CHAPTER 14  POST-WAR DEVELOPMENTS: ACE

Short Range Blind-Fire

At the end of the war the 3 cm (X band) wavelengths were coming into use.

An auto-follow radar to provide blind-fire with a twin before gun-mounting
was the first development, Type 262, but was not available for fitting until
after the war. The mounting was self-contained; guns, predictor and radar
were all on the mounting. The peak power output of the radar was 30 kW, with
a single mirror for transmission and reception. Conical scanning was given by
spinning the mirror itself, its axis being aimed from the axis of rotation.

The requirement was to pick-up an aircraft target at 7000 yards range and be
able to track it in all three co-ordinates sufficiently accurately for
fire-control purposes by the time it had reached 5000 yards. Hence to pick-up
the target in the shortest possible time the "search and lock-on" had to be
etirely automatic immediately a target had been 'indicated' to 262 from the
T radar, first Type 293 and later 922 with its much faster rate of aerial
rotation (90 rpm initially) and 1 KW output power on 10 cm. The 262 then
scanned 30° in azimuth in one second, the aerial being elevated 30° at the
end of each scan; at the same time it explored the space 750 yards either
side of the indicated range 30 times a second. When the target was picked-up
the aerial automatically locked on to the target; the predictor ran into
alignment with the mirror's axis of rotation and the guns automatically
followed the predictor. (See ref 400 on p 187, pp 371 and 2.)

Radar for Guided Missile System (Sea-Link)

In 1944 E3D was asked by the Naval Staff to develop an up-to-date Fire
Control System for AA batteries in ships when provision of computers from the US
coastal For up to 5.25 in guns in all types of ships destroyers and above, and
for both aircraft and ship targets. The system would have consisted of a fully
stabilised director on which the radar was mounted, and a 'transmission station'
in which was housed the computing mechanism and the radar auto-follow, and
possibly display equipment. However, with conventional guns most people are
agreed that AA-fire can only be efficient out to about 7000 yds. Beyond this
range, due to the long time of flight greater than 10 secs, it can only be
deterrent in value .......... Beyond 7000 yds will eventually, it is expected,
be entered for by controlled projectiles". Work proceeded on X-band towards
this Long Range System B. Type 262 was in effect Medium E3D. The later E3B3
with Radar 934, based on the US RP 56, by Spraggy type and Beaconsfield was to control
4.5 in. turrets as relatively close range weapons when the HMS covered the long
ranges.

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But in Nov 43 a staff requirement for directed projectiles was launched by EBD.

"The advent of jet and rocket propelled aircraft makes it necessary to prepare for aircraft speeds in the vicinity of 600 mph at heights of 30 to 50 thousand feet. Airborne radar makes it possible for the aircraft to attack at such great heights even when cloud only permits fleeting glimpses of the target; and completely blind attacks may take place. The advent of the directed or propelled projectile and the imminent addition of bombing devices has released the aircraft from the constraint of an aiming gun, straight, curved, level or diving. Any form of long-range gunfire depends on the prediction of future position at a future time at least equal to the duration of the time of flight after enfilde. Even a perfect blind-fire system giving present and immediate past movements, with a perfect curve-course predictor, would thus be ineffective against the incoming attack. It is clear that a radical change in our attack on this problem is required. No projectile of which control is lost when it leaves the ship can be of any use to us in this matter."

Since there was a similar General Staff requirement the Guided Air Projectile (GAP) programs began. On 16.1.44 the Assistant Controller (R & D) Dr G F Goodove, acting as chairman held the first GAP committee meeting. It was convened to consider the desirability of setting up an organization for dealing with problems relating to guided AA projectiles and the form such an organization should take. It was attended by senior representatives of the War Office, Ministry of Supply, MFR, and Admiralty departments concerned. It was unanimously agreed to set up the organization; vice-chairman Mr Don Lockespeare, Director General EBD (MFR). Four sub-committees were formed: Propagation, Dr Crow, Controlling Projectile Devs; Aerodynamics, Mr Lockespeare; Radio and Radar, Dr Paris NOS; Stabilization and Servos, Col Horsemann R A G S. Subsequent to the meeting definite staff requirements were put up by DRA War Office and DAD Admiralty.

On 2.5.44 the GAP Committee made its first report that there was a reasonable prospect of successful development "but the x and d effort will be very great; the minimum period for development under the most favourable circumstances will be two years...... The project should be tackled in two stages. First to carry out the experimental work to determine the essential data for the design of a prototype; second the development proper." The working committee proposed 17 officer staff on Radio and Radar (ARMY 7, RAR 4, RAR 6) and G at AML.

For the control of the projectile in the air it was early agreed that self-control to maintain itself in the radar beam to the target should be the system (beam riding). The newly proposed Naval X-band set (known as 501 and
initially for LRS1: see paper of May 1944 by J F Coles in file Pl/301) soon came to be regarded as naturally the set for the control of the naval missile. On 12.1.45 HDG wrote after discussion with Mr Coles: "It is now reasonably certain that the Radar for LRS1 will also do for the Radar for GBP. The latter took precedence over LRS1 and then had overriding priority; in 1949, surprisingly late, LRS1 work ceased and the effort available was devoted to the epoch-making GBP which finally came to fruition in the late fifties. The full story of the first 10 years, 1944-54, has been recorded by H V Pont and other members of the 901 Project (unpublished) preserved as 'Archives 17': see also technical note G/83/24 and B on the X-models which went to the Aberporth trials range in 1949.

