cliff Site*
1,000	12	50
5,000	27	60
20,000	48	55
30,000	36 (in second lobe)	50

At certain angles of elevation signals from the aerial system when used normally, and when switched to gap-fill are equal. Thus when equal signals are observed, the height can be determined, since the range is known. The height finding facilities are therefore extremely limited.

Typical Detection Ranges on Surface Vessels :—

Type of Vessel	*Detection Range for 200 ft. Site*
Large M.T.B. " Hunt " destroyer	} Insufficient data available.

Range Accuracy $\pm$ 1 mile up to 40 miles.

Bearing Accuracy $\pm$ 2°.

Range Discrimination (for two targets on same bearing) $\frac{1}{2}$ mile.

Bearing Discrimination (for two targets at same range) 20°.

Highly susceptible to permanent echoes mainly due to wide beam of radiation and side lobes. Sites have to be carefully chosen to avoid cluttering trace with PE's.

The simple non-beamed *IFF Mark III* Aerial system used gives no bearing discrimination, leading to considerable clutter, but see para. on " Presentation ".

American Equivalent

SCR 602—T.6.

Relevant Instruction Manual

C.D.0334A, Chap. I, Air Ministry issue.

Local Plotting Facilities

A plotting board is provided.

Communications

R.A.F. Wireless Set No. 12, or Army Wireless Set type 22.

Ventilation

Fan extractor (truck-mounted set).

IFF Mk III.

An omni-directional IFF Mk. III aerial system is used, but consideration is being giving to the fitting of a beamed system.

Frequency (Wavelength)

Mk. II—176 mc/s. (1.7 metres) ; Mk. III—212 mc/s. (1.4 metres) ; Mk. IV—193 mc/s. (1.5 metres).

Anti-Jamming Properties

Frequency fixed. A-J devices are fitted but only give a small measure of protection. Very seriously affected by *Window.*

Personnel required to Operate and Maintain (on a 3½-watch basis)

Mechanics	*Operators*
1 N.C.O. (i/c)	3 N.C.Os
1 Other Rank	5 Other Ranks (2 Wireless Ops.)
	1 Wireless Op. Mechanic

Presentation

A 6″ range tube display and 9″ PPI are used.

The *IFF Mk. III* together with attenuated Radar signals are displayed on a separate trace below the main Radar trace on the range tube. With the present system range correlation only is available, but some bearing discrimination will be afforded by a system now under consideration.

Power Supply

80v. 2,000 cycles and 24v. D.C., supplied from an alternator and generator driven by a 350 cc. twin-cylinder Douglas Petrol Generator Set.

TITLE OF SET:

AMES Type 6
Mark V (AA No. 4 Mark IV)
Light Warning Set (L/W)

Status

Mark V is being produced in limited quantities.

Function

Light mobile equipment for general early warning of aircraft and surface vessels particularly in assault operations. Provides limited warning until heavier longer range and more accurate equipment can be installed.

Description

A 15-cwt. truck installation with multiple Yagi aerial system power turned at 4 r.p.m. or hand operated. Uses some radio equipment as Marks II, III and IV but modified to operate on a high frequency. In this case the travelling height of the vehicle is 11'.

Frequency (Wavelength)

600 mc/s. (50 cms)

Anti-Jamming Properties

Owing to narrower beam of radiation will be less vulnerable to jamming and *Window* than earlier Marks, but will still be badly affected by *Window*.

Personnel Required to Operate and Maintain (on 3½-watch basis)

Mechanics	*Operators*
1 N.C.O. (i/c)	3 N.C.O.s
1 Other Rank.	5 Other Ranks (2 Wireless Ops.)
	1 Wireless Op. Mechanic

AMES Type 6 Mk. V, showing IFF Mk. III Aerials at rear of Truck

Presentation

A 6″ range tube and 9″ PPI are used.

Power Supply

80v. 2,000 cycles and 24v. D.C., supplied from an alternator and generator driven by a 350 cc. twin-cylinder Douglas Petrol Generator Set.

Performance

Same remarks apply as for Marks II, III and IV, except that cover on low flying aircraft and surface vessels is somewhat improved due to higher frequency.

Performance on medium and high flying aircraft not as good as earlier Marks.

Typical Detection Ranges on Aircraft for Two Sites :—

	Detection Range (statute miles)	
Height of Aircraft in ft.	*Flat Site*	*400 ft. Cliff Site*
1,000	15	30
5,000	36	50
10,000	48	50
20,000	35	50
30,000	28	45

No height finding facilities.

Performance figures on surface vessels not available. Expected to be, if anything, somewhat better than earlier Marks.

Aerial system gives narrow beam and improved discrimination over Marks II, III and IV, leading to less clutter from permanent echoes.

IFF Mark III system suffers from the same disadvantages as in earlier Marks of AMES type 6.

American Equivalent

AN/TPS-3.

Relevant Instruction Manual

An information Memorandum is being prepared—R.A.F. issue.

TITLE OF SET :

AMES Type 9(T)

Mobile Radar Unit (MRU)

Status

Obsolescent. Production ceased. Still many Stations in operation overseas.

Function

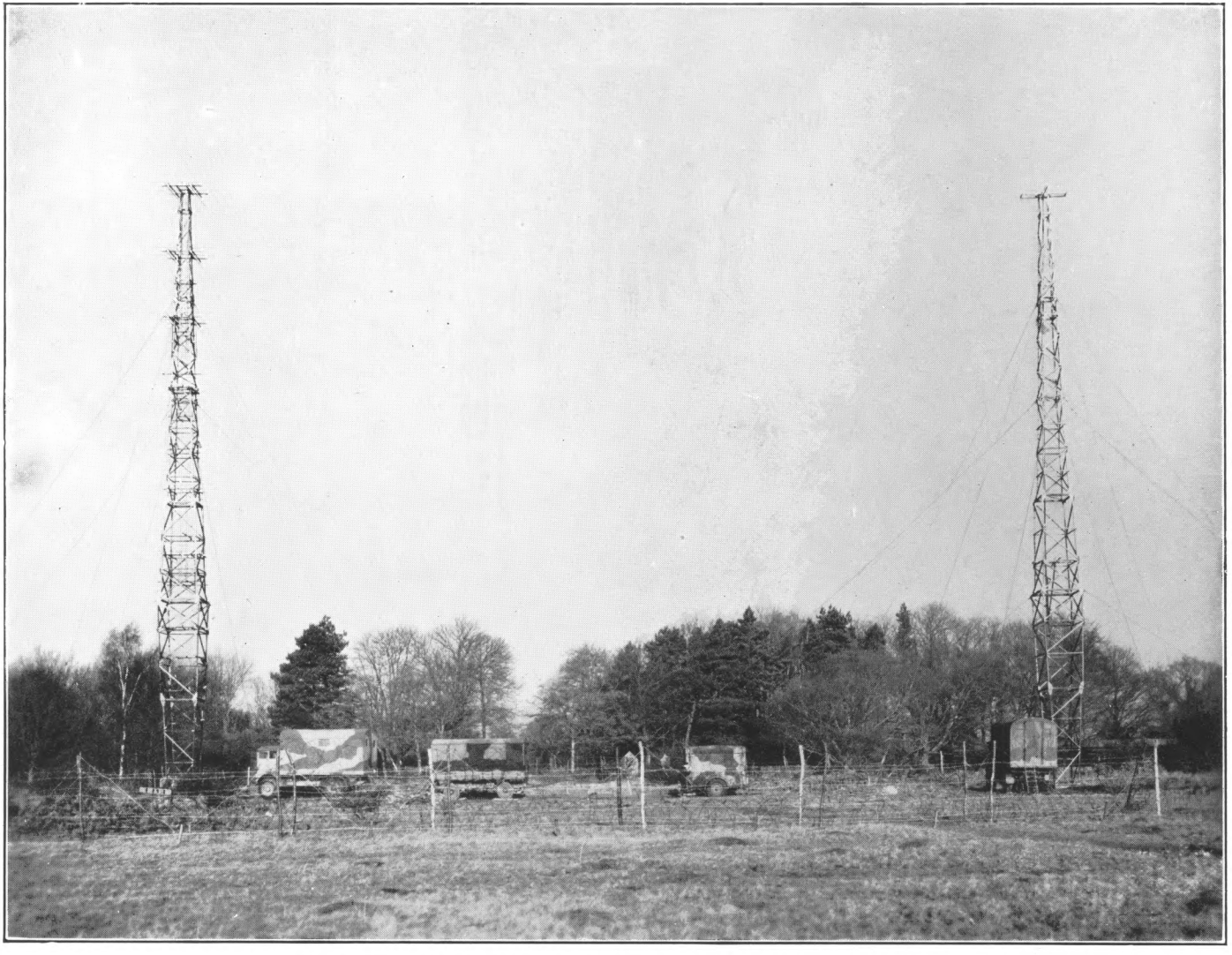
A mobile set giving early warning against high and medium flying aircraft with height finding—used for defence of base areas.

Description

This equipment employs fixed aerial systems mounted on two 105′ masts which when dismantled are transported on trailers. The transmitter and receiver/operations room are carried in separate prime mover vehicles. The station requires about 2 days to put into operation after arrival on site.

The technical vehicles are as follows :—

Vehicle	*Weight*		*Dimensions (travelling)*		
	tons	*cwt.*	*Length*	*Width*	*Height*
Receiver Prime mover (RV412) ...	6	5	22′ 6″	7′ 4″	11′ 0″
Transmitter Prime-mover (RV411) ...	7	4	22′ 5″	7′ 5″	11′ 0″
2 Mast Trailers (RV451)	5	1	22′ 6″	7′ 8″	12′ 0″ (mast in sections) 7′ 0″ (mast in piece parts)
Winch Prime mover (RV460) ...	7	12	21′ 6″	8′ 0″	10′ 0″
2 Power Unit Prime-movers (RV456)	7	4	22′ 5″	7′ 4″	8′ 6″



AMES Type 9 (T), showing Transmitting and Receiving Masts

Performance

Dependent on site. Azimuthal coverage normally 360°. Useless for low and very low flying aircraft or surface vessels.

