

A Comparison of European Air Forces
Before World War Two

by

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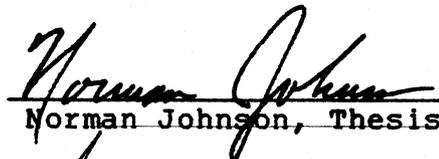
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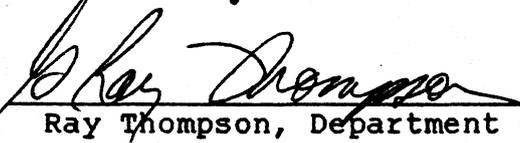
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Table of Contents

Preface.....1
I. Soviet Air Force.....9
II. German Air Force.....48
III. British Air Force.....98
IV. French Air Force.....134
V. Italian Air Force.....151
VI. Conclusion.....157
Appendix/Endnotes.....170
Bibliography.....240

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PREFACE

For the last several hundred years before the arrival of the Twentieth Century, warfare had not seen the introduction of a new weapon. The Twentieth Century would not only witness a decline in the importance of naval warfare and cavalry forces but would also see the debut of one of the last truly "man oriented" weapons: the airplane.

Though aviation originated in America, it was across the Atlantic in Europe that the new development found a home. French, German, and British aristocrats and industrialists fancied the wobbly, wooden craft, and soon Europeans were building their own airplanes. While the development of aviation in each country was separate from parallel developments in other countries, most countries followed roughly the same patterns, and by World War One several countries had fledgling air fleets.

Eventually the airplane would mean that destruction could be "hand-delivered" over greater distances than ever before. During the first years of aviation, however, emphasis on airplanes as reconnaissance craft was the norm. When pilots realized that they could shoot each other with pistols while in the air, aerial combat was born. Bricks dropped out of planes over enemy territory were soon replaced by bombs, and aerial bombardment was invented.

The inter-war period contained continued aviation advancement which was often influenced by the national character of the country involved as well as by the traditions established during the First World War. Because most nations disarmed after the war (or, in the case of Russia, had few planes left) the aviation rearmament of the

1930s had little base on which to rest and was conducted largely from scratch. Rearmament took on different forms in different nations. The Soviets, due to the nature of their government (and the personality of their leader), were able to control the production and quantity of aviation materials more easily than other countries. Britain, who tried to stay away from industry pressure for as long as possible, had less success in controlling production, while the Germans appear to have trod a line in between the previous two, but were limited by other factors. The French, hampered by an inadequate industry, rearmed with mixed success at best, and by 1939 the Italians had little to brag about concerning aviation.

When discussing rearmament for World War Two, it is perhaps natural to ask "Who was best prepared?" or "Who had the best planes?" The following work, while designed more as a survey than an examination of these questions, must inescapably tackle these issues. Outwardly, it would appear that the Soviets, despite a numerically huge air force, were poorly prepared for war in the air, judging by their early performance against the German Luftwaffe. Conversely, the British, with a somewhat small air establishment but favorable tradition, were much readier for the outbreak of war, though the Nazi Luftwaffe, by merit of her performance in the Spanish Civil War and considerable pre-war build-up, stands out as the best prepared at first glance. In terms of aviation technology, Germany in the mid-1930s had been more advanced. The true answer to the question of air preparedness remains to be discovered, however. Italy and France, because their

air forces played considerably smaller roles than did other powers, will enter into the examination only fleetingly, and the discussions of French and Italian aviation are unfortunately greatly limited by an near absence of primary material. Thus, included in the text are examinations of the air forces of Great Britain, Germany, the Soviet Union, France, and Italy.

With a work of this not small magnitude, problems arise that, while not insurmountable, have an effect on the fabric of the text. Perhaps the most influential and regrettable roadblock, and also the one most beyond control, is the status of the German World War One, Weimar, and Nazi aviation documents. Unfortunately, nearly all of these files were destroyed either during Allied bombing attacks or by German officials as the war was ending in 1945. A potential language barrier for those with no knowledge of German is largely avoided by the wealth of translated material. The scholar with little or no knowledge of French has no such luxury, however, for very little concerning any stage of French aviation has been produced in English. French government documents do remain, though they are still covered by secrecy laws prohibiting their release. The French have proven quite stingy with their documents, unlike the British. Though many British documents are under secrecy laws, some have been released. The military scholar seeking British war information is aided immensely by the publication of several official histories by the British government, all based on the official documents. For a work of this not unlimited size, such an abundance of source material can seem unnerving and intimidating, but such a surplus can hardly be complained about, and the only

period of British aviation that the coverage is the slightest bit spotty on is the mid-1920s.

The Iron Curtain has proved to be as much of a barrier as language for the western scholar researching the Soviet military. As might be expected, Soviet government papers have remained far beyond the reach of foreign scholars, and the official histories require close scrutiny and cross-referencing. Within the next ten years, a work will emerge from a western scholar that is based largely on heretofore inaccessible Soviet papers, however. Only the pre-Soviet period of Russian aviation remains sketchy, fortunately. Last are the Italians. Whether or not the Italians have any official papers is open to debate and, in addition to a lack of official publications that have been translated, next to nothing has been written in English on any aspect of Italian aviation, an inexcusable state of affairs.

An extremely brief examination of some of the sources that seemed the most helpful is perhaps also in order. The sources for this text have proved in some instances to be nearly over-abundant, while in other cases there has been little information. For simplicity, each nation's sources have been limited to around the five most valuable. Many of the German flight officers have published memoirs, but most have little practical application to a work such as this. Werner Baumbach's The Life and Death of the Luftwaffe proves quite useful, however, as does The Development of the German Air Force, 1919-1939 by Richard Suchenwirth, which is not as well written, unfortunately. The best source on early German aviation consulted was, without a doubt, John H. Morrow's

admirable German Air Power in World War I. Morrow is probably the leading authority on World War One German aviation. Dealing directly with German rearmament in general are Barton Whaley's Covert German Rearmament, 1919-1939: Deception and Misperception and Arming the Luftwaffe authored by Edward Homze, and though both are secondary sources they each provide vital and accessible information.

Some of the most valuable sources on Soviet aviation are strange cases, for while they are primary material, they are not native Russian sources. A prime example is Walter Schwabedissen's informative The Russian Air Force in the Eyes of German Commanders, written from reports and interviews with German aviators and Army leaders from the eastern front. The multi-volume set entitled The German Air Force vs. Russia is indispensable, though Herman Plocher's volume on 1942 could not be obtained for use in this study. Editor Ray Wagner's The Soviet Air Force in WWII: The Official History and M. Kozhevnikov's The Command and Staff of the Soviet Army Air Force in the Great Patriotic War 1941-1945 both need to be used with caution as they are not always accurate (being official Soviet publications), though the former is more dependable than the latter. Robert Kilmarx's definitive A History of Soviet Air Power provides a good basic account of Soviet aviation from the early 20th Century to the 1960s, when the text was published.

The multitude of reliable official texts courtesy of the British government make the selection of favorable Royal Air Force works much easier. Some of the official works have more detail on aviation than others, but without a doubt The Strategic Air

Offensive Against Germany: 1939-1945, a three-volume series written by Sir Charles Webster and Noble Frankland is the most useful. Focusing on the home defense of Great Britain is Basil Collier's The Defence of the United Kingdom, an almost equally valuable attempt, while N.H. Gibbs' tome entitled Grand Strategy I: Rearmament Policy proves unequalled in its examination of Britain's general rearmament. No official account was available for Britain's air efforts in the First World War, but Maurice Dean's The Royal Air Force and Two World Wars and Malcolm Cooper's Birth of Independent Air Power: British Air Policy in the First World War go a long way to filling in an otherwise conspicuous gap.

A virtual lack of primary material in English dealing with the French air forces has made it necessary that France's air corps be dealt with in some less detail. Judith Hughes' authoritative To The Maginot Line: The Politics of French Military Preparation in the 1920's and Anthony Adamthwaite's noteworthy France and the Coming of the Second World War provide a decent picture of the general state of French military rearmament, but neither has extensive aviation coverage. Extensive and seemingly trustworthy coverage of French aviation is given in a dissertation entitled "French Air Policy 1919-1939," though over-reliance on such a text is not wise, despite Robert Krauskopf's efforts on his work. Unfortunately, Krauskopf's text also emerges as one of the best sources on Italian aviation, which is not a good sign. Dale Walker's short, popular article "The Great Warbirds 1914-1918: Part IV: The Other Nations" is one of the better, though hardly excellent, sources on early Italian air power, while Pietro

Badoglio's World War Two memoir, called Italy in the Second World War, provides only scant detail on the Italian air force (though he says that Italy's air force was held back by the Allies after Italy's change of sides).

As will become quickly obvious, the coverage given to World War Two itself is shamefully inadequate overall, but perhaps acceptable considering the scope of this text. The Second World War and the air forces' successes or failures in the conflict are both directly a result of what occurred in the years before 1939, thus more than a mention had to be made of some major points in the war that concerned aviation. However, it should be remembered that the ongoing development of aeronautics, strategy, and aircraft types during the war must be pointed out to display the effectiveness or ineptitude of the pre-war planning in a nation's aviation establishment, and that a complete examination of the war, its battles, and its total outcome is not the purpose of the explanations of the preceding matters. Unfortunately, this focus necessitates the unpleasant task of leaving out most of the war detail, leaving a scant portrayal of an otherwise fascinating tale. But, expecting forgiveness should not be unreasonable under these circumstances. In addition, there has been little or no mention of the non-European contingents of the various air fleets, most notably those in the Far East, a campaign which saw most of the aviation activity in the hands of the Japanese and Americans. In any event, coverage has been limited to the European/Atlantic Theatre.

With a work of this size and the length of time spent

researching it, there are always those along the way who contribute in some fashion or another. Above and beyond all others who should be acknowledged is Dr. Ray Thompson, who will perhaps forgive the military focus of this text. Dr. Norman Johnson, the thesis advisor, and Mrs. Sylvia Bradley and Dr. Robert Berry, graduate committee members, also need to be recognized. Of the scores of others who offered input on this work (not always solicited), Lt. Kevin Umbaugh, U.S.A.F., has undoubtedly provided the best discussion and friendship along the way. Finally, all those (including S.A., J.A., and D.C.) to whom room will not allow personal thanks must also be acknowledged, for many have made hard times bearable and good times better.

CHAPTER I

THE SOVIET AIR FORCE

When the Germans attacked Russia in June of 1941, the Luftwaffe faced an air force which sported obsolescent planes, a reorganization plan half underway, and which was desperately awaiting new aircraft. In addition, the Soviet air force was still recovering from the loss of many of its leaders in a series of purges undertaken by Stalin in the mid-1930s. Yet, despite these seemingly insurmountable odds, the Red Air Force managed to survive the German onslaught. How the Soviets were able to survive the surprise German attack called "Operation Barbarossa" has been a topic of interest, as has the analysis of the relatively secretive Russian military build up before the war. The Soviet air force, however, has been a subject of surprisingly little research, despite an invaluable role in the defense of its homeland. The Red Air Force rebuilt itself essentially from scratch after the Bolshevik Revolution and the ensuing Civil War and by 1941 was only a few years behind other major air forces. In fact, for a brief period during the 1930s, the Soviet air force was on a par with any other, though several key factors led it to lose this position of equality. As war progressed, most of the deficiencies of the Soviet air force vanished.

The attention paid to aviation in Czarist Russia during the science's infancy was equal to or perhaps greater than the

interest flying received in other nations. Before 1909, although most attention was focused on airships, some interest developed in heavier-than-air craft and several flying clubs had even emerged.¹ Even though the army was fascinated by early aircraft, funding was extremely sparse and cash had to be raised by "public subscription."² Despite the struggle for monies the most important flying club, the Imperial All-Russian Aeronautics Club, managed to place orders for nine air craft in 1909.³ Some sources are quick to point out that these early efforts of the Russians should not be underemphasized; the United States military, for example, had acquired only one airplane by 1910.⁴

In 1910, the Russian Army established the "Central Aviation School for Officers," and although details of its workings or set-up are lacking, it is known that only a few graduates were produced during the first year or two.⁵ Because the organization of the infant Russian air wing was deficient, the training of the pilots and ground crews was slow, and also because aircraft were foreign-made and few, the Imperial Air Force did not develop fast enough to prepare for a major war,⁶ and although the number of aircraft had increased from roughly 32 or 40 planes at the end of 1910 to nearly 250 by early 1913, only 150 of these 250 were not obsolescent, dated planes.⁷ The Russians purchased all but a few of their planes from elsewhere, with French Farmans and Nieuports being the favorites while other foreign designs such as the Bristol, Morune, and Albatross were also visible. Some flying boats were purchased from Curtiss, a U.S. company, for the

Imperial Navy.⁸

A handful of native designers did manage to make some valuable contributions to aviation during this time, however. Igor Sikorsky designed and built the first four-engined plane, the Ilia Mourometz. Used in different models as a transport or as a bomber, Sikorsky's plane is regarded as a marvel in that early period.⁹ Other than Sikorsky's craft and a few isolated prototypes, however, Russia's own attempts at the design and manufacture of airplanes before World War One were largely fruitless or even comical.

As World War One started, the government increased its efforts to bolster the air forces. Native production was boosted, more planes were purchased from outside sources, and an attempt was made in 1914-15 to replace some of the older models.¹⁰ The Russians entered the war with a front line strength of 244 airplanes, a figure which compared favorably with "Germany's 252, France's 138, Great Britain's 56, and the United States' 17."¹¹ The Russians were, in fact, second in Europe in spending for aviation shortly before the war.¹² Irrespective of these developments and an increase in industrial capacity, the Imperial Air Force lagged behind her European counterparts in such major areas as quality of planes and training of pilots, and after only a month of war the Russians had only 145 aircraft left in service.¹³ The beginning of World War One would not be the last time that the Russian air wing would suffer grave casualties at the start of a major conflict.

In 1915 the first native-designed and built fighter rolled off the Russian assembly lines. The RBVZ-S-16 was built in small numbers and was favored by Russian pilots.¹⁴ Unfortunately, the new fighter was outclassed by foreign fighters of the time and was soon replaced by other original designs.¹⁵ One older model, the IM-5 created by Sikorsky, stayed in production and provided a large bomber-type plane for the Russians. Production of the IM-5 continued until 1916, by which time about 75 had been produced.¹⁶

By the end of 1916 the Russian air force swelled to nearly 716 planes, a figure which is somewhat misleading. During the war, the size of the army had doubled, and thus the number of planes should nearly have doubled, which it basically did. However, the quality of the planes in the Russian force was much lower than elsewhere (the air corps consisting of sub-par Russian copies of foreign craft, obsolescent or worn-out planes purchased from elsewhere, and a small handful of poor native designs), and thus the Imperial Air Force was actually little better off than when the war started.¹⁷ And with the increase in quantity and quality in other nations, the Russians were, in actuality, worse off than ever before.

Overall, the fledgling Russian aviation industry produced between 1500 and 2000 airplanes per year from 1915-1917. Most of the planes used in Russia, even by 1917, were still of foreign origin.¹⁸

Sources are in great disagreement about the size of the air

force which existed at the start of the Bolshevik Revolution in 1917. Alexander Boyd, who is regarded by some as the major authority on pre-World War Two Soviet aviation,¹⁹ says that between 2000 and 2500 planes were available to the Bolsheviks,²⁰ while others suggest that the figure is closer to 500.²¹ Robert Jackson, author of a more popular work on Soviet aviation, lowers the figure of planes available to the Red forces to only 150.²² Unfortunately, the picture is not even this "clear;" Boyd's figures suggest that about 579 craft would have been directly accessible to the Bolsheviks, while over a thousand planes were either scattered over the nation or under construction and repair.²³ Kilmarx, whose History of Soviet Air Power is generally viewed as the definitive work on Soviet aviation, does not give figures but does emphasize the disintegration of air units during the revolution and the subsequent civil war.²⁴

Very little has been written specifically about air involvement in the Russian Civil War. While the number of aircraft that participated was seemingly quite small, air power during the civil war is important because the foundation of the later Soviet air force is found there. While considerable credit is given to the White Force's air units in the anti-Bolshevik attack on Tsaritsyn in the summer of 1919 (the White aircraft destroyed a large relieving force),²⁵ it is the workings of the Red Air Force that are more important. Within weeks after the Bolshevik take over, attempts were made to establish an aviation bureau, but more pressing needs and the scattered nature of the

remaining air units delayed the formation of a stable air command until May 1918.²⁶ The nationalization of factories had begun at the end of 1917, but aircraft production had already plummeted during the turmoil and would not begin to recover until after 1923. In order to aid the economic recovery and actual production of the aircraft industry, concentration on one or two simple yet versatile designs occurred at each factory. These designs, of course, were not always successful ones. In an attempt to stabilize and repair the depleted air corps, British, German, and other foreign models were copied and put into production. In addition, foreign aircraft were purchased to supplement the as-yet minuscule native output.²⁷

In 1920, an official Aviation Research Institute was established and designed an aircraft production program for the next ten years. This new plan was soon trashed, and because this early institute was not particularly successful, 1922 saw the opening of a new design study group headed by Nikolai Polikarpov, an experimental aeronautical engineer, near Moscow. This GAZ-1 factory, as the new facility came to be called, would provide excellent aircraft in the next twenty years.²⁸

Following the signing of a treaty between Germany and the Soviet Union, German aviation plant workers arrived in Russia to help in a new German-Soviet cooperative plant set up near Petrograd. In addition, Russian engineers were allowed to study aircraft production methods in German factories.²⁹ Asher Lee emphasizes the effect that this German influence had on Soviet

air philosophy and production. The Germans, for example, did not believe in a strong strategic bomber wing, an idea that the Soviets followed up until the end of World War Two. Much of the air force was actually made up of German planes or Soviet copies of German planes, and German officers were in charge of many of the Russian flying schools during this period.³⁰ Without this considerable aid from the Germans, the Soviet air industry would have been hard pressed to improve as it did, at least for several more years. However, the airplane plants hired many unskilled workers, and also lacked tools and proper techniques. These factors combined with the irregular supply patterns that existed left the aircraft industry on much less than a solid base.³¹

The establishment of the NEP, or New Economic Program, by Lenin in March 1921 was the dominant feature of Russian political and economic life after the Civil War. The New Economic Program returned a large part of industry to private hands, usually in a lease arrangement. Because the industries once again operated on a profit-making basis, however, the production of consumer goods improved quickly while heavy industry was left behind,³² though despite this short-lived departure from heavy industry in many Russian factories, aircraft research continued heavily during the early years of the NEP. At an institute known as TsAGI, A.N. Tupolev, who would become one of the great Soviet aircraft designers, built the ANT-1, a light transport. The following year an experimental fighter was designed by Polikarpov.³³ For the next two years, however, the aviation industry was in general

poorly organized and conceived.³⁴

In 1923 the entire Soviet military began a drastic reorganization. Whereas the air units had fallen under the direct control of the army commanders to which they were assigned, a separate command group, the Chief Directorate of the Air Forces of the Red Army, was now in charge of the overall administration.³⁵ Leon Trotsky, who was Minister of War, founded the Society of Friends of the Air Fleet (ODVF) in 1923 in order to "promote interest in aviation by arranging air displays, visits to factories and airfields, lectures and exhibitions" and so on.³⁶ The ODVF made extensive use of all manner of propaganda in order to popularize aviation, producing banners with slogans such as "Workers! Build An Air Fleet!" and "What Have You Done for the Red Air Fleet?" Donations from the Society of Friends of the Air Fleet, in fact, paid for many new Russian planes.³⁷

Late in 1923, the R-1 went into production. Designed like the British DeHavilland 9A bomber, the R-1 would become the basis of Soviet aviation for nearly a decade, and over 1000 R-1s would be produced over the next five years.³⁸

Once NEP had gotten under way, expansion was a nearly inescapable outcome. Tupolev designed an airplane called the ANT-4 which flew in 1925, causing the Germans to complain of patent infringement because the craft was very similar to a German model.³⁹ Unfortunately, despite an increase in the number of plants and factories, the "lack of a machine-tool industry. . . the shortage of metals, and the scarcity of technically trained

manpower" hampered the air industry and prevented it from developing faster.⁴⁰ Other planes were created under NEP as well. The I-2bis was the first Soviet fighter to go into production in series (which meant that changes and improvements in the same basic model could result in new versions), and later an I-3 and an I-4 emerged. The I-4, incidentally, stayed in service until 1933. Polikarpov, who designed the I-3, also designed a new training craft called the U-2, a lasting contribution whose name was changed to Po-2 to commemorate Polikarpov's death. The U-2 was still the standard trainer well after World War Two.⁴¹

Mikhail Frunze, who in 1925 became the Minister of War, pushed for Soviet independence from foreign aircraft orders. More urgent was the production of airplane engines which had been a proverbial thorn-in-the-side for Russian aviation since the beginning and was sorely inadequate; in 1924 only 9% of Russia's requirement of aero engines were produced in the country. While Frunze was instrumental in the development of Soviet aviation (mainly for this push towards independence from foreign sources), he remained uncertain about the future role of aviation while saying that a country without an air force would face "inescapable defeat" in a major conflict.⁴²

As the end of 1928 approached, the Red air fleet (by now known as the "VVS") was made up of foreign and some native aircraft, many of which may have been obsolete.⁴³ Although Soviet sources say that by 1928 most of the airplanes in the Soviet air force were of Soviet construction,⁴⁴ this was probably not the

case at all. Between 1923-1928, the total strength of the air corps rose from 400 to about 1080, and over 800 of the larger total had been purchased elsewhere.⁴⁵ In October 1928, Stalin announced the first of what he called "Five Year Plans."

The "Five Year Plan" revealed by Stalin was not a concrete, pre-stated scheme at all. There was no blue print, contract, or guide, and in fact the proposed figures for various industries would not signal success if they were reached, because they were designed to be exceeded, not met.⁴⁶ During the First Five Year Plan, between 1928 and 1932 the national income grew by over 60%. Industry improved dramatically; production of motor vehicles, for example, rose from 800 built in 1928 to nearly 24,000 in 1932, at the end of the plan. "Metal-cutting machine tools" production rose from 2000 in 1928 to 19,700 by 1932.⁴⁷ Steel production, which had fallen to 115,000 tons a year in 1919-1920, crept up to 4 million tons in 1929 and by 1932 steel production was up to six-and-a-half million tons for the year.⁴⁸ Unfortunately, the tremendous growth in heavy industry and the surge in the economy placed a great burden on the general populace.

The production of consumer goods lagged behind that of other goods, while whole populations were dislocated as peasants were forced onto collective farms.⁴⁹ Many necessary items were either rationed or not produced at all, and harsh labor conditions awaited the population in the factories. The goals set for the First Five Year Plan were amazing: industrial output overall was expected to increase 250 percent while heavy industry was to

improve by 330 percent. Even agricultural production, which stagnated under the First Five Year Plan, was slated to increase by 150%. And, in 1930, the Party Congress called for the program to be finished in four years instead of five.⁵⁰ By 1932, a large expansion in industry had indeed been achieved, but the results were not all satisfactory, for the quality of the products was often inferior.⁵¹

The aviation industry also experienced some gains during the First Five Year Plan from 1928-1932. Some Soviet sources say that the aviation industry increased by 750% while the number of technical personnel and engineers increased by 1000%, both of which seem unlikely.⁵² Most of the early standard Russian aircraft were produced during the First Five Year Plan, and the personnel strength of the Soviet air force increased substantially. In 1926 there had been about 10,000 men, including all types of personnel, in the Red air force while in 1931 the number had risen to 29,000 men. By 1932, nearly 50,000 men were involved with the Soviet air units. The number of aviation students increased as well, ballooning from 1000 to nearly 5000 in 1931.⁵³

Although a major reorganization of the Red air force had occurred during the New Economic Program, some further changes were undertaken during the Five Year Plan. In 1930, separate aircraft trusts were set up for civil and military flying; ZAGI, the central office for aviation production and design, had become overburdened dealing with both. Due to the increasing scope of

aviation and industry, other groups were set up to deal with various aspects of aeronautics. An organization called ZAMI, for instance, came into existence in 1930 and was created to address the development of airplane engines, and in 1932 another group, VIAM, was started to supervise the "quality of aircraft materials."⁵⁴

Like the previous five years, 1928-1933 was also a period of increased research and design in Soviet air circles. The I-9, I-10, and I-11 were designed but ended up on the cutting room floor. Polikarpov designed an I-13 biplane in 1933, which would be the forerunner of the I-15, a fighter that would become famous not long after its maiden flight later that same year.⁵⁵

Overall, despite the seeming successes in the aviation industry, the Five Year Plan failed to reach several targets, leading to further re-working of other elements of the aviation sphere such as the TsAGI, one of the main centers for research and design, and the Civil Air Fleet (GVF), which dealt with non-military aviation.⁵⁶ Some sources emphasize that during the First Five Year Plan the Russians were, in effect, able to create a new air force from nothing, and although the force did not meet quality or efficiency standards that existed elsewhere, the Soviet air force, numerically, had to be considered a "power factor."⁵⁷ More progress would occur during the Second Five Year Plan, underway by 1933.

A new U.S. interest in Soviet aviation would also develop in 1933. In September, Colonel Charles A. Lindbergh, the world-

famous aviator, visited the Soviet Union and toured several new factories and aviation plants. Lindbergh, who was to reverse his opinions later, declared that he was so impressed by the Russians' "technical achievements" that he wished to return in a few years to see the continued progress.⁵⁸ At roughly the same time as Lindbergh's visit, Soviet engineers were studying at Curtiss-Wright factories in the United States. While the Russian engineers were at the plants to study production techniques, they were also exposed to design ideas and took favorably to the DC-3, which would become one of the world's best-known and longest-lasting transport planes.⁵⁹

The Second Five Year Plan resulted in more improvements in heavy industry. Another impressive surge in motor vehicle production occurred, with an increase of 176,000 produced in the years 1932-1937. Similarly, output of crude steel increased from 14.5 million tons in 1933 to 27.8 million tons in 1937.⁶⁰ While the aviation industry seemed to be producing enough to keep the Soviets from falling behind in the air race, eventually quality standards and organization were in need of improvement. Many new factories were being constructed, especially near the end of the Second Five Year Plan, and by 1936, between "200,000 to 250,000 workers were employed in the Soviet aircraft industry."⁶¹

The procedure of training pilots also changed during the Second Five Year Plan. Much of the pilots' first taste of flying would occur in an organization known as Osoaviakhim, a paramilitary group which subsequently increased its aviation

activities. From the Osoaviakhim, the trainee was then assigned to a beginner's flying school and later to a fighter, bomber, or other specialized school. Then, the pilot would be sent to either an operational air unit (a regular duty post), a training squadron, or a reserve unit. Commissioned pilots would spend time learning other military areas.⁶² However, while the I-5 and I-6 fighters were suitable for training in the early 1930s, these craft continued to be used long after pilots should have been training on more modern craft,⁶³ and thus training was not as effective as it might otherwise have been.

Several types of new aircraft were designed during the Second Five Year Plan. The I-15, which was created late in 1933, was improved, resulting in an I-15bis, capable of around 230 miles per hour, and an I-153 with a top speed of nearly 240 mph. The I-153's engine was not powerful enough to keep up with some of the new fighters of other countries, however. By late 1934 another engine was used in production of the I-153, resulting in a new top speed of 265 mph, which made the improved I-153 one of the fastest production planes in the world at the time. Polikarpov, who designed the I-15, created the I-16 as well. The I-16 was originally capable of speeds of up to 270 miles per hour, and the little "Rata," as the plane came to be known, was produced in huge quantities. By the end of the Rata's front-line career, 20,000 had been built.⁶⁴

Consideration was given during the Second Plan to a strategic bombing wing, contrary to what the practice had been up

to that time. The TB-3, designed by Tupolev, was a large, unmanageable heavy bomber made of corrugated metal,⁶⁵ and was the first four-engined single-winged bomber to go into production anywhere. The TB-3 went into service in 1932. The SB series, also a creation of Tupolev, was smaller and faster than the TB-3, and the SB-2, which began its career in 1936, was actually quicker than many of the contemporary fighters and any other bomber. The range of the SB-2, however, was considerably shorter than the heavier bombers.⁶⁶

The industry improvements affected the air forces considerably during the Second Five Year Plan. The number of airplanes increased from around 2,200 in 1933 to over 5,400 in 1938. Of these total forces in 1938, about 4,200 planes were roughly modern or at least considered "front-line" craft.⁶⁷ The actual production of combat aircraft skyrocketed from only 627 planes in 1933 to nearly 7,000 by 1939.⁶⁸ With this numerical improvement came the establishment of a separate Far Eastern Air Force.⁶⁹

Two other events would occur during the Second Five Year Plan which would stagger the Red Air establishment. A civil war erupted in Spain, providing an ideal opportunity for the testing of new planes and tactics in combat. Following the Spanish revolution, Stalin would eliminate innumerable military personnel through a series of purges. Soviet aid to the Spanish government was almost exclusively military during that country's civil war. The shipping of arms and personnel to the Loyalist forces in

Spain was secretive and generally separate from more publicized Anti-Franco/Fascist propaganda.⁷⁰ The conflict as a whole was seen as both a chance to study air tactics and also to spread the ideas of communism.

Russian I-15, I-16, and SB-2 aircraft were sent to Spain to fly for the Republican/Loyalist forces, and were originally manned by "volunteer" Soviet pilots. The R-5 reconnaissance bomber also saw action in Spain. By the next year, 1937, the Soviets had increased the size of their air fleet in Spain in response to a German increase in air support for the Fascist Nationalist forces.⁷¹ The SB-2 was originally very successful as it was faster than many of the Italian-provided nationalist fighters, while the little Rata was probably the best fighter in Spain during the first six months of conflict.⁷² The I-16 proved itself to be "markedly superior to the German Heinkel He 51," which was the main German contribution to the Spanish Fascist forces, and the I-16 could also outrun the Italian Fiat CR 32.⁷³ The I-15 could fly about 240 miles per hour, while the I-16 could reach speeds of up to 270 mph. The He 51 could only fly 205 mph, while the Fiat CR 32 fighter managed speeds of up to 233 mph.⁷⁴ By the early spring of 1937, in fact, the He 51 had to avoid combat with the highly superior Russian planes. A clear Republican air superiority had emerged.⁷⁵

By April 1937, the newest types of German aircraft began arriving in Spain when the He 111B-2 and the new Me/Bf-109B fighter were sent to oppose the Republican forces. The Dornier

Do 17 bomber was also sent to Spain.⁷⁶ Eventually, it became clear that the newer German models were superior to the main Russian aircraft, and by 1939, when Russian withdrawal was well underway, the Russian planes built within the last few years were nearing obsolescence. While not hopelessly outmatched, the Soviet air units were "hard-pressed to match the . . . Messerschmitt Bf-109s, He-111s, Dornier 17s and Ju-87s."⁷⁷

Some of the main lessons of the Spanish Civil War for the Soviet air force were apparent. There was most assuredly a need for a new generation of aircraft, for instance, and while the SB-series light bombers performed fairly well in a ground-attack role (which they had not been designed for), they proved inadequate as bombers.⁷⁸ However, partially because of the success of the SB-2 and 3 as ground attack craft and their failure as bombers, the Soviets became more concerned with the development of a tactical air force than with the re-creation (as the Russian bombers were outdated) of a strategic bombing wing.⁷⁹ Part of the reason for the failure of the Soviet bombing arm was much more simple; the TB heavy bombers, while approaching old-age, were still the main long range bombers, and none of these made the trip to Spain.⁸⁰

Because the Soviet Air Force had ended the Spanish war with a less-than-stellar performance record, a multitude of criticism flooded the government and the military. Stalin responded ruthlessly, killing many of those who were complaining as well as many who were being complained about.

