

TYPE 277T IN ACTION

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Type 277T, the mobile shore version of Type 277, consists of slightly modified Type 277 panels and Type 242 panels mounted in a trailer cabin rotatable by hand from inside. On the roof is fitted a horizontal 15 ft. cheese reflector for the Type 277, while the Type 242 dipole array is situated above the cheese with a wire mesh reflector of equal curvature.

It must be stressed that the aerial gain of Type 277T is more than twice that of Type 277 and the radiation pattern is very different, being narrower in the horizontal plane, with a 70° coverage in the vertical plane. Moreover Type 277T stations are usually situated about 400 ft. above sea level. Results from Type 277 aboard ship should not be expected to be similar to those from Type 277T.

Type 277T has both 'A' scan and P.P.I. display.

In the first half of last year when the Luftwaffe was employing low flying sneak raider tactics against the South of England, a chain of Type 277T stations was installed along the coast.

The first station of the chain was controlled and manned by the Royal Navy and was in full operation less than a month after completion of operational trials with the prototype of this set.

Stations subsequently established and manned by Royal Air Force and W.A.A.F. personnel were controlled by 60 Group, R.A.F., to whom an A.S.E. officer and crew were lent for the purpose of carrying out installations.

Feeding aircraft plots to R.A.F. filter rooms and service vessel plots to the nearest Naval operational room, these sets proved highly successful. They are still operating with considerable effect.

OPERATIONAL PROCEDURE.

Type 277T has 3 'A' scan ranges, 30, 60, and 120 sea miles. The shortest range is seldom used. When on aircraft priority the 60 mile 'A' scan is generally used as this range is sufficient for warning and interception purposes. The rate of sweep is adjusted to give adequate warning over the arc of sweep. When on surface vessel priority the 120 mile scan is used.

Stations operating under the dual role now use the 60 mile scan most of the time with one sweep on the 120 mile scan at intervals.

The P.P.I. display is primarily used on R.A.F. stations and is gradually gaining favour for Naval purposes. With the maximum range of 50 land miles, the P.P.I. is gridded and the P.P.I. operator passes the grid reference of targets direct via a head and breast set to the filter room. The display is especially valuable when air-to-air and air-to-surface-craft interceptions are in progress.

The Type 277T manned and controlled by the Royal Navy has been especially successful in controlling air-to-surface and surface-to-surface interceptions.

PERFORMANCE.

Type 277T has been used both for straight plotting - on our own convoys and independently routed vessels and on those of the enemy along the French coast - and to provide information necessary to carry out controlled interceptions of enemy vessels by our destroyers and light coastal forces.

Following are a few extracts from operational reports from some of the stations in the South and Southwest of England:-

In November 1943 Station 'A' (height above sea level 400 ft.) picked up a hostile destroyer and plotted it until it was attacked by two of our M.T.B.'s which has been picked up some time previously.

In early September, 1943 Station 'B' (height 486 ft.) picked up a small sailing vessel. An M.L. was sent out to intercept and plots were passed on both craft every five minutes. An interception was effected and both vessels were plotted until they faded into wave-clutter.

In October, 1943, Station 'C' (height 410 ft.) picked up a battleship and 4 destroyers (signal noise ratio 7 - 6) and passed to N.O.R. as 2+ vessels. Later, when the signal-to-noise ratio increased, the 5 vessels were seen separately.

At one time in June, 1943, Station 'W' plotted 2 chasseurs, a group of landing craft, an M.L. patrol, an east-bound convoy, a destroyer and 3 separate sets of mine sweepers. One night last November this station handled 14 tracks of which 5 were those of convoys, six were M.L. patrols, 2 were landing craft and one a large merchant vessel.

Perhaps the most interesting example of aircraft plotting is provided by the Naval station. Early last year this station picked up a group of low flying enemy aircraft a few seconds after they had crossed the French coast. No other set was capable of detecting these planes which came in at zero feet. As the result of the warning given, 400 children in a school in a town of South East England were able to get to shelter. Four minutes later the school building suffered direct hits. Within an hour after the detection, R.A.F. Filter Room congratulated the 277T crew, informing the Officer in Charge that it was solely due to their warning that the 400 children were saved.

RADAR TYPE 277S.

This set is intended to replace Type 277T where a permanent shore station is needed.

It is housed in a concrete building of ample dimensions, supporting on the roof a heavy aerial system designed to operate in gales up to 120 miles per hour.