Typical Detection Ranges on Aircraft for Two Sites:—

Height of Aircraft in ft.	*Detection Range (statute miles)*	
	Sea-level Site	*200 ft. Site (height finding sacrificed)*
1,000	23	32
10,000	72	100
20,000	100	136
30,000	118	150

Height finding facilities are very much dependent on the site. For an extensive level site, theoretical charts can be used, but other sites require calibration. With a reasonable site, height finding limits are 3°-10°.

With high sites (giving increased ranges on lower flying aircraft), height finding is sacrificed.

Height Accuracy ± 2,000′ for average site.

Range Accuracy ± 1 mile.

Bearing Accuracy ± 8°. (Better at ranges below 50 miles).

Range Discrimination (for two targets on same bearing) ½ mile.

Bearing Discrimination (for two targets at same range) 5°.

Very susceptible to permanent echoes.

The *IFF Mark III* interrogation facilities provided suffer from lack of bearing discrimination. The non-beamed aerial system leads to interrogation of aircraft over a wide area, and general clutter on other sets.

American Equivalent

No exact counterpart.

Relevant Instruction Manual

C.D.0878, Chap. 8, Air Ministry issue.

Local Plotting Facilities

A plotting board is provided.

Communications

Standard telephone facilities and wireless communication (R.A.F. Wireless Set No. 20) are provided.

Ventilation

Forced air with filters. Internal heating facilities.

IFF Mk. III

Separate single dipole *IFF Mark III* receiving and transmitting aerials are fixed to the two 105' towers.

Frequency (wavelength)

42.5 mc/s. (6.86 metres) to 43.75 (7.06 metres).

Anti-Jamming Properties

Equipped with certain A-J devices but cannot combat a concentrated jamming attack, particularly as a large variation of frequency within the band is a lengthy procedure. Can usually plot satisfactorily in the presence of *Window*.

Personnel Required to Operate and Maintain (on a $3\frac{1}{2}$-watch basis)

1 Technical Officer.

Mechanics	*Operators*
3 N.C.O.s	5 N.C.O.s (1 Wireless Op.)
2 Other Ranks.	11 Other Ranks (1 Wireless Op.)

Presentation

Signals from the crossed dipole receiving aerial system are passed to the receiver through a Goniometer. They are displayed on a range tube, and the bearing of individual echoes obtained by D/Fing to zero with the Goniometer. Heights are obtained by comparison of signals between aerials at different heights. The *IFF Mark III* signals are displayed on a parallel trace, giving range correlation between *IFF* and Radar signals. There is no *IFF* bearing discrimination.

Power Supply

230v. 50 cycles single phase, supplied by 20 KVA Mk. II Lister-Generator set.

TITLE OF SET:

AMES Type 11

Marks II (T and M), III (M) and IV (M)

Status

Mark II—In full scale production. Initial convoys (T)—remainder (M). Mark III (M)—Production just commencing. Mark IV (M)—Still under development.

Function

An A-J standby giving early warning plan position information on medium and low flying aircraft. Standby to AMES type 5 and AMES type 15 equipments. Can be used in conjunction with AMES type 13 Mark II set to form a GCI convoy (see AMES type 22). Can also be used in surface-watching role.

Description

Mark II. A mobile convoy, the main components being a prime-mover operations room and aerial trailer (T) or prime-mover (M). The aerial system uses a double truncated paraboloid of 26" overall width, common to transmitter and receiver. This reduces in size for transport. The position of the radiating elements is remotely controlled to give increased upper and lower angle cover. The transmitter and initial receiver stages are housed in a cabin which rotates with the aerial system. The signals are piped from the aerial vehicle at a standard intermediate frequency. In the prime-mover operation these signals are displayed on both range tube and PPI displays. A modification kit is in production to enable the AMES type 13 height display to be made on the range tube.

The aerial is power turned at speeds up to 6 r.p.m. with inching facilities, and is controlled from a control unit in the operations room.

The aerial system has to be jacked off the RV433 prime mover vehicle before use in a GCI role, this requiring about 1 hour.

AMES Type 11 Mk. II (M). Prime-mover Aerial/Transmitter Vehicle (RV 433) only

Presentation

A range tube and PPI display are provided—the technique being essentially the same as that employed for AMES type 5.

The range tube can be modified to give either type 11 range information or AMES type 13 height display.

IFF Mark III facilities now being produced will have a display on a separated trace on the range tube. Later, for use when the range tube is occupied by the AMES type 13 height display, *IFF Mark III* signals will be displayed as sideways amplitude deflections associated with the corresponding Radar signal on the PPI tube.

In the Mark III version using the *Display Unit type 5*, *IFF* and Radar signals will be displayed on an additional PPI tube.

Power Supply

230v. 50 cycles single phase, supplied by 20 KVA Mk. II Lister Generator Set. Standby generator is provided.

Performance

Theoretically, cover over 360° is available.

The aerial beam can be tilted from the operations room to provide increased upper and lower angle cover in the vertical plane.

With the aerial system on a trailer (Mark II(T)) even with this facility a gap occurs about 6° elevation.

The removable aerial system used with the prime mover version (M) tends to raise this gap to a higher angle as a result of its lower mean height.

The high power transmitter to be used in the Mark IV version will result in ranges about 40 per cent. in excess of those quoted below.

Performance on low flying aircraft and surface vessels will improve with increasing height of site.

Typical Detection Ranges on Aircraft :—

	Detection Range (statute miles)	
Height of Aircraft in ft.	*Sea level Site (GCI) (prime-mover version)*	*200 ft. Site*
500	—	20
1,000	20	30
5,000	43	70
10,000	58	90
20,000	73	85
30,000	80	—

Typical Detection Ranges on Surface Vessels :—

Type of Vessel	*Detection Range for 120 ft. Site*
Large M.T.B.	28,000 } figures from one series of trials only
" Hunt " Destroyer	37,000 } are available.

Range Accuracy ± 1 mile.
Bearing Accuracy ± 1°.
Range Discrimination (for two targets on same bearing) $\frac{1}{2}$ mile.
Bearing Discrimination (for two targets at same range) 3°.

The technical vehicles comprise :—

Vehicle	*Weight*		*Dimensions (travelling)*		
	tons	*cwt.*	*Length*	*Width*	*Height*
Aerial/transmitter vehicle (RV433)					
Trailer	5	14	21′ 9″	8′ 6″	11′ 7″
Prime Mover	8	1	25′ 3″	8′ 6″	14′ 2″
Display vehicle (RV432)	5	5	24′ 5″	7′ 5″	9′ 8″
2 Power unit prime-movers (RV456)	7	4	22′ 5″	7′ 4″	8′ 6″

VHF vehicles will be required when this convoy is used in a GCI role. In the Marks III and IV versions the aerial system will be mounted on a prime-mover (RV435), and a *Universal Operations Vehicle* using the *Display Unit type* 5 will be incorporated (RV467). In addition the Mark IV convoy will embody a high power transmitter.

Local Plotting facilities

Two plotting boards are provided, one for sector liaison and one for navigational purposes during interceptions.

Communications

Standard telephone facilities and VHF R/T (for GCI role) are provided.

Ventilation

Forced air cooling with filters. Heating facilities.

IFF Mk. III

The *IFF* aerial system uses an 8 bay broadside array mounted above the radar aerial system with the interrogator/responsor housed in the cabin on the aerial vehicle.

Frequency (wavelength)

Marks II, III, IV. Capable of rapid variation between 500-600 mc/s. (60-50 centimetres).

Anti-Jamming Properties

Frequency flexibility in combination with moderately narrow horizontal beam of radiation makes this set more difficult to jam effectively than AMES types 5 and 15.

Is affected by *Window* especially when cut for this frequency but not as seriously as AMES types 5 and 15 due to better discrimination.

Personnel Required to Operate and Maintain (on 3½-watch basis)

When operated as an individual convoy technical personnel required will be as for AMES type 5 (*q.v.*).

When operated in GCI role in conjunction with AMES type 13 (forming AMES type 22) technical establishment will be as for AMES type 15 (*q.v.*).

Less susceptible to permanent echoes than AMES type 5 and type 16 equipments. Beam tilting can be employed to reduce effect of these at low angles.

IFF Mark III facilities will give good range correlation and reasonable bearing discrimination.

American Equivalent

A Canadian version of AMES type 11 exists very similar to the British type.

Relevant Instruction Manual

Mk. II, C.D.0407A, Air Ministry Issue.

TITLE OF SET:

AMES Type 13

Marks II, III and IV

Centimetre Height Finding (CMH)

Status

Mark II—In production.

Mark III—An improved version pending introduction of Mark IV. Probably only a limited quantity.

Mark IV—Final model. Should be available in quantity by late 1944.

Function

A mobile high power 10 cm. height finding equipment, independent of site, for use in conjunction with plan position sets, thus giving excellent interception facilities (*vide* Remarks).

It can itself be used as plan position equipment for detection of very low-flying aircraft and surface vessels.

Description

The main component is the aerial prime-mover vehicle which has a waveguide-fed vertical " cheese " aerial system with the transmitter and initial receiver stages mounted at the rear. Signals are passed to a nearby operations room at a standard Intermediate frequency.

The " cheese " reflector is pivoted horizontally and is oscillated about this axis once every ten seconds, thus tilting a narrow " sheet " of radiation up and down over a range of 20° in elevation.

The aerial system is power turned, giving continuous rotation from 0-6 r.p.m. in either direction, and pre-set auto-follow (*i.e.*, a hand knob is set to a bearing and the array turns on to it in its own time).