In December 1934, S.M. Kirov, an "old guard Bolshevik," had been murdered, and Stalin begun a huge investigation for insurgents and malcontents.⁸¹ A Purge Commission swung into full gear and by the time the Spanish war was going poorly for the Soviets, Stalin was searching for scapegoats, who were not hard to find. Tupolev, the noted designer, was arrested but later freed, while the commander of the Soviet Air Force, Jans Alksnis, was less fortunate and was shot,⁸² Even L.V. Kamenev and G.E. Zinoviev, both important old line Bolsheviks who had each opposed Stalin's policies, lost their lives. Overall, three of the top five military commanders, all of the military district leaders, and "tens of thousands" of lower commanders and leaders were purged, either being put to death or disappearing.⁸³ The development of the Soviet Air Force was hampered by the purges (undertaken partly because of the failure of the air arm in Spain), but to what extent would not become clear until several years later.

Another Five Year Plan was ushered in during late 1937-early 1938. The new Third Five Year Plan started with an industrial system which had begun to stagnate during the last years of the previous Five Year Plan, and during this plan a new economic head was appointed. Primarily, the Third Five Year Plan was designed to revive the slumping heavy industries. The production of iron ore or high grade steel in 1936-1937 had not increased, while the output of things such as coal, oil, and machine tools increased only slightly during the same period.⁸⁴ Arms production and the

aircraft industry had not stagnated, however, and by the time of the Third Five Year Plan the front-line strength of the VVS was around 3000, about one-third of which were bombers,⁸⁵ although the total available number of planes was probably 4500 to 6000.⁸⁶ It had become obvious after the Spanish Civil War, however, that new types of aircraft were needed, and it was during the next few years that some of the new types would succeed in putting the VVS nearer to a position of international equality than it had ever occupied before.

Polikarpov designed an I-17 which was to replace the aging I-16, but the prototypes were not pleasing.⁸⁷ However, a new generation of fighter was on the horizon in the shapes of Yak, LaGG, and Mig models. New bombers were also crystallizing. The Pe-2 was entering production as a fast ground attack plane and dive bomber, and would sport a top speed of 335 mph, while the TB-7 had already entered service as the replacement for the archaic TB-3.⁸⁸ The DB-3 also entered service as a long-range bomber during the first half of the Third Five Year Plan.⁸⁹ Perhaps the most notable of the Third Plan's aircraft was the Il-2. The Il-2, which was created by Ilyushin and became known as the "Shturmovik," was designed specifically as a ground attack plane whose primary mission would be to attack enemy troops and position. Built in response to Soviet failures in ground support in Spain, no other Soviet airplane of World War Two was better suited for a job than the Shturmovik was suited for ground support.⁹⁰ Before these new types of aircraft could escape from

the factory, however, the Russians would wage war, in 1939, not on the Germans threatening Europe, but on the tiny, wintry nation of Finland, which had refused to concede a section of land to the larger nation. The stubbornness of the Finns would surface again.

The Soviet air force had been evaluated in several different ways throughout 1939, mostly unfavorable. Charles Lindbergh, who had been greatly impressed with Russian aviation only a few years before, returned in 1938 for a second visit, and declared that while the Soviet planes could be used "effectively in a modern war," they were not as good as those in other countries.⁹¹ Overall, Lindbergh was not particularly impressed with Soviet aviation by 1938 and in a letter to Joseph Kennedy, the American envoy in Great Britain, said he "would not place great confidence in the Russian air fleet."⁹² Early 1939 estimates of Soviet air strength ranged from as high as 8,000-10,000 planes to a more likely 7,300 aircraft, according to American sources.⁹³ Of the 7,300, however, only about 4,500 were considered front-line, and of these many "are obsolescent, with mediocre characteristics . . . and are . . . outclassed" by English and German planes.⁹⁴ Meanwhile, many British felt differently about the Soviet air arm, it seems; David Lloyd George, a former prime minister, called Lindbergh a "tool" and "reiterated his own opinion that Russia had the finest air force in the world."⁹⁵ Unfortunately for Lloyd George, and even more unfortunate for the Soviets, the Russian air force was not the finest in the world and would

experience a somewhat unpleasant surprise as the invasion of Finland began.

The Soviet Forces as a whole were not ready for the so-called "Winter War," and the Red air units in particular were "poorly organized, ill-trained, and extremely ineffective."⁹⁶ The Finnish Air Force was perhaps the antithesis of the Soviet air squadrons; tiny, but well organized. Extremely tiny, in fact, for the Finnish air fleet was equipped with about 100 obsolescent fighters (such as the Fokker C-10, C-5, D-2, British Bulldog, some Gloster Gladiators, and the sleek but comparatively slow Fokker XXI), none of which was able to keep up with the I-153s and I-16s used by the Soviets.⁹⁷

In spite of a large numerical advantage held by the Red air units, the Soviets' air missions were poor, often comical attempts. A Finnish source tells of a captured Russian pilot who had misunderstood his orders and ejected instead of dropping his plane's bomb load, while in the same raid by SB-2s, only a few bombs managed to land anywhere remotely inside the target's perimeter.⁹⁸ The logistics of the eventually successful Russian land invasion are not of interest here, though the outcome of the air war displays the need for improvement in the Soviet air arm. The Soviets committed between 2,000 and 2,500 planes to fight the minuscule Finnish air arm,⁹⁹ but the Soviet losses of aircraft were proportionally astronomical; one Finnish account placed enemy losses at about 900,¹⁰⁰ while another breaks the total figure down. Finnish pilots have been confirmed to have shot

down 240 Russian planes, with another 440 or so being destroyed by anti-aircraft fire. Perhaps, according to this Finnish source, Soviet losses were as high as 1000 planes. This same work, Engle and Paananen's The Winter War, cites Finnish losses at only 62 planes.¹⁰¹ Finally, Kilmarx places Russian losses at about 900 aircraft.¹⁰²

The Soviets managed to defeat Finland, and although important Soviet sources are strangely silent about the costly Winter War, widespread changes to the Red air force began immediately following the conclusion of the conflict in early 1940.¹⁰³ During the early 1930s, the VVS' main tactical unit had been the squadron, made up of 20-30 planes which were then grouped together into air brigades. Air brigades were assigned to military districts or to ground armies. In 1940, the basic tactical unit became the air regiment, made up of 60-64 planes, and four or five regiments would form a new air division. Within each regiment, the composition was either "integral, or homogeneous, or mixed, or composite." Mixed regiments were more common and because they consisted of assorted types of aircraft, the mixed regiment was quite versatile, able to perform a variety of air activities.¹⁰⁴ The VVS organization was also restructured into four major components:

- Aviation of the High Command, or DBA, which was in charge of long-range and strategic bombing;

- Front Aviation, which was made up of the Air Forces of each Military district;

Presumed Wartime Organization of Soviet Army Air Forces

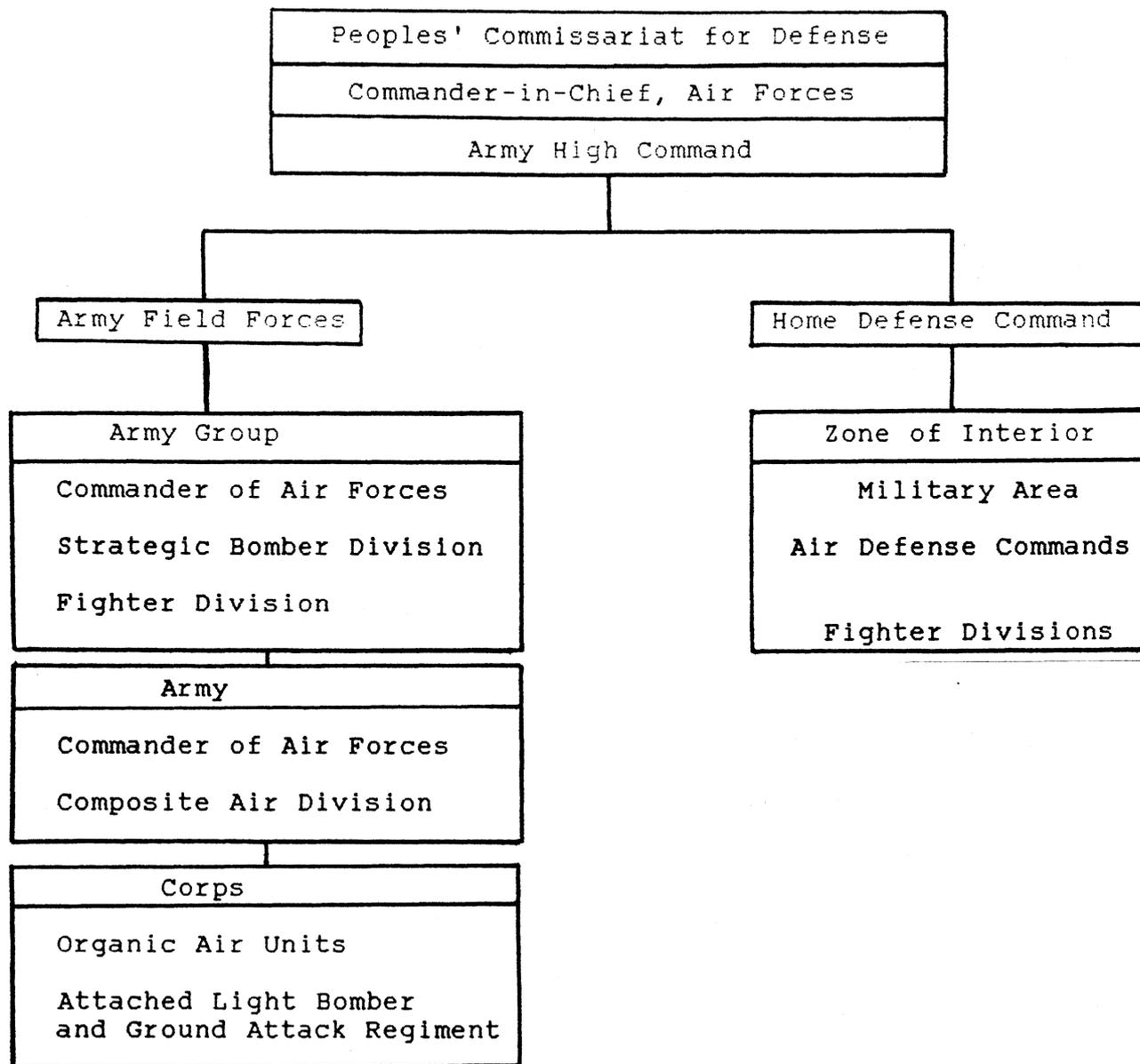


Figure One

-Army Aviation, which consisted of the Combined Arms Army Air Force;

-Organic Aviation, which had air squadrons assigned to a lower level organization such as a corps or division.¹⁰⁵

Thus, the reorganization for wartime operations of the Soviet Air Force could be diagrammed as in Figure One.¹⁰⁶

To improve logistics and ground support, air base regions were created which served a particular front or a certain air division. A new system of maintenance units was also developed, with each unit serving one or two regiments.¹⁰⁷ New airfields were also constructed starting in 1939, with many becoming operational in 1940-1941. The Soviet airfields were divided into several categories by the Germans; First class airfields could accommodate a regiment, had permanent concrete constructions and underground fuel tanks, and often had railway connections, second class airfields could hold a bomber regiment (which was smaller than a regular regiment), but usually had wooden structures and regular fuel tanks, third class air strips had no permanent buildings and only fuel drums, while a landing strip was simply a cleared runway. Each air regiment had several airfields of various types, with a first class airfield usually being designated as the regimental headquarters.¹⁰⁸

These changes were designed especially to increase the cooperation between the air and ground forces, but in actuality the reorganization decentralized control of the air forces, later causing communication problems. Unfortunately, these

organizational changes were only half completed when the Germans attacked on June 22, 1941.¹⁰⁹

New aircraft to take the places of the aging I-15s and I-16s were being rushed through production during 1940-1941. The DB-3 medium bomber was modified to carry a larger bomb load. The much-needed new fighters were being hurried out of the factories; the Mig-1 and Mig-3, capable of nearly 400 mph, the LaGG-3, which could fly 354 mph, and the Yak-1, with a top speed of 364 mph. The speeds of these three types were comparable to the Bf-109s, but even by the spring of 1941 the I-series planes were still the main element of the Soviet Air Force.¹¹⁰ In fact, by June 22, 1941, only 399 Yak-1s, 1309 Mig-3s, 322 LaGG-3s, 460 Pe-2s, and 249 Il-2s had been produced,¹¹¹ while few had actually been delivered. So, just as the reorganization of the VVS was getting underway by June 1941, the reequipping of the Soviet air fleet was interrupted midstream by the outbreak of hostilities.

The strength of the VVS that awaited the Luftwaffe was probably somewhere near 6,000 or 7,500 planes.¹¹² Some estimates suggest a much lower figure, such as 4000 aircraft, while German intelligence estimates produced a figure of 7,300.¹¹³ Despite a large numerical superiority (the Luftwaffe had about 2,800 aircraft), the total Soviet aircraft losses early in "Barbarossa" would be unbelievably high.

"Barbarossa," the Nazi invasion of the Soviet Union, began shortly after dawn on June 22, 1941. Hitler proceeded with the attack, despite considerable opposition from German military

leaders who feared a long two front war, hoping to end the conflict relatively quickly. The Germans' element of surprise was costly to the VVS; by noon, 1,200 Russian planes were destroyed and by nightfall, the Russians had lost nearly 2,000 aircraft.¹¹⁵ While the Soviet news lied about the extensive destruction wrought on the first day of the attack,¹¹⁶ the official Soviet history of the Red Air Force in World War Two admits that Russian aircraft losses amounted to "around 1200 airplanes, including 800 that were destroyed on airfields."¹¹⁷ By comparison, the German Air Force lost only somewhere between 20 and 35 planes during the first day's fighting.¹¹⁸

While German troops advanced eastward across the Russian landscape, Luftwaffe planes bombarded Soviet troops and installations. The archaic I-series airplanes stood little chance against the German fighters, while any Soviet bomber that took off was asking to be shot down, especially since there were often no fighter escorts for the bomber squadrons.¹¹⁹ Besides these unfortunate factors for the Soviets, their pilots were often intimidated by or even afraid of the Germans, usually attempting to avoid combat with Luftwaffe planes.¹²⁰ Within the first week of aerial combat, 4,990 Red aircraft lay in ruin, while only 179 German planes met a similar fate.¹²¹ Despite the continual loss of large sections of their available aircraft, the Soviet air fleet was not destroyed, and in fact would stage a miraculous comeback over the next year.

Behind the VVS' incredible comeback was an amazing, although

confusing, relocation of Soviet industries towards the east, out of reach of the German bombers which had insufficient range.¹²² Despite plans to the contrary, the Russian industry had little reserve capacity for the aviation industry as war started, but even if war had been somehow postponed until 1942, Soviet industry would still not have been prepared. As the Germans invaded, areas of key industry were often lost, though much of the industries were evacuated starting on the third day of war. Organizations were set up to supervise the evacuations of people and industrial plants, most of which went to western Siberia. Although the evacuation of Soviet industry is usually praised by historians, the whole affair was particularly haphazard. The refugee movements were usually chaotic, sometimes returning evacuees to where they had departed from, while officials, to avoid any assets being captured at any cost, were known to have "dispatched (items) on journeys of extreme length-to central Asia, Siberia, even the Far East," and not even supplies slated for the front lines escaped this fate.¹²³ Other officials would watch the same loaded trains shuttle back and forth through their towns several times before intervening. Amidst this mass of moving mess, however, over a hundred aircraft factories were moved, although production was, of course, severely limited for a long while in most factories.¹²⁴ The relocation of the aviation plants guaranteed that adequate reinforcements would be forthcoming.

By late summer 1941, the Soviet air force would increase its

activity as the number of aircraft began to stabilize. After the first few days of combat, the Luftwaffe was forced into ground support duties by the German high command, a role they were neither accustomed to nor prepared for.¹²⁵ While a detailed tactical and/or strategic analysis of the "Great Patriotic War," as the Russians called the segment of World War Two which they participated in, is out of the scope of this work, it is important to see the role aircraft played in the overall scheme and to also note the continued development of the Soviet Air Force.

The loss of such a large number of planes in such a short period of time at the start of hostilities was a sharp blow to Soviet confidence. The sudden fall from an air force which was the "world's largest . . . to one that could not even maintain local air superiority" was a shock which surprisingly did not deter the Soviets.¹²⁶ The Germans pushed towards Leningrad during the late summer, but the offensive was not successful despite aid from Finnish troops, and from July 22 to September 22, 1941, about 800 German planes were destroyed by the VVS. Although official Soviet sources desire to show otherwise, things were not yet well; Leningrad was besieged in September.¹²⁷ By October, a German offensive against Moscow was underway.

Originally, only 364 Russian front-line airplanes defended Moscow, but the figure rose to nearly 1,000 planes.¹²⁸ An unpleasant surprise, the presence of the Shturmovik in force awaited the Germans in Moscow;¹²⁹ the effectiveness of this craft

can be seen in the fact that between 68 and 80% of air missions were being flown in support of ground units.¹³⁰ The Soviets were able to establish air superiority, a task of no small consequence, and were able to maintain it over Moscow.¹³¹ Throughout this time, Russian units were receiving more and more of the newer types of planes. The German attack was halted, but the importance lies more in the lessons the Soviets garnered from the attack. Aside from plain practical experience gained by pilots and ground crew, the attack on Moscow showed the Soviets how effective ground attack operations could be, and also pointed out that the existing structure of the VVS was a hindrance to the cooperation between air units and to the effective concentration of air forces against targets. In addition, an urgent need for a strong reserve force was noted, and by the next year several reserve corps would be formed.¹³² The Battle for Moscow was followed by a Soviet counteroffensive in December 1941, during which the Soviet air fleet was a noticeable presence.

The Soviet air fleet hampered the retreat of the German forces by "small, but often very troublesome attacks" on German positions.¹³³ While the Soviet winter counteroffensive was largely able to force the Germans backwards, the winter proved to be an exceptionally tough time for both sides. The Germans in particular were faced with weather they were unprepared for; in fact, some sources say that Moscow might have been taken had it not been for the arrival of the extreme weather conditions.¹³⁴ Many of the German airfields were practically inoperable during

the winter months and planes experienced all sorts of mechanical dilemmas in the winter, ranging from frozen oil to shattering parts. Thus, by the winter of 1941-1942, the worn and haggard Luftwaffe was pressured increasingly by a Phoenix-like VVS.

Walter Schwabedissen, a general with the Luftwaffe on the eastern front, has evaluated the various arms of the Soviet air force in 1941. Concerning the fighter arm, Schwabedissen says that while the average Soviet pilot was generally frightened of the Germans, the best Russian pilots were about equal to the German fliers although most Russian units sought to avoid combat with the Luftwaffe. Schwabedissen points out that despite the heavy initial defeats, the Russians were able to preserve their production capacity and thus created an ideal situation for the replacement of fighters.¹³⁵ The ground attack arm was inadequate and the planes used were unsuitable, though the arrival of the Il-2 managed to change that to a large extent. Schwabedissen praises bomber pilots as courageous, especially considering the inferiority of their aircraft, but the bombers' efforts are largely dismissed by Schwabedissen as insignificant and ineffectual.¹³⁶

By early spring 1942, the Soviets were able to assume a voluntary defensive position, hoping to recover from the harsh winter fighting. As summer approached, the Soviet air units were being stocked with increasing numbers of Yak-1, Il-2, and Pe-2 aircraft, and the La-5, the newest type of fighter, had entered production,¹³⁷ and the Russian aviation industry was well on its

way to recovery; during the first half of 1942, over 8,000 combat aircraft were built, and during all of 1942 nearly 26,000 planes left the factory.¹³⁸ And along with the increase in strength and quality of the VVS came another reorganization at the hands of a man who would become an aviation hero.

General A.A. Novikov became Soviet Army Air Force Deputy Commander, in 1942 and undertook a series of reforms which would improve the efficiency of the air arm. While it is important to remember that the VVS was never a separate body from the army, the changes in 1942 allowed the air force to operate more effectively within the confines of the combined force. Novikov took particular units and assigned them to each front, creating what was called an "air army." For example, the "Leningrad Front" consisted of eight fighter regiments, one ground-attack regiment, and three bomber regiments. There was also created a section to analyze and plan the activities of the air fronts which would also address new tactics and applications. In addition, air assault groups were formed which would provide overall assistance to the VVS air armies. The ground services and rear organizations were also improved.¹³⁹ These changes and others made the air force more effective especially in the ground support roles which were quickly becoming the primary mission of the VVS.

Unfortunately for the Germans, things would get worse in 1942. Several times German armies were surrounded and had to be supplied by airlift, a costly endeavor. To make matters worse,

one of the German air fleets was recalled from the eastern front and sent to the Mediterranean theatre, which further crippled the Luftwaffe's Russian frontal strength. In fact, after 1942, the Germans could only send a small portion of their best airplanes and pilots to the eastern front.¹⁴⁰

By the end of 1942, the Battle of Stalingrad had been raging for a few months, and though the logistics and ground conflicts are not of interest here, historians often mark the battle as the turning point of the war. The Luftwaffe committed just over 1,000 aircraft to the Stalingrad attack, while the Soviet air reinforcements totalled over 1,000 planes. By December 1942, it was apparent that the tide was shifting to the Soviets.¹⁴¹

During 1942 several new types of aircraft had been introduced into Soviet squadrons. The Yak-7 emerged from the factory late in the year, preceded by the La-5, a replacement for the LaGG-3 and which was made out of wood.¹⁴² Both of these planes, while not really any faster than their immediate predecessors in level flight, could actually dive and climb faster. The Su-2, Mig-3, Pe-8, and the Yak-4 (an unsuccessful bomber-type) had gone out of production in 1942, allowing industry to concentrate on the better types of aircraft.¹⁴³

With 1942 having passed and the Soviets challenging the Germans for air supremacy, it might be appropriate to digress and examine another chapter in the air war between Germany and Russia. As the German invasion began, foreign aid started to trickle into Russia in the form of military items, industrial

tools, and raw materials. The aid from abroad also included aircraft.

The first shipment of American planes to the Soviet Union occurred in July 1941, when American P-40s were ferried into Archangel.¹⁴⁴ The British, who felt they could not really contribute much originally to the Russians, did send several squadrons in August to the Soviet Union equipped with the newer models of the Hawker Hurricane. These RAF units trained Russian pilots to fly the Hurricane, taught British air tactics, and flew support missions with Russian bombers until October.¹⁴⁵ The United States was the primary foreign contributor to the Soviets' war effort, however.

Mainly, P-39 and P-40 fighters, A-20 and B-25 bombers, and some C-47 transports made up the American lend-lease packages. A Soviet detachment was sent in September 1942 to Fairbanks, Alaska, to help ferry planes from there to Siberia and also to receive training in the flying and maintenance of the various types.¹⁴⁶ The total aircraft exports from the United States amounted to roughly the following, divided up by type of plane:

Fighters

P-39	4,719 planes
P-40	2,097
P-63	2,400

Bombers

A-20	2,908
B-25	862

Transports

C-47	707
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Other Types

approx. 300+ planes¹⁴⁷

In addition to this United States aid, the Russians received British Hurricanes and some Spitfires from Great Britain.

The value of lend-lease to the Soviet Union has been disputed ever since. Because the native aircraft production in the Soviet Union during the same period totalled nearly 100,000 aircraft, it is hard to see how the receipt of 14,000 aircraft could have made a difference.¹⁴⁸ In fact, one Soviet source does not even mention the U.S. assistance,¹⁴⁹ while another says that "Aid from our Allies, England and the United States, lend-lease, was insignificant."¹⁵⁰ Perhaps the value of these craft in combat can be questioned, as the types sent had been rejected by the American pilots as they did not measure up to their requirements, but most were equipped with advanced features such as radios, radar, and better armament, which could all be studied and used by the Soviet engineers.¹⁵¹ And especially during the "dark days" of 1941-42, the lend-lease airplanes were "absolutely crucial" until the Soviet aircraft industry could fully recover from the upheaval of war.¹⁵² In addition, the planes may have also been important for morale, and some of the U.S. craft, such as the P-63¹⁵³ and the P-39, were liked by the Soviet pilots.¹⁵⁴ In any event, for better or for worse, lend-lease continued until 1945.

For the first time in the war, control of the air passes to the Soviets in 1943. In fact, except for isolated incidents, the Soviet air force was able to "dominate and dictate almost the entire air situation." The Luftwaffe had to pull training planes for front-line service, and hardly any reinforcements were sent

to aid the ailing Luftwaffe after 1943. As the year wore on, the Russians would operate nearly five times as many fighters as the Germans,¹⁵⁵ and the technological advantage once held by the Germans all but evaporated. The only significant addition to the German air corps in 1943 was the remarkable Focke-Wulf FW 190, which, while probably the Germans' best fighter of World War Two, was not delivered in sufficient numbers to the eastern front to have a noticeable effect.¹⁵⁶

In the spring of 1943 there were about 3,000 German planes on the eastern front, and perhaps about 5,200 Soviet aircraft, divided into thirteen air armies. In addition, increased attention was being paid to strategic aircraft, and the ADD, the air division responsible for long range aviation, consisted of 700 planes.¹⁵⁷ The first major conflict in 1943 was the Battle of the Kuban, for which the Germans shifted many air units towards the southern front.

The Kuban region, in the northern Caucasus, was crucial to the Germans in the attempts to regain an initiative on the eastern front. The air battles over the Kuban were characterized by huge dogfights between large formations and heightened air activity on both sides.¹⁵⁸ Von Hardesty says that although the air battles of the Kuban conflict are among the most pivotal in World War Two, the Kuban as a whole has been relegated to the back burner because there was no major breakthrough involved in the ground conflict. The Kuban operations, however, mark the transition of the VVS from a defensive force to one with an

attitude for offense.¹⁵⁹

During the spring, movement on the ground was hard due to the thawing of the earth, and by March and April ground operations were at a virtual standstill. By July, the Red Army was pushing the Germans slowly backwards out of the Kuban region.¹⁶⁰ The missions of the Soviet air units had all along been to attain air supremacy, cover the ground forces, and defend an amphibious landing. The first major air battle, in fact, had been in support of a Soviet amphibious landing in April, where the VVS played "an important role in repelling all enemy attacks."¹⁶¹ Also, the Red air units supported the ground forces adequately, even having chances to experiment with different techniques.¹⁶² The Red air corps was victorious over the Kuban region, jeopardizing the German positions in the Crimea and the Black Sea and weakening the German supply lines, though the focus was to shift quickly elsewhere by the summer.

The Ukrainian town of Kursk was the location of an enormous armor battle in the summer of 1943, and although Kursk is remembered mainly for this epic tank struggle, there was considerable air involvement from both sides in the conflict. The Kursk offensive would be the last major one by the Germans, and would not end on a happy note for Hitler's forces.

Against the Luftwaffe's 2,050 aircraft the VVS gathered about 2,900 planes, according to official sources, while other sources cite 5,400 Soviet planes in action.¹⁶³ In early air combat over Kursk, the Soviets destroyed 330 enemy planes while

losing 153 of their own, and the losses of German aircraft continued to increase.¹⁶⁴ Losses to German ground units were significant as well, due in part to a new anti-tank cannon that equipped many Soviet fighters,¹⁶⁵ especially the new two-seat Il-2M3 Shturmovik, and also to a new type of anti-tank bomb developed by Russian engineers.¹⁶⁶ By July, the Battle for Kursk was well underway and despite numerous tactical errors by the Soviet forces, the Luftwaffe suffered heavy losses. Between July 5 and 8, the VVS downed over 850 German planes while losing about 560 of their own craft.¹⁶⁷

Kursk saw little change in the VVS' practice of flying in ground support. Fully 65% of the Soviet air missions were flown in support of ground troops, though the VVS maintained air supremacy after the Kursk offensive ended.¹⁶⁸ After the first week of combat, in fact, the Luftwaffe was so reduced that it was never again able to affect the outcome of ground fighting, as losses suffered were not really replaceable. The ensuing Belgorad-Kharkov Russian counteroffensive marked the first time that the Red air force entered an offensive with an advantage in fighters. As time went on, the gap between the two air corps would only widen; though the Luftwaffe had 5,585 total front line craft, only 306 operational airplanes were on the eastern front in late 1943, while about 3,254 Soviet planes were in action in November.¹⁶⁹

The numerical superiority of the VVS was made possible by an aviation industry which continued to recover, grow, and improve.

In 1943, the Soviet air factories turned out nearly 30,000¹⁷⁰ combat planes and, because these were all improved models, by 1944 eighty-seven percent of fighter groups, 100% of ground attack groups, and 74% of bomber groups were equipped with the newest aircraft.¹⁷¹

While 1944 and 1945 were largely characterized by German retreats and Soviet mop-ups, on occasion the Luftwaffe was able to assemble 2,000 planes (many of which were obsolete biplanes). In fact, the survival of the Luftwaffe is credited only to the fact that the VVS' squadrons flew almost exclusively in support of ground troops rather than seeking out and destroying Luftwaffe units. Slowly but surely one area after another was liberated from the Germans; by February 1944, the Soviets had broken out of a blockade around Leningrad, and by later spring most of the Ukraine was freed from the Germans. By May, the Crimean Peninsula, through an effective cooperative air, land, and naval attack, was recaptured by the Soviets.¹⁷² During August, the Soviets invaded Rumania, and had taken Estonia, Lithuania, and Latvia, and soon were pressing towards the East Prussian border.¹⁷³

During 1944, the VVS was able to use massive amounts of aircraft in battle, often sending 1,000 or more planes at once over the battlefield, which caused the German troops immeasurable grief. As 1944 came to a close, the Luftwaffe was barely able to cover the frantic retreats of the German ground forces, and 1945 would not provide any respite for the Germans whatsoever.¹⁷⁴

The last year of the war, 1945, was the setting for the arrival of more new types of Soviet aircraft on the German-Russian front. The Il-10 Shturmovik, an improved Il-2, was capable of only 315 mph but was as heavily armed as its predecessor. The Il-10 began raining terror on German ground units in early 1945. An addition to the La-5 units late in 1944 was the La-7, which could reach speeds of 417 miles per hour but was not produced in great quantities. Though not completed until after the war, the Soviets rushed to make copies of several American B-29s that had fallen into their hands, hoping to create a much-needed long range heavy bomber. Work on this Tu-4 was not finished in time for the end of war, however. Finally, improved Yak-9s appeared in quantity. The improved Yak-9 was a sleek fighter/interceptor which could fly up to 434 mph.¹⁷⁵

The Germans were in no position to withstand the attacks of these new aircraft; even though the Luftwaffe totalled 5,500 planes, only 1,875 were on the eastern front while the VVS fielded 15,815 aircraft.¹⁷⁶ The La-7 and Yak-3 were superior to the Bf-109G and Fw-190s and the Soviet pilots, now full of confidence, flew aggressively and successfully.¹⁷⁷ Soviet fliers commanded the skies throughout the Red Army's conquests of Koenigsburg and Poland, during which the VVS sported a twenty-to-one advantage over the fleeting Luftwaffe. By April 1945, the Russians were planning an attack on Berlin, and the Germans had crammed every aircraft they could find, totalling about 2,000 planes, onto airfields in and around Berlin. Unfortunately for

the defenders, the VVS brought with it 7,500 planes, mostly to support the ground invasion.¹⁷⁸ In fact, nearly 75% of the VVS' missions over Berlin were in their characteristic ground support role.¹⁷⁹

The battle over Berlin was, however, not an easy one. Fighting with their backs to the wall, the Luftwaffe lost 1,132 planes but destroyed 527 Soviet aircraft.¹⁸⁰

CHAPTER II

THE GERMAN AIR FORCE

Following World War One, all of the major European powers underwent some form of air disarmament, including Germany. Unfortunately for the Germans, the disarming of their air wing was involuntary, called for by the Versailles Treaty, and resulted in a long period of covert rearmament in Germany. This period, which saw the rebuilding of the German air establishment, also left the new German Air Force unprepared for war.