Merchant Marine Radar

The use of radar specifically for navigation had been studied at ASE for some years. The requirement first arose in connection with combined operations, when modified 10 cm airborne (223) radars were fitted in some landing craft. Experience with these sets showed the need for higher frequency in order to obtain better bearing discrimination and low clutter, to assist in recognizing coast lines. An X-band set was used in navigational trials in the Scheldt Bight with considerable success, and further tests in the Thames with Type 972 confirmed the importance of characteristics obtainable only by operation on higher frequency in the 3 cm band.

With the end of the war the Ministry of Transport sought Admiralty advice in drawing up a performance specification for a Merchant Ship radar, and a specification calling for an X-band equipment of high discrimination was agreed on. ASE produced sets approximately to the required performance; an experimental set primarily used for tests with corner-reflector; and a more fully engineered set designed to meet the specification in order to demonstrate the facilities to the shipping interests, and to provide a source of information for assisting radio manufacturers who attempted commercial production of merchant ship radar. A Ministry of Transport group of approx. 15 staff has continued within ASE/AMBS since that time.

Fighter-Direction Radar

In parallel with the missile system work, the first line of defence, the fighter, operating at ranges beyond the missile coverage, was provided with the (probably) illiterate in carrier-borne radar, the 3-D 934, operating into the comprehensive display system, CSS. The creation of this fighter-direction system began in 1948, the first one going into HMS 'Victorious' in 1957 and 'Eagle' (only) had the first computerized system (Motion Data Automation) in 1964. Only the conception of the system fails to be highlighted within the
early post-war period with which the present work concludes: the aircraft and electronics of these great ships deserve and will possibly have, one day, their own historian.

An important component associated with these complex radar systems in the above termed 'trainers'. Extensive notes recording the major trends and stages in the evolution of these for Naval radar training have been specially contributed by A D Brown (filed in 'Archives 13').

The narrative has now arrived at the time of the Golden Jubilee of the first WR Dept of the Navy born 20.8.1936 on HMS "Defiance" at Devonport. We have seen how "Vorson" took over control in 1936 and how the Dept was transferred in June 1917 to HM Signal School, Portsmouth. This School had been founded early in the 19th century and was responsible for training all naval signal personnel in the signalling methods then in use, flags, semaphore and lamp. The staff from "Vorson" were incorporated in a new Experimental Dept, the title of Wireless Commander being changed to Experimental Commander. The training side of the Wireless Station was amalgamated with the training of signalmen in the School. The expanded Establishment thus had charge of experiment, development and training on all aspects of Signals and particularly in the latest and most important method, wireless telegraphy.

In the period after the Armistice the organisation of the Experimental Dept was established formally by its then head, Cdr James Sonerville, along lines very similar to those which had existed for the preceding 15 years or more, and which continued with very minor changes for the next 17 years.

After the rearrangement programme got under way in the 1930's the WR staff expanded considerably and then further with the introduction of radar work in 1936 and later with the outbreak of war. By the end of 1940 it had become necessary to make new quarters for the Experimental Dept which therefore moved to Haslemere in April 1941 on the Communications side, and to Witley in Sept 1942 on the Radar side, and became an independent command ASI on 30.6.44, under a Captain Superintendent. At about the same time the Signal School proper moved to Keyhaven.

By 1945 the Scientific and Experimental (S and E) staff was some 150 in number. It is instructive to show the growth of expenditure on fleet equipment from 1920 to 1946/7:

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The expenditure on R and D itself during this period is not available but in 47/8 it was of the order of £750,000.

Mr C H Horton, after a period in DSM became Chief Scientist on 9.10.45. A major reorganisation followed in Feb 1947; the new organisation coming into force gradually during the year with a nominal R and D complement of 275. A copy of the Name is in 'Archives 5', the main objectives being:

"the full development of a few important projects; high quality scientific work to form the basis of future advance; and the education of every member of the Establishment for potential responsibilities and activities of the future. It is hoped that staff on scientific work will not fall below 20% of those on projects ...... It is proposed to organise Project Development by self-contained teams capable of producing their own broad-based models. The Project Leader may be a physicist or an engineer and he will be responsible for

- the technical soundness of the plan as a whole,
- production of the detailed technical specification,
- seeing that the units of the project are properly matched to one another and progressed at suitable relative rates,
- liaison and argument with other branches of DSM.

The Project Leader is in command up to the stage of a successful trial in a ship at sea, but he will always have associated with him one or more members of the Design Dept. The essential point is that the engineer who designs and organises the pre-production models will have been in the project from the start. Up to the point of a successful sea trial or a first model his allegiance will be to the Project Leader, after that his allegiance is to D.

The projects have been grouped on the chart in a way which is intended to parallel as closely as possible the corresponding groupings in the Admiralty and the Ships ............

Close financial control and accuracy are a fundamental feature of our British constitution; to expect the financial implications of our activities to be otherwise is to disregard the accuracy and timely knowledge of financial details is therefore of prime importance."

The four major project divisions were then: Communications, R/P and DSM; Radar Warning and Action Information Organisation; Weapon Control and Target

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The tendency towards replacement of the Design Dept mentioned above by outside Development Contractors began at about this time, the first case being the Type 600 series of HP communication system units referred to on p 127. And during the 1950s it became normal for the whole of the electronics side of projects to be done by development contract. Aerial techniques and engineering have remained largely 'in-house' together with basic system research, system formulation and assessment which always from the earliest days have been the province of the naval specialists and their scientific and engineering colleagues. The latter became the RNES in Sept 1946, and then 50 years almost exactly from radio's beginnings in "Defiance", with Sir Charles Wright KCB, BNR from 1934, as the first Chief of the RNES and Sir Frederick Brandrett succeeding him in May 1947. On the 1 Jan 1948 ASE became ASHE; the preparation of the Portsdown site began that year. The Headquarters continued at Lythe Hill House until 1.5.52 when the move to Portsdown was completed.*