When it is desired to use the set in a plan position role the aerial system can be fixed at zero elevation and rotated continuously in azimuth.

AMES Type 13 Mk. II. Aerial Vehicle (RV 461) only, showing vertical " cheese " aerial system

Presentation

The height finding display takes the form of a vertical section of sky with lines of constant height approximately horizontal. The echoes appear as short bright lines from which range and height are read off directly. The operating technique consists in setting the aerial system to the azimuth of the target of which the height is required and reading this off directly using range correlation.

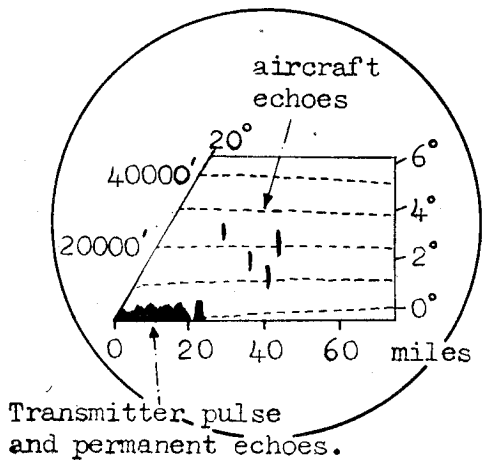


FIG.3. A.M.E.S. Type 13 height display.

Power Supply

230v. 50 cycles single phase, provided by a prime-mover 20 KVA Mk. II Lister Generator Set. A standby is supplied.

Performance

The radiation from this set is in the form of a narrow sheet of about $1\frac{1}{4}°$ vertical and $7\frac{1}{2}°$ horizontal beam width. There is thus very fine discrimination in the vertical plane, and height finding accuracy is independent of the site.

When used as height finding equipment the maximum detection range on aircraft is 60 miles.

When used in a plan position role, detection ranges on low-flying aircraft and surface vessels will be identical with those for the AMES type 14 Mark III, and performance will improve with increasing height of site. It should be noted, however, that the bearing discrimination is not as good as that of the AMES type 14 Mark III as the AMES type 13 was not primarily designed for this purpose.

Height Finding Limits $\frac{3}{4}°$ to 10°.

Height Finding Accuracy $\pm \frac{1}{4}°$.

On a normal site permanent echoes should not seriously interfere with height finding except for aircraft below 5,000'. The site will, however, have to be carefully chosen to avoid obstructions at low angles of elevation.

The aerial system has to be demounted and erected by hand before and after travelling, requiring about an hour.

The Mark IV set will incorporate a *Universal Operations Vehicle* using the *Display Unit type* 5.

The basic AMES type 13 convoy consists of the composite aerial/transmitter/receiver vehicle, and a prime-mover universal operations room together with a mobile power supply. Details of the technical vehicles of the convoy are as follows :—

Vehicle	*Weight*		*Dimensions (travelling)*		
	tons	*cwt.*	*Length*	*Width*	*Height*
Aerial/transmitter vehicle (RV461) ...	9	2	25′ 8″	9′ 6″	10′ 3″
Display vehicle (RV432)	5	5	24′ 5″	7′ 5″	9′ 8″
2 Power unit prime movers (RV456) ...	7	4	22′ 5″	7′ 4″	8′ 6″

Local Plotting Facilities

A plotting board is provided.

Communications

Standard telephone facilities are provided.

Ventilation

Forced air cooling with filters. Heating facilities.

IFF Mark III

These facilities are not yet fitted to AMES type 13 convoys.

Frequency (wavelength)

3,000 mc/s. (10 cms).

Anti-Jamming Properties

In view of the high frequency and highly directive aerial system this set should prove difficult to jam effectively, especially by ground jammers, and operations will not be seriously hampered by *Window*.

Personnel Required to Operate and Maintain

This set will mainly be used in conjunction with the plan position AMES type 11 (forming AMES type 22), or AMES type 14 (forming AMES type 21) convoys. In this role the operations vehicle will require *one* additional operator for the AMES type 13 equipment. When used as an isolated unit the personnel required will be as those for AMES type 14 Mark III.

American Equivalent

No exact equivalent.

Relevant Instruction Manual

Mk. II—C.D.0473A(2), Air Ministry issue.

Remarks

When used in conjunction with AMES type 11 (see AMES type 22) or AMES type 14 (see AMES type 21) mobile plan position equipment for either interception or reporting, a common universal operations room will be used for two displays. If, however, the combined convoy is to operate in both controlled interception, and reporting roles, the two operations rooms will probably be required.

When AMES type 13 is used in conjunction with static equipment or earlier marks of AMES type 15, it will again be necessary to use the whole of the basic AMES type 13 convoy and to relay height information from the AMES type 13 operations room to the main operations room.

TITLE OF SET :

AMES Type 14

Marks III and IV

Status

Mk. III in production Mk. IV will supersede in late 1944.

Function

A completely mobile high power 10 cm. convoy primarily for detection and plotting of surface vessels and very low flying aircraft, operating with continuous rotation. Gives good cover on low and medium flying aircraft. Can also be used as a 10 cm. GCI station in association with AMES type 13 (combination then known as AMES type 21).

Description

Mk. III. The convoy consists essentially of prime mover aerial/transmitter vehicle and display vehicle. The aerial system is similar to that of the AMES type 13 Mk. II, but in this case the " cheese " is mounted with its long axis horizontal, thus giving a fine azimuthal beam of radiation, and extensive vertical cover. Further, the " cheese " can be tilted in elevation to 6°, 3° or 0°, thus providing extended cover at higher angles of elevation.

The signals are passed from the aerial vehicle, on which is also mounted the initial receiver stages, at a standard intermediate frequency. The Mark III version will use an operations vehicle essentially the same as that for the type 11 Mk. II. The aerial is power turned at speeds up to 6 r.p.m. with inching facilities and provision for automatic sweeping between selected azimuths, being controlled from a unit in the operations vehicle.

The complete mobile station consists of :—

Vehicle	*Weight*		*Dimensions (travelling)*		
	tons	*cwt.*	*Length*	*Width*	*Height*
Aerial/transmitter vehicle (RV462) ...	8	16	25′ 9″	10′ 5″	10′ 3″
Display vehicle (RV432)	5	5	24′ 5″	7′ 5″	9′ 8″
2 Power Unit prime movers	7	4	22′ 5″	7′ 4″	8′ 6″

AMES Type 14 Mk. III. Aerial Vehicle (RV 462) only, showing horizontal " cheese " aerial system

For inland sites a maximum range of about half that obtained for a coastal site can be expected. For unusually level, or marshy sites, greater ranges will be obtained. The gap-filling property of the aerial switching arrangement is taken into account in the detection ranges quoted ; and also the facility for tilting in the GCI role.

Typical Detection Ranges on Aircraft :—

Height of Aircraft in ft.	*Inland Site (GCI)* (aerial at 3°)	*Detection Range (statute miles)* 200 *ft. Coastal Site* (aerial at 0°)
50	—	28
1,000	37	50
10,000	55	112
20,000	60	105
30,000	42 (gap filling)	78 } gap filling
40,000	—	82 }

Typical Detection Ranges on Surface Vessels :—

Vessel	*Detection Range for 200 ft. site.*
Large M.T.B.	40,000 yds.
" Hunt " Destroyer	57,000 yds.

Range Accuracy Up to $\frac{1}{4}$ mile.

Bearing Accuracy $\pm$ 1°.

Range Discrimination (for two targets on same bearing) About $\frac{1}{4}$ mile.

Bearing Discrimination (for two targets at same range) 1°.

Little trouble from permanent echoes should be experienced if the site is well chosen.

American Equivalent

No exact counterpart.

Relevant Instruction Manual

C.D.0474A, Air Ministry issue.

Mk. IV In the Mk. IV version a *Universal Operations Vehicle* (RV467) incorporating a *Display Unit type* 5 will be used.

Local Plotting Facilities

Two plotting boards are provided.

Communications

Standard telephone facilities are provided.

Ventilation

Forced air cooling with filters. Heating facilities.

IFF Mk. III.

An *IFF Mk. III G* system is under development.

Frequency (wavelength)

3,000 mc/s. (10 cms.).

Anti-Jamming Properties

The high frequency and highly directive aerial system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack.

Operations can usually be carried on in the presence of *Window*.

Personnel Required to Operate and Maintain (on a 3½-watch basis)

When operated an individual convoy in an early warning role technical personnel required will be as for AMES type 5. When operated in a GCI role with AMES type 13 (forming AMES type 21) the technical establishment will be as for AMES type 15.

Presentation

A range tube and PPI are provided, the technique being essentially that employed for AMES type 5. The range tube will be modified to display either AMES type 14 range information or AMES type 13 height display.

The Mk. IV version will employ a *Display Unit type 5*.

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator. Normal source 20 KVA Mk. II Lister Generator.

Performance

Power turning overcomes limitation of AMES type 57 (14 Mk. II) regarding missing of fast low-flying aircraft.

Screening must be avoided in siting. Highest sites give best performance under normal meteorological conditions. Very low flying aircraft can be detected at a range slightly over the optical horizon. Limiting range on aircraft for coastal site is about 110 miles, this not normally being attained on very low flying aircraft due to horizon limitation.

TITLE OF SET:

AMES Type 15
Mark I (formerly AMES Type 8E)
Marks II and III
COL/GCI/CHB

Status

Mark I is in extensive use overseas. Mark II is in production. Mark III is projected.

Function

A mobile equipment having height finding facilities used for :—

(*a*) Ground Controlled Interception (GCI) of medium and high flying aircraft.

(*b*) Early warning of low and medium flying aircraft without height finding (COL). Will also provide cover on surface vessels in absence of 10 cm. equipment.

(*c*) Early warning of medium and high flying aircraft with height information (CHB).

