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[1953]

THE GERMAN AIR FORCE

AIRCRAFT PROCUREMENT

BY

STUDIENGRUPPE GESCHICHTE DES LUFTKRIEGES
KARLSRUHE, GERMANY

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THE GERMAN AIR FORCE
AIRCRAFT PROCUREMENT
PART ONE

CHAPTER 1

ORGANIZATION AND MISSIONS OF THE VARIOUS OFFICIAL AGENCIES[1]

The intentions of a number of German firms manufacturing aircraft and aircraft engines after World War I to develop
lop an aircraft industry to meet the coming requirements of peacetimes were frustrated by the conditions of the Treaty of Versailles, and all preparatory work already under way for this purpose had to cease.

This for the time being excluded Germany as a competitor in this important and hopeful field and from the gradually developing field of air traffic.

Furthermore, Germany was excluded from participation in the technological developments involved.

These measures had an incisive impact on German technology and economy. On the other hand the measures resulted in a previously inconceivable impetus to gliding, a circumstance to which post-war promotion of the concept of aviation in Germany was due after the lost war.

It was only after a less severe interpretation was placed on some of the definitions of the Treaty that attention

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could turn to the problems of powered aviation sports and air communications within a restricted scope.

2 It was 1926 before the Paris Agreement on Air Traffic brought about a removal of the restrictions to which Germany was subject in the construction of aircraft for civilian purposes. The measures of the Treaty remained in force which prohibited German construction of aircraft for military purposes or any practical activities in this field.

The Paris Agreement enabled Germany, within certain limits in the field of civil aviation, to at least partially achieve current technical standards by means of theoretical scientific research and experiments carried out particularly in the German Experimental Institute for Aviation (Deutsche Versuchsanstalt fuer Luftfahrt) and through the rapidly developing activities of commercial aviation. However, the progress thus made was not sufficient for competition against foreign countries.

The essential conditions for German competition in the aviation field were high standards of development and testing, wide experience in air traffic under severe conditions,

1. Only few original sources are available covering the 1919-1932 period, for which reason use has been made of information obtained from General der Flieger Wimmer, contributions from the engineer personnel in responsible positions during the period, and the personal experience of the present author.

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2 the evaluation and application of the knowledge thus gained. These conditions can be achieved primarily through the use of military types of aircraft because of the severe test to which such aircraft are subjected in practical use, and this applies more especially to fighter types which are subjected to the most severe conditions in actual use. Neither with sports nor with commercial aircraft alone is it possible to achieve the necessary conditions.

For the above reasons military aviation is an important factor for technical development and in its bearing on the ability to face competition. Since these conditions could not be achieved, technological progress in Germany was subject to restrictionsand the result was that Germany lagged constantly behind foreign countries in the field of technological development.

This was a severe disadvantage for the German economy, since the serious lack of raw materials within the national

3 borders created the urgent necessity to exploit all avenues to increase trade, particularly export trade.

Whereas the measures providing for disarmament of the former belligerent states after World War I created a certain measure of security and hopes for a peaceful existence, Germany found herself facing an entirely changed situation after the various abortive disarmament conferences. Sources of

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especial concern were the ruling political tendencies in the reestablished state of Poland and in the the newly emerged Czechoslovakia plus the politico-military protective agreements concluded by France with Poland, Czechoslovakia, the Balkan States, Rumania, and Jugoslavia. In view of Germany's neutralized position the danger once again existed that she would be surrounded in the event of another war.

The military forces Germany was permitted to maintain, and known as the Reichswehr, comprised an army 100 000 strong plus a navy with 15 000 personnel. These forces were not permitted to have tanks or aircraft so that, in view of Germany's geographical position and the political situation, they could not provide the required protection. Another important factor was that the newly established state of Czechoslovakia, by virtue of its geographical position, constituted a take-off area for hostile air forces which presented an extremely serious threat to Germany.

In view of these facts and because of the existing conditions of the Treaty of Versailles which prohibited any activities within Germany bearing on home air defense, one of the most urgently important tasks of the German Government was to ~~[illegible]~~ closely watch all developments in the field of aviation abroad

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4 and to prepare the appropriate plans.

For this purpose and on the insistence of the Army High Command a special group was formed within the existing Reich Defense Ministry. The mission of this group was to watch developments abroad and at the same time concern itself with the theoretical work of preparation for the necessary measures which would have to be introduced in the field of aviation. The group was placed under the Troops Office (Truppenamt) and designated Group T-2-V (L)[1], later Inspectorate 1 (L). In its final form the group contained all sections and subsections which would be essential in the event of an establishment of an air force, namely, sections and sub-sections to handle the following subjects:

Operations and Tactics
Personnel matters
Technology
Economy
Organization and Budgeting
Air Intelligence
Training and Education
History and Passive Air Defense.

The organization of the group is shown in Appendix 1 to the present study.

In addition to this group, intended primarily for tactical preparations, an Air Technology Sub-Section was established almost simultaneously under Captain Student as part of the Weapons and Equipment Inspectorate.

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5 The mission of this sub-section was to study foreign air armament activities, the performances of foreign air craft, and to compile the findings to arrive at the basis probably serving for the preparation of regulations governing air operations in foreign armies, besides analyzing the requirements against the possibility of future German air armaments.

The sub-section was also to support and promote glider sports and to handle problems of military economy

Another outcome of the trains of thought dealt with here was the inclusion in the 1922 Russo-German Trade Agreement of an agreement regulating a mutual exchange of experience and providing the possibility to test German military equipment on Russian soil. Priority was given here to tasks which were designed exclusively to serve in support of the ground forces.

With the continued expansion of the various technical and technological sections within the Weapons and Equipment Inspectorate deceptive organizations were established around 1925. These organizations were to concern themselves both in theory and in practice with the implementation of the tactical findings worked out by Section TA II (L), which from 1924 to 1927 was responsible directly to the Troops Office, and later by Inspectorate I.

Footnote 1, p. 5: L - Abbreviation of "Luft" (Air).

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5 The conditions of the Treaty of Versailles were still in force which prohibited all German activities bearing on problems of military aviation. Therefore the organizations concerned had to be organized as civilian agencies and in such a manner that they would appear to be independent of military authorities. Their functions extended into the most important fields of development, manufacturing, and military economy problems concerning military aviation.

The various organizations established by 1928, together with the chains of command by which they were controlled, are shown in Appendix 2 to the present study.

6 The organizational setup corresponded to the conventional sequence of development, testing, and procurement of Army equipment and presupposed that the phases of development and testing would be completed before the item of equipment concerned would go into production.

The delays necessarily caused by the separation of the various phases in the creation of new types of equipment had hardly any effect on the equipment then in use in the Army, the only exception being that of tanks, since the Army was not in urgent need because of the types already developed and in use.

Circumstances were entirely different in the field of

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aviation. Both during and after World War I new experience had been gained and analyzed, and these finding had to be applied in their completeness in all aircraft, aircraft engines, and other types of equipment for introduction. In contrast with the Army, military aviation had to commence from scratch, so that delays caused by the organizational setup could not be tolerated.

The existing circumstances therefore necessitated close cooperation between the developing and procurement agencies in order to insure the earliest possible delivery to the troops of all newly developed types of equipment.

Since the necessary conditions existed within the deceptive organizations, so far as organizational and personnel requirements were concerned, to make practical work possible, the necessity arose in the practical execution of the planned missions to bring about a firmer consolidation of the various agencies, some of which were in widely separated locations. This appeared all the more desireable in view of the fact that the possibility to do so existed so far as internal policies were concerned.

Following the establishment of an Army Ordnance Office the various organizations were therefore consolidated in 1928-1929 to form one section under Captain Volkmann and placed under direct control by the Chief of the Army Ordnance

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7 The reason why the functions of Sections WaPrw-6-F and P-6-F were merged was that the divergities of opinion between them were so serious that they made themselves felt even within the Troops Office and took up time for clarification.[1]

Consolidation of the agencies was an essential condition for close cooperation between those handling development, procurement, acceptance, and industrial preparations, and the fusion had an exceptionally advantageous effect on execution of the primary mission, that of creating the necessary basis for the intended establishment of air power.

Organized as shown in Appendix 3, the new section comprised all technical fields of activities of a future air force. This provided a basis for continued development. Numerically, however, the section was in no position to deal with the problems which would arise in practice once rearmament started, since only one person, or at the most two, was assigned for each subject dealt with.

With support from this skeleton organization it was possible in 1925-1929 to make the necessary basic preparations, so that a start could be made in 1929 at measures for the practical implementation of the requirements worked out by Sections T-II-V and T-II (L). later known as Inspectorate 1.

1. Appendix 3.

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8 From then on the group, which later became a branch, was expanded in consonance with its expanding responsibilities as will be seen from Appendix 4.

Parallel with the establishment of the group for tactical planning in the Troops Office and the section in the Weapons and Equipment Inspectorate for technical preparations, a sub-section was established in 1923 within the Sea Transportation Branch. The mission of this sub-section was to study the tactical problems of naval air power and the necessary preparations for measures to be taken against the eventuality of the establishment of a naval air force. At the same time a sub-section staffed by five qualified engineers was established within the Navy High Command to handle the technical problems arising from tactical requirements and implementation of the appropriate measures in industry.

Branch 1-2-V (L) endeavored to secure cooperation between this naval section and the Army's Section Wa-Prw-6, but these efforts failed against resistance by Sub-Section H3, the naval agency. It was 1 October 1929 before arrangements could be made to so define the work of the separate organizations that it was at least to some extent possible to prevent duplication of efforts in the development stages and in the awarding of contracts to industry.

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CHAPTER 2

PREPARATORY MEASURES FOR REARMAMENT

The purpose of the preparatory measures which commenced in 1926 in the armament field was to insure

a. Training followed by

b. Emergency type equipment, again followed by

c. Equipment proper.

Ad a, above: Some of the aircraft required for training purposes were purchased from foreign manufacturers, some of them were planes manufactured in Germany for commercial aviation, plus a few experimental models.

The German aircraft in use included the Fokker D-XIII, the Rohrbach Ro-XIII, and the Albatross L-75/77 and L-78.

The first steps to be taken by Section Wa-B-6-F therefore involved measures to insure operability of these models and a reliable supply of spare parts.

Ad b, above: The basis for computation of basic emergency equipment was calculated from the measures which would become necessary in the event of an attack by Poland against Eastern Prussia. In this event only temporarily converted training aircraft, primarily of the Junkers W-33 and W-34 types, would have sufficed with the addition of only a few Albatross L-76/77 and L-78.

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9 Apart from the measures taken in the field of training and emergency equipment, a responsibility of the previously mentioned Section T-2-V (L), organized in the first few years after World War I as the agency responsible for all tactical air problems was to secure the data which would become necessary later for the establishment of an air force and to make available to the technical agencies of the Weapons and Equipment Inspectorate and of the Army Ordnance Office the directives and basic information which would be required for the implementation of the necessary measures.

The theoretical studies, which were conducted with a special view to Germany's highly exposed position to air attack, resulted in the preparation of a manual by Captain (Cavalry) Baeumker of Section T-2-V (L). Captain Volkmann, at the time Chief of Section Wa-B-6-F protested seriously against this manual, since even its partial implementation required industrial conditions which did not yet exist, and since the basic requirements stipulated in it completely disregarded manufacturing principles.

A few test models were then constructed in order to test and clarify the technical possibilities available in German industry and to ascertain the performances achieved. Consonant with the then current principles governing the missions of air power, the test models thus designed were

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9 intended for direct support missions, in support of ground troops in combat. On the basis of all considerations involved Captain Student established specifications for the following types:

1. A home-defense single-seater fighter, official designation Arado SD 1, generally called the Heitag for purposes of concealment. The fuselage was designed for a Bristol-Jupiter engine purchased indirectly from Britain.

2. A reconnaissance model for use in divisional squadrons, official designation Albatross L-76/77, but generally known as the Erkudiste for purposes of concealment. This was followed by the L-78, powered by a BMW-VI engine.

3. A combined night-fighter-reconnaissance plane, officially designated Df-22 and manufactured by the firm of Bayerische Flugzeugwerke at Augsburg, but generall known as the Najeku for purposes of concealment.

4. A long-range medium altitude reconnaissance plane to serve simultaneously as a medium bomber, officially designated He-41 and powered by a BMW-VI engine. This model was manufactured by the firm of Ernst Heinkel-Flugzeugwerke Warnemuende and was generally known as the Erkundgros for purposes of concealment.

This plane was a multi-purpose model which could carry either bombs or photographic equipment. The basic stipulation here was that the requirements of the dual missions should not conflict, so that the plane could be used for either of its two missions without any changes except the exchange of certain items of equipment, which would in no way influence its flight performances and flight properties.

The designing and construction of these individual models proceeded without any detailed tactical specifications, the

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10 manufacturing firms receiving only general directives concerning flight performances and equipment.

The development of the above aircraft models, which was more or less completed between 1927 and 1929, created the possibility to give the manufacturing firms a basis on which to work in the construction of military aircraft and on the other hand established a starting point for continued tactical deliberations. With the exception of the L-76/77 and the L-78, none of these models continued in production. The models constructed found use as test planes and as fuselages to test engines.

Ad c,1, above: On the basis of the experience gathered, the Troops Office and Inspectorate 1 (L) was able in 1929 to formulate specifications for the first phase of the main program of rearmament. The aircraft thus placed in service were to serve as initial equipment for the units of the enlarged Reichswehr of twentyone divisions.

The established specifications called for speed performances of 132 miles (220 kilometers) by bomber, 210 miles (350 kilometers) by fighter, and 150 miles (250 kilometers) by reconnaissance aircraft.

These stipulations for planes also intended primarily for Army support missions resulted in production of the following models:

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11 1. A close reconnaissance plane, the Heinkel He-46, powered by an Sh-22 engine.

2. A long-range reconnaissance plane, the Heinkel He-45, powered by a BMW-VI engine.

3. a single-seater fighter, the Ar-65, powered by a BMW-VI engine and manufactured by the firm of Arado. This model was preceded by the Arado Ar-64 powered by an air.cooled engine, which was not adopted for use because its engine caused obstructed vision.

4. A night-fighter, the Do-11 powered by two BMW-VI engines, manufactured by the firm of Dornier and replaced very soon by the improved Do-13 and Do-23 models.

At the same time the Navy within the first phase of its rearmament program had initiated development of the following models intended to support naval units in attack operations:

1. A single-seater naval fighter, the Heinkel HD-51, powered by a BMW-VI engine.

2. A naval close reconnaissance plane, the Heinkel HD-60, catapult-launched, and powered by a BMW-Vi engine.

3. A naval dive-bomber, the Heinkel HD-50, powered by a BMW-VI engine.

12 4. A naval multi-purpose plane, the Heinkel HD-59, powered by two BMW-VI engines.

5. Plans also existed for modifications to render the Do-Wal seaplane suitable for use as a naval reconnaissance plane.

In addition to the above, the Navy awarded to the firm of Heinkel a contract under which the firm was to develop

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12 an aircraft-launching catapult, an item of equipment of particular importance for the Navy.

Apart from the models enumerated above, competing aircraft manufacturers had also developed aircraft types. These included the following:

two close reconnaissance models developed by the firm of Focke-Wulf, the FW-39 and FW-401

a single-seater fighter, the Do-10, developed by the firm of Dornier and Rorfix, at the premises of the firm of Rohrbach, Berlin.

In spite of the necessity for a simultaneous development of the necessary weapons, radio instruments, and general items of equipment, which resulted in considerable construction difficulties, tests with the adopted models reached a point by 1932 that they could be proclaimed as ready to go into production.

Exceptionally serious difficulties had arisen during this work, since it had not only been necessary to catch up with the lead foreign powers had achieved in the post-war years but also to incorporate improvements resulting from tests carried out in the meanwhile with individual parts under insistence by the Section Wa Prw 8. One of the improvements was a protected fuel tank.

Although it was 1929 before Inspectorate 1 (Air) could formulate the appropriate tactical specifications and 1930

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12 before the resultant d velopment contracts could be awarded to industrial firms in the spring of that year, it was possible to carry out the final field tests at Lipezk, in Russia, in the summer of 1931. This can be considered an exceptional achievement by the industry and by the Section Wa Prw 8, which had only a very small staff available to cope with the work. The magnitude of the achievement is emphasized by a comparison with the small budget available at the time. The annual budget in 1930-32 amounted to only five million Marks, and completion of the program with the means thus available called a maximum exploitation of all means available.

The developments initiated as part of the first phase of the main rearmament program provided a basis from which to work to meet the requirements of the main missions evolving from ground combat.

On the basis of experience gained in World War I and under the impact of the spectacular progress made in aviation, particularly after the end of that war, the concepts of future air warfare underwent a radical change.

Such factors as increased operating ranges, increased operating altitudes, improved speed and climbing performances, increased loading capacities involving bigger bomb loads and improved weapons, plus improved safety in operation all combined to assign air power independent missions within the

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13 overall pattern for the conduct of a war and as a separate branch of the armed forces.

In foreign countries these considerations had resulted in the establishment of air power as a separate branch of the military establishment. In Germany, however, the Troops Office rejected such ideas and always considered air power as an adjunct of the Army and held the view that air power need only be employed within the framework of Army operations.

14 Ad c,2, above: In the summer of 193- and after completion of the development work for the first phase of the main armament program, Section Wa Prw 8 formulated new tactical specifications for continued development work.

A draft prepared by Inspectorate 1 (Air) for the same purposes provided solely for improved performances by the existing basic models.

In viewof the existing general situation, however, the Chief of Section Wa Prw 8 called not only for continued improvement of the existing models but also for a study of the problems of a heavy bomber. For the time being the new model was to be constructed only as a wooden mockup with the limited means available. Plans to implement these requirements stated by the Chief of Staff of Inspectorate 1 (Air) failed to materialize, however, because of the results brought about by

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15 the accession of the National Socialist Party to power.on 30 January 1933.

It was only after the establishment of an Air Defense Office (Luftschutzamt) early in 1933 and after all work bearing on military aviation had been centralized under this office, that Lieutenant Colonel Kuehl, Chief of Branch 1 of the Command Office (Air) and Colonel Wimmer, later Chief of the Air Technical Office, resumed work in this direction and formulated the resultant requirements.of a tactical nature for the second phase of the main rearmament program. In this second phase due consideration was to be given to the concepts of a possible strategic use of air power with due regard to the directions of attack recognized as important at the time.

The tactical requirements thus formulated provided for the development of a medium bomber and a dive-bomber, plus

15 continued development of a single-seater fighter and reconnaissance model.

The Navy had already developed a dive-bomber, and the newly formulated specifications aimed at further development of this model for use in naval and land operations.

In addition to the types just mentioned, Colonel, later General, Wimmer also called for a heavy bomber in addition to a medium bomber.

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15 Basing their decisions on a memorandum submitted to them, the Chief of Branch 1 of the Air Command Office and the Chief Engineer of Branch 2 rejected these requirements initially. In view of the long time which would be required for a development project of this type and the certainty that newly developed power units would be available by then, and in view of the fact that no time would be available for development later if the necessity arose for a heavy bomber, Wimmer succeeded in interesting General Wever, Chief of the Luftwaffe General Staff in the matter and convincing him of the necessity of the project. General Wever thereupon decided in favor of initiating the development, making such points as the supply of such aircraft to the troops and the size of the final product contingent upon the results obtained in later tests.

The Technical Office thereupon awarded the firms of Dornier and Junkers contracts to each develop two separate models for use as 4-engine aircraft. The firm of Heinkel was encouraged to participate in the competition on its own initiative if it so desired.

As a result of the tactical specifications formulated for the second phase of the rearmament program the following aircraft models were developed after 1933:

Heinkel He-111 as a medium bomber or long-range reconnaissance plane;

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16 Arado Ar-68, followed later by the
Bf-109 of the Bayerische Flugzeugwerke as a fighter;

Henschel Hs-123, followed later by the
Junkers Ju-87 as a dive-bomber;

Focke-Wulf FW-189 and
b Henschel Hs-126 as close reconnaissance planes.

The Dornier Do-17, a model used later to equip a number of field units, was not included in the stated tactical requirements. The development of this model was due to suggestions by Major von Richthofen, at the time in charge of development, to the Chief of of Office C, General Wimmer, to design a bomber which would be as fast and if possible even faster than the fastest fighter aircraft in service at the time. At the time the project was conceived as a,study in aerodynamics, and the blueprints were to provide for closed-bottom bomb shafts and for two M-15 machine guns on rigid mounts in the rear. These rear guns were intended more as a morale factor than as tactical weapons of rearward defense for the pilot, who could operate them by means of a mirror.

As part of the second phase of the rearmament program Office C awarded the firm of Dornier contracts to construct these aircraft as light bombers, and the favorable impression gained in tests carried out before General Wever at Rechlin resulted in continued development of the model.

As early as in 1932, during the preliminary discussions

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17 concerning the tactical requirements for the first phase of the main rearmament program, suggestions had been taken under consideration to use the Ju-52 commercial plane as an improvised bomber, but no decision had been reached on the matter. After the assumption of power by the National Socialist Party the plane was included as a supplementary armament requirement. A number of units later received adapted planes of this type as their equipment.

The aircraft types adopted and enumerated above all met the performance requirements stated in the tactical-technical specifications. They are enumerated in the compilation of aircraft types included with the present study as Appendix 5.

