

THE WORK OF THE RESERVE AIRCRAFT SUB-COMMAND AND THE HOME AIR COMMAND

PART 3

REPAIR OF DAMAGED AIRCRAFT

Aircraft Repair Categories

Because of the large number of aircraft which have to be repaired each year (about 500 Category 3 and 4 in 1950) it is not practicable to prepare a detailed defect list for each aircraft; instead they are categorized into a broad "Repair Category" on general merits. These are as follows:—

- Category 3.* Repairs which cannot be undertaken by the flying unit without interference to the flying task, but which are not bad enough to merit removal to a repair unit for thorough overhaul. For these "on site" repairs, a limit of about 500 man-hours is usually accepted, and the repair is confined to making good the specific damage; only the most urgent safety modifications are carried out. Repairs after an average "belly-landing" can be handled efficiently and economically in this way.
- Category 4. (Repair)* This is used for more extensive repairs, for which the aircraft must be removed to a repair unit (naval or civilian). The specific damage is repaired, and the aircraft is surveyed and all defects are made good. All outstanding modifications are also carried out.
- Category 4. (Recondition)* This is an extension of the Category 4 (Repair) and is used for aircraft which have flown for a long period since the last overhaul, and which may therefore be suffering from general "fair wear and tear" as well as—or instead of—crash damage. Every individual component (instruments, pumps, jacks, ancillaries, etc.), is stripped down for survey and repair, and full functional test. On completion of the reconditioning process, the aircraft should be up to the standard of a new aircraft. On completion of Category 4 (Repair) or (Recondition) the aircraft is given a full Test Flight by a qualified Maintenance Test Pilot.
- Category 1.* Minor work, which can be carried out by the flying units,
Category 2. without interference to the flying task, and do not fall within the province of this article.

"Categorization" of Individual Aircraft

When any unit in the Home Air Command or Home Fleet considers that one of its aircraft needs repair in Categories 3 or 4, due either to accidental damage or to honourable old age, the particulars are signalled to Rear Admiral Reserve Aircraft. A Survey Officer is then sent by the Rear Admiral Reserve Aircraft to inspect the aircraft and to decide which category is appropriate, having regard to the extent of the damage, the general condition of the aircraft and its "cumulative age" since last overhaul.

This cumulative age takes into account the conditions under which the aircraft has been utilized. Front-line and operational types of aircraft are



R.N.A.R.Y. DONIBRISTLE—SEA FURY AIRCRAFT FOR RECONDITIONING

reconditioned at intervals not exceeding 24-30 cumulative months, whereas training and auxiliary types are allowed 36-40 cumulative months. Every month in a flying unit is counted as a full month towards reconditioning, but every month in storage counts less, depending on the type of preservation in which it has been kept. Allowance may also have to be made for climatic conditions, for high-intensity operational flying, for the type of aircraft, for wooden or metal construction, and so on.

Should an aircraft survive its full allotted "cumulative life" without suffering accidental damage or excessive deterioration, it is allotted in for reconditioning to bring it up to date with modifications, and for general survey. This is done by Rear Admiral Reserve Aircraft on his own initiative.

Once the aircraft has been nominated for Category 3 or 4 repairs, a replacement aircraft is issued.

When aircraft arrive back in the United Kingdom from abroad, Rear Admiral Reserve Aircraft's Survey Officers inspect them and categorize them on their merits. To save time the officers sometimes join the ship at Malta or Gibraltar.

Engines and Power Plants

The repair categories for engines are the same as for airframes, though in the great majority of cases the engine is given a complete Category 4 (Recondition) and not one of the lesser categories. The reconditioning life of engines is entirely dependent upon the flying hours, and engines arrive



R.N.A.R.Y. DONIBRISTLE—ENGINE REPAIR SHOP

for overhaul either due to damage or defects, or to expiry of the allowed flying hours.

