GERMAN AIRCRAFT MAINTENANCE

COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE
LONDON—H.M. STATIONERY OFFICE

GERMAN AIRCRAFT MAINTENANCE

JULY 1945

Reported by
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NavTecMisEu

CIOS Items 25 and 26
Aircraft and Aircraft Engines

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE
G-2 Division SHAEF (Rear) APO 413

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SUMMARY

The material contained in this report was obtained from allied documents, from interrogation of German Luftwaffe personnel, and from examination of German operating facilities and equipment. German aircraft maintenance appeared to be satisfactory. Equipment examined was generally well cared for and in good operating condition. The organization of the maintenance side of the Luftwaffe was sound, the personnel well trained, and the procedures and practices practical in that they were designed and subsequently modified as necessary to accomplish the task of keeping aircraft flying with a minimum of waste, effort and material. Their supply program was well managed and elastic, and emphasis on practical design was evident on all equipment. However, the quality of tools and potential scope of work appeared markedly inferior to those of the U.S. Naval aircraft maintenance program; there was no provision for continual supervision and improvement of maintenance of operating equipment in the field by the German Air Ministry.

GERMAN AIRCRAFT MAINTENANCE

1. Introduction.

The information contained in this report was gathered from Allied documents on the German Air Force, from prisoner of war interrogation reports, from interrogation of German technical officers and enlisted personnel captured on enemy fields, and from examination of airfields, hangars and equipment in the British Second Army area. Much of the equipment was damaged by bombing, and in some cases, demolition; most of the personnel and records had been evacuated from the majority of the fields visited. However, it was possible to find sufficient information to reconstruct a sufficiently clear picture of the German aircraft maintenance program, and to note therein a number of examples of organization and practice which are worth consideration by the U.S. Navy. The material is presented in three sections: organization, maintenance information, and summary and recommendations.

2. Organization.

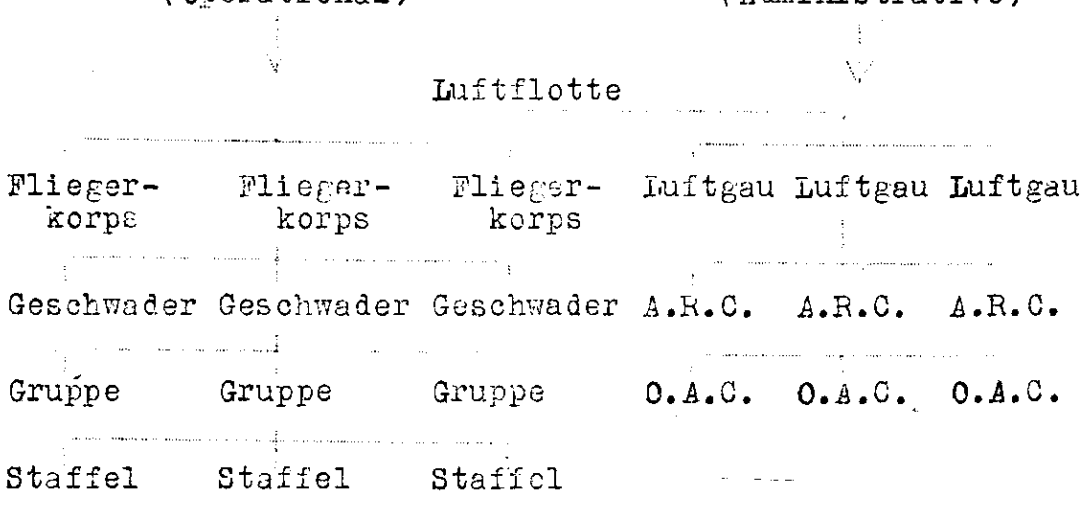
(a) General.

(1) One of the main reasons why the German Air Force was so successful during the first years of the war was that from its very inception a comprehensive and thorough plan of organization was adopted and followed. Basically there were two (2) distinct and separate lines of command: the operational and the administrative, the latter including maintenance and supply. As a result, flying units could train and operate virtually unhampered by the problems of administration and supply. The administration and supply branch benefited similarly by having a well trained group of officers whose practical experience was utilized to the best advantage, and who were kept in the field of their specialty.

