

Nevertheless the set has serious drawbacks which have led to the decision to replace it with 960. These drawbacks are as follows:

- (a) Unreliability as the result of poor design and the fact that it has been altered and modified continuously during the war without any single end in view.
- (b) Easily jammed by enemy countermeasures.
- (c) Beam width too wide for convenient use with PPI.

3 960 This is the latest airguard set and is to replace 79 and 281 in all cruisers and larger ships. The wavelength is the same as for 281 namely 3.5 metres but can be quickly varied over a narrow band to avoid attempts at jamming.

Owing to the wavelength used, it will not have good low cover and the remarks on 281 in this respect also apply to this set.

Its main features are as follows:

- (a) Long range of detection - approaching 200 miles depending on the height of the target.
- (b) Beam width. When fitted to carriers this set will have a large mattress aerial which will confine the beam to about 17° .

When fitted to other ships a simpler aerial will be fitted giving a beam width of 35° as with 281.

- (c) Range discrimination. Pulse length will normally be about one mile reducible to half a mile for skiatron display.

- (d) Speed of aerial rotation Normally 4 rpm which can be increased to $7\frac{1}{2}$.

This set will be fitted with a modern display unit and control panel called "Universal display unit - UDU" and will be operated with types 980 and 981 in carriers when used for directing aircraft.

SEAGUARD

271/2/3 PQ obsolescent
277
277Q
268

TYPES 271/3

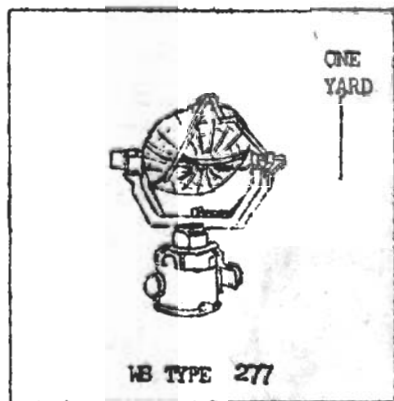
These sets first fitted in escort vessels for A/S work and later in larger ships are the parent sets of modern naval radar. They have now been superseded by the more powerful 277 (or 293) but many are still at sea. They all have hand rotated aerials.

5 TYPE 277

The standard seaguard set fitted to some escort vessels and all ships larger than destroyers. It is powerful and reliable and will give echoes from surface targets within horizon range and low flying aircraft.

Its principle features are:

- (a) Wavelength 10 cms.
- (b) Beam width 5° in both vertical and horizontal planes.
- (c) Aerial stabilized in azimuth and elevation.
- (d) Discrimination 300 yards in range (short pulse 75 yards).
- (e) Beam can be elevated for measuring the height of an aircraft, provided that the aircraft has an angle of sight greater than 4° and less than 40° and not more than 25 miles away. Its use in this respect is makeshift and of little value.
- (f) Displays "A" PPI and sector selector with provision for obtaining accurate ranges.
- (g) Aerial speed of rotation continuously variable from 0-15 rpm.



6

TYPE 268

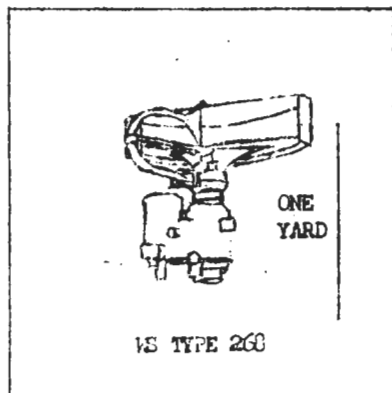
A small ship set of Canadian design and manufacture operating on a wavelength of 3 cms. Its principal value lies in its narrow beam width and short pulse length which gives an excellent land picture and discrimination between targets close together.

When fitted low its range is very frequently extended by a semi-permanent refracting atmospheric layer at about 30-40 feet.

It is to be fitted to all classes of ships as a navigational set. It is also being fitted to merchant ships.