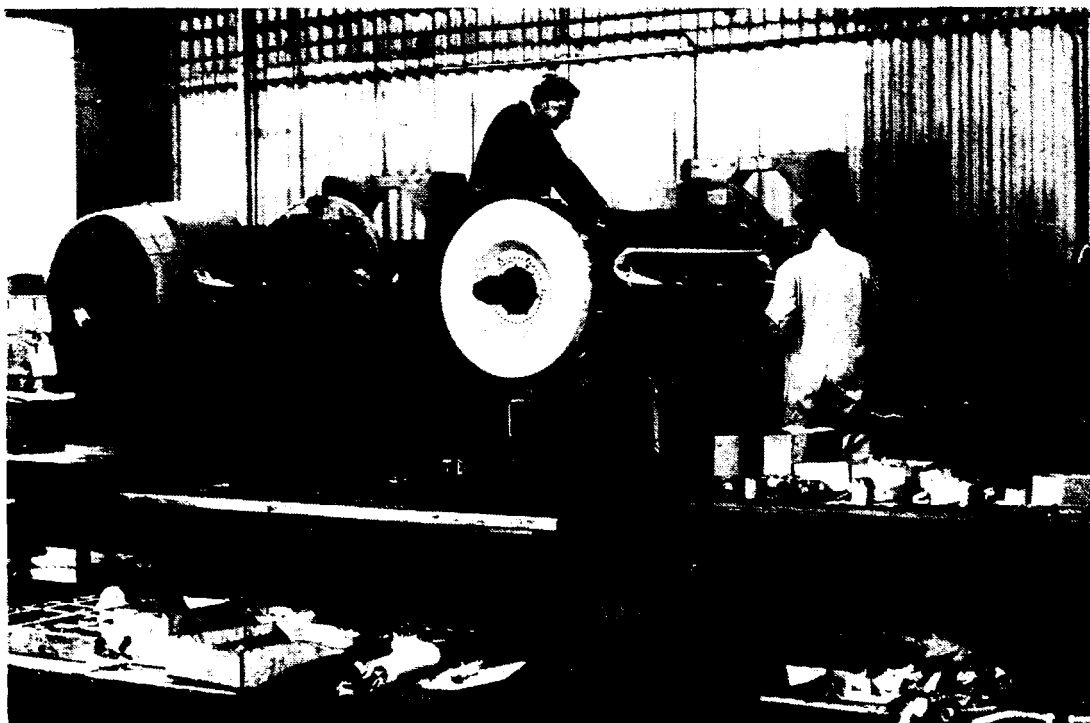
Engines which have suffered mechanical failure are normally given a period of "quarantine" before repair, whilst the cause of the failure is being investigated, and if the cause is obscure or unusual a detailed investigation may be ordered at an Aircraft Repair Yard or at the manufacturers.

On completion of the reconditioning, all engines are given a carefully controlled test run in an Engine Test House, which lasts several hours at various control settings including a period at take-off or combat power, and also acceleration tests; the Test Houses have a full range of instruments and comprehensive readings are recorded. A proportion of engines are stripped after the test-bench run, to examine the condition of the parts and to ensure that the initial assembly process was correct in all details.

A small percentage of the engines reconditioned in the Aircraft Repair Yards are sent to the manufacturers to be "proof tested" and stripped for examination and report, to ensure a uniformly high standard of repairs. The aircraft engine is a very highly stressed unit and there is no margin for even minor error.

Conversion Programmes and Modification Programmes

From time to time it becomes necessary to convert aircraft from one role to another, or from one Mark to another; this is usually done by the parent firm on a special contract. Large and urgent modification programmes



R.N.A.R.Y. FLEETLANDS—GRIFFON POWER PLANT BUILD-UP

sometimes arise, which may need to be carried out "On Site" or "At Works" by naval parties or by contractors. The administration of these programmes, the feeding-in to the works, and the supply of replacement aircraft to flying units, is all carried out by the Rear Admiral Reserve Aircraft.

General Trend of Repairs

As aircraft get larger and more difficult to transport, the gain in economy by carrying out repairs "On Site" is rapidly increasing. It is also more important than ever to reduce turn round time, and consequently the number of aircraft which are needed to support the flying establishments. With the soaring cost of new aircraft, both in man-hours and money, this factor is of great national importance. The trend is therefore towards doing a higher percentage of repairs "On Site" and an organization of highly-trained mobile Service-manned parties is at present being developed to supplement the Contractors' Working Parties who alone have been used in the past.

In peacetime it pays to carry out extensive and thorough reconditioning, to ensure a long life of full efficiency. In wartime the policy would swing towards more repair and less reconditioning, because:—

- (a) Aircraft types become obsolete much more quickly, and often before they attain the reconditioning age.
- (b) The wastage rate of aircraft is much higher, so that few would in any case attain the reconditioning life.
- (c) The repair capacity would be over taxed, and it would be essential to achieve quick turn round, and to reduce the work done to the minimum.

Repairs in R.N. Aircraft Repair Yards and in Industry

The three Naval Aircraft Yards form the backbone of the Naval Air Repair Organization and provide most of the repair capacity for our main operational aircraft types. About 50% of the entire repair arisings are dealt with by industry but this includes all the types which are only held in small numbers, most of which are second line types. Thus the Naval Repair Organization provides guaranteed repair capacity for the operational side of Naval Aviation in peace, and in war at least until considerable expansion of the flying establishments has taken place. It is reasonable to assume that in the meantime repair capacity in industry could be built up as in fact happened during the last war.

The Naval Repair Organization

From a naval point of view, it is of course more satisfactory to retain direct control of repair facilities. The advantages include:—

- (a) Greater flexibility in planning both repair capacity and its location.
- (b) More rapid turn round of individual aircraft and greater overall economy, because capacity is directly geared to the number of aircraft in use.
- (c) Broad control of the dispersal of repair of the important aircraft types. It is prudent to disperse the repair of an important operational type between at least two and preferably three widely spaced sites, one of which may be in industry.
- (d) Naval Aircraft Repair Yards are designed to handle repairs to engines and components including instruments and electrical equipment. Very few aircraft firms care to tackle this work and most rely on sub-contracts. Further the N.R.O. has direct access to the highly developed Naval Air Stores Organization.
- (e) Costs compare very favourably with industry, since repair is the primary task of the Yards, and not secondary to new aircraft production or other work. Detailed planning and progressing of work is carried out more efficiently with a gain in economy.
- (f) The secondary task of the Yards, concerned with the servicing and repair of aircraft components, instruments and equipment, provides valuable support for the Director of Stores and for Naval Aviation generally. About 40% of the work of the N.R.O. is on engines and components.
- (g) Last but by no means least the particular requirements of Naval Aviation can be met without delay, tasks being varied and priorities adjusted where necessary. It is sometimes most necessary to accept dislocation to meet an operational need and this can only be done in the N.R.O.