(2) In the main, the German Air Force was divided into Luftflotten on a territorial and not a functional basis.

2. Organization (a) (Con'd.)

The following diagram illustrates the operational and administrative chains of command:



(b) Luftflotte.

The Luftflotte was both an operational and administrative command, though both functions were exercised through a separate chain of command. It had an area assigned to it and was comparable to a major U.S. Army Air Force. Normally it was comprised of one to three (3) operational Fligerkorps and one to three (3) administrative and supply Luftgaus. All commands below the Luftflotte were either entirely operational or entirely administration and supply.

(c) Fliegerkorps.

The Fliegerkorps was a purely operational flying command consisting of ten (10) to twenty-five (25) Gruppen and usually was assigned to a specific geographic area. Ordinarily a Fliegerkorps included all types of aircraft but operational conditions often necessitated specialized Fliegerkorps (night fighter, etc.) which were moved about as the military situation dictated.

2. Organization (Cont'd.)

(d) Geschwader.

The Geschwader was a purely operational flying command normally comprised of three (3) Gruppen. Each Geschwader had a Kommandateur and a small staff which remained intact even when the Gruppen were separated.

(e) Gruppe.

The Gruppe was the standard basic flying unit for both operational and administrative purposes, and was comprised of three Staffeln. Normally it had twenty-seven (27) aircraft plus three (3) for the Gruppe staff, making a total of thirty aircraft. It had a Kommandateur, Adjutant, Operations Officer, Technical Officer, and Medical Officer, of which all but the latter were active flying officers. There was no full-time Intelligence Officer.

(f) Staffel.

The Staffel was the lowest operational command and was comprised of nine aircraft. Usually it had its own mobile repair shops necessitated by the need for dispersal.

(g) Luftgau.

The Luftgau was a large regional administration and supply command usually comprised of five (5) or more Airfield Regional Commands (A.R.C.) Ordinarily, a Luftflotte contained one to three (3) Luftgaus.

(h) A.R.C.

The Airfield Regional Commands were mainly administrative and were responsible for defense, maintenance of both aircraft and motor transport, airfield development, supplies, and air movement control throughout their regions. It represented a very real decentralization of authority, and was extremely important in giving mobility and elasticity to the activities of the German Air Force. An Airfield Regional Command was usually comprised of ten to twenty-five Operational Airfield Commands (O.A.C.).

2. Organization (Cont'd.)

(i) O.A.C.

The duties of Operational Airfield Commands were both practical and administrative. Its primary mission was the maintenance of aircraft and flying facilities, and it included airfield defense, but it also handled the housing, feeding, and supply for all units based at its field. Operational Airfield Commands were attached only to airfields equipped completely with hangar, repair, building and transportation facilities.

(j) Fliegerhorste.

The Fliegerhorste was the name given to the unit comprised of the airfield, buildings, hangars, equipment and the O.A.C. based on the field. As a unit it was the best example of the definite division between the flying side and the administrative and supply side of the German Air Force. When there was a flying unit in occupation, its commanding officer took precedence over all other officers at the airfield as long as the flying unit was based there. When there was no flying unit at the field, the Commandant of the Operational Airfield Command was the senior responsible officer. The flying units were mobile and moved frequently, but the Operational Airfield Commands remained stationary.

(k) Werft.

(1) The average Operational Airfield Command consisted of between three hundred fifty (350) and four hundred (400) officers and men, of which one hundred fifty(150) men and three (3) officers comprised the Werft, the actual aircraft maintenance section. Frequently civilian engineers were employed in officer capacity, usually two (2) or three (3) civilians to one Werft. The maintenance work performed was confined to major work and work beyond the capacity of the Staffel personnel, who handled all servicing and the majority of minor repairs. In some of the larger Fliegerhorsten, it included minor overhaul of both aircraft and engines.