Description

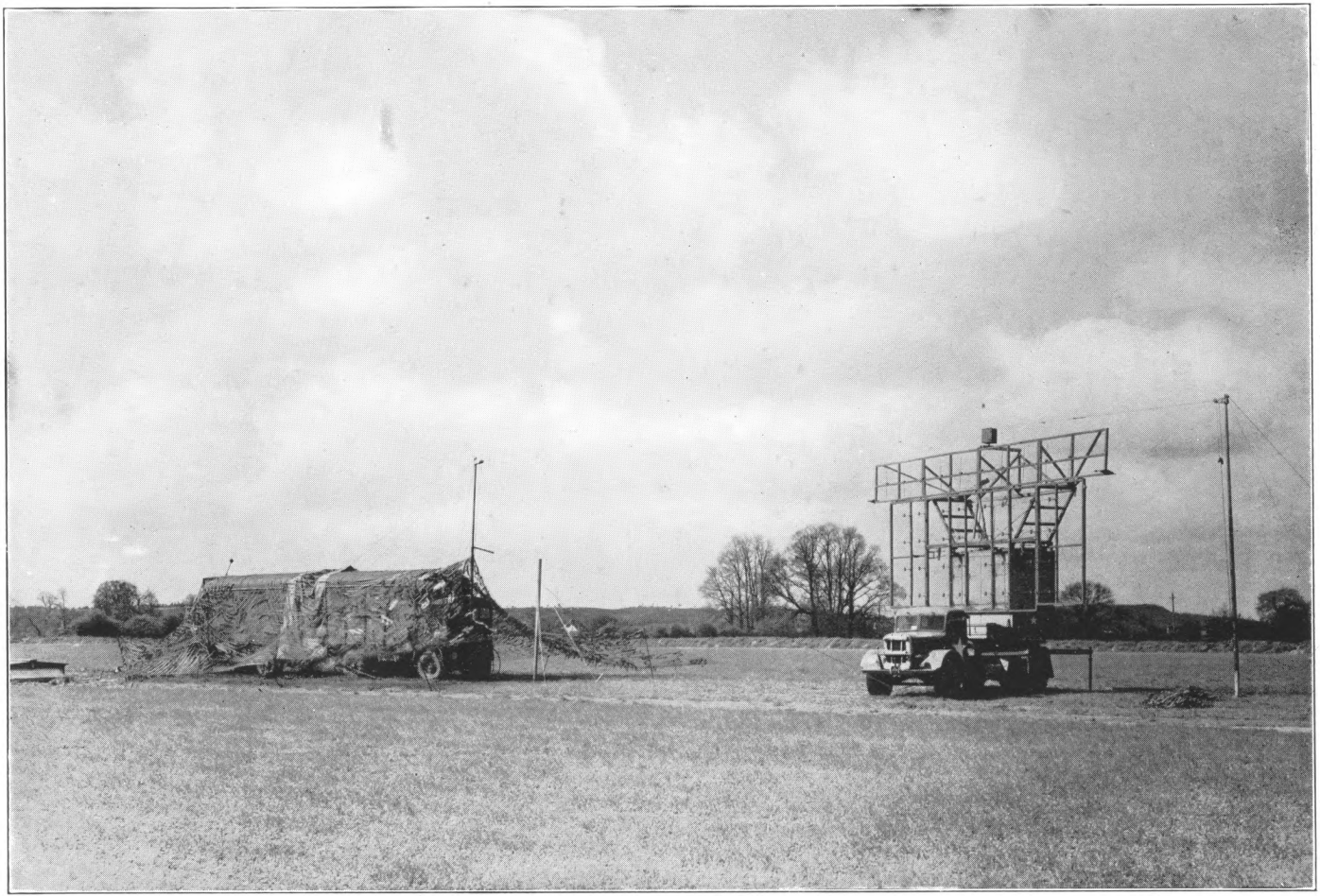
The aerial system is mounted on a prime mover, being used both for receiving and transmitting, and consisting of 4 bays of 8 dipoles each, at an average height of 10 ft. The radiation is thus beamed as in AMES type 5 Mark II. The array is power turned at speeds up to 6 r.p.m. with inching facilities. For transport, the aerial system is folded back. The transmitter and receiver operations room are also in prime movers.

The technical vehicles comprise :—

Vehicle	*Weight* tons	cwt.	*Dimensions* Length	Width	Height
Prime mover transmitter (RV405) ...	7	5	21′ 3″	7′ 7″	12′ 0″
Prime mover receiver (RV409) ...	6	19	20′ 6″	7′ 8″	12′ 2″
Prime mover aerial (RV457/8) ...	4	19	17′ 3″	7′ 7″	11′ 3″
2 prime mover power units (RV456)	7	4	22′ 5″	7′ 4″	8′ 6″
Prime mover VHF transmitter (RV150)	7	12	23′ 0″	7′ 6″	9′ 9″
Trailer VHF receiver (RV100) ...	5	19	22′ 4″	7′ 4″	9′ 10″

Local Plotting Facilities

Two plotting boards for sector liaison and navigational purposes are provided.



AMES Type 15 Mk. II showing camouflaged Transmitter and Operations Vehicles (RV 405 and RV 409), and Prime-mover Aerial Vehicle (RV 458) fitted with IFF Mk. III Aerial system above the Radar array

Performance

In the GCI role coverage over 360°, except for the sector screened by the line of convoy, should be available unless restricted by the nature of the site. For GCI operations a flat site or saucer shaped depression gives the best results. In the COL role the performance is essentially similar to that of the AMES type 5 Mark II. The same siting requirements apply when used in the CHB role as for GCI, except that cover over 360° may not be necessary and the siting requirements are thus less stringent.

Typical Detection Ranges on Aircraft for Two Sites :—

	Detection Range (statute miles)	
Height of Aircraft in ft.	*Flat Site GCI/CHB*	*400 ft. Site (COL)*
500	—	Ranges of the same order as for AMES type 5, but about 10-20 per cent. less.
1,000	—	
5,000	40	
20,000	70	
30,000	80	
40,000	90	

Ranges on surface vessels slightly less than AMES type 5 Mark II.

Height finding accuracy depends upon the site. Where a good site is available reasonable results can be obtained using theoretical charts. Elsewhere calibration flights have to be made. Height finding limits are usually from 4° to 20°.

Height Finding Accuracy ± 1,000′ when calibrated. Theoretical height charts are supplied which give reasonable accuracy with well-chosen site.

Range Accuracy ± 1 mile.

Bearing Accuracy ± 1°.

Range Discrimination (for two targets on same bearing) ½ mile.

Bearing Discrimination (for two targets at same range) 12°.

In common with AMES type 5 Mark II very susceptible to permanent echoes and again careful siting is necessary to avoid clutter.

The proposed *IFF Mark III* system will permit of a reasonable bearing discrimination, as the aerial will give beamed radiation and will rotate with the main aerial system.

American Equivalent

SCR 527 nearest counterpart.

Relevant Instruction Manual

Mark I—C.D.0420A ; Mark II—C.D.0420B, Air Ministry issue.

Remarks

Earlier versions known as AMES type 8.

Communications

Standard telephone facilities and VHF/R/T are provided.

Ventilation

Forced air cooling with filters. Heating facilities.

IFF Mark III

The aerial system will consist of a broadside array mounted above the Radar aerial system.

In the Mark III version it is intended to dispense with the separate transmitter vehicle and mount a smaller transmitter behind the aerial system. This vehicle will be the RV466. A *Universal Operations Vehicle* with *Display Unit type* 5 will be used.

Frequency (Wavelength)

Mark I. 209 mc/s. (1.45 metres).

Mark II. 193, 200 or 209 mc/s. A kit is provided which enables the frequency to be changed in the field.

Anti-Jamming Properties

In the Mark II version the frequency change facilities give a small measure of protection against jamming. In general very vulnerable to deliberate jamming attack. Seriously affected by *Window*.

Personnel Required to Operate and Maintain (in GCI role) ($3\frac{1}{2}$-watch basis)

1 Squadron Leader and 2 Flight Lieutenant Controllers, 1 Flying Officer (Technical).

Mechanics	*Operators*
3 N.C.O.s	5 N.C.O.s (1 R/T Operator)
2 Other Ranks	19 Other Ranks (3 R/T Operators)
1 Other Rank (Wireless Mechanic)	

Presentation

The display is very similar to that used in the AMES type 5 Mark II. The range tube display, however, is modified to permit of height finding. When height finding is desired the aerial system is split into upper and lower components and signals from the two are displayed side by side on the range tube trace. The amplitude ratio of these is judged, and by means of a chart the height of the aircraft is read off.

The *IFF Mk. III* system displays *IFF* echoes on a separated trace on the range tube. The AMES type 15 also has the facility (*IFF Mk. IIIG*) of displaying an *IFF* signal on the PPI tube given by direct interrogation of a suitable airborne set by the Radar transmission (*vide* Introduction, para. 10 iv).

Power Supply

230v. 50-cycles single phase, provided by prime mover 20 KVA Mk. II Lister Generator Set. A standby set is provided in the convoy.

TITLE OF SET :

AMES Type 21

Marks II, III, IV

High Power 10 centimetre GCI

Status

Production of Mk. II commencing ; Mark III will follow after limited number of convoys ; Mark IV will commence production in late 1944.

Function

Fully mobile composite station having excellent height finding facilities ; for ground controlled interception in difficult terrain and in presence of jamming or *Window*, or for early warning of surface vessels and very low, low and medium flying aircraft, with height finding.

Description

Mark II—A combination of AMES type 14 Mk. III (*q.v.*) and AMES type 13 Mk. II (*q.v.*).

Mark III—A combination of AMES type 14 Mk. III and AMES type 13 Mk. III.