Up to 1929 the tactical and technical agencies of the Army and the Navy took no steps to influence the development of the aircraft types used to give basic and advanced training. Such planes were developed by the manufacturing firms on their own initiative or in cooperation with the training organizations then in operation, the Sportflug GmbH (Aviation Sports Society), or the German Commercial Pilot School (Deutsche Verkehrsfliegerschule).

Following modification of the definitions of the terms of the Treaty of Versailles, and after withdrawal of copies of military planes, the following models were in use up to 1932 for primary training for the Pilot Certificate Class A:

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17 Heinkel HD31, with 100 hp Mercedes engine;
Flamingo U12a, with Sh 11 and Sh 12 Siemens engine;
Albatros L68a, with " " " " "
ALbatros L101 , " Argus Engine Type As 8;
Heinkel He72, " " " " " (Kadett);
Focke-Wulf FW44, " Siemens Engine Sh 14 (Stieglitz).

The following models were used in advanced training for Pilot Certificate Class B:

18 Arado SC1, with BMW IV engine, Bayerische Motorenwerke
Arado SC2, " " " " " "
Albatros L75 " " " " " "
Heinkel HD 22 " " " " " "
Junkers F 13 " " " " " "
later with Junkers L5 engine;
Junkers W 33 with L5 engine, Junkers Motorenwerke;
Junkers W 34 " " " " " ,later with Sh 22 engine, Siemens Motorenwerke.

In training for Pilot Certificate Class C use was made of Junkers Model G-24 aircraft,powered by three type L5 engines.

All of these models had been adequately tested by the various civilian training centers so that they provided an adequate basis later for initial and advanced training in military aviation.

For the training of naval air personnel the Heinkel HD-42 was available for initial training and the Junkers W-34 and the Dornier Wal for advanced training.

The stated tactical requirements for the second phase

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13 of the rearmament program called for development of special aircraft for Classes A and B training, and resulted after 1933 in production of the following models:

Buecker Bue-131 (Jungmann) for initial training;
" Bue-133 (Jungmeister) " aerial acrobatics;
Arado Ar-66 with Argus Type Ar-10 engine, for advanced training;
Arado Ar-76, a high-wing monoplane, for tactical exercises.

Id c,3, above: Development of aircraft for military purposes was supported by observation of foreign activities in this field, by experimental constructions carried out on foreign soil, and by means of construction contracts placed abroad.

In the development of aircraft engines, in contrast, efforts were made to take advantage of the development work done towards the end of World War I and to incorporate features of engines purchased abroad, primarily of the Napier-Lion type. The latter purpose was served well by a two-seater double-decker reconnaissance plane manufactured abroad by the firm of Albatros and powered by a Napier-Lion engine.

In addition, Captain Student instructed the Bayerische Motorenwerke to develop an engine approximating the Napier-Lion. The starting point here was the 240 h.p. BMW IV engine developed for the Aerolloyd, one of the two existing

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19 German commercial air lines. By doubling the number of cylinders the Bayerische Motorenwerke produced their BMW VI engine. This engine was tested in 1926 with the Heinkel HD-41 fuselage, which served as the forerunner for the HD-45 long-range reconnaissance plane developed some time later.

With further development the performances of this engine were increased to 600 horse power. Apart from a few exceptions, this engine remained the only model in this class which could be used in the first test fuselages and for the majority of the fuselage types adopted for the first phase of the rearmament program.

Another firm which concerned itself with the development of new types of engines for the air services it operated was the firm of Junkers. Here, a six-cylinder vertical engine, which was not placed in serial production, was followed by the L-2 to L-5 models, designed along the lines of the BMW-IV as water-cooled in-line six-cylinder engines. Owing to its operating reliability the latter soon played a major role in commercial aviation and in the training program for advanced pupils. Later, however, no further work was done to continue developement of these engine types.

Captain Student had also instructed the firm of Argus to develop an engine with a thrust of 15-1800 horse power. From the tactical and technical viewpoint this was a long-

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range project far ahead of the standards then reached in the technological field. It was found, however, that industrial techniques were not yet far enough advanced to handle problems of this type, so that the development project had to be cancelled. The plan had been to develop a dual-W (Doppel-W-Motor)engine and work had by this time progressed to the point where the engine was being subjected to brake tests. However, it was too heavy and large for installation in any of the fuselages then in existence.

Parallel with the water-cooled engine types, work started soon after, on instructions from Captain Student, on further development of the available air-cooled engine types, a mission assigned to the firms of Siemens and Bayerische Motorenwerke.

After relaxation of the definitions of the Treaty of Versailles, the firm of Siemens had developed the Sh-10, Sh-11 and Sh-12 air cooled engines for sporting and training aircraft, and followed these up later with the Sh-14. On the basis of work which had been done during World War I, ~~Siemens received instructions~~ in the course of which Siemens had developed the rotary engines then used, the firm received instructions to develop an air-cooled engine with performances at least equal to those of foreign made engines of this class. The engine thus under development was designated the Sh-20.

However, it was a big step from the production of

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21 engines for sporting model aircraft to the development of an engine in this class, and work proceeded very slowly.

At the same time the Deutsche Lufthansa Airways was very interested in the production of more powerful air-cooled engines due to observations made abroad. The technical section of the Inspectorate therefore suggested the purchase of foreign engines to serve both the firms of Siemens and Bayerische Motorenwerke for study and for production in Germany under license. Pursuant to these suggestions, the Bristol-Jupiter engines was secured for Siemens. The firm of Gnome-Rhone had already secured the sole rights to manufacture these engines in Europe, so that the manufacturing licence had to be purchased from them. This proved a particular advantage, since all drawings and specifications had already been converted to the decimal system.

In addition, the firm of Bayerische Motorenwerke received instructions to purchase the manufacturing licence for the air-cooled engine manufactured by the American firm of Pratt and Whitney.

Contrary to military planning, the Deutsche Lufthansa Airways purchased the patents for the Hornet engine instead of those for a high-altitude engine, assuming that it would require large numbers within the foreseeable future because of the rapid expansion of air communications.

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22 According to the views prevalent at that time, water-cooled engines were intended for fighter aircraft because of the fact

23 that they offered less obstruction to vision, while the air-cooled engines were intended for bomber aircraft. For this reason both types of engines were simultaneously under development, the water-cooled types by the firms of Junkers and Daimler, the air-cooled types by the firms of Siemens and Bayerische Motorenwerke.

It was under this project program that the firm of Siemens finally produced its Sh-20, besides a model patterned on the Jupiter, which was designated the Sh-22 and used to power the He-46 close reconnaissance fuselage.

The Hornet engine was manufactured under licence by the Bayerische Motorenwerke and used primarily ba the Deutsche Lufthansa Airways in commercial air communications.

It was in the course of these processes of development that the accessories necessary for the purpose, such as exhaust turbines, and compressors, were developed.

Learning from the models manufactured under licence, German industry was able to catch up at least a large part of the lead foreign manufacturers had gained and to create conditions for further research and development.

For use in the fuselages adopted for the first phase of the rearmament programtwo engine types were thus available,

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namely

BMW-VI, manufactured by the Bayerische Motorenwerke and
Sh-22 , " " the firm of Siemens.

After General Wimmer (at that time in major rank) had taken over Section WaPrw 8[1] in 1929 the long time required for the development of engines created the necessity to introduce precautionary measures designed to secure modern engines with improved performances for the second phase of the rearmament program.

However, a number of official agencies continued to concern themselves with the development of engines, availing themselves of the services of various industrial firms in accordance with their specific requirements. The Army made use primarily of the Bayerische Motorenwerke, the Navy of the Daimler Benz concern. Contrary to the Army, the Navy had no interest in high-altitude engines, while the German Commercial Aviation School restricted itself to its own particular purposes in the matter of future developments.

The interests of the various official agencies concerned thus diverged widely one from the other, so that the German industry was assigned numerous varying missions which prevented a rational use of manufacturing capabilities.

Under instructions from General Wimmer the engine development specialists of Section WaPrw 8 [See Footnote]

1. This should probably read WaPrüf 6. WaPrw 8 was responsible for optical instruments, mapping, etc.--Translator

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23 therefore compiled a long-range program and endeavored to consolidate all engine-development work carried on by the various agencies. The outcome of these efforts was the establishment of an Engine Development Commission (Motoren-Kommission) under the chairmanship of Regierungsrat Baeumker and consisting of members from the engine development specialists of the Army, the Navy, the Commercial Aviation School (Verkehrsfliegerschule), the Deutsche Lufthansa Airways, and the German Experimental Institute for Aviation (Deutsche Versuchsanstalt fuer Luftfahrt).

The establishment of a commission of this type was also necessary for financing reasons. Because of the conditions imposed by the Treaty of Versailles the Reichswehr (Germany's post-World War I 100 000-man army) had only very limited funds available for aviation purposes. The administration of the Aviation Budget (Luftfahrtetat) was a responsibility of the Aviation Branch of the Reich Ministry for Transportation and Communications and was handled by Oberregierungsrat Muehlich-Hoffmann and Regierungsrat Baeumker, and the newly established commission served to maintain liaison with the industry.

Consonant with the existing political and geographical conditions, main emphasis in all planning by Section WaPrw 8 [see Footnot on page 29] was on the development of a

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24 single-seater fighter in order to be able to establish an effective defense system. This created the requirement to concentrate first of all on the development of a water-cooled engine.

For the above reasons the program compiled by the engine-development specialists of Section WaPrw 8 [see Footnote on page 29] provided primarily for development of a 30-liter water-cooled engine.

The specifications drawn up for the industry on the basis of technical requirements was approved by the Engine Development Commission. These specifications called for a 12-cylinder high-speed engine and transmission with a small piston stroke and a high number of revolutions, giving a thrust of 800 horse power. The engine was to have inverted cylinders to provide as clear a field of vision as possible.

On the basis of these specifications three concerns manufacturing engines submitted tenders. The final outcome was production of the Jumo-211 by the firm of Junkers and the Da-600 by the firm of Daimler-Benz after 1933.

The Navy had expressed misgivings concerning the specifications, giving its opinion that the jump from existing models to engines with a thrust of 800 horse power was too great.[1]

1. Footnote on page 32.

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25 The objections raised by the Navy resulted from comparisons with the Rolls Royce Kestrel engine, which at the time was playing a major role in the equipment of the British Royal Air Force. However, the specifications were designed for a time at which it was safe to assume that this engine would already be outdated.

At the request of the Navy, the firms of Junkers and Bayerische Motorenwerke nevertheless were given specifications and directives for development of a 20-liter engine. These resulted after 1933 in production of the Jumo-210 by the Junkers-Motorenwerke and the BMW-110 by the Bayerische Motoren werke. However, these two engine types were not destined to play any important role in the equipment of field units and only the Jumo-210 went into small-scale serial production.

In order to prevent unnecessary loss of time and expenditure of funds and acting on instructions from higher headquarters, General von Richthofen, at that time in major rank and in charge of engine development, halted the BMW-110 project in order to release development capacities for the development of air-cooled engines.

Footnote 1 to page 24: According to General Wimmer, the Navy raised no objections against the 20-liter engine, which was intended for twin-engine aircraft, but considered the jump to 30-liter engines too great. This view seems unlikely, however, since the 20-liter engine actually did not play any important role in the powering of aircraft and its production was soon halted.

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25 Besides the 30-liter class water-cooled engines, the firms of Siemens and Bayerische Motorenwerke also received instructions to develop a twin-row radial air-cooled engine for bomber aircraft. Neither of the firms had any success in these efforts, which in the case of the Bayerischen Motorenwerke may have been due in part to the fact that the firms's chief designer was more interested in water-cooled engines.

For the second phase of the main rearmament program the following engine types were thus under development after 1935:

Daimler-Benz: DB-600 } in the 30-liter class
Junkers : Jumo-211 }

Siemens : Sh-22

Bayerische Motorenwerke: BMW-132

and in the 20-liter class:

Junkers : Jumo 210

Bayerische Motorenwerke: BMW-110.

All of the above were developed as fuel-injection engines.

For the Aviation Sprot Schools (Sportfliegerschulen) established after relaxation of the terms of the Treaty of Versailles, the firm of Siemens had developed air-cooled engines, namely, the Sh-10, 11, and 12 with thrusts between 80 and 100 horsepower. These were followed later by the

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26 120-horsepower Sh-14. During World War I the firm of Daimler had constructed a small number of 100-horsepower engines and installed them in sporting model aircraft.

These engine types sufficed for initial training in the few Aviation Sport Schools which sprang up and in the newly established German Commercial Aviation School.

The firm of Daimler and Hirth, meanwhile, had commenced production of 20-horsepower engines, air-cooled, for use in small aircraft.

27 In the event of war the possibility existed to make use of the large civilian-purpose manufacturing capabilities of the firms of Siemens and Daimler, for which reason provisions were made for these firms to manufature military type aircraft engines. Other firms therefore had to take over the task of manufacturing smaller engines for training aircraft. Plans provided for the firms of Argus and Hirth to take over this field of endeavor.

Within the pattern of the tactical requirements for the second phase of rearmament and under instructions from Section WaPrw 8 [See Footnote on page 29], ~~developed and manufactured the As-8, an 30-horsepower~~ headed by Major Wimmer, the firm of Argus developed and constructed the As-8, an 30-horsepower engine for sporting and training model aircraft, while the firm of Hirth developed and manufactured

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27 the 65-horsepower HM-60-R for the same purpose. Both of these were in-line engines with inverted and air-cooled cylinders.

The same two firms then developed the 200-horsepower ~~AS-11~~ As-10 and the 160-horsepower HM-506 for training aircraft, for which purpose the BMW-IV, BMW-V, and L-5 engines were also available.

The purpose behind development of the 200-horsepower engine was to commence initial training with aircraft of this type, in order to shorten the training period, and to use the aircraft with 100-horsepower engines for overland flights in order to economize in fuel.

Ad c,d, above: The instruments with which aircraft had been equipped during World War I were consonant with the general technical standards ~~achieved~~ achieved then in aviation and with the demands made on aircraft in accordance with the air tactical principles of the time. Apart from short flights during cloudy weather, air missions could only be performed during conditions of ground visibility, and with the exception of the compass the instruments on board an aircraft were of small significance in the execution of tactical missions.

Furthermore, the ruling view at the time was that the pilot's "feel for flight position" was the decisive factor

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28 in the execution of a flight mission, so that the instruments on board were needed only for control purposes. It was thought that the failure of an instrument would have no important impact on the ex cution of the mission.

The instrument panel therefore had only the more important instruments to control flight and check the functioning of the engine, namely, a speedometer, an altitude meter, a revolution and a fuel gauge, and thermometers showing the temperature of the water and oil. The only navigational aid used was the compass.

It was only towards the end of the war that new tactics, separate from the usual missions~~xxxxxxxxxx~~ of direct support for the ground forces, developed. These new tactics necessitated night flights and required instruments far exceeding past requirements. Fulfillment of these new requirements in respect to instruments was to make possible the transition from intuitive flight to instrument navigation.

All development work in this new direction was brought to a halt after the war by the conditions of the Treaty of Versailles.

29 After relaxation of the treaty conditions the resumption of aviation sport did not present a big enough impetus to resume research on aircraft instruments, since those in use were adequate for the usual purposes.

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29 It was only after the commencement of air traffic over long distances, with the consequent necessity for all-weather and night aviation, plus the need for increased operating and traffic safety as well as punctuality, that greater demands were made on the instruments with which aircraft were equipped.

Another factor which promoted and accelerated work to develop improved aircraft instruments was that of the tactical-technical demands stated within the pattern of the second phase of rearmament. In spite of the small financial gains successful work in this field promised, certain firms turned their attention to the new problems.

Pursuant to the terms of the Treaty of Versailles all records on the work of development already done in the field had been destroyed at the end of the war, so that all research had to start once again from the very beginning. In view of the enormous amount of work involved and the large expenditure of funds in comparison with the small returns which could be expected, the decision of industrial concerns to undertake this mission is particularly praiseworthy.

After World War I foreign countries had promoted work in this field with particular vigor, so that they had a considerable lead over Germany. In efforts to eliminate this lead and in addition to the work proceeding in Germany, the

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30 German Experimental Institute for Aviation procured instruments from abroad, subjected them to careful examinations, and made the results available to the interested firms.

So far as the normal instruments were concerned, a number of firms had already embarked on courses which involved the threat of dissipated efforts. Some of the aircraft manufacturing concerns had already commenced work on developing instruments designed specifically and only for use in their particular types of aircraft. Pursuance of this course would have produced intolerable conditions so far as the future equipment of military units was concerned in view of the maintenance of stocks and the supply of spare parts.

For the above reasons the Weapons and Equipment Inspectorate compiled normalization regulations designed to insure uniform overall sizes and standard fastenings to insure ready changeability of instruments. These were followed by directives governing the development of airborne instruments for the various purposes required. The purpose of the directives was to establish sound basic principles regulating the manufacture, testing, acceptance, outside marking, and uniform possibilities for inspection and checking by the air pilot.

The directives thus published covered all important categories of airborne equipment, namely,

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30 1. Engine control instruments;

2. Flight control instruments;

3. Instruments for automatic steering;

4. Navigational instruments;

31 5. Altimeters;

6. Rescue and safety instruments and equipment;

7. Airborne electrical instruments and installations;

8. ~~[illegible] facilities~~ Airborne intercommunications facilities;

9. Medical equipment;

10. Clothing;

11. Take-off and landing equipment.

In spite of the meagre means available to them, the industrial concerns accepted these directives and normalization regulations and adhered to them.

In contrast with other airborne instruments, the development of which presented no serious difficulties, the development of the instruments required to create conditions for all-weather and night aviation presupposed solution of a number of technical problems bec use of the missions aircraft would have to be used in. At the same time efforts had to be made to develop improved navigational instruments.

The centerpin in all this work was development of a reliable ~~flight-angle control~~ flight indicator instrument (Fluglagegeraet). In this respect mention must be made here of the specially developed Gyrorector produced by the firm of Gyrorector GmbH and tested by the Deutsche Lufthansa Airways, which was, how-

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31 however, too bulky for installation in any but multi-engine aircraft. Since instruments of this type, particularly the Sperry horizon instrument in America, were already so far developed that they could be considered ready for use, continued development of the Gyrorector was halted.

Once development of the bank-and-turn indicator was completed, this instrument and the Sperry horizon instrument pro-

32 vided the necessary conditions for blind and instrument navigation. The firm of Askania purchased the rights to construct the Sperry instrument under licence.

On the whole the work of instrument development was greatly promoted by willing cooperation from all concerned, the Lufthansa Airways, the German Experimental Institute for Aviation, the proving and testing institutes, Branch 3 of the Weapons and Equipment Office [See Footnote on page 29], the Navy, and the German Commercial Aviation School.

In making use of the pneumatic dirve system, the firm of Askania was following American examples. The system was used during development of the telecompass and the directional control instruments, but was found later to be less suitable than the electric drive, which permitted more compactness and in all respects more favorable solutions. It must nevertheless be acknowledged that the firm of Askania pioneered the way in this field of endeavor.

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32 The electrically driven directional control instrument was a development by the firm of Siemens, which, however, took years to complete. Known as the K4us , this equipment came into general use.

Whereas the research and experimental work already carried out by the Lufthansa Airways and the Commercial Aviation School was a great help in the development of suitable equipment of a general nature and of navigational and automatic steering equipment, development of all items not required by the airways had to commence from the very beginning. This included such items as elevators, rescue and safety equipment, and clothing.

The development of rescue and safety equipment, and this applied in particular to parachutes, was a matter of primary importance. In the past there had been practically no need for such items, so that development had halted at the stage reached during World War I, in which only ~~anchored~~ static-line parachutes had been used. For the rare parachute jumping exhibitions held during aviation shows after relaxation of the Versailles Treaty conditions these were adequate.

In developing emergency and main items of equipment for the new types of aircraft, it was necessary, among other considerations, to make allowances in designing training

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33 parachutes for increased flight speeds. No records were available on this subjects, so that the necessary data first had to be established. Initially the ~~[illegible]~~ static-line parachute was used for this purpose, and with its use the strains and stresses occurring at the moment of the jump, and while the parachute was opening, had to be determined at various speeds. This was done with the aid of a dummy weighing 220 lbs (100 kilograms) containing the necessary registering instruments, a statoscope and a component-acceleration-recorder (Komponenten-Beschleunigungsschreiber). At the same time the whole process was registered by three phototheodolite stations (Fotomess-Theodolit-Stationen). Tests were then extended to free-fall parachutes, comparisons being made between the American, Italian, Swedish, and French types.

The outcome of the above research and experimental work was the development of a free-fall parachute for aircraft crew members and of a static-line parachute for paratroopers, while work continued on the development of a freight parachute.

34 Experiments for the aircraft speeds then achieved were completed by 1932. This applied also to breathing apparatus, aviation clothing, electrically-heated underwear, helmets, boots, goggles, protective face masks, and gloves.

The fact that air units, besides their missions of

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34 direct ground support, would have the mission of procuring through air reconnaissance the intelligence data needed by the command for the conduct of operations presupposed the development of high-quality photographic equipment. In this field development work commenced as early as in 1924, and the research carried out included such subjects as the actual photographing operation, and the supplementary processes of developing, copying, enlarging, and interpreting, for all of which the necessary equipment, ~~had been taken under development, and all of which were designed to handle~~ film, plates, and paper, had been taken under development. For this purpose and under instructions from the Troops Office, a special Photographic Section had been established in 1924 within the Reich Defense Ministry as part of the Experimental Institute for Aviation. In 1927 the section was attached as Branch 1 to the Army Ordnance Office while the responsibility for testing was assigned to Branch M of the German Proving Institute (Deutsche Versuchsanstalt).