The aerial consists of a 15 ft. "cheese" mounted above the Type 242 dipole array and its wire mesh reflector. Power turning is used, either for sector sweeping or continuous rotation, though for continuous rotation the Type 242 aerial must be disconnected. Hand operation is provided for emergency use.

The panels are similar to those used in Type 277T, giving P.P.I. and "A" scan display.

RADAR CONTROL OF SQUID

The preliminary trials of R.T.U. 54, which is the special R.T.U. used in Radar Control of Squid, have been carried out and have proved most successful. It is also intended to use this R.T.U. for ranging when Shark Projectiles are used, as short ranges of the same accuracy are required in this case. Trials with Shark projectiles were also combined with the ones mentioned above and were equally successful. Every effort is being made to get this attachment to sea as soon as possible. It is hoped to commence fitting in October.

RADAR IN SUBMARINES

The promise made in the last issue to deal with future developments of Radar in Submarines cannot at the moment be implemented for security reasons. The developments envisaged at the moment are very much more far-reaching than was expected, and it would be inadvisable to include a summary of them in a confidential publication, but the improvement of Type 267W to enable Submarines to carry out attacks with the minimum possible risk of detection by the enemy is receiving the greatest attention.

A certain amount of difficulty is being experienced in providing components which will stand up to the extremely rigorous conditions of service in a Submarine in the tropics. A few cases of failure with type 291W have already been reported, but hardly sufficient yet to enable a decision to be reached as to whether these are isolated cases or whether they are likely to become general. It is realised what a nuisance extra paper work is, but it would be very much in the interest of the Submarine Service if any breakdowns thought to be from this cause could be stressed in the Routine Reports, and if considered necessary, an advance report made by signal.

W/T AERIAL ARRANGEMENTS IN THE FLEET

It will be of interest to the Fleet to know something about the way in which the problem of aerial siting in H.M. Ships is tackled and it is proposed to devote a few paragraphs to what is one of the most complex problems for both scientist and constructor.

A casual glance at any aerial arrangement in one of H.M. Ships is bound to set the observer thinking. He will either dismiss it from his mind thinking that it is an act of God and that the aeriels just get fitted there according to their size, weight, and degree of suitability, or he will give a thought and perhaps sympathy, to the various departments who have had to struggle to produce such an arrangement in one of H.M. Ships.

It is true to say that the aerial arrangement of all classes of H.M. Ships now receives the very closest scrutiny by technical departments, from the inception of the Staff Requirements until the ship is ready for action. In A.S.E. much thought has recently been given to this problem and a special Aerial Panel has been formed with a view to studying the aerial rig of all classes of ships so that instant advice on technical matters is always available to Application Officers and to the naval constructors in search of information with regard to masts, yards and fittings.

The aerial problem begins, in the case of the larger class of ship, with the Staff Requirements where a paragraph is included in the communication section stating the desired separation between masts. In the larger ships it is now possible to receive on a number of lines whilst the ship is actually transmitting, by having a pre-determined distance between the two masts.

The present tendency of the constructors is to place the masts as close together as possible to meet the very increasing need for high angle armament, with particular reference to clear arcs of fire aft.

As soon as the first outline drawings of a ship are available, an outline silhouette of the ship is forwarded by D.N.C. to A.S.E. On arrival in A.S.E. the silhouette is studied by the Aerial Technical Panel to see to what degree the communication and Radar Staff Requirements are likely to be met in D.N.C.'s proposed ship.

To decide on the mast and aerial arrangements in a ship completing in two or three year's time is not easy, for the performance of the sets in the ship will certainly not have been determined except possibly in the laboratory.

As a result of the Aerial Panel's first investigation of the ship's plans, a visit to D.N.C. will probably be made and certain recommendations as to the heights and disposition of masts will be discussed.

It may be desired to get the masts reduced, heightened, brought closer together or further apart. D.N.C. will also be furnished with a list of the equipment that it is proposed to fit, the weight involved and the degree of all round view required for each set. He will also be told of the limiting factors to be considered when siting the various equipments, i.e. length of aerial feeder, etc.

As the requirements of other departments with regard to the ship's design frequently conflict with the communication and Radar requirements, meetings are arranged between the various "users" to settle what in the end will be the best compromise between all departments concerned. During these meetings, the A.S.E. technical opinion will be given on the performance of the radio sets under varying conditions of height and site. The resulting arrangement is the best compromise which can be arrived at between the conflicting departments.