Mark IV—A combination of AMES type 14 Mk. IV and AMES type 13 Mk. IV using *Universal Operations Vehicle* with *Display Unit type* 5. In all these combinations either one or two operations vehicles may be used, depending whether a separate reporting room is required in addition to the vehicle used for interception control.

American Equivalent

None exists.

Relevant Instruction Manual

Mk. II—C.D.0475B, Air Ministry issue.

Remarks

For all other information refer to the data sheets on AMES types 13 and 14 and 22.

TITLE OF SET :

AMES Type 22

Marks I, II, III, IV

50 cm. GCI with High Power 10 cm. Height-finding

Status

Mark I in production , Mark II will follow after limited number of Mark I convoys ; Mark III will commence production in late 1944 ; Mark IV will be available in early 1945.

Function

Fully mobile, composite station, having excellent height finding facilities for ground controlled interception in difficult terrain, and with better performance in presence of jamming and *Window* than AMES type 15, though not as good as AMES type 21.

Can also be used for early warning of surface vessels, very low, low and medium flying aircraft, with height finding.

Description

Mark I—A combination of AMES type 11 Mark II (*q.v.*) and AMES type 13 Mark II (*q.v.*).

Mark II—A combination of AMES type 11 Mark II and AMES type 13 Mark III.

Mark III—A combination of AMES type 11 Mark III and AMES type 13 Mark IV using *Universal Operations Vehicle* with *Display Unit type* 5.

Mark IV—A combination of AMES type 11 Mark IV and AMES type 13 Mark IV also using *Universal Operations Vehicle.*

In all these combinations either one or two operations vehicles may be used, depending whether a separate reporting room is required in addition to the vehicle used for interception control.

American Equivalent

None exists.

Relevant Instruction Manual

C.D.0476A, Air Ministry issue.

Remarks

Compared with AMES type 21 the plan position component has less bearing discrimination and will be worse affected by jamming, *Window* and permanent echoes. The range of the AMES type 11 portion, however, is greater than that of the AMES type 14 portion of the AMES type 21 when used in a GCI role. For other information, refer to data sheets on AMES type 11 and AMES type 13.

TITLE OF SET :

AMES Type 31

(CD No. 1 Mark V)

Status

In general use in the U.K. and abroad. Being replaced by medium power AMES type 41 or high power AMES type 50/58 series.

Function

A low power 10 cm. transportable equipment for detection and plotting of surface vessels.

Description

The whole equipment is housed in a transportable wooden cabin, with a single waveguide-fed paraboloid aerial system mounted above the cabin on a rotatable shaft.

The aerial system is hand-turned, and is collapsed for travelling.

The Radar equipment is NT271P.

Details of the cabin are as follows :—

Weight	*Dimensions (travelling)*		
tons cwt.	*Length*	*Width*	*Height*
2 5	11′ 0″	6′ 11″	8′ 0″

Local Plotting Facilities

A plotting board is provided.

AMES Type 31 (CD No. 1 Mk. V). The AMES Type 41 (CD No. 1 Mk. V*) is essentially similar in appearance

Range Accuracy ± 200 yds. up to 10,000 yds.
± 500 yds. from 10,000–75,000 yds.

Bearing Accuracy ± 1°.

Range Discrimination (for two targets at same bearing) 400 yds.

Bearing Discrimination (for two targets at same range) 3°.

Little trouble from permanent echoes should be experienced if the site is well chosen.

The proposed *IFF* aerial system will have inherently poor bearing discrimination.

American Equivalent

No exact equivalent. Nearest is SCR 682—higher power, tower installation.

Relevant Instruction Manual

EMER Tels. O.462/2, War Office issue.

Communications

An Army tele-F set is provided.

Ventilation

Fan extractor. Heating facilities.

IFF Mark III

These sets are to be fitted with a double Yagi *IFF* aerial system and will use a Naval type 242 interrogator/responsor.

Frequency (Wavelength)

3,000 mc/s. (10 cms.)

Anti-Jamming Properties

The frequency and highly directive aerial system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack. The effect of *Window* on operations should only be slight.

Personnel Required to Operate and Maintain (on 3½-watch basis)

Mechanics	*Operators*
2 Other Ranks	4 N.C.O.s (1 i/c)
	8 Other Ranks

Presentation

A small 5" range tube fitted with a graduated scale is used.

Plots are obtained by turning the aerial system until the echo reaches a maximum, the bearing being read off by means of a scale and pointer geared to the rotating column. This range and bearing information can then be passed as such or converted to grid co-ordinates by the use of a local plotting board.

The proposed *IFF* design gives *IFF* signals on a separated trace below the Radar trace, the same range scale applying to both traces.

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator.

Normal source 15 KVA or 20 KVA Mk. II Lister Generator Set.

Performance

Owing to limited range and combination of narrow beam and hand turning not used for detection of aircraft. Screening must be avoided in siting. Highest sites give best performance under normal meteorological conditions.

Typical Detection Ranges on Surface Vessels :—

Detection Range for 200 ft. Site

Vessel	*Detection Range*
Large M.T.B.	28,000 yds.
"Hunt" Destroyer	44,000 yds.

TITLE OF SET :

AMES Type 37

(CD No. 1 Mark IV)

Status

In extensive use overseas as a mobile set. Production ceased. Superseded by AMES type 57 (*q.v.*).

Function

A low-power 10 cm. mobile set for detection and plotting of surface vessels.

Description

The entire equipment is housed in a wooden cabin on a 4-wheeled trailer. A double paraboloid aerial system is attached to the side of the cabin and is removable for travelling.

The Radar equipment is NT271P.

The cabin is hand-turned.

Details of the trailer are as follows :—

Weight		*Dimensions (travelling)*		
tons	*cwt.*	*Length*	*Width*	*Height*
6	12	23′ 0″	7′ 6″	12′ 0″

Local Plotting Facilities

A plotting board is provided.

Communications

An Army type tele-F set is provided.

Ventilation

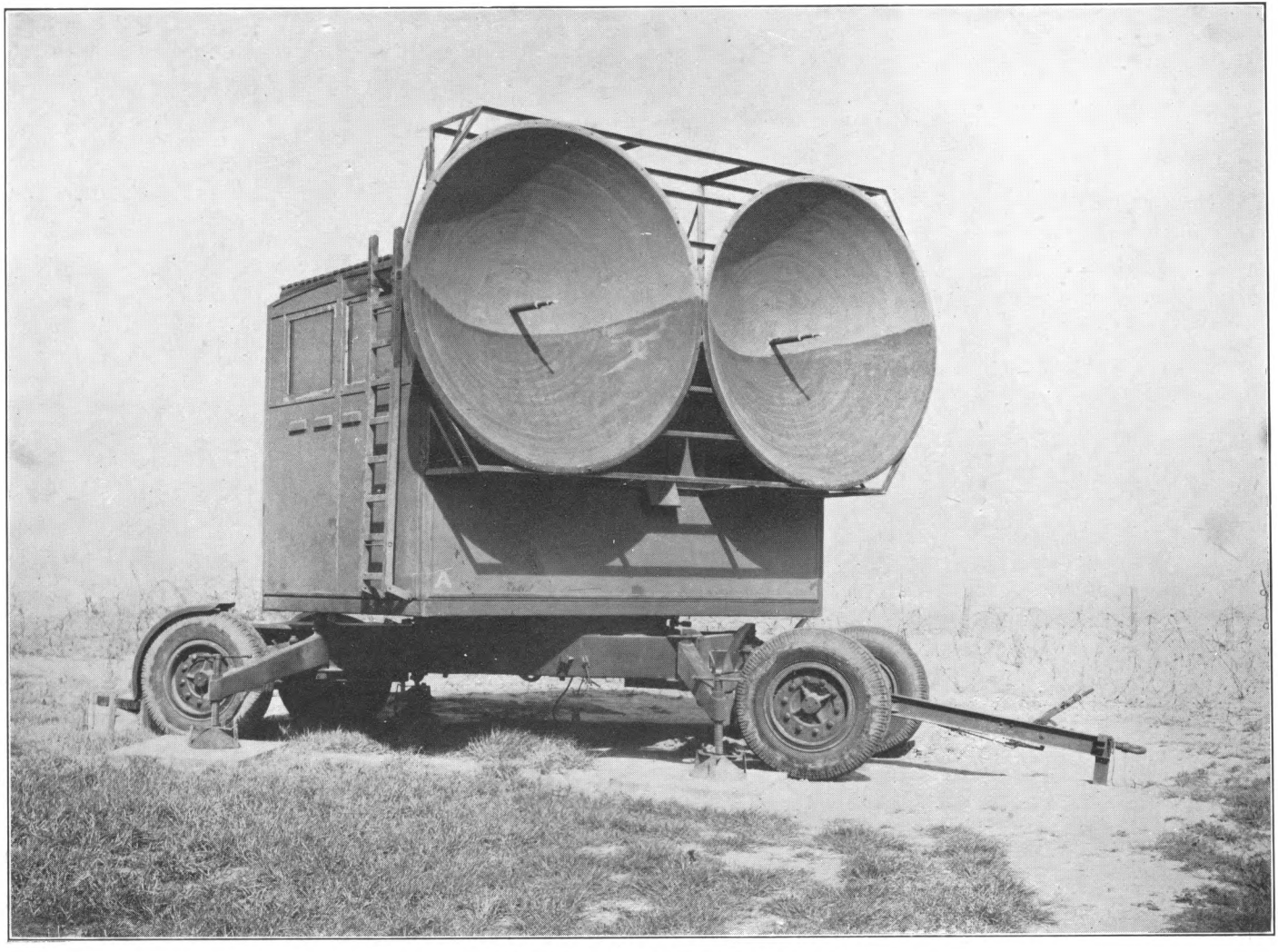
Fan extractor. Heating facilities.

IFF Mark III

These sets are to be fitted with a double Yagi *IFF* aerial system and will use a Naval type 242 interrogator/responsor.