During the initial stages all research and development had to be based on the instruments and equipment available in World War I, during which use had been made primarily of the 25/13 x 18 model hand-operated camera. A later model, the 21/13x18 was made available in 1925 by the firm of Zeiss, Jena, which could be hand-operated or installed in the

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34 hull knee-action swivel mount. This model was the forerunner of the recording aerial mapping camera. From it an improved model was first developed, which could take a photo 18x18 centimeters in size with a projector lens focal length of 21 centimeters. Following careful tests six of these cameras were procured in 1928, and another twentyeight in 1939.

The above camera in turn was followed by the Rb/50/18,

35 with a projector lens focal length of 50 centimeters and taking an 18x18 centimeter photo. Development of this camera was completed in 1932.

Simultaneously with the above projects, work commenced on development of a heavy type treble recording aerial mapping camera (Dreifachreihenbildner) by the firm of Lytax in Freiburg, which could take 13x30 centimeter photos with a projector lens focal length of 50 centimeters.

The above cameras were operated electrically by means of a variable cone-pulley drive (Stufenwechselgetriebe) first produced by the firm of Zeiss in 1926. A similar system was developed simultaneously by the firm of Voelk, Berlin, of which 3[illegible] were procured in 1934.

Another camera developed from the former hand-operated 25/13x18 model with its projector lens focal length of 90 centimeters, 1:4.5, was the new model with a projector lens focal length of

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35 90 centimeters, 1:3.5, and a streamlined casing. This camera and a simplified film case for use with it were completed early in 1933.

While the above projects were in process, work also proceeded on development of the necessary filmdeveloping machine (work on which had to be abandoned, however, since it was found unusable for military purposes), the copying ~~xxxxxxx xxxxxxxx~~ machine, the reproducing and enlarging machine, the viewer box, the developing machine, the photo laboratory truck--which was to serve as an advanced or forward photo laboratory, and the Vakublitz flashlight for night photography.

36 On the basis of experience gained in field exercises work also commenced to design special boxes for the transportation of the transforming, reporducing, and enlarging machines, all of which were ready for the field in the summer of 1932. Finally, the transportation boxes were improved in 1934 to serve as permanent casings for the machines involved.

The development of airborne and ground radio equipment was handled by Branch WaPrw 7, the branch responsible within the Army Ordnance Office for Army signal equipment.

In spite of some inherent weaknesses, the following

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36 instruments could be declared ready for delivery by 1932:

Radio Instrument Model	Operating on Wave-Length
Fu-G-III and Fu-G-V	50-100 meter band and 500-1000 meter band
Fu-G-IV	50-1000 meter band
Fu-G-VII	30-120 meter band
Fu-G-VI	for use on fixed waves (Welleninseln) within the stated wave ranges.
Peil[1]-G-I	400-1720 meter band.

The above radio instruments were intended as equipment for the aircraft models adopted for the first phase of rearmament.

Acting on instructions from Branch WaPrw 8 [See Footnote on page 29] the appropriate section of the Army Ordnance Office in 1930 had designed the MG-15 machine gun specifically as an aircraft weapon. The weapon met all stated requirements for use in aircraft; it was light and had a short barrel.

Overruling protests by Branch WaPrw 2 (the Infantry Weapons Branch of the Army Ordnance Office--Translator), von Bockelberg, then Chief of the Army Ordnance Office, had in 1930 decided on its procurement after a demonstration given at Kummersdorf. However, the weapon was not yet ready for delivery for the emergency equipment program, so that use had to be made of the Model 08/15 light machinegun of World War I, which was also in use by the ground forces.

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37 For the aircraft types for the first phase of rearmament, the main weapon used was the Model MG-15 machine gun, installed on swivel and on rigid mounts. For the rigidly mounted guns the mechanism was synchronized for fire through the revolving propellor blades. In 1933 the Model MG-17 machine gun was taken under development for rigid mounting.

Anti-tank phosphor ammunition, also developed by the Army was available, while tracer ammunition was used for special purposes in air combat.

As in the case of the Model 08/15 machine gun, use had o be made of the World War I bead-and-ring sights for swivel-mounted machine guns. The same sights, as well as a new reflector sight developed by the firm of Oigee was available for the machine guns on rigid mounts.

Development of the Model 29 gun-ring bracket mounting was based on a foreign model, affew of which were purchased abroad and tested in Hd-45 and He-46 type aircraft.

To eliminate acceleration impact on the gunner, a swing seat, Model D-30, was developed by Diplom Ingenieur Mix, the responsible expert in Branch WaPrw 8 [see Footnote, page 29] and installed later.

In the matter of bomb development the only possibility during the early stages was to carefully observe the work

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done abroad in this field. It was found that the Americans
German World War I
38 were continuing the development of air-mine type bombs with thin casings in place of the British type of thick casings in tests carried out against old German warships. The reason here was that better results were expected in the case of near hits with mine-type bombs than with multi-purpose bombs. The Americans had departed from the principle of streamling bombs and were using seamless pipes, giving their bombs a cylindrical shape. Because of the good ballistical properties achieved they retained this shape also for smaller caliber bombs.

When work on the development of bombs was resumed in Germany, it was found that the DuW type bombs used during World War I broke apart while in the air when dropped from great altitudes and at great speeds because of their spin, which was designed as a stabilizing factor. Entirely new principles therefore had to be adopted.

The first new types developed were a 22-pound (10 kilogram) fragmentation bomb, and a 110-pound (50 kilogram) and a 550-pound (250 kilogram) mine-type bomb, all for use against land targets; and a 1100-pound (500 kiligram) mine-type bomb for use against ships. In its effects and production methods the 22-pound bomb was patterned on the high-explosive shells used by the field artillery.

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38 The next types developed were the SC-50 and SC-250, both ~~fragmentation~~ mine-type fragmentation bombs. One feature of these was that they were attached to the bomb clips by means of a ring opening at the center of gravity, if necessary even at the point. In contrast, the SD-fragmentation bomb could only be carried in suitable magazines placed vertically, whereas the SC-500 could only be carried horizontally.

39 The first SC-type bombs produced consisted of a forged steel nose with a middle-piece of seamless piping welded on, to which the tail piece, ~~xxxxxxx~~ with stabilizers riveted on, was screwed.

However, new tactics of attack in low level and dive-bomb release runs created a necessity for stronger bomb casings. The development of bombs therefore had to go hand in hand with aircraft development.

In the case of incendiary bombs it was possible to follow the pattern adopted in World War I, using the Elektron B-1-E 2.2-pound (1 kilogram) type. Although there was no possibility to test this bomb under actual conditions of warfare it was safe to assume that effective large-area results could be achieved in mass drops. The only necessary improvement was that of durability and protection against weapons fire, problems which were soon solved.

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39 In the field of bomb-sight devices the Fl-219 Goerz bomb sight was available for use in night operations. Here the basic principles had been developed in World War I and had later been brought up to date.

In addition, the firm of Zeiss, Jena, through a subsidiary firm abroad, had even before 1933 developed the Lotfe-6, a fully automatic ~~xxxxxxight~~ telescopic bomb sight for use during daylight. This instrument was modified for use by a bomber in a prone position, as was to be the case in German

40 aircraft, and given a gyro stabilizer.

As in the case of machine guns, mounts, and gun ring bracket mountings, the items of bomb release equipment were developed by firms specializing in this type of work in order to insure uniformity and thus simplify resupply operations for the various types of aircraft. Before contracts were awarded, a number of firms were requested to submit tenders. The bomb release was ~~xxxxxxxx~~ a mechanical process, and only the naval multi-purpose aircraft type had electrical bomb release equipment.

For the aircraft types designed for the first phase of the main rearmament program the bomb types planned were as follows:

Aircraft

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40

For Aircraft Type	Bomb Caliber	Bomb Type	Bomb Sight
AR-65	132 pounds (60 kilogram)	1 Vemag-6-C-10	
HD-51	as above	as above	
He-46	264 pounds (120 kilogram)	2 Vemag 6-C-B	Fl-219
HD-45	440 pounds	2 Vemag 6-C-10 and 2 BFC-50	Lotfe-6 (Unit lead aircraft only)
HD-50	1100 pounds (500 kilogram)	1 PVC-500	Revi
HD-60	308 pounds (140 kilogram)	1 Chemical Projector Type S-125	
HD-59	2200 pounds (1000 kilogram)	4 Mega 5-C-50	Lotfe-6
	or	1 PVC-1000	
	or	3 Chemical Projectors Type S-200	
DO-11	2200 pounds	4 Vemag 5-C-50 and 4 MHC-250	Lotfe-6

Plans for the auxiliary bomber, Type Ju-52, intended for inclusion in the main rearmament program provided for six 550-pound (250 kilogram) bombs, vertically suspended.

41 In place of each of these six bombs, the plane could carry four 110-pound bombs with the use of separating plates in the bomb shaft, or sixteen 22-pound bombs (fragmentation) with the use of racks, or 144 B-I-E bombs suspended in containers.

The reason for the vertical loading of bombs in these aircraft was that the frame sections were too narrow for horizontal loading.

Development of the required ground equipment used for the servicing of aircraft could be based on the work already

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41 done by the Lufthansa Airways. Development of the special items of equipment required, and this applied particularly to those needed for bomb-loading operations, went hand in hand with development of the items they were required to service.

Ad: C,5, above, Raw Materials and Semi-Manufactured Items. In World War I timber and cloth were the main items used in the manufacture of German aircraft fuselages. Steel was used only on parts of the spars where timber was not strong enough or where it was particularly advantageous in use, for example, as undercarriage axles and supports, in the framework, and at the joints between the separate sections.

Towards the end of the war steel tubing was used for the frame of the rump, which was then covered with cloth. Timber continued in use for the wings and for parts of the steering assemblages. Work was in progress at developing light metal construction methods, but the progress made by the end of the war was negligible.

The transition from the use of timber to the composite steel-tubing and timber structure and later to light metal structure was due in part to the growing shortages in the materials hitherto used in the construction of aircraft fuselages, namely pine from Poland and Siberia for the ribs and other bulky wooden parts, and the shortage of beech timber from the Courland for the manufacture of plywood. The

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42 types of timer grown in German did not meet the requirements for aircraft construction.

When work commenced in 1924 on preparations for the future reestablishment of German air power, advance planning therefore had to be based on the experience available from the past war. The objective was to prevent a recurrence of wha what had happened in World War I, to compensate in some way for Germany's poverty in practically all raw materials required for armament purposes, and to prepare against the possibility, as far as possible, that Germany might again be cut off from all sources of supply, a thing which could easily happen because of her unfavorable strategic position.

The trend emerging at the end of the war to use aluminium in the construction of aircraft of the larger types called for measures to insure the manufacture of aluminium in times of war or crisis. The peacetime requirements in aluminium for the few commercial aircraft needed and for development of the types needed for the emergency rearmament of the first phase played no role at all. Steps had to be taken to insure adequate supplies of bauxite and copper, the most important components used in the manufacture of aluminium, against the eventuality og larger requirements at some future date.

The need also arose to create the possibility to

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43 produce substitute materials. This resulted in the development of the light metal known as Electron, which could be produced from German raw materials. The IG Farben Works, Bitterfeld succeeded in developing two alloys of this metal, but neither of them could serve as an equivalent substitute for aluminium because of their rapid corrosion. This disadvantage was admittedly to some extent reduced by the development of special methods of painting, but an experimental aircraft constructed exclusively from Electron revealed that the servicing and check systems were far greater when this metal was used. This created conditions which could not be met during a war, for which reason a general use of the metal was out of the question.

Extensive experiments showed that the one alloy, known as AZF, which was the stronger of the two alloys, could be used for parts not subjected to heavy strains and stresses, while the alloy known as AZM could be used for contour parts of the fuselage. Besides its use in semi finished parts, Electron proved useful for cast engine casings. Since the metal was damaged by sea water in spite of the protective surface coating, its use remained restricted to land-based aircraft.

Another product of the various experiments was the Al-Mg alloy known as Hydronalismus, which was sea water resistant and could therefore be used in the construction of seaplanes.

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43 As a casting alloy, this metal found use for the tops of engine cylinders.

The Rackwitz Metal Roller Mills (Walzwerk Rackwitz) was established near Leipzig to process these two semifinished products, Electron and Hydronalium.

In the event of war it was to be expected that requirements for Electron and Hydronalium for aircraft and even more so for incendiary bombs would grow in the event of war, and since the electricity required for their production was double the requirement for the production of aluminium, it was not possible to use these metals in any large measure for other purposes, particularly not for Army equipment.

Germany lacked own supplies of practically all elements required in the production of high-quality steels, namely such metals as nickel, chromium, wolfram, cobalt and tin. In order to make the armament industries as independent as possible of foreign supplies, efforts had to be made to reduce the percentages of such metals needed to the lowest minimum or to replace them by others more readily procurable within Germany. The appropriate research and experimental work commenced as early as in 1920, aimed, for example at reducing to a minimum the nickel required in the manufacture of engine parts subjected to excessive wear and tear, such as crankshafts and valves. In some cases it was possible to substi-

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44 substitute molybdenum for nickel.

Among other items, great difficulties were encountered during World War I in the procurement of adequate supplies of plywood, since the beech timber needed for its manufacture was not available from natural sources within Germany in the appropriate quality or the required quantity. The only logical sources of supply were Poland and Courland.

Owing to the political tension due to the newly established national borders after the war, and this applied in particular to the Polish Corridor and to Danzig, it was not possible to depend on supplies from Poland in the event of any future war. Owing to their structural features and their unfavorable strength to weight ratio, the types of timber grown within Germany did not meet requirements for the conventional methods of plywood manufacture. New methods therefore had to be sought to compensate for the disadvantages of German-grown timber by means of different plywood manufacturing processes.

45 Very detailed research and experiments finally produced an improved beech plywood in which ~~the weaknesses~~ the weak points of German-grown beech timber were offset by glueing together very thin layers in such a way that the grain formed a close criss-cross in all directions. One advantage in the use of such thinly cut plywood was the possibility to press-form

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45 the plywood into the aerodynamical shapes required for various construction elements. Special types of presses were installed at the plywood factories for this purpose.

Another problem requiring solution in the new methods of plywood manufactur was that of gluing. In the past casein had been used in gluing plywood for aircraft manufacture. However, the source of casein is milk, a commodity which had to remain reserved for human consumption during a war. Experiments resulted in the use of Lego artificial gum tissue, later replaced by the Kaurit gluing system. For both of these systems all raw materials were readily available in Germany. The work done in this field initiated processes which were destined to play a role of growing importance in the economy in general.

Difficulties similar to those just discussed were encountered in the matter of aircraft covering fabric, since it proved impossible initially to manufacture a strong enough fabric from German-grown flax. During World War I it had been possible to use yarn made from Belgian flax, which met the required standards of tensile strength. As long as Belgium was held by German troops no serious difficulties were therefore encountered in this field. In the eventuality of any future war this source of supplies could not be relied upon. This created the necessity to develop processes making

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46 possible the use of German-grown flax. An experimental roasting plant was established for this purpose, and after long work a roasting method was finally developed after 1933 which made it possible to manufacture airplane covering fabric of adequate strength from selected German-grown flax. One condition of success, however, was that the farmers carefully sorted out their high-quality flax, a target which was achieved through the payment of bonuses.

Special spinning and weaving machines had been available for the processing of Belgian flax. After the war these had been dismantled and no lucrative reason existed in Germany to develop machinery of this type. Consequently, there was no possibility prior to 1933 to manufacture the necessary fabric within Germany.

Until the necessary machines could be procured from abroad it was necessary to purchase the required airplane covering fabric in foreign markets, particularly from England. This, however, gave foreign countries the possibility to check the number of aircraft being manufactured in Germany.

The position was similar in the matter of streamlined cables, which, because of their reduced air resistance, had taken the place of the former bracing cables used in double-decker aircraft. Because of the small quantities required no German firm had any interest in carrying out the neces-

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46 necessary experiments and to manufacture the required types of wires. Since the cables had to be manufactured in fixed lengths, their import again provided foreign intelligence services with an opportunity to keep a check on Germany's aircraft production.

47 After extensive efforts success was finally achieved in having the wire cables manufactured by the firm of Kuhbier, Dahlerbrueck.

In the event of war difficulties also had to be anticipated in the procurement of chromium-molybdenum precision steel tubing for use in fuselage construction. Here again the quantities required were so small that no German firm was willing to carry out the preliminary trials necessary to insure that the finally manufactured product would be within the extremely narrow limits of tolerance, so that the tubing had to be imported from Sweden. Efforts to restart the manufacture of welded tubing also failed because the necessary installations had been destroyed after the end of World War I.

Finally the firm of Krenpring, Solingen, was induced to take up the production of the necessary tubing.

German requirements in foreign raw materials for the manufacture of varnishes were initially insignificant, and remained so as long as requirements remained restricted to the needs of sporting aircraft and aircraft of the Lufthansa

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47 Airways, so that there was no incentive for industrial firms to expend efforts and funds on the necessary research and development work.

The need to have home sources of raw materials supplies to provide against any possible isolation from outside sources led in the second phase of the rearmament program to the introduction of fundamentally important measures in this field.

48 These applied in particular to the development of anti-corrosion paints for seaplanes and the varnishes required for aerodynamic purposes. A number of varnish manufacturers commenced work in this field in 1929.

Methods were finally developed to use German wood pulp cellulose in place of the imported cotton fuzz, and, for anti-corrosion varnishes, to replace imported oils and gums by artificial gums manufactured in Germany, which would be available in adequate quantities at all times for aviation purposes.

There was no possibility to make funds available on any appreciable scale for all of the research and development work described above, or for the work of testing steel tubing, streamlined cables, electro-metals, and varnishes. Also there were small prospects at the time of any appreciable increase in the consumption of such articles, and the unselfish action of the firms which participated in the work therefore deserves recognition.

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48 In contrast with what has been said above, all efforts failed to interest the German artificial silk industry in the development of a fabric suitable for parachutes, although possibilities existed here to offer the incentive of financial support. The regulations compiled by Section WaPrw 8 [See Footnote on page 29] governing the structure of parachutes were based on years of systematic study of the properties and suitability of various fabrics made from cotton, linen, flax, artificial and natural silk. Natural silk had been found the most suitable, but was not available within Germany.

Since the efforts made in 1930-31 to interest German

49 artificial silk manufacturers in the production of a fabric suitable for parachutes from German raw materials, natural silk had to be imported from foreign countries. This could have had a serious impact on the production of parachutes in the event of war.

However, even the imported silk thread, which came from France and Japan, proved only conditionally suitable, since qualities varied widely and a loss of between 25 and 30 percent unsatisfactory fibre had to be taken into account.

The firm intention to give aircraft crews a parachute which could be regarded as a completely reliable piece of rescue equipment left only one course open. This was to produce the silk-worm cocoon in Germany and from it gain

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49 basic raw material for spinning into thread within Germany. However, no firms were known in Germany which could have handled the spinning of the raw silk thread.

The various investigations carried out in this field finally brought to light the fact that silk-worm breeders residing in various parts of German after the first World War had formed a union to propagate this industry. This union had an agreement with the silk spinning works known as the Seidenwerk-Spinnerei-Huette, Celle, established in 1928. Under the agreement, members of the union delivered their cocoons to the spinnery and in return received finished silk products. This firm willing agreed to the suggestions by Section WaPrw 8 [See Footnote on page 29] to produce a fabric suitable for parachutes and finally solved all problems in this field.

In addition to the need to economize to the utmost extent in imported manufacturing materials, the need existed for early measures to restrict the variety of types of semi-finished products manufactured in order to simplify final manufacturing processes.

Investigations by the responsible sub-section of Section WaPrw 8 in 193 revealed that, according to industrial firms working for the air force, there were then in use

74 types and alloys of steel
40 non-ferrous metals
91 light metal alloys.

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50 In their chemical and mechanical characteristics many of these alloys were hardly any different one from the other, and in the event of a war there could be no doubt that the need for such a large number of varying metal alloys would have been a great disadvantage. It necessitated costly storage of finished and semi-finished items on a scale which could not be tolerated, especially in times of peace. In the case of the Lufthansa Airways, for example, the stocks which had to be held in reserve had mounted to a total purchase value of two million Marks.

Through a cooperative system founded in 1932 between the producers and users of industrial materials and aircraft operators under the subsection of Branch WaPrw 3 responsible for industrial problems the number of approved alloys was very soon reduced to the following:

33 types of steel
12 non-ferrous metals
36 light metal alloys,

51 or to roughly 40 percent of the number formerly in use. Of the approved materials, 13 were used in fuselage construction, 32 in the manufacture of engines alone, and 36 for various items of equipment.

The materials thus approved were designated Aviation Industrial Materials (Fliegerwerkstoffe) and standards of their

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mechanical, chemical, and technological characteristics were established specification sheets to which they were required to conform . These specification sheets were later compiled by the Technical Office of the Reich Air Ministry in 1935 to form an Aviation Industrial Materials Manual (Flugzeugwerkstoff Handbuch).