Before A.S.E. is ready to advise on all the points required in an aerial problem, it is necessary to carry out field and sea trials to determine the limitations of the sets in varying conditions in H.M. Ships. Such data is always available to the Aerial Technical Panel and is referred to whenever one of H.M. Ships is refitted with new equipment, the performance of which is known, and is called for when the performance of new equipment is not known.

There are many factors influencing the aerial problem which can be enumerated below and which are taken into consideration when viewing the aerial arrangement as a whole.

- (a) Separated transmission and reception for communication.
- (b) Range and all round performance of Radar sets.
- (c) Blanking of Radar sets due to ship's structure and to other Radar sets.
- (d) Effective height of transmitting and receiving aerials for communication purposes, both H/F and V.H/F.
- (e) Clear site required to give all-round performance with V.H/F communication aerials.
- (f) Vulnerability of Masts.
- (g) Provision of emergency and battle aerials.
- (h) Ensuring minimum interference between Sets of various types, powers and frequencies.
- (i) Finding sites suitable for D/F on M/F, H/F, V.H/F and U.H/F.

It will be apparent that for an all round view the ideal position is at the top of the mast and thus there are many claimants to this coveted position. The question of top weight has also to be considered as well as that of operational requirements and technical efficiency.

It is now possible in some cases to mount one or more light arrays above what was formerly the mast head set (e.g. in Fleet Carriers the 'J' match aerial and Type 243 aerial above Type 281B aerial). H/F and V.H/F D/F arrays are strong claimants to the top of the mast as they must be free from screening and reflection from rigging and superstructure.

Whip aerials have been designed to withstand a wind strength of 130 miles an hour or 1" icing.

It is intended to include in the next issue a short description of the various types of aerials and their uses.

RADAR REFLECTOR BALLOONS

As a convenient means of lining up, testing and exercising radar, a reflector balloon has been developed.

This balloon-borne reflector consists of a "nightshirt" of celanese fabric interwoven with fine wire and shaped to fit a 3'6" meteorological balloon.

For use with GA and GC radars the reflector is used as a free balloon having rates of ascent up to 500 feet per minute.

With WS sets the balloon is tethered by a fine cord to a light float, heights up to 200 feet being obtainable. The float follows the balloon's movements by skimming the water's surface, while at the same time it is of sufficient weight to prevent it from taking off.

It is hoped that the balloon and reflector "nightshirt" will be available for issue as part of the test equipment of radars Types 275 and 262. For WS sets the kit when available will consist of balloon, "nightshirt" and float.

The gear will provide a convenient means of performance measurement in areas where no other echoes exist.

POWER SUPPLIES POLICY

In general it is Admiralty policy to fit A.C. outfits with duplicate machines for the main ship sets for the following reasons :-

A. Reliability.

It is important to fit duplicate machines where sets are run for long periods (e.g. 271 sets) and also where a number of sets are run from a single outfit (e.g. 282/4/5) because:-

- (a) it affords an opportunity of giving machines necessary maintenance
- (b) the breakdown of one machine does not put the set(s) out of action.

B. Vulnerability.

It is desirable that the A.C. machine should be sited adjacent to the set it serves so that both set and power supply are equally vulnerable. This is not generally practicable and the policy is therefore to fit duplicate machines separated as far as possible, either one forward and one aft, or one port and one starboard, with a water-tight bulkhead between them. The cable runs are also kept separate as far as possible. Thus if one machine is put out of action it is still possible to run the set from the other. The power inputs to the machines are also duplicated in case of breakdown of part of the supply. Thus where ships are fitted with ring-mains, supplies are taken from opposite sides of the ring-main.

In some ships, though it is otherwise desirable, duplicate machines are not fitted because of space limitation (e.g. 291 in coastal craft and 277 in small ships).

In certain cases duplicate machines were specified but single machines were fitted because, at the time of fitting, supplies were limited (e.g. some 271's only received single machines with their DUK outfits). Additional machines will be supplied retrospectively as they become available.

In cases where one set is run in conjunction with another, (e.g. Type 242) it is arranged that, where possible, they shall use the same power supplies so that they "sink or swim" together.

The single 230 v. 3 phase motor-alternator in small ships fitted with Type 277 cannot be run continuously without grave risk of breakdown. This raises difficulty with regard to the waveguide dryer equipment.