(2) Each Werft was divided into three (3) sections: repair, test and supply. In a Werft of one

2. Organization (2) (Cont'd.)

hundred fifty (150) men, the division was usually one hundred five (105), ten (10), and thirty-five (35), respectively. The table below shows an average distribution of enlisted ratings within the three (3) major departments.

Kliegerhorste
Kommandateur
↓
Technische Leiter
(Director of the Werft)

REPAIR	TEST	SUPPLY
(One Officer or Civilian)	(One Officer or Civilian)	(one Officer)
37 Metalsmiths	3 Structure Mechs	10 Clerical
20 Structure Mechs	4 English Mechs	25 Store-keepers
26 Engine Mechs	2 Specialists	
12 Specialists (Instruments, etc)	1 Electrical	
6 Electricians		
105 Total	10 Total	35 Total

No provision was made for radio or radar technicians because there was very little radio or radar repair effected in the field. Minor work and adjustments were done but serious trouble resulted in the replacement of the whole unit, the defective one usually being sent back to the factory for repair.

(1) In summary, there is one feature of the organization of the German Air Force which stands out, namely the sharp division between the operational and administrative functions. It was rigidly maintained and each exercised its own chain of command up to the level of the Luftflotte. This differentiation proved advantageous to both in that it provided each with freedom from details not directly connected with the accomplishment of the mission. Similarly, aircraft maintenance was divided into servicing and repair. Servicing, including the normal gassing, oiling, greasing, and minor operational discrepancies, was

2. Organization ( ) (Cont'd.)

performed by the ground personnel of operating Gruppen. It could easily be effected because its scope included only work which did not require elaborate organization, administration, or equipment. Major repair work requiring these features was performed by the Werften and this came under the jurisdiction of the administrative side of the German Air Force which was adequately staffed and equipped to handle the work.

In the posting of enlisted maintenance personnel, the most experienced and capable men were always assigned to Werften in preference to Staffeln. Personnel of limited capabilities could not be assigned to Werften. In effect, this provided an effective means of keeping incompetent personnel out of organizations which were designed to do the more important maintenance work. This naturally did not mean that Staffeln received only inferior personnel, but simply meant that a definite effort was made to keep more experienced and more capable personnel in places where their experience could be utilized.

The basic organization and segregation of operational and administrative functions proved quite successful and it gave the German Air Force the mobility and efficiency that proved so successful during the first stages of the war. The later superiority of the Allied air forces was largely due to operational success and superior strategy and tactics rather than to any organizational weakness of the German Air Force.

3. General Maintenance Information.

(a) General.

The subsequent subjects were used for interrogation and examination and were selected as giving a general coverage of field maintenance. In some cases the results obtained in different localities contradicted each other, but this was attributed to minor differences of operation in different activities. In general, practices were uniform and the following information is submitted for interest.

(b) Structural (Seaplane).

Originally structural checks were carried out

3. General Maintenance Information (b) (Cont'd.)

on seaplanes every 100 hours, but during the past two (2) years the period was increased to 200 hours for operational convenience. Checks were complete and similar to those of the U.S. Air Forces.

(c) Structural (Landplane).

Structural checks were carried out on landplanes every 300 hours and were similar to those of the U.S. Air Forces.

(d) Engine.

Engines were inspected and checked every 25 hours. In addition, they were given a very complete check every 150 hours when all accessories were removed, checked and reinstalled.

(e) Propellers.

Propellers were checked usually every 12 hours (on every engine check and once in between).

(f) Overhaul.

(1) All engines were overhauled after 450 hours (three 150 hour periods). No provisions were made for time extensions, and all personnel interrogated confirmed the fact that the time policy was rigidly followed. Overhaul methods were standard and the majority was done by civilian contractors. A small percentage (15 percent) was done by small Luftwaffe overhaul shops located on some of the larger permanent airfields. Technical officers stated that no noticeable differences were apparent between service and private overhauls. All overhauled engines were run in and tested on engine test stands. The tests were standard and comparable to U.S. Naval engine tests. Overhaul procedures and standards appeared to be noticeably lower than ours. Evidently standards were set as low as possible but still meeting operational requirements satisfactorily. While acceptable, the quality of a German overhauled engine could not compare in finish and precision with the best of American overhauled engines.