This careful selection of construction materials later resulted in simplified construction and procurement processes in the case of numerous heat-treating installations and to an easily controlled recording of experience.

The limited number of approved industrial materials made it possible to reduce the number of items stocked according to the metal they were made of, their form and measurements, and according to whether they were manufactured by a drawn or pressing process from metal.

Ad a,b, Recover Manufacturing Preparations. The gradual reestablishment of the German aircraft manufacturing industry after relaxation or cancellation of certain conditions of the Treaty of Versailles relating to the construction of civilian type planes led to an extremely diversified structure of the various concerns working in this field. A few firms which had managed to carry their factories through the prohibition period by converting to the manufacture of general consumer

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51 commodities were able to use their existing plant and commence the manufacture of aircraft without any serious difficulties.

52 In view of the small sales they could expect, other, newly established firms found themselves compelled to operate with the simplest working data and the most primitive installations, usually intended as a temporary setup.

On the whole each such firm had started its own terminology, giving the various parts manufactured ~~their~~ its own designations, and the designations thus established by the various firms varied widely. The usual system was to give each item a number made up of digits, both Roman and Arabic numerals, selected at random and signifying the construction plans involved instead of the finished article itself, as would have been necessary to be able to trace an item through the various workshops involved up to the time of delivery of the finished product.

In the process of manufacture, the item involved was generally given a name or some other designation according to its position in the composite construction drawing of which it was a part. In storage, again, the same items were given designations fitting into the storage system of registration or which would meet commercial requirements, so that the connection between an article under manufacture and the same article on sale could only be traced by means of codes.

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52 For reasons of economy and even more so because of technical armament considerations it was essential that it should be possible without friction and without interruption to have the various items of equipment manufactured under licence by serial production methods. This presupposed the establishment of uniform directives and uniform measures and specifications. These were designed to insure ready exchangeability of the various elements and individual parts.

53 The realization of this requirement was complicated by the fundamentally differing capabilities of the various firms, by the widely diverging nature of their plant installations and organization, and by their differing principles of development activities. It was even well-nigh impossible to have any one model from the firms manufacturing light metal aircraft, and there were only three such firms, manufactured under licence without fundamental changes designed to coordinate the factories' organization and equipment, and the difficulties were even greater where the firms manufacturing aircraft of mixed or timber construction were concerned.

In its initial preparatory planning for the establishment of an air force, the Weapons and Equipment Inspectorate recognized these circumstances.

In order to create conditions for smooth operations in the serial production of aircraft and aircraft parts, and for

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53 arrangements to manufacture under licence, a "production Section" (Dienststelle Fertigung) was established within the Inspectorate in 1926 and placed under Branch Wa B 6, the Procurement Branch.[1]

The Treaty of Versailles conditions prohibiting German practical work in the field of military aviation were still in force. For this reason the Production Section had to carry on its activities as a private firm out side of the Inspectorate premises, but in close official contact with the Inspectorate, inorder to perform its missions.

The purpose of the newly established section was to create the necessary conditions for serial production under licence through the establishment of uniform standards and specification in the preparation and execution of construction data.

This meant that demands had to be made on the firms which represented an interference in their responsibilities and which were not consonant with the ruling tendencies of basic German internal policies at the time. In view of the anticipated necessity for large numbers of private firms to cooperate closely for the purposes of rearmament consideration for the separate policies of individual firms was impossible. Great demands were thus made on the understanding of the various enterprises, which were unfortunately not al

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53 always treated with the proper consideration.

In order to insure the greatest possible measure of success in the cooperative system of working, it was essential to introduce all the necessary measures and insure their uniformity. This included preparations to insure smoothly functioning production under licence, meaning that items of equipment or parts of such items would be manufactured outside of the firm where they had originated. Firms which were to manufacture or repair items under licence had to understand that it was immaterial from what firm their manufacturing data originally came. It was essential that in such data they would find the same methods they were accustomed to in their own data, for similar items, and that they would recognize these either automatically or by means of easily intelligible instructions. The purpose here was to secure better production performances through simplification and to reduce the time spent in thought on processes which would naturally be repetitious. The purpose of standardization or normalisation was to insure that, in the production of all items of equipment, each of the many thousand component parts or elements would be ready for use in satisfactory quality, adequate quantities, at the appointed time and the appointed place. In short, the purpose was to reduce the manufacturing processes to a minimum of time.

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55 Without regard for the size of the equipment involved or the quantities which might be required, all preparations for manufacturing had to be such that they would be useful in all stages of the manufacturing processes.

The advantage of standardized construction data was that all engineering personnel, once they had become familiar with that data, would find the same terminology and so forth in all agencies concerned with air armaments. Each individual one of the thousands of parts making up an aircraft, its engine, and its equipment was systematically catalogued by a numbering system and through this system could be traced to its origin.

Although all these preparations involved a volume of work far in excess of the preparatory work normally involved under the organization of the individual firms, its value was demonstrated as soon as a second aircraft of a developed model was to be constructed.

The real mission of the Production Section was thus to prepare the aircraft manufacturing industry systematically for the mass production of the various items of equipment required in order to avert the complications which would presumably have resulted from inadequate manufacturing preparations; and from shortages in raw materials and semi-finished products, skilled labor, machine tools, other tools and gauges.

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55 It was also essential to avoid too exacting standards of quality in the raw materials and semi-finished products required. Otherwise their use under wartime conditions could result in production difficulties and lead to inadequate supplies in the various items of equipment.

Production directives classified the various types of equipment in categories on the basis of distribution of labor, manufacturing areas, transportation facilities, and spare parts requirements. The target was to reduce the number of raw material and semi-finished product types; to avoid heat processes; reduce the number of dissimilar items; to promote the development of non-cutting processes of forming; increase the number of similar parts; reduce the necessity for checks; insure the interchangeability of individual parts and part-assemblies; and to facilitate the use of individual parts and part-assemblies from various sources without the time-consuming necessity for fitting, adapting, and gauging.

The basis for all manufacturing preparations was provided in the technical specifications, which contained details on the construction processes and performances, and in the lists and drawings distributed to all agencies and firms participating in the preparations, the execution of contracts, and the accounting.

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56 The numbering system was designed to identify unmistakably the various items of equipment and the part-assemblies of which they consisted, as well as the individual parts of which the part-assemblies consisted. Each item of equipment, each part-assembly, and each individual part, withothe exception of standard items, received a catalog number. Construction drawings were not required for each individual part, so that drawing or blueprint numbering was not necessary, but each part had to have its catalog number.

This system of catalog numbering dispensed with the necessity to give the individual items spare part and storage numbers and, when properly applied, insured against mistakes.

The item catalog and drawing or blueprint numbering system as well as the list numbering system are explained in Appendixes 6 and 7 to this study.

Another mission of the Production Section was to insure standardization. ~~All parts were examined for the most part.~~ As far as possible only normal standard types were used as parts. These met the specifications of the National Bureau of Standards and were designated as DIN (abbreviation of Deutsche Industrienorm--German Industrial Standards). For Air Force purposes they were designated DIN-L[1]. In some cases individual factory standards were in use, provided they were

1. German Industrial Standards--Luftwaffe.

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57 approved by the Luftwaffe and were in general use.

As time went on the compilation of "Standards-Sheets" (Normblaettersammlung) grew to the size of four volumes, which in 1945 contained 660 sheets describing 25 000 parts of standard shapes and sizes. By 1927 the Aviation Committee of Standards (Fachnormenausschuss Luftfahrt) had issued ten sheets showing standardized items; this number grew to 4000 sheets by 1943, to which another 4200 standardized items were later added.

In the case of aircraft fuselage construction, for example, the percentage of standardized parts in use mounted to between 35 and 45 percent by 1943.

Besides this wide spread use of parts conforming with the specifications of the National Bureau of Standards, another measure of rationalisation was the increasing use of other parts used repeatedly. Here the number of such parts varied in the individual types of aircraft between two and 200.

In contrast with the specifications of the National Bureau of Standards, every ~~part~~ aviation equipment part approved as a standard item had to consist of only one raw material in order to insure that it was equal in quality to non-standardized parts.

In establishing the specifications for approval as Standard Aviation or Standard Aviation Equipment Items (DIN L

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52 and Lgn-Normen)[1] consideration was given whenever possible to the foreign standards (ISA Standards) already in existence.

1. Lgn.-Normen: Aviation Equipment Standards.

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CHAPTER 3

INDUSTRIAL DEVELOPMENT UP TO 1933

FIRMS MANUFACTURING AIRCRAFT, AIRCRAFT ENGINES, AND AIRCRAFT EQUIPMENT

The majority of the sixteen aircraft factories operating during World War I had to close down. A few succeeded in converting, on a greatly reduced scale, to the manufacture of other products. Installations serving specifically for the manufacture of aircraft had been removed or destroyed.

In particular all aircraft hangars with wide spans had either been demolished or rendered unsuitable for their normal use. Other parts of the workshops had been converted to other uses.

It was only after relaxation of some of the conditions of the Treaty of Versailles that a new aircraft industry began to develop in Germany. However, this development was very gradual and on a very small scale, since the treaty conditions still only permitted the construction of aircraft and aircraft engines only within defined limits.

59 In efforts to preserve their factories and retain at least some of their specialized personnel, some of the firms had established subsidiary factories in foreign countries. Thus, Dornier had established a factory in Altenrhein, Rohrbach a factory in Kopenhagen, and Heikel and Junkers had

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59 factories in Sweden. These factories received no contracts from Germany. Owing to their subsidiary factories abroad, however, they were able to reestablish themselves in the aircraft industry in Germany without any considerable difficulty.

Following the successful outcome of the gliding competitions held at the Rhoen in 1920 and 1921 a few newly established firms had taken up the manufacture of glider aircraft. Here, developments led through the construction first of gliders with auxiliary engines finally to the manufacture of sporting model aircraft, or to the development of specialized types of powered aircraft, such as the Ente developed by the firm of Focke-Wulf. Of the firms in this class two, namely, Focke-Wulf and Messerschmitt became significant in the pattern of rearmament.

Another small group of firms established after World War I aimed at the development of sporting and training aircraft. Of these the firms of Arado, in Warnemuende, and Raab-Katzenstein, in Kassel, merit special mention. Even in those early days the firm of Heinkel achieved some importance through the manufacture of aircraft for foreign purchasers.

The firm of Arado specialized primarily in the manufacture of powered training aircraft, which were used for advanced training by the German Commercial Aviation School. Attempts

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59 to develop small powered commercial aircraft for the Lufhansa Airways were unsuccessful.

60 A new departure in the field of aviation sports was the development of a light airplane in 1925 by the firm of Klemm, in Boeblingen. The aircraft models produced from this prototype aroused considerable interest at the time because of their general performances and the long distance they could cover, and did much to preserve and promote the interest of the younger generation in Germany in aviation sports.

Of the factories in existence in World War I, the firm of Albatros also took up the manufacture of sporting aircraft and training aircraft for beginners and advanced pupils.

In spite of the restrictive conditions of the Versailles Treaty, the above circumstances at least made it possible to make a modest start in the reestablishment of German aviation and to give German aviation some place in the world.

However, all work done by the firms mentioned above was directed toward individual construction; the factory installations and the models developed were designed specifically with a view to the construction of individual aircraft, and not one of them would have been able to build aircraft by serial production methods. Each of the three firms specializing in the construction of metal aircraft had developed its own principles of construction. These in turn required

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60 presupposed specialized working methods and procedures, and the transposition of these from one firm to another meant that the receiving lost its own identity almost completely.

Firms other than the above had continued working on the development of the aircraft types then conventional, namely with fuselages of steel tubing, cloth covering, and wooden wings, some adhering to the purely wooden type of structure. Here also each firm had adapted its installations, workshops,

61 and everything else involved to the specific type of construction it engaged in, and the whole system could not be used elsewhere.

For all practical purposes it can therefore be said that not a single factory existed in Germany which, with its own installations, could have constructed an aircraft type produced by some other factory.

The manufacturing capabilities of the various factories were also planned expressly and exclusively for individual aircraft construction, with only a few firms, such as Dornier, Junkers, and Heinkel, equipped to handle small serial production.

Only the firms of Dornier and Junkers had developed overhauling and repair systems for their types of construction

The recovery of the German aircraft manufacturing indus-

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61 industry was closely linked with the current economic situation of Germany as a whole, and most of the firms involved were entirely dependent on the circumstances ruling within the country. The most progress was therefore made between 1926 and 1930.

Later, when the almost world-wide economic crisis made itself felt in Germany, government contracts awarded through the Lufthansa Airways decreased steadily. The small foundation on which the aircraft industry was based therefore contracted more and more. For practical purposes it can be said that only eight firms were still in existence at the end of 1932, and of these the firm of Junkers also would have had to close down if the Reich Transportation and Communications Ministry had not supported it because of the importance of the factory itself and because of the growing significance of world-wide air traffic.

The firm of Bayerische Flugzeugwerke had also been compelled to cease operations with the exception of work which continued to complete the rest of a contract from the Lufthansa Airways for the manufacture of Type M-20 aircraft. After completion of this contract, the firm had nothing more to do. The other six firms tried to remain in existence by means of retrenchments and by the handling of foreign contracts.

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62 Conditions were more favorable for the aircraft engine industry. The prohibition of powered aviation in Germany had also brought the aircraft engine factories to a standstill. However, the firms of Daimler and Benz were able to fall back on other items in their manufacturing programs, the manufacture of motor vehicles, and could thus continue in existence and adapt their experience for use in the construction of surface motor vehicles.

The Bayerische Motorenwerke, which had developed from the firm of Rapp, initially took up the manufacture of brakes for the national railways, the Reichsbahn, and later made engines for the motorcycles produced by the firm of Victoria. Later, the firm went over to the manufacture of complete motorcycles. This firm therefore also succeeded in keeping its head above water, retaining its personnel, and preserving the experience gained in the past. After relaxation of the Treaty conditions it was able to turn its attention to the manufacture of aircraft engines without any difficulty. After first producing engines for aircraft used in advanced training, the firm then manufactured engines for commercial airlines.

Concurrently with its resumption of aircraft fuselage construction, the firm of Junkers commenced developing an engine of its own ;primarily for its F-13 general traffic

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62 aircraft, a model found exceptionally useful in commercial aviation and for training purposes. This brought the firm of Junkers into the aircraft engine manufacturing field.

63 What has been said concerning the two firms of Daimler and Benz, which combined to form one firm during the depression, applied largely to the firm of Siemens. Due to the other items on its manufacturing program this firm also was able to weather the prohibition period and, after relaxation of the treaty condition reverted without difficulty to the development of water-cooled engines for aircraft, a branch of activities it had engaged in during the past war. In line with the existing interpretations of the Treaty conditions, the firm concentrated on the construction of water-cooled engines for sporting and training planes.

After fusion, the new firm of Daimler and Benz adapted its program to the existing conditions and, as a transitional program, manufactured a small engine of 20 horsepower for the light type of aircraft made by the firm of Klemm.

Another firm which was able to fall back on an extensive program of surface motor vehicle engine manufacturing was Argus. After relaxation of the Treaty conditions this firm took up the development of air-cooled aircraft engines with inverted cylinders, of the in-line type, and later also manufactured circular base rings.

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63 Similarly to the firm of Argus, the firm of Hirth, first established after relaxation of the Treaty conditions, concerned itself with the development of water-cooled in-line engines, with inverted cylinders.

Having no other branch of manufacturing activities to fall back on, all other aircraft manufacturing firms in operation during World War I had to close down and were dismantled.

64 With the exception of the firms of Hirth and Argus, all factories manufacturing engines were subsidiaries of other concerns serving civilian purposes. The equipment these factories had for the manufacturing of aircraft engines was designed specifically for the engine types they themselves developed, and comprised only the most essential machinery, tools and other installations, a circumstance similar to that in the case of aircraft fuselage factories. Conditions for serial production therefore did not exist.

Similar conditions prevailed in the industry producing items of general equipment. Already in World War I the production of flight and engine control gauges had in almost all cases been treated merely as a sideline by the firms concerned. A few firms manufacturing similar equipment for surface motor vehicles could without difficulty meet the requirements of the small number of sporting and training aircraft initially allowed.

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64 The fact that a number of firms devoted themselves energetically to this problem in order to uphold Germany's reputation in the field of aviation and in spite of the small market available, merits special recognition. The firms which deserve special mention in this respect were the following:

Askania, Berlin,
Fuess, Berlin
Lufft, Stuttgart
Morell, Berlin
Bruhn, Berlin.

What has just been said applies equally to the development of automatic steering devices by the firms of Askania and Siemens, both in Berlin, and to the blind navigation equipment developed by the following firms:

Gyrorector, Berlin
Anschuetz, Kiel
Zuern und Jackenkroll, Berlin
Ludolf, Bremerhaven
Goerz, Berlin
Deutsche Benzinuhren Gesellschaft, I.C.Eckardt, Stuttgart
Dr. Behm, Kiel
Allgemeine Elektrizitaetsgesellschaft, Berlin.

The firms mentioned here are only a few out of the large number (large for the conditions as they then existed) engaging in activities of the type under study here, which serves to illustrate how widely scattered these activities were and how difficult it was to achieve the development of items of equipment in conformity with uniform principles.

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65 The important task of developing photographic equipment was handled by the firm of Zeiss, in Jena. The need here was for hand-operated cameras, panorama cameras, and transforming equipment.

Work on other projects in the field of photography could be assigned to the following firms:

Firm	Handling development of
Lytax, Freiburg	Treble panorama cameras
Voelk, Berlin	Camera operating gear
Correx, Berlin	Film developing equipment
Voelk, Berlin	Copying equipment and transportation boxes
Drewe, Berlin	Duplicating and enlarging equipment
Luchterhand & Freitag, Berlin	Photo-laboratory wagons.

No difficulties were encountered here in respect to the capacities of these firms, particularly because a large part of the work was done during the economic depression.

66 For the development and manufacture of wireless telegraphy equipment use was made of the firms of Telefunken and Lorenz, both in Berlin and already working for the Lufthansa Airways. The development work assigned to these firms and the contracts awarded them to meet the small requirements in the models developed and needed for the first phase of the main rearmament program prior to 1933 presented no problems.

Of the firms which had manufactured parachutes during

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66 World War I only one, the firm of Schroeder & Co., Berlin, had managed to preserve its manufacturing facilities. Together with the firm of Zehler & Stelling, established later, this firm handled the small requirements of the time.

The mission of developing and designing suitable clothing was assigned to the firm of Heissler, Berlin.

Under the Treaty of Versailles the only firm permitted to manufacture weapons for the German Army was Rheinmetall-Borsig Berlin. Contact with this firm was maintained by the Weapons Branch of the Army Ordnance Office. No other firm being in existence for the purpose and since no need existed for the development of new weapons for aircraft Branch WaPrw 8 (see Footnote on Page 29) had to rely on this firm for the supply of weapons. No change occurred here prior to 1933. The same conditions applied in the field of ammunition, which had to be supplied by the appropriate branch of the Army Ordnance Office.

The firm of Weber & Argus, Berlin, developed and later manufactured gunning bracket mountings (Drehkranze), the firm of Allgemeine Elektricitetsgesellschaft produced reflector bombing sights, and the firm of Siemens, Berlin, manufactured ammunition boxes. With the exception of the firm of Argus, which was fully occupied with the manufacture of

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87 engines for sporting aircraft, no equipment was available for large scale production. The manufacture of the small quantities of equipment needed proceeded in special workshops.

As previously mentioned, the firm of Goerz, Vienna, developed the Model Fl-219 bomb sight, and foreign subsidiaries of the firm of Zeiss, Jena, the Lotfe-6 bomb sight. No manufacturing facilities were available to meet the requirements in bomb release equipment for reestablishment of air power. The firm of Haber developed and manufactured a small number of such instruments.

In the case of ground equipment it was possible to make large use of the items used by the Lufthansa Airways. Enough firms equipped for general machinery construction were available for this purpose. Additional specialized types of equipment which were needed were designed by the Aircraft Fuselage Section or the Aircraft Engine Section.

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CHAPTER 4

SUMMARY

The gradual build-up of the tactical and technical agencies required for an air force to be newly created had reached a stage by 1932 at which the tactical agencies could serve as a basis for the establishment of an Air Force General Office or, in other words, an Air Force General Staff, while the technical agencies could serve for the establishment of an Air Force Technical Office within the Air Ministry. The organization of Section WaPrw 8 as a technical branch within the Army Ordnance Office[1] could be retained without any basic changes for later expansion to form a Technical Office. It contained personnel qualified to handle all problems which could arise in the equipment of a modern air force in the light of the technical standards then achieved.

Initially, the section had to concentrate on creating the technical conditions essential for the establishment of the planned eight squadrons, which were to be increased to sixteen in case of any emergency. After construction of the first aircraft test models it was therefore necessary to compile specifications for further development of the first models on the basis of the tactical requirements stated by Inspectorate 1 and to award the appropriate contracts to

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68 industrial firms.

While these contracts were being carried out another mission of the section was to supervise work to insure that the stated specifications and principles were adhered to in the manufacturing processes, to test the aircraft fuselages, engines, and equipment after delivery, and to make the results of these tests available to the industry for use in the further construction or improvement.