The waveguide dryer must therefore be run with discretion. In dry fine weather it need only be switched on, say, 2 hours before the set is to be used and it should be run continuously only when there is exceptional humidity. It should be run for 4 hours before the set is used after a stay in harbour.

If the set is run with a damp waveguide, performance will be reduced until the waveguide dries out.

TYPE 281

Type 281 was first fitted in 1941 and was intended originally to replace Type 279. It was soon found, however, that it was valuable to have WA sets on two different frequencies, particularly in view of the type of cover provided by each and the greater safety factor from a jamming point of view, and Type 279 remained in a proportion of ships. Type 281 was developed at a time when there was a lack of gummy sets and the R.B.L.11 was provided to help to fill the gap.

TYPE 281B

The set had not been in use very long before the advantages of providing a common transmitting and receiving aerial were realised and development work was started. This work was accelerated by the experience of *INDOMITABLE* and *VICTORIOUS* in dealing with the massed air attacks during the Malta Convoy Battle of August 1942, which revealed the need for two WA sets in a Fleet Carrier. As a result, the first 281B's were fitted at the end of that year in *UNICORN* and *INDOMITABLE*. Both installations were successful and other ship fittings followed. It was decided that ultimately Type 281 would be replaced by Type 281B in most ships. In battle-ships and cruisers another great advantage of a common transmitting and receiving aerial for the WA set was that it released the other masthead for a WC set, whose primary function was target indication.

PLAN DISPLAY

When *INDOMITABLE* received her Type 281B she was given also a prototype model of the skiatron. The fitting of plan displays had up till then been received with some mis-giving owing to the wide horizontal beam width of the set. To overcome this difficulty methods of providing a narrow beam (Beam Sharpening) without increasing the size of the aerial were tried, but were finally abandoned. Experience with the skiatron, however, showed that, despite the beam width, plan displays were a success. In the meantime development work on a standard 9-inch P.P.I. for various sets (including Type 281) had been commenced and production was begun in the summer of 1943. The first Type 281 to be fitted was that in *ILLUSTRIOUS*. Skiatrons were a more complicated problem for the production point of view and it was the end of the year before the first standard models were fitted. At the present time a Type 281 without a P.P.I. is rather an exception while skiatrons are becoming quite common.

The introduction of plan displays underlined two features :-

- (a) The comparative uselessness of the R.B.L.11. Unfortunately, however desirable it may seem, a complete removal involves a major modification to the set and it has not, as yet, been possible to undertake this in *A.S.E.* Private enterprise has, however carried out this modification in certain ships, and particulars of satisfactory ways of doing so are being ascertained.
- (b) The need for continuous rotation.

TYPE 281BM

The provision of continuous rotation has involved a considerable amount of research work and many difficulties have been encountered. Early experiments showed that a slip ring assembly would be best and this was adopted. Development work had to take second place to many other more urgent projects and it is only in the past few months that progress has been rapid. It is now expected that fitting will commence in the Autumn of this year. The set will then change its type number to 281BM and various other changes will be incorporated at the same time. These are :-

- (a) A new top mast and pedestal (Type No. 19AD) carrying the slip ring assembly and a polythene feeder from the slip rings to the aerial.
- (b) A new control unit (20L) which will incorporate a 9-inch P.P.I. in place of the present bearing circle.
- (c) A re-matched aerial system; it is realised that the present aerial has a bad mis-match.
- (d) Slip rings for Type 243, the test aerial and a V.H.F. aerial.

L43 AND L44.

Plan display requirements for constant or continuous rotation have brought other problems, connected mainly with interrogation and height-finding.

- (a) Interrogation - L43. In order to get consistent I.F.F. responses it is normally necessary to stop the aerials on the bearing of the echo. The use of Panel L43 will overcome this difficulty since it uses a long persistence cathode ray tube on which the A scan flashes up each time the aerials pass through a selected bearing. The I.F.F. response from a hand rotated aerial which can be set on the same bearing then appears on a second trace and the response can be associated with its echo.
- (b) Height-Finding - L44. A similar system will be used for height-finding on the L44. This will allow the amplitude of the echo to be measured more or less at leisure and will permit detailed examination of echoes. L43 is expected in the Autumn of 1944 and L44 (which is almost identical) shortly afterwards.