3. General Maintenance Information (f) (Cont'd.)

(2) The standard overhaul period for aircraft was 600 hours, but this was not strictly followed. The aircraft were partially disassembled after 600 hours (wings, tail surfaces, landing gear, etc.) and if visual inspection indicated that the plane was in good condition, it was reassembled and flown an additional 300 hours before overhaul. The majority of aircraft overhaul was done on a contract basis by private companies, though a small amount was done by the Werften on the larger fields.

(3) In the main, overhaul practices and procedures for both aircraft and engines were found to be standard. The main difference between German overhaul and the U.S. Naval overhead was dispersal. Surfaces, wings, landing gears, etc., might be overhauled by as many different companies with final assembly taking place at the activity that overhauled the fuselages. It is interesting to note that a substantial portion of overhauled parts were sent to aircraft assembly plants for incorporation in new aircraft. This practice did give the German supply organization an advantage of elasticity and a form of insurance of parts availability. If the normal supply of a certain sub-assembly was curtailed, it was possible to increase the intake of overhauled sub-assemblies and thus permit the continuance of production of new planes. The obvious disadvantage of this practice was the provision of second-hand parts in new airplanes. However, interrogation of technical officers could uncover no known instance where this had resulted in a structural failure.

(g) Greasing.

All aircraft were greased daily. It was standard practice for each Staffel to have one man assigned permanently and exclusively to this work, using a portable greasing machine of standard design.

(h) Washing.

All aircraft were washed daily. The writer inspected a number of aircraft captured in operating condition and virtually without exception, they were clean and well lubricated.

3. General Maintenance Information (h) (Cont'd.)

Special inquiries were made on both greasing and cleanliness of aircraft because these two fundamental prerequisites of satisfactory maintenance are often neglected. Technical officers confirmed the fact that considerable effort was expended on cleanliness.

(i) Storing.

Interrogation about preserving and storing aircraft in pools brought out an interesting bit of negative information. Three technical directors of maintenance Werften stated that they had no experience in local preservation since for the past two (2) years there had not been enough airplanes available to fully equip operating units. Planes invariably went directly from factories to squadrons. This speaks well for Allied combat efficiency and strategic bombing. However, it was noted that the Germans were very careful in preserving engines shipped to and from overhaul. No pliofilm bags or moisture plugs were used, but engines were filled with oil and open parts were sealed. While considerable care was taken of the interior of engines, the exterior was usually allowed to suffer minor corrosion, but no engines were found that appeared to be unusable.

(j) Lines.

The various lines and tubes (oil, gas hydraulic oxygen, etc.) were identified in the conventional manner by color or colored bands.

(k) Quick-Change Stands.

The German Air Force made extensive use of quick-change engine stands. Units were complete, including all cowling and accessories. Assembly usually took place at supply depots and sometimes at the Werften. The engine stands themselves were of a standard design and no new features were noted. Every operating airfield that had not been completely evacuated had an adequate supply of engine set-ups on hand.

(l) Oil Dilution.

Oil dilution was standard practice for cold weather operation. Interrogation established the fact

3. General Maintenance Information (1) (Cont'd.)

that the Germans experienced little difficulty resulting in damaged engines due to improper dilution by inexperienced personnel. A copy of the standard German cold weather operation handbook, containing dilution tables for the various engine models, has been forwarded to the Maintenance Division of the Bureau of Aeronautics. Several German technical officers were interrogated in oil dilution because the U.S. Naval experience with oil dilution has shown considerable difficulty due to improper dilution. There are two (2) factors, both pertaining to oil properties, which might have a bearing on German success. First, the synthetic oil used for lubricating might be less easily washed from the cylinder walls, etc., by over-dilution. Second, it is possible that the German practice of reconditioning and re-using oil may, over a period of time, result in a better lubricating oil which would be less susceptible to quick solution in gasoline or which may retain a more cohesive property and thus be less easily washed from cylinder walls, bearings, etc. Interrogation along this line did not indicate that the Luftwaffe officers were aware of any unusual lubricating qualities of their oil. They considered the dilution tables in the handbook to be accurate and took it for granted that they were accurately followed. None knew of a case where an engine had seized due to excessive dilution.