Although experiments with balloons and other lighter-than-air craft had been going on in Germany for years, the first German aircraft were essentially poor copies of foreign models, including those designed by the French, Americans, and even the Austrians.¹ The War Ministry, however, was generally unwilling to fund extensive aeronautical research, since it was unclear whether or not airplanes would be of any military value (and at the time they were not). In addition, the airship had captured the public's fancy, while the primitive airplane, which was incapable of "spectacular feats," proved at first unable to compete with the ongoing romanticism of the airship.²

By 1909, civilian interest in aircraft in Germany was increasing, and while the army itself had no planes, the military began to recognize the need for pilots and soon began providing very small subsidies to several private aircraft designers.³ The

same year, the first German Academy of Aviation was founded in Munich, though few details of its operation remain.⁴ The interest of the private citizen resulted in the formation of various local flying clubs and groups, the largest of which was called the "German Aviators Association."⁵ Late in 1909 the army decided to commission the construction of its own plane, an effort which resulted in an embarrassing failure a year later.⁶

The next year, 1910, saw heightened attention directed towards aviation research. Though a few airplane contracts were awarded by the government, little official encouragement was given when the first "official" pilots began training at the first "official" aviation training school. Not only did the training take place in a donated plane, the instructor was a volunteer, and there no funds available, all testifying to the still cautious attitude displayed by the War Ministry towards heavier-than-air craft.⁷ Within the next few years, the quest for aviation in Germany would become more organized, and because the German military held the key to any need for airplanes, the military establishment was able to guide the fledgling aviation industry and also to prevent any monopolies or cartels from developing. And, in order to avoid any conflict with the military, the industry adhered to stringent demands established by the armed forces.⁸

Because the military aviation contracts were felt to be extremely important by the German government (and were thus guaranteed, in a way), the growing aviation industry was largely

shielded from an economic recession in 1911-1914 that hit other industries rather hard. August Euler had opened the first German aircraft factory in 1908, and was followed shortly by other factories such as Albatross, Rumpler, and Aviatik.⁹ Work on airships, meanwhile, continued amidst the development of heavier-than-air craft.¹⁰ By April 1911, the War Ministry was in possession of seven or eight planes, and the total reached nearly 30 aircraft by the end of the year.¹¹

The increase in the number of planes was accompanied by a corresponding need for new pilots. On March 10, 1911 the War Ministry called for "young unmarried Lieutenants" willing to undertake a course in aviation and air reconnaissance.¹² Generally, initial pilot training was provided by the aircraft manufacturer, due to the large number of pilot-trainees, in a kind-of sub-contracting arrangement. The pilots' training, after early 1912, was completed at an organization called the Instruction and Research Institute.¹³ Overall, the larger factories (such as Albatross and Rumpler) were better able to provide adequate training for pilots, and were also typically able to create better planes.¹⁴

In March 1912 the War Ministry decided to acquire 91 more planes by October, though it was becoming apparent that the industry needed more money to produce the kind and quality of planes the army wanted and thought they needed; research could not continue fast enough under the small subsidies given thus far by the government.¹⁵ More aircraft was not the only change for

the growing German air establishment in 1912. In October, a step was taken to organize the existing air units into the basic formation of a German air service when groups of fliers were assigned to each army corps. The General Inspectorate, however, fearing a loss of control over military aviation, refused to allow the creation of a bureau concerned only with aviation.¹⁶ In the same year, the Reichstag passed a bill providing pensions for military aviators and declared that military aviation accidents would henceforth be classed as war casualties.¹⁷ Thus, although a separate agency for aviation was not yet a reality, the overall lot of airmen and aviation was very slowly but surely improving.

Indeed, the lot of aviation would continue improving, and more quickly, after 1912. Between 1912 and 1913, the number of German military planes grew from 139 to 461, while the airplane budget increased from 3,391,250 marks to nearly 16,000,000 marks in the same period.¹⁸ In 1912, a public fund known as the National Aviation Fund was created to help finance aviation. The committee that sponsored the program was made up of various professionals, and by December the group had received over seven million marks, a substantial amount.¹⁹ Some of the fund was used for training programs, and while pilot training continued at a fast pace to keep up with the larger number of new planes, the industry itself was briefly faced with a dilemma. The War Ministry's estimates of its aircraft needs for the next few years (which were unrealistically low) would prove insufficient to

maintain the industry. All the while, the government was encouraging growth in the air industry but was not accompanying the growth with an increase in contracts.²⁰ This resulted in only a few strong new companies, such as Gotha, emerging in the next few years, but surprisingly did not hamper the growth of most of the larger companies.²¹

The establishment of the National Aviation Fund is regarded by many aviation historians as the turning point in pre-World War One German aeronautics, and the turn around in military aviation also fueled the industry, for the government soon realized that new contracts were in order. It was the dependence of the aviation industry on military contracts that managed to shield the businesses through the slump of 1911-1914 mentioned earlier.²² As the rest of Germany tried to pull itself out of the economic gutter it had existed in for three years, the aviation industry began to grow again and continue to produce. Although some suggest that there was not close cooperation between the military and the industry, there can be no question that the German air industry attempted to improve its own position by making every effort to please the military establishment. And, to keep the somewhat uninfluential air companies in line, the military would often pressure and even humiliate owners.²³

Part of the pressure exerted by the army was in pursuit of standardization, not necessarily of manufacturer, but of type, which would result eventually in better aircraft. Generally two standard types were popular in 1914; the Taube, a large plane

with bird-like wings which was nearing obsolescence, and a type called the tractor biplane,²⁴ which had propellers behind the pilot rather than in front of him. Not only was industry starting to make better, more standard planes, but more of them, for by early 1914 the best eight companies could turn out a combined 103-112 planes a month.²⁵ Most of the varieties of German biplanes were equal to or superior to those elsewhere,²⁶ though the German air arm itself was slightly behind the French, but ahead of the British.²⁷ Some hold, however, that the German air arm, while numerically inferior to the French, "possessed many features that were superior to those" of other nations' air corps.²⁸

The difference between the various air powers could perhaps be in part due to the different approaches used by the respective nations. The British preferred to have a single airplane design in mass production in government factories, while the French stressed creativity and had the greatest variety and the least standardized industry. The Germans, as has been seen, relied on private industry like the French, but were trying for more standardization than the French. Each approach has advantages and drawbacks. The French, for example, gained creative designs, but because there were so many different French types supply and repair were nightmares for the French. The British, meanwhile, had a small number of types of aircraft, which enabled the Royal Flying Corps to easily repair and supply the air units. The Germans, attempting a middle ground, eliminated much creativity

but unfortunately were unable to gain the advantages held by the British.²⁹

Figures vary on the number of German airplanes available on the eve of the World War One. It is generally believed that the German military possessed between 218 and 320 planes, which compared favorably with the number available to other major powers.³⁰ Though most everyone assumed, correctly at first, that aircraft would be used mainly for reconnaissance and courier duties, things would change as war wore on, for the destructive capability of the airplane would grow by "leaps and bounds."

There has been considerable debate as to whether or not the German air units were ready for World War One. Numerically, the answer would appear to be prepared, for if the Germans had between 218 and 320 planes, they outnumbered the British by perhaps two-to-one, while the French had around the same number as the Germans. The Russians, who would technically remain in the war only until March 1918, fielded about 200 airplanes.³¹ The German air organization was rather poor, as shall be seen later, though not disastrous. In any event, because the performance of the German air units would prove adequate, it would seem that the German air arm was indeed as prepared as could be expected, considering aviation had never appeared in a war before.

Germany's first air offensive occurred on August 31, 1914, when a single German pilot lobbed several small bombs out of his plane over Paris.³² The German air organization proved so poor that the Inspector of Flying Troops himself had to go to the

front to re-establish control over his air units. Not only did his presence in the field do little to control the units, but the Inspectorate was hampered during his absence. A lack of aviation staff officers may have largely accounted for the sub-par organizational structure of the German air establishment.³³ Changes would not take long, however. The assigning of staff officers to the field units improved organization somewhat, as they served as intermediaries between the Inspectorate and the actual field units. The new staff positions are seen as an "important step" in the ongoing development of German air organization.³⁴

As 1915 came and went, considerable reorganization of air units occurred. New units devoted to reconnaissance were created, as well as new, separate bomber units. New training facilities were opened, as were several new airfields,³⁵ and a new committee was formed to inspect and accept new aircraft from the air industry.

The industry had, of course, experienced change as result of war. During a meeting between top business officials and several Reichstag members, the companies agreed to keep the prices of planes at pre-war levels and to allow the military free use of some lesser patents. The military, in return, promised ample contracts and several other concessions. These promises did not hold, however; soon, Albatross, LVG, and Rumpler, all important aviation companies, asked for price increases. These increases were sought just as the army had received several shipments of

nearly unacceptable airplanes, which did not help the firms' case.³⁷ Finally, in February 1915, the army agreed that prices needed to be raised, and did so. The army knew that the result of prices that did not keep up with supply costs would spell lower standards.³⁸ Lower standards would not help the development of several new models of aircraft that were just over the horizon in early 1915.

In mid-1915, it was discovered that the Germans had produced a version of a huge Russian plane which had been captured. The new airplane was called an "R-plane." Conceived of as a "long-range strategic weapon for attacking objectives deep within enemy territory,"³⁹ the R-plane was reported to be revolutionizing air warfare. Long before they actually would, the R-plane was believed to be capable of reaching London.⁴⁰ The largest planes to participate in the war, the R-planes were at first assigned to the relatively calm Eastern Front where they could be evaluated.⁴¹ Another large plane was the C-series observation plane which, although very near obsolescence by 1915, came to be one of the first planes armed with fixed machine guns. Anthony Fokker, who had become one of the top designers in the world, produced his E-type fighter for service in the spring of 1915.⁴²

Not only were Fokker's E-series monoplanes superior to their foreign counterparts, but the series included an adaptation of a French invention enabling the plane's machine gun to fire through its propeller. The plane spelled air superiority for the Germans until spring of the following year and made Fokker a legend,

despite the fact that the plane would occasionally shoot off its own propeller.⁴³ The invention changed air warfare and increased the destructive potential of the airplane.

Though in January 1916, the Fokker E-series airplanes "outengined and outpowered" the Allied craft,⁴⁴ as spring turned to summer newer Allied planes managed equality or superiority over Fokker's E-3s. When new Albatross fighters began arriving on German airfields in late August, 1916 the air advantage would shift back to the Germans.⁴⁵ That same month, a new German bomber also made its first appearance. The French War Ministry announced the existence of the Gotha G-4 before it would be encountered in combat, but it was not long before the new two-engined biplane bomber would make its presence felt.⁴⁶

Despite the fact that the aviation industry was manufacturing better planes, 1916 was not an easy year for the businesses. Early in the year a complicated patent battle erupted over patents on armed planes, and the government, which did not want to merely intervene with a wartime decree, nonetheless wanted to be able to bend the rules to suit its own interests.⁴⁷ Even though the number of aircraft companies had grown from 14 in late 1914 to 26 in 1916, the size of the companies had grown, and the monthly deliveries of aircraft had doubled over the last year, the government, faced with what is now considered the beginning of true aerial warfare, feared the worst. In an attempt to quickly win the war, the government "decreed total mobilization" of all industry, a plan known as the

"Hindenburg Program." Though the details of the program are not of note here, the program has been criticized as uncoordinated and unrealistic, and caused a near-exhaustion in German industry.⁴⁸

While the aviation manufacturers went through proverbial "ups-and-downs," the organization of the German air corps was to experience some changes as well. On August 10, 1916 the first official fighter squadron was formed; before this date, single-seat fighters had not had separate, permanent units. Called "Jagdstaffel," these units at first were made up of elite pilots only, and seven of these special groups had been assembled by October.⁴⁹ In addition, a new school was set up to train better pilots.⁵⁰ Numerous other reorganizations occurred as well.⁵¹

The year was also noteworthy because of perhaps the heaviest fighting of the war. During the Battle of Verdun, large concentrations of German planes helped the ground troops and also established air superiority behind enemy lines until the French air units forced the Germans into a defensive position. The Battle of the Somme saw an outnumbered German air force embarrassed as newer and better Allied craft harassed aging Fokker and Pfalz (another large company) E-planes.⁵²

The advantage of having the superior planes would shift once again in late 1916/early 1917. The new Albatross fighters, the D-1 and D-2, made up about 67% of the front-line fighters by early 1917, and a D-3, while faulty, emerged and became an important addition to the air corps.⁵³ And these fighters were

not the only German aircraft to prove themselves in 1917, for the Gotha bombers and R-planes began bombing London in mid-year,⁵⁴ by which time the German air force was functioning at full strength, approximately 2,200 aircraft.⁵⁵

The Allies began to recover the edge until late 1917, when the next line of better German planes were produced. The Albatross D-5 would prove dangerous to the pilot and inferior to the Pfalz D-3, introduced six months later. Fokker triplane fighters, with three wings, would be endorsed by Manfred von Richthofen, Germany's greatest war ace, despite structural problems that could not be resolved. These Fokker Dr-1s' superior maneuverability largely compensated for the construction drawbacks, however.⁵² Hugo Junkers, a noted German designer, had been working with all-metal designs for a few years, and his J-1 entered service late in the year. Heavy and slow, the all-metal craft was able to absorb considerable damage, but was an only partially successful model.⁵⁷

During 1917 the aviation industry, and also the whole industrial structure of Germany, was hampered by skyrocketing raw material costs and wage demands. The shortage of raw materials was complicated by several factory accidents and numerous instances of hoarding of materials by companies.⁵⁸ Perhaps, as many have speculated, the various "all-or-nothing" programs had taxed the German industries too much.

The ever-changing set-up of the German air units fared little better than the industry did. In 1917 and 1918, the

organization was plagued by "administrative confusion and inefficiency."⁵⁹ The declaration of war by the United States did nothing but complicate matters for the already declining Germans. Several more elite units were formed, one headed by Richthofen himself, and though these units recorded more victories than did regular units, a lack of quality leadership prevented the formation of a large number of such groups.⁶⁰ In fact, Richtofen and the number two German ace, Werner Voss, both died in early 1918, subtracting two of the greatest influences on aviators of both sides.

The final year of war held little optimism for the German air establishment. Even though superior planes continued to emerge from German factories, the Allies gained a greater and greater numerical supremacy. One of the new models, the Fokker D-7, was and is still generally regarded as the best fighter of the war and was never bested by the Allies. The Fokker D-7 was the only plane to be specifically mentioned by name in the peace treaty that ended the war.⁶¹ During early 1918, the German air arm was at its strongest, but to no avail. The German air industry was faced with insurmountable shortages and labor unrest, and few positive signs for the future. Thus, although German technical skill proved equal to that of their enemies, the lack of material and other factors doomed the air establishment. German planes shot down more planes than they lost up until the end of hostilities, but vastly superior numbers of Allied aircraft proved invincible.⁶² War ended on November 11, 1918 with

the German air arm consisting of over 2,700 planes while the Allies had perhaps ten times as many.⁶³ The Commanding General of the German air units, when issuing his demobilization order, said "Undefeated, the German Air Force complies with the armistice."⁶⁴ If nothing else, World War One clearly displayed Germany's economic disabilities, for by the end the populace was nearly starving, the industries were ragged, and important resources were scarce.⁶⁵

After the air force was demobilized, some pilots were transferred to the newly-formed Reichswehr, or national Army, and to police air units,⁶⁶ but these units were also forbidden when the Treaty of Versailles was signed in June 1919.

The Treaty of Versailles said that the vanquished Germans could not maintain any sort of aviation. Not only was the German military forbidden to use any planes, but there could be no aeronautical research, design, manufacture, or importation of any part of any stage of aviation. The Germans were, however, allowed to keep 140 planes and 169 aircraft engines for commercial use. On July 1, 1920 the Germans could begin rebuilding their aviation industry.⁶⁷ The next twenty years would show that aviation had proved its value in war, as the Germans began reconstructing their air corps into a body unlike any other.

The "very harshness" of the Versailles Peace Treaty "proved a spur to German politicians, soldiers, and industrialists, who proceeded with deliberate care to evade its provisions,"⁶⁸ and the

first phase of German rearmament, actually called "disarmament" and lasting from 1918-1920, consisted of the hiding away of certain key industrial resources. Even though this action of hiding resources was militarily insignificant, politically and organizationally it signaled a cooperation between politicians, military men, and industrialists that would shape the future course of rearmament.⁶⁹ The next period of general rearmament (including air rebuilding) lasted from 1920-1926, and was characterized by arms evasion under the direct eyes of an Inter-Allied Control Commission, sent in to supervise German disarmament.⁷⁰ The Commission was not particularly adept, and for this reason it is of interest.

Anthony Fokker, the airplane designer, had set up a new factory in his native Holland, and was able to sneak huge amounts of equipment and money out of Germany past the Commission. Although Fokker's direct work for the Germans would be negligible in the years to come, the Dutch factory proved to be a haven for Germans with aviation skills. A young ex-pilot named Hermann Goring, former commander of the famed Richthofen Squadron, was employed as a salesman by Fokker.⁷¹ It was General Hans von Seeckt, the Commander-in-Chief of the Reichswehr, however, who demanded the formation of a liaison committee of Germans to "help" comply with the Commissions inspections and orders. The officer in charge of the liaison group was a staunch opponent of the oppressive peace treaty and proved a hindrance to the Allies' efforts.⁷²

Von Seeckt also was convinced that air power would be a key in any future war, and to facilitate the interest in aviation, a new organizational nucleus of a German air force was created which consisted of four different offices. From the Versailles-allowed Defense Ministry and the new offices (which existed primarily on paper) would spring later aeronautical organizations in Germany.⁷³ Von Seeckt was also committed to maintaining a reserve of pilots, and knew that the air industry could not be allowed to vanish; in the wake of post-war inflation, only a few aviation companies had survived, including Junkers, Heinkel, Albatross, and Dornier.⁷⁴

As has been seen, from 1920-1926 the Germans attempted covert rearmament while still under the moderately watchful eye of the Inter-Allied Commission, whose ineptitude has also been briefly hinted at. Because von Seeckt realized that his troops' imaginary wargames would be quite inadequate combat preparation, the Germans began looking elsewhere for training grounds, and before long would find them. Russia and Germany signed a commercial agreement on May 6, 1921, and concluded the Treaty of Rapallo a year later, establishing official economic and diplomatic relations between the two nations. Meanwhile, word of the new air departments in the German Defense Ministry had leaked out.⁷⁵

Contained in the Treaty of Rapallo was a secret military passage in which the Russians agreed to provide land for airfields where the Germans could covertly train pilots and

crews, in exchange for a sharing of any technical information garnered by the Germans.⁷⁶ Hugo Junkers acquired a subsidy from the German government to establish a cooperative factory near Moscow, which opened in late 1924, producing reconnaissance planes for the backward Russian Air Force. The Junkers Moscow venture had a considerably checkered existence, however; before long, the factory faced bankruptcy as Russian purchases fell far below expectations. The venture would close in 1927.⁷⁷

The training facilities established in Soviet territory would fare better than Junkers' commercial attempt. A flying school was opened at Lipetsk, about 300 miles south of Moscow, and became fully operational around 1925. Fifty Fokker D-13 fighters made up the original training fleet, which also included planes used for bombing practice and air photography work.⁷⁸ Though the Rapallo Treaty, largely responsible for these Russo-German developments, may have cost the Germans some of the west's confidence, the secret provisions of the pact laid the foundation for a re-developed German air force.⁷⁹ Strangely, the plans of Germany to work in Russia were not unknown,⁸⁰ but were dismissed largely as rumor.⁸¹ This would not be the last time Allied powers disregarded intelligence reports about a growing air force in Germany.

The establishment of German training fields in Russia was not the only aviation development between 1920-1926. Junkers had started making civilian passenger planes, which were allowed after the early 1920s. As a result of Junkers' financial blow in

Russia, Junkers had to turn over the airline he was creating to the German government. The government then had a fledgling bomber training organization, perfectly legal, which would train pilots on bomber-type aircraft.⁸² In 1924, a sport flying group was formed, where sporting planes which met the Versailles limitations were flown. This hobby group, known as the Sport Fliers Limited, as well as other such outfits, were secretly subsidized by the German treasury.⁸³ Not only would these hobby clubs perpetuate the interest and popularity of aviation, but they would also provide the first practical training of many later military aviators. And, all of these efforts were either legal, as in the case of the Sport Fliers (not counting the secret subsidies), or hidden from the muddled Inter-Allied Commission, who, supposedly, were "satisfied that Germany (was) living up to the Versailles Treaty provisions."⁸⁴

The year 1926 would see new developments on the German aviation scene. Despite reports abroad that Germany was secretly building illegal planes in other countries,⁸⁵ the Allies were negotiating with the Germans for a lessening of the Versailles restrictions. In May 1926, the Paris Air Agreement was signed, which essentially gave Germany independence in civil aviation and allowed her to build aircraft that were similar to the current types available in other countries. There was, of course, no provision allowing Germany military aviation, which was still strictly prohibited.⁸⁶ Some historians suggest, however, that the withdrawal of civil limitations by the Allies helped lay the

foundation for the German Air Force. After all, such planes as the "Heinkel 111, Junkers 52, Dornier 18, Junkers 90, Junkers 86, and the Focke Wulf 200," all of which would become important Luftwaffe craft, were all originally classified as civilian planes.⁸⁷ Other planes began to be developed under the new sporting plane freedom as well, including designer Willy Messerschmitt's Bf-108, a sleek monoplane that would be the direct forerunner of the Bf-109, Germany's "workhorse" fighter early in World War Two.⁸⁸ These planes, however, would not actually appear until the mid-1930s.

The Inter-Allied Military Control Commission began to withdraw from Germany in 1926, and by January 1927 they were mostly out of the country. In their final report, the Commission concluded that not only had Germany never disarmed, but "had never had the intention of disarming, and for seven years had done everything in her power to" trick the Commission. This final report, however, was largely ignored and suppressed. The withdrawal of the Commission did not mean that Germany could begin berserkly rearming, but rather that "design, testing, and training" could proceed under slightly less cover.⁸⁹ A new phase of German rearmament was ushered in, characterized still by covert rearmament, but without the "watchful" eye of the Commission. This new phase of rearmament would last until 1935.

Though von Seeckt had been forcibly retired in 1926, reorganization of the air establishment continued. The Training Inspectorate was divided into several sections, and these new

divisions became a cover for further development of an air force.⁹⁰ The training program itself was also revamped; 60 men would be selected annually to take a flying course with a year of beginning training in Germany and six months of flying in Russia. Of these new pilots, the best would be maintained as instructors, while the others would become either reservists or would continue flying training.⁹¹ Between 1925-1933, the base at Lipetsk produced 120 fighter pilots and 100 observers,⁹² and also provided the testing ground for many important prototypes. The Russians, who were benefitting from any knowledge acquired at the cooperative air bases, were interested in and were often allowed to fly the German test models. Between 1928 and 1932, military prototypes of the Arado Ar-64 and Ar-65, the Heinkel Hd-38, He-45, and He-46, and the Junkers K-47 all flew at Lipetsk as did the Dornier Do-11.⁹³

While the whole state of aviation in Germany was changing due to the training facilities in Russia as well as the exit of the Inter-Allied Commission, the air industry was experiencing its own changes. The Reichswehr, from 1924-1928, had contracted for prototypes, usually purchasing only one plane from a small number of firms. In 1928, military aviation specifications were set by the Reichswehr, who invited plans and cost estimates to be submitted. The German aviation industry in 1929 was made up of eight plane and four engine plants, and the growing need for test models pleased the business owners even though up until 1929 all of the construction had been prototypes.⁹⁴ As always, however,

things did not stay "rosy" and what had been a promising outlook for the industry was marred by an economic slump in 1930 which affected all of the business community.⁹⁵

Despite "retarded progress" of the air industry and an overall lack of capital, the German air establishment remained undaunted and predicted that their companies would expand again later in the year. As 1930 wore on, however, capital was not forthcoming, and by the end of the year the economy was struggling with a major banking crisis.⁹⁶ In addition, as this crisis was hitting, the German government decided to ignore another Versailles restriction when they authorized the stockpiling of military materials, including aviation equipment. The Ordnance Office, in charge of military supplies, argued that stockpiling was necessary in case Germany were to go to war; the office estimated that the air force would lose 50% of unit strength per month in combat, thus showing a true need for stockpiling in peacetime.⁹⁷

By 1930 and 1931, the Germans had begun curtailing the activities of and funding for the Lipetsk training facility, as the money was needed in other parts of aviation. The Russians were incensed, and demanded that the Germans not only keep the base open, but also pay rent for the land. The Germans refused, and the base was closed in 1933. The closing of the base is not generally regarded as a militarily sound move, but one that was precipitated by political and economic pressures.⁹⁸

Problems abounded elsewhere as well. The air industry,

though working as it could, was essentially inadequate for nearly any large-scale rearmament production, and an optimistic prediction in around 1930 said that perhaps Germany could produce 9000 planes over the next several years.⁹⁹ Undoubtedly, some of these new planes would include the Heinkel He-51, Arado Ar-65, and the Do-11, which were all undergoing their final tests in 1932-1933. With the production of some of the aforementioned types, Germany was finally once again in possession of planes that were at least as good as corresponding models abroad.¹⁰⁰ German designers were also working on heavy, four-engined bombers, which proved to be a continually haunting spectre for the German air force after the early 1930s.

Between 1920 and 1933, the Reichswehr had done all it could to ensure the existence of some sort of air force. A new year, 1933, would arrive and see all manner of aviation changes, technical and otherwise. Adolf Hitler was picked to be Chancellor of Germany, and a new episode in German air rearmament was ushered in. A newspaper report of early 1933 was an indication of things to come when it stated that Germany would outspend France in aviation equipment in 1933.¹⁰¹

Organizational changes occurred soon after Hitler's assumption of power. In April, an Air Ministry was created and Hermann Goring chosen as its Minister. Goring had been a Nazi for years, and Erhard Milch, the head of Lufthansa, the German state airline, was selected as Secretary of State for Air. Walther Wever became the air force Chief of Operations while

Albert Kesselring became the Supply and Organization officer. The Luftwaffe, as the German air force would come to be called, now had a new set up, and was also beginning to develop new ideas.¹⁰²

In April 1933, Goring spoke on the matter of German aviation, pointing out the "vulnerability of the chief industrial districts of the Reich" and added that "a people imbued by iron will to exist as a nation will also be able successfully to defy danger from the air."¹⁰³ Indeed, the Nazis would plan on defying danger from the air and learn to rain danger from the sky, through larger scale rearmament of their air establishment. The following year, the He-51, He-45, He-46, Ar-66, and Focke Wulf Fw-44 entered production, while the Ju-52 was already being produced for Lufthansa. The Junkers Ju-86 and Heinkel He-111 were in their early experimental stages and were envisioned as bombers.¹⁰⁴ It was also about this time that Germany began experimenting with dive bombing planes. Milch added new contracts to stimulate the air industry and also helped subsidize new factories. Heinkel, Dornier, Junkers, Arado, and Messerschmitt's factories all expanded in 1933, and other enterprises, such as the Henschel Locomotive Works, branched out into aviation, encouraged by Milch's blossoming programs.¹⁰⁵

Interestingly, it was during this period that the aircraft industry gained the experience which enabled Germany to actually succeed in building a large air force. Factories were built with newer facilities and more modern tools, which in turn speeded up

the production time for aircraft.¹⁰⁶ Although Germany as a whole had only partially recovered from the recent depression, Milch's plans for expansion in 1933-1934 would be adequate to begin strengthening the aviation sphere.¹⁰⁷

Overall monthly aircraft production in Germany rose from 30 in 1933 to about 425 by 1936. These increases, as well as increases in other areas of rearmament, did not at first seriously tax the German industries.¹⁰⁸ The aviation increase can partially be attributed to Milch's ambitious "Rhineland Program," a plan to equip Germany's air force which was to be finished in September 1935. The scheme called for around 4,000 airplanes, consisting of roughly equal numbers of trainers and regular planes, to be delivered within a year. The exact figures vary somewhat, according to source, however.¹⁰⁹ This new and surprising undertaking did not pass uncovered by the media, who declared that "Germany's air rearmament will be completed by 1936" despite what was still considered rearming "in secret."¹¹⁰

While this planning for the future was underway Germany was creating and equipping her first new air units. By the end of 1934, 270 bombers, 99 fighters, and 303 reconnaissance planes had been organized into squadrons,¹¹¹ and thus the first actual, solid base for the Luftwaffe was laid.

Though problems still existed in the German aviation industry, such as engine production difficulties,¹¹² the gains made by the air industry were undeniably impressive. The gains in monthly production, noted above, were attributed to the new

expansion plan, but without a growing industry the plan would have been impossible. An increase in aviation plant employment was also behind the gain; between January 1933 and January 1935, total employment in the aviation plants leapt from barely 4,000 to an astonishing 53,865. The value of produced goods in aviation plants also climbed, from about 59 billion Reichsmarks in 1933 to nearly 240 billion in 1934.¹¹³ Clearly, the basis of German aviation was becoming increasingly solid. Nineteen Hundred and Thirty-Five would see a most amazing development, as yet another phase of German rearmament would come to a close when in March Goring officially announced the existence of the Luftwaffe to the world.

On March 10, 1935, Goring told a newspaper reporter that he intended to "create a Luftwaffe which, if the hour should strike, shall burst upon the foe like a chorus of revenge," but also that the Luftwaffe was to be an "extension of our national defenses." Goring also added that his "guiding line" was not "the creation of an aggressive force . . . but merely (one) strong enough to repel . . . attacks on Germany."¹¹⁴ Thus, Goring made the existence of the Luftwaffe public, and although it was still illegal, Goring stressed that the force was to be strictly defensive in nature. Only several days earlier, Hitler had signed a decree stating that the Luftwaffe was a separate and equal branch of the military; Goring's press encounter had been merely to publicly confirm the decision.¹¹⁵

Others also confirmed the defensive posture of the new

German air force. Erhard Milch, Secretary of State for Air, testified at the post-war trials that starting in 1935, a defensive air force began to be built up. Milch also provided an insight into the direction which the Luftwaffe would take, saying that the Luftwaffe was not designed for a long aggressive war, but rather as a force of fighters and a few bombers, just enough of a force to prevent any of Germany's neighbors from attacking her.¹¹⁶ Milch testified that his impression of Goring was that the latter was against war, and Goring, in his newspaper interview, said that the German air force "will never be employed to threaten the peace of other nations."¹¹⁷

Some foreigners also saw the German air arm as designed for peace. Arthur Robinson, a former United States Senator, observed some German aviation factories and concluded that, despite an obvious concentration on armaments, the Germans did not want anything but peace.