Frequency (Wavelength)

3,000 mc/s. (10 cms.).



AMES Type 37 (CD No. 1 Mk. IV)

Anti-Jamming Properties

The high frequency and highly directive aerial system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack.

Operations can be carried on in the presence of *Window*.

Personnel Required to Operate and Maintain (on 3½-watch basis)

Mechanics	*Operators*
2 Other Ranks	4 N.C.O.s (1 i/c).
	8 Other Ranks.

Presentation

A small 5″ range tube fitted with a graduated scale is used.

Plots are obtained by rotating the cabin and aerial system until the echo reaches a maximum, the bearing being read off by means of a scale and pointer.

This range and bearing information can then be passed as such or converted to grid co-ordinates by the use of the local plotting board.

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator.
Normal source 15 KVA or 20 KVA Mk. II Lister Generator Set.

Performance

Essentially the same as AMES type 31 (*q.v.*).

Typical Detection Ranges on Surface Vessels :—

Detection Range for 200 ft. Site

Vessel	*Detection Range*
Large M.T.B.	28,000 yds.
"Hunt" Destroyer	44,000 yds.

Range Accuracy ± 200 yds. up to 10,000 yds.
± 500 yds. from 10,000–75,000 yds.

Bearing Accuracy ± 1°.

Range Discrimination (for two targets on same bearing) 400 yds.

Bearing Discrimination (for two targets at same range) 3°.

American Equivalent

No exact counterpart.

Relevant Information Manual

A.6915, War Office issue.

TITLE OF SET :

AMES Type 41
(CD No. 1 Mark V*)

Status

Production ceasing. Many sets overseas and a small number in the U.K. Is replacing low power AMES type 31.

Function

A medium power 10 cm. transportable equipment for detection and plotting of surface vessels, as for AMES type 31 but giving improved performance.

Description

Essentially similar to AMES type 31, but employing a higher power Radar equipment (NT271Q).

The cabin is the same size and weight, but is built of hard-wood.

Ventilation is somewhat improved.

IFF Mark III facilities will be similar to those for the AMES type 31.

Frequency (Wavelength)

3,000 mc/s. (10 cms.).

Anti-Jamming Properties

The frequency and highly directive aerial system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack. The effect of *Window* on operations should only be slight.

Personnel Required to Operate and Maintain (on 3½-watch basis)

Mechanics	*Operators*
2 Other Ranks	4 N.C.O.s (1 i/c).
	8 Other Ranks.

Presentation

A small 5" range tube fitted with a graduated scale is used. Plots are obtained by turning the aerial system until the echo reaches a maximum, the bearing being read off by means of a scale and pointer geared to the rotating column. This range and bearing information can then be passed as such or converted to grid co-ordinates by the use of a local plotting board.

The proposed *IFF* design gives *IFF* signals on a separated trace below the Radar trace, the same range scale applying to both traces.

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator.

Normal source 15 KVA or 20 KVA Mk. II Lister Generator Set.

Performance

Main difference compared with AMES type 31 is increase in detection ranges.

Typical Detection Ranges on Surface Vessels :—

Detection Range for 200 ft. Site

Vessel	*Detection Range*
Large M.T.B.	35,000 yds.
" Hunt " Destroyer	51,000 yds.

American Equivalent

No exact counterpart. Nearest equivalent SCR-682 (tower installation, higher power).

Relevant Instruction Manual

EMER Tels O.412, War Office issue.

TITLE OF SET :

AMES Type 50

Admiralty title NT277S. Admiralty static high power 10 cm. station

Status

In production in small quantities for use in the U.K. and Overseas.

Function

High power 10 cm. static set used in established coastal areas for detection and plotting of surface vessels and very low flying aircraft.

Description

All equipment is contained in a brick or concrete structure. A 15′ × 2½′ "cheese" aerial system is used, being fixed at zero elevation and mounted on the roof of the structure.

The Radar equipment is NT277A.

The turning gear is power operated, rotating the aerial system at speeds up to 6 r.p.m. with inching facilities, and has the ability to automatically sweep over a pre-set arc.

Local Plotting Facilities

A plotting board and associated equipment are provided.

Communications

Telephone, R/T, or W/T facilities depending on local requirements.

Ventilation

Dependent on whether the station is to be installed in temperate, tropical or Arctic areas.

IFF Mark III

The aerial system is fitted below the main "cheese" aerial and a Naval type 242 interrogator/responsor is employed.

AMES Type 50 (NT277S)

Typical Detection Ranges on Surface Vessels :—

Detection Range for 200 ft. Site

Vessel	*Detection Range*
Large M.T.B.	38,000 yds.
" Hunt " Destroyer	55,000 yds.

Range Accuracy ± 200 yds. up to 10,000 yds.
± 400 yds. from 10,000 yds. upwards.

Bearing Accuracy ± 1° or better.

Range Discrimination (for two targets at same bearing) 400 yds. but worse using long range scale.

Bearing Discrimination (for two targets at same range) 1.5°.

American Equivalent

MEW and SCR 615A.

Relevant Instruction Manuals

H.525, H.525A and R.H.527, Admiralty issues.

Remarks

See data sheet on AMES type 52.

Frequency (Wavelength)

3,000 mc/s. (10 cms.).

Anti-Jamming Properties

The frequency and highly directive system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack.

Operations can be carried on in the presence of *Window*.

Personnel Required to Operate and Maintain (on 3½-watch basis)

1 Technical Officer.

Mechanics	*Operators*
1 N.C.O.	1 N.C.O.
	8 Other Ranks.

Presentation

A small 5″ range tube and one 9″ PPI are provided, the latter for reporting and tracking of targets.

The *IFF Mark III* signals are displayed on a separated trace on the range tube.

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator.

Normal source two 15 KVA Lister Generator Sets, with one as standby.

Performance

Power turning overcomes limitation of hand-turned sets regarding missing of low flying aircraft, and assists in early detection of surface vessels.

Usually restricted in azimuth by adjacent land masses on coastal sites. An average site should give good cover over about 120°.

Highest sites give the best performance under normal meteorological conditions.

Little trouble from permanent echoes should be experienced if the site is well chosen.

Very low flying aircraft can be detected at a range slightly over the optical horizon.

Limited range for aircraft with coastal site is about 80 miles, this is not normally attained on very low flying aircraft due to horizon limitation.

No height finding facilities.

TITLE OF SET :

AMES Type 52 and Type 56

Static high power 10 cm. stations

Status

AMES type 52 is standard U.K. static high power 10 cm. early warning station. Type 56 is a typical tower installation, two of which are under construction in the U.K. and one Overseas. Other types in high power 10 cm. AMES types 50-56 series also exist in small numbers in U.K., some being ground stations as AMES type 52 and others tower installations as AMES type 56.

Function

High power 10 cm. static sets used in well-established coastal areas for detection and plotting of surface vessels and very low flying aircraft, operating with continuous rotation. Can be used for low and medium flying aircraft if no other Radar cover available for these.

AMES type 56 and other tower installations used when only low sites are available, in order to raise height of aerial system and improve cover.

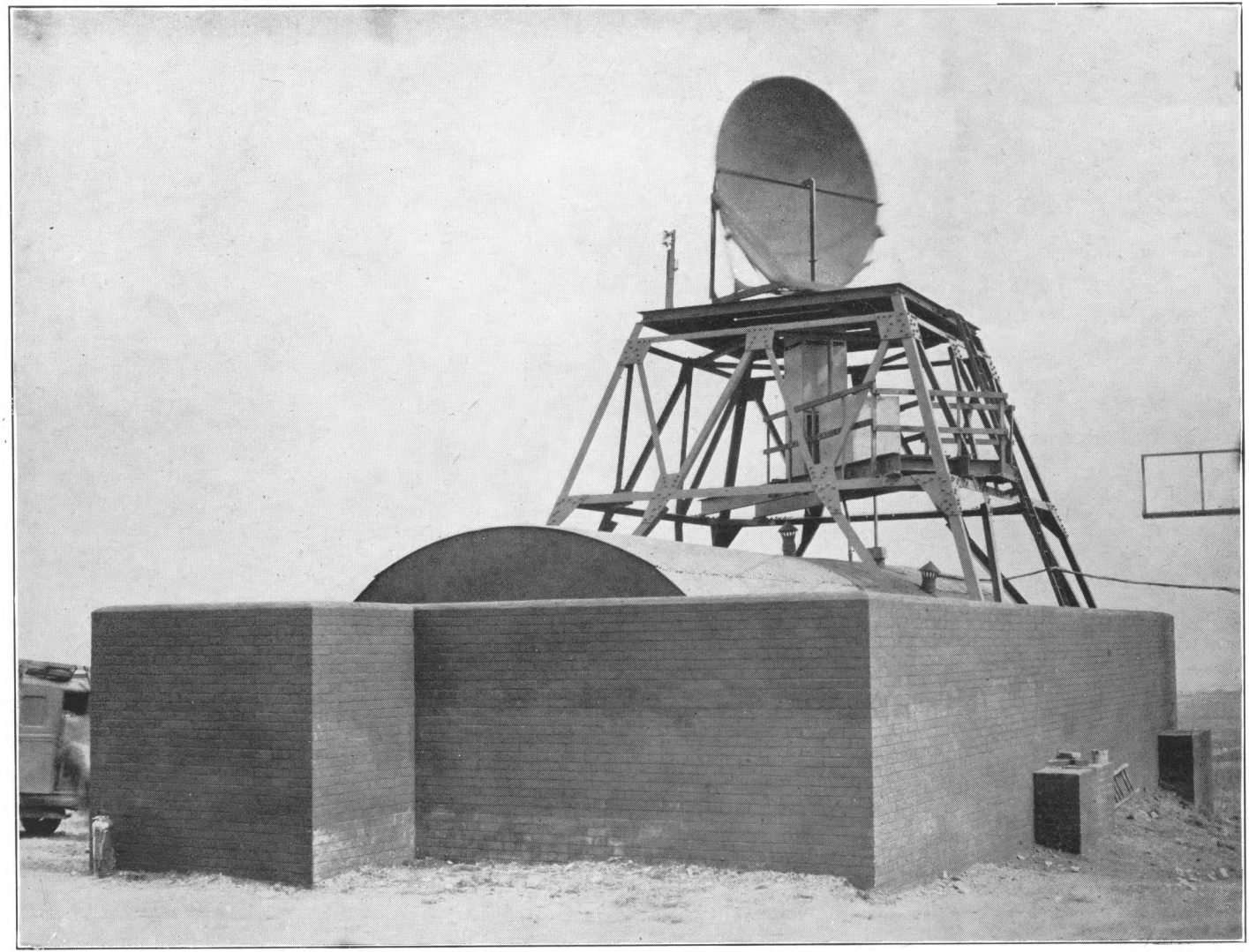
Description

AMES type 52

All equipment and operations room contained in full Nissen hut. This is straddled by 21′ steel gantry on which is carried a 10′ paraboloid aerial system. The transmitter cubicle is divided off from the operations room.