So far as procurement was concerned, it was not possible to award any large contracts because of the small funds available and because of the lack of technical facilities for serial production methods. Following the construction of a few Albatross-L-76/77 and the purchase of a small number of Fokker-D-XIII aircraft from the firm of Fokker, in Amsterdam, to be used for training purposes at Lipezk, in Russia, tests were carried with six L-78 models developed by the firm of Albatross in the course of a year to establish the manufacturing principles for these planes. The six planes were also used for training purposes at Lipezk.

A special mission was that of procuring the necessary auxiliary parts to convert as bombers the Ju-52 aircraft type in service with the Lufthansa Airways as a commercial plane. The parts were stockpiled for future use, but were never needed, since the Luftwaffe used the Ju-52 exclusively as a

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transport plane.

In other respects procurement activities extended to preparatory measures, to the compilation of planning data based on investigations into the manufacturing capacities of the firms earmarked to handle serial production, and above all to the matter of raw materials and semi-finished products, which was of particular importance because of Germany's poverty in raw materials.

70 Because of the small budget on which it had to operate and because of security reasonsSection WaPrw employed only a a small number of personnel in spite of its wide field of activities. Most subjects were handled by only one person, the maximum on any one subject being three.

In spite of the small number of personnel thus employed, all preparatory work for the planned reestablishment of an air force had to be completed by 1934. This made it impossible to adhere to the normal cumbersome and bureaucratic official procedures. It was only natural that personal contacts developed between members of the section and industrial leaders, a circumstance which produced exceptionally favorable results later in the rapid industrial buildup.

It was due to these close personal contacts that Germany to a large extent succeeded in eliminating the technical lead foreign countries had in spite of the basic nature of t

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70 the innumerable tasks which had to be performed in the 1928-1932 period.

At the end of 1932 the pilot models for the aircraft to beassigned to the air forces of the first phase of the main rearmament program were ready, tests had been concluded, and they were declared suitable for procurement. The models were as follows:

Heinkel Close Reconnaissance Plane He-46, with Sh-22 power unit,

Heinkel Long-Range Reconnaissance Plane HD-45, with BMW-VI power unit,

Arado Single-Seater Fighter Ar-65 with BMW-VI power unit,

Twin-Engine Dornier Night Bomber Do-11 with two BMW-VI engines.

Everything was ready for the manufacture and procurement of the above aircraft together with all accessories and items of general equipment, protected fuel tanks, weapons, bombs, ammunition for weapons fire, photographic and wireless equipment, and the required specialized ground equipment.

71 For the naval air forces the following basic models were ready and suitable for procurement at the end of 1932:

Heinkel Naval Single-Seater Fighter HD-51 with BMW-VI power unit,

Heinkel Naval Close Reconnaissance Plane HD-60 with BMW-VI power unit, adapted for catapult launching,

Heinkel Naval Dive-Bomber HD-50 with BMW-VI power unit,

Heinkel Naval Multi-Purpose Plane HD-59 with two BMW-VI engines.

In addition, tests had been concluded showing the

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71 Dornier Do-Wal Seaplane suitable for conversion as a naval long-range reconnaissance unit.

The relatively quick activation of the first units for the first phase of the main rearmament program after 1933 was made possible by previous planning for units to be activated in 1934 for the expanded Reichswehr and by the completion of the preparatory work which had been necessary for this purpose.

The achievement of this target within less than three years must be considered an exceptional performance not only by the official agencies concerned but also by the industry in view of the many obstacles which had to be overcome. ~~XXXXX XXXXXXXX~~ Among other causes these obstacles were due to the general economic conditions ruling prior to 1933, the restrictions to which Germany was still subject in the matter of aviation, technical and economic difficulties, the few possibilities available for basic research work, the small budget available to the military establishment, and the difficulties resulting from the physical separation of the agencies handling development from those responsible for proving.

It must be borne in mind here that Germany's geographical and economic position created problems calling for measures which would have been unnecessary in foreign countries.

Completion of the work involved in the development of the aircraft types and equipment needed for the first phase

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72 of the main rearmament program by 1932 created an important prerequisite for the activation of the units. However, the system was not completely adequate to meet the requirements of serial production, which was essential for reasons of economy and to meet needs in the event of mobilization.

Actually, serious difficulties were encountered after 1933 when items of equipment were to go into serial production, since the structure of these items was too complicated and, on the other hand, because if they had been redesigned in line with mass production principles this would have caused serious interferences with the current manufacturing processes.

Another point was that blueprints were not always free of errors and that no facilities were available in perfectly sound condition for the purposes of serial production. It had not been possible prior to 1933 to give the construction plans the thorough restudy which would have been necessary nor to develop the required installations, gauges, and other facilities.

Since the Production Section had only commenced operations in 1926, and since the ~~L-73 aircraft designed~~ principles established by that section could only be tested on the Model L-73 aircraft, these principles could not be taken into consideration for the aircraft models planned for the emergency rearmement

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72 program. In the case of engines and equipment the construction data prepared prior to 1933 therefore caused difficulties since the items in question formed only a part of the manu-

73 facturing programs of the firms concerned, which had developed and adhered to their own systems and principles for years past in their production for the civilian markets.

The purpose of the preparatory work done in the field of military aviation was to again ~~[illegible]~~ be able to participate in current technical progress and to eliminate the lead foreign industries had achieved.

One of the purposes in designing and constructing test models of the various classes of aircraft was to incorporate in a few models the points established in tactical deliberations as being necessary, and to submit them to tests. More extensive measures were not intended. Any attempt to place aircraft in serial production, even on a very small scale, would have encountered practically unsurmountable difficulties. The funds made available to the Reichswehr were rigidly controlled and checked, and according to existing regulations the military budget was not allowed to contain funds allocated for any measures taken in the field of aviation technology. Financially, the Reichswehr (Defense) Ministry therefore had to rely heavily on the budget of the Transportation and Communications Ministry for funds needed in the execution

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73 tasks connected with aviation. The Transportation Ministry, however, permitted such work for military purposes only within very narrow confines. Some of the missions were brought to a successful conclusion through use of money from the Ruhr Struggle Fund (Ruhrkampffond).[1] However, the combined funds obtained from these two sources were inadequate for preparations for any procurement program, far less for the im-plementation of any such program.

Pursuant to conditions of the Versailles Treaty the German Government had prohibited the stockpiling of aircraft. Apart from the financial difficulties, the serial production of aircraft for the units to be activated within the pattern of the expanded Reichswehr therefore would have caused difficulties in domestic policies.

It was 1930 before efforts to have the stockpiling prohibition removed succeeded. Preparations for the activation of air units therefore could only commence after that date.

With the manufacturing facilities available the German aircraft industry up to 1932 was in no way able to execute contracts for serial construction or for manufacturing under licence. This was because of the widely diverging construction systems and principles of the various firms, their fundamentally different working organizations and installations. So far as capacities were concerned the majority of the

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74 existing firms were only equipped to construct individual aircraft.

For use as planning data for the reestablishment of a German air force and in the event of a mobilization, a study was conducted in 1928 on existing industrial conditions in order to ascertain the available aircraft manufacturing capacities. One purpose in the study was, to ascertain to what extent the production of equipment could keep pace with the construction of aircraft. For purposes of the study the following aircraft types were taken into consideration:

a. For Army Air Units, as Combat Planes.

Albatross L-77-v
Junkers K-37
Rohrbach Ro-VIII

b. For Army Air Training.

Udet U-12 (Flamingo) for basic training
Arado SC-1 for advanced training.

75 c. For the Navy.

Heinkel He-7
Heinkel HD-30
Heinkel He-31
Heinkel HD-15
Albatross L-77-v.

The following engines were taken into consideration for the above aircraft fuselages:

BMW V-a
BMW VI
Junkers L-55
Siemens Sh-12 and
Jupiter and
Hornet.

Footnote 1, p. 90: In 1921 French and Belgian troops occupied towns in the Ruhr. The Ruhrkampffond was established to support a German campaign of passive resistance. Translator.

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75 The study revealed that, theoretically, the following numbers of aircraft and aircraft engines could be manufactured within one year (1929):

7 006 aircraft fuselages for Army units
1 746 " " " Navy units
11 202 engines for Army fuselages
3 207 " " Navy " .

Figures for the planned authorized first equipment were

For Army units 2 293 aircraft
For Navy units 750 aircraft.

The study was strictly theoretical in nature because it was not possible to take into consideration the time required for production to get under way, and because none of these essential information was available on the procurement of manufacturing installations and funds. In all cases construction data was in such a condition that the models of one firm could not be manufactured under licence by another firm.

The firms taken into consideration in the computations included aircraft factories currently in operation, factories which had closed down shortly after World War I, and truck, car-body, and agricultural machinery producers, the conversion of which to aircraft construction would have taken at least one year and some of which probably would not have been able to participate in aircraft production at all.

Conditions were similar in the field of aircraft engine

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76 construction. Plans included firms earmarked for employment in the project of Army motorization.

Although the factory space recorded as available underwent no changes, in the years following 1938, manufacturing facilities decreased because of the economic crisis which then commenced, and because some of the firms involved had to be cancelled in part or wholly from calculations; this applied to three fuselage and eight aircraft engine factories. The intention ~~of the Reich Transportation Ministry to use funds from the Transportation Ministry~~ for the purpose of engine stockpiling (an assumed factor in the study) proved inapplicable, because clarification on this point could not be obtained from that Ministry. In the event of war the only possibility therefore would have been to procure what was needed from foreign sources.

The findings of the study were even more unfavorable in the case of aviation fuels. The first basic issue could only have been provided ~~two-thirds of from available~~ from available stocks by ignoring Army requirements; two-thirds of resupply needs could have been provided from current stocks and incoming supplies. Since no installations for the conversion of coal to oil existed

77 in the parts of Germany which would have had to be defended, it would have been necessary to depend on available stocks, which would have sufficed for fifteen months.

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77 The economic difficulties of 1929 to 1933 not only reduced the number of firms available for aircraft production, but also had a particularly adverse impact on the skilled labor situation. Besides the loss of the entire staffs of the firms which had gone into liquidation, the other firms also had to reduce their staffs. In 1932 all personnel employed by all firms united in the National German Aviation Union numbered only 3 800. For a long time past there had no longer been any possibilities to train apprentices, and in spite of the enthusiastic interest evinced in aviation sports and aviation clubs, very few people felt any inclination to work in the aircraft industry because of the poor remuneration offered.

The same conditions ruled in respect of engineering personnel. On an average only one student per semester and university or technical college completed studies in aviation engineering. Under these conditions it would have been a hopeless undertaking to endeavor to meet the requirements in aviation engineer personnel in the event of any rearmament.

Finally, it can be said that, although the official organizations within the Troops Office, the Army Ordnance Office, and the Navy existed in their basic elements, and although the aircraft models required for the first phase of the main rearmament program , together with appropriate engine

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engines and other equipment had been developed and tested, practically all items of equipment, in their structural features, were not ready or suitable for manufacturing by serial production methods or for manufacturing under licence.

The aircraft manufacturing industry was not equipped to handle large scale serial production projects with the working organizations then in existence, with its available capacities, or with its installations. In addition the financial position in industry deteriorated during 1930-39 to such an extent that some firms had to close down entirely while others had to drastically reduce their staffs.

Federal funds were used to keep in operation the firms of Junkers, Dornier, Heinkel, Focke-Wulf, and Arado as the concerns of basic importance in the event of any future rearmament. If the intention had existed to commence the serial production of aircraft or aircraft engines, the existing circumstances would have made this exceedingly difficult. The implementation of preparatory measures against the event of a mobilization were entirely out of the question.

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PART TWO

PROCUREMENT
1933-1945

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CHAPTER 1

ORGANIZATION AND MISSIONS OF THE RESPONSIBLE OFFICIAL AGENCIES AND OF THE INDUSTRY

a. Introduction. One factor which will decide the outcome of a war is the availability of a modernly equipped and well trained military force, another is the availability of production capacities and supply possibilities for all equipment needed and adequate food supplies.

Shortage of the materials needed for the production of high-quality steel and other manufacturing materials, the lack of oil wells, and other similar factors had resulted in Germany's defeat in World War I, because the Allied blockade had prevented procurement from foreign sources.

In the light of experience gained in World War I far more farreaching measures had to be introduced in Germany for rearmament than would have been necessary in most other countries. Progress in all technical fields after that war had to a great extent rendered the equipment in the hands of the troops obsolete and had also had a serious impact on the principles of the conduct of warfare. The striking power of a military force therefore hinged largely on the extent to which the technical equipment of that force could be maintained at the highest possible standards. This requirement presupposed thorough advance preparation of the armament industry, which

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81 would include practically the entire national economy.

After World War I Germany was unable to engage in preparations of this kind because of the prohibitive clauses of the Treaty of Versailles.

When rearmament commenced in 1933 one of the most important responsibilities of the Reich Goverment was, therefore, to create organizational conditions to insure armament activities and thus also to insure the functioning of the economy as a whole, which would influence armament production.

To handle missions concerning the armament industry which extended beyond the military scope, the Reich Defense Act (Reichsverteidigungsgesetz) of 21 May 1935 established the Reich Defense Council (Reichsverteidigungsrat)[1] as the highest authority in this field, and of which the Cabinet Ministers as well as the Reich Leaders of the National Socialist Party (Reichsleiter der NSDAP) were members. The appointment of the Reich Defense Minister as permanent deputy of the Head of the State insured that the military command would be able to exercise an influence on the council.

The Reich Defense Committee served the Reich Defense Council as a working committee. This committee was made up of members from each of the authorities represented in the Council, with the mission of supervising the preparation of aid directives for planning against the eventuality of a mobilization.[2]

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81 In order to insure a decisive military influence, the Chief of the Joint Military (Wehrmacht) High Command was appointed chairman of the committee.

The system just described at the same time served to secure contact between the participating civilian authorities,

82 the Plenipotentiary General for Military Economy, and his field agencies(the Provincial Prefects--Oberpraesidenten), and later with the Agricultural Offices (Landwirtschaftsaemtern), and the Military Economy Staff of the Joint Military High Command.

The establishment of the highest level directing organization created the possibility to insure a uniform control of the entire economy as a preparatory measure against the eventuality of a mobilization. In this setup the Plenipotentiary General was responsible for all subjects involved in the industrial economy, the food supply and agricultural spheres, foreign trade and currency controls, industrial transportation, personnel registration and labor problems, credits and finance, while the Joint Military High Command or its Military Economy Staff was responsible for all matters

Footnote 1 on page 99: Explanatory and supplementary information from Dr. Schlayer, OKW/WFSt Diary (Historical Division, USAREUR. Note by Translator)X

Footnote 2 on page 99: See Protocol of the meeting of the Reich Defense Committee (Reichsverteidigungsausschuss), XXXXXXXXXXXXXX

Footnote 1 on page 99: See Appendix 8. See also "aus der 11. Sitzung des Reichsverteidigungsausschusses vom 6.12.1935."

Footnote 2 on page 99: See "Erlaeuterungen und Ergaenzungen zu der Kriegstagebuch-Ausarbeitung des OKW WFSt"(by General Warlimont, in Historical Division, USAREUR. Note by Translator)

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82 of an intrinsically armament nature,[1] namely,

1. The issue of combat directives to all three branches of the military establishment, the Army, the Navy, and the Air Force,

2. The issue of directives to all three military branches for preparations for mobilization;

3. Centralized intelligence and counterintelligence activities;

4. Directives governing armament activities.[2]

In further moves to clarify the division of responsibilities differences of opinion became apparent between the Plenipotentiary General on the one hand and the Military Economy Staff on the other.[3] Clarification here was an indispensable condition for uniform direction of all armament activities.

83 The Plenipotentiary General demanded that all forces of the economy to be mobilized in the interests of national defense should be organizationally consolidated under his control. Although a number of draft solutions were prepared, no satisfactory arrangement was worked out in spite of years of effort.

The speedy and smooth transition of an economy to mobilization conditions in the event of a military mobilization

1. See "Erläuterungen und Ergänzungen zu der Kriegstagebuch-Auswertung des OKW WFSt." (by General W. Warlimont in Historical Division, USAREUR--Note by Translator).
2. See "aus der 11. Sitzung des Reichsverteidigungsausschusses vom 5. 12. 1935."
3. See "Die Entwicklung ab 1935 innerhalb der deutschen Gesamtrüstung. See also "Denkschrift zur Wehrwirtschaftsordnung und Wehrwirtschaftsorganisation. Wehrwirtschaftliche Abteilung des Technischen Amtes LC II Nr. 144/38, v. 5. 11. 38."

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83 hinges largely on a smooth functioning of the organizations under the responsible authorities. One condition here is that cooperation between all involved agencies must be achieved already during peace, so that the peacetime organization will correspond to the basic features of the organization under mobilization conditions and will only require expansion. In view of Germany's exposed military position this condition had definitely to be secured. Owing to diverging opinions, however, this target was not achieved, and cooperation at this level produced no practical results.

For the above reasons the essential economic conditions, so far as they were a responsibility of the Plenipotentiary, had not been fulfilled by the time war broke out. It is to be assumed that it was these circumstances which finally led to abolishment of the post of a Plenipotentiary General in December 1939, particularly in view of the fact that the agencies of the office had proved to be inadequately staffed for their missions.[1]

The military organization can be regarded as having been fully capable of performing its missions.

84 It had also become evident that it was not possible within the scope of the Plenipotentiary General to handle with sufficient intensity and speed the work required to at

1. See "Die Ruestung der deutschen Wehrmacht bezw. des deutschen Heeres im 2. Weltkrieg." (Excerpts, p. 13.

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84 least partially close the gaps in preparations to insure the armament situation, for which reason the Four Years Plan was established under General Goering in 1936.

The purpose of the Four Years Plan was to make Germany as independent as possible of foreign imports in the most important fields. The primary missions under the Plan thus involved measures to increase the output of steel; chemical products--above all synthetic rubber and synthetic fuels; and to improve the food supply situation.

The Military Economy Office of the Joint Military High Command was a member organization of the General Council (Generalrat)[1], the controlling body of the Four Years Plan. This preserved contact with the armament industry but considerably curtailed the freedom of action of the Military Economy Staff in this field.

Concurrently with the dismissal of the Reich Defense Minister and the deactivation of his Office in 1938, Goering, as Head of the Four Years Plan, took the position of Chairman of the Reich Defense Council. This further restricted the influence of the Joint Military High Command in the Council.

To secure a firmer consolidation of all national defense missions the Defense Council and Defense Committee were absol-

1. Ibid, p. 18.

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84 abolished shortly before the outbreak of war. At the instance of Goering, their place was taken by a Ministerial Council for National Defense (Ministerrat fuer die Reichsverteidigung) limited to four members. The four members were the Chief of the Joint Military High Command, Goering, Lammers,+ and Bormann.++ The responsibility for management in this new council passed from the Joint Military High Command to the Chief of the Reich Chancellory.

At the beginning of the war the direction of armaments was thus in the hands of the Ministerial Council on the one hand and of the Joint Military High Command on the other. Although the Chairman of the ~~XXXXXXX~~ Ministerial Council for Defense on 4 September confirmed the responsibilities of the Chief of the Joint Military High Command in the field of armaments, the new arrangement nevertheless imposed considerable restrictions on his activities.[1]

In 1939 friction between the various responsible authorities, namely, the Plenipotentiary for the Four Years Plan, and the Joint Military High Command, plus the threatening developments in the armament situation, led to the establishment of the Reich Ministry for Weapons and Ammunition under Dr. Todt.+++

1. Ibid, p. 11.
+ Lammers: Chief of the Reich Chancellory (Note by Translato
++ Bormann: " " " NSDAP " " " "
+++ Chief of the Organisation Todt, a paramilitary labor organization, auxiliary to the military establishment.
+,++, and +++: Notes by Translator.

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85 This organizational change may have been due partly to the cumbersome working procedures of the Army Ordnance Office which adhered in its internal structure to the old methods of armament proceduresand had therefore become too inflexible. Owing to the inadequate preparations which had been made for the conduct of war there was a constant need for improvisations with which the old organizational forms were no longer commensurate.

The primary mission of the new Ministry was to insure ammunition supplies; in addition, Dr. Todt did his utmost to support the Army Ordnance Office in the execution of its other armament missions for the Army. He did nothing to interfere

86 directly with the authority of the Navy or the Air Force, but attempted to improve the organization of the Army Ordnance Office, which concerned itself with its own development work and supervised procurement right down to the level of subcontracting manufacturing firms, by bringing it more into line with the procedures introduced by the Air Force Technical Office, and by introducing the methods used by that Office.

When Dr. Todt was killed in an air accident, Dr.Speer took over the new ministry. His goal was to consolidate control of all armaments for all three military branches under direction by his Office. This he succeeded in doing with relative ease, so far as the Army and Navy were

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86 concerned, but it was July 1944 before he was able to bring Air Force armaments under his control through the Fighter Production Staff (Jaegerstab).

The changing forms of organisation designed to serve the mission of insuring appropriate armaments as the basis requirement for defense, in themselves show the vacillations which occurred in the execution of the missions involved. The situation was further complicated by the widely diverging views of the various controlling authorities, which led to contradictory measures, particularly in the case of the Plenipotentiary General.

In order to secure consistency, a planning Committee (Planungsausschuss)[1] was finally constituted at the instance of the Military Economy Staff of the Joint Military High Command in agreement with the Minister for Economics, the Ministry for Labor, the ~~Chief~~ Plenipotentiary General of the Four Years Plan, and the Chief of Transportation. However, this Committee remained ineffective because Dr. Todt, who had meanwhile been appointed to

87 control the entire building construction industry, refused to join it.