Details of the organization evolved for the planned repair of naval aircraft at R.N. Aircraft Repair Yard, Fleetlands, are given in Volume 4, No. 3 of the *Journal of Naval Engineering*, published in October, 1950.

Repairs in Industry

Contracts are arranged by Admiralty through the Ministry of Supply, the details of feed-in of aircraft and engines to the firms and technical liaison being administered by the Rear Admiral Reserve Aircraft.

Each aircraft and engine manufacturer can carry out repair work, either



R.N.A.M.Y. BELFAST—SEA OTTER PRODUCTION LINE

in their own works or by using an associated “Fringe Firm” allocated to them by the Ministry of Supply; this system has been developed to build up the repair capacity of general aviation contractors, which are less likely than the parent firms to switch over to new production in an emergency.

The reasons prompting the use of civilian industrial facilities include:—

- (a) In the interests of simplicity and efficiency it is undesirable to undertake more than 2 or 3 aircraft types at an Aircraft Repair Yard, and since there are only three Yards in the Naval Repair Organization, all the aircraft types in Naval Aviation cannot be covered by them.
- (b) There are some aircraft types held only in small numbers. Repair arisings are insufficient to justify a special line, with all it entails in the way of technique, equipment, spares and training in an Aircraft Repair Yard.
- (c) The degree of damage sometimes requires costly production-jig facilities or special equipment beyond that held in the Yard, the aircraft still being economically repairable by the manufacturers.
- (d) Specialized types of construction requiring special plant or processes, not economically justifiable in a Yard (e.g. the pressed plywood Sea Hornet).
- (e) Alternative capacity must be preserved in industry to meet the greatly increased repair tasks in time of war.

The work in industry is similar to that of the Naval Repair Organisation, i.e. the repair and reconditioning of airframes and the overhaul of engines; allowance is made in the Naval Financial Estimates for the contracts required to cover the ensuing financial year.

Planning for Repair

Nothing has so far been said about planning Yard capacity and contract cover in industry for repair. Quite a major task is involved as the following approximate figures for a recent financial year will show.

Number of major repairs or reconditions—500 aircraft of 20 different types.

Number of engines overhauled or repaired—700 of 10 different types and 20 different marks.

The aircraft arisings can be computed in advance with some fair degree of accuracy.

(a) Accident damaged aircraft—the utilization, total flying hours and total number of aircraft of a given type operating during a particular period, will be known in advance. From experience and previous statistics the accident rate will be known, and the total number of accidents causing damage in the various categories can be estimated.

(b) Time-expired aircraft becoming due for reconditioning can be assessed fairly readily from the records held for each aircraft by the Rear Admiral Reserve Aircraft.

There are, of course, many complicating factors such as the proportion of aircraft expected to become time-expired which fall victim to accident in the meantime. The accident rate for an entirely new aircraft type may also be difficult to predict due to unusual design features or deck landing techniques, i.e. the advent of the tricycle undercarriage has almost eliminated bounce on landing; and the improved view for deck landing of the newer types of jet aircraft will almost certainly reduce deck landing accidents in spite of their higher arrival speed. Allowance must be made for all these factors, and a master forecast is produced of the total requirement for aircraft repair for each financial year. An allocation plan is then made, dividing the aircraft between the Aircraft Yards of the Naval Repair Organization and industry; for the Yards a more detailed input and production programme is produced every four months. However well the programme may have been planned, both the repair arising rate and the production requirement are constantly fluctuating owing to outside factors such as unforeseen operational requirements (e.g. Korea), the dependency of flying hours on weather conditions, shipments of aircraft abroad at short notice and delays in the formations of new Air Groups, because new construction is not coming up to expectations. Hence for both the Naval Yards and for industry, the repair situation must be kept under constant review, and continual adjustments have to be made.

Tail Piece

The question is often asked “Why is the Rear Admiral Reserve Aircraft at Arbroath? It is not even one of his own stations!” The Rear Admiral Reserve Aircraft’s headquarters came to Arbroath before the Home Air Command was re-organized and when he was still responsible for technical training. This was many years ago and in the interim a highly trained staff of civilians, most of whom live locally, has been built up to assist the naval staff in dealing with the very specialised work we have tried to describe in this article. They would be most difficult to replace, particularly at the present day.

Arbroath has an excellent weather factor for air travel and is only 2½ hours from the furthest R.A.R.A. unit. When flying is impossible there is a good rail service to fall back upon. Less working time is, in fact, wasted by an overnight journey to London than by day travel from the Midlands.