The Radar equipment is basically NT277A.

The aerial system is fixed at zero elevation and power turned at speeds up to 6 r.p.m., with inching facilities, being controlled from a control unit in the operations room.



AMES Type 52 with Blast Wall round Operations Hut

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator. Normal source mains or 20 KVA Mk. II Lister Generator.

Performance

Power turning overcomes limitation of AMES type 57 (14 Mark II) regarding missing of fast low flying aircraft.

Usually restricted in azimuth by adjacent land masses on coastal sites. An average site should give cover over about 120°.

Highest sites give best performance under normal meteorological conditions, hence the use of tower installations on low sites.

Very low flying aircraft can be detected at a range slightly over the optical horizon.

Limiting range on aircraft for coastal site is about 130 miles, this not normally being attained on very low flying aircraft due to horizon limitation.

No height finding facilities.

Typical Detection Ranges on Aircraft :—

Height of Aircraft in ft.	*Detection Range (statute miles) 200 ft. Coastal Site*
500	28
1,000	50
10,000	130
15,000 (limit of cover)	110

Typical Detection Ranges on Surface Vessels :—

Vessel	*Detection Range for 200 ft. Site*
Large M.T.B.	41,000 yds.
"Hunt" Destroyer	57,000 yds.

Range Accuracy ± 200 yds. up to 10,000 yds.
± 500 yds. from 10,000 upwards.

Bearing Accuracy ± 1°.

Range Discrimination (for two targets on same bearing) 400 yds. but worse using long scale range.

Bearing Discrimination (for two targets at same range) 2°.

Little trouble from permanent echoes should be experienced if the site is well chosen.

AMES type 56

Here the same operations room Radar equipment and turning gear is used, but the aerial system is mounted on a 240′ wooden AMES type 5 tower, truncated to a suitable height.

Other types in AMES 50-56 series use various forms of ground and tower installation, and in some cases different turning gear. All types use NT277A Radar equipment.

Local Plotting Facilities

Usually two plotting boards are provided.

Communications

Standard telephone facilities.

Ventilation

Forced air with filters. Heating facilities.

IFF Mark III

For the AMES type 52 and other ground stations it is proposed to fit an 8-bay broadside array with " split " facilities to the paraboloid. A design for the tower stations is not yet finalised.

Frequency (Wavelength)

3,000 mc/s. (10 cms.).

Anti-Jamming Properties

The high frequency and highly directive aerial system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack. Operations can usually be carried on in the presence of *Window*.

Personnel Required to Operate and Maintain (on 3½-watch basis)

Mechanics	*Operators*
2 N.C.O.s	4 N.C.O.s (1 i/c)
2 Other Ranks.	15 Other Ranks.

Presentation

A 5″ range tube and two 9″ PPI's are provided, one each of the latter for air and surface reporting respectively. The *IFF Mark III* signals will be displayed on a separated trace on the range tube.

American Equivalent

MEW. Gives greater ranges.

SCR 615A. Has also height finding facilities. The SCR 615A is a static 10 cm. set with a tower-mounted paraboloid aerial system, the display systems being contained in a building not provided with the equipment at the base of the tower. The set requires a 60 cycle 3 phase 4 wire power supply (120v. phase voltage).

Compared with the AMES static 10 cm. stations, it gives similar maximum ranges. It has, however, an additional height finding facility, reading heights down to 2°, and is provided with accurate ranging giving an accuracy of 150 yds. It has no *IFF Mk. III* facilities.

Relevant Instruction Manual

In preparation. No reference number yet allotted.

Remarks

See data sheet on AMES type 50.

TITLE OF SET :

AMES Type 57—UK

AMES Type 14 Mark II—Overseas

Admiralty title NT 277T

Status

In production and in use in U.K. and overseas in small quantities. Will be superseded by AMES type 14 Mks. III and IV.

Function

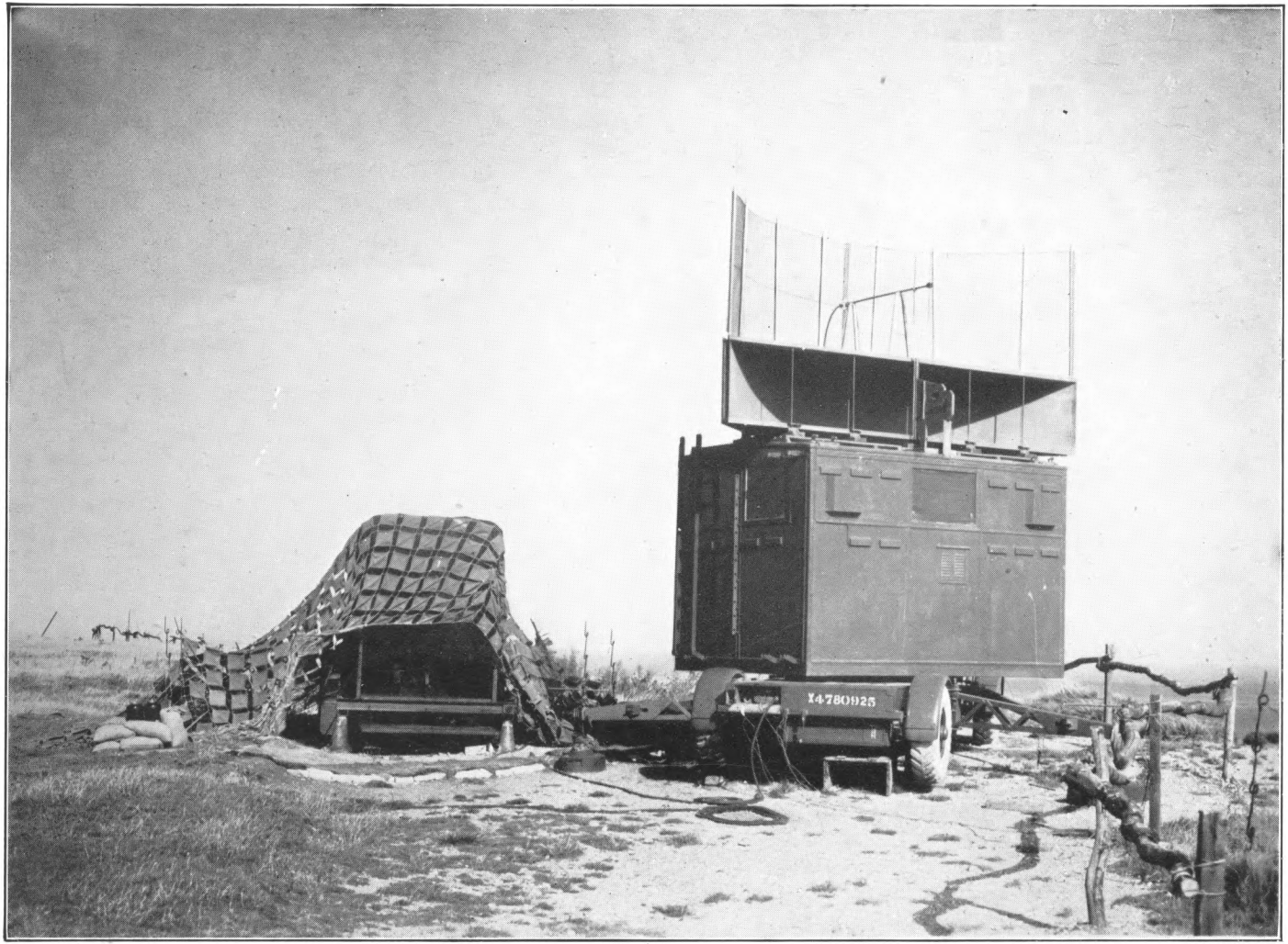
A high-power 10 cm. mobile set for the detection and plotting of very low flying aircraft and surface vessels.

Description

The complete equipment is housed in a wooden cabin, turntable-mounted on a four-wheeled trailer.
The aerial system comprises a waveguide-fed horizontal " cheese " fixed to the cabin roof.
The Radar equipment is NT277A.
The whole cabin is rotated by hand.
The technical vehicles are as follows :—

Vehicle	*Weight*		*Dimensions (travelling)*		
	tons	*cwt.*	*Length*	*Width*	*Height*
Set trailer (RV431)	7	6	25′ 0″	7′ 10″	13′ 6″
2 Power unit prime movers (RV456) ...	7	4	22′ 5″	7′ 4″	8′ 6″

A " Matador " or equivalent towing vehicle is required for this set.



AMES Type 57 (14 Mk. II), showing obsolescent IFF Mk. III Aerial system mounted above Radar "cheese" Reflector

Performance

Hand-turning is a limitation for aircraft detection as these can be missed during slow sweep, and also if many stops made for counting surface vessels.