(m) Cold Weather.

Extensive use was made of internal combustion preheaters during the early part of the war. This was somewhat curtailed during the past year by shortages of both material and fuels. Limited use was made of electric heaters which were not considered practical with the need for wide dispersal of aircraft and difficulties in providing sources of electrical current.

(n) Modifications.

The German Air Force carried out an extensive program of modifications and changes in the field. When the design section of the Focke-Wulf company was captured early in April 1945, there were still between 500 and 600 draftsmen working on drawings for FW 190 modifications, despite the fact that this plane had been in service for two years. This was a source of

3. General Maintenance Information (n) (Cont'd.)

inconvenience to the chief designers, because at the time of capture only about 200 draftsmen were "available" for work on the projected new TA 183 jet fighter. Interrogation of the Luftwaffe pilots at the Fassberg airfield further brought out the fact that frequently planes were grounded for the incorporation of modifications. It was the rule rather than the exception for the number of changes and modifications on operational aircraft models to reach 300. Approximately three-quarters ($\frac{3}{4}$) of the modifications were structural. All modifications in the field were accomplished by the Werften and it was the policy to have manufacturers incorporate changes in production as soon as possible.

(o) Spare Parts.

The German spare parts program was very well organized and efficient. Considerable difficulty was experienced during the last year of the war, but it was due mainly to Allied strategic bombing of both sources and transportation lines. There were three (3) types of storage depots. The Zeugampten were the largest, there being two or three to each Luftgau area. Complete stocks of all aviation material were carried. Each Zeugampt served from five (5) to ten (10) Luftparken which also carried complete stocks but in reduced quantities set up on a quota basis. Each Luftpark served a varying number of Gerate Ausgabestellen which were located on all the large Fleigerhorsten. The latter served the local field and also the outlying dispersal fields and landing strips. Supplies were carried in stock only for the aircraft operating from those fields at the time. When a Werft needed a part it applied to the nearest Gerate Ausgabestelle. If the part was not available there, the Werft further applied to the nearest Luftpark. If the Luftpark did not have it in stock, it immediately took steps to obtain it from its parent Zeugampt. A Werft never could apply directly to a Zeugampt for material. Strict adherence to this gave the German Air Force complete and accurate spare parts consumption records and they did an excellent job of cutting down waste and at the same time provided adequate stocks of spares. Further control and elasticity was given by the overhaul policy mentioned before which made overhauled parts available to both new planes and overhauled plane production activities.

3. General Maintenance Information (Cont'd.)

(p) Oil Changes.

It was standard practice to change oil on each 25 hour engine check. The waste oil was shipped in drums to refineries for filtering and reconditioning. The personnel interrogated did not know of any portable filtering machines which could have filtered oil in the plane. The practice of reconditioning oil is worthy of note, because of the U.S. Naval tests which indicated that the sludge content of oil decreased after a period of use while the lubricating properties remained unchanged. It might, therefore, be possible to develop a more efficient lubricating oil by a process simulating operation to reduce sludge content.

(q) Spark Plugs.

Spark plugs were changed on each 25 hour check. Every Werft had a small shop for cleaning and checking plugs before reinstallation. This period between changes is considered excessively short. When asked if there was any particular reason for the short time, Luftwaffe personnel were of the opinion that it was done more because of habit than because of short plug life. However, interrogation revealed that very little magneto drop-off trouble was encountered and plug changes between checks were very rare.

(r) Radio-Radar.