Its principle features are:

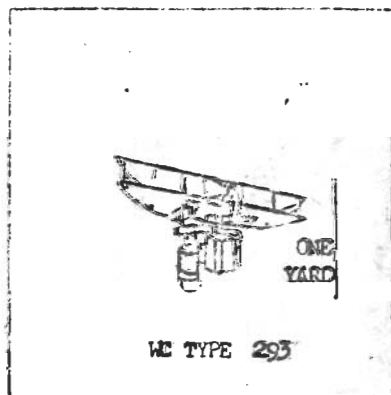
- (a) Wavelength 3 cms.
- (b) Small aerial.
- (c) Light weight of set.
- (d) Discrimination about 75 yards in range: beam width 2° .
- (e) Displays "A" and PPI.
- (f) Aerial is not stabilized.
- (g) Electrically very complicated.
- (h) Badly designed for maintenance.



POINTER The pointer set is type 293 fitted with a Target Indication Unit.

Basically the set is the same as 277 but the aerial is different and produces a beam $2\frac{1}{2}^{\circ}$ wide in the horizontal plane and about 30° in the vertical. Thus targets both on the surface and in the air will be detected but its range is not greater than about 15 miles.

The set is fitted in fleet destroyers where it combines seaguard and pointer duties and as an additional set in larger ships.



Principle features are:-

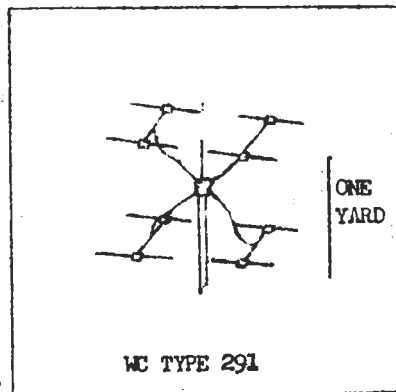
- (a) Wavelength 10 cms.
- (b) Air and surface cover 12-15 miles.
- (c) Lightweight aerial not stabilized.
- (d) Aerial speed of rotation $7\frac{1}{2}$ or 15 rpm.
- (e) Displays "A", PPI and sector selector with provision for obtaining accurate ranges.

SMALL SHIP SETS

7 TYPE 291

This is a small combined air and surface warning set suitable for trawlers, coastal forces craft and destroyers. It gives moderately good cover. A destroyer fitted with it would detect a battleship at 17,000 yards and aircraft at about 30 miles provided the aircraft was not too low. Its main features are as follows:

- (a) Wavelength $1\frac{1}{2}$ metres.
- (b) Light weight aerial and small compact set.
- (c) Discrimination two hundred yards in range: beam width about 35° .
- (d) Poor PPI picture.
- (e) Set is unsuitable for aircraft plotting or directing.



8 TYPE 970

A makeshift 10 centimetre set developed from the RAF. H2S. It gives a good PPI picture but poor range. It was fitted in a large number of invasion craft.

9 TYPE 267

A submarine set having two transmitters, one similar to 268 for surface warning and one similar to 291 for air warning. Echoes from both units are switched at will to the same PPI thus giving a combined picture.

GUNNERY

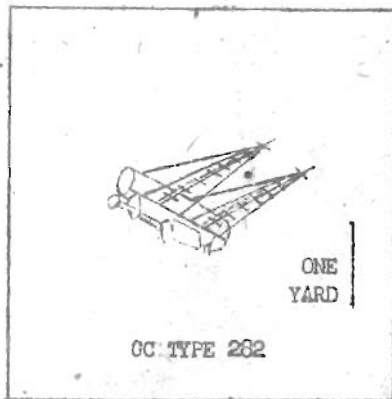
282/M/P	}	obsolescent
283		
284/M/P		
285/M/P		
274		
275		
262		
931		

10 TYPE 282 VARIETIES

All the 282/5 types of set operate on a wavelength of half a metre. This gives moderately good coverage but the wavelength is too long for full horizon coverage. For this reason all these sets were doomed the moment 10 centimetre radar appeared.

TYPE 282 - A close range set for use with pom-pom and bofors guns. Provides bearing and range but not angle of sight. Will eventually be replaced by type 262.

TYPE 283 - A barrage set for firing an automatic fixed range barrage with main armament. Will eventually be replaced.