It is important to briefly consider the direction and mission of the embryonic Luftwaffe. Perhaps the view held by historians of the Luftwaffe being envisioned as a body for ground support of troops is not correct. While the goal of ground support is an important one, and was most assuredly the primary goal of the Soviet Air Force, Walther Wever, the first Luftwaffe Chief of Staff, advocated an approach which said that "the nature of the enemy . . . the character of his people. . . as well as one's own military capabilities" would dictate how air power was used.¹¹⁹ So, it would seem that, overall, the Luftwaffe was

originally designed as a flexible force, capable of meeting many challenges. In any event Goring, later in the year, personified the feeling amongst the Luftwaffe when he spoke:

" . . . a symbol of forward storming spirits, of passionate energy which rules us all for this instrument, which was broken for us at one time, which was denied to us, because it was known with what spirit we would fill it. But we have allowed it to rise again today, so that a strong air force could protect the Reich once more."¹²⁰

The Rhineland Program had been largely completed by 1935, and the Luftwaffe had grown to a supposed size of about 48 squadrons by August.¹²¹ The size of the Luftwaffe continued to grow through 1935 and 1936, though as always figures vary as to just how big the air force was. The monthly production of aircraft rose from about 265 in 1935 to 426 in 1936,¹²² while the actual front line combat strength of the Luftwaffe ranged from only 400 planes in early 1935 to around 1,000 by 1936.¹²³ Later in 1936, the Luftwaffe could boast of 1,833 airplanes.¹²⁴

During 1935 and 1936, the aircraft industry was growing quickly as well, spurred on by multiplication of air contracts. Foreigners marvelled at the new aviation plants being built, while groups such as the British Air Ministry and the British Foreign Office argued over how quickly they thought the German industry could build up a huge force.¹²⁵ British intelligence overall, however, was relatively poor at this time, and consistently overrated the German air establishment's numbers and industrial capacity. Often, even if some correct information was obtained, both English and French Intelligence succumbed to

"political considerations" and rarely suggested any action.¹²⁶

The two years before 1937 saw the German economy in somewhat of an unsteady position. On one hand, brilliant ideas such as the "Mefo Bill" sprang up as a way to help pay for rearmament. The Mefo Bill, essentially, was an "I.O.U.," issued to those who loaned money or industrial capacity to the government, and was backed up by the German treasury. Through this and similar programs, the Nazis practiced "deficit spending" to finance the build up of their armed forces. And, though it has often been assumed that the German economy (and air industry) was taxed by the rearmament programs, this was apparently not the case. By 1937, for example, the whole industrial picture was so favorable that both the consumption of consumer goods and government spending on non-war materials "equalled or exceeded previous peak levels."¹²⁷ The depression, of course, had an effect on these previous peak levels. While the economy had these pleasing items in their corner, a battle was raging between the economic planners and the governmental officials such as Hitler and Goring about the future of the economy and its relation to rearmament plans.¹²⁸

Irrespective of the battle for control of the economy that was occurring, the aviation industry was responding to air rearmament plans formulated by the Air Ministry. The first post-Rhineland Program production plan was named, logically, Production Plan No. 1. The plan combined a small part of the Rhineland Program which had not been completed with a new

schedule and called for over 11,000 aircraft to be built by late 1936. This plan was modified three times during 1936, eventually requiring that older models be produced to fill immediate equipment needs.¹²⁹ These changes and difficulties should not suggest, however, that unsatisfactory planes made up Germany's forces; most of the planes produced after 1932 were at least as good as comparable models in other nations.¹³⁰ In fact, many of the early models of the eventually important craft were developed in this time span.

Perhaps the most well-known German plane of World War II was the notable "Stuka" Ju-87 designed by the Junkers works. The whistling dive bomber had won favor in 1935 during dive-bomber-contract competitions. Charles Lindbergh, the famed American aviator, happened to witness the competition and Ernst Heinkel, who had a plane in the tourney, remarked that Lindbergh "knew more about the Luftwaffe than anyone in the world." While the Hs-123 was the current dive bomber in the German air force, the Ju-87 would begin replacing it by 1938. Dive bombing, however, had its early skeptics, including Wolfram von Richthofen, a relative of the World War One ace, who ironically would become an excellent dive bomber pilot during the war.¹³¹ Other newer planes were crossing the production horizon as well. The He-51 was the main fighter of the Luftwaffe before the war, when it would be replaced by the Bf(Me)-109, despite early complaints about the Bf-109s poor banking abilities and heavy wings. The Bf-109 was also criticized for its lack of range when the first models

arrived in air units in 1937. Regardless of its disadvantages, some of which be improved upon in later versions, the Bf-109 would prove a formidable fighter in combat.¹³²

The short range of the Bf-109 required that a sturdier, longer-range fighter be developed. To answer this problem, Messerschmitt, who had created the Bf-109, built the Bf-110. Although the plane would become a good night fighter and bomber interceptor, the sluggish craft was too slow to be an effective long-range bomber escort. The Bf-110 would begin service in mid-1938.¹³³

Many new bombers were in varying stages of design or production, but these will be dealt with later. At this juncture, it is perhaps as good a time as any to briefly examine the top level Luftwaffe organization and the personalities of the men who occupied the positions.

Hermann Goring, who became the Commander-in-Chief of the Luftwaffe after 1935 (before that he was simply "Air Minister"), was at the top of the Luftwaffe hierarchy, though subject, of course, to Hitler's orders and whims. Goring's personality was a mixture of good and bad qualities; on one hand, Goring was ambitious, talented, and even at times soft-hearted and caring,¹³⁴ but he was also seen as temperamental, greedy for recognition, and unethical. It is perhaps his failure to take a stand against the more immoral of Nazi policies that was his greatest fault, however.¹³⁵ Walther Wever was Goring's first Chief of Staff and served until his accidental death late in 1935. Wever is seen as

a catalyst that held the Luftwaffe leaders together and prevented in-fighting, and also as a competent leader. Because he died early, Wever's role in the Luftwaffe was limited.¹³⁶ Some of the activities of the State Secretary of Aviation, Erhard Milch, have been glanced at already. Milch was a competent and energetic deputy for Goring, though prone to being overly sensitive and easily influenced by personal impulses.¹³⁷

Until 1941, Ernst Udet was the Chief Supply Officer of the Luftwaffe. Though he seemed to be the "most cheerfully serene" Luftwaffe leader, Milch was also the first to lose complete faith in the chances for victory in war and committed suicide. Udet, while a man of talent, lacked the firmness needed to keep a strong grip on the aviation production aspects of supply and lacked the self-esteem for such a position.¹³⁸ Finally, the next permanent Luftwaffe Chief of Staff was Hans Jeschonnek, who took the office in 1939. Jeschonnek was bright, alert, and quite loyal to Hitler and while hard-working, Jeschonnek was prone to depression. In 1943, Jeschonnek too committed suicide. While there were other figures with an influence on the Luftwaffe, such as Albert Kesselring, an interim Chief of Staff, and the Minister of Armaments, Albert Speer, the aforementioned leaders would shape the Luftwaffe from start to finish.

The end of the Luftwaffe as a "defensive force" came perhaps in 1937. Up until 1937, said Kesselring, there was no offensive air force and the bombers being built were inadequate.¹⁴⁰ From 1937 on, however, the Luftwaffe would engage in prestidigitation,

making its growing force seem larger and more formidable than it actually was. Concrete plans were still being formulated for actual growth through the year, however.

Production Plan no. 4, which was to be effective from October 1936 to March 1938, would prove hard for the aircraft industry. Previously calling for mass production of the newer types late in the period, the plan was altered by the Luftwaffe command so that these better models were to go into production sooner than was reasonable. To modernize the Luftwaffe, Goring changed the plan more, increasing the number of Bf-109s and Do-17s (a new bomber). Firms were instructed to concentrate on production, except for Junkers, Heinkel, and the BFW factory, who were to also work on development and trouble-shooting in current models. Plan 4 was scrapped, however, and Production Plan no. 5 was issued, covering April 1937 to October 1938. While the overall production under the new plan was to be higher than in no.4, the average monthly production was expected to be lower than previously because of the anticipated problems in introducing the newer types. In September, Production Plan 6 would replace Plan 5.¹⁴¹

The reasons for the constant changes in production schedules were many, though several rise to the surface of importance. Throughout the 1930s, there was a worsening material shortage in Germany, as the country was relatively resource-poor. More importantly, however, was the existence of an aviation industry slump which began in 1937, spurred on by several factors. This

period of industrial stagnation, which would last for two years, would leave the Luftwaffe largely unprepared for war.¹⁴² The instability of aviation production in 1937-1938 was in turn worsened by the raw material difficulties. Though outside the scope of this work, the material troubles included oil production, an achilles heel for the Germans throughout the 1930s and 1940s, and steel production. The Rubber industry was one of the few deemed adequate for Germany's needs.¹⁴³ The industrial slump and raw material shortages would both continue.

As a result of the production stall, cutbacks had to be made, and one of the victims of the cutback was the heavy (or "four-engined") bomber program. Although Milch would later testify that it was primarily due to the prohibitive cost of four-engined heavy bombers that the program was discontinued,¹⁴⁴ the four engined bomber had for several years been the object of controversy in Germany. After 1933, the Luftwaffe had sought to develop a heavy bomber and Wever, who would later be Chief of Staff, became an advocate of "strategic" bombing.¹⁴⁵ By 1936, two designs were ready; the Junkers Ju-89 and Dornier's Do-19. Both of these planes, though relatively underpowered with weak engines, were more than adequate as a starting point for further development. Even though the thought of having heavy bombers was at first supported, Goring, in 1937, stopped experimentation and development of the Ju-89 and Do-19, having succumbed to arguments that the models and the concept behind them was overrated and that some other current planes would serve just as well.¹⁴⁶ Soon

after this, however, the Luftwaffe General Staff would once again call for a heavy bomber.

The Ju-88 was one of the aircraft that was to help alleviate the need for a four-engined bomber. Although the Ju-88 would prove to be the most versatile German aircraft of the Second World War, it could only pretend to be a long-range, heavy bomber due to its short range and light bomb load.¹⁴⁷ The Ju-86 was also to be used, though obsolete, erratic, and probably easy prey for enemy fighters. In addition to the preceding craft, the He-111, nearly obsolete by wartime, had a smaller bomb load than even the Ju-88 but was counted on to be effective.¹⁴⁸ In response to the air force's later demand for heavy bombers, Heinkel developed the He-177, an aircraft with considerable potential whose career was ruined by a foolhardy Luftwaffe requirement that it be able to dive bomb. Though the insistence that the He-177 be capable of dive bombing was eventually dropped, many crews and test pilots were lost.¹⁴⁹

Although the "bottom line" was that the German air force staff was essentially unsure of the need for a long-range, heavy bomber, the fault for not having one in wartime cannot all be their own. Overall, technical miscalculations were of great fault, though it was the staff that committed most of them. The assumption that the medium bombers could "do the job" was a foolish one, but a lack of technical advancement is also to blame for the trouble. Goring later said that he did not want to build four-engined bombers because the necessary technical and

production conditions did not exist, and he was partially correct.¹⁵⁰ Kesselring noted the lack of range and bomb capacity of the existing bombers,¹⁵¹ but the lack of more powerful engines, another of the difficulties, can hardly be blamed entirely on the Luftwaffe staff. In addition, the Germans lacked a bomb-sight accurate enough for decent "level-bombing."

Another problem facing the German heavy bomber program was the lack of material resources. Since aluminum was scarce, and many more fighters or smaller bombers could be built with the same amount of metal it took to construct large bombers, heavy bombers became a victim of raw material shortage.¹⁵² Regardless of any other factor, even if the Luftwaffe had possessed four-engined bombers, they did not have fighters with enough range to escort the bombers. The Me-110, the standard long-range fighter, was an easy target for Allied fighters and would have been of little help, while the Me-109's lack of range has already been discussed.

While the bomber controversy was ending in 1937, the aircraft industry continued working on other designs. The Henschel Hs-126 was ordered as a short-range recon plane, and the company also began work on the effective Hs-129. Despite the fact that few of the Hs-129s were produced, the plane was a factor on the Eastern Front during war. The Arado Ar-96 was on the drawing table by 1937 and would become the Luftwaffe's standard advanced trainer.¹⁵³ As is obvious, the air industry was by no means dormant during the bomber controversy.

Nearly as important to the overall development of the German air force as the cancellation of heavy bomber work was the escalation in 1937 of the Spanish Civil War. In 1937, German intervention in the conflict would increase greatly. The Spanish Civil War provided a chance to portray the might of Germany's armed forces, and in 1936 Ju-52s began ferrying General Francisco Franco's troops from Africa to Spain. The Condor Legion, as the German contingent was known, originally possessed only a small number of planes,¹⁵⁴ but later the numbers increased. Because the overall conflict is described elsewhere, less detail is needed here. Originally, He-51s and Ju-52s were the main components of the Condor Group, both of which the later models of Russian I-15 fighters could almost catch. Before long, however, the first Bf-109s, Do-17s, and He-111s were shipped to Spain, which irrevocably turned the tide (which had shifted back and forth since the start) to the Germans' favor. The arrival of Soviet I-16 fighters managed to earn the respect of Bf-109 pilots and stem the tide somewhat. Some Ju-87s saw action in Spain as well.¹⁵⁵

Of much more interest here than specific engagements in the Civil War is the experience gained by the Condor Legion by the end of hostilities in 1939. Valuable combat experience was gained by the German pilots and maintenance experience by the crews. Seeming to reinforce the General Staff's decision to delete heavy bombers was the success of planes used in close ground support and dive bombing, which tended only to reinforce an already tactical mindset. The few strategic operations undertaken by

bombers were misleading and mixed in result. Some strategic bombing attacks were successful, as the "new and fast He-111" could actually outrun the enemy fighters.¹⁵⁶ But the lesson that fast medium bombers could outrun fighters and "lay waste" would be a faulty one, and a costly misconception later.¹⁵⁷ The war also helped point out some problems with the Hs-123 early dive bomber and the Ju-86 bomber.¹⁵⁸

An expansion of the aviation industry was to occur in 1938, as was the multiplication of problems. Even though by 1938 most of the major aviation manufacturers had back-up plants, production did not reach expected levels; the production plan which was in effect on April 1, 1938 called for 1,377 planes to be delivered per month, while, for comparison, only about 500 were delivered in June. Throughout 1938, under Production Plans 6, 7, and part of 8, the Luftwaffe expected 4,129, 3,971, or 3,710 combat planes respectively. The industry managed 3,350 combat types in 1938. As time went on, however, the "position of actual output worsened faster and by a greater margin" in relation to expected production, mainly because of the continued introduction of newer styles of planes.¹⁶⁰ Meanwhile, the British Intelligence establishment was unable to acquire reliable figures on German strength and airplane production, though the industry was stagnating and planning was beginning to suffer.¹⁶¹ In late 1938, Germany revealed that its air strength was only 3,000 aircraft, a figure much lower than foreign intelligence had suggested.¹⁶²

Part of the reason that foreign intelligence was surprised in 1938 at the relatively small number of German planes was that visitors to Germany had reported otherwise. The most notable visitor to pre-war Germany for the purpose of aviation inspection was Charles Lindbergh, the famous aviator, who visited several times, viewing factories and German aircraft. The He-111, Ju-86, Ju-87, as well as the Me-109 were all seen by Lindbergh, who noted the potential of the Bf/Me-109 fighter and who also saw a prototype of the Me-110. Although Lindbergh's technical estimations of German craft were correct, his approximation of total air strength was rather high.¹⁶³ And though Lindbergh overestimated the numbers and strength of the Luftwaffe, his visits did manage to turn the eyes of the world towards Germany more than before. Other figures and politicians would visit Germany in the late 1930s, most returning with a much stronger picture of Germany than actually existed.¹⁶⁴

The year before war erupted was not a favorable one for new development of planes, as planning had deteriorated as had research. The disastrous Me-210, viewed as a replacement for the Me-110, was slated to enter production despite having failed every prototype test. The Me-210 was considered a "death machine" by its test pilots.¹⁶⁵ The call for He-177s went out in 1938 as well, though still as a dive bomber, and the continued production of the Me-110 was an undesirable yet necessary event.¹⁶⁶ Work on jet powered and rocket engined planes was on the horizon.

By the end of 1938, German air strength stood at about 2,847 (of which 1,669 were ready for combat), a figure which is fairly standard across sources.¹⁶⁷ While numerically superior at the time to most potential enemy's air force, the German air force was "far from the awesome dealer in death and destruction that . . . enemies feared" mainly because of the comparatively low reliability of some of the German models.¹⁶⁸

Politically, perhaps, 1938 was of greater import than any year since the end of the First World War. Germany occupied Austria and the Sudetenland in 1938, and at the infamous Munich Conference Hitler essentially received permission to do so. It seemed obvious to all that Hitler did not want war, and with the cession of certain territories to Germany the threat of war would diminish.¹⁶⁹ The Luftwaffe's part in the occupations was largely ceremonial and designed to boost morale.¹⁷⁰ Nonetheless, the Luftwaffe would be changed in late 1938 and early 1939, for shortly after the Munich meeting, Hitler and Goring announced another huge rearmament project.

In October 1938, Hitler demanded a five-fold increase in the Luftwaffe. Mainly in response to the possibility of a two front war, the plan emphasized long range bombers and escorts that could strike the English.¹⁷¹ Unfortunately, the expected increase could not be realistically completed until 1944-1946, and the fuel supply needed for such a force would be unattainable.¹⁷² In addition, the air industry was still struggling, and had delivered only 4,800 of its planned 9,800 by late 1938. Thus,

the plan was revised nearly continually until war erupted in September 1939.¹⁷³

The industry problems did not cease, however, but were intensified by supply shortages and so on. Plan number 8 from early 1939 specified that 7,095 combat planes were to be constructed that year, but by February Plan no. 11 had superceded it and called instead for 6,357 combat aircraft during the year. Plan 11 was to run until April 1942 and would result in a total of 15,470 being delivered. These plans were still too ambitious, and observers noted that perhaps the industry was saturated.¹⁷⁴

The theories about Germany's aviation industrial problems are many, some of which have already been extrapolated upon and include such hypotheses as material shortages and developmental difficulties. Perhaps the industry was just not capable, as suggested above, of keeping up with the gigantic requests from the government. A large part of the blame must rest on Goring, Hitler and the Luftwaffe General Staff, however, whose constant alteration of plans and changes in mind-set prohibited the air industry from concentrating on steady production. The conflict of views on the role of the air force was a stumbling block to the planning of production, while the time needed to build a decent aviation industry was prohibitive to the building of an overnight air force.¹⁷⁵

Political conflicts spilled over into economic circles, hampering the effectiveness of build-ups for war. Hitler, after making his five-fold demand, failed even to follow up on his

order for the new plan. Most of the poor planning and partial lack of technical expertise were not actually Hitler's fault, however.¹⁷⁶ It was increasingly clear that the Nazis were not particularly effective in planning economies or industries and had to fall back, as can be deduced from the preceding incidents, on improvisation.¹⁷⁷ Thus, though the Nazis can be credited with inventiveness and making do with what they had on hand in dealing with the aviation problems, improvisation can hardly be considered a viable solution to the complex and ongoing anxieties facing the German air force in the late 1930s. It is true, nonetheless, that the whole situation was an "amazing achievement of organization to have attained such efficiency under the existing limitations" as Kesselring would later offer.¹⁷⁸

Several new types of aircraft were set to emerge in 1939, despite the meddling of Goring and others in the industry. The Focke-Wulf corporation began work on the Fw-190, which later in the war would become the best German fighter. The He-177 prototype finally flew somewhat successfully in 1939, as did the Hs-129 prototype. Work began on the first jet in 1939, as Messerschmitt started designing and testing what would become the Me-162 "Komet." Finally, Messerschmitt also flew his first Me-210 late in the year, a plane which has already been cited as an ill-fated model.¹⁷⁹

Figures on late 1939 German air strength tend to vary, though mostly due to interpretation. Kesselring, the important and influential Luftwaffe figure, estimated that there were 3,000

aircraft on the eve of the Polish campaign in September, while Werner Baumbach, a bomber general, guessed there were about 4,333 airplanes available to the Germans at that time.¹⁸⁰ Other sources' numbers range from 3,958 to 3,646 to 2,000.¹⁸¹ When Germany attacked Poland, however, only part of the above totals would square off against Poland's archaic air force, which consisted of about 396 mouldering planes. Obviously, the Luftwaffe would have no difficulty attaining and maintaining air superiority over the skies of Poland.¹⁸² The Luftwaffe, though, was to play primarily a ground support role in Germany's invasion of Poland, but the question arises as to whether or not the German air force was prepared for war. Despite the problems and difficulties, can the Luftwaffe be considered to have been ready for the war that erupted in 1939?

Almost to a man, sources suggest that, in fact, the Luftwaffe was not ready for a conflict of the type that began. A Luftwaffe official, Bodenschatz, testified at Nuremburg that the Luftwaffe, in terms of leaders, training, and materials, was not ready for war in 1939. Milch, at the same trial, agreed, saying much the same, though Baumbach skirted the issue, commenting that "The German air leaders . . . were convinced of the . . . superiority" of the Luftwaffe and by wondering how, despite the problems, how the Allies could have beaten Germany.¹⁸³ Most sources, authoritative or amateurish, concur that the German air establishment was ill-prepared for World War Two.¹⁸⁴ The question, not to be answered here unfortunately, remains,

however, of how ready were Germany's enemies?

Though the Polish campaign can hardly be considered much of a challenge for the Luftwaffe and the Germans, it showed that the Luftwaffe and the other Germany military arms could strike quickly and with some efficiency, and also showed that this new war was not to resemble the last one. The spring of 1940 would contain much more of an obstacle for the Luftwaffe in the form of the French, who had promised the Poles to go to war with Germany if Poland was attacked. The Germans estimated that the French Air Force consisted of about 2,500 front-line aircraft, though only about 30% of these could be considered "modern."¹⁸⁵ While some have suggested that it was the French Air Force's weakness that led to France's downfall, this belief can largely be refuted. Granted, the French air force failed to protect France's ground troops from the air, but it was the Luftwaffe's ability to prepare the way for the German armored divisions and also to guard the German's precariously long and exposed supply lines that proved vital.¹⁸⁶ Following the Battle for France, the Germans could rest and turn their attention to an island nation north of conquered France; Britain.

The first major failure of the Luftwaffe during World War Two was in allowing a large British retreat from Dunkirk to succeed. Goring had insisted that the air force be permitted to dispense with British Army, which was at Dunkirk, but failed to do so. Poor weather was largely at fault for the failure, though the blame must still lie with Goring because of his insistence in

dealing with the Allied force. Soon, England would be attacked by the Luftwaffe in what would become known as The Battle of Britain.

In late 1940, German air strength available for an attack on Britain stood at around 700-800 bombers, 343 dive bombers, 230 manned twin-engined fighters, and 760 single engined fighters. According to the same source, Britain mustered perhaps 960 aircraft, mostly fighters. By September 1940, the British would have only 665 airplanes in combat against a total German contingent of nearly 1,600 aircraft.¹⁸⁷

Unfortunately, the details and heroics of the pilots of both sides are beyond the horizon of this text. Winston Churchill said on August 20, 1940 that "Never in the field of human conflict was so much owed by so many to so few," and his statement is a relatively accurate summation of the conflict over Britain.¹⁸⁸ The results of the conflict and reasons for the results are almost universally agreed upon. The lack of a heavy bomber, which has been noted before, stopped the Germans from seriously threatening British industry, and the British industry was able then to increase their air production to twice that per month of the Luftwaffe, while the ineffectiveness of the Me-110 proved that German foresight, planning, and strategy had largely failed. The element of surprise, which the Germans had counted on, was lost because of excellent British radar, giving the Royal Air Force pilots time to get airborne, where they usually faced Me-109s being wasted as bomber escorts; this misuse of Germany's

premiere fighter was another serious mistake, though there really was no alternative since the Me-110 proved easy prey for British fighters. Finally, the Luftwaffe was not able to establish a single goal and stay with it, for not only was Goring constantly switching objectives, but Hitler was already diverting force to prepare for his attack on Russia. And, despite all these events, the Luftwaffe learned no "lessons" after the Battle of Britain tailed off in early 1941.¹⁸⁹

During the Battle, both sides suffered heavy losses in what was to be the only major specifically air campaign of the war. Although the figures for Luftwaffe losses were inflated by the British and lowered by the German home front reports, the Germans lost about 1,408 combat planes between July and September 1940.¹⁹⁰ The British lost approximately 915 fighters through late 1940. It should be noted, however, that the British Royal Air Force losses were much less devastating than the German casualties for, since the combat occurred over Britain, if a British plane went down, its crew could often survive and return to duty. If a Luftwaffe craft was shot down, even if the planes managed to crash-land and the crew survive, it was most likely in England and thus the crew and plane would be lost for the rest of the war.¹⁹¹ A major conflict ended in early 1941 when the Battle was called off by the Germans, although Luftwaffe planes would continue to hound R.A.F. craft in the sky over Britain until war's end. Things would not be the same, however; the Luftwaffe had been humbled to an extent, and refused to learn from their

mistakes.

Later in 1941, the Germans were confident and the aggravation of the Battle of Britain had faded. An early conquest of Crete, in which the Luftwaffe played a key role, succeeded but at great cost and with little long-term significance.¹⁹² Industry though 1941 still attempted to expand and shake off the stagnation of the last few years, and had begun to create the framework for a full mobilization of the economy.¹⁹³ In late 1941 deliveries of the Fw-190, destined to become Germany's best fighter of the war, began. The Fw-190 was by far the most advanced fighter of any nation at the time of its introduction, and was capable of speeds up to 426 mph. While the Fw-190's range was better than the Me-109's, it was still insufficient for long-range bomber escorting, however.¹⁹⁴ A most fateful decision was made by Hitler in 1941 as well; the order to invade Russia. The attack, late in the year, would signal an irrevocable turning point in the war which had actually been going fairly well thus far for the Germans.

The German air battles with the Soviets have been briefly surveyed elsewhere, but it is important to note that most of the Luftwaffe staff was opposed to the attack on Russia. The German air force was faced with a renewed strike on Britain, probable United States entry in the war, and increased air demands in the Mediterranean, and while the Army was in the same situations, their organization allowed much more rotation of forces between combat and much less stressful assignments.¹⁹⁵ In addition, the

lack of strategically capable bombers continued to plague the Germans during the Russian campaign as the absence of such craft had during the British air war. Perhaps most foolish is the fact that the Germans had a full year to plan for Operation "Barbarossa," but made no serious attempts at altering their organization or adding strategic planes. And, the downed Russian air crews, as with the British, were often able to return to the skies later. Finally, Germany should have committed herself to knocking out Russian industries whose strength would later provide an enormous amount of planes and tanks for use against Germany.¹⁹⁶ Operation Barbarossa would last well into the war, but was never particularly successful for the Germans after their original victories. In 1941, the German front-line airplane strength was about 3,340, while in mid-1942 a peak of 4,800 planes was reached. By the end of 1942, the Luftwaffe had only 3,950 front-line planes. Though this number may not seem high, most of the nearly 4,000 Luftwaffe planes could (and should) have been focused on the Eastern Front and Mediterranean, which they were not; many were still in western Europe, which was only just becoming a major front again.¹⁹⁷ The seemingly low number of planes should not suggest an aching industry, for overall production of aircraft rose over 82% from 1940 to 1942,¹⁹⁸ and output managed to cover losses through 1943.

In 1942 the Germans were also to experience heavy bombing attacks on their homeland for the first time. The German fighters were able by 1943 to inflict considerable casualties on

the well-armed and armored American bombers which had appeared on the scene, but the tables soon turned on the Luftwaffe, and as the year wore on the threat to Germany herself was so great that Hitler gave priority to the home air front. Throughout this period the Me-109 was slowly becoming outdated, but a replacement better than the Fw-190 was not to be found. Most other types, such as the Do-217 and Me-110, were by 1943 to appear only at night.

Slowly but surely, Germany's plight was worsening as the Allied vise closed on her. The Luftwaffe was now numerically inferior and thus could hardly stem the advance of the Allied air units on all fronts. With ground support responsibilities, German fighters were not always available to slow the intrusion of enemy bombers over Germany. Most agree that Germany's last hope, and one that was squandered, was the opportunity to utilize the jet.

The first mistake (and the most costly) of the Germans in regard to jet aviation was in not allocating more resources for their development and then pushing production. The jet prototype designed by Messerschmitt flew in 1942, but was not designated for series production until late 1943. As if this was not late enough, Hitler then insisted, later violently, that the Me-262 jet fighter be produced as a "super-speed bomber." The next year, the Fuhrer was furious when he discovered that his orders were largely being disregarded.

Due to Hitler's meddling, only 564 Me-262s were built by the

end of 1944, and later demands by Hitler to have more produced came much too late. The existence of a sizable jet fighter force of Me-262s would have lessened the severity of 1944 and 1945 Allied bombing attacks, and might have turned the tide of the air war back to the Germans' favor.²⁰⁰ The existence of other models does not serve to clarify the picture, either. The Arado Ar-234, for instance, was specifically designed as a jet bomber and was near readiness when Hitler demanded that the Me-262 become a bomber. Not only was the Ar-234 capable of speeds up to 460 mph (faster than virtually all other aircraft), it had a range of over 1,000 miles and a bomb load of over 4,000 lbs. On the other hand, the He-162 "Salamander" jet probably would not have amounted to much, as it was a last gasp attempt and did not see much, if any, action. The Me-163 may have proved valuable if many had not exploded due to its dangerous rocket fuel.²⁰¹ But, these types did not spill forth in adequate numbers to alter the course of war, and must therefore go down with the long range bomber as an irritating "what if?" in the Luftwaffe's war exploits.

Although the success of Allied bombing of Germany can be disputed, there is no question that it was costly to both sides. The Germans were faced with increasing damage to industrial sites and cities while the Allies suffered staggering losses of planes and personnel until late 1944-early 1945. After 1944, the Allies had long-range fighters that could escort the bombers and thereby cut down losses. The Germans responded by moving and

decentralizing their industry, with the result that German production reached its highest output in 1944. Soon, however, the Allies had established complete air superiority over Germany.²⁰² As 1945 arrived and ticked by, the Luftwaffe began to send everything it had left against the advancing opposition. At the Battle for Remagen Bridge, for example, an unusual combination emerged, with the old and new combining; Ju-87 Stukas, obsolete, hopelessly outclassed by the most mediocre Allied fighters, and not having been employed during the day for five years, took to the sky with the sun alongside the favorable new jet aircraft. Too many factors, lack of fuel, pilots, and the concentration of enemy air power among them, sealed the Luftwaffe's fate.²⁰³

After early 1945, the Luftwaffe emitted little more than an occasional sputter. Though having an on-paper strength of about 5,000 planes, only around 1,500 of these were relatively first-line.²⁰⁴ Speer and others in Germany tried to prepare for defeat by maintaining production of basic items and by seeing that food was distributed. Hitler committed suicide in April 1945 while Berlin was surrounded by the Russians and as German cities were beginning to surrender. The remnants of the once-proud Luftwaffe lay mainly abandoned on German airfields. While the dignity of the former Luftwaffe leaders would never decline, there was now, unlike at the end of World War One, no doubt. This time, there would be no announcement reading "Undefeated, the German Air Force complies with the armistice."

CHAPTER III

THE BRITISH AIR FORCE

The Royal Air Force in 1918 was the strongest air corps in the world and was the standard by which all other air groups were measured. Despite this position of power, the British government did not give a full commitment to the Royal Air Force and by the 1930s the force had deteriorated into a second-rate, obsolescent air wing. Thus, because of financial concerns, a lack of a clear future vision, and an absence of much proof that aircraft could be truly destructive, the British air force had to struggle when it began to rebuild in the mid-1930s. Only due to a moderately successful rearmament plan, intervention by the United States, and perseverance was Great Britain able to present herself for the air war in the Second World War.