Very little radio or radar repair was done in the field either by operating or service units. Only minor repairs (tube changes, etc.) were done by Staffel personnel. The manufacturers assembled units with different colored screws, the color indicating whether the part could be removed or disassembled in the field. When troubles were encountered, it was standard practice to change the entire radio or radar unit. Mounting design and installation were designed to facilitate this, and a few mounting screws and two (2) or three (3) connections were usually all that it was necessary to disconnect. Defective units were then returned to the manufacturers for repair and reconditioning. To overcome the difficulty and time necessary for shipment of defective equipment back from forward areas, elaborate especially equipped

3. General Maintenance Information (Cont'd.)

trucks were designed as mobile radio and radar shops. Extensive use was made of these mobile units in forward areas.

(s) Training.

The training program for German ground personnel was excellent. Wherever possible, assignment was made in order to take advantage of civilian experience. At the outset of the war, the training course for aircraft fitters (mechanics) lasted twelve (12) months and covered work on a number of currently operational engines and aircraft. The course started with two (2) months of theoretical instruction on basic engine principles and aerodynamics. After a written examination, the students passed on to two (2) months of actual work on engines, of which the last two (2) weeks consisted mainly of "trouble shooting" on engines put out of action by the instructor. The next stage was two (2) months of practical work in an aero-engine factory, followed by two (2) months of work in an airframe factory and two (2) months in an accessory or propeller plant. The final stage was a two (2) month period of review back at the school, followed by an examination. Personnel failing the examinations given at the completion of each stage were usually given four (4) to six (6) month abbreviated course on servicing and were posted to a normal servicing (as distinct from repair) unit. Wartime conditions forced the shortening of the main course to six (6) months, but the good balance between theory and practice was maintained and the caliber of maintenance personnel was generally high. The practice of having the trainees spend the majority of their training time doing actual work is worthy of note. Classroom work and lectures were kept to a minimum. As a result, the men coming out of school could start in productive work with a minimum of indoctrination and instruction. Usually, trainees spent two (2) weeks at a classification center before posting to operating units where qualities of leadership and general military conduct were evaluated.

(t) Forms.

(1) All German repair and maintenance units

3. General Maintenance Information (t) (Cont'd.)

used standard Luftwaffe forms, most of which were similar to the forms used by U.S. Air Forces. The German procedure for handling reports of unsatisfactory or defective material was identical with the U.S. Navy RUDM system, but the form used was slightly different. It was more of a check-off sheet and it specifically called for more information in detail. There were separate forms for aircraft, engines, propellers, accessories, oxygen equipment, etc. Completed forms were all sent to the German Air Ministry which issued technical notes, orders and changes similar to standard BuAer publications. These notes, changes, etc., were based on information obtained both from contractors and from German Luftwaffe research and test activities. A picture of a sample report appears in Figure 1. Translated titles have been inserted.

(2) A notable feature of German Air Force maintenance publications is the standard use of maintenance and repair pamphlets. These were issued for all aircraft, engines, propellers, and major pieces of equipment. They were standard in form and layout and facilitated the keeping of technical libraries. For aircraft and engines, these maintenance pamphlets were 10" x 12" in size and bound with a durable cardboard cover. For other accessories and pieces of equipment, they were 5" x 7" and similarly bound. The contents were confined to actual assembly and maintenance data that could and would be used in the field.

(u) Design.

(1) The one aspect of the German aircraft maintenance picture that stands out above all the others in making for ease and speed of work in the field is the control and direction of design. Continual and effective efforts in this direction have had a marked effect on the maintenance program. New equipment was designed to utilize as much as possible parts already in service. This was particularly true with standard fittings, hoses, studs, gaskets, nuts, bolts, etc.; in fact, with all of the standard type maintenance stores. But the effort did not stop with small parts. For example, new engines were designed to use the same accessories as engines in service, unless the accessory was totally inadequate. Similarly, engines produced by

Reporting Service Unit	Owner	Location and Date

PROPELLER

DISCREPANCY NO.

Report

Subject of Report

Plane

Model Ser No.

