OPERATIONAL PROBLEMS

Transportable Radar Stations

The problems presented in the operation and control of transportable radars deserve special attention. The extensive use of the LW/AW and later of transportable GCI's taught us many lessons. The first transportable radars used by the RAAF were constructed in MELBOURNE from two ASV sets with portable aerial systems and were sent at short notice to NEW GUINEA with a crew of a Sergeant and three men each. They were eventually established at Eastern entrances to MILNE BAY where they were to give warning of the approach of aircraft and shipping.

From the beginning the enterprise was unfortunate. They were sent out into the blue and were immediately forgotten, with the result that they became unserviceable, the personnel were neglected, and serious loss of life could have occurred under less favourable conditions. The lessons of these two stations should have been learned when LW/AW's were formed but unfortunately events were occurring so quickly in those days that adequate preparations were not practicable. The first LW/AW's were formed in SYDNEY, also at short notice, and were transported to NEW GUINEA by air or surface transport. The results depended mainly on the skill and experience of the station CO.

Most of the COs in those days were men straight from the accelerated University course, usually under the age of 21. While technically qualified, they were not used to handling men, least of all under tropical jungle conditions. No others were available, however, and they had to be sent. In some cases results were excellent and in others administration and discipline suffered considerably. The problem was eventually met, firstly by not commissioning men who were under the age of 22, and secondly by posting an additional officer with administrative experience to stations situated in out of the way areas.

Another problem of the early stations was the difficulty of securing NCOs. All the radar people were boys together. They had come straight from radar school and stations usually formed with no NCOs whatever. It fell on the shoulders of the area receiving the station to appoint acting NCOs from those who appeared to warrant the responsibility but here again the interest taken by the area varied and it was not until Radar Wings were formed that the stations received the attention which they required.

Guards

One of the problems was the provision of guards. The need for guards varied from anti-pilfering duties in Southern areas to protection against the enemy in Northern areas. A policy was eventually adopted of posting four guards to Southern stations while the guards for Northern stations varied at the discretion of the local Commander. Radar stations were often the closest Allied troops to the enemy and some stations in NEW GUINEA area were allotted as much as a platoon of infantry. This was often justified as wandering bands of Japanese were encountered on several occasions. A further problem arose in Southern Dutch New Guinea where stations were located in head-hunter country. Here again special guard arrangements were necessary.

5g Special Training for Radar Personnel

From the beginning it was obvious that those men being posted to radar stations required special training. The policy was adopted of putting all such men through special commando courses and following this with a period of special training at a radar station. However, so great was the demand for stations that it was not until late 1944 that this policy could be implemented. A special organisation was eventually set up at Radar School, RICHMOND, for the jungle training of radar stations. New stations were formed at the radar school and were then sent into the mountainous country near RICHMOND where they carried out several weeks training in camp life operations and tactics. This produced, long after it was due, a party of men who had some chance of looking after themselves when they arrived in tropical areas.

6c The Problems of Air Transport

The first LW/AW left MASCOT by air and nearly all subsequent ones also travelled by air. One of the difficulties was the provision of suitable handling facilities at the end of the air journey. Eventually it became possible to provide a jeep and trailer for each station so that equipment could be moved from the aerodrome to the final site. Other problems were those of schedules of equipment, proper packing, priorities of movement, etc, all of which were eventually reduced to a formula.

6' The Problems of Isolated Sites

Once a station was established in the jungle it was usually many miles from its supply base and perhaps hundreds of miles from its filter room. Supplies were arranged by various means, often by special small boats run by radar wings, and at times by air. Communication was usually by radio, two complete radio sets being supplied to each station, or when landline communication was possible, one radio set as a reserve to the landline.

6) Security of Communications

From the earliest days much thought was given to the problem of security in passing plots by radio. A false grid system had been used in ENGLAND but the first step here was to introduce a special code which was applied to all radar plots. This code was soon abandoned owing to the delays which it caused and most telling was eventually done in clear. As time went on the need for security decreased with the dwindling of enemy forces but the problem still remains and no adequate solution has yet been produced.

6) Power Supplies

Possibly the greatest problem with which the radar organisation along with many other had to contend was the provision of a light and reliable power supply. The first radar stations went to NEW GUINEA equipped with a twin cylinder air-cooled motor, originally designed to drive a Howard agricultural cultivator, driving a 2½ KVA alternator. This motor required very careful maintenance and gave considerable trouble when it was not forthcoming. Fortunately the problem was tackled early by the Signals and Technical staffs and a set was eventually produced comprising a Ford 10 horsepower engine driving a 5 KVA alternator. It proved to be a very excellent solution to the problem as it was extremely reliable. However it suffered from the serious disadvantage of weighing 15 cwt and as two of these were always sent with a radar station they represented more than half the weight of the technical equipment.

Unfortunately, right up to the last days of the war, no better solution was found than these sets and we finished the war still short of a really suitable power supply. Much time was spent in designing radar equipment which could be broken down into man pack sizes of about 150 pounds each but this work was more or less wasted as it became necessary when a station was to be operated continuously for any length of time to send a Ford 5 KVA generating set weighing 15 cwt as its power supply. Towards the end of the war lighter weight units were becoming available in AMERICA but their saving in weight over the Ford set was not outstanding, and no information is available on their comparative reliability. A real solution to the problem still remains to be found.

64 The Problems of Operations Rooms and Filter Rooms

The Air Defence Organisation in AUSTRALIA got away to a bad start but it is most surprising that no real attempt was made to rationalise it for three years. Mention has been made of the difficulties experienced with filter rooms and the problem will be enlarged on here. In January 1942 with the fall of SINGAPORE a frantic programme was commenced in AUSTRALIA for the provision of filter and control rooms at focal points. At the same time a training organisation was established at New Lambton, NEWCASTLE, this school being intended to become operational in the event of an attack occurring. No good purpose will be served in outlining the incredible series of mistakes and disorganisation which followed but the trouble can probably be traced to the failure of the air staff to realise the requirements of air defence.

The Air Staff at that stage was a mixture of American, Australian and RAF, the RAF personnel being aware of the requirements and trying to establish an organisation following British precedent, while the remainder worked on new ideas of their own. The first result was a control organisation which had no connection with or understanding of the reporting organisation - either radar or air observer corps. These misunderstandings were exaggerated by the personnel who were chosen as controllers; in most cases they were failed aircrew or other officers who had no conception of the problems of air defence. The situation became worse until in 1943 I was able to gain control of filter rooms and combine them with Radar into one organisation, thus remedying part of the difficulties.

Another factor militating against success was the influence of ex 3 Squadron personnel at RAAF Headquarters. These officers had come from fighter squadrons operating in the desert and had established an excellent name for themselves. Unfortunately, however, they had had no experience whatever of static air defence and had never been controlled by radar to an interception. They tended therefore to think of fighters in terms of desert warfare, tactics which were extremely successful in close support at MILNE BAY but were quite unsuitable for the radar controlled defence of DARWIN. Further difficulties arose in the case of GCI controllers. This was partly due to the fact that the number of Japanese night raids was very small and there was no real need for GCI control. Nevertheless and rightly, the Air Staff required GCI facilities at all fighter sectors.

It was not until 1944 that this GCI problem was straightened out with the importation from ENGLAND of two trained officers, one experienced in GCI and the other in filter rooms and fighter interception. Meanwhile the lessons had been learned in operational areas, particularly at DARWIN, by bitter experience, and DARWIN had become a very efficient air defence organisation. MORESBY on the other hand was under the control of the Americans who had not by this time developed a really successful system of control of their own.

It was unfortunate that while the RAF control system had been adopted in toto by the American training organisations in AMERICA and in fact officers trained in this system were being sent to NEW GUINEA from AMERICA, the Americans in NEW GUINEA refused to abandon their local system and the controllers from AMERICA had to forget the British-American system and learn the local NEW GUINEA system. And so it went on until by the time the Philippines were reached and the RAAF was operating from MOROTAI, experience, combined with a certain amount of advice from overseas had produced an effective control system. In the case of the RAAF this resulted in the establishment of MFCU's and ADHQ's, where the fighter defence organisation was an entity, Radar, observers, filter, control and fighters all being under the officer responsible for air defence.