PERFORMANCE METER.

The recent issued edition of the Handbook contains an Appendix on the Performance Meter. Unfortunately just as this went to press, the proposed test aerial proved to be unsuitable since it received most of its 'pick-up' from the flexible feeders instead of from the Type 281 aerial. A new aerial had to be designed; this is now going into production and it is hoped to commence fitting within the next month or so.

Trials with this performance meter have led to an investigation of various problems in connection with noise. Results of these are still rather inconclusive, however.

PRE-AMPLIFIER M81

The M81 (a modification of the M58 used in Type 286) has now been fitted in about a dozen ships and by the time this Bulletin appears, practically all Type 281B ships will be receiving their supplies. The resulting increase in performance is dependent somewhat on the quality of the P23 receiver to which it is fitted. A similar pre-amplifier for the P13 receiver of Type 281 cannot be provided so simply, owing to the different type of input, and it is unlikely that one will be developed.

The increase in range resulting from the M81 has made it necessary to increase the length of the scan beyond the present 100 mile limit. A modification to achieve this will shortly be produced.

GENERAL PERFORMANCE.

Recent complaints that the set was not detecting high-flying aircraft have been made the subject of a special investigation. Trials with aircraft at 30,000 ft. have failed to show any abnormality, the results being quite consistent at all heights tried. This is in agreement with the results of previous investigations.

R.I.I.C.

There has existed for some time a requirement for a form of library in the main Royal Naval Radar School, which shall contain all the latest available information on technical matters for the use of Radar officers generally. In addition, there has been a long felt need for a compendium of collated Radar information - theoretical, technical and operational, especially the latter - for the same users.

Captain, Radar Training has therefore inaugurated the R.I.I.C. - The Radar Instructional Information Centre - where up-to-date information properly indexed and filed, is available on all Radar subjects to officers who return to the seat of learning. This is housed at present in Signal Section, R.N. Barracks, Portsmouth, but will be transferred to the Radar School in H.M.S. COLLINGWOOD at some future date.

In order to maintain efficiently an organisation of this type, C.R.T. needs information from you at sea. A great deal is already gleaned from action and other reports but we need more and more of those problems met with and solved at Sea, which others will be faced with in their time. We do not set up in any way as rivals to the Admiralty Signal Establishment but we do want intelligence on all radar matters for use in the Instructional Sphere.

Give us your assistance in keeping Radar well and truly on the map. Send queries, quips, hints and tips to the Captain Radar Training at H.M.S. COLLINGWOOD as well as to others, and share your hard won knowledge with the youngsters of the branch as well as the more mature members in search of refreshment.

(Editor's Note: The above has been contributed by the staff of Captain Radar Training)

STOP PRESS

RADAR TYPES 271Q AND 291. OPERATION FOR LONG PERIODS.

Reports from sea indicate that Radar Types 271P/Q and 291/U/W are being switched off for cooling purposes at regular intervals.

These sets can run for indefinite periods, but should, of course, be rested when not required.

There is no need to obey the old precautions taken with Radar Types 286P/PQ which required the radar to be switched off for ten minutes in every half-hour.

PANEL R.B. L.11. IN TYPE 284/B.

Projected modifications to Type 284/B will probably involve the use of all circuits connected with the bearing tube of Panel L11. In the meantime, therefore, no ship should continue with plans for removing all, or part, of this panel from the set. Future policy in this matter will be promulgated shortly.

RADAR TYPES 282/3/4/5.

Main fusing of Amplifier M53 should be of 1 amp. fuse wire (Patt. 2027). The use of heavier fuse wire eliminates the protection to Patt. 3722 transformer which may therefore break down.

B.R.222.

In the past year, B.R.222, Notes on W/T Sets, has been revised and a considerable number of new sections and sub-sections added. The distribution has also been revised and covers all vessels from Battleships to Corvettes, a reprint of 1000 copies has recently been made, and copies should be demanded from S.N.S.O., R.N. Store Depot, Park Royal, LONDON N.W.7.

CREST FOR A.S.E.

Suggestions are invited for a crest for the Admiralty Signal Establishment.

'D' DAY BROKE AS WE WERE ABOUT TO GO TO PRESS - LET US HAVE THE STORY OF YOUR RADIO EXPERIENCES - YOUR SUGGESTIONS AND YOUR COMPLAINTS FOR INCLUSION IN YOUR BULLETIN.