Manufacturer

Engine

Model Ser No.

Manufacturer

Propeller

Part Number

Manufacturer

Serial Number

No. of Hours

Designation

Part List Number

Manufacturer

Serial Number

Record of Work

Number of hours and flights since Installation -- new or repaired?

DISCREPANCY (Description of behavior and appearance - Supposed cause - Sketches - Photographs)

Layout	Distributor	Test Group	Tech Director

3. General Maintenance Information (u) (Cont'd.)

different manufacturers could often use identical accessories with the installations so designed that they were interchangeable. Accessibility, ease of inspection and adjustment were also considered. Part numbers were standardized and different manufacturers used the same part numbers for the same parts. If equipment was to undergo only limited maintenance and repair work in the field, the manufacturers incorporated features in design to facilitate this. An example is the use of colored bolts and screws in the assembly of radio and radar equipment to indicate what could or could not be disassembled. The policy on equipment requiring highly specialized maintenance was to change whole units, and installations were kept simple and accessible to facilitate this. These standard installation design requirements made the interchange of different types of radio equipment in the field a relatively simple problem.

(2) Occasionally the Germans sacrificed performance to some extent to simplify upkeep. The use of a limited number of standard tubes in radio equipment was expressly for the purpose of simplifying supply and repair problems, even though it did mean a reduction in operating efficiency. It is debatable whether or not the Germans carried this too far in some respects but it was also very evident that considerable benefit was obtained from the effort expended in keeping maintenance and installation in mind in the design of aircraft and equipment.

4. Summary and Recommendations.

(a) Advantages.

There were three (3) major advantages of the German aircraft maintenance program. First, the sound organization which separated the operational functions from the administrative and supply functions and thereby permitted each to carry out its mission unencumbered by details not directly pertaining thereto. It should be noted that supply was handled entirely within the Luftwaffe organization. Second, the thorough and practical training given to maintenance personnel. The utilization of contractors' factories is noteworthy, but the large percentage of training time actually spent at work is considered the most important factor. Third, the constant effort on the part of designers and

4. Summary and Recommendations (a) (Cont'd.)

manufacturers to incorporate features which would speed up and simplify repair and replacement in the field. Considerably time and effort in the field was conserved by this, and is considered to be the most praiseworthy feature of the German aircraft maintenance program.

(b) Disadvantages.

The German method, however, had several drawbacks. By relying mainly on civilian contractor overhaul, the Luftwaffe deprived itself of large and well equipped centers where experimental or highly secret modifications could be carried out. During wartime conditions, it is undoubtedly sound to have civilian facilities accomplish a substantial portion of the routine overhaul load, but it is not considered sound to rely entirely on contractor overhaul. Armed forces should have a maintenance and repair organization capable of every type of repair or overhaul function. By limiting the scope of active repair activities, the German Air Force also limited the possibilities of development and improvement of their military maintenance. Furthermore, inspection of overhaul establishments indicated that layout, equipment, and procedures were inferior to ours. Dispersal and bomb damage were contributing factors, but lack of planning, and of supervision by a military organization is also considered a contributing factor. Completed overhauled products appeared satisfactory but with a relatively small safety margin. No direct liaison set up between the German Air Ministry and operating activities could be found. Communication was entirely by mail or report, resulting in a lack of coordination and loss of time in handling difficulties that arose.

(c) Recommendations.

General field aircraft maintenance is dependent upon a number of variable factors. Personalities and individual capabilities play an important part in the performance of maintenance work. For this reason, it is difficult to make specific recommendations, but the following two, which proved successful in the German aircraft maintenance programs are submitted for consideration.

4. Summary and Recommendation (c) (Cont'd.)

(1) That the feasibility of bringing aircraft supply under control of the Bureau of Aeronautics be thoroughly investigated. A large part of the problem of aircraft maintenance is essentially a matter of the supply of parts and equipment.

(2) That continued effort be made to have design and manufacture develop and incorporate features making for ease and simplification of maintenance problems.

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