65 Plots on Shipping

Throughout most of the war, the greatest difficulty was experienced in dealing with shipping plots. In the days of the Joint Services Committee on air warning, the Navy had expressed their need for special coast watching equipment at six points around the Australian coast and as the RAAF was due to install air warning stations at these points, it was agreed that they would also assume responsibility for special ship watching radar. Even before this special radar was installed, the standard air warning stations produced many shipping plots, in the case of KIAMA up to ranges of 60 and 70 miles, and these were passed in the same way as air plots by telephoning to the filter room. It had been agreed that the Navy would be responsible for dealing with information from this point onwards.

The first difficulty was encountered when plots began to arrive in the filter room and no naval representative was available, nor was the NO i/c interested. From then on a long and complicated series of discussions took place between RAAF Headquarters and Naval Headquarters which resulted eventually in the establishment at least in Melbourne Fighter Sector of a Naval Section manned by navy personnel for the special purpose of dealing with shipping information. Similar arrangements were eventually made at other Fighter Sectors but in every case the greatest difficulties were experienced in interesting the Navy in shipping plots.

It eventually became obvious that owing to the restrictions on radio signalling imposed upon ships at sea, the Naval authorities had no information as to what ships were likely to arrive off the Australian coast and therefore no real identification was possible of these shipping plots. This more or less unsatisfactory state of affairs persisted right up until the end of the war, when with the advent of the ADHQ organisation, slightly better co-ordination was possible. The problem will continue in the future and warrants special attention.

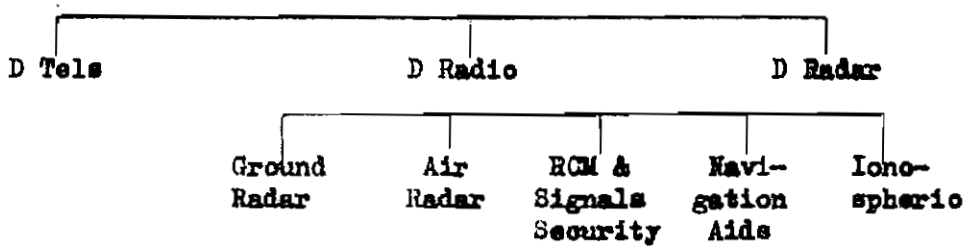
THE SITUATION AT THE BEGINNING OF 1945

I returned from overseas service in December 1944 and in March 1945 was again appointed Director of Radar. Considerable changes had taken place in the meantime, chief amongst which were the following:-

66 Organisation at RAAF Headquarters

About April 1944 the CAS, who had for some time considered that closer co-ordination was necessary between Signals and Radar, decided to amalgamate the two directorates under a common head and the Directorate of Radio Services was formed with Group Captain Chamberlain as Director. He controlled two deputy directorates, D/D Radar headed by Wing Commander J.T. Phillips and D/D Signals headed by Wing Commander V.E. Marshall. This arrangement continued until the end of 1944 when Group Captain Wiggins left his post at RAAF Command and became Director of Radio, RAAF Headquarters. He then appointed Group Captain Marshall to draw up an entirely new organisation for the Signals and Radar services. This organisation was introduced early in 1945 and from the Radar point of view is outlined below:-

Director of Telecommunications and Radar



D/Radio was responsible for planning, personnel, publications, etc, D Tels for Signals organisation, D/Radar for the operational aspects of the sections shown above, while D Tels was the common provider of all equipment. Very soon after this organisation was introduced the European war ended and reductions began to take place at RAAF Headquarters with result that the organisation did not get a fair trial. It tended however to be top heavy in that it required a considerable increase in personnel at RAAF Headquarters to do the work which had previously been done by smaller numbers. In essence it really meant the scrapping of the unwieldy signals organisation and the re-modelling of the whole of the Radar setup.

67 No 1 RIMU

No 1 RIMU had been re-named Radio Development and Installation Unit and took over responsibility for signals matters as well as radar.

68 Radar Wings

These had been abolished and in their place a number of RIMU's had been established which were responsible for the storage, installation and repair of all communications and radar equipment in the area. They also served as base organisations for mobile formations.

69 ADHQ's

After an apparently interminable period of indecision a firm move had been made to gain proper control of the air defence problem in the formation at the main points in static areas of Air

Defence Headquarters. This organisation really amounted to the pooling of all matters concerning air defence, including radar filter rooms, operations rooms, air observer corps and fighter squadrons under an officer sufficiently senior and experienced to accept responsibility for the air defence of the area. It was the first time the air defence problem had been appreciated properly and it looked like producing order out of the existing chaos.

Prior to this an attempt had been made to establish a system of zone filter rooms which regarded the radar, observer corps and filter room organisation as a permanent facility which could be used by a mobile operations room and fighter organisation to "tap in" wherever a threat appeared. The arrangement was very logical but was never brought to completion owing to the shortage of manpower and the diminishing need for it as the war moved north. The new ADHQ organisation was at least a workable solution but again it was to be paralysed by the shortage of manpower and the need to send all able-bodied personnel to Northern areas. However, it sets an excellent precedent for the future.

10 MFCU's

In the process of re-organising air defence, steps had been taken to provide a more logical organisation for mobile operations in the establishment of a number of fighter control units. These units were designed to follow the war in operational areas and were equipped as self-contained units with LW/AW and GCI radars, communication systems, filter and operation rooms and ample staff. They did not control the fighter squadrons but were actually placed at the disposal of the local fighter commander who co-ordinated the whole organisation. Here again order was produced out of comparative chaos and MFCU's were used successfully in the operations of TARAKAN, BALIKPAPAN and LABUAN. The fact that the enemy air opposition did not warrant so elaborate an organisation was incidental.

11 RAAF Command

Early in 1945 RAAF Command moved to MOROTAI where it was established in the same area as Headquarters 1st TAF. By this time it had accumulated a complete radar staff of its own, the Staff Officer Radar functioning under the Chief Signals Officer. The staff officer radar, however, had surrended his original responsibility for operational control and confined himself to more technical matters. A staff officer filter rooms had been appointed under the Director of Operations, and being a radar officer he was in a position to deal with operational matters concerning radar.

At the same time the problems of higher policy were dealt with by the Director of Operations in consultation with the Staff Officer Radar. This organisation again had placed operational responsibility where it belonged. I found that some dissatisfaction had arisen concerning RAAF Command's employment of the radar organisation this situation culminating in a minor revolt at the Signals Officers' conference towards the end of 1944. This was an echo of previous differences which had arisen in 1943 over the employment of 4 radar stations in the Gulf of Carpentaria and one in the wilds of NEW GUINEA. All these stations had been sited in completely isolated areas where not more than one aeroplane per day was ever plotted and nothing is more calculated to undermine the morale of a radar station than inactivity. When this was backed up by an extremely inefficient communication system the flight of the stations was unenviable. In spite of this they were kept in these positions by RAAF Command for many months after the threat which caused them to be placed there had disappeared.

A similar situation had developed in NEW GUINEA where our radar organisation was under the control of 5th Air Force but had to serve a dual master in RAAF Command. The Americans tended to send RAAF radars into very sticky positions, the worst example being the establishment of a radar on BATT ISLAND near MANUS some time before the landing took place. This station was withdrawn some weeks later with two men dead and all the crew seriously ill. 5th Air Force preferred to send RAAF radars to these jobs, if not because the jobs were unsavoury at least because the RAAF personnel and equipment were the only ones in the area which could be relied upon, and the situation became so bad that a serious shortage of manpower developed; after the MANUS operation RAAF Command was forced to curtail considerably the number of radars at the disposal of the Americans.