The necessity to continue normal peacetime missions in addition to the tasks connected with rearmament gradually became too heavy a burden for the staffs available. If some

1. Ibid, p. 17.

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87 agency or other failed to accomplish its mission to the expected extent, the fault was therefore sought in the organizational setup, not in the mission assignment as such, and a new organization was established.

Conditions were similar in the various levels of the military command. The Air Force was compelled to start practically from scratch, since no foundations existed in 1933 which would have facilitated fulfillment of the innumerable tasks in the field of armaments. For a quick start this was an advantage, since military and industrial planning could proceed unhampered by tradition-bound forms of organization, which were the ruling factors in the case of the Army and the Navy. It enabled the Air Force to retain the basic form of the organization found in the Army Ordnance Office for its newly established Technical Office, but in a form adapted to the modern requirements of technology and to avoid all complications which might be caused by organizational forms.

The result of the circumstances just described was that the Air Force could start its armament work from the very beginnings in 1933 on a fundamentally new basis, so that everything could proceed initially without friction or hindrances.

88 In unremitting work lasting a number of days and nights, the basic principles for air armaments were established

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88 before the Joint Military High Command had any chance to make its influence felt.

To achieve firmer control and to avoid duplication of effort the Army High Command when rearmament commenced thought it essential to consolidate the top-level organizations of all agencies handling military-tactical and technical problems of aviation. These agencies were consolidated in the Air Defense Office.[1] The agencies concerned were as follows:

Inspectorate 1 (Air), hitherto a tactical staff within the Army Troops Office;

Branch WaPr 3, hitherto a technical staff within the Army Ordnance Office;

Branch Wa N 1, hitherto a supply staff in the Army Ordnance Office;

Asta 1, hitherto a staff responsible for air defense problems within the Joint Military Command Office (Wehrmachtamt).

The intention was that the Chief of the Air Defense Office should be directly responsible to the ~~Defense~~ Reichswehr Ministry to advise the Army and Navy High Commands on all aviation matters.

Accordingly, the subjects included in the mission of the office were as follows:

Air Force Tactics

Organization and Preparations, in Line with Directives from the Chiefs of the Army and Navy High Commands, for a

+ See translator's footnote on p. 109.

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88 state of ~~[illegible]~~ mobilization.

89 Troop Training

The Issue of Directives to the Appropriate Agencies of the Army and Navy High Commands for the Development of all Items of Equipment and all Types of Ammunition

Weather Service, with the Exception of the Army Field and the Naval Weather Services

All Problems of National Air Defense and of Air Raid Protection outside of the Military Services, in cooperation with the Army and Navy High Commands.

The assignment of the Air Defense Office directly under the ~~Reich Defense~~ Reichswehr Ministry+ actually created an independent Air Force, but not yet as a separate branch of the military establishment, since it still had no command agency equal to the Army and Navy High Commands. Furthermore, as its assigned missions show, it was still subject to the directives received from the Army and Navy High Commands. The mission assignment thus did not provide for an independently operating military branch but only for an auxiliary force serving the Army and the Navy.

However, the organization thus decreed existed for only a short while and in practice never went into effect. On 27 April 1933 Reich President von Hindenburg ordered establishment of a Reich Commissariat for Aviation, which was to be

1. See Decree (Verfügung) "Die Rw.-Min. Nr. 401/33, H.H., D. I (6), 27. 3. 33."

+ The Reichswehr was Germany's small post-World War I military force, generally known as the 100 000-man army

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89 assigned directly under the Reich Minister for Defense. The Air Defense Office thus was taken out of the sphere of authority of the Reichswehr Ministry on 15 May 1933.

The military and civilian agencies handling aviation problems were then consolidated in the Commissariat, which was organized as follows:

Reich Commissariat for Aviation

Air Command Office, which had developed from the agencies formerly in the Reichwehr Ministry.

General Air Office, in which all civilian aviation authorities and all air technical services were consolidated.

Administration Branch.[1]

By 1 October 1933 this organization had changed, as follows:

Reich Commissariat for Aviation

Air Command Office.
Civil Affairs Office (Zivile Amt).
Technical Office.
Administration Office.
Supply Office.

The Air Command Office provided the cadre for activation of the Air Force General Staff.

The mission of the Civil Affairs Office was to consolidate all civilian aviation authorities.

1. Appendix 9.

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90 The former Technical Section, now an independent office, handled all technical problems, including research, together with the research stations of the German Experimental Institute for Aviation, in Berlin-Adlershof and Braunschweig, and the Aerodynamics Research Institute (Aerodynamische Versuchs-Anstalt) in Goettingen. In the past all research had been controlled by the Reich Transportation Ministry.

The mission of the Administration Office was to manage the Aviation Budget, and real estate, and to procure clothing and food supplies for the Air Force.

The Supply Office controlled the various ordnance offices and the reserve supplies they administered, and was responsible for the supply of technical equipment and all other equipment to the troops.

Establishment of the Reich Commissariat, the forerunner of the Air Ministry, placed Goering under dual controls. As Reich Minister for Aviation, which he was to become later, he was responsible directly to Hitler, Head of the State; as Commander in Chief of the Air Forcake was responsible to the Reich Minister of Defense. In addition Goering held the posts of Director of the Four Years Plan and of Chairman of the Ministerial Council for Defense.

The authority vested in Goering by virtue of these com-

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91 in combination enabled him to provide more support for the rapid build-up of the Air Force than the Commanders in Chief of the Army and the Navy were able to secure for their branches of the military establishment.

The controversies which developed later hampered all efforts to secure a uniform direction of the armaments for all three branches of the military establishment by the Joint Military High Command. Exploiting the authority vested in him as Director of the Four Years Plan, for example, Goering was able to circumvent the requirements of the Joint Military High Command allocations of available materials.

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92 b. The Air Force Technical Office and Its Missions.

The salient feature in the missions of the Technical Office was the requirement to provide equipment superior to that of other countries, and to supply it in adequate quantities and at the appropriate time.

The missions of the Office covered two distinct fields of endeavor. The one was that of the constantly current work of development and procurement on the basis of stated tactical-technical requirements plus the experience gathered by troops all within the scope of the funds made available from the military budget. In this work it was essential to assume that, under normal circumstances, adequate industrial capacities and adequate forces would be available.

The industrial and man power potentials were the decisive factors in planning and preparing for mobilization. The requirement that execution of the mobilization plan should proceed as speedily and smoothly as possible presupposes uniformity at least in basic features of peacetime planning and planning for mobilization.

In preparing a peacetime program it is therefore essential to take into consideration the industrial expansion intended under the mobilization plan, the labor situation which might develop through the recruitment of personnel for military service, the anticipated raw materials and

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95 92 semi-finished products supply situation, resupply needs, the required repair facilities, and similar factors, and to study them in mobilization exercises.

Another important factor here was the development and introduction of modern manufacturing methods and their inclusion in planning. 94 93

Besides this important field of activities which had a decisive impact on the striking power of the military forces, the second field involved the mission, since the Technical Office was the responsible authority on technical subjects for the ~~XXXXXXX~~ tactical command, — to provide the command data covering a long period into the future for command planning. This mission gave the Office, as a consulting agent on technical matters, added importance.

A basis for work in this field was provided by the results obtained with contracts placed by the research stations in the light of information concerning developments abroad and in the light of probable progress in technological sciences. Future Superiority of the troops served depends on the accuracy of the data thus processed; if work is too slow in this field, or if conclusions are drawn from results obtained after inadequately through research, the result might be at least temporary inferiority of the troops served.

Responsible leadership in the Technical Office and the availability or at least the prospects of adequate funds

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93 thus will have a decisive impact on the conduct of warfare and on the methods of combat.

The gravely responsible command mission thus devolving upon the Technical Office must be the determining factor in its organization if the Office is to accomplish its mission to full satisfaction. Unfortunately this requirements was not always given proper consideration, and serious reverses were the result.

94 Under General (then Colonel) Wimmer, the Technical Office from the moment of its establishment handled all technical matters and problems.

The old organizational pattern, as it had existed in the former Branch WAPrw 8, had been retained during the interval under the Air Defense Office. Although this organization corresponded to that of the Army Ordnance Office to outward appearances, its mission assignment was fundamentally different. All work and every responsibility that the industry could do and bear was assigned to the industry.

The advantage of this method was that the organization could be small, flexible, and forceful in spite of the great volume of tasks to be accomplished. At the same time it resulted in closer collaboration between the research, developing, and procurement agencies, contrary to what happened in the Army Ordnance Office.

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94 The Technical Office contained elements dealing with all procurement matters requiring special technical handling. The subjects not handled were food supplies, clothing, billeting, and general passive air defense matters.

Up to 1932 the various research agencies, such as the Deutsche Versuchsanstalt fuer Luftfahrt, at Berlin Adlershof and in Braunschweig; and the Aerodynamische Versuchsanstalt-Goettingen, carried out their research and experimental projects partly under instructions of industrial concerns and partly for their own purposes. Channeling instructions in the form of ~~directives~~ mission assignments from a coordinating center did not exist.

Branch WaPr 8 had in the past admittedly assigned the research stations missions dealing with sectors of the subject

95 of aviation, but these had been only short-term projects because of the existing conditions.

The conduct of basic research work had often been unfavorably influenced by the rivality which existed between the Branch WaPrw 8 on the one hand and the Aviation Branch of the Reich Transportation Ministry, since appreciable funds could only be made available by that Ministry, which naturally was always inclined to give its own interests preference. The inclusion of research as Branch 1 of the Technical Office created the possibility to organize research work along the

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95 lines of basic investigation and to furnish the research agencies the corresponding directives.

II The Development Branch, initially under Naval Captain Sieburg and then under Major von Richthofen, now also assumed responsibility for air force subjects dealt with by other branches and sections of the Army Ordnance Office in the past, thereby achieving better control of the whole complex of work involved. The subjects involved included primarily radio communications--previously handled by Branch WaPrw 1, and photographic equipment, previously handled by Branch WaPrw 2. For the time being the development of bombs remained a responsibility of the Army Ordnance Office. Difficulties had to be overcome before the responsibility for weapons was transferred to the ~~XXXXXX~~ Development Branch.

The independent section handling production problems as a private firm, registered as the Fertigungs G.m.b.H., outside of Branch WaPrw 8, was now incorporated with the Development Branch as Section CII,6. The subordination of this section to the Procurement Branch was discontinued because of the evident necessity for the Production Group to commence participation at the very beginning of a construction project in order to avoid duplication of efforts by insuring that due regards was shown for the production principles already embodied in the construction blueprints.

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96 One disadvantage here was that in the case of models which were not later placed in serial production the preparatory work of designing and construction was greater than would have been the case otherwise. However, this disadvantage was balanced by the advantage that no necessity arose to redesign and draw the blueprints for the models actually adopted for procurement and thus destined for serial production.

The Rechlin and Staaken Research Stations, ~~plus~~ to which were added the Travemuende Naval Proving Station controlled by the Navy in the past, remained directly under the Chief of the C-Office.* The purpose here was to insure proper critical testing by an agency independent of the Development agencies and thus capable of giving unbiased opinions.

A special proving station was established in Diepensee to test items produced by the industry under contract.

On ~~1 January~~ 1 January 1933 the Staaken Proving Station was deactivated and its appropriate functions were transferred to Rechlin.

The subdivisions of the Procurement Branch, initially under Major Wegener, Retired, and later under Major Leeb, GSC, approximated the subdivisions of the Development Branch, one difference being that Section C III, 3 handled all problems of equipment, including radio equipment, weapons, bombs, ground equipment, etc. The Building Construction Control Section

* Later became the Technical Office

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97 (Gruppe Bauaufsicht) the field agencies of which were responsible the execution and acceptance of construction projects, was placed directly under the Chief of the Procurement Branch, since the bulk of its missions dealt with procurement. The Construction Supervising Teams (Bauaufsichten) in individual factories received their instructions directly from the section chief, and the developing and procurment agencies for the various items had no authority to give instructions of any type to them. This insured that the essential independence of the accepting organization would be preserved. This independent position of the Construction Control Section proved a sound arrangement and remained unchanged in later reorganizations.

To handle problems involving a number of firms, insofar as they were not problems handled by the Construction Control Section, and to handle all peacetime problems involved in preparations against the eventuality of mobilization, Military Industrial Inspectorates (Wehrwirtschafts-Inspektionen) had been established, which were responsible within the industry for the interests of all three branches of the military.

For the above reasons it proved necessary to create a Section C III, 5 within the Procurement Branch to consolidate the various activities.

Since the antiaircraft arm, as a weapon of air defense,

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97 was part of the Air Force while its procurement problems were handled by the Army Ordnance Office) was necessary to create a liaison agency which could insure that the ruling general principles of procurement and the specifications stated by the Air Force General Staff received proper consideration by the

98 Army Ordnance Office. However, this liaison agency was deactivated later because it was not furnished the necessary authority to perform its mission to satisfaction.

The demands made on industry mounted rapidly after 1933 and this created the necessity for a planning agency to direct an industrial expansion commensurate with the stated requirements of the Air Force General Staff. An appropriate sub-section was established under the title Staff Engineer (Ingenieur beim Stabe) within the office of the Chief of the Procurement Branch. The mission of this sub-section was to exert an influence in line with uniform principles on industrial expansion and on the various specialized sections and subsections of the Branch in the execution of their missions.

Contrary to the set up in the Army and Navy Ordnance Offices, the function of awarding legally binding contracts was separated from the technical responsibilities of the specialized sub-divisions, in order to relieve the latter of as much administrative work as possible. For this purpose a section was

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98 attached to the C-Office to handle development contracts and another to handle procurement contracts. These two were later combined to form one section, so that the Procurement Branch now comprised four sections, namely

Section LC-I: Research
Section LC-II: Development
Section LC-III: Procurement
Section LC-IV : Budget

The mission of Section LC-IV was to combine the contents of advances notices furnished by the technical sections to industrial concerns with the information from comments by the latter to compile proper instructions and to conclude

99 appropriate contracts with the industrial concerns. These contracts formed the vouchers needed for financing the contracts as prescribed by budget regulations. The purpose of this method was to insure uniform principles in the awarding and payment of contracts in all traffic with the industry. At a later stage the section also prepared and managed the budget for the entire C-Office, which until then was handled by the Administration Branch.

The work to be completed by the industry from 1933 on created an exceptionally large need for personnel, which the industry was by no means able to meet. Because of the years of economic depression prior to 1933 and because employment in the aircraft industry offered no real incentives, the

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99 conditions needed for execution of the contracts did not exist. Special measures were therefore needed in the personnel field to improve both the quality and the numbers available. The fact that practically no new personnel had been trained for the industry since the end of World War I made it necessary to create an organization for the training or retraining of available labor reserves, some of them taken later also from other professions. A newly established Office for Industrial Personnel (Buero fuer Industriearbeiter) in 1934 received this mission. This office was placed directly under the Chief of C-Office because these measures in the personnel field would affect both development and serial production work to be carried out by the industry.

In his mission of supervising and directing technical

100 affairs the Chief of C-Office was supported by the Chief Staff Engineer, directly under his control; his Chief of Staff supported him in his military missions.

In 1936 Colonel Udet replaced General Wimmer as Chief of the Technical Office.[1] Under Colonel Udet no basic changes in the organization occurred until 1938. In that year a phase of rapid but nevertheless systematic expansion of the organization of the Technical Office, going hand in hand with a correspondingly large increase in the technical missions to be performed, was brought to a successful close. Under

1. Appendix 11.

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100 General Wimmer in particular the target had been to supply to the troops aircraft with performances superior to foreign types and at the same time to create conditions for the serial production of these aircraft, and this target had been achieved. At the end of this organizational phase, the status of development and of serial production capabilities had achieved standards far above those in foreign countries.

The requirement to furnish the troops aircraft and other equipment which were as modern as possible necessitated a reduction of the time lag between the commencement of development and serial production. Safety and tactical factors, however, made it impossible to bring about any appreciable reduction of the time spent on the development, proving, and production phases. The only possibility to accelerate matters was therefore to have the three phases overlap. Such methods, however, would necessarily result in undefined areas of re-
101 sponsibility which, in the case of reverses, would lead to undesireable controversies.

These evident difficulties finally caused Udet, meantime promoted to Brigadier rank, and Chief Staff Engineer Lucht to consider a reorganization of the Technical Office. The object was to establish clearly defined areas of responsibility for each item of equipment from the moment it first went into development to the moment it was delivered.

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101 The only possibility was to establish specialized branches and assign each of them full responsibility for the development, proving, preparatory manufacturing measures, and procurement of specific items of equipment. In this way one branch chief would be responsible for his items through all phases from development to final delivery of the finished article.

One special advantage of this organization would be that the specialist engineer at the head of a branch would have a better control over the various phases involved in his field of activities and could take quick action to remove difficulties.

All functions not of a specialized technical nature could be consolidated in some other sub-division. These functions included primarily planning, military economy, research, and security.

In 1938 General Udet reorganized the Technical Office in line with the trains of thought outlined above.[1]

102 Another factor contributing towards the change was the desire, particularly of the Chief Staff Engineer, to give the engineer personnel within the organization a status commensurate with the significance of technology in the Air Force

1. Appendix 12: "Dienstanweisung für den Chef des Techn. Amtes, Anlage 7 zu Genst. 2. Abteilung Nr. 200/38, g.Kdos. (I), v. 10.1.38."

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and the responsibility they had to shoulder in their work.

There can be no doubt that the rapid progress made in the technical build-up was due, apart from the exceptional performances of the industry, to the unreserved devotion of the initially very small staff of engineer personnel when rearmament began. In view of the expanding scope of the technical missions involved responsible participation by the engineer personnel had become an urgent necessity.

The new organization resulted in the establishment of Branches LC-1-13 and LC-1-4 with parallel functions in the fields of planning, military economy, manufacturing direction, proving and acceptance, research and safety, and LC-7-13 responsible for the technical subjects of aircraft, aircraft engines, radio technology and navigation, aircraft weapons and ammunition, and bombs and ground equipment.

However, this organization had the serious disadvantage that the work of the individual specialized branches proceeded in complete separation from one another, and that no agency existed to issue basic and directing instructions for the functions of development and procurement.

Both General Udet and the Chief Staff Engineer were interested almost exclusively in development activities, so that the various branches were to some extent taken care of, but fundamental planning for development was lacking.

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103 In line with current views, the fundamental tendency at the time was to place great value on the attainment of the highest possible standards of technical perfection, concurrently with an intentional neglect of quantitative production. With only one exception, development engineers were appointed to head all branches, and their efforts were directed towards developing all equipment to the highest possible state of perfection. In the case of items intended for serial production, their natural desire was to currently incorporate during the preparatory phases all lessons learned from development and proving activities, and all experience gathered by the troops in the meanwhile. This necessarily resulted in an excessive expenditure of effort, constant interference with production, greatly reduced output, and very serious difficulties in the matter of spare parts supplies.

The functions of the procurement groups within the specialized technical branches were admittedly governed by the requirements of the procurement programs, but the branches themselves lacked coordinating time controls. The Planning Branch was unable to assume responsibility for this mission, since it was fully occupied with its own program functions, which involved semi-finished products, personnel matters, expansion processes, tooling machinery, and planning, and had no opportunity to accept coresponsibility and influence the

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103 the progress of work.

The mission of the proving sub-division was to furnish the technical command and the General Staff with a critical appraisal of the characteristics and the possibilities for use of each item of equipment, and this appraisal had to be arrived at independently of the agencies of the Technical Office which controlled or influenced the work of development.

By assigning the proving subdivisions under the various specialized technical branches the safeguards against unbiased appraisals had been destroyed and the danger existed that the troops would receive equipment which was not adequately tested.

That was bound to have particularly disadvantageous results was that all thirteen branches were each directly under the Chief of the C-Office. The head of each branch had the right and the duty to report directly to him. The heavy burden of details which thus devolved upon the Chief of the Office prevented a uniform and long-visioned direction of the Technical Office.

The disadvantages of the new organization hardly made themselves felt during peace, when main emphasis was on development work, but produced drastically harmful results during the war.

104 c. The Office of the Chief of Air Forces Special Supply and Procurement Service under Generalleutnant (Major General) Udet.

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104 The organization of the Technical Office as shown in Appendix 12 to this study was not destined to last long. A decree dated 1 February 1939[1] established the post of a Chief of Air Force Special Supply and Procurement Service combining all sub-divisions handling and processing technical missions.[2]

It can be assumed that the purpose of this establishment was to raise the status of the technological subdivisions in relations with other commands and at the same time to provide an opportunity to promote the Chief of the C-office, General Udet.

The organization plan provided for extension of the authority of the Chief beyond the scope of the existing C-Office to include economic control of industry and the control of supplies. The incumbent was thus fully responsible for the maintenance of the troops in a state of technical readiness. In addition to the existing Technical Office, plans provided a Department of Industrial Economy (Amtsgruppe Industriewirtschaft, and assignment of the ~~zuführungsstab und~~ ~~which~~ the Supply Office ~~was assigned~~.

The Chief of Air Force Special Supply and Procurement Service (Generalluftzeugmeister) exercised direct control over six staff branches, plus the Technical Office, the Department of Industrial Economy, and the Supply Office. Consolidation

1. See "Gliederung des RLM v. 1.2.39 (Min.A.A.I Nr.30/39) v.
2. Appendix 13. See also "Der Reichsminister der Luftfahrt --continued.