Aeronautical experiments began in Britain at an early date, though in 1909 the British government actually ordered that all work on airplanes had to cease because of expense. Later, the ban would be lifted, resulting in the formation of the Air Battalion of the Royal Engineers in 1911 as the first squadron of British military aircraft. Consisting of a few pilots and some battered planes, the group's lifespan was very short and the air battalion was disbanded after a humorous and unsuccessful attempt at air maneuvers.¹

Between 1912 and 1914, few planes were actually constructed

in Great Britain and even talented air pioneers such as T.O.M. Sopwith and A.V. Roe were set back by the scarcity of government contracts. The air interests in other nations were being served little better, but the British began receiving "grim" warnings about the growth of German militarism.² Though military aviation would become divided into two groups for most of World War One, a unified Flying Corps was created in 1912 and given 308,000 to begin operations.³ Practically from the start, however, two groups within the whole emerged. The Army section, which would before long be known as the Royal Flying Corps, would become concerned with air support for the British Expeditionary Force in France during the early part of World War One, while the Naval air arm, called the Royal Naval Air Service by 1914, embarked on bombing runs, zeppelin base attacks, and, of course, sinking ships.⁴ Thus, each arm developed primarily as a result of their individual service's requirements. Unfortunately, Britain's newly-born aviation industry was not yet able to meet the aircraft demands of both services, and the resulting competition for support strained an already tenuous relationship between the two.⁵

The First World War broke out amidst some hysteria in England over possible Zeppelin attacks on English cities. Winston Churchill, then the Minister of the Admiralty, feared that "at any moment half a dozen Zeppelins might arrive to bomb London. . ." though he admitted later that he did not consider aerial attack that much of a concern.⁶ The British air units

began the war with about 179 airplanes between the two aviation wings, and 63 planes accompanied the relatively small British Expeditionary Force when it left for France. The R.N.A.S. was given most of the responsibility for the air defense of Britain proper.⁷ Most of the airplanes in service with the Royal Flying Corps were barely adequate types such as the Be-2c bomber and several early French models.⁸

The early operations on the Western Front by the British air units proved disappointing, but the air services were slated for a large expansion in 1915 following the replacement of air chief Sir David Henderson by Colonel Hugh Trenchard.⁹ Trenchard's appointment came at a crucial time, for new German models that were much better than any Allied planes were appearing on the front.¹⁰

Fortunately, Britain's aviation industry was finally gearing up for full-scale war production by 1915-1916, and the production of aircraft in Britain increased from only 211 in 1914 to over 6,000 in 1916.¹¹ Even by 1915, however, neither bombing attacks or the infrequent air-to-air attacks were particularly effective; between March 1 and June 20, 1915, 483 attacks by British planes dropped 4,062 bombs with negligible results. Machine guns were not yet effectively mountable on the front of aircraft, as the slight craft could usually not carry the extra weight.¹² Thus, due to small numbers of planes and because of the primitive equipment, the air force did not play a very important role through late 1915.

German Fokker planes ruled the skies into late 1916, by which time a new generation of Allied fighters entered battle. The DeHavilland D.H.-2 was a pusher biplane, so called because the propeller, located behind the pilot's compartment actually "pushed" the plane. The D.H.-2 was also the first British single-seat fighter. The Sopwith Pup, the most popular British fighter of the war, was specifically designed to combat the newest German airplanes.¹³ With the addition of new types the Royal Flying Corps grew in size and effectiveness. British air units participated in both of the major battles of 1916, the Somme and Verdun, with some success. By the Battle of the Somme, the British and their Allies could claim a large measure of air superiority,¹⁴ though during the Verdun campaign things had not been quite as easy.

Conflicts between the two air divisions had been going on throughout the war, and the formation of a Joint War Air Committee to solve their differences did little, as it failed due to its lack of authority to coordinate the activities of the two air wings. Though the Joint War Air Committee is viewed as a step in the right direction towards coordination, the R.F.C. and R.N.A.S. could not agree on several key points, such as who should participate in long-range bombing.¹⁵ Between May and December 1916, an air board was established under Lord Curzon to examine many of the major issues of argument between the air branches.

Curzon's air board had no official executive powers and no

policy-determining powers, and a case could be made that the board served only to heighten controversy.¹⁶ However, Curzon acted as a catalyst to later change, and in fact the President of the air board was able to improve aircraft supply, coordinate air support for troops, and incorporate aircraft production under the Munitions Ministry. In the long run, Curzon's air board proved to be the predecessor of the Air Ministry.¹⁷

The victories at the Battles of the Somme and Verdun gave the British a false sense of superiority,¹⁸ for when the German Imperial Air Force re-emerged, the re-organized and improved force was once again a worthy foe for the British. Losses in the R.F.C. increased, with a subsequent lowering in pilot quality as pilots had to be replaced more quickly than previously and also a decrease in strategic bombing attempts.¹⁹ With the influx of new planes into the German ranks were new Albatross fighters which would usher in an early period of 1917 known as "Bloody April." For the first few months of 1917, the Allies were largely at the mercy of their foe's air forces (for the last time).²⁰ An air board set up in late 1916 had dragged its feet rather than offer any solutions to the debates between the two groups of British aviation, but public outcry in late 1917 would push the government into hastier action.

In May 1917, huge German Gotha bombers started attacking south-east England. The British home defense squadrons, designed to deal with Zeppelins, proved ineffective in fighting off the attackers. The public was outraged, especially after a series of

June and July raids that killed or injured over 800 civilians in London; a raid on June 13 alone killed over 150 people. Parliament verbally lashed the sub-par defense network, and it was in this period of late summer that Londoners became accustomed to seeking refuge in the tubes of the Underground. The Gotha raids continued, though largely at night, until early 1918.²¹ As is often the case, a perceived crisis prompted action on the government's part and following the first Gotha raid the British appointed Jan Christian Smuts, a South African diplomat and soldier, to examine and report on the state of British aviation. Without a doubt, the report produced by Smuts was the most valuable result of the summer of 1917 German bomber attacks on England.

Smuts' report, completed by August 1917, recommended that a new air defense group be created around London, the necessity of which was not in doubt.²² The report, however, also advocated a separate and independent air force, a suggestion that caused considerable controversy. Though the idea of a separate air corps was not a new one, opponents argued that the creation of a segregated air force would only be the product of Gotha-induced hysteria.²³ The establishment of an Air Ministry to accompany the new air force was also recommended, and this idea had many supporters, including Churchill. Interestingly, Smuts also prophesied that air power would one day be the main form of warfare.²⁴ Critics argue that the unification of the R.N.A.S. and R.F.C. was unnecessary, and there is some truth to this

assertion. Had an air board with sufficient authority over both air arms been created previously, many of the areas of conflict could have been cleared up without the extra action of unification. In any event, Smuts' report was approved in principle a week after it was submitted.²⁵ Though the Royal Air Force would not actually come into being until the next year, it was born on paper in late 1917.²⁶

Meanwhile, another shift in air superiority had occurred in 1917 and, once and for all, the Allied air forces would achieve dominance over Germany's air corps. The D.H.-9 entered service after the Gotha raids in an attempts to improve British bomber squadrons. Britain's fighter groups also benefitted from new types, as the S.G.-5a and the famous Sopwith Camel were delivered to squadrons in 1917. The S.E.-5a was an easier plane to fly and actually faster than the Camel, but the new Sopwith was highly maneuverable and superior to any German fighter. The Sopwith Camel is perhaps best remembered as being the plane used to finally bring down Baron von Richthofen, the infamous German ace known as the "Red Baron."²⁷

The next year, on April 1, the Air Force Constitution Act officially combined the two air wings into the Royal Air Force.²⁸ Until the end of the war, however, the army continued to exert considerable influence on the actions of the air units and both the Army and Navy found it hard to separate the new organization from its old service allegiances.²⁹ Despite numerous personnel troubles the new Royal Air Force survived early turmoil, but when

the war ended a huge military demobilization occurred. The air force that had totalled nearly 23,000 aircraft at war's end was reduced to a fifth of its previous size.³⁰ Outstanding contracts were cancelled, huge amounts of equipment simply destroyed, and only a few of the pilots offered peace time commissions. Unlike the other two military services, the Royal Air Force had no established peace time role to fill. This fact, combined with the lack of any concrete future plans, was to haunt the R.A.F. through the next decade.³¹

During the 1920s and 1930s, the R.A.F.'s activities can be divided into three phases; a "battle for survival" lasting from 1918 to 1923, a "stabilizing" period from 1923 to roughly 1934, and a rearmament phase from 1934 until 1939. The first phase, the fight for survival, saw the Air Ministry bombarded with attacks on its sovereignty by the press, parliament, and the cabinet, while the first and part of the second period included the R.A.F. employed in a peace time police role in various parts of the globe.³²

Confidence in the air fleet increased in 1921 when eleven fighter planes helped put an end to the 34 year reign of the "Mad Mullah," the native ruler of Somaliland who had been a thorn-in-the-side of British authorities.³³ The following year the R.A.F. was sent to Iraq, where they proved so successful that control of Palestine, Trans-Jordan, and the Aden Protectorate passed to the Air Ministry in the next several years, a move which provoked some debate.³⁴ Despite these successes in foreign lands, the

Royal Air Force was in poor shape overall. In 1932 the United Kingdom itself had only 24 first line aircraft, and by the next year only sixteen of these remained in service. In addition, the R.A.F. squadrons in India, which were supposed to provide key support to the British Army, were condemned by Air Marshal Sir John Salmond, who was sent to examine the force but returned with a "damning" report stating that the air units in India were useless. Within another year, the entire Royal Air Force division in India would be grounded for a lack of spare parts.³⁵

The fact that the air force should be the first line of defense was becoming evident to British politicians, however. In August 1922, an expansion plan of 23 new squadrons was accepted, and although the anticipated result of 158 aircraft could hardly be expected to withstand an attack by 300 bombers and 300 fighters (which it was created to do), the plan was an ancestor of the system which would eventually save Britain in the early years of World War Two.³⁶ As suggested, however, this new expansion plan was inadequate; the French in 1923 could boast of an air force of over 3,000 planes although they had no separate air ministry.³⁷ The British began to feel threatened by the large air force that existed across the channel in France. While most agree that the fears of Englishmen that French bombers would level British towns were ridiculous,³⁸ the expansion program was increased to provide for 52 squadrons rather than 23.³⁹

During the interwar years, there was little direct government funding for new aircraft construction. However, if

the nucleus of an industry was not maintained, there would be trouble in the event of a war. To maintain an industrial base in aviation, the Air Ministry decided to "establish a 'ring' or family of firms which would get special treatment from the Air Ministry." Besides supporting a small group of aircraft manufacturers, the Ministry was able to contribute money to the ongoing development of better airplane engines.⁴⁰

In 1925-1926, the air budget increased by 652,000 from the year before, but this increase did not signal a turn around in R.A.F. strength. Because of several factors, the Air Ministry postponed the expansion to 52 squadrons late in 1925, and as a result only six squadrons materialized over the next three years.⁴¹ In 1928, only 495 planes were built in Britain, with only a few of these going to form new squadrons.⁴² Between 1926 and 1932, however, a total of eleven new squadrons were created, and by the spring of 1932 the R.A.F. was just ten short of the full 52 squadrons planned by the early 1920s expansion program. In spite of this growth in aircraft, the British air fleet, which had once been the best in the world, had slipped to fifth behind France, Italy, the United States, and Russia.⁴³

The R.A.F. of the 1920s was an interesting mix of a very few new models and many older planes. While new bombers such as the Vickers Virginia, Fairey 111F, and the Hawker Horsley made up much of the bomber force, there were still many D.H.-9s of World War One vintage in service. The fighter forces were of more modern date, consisting of Bristol fighters and Gloster

Gamecocks.⁴⁴ Generally speaking, though, even these types were only barely adequate themselves, and the unfavorable status of Britain's air corps would help determine British policy in the years to come.

By 1932, it became advantageous for the British to seek a disarming agreement with the major powers. The British, with a sub-par army, an aging navy, and a tiny, obsolescent air force, had much to gain from such an agreement, while a country such as France (with nearly twice as many airplanes as Britain) stood very little to gain by disarming. An important consideration towards disarmament was the "removal of the fears by reason of which so many countries . . . submit to the financial and economic burdens" that come with large armaments.⁴⁵ In the February 1932 London Conference on disarmament the focus was mainly on military matters, with the British pushing for disarmament. Germany withdrew from the meeting when she was denied military equality and even though the conference dragged on into the following year, it was obvious that no plans for reduction would bear fruit.⁴⁶ Thus, the prospect of full-scale rearmament as a reaction to the ever-solidifying specter of the German military loomed on Britain's horizon.

According to some, the existence of a strong air corps "opened the prospect of long-term peace" because "air power would be too appalling . . . as a means of enforcing policy."⁴⁷ During the week of June 16, 1934, Britain stated that if no other nations would consider curtailing the growth of their air forces,

the British would be forced to double the size of the R.A.F. and expand its personnel. To justify this anticipated expansion, the British cited both "the wide-spread belief that Germany . . . has secretly been piling up air armaments" and the growing discrepancy between the United States' air programs and the Royal Air Force's pursuits.⁴⁸ A month later, the government announced the first of several official agenda of the 1930s designed to rebuild a powerful air force in Britain.

Scheme "A" was initiated in July 1934, and the plan consisted of a 20 million expenditure over the next five years for aviation. Scheme "A" would result in a force of 1,252 first-line aircraft by early 1939, a realistic expectation if all went well, though hardly providing an adequate force in comparison to those elsewhere.⁴⁹ Of these 1,252 craft that would be built, 500 bombers and 336 fighters would be employed in Home Defense squadrons. The plan, however, failed to provide for an adequate reserve force and many of the planes ordered were obsolescent models. Scheme "A" did manage to lay the groundwork for a decent training organization.⁵⁰ Nonetheless, Scheme "A" was never put into action because it was viewed as a faulty plan; it had become obvious that Scheme "A" would prove inadequate. A Scheme "B" was scrapped, and on May 1, 1935 the Air Ministry announced plans for what would become Scheme "C." The new program was presented to Parliament on the 22nd of May, and the plan called for Britain to spend an extra \$25,000,000 in 1935 to "keep abreast of Germany in military aviation."⁵¹

Although it was eventually discarded like Schemes "A" and "B," Scheme "C" provided for 1,512 aircraft by March 31, 1937, a notable increase in number of planes and a "great acceleration" in production time.⁵² Eight hundred and sixteen of the 1,512 planes were to be bombers, with a higher proportion of medium and light bombers than before. Unfortunately, like the first attempts, Scheme "C" did not provide for an acceptable reserve force.⁵³ Therefore, the scheme had hardly been proofread when further needs of the R.A.F warranted the rejection of Scheme "C."

The early plans for air expansion had many weaknesses. The fighter force was not expanded proportionally to the bomber force, but the threat of air invasion by the Germans (which was emerging by 1935) necessitated more new fighters. More important was the fact that many of the new bomber squadrons were to be composed of light bombers which would be of little use in any attacks on Germany. The light bombers were much cheaper, however, and thus more squadrons could be created. In addition, no decent medium or heavy bomber was in production by the British air industry at the time. The extra bombers, however, meant that more crews could be trained and also that these planes could one day make up a reserve force.⁵⁴ The British air corps had relatively few models to pick from in the early 1930s.

The fighters to be constructed under Scheme "C" were slated to be the Gloster Gauntlet and the Gloster Gladiator, which was still in the prototype stage. The Hawker Aircraft company took over the Gloster company in 1934, and one of their first products

would be the Hawker Hind light bomber. The Bristol Bulldog, already in service, was the most-widely used Royal Air Force fighter until 1936 and served alongside the Hawker Hart, an aging model of which the Hind was a variant.⁵⁵ In late 1935, several new bombers were in the experimental stage, although both the Handley-Page Heyford and the Fairey Hendon were obsolete almost immediately after they were delivered. The Avro Anson, another bomber, would provide valuable, steadfast service as a training craft later during World War Two. High hopes for the Heyford, Hendon, and the Anson were expressed in October, and it was assumed that these types would replace the old Vickers Virginia bomber.⁵⁶ The new bombers, as well as the newer fighters, were surely taken into account when a new plan for expansion, Scheme "F," came into being.

It is interesting to note the frantic and panicky nature of the first several expansion plans. Scheme "A" was a failure and was criticized mainly because there lacked a "clear long-dated policy which would have permitted careful and detailed planning."⁵⁷ Although less haphazard, Scheme "C" was even more frantic than the previous plans, due to the increase in production and decrease in the time allowed for the expansion. During Scheme "C," the purchase of 3,800 new aircraft had been authorized, but all of these "new" craft were to be obsolete types which could be built quickly and easily.⁵⁸ But even though the early steps to air rearmament failed, Scheme "F" would succeed to a certain degree, putting R.A.F. policy closer to

solid ground. The new program was "designed not to increase the number of squadrons, but to improve offensive power."⁵⁹

For the same reasons that the previous schemes had failed, Scheme "F" would prove successful. Most importantly, the Scheme called for an increase in spending for reserve purposes, allowing for a reserve force of 225% of the size of first line squadrons. The plan also considerably strengthened the air force, as the obsolescent Hawker Hinds and Harts were to be eliminated in favor of medium and heavy bombers such as the pristine-new Whitley and Wellington models, and also the recently produced Bristol Blenheim and Fairey Battle.⁵⁹ In addition, badly needed fighter squadrons were added. Some assert that Scheme "F" was the first "operational rather than political" air rearmament plan.⁶⁰ There is no doubt that Scheme "F" was the most workable and reasonable plan to date, and soon after the new program was accepted by the government, a reorganization of the Royal Air Force was enacted with the hope that Britain's air fleet would be better prepared for a possible war.

On June 18, 1936, the Air Ministry unveiled their plans to restructure the air force. The new arrangement was to consist of Bomber Command, Fighter Command, Coastal Command, and a Training Command. Each of these new wings of the R.A.F. had a separate Commander-in-Chief who answered to the Air Ministry, and each division had its own goals and responsibilities.⁶¹ Bomber Command's policies upheld the belief that the primary role of an air force should be offensive and strategic, not defensive, while

Fighter Command's goal was solely to "attack the enemy wherever he can be found within fighter reach."⁶² The Coastal Command was extremely important, for the group was responsible for defending the British coast, protecting Allied shipping, and flying marine reconnaissance missions. The Coastal Command also coordinated missions with the Royal Navy's Fleet Air Arm. The area that Coastal Command had jurisdiction over enlarged steadily after war broke out in 1939.⁶³ The last major command, Training Command, assumed virtually all responsibilities concerning training.

The creation of these commands did several positive things. Obviously, it compartmentalized and organized the Royal Air Force more efficiently. The reorganization improved communications within and between divisions and streamlined the communication structure between the lowest levels of the air force and the Air Ministry. The organization, duties, and equipment of all the commands became more complex as the war began, and the restructuring may have been made the extra work easier. There were to be some disadvantages as well. The compartmentalization of types often prohibited missions from having full effect, partly due to the fact that the bombers were not yet quite capable of performing what was to be their expected goals. Finally, the pre-World War Two fighters were not armed heavily enough to shoot down enemy bombers. Thus, the segregation of types would for a while prove to be a mistake.⁶⁴

That same year also saw the entry into production of two fighter planes that would be instrumental to British survival

during the early years of World War Two. Sir Hugh Dowding, who was Fighter Command's leader, was a staunch advocate of the new "Spitfire" fighter, as was Lord Swinton, the Secretary of State for Air. Though some (including its designer) chaffed at its name, the Spitfire would become the only Allied fighter to stay in continuous production for the entire war. The other plane, the Hawker Hurricane, has been referred to as "one of the world's great fighters," and proved to be a fantastic "workhorse" plane for the British. The Hurricane was capable of 316 mph, while the Spitfire could reach 355 mph. The early German Me-109 fighters had speeds of about 350 mph.⁶⁵ Very few of these types would be ready for war in 1939, however, and thus the continued expansion of the air fleet was essential.

Because Hitler had reoccupied the Rhineland territory in the early part of 1936, British rearmament became as frantic as ever. In a move that infuriated the aircraft industry, the Air Ministry announced that the R.A.F. would order some aircraft from Canada and the United States. The British ordered 200 Lockheed Hudsons, airliners that could be converted for use as Coastal Command reconnaissance planes, and 300 other types of aircraft from Boeing. This early import of United States' planes sparked a flood of purchases throughout the next few years as well as during the war. In January 1937, the proposals that became known as Scheme "H" were made. The new plan called for raising the first line strength of the Royal Air Force while weakening the reserves and various overseas units. The air staff itself was

not particularly pleased with the proposal, and thus the Air Ministry rejected it.

Following some first-hand reports by Americans on German air power, the British set out to re-work their programs. Overall, the schemes had not been particularly successful, so Lord Swinton put forth some new arrangements that could improve the trashed Scheme "H." Swinton's proposal suggested improvements in recruiting and training, simply because these were areas that could not be "caught up" once they lagged behind the Germans; while Swinton was very impressed with the Nazi ability to increase their production and programs rapidly on short notice, he knew that while the actual production of aircraft could be hastily increased, it was too risky to shorten training time. Lord Swinton's plans were accepted and several months later he returned with more recommendations, revealing Scheme "J" in late 1937. The Scheme slightly lowered the reserve corps again and raised the number of bombers. Overall, Scheme "J" provided for a force of at least 2,500 airplanes by mid-1939.⁶⁸ Specifically, the number of bomber squadrons would be raised by 20 while the number of fighters would be lowered (though the fighters would be of higher quality because of the new types). A completion date of Spring 1940 was agreed upon, but the Air Ministry "recoiled" from the cost.⁶⁹

The approval of such a plan as Scheme "J" is unusual considering the mind-set of the British at the time. The British feared a "knock out" blow at the hands of German bombers, and the

concern permeated government and society for years. The "knock out" theory stated that England could be emotionally knocked out by a quick, heavy attack by foreign aircraft and would yield before any kind of retaliatory attack could be mounted. The defense against a prospective "knock out" attack was to have enough fighters available to prevent an air "blitzkrieg" (for lack of a better term), but the emphasis of Scheme "J" had been on an offensive bomber force.⁷⁰ Thus, Scheme "J" "flew in the face" of the underlying fear and concern and undermined the "knock out" blow defensive strategy.

Because the cost seemed prohibitive, Scheme "J" was trimmed down, with the same number of fighters being slated for construction but with a slight decrease in planned bomber production. The expenditure was not trimmed enough, however, and what had been termed Scheme "K" was rejected in early 1938. Scheme "L" was submitted shortly thereafter and was basically just a new Scheme "K" with a new completion date and provisions for a larger reserve. The proposal of Scheme "L" undoubtedly brought snickers from every corner; the implementation of the project would have required a huge number of new pilots and aircraft over the next year, and an enormous amount of overall production.⁷¹ Essentially, however, the government authorized the Air Ministry to "order virtually all the aircraft they could get," which they did. Over 4,000 new airplanes were ordered for the next year alone. Unfortunately, Britain faced a bind; while the bomber strength of England would not match the expected

German strength of 1939 by 1940, an increase in bomber production was less valuable at the beginning of a conflict (because fighters were needed to secure initial air superiority) and much more expensive than fighter plane construction. Nonetheless, despite potential financial and industrial problems, Scheme "L" was accepted by the Air Ministry and passed on to the British government.⁷²

Earlier the British had purchased the Lockheed Hudson from overseas, and once again in 1938 the eyes of the Air Ministry turned across the Atlantic, for a fear had suddenly come over the British cabinet that if the R.A.F. could not get help from elsewhere the nation might find herself in a position of "serious inferiority" if war started. Following the German invasion of Austria in March, the British became frantic, and the absence of a heavy bomber in the Royal Air Force was a glaring deficiency. Experts from Great Britain hurried over to the United States to tour various factories, which could produce up to 2,000 planes a year for the British air fleet.⁷³ Britain also looked to Canada for help, hoping to purchase bombers there as well.⁷⁴

The Germans had experienced no penalty when they occupied the Rhineland, and thus in mid-1938 the German government laid claim to a chunk of Czechoslovakia. The British were frantic and set up an appointment with Hitler in Munich. The result of the Munich Conference was the annexation of a large part of Czechoslovakia, given away by the British and French to appease Hitler. The loss of the Czechoslovakian front, where the Germans

had stationed most of their troops, was a serious blow, for the Germans could then shift their attention towards France. In addition, the Czech military was a sizable and decent force. British opinions on the annexation of Czechoslovakia were mixed, but largely negative. Sir Alexander Cadogan, present at the Conference, believed that the British "ought to have reacted against the occupation of the Rhineland," but since they did not, the British could no longer "police Europe . . . or join in crusades where our direct interests are not threatened."⁷⁶ Winston Churchill stated that the British were in the "presence of a disaster of the first magnitude" and refused to believe that the agreement had been a triumph for British diplomacy.⁷⁷ Regardless of opinion, the day of the concession of Czechoslovakia to the Nazis was a dark day for Britain and the world.

In retrospect, it is apparent that the British should have been less willing to recoil from the German threat. France was equipped to defeat a large part of Germany's army with a quick offensive, but the French were resolved not to fight and their army was not prepared to go on the offensive. The feared image of Germany making "mincemeat of Gauntlets, Furys, and Demons" (British fighters) had to be dismissed, because the German fighters did not have the range to reach England.

Conversely, however, Fighter Command was not in the best of shape; a squadron of Spitfires existed, but only a tiny number of pilots had been trained to fly them; several squadrons of Hawker

Hurricanes were available but due to mechanical trouble could not fire their guns above 15,000 feet; the Gloster Gladiator was dependable but not excellent; the Gauntlet was nearing the end of its usefulness; and the Fury II and Demon had passed on into obsolescence. Because the Luftwaffe was concentrated on the Czechoslovakian border, however, the nightmare of Britain's obsolete biplanes being outrun by German bombers would not come to pass. Thus, as long as Czechoslovakia remained in the picture (and Britain was forceful enough to keep her there), a stalemate could have been maintained. Along similar lines, most of the Bomber Command was obsolescent and the Bristol Blenheim, a twin-engined small bomber, was even being used as a fighter.⁷⁹ And even if German aircraft were of a higher quality overall, the huge disparity of numbers, along with the fear of the Germans' ability to deliver the "knock out" blow, was a myth; it is also a "simple fact that no German fighter could have reached Britain from bases in Germany" in 1938, and also a reality that only two types of German bombers had the range to reach Britain.⁸⁰ Regardless, the development of the Munich Conference forced the British to once again assess the needs of not only the R.A.F., but their whole home defense system as well. Numerous changes were made in the layout and organization of the home front defense networks, and the air corps once more received a new plan.

Sir Kingsley Wood, the Secretary of State for Air in 1938, asserted that fighters should indeed be the top priority, and

bombers had to be secondary. Wood also suggested that older types be replaced by newer craft immediately and fully intended to order only a few new types to help standardize the air force. His new plan, Scheme "M," asked for 3,700 fighters and 3,500 heavy bombers eventually, but Wood asked for "immediate authority" to order 1,850 fighters, 1,750 heavy bombers, and 2,400 other airplanes. Because large numbers of Spitfires and Hurricanes were not yet available, however, the Air Ministry was forced to substitute large numbers of Blenheim light bombers. The Blenheim would perform admirably in light of its abilities, but its increased demand was purely a stop-gap measure. Scheme "M" was the last pre-war program, and although it did not immediately have any noticeable effect it provided for increases that would be felt by the Spring of 1942. Unlike previous plans which cancelled preceding Schemes, Scheme "M" did not supercede Scheme "L."⁸¹

As 1939 arrived, war seemed more likely. The Royal Air Force was still far from ready, for only some 660 fighters made up Fighter Command, and virtually all of these were the older types. The R.A.F.'s total strength of around 1,606 planes in early 1939 was about half of Britain's estimate of German strength at the time.⁸² The Royal Air Force was nonetheless held in fairly high regard by some, such as Major George Eliot, who said that "all things considered [Britain's air force] is probably the most formidable air arm in Europe."⁸³ Others did not share Eliot's positive picture of the British air corps, such as

Liddell Hart, a noted historian who observed that none of the bomber squadrons appeared complete, noted how the numbers of bomber crews who had worked together before was small, and also asserted that finding the target while attacking from the air had not been adequately studied.⁸⁴

Much of 1939 was spent merely re-working strategy and tactics for the war that seemed inevitable. Bomber Command had developed strategic plans for the bombing of German power supplies, oil facilities, and key industries. Unfortunately, whether these plans for bombing could be expected to work was unknown. Not only did the pilots of the bombers have no experience in bombing, it was unknown if the bombers themselves could break through the German air defenses. Even if the bombers did get through, they had no idea what parts of the targets to hit and what kind of damage would be done if the targets were struck. Although bombers were currently inadequate and bombing could not initially be expected to accomplish much, Bomber Command had hope that someday bombing would be an important factor in warfare, especially as heavier bombers were in production in Britain.⁸⁵ The same year was also spent waiting, not only to see if war would actually erupt but also for an air industry which had been ordered to increase its production astronomically to fill the desperately needed orders for new airplanes. Thus, to digress and examine economic and industrial matters is of utmost importance, and the timing must be excused.

As stated before, all aspects of Great Britain's military

had been allowed to deteriorate following World War One. Not until 1934 did anyone actually push wholeheartedly for increased air expenditures. Winston Churchill spoke in the House of Commons on February 7, 1934, saying "I cannot conceive how . . . we can delay in . . . having an Air Force at least as strong as that of any power that can get at us."⁸⁶ A month later, Churchill argued for international air equality, stating that "Not only would the danger of our being attacked be greatly decreased, but the character of the attack . . ." would be within "accepted conventions."⁸⁷ Despite the support of Churchill, the rebuilding of the air arm was not going to be economically easy, though. In mid 1934, a 20 million expenditure was approved. The other services continued to be neglected, however.⁸⁸ The following year the production and purchase of 3,000 obsolete aircraft was ordered in an attempt to temporarily bolster the sub-par air establishment.

There was some discussion in 1935 as to whether or not the government would "compel industry to organize for defense production through force of law." Prime Minister Neville Chamberlain had no intention of forcing industry to produce, but he recognized that cooperation was needed. However, because the government and industry worked so closely together, there was serious lag in the time that a contract was approved and the time that it took to produce the contents of the contract, because of the time needed to process the package on both ends. To assure continuity and guarantee a fair distribution of work, however,

the government turned increasingly to non-competitive contracts, as was the norm in the rearming countries.⁸⁹

In 1936, a system of "shadow factories" was established. The shadow factory was a plant that could be shifted over with ease to war production in war time. In peacetime, a factory might not only build automobiles, but also produce airplanes and engines that could be used to provide both reserves and expansion aircraft. During war, the factory would shift to producing only airplanes and engines. There were shadow factories for all types of items, and production of aircraft increased as these factories were put into operation.⁹⁰ The first types of airplanes to be built in the shadow factories were the Fairey Battle and the Blenheim, important early models.⁹¹ Pricing problems emerged, however, and threatened to bring rearmament to a screeching halt. The concerns in pricing of aircraft are somewhat apparent. How could a price be set for planes that had never been produced before? Could the government break off a contract because of expense or obsolescence? Should the government be permitted to view the records of the manufacturers?⁹² These and other questions arose but the government was slow in dealing with them.

The next year would see the first widespread borrowing by the British government as rearmament expenditures began to stagger the Treasury. Parliament approved a 400 million loan which would be spread over a five year period at 80 million a year. Although the sum seemed large Churchill said, "It is necessary to compete with the [large amounts] that have been

spent . . . in Germany."⁹³ Obviously, both Parliament and the Treasury were loath to pass such an increase, but the extra funding was desperately needed. More funding was approved in 1938, and this new funding would be concentrated in the next two years so that Britain would be prepared for war should negotiations falter. Unfortunately, the Treasury had the firm belief that continuing to spend so much on defense would destroy the British economy, thus destroying (obviously) the nation's ability to defend herself.⁹⁴

All the while, production of aircraft had been increasing slowly. While early figures of British airplane production are scarce, from 1938 to 1940 the number of planes built rose from 2,827 to over 15,000. Due to mounting tension between workers, the Air Ministry, and the aviation industry (who claimed that the Ministry was "arbitrary rather than cooperative"), labor organizations came to play an increasingly important role.⁹⁵

A prime example of the troubles that occurred can be found in Scheme "L." As seen earlier, Scheme "L" was a revised "K" that called still called for more bombers mainly because the air staff realized the ineffectiveness of a potential counter-offensive by Bomber Command following a German attack should war break out. The Treasury objected to the new plan because it established contracts longer than twelve months in advance, which was not standard practice, and also because the plan required an increase of 60 million over the Air Ministry's budget. There was fighting back and forth about the plan but it was finally

approved.⁹⁶ It has been suggested that without Scheme "L" Britain would not have survived Germany's initial aerial attacks.⁹⁷ Other battles occurred at every step of practically each new funding dilemma, but the example of Scheme "L" serves to illustrate the whole process. After war started, the Treasury retained very little authority over their purse strings. The defense budget of 1939-1940 included borrowing another 720 million to help cover expenses. The Treasury made what amounted to a final attempt at seriously regulating defense expenditures, but failed.⁹⁸

The problems between industry, Treasury, Parliament and Air Ministry in Britain were unlike those in the totalitarian states who could rule by decree and order production or funding. In fact, even other democratic countries such as the United States faced different concerns. Basically, the British air industry was not capable of meeting the early requests of the air corps, and when the manufacturers were ready, new problems began. The Treasury had to remain concerned about the economy of Great Britain and had to juggle all types of expenditures, since other programs needed funding as well. Parliament, though usually ignorant of any of either side's arguments, was the closest thing to a mediator in the battles between the other three participants in rearmament. Finally, though the Air Ministry had a relatively realistic picture of its needs and expectations, it was continually frustrated that it had to operate in a framework of other principles and events that did not interest or concern it. Thus, due to conflicts between the financial realm, the

production sphere, the political area, and the actual defense coordinators, rearmament was not easy for any of the military divisions, not even for the oft-supported air force.