Screening of operational sector must be avoided in siting.

Highest sites give best performance under normal meteorological conditions.

Little trouble from permanent echoes should be experienced if the site is well chosen.

Very low flying aircraft can be detected at a range slightly over the optical horizon, but see previous remarks. Limiting range on aircraft is about 80 miles, this not normally being attained on very low flying aircraft due to horizon limitation.

Typical Detection Ranges on Surface Vessels :—

Vessel	*Detection Range for 200 ft. Site*
Large M.T.B.	41,000 yds.
"Hunt" Destroyer	57,000 yds.

Range Accuracy ± 200 yds. up to 10,000 yds.
± 400 yds. from 10,000 yds. upwards.

Bearing Accuracy ± 1°.

Range Discrimination (for two targets at same bearing) 400 yds., but worse using long range scale.

Bearing Discrimination (for two targets at same range) 1·5°.

The proposed *IFF Mk. III* aerial system will have good bearing discrimination.

American Equivalent

SCR 582 Mk. III truck-mounted set—lower power.

Relevant Instruction Manual

Handbooks H.525 and H.525A, Admiralty issue ; C.D.0474B, Air Ministry issue.

Local Plotting Facilities

A plotting board is provided.

Communications

Telephone facilities are not provided, but an R.A.F. Wireless Set No. 20 is provided with R.A.F. overseas convoys, and similar provision is made with Naval convoys.

Ventilation

Intake fan. Heating facilities.

IFF Mark III

The present *IFF* aerial system employs a chicken-wire reflector and is mounted above the radar " cheese " aerial. An improved 12 bay array which fits on the cabin side is replacing this system.

Frequency (Wavelength)

3,000 mc/s. (10 cms.).

Anti-Jamming Properties

The high frequency and highly directive aerial system of this set will make jamming difficult, but cover will be definitely restricted in the event of a concentrated jamming attack.

Operations can be carried on in presence of *Window*.

Personnel Required to Operate and Maintain (on 3½-watch basis)

Mechanics	*Operators*
2 N.C.O.s (1 i/c)	4 N.C.O.s
2 Other Ranks	11 Other Ranks

Presentation

A small 5" range tube fitted with a double graduated scale, and a 9" PPI are provided, the PPI coils being driven mechanically from the hand-turning control.

Plots are obtained by turning the aerial system until the echo reaches a maximum on the range tube. The bearing can then be read off by means of a scale and pointer geared to the rotating column, and the range from the range tube.

The PPI provides information directly in the form of grid co-ordinates, and is normally used for plotting, the range tube being employed for counting and identification.

IFF Mk. III signals are displayed on a separated trace below the Radar trace, the same range scale applying to both traces.

Power Supply

Requires 230v. 50 cycles single phase, converted to 180v. 500 cycles by motor alternator.
Normal R.A.F. source 20 KVA Mk. II Lister Generator Set.
Normal Naval source 15 KVA Lister Generator Set.

TITLE OF SET:

AA No. 3 Mark II (GL III)

Status

In general use in U.K. and abroad.

Function

Mobile equipment for accurate fire control of HAA Artillery. Transmits continuous measurements of range, bearing and elevation of aircraft to predictor.

Description

Steel cabin on four-wheeled trailer housing a fixed presentation unit, and a rotor unit capable of rotation about a vertical axis. Above the cabin the rotor unit supports two paraboloids capable of rotation about a horizontal axis.

Standard fire control set for Mobile HAA Regts. with the Field Force.

Equipment has limited searching ability owing to narrow beam.

Radar, AA, No. 4, Mk. III, normally provided as putting-on set.

Special employment for CA/AA dual role weapons.

No special siting requirements.

Transmitter peak power output to be raised by introduction of type CV120 or CV232 magnetron.

Time into action : 20 mins. from Halt.

Details of the vehicle are as follows :—

Weight		*Dimensions (travelling)*		
tons	*cwt.*	*Length*	*Width*	*Height*
9	10	28′ 0″	9′ 4″	11′ 10″

Radar AA No. 3, Mk. II

Performance

Maximum Detection Range (Medium Bomber) 27,000 yds.
Range Output Accuracy ± 25 yds. up to 36,000 yds.
Range Output Smoothness 25 yds. (Average error variation between successive readings at 2 secs. time intervals.)
Bearing Output Accuracy 10 mins.
Bearing Output Smoothness 10 mins. (Average error variation between successive readings at 2 secs. time intervals.)
Elevation Output Accuracy 10 mins.
Elevation Output Smoothness 10 mins. (Average error variation between successive readings at 2 secs. time intervals.)
Discrimination Range, 250 yds. ; Angle, 4°.

American Equivalent

SCR 584 ; SCR 545.

Relevant Instruction Manual

A6373, War Office issue.

Towing Vehicle :—Artillery tractor (AEC Matador).

All data is automatically transmitted by high-speed and low-speed Magslip equipment.

Turning Gear : Rotor turned in bearing by hand-operated power Selsyn ; maximum rate 10°/sec.

Controlled Power turning (Slewing) to give up to 18°/sec. to be fitted.

Paraboloids moved in elevation by hand-operated power Selsyn ; maximum rate 10°/sec. ; limits—5° to 95° elevation.

Communications

Telephone communication to the Fire Command Post is normally provided.

Ventilation

Forced air with filtering and heating facilities.

IFF Mark III

Identification normally associated Radar, AA, No. 4, but *IFF* units to be fitted to provide separate means of identification if required.

Frequency (wavelength)

2,750-2,855 mc/s. (10.8-10.6 cms.).

Anti-Jamming Properties

H.F. band stop filter fitted. High operational frequency and angular discrimination result in low susceptibility to jamming. Operations can usually be carried on in the presence of *Window*.

Personnel Required to Operate

Four : one for technical adjustment and one each for range, bearing, and elevation.

Presentation

Range : Two range tubes giving coarse and fine range respectively on horizontal time base. Target selected by strobe on coarse range tube and range determined by setting target echo to crosswire on fine range tube by handwheel.

Bearing and Elevation : Side-by-side display of vertical echoes which are matched by operation of handwheel.

Power Supply

230v. 50 cycles single phase A.C., converted to 230v. 420 cycles single phase A.C. by alternators on Radar trailer.

Normal Source : 15KVA Lister Generator.

TITLE OF SET :

CA No. 1 Marks II, II* and III*

Status

In general use in U.K. and abroad.

Function

A 10 cm. static set for control of Coast Artillery. The Mk. II sets are of low power, and are being converted to medium power (indicated by the star in the nomenclature).

Description

The equipment, which consists of a separate transmitter, receiver-presentation unit and monitor receiver, is housed in a concrete building above which is mounted the rotating aerial system. In the Mk. II and II* stations the aerial system is supported on a steel gantry ; in the Mk. III* stations the turning gear is lighter, and the aerial turntable is mounted directly on the roof of the building.

Standard CA fire control set.

Radar equipment employed is Naval type 271P in Mk. II, and 271Q in Mk. II* and III* stations.

Aerial system may be mounted on 60′ steel tower at low-lying sites where operationally necessary.

All data automatically transmitted by high-speed and low-speed magslip equipment through a displacement corrector.

The aerial system is driven by an oil motor with hand-controlled sweeping. Separate mechanical turning is available.

Communications

Telephone communication to the Fire Command Post is normally provided.

Ventilation

Forced air with filtering and internal heating facilities except in U.K.

IFF Mark III

Naval type 242 units, with double Yagi aerial system mounted on main aerial assembly, are fitted when required. Identification normally provided by associated CA No. 2 equipment.

Frequency (wavelength)

2,970-3,030 mc/s. (10.1-9.9 cms.).

Anti-Jamming Properties

No A-J devices fitted.

Operations should be little affected by *Window*.

Personnel Required to Operate

Three : one N.C.O. i/c, and two operators, one each for range and bearing. Normal establishment :—3 N.C.O.s and 7 Other Ranks, plus 1 REME mechanic.

Presentation

Range : C.R. Tube, with echoes on spiral time base. Target selected and range determined by moving cursor to echo by handwheel.

Bearing : C.R. Tube, with side-by-side display of vertical echoes which are matched by operation of handwheel.

Power Supply

230v. 50 cycles single phase A.C., converted to 180v. 500 cycles single phase by motor alternator.

Normal Source : Supply mains or 15 KVA Lister Generator.

Performance

Maximum Detection Range with set 200 ft. above M.S.L. :—

Mk. II—20,000 yds. on M.T.B. 32,000 yds. on Destroyer.

Mks. II and III**—25,000 yds. on M.T.B. 40,000 yds. on Destroyer.

(Ranges considerably increased under abnormal meteorological conditions.)

Range Output Accuracy ± 50 yds. from 2,000 yds. to 36,000 yds.

Range Output Smoothness 25 yds. (Average error variation between successive readings at 10 secs. time intervals.)

Bearing Output Accuracy ± 10 mins., through 360° in Mk. II ; 320° in Mks. II* and III*.

Bearing Output Smoothness 7.5 mins. (Average error variation between successive readings at 10 secs. time intervals.)

Discrimination Range, 200 yds. ; Bearing 3°.

American Equivalent

SCR 296.

Relevant Instruction Manual

Mks. II* and III* A7164, War Office Issue.

TITLE OF SET :

CA No. 2 Marks I and I*

Status

In general use in U.K. and abroad.

Description

This equipment is identical with the AMES type 31 (CD No. 1 Mk. V) and AMES type 41 (CD No. 1 Mk. V*) (*q.v.*).

Personnel Required to Operate

Normal establishment : 2 N.C.O.s and 4 Other Ranks plus 1 REME mechanic.

American Equivalent

SCR 582, SCR 682.

CA No. 1 Mk. 11*

CA No. 1 Mk. III*