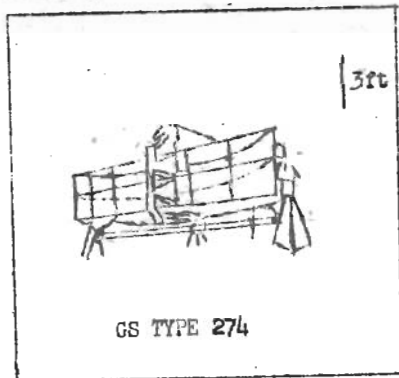


TYPE 284 - Main armament set providing range and bearing. It is in this set that the limitation of range made itself most felt as it was inadequate for a capital ship and barely adequate for a cruiser. Will be replaced by type 274.

TYPE 285 - High angle armament set providing range and bearing but not angle of sight. Will eventually be replaced by type 275.

11 TYPE 274 - A "10 centimetre" main armament set for battleships and cruisers. It provides good range and good range and bearing accuracy. Its principal features are as follows:-

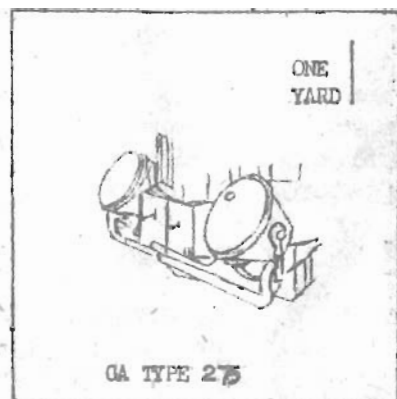
- (a) Wavelength 9 cms.
- (b) Range accuracy 15 yards approx.
- (c) Bearing accuracy 3 minutes.
- (d) Bearing display panel fitted in TS.
- (e) Splash observation display making spotting for range possible. Spotting for line is not accurate although it is possible to see which side of the target the shot falls. Eventually type 931 will be fitted with 274 for spotting.
- (f) Range discrimination about 100 yards.
- (g) Beam width $1\frac{1}{2}^{\circ}$; bearing discrimination 3° .



12 TYPE 275

A "ten centimetre" high angle
 armament set for destroyers and above
 giving range, bearing and angle of sight.
 Its principal features are as follows:

- (a) Wavelength 9 cms.
- (b) Range accuracy 15 yards approx.
- (c) Bearing and elevation accuracy
 10 mins.
- (d) Director training and elevating
 controlled by radar operator by
 remote power control.
- (e) Owing to the narrow beam of the
 set (6° approx.) it requires a
 TIU and 293 to put it on the
 target.



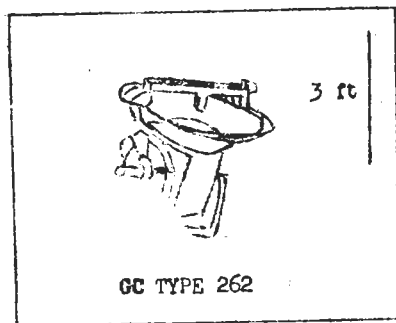
13 TYPE 262

A 3 centimetre set for close range weapons which operates an auto following director. It gives accurate range, bearing and elevation. The set forms an integral part of the gun mounting or director with which it is fitted. Its principal features are as follows:-

- 1 Wavelength 3 cms.
- 2 It will search 15° either side of an indicated bearing from 0° to 90° in elevation over a range of 1500 yards i.e. 750 yards either side of an indicated range.
- 3 Set "locks on" when the target is detected.

14 TYPE 931

This is a spotting set for use with 274. It operates on a wavelength of $1\frac{1}{2}$ cms. and produces a picture of very fine resolution. In operation its beam is switched rapidly in a small arc across the target. Display is by B-scope and errors in both range and bearing of splashes can be read off directly from the display. None of these sets have yet been fitted.



FUTURE DEVELOPMENTS

15 AEW

A system of airborne early warning is projected by which an aircraft operating with a ship will relay the radar picture obtained in the aircraft to the ship. The range expected from an aircraft flying at 20,000 is about 170 miles. This is in the very early stages of development at present.

16 980/1

These two sets are designed to be fitted in carriers to operate with 960 for Fighter Direction purposes.