Technical Details

72 Ground Radar

A number of new radars were under development as listed elsewhere, including the LW/AWH, GCI Mark II, GCI Mark III, LFC, AW Mark V, etc. Of these only the GCI Mark II ever got into operations, the remainder being in the hands of Radiophysics when the war ended. During a visit to MOROTAI early in 1945, I was successful in obtaining RAAF Command's agreement to the cancellation of the AW Mark V project. It was intended that this should be an AW equipment completely re-designed to embody all possible anti-jamming measures. At the same time the AWH was being designed to perform the same function better, and RAAF Command agreed that enemy opposition was so slight that the extra facilities provided by the AW Mark V would not be needed before the AWH was available.

73 Airborne Radar

ASV Mark II was in extensive use, with various modifications including a Polyplexer, and an extensive organisation of ASV beacons had been established throughout operational areas. A number of ASD equipments were being operated in Venturas but these never reached large numbers, while ASB was in use in some of the Catalinas but was being replaced. A new project, SCR 717 in Liberators was just coming into being and will be dealt with separately.

74 Radio Countermeasures

Plans were in hand for a special Ferret flight of two Liberators carrying all manner of detection and recording equipment and elaborate plans had been laid for training personnel in RCM matters. At the same time a complete survey had been made of all RAAF radar and radio equipment with a view to the introduction of anti-jamming measures.

75 Ionospheric

A thriving organisation had been built up and a new contract was under way for the production of a re-designed recorder which was to be established at such places as MANUS, and one of which was likely to be sent to CHUNGKING. At the same time considerable thought had been given to the problem of tropospheric investigations based on anomalous propagation records by RAAF Radar Stations, and a special investigation by CSIR was under way at DARWIN.

76 Navigation Aids

These were now the responsibility of the Director of Radar and were in a turmoil. The standard RAAF navigation aid had been high frequency D/F but this now looked like being abandoned. Much

discussion arose as to suitable replacements and the policy to be adopted to meet RAAF Command's operational requirements for navigation aids in all Service aircraft. The matter was so bound up with future Civil Aviation policy, RAF policy and the advent of new equipment that no easy solution was possible.

Of all the navigation aids Loran deserves special mention. The Americans had established a Loran chain in the Darwin area and this had been used by American aircraft operating over the NEI. As the equipment became available it began to arrive in AUSTRALIA in transport aircraft, bombers, and in fact all large aircraft supplied from USA, and it found the RAAF unprepared to use it. A training school had been established by the Americans at NADZAB and a number of RAAF personnel had been sent to this school, after which an attempt was made to introduce Loran training at OTU's.

The story is really a repetition of the old ASV story in which much technical equipment was flown in RAAF aircraft but not used because the crews were insufficiently trained. This persisted, making little improvement up to the time the war ended, and was due partly to the fact that so many other navigation aids were available that the crews did not bother to learn to use a new one.

77 Operations in 1944

By the beginning of 1944 radar in the RAAF had had its day, mainly because opposition by the enemy had practically disappeared. Airborne radar was used only as a navigation aid if at all, except in the case of Catalinas in the laying of mines in enemy waters. Ground radar, which was finally available in good numbers, had no enemy aircraft to plot. In Southern areas an attempt by RAAF Command to maintain the already unemployed chain of fixed stations had to be abandoned owing to the shortage of manpower, and stations were gradually closed down until by the end of the war comparatively few were operating.

In a flush of enthusiasm a very elaborate MFCU organisation had been established to cover the projected attacks in BORNEO. This again, as it happened, proved to be unnecessary in that the total number of enemy aircraft seen during all the Borneo operations could almost be counted on the fingers of both hands. The RAAF had finally built up a really adequate radar organisation only to find that there was no real use for it. This story is a little akin to the one of radar and filter rooms in 1942 where the over-elaborate ones in Southern areas saw no enemy and never became efficient, while the scratch ones in Northern areas which had a real enemy to deal with became very expert. So with radar in operational areas. In the bad days of 1943 during the NEW GUINEA operations, radar turned up trumps under appalling conditions. By the time it became properly organised in 1945 there was no use for it.

78 Liberators and SCR-717

The introduction of Liberators towards the end of 1944 warrants special attention. Specifications for the Liberator had been considered as early as 1943 and originally RAAF Command stated that no radar would be necessary, or alternatively that ASV Mark II would be adequate. Early in 1944 it was announced from AMERICA that the Liberators available would have SCR-717 and AN/APQ5B already installed, so RAAF Command agreed to accept them with this fitment. SCR-717 is a sea search 10 centimeter radar specially designed for anti-submarine work and AN/APQ5B is a highly specialised radar used in conjunction with SCR-717 as a low altitude bomb sight - that is, below 2,000 feet.

The first 78 Liberators arrived without radar and RAAF Command immediately asked for retrospective fitment to standardise them with the remainder. RAAF Headquarters agreed to fit SCR-729 but as the remaining radar required 3,000 man-hours per aircraft and manpower was exceedingly short, no action was ever taken to install it and the project finally lapsed, RAAF Command still requiring it and RAAF Headquarters unable to comply.

In August 1944 RAAF Command asked that all Liberator crews should be trained in the use of LAB and as a result Flt Lts McQueen and Tyler with two aircrew officers were sent to USA for training in its use. At this stage it is necessary to point out that APQ5B had been built specially for very low altitude attack on ships under conditions of zero visibility and two special American squadrons had operated in this area in 1943 with excellent results. The equipment, however, was so highly specialised that only continuous practice and the devotion of the aircraft to this special role full-time was likely to achieve reasonable results. It is not clear, therefore, why RAAF Command specified that all Liberator crews should be trained in its use.

On return of the party from AMERICA training of mechanics and WAGS was commenced at Radar School, MARYBOROUGH, using SCR-717 equipment which had been used to train American personnel. From there partly trained WAGS went to BALLARAT where they joined aircrew members and received further training on ground handling and some flying. They were finally crewed up at TOCUMWAL in the heavy bomber OTU and an attempt was made to produce efficient low altitude blind attack crews.

From the start the project was unfortunate. As with many previous RAAF aircraft an attempt was being made to produce a general purpose crew and therefore a correspondingly short period of time was available for radar training, the period being in fact about one-quarter of that declared by the Americans to be necessary. It was agreed that this extra time would be made up when crews arrived in operational squadrons but here again arrangements seemed to go wrong as the aircraft were used mainly for high altitude day work and later in close support and there is no record of the special radar equipment ever being used against the enemy. As the strategic situation was changing fairly rapidly about this time the reason for this may have lain in the move of the Japanese northwards but the net result was that practically all the time and effort spent on radar training, particularly in the use of APQ5B, was wasted. A similar story with minor variations can be told of Loran in those days.

74 Organisation for Production

Of all the problems which confronted radar the production of equipment was by far the greatest. Enlistment of personnel, training, and establishment of suitable organisations were all easy in comparison, as they followed accepted Service practice. Never before, however, had the Services been faced with the problem of translating a scientist's dream into an operational requirement and then securing equipment to put it into practice. The original conception has been mentioned in the discussion on Radiophysics Laboratory. In this case RP Laboratory was to produce prototypes and PMG Laboratory was to arrange manufacture.

The first problem which arose was the need for operational tests on the prototype. This meant that the RP Laboratory had to produce equipment which could be used operationally by the Services. A strong Service flavour was therefore necessary in the RP Laboratory. Unfortunately, this had not been arranged, partly because the problem does not seem to have been properly appreciated, partly because of the shortage of suitably qualified personnel, and partly because the Laboratory intended originally to do only "Research". The Laboratory in those days tended to be a law unto itself and the result can be seen in the ASV equipment which, when finally produced as a prototype complete with manufacturing drawings, could not be manufactured without re-design.