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105 of the six staff branches handling routine matters would have relieved the Chief of much detail work. These branches had been taken out of the C-Office and could have been organized under an office or a department. This measure would have been an urgent necessity in view of the greatly expanded fields of responsibility of the Chief in comparison with those of the C-Office. This opportunity in the new organization was not exploited. Furthermore, General Udet in his new position reserved to himself direct control of the Technical Office. This seriously harmed organizational relations. The heavy burden placed on the Chief by assigning under his direct control the six separate staff branches, the eight branches of the C-Office plus the proving sub-divisions, Department F, and the Supply Office far exceeded previous conditions. The multiplicity of missions facing Udet exceeded human capabilities and resulted in confusion and in many cases lack of leadership and control. The various branches sometimes had to wait months for a decision from him, and were thus compelled to proceed with their work in accordance with targets they themselves established. That the projects involved did not collapse was due solely to the excellent cooperation of the various branches among themselves.

Footnote 2, p. 128--continued: "und Oberbefehlshaber der Luftwaffe, Zentralabteilung A 7 11, 10 Nr. 1570/39 Nr. Org. Anordnung 23 fuer die Umgliederung des RLM v. 15.10.39 (Stellenplan).

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106 It is to be assumed that the cause for this failure to exploit the opportunities to relieve the strain on Udet is to be found in him personally. On the one hand he was personally particularly interested in the development of aircraft, a subject of which he would not allow himself to be deprived by a department chief assigned under him, on the other hand the extent of his ~~XXXpeXXXXXXXXXX~~ field of activities and the grave responsibilities he had to shoulder weighed heavily upon him, since he did not feel himself equal to them.

The way in which development of serial production facilities were neglected finally resulted in grave attacks against him during the war.

It was these circumstances plus controversies with Field-
107 marshal Milch which finally drove him to suicide.

The organization of the Office of the Chief of Air Force Special Supply and Procurement Service as shown in Appendix 15 to this study remained in existence from 1 February 1939 to 1 November 1941.

No change occurred in the organization of the Technical Office with the exception of the measure assigning the six branches handling routine matters, which from then were designated GL 1-GL 4, and Bf S and Bf S (A), directly under Udet's control. This made the Technical Office purely a specialized agency.

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107 in which the individual specialized branches were almost all headed by development engineers.

The quick conclusion of the campaigns in Poland and France seemed to vindicate the soundness of this organization, and the adequately long interval between the two campaigns provided time enough to replace losses, which strengthened the favorable impressions.

The formulation of technical missions for the industry and the contractual procedures involved in the development and procurement contracts were responsibilities of the Technical Office, but the Administration Office was responsible for the administration of the budget and for the financing of the industry. By reason of this division of responsibilities both of these offices claimed the prerogative of leadership in the industry, the Technical Office from the viewpoint of technology, the Administration Office from the financial viewpoint.

108 On the one hand the Technical Office handled all planning for industrial expansion on the basis of the procurement program in line with planned preparations for mobilization and air defense measures, on the other hand the industry was dependent on the Administration Office for the financing of the projects involved.

To clarify the situation the Administration Office in

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108 a memorandum dated 1938 requested a clearcut division of authority in relations with the industry in a technical and a financial field, with the Administration Office assuming sole responsibility and authority in the financial field, for which purpose it was to take over Branch Ic IV of the Technical Office. This would make the Technical Office dependent upon the Administration Office in the execution of its technical missions.

The views forming the basis for this memorandum, namely, that the armament program and expansion of the industries could now be considered as completed so that there was no longer any need to give the technical mission the high priority of the past, were fallacious.

Furthermore, since the ~~XXXXXXXXX~~ execution of technical missions is only possible in close association with economic considerations a separation of industrial support activities in two fields, a technical and an economic field, under two separate and independent offices, cannot be tolerated. Both of these fields must be handled in close organizational association.

For these reasons the newly appointed Chief of Special Supply and Procurement Service was assigned control of both technical and financial support of the industry. Branch LD 1, until then under the Administration Office and

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109 responsible for industrial financing, was placed under the Chief of Special Supply and Procurement Services and consolidated with Branch LC IV to form Department (Amtsgruppe)GL/P.

The mission of the new department was that of financing current contracts and handling all economic matters in relations with the industry. This measure made uniform support action and uniform leadership of the industries supporting the Air Force possible. Within the office of the Chief of Special Supply and Procurement Service it established direct contact between the responsible technical and economic personnel, in particular between the Planning Branch and Branch GL/P 3, the latter being responsible for economic relations with the industry. Cooperation between these two agencies proved exceptionally sound during peace and particularly so during the war.

Pursuant to the decreed organizational set-up, the Supply Office also came under the Chief of Air Force Special Supply and Procurement Service.

Controversies between the Technical Office and the Supply Office in the past had been due to functional factors and to conflicting personalities. In the functional field, differences arose primarily from alleged inaccuracies in the monthly procurement reports, submitted by the Technical Office, the figures of which did not agree with the numbers and quantities of aircraft

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110 and other equipment delivered to the Supply Office, as well as from resupply difficulties, since the troops held the Supply Office responsible for lacking aircraft, equipment, and spare parts. The failure to complete the planned deliveries was due to factors for which the Technical Office could not be held responsible, since the planned numbers included aircraft intended for outside purposes, such as for export, for travel purposes, and for training.

Spare parts difficulties were in part due to General Staff requirements for deliveries exceeding those provided for in the programs, and these demands could only be met by the use of available spare parts.

Conditions were similar in the industry, where spare parts sometimes had to be used to meet the requirements of the aircraft production program.

The purpose in transferring the Supply Office was to insure better equipment and spare parts supplies to the troops but this purpose was not achieved. There was no possibility to remove difficulties in the re-supply fieldthrough organizational changes at the Air Force High Command level, since they were due to functional causes.

The missions of the Chief of Air Force Special Supply and Procurement Service and of the Supply Office aimed at

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110 one and the same final purpose, that of insuring ~~[illegible]~~ ~~[illegible]~~ that the troops would receive modern and sufficient equipment, but the Supply Office had to represent the interests of the troops alone, whereas the Chief of Special Supply and Procurement Service had to base his decisions on conditions as they existed in the industry.

The functions of the Supply Office thus belonged really within the scope of the Quartermaster General, to whose office ~~[illegible]~~ the office was later transferred.

Cooperation between the Supply Office and the Technical Office improved considerably after the consolidating measures described in the foregoing pages, but this was due more to the new head of the Supply Office than to other reasons. The improvement remained even after the office was transferred to the Quartermaster General.

The gathering and compilation of experience from the troops had been a mission of Air Inspectorate L In 5, responsible for safety and equipment, under Inspector General Milch. This data was of high importance for the continued development of existing and the new development of equipment not yet in use, and was passed on by the Inspectorate to the appropriate branches of the CeOffice. Important modifications affecting operational safety and tactics had to be given due regard

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111 even in the case of equipment items currently in process of serial production, while other data was used in preparation for new production series or for completely new development projects. The time lost by routing experience from the troops through Inspectorate L In 5 at times resulted in conflicting views concerning what measures had to be taken. It therefore appeared necessary to create an agency within the C Office with the mission of gathering and processing experience.

Inspectorate L In 5 was therefore relieved of those responsibilities, which were assumed by three newly established agencies, namely, the Chief of Air Traffic Safety Control, Inspectorate L In 5, and Branch GL 6.[1]

The mission of the Chief of Air Traffic Safety Control was to handle all air safety problems insofar as they were connected with air accidents, flight behavior, and air safety measures, while Inspectorate L In 5 was responsible for inspections to insure a proper training status of the troops and to give the troops practical instructions with the use of equipment.

The third agency, ~~Inspectorate~~ Branch GL 6[1] was placed directly under the Chief of Air Force Special Supply and Procurement Service as a separate staff branch responsible for the exchange of experience with equipment, the processing of complaints and modifications, technical instructions to the

1. Letter Generalingenieur a.D. Huebner, 9 Sep 1955.

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112 troops on the use of new items of equipment, equipment modifications carried out by the troops, and the supervision and inspection of air technical installations and air technical personnel, such as central and field hangar/ and workshop/units.

This new arrangement considerably improved contact with the troops and expedited the movement of experience gained in the field. Furthermore, it did away with the old arrangement, under which two technical agencies had existed within the Air Ministry handling the processing of troop experience (Inspectorate L In 5 and the Technical Office).

113 Even under the new organization, however, the functions of Branch GL 6 and Inspectorate L In 5 overlapped in the matter of technical instructions to the troops, a defect which was remedied later when Inspectorate L In 5 restricted its action to aircraft weapons.

d. <u>The Special Air Force Supply and Procurement Service under Field Marshal Milch</u>. During the Air Battle for Britain the German Air Force had suffered heavy losses in personnel and materiel, and its striking power had been weakened seriously. In spite of detailed preparations for mobilization, the current output of the aircraft industry had shown no appreciable increase since the outbreak of war, and was therefore inadequate to replace the materiel losses or make any appreciable contribution towards relieving the exceedingly

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113 critical situation.

Since no functional solution was possible, Goering endeavored to bring about an improvement through organizational measures. As Chairman of the Ministerial Council for National Defense he furnished Field Marshal Milch with the necessary authorization[1] and assigned him the mission of increasing current industrial output fourfold throughout the industries supporting the Air Force. The authorization empowered Milch to take all and any steps necessary to create the conditions essential for the required industrial output, including measures to secure additional factory space and installations, to confiscate factories, to seize construction materials and equipment through dispossession measures, to erect temporary type structures, to confiscate machinery of all types and distribute it to air armament factories, to seize raw materials for use in the air armament program, to intervene in the personnel matters of the industry without regard for existing contracts, and to deviate from existing regulations concerning the financing of the conduct of the war.

The authorization gave no details on the time within which the target was to be achieved, for which a number of years had to be foreseen.

Since the missions assigned with the authorization in

1. See Reichsverteidigungsrates vom Juni 11 (6.42).

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114 some cases extended into fields which were a responsibility of the Chief of Air Force Special Supply and Procurement Service it would have been essential to define the limits of authority in order to achieve fruitful cooperation. Milch no longer had command authority over Udet since the latter's direct assignment under Goering on 18 January 1938.[1]

What made the need for clarification here particularly urgent was the stated requirement to increase industrial support for the Air Force fourfold, which restricted Udet's activities in the fields of research, development, and proving. However, Goering failed to define the fields of authority and the natural result was strained relations between Milch and Udet. These became markedly evident when Milch submitted re-

115 commendations for a reorganization of the Office of the Chief Air Force Special Supply and Procurement Service, which Udet initially rejected but finally had to agree to on 7 September 1941. The strained relations developed into an open rupture when Udet, on the one hand, reported alone and without the knowledge of Milch to Goering to submit Procurement Program 17 A, while Milch, on the other hand, interfered in the personnel affairs of Udet's office. In a discussion which the followed at Goering's headquarters, mutual conferences were agreed upon but Udet was sent on furlough to restore his health.

1. See "Dienstanweisung fuer den Chef des Techn.--Continued

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115 After Udet's death Milch was appointed Acting Chief of Special Supply and Procurement Service in November 1941.

As a prerequisite for increased industrial output, a basic reorganization of the service[1] thereupon took place.[2] In order to obtain firmer control the hitherto separate staff branches, which had meanwhile expanded in consonance with their increased responsibilities, were consolidated to form one office, the Planning Office, under General von Gablenz.

Colonel Vorwald, GSC, was appointed to head the Technical Office, which changed the situation in which the Chief of Air Force Special Supply and Procurement Service had simultaneously been at the head of the Technical Office.

116 The Industrial Economy Department was raised to the status of an office, placing it on an equal level with the Technical Office and the Planning Office.

Within the Planning Office the Planning Department was responsible for the routine missions (Querschnittsaufgaben) essential for the execution of the assigned program. These missions involved basic planning for equipment in cooperation with Branch 6 of the Air Force General Staff, measures to insure the availability of the raw materials needed for the program and for industrial expansion, planning for the industrial expansion in cooperation with the other appropriate Government agencies, and industrial personnel planning.

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116 Basically, the subdivision of responsibilities within the new office remained the same as formerly when the office had been the Industrial Economy Department.

The Military Economy Department of the office maintained contact with the Air Force branches of the individual armament inspectorates and furnished them all data needed for all organizational, armament-technical, and personnel data needed for their action.

The subjects of mineral oils, oil storage installations, etc., were taken out of the mission assignment of the former Military Economy Branch and assigned to a separate branch. This branch and the officer for special missions and liaison agencies were placed directly under the Chief of the Planning Office.

The causes for the neglect of serial production requirements were sought partly in the past form of organization and personnel appointments in the Technical Office, for which reason this office underwent a fundamental reorganization.[1]

1. See "Techn.Amt GL/C Nr.5042/43 geh. v. 25.1.44."
Footnote 1, p. 139--continued: "Amtes, Anlage 7, zur Verfuegung Geist.2.Abtlg. Nr.200/38 g.Kdos.(I) vom 18.1.38."
Footnote 1, p. 140: See Appendix 14.
Footnote 2, p. 140: See "Handakte Milch, Umorganisation der Dienststelle des General Luftzeugmeisters (undated) u. Verf. RdL u.OB.d.L. AZ 11, 10 Nr. 1420/43 geh. ZA Min.B (223 und 211).

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117 The subjects of development and procurement were consolidated in special departments, while the Proving Branch, as an appraising agency, was again placed directly under the Chief of the C Office.

Owing to its increased workload during the war the Proving Branch had expanded. Besides the Tarnowitz Proving Station, a proving station for radar instruments was established at Wernecken, and one for V-1 weapons in Peenemuende. After the Air Force assumed responsibility from the Navy for the development and procurement of aerial torpedoes two proving stations were established for this purpose, one at Gotenhafen (Gdynia), the other at Neusee. The Udetfeld Proving Station in Poland and the Foggia Airfield in Italy were used for special aircraft tests.

This new arrangement avoided the complications which had evolved from the consolidation of the functions of development, proving, and procurement in the individual specialized branches, and which had made a uniform control of development and procurement so difficult. It restored the original organization of the C Office.

Later in the war the Development Department and the Procurement Department expanded through addition of the branches for aerial torpedoes after this responsibility was taken over

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117 from the Navy; the Development Department expanded through addition of an Industrial Materials Development Branch; and the Procurement Department received the Branches handling front requirements, air signal equipment, and antiaircraft artillery repairs, each under a separate chief.

Because of shortages in raw materials and the necessity to find substitutes on an increasing scale, work in this field became increasingly important.

118 The long distance at which field units were based from the zone of interior while assigned for front duty made it necessary to establish forward repair shops as close to the units on line as possible. These workshops operated as industrial concerns under their parent firms, but were tactically assigned by the Chief of the repair branch concerned.

The Chief of the G-Office also controlled the Industrial Production, Foreign Equipment, and Construction Control Branches, each a separate subdivision.

From 1941 to 1942 research work was a responsibility of the Development Department. Mission assignments and the execution of missions were therefore influenced largely by the current development problems. Owing to these short term projects, the Department was unable to devote enough attention and effort to its really important mission, that of long-range basic research. The intended purpose of the measure placing

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118 the department directly under the Chief of Air Force Special Supply and Procurement Service as a research control agency was therefore to insure the execution of research missions on the widest possible basis. The significance of this mission was made evident by the transfer to the department of a Commission for the Direction of Research (Commission der Forschungsfuehrung). Men who were leading scientists at the time, such as Professor Prandl, Professor Georgii, Professor Seewald, and Ministerial Director Baumker were members of t the Commission, the latter as Director. All experimental and proving stations were made available to the Commission as well as the appropriate institutes of universities.

In order to create closer contact between the technical agencies handling the development of antiaircraft artillery weapons and the Reich Air Ministry, in particular with the Office of the Chief of Air Force Special Supply and Procurement Service, the Antiaircraft Weapons Development Department, which operated within the Ordnance Office, was redesignated as the ~~XXXXXX~~ Air Force Antiaircraft Weapons Development Department (L-Flak) in 1940. In 1942 the department was placed under the Chief of Air Force Special Supply and Procurement Service and

119 redesignated OL/Flak-2.[1]

The department comprised four branches, a Ballistics,

1. See "Beitrag zur Entwicklungsgeschichte Erhalt von Generalfeldmarschall Kesselring, von Gen. Otto Wilh. v. Renz, pp. 29 ff.

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119 an AAA Equipment Development, a Technical Central, and an AA Weapons ~~[illegible]~~ Development Branch, and another branch was added in 1944 with the mission of rocket development. However, the new establishment caused duplication of efforts and overlapping with the development activities of the C Office, and this led to constant friction.

Separate from Branch GL/Flak E, Branch GL/Flak Rue had been added to the Special Supply and Procurement Service in 1941[1], in order to have a supervising agency which would insure that the raw materials furnished by the service to the Army Ordnance Office for antiaircraft artillery purposes were actually used for those purposes.

While the post of a Chief of Air Craft Special Supply and Procurement Service existed other reorganizations took place which had little influence on procurement but cannot be ignored in an appraisal of the service.

When the post was first created for General Udet after deactivation of ~~[illegible]~~ Inspectorate 3, also known as Inspectorate 5, Branch GL 6 had handled the exchange of technical experience, claims, and modifications. However, the

120 lack of a central agency for the processing of technical problems with the troops proved a disadvantage after deactivation of Inspectorate 3. For a time Field Marshal Milch

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2. See "Stellungnahme v. Gen. zur Geschichte der deutschen Flakartillerie, p. 10 (MS).

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120 resisted another organizational change, but in the spring of 1943 considered it necessary. A decree by Goering dated 17 May 1943 therefore established the post of a Chief of Troops Technology (General der Truppentechnik[1]), again consolidating Inspectorates L In 5 (Air Traffic Safety Control) and GL 6 under one head, who was responsible directly to the Inspector General. However, even this organizational measure failed to achieve the desired purpose. Finally, the Chief of Troops Technology was placed within the newly established Technical Branch under the Quartermaster General.

At the air technical schools and for the purposes of training, an agency had been established to develop training equipment in the form of realistic models. This branch was later taken from the ~~XXXXXXXXXX~~Special Supply and Procurement Service and placed under the Chief of Training Affairs to insure speedier availability of the required data. However, this measure delayed the development of models meeting the requirements of up-to-date technology, so that removal of the branch from the Special Supply and Procurement Service adversely affected troop training.

Similar difficulties were encountered in the case of the Plenipotentiary for Industrial Personnel, responsible in the past for the training and retraining of industrial per-

1. See "Verfuegung 'Der Reichsmarschall des Grossdeutschen Reiches' u.Ob.d.L. AS 11b 10 Nr.282/43 geh.--Continued

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121 personnel for the industries supporting the Air Force. In order to apply the experience gained in these training activities to troops training, the mission of the agency was extended to include preparatory aviation schools. However, this created dual controls, on the one hand by the Air Force Special Supply and Procurement Service, on the other hand by the Chief of Training Affairs.

In spite of the steady increase in training and retraining activities for the industry because of the inclusion of the industries of the countries occupied since the outbreak of the war, the agency was taken out of the Special Supply and Procurement Service under orders from the Chief of Training Affairs and contrary to recommendations by the Chief of Special Supply and Procurement Service and by General Meyer, the Plenipotentiary for Industrial Personnel.

In the past the combination of industrial training with the training of aviation personnel had had a particularly favorable effect on the troops. The assignment of these responsibilities under the Chief of Training Affairs delayed the speedy and direct application of experience to modern equipment. A better solution would have been to bring about even closer contact between the industrial training program and the air-technical schools.

Footnote 1, p. 146--Continued: "Org. RLM)' v. 17.3.43:" See also "AmtschefBesprechung GL v. 20.8.42," in which conferference Milch stated that the consolidation would improve effectiveness, since the existing organization resulted in duplication of effort and parallel work (558).

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121 Repeated changes occurred in the control of the Planning Office. After the death of General von Gablenz in an air crash, General von der Heide was appointed Chief, but died shortly after his assignment. The new incumbent was Colonel Diesing, GSC, with whose appointment early in 1944 the functions of the Office were reorganized in three departments[1],

122 namely,

Department I: comprising the Equipment, Raw Materials, and Industrial Personnel Planning Branches.

Department II: comprising the Industrial Construction Planning, the Relocation of Industries Planning, and the Tooling Machinery Branches.

Department III: to handle military economy and comprising the Military Economy Organizations and the Industrial Security Branches.

The Technical Military Economy Branch (Abteilung Technische Wehrwirtschaft) had been removed from the Air Force Special Supply and Procurement Service and assigned under the Minister for Armaments and Wartime Production(Min.Ruk).

e. The Industrial Council. A decree by Goering dated 14 May 1941 established the Industrial Council (Industrierat)[2] as an industrial advisory body in the planning and execution of the increasing armament missions.

1. See "GL/A - Befehl Nr. 41 vom 9. 2. 1944.
2. Karlsruhe Document Collection.

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At the same time the measure was designed to bring about closer contacts and closer personal collaboration with the appropriate agencies of the Air Force Special Supply and Procurement Service, and provide support in the manufacture of aviation equipment.