By the time war started, of Germany, Britain, and France, the French air fleet had the lowest number to top-quality aircraft. An attempt by the French to purchase American Curtiss P-40 "Kittyhawks" was not wholly successful and fell through after the fall of France in 1940.⁹⁹ The British accepted delivery of most of the Kittyhawk fighters. The French had concentrated on strategic bombing craft until 1933, when plans for a multi-purpose craft were drawn. The resulting "BCR" craft (bombardment, combat, and reconnaissance) emerged as a plane that was neither suited to tactical operations such as ground support or air-to-air warfare, nor to strategic bombing. By 1935 the French air wing was terribly deficient, outclassed already by the rebuilding Luftwaffe, and possessed an offensive strength of next-to-nothing. Germany's aircraft production increased throughout the 1930s to perhaps as much as four times that of the French. This incredible growth in size of the Luftwaffe helped inspire the fear of the "knock out" blow and, as noted previously, Britain asked for aid from the United States, who in 1937 was just beginning serious production of military aircraft.¹⁰⁰

During the 1920s and 1930s the United States had concentrated on civil aviation. The flights of Charles Lindbergh and large airliners had painted a "happy and fun" picture of

aviation for the American public. The United States' air arm, like that of the French, was an extension of the army, and there were relatively few advocates of a separate air branch. The policy of the Army Air Corps was open to two interpretations. The first point of view stated that defense was an interim plan required by the existing political system and that offense was actually the primary mission of the air wing. The second viewpoint held that the goal of air policy should be the prevention of any enemy air bases within striking distance of the United States. The most notable of all the buildings programs pursued by the United States was the bomber program. Most consider the American heavy bombers the finest in World War Two, and the first B-17s (a bomber which would become the backbone of the U.S. bombing squadrons, as well as an invaluable addition to the R.A.F.) were delivered in early 1937. In order to compare the aircraft production figures of the United States in relative terms, it is necessary to remember that although the U.S. had an incredible industrial potential, the aircraft industry was not mobilizing for war nor yet preparing for war in 1939. Between 1932 and 1939, the production of military aircraft by American aviation plants totalled about 8,040 planes, many of which would later go into battle in the Pacific.¹⁰¹

War began in September 1939 as Britain and France stood behind their promises to declare war on the Third Reich should Poland be invaded by German troops. Until April and May 1940, however, there existed a state of "phony war," or alternatively

"The lull before the storm."¹⁰² There was an "absence of heavy air attacks on the United Kingdom," although the threat and fear of an all-out air attack on Britain was still widespread. From the beginning, Bomber Command attempted to carry out strategic bombing attacks. The German Ruhr, an industrial center, was one of the major targets and despite some who "regarded the Ruhr as a crippling blow if we [the British] could bomb it successfully," early bombing attacks were either ineffective or disastrous to the R.A.F.¹⁰³ Britain's air strength at the outbreak of war was roughly 1,660 first line planes and perhaps around 2,000 reserve planes of varying quality.¹⁰⁴

With the fall of France and the overrunning of the Low Countries in 1940, Britain was not only alone in the new war but was now within range of German air bases in the conquered territories. By the end of May a large portion of the Luftwaffe was based in Holland, Belgium, and also in Nazi-occupied Northern France because Hitler was contemplating an invasion of the British isles.¹⁰⁵

The first part of Hitler's invasion plan included air attacks and bombing designed to "soften" and demoralize the British, and by early July the frequency and strength of German air raids visibly increased. During the first few weeks of what would develop into the Battle of Britain, hard lessons were learned by both the Germans and the British. For example, the British pilots flew in a tight formation that tended to be inflexible and hard to adjust, and learned the hard way that a

change was badly needed. The Luftwaffe, in turn, discovered that the Me-110, that important twin-engined fighter, was increasingly ineffective as a bomber escort, while the misused Me-109, the mainstay of the German air corps, emerged with three disadvantages. First, the Me-109 had to be more heavily concentrated as bomber escorts because of the Me-110's failure, while secondly the bomber crews insisted that the escorts follow closely, thus hampering the fighter's good combat ability. Finally, a certain number of Me-109s had to be held back in order to escort damaged bombers back to friendly bases. In addition, the Germans were so dependent on the Me-109 that where the fighter could not go because of its limited range, the Luftwaffe could not go. Thus began an air battle unparalleled in the annals of aviation history. Today, London still bears scars of the "blitz" of 1940.¹⁰⁶ The emergence of a victorious Royal Air Force set the stage for heroics by British pilots later in the war and also epitomized the undying British spirit.

The Battle of Britain, which warrants much more attention than is devoted here, began on July 10, 1940. Some speculate that without their far superior radar network the British would have been doomed, but not even this speculation can take away from the achievements of the Royal Air Force pilots. Fighting against somewhat heavy odds, the air corps managed to hold off repeated air attacks from the Luftwaffe. The air attacks collectively known as the Battle of Britain ended in September, though the Luftwaffe continued attacking England until later in

the war. It is interesting to note, romanticism aside, that the R.A.F. was never really on the verge of losing nor was England ever in any great danger of succumbing to an invasion. Between August 5 and September 20, the period usually considered to be the main phase of the conflict, only on two days did the British lose more planes than the Germans, and on only other three days were their losses equal.¹⁰⁷

The Battle of Britain was followed by a Battle of the Atlantic, which involved British air units, mostly the not-so-prepared Coastal Command, defending British shipping, attacking German ships, and also striking at German U-Boats.¹⁰⁸ The Battle of the Atlantic would not end for a long time, during which time the R.A.F. would increase her strategic bombing of German sites. The Royal Air Force bombings would be more successful when newer types of large bombers arrived in 1941. Of these new bombers, even the smallest, the Manchester, had a load of 7,500 lbs. and could carry twice as much as current types. The Halifax could carry 8,000 lbs., while the Stirling, the best Allied-bomber of the pre-U.S. war years, could deliver 10,000 lbs. of bombs.¹⁰⁹ Britain's air war effort is, in general, marked by the continual introduction of new and better types of aircraft which allowed them to keep improving the effectiveness of their air operations.

A thorough examination of Britain's air involvement in the Second World War is unfortunately not feasible here, nor is it necessary. A complicating factor in any such examination is that the British also took part in many air missions in cooperation

with the United States' air units, as a somewhat secondary but valuable participant. Unfortunately again, even if these raids are ignored, an overabundance of activity still remains. Therefore, only the briefest of mentions is reasonable with some discussion of British military aviation as it continually developed during the war.

The introduction of a new long-range fighter, the Bristol Beaufighter, was a noteworthy event shortly after the Battle of Britain. While not particularly fast, the Beaufighter had excellent range and could escort bombers farther than other current models and proved a decent night fighter.¹¹⁰ While the Beaufighter was debuting in northern Europe, the R.A.F. was beginning operations in the Mediterranean, where it would encounter mainly Italian aircraft at first. Between June 1940 and April 1941, the Royal Air Force and British ground forces had little trouble with the Italians, but the next three months saw an increasing German presence in the region.¹¹¹ Field Marshal Erwin Rommel succeeded in turning the tide briefly in German favor, though his victories were short-lived, for by July 1942 the British, fighting in their only major land campaign, had defeated Rommel and were pushing the German forces backwards. The Royal Air Force at this stage had as its main duty attacking (continually) Rommel's supply lines, both on land and sea.¹¹² As 1942 ended, the end was indeed in sight for the Germans in North Africa and the R.A.F. continued to play a large part in many of the decisive Allied attacks during 1943 in the Mediterranean.

It was becoming clear by 1941 that Bomber Command's models were not living up to expectations. Even the newer types such as the Manchester, the Stirling, and the Halifax were inadequate, and early designs of the American B-17 being used by the Royal Air Force had emerged with technical problems. In 1941, however, the prototype of the Avro Lancaster flew, and the heavy bomber would eventually become the mainstay of the late-war British bomber force. Sir Arthur Harris, who would later be Commander-in-Chief of Bomber Command, was largely instrumental in pushing the Lancaster into production, having recognized its merits.¹¹³ The construction of over 7,000 Lancasters was perhaps the key to Bomber Command's growing strength and by 1943 the force was a most potent one.¹¹⁴ Nearly as noteworthy as the new heavy bomber was the emergence of an all-wooden light bomber called the Mosquito. Equipped to carry up to 2,000 lbs. of bombs, the fast Mosquito was capable of speeds of up to 425 mph, though its normal speed was about 315 mph. The new light bomber saw considerable service as a reconnaissance plane, but it is most well-known for several daring "commando" raids which it participated in through the last two years of the war.¹¹⁵ Without a doubt the Mosquito was a god-send, replacing the mouldering British light bombers, and could easily be considered one of the great war planes of the Second World War.

While a variant of the Mosquito saw some action as a fighter (though the original models were unarmed), Britain was not short on new fighter production. Upgrades of both the Hurricane and

the Spitfire kept those planes at least as capable as newer German fighters, and the Beaufighter had proved itself a notable addition. The Typhoon fighter debuted late in 1943 as a ground attack fighter/bomber, and with its top speed of over 400 mph survived early troubles to become an important airplane.¹¹⁶ Late in the war, the Hawker company, who had created the Typhoon, produced the Tempest, the fastest fighter to date. The first Allied jet fighter, the Gloster Meteor, was in service by 1945 but encountered no German aircraft; it has held back in England for defense against German flying bombs which had begun hitting Britain.¹¹⁷

In a nutshell, the Royal Air Force and the U.S. air corps spent most of 1944-1945 slowly but surely pushing back the battered and aching Luftwaffe. The heavy strategic bombing attacks of those years leveled many German cities, though there remains debate as to whether the bombing runs hampered German industry enough to cause defeat, or whether the damage was more psychological. At the end of war, the R.A.F. was, in terms of quality, the best air force in Europe. Interestingly, the Spitfire remained in service for another nine years, and the Mosquito for ten years. The successful Lancaster survived in active duty until 1956, and the last major World War Two British combat aircraft to exit service did so in May 1960, when the Bristol Beaufighter flew its last sortie over Singapore.¹¹⁸

CHAPTER IV

The French Air Force

The French Air Force was destined to play a minute role in the Second World War, partly because of its ineffectiveness but primarily due to the fall of France in 1940. During World War One, however, France's air corps was an important element in the conflicts, and the French "Aviation Militaire" would establish a tradition that would guide aeronautics in the interwar period in France.

In September 1909, the French Army placed its first order for airplanes. The pilots, who were selected from the artillery branch and the corps of engineers, were trained by the plane manufacturer. Unfortunately, as the pilots were drawn from two different branches of the Army, both divisions felt they should control military aviation. The conflict was solved when, in 1910, military planes were placed under an Inspector General of Military Aviation.¹

The year 1910 would see other developments in French aviation as well. A public fund raiser, sponsored early in the year by a newspaper, collected nearly \$52,000 for the procurement of aircraft, and shortly hereafter the first French Army pilot graduated from flight school.² Several months later, the first aerial photographs were taken, by Frenchmen on military

manuevers. During the same flights, the pilots also experimented with radio transmissions while in the air. By November 1910, the army owned 30 planes and had 41 pilots. The next several years would show even greater growth.³

The next few years saw French aviation at the forefront, though a report suggesting that French industry had already produced 1,300 airplanes was probably exaggerated.⁴ The number of military pilots increased to 139 in 1911, however. Money was forthcoming as well, and in fact the French air establishment would not at first suffer from lack of funds as was often the case in other countries.⁵ The following year, over \$4 million was allotted for French military air equipment, and by mid-year the figure was increased to over \$6 million. Hoping to create a decent air force, the government continued to encourage public donations, and an aviation lottery was even suggested.⁶ The public donations, or subscription, amounted to nearly \$1 million by 1913.⁷

Aerial strength increased along with improved finances. Military planes numbered around 72, divided into 12 escadrilles, or squadrons, of six planes each. Overall, there may have been as many as 600 airplanes in France during 1913.⁸ By the time war broke out in late 1914, the French could boast of between 138 and 160 operational planes.⁹ Originally, there was little notion of the airplane as an offensive weapon, as it was though that the plane would be most useful in reconnaissance duty. This belief was not without some merit, for it was air reconnaissance reports

that were largely responsible for the Allied attack on the Marne late in the year.¹⁰

The superiority of French aviation was quickly evident "on" the battlefield, and the French are credited with many aviation "firsts." Not only was the observation of the German error that led to the battle of the Marne a French activity, but a Frenchman was also the first pilot to shoot down an enemy plane, instantly ushering in a new phase of warfare.¹¹ The superior position of French aeronautics also had its drawbacks; because France's aviation industry was so prolific, the French air corps suffered from an overabundance of plane types which caused a nightmare for supply officers and maintenance workers.¹² Air combat would increase in 1915, a year during which several newer types of planes appeared.

The Nieuport XI was to be one of the most famous of early World War One planes, and without a doubt it was the most notable French airplane to enter service in 1915. Maneuverable and with a good rate of climb, the Nieuport XI "Baby" was unfortunately not a match for the better German planes that would appear later in 1915.¹³ Aerial bombing became a new and desirable weapon in 1915, and the Caudron G-4, the first two-engined plane to appear on the western front, was designed specifically to fulfill that role for the French. The operational life of the G-4 was rather short, however.¹⁴ While the French had the first true bomber on the front, they also led the Allies in advocating bombing; an additional strategic air arm was planned late in the year, but

its call for 5,000 new bombers was rather unrealistic. At the time, France's bomber squadrons totalled about 126 planes, a figure which grew to 600 bombers.¹⁵ And, despite the fact that bombing was not yet particularly effective, both the Allied and Central powers made efforts to use bombers in tactical as well as strategic roles. The French, from 1916 on, would move steadily towards frequent tactical support by bombers of their ground forces.¹⁶

During the first huge battle of 1916, Verdun, the French suffered heavy aviation casualties, for only the Nieuport XI was capable of holding its own against the German planes. The "Baby" would be replaced by an improved model following the Battle of the Somme, but even the new Nieuport 17 had a hard time keeping up with the newer German airplanes. The new French Spad VII made a brief appearance in 1916, but proved a disaster as it had not been flight tested.¹⁷ Also during 1916, a group of American volunteer pilots were consolidated, and the group warrants a brief note.

Originally called the "American Escadrille," the flying corps of American airmen was formed in 1916 by an American named Norman Prince, though it is hard to give all of the credit to any one person. At first, French officials were not particularly enthusiastic about the idea, but mounting losses to the Germans changed their minds.¹⁸ American aviators had already been fighting for the French and had gained the admiration of their Allied counterparts.¹⁹ Following the formation of the escadrille,

however, there problems. First, the use of "American" in the name of the squadron provoked concern, as the United States was a neutral country. The name problem was easily remedied, and in December the name was officially changed to "Lafayette Escadrille," in honor of the American Revolutionary French general who had aided the New World rebels. In addition, the American press was not portraying the pilots as they would have preferred, and were often far from sympathetic. While the Lafayette pilots were fighting primarily because they felt it was their duty and responsibility to democracy, they were usually portrayed by the newspapers as ". . . privateers, vicious men who loved to kill . . ." ²⁰ usually accepted by the public as a "vanguard of American volunteers," ²¹ the squadron scored 57 confirmed victories during the war, but were transferred to the U.S. Army Air Corps when the U.S. declared war on Germany in 1917. ²² The entire story of the Lafayette Escadrille, its members, and their antics is, unfortunately, outside the realm of this text.

In 1917 the Spad VII returned to the front, having been withdrawn for a year of flight testing. The same year, the Spad XIII replaced the Spad VII, while the Bregnet 14B2 bomber would prove to be the best bomber-reconnaissance airplane designed by the French during the war. ²³ The Spad XIII was a particularly favorable aircraft with a top speed of 138 mph, which was faster than any other plane in the war. The American pilots of the Army Air Services also favored the Spad 13. These new types of

aircraft, along with troubles in the German air corps, contributed to a clear Allied superiority of the air by mid-late 1917, by which time the French had 3,556 first-line planes in their force.²⁵

The final year of World War One would witness the weakened German air force being beaten back by the Allied air corps. By war's end, the French possessed over 3,000 airplanes,²⁶ and though aviation had found its way into modern aviation the role of aviation in peacetime was "up-in-the-air." Most nations responded to peace by disarming their air fleets, but the French would not undergo such massive abandonment of their air force.

During the 1920s, France maintained the largest air force in the world; in 1923, for example, the French still had 260 squadrons made up of over 3,000 airplanes. Much of the 1920s French air units were made up of fighters like the Nieuport 29 and bombers such as the Breguet 16. In addition, the air corps was by no means inactive, for in 1925 French aircraft saw duty in a Moroccan conflict.²⁷ Though the air units "proved to be indispensable" to the ground troops, the campaign in Morocco turned out to be a long and tiresome one. During the mid-1920s, models such as the Spad 81, Wibault 7, Morane-Saulnier 35 and the Potez 25 joined the air ranks, and the names of their manufacturers would become more and more prominent on the French aviation scene. The French air force also saw combat in Tunisia and Syria.²⁸

Generally, it is held that French military planning in the

1920s started as a well-integrated scheme but slowly began unraveling and resulted in a very defensive approach.²⁹ In addition to ongoing conflict over who had jurisdiction over the air force (a debate which will be mentioned briefly later), there arose arguments over doctrine within the air establishment itself. A dominant line of thought in the 1920s, and which would prove foolish, was the belief that a multi-purpose airplane could be developed to perform all necessary duties; fighting, bombing, and reconnaissance work. While not very effective at any of their required duties, these general-purpose airplanes proved better light bombers than anything. Overall, tactical support of the army was still supposed to be the main responsibility of the air corps, with the only exception being some strategic operations directly following the outbreak of a conflict. In general, however, the French air forces were not being equipped with aircraft capable of decent strategic activities, nor ones capable of delivering effective tactical support.³⁰

While some suggested that the air arm could be of considerable offensive value, the defensive posture of the country and the belief of some influential French aviators that only aerial reconnaissance was useful prohibited the development of a more offense-capable air force. Interestingly, it was stated in the official tactical manual that during the day planes would reconnoiter and only at night would they attack enemy positions.³¹ Most of these and the other detrimental debates were spawned largely by jealousy and inter-service rivalries, since

with limited funding in peacetime, each service had to fight for what it thought it needed.

Besides the difficulty of developing an agreeable and unifying doctrine, the French air force faced other road blocks during the 1920s. Because Britain and France had exited the war as dominant European powers there was bound to be some tension, and from 1920-1924 Anglo-French relations were strained. France had planned all along on maintaining a large air force after World war One, but the British, noting a growing disparity between the two air forces in favor of the French, were quite alarmed. Many British feared, unrealistically, that France had great strategic capabilities and might consider using their force on England. British fear was compounded and encouraged by the disparity of numbers; only 650 aircraft in Britain versus nearly 1,300 French planes by the end of 1925. Though the period of turbulent relations with France resulted in a British air expansion program, affairs between the two powers were already improving by 1924-1925.³²

As seen above, organization and jurisdiction were thorns-in-the-side of French aviation in the twenties. Although following the war military aviation was reorganized along traditional army lines,³³ between 1919 and 1921 the control of military aviation would pass between at least three different offices. Control of aviation after 1920 was spread out amongst the branches of the War and Navy Ministries, who would allocate funds but had no authority whatsoever over any aspect of research or development.³⁴

And French industry itself was a burden; because French industry was poor and outdated, its state became an obstacle to better planning and aviation growth. Due to a weak industrial base as compared to Germany, France resigned herself to the impossibility of any offensive, quick war and continued developing defensive strategies.³⁵ French industry had suffered from a near-complete lack of natural resources for years, and the decline of the Franc after the war did not improve the industrial scenario. While these difficulties somewhat hampered even the aviation industry, France's air industry flourished in the 1920 unlike any other nation's.

Between 1920 and 1927, French aircraft production stayed at a high level and even encouraged many struggling factories to enter into aeronautical manufacturing. The heightened production of this re-equipment program could not be realistically maintained, however, and by 1927 the air industry was experiencing considerable trouble.³⁶

After the mid-twenties the French government began a policy of distributing contracts to aviation plants, similar to the programs in other countries at the time. Orders would be spread through many firms with the hope that as many as possible could stay in business. Unfortunately, such circumstances hardly encourage the risky experimentation of newer types of aircraft, vital in maintaining an effective, modern air fleet. Observers soon noted a lack of new ideas in French aviation as compared to other places.³⁷ Thus, a second phase (if a first phase of post-

war French aviation is 1919-1927) of French aviation after World War One can be placed between 1927, a year of trouble in the aviation sphere, and 1934, the year the French would finally create their own independent air force.

Without much argument, it can be fairly suggested that the crowning achievement of the second phase of post-war French aviation was the creation of an Air Ministry in 1928, although it was defiantly a mixed blessing. While the air units seemed to be consolidated under the new Ministry, the units necessary for the tactical support of the army (which was most of the force) actually remained under the control of the War Minister.³⁸ Some suggest, however, that during this second era of aviation in France that efforts were counterproductive; while some praised the new Ministry of Air, others cursed it, while the army suggested that "unity of command" had been dismantled.³⁹ The development of a unifying doctrine within the air establishment was somewhat retarded, even though advocates of strategic bombing, as was the trend at the time, were the most influential group. These bombing advocates were barely able to contend for attention with army cries of disunity and other political pressures, however.⁴⁰

Following some organizational overhauls, the air corps became officially known as the "Armee de l' Air" in April 1933. The French aviation industry, meanwhile, was once more optimistic about the future in 1933, following a few years of struggling.⁴¹ The next year, the French air force became an independent (though

hardly equal) branch of the military, ushering in a third phase of aviation in France. For practical purposes, this third post-war phase will become the first phase of French air rearmament for World War Two.

The interrelationship of all the elements of the French air establishment are no more complex than those in other countries, but for simplicity the examination of the period from 1934-1940 will be divided roughly into political details, economic influences, and also into industrial developments.

When the Popular Front government came to power in 1936, Pierre Cot, a previous air executive, was returned to the Air Office as Air Minister. Cot not only wanted to increase the strategic bombing force at the expense of the tactical support craft, but also wanted to change the social make up of the officer corps. In addition, Cot reorganized the air force in an unfavorable fashion. On the surface, Cot's policies seemed reasonable and coherent, but were designed only to undermine the traditional military influence on the government. Cot's policies were far from realistic given "aviation technology or strategic realities."⁴²

In addition, Cot put forth a "Plan II" to rebuild and re-equip France's aging air corps. Plan II called for the production of 2,400 planes in three years but was superseded by Plan IV, which called for 4,100 airplanes within three years. Unfortunately, the government would not approve the plans, though the aircraft industry was nationalized by early 1937 in an

attempt to prepare for such expansion. Air strength varied from 1936 to 1937.⁴⁴

Economically, the situation was as variable as could be. The German armaments budget of 1934-1935 proved unnerving for the French, who were beginning to feel the effects of a delayed depression. Despite the fact that money would always seem to be the major deterrent to an aviation build up, there was a surplus of 60% in the French military budget in 1935. The nationalization of the air industry, while beneficial in the long run, was crippling economically in the short term and combined with rising costs to hurt the aviation industry.⁴⁵ Cot had pressed for an equal share of the military funding, but never got it. In fact, France never gave their air fleet a 33% share of the military budget.⁴⁶

New Types of aircraft did manage to reach French squadrons despite the various problems. The Potez 540 and D-370 aircraft saw action in the Spanish Civil War in the late 1930s but performed poorly, as they were outclassed by German airplanes. A year after the previous types emerged, the Dewoitine D-510 debuted but was not much of an improvement. After Cot left, his successor announced Plan V for 1937-1938.⁴⁷

Up to 1937-1938, there appears little doubt that the French followed no consistent and productive plan for air rearmament. This near-total lack of direction was not uncommon in Europe during the first half of the thirties, however. It is not as easy to determine if the French air rebuilding plans between

1938-1940 were better or worse than in the years previous. In addition, France made desperate, but not wholeheartedly successful attempts to procure American aid in the post-1938 years, a chapter in French aviation which calls for a brief glance.

Desperate is perhaps an appropriate word to attach to France's aviation situation after 1937. It was quickly becoming apparent that war was almost inevitable, and a mad rush to rearm ensued in Europe, and despite an over-optimistic report from Cot during his last days in office the state of aviation in France has to be called urgent.⁴⁸ By the end of the year, the British estimated only 1,195 French planes to nearly 2,000 German aircraft. Flying in the face of Cot's last report was General Vuillemin's remark that the French air force could not survive two weeks in a war with Germany. Vuillemin also pointed out that only 700 French aircraft were available in September 1938, hardly an adequate figure, and the General added that not only were these numbers insufficient for tactical support of the ground forces, but also that the air force would be unable to protect civilians as they evacuated.⁴⁹

Cot's successor as Air Minister, Guy la Chambre, can hardly be faulted for the poor state of French aviation, for none of the roughly 1,300 planes he inherited were comparable to current models in any other major country. The Dewoitine 500 and 510 fighters were the most up-to-date, but were at least 70 mph slower than Germany's Me-109 or the British Hurricane and

numbered only 250. French bombers suffered similar gaps in performance. To his credit, la Chambre cancelled many production plans for obsolete planes still in the budget and pushed Plan V into action. Plan V called for 2,617 first-line planes to be produced by April 1940 and required a considerable increase in monthly aircraft production in French factories. La Chambre's overall plan was to purchase or build more than 4,000 new planes by 1940, a goal which he was to fulfill.⁵⁰ Unfortunately, la Chambre stressed the earlier tactical role of aircraft, discarding Cot's strategic decisions. Not only did this change in orientation alienate the officers of the Armee de l' Air (who were quite tired of such seemingly continuous changes) but it left the air corps unprepared for either strategic strikes or tactical duty.

In 1938-1939, the French air force was a motley assortment of aircraft types. The Potez 630 fighter, the 631 twin engined fighter (which, due to its near-identical appearance to the German Me-110, was often shot down inadvertantly by R.A.F. pilots, much to the chagrin of the French), and 637 reconnaissance plane were all nearing service by 1939, as were the new Moraine Ms-406 and Bloch 152. The Moraine fighters were a nightmare to build, however, as was the otherwise decent Loire 45 medium bomber. The Bloch 174 fighter might have been a match for the German Me-109, but few were available by wartime. The bulk of the air force was made up of 1934-1936 vintage types, though the other air forces of Europe also had some obsolescent

planes in their air fleets. The modern types found in the other countries of Europe were, for the most part, far superior to French designs, however.

The dilemma facing French aviation could have been improved if more emphasis had been placed on acquiring American planes. The little help that was gained helped incredibly, however. The P-36/40 was ordered from the United States, as these were the only types that seemed capable of dealing with the German planes. Despite considerable opposition in France, the order went out in May 1938 for 100 P-36s as well as 215 light bombers and 200 trainers. Though many of these were never delivered, the planes that did materialize saw action, and did in fact almost measure up to the German planes.⁵²

Despite the last minute attempts at procurement and the increase in production of war planes, the French air force was far from being prepared to meet any German attack. The fault lies not in the 1938-1940 period, but rather in the early thirties since a serious air rearmament program did not begin until 1938. Since wholehearted attempts did not start until 1938, it is unlikely that much more could have been done to increase production, since resources and manpower were most likely already stretched to their limits. In fact, by 1939 the air industry was optimistic, as was General Vuillemin, about the growth of the French air fleet. This optimism would be disturbed by the outbreak of war in late 1939.

The optimism in the French air establishment ran so high

that General Gamelin, the chief of staff, told the Foreign Minister that the French air force (and the army) was "excellent," a clear misjudgment created by the false sense of improving security.⁵⁴ By the eve of war in 1939, many fighter units had been able to re-equip with modern fighters, though the French modern fighters were, as pointed out earlier, outclassed by equivalent German airplanes. In September 1939, about 1,240 modern aircraft were available to the French out of a total air strength of nearly 3,600.⁵⁵

Between September 1939 and the beginning of the German invasion of France in May 1940, the Armee de l' Air was able to continue its slow modernization of its squadrons. While figures vary somewhat, about 2,000 first line, modern planes were in service in the French air force in 1940. It is generally agreed, however, that the addition of new planes was too little and much too late.⁵⁶ The majority of the French fighter squadrons were made up of types such as the Morane 405 and 406, but was still mainly the archaic Dewoitine 501 and 510 which had no chance of catching even the slowest German bombers. Some Potez 631 squadrons were ready for combat, though their resemblance to the Me-110 cause many to be shot down by friendly fire. The Dewoitine D-520 was not available in any significant quantity, but would become France's best fighter; even it, however, was barely able to pursue the German Me-109.⁵⁷ As if the battle confronting the fighter squadrons was not trouble enough, the bomber units were embarrassingly inferior. Slightly over half of

the bombers were relatively modern planes such as the Loire 45, Amiot 351, and two American models, but many near-useless and aged Amiot 143, Bloch 210, and Farman 221 planes were still in service.⁵⁸

During the Battle of France in 1940, the French air force lost around 750 planes while the Germans suffered losses totalling 1,284 aircraft. The French, not backed by huge resources or an incredible industrial base, "fought as best they could but went down to certain defeat. Some are quick to point that it is unrealistic to expect a nation bent on avoiding conflict to be able to stand up to a military designed for aggressive warfare, but there can be no denying that the French made a spirited and direct attempt at increasing their air force after 1938. Lack of an adequate industrial base, few resources, and haphazard planning in the early thirties combined with a surprisingly quick German ground victory to spell the defeat of the Armee de l' Air.⁵⁹

French airmen continued to fly, but under as many different flags as there were major participants in the Second World War. Many French pilots trained in the United States, and many ended up fighting for the Russians, English, or Vichy forces. Still other French aviators flew for the German-occupied French air fleet. The French air force, perhaps, is the epitome of unpreparedness before World War Two and, unlike the equally unprepared Soviet air force, did not have the industry to expand quickly enough.