When the British ASV equipment was handed to the PMG Laboratories, success was finally achieved as the same organisation designed the equipment and arranged production, and this gives the key to the problem. By the end of 1941, and with the entry of JAPAN into the war, production problems reached new heights. The Americans entered the field and it looked as if chaos would develop. Fortunately the problem was properly appreciated and it was decided that a central organisation should co-ordinate all radar production. In January 1942, therefore, the matter was handed to the Department of Munitions, a Directorate of Radio and Signals Supplies being formed to deal with it.

This directorate was headed by Lt Col S.O. Jones, an Army signals officer, who had seen service in the Middle East and had been a PMG engineer. From then on things took a turn for the better although the most difficult stage was just beginning. The Directorate of Radio and Signals Supplies, although formed from scratch and comprising an untrained staff, gradually gained control of supply arrangements and finally was able to look after production as well. The story of radar at this stage (1942-1943) is one of continual shortages of vital items of equipment. Very great difficulty was experienced in securing supplies of "micropup" transmitting valves which were the essential valves in ASV as well as SHD and AW. These were secured in very small numbers from overseas until finally the Directorate was able to set up manufacturing facilities in AUSTRALIA.

Similar difficulties were experienced with many other types of equipment including concentric cable, 1852 valves, etc etc, but the co-ordination of all requirements under one Directorate enabled supplies to be distributed in order of priority and saved untold duplication and confusion. In the services a working committee had been set up to advise day to day distribution of items in short supply as they became available, while with the move of GHQ to BRISBANE an Allied Services Signals Standardisation Committee was organised on which all Services, together with Munitions and CSIR were represented. This committee helped to eliminate duplicate production and ordering of equipment and at the same time had some success in persuading several services to accept the one type of equipment instead of having a special design for each.

8. Supply from Overseas

The institution of lease-lend arrangements by AMERICA in 1941 opened the way in theory to the unlimited supply of American equipment and an organisation was set up in WASHINGTON to procure and despatch equipment as it became available. The difficulties which this organisation experienced and the complications of procedure are almost unbelievable. The RAAF sent Squadron Leader J.T. Phillips to WASHINGTON towards the end of 1942 for the official purpose of securing information on the situation and returning to AUSTRALIA. Actually he stayed in WASHINGTON for nearly two years and was able to shepherd Australian radio and radar orders through the many supply channels.

Ordering in WASHINGTON was done by Australian War Supplies Procurement and in AUSTRALIA a section of the Customs Department, known as Division of Import Procurement, was the ordering authority. The complications which arose between Division of Import Procurement, Munitions and the Air Force in AUSTRALIA and AWSP and the Air Force in WASHINGTON were considerable. As an example of what happened, AUSTRALIA was asked, early in 1943, for its forecast of airborne radar requirements for the next 12 months. Although this request had been with Div Impro in AUSTRALIA for some considerable time, the Air Force was given only a few days to produce the answer. After this forecast had been telegraphed to WASHINGTON by Directorate of Radio and Signals Supplies, WASHINGTON asked for firm orders, giving only one day for a decision to be made. Munitions passed the forecasts as firm orders, the figure totalling about £2,000,000.

Most of this had later to be cancelled owing to changing Air Staff Requirements, causing ill feeling on all sides. This one incident is quoted as an example of many similar occurrences which indicated the confusion existing at the time. Towards the end of 1943 the position began to stabilise and the Directorate of Radio and Signals Supplies gained a firm grip on the situation. From then on ordering became easier and things were sorted out much better.

9. Research and Design for Production

It has already been shown that from an early stage complications arose between the research and the production organisations and a study of past history may help to point the way for the future. In the original conception Radiophysics Laboratory was to undertake research and development and the PMG Laboratory production. Very quickly difficulties arose owing to overlapping or gaps between the two organisations and no real satisfaction was ever reached until the one organisation handled all aspects of the problem. The Radiophysics Laboratory soon realised its shortcomings and endeavoured to overcome them by setting up a model shop in which workable equipments could be produced in sufficient numbers, to provide up to half a dozen for operational use.

Very soon too the PMG's Department practically withdrew and the problems of production were taken up by the Munitions Department. The situation had thus changed to Radiophysics producing workable models and Munitions organising production with the manufacturer. Here again things went wrong. Most RAAF production was done in SYDNEY where the representative of Munitions was the Board of Area Management. Unfortunately Munitions Headquarters in MELBOURNE appeared to have very little control over the Board of Area Management which caused considerable trouble by acting regardless of MELBOURNE wishes, and it was only the presence and tact of the RAAF Radar Liaison Officer in SYDNEY which allowed arrangements to run smoothly.

Taking a cue from overseas methods Radiophysics and munitions finally adopted the practice of inviting engineers from the radio firm selected to make the final equipment to work in the laboratory until finality had been reached and then take the prototype to their own factory and organise production. In this way a reasonably smooth process was finally arranged. Experience gained by the Australian organisation, combined with policy developed overseas, points more and more to the importance of not separating research development, and to a certain extent, design for production. On the other hand it is the declared policy of CSIR that Radiophysics Laboratory must confine itself to pure research and that other organisations can be given the job of development and design. This policy, though declared during the war, was never carried out. In the first place, Radio Physics Laboratory did practically no pure research, and secondly the logical development of the system forced on them the necessity for following the job through to the manufacturing stage.

If the policy is to be followed, the laboratory does not need its large model shop which should be given to the appropriate organisation. Above all though, it is essential that the organisation for applied research, development and design for production be co-ordinated.

6) The New South Wales Government Railways Annexe

As soon as Radiophysics commenced the production of prototypes and the SHD programme was accepted, need arose for the manufacture under conditions of reasonable security, and particularly where suitable priorities could be obtained, of the new equipment. Early in 1941 the Radiophysics Board decided that this work would be done in the New South Wales Government workshops. As the work grew in scope however, it soon became necessary to set aside a special establishment for the purpose and at the end of 1941 a special Railways annexe was established from money provided by the Radiophysics Board.

This annexe was under the direction of the Chief Electrical Engineers Department and Mr. J.G. Worledge was directly responsible. Its first efforts went into the production of SHD aerial systems for the Army but interest very soon shifted to RAAF AW aerial systems which were based on the Army SHD. From then onwards RAAF work grew considerably and included such items as the construction of a combined operating hut and aerial system for AW and the installation of English CHL arrays on these huts when necessary. In August 1942 the first LW array was produced and from then on the annexe devoted most of its effort to LW, a total of well over 100 arrays eventually being produced.

From the beginning of 1944 the annexe acquired a very wide field of interest, producing LW centimeter sets for the Army, prototype centimeter sets for the Americans and prototypes of a number of equipments for the RAAF. The remarkable thing about the annexe was the versatility of Mr. Worledge. His ingenuity and readiness to meet suggestions for improvement often meant that modifications to equipment were produced almost as quickly as their need became apparent.

So co-operative and understanding was he that it was decided that the RAAF programme would benefit considerably if he visited the operational areas, and early in 1943 he did a tour of the New Guinea areas, gaining first-hand information of the problems being met by the LW-AW radar and on his return was able to contribute materially to improvements in design. It can reasonably be said that without the services of the Sydney Radar Liaison Officer on the one hand and Mr. Worledge and the New South Wales Government annexe on the other, development of RAAF Ground Radar would have been from 6 to 12 months slower.

83 Movement and Storage of Equipment

With the movement of the war northwards a Transport and Movements Organisation was established to take care of the extended lines of communication. This organisation had sections at all focal points and was responsible for receipt, storage and forwarding of equipment from Southern areas. Its operations involved for one reason or another the loss or ruin of many thousands of pounds worth of equipment.

In the first instance equipment was despatched from Southern areas inadequately packed, with the result that serious breakages and pilfering occurred. On arrival at Northern areas such as TOWNSVILLE, inadequate storage was available for equipment awaiting forwarding, with the result that the already broken packages lay for considerable periods in the rain. Further damage during shipment followed by more extensive periods in the open resulted in much of the equipment which reached such places as NEW GUINEA being practically useless.