123 The duties involved were the deciding factor in the selection of members for the council.[1] The activities of the Council were to extend primarily into the creation of conditions for execution of armament contracts for the Air Force, namel, in the subjects of manufacturing, tooling machinery, raw and semi-processed materials, organization, aircraft construction, and liaison with the economic groups. Some of these activities fell within the province of Minister for Armaments and Wartime Production, and in these fields the Air Force could do nothing to improve conditions.

In its original composition the activities of the Council produced no appreciable results.

The date of establishment gives rise to the assumption that the motivation was the unfavorable status of air

1. The members were initially Director Frydag, Dr.Ing.Werner, Director Bruhns, Director Karl Lange, Director General Dr. Koppenberg, Director Egger. Functionally, the following came into prominence: Director Westrick (Aluminum); Director General Voegler (Iron and Steel); Admiral Laahs (president of Economic Group for Aviation Industry (Wirtschaftsgruppe Luftfahrtindustrie).
2. See "Der Reichsmarschall des Grossdeutschen Reiches, 14.5.41.
3.

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123 armaments and the concern felt on this account[1], plus the desire to shift some of the responsibility in the industrial field to the industry.

General Udet was Chairman of the Industrial Council, but used the powers thus vested in him on only two occasions.

Operationally, the Industrial Council only came into play after Milch had taken over the Air Force Special Supply and Procurement Service. Its consulting activities concerned the specific armament matters of the Air Force, namely, the manufacture of aircraft, aircraft engines, radio, navigational, and radar equipment, and its composition, in point of personnel was changed accordingly. New members appointed were Director Frydag, handling aircraft; Dr. Werner, handling aircraft engines; Dr. Heyne, handling navigational, ~~equipment~~ radio, radar, and general equipment.

The members of the council participated in all conferences of the Air Force Special Supply and Procurement Service, and cooperated with the appropriate service branches, bat had no responsible functions and no command authority. Apart from a few difficulties due to personality factors in two members, cooperation proceeded without f iction.

1. The view expressed by one party that establishment of the Industrial Council was due to inadequate experience of the engineer personnel of the Technical Office is incorrect, since the directives prepared by the Office for the armament industry were acknowledged by the industry as appropriate. See also chapter on Personnel. Asked for the reasons for the establishment, Field Marshal Milch stated it was due to Goering's d sire to surround himself with a large circle of important personages.

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124 When Speer assumed control of all armament activities for the Air Force the Industrial Council was deactivated and its members continued their missions within the pattern of the Ministry for Armaments and Wartime Industry.

f. Special Plenipotentiary Dr. Koppenberg. In efforts to increase the existing lead over foreign air armaments efforts were to be made to introduce the Ju-88 as early as possible. This was the reason why Dr. Koppenberg, Director General of the Junkers Works, was appointed Special Plenipotentiary for this aircraft model.[1] Under instructions from the Chief of Air Force Special Supply and Procurement Service, he was thus to take all measures, within the limits of his authorization, to achieve this target.

His authorization empowered him to take all steps to insure the earliest and largest possible production of the Ju-88. One condition was, that interference with other procurement projects was to be avoided.

Within the prescribed scope, Dr. Koppenberg had the authority to issue directives to issue directives to all firms participating in the construction of the Ju-88.

Misgivings undoubtedly existed from the very beginning, since it was realized that the preferential treatment of one part of the armament program would naturally cause an adverse impact on other aircraft models. Misgivings were also felt

1. Letter "Reichsminister der Luftfahrt, 30.9.38, to Koppenberg

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125 about Dr. Koppenberg personally. In view of his ruthlessness and sometimes biased attitude the fear existed that he would exploit his powers in favor of his firm at the expense of the firms which were to manufacture the aircraft later under licence. A later letter,[1] written by Goering at the instance of Udet to Dr. Koppenberg, therefore contained supplementary instructions.

Since the industry was already encountering supply difficulties in 1938, and since the industry was compelled to give preference to the Ju-88 in all fields, the production of other aircraft models and items of equipment actually did suffer.

In spite of this, and contrary to the promises made by Dr. Koppenberg, the envisaged acceleration and increased production of the model were not achieved and the planned equip-
126 ment of the air units was delayed. For this reason, Dr. Koppenberg was relieved of his special mission in October 1941.[2]

g. The Fighter Production Staff. Field Marshal Milch had succeeded in bringing about a considerable increase in aircraft and other equipment production. However, output was still inadequate to prevent the increasingly frequent enemy air attacks against German territory. Repeated demands to award at least fighter production first priority were rejected.

1. Letter "Reichsminister der Luftfahrt und Ob.d.L. Min. A Nr. 1847/38 geh." 30 Sep 38.
2. Letter "Der Reichsmarschall des Grossdeutschen Reiches vom Oktober 1941 (?)" (831).

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126 Air armement operations had meanwhile become largely dependent upon the Minister for Armaments and Wartime Industry, since he had been assigned responsible for Army and Navy armaments and controlled raw materials, tooling machines, and factory space. The authority vested in the Minister in these fields had hitherto prevented the necessary increase in air armaments.

Concentrated British and American air attacks against aircraft factories manufacturing fighter aircraft had caused
127 damages which the Chief of Air Force Special Supply and Procurement was no longer able to remedy with the means available to him. A situation had developed in which the service was not allocated labor, construction material for repairs to damaged fighter aircraft factories or transportation to relocate machinery, while less damaged factories under the Minister received full support and all supplies needed.

When the air attacks finally placed the entire armament industry in jeopardy the Chief of Special Supply and Procurement had no choice but to request that the Minister should assume responsibility for fighter aircraft production.

For this purpose the Minister on 1 March 1944 decreed establishment of a Fighter Production Staff (Jaegerstab),[1] planned as a mutual organization of the Minister and the Chief of Special Supply and Procurement Service, and controlled

1. Der Reichsminister fuer Ruestung u.Kriegsproduktion, 32 922 g.v. 1.3.44.

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127 jointly by Minister Speer and Field Marshal Milch.

The chief local official of the National Socialist Party (Hauptdienststellenleiter der NSDAP) was appointed chief of the new staff.

The primary mission of the new staff was to insure execution of the fighter production program and the repair or relocation of damaged factories. He was empowered to give the measures necessary for this purpose preference over all other tasks considered of dire importance , the only exceptions being the manufacture of ball-bearings, concrete take-off strips for daytime and night fighters, public utilities, and communication facilities in bombed cities. He was authorized to use all construction labor throughout Germany without regard for any adverse results.

Officials f om the Ministry were assigned responsibility for the individual subjects of construction, special construction projects, component parts supplies, labor, confiscation of relocation projects, transportation, electricity supplies, social welfare, and the production of Me-262 aircraft.

The fact that fighter aircraft production was given first priority within the entire program of the Ministry immediately after the control of fighter production passed to the Staff, whereas all previous requests in this direction by the Chief

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128 of Air Force Special Supply and Procurement Service had been rejected, confirms the assumption that Saur, now at the head of the Fighter Production Staff, had intentionally hampered Air Force armaments in order to concentrate responsibility for the armaments of all three branches of the military under his control.[1] In logical adherence to this target, Milch was later squeezed out of control by Saur and no longer participated in and of the staff conferences.

129 h. The Armament Staff in the Ministry for Armaments and Wartime Industry.[2] Provisions were that the Fighter Production Staff was to remain in operation for only six months. However, Saur exploited this time to achieve great influence over the whole complex of Air Force armaments.

The separation of fighter production from the rest of the aircraft manufacturing program soon created difficulties between the Special Supply and Procurement Service and the Fighter Production Staff, since the removal of one part from the homogeneous program of aircraft production logically resulted in the issue of directives by two separate ministries within one and the same industrial pattern. Furthermore, Saur ordered the cessation of production of aircraft other than fighter types without consulting the Chief of Special Supply and Procurement.

1. Appendix 15.
2. Decree (Erl ss): "Der Reichsminister fuer Ruestung und und Kriegsproduktion," 1 Aug 44.

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1. See Erich Welter: "Falsch und richtig Planen." See also Hubner: "Bemerkungen zur Arbeitsweise des Jaegerstabes:" "With the means available to this ministry [the Ministry for Armaments and Wartime Production] it was not too difficult for the Fighter Production Staff to restore the badly damaged factories as well as the other manufacturing installations made available and to increase fighter aircraft output, since this involved only the final stage in operations of the armament industry, namely the manufacture of the final product, while the fundamental weakness inherent in the overall capacities of industry could only be remedied with difficulty or not at all within the required time.

2. Appendix 15.

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129 This measure as the war proceeded seriously reduced the significance of what was left of the program under the Chief of Air Force Special Supply and Procurement Service, so that the Minister for Armaments and Wartime Production encountered no serious difficulties in his efforts and assumed responsibility for the rest of the Air Force armament program on 1 August 1944. The provisional arrangement, intended for a six months period, thus resulted in the entire complex of Air Force armaments coming permanently under the Ministry.

This meant that the Ministry for Armaments and Wartime Production was now solely responsible for the armament programs of all three branches of the military establishment.

Within the Ministry, Minister Speer with a decree dated 1 August 1944 assigned responsibility for the execution of priority programs of the three military branches to the Armaments Staff,[1] of which he himself was the chief with Saur acting as his deputy and chief of staff.

130 The programs involved here were those which were of the most immediate importance to provide a basis for the continued conduct of the war, namely,

the Air Force Program

the Navy Program

the Infantry Program, including the program for motor vehicle and assault gun production

the Tank Production Program

the Locomotive Production Program

1. Decree: "Der Reichsminister fuer Russtung und Kriegsproduktion," 1 August 1944.

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130 the AAA Program
the Artillery Program
the V-Weapons Program
the Repair Services Program.

All other projects had to take second place because of the lack of materials and personnel and because of transportation difficulties.

The purpose in establishing a special Armaments Staff within the Ministry for Armaments and Wartime Production was to have as small and flexible a group as possible for the execution of the program comprising exclusively members of the agencies concerned as responsible for one specific field of endeavor.

Consequently, the staff comprised members from the offices of the Ministry for Armaments and Wartime Production, namely, from the Transportation, Raw Materials, Planning, Electricity Supplies, Central, and Construction Offices, plus representatives from each of the appropriate specialized branches of the Ministry's Technical Office, the Iron and ~~XXX~~ Steel, Iron Processing, Iron and Steel Construction, and other branches. In order to avoid the complicated and slow channels of bureaucracy in relations with the other ministries and agencies involved, whose support was needed in the execution of missions, the staff also included one representative from each such ministry or other agency as a personal staff

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131. The Joint Military High Command and the three military branches each assigned liaison personnel.

The Armaments Staff can thus be described as a working body consisting of responsible authorities from each of the ministries participating in execution of the top-priority armament program and operating under control by the Ministry for Armaments and Wartime Production.

A characteristic feature for the working methods of the staff was the appointment of a Special Executive for each of its current projects or fields of activities. Since uninterrupted production was no longer possible because of materials and manpower shortages and transportation difficulties, the staff endeavored to achieve its purposes through the appointment of individuals.

As field agencies, the staff appointed Factory Executives at the factories involved. These executives were responsible directly to the staff and were to supervise the execution of all orders given.

Because of the continuous deterioration of the armaments production situation and because, particularly in the last year of the war, normal manufacturing procedures were no longer possible, the staff endeavored to overcome difficulties through appointment of the following special executives:

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131 A Special Executive for new types of aircraft and other items of equipment going into production for the first time, such as the Me-262 plane, and the TL-engine.

Aspecial Executive for Main Factories.

A Program Special Executive for each separate program, in each case furnished with the necessary special authorizations.

The existence of these appointed individuals in addition the the other agencies: the armaments and weapons inspectorates, the armament detachments, the coprs areas deputies (Wehrkreisbeauftragten), the armament commissions, the Reich defense commissars, and the organs of industry operating under their own responsibility, the committees and special committees, and the main and special ring organizations, authorities and responsibilities overlapped seriously, confusion existed concerning the proper authorities, and the whole system resulted in conflicting instructions and directives.

i. The Chief of Technical Air Armaments in the Air Force High Command. When the Fighter production Staff assumed responsibility for the manufacture of fighter aircraft, the most important field at that stage of the war, this seriously reduced the significance of the responsibilities left to the Chief of Air Force Special Supply and Procurement Service.

The transfer of other production missions to the Arma-

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132 Armaments Staff necessitated a reorganization of the Air Force Special Supply and Procurement Service[1] in line with the main remaining field of endeavor, that of development. In addition, the Commander in Chief of the Air Force was still responsible for the direction of research and proving, together with all proving stations involved.

Another branch which remained was that responsible for construction control. The responsibilities of this branch increasedin the acceptance of aircraft and equipment delivered by the Ministry for Armaments and Wartime Production, since

133 it was to be assumed that defective aircraft would be delivered by the Ministry in efforts to fulfill its planned production programs.

In addition to the above and all branches influencing development, including the Foreign Armaments Intelligence Branch as the agency providing information on developments abroad, plus the branches handling AAA development and AAA armaments, the Commander in Chief of the Air Force retained control of the Mineral Oils Branch, since this branch played a deciding role in the supply of fuel for the Air Force.

The Chiefs of Forward Repair Shops for aircraft, radar equipment, and AAA equipment remained attached to the Chief of Air Force Special Supply and Procurement Service, since they had to cooperate closely with the front line agencies.

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133 A new Program Planning and Requirements Compiling Branch (Stelle fuer Programmplanung und Forderungzusammenstellung) served to maintain liaison between the Air Force General Staff and the Armaments Staff. Its chief mission was to represent at the Armaments Staff the requirements stated by Branch 6 and the Air Force General Staff.

Consolidation of the remaining responsibilities, enumerated above,[1] took place under a newly appointed Chief of the Air Force High Command Technical Air Armaments Department (Dienststelle des Chefs der Technische Luftruestung des OKL).[2]

All other agencies hitherto engaged in the execution of production missions and in preparatory work for such purposes were deactivated. The personnel thus released were in most cases available for assignment to the appropriate main committees. Accordingly, the responsibilities involved were assigned to the appropriate offices of the Ministry for Armaments and Wartime Production as follows

Personnel Planning to the Armaments Office

Semi-Processed Materials Planning to the Products Delivery Office (Zulieferungsamt)

Allocations Processing to the Raw Materials Office.

Continued existence of the Palnning Office in the Air Force Special Supply and Procurement Office was thus unjustifiable and it was deactivated.

1. Appendix 16.
2. See "Oberkommando der Luftwaffe, Generalquartiermeister /44 geh.(2.Abtlg.(I), July 1944.

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134 The former functions of the office in the procurement fields of all technological subjects were transferred to the new main committees.

The position which now developed in practice was that the majority of the personnel hitherto employed in the Procurement Department on the subjects of program planning and execution continued in the same activities within the main committees. It was due to this fact that the various projects continued to proceed with relatively little interruption in spite of the organizationally fundamental changes which occurred. Another contributing factor here was the long time during which these personnel had cooperated with the industry, which had a very favorable effect on the continued processing of work.

A clear-cut separation between the functions of development and production was impossible so that there was no possibility to clearly define the field of authority of the Chief of the Technical Air Force Armaments and those of the Armaments Staff. Conditions developed under which the former continued to handle production missions although they were formally a responsibility of the Armaments Staff.

Successful handling of the subjects remaining within the Technical AF Armaments Office was largely dependent upon the Ministry for Armaments and Wartime Production because

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135 the Ministry controlled all raw materials and semi-finished products and factory spaces. On the other hand, the Ministry had to depend on the development and proving branches for completion of their work to enable it to complete its programs. These circumstances led to frequent interference and sharp controversies, so that the whole system failed to produce the harmonious cooperation required in the interests of the Air Force.

k. The Ministry for Armaments and Wartime Production.[1] Whereas the Armaments Staff could be considered as a policy group of responsible authorities directing the whole program, execution of the directives received was largely a responsibility of the various offices of the Ministry.

The Ministry itself had been formed by expansion of the former Weapons and Ammunition Ministry after being taken over by Minister Speer, and it had been reorganized accordingly, to cope with its expanded missions.

The mission comprised a uniform direction of all production of the military economy, which implied the control, guidance, and direction, and operation of the entire wartime economy. The purpose was to achieve tight and uniform planning and direction of requirements and production with the objective of further increasing the armament output.

1. Appendix 15.
2. See "Der Reichsminister fuer Ruestung und Kriegsproduktion und Generalbevollmaechtigter fuer--Continued

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136 The execution of this mission was governed by the basic directives contained in decrees issued on 29 April and 16 September 1943 by the Reich Minister for Armaments and Wartime Production and Plenipotentiary General for Armament Missions.[1]

The latter of the above two decrees contained the instructions for the creation of a Planning Office within the Ministry for Armaments and Wartime Production in implementation of an order by Goering dated 4 September 1943. The chief mission of this office was to process centrally all basic data for war economy planning in preparation for decisions to be taken by the central planning agencies and to supervise implementation of the measures decided upon. Based upon the available supplies of raw materials, such as iron, coal, mineral oils, nitrogen, these decisions involved the production and allocating plans for the entire wartime economy established from the requirement plans worked out for all areas under German authority.

The Planning Office also submitted recommendations to

1. p. 163, Footnote 2.
2. Footnote 2, p. 163--Continued: Ruestungsaufgaben im Vierjahresplan ZA/Org. 9000/2-174, 20.10.43," and "Erlass des Generalbevollmaechtigten fuer Ruestungsaufgaben im Vierjahresplan und des Reichministers fuer Ruestung und Kriegsproduktion ueber die Aufgabe d. Planungsamtes, 16 Sept. 1943 Z.A. Org. 9000 12-143.

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136 the Central Planning Authority (Zentrale Planung) for the allocation of man power to the individual branches of the economy throughout all territories under German jurisdiction, and to maintain statistics on such allocations; posted the Zentral Authority on dangerous factors and on the import of commodities of military importance. In addition it represented the requirements of the wartime economy in exports and imports in relations with the Reich Minister for Economy. Another duty of the office was to inform the Central Planning Authority in advance concerning any
137 priorities awarded which would affect allocations of man power or materials to the various industrial branches.

From the above it will be seen that the Planning Office assumed responsibility for all functions formerly performed by the Military Economy Branch of the Joint Military High Command and then by agencies of the Four Years Program, which gave the Office a key position within the Ministry for Armaments and Wartime Production.

The plans prepared by the Central Planning Authority were further processed by the other offices of the Ministry. These functions can be classified in three categories;

Production functions
Routine or supporting functions (Querschnittsaufgaben)
Coordinating functions.

Production functions were a mission of the Production offices.

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137 The routine or supporting functions were taken care of by two of the production offices in part, and in part by three of the specialized offices or agencies.

The responsibilities of the production offices extended from the stage of raw materials supplies to the final stage of manufacturing the final product. Consonant with the various functions involved, the responsibilities were subdivided among the following agencies:

The Raw Materials Office
the Armaments Deliveries Office
the Consumer Commodities Production Office
the Armaments Manufacturing Technical Office
the Construction Office
the Electricity Supplies Office.

These offices were to exercise technical supervision over the independently operating industrial organs and to insure speedy execution of the contracts and missions they were awarded.

The industrial organs corresponding to the offices, namely, the Economic Groups, the National Associations, the Main Committees and Main Rings, were attached to the offices and served to channel their orders. For this reason they were taken out of the control of the Minister for Economics.

The Raw Materials Office controlled

the raw and other basic materials industries, excluding iron;

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138 Coal, the mining industry in general, metal production and metal alloys

wood, pulp, and paper manufacturing

Raw materials for the textile and chemical industries

mineral oils, rubber, and industrial fats.

The Industrial Deliveries Office controlled

iron production, roller mills production

iron and other metal casting products, wrought metal products

industrial materials improvements

machinery parts, technical castings and welding techniques

industrial glass, ceramics, stone and earths

plastics and other artificial materials

gunpowder and other explosives and semifinished products enumerated on special lists

electrotechnology, fine mechanics, and optical instruments

steel and iron construction, excluding railcar and building construction

armament equipment and installations, sheet and other iron, and other metal wares and chains

machinery construction, excluding that required for oil fields and generators.

The Raw Materials Office was also responsible for the delivery of semifinished products for the coordinated armament programs the execution of which was a responsibility of the Chief of Air Force Special Supply and Procurement.

The Consumer Commodities Production Office was responsible for

textiles in general, clothing, etc.

leather, footwear

wood and paper processing, printing

glass and ceramics (excluding technical) tobacco processing.

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139 The Technical Office was responsible for

armaments manufacturing in general, weapons, ammunition, tanks, motor vehicles, railroad vehicles, shipbuilding, torpedoes.

The Construction Office was to handle all building construction problems, which included

projects of the Plenipotentiary for Building Construction

Projects of the Air Force and the Passive Air Defense Services (excluding Passive Air Defense projects in the occupied territories)

The Construction Office also furnished members and the chairmen for national construction and regional planning committees.

The Electricity Supply Office controlled and directed all operations connected with electricity supplies.

The industrial organs attached to the various offices are shown in Appendix 17 to this study.

The routine or supporting functions were those which affected all fields of endeavor or at least a majority of them, and which therefore required uniform handling in all fields. Here, another mission of the Planning Office was to standardize the planning bases of the various committees, rings and economic or industrial groups in line with uniform principles and consolidate their results; to draw the proper conclusions from program modifications, to approve or disapprove extensions exceeding five million Marks to construction plans and existing premises, and to establish manufacturing priorities.

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