CHAPTER V

The Italian Air Force

The beginning of the Italian air force is not unlike the emergence of other nations' air corps. There were many aviation enthusiasts in pre-World War One Italy, however, and by 1910 the first flying school was opened in Italy, near Rome.¹ In the middle of the year, the government had set aside nearly \$2,000,000 for aviation and also had made provisions for aviation construction facilities and hangers. Thus it can be asserted, quite reasonably, that the Italians were slightly ahead of other countries in aeronautical work at this early date.²

By 1911, the Italians and Turks were at odds in the Italo-Turkish War, fought mostly in Libya. Airplanes were used for military purposes for the first time ever in November, when an Italian aviator, after making a reconnaissance flight, dropped four bombs on a Turkish camp.³ Later in the month, several planes again dropped bombs on and destroyed another enemy encampment.⁴

Popular favor for aviation in Italy was as great as anywhere else, and an organization known as the National Aero League was formed and a popular subscription brought in enough money for 100 planes by September 1912. Another group, formed in 1913, asked to construct 200 planes for the government using \$600,000 allotted

for airplanes during the Italo-Turkish conflict.⁵

As World War One broke out in Europe, Italy had 13 squadrons, made up mainly of foreign aircraft. By the time Italy joined the war, she had 150 planes divided into 15 squadrons and many more aircraft planned for construction. Even a few bomber types were slated for production, and there were already several native designs in use in 1915.⁶ Within two years, the numerical strength of the "Aeronautica del Regio Esercito" had grown to nearly 4,000 military airplanes, including 15 fighter squadrons, 14 bomber squadrons (made up of the native Caproni Ca-42 heavy bomber), and 30 reconnaissance and observation squadrons. At the signing of the Armistice the number of squadrons had risen to 68.⁷

The Italians were committed to post-war air expansion. In 1918, the air industry had produced 6,523 planes was capable of continuing reasonably heavy production.⁸ The product that emerged from Italian air factories was often lacking in quality, however.⁹ Italy herself was to suffer the effects of economic crises in 1926-1927 and 1929, but it was during these economically troubled years that Italy moved towards becoming an industrial nation.¹⁰ Also, in the 1920s, the air theories of Italian General Giulio Douhet, which would become quite influential throughout the world, stressed the strategic potential of air power. Not only did Douhet suggest that an independent air force was a necessity, but he also disdained the idea of any "reserve" air fleet. Defensive aircraft, added

Douhet, were a waste, and fighter aircraft served only to escort bombers to their targets, which should be hit in heavy, quick attacks. Though Douhet's theories were popular in Italy and maneuvers successfully carried out using Douhet-influenced squadrons, the Italian air corps did not continue to develop along his model. And, unfortunately, bombers which fit Douhet's ideal were too advanced for existing production capabilities.¹¹

Douhet's theories found some acceptance in all air corps, but nowhere was a full implementation of them attempted. The British, especially, found Douhet's ideas of bombing civilians rather loathsome.¹²

Following Mussolini's arrival in power, the Italian air force was granted independent status and its own Ministry, and there is no questioning the "Regia Aeronautica's" continued strength; Italian planes and pilots won many international flying competitions during the 1920s. Unfortunately, victories in such competitions soon took predominance over preparation for combat, which was becoming inevitable with Mussolini's eye on Africa.¹³ The late 1920s and early 1930s would see the Italian air arm being used largely and often strictly for propaganda purposes.

Though France and Italy were involved in ongoing diplomatic and military talks in the early 1930s, Italy's undertaking of several small wars in Africa severely strained otherwise improving Franco-Italian relations. Italy was already considered a relatively well-armed power, but she prepared for an approaching invasion of Ethiopia by beginning a rather intensive

rearmament program (which would result in over 8,500 airplanes being ordered between 1935-1939). It was determined by Mussolini that the Regia Aeronautica would play a major role in the attack on Ethiopia, and between 300-500 airplanes were deployed for African duty.¹⁵ The Italians earned a hard-fought victory in Ethiopia, but the rather one-sided victory hardly prepared the air corps for the much tougher battles which loomed over the horizon.¹⁶ Italian involvement in the Spanish Civil War also served to heighten Italian pride in their air force.

Through 1937, the Regia Aeronautica remained roughly the equal of the Luftwaffe in terms of quality and even quantity. A change in emphasis from strategic planes to tactical aircraft, however, combined with an unwise decision to manufacture only air-cooled engines (as opposed to better liquid-cooled engines), led to a decline in the strength of the Italian air corps.¹⁷ In addition, Italy's smaller industrial base, lack of resources, and lower economic potential served only to hamper continued air build-up in Italy.¹⁸

As previously mentioned, the quality of Italian aircraft was close to that in other forces through most of the 1930s. For this reason, as well as to note with what planes the Italians would enter World War Two, it is desirable to examine the most common and most noteworthy of pre-war Italian aircraft. Up until 1940, the Fiat Cr-42 was the mainstay of the Italian fighter squadrons. A highly maneuverable biplane, the Cr-42 was outclassed by the British fighters such as the Spitfire. The

heirs to the Cr-42, the Fiat G-50 and the Macchi Mc-200, were little better, but were at least monoplanes.¹⁹ Another fighter, the Breda Ba-65 ground attack craft, was obsolete by 1940.²⁰ Despite the likely ineffectiveness of the fighter planes, the bombing divisions were actually quite well off. The primary bomber, the Savoia-Marchetti S.M.-79, was a decent plane and was described by the British as an efficient and successful torpedo bomber, while the Fiat Br-20 proved a solid medium bomber. The CRDA Cant Z-1007 "Kingfisher" and the Savoia-Marchetti S.M.-82 also saw service as bombers, and even a four-engined bomber, the Piaggio P-108, was involved by the early 1940s.²¹ As a whole these types were, however, inferior to foreign types, save perhaps those bombers built by the hapless French.

The strength of the Italian air force in 1939-1940 is open to debate. Some say that the Italians claimed a force of over 3,000 combat aircraft while an internal investigation revealed only 982 as ready for duty. A more likely figure of air strength is one placed at around 1,000, though the Germans, counting on later Italian help, expected to find 2,000 planes in Italian hangars.²² Perhaps of greater import was the fact that supplies of aviation fuel were only expected to last about a month and a half during war. By 1940, though, the Regia Aeronautica possessed at least 1,609 first line planes, of which just over 1,000 were combat ready.²³

The deficiency of the air force was not unknown to Mussolini and his air staff, however. As has been suggested, the air

industry was simply incapable of sustaining production at a high enough rate to satisfy demand, nor was the air force ready to go to war, facts recognized by the top Italian leaders. Thus, when Germany went to war in 1939, Mussolini told Hitler that Italy could not go to war in her present state without considerable aid, which Hitler could not afford to give. It was not until 1940 that Italy would enter the Second World War.

With few exceptions, Italy's air performance during World War Two was disappointing. In fact, Italy was nearly as much of a burden to the Germans as an ally as they were as an enemy later. After Italy changed sides several new types of airplanes came into service, most notably the Macchi Mc-202 and 205, exceptional fighters despite being greatly under-armed, and the Fiat G-55, a fast, excellent fighter.²⁵ Any overall evaluation would conclude that Italy, with poor production capability, few natural resources, and poor planning, was able to produce an air force quite admirable for a second-rate power, such as the Italians were doomed to be during World War Two.

CHAPTER VI

Conclusion

Attempts at comparing the programs of different nations inevitably run into difficulty because of the difference in government forms and national character. Such observations are not impossible, however, and because it is somewhat easier to draw some parallels and similarities any attempts at comparison are thereby aided.

The development of aviation in Russia was interrupted by the outbreak of Civil War and subsequent strife. From 1917 to 1920 (with the formation of an official research institute) or 1922 (when a design study group was created), aeronautical research and advancement was put on hold, and it may be no coincidence that the Soviets at the beginning of World War Two appeared to be about 3-5 years out of date. The first years of the 1920s were characterized by Russian dependence on foreign orders for most of the Soviet air planes, though during NEP aviation work in Russia was far from stagnant and Socialist workers were encouraged to support aviation.

Stalin's Five Year Plans would, of course, benefit the aircraft industries as they did all of heavy industry. Not only did the aircraft industry grow by up to 750%, but the personnel

involved in the industry increased by perhaps as much as 1000%. The size of the air corps itself grew by 40,000 men between 1926 and 1932, and the organizational structure was improved several times during the early Five Year Plans. The growth in industry and personnel also fueled the research and development areas of aviation, where the Russians tried desperately to catch up with other nations in aeronautics.

It was during the Second Five Year Plan that the I-153 and I-16 fighters emerged, putting the Russians at decent footing in relation to current types in other countries. Unfortunately, these models would be improved little between their introduction in the mid-1930s and 1939, leaving the Russians behind at that later date. Russia dabbled briefly with the development of a long-range strategic bomber in the thirties, the attempts were not continued and thus the Soviets had no decent heavy bomber ready for World War Two. Production was becoming better and better in the air establishment, and in a hint of things to come later, production of military aircraft jumped from only 627 planes in 1933 to almost 7,000 craft in 1939. In the midst of the Second Five Year Plan, the Spanish Civil War broke out, during which the Red air corps was proven hardly a match for the current German types of planes. The lessons learned in the Civil War in Spain would include ground support of troops and the ineffectiveness of the Soviet light bombers. Soviet aircraft would fare little better in the Winter War of 1939 against Finland, during which 100 mouldering Finnish fighters would claim

nearly 240 Russian planes before being crushed by sheer numbers of Red planes.

The Winter War was hardly an auspicious preparation for World War Two for the Russians, who were desperately trying to re-arm just as the Luftwaffe attacked in 1941. Though on the first day of fighting the Germans would destroy over 1,000 planes while losing perhaps 40 of their own aircraft, the battle was never again so easy for Hitler's air corps. Within three years, Soviet airplanes were as good as most German types and, in addition to having tremendous numerical superiority, as war went on saw increasing numbers of obsolescent German planes on the eastern front. Eventually, the Soviets turned the tide for good, and in 1945 attacked Berlin.

Germany's defeat in 1945 was that nation's second loss in forty years. Before the First World War, aeronautics was as popular in Germany as anywhere and training of pilots occurred at the aviation factories. The industry was shielded from an early economic slump by government support, and new companies emerged, though the larger companies were better able to provide training for military pilots. A public fund helped the government acquire more planes as well, while the rest of Germany struggled with a depression. By the start of World War One, Germany was equal to most other powers in the air, and a German pilot would conduct the first offensive aerial action of the war in late 1914.

Most of the early German airplanes proved superior to

comparable models on the Allied side, and the last notable German wartime craft, the Fokker D-7, was named in the Versailles Treaty as expressly forbidden. The Peace Treaty that ended the First World War forbade any German pursuit of aviation but actually encouraged covert rearmament by its harsh provisions and humiliating punishments. Many German designers fled the country and set up shop in neighboring states, where they continued doing research and producing planes for Germany, secretly.

Germany continued rearming in secret until 1935, when the existence of a German air force was made known to the world by Hermann Goring, the Luftwaffe leader. By this time, Germany's air corps was made up of such models as the Heinkel He-46, the Arado Ar-66, and the Junkers Ju-52, with more noteworthy types on the way. The start of the Spanish Civil War later in the decade gave Adolf Hitler an opportunity to display a small part of his air corps' capabilities, and the new Me-109 fighter proved itself as the best fighter in the world. Meanwhile, early models of the screaming "Stuka" Ju-87 dive bomber had rained terror from the skies on the opposing Spanish forces. While Hitler's larger bombers had slightly less success, there was no doubt that by 1938 the German Luftwaffe was the most fearsome airborne force on the globe.

The Luftwaffe played a considerable role in the attack on Poland in September 1939, and played an even larger role as it destroyed the hapless French air fleet during Hitler's invasion of France in 1940. When the attention of Germany turned towards

Britain and the Royal Air Force, however, the foe proved to be the proverbial horse of a different color, and the Luftwaffe's attempted submission of the British was a failure. Hitler's next move, the launching of Operation "Barbarossa" later in the year, proved a most foolish one and most certainly sealed Germany's fate. While early victories pleased the Luftwaffe, before long Russia was able to bring her huge industrial capacity to bear, sealing Germany's fate even further.

An examination of the Luftwaffe's role in the Second World War brings up many questions. Could the Luftwaffe have won if Hitler had not meddled with all aspects within the aviation sphere? If certain new types had been allowed into service sooner, such as the He-177 bomber or the Me-262 jet fighter, would the outcome of the war been any different? Unfortunately, even the most knowledgeable are left only to speculate on such matters. Another intriguing question that arises asks what effect the presence of German heavy bombers would have had on the Battle of Britain.

As in other countries, early aviation in Britain was in the hands of aristocrats and industrialists. Pre-World War One aeronautical groups were severely hampered by a virtual lack of funding, and the existence of two separate groups of military aviators (the Naval air arm and the army's Royal Flying Corps) did not provide for a "unified front," for the two sides bickered continuously. Attempts at compromise and cooperation between the rival Royal Naval Air Service and the R.F.C. failed and the

doctrinal questions worsened; the question of strategic bombing was a heated debate topic, for instance. In any event, following a report by Jan Christian Smuts, the two branches of military aviation became one, though in practice they were still usually affected by their previous service's wishes. At the end of World War One, the British Royal Air Force was the largest and most powerful in the world.

Unfortunately, because the air corps had no traditional peace time role, and because a huge air disarmament occurred, the new branch of the military had to fight for its survival. During the 1920s, and R.A.F. served as an overseas police force, mainly in the Middle East. At home, the government decided that in order to insure the survival of a nucleus of an air industry that a series of factories (called a "ring") should be subsidized and supported. By the early thirties, however, Britain's air fleet was in poor shape, and attempts by the British to seek international air disarmament met with little enthusiasm from foreign diplomats.

A series of "Schemes" which began in 1934 planned Britain's subsequent air expansion. Newer British planes were appearing by 1935, with models such as the Gloster Gladiator entering service and with the Hurricane and Spitfire looming over the horizon. British bombers were being developed as well, and eventually models such as the somewhat successful Manchester and Halifax provided the basis for the medium bomber force in the early stages of World War Two. Coinciding with the appearance of new

planes was the restructuring of the air corps in June 1936 under a plan which created three "Commands," each with a different jurisdiction. While this new system would be cumbersome at first, it worked well during war time and more commands were added later.

The R.A.F.'s first big test after war started in 1939 was the Battle of Britain, during which a slightly smaller number of British airplanes managed to hold off an intimidating, but not much larger, Luftwaffe. From there, much of the air action in the mid-war years occurred in North Africa. Newer and better heavy bombers improved the strategic bombing capability of the British, who began bombing German cities. When the United States air units began arriving in Europe, they teamed up with the British for unparalleled bombing raids on the cities in Nazi Germany. The most noteworthy accomplishment of the British air establishment during the Second World War is probably the continual introduction of new types of aircraft, which generally improved as time went on. This continual modernization of the R.A.F. was more drastic and effective than any other, and it kept the German air force on the defensive for nearly the whole war.

The French air force had a distinguished past record from World War One as it prepared to enter World War Two, but it also had a more recent record of trying to get adequate planes out of an inadequate and perhaps saturated aviation industry. Despite desperate last-minute attempts at rebuilding the air corps, France was hopelessly under-prepared and outclassed by the German

Luftwaffe in 1940. The Italians, in similar fashion, hoped for too much out of their industrial establishment, and while Italy had a decent air force for a minor power, she was in no position to single-handedly take on Britain's air fleet in the Mediterranean.

Before a reasonable speculation on the nagging question of "who was prepared?" can be asserted, a brief analysis of the actual rearmament plans, their economics, and their effects must be made in relation to each other. As stated before, differences in government policies and forms make this task somewhat awkward, but at the same time the lack of similarity makes a comparison easier in some ways as well.

It is simple to compare economics in war build-up in many respects, because the rearmament almost always results in a huge debt, regardless of the precautions taken. While all nations had public funds in the early days of aviation, the presence of such subscriptions in the pre-World War Two era would have proven of little consequence. The German "Mefo Bill" concept was rather revolutionary and brilliant, consisting of what was basically an I.O.U. from the government given in return for borrowed money or industrial capacity. Through this and other ingenious plans, the German government was able to practice a great degree of controlled "deficit spending." Unfortunately, no one ever got to collect on these bills, and thus the point is moot. Overall, however, the German economy was prosperous just before the war and not terribly taxed yet by rearmament demands (though a slump

in the aviation industry in 1938 proved a major concern). Debate over by whom and to what extent the economy should be controlled raged in Germany, however. By war's end, the German populace would be suffering from a lack of food and essential items, but the process of rearmament was hardly harmful to them.

In the Soviet Union, rearmament did prove somewhat harmful to the populace. Under the Five Year Plans, Stalin placed the emphasis on heavy industry and military items and neglected consumer goods and other necessary items. Thus, while Russia was able to start the war with a huge air fleet (irrespective of the quality of the planes at this point), the population had suffered greatly in order to provide a degree of military preparedness. Public subscription remained a noticeable commodity in Russia, for despite their hardship the extremely nationalistic Russians would often dig deep in their pockets to provide a little extra for rearmament. Even in Soviet Russia, however, the cost of modern military items was much too high for subscription to stay an important economic event. Fortunately for the Russians, new types of planes were soon to arrive after the start of war from their bustling factories. Without a doubt, the Soviet Union produced the most amazing industrial mobilization of any of the early war powers, especially considering that many of its factories had been moved and were just gearing up for production.

When comparing each air force, a numerical analysis is far from sufficient. Unfortunately, there are also many subjective factors to consider, such as the quality, the maneuverability,

and the handling of the plane, which are all difficult to quantify. The German Me-109 is better than, for example, the Russian I-16 or LaGC-3, but is it better than the Hurricane or the Spitfire? Should the subjective factors be considered at all, for they may not be reliable; the American P-39 fighter was shipped to Russia under Lend-Lease because it was viewed as a failure, but in Russia the Aircobra was used with considerable effectiveness. The previous example should serve to show the problem with subjective or even situational evaluations of aircraft types. Also burdensome is the usually useful "benefit of hindsight."

The British defeated the Luftwaffe in the Battle of Britain, but was the R.A.F. "better" than its German counterpart? Numerically, the two forces were somewhat close, but with hindsight it is rather easy to suggest that the British were in fact better than their German foes. The plane types used by each side were comparable in some ways; the Me-110 proved to be a failure, but the Me-109 was at least equal to the British fighters in many ways. German bombers were easy prey if caught by British pilots, but inadequate fighter cover is hardly the fault of the bomber squadrons, and the bombers are not designed to fight off enemy fighters by themselves. There were other factors against the Germans, such as the judgement errors committed by Luftwaffe and the lack of a long-range escort fighter but, irrespective of these elements, with the burden of hindsight prohibiting any other decision, it must be asserted

that the British seem to have been better prepared in the air than the Luftwaffe.

On the eastern front, the Luftwaffe's complete domination of the Soviet Union on the ground and in the sky makes the question of preparedness an easy one. Germany was infinitely more prepared than were the Russians, and only after the strains of a two-front war were being felt by the Germans and the complete mobilization of Russian industry had occurred did the Soviet Union regain any ground or air.

Without a doubt, Germany would have been the best prepared for war if several things had happened before or during the conflict. First, if the war had started in 1937 or 1938, the Luftwaffe would have dominated both the Royal Air Force and the VVS, for Britain still had only a small air contingent (and no Spitfires or Hurricanes) and the new Russian airplane types would have been four or five years away, instead of one or two as in 1939. Also, if Germany had attacked Russia in 1937 or 1938, the Soviet industries would not yet have started moving to the east and would have been in range of the otherwise sub-par German bombers. Second, and perhaps of greater importance to the air war itself was the halting of most aviation research in Germany while the British and Russians continued to produce new and improved types. The prohibition against aeronautical research prevented the development of a second generation of German planes from arriving. In Russia, for example, a second generation of planes such as the Mig-3 and a third generation which included

the favorable Yak-9 emerged, and Britain also saw two new generations of airplanes. After war started, the Luftwaffe took delivery of only one major type, the FW-190 fighter, which was an early second generation model. While perhaps German industry was taxed by the mid-war years, production could (and should) have been switched from an obsolete type such as the Ju-87 and gone to a plane such as the Me-262, which would have been ready and in combat in great numbers had Hitler not interfered with its development. The emergence of other jets, including long-range jet bombers, would have been practically guaranteed if the Fuhrer had not ordered a halt to aeronautical research soon after war broke out. Either way, the Germans' fate was sealed because their planes were destined to become outdated. Their aircraft were the best types available in 1937-1940, but after that those same planes, most of which remained in service with improvements, were outmatched by newer Allied models.

While it seems that the focus of the conclusion has been on the Second World War itself rather than the period of rearmament, it is impossible to evaluate any aspect of rearmament without seeing and understanding what effect these aspects had on an air force when it was in "action." Thus, considering all of the factors, but especially each air force's first performance against one of the others (the Luftwaffe easily beat the French air fleet, but that combat doesn't give any insight into whether the Germans were better off than the British or not) and the continuing development of new aircraft types as war waged, it is

virtually impossible to reach any other conclusion than one which asserts that the British, while not "ready" for war, were "readier" than any of the other air corps. The Royal Air Force's rearmament programs were different from those in other nations in that many of them did not simply supersede the one that came before it, which kept industry working consistently and also helped stifle complaints from the air industry that plans were constantly being changed. None of the air forces were truly "ready" according to their plans, but when readiness in relation to the other powers is the only important factor, the plans become almost, unfortunately, meaningless except that without them no one would have had any planes at all ready for combat during the Second World War.

APPENDIX

ENDNOTES

Notes for Chapter One

1. David Jones, "The Birth of the Russian Air Weapon 1909-1914." Aerospace Historian 21 (1974): 169.
2. Jones 169.
3. Jones 169.
4. Robert Kilmarx, A History of Soviet Air Power (New York: Frederick Praeger, 1962) 5.
5. William Green and John Fricker, "The Soviet Air Force," The Air Forces of the World (London: MacDonald, 1958) 244. They mention the establishment of the school as does Jones, who mentions a school opening in 1910 near Sevastopol. The air school of Green and Fricker's mention was in the north, however. Jones 170 dates the opening of a school to 1911.
6. Kilmarx 5.
7. Kilmarx 7. Only Kilmarx mentions figures, while other sources do mention an increase. Jones says there were only 16 planes at most in service at the end of 1910.
8. These foreign purchases are described in most sources, and there seems to be no discrepancies. See Green and Fricker "Soviet" 244 or Kilmarx 7, especially.
9. John Strand, The Red Air Force (London: Pilot Press,

1943) 9 and Walter Scwabedissen The Russian Air Force in the eyes of German Commanders (New York: Arno Press) 1, who calls the Ilia a "remarkable achievement at that early date."

10. Kilmarx 12, 13.

11. Jones 171. These figures are surprisingly consistant, except for Nicholas Golovine, The Russian Army in the World War (New Haven, Conn.: Yale University Press, 1931), who says 263 planes.

12. According to a March 17, 1912 figure published in "Army Aviation Estimates," New York Times 17 Mar 1912, IV 10:1.

13. Jones 171.

14. Green and Fricker "Soviet" 244.

15. Kilmarx 15.

16. Strand 10. Sources cite that 70-75 of the IM-5 were built.

17. Golovine 150, 151.

18. Schwabidessen cites the overall production figure, while most sources confirm Green and Fricker's origin of most of Russia's air power.

19. Jacob Kipp, "Studies in Soviet Aviation and Air Power," Aerospace Historian 31 (1984): 43-50.

20. Alexander Boyd, The Soviet Air Force since 1918 (Briarcliff Manor: Stein and Day, 1977) 1.

21. Asher Lee, Soviet Air Force (London: Duckworth, 1952) 17, and Schwabidessen 1. Perhaps this is a good general figure.

22. Robert Jackson, The Red Falcons: The Soviet Air Force

in Action, 1916-1969 (London: Clifton, 1970) 11.

23. Boyd 1.

24. Kilmarx 25-27. All major sources agree that the air industry suffered tremendously as a result of the revolution.

25. Jackson Red 16.

26. Kilmarx 37, 39.

27. Boyd 6-8.

28. Jackson Red 23.

29. Boyd 9. Kilmarx gives a scattered account of these events, while Jackson Red places the date at 1923.

30. Lee Soviet 21 and Jackson Red 25.

31. Kilmarx 65.

32. Robin Higham and Jacob Kipp, Soviet Aviation and Air Power: A Historical Prospective (Boulder, Colorado: Westview, 1978) 32. Higham and Kipp perhaps do the best job on this early industrial period, which tends to be confusing.

33. Kilmarx 67. These early models did not amount to much.

34. Kilmarx 75.

35. Jackson Red 26.

36. Boyd 13.

37. Boyd 14. Boyd captures the spirit of the ODVF better than any of the other sources. Surprisingly, little seems to exist in english about this obviously instrumental organization. Soon hereafter, though, Trotsky fell from favor; perhaps this partially accounts for the lack of information.

38. Higham and Kipp 37 and Kilmarx 67. Kilmarx supplies

the production figures.

39. Boyd 26, 27.

40. Kenneth Whiting, Soviet Air Power, 1917-1976 (Maxwell AFB, Alabama: Air Force Press, 1976) 49. Whiting's work is full of facts and easy to read, but is not written particularly well.

41. Boyd 30, 31.

42. Whiting 42.

43. Whiting 45.

44. Ray Wagner, The Soviet Air Force in WW II: The Official History (Garden City, N.Y.: Doubleday, 1973) 7.

45. Kilmarx 83. Kilmarx equates the British and Russian air forces in 1928, but Boyd says that there under a thousand Soviet planes in 1928, which would make the Red Air Force smaller than their British counterparts.

46. Anna Louise Strong, The Stalin Era (N.Y.: Mainstream, 1956) 25. Strong presents a view of the Stalin time that is a more popular and social history.

47. Mark Harrison, Soviet Planning in Peace and War, 1938-1945 (Cambridge, Mass.: Cambridge University Press, 1985) 6. This work seems to be a good source, though many of the economic ideas and principles are lost to those with no economic background.

48. Whiting 46.

49. Whiting 45 and Strong 33.

50. Whiting 45, 47, and 48.

51. Lee Soviet 24.

52. Whiting 49.
53. Kilmarx 86, 87. Most other sources neglect statistical data on the aviation increase during the Five Year Plans.
54. Lee Soviet 24, 25. Kilmarx also mentions the creation of these new organizations, but is not as clear as Asher Lee.
55. Jackson Red 32. Most sources, of course, tell of the emergence of the I-15. Also see Kilmarx 127 and Boyd 34.
56. Green and Fricker "Soviet" 247.
57. Schwabidessen 7.
58. "Soviet Aviation wins Lindberghs," New York Times 29 Sept. 1933, 17:1+.
59. "Soviet to Produce Wright Air Engine," New York Times 12 Nov. 1933, 15:1. Article announces the presence of Soviet engineers in the United States.
60. Harrison 6, 253. Motor vehicle production in 1932 was 23,900, while in 1937 the figure was up to 199,900.
61. Kilmarx 153-157.
62. Kilmarx 132, 133. Kilmarx gives a detailed, clear account of Soviet air training.
63. Lee Soviet 26.
64. Jackson Red 33, 34. While all major sources tell of the development of the I-15 and I-16, Jackson's is the easiest to follow. All details between sources seem to be in line with each other.
65. Lee Soviet 29.
66. Wagner 7-9.

67. Kilmarx 126.
68. Harrison 250. An appendix to Harrison's work gives detailed information about annual rates of production for every major industry, from armaments to coal, and so on.
69. Lee Soviet 26, 27.
70. Kilmarx 143.
71. Boyd 75-78. Sources disagree on the original air commitment, but it was not large.
72. Jackson Red 42, 44.
73. Jackson Red 44.
74. "Soviet Planes Described," New York Times 7 Apr. 1937, 14:5. The figures for the Axis aircraft are found in David Mondey's Concise Guide to Axis Aircraft of World War II (Feltham, Middlesex: Temple Press, 1985) 56 and 81.
75. Jackson Red 46.
76. Boyd 78.
77. John T. Greenwood and Von Hardesty, "Soviet Air Forces in World War II," Soviet Air Forces, ed. Paul Murphy (Jefferson, N.C.: McFarland, 1984) 37.
78. Schwabidessen 46, 47. It is generally accepted that the SB series could not carry enough payload to be effective bombers.
79. Greenwood and Hardesty 37, and Kilmarx 146, comment briefly on the obsolescence of Soviet bombers and the failure of strategic air units in Spain, while Jackson Red 56 discusses the realization of the Soviets that they needed to develop ground

attack craft.

80. Kilmarx 146. The author also brings attention to the inaccuracy of high altitude bombing.

81. Albert Seaton and Joan Seaton, The Soviet Army: 1918 to the Present (N.Y.: NAL Books, 1986) 99.

82. K.E. Bailes, "Technology and Legitimacy: Soviet Aviation and Stalinism in the 1930's," Technology and Culture 17 (1976): 68, 71.

83. Seaton and Seaton 99.

84. Harrison 253.

85. Hanson Baldwin, "Russians Buttress War Machine," New York Times 23 May 1937, 10:2.

86. Green and Fricker "Soviet" 250. Kilmarx says about 4,200 planes were "front-line" in 1937.

87. Green and Fricker "Soviet" 250.

88. Kilmarx 159.

89. Green and Fricker "Soviet" 251.

90. Kilmarx 159.

91. Charles Lindbergh, The Wartime Journals of Charles A. Lindbergh (N.Y.: Harcourt Brace and Jovanovich, 1970) 54. Lindbergh flew a bomber, probably a DB-3 or SB, and a fighter, most definitely the I-153, judging by the performance stats Lindbergh provides.

92. Leonard Mosley, Lindbergh: A Biography (N.Y.: Doubleday, 1976) 228, 229. Mosley is overall rather anti-Lindbergh.

93. "Russia has Mystery Role in Europe's Drama," New York Times 7 May 1939, V 3:3+ suggested 8-10,000 planes, while later, on July 12, 1939, Hanson Baldwin's "4,000 in Air Fleet Built up by British," New York Times 10:2 says there were 7,300 aircraft in the Russian arsenal.

94. Baldwin "4,000 in Air Fleet" 10:2. Only heavy bombers were not outclassed by foreign planes.

95. "Lindbergh 'Amiable Tool' in Lloyd George's Opinion," New York Times 20 May 1939, 2:5. Lloyd George was obviously mistaken.

96. Greenwood and Hardesty 37.

97. Higham and Kipp 64. Higham and Kipp do a better job than the other Soviet Air Force books with the Winter War. Kilmarx says there was 150 fighters in the Finnish Air Force, while Eloise Engle and Lauri Paananen, The Winter War: The Russo-Finnish Conflict 1939-40 (N.Y.: Charles Scribner's sons, 1973) says there was actually 162.

98. Engle and Paananen 57 tell of some of the Soviet mishaps, while Michael Parrish, "Command and Leadership in the Soviet Air Force During the Great Patriotic War," Aerospace Historian 26 (1979): 194 says that the Soviets accidentally bombed their own embassy during their first air attack on Helsinki.

99. Kilmarx 151, 308.

100. Higham and Kipp 65.

101. Engle and Paananen 62.

102. Kilmarx 153. Kilmarx says that the Soviet losses were due to the obsolete nature of the Russian planes. This suggestion, however, is almost comical as an excuse; the Finns were most certainly flying a more obsolete, motley assortment of archaic aircraft! Kilmarx also says that the Russians "found enemy opposition much more difficult to overcome than they had expected" but also encountered "comparitively little air opposition." If the heavy losses suffered by the Red Air Force was due to "little opposition," what kind of losses would the Soviets have suffered if the Finns had been "stiffer" competition?! Kilmarx is perhaps not the best source on the Russo-Finnish War.

103. Wagner's Official History of the Soviet Air Force in World War II tells of the first two Five Year Plans, but does not even mention the Finnish conflict. It adds that by 1939 some consideration was being given to improving the force, but does not say what the cause of this re-evaluation was.

104. Greenwood and Hardesty 38.

105. Greenwood and Hardesty 39.

106. Schwabidessen Figure 3, pp. 20, 21.

107. Hardesty 57.

108. Schwabidessen 28.

109. Greenwood and Hardesty 39, 40.

110. The speeds of the new Russian planes are from Hardesty 250, who provides an easy to read appendix about the Soviet craft. All major sources, however, discuss the comparative

speeds of the various aircraft.

111. M. Kozhevnikov, The Command and Staff of the Soviet Army Air Force in the Great Patriotic War 1941-1945 (Moscow: Nauka, 1977) 13. Kozhevnikov, who is a Soviet military historian and a Soviet Reserve aviation officer, was part of the team that authored the official air history of the VVS in World War Two. His work, The Command, is quite objective and is actually enjoyable to read.

112. According to Richard Lukas' "The Impact of 'Barbarossa' on the Soviet Air Force and the Resulting Commitment of United States Aircraft, June-October, 1941," Historian 29 (1966) 61. Asher Lee says only over 5,000, while another source says 7,300.