Fortunately, the radar organisation suffered less than most from this system, mainly because equipment was fragile and secret and consequently received better packing and was usually escorted. However, considerable damage was suffered and a move was made in 1943 to produce adequate sets of transit cases which would ensure proper protection of the equipment in transit and storage.

A further problem appeared, when on a number of occasions during landing operations radar equipment was thoroughly swamped by salt water with tragic results. In 1944 therefore a determined effort was made to produce a set of transit cases which would be sufficiently strong for transport purposes and which would be watertight when closed, so that if necessary they could be thrown overboard and floated ashore. By the end of 1944 these cases were approaching production and several of the radar stations which took part in the BORNEO operations were fitted with them.

To summarise, it may be said that, from the many bitter experiences of losses during transit and storage it became obvious that the greatest possible precautions had to be taken in the construction of transit cases, otherwise the strenuous efforts of the production organisation were largely wasted.

84 Tropicalisation

Before the war commenced the RAAF had seen very little service in tropical areas and although it was realised in a general sort of way that special precautions were necessary in the manufacture of radio equipment to withstand tropical conditions, no experience of these precautions had been obtained. From the radar point of view the tropical problem was first seen at MILNE BAY towards the end of 1942. A CHL equipment was established there but it was soon found that the receiver broke down frequently due to arcing over of high tension components. It was also found that this trouble occurred only after the equipment had been non-operative for some time, and herein lay the secret which was to save us for almost two years before proper precautions were taken.

It was realised that the breakdowns were due to the condensation of moisture on and in various components such as transformers owing to the cooling down of the equipment and the sucking in of humid air which then condensed. Very soon after this AW radars without special tropic proofing were sent to the New Guinea area and it was found that the provision of a heating element at the base of each cubicle would save most of the trouble. The

element was switched on whenever it became necessary to close down the equipment, thus ensuring that the air inside the cabinet was well above ambient temperature at all times. These precautions combined with the sealing of high tension transformers in airtight cans made the AW radar a reliable equipment under almost any conditions.

It should be noted at this stage that this is only half of the trouble of tropicalisation; the other half lies in the problems of transit and storage. It is probably safe to say that almost any piece of radio equipment which has been constructed to sound manufacturing principles will operate indefinitely if treated as outlined above. However, special precautions are necessary for equipment which is to be left in store for some time or transported by road or sea. In this case high humidity often results in the growth of fungus on various components and deterioration of metal finishes, etc. It was this fungus growth combined with results of bad maintenance and atrocious transport and storage which finally prompted a move by CSIR early in 1943 to attack the tropical problem. A number of scientists were appointed and Flt Lt Kerr-Grant, a RAAF radar officer, was attached to the party which then proceeded to NEW GUINEA to examine tropical conditions. The party investigated all manner of tropical conditions, particularly the performance of clothing, etc, but it cannot be said that much advantage accrued to the RAAF radar organisation from their investigations, which tended to be long term rather than immediate. In short, the progressive modifications which had been introduced by the Service with the progress of time had already succeeded in making the radar equipment reasonably tropic-proof, so the discoveries of the tropical investigation section were more applicable to industry in the post war period.

Early in 1943 the RAAF began to take a keen interest in tropical problems. This was due to the impending South East Asia operations and it is quite surprising that the RAF who had been supplying equipment to the India, Burma, Singapore area for many years previously, had not already evolved its own tropicalisation processes. However, they had had word of the developments in AUSTRALIA and in response to a request two officers, Sqn Ldr Hannam and Flt Lt Parr, were sent to ENGLAND to assist the Ministry of Aircraft Production in any way possible. It is not intended to outline their activities here but the RAF embarked on a major plan of tropicalisation which was cut short by the early end of hostilities. This is an interesting example of Australian aid to the UK instead of the reverse.

THE PERSONNEL WHO MADE IT POSSIBLE

85 ### During Hostilities

No record of the radar organisation would be complete without special reference being made to the personnel who made it possible. There is a strong tendency to think of radar in terms of technical equipment capable of a certain performance and to ignore the human beings whose skill and ingenuity produced it and whose tenacity and enthusiasm made it produce the best results. Throughout this record, mention has been made in various places of individuals by name. They are not the only ones deserving comment, they merely happen to be those concerned with very interesting stages of development.

While great credit was due to those who built up the organisation and assisted in the design and production of the equipment, the greatest credit is due to those who worked on radar stations and in aircraft in the face of the enemy. We have the first classic example at DARWIN where the personnel of the unfinished radar station took no part in the general evacuation which followed the first Japanese attacks, but worked with renewed vigour on their station. Throughout the whole war, the ground radar story repeatedly shows examples of this type of tenacity. Stations erected and operated on lonely islands or at inaccessible places in the jungle with very poor communications with base areas had to rely on their own resources to compete with the menace of nature in climate and disease or of the enemy in bombing or marauding forces. Aircraft using ASV put up very creditable performances, particularly in the case of night operations by Catalinas during which at least one enemy vessel was sunk. It was only the incredible courage and ingenuity of all these people that made the organisation useful. Presented with comparatively untried and definitely unreliable equipment to be used in inaccessible areas where no facilities were available, they made it work and kept it operating, knowing that many others depended on them.

86 ### At the Conclusion of Hostilities

When the war ended, the radar organisation included over 130 ground stations and 500 aircraft fitted. This required approximately 300 officers, 1500 mechanics and 1400 operators with a total of at least 4000 personnel of various ranks and musterings on ground radar stations alone. As soon as the demobilisation started, radar personnel appear to have headed the exodus with the result that shortly afterwards practically no radar personnel of any kind were left in the Service. The reasons for this are various, but there are probably two main ones.

Firstly, there were no permanent radar personnel, all having been secured for the duration of hostilities and they were naturally keen to get back to civilian life, many of them going to their original or new jobs and many others to finish University courses. Secondly, the lot of radar personnel, at least on ground stations, was not an enviable one. While they were happy to serve in lonely and isolated spots in the bush during war, they were not keen to continue this existence in peacetime. Combined with this was a certain resentment of their treatment.

When in 1944 signals and radar were combined, the radar people were placed under the control of the local signals organisation and, invariably, the signals personnel being senior, radar took a second place. They felt, rightly or wrongly, that in addition to this they were given a raw deal by their signals masters and some resentment existed in many places.

All this points a lesson for the future. With the co-ordination of signals and radar, there must eventually be a common radioman rather than a signals or radar, and the sooner this co-ordination is achieved the better. In the meantime, the radar people are not a dead loss; many of them are completing University courses and in a year or so time will be much more useful than they were when they left the Service. They are thus a potential reserve against the day when better terms and conditions can be offered them and really qualified men are again required.

CONCLUSION

Radar, which started from zero in 1939, became the greatest scientific development of the war. In conjunction with the fighters, it won the Battle of Britain, and in Coastal command it put an end to submarine warfare. In conjunction with fighters, it stopped the Japanese raids on DARWIN, and the tremendous Japanese losses at bases without Radar cover in the islands are an indication of what would have happened to Allied bases in Northern Australia and NEW GUINEA in the absence of radar warning.

As far as AUSTRALIA was concerned, it reached its peak in 1943. In the LW/AW and ASV Mark II, AUSTRALIA had two weapons which proved to be adequate for the rest of the war. For the war against the Japanese in particular, the LW/AW equipment was ideally suited to the conditions in this theatre and no other equipment in existence could have done the same thing so well. By 1945, however, a complete reversal had taken place. The war requirements had changed from air transport to sea transport, and European type radar was suitable for these tactics; in fact, with the possible introduction of RCM and the masses of aircraft likely to be encountered, European type radars were desirable.