980 is a ten centimetre close range airguard set with a beam width of $1\frac{1}{2}^{\circ}$ in the horizontal plane and about 40° in the vertical providing coverage to a range of 60 beyond the horizon and a height of 40,000 feet. The display from this set will be that normally used for aircraft directing as the picture will be much sharper and clearer than 960 which has a much greater beam width and pulse length. 960 will then be used purely for long range warning.

981 is a long range narrow beam set intended for height finding by measurement of angle of sight. Its beam width is expected to be about 2° in both planes and its range for heightfinding about 60 miles.

The aeriels for 980 and 981 weigh about 12 tons each and the sets are only intended for fitting in carriers. Fleet-carriers will have two each.

17 GUNNERY

The 274 and 275 meet staff requirements in range, bearing and heightfinding and development is expected to proceed in the direction of auto-following for all classes of armament. A system known as IRS (Long range system) is being developed for HA armament. The radar problem here is simpler than the problem of obtaining non-hunting auto-following machinery.

18 NAVIGATIONAL SET

Development is proceeding with the design of a set for navigational purposes for the merchant service. It will have a pulse length of about 75 yards and a beam width of 1° and is expected to give an accurate picture of land echoes. Its wavelength is expected to be three centimetres. Provision will be made for projection of an image of the PPI Picture onto the chart.

19 IMPROVEMENTS

Expected improvements in design have been referred to on earlier pages and include, shorter pulse lengths, narrower beam widths, better aerial control, anti-jamming circuits, better display panels, discrimination between fixed and moving targets.

Chapter VI

LIST OF NAVAL RADAR SETS & THEIR USES

CLASSIFICATION:

WA	...	...	Warning of Aircraft
WS	...	...	Warning of Surface Craft
WC	...	...	Warning Combined (aircraft and surface)
WCH	...	...	Warning combined with Heightfinding
GS	...	...	Gunnery Surface
GA	...	...	Gunnery Aircraft
GC	...	...	Gunnery Close Range
GB	...	...	Gunnery Barrage
TI	...	...	Target Indication
INT	.....		Interrogator
IRT	...	...	Interrogator Responder Transponder
TPD	...	...	Transponder
IFF	...	...	IFF Set
BCN	...	...	Radar Beacon
GCA	...	...	Ground Control Approach
+	...	...	Signifies under development or experimental

Type No	Class of Set	Where Fitted	Remarks
79/B 242	WL INT	Cruisers and above Ships fitted with types 271/2/3/5, 291; also with 277/293 when 242M is not available.	Mk. III System
242M	INT	Ships fitted with 277/293.	Mk. III System superseding 242.
242P	INT	With 277 in ships fitted with 960 & 277; with 960 in ships fitted with 960 & 980.	
243	INT	Ships fitted with 79/B or 281/B	Mk. III System 243Q replaces 243 with 281/B
243M	INT	Ships fitted with 279/B	Mk. III System
243Q	INT	Ships fitted with 281/B	Mk. III System (A-band) Fitted in conjunction with 941
244	INT	Ships fitted with US type SG or SL	Mk. III system
249	-	-	Recording equipment
251M	BCN	Cruisers and above and certain light craft	
251MS	BCN	Shore Stations	
251P	BCN	Certain Aircraft Carriers	Used with "Lucero"
253	IFF	All HM Ships	Mk. III System
253P	TFD	All HM Ships	Mk. III System with coding (IFF & BCN)

Type No	Class of Set	Where Fitted	Remarks
253PS	TFD	Lighthouses	Mk. III System with coding (IFF & BCN)
253MW	TFD	Submarines	Mk. III System with coding (IFF & BCN)
253S	IFF	Lighthouses	Mk. III System (IFF)
255	BCN	Launched from surface ships ML's etc.	Marker buoy for Landing operations (BCN)
255M	BCN	Launched from submarines	Marker buoy for Landing Operations
256	BCN	Shore Stations	
257/M	BCN	Carriers	Aircraft Homing (no longer to be fitted)
257S/MS	BCN	Shore Stations	Aircraft Homing
262(1)	GC	STAAG Mountings	
262(2)	GC	CRBF Directors	
262(3)	GC	CRSI Directors	
262(4)	GC	BUSTER Mountings	
263(1)	GC	MRSI Director	
267W(1)	WC	Submarines ("T" Class)	
W(2)			
267W	WC	Submarines ("T" & "A" Class)	
+267PW	WC	Submarines ("T" & "A" Class)	
267QW	WC	Submarines ("S" Class)	
268/M	WS	Capital Ships	
268/MU	WC	Coastal Craft	
271P/PR	WS	Destroyers and below	
271Q	WS	Destroyers and below	Supersedes 271P/PR
271QR	WS	Destroyers and below	

Type No	Class of Set	Where Fitted	Remarks
272P/PR	WS	Cruisers and above	
273	WS	Shore Stations	
273P/PR	WS	Cruiser and above	
273PS	WS	Shore Stations	
273Q/QR	WS	Cruisers and above	Supersedes 273P/PR
273QS	WS	Shore Stations	Supersedes 273PS
274	GS	Cruisers and above	Supersedes 184
275	GA	Cruisers and above; certain Destroyers with Mk. VI Directors	For AA/S Surface
277/P	WS	Corvettes and above	
277Q	WS	Cruisers and above	Supersedes 277P
277L	WS	Issue to Ministry of Supply (Arty use)	
277AM	WS	Issue to Air Ministry	
277F	WS	Ships set adapted for Shore Stations	
277S	WS	Fixed Naval Service ashore	
277T	WS	Mobile Naval Service ashore (vans)	
279/B	WA	See under 79/B	
281/B	WA	Cruisers and above	Being replaced by 281BP/BQ
281BP/BQ	WA	Cruisers and above	
282M3/4	GC	Sloops and above with Bofors Mountings or Pom-Pom Dir's	

Type No	Class of Set	Where Fitted	Remarks
282P/P1	GC	Sloops and above with Pom-Pom Directors	Supersedes 282M3/4
282P2	GC	Sloops and above with Bofors Mountings	
283	GB	Cruisers and Capital Ships	With ABU Mk.I
283M	GB	Cruisers and Capital Ships with CPUI	
284M3/M4/ P3/P4	GS	Cruisers and above in conjunction with main armament	For close range analysis
285M3/M4/ P3/P4	GS	Ships fitted with AA or AA/ Surface Guns	
285Q	GA	Destroyers fitted with "K" DCTs only	
288	GC	AA Training Centres	
291/M	WC	Destroyers and below	
291U	WC	Coastal Craft	Measurement of muzzle velocity Long range system Mk.I Shell splash sets Mk.III System ("G" - band) Mk.III System ("G" - Band); fitted in conjunction with 243Q
291W	WC	Submarines	
293/M/P/Q	WC	Fleet Destroyers and above	
+900	WC	-	
+901X	GA	-	
+930/931	GS	Cruisers and above	
+940	INT	Ships fitted with 960	
941	INT	Ships fitted with 281/B/ BP/BQ	

Type No	Class of Set	Where Fitted	Remarks
942	IRT	Submarines	Mk. III System: replacing 253MW Marker beacon used with 970
951	BCN	-	
952	BCN	-	
953	BCN	Cruisers and above, and certain light craft	Portable marker beacon used with 970/1 Fitted in certain ships in lieu of 251M
+960/P	WA	Cruisers and above	
961	GCA	Aircraft Carriers	Superseding 79 and 281 series Modified-ASV Mk. XI Set
962	GCA	Experimental	
970	WS	CCO Ships	
971/M	WS	CCO Ships	
972	WS	Selected ships only	
+980	WC	A/C Carriers	
+980S	WC	Shore Stations	
+981	WCH	A/C Carriers	
+981S	WCH	Shore Stations	
+992	WC	Experimental	

OBSOLETE OR OBSOLESCEENT SETS

Type No	Class of Set	Remarks	
241	INT		
245	INT	Only one fitted (HMS Boxer)	
251	BCN		
251W	BCN		
252/M/P	IFF		
253S	TPD		
256	BCN		
258	BCN		None fitted
259	BCN		
267/U	WC		
269	GS/C		None fitted
276	WS		
279	WA		
280	WA		
286	WC		
287	WS		
290	WC		
990	WC	None fitted	
991	WS	None fitted	

RADAR
INSTRUCTIONAL
PRODUCTION
SECTION

Ref: RIPS/B 32 (2)

H.M.S. COLLINGWOOD
FAREHAM
HANTS