113. Jackson Red 80 says 4,000, while Herman Plocher, German Air Force vs. Russia, 1941 USAF Historical Study, no. 153 (N.Y.: Arno Press, 1965) 19 tells of the German intelligence estimate.

114. Lukas "The Impact. . ." 61.

115. Boyd 110. Jackson 84 says that 800 of the noon total and around 1489 of the dusk total were destroyed as they sat on the ground.

116. Boyd 111.

117. Wagner 35.

118. Wagner 37 says "more than 20 planes," but Boyd 110 says 35 Luftwaffe craft were destroyed. Kozhevnikov The Command 36, however, says that over 200 "Facist" planes were destroyed on

the first day.

119. Plocher 1941 41.

120. German sources tell of the apparent personal inferiority of the Soviet pilots; Schwabedissen says that the pilots lacked self-confidence but also cites the courageousness of the VVS pilots on page 105. Plocher 1941 says, on page 41, that Soviet fighters had turned and fled when fired upon even at long range.

121. Plocher 1941 41.

122. Plocher 1941 43.

123. Harrison 56, 57, 60, 63, 65-75.

124. Harrison 75, 78, 88.

125. Higham and Kipp 80. The Germans' main dive bomber/ground attack plane, the Ju 87 "Stuka," was nearly obsolete by this time, and the search for a replacement was a very slow and largely fruitless one.

126. Lonnie Ratley III, "A Lesson of History: The Luftwaffe and Barbarossa," Air University Review 34 (1983): 59.

127. Wagner 49 and 53.

128. Wagner 69 tells of Moscow's original defensive air fleet; Lee Soviet 128 gives an eventual figure of 1,000.

129. Von Hardesty, Red Phoenix: The Rise of Soviet Air Power (Washington, D.C.: Smithsonian Press, 1982) 66.

130. Wagner 72 and 74.

131. Jackson Red 90.

132. Wagner 89.

133. Plocher 1941 154. The statement, in context, described the antics of the winter 1941-42 Soviet air units in general.

134. Plocher 1941 251.

135. Schwabedissen 105-106.

136. Schwabedissen 124 speaks of the ground attack arm, while 144 discusses the combat arm.

137. Wagner 91. Kilmarx 184 says that new units made up of just these current types were being formed.

138. Harrison 250 and 251 gives quarterly rates of production. Wagner 91 indicates 21,342 military planes built in 1942, a figure which is actually lower than Harrison's.

139. Kozhevnikov Command 68 and 73. While Hardesty deals somewhat with the changes and Wagner mentions them, no one does a good job of outlining the reforms nor is anyone able to clearly show how these changes affected operations. Schwabedissen's attempt is okay, but Kozhevnikov's, despite being somewhat disjointed and confusing, is the best.

140. Lee Soviet 129.

141. Lee Soviet 135 and 136.

142. Jean Alexander, Russian Aircraft since 1940 (London: Putnam, 1975) 168 and 172, and 424 and 426. All main sources talk of these new aircraft.

143. Wagner 111 and 116.

144. Richard Lukas, Eagles East: The Army Air Force and the Soviet Union 1941-45 (Tallahassee, Fl.: Florida State University

Press) 29. Lukas' book is a very good account of the Army Air Corps' aid to the Soviet Union.

145. Strand 27-29. This is the only source dealing with the VVS that tells of the RAF squadrons that flew with the Russians.

146. Otis Hays, "White Star, Red Star," The Alaska Journal 12 (1982): 9 and 17. The author was assigned to the liason program in Alaska during 1943 and 1944, and writes a nice commentary on the workings and conflicts of the arrangement.

147. Hardesty 253. Hardesty compiled his information from Lukas' work; Lukas does not give totals, but breaks down the exports into each individual shipment.

148. Jackson Red 96 gives the total production figure, although it could have been found in other sources, and Hardesty 253 the total aid numbers.

149. Kozhevnikov neglects the aid entirely.

150. Wagner 91.

151. Kilmarx 208.

152. Lukas Eagles 232, which points out that the U.S. "played the role of the eager, generous, rich and often bumbling suitor . . . met by a reluctant, capricious and suspicious Soviet Union" and also that this was the pervading feeling between the two powers during war.

153. Jackson Red 96.

154. Schwabidessen 197. The author says, surprisingly, that the P-39s proved to be tough adversaries while the Spitfire,

a much superior plane, did not. Perhaps the Spitfires were early models, or maybe the P-39 was better suited for the Russian pilots.

155. Lee Soviet 138-140.

156. Herman Plocher, The German Air Force vs. Russia, 1943. USAF Historical Study no. 155 (N.Y.: Arno Press, 1967) 245. Wagner 134 notes the arrival of the FW-190 and the new Me-109G-2.

157. Kozhevnikov 107 and 108. Kilmarx 205 points out the Pe-8, which would become the main Soviet bomber. Hardesty 165 details each day's aircraft losses.

158. Kozhevnikov 108-126. In most instances through the end of the war, this source is surprisingly consistent with others.

159. Hardesty 121-122.

160. Kozhevnikov 108-126.

161. Kozhevnikov 112.

162. Kozhevnikov 115-116.

163. Hardesty 150 and 152, and Kozhevnikov 126.

164. Kozhevnikov 132-136 and Higham and Kipp 102.

165. Hardesty 153 and Higham and Kipp 102.

166. Hardesty 153-154 and 171-172 notes the effectiveness of these new types of arms. Higham and Kipp 102 acknowledges the Il-2M3 as well.

167. Kozhevnikov 134-136 and Hardesty 161-162.

168. Wagner 186, 381.

169. Higham and Kipp 103 says that the VVS had numerical

fighter superiority for the first time, while Hardesty 183 gives the Luftwaffe operational figure. Higham and Kipp 106 provides both the German and Soviet numbers.

170. Wagner 215 says 35,000, Kozhevnikov 127 says 34,800, while Hardesty 252 asserts 34,884.

171. Kozhevnikov 127 supports these figures, which seem to be pretty standard.

172. Hardesty 189, among others.

173. While a note is almost unnecessary here, Wagner, Higham and Kipp, and Kozhevnikov provided the information, available in any World War Two source.

174. Higham and Kipp 108 tells of the Il-10, Lee Soviet 159 of the Yak-9, and Lee Soviet 176 notes the TU-4 copy of the B-29. Wagner 392-393 and 396 provides the best data for the Yak-9.

175. According to Jean Alexander's Russian Aircraft.

176. Figures supported by Hardesty 189 and 204, and Higham and Kipp 115.

177. By now, the newest Soviet fighters were at least equal to all of Germany's current models.

178. Kozhevnikov 182.

179. Hardesty 210.

180. Kozhevnikov 189.

Notes for Chapter Two

1. John H. Morrow, German Air Power in World War I (Lincoln, NE.: University of Nebraska Press, 1982) 4. Morrow has written as extensively as anyone on early German aviation.

2. John H. Morrow, Building German Air Power, 1909-1914 (Knoxville, TN.: University of Tennessee Press, 1976) 15.

3. Morrow Building German 19-21.

4. "School of Flying Founded," New York Times 18 Mar 1909, 1:6.

5. Morrow German Air Power 5.

6. Morrow Building German 21-23. Alex Imrie's works, other important sources for this early time period of German aviation, do not make mention of this failed craft, called a "three-winged abomination" by Morrow.

7. Morrow German Air Power 5 tells of several contracts awarded, and says that development and design were left to industry. Alex Imrie's Pictorial History of the German Army Air Service, 1914-1918 (London: Ian Allen, 1971) is a good source, and page 14 points out the lack of "official" encouragement by the perhaps overcautious German army.

8. Morrow German Air Power 6 suggests that the military influence over the aviation industry directly prevented any monopolization.

9. Morrow's German Air Power 7 is the only source that

specifically mentions the effects of the recession on the industry. Morrow Building German mentions the early factories by date, though other sources do not address exactly when these first factories came into being.

10. "New Airship Built of Iron," New York Times 4 Mar 1910, 3:3. Military maneuvers conducted in September 1910 contained both airships and airplanes, related in "Airship is Feature of Army Practice," New York Times 25 Sept 1910, III 2:1+. The latter article also notes that "In aerial strength the Germans are at present at a disadvantage."

11. Sources disagree on the August 1911 figure, but only slightly. Alex Imrie's Pictorial History 16 says that eight planes had been obtained by soon after April 1, 1911, although according to Morrow in Building German 29, the War Ministry had purchased seven planes. Building German 43 provides the end of the year figure.

12. "Germany Calls For Airmen," New York Times 11 Mar 1911, 5:2.

13. Imrie Pictorial History 16 and Morrow Building German 40 tell of the early training at factories.

14. Morrow Building German 41.

15. Morrow Building German 44 and 47.

16. Imrie Pictorial History 17 and Morrow Building German 51. Morrow Building German 51 also deals with the Inspectorate's refusal to allow the separate agency. The Inspectorate dealt with aviation and transportation.

17. "Pensions for Army Airmen," New York Times 22 May 1912, 4:4.

18. The increase in planes appears in Morrow German Air Power 7, while both of Morrow's books give consistent figures for budgetary increases. Morrow Building German 52 has somewhat more detailed budget considerations. In "German Air Fleets to cost \$37,500,000," New York Times 30 Mar 1913, III 3:7, a figure of \$2,250,000 is given for the airplane budget.

19. Morrow Building German 57, 58. Page 59 provides the specific breakdown of how the money was to be spent.

20. Morrow Building German 48, 57.

21. Morrow Building German 52, 53. Morrow is very unclear on this subject. Though he says that contracts were not keeping up with industry growth, Morrow says growth continued. The government, the author says, encouraged diversification, but Morrow does not indicate the success or failure of the attempts, nor does he speculate on the cause of the continued success of the aviation companies as a whole.

22. Morrow Building German 70, 60, 71, 84. The fund was primarily used to purchase 62 planes, for military aeronautical research, and also for training.

23. Morrow Building German 72, 81. Morrow says there was little cooperation.

24. Morrow Building German 81. Dale Walker's "Great Warbirds 1914-1918 Part III: Germany," Aviation Quarterly 6(3) 1980: 260 points out that these two types made up most of the

German air strength in August 1914.

25. Morrow German Air Power 7.
26. Morrow German Air Power 8.
27. "Fliers a Big Factor in Six-Power War," New York Times 31 July 1914 4:3 says that the German air fleet was inferior to the French. Morrow German Air Power 11 confirms this, adding that the British were in turn inferior to the Germans.
28. Imrie Pictorial History 21 points out that there were indeed some features that were superior to Germany's rivals', but does not specify what these fabulous features were.
29. Morrow German Air Power 12.
30. Figures vary slightly. Walker "Great Warbirds: Germany" 260 says that the "theoretical" strength was 294, of which 218 were useable. Morrow Building German gives a range of 295-320 functional aircraft, but in Morrow German Air Power 12, he says that 250 of 450 planes were held as front'line by the Germans. Imrie Pictorial History provides divisional, etc., make up, but not straight figures.
31. Morrow. German Air Power 12 and Morrow Building German 87.
32. Walker "Great Warbirds: Germany" 260, 262.
33. Morrow German Air Power 16, 17.
34. Imrie Pictorial History 26, 27. Imrie calls the "stofl" an important step. Morrow German Air Power 37 mentions the new staff officers and says they served as liason and also to help coordinate industrial plans.

35. Imrie Pictorial History 29, and 30. Other sources suggest similar.

36. Morrow German air Power 37.

37. John Morrow, "Industrial Mobilization in World War I: The Prussian Army and the Aircraft Industry," Journal of Economic History 37 (1977): 37 and 38.

38. Morrow "Industrial" 40.

39. G.W. Haddow and Peter M. Grosz, The German Giants: The Story of the R-Planes, 1914-1919 (London: Putnam, 1969) 9.

40. "Build Big Biplane on Russian Model," New York Times 7 Sept 1915 2:4.

41. Haddow and Grosz 9, 10. The early experience of the R-planes provided valuable information about the construction of later aircraft.

42. Walker "Great Warbirds: Germany" 262. Walker's article provides technical information for all major types of German aircraft to appear in the war. The information is generally consistent with that in other sources; Imrie's works provide more technical information than do Morrow's.

43. Imrie Pictorial History 28. Morrow German Air Power 40 and 41 says similar.

44. "Best Aircraft Now said to be German," New York Times 20 Jan 1916 1:2, "New German Planes of Great Speed," 21 Jan 1916 3:4, and "New German Plane Charges Headlong," New York Times 22 Jan 1916 1:6+. All of these articles illustrate the attention that Fokker's E-3 garnered overseas.

45. Morrow German Air Power 60 and 62.

46. "Huge German Airships Not Used in Battle," New York Times 4 Aug 1916 3:2 announces the existence of a huge twin-engined craft. The Gotha bomber became operational in the fall, so presumably the G-4 is the plane noted by the French.

47. Morrow German Air Power 57-59.

48. Morrow "Industrial" 43 cites the growth in companies and deliveries. Morrow German Air Power 71 says that the air battles of 1916 were the start of true aerial warfare, while pp. 72, 73 deal with the Hindenburg Program. As can perhaps be gathered, Morrow is more concerned with the industrial aspects of aviation than are other sources such as Imrie's works.

49. Alex Imrie, German Fighter Units, 1914-May 1917 21 and 39, Imrie Pictorial History 38, and Walker "Great Warbirds: Germany" 262 all mention this change. Imrie especially emphasizes it.

50. Imrie German Fighter, 1914-May 1917 40.

51. Imrie German Fighter, 1914-May 1917 39-41. The reorganization of air units consisted of the following areas: A new position to help coordinate the use of German air services, a new long-range recon division, a ground support and artillery observation division, a group for escorting the previous group and for performing short-range recon, the aerial fighting "Jagdstaffel," and the long-range bombing arm.

52. Imrie Pictorial History 32-35 does a decent job of showing the German air units' use in earlier battles. Cyril

Falls' The Great War (N.Y.: Capricorn, 1959) does a fair job of providing background on the battles, but focuses mainly on the British.

53. Morrow German Air Power 90.

54. Haddow and Grosz 28. C.M. White's The Gotha Summer is a lively, very detailed yet readable, account of the German air raids on England between May and August 1917.

55. Imrie German Fighter Units, June 1917-1918 (London: Osprey, 1978) 3 says the units were up to strength, but neglects the actual number. Morrow German Air Power 92 says that industry's goal had been 2,322 planes, and that source credits the air corps with 2,271.

56. Information on the Albatros and Pfalz models was from Morrow German Air Power 90, 91, and 111. The Fokker triplane is noted in all the major sources, but Morrow German Air Power 112-113 gives a clear and straightforward explanation of the advantages and disadvantages of the Dr-1.

57. Walker "Great Warbirds: Germany" 270 and Morrow German Air Power 106.

58. Morrow "Industrial" 45, 49.

59. Morrow German Air Power 190.

60. Imrie German Fighter Units, June 1917-1918 4 and 7, though Morrow's German Air Power also mentions Richthofen's group.

61. Morrow German Air Power 113, 121, and Walker "Great Warbirds: Germany" 267. Walker mentions the inclusion of the

Fokker D-7 in the Versailles treaty by name.

62. Morrow German Air Power 121-125, 138, and 139.

63. Morrow German Air Power 140. Imrie Pictorial History says 2,709 aircraft at war's end.

64. Richard Suchenwirth, The Development of the German Air Force, 1919-1939 (N.Y.: Arno Press, 1970) 2.

65. Williamson Murray, Luftwaffe (Baltimore: Nautical and Aviation Publishing Company of America, 1985) 2. Generally, the state of German economy is outside the scope of this work, save its effects on the aviation industry.

66. Suchenwirth Development 3.

67. Most sources at least mention Versailles. The best information concerning the treaty's aviation clauses comes from Herbert Malloy Mason jr. in his The Rise of the Luftwaffe (N.Y.: Dial Press, 1973) 38-39, which gives the provisions plus the date for industry rebuilding. Werner Baumbach's Life and Death of the Luftwaffe (N.Y.: Coward-McCann, 1960) is an important primary source, and page 17 tells of Versailles and also the number of planes Germany could keep. Many sources, however, deal strictly with either the World War One period or the later rearmament period after 1920 or so. Asher Lee, a noted aviation historian, provides some information on demobilization in his German Air Force (N.Y.: Harper and Brothers, 1946).

68. Barton Whaley, Covert German Rearmament, 1919-1939: Deception and Misperception (Frederick, Md.: University Publications of America, 1984) 1. Whaley's attempt is of

considerable value, for not only does he cover the major aspects of rearmament, it is a relatively new work.

69. Whaley 2. Whaley's four phases of rearmament will be used in this work. The other three, which will be introduced as appropriate, are as follows:

- 1920-1926; marked by arms evasion under direct eyes of Inter-Allied Control Commission inspectors;

- 1927-1935; covert rearmament;

- 1935-1939; overt rearmament.

70. Whaley 2 and 8. Whaley's work goes into detail on the Commission, while aviation sources generally make little mention of it. The British Air Ministry's The Rise and Fall of the German Air Force, 1933-1945 (N.Y.: St. Martin's Press, 1983) mentions it and Mason's The Rise also acknowledges its existence. J.H. Morgan's Assize of Arms: The Disarmament of Germany and her Rearmament (1919-1939) (N.Y.: Oxford University Press, 1946) deals extensively with the Commission and is regarded as an important work, but almost completely neglects any discussion of aviation. Baumbach devotes a line to the Commission.

71. Whaley 12-14.

72. Whaley 9-10.

73. Suchenwirth Development 5-7. Mason 86-94 or so discusses von Seeckt's role as well, focusing more on the regular army units. Air Ministry 1 suggests the Reichswehr Defense Ministry as a nucleus for later development.

74. Gerd Hardach, "Banking and Industry in Germany in the

Interwar Period 1919-1939," Journal of European Economic History 39 (1984): 209 discusses the particulars of post-war reconstruction of industry and inflation, while Whaley 24-25 cites the remaining companies.

75. "Progress in Civil Flying," New York Times 28 July 1921, 2:6.

76. Baumbach 18, Suchenwirth Development 12 and 13, and Peter Townsend, Duel of Eagles (N.Y.: Simon and Schuster, 1970) 54-55, though most sources mention the arrangement. Townsend's work is a popular work focusing a little more on the R.A.F. than anything else.

77. Mason 144 and Suchenwirth Development 13-14.

78. Suchenwirth Development 13, Hanfried Schliephake The Birth of the Luftwaffe (Chicago: Henry Regney, 1971) 14, and Baumbach 18.

79. Schliephake 13.

80. "Says Germany Builds a Secret Air Fleet," New York Times 12 Aug 1923, VII 6:6.

81. Suchenwirth Development 12.

82. Mason 118-119, 144-145.

83. Suchenwirth Development 11 and Mason 135-136.

84. "Denies Making Air Fleet," New York Times 7 Feb 1925, 3:6.

85. "Find Germans Are Making Forbidden Planes, Operating Shops in Sweden and Switzerland," New York Times 19 Jan 1926, 5:3.

86. Suchenwirth Development 15 and Whaley 25. Baumbach 18 tells of Germany's concessions that had to be made in exchange for the new agreement, such as no more government aid for sport flying groups.

87. Lee German 1-2. Other sources note some of these planes' civilian origins, especially the Ju-52, which would become the Luftwaffe's main transport.

88. Whaley 26, Lee 11, and Edward Homze, Arming The Luftwaffe (Lincoln, NE.: University of Nebraska Press, 1976) 129 and 130 all tell of the Bf-108. Though the other planes do not fit directly into the commentary at this point, it is important to show the long-term effects of the new provisions.

89. Whaley 33 and 41. Strangely no other main source even mentions the withdrawal of the commission, and equally few devote more than a mention to its existence.

90. Suchenwirth Development 20. The whole situation at the time, roughly 1926-1929, is a confusing mess.

91. Suchenwirth Development 26, 27.

92. From Homze Arming 20, who gets his numbers from Suchenwirth's Development; the figures are found on page 28.

93. Mason 161 lists these types, as does Suchenwirth Development 31. Suchenwirth does not, like some other sources, downplay the importance of the cooperation. The Do-11's testing at Lipetsk is pointed out by Suchenwirth. Homze also mentions these craft, having used Suchenwirth as his source for this point.

94. Homze Arming 24-31 gives a good basic account of the late 1920's in the aviation industry.

95. Suchenwirth Development 23.

96. "Germany Expects Aviation Expansion," New York Times 2 Jan 1930 and Hardach 215. Hardach deals largely with the banking crisis of 1931 in his article.

97. Homze Arming 35.

98. Suchenwirth Development 32-34. Mason 164 also notes the closing in late 1932, as does Walter Schwabedissen's The Russian Air Force in The Eyes of German Commanders 4-5.

99. Suchenwirth Development 35-36 and Homze Arming 33.

100. Schliephake 21 and 28. Other sources usually note the planes, as discussed earlier, in a "1928-1933" framework.

101. "Germany's Aviation Outlay Seen Larger Than France's," New York Times 26 Feb 1933: 8:2.

102. Townsend 95-97, Lee German 4, Homze Arming 49, Air Ministry 4-6 all tell of appointments in the new ministry.

103. "Reich Forms Body for Air Defence," New York Times 30 Apr 1933: 29:3.

104. Air Ministry 7. The emergence of these craft is noted elsewhere as well.

105. Mason 179 and Townsend 101.

106. Suchenwirth Development 120-121.

107. Information about Germany's long-lasting effects from the slump can be found in Burton Klein's Germany's Economic Preparations for War (Cambridge, Mass.: Harvard University Press,

1968) 4-5.

108. Klein 19, 21.

109. Homze Arming 80 calls the plan the "Rhineland Program," and breaks the numbers down as follows:

Bombers	792
Fighters + recon planes	<u>926</u>
Sub-Total	1718
Naval Aircraft	<u>149</u>
Total Combat Planes	1867
Trainers, all others	<u>2154</u>
GRAND TOTAL	4021

Air Ministry 8 differs slightly:

Total Combat Planes	1863
All Others	<u>2158</u>
TOTAL	4021

Mason 180 says over 1067 combat planes and greater than 2050 other types. Suchenwirth Development also refers to the Rhineland Program, saying 4029 planes were slated for construction, adding that about 1073 of these were bombers or fighters.

110. "Reich to Be Armed in Air With Mighty Fleet by 1936," New York Times 11 May 1934: 1:4+.

111. Wilhelm Deist, The Wehrmacht and German Rearmament (Toronto: University of Toronto Press, 1981) 59. A relatively new work.

112. Homze Arming 83 and Suchenwirth Development 129. Air engine production was often a "thorn-in-the-side" when nations were trying to develop an aviation industry.

113. Homze Arming 93. Klein hints at such growth, but as his book is geared towards the German economy as a whole, he does

not provide exact figures.

114. Trial of the Major War Criminals before the International Military Tribunal: Official Text in the English Language. (Nuremburg, Germany: Secretariat of the Tribunal, 1947) Vols. II, 339 and IV, 539. The trial records are invaluable as primary material since many of the Luftwaffe records were lost. Goring's files, in particular, are gone. Quotes taken from testimony.

115. Most sources tell of Hitler's decree, and Townsend 111 and Schliephake 34 are just two of these.

116. Trial of the Major War Criminals, Vol. IX 45-46.

117. Trial of the Major War Criminals, Vol. II 339 relates Goring's assurance that the air force was to be for peace, while Vol. IX 49 explains Milch's opinions on Goring.

118. "Robinson Returns Derisive of Russia," New York Times 15 Sept 1935: 24:3.

119. Williamson Murray, "The Luftwaffe Before the Second World War: A Mission, A Strategy?" Journal of Strategic Studies 4 (1981): 264.

120. Hermann Goring, The Political Testament of Hermann Goring: A Selection of important Speeches and Articles. (N.Y.: AMS Press, 1972) 151. From a speech of 12 October, 1935.

121. Schliephake 35.

122. From R.J. Overy, "German Air Strength 1933 to 1939: A Note," The Historical Journal 27 (1984): 468. Overy says he got some of his figures from Schliephake.

123. Overy "German Air Strength" 468.

124. Mason 190. The break down is as follows:

372	Do-11 and Do-23 bombers
450	Ju-52 bomber/transport
51	He-50 dive bomber trainers
251	Ar-64, Ar-65, He-51 fighters
320	He-45 long range recon. planes
270	He-46 short range recon. planes
119	various naval planes

125. "Huge Gain is Seen in Reich Aviation," New York Times 21 Oct 1936: 5:1+ deals with the factories, while Wesley Wark's "British Intelligence on the German Air Force and Aircraft Industry," The Historical Journal 25 (1982): 630 tells of the arguing in Britain.

126. Whaley 51-52.

127. Whaley 50 and Suchenwirth Development 159-160 both talk of Mefo Bills, and Klein 76-82 attempts to dispel some of the myths about economic rearmament.

128. From Amos Simpson's article "The Struggle for Control of the German Economy," Journal of Modern History 31 (1959). Simpson's article does a respectable job of conveying the difficulties of an otherwise complex confrontation.

129. Homze Arming 104-105.

130. Schliephake 28, and most information would support this if planes of other countries were compared to German designs.

131. Mason 201-204, Schliephake 36-37, and Matthew Cooper The German Air Force 1933-1945 An Anatomy of Failure (London: Jane's, 1981) 49. All of these sources address the issues

relating to the Stuka.

132. Suchenwirth Development 152-153 mentions the disadvantages while Cooper German 52-53 cites the lack of range.

133. Cooper German 52-54. Suchenwirth Development 153 says that the Bf/Me-110 was obsolete as soon as it was produced. The real trouble began in 1938-1939 when the successor, the Me-210, was a total failure.

134. Leonard Mosley, The Reich Marshal: A biography of Hermann Goring (Garden City, N.Y.: Doubleday, 1974) 360, Lee German 7, and Richard Suchenwirth Command and Leadership in the German Air Force (N.Y.: Arno Press, 1969) 132. Command is an incomparable source for details of the Luftwaffe officers' personalities, strengths, and weaknesses.

135. Lee German 7 and Suchenwirth Command 135. Mosley Goring 361 suggests Goring's greatest fault was his failure to object to unethical Nazi activities.

136. Suchenwirth Command 14-15.

137. Suchenwirth Command 19-33. Provides an excellent monograph on Milch, a good worker hampered by a few faults.

138. Suchenwirth Command 53, 91, 109, 111.

139. Suchenwirth Command 284-292 and Homze Arming 236-237.

140. Trial of the Major War Criminals, Vol. IX 174-175. From Kesselring's testimony.

141. Homze Arming 149, 151-153, 155 and R.J. Overy's "The German pre-war aircraft production plans: November 1936-April 1939." English Historical Review 15 (1975): 781-787.

142. Deist 89.

143. Klein 32-33, 41-45, and Overy "The German Pre-war" 791. The shortages of raw materials in Germany before and during the war is a well-known fact.

144. Trial of the Major War Criminals Vol. IX 61.

145. Richard Suchenwirth Historical Turning Points in The German Air Force War Effort (N.Y.: Arno Press, 1968) 415, Schliephake 38-39, Baumbach 21-22, and Edward Homze's "The Luftwaffe's Failure to Develop a Heavy Bomber Before World War II," Aerospace Historian 24 (1977): 21, each of which relates Wever's dedication to the development of a strategic air arm.

146. The problems of the four engined bomber are widely covered. Homze "Luftwaffe's Failure" 22 and 25, Suchenwirth Historical 41 and Development 153-154, and Cooper German 69 address the issue admirably.

147. Mondey's Concise Guide to Axis Aircraft of World War II 118 expresses the opinion that the Ju-88 was the most versatile German craft of the war. In Cooper German 69, a letter written to Jeschonnek by a commander of an air corps notes the lack of range, and R.J. Overy's "From 'Uralbomber' to 'Amerikabomber': The Luftwaffe and Strategic Bombing." Journal of Strategic Studies 1 (1978): 167 cites the lack of adequate carrying capacity; the British Lancaster, a common Allied medium bomber, could carry 14,000 lbs. of bombs up to 1,600 miles, while the Ju-88 could only fly up to 620 miles with 3,960 lbs. of bombs.

148. Cooper German 46, Homze "Luftwaffe's failure" 25, and Mondey 83-90.

149. Mondey 95-96, Mason 259, and Suchenwirth Historical 42-43 all relate the He-177's unfortunate life.

150. Trial of the Major War Criminals Vol. IX 281.

151. Trial of the Major War Criminals Vol. IX 174-175.

152. Overy "'Uralbomber'" 171-173 notes lack of powerful engines. Homze "Luftwaffe's Failure" 21 and 22 notes lack of a bomb sight, as does Suchenwirth Historical 28-29. The raw material shortage's effect on heavy bombers is well-cited; Goring in Trial of Major War Criminals 281, Suchenwirth Historical 29, and Homze "Luftwaffe's Failure" 25 point out the shortage's effect, but most suggest the problem should have been dealt with instead of used as an excuse.

153. Information on the Hs-123 is found in Homze Arming 150, Mondey 99-101. The Hs-123 also had dive bombing capabilities. The Hs-129 is addressed in Mondey 101-103 and Cooper German 82, while Mondey 14 deals with the Ar-96.

154. Whaley 61 and Gabriel Jackson's The Spanish Republic and the Civil War 1931-1939 (Princeton, N.J.: Princeton University Press, 1965) 334. Hugh Thomas' definitive The Spanish Civil War (N.Y.: Harper and Row, 1977) 469-470 notes the founding of the Condor Legion. Though the treatment here hardly does the conflict justice, it is dealt with elsewhere as well, and the main results for purposes herein are the experience gained by the Germans and the success of ground support activities.

155. Mason 228-237 does a decent job on air involvement in Spain, also seen in Lee German 14-16, Schliephake 42-44, and Air Ministry 13-17. Hugh Thomas' work is perhaps the best general account of the Spanish Civil War and devotes the most coverage of any non-aviation source examined on the Condor legion.

156. Air Ministry 14-17 tells clearly of these lessons.

157. Air Ministry 17.

158. There is a problem here, for Lee German says Ju-86 and Hs-123, and though others (Schliephake and Air Ministry) note the presence of Hs-123s, no one else acknowledges the presence of Ju-86s in Spain. Perhaps Lee means the Stuka Ju-87, which was revealed to have some slight difficulties.

159. Homze Arming 189-190.

160. Overy "German Pre-War" 786. Other sources include this information, especially Schliephake, but no one else breaks it down as clearly or easily.

161. Wark 639 on British Intelligence, who calls the period from 1937-September 1938 a period of blindness. Overy "German Pre-War" 787 for the rest.

162. Otto D. Tolischus. "Germany Admits Only 3,000 Planes," New York Times 27 Oct 1938: 20:1+.

163. Robert Hessen. Editor. Berlin Alert: The Memoirs and Reports of Truman Smith. (Stanford, CA.: Hoover Institution Press, 1984) 104-105, 111-112, and 114-117. Smith was the U.S. Army air attache in Berlin.

164. Hessen 106 gives a list of visitors, and Lois

Schwoerer's article "Lord Halifax's Visit to Germany: November 1937," Historian 32 (1970) tells of the British noble/diplomat's visit to Hitler.

165. Mason 256-257 and Mondey 184-186.

166. Schliephake 50 and Mason 157.

167. Overy "German Air Strength" 468 gives the figure. Air Ministry 19 says 2,928 with 1,669 "servicable" which Cooper 85 supports (though it is quite possible that Cooper used the Air Ministry work as a source).

168. Cooper German 85-86.

169. Lee German 16. For more detail on the Munich agreement and its effects, Francis L. Loewenheim, editor, Peace or Appeasement? Hitler, Chamberlain, and the Munich Crisis (Boston: Houghton Mifflin, 1965), Joachim Remak The Origins of The Second World War (Englewood Cliffs, N.J.: Prentice Hall, 1976) and Telford Taylor's authoritative Munich: The Price of Peace (Garden City, N.Y.: Doubleday, 1979) were also consulted.

170. Lee German 16.

171. Homze Arming 222 and Overy "German Pre-War" 789. Schliephake 50 notes