Australian radar therefore suffered a complete eclipse; from being the only radar suitable to the area, it became outdated in the matter of a year and we finished the war with completely antiquated radar by European standard. This, combined with the almost complete loss of radar personnel, takes us back to scratch, but with one advantage; we are not hampered by masses of radar which might have been of use for some time during peace. Our radar is so out of date that completely new and up to date radar - radar which has not even been designed yet, must be secured. It will be the outcome of research carried out on the new Rocket Range in SOUTH AUSTRALIA, and our war-trained radar men will be the reserve of experience which will be necessary for this work in the future.

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APPENDIX A

RADIOPHYSICS ADVISORY BOARD

The history of the Radiophysics Advisory Board is really that of radar, at least up to 1943. The Board was appointed on the 26th October 1939 and held its first meeting on the 29th November 1939. Its constitution and responsibilities are set out in file 201/14/46 at enclosures 3A and 11B. The original membership of the Board was as follows:-

Professor J.P.V. Madsen - Chairman

Director-General, PMG's Department

CNS

CGS

CAS

Chief Executive Officer, CSIR

Sir David Rivett

The Board was originally designed to control all Radiophysics activities in AUSTRALIA and as time went on this control was extended from decisions as to what work was to be undertaken at the Radiophysics Laboratory to co-ordination of Service orders for radar equipment, co-ordination of manpower requirements, training, etc. The Board was originally under the Minister for CSIR but in May 1940 it was found necessary to change this control to the Minister for Defence Co-ordination who at that time was the Prime Minister. He appointed Mr. Sheddon as his representative to deal with all matters raised by the Board.

This changeover became necessary owing to financial difficulties which arose because of the great number of Government Departments with which the Board had to deal. The original chairman was Professor (later Sir John) Madsen of Sydney University but when he left to visit UK in March 1941 the services of Professor White were obtained from NEW ZEALAND and Professor White occupied the chair until November 1941. From its inception the proceedings of the Board appear to have been dogged by misunderstandings. The Chairman of the Board was also the Chief of the Radiophysics Laboratory and a member of CSIR and as Sir David Rivett was also a member, CSIR had the biggest individual representation.

This was no doubt correct, as CSIR was fostering radiophysics work, but it had unfortunate results which were largely due to the very high level at which the Board operated and the fact that while CSIR had technical representation, the Services were represented by their chiefs whose knowledge of technical detail was not extensive. The net result was that the Service Chiefs were "blinded by science" and the progress of radar was marked by a long string of promises which often proved impossible of fulfilment.

The trouble lay mainly in the fact that the scientists of CSIR, in the usual enthusiasm of scientists, did not foresee the difficulties involved and the considerable time necessary to design equipment and produce prototypes. Further, even when prototypes were produced they had to be handed to PMG's Laboratory for manufacture and it was then found that they had been produced by people without knowledge of commercial technique and, as a result, had to be re-designed before they could be manufactured. From the Services point of view the fault lay in the fact that there were no scientific advisers available to the Chiefs of Staff, with the result that the Chiefs had to meet the scientists in conditions where they were out of their depth and had to waste much personal

time listening to technical details which they could only refer second-hand to their technical staffs.

As time went on it became more and more apparent that the influence of CSIR on the radar programme was too strong. The problem had moved from pure research (if it had ever dwelt their for long) to development and production of prototypes. Further, the Chiefs of Staff began to realise that they could not cope with the technical detail involved and therefore in December 1941 a number of changes were made. The control of the PMG's Department had been switched to the Department of War Organisation of Industry and it was considered that Mr. McKay, Chief Electrical Engineer, should be appointed to the Radiophysics Advisory Board. As Munitions was coming into the picture in the procurement of equipment, Mr. Brodribb was also appointed to the Board. Mr. Witt, Chief of the PMG's Laboratories, attended the meetings as representative of the prototype and production organisation and thus the Board acquired a production bias which was very necessary at this stage.

At the same time a Radiophysics Technical Committee was appointed to discuss technical detail. Members of this Committee were:-

Professor White - Chairman	}	Radiophysics Laboratory
Sir John Madsen	}	
Commander H.J. Buchanan	-	Navy
Lt Col F.N. Nurse	}	Army
Captain N.R. Buring	}	
Gp Capt C.S. Wiggins	}	RAAF
Wg Cdr A.G. Pither	}	
Mr. S.H. Witt	-	PMG
Lt Cdr Whittaker	-	RN

From this time onwards all technical matters were referred to this Committee whose proceedings were referred to the Radiophysics Advisory Board for decision as necessary. In July 1942 a further change took place when the Chiefs of Staff handed over their seats on the Board to their representative technical officers. As I was then Director of RDF, I was appointed to represent the CAS. All this time increasing dissatisfaction had been felt by the Services with the progress of radar, and at the meeting of the RP Board on 14th July 1942, a revolution took place.

The cause of this dissatisfaction was the conduct of the Radiophysics Laboratory and will be dealt with separately. File 201/14/173 sets it out in detail and it hinged around the fact that the design and production of radar equipment had lagged so much that the services had lost faith in the CSIR management. The Services arrived at the Radiophysics Board meeting on 14th July 1942, determined to overthrow CSIR control. CSIR was equally aware of the general feeling and Sir John Madsen opened the meeting by tendering his resignation (File 201/14/125 - Enclosure 28B). He pointed out that the role of CSIR was to engage in research and that the problems of production were rightly the problems of the Services or other organisations. Mr. McVey was nominated as chairman and things looked like taking a new turn.

However, at the 22nd meeting of the Board on 24th September, it was announced that the Prime Minister had decided to transfer the Board back to the Minister in charge of CSIR. Sir David Rivett stated

that he had not been responsible for this move nor was he in sympathy with it, but there appeared to be no alternative. At this meeting considerable discussion took place concerning the proper roles of each of the authorities concerned with radar, ie RP Laboratory, Munitions, PMG's Department, RP Board, Services. This matter will be dealt with under "production". From this time onwards the Radiophysics Advisory Board suffered a decline. More and more work was done at the level of the technical committee and from the middle of 1943 onwards the Board became more or less a figurehead, meeting at less frequent intervals.

APPENDIX B

RADIOPHYSICS LABORATORY

This laboratory was formed late in 1939 for the purpose of carrying on radiophysics work in AUSTRALIA. Initially (pre-war) it had the following role:-

(a) Instruction and training of staff in the use of equipment;

(b) Adaptations of equipment to suit the particular needs of AUSTRALIA and NEW ZEALAND;

(c) Research on special parts of radiophysics, decided in consultation with Great Britain;

(d) Training of personnel for operating equipment;

(e) Assistance to neighbours, particularly NEW ZEALAND;

(f) Planning for possible production in emergency;

(g) Application of radiophysics technique to the needs of civil aviation and industry.

With the outbreak of war and the visit by Professor Madsen to ENGLAND, arrangements were made with the British authorities that the Australian Laboratory should become a sub-centre to the main activity in Great Britain. The British Government was to provide samples of equipment, stocks of components and drawings of equipment. The Services immediately started asking for equipment and it was arranged that the laboratory would design and produce equipment up to the prototype stage and then hand over working drawings to the PMG Laboratories in MELBOURNE who would arrange production. The RP Laboratory was accorded absolute priority in the acquisition of scientific apparatus, equipment and personnel, and grew very rapidly into a large and influential organisation.

Owing to an unfortunate combination of circumstances its operations were soon covered by a shadow from which they did not emerge for some years. From the RAAF point of view the ASV project was the main case in point. The original Australian ASV equipment was based on the British Mark I although a Mark II had already been designed in ENGLAND, and because of repeated delays it had not reached prototype stage when a British Mark II equipment became available in AUSTRALIA 18 months after work had commenced on the Australian version. Shortly after this the Australian version was ready for handing over to the PMG Laboratories and it was then found that although it had been brought to the prototype stage with complete working drawings, manufacture would be impossible without re-design by people familiar with manufacturing techniques.

This, combined with the fact that it was based on an antiquated design, led to the decision in August 1941 to hand the whole project to the PMG Laboratories who would proceed to copy a British Mark II equipment, starting again from scratch. Thus, from the RAAF point of view the RP Laboratory had spent 18 months on a project which was very largely wasted. From this time onwards the RAAF had practically no interest in the laboratory until the war with JAPAN and the advent of the AW equipment which, it may be said, was the only worthwhile produce of the laboratory in the first three years of its existence. In March 1942 dissatisfaction by the Services resulted in a proposal for its re-organisation. Details of this move are set out in file 201/14/173.

The following record of SHD equipment as provided by the Army on this file is an indication of the situation:-

July 1940 - Orders placed for six sets, this number later being increased to 30.

September 1940 - RP Laboratory informed the Board - "15 sets would be completed almost at once".

May 1941 - Professor White informed the Board that it appeared that in August next SHD sets would be in production at the rate of one per week.

September 1941 - A schedule showing delivery forecasts was distributed by Professor White covering 18 sets, the first to be delivered in September and the last in January 1942.

March 1942 - One set just installed and two others nearing completion.

A similar story is recorded of GL equipment. In November 1940 the Chairman of the RP Board reported that "work on an improvised GL set would be completed in 6 to 8 weeks". At the RP Board meeting on 24th September 1942 (file 201/14/125) it was decided to cancel all work on Australian GL equipment as adequate supplies were arriving from overseas. At this stage Australian GL had not commenced production.

The chief cause for complaint by the Services was the inability of the Laboratory to live up to its promises, due, the Services felt, to poor organisation within the laboratory. Various proposals for re-organisation were made but they never reached CSIR officially and the Services responded by taking as many projects as possible away from the laboratory and dealing with them direct through manufacturers. In the case of the Navy this resulted in a contract for centimeter radar with AWA in which Radiophysics played no part.

The Air Force had no important items with RP until the beginning of 1943 when RP was invited to assist in the design of a transportable GCI. In July 1943 negotiations were again opened up for the design of an air warning equipment giving heights, and based on a 30 centimeter magnetron which had been produced by Professor Martyn in Melbourne University.

This equipment is mentioned elsewhere but a study of its progress is outlined on file 201/59/4 - Enclosure 74A will serve to indicate the general situation:-

8/7/43 - Original specification raised (see file 201/28/258 - Enclosure 20) given priority 1 by Radiophysics Laboratory and an experimental set to be completed by December 1943.

19/4/44 - CSIR reported that the experimental set had reached the stage where co-operation with the manufacturer was desirable.

3/6/44 - Air Board Agendum 5881 provides £20,000 for the development of two prototypes LW/AWR Mark II to be delivered by December 31st 1944.

2/9/44 - File 201/63/1, Enclosure 7A severely criticises Radiophysics for failure to carry out certain requirements for LW/AW Mark II and suggests that the project be taken from the laboratory and given to a suitable manufacturer.

22/11/44 - Experimental model to be tested at BONDI during December. AWA unable to start their prototype until later.

After this continued delays and changes occurred until finally with the conclusion of the Japanese war the project was cancelled and diverted to a new system abandoning height-finding.

The problem of Laboratory, Scientist and Service has been dealt with elsewhere. That they can be made to work together is demonstrated in the success achieved by TRE and the RAF in ENGLAND and MIT and the Services in AMERICA. Each had its troubles, no less than did the Australian counterpart. From the RAAF point of view, the RP Laboratory was extremely valuable at many stages in the war, the real possibility for improvement being the achievement of quicker and more definite results.

The one lesson which must be learnt for the future is the need for close and properly organised co-ordination, and above all, really experienced business management of the laboratory. This of course crosses the principles of the scientist who claims that he must be "free and unfettered". Unfortunately, however, the free and unfettered scientist is usually no business man, and the answer lies in some kind of compromise.

VISITS BY OVERSEAS SCIENTISTS

The development of radar in AUSTRALIA depended for its progress on contact with overseas. This was due mainly to the astonishing amount of effort which was put into radar both in ENGLAND and AMERICA and the consequent difficulty of thinking of something which had not already been thought of before. This, combined with the need to concentrate on immediate requirements, resulted in the development here of overseas ideas to suit Australian conditions rather than much original work. Naturally some pains were taken to keep in touch with overseas organisations but the greatest benefits accrued from personal visits by outstanding overseas scientists. During the war there were visits by three noted foreigners - Professor Oliphant and Sir Henry Tizard from UK, and Dr Compton from USA.

Professor Oliphant

Professor Oliphant arrived here when things were at their worst in mid-1942. He brought a breath of hope from overseas and helped us, at a time when we were completely smothered by local problems, to get a glimpse of the future. He told of the developments of centimeter radar and forecast its use in specialised operations such as landings where it would be employed to direct the landing force from the control ship and by beach control parties ashore. Such techniques were eventually seen in action at LEYTE and other places in 1944.

In a paper presented to the Radiophysics Advisory Board on 23rd June 1942 - File 201/14/125, Enclosure 15D - he summarised the overseas developments, compared Australian conditions as he saw them with those in UK, and emphasised the need for the supply of better information to operational commanders. He felt that operational requirements arose more from the scientist's applications of his equipment to the problems of the commander than from the commander's request for equipment to meet a certain need, and he advised strongly that some simple arrangement should be made by which free exchange of information between Radiophysics and the Allied Command could take place. This advice was followed for a time in that conferences took place between Radiophysics and RAAF Command on several occasions but owing to various difficulties they were discontinued.

Sir Henry Tizzard

In the Spring of 1943 Sir Henry Tizzard arrived in AUSTRALIA. Sir Henry, who was scientific member of the Air Council, had played a leading part in the applications of science to the RAF and who led the first UK radar mission to USA, approached the problem from a different point of view. His interest was more operational than detailed and in discussions with the CAS and the Senior Air Staff his suggestions resulted, amongst other things, in the establishment of an operational research section and an Aircraft Performance Unit. In addition he visited Radiophysics Laboratory and took back to ENGLAND a very favourable impression of the Australian LW/AW.

Dr Compton

In 1944 Dr Compton of MIT visited AUSTRALIA and the South West Pacific area to examine the general radar situation. As a result of this visit the American Forces embarked on an attempt to provide lightweight radar equipment based on the conversion of airborne equipment to ground use, and several prototype equipments were manufactured by NSW Railways Annexe. At the same time some

attention was given to RCA and a small team of American scientists came to AUSTRALIA to work with the Radiophysics Laboratory on common problems.

These three visitors were the outstanding ones. On a lower plane numbers of Servicemen and civilians came to AUSTRALIA from time to time and reciprocal visits were made. Such exchanges are vital to the rapid and successful progress of such an enterprise as radar and should be encouraged in the future.

AIRCRAFT FOR RADAR EXPERIMENTAL FLYING

RP Laboratory

Throughout the development of radar, continual arguments took place concerning the provision of aircraft for the RP Laboratory. The first contact of the laboratory with aircraft took place at RICHMOND in the earliest days of ASV when English ASV Mark I was being fitted to four Hudsons. Even at this stage the elements of the difficulty became apparent. Either the squadron wanted to fly the aeroplane but was hampered by laboratory men working on it, or the laboratory men wanted to carry out air tests and the aircraft was unserviceable. With the removal of the ASV programme from the laboratory, interest in aircraft waned until 1942 when the problems of temperature inversion arose.

It was found that under certain weather conditions coastal radar stations could detect shipping at ranges very much greater than normal and it was decided that investigation flights should be carried out on the Sydney coast in an endeavour to discover the cause of this phenomenon. After some trouble arrangements were made for an Anson from the Communication Flight at MASCOT to do this work but from then on calls for aircraft from the laboratory became more frequent, particularly when it became necessary to test the Army SLC equipment which was being developed. When an American ASG equipment became available towards the end of 1942, a Beaufort was allotted specially for the installation and testing of this equipment and finally two Ansons were attached to Communication Flight MASCOT for the special use of the laboratory.

It is now clear that the only satisfactory method of producing air-co-operation for the RP Laboratory is to allot aircraft permanently for the purpose. There is always a feeling on the part of the Service that the scientist is using the aircraft for purposes other than the agreed programme - that is, for the purposes which do not appear to have any immediate application, but this must be accepted. A parallel can be drawn from the case of the British TRE where an entire RAF Station - Defford - was allotted for radio experimental purposes. In this case the station was used not only for purely experimental flying but also for the fitment of prototypes and special radio devices which became necessary to meet the rapidly changing tactics of the enemy.

Aircraft Performance Unit

The problems of radar development were finally faced by the RAAF by the establishment of No 1 Aircraft Performance Unit at LAVERTON about June 1944. This unit, which was a logical development from the test and performance flight, included a radar section and thus for the first time the RAAF had an organisation whose activities were devoted solely to developmental work. An effort was immediately made to build up the radar section of No 1 APU with equipment and suitably qualified tests were carried out by APU instead of Radiophysics. It is important to notice here that greater efficiency would have been achieved had APU and the Radiophysics Laboratory been close enough together to allow co-operation. APU aircraft could have been used for RP Laboratory tests and vice versa and better results would have been achieved.

TRAINING

Most of the training problems have already been dealt with chronologically but it is appropriate to summarise the progress of radar training here.

Commencement Training

On my return from the UK in may 1941 we were faced with the problem of providing radar officers and mechanics to service ASV in GR squadrons. Flt Lt M.A. Brown was made available from the signals organisation and he with four wireless mechanics was sent to Radiophysics Laboratory about June 1941 to receive preliminary training in ASV. On completion of their course they formed No 1 RDF School as a lodger unit at RICHMOND, the first course commencing in July. This school was later enlarged.

About August 1941 Squadron Leader A.E. Mitchell and four RAF radar mechanics arrived from the UK with a COL radar station. I had made arrangements for this with Air Ministry whilst in ENGLAND, the idea being to train ground mechanics for the RAF. By the time war broke out four radar courses had been started at the school, a batch of ten mechanics had been sent to ENGLAND in October to join No 10 Squadron which was being fitted with ASV, and four officers and a number of mechanics had been sent to SINGAPORE to assist in the forthcoming ASV project.

University Course

In August 1941, after considerable discussion between Radiophysics personnel and Chiefs of Staff and the Universities, agreement was reached to use Sydney University for RAAF radar officer training. I visited Sydney, Melbourne and Brisbane Universities, selected 50 suitable personnel, had them enlisted and commenced training by 15th September. We thus had a reasonable number of officers in training although numbers of mechanics available were low.

Technical School Training

In September arrangements had been completed by the Signals people to carry out wireless mechanic training at Melbourne Technical College. Courses were started every month, 50 trainees to each course. The first course completed its training in Melbourne Technical College in February 1942, by which time arrangements had been made to draft half of these to radar school for a two months radar course, after which they would be available as radar mechanics. This arrangement continued for some considerable time and was the main source of mechanics.

Radar Operators

From the beginning difficulties had been experienced in securing suitable operating personnel. These were originally provided from failed aircrew and other personnel unsuitable in their original musterings, but in May 1942 ABO N 399 introduced the trade of Radio Operator Group II, commencing with a trainee radio operator who did four weeks at Radar School and twelve weeks on a Radar Station before remuster. This was followed in July by the commencement of WAAAF training.

WAAAF Training

As has already been explained, very great difficulties attended the introduction of WAAAF Radar operators in that although

considerable numbers of WAAAF were available and were trained, objection by the Minister to employment of WAAAF at isolated radar stations and in Northern areas resulted in several hundred WAAAF trainee operators being unemployed for periods up to twelve months or more.

Training in Airborne Radar

In July 1942, with the commencement of No 1 OTU, arrangements were made for all wireless air gunners to receive some ASV training. This training had good results and in January 1943 a special ASV conversion course was started for the purpose of training wireless air gunners already in squadrons before the OTU syllabus commenced. These two courses were later extended to include other aircrew, including pilots and navigators.

The Liberator Problem

The receipt by the RAAF of Liberators from USA produced an outstanding problem, examples of which had been seen in varying degrees in respect to other equipment. The problem has been outlined elsewhere but it can be mentioned here that Liberator crews were first trained in radar at the Radar School MARYBOROUGH, after which an air flavour was added in pre OTU training at BALLARAT and finally an attempt was made to give operational training at OTU TOCUMWAL. Unfortunately equipment available was meagre and the problem was out of all proportion to the facilities, resulting in many Liberator crews being incapable of operating the equipment they carried. The fact that no operational use was available for the equipment was incidental.

Output from the School

Over a period of four years operations, the school produced the following personnel:-

Officers	- 300
Mechanics A	- 840
Mechanics G	- 687
Operators	- 1423

Lessons Learned

The outstanding lesson common to all equipment and nearly all wartime training is the need to have aircrews adequately trained before they are sent into operation with their equipment. This problem, although no doubt fully realised long before the last war, almost resulted in the abandonment of ASV in Coastal Command when it was needed most. It was introduced under the greatest secrecy, no training was given, and this, combined with the unreliable equipment, resulted in no use being made of it. Similar results were found in AUSTRALIA on the introduction of ASV and the perpetuation of the mistake in the Liberator programme, although partly due to the very serious equipment problems of the time, was probably due in the main to the failure of the Air Staff to learn the lesson.

A further lesson learned was the need for catering for progressively lower standard personnel as the war continued. The original course of six months produced from the material available at the beginning of the war a reasonably capable mechanic. By the end of the war the course lasted more than 18 months and the final product was not as good as the product of the first six month courses. Probably the real solution to this problem lies in increased specialisation. By the end of the war, in spite of an extended training period, it was still necessary to train personnel in one equipment only and to re-train them for any new equipment. It may even be necessary in future to train in specialised parts of an equipment and this matter requires very careful watching.

When the war extends over such a wide area as it did in the Pacific another problem arises in the transport of personnel to suitable centres for refresher training. The introduction of new radars, particularly ground type, should normally be accompanied by the provision of freshly trained crews to take them into the field; when manpower was scarce this was not always possible and in this case various makeshift means had to be employed such as the introduction of the equipment to the field by special training parties. I do not consider that this is the real answer as new radars are likely to be vastly different from the ones they replace, and the only adequate solution is the withdrawal of personnel to radar school for proper refresher training. The problem will always exist and must be met as the circumstances at the time dictate.

SOME FILES OF INTEREST

File No	Title	Notes
201/28/191	RDF Station, MORESBY	
201/19/16	Use of IFF in Aircraft - Policy	
201/14/173	Radiophysics Laboratory - Proposal for re-organisation	Details of dissatisfaction with Radiophysics Laboratory
201/14/67	Submarine Location by RDF	Account of first successful submarine patrol
201/14/7	Training RDF School	
201/14/19	IFF Fitting to Ships - Policy	Discussions with the Navy on IFF
201/18/5	ASV in Hudson aircraft	
201/23/60	RAAF Reports to Radiophysics Advisory Board	History of radar up to September 1944
201/14/46 201/14/45 201/14/125	Minutes of Radiophysics Advisory Board	Parts 1 and 2. See also later parts for further meetings.
201/23/64	Radiophysics Technical Committee	
201/28/27	RDF Liaison Officer, SYDNEY	
201/28/64	Radar Organisation in AUSTRALIA	Criticism of radar and proposal for re-organisation
201/28/65	Radar Stations - Priority of Construction	
201/28/209	Schedule of Radar Stations	Schedules of Stations at various dates up to December 1944
201/16/218	Transportable AW Sets for Allied Air Headquarters	The inception of transportable AW
201/20/59	Forecast of RAAF and WAAAF Establishments	
201/20/72	Personnel RDF Use of WAAAF Personnel	Story of the WAAAF
201/36/4		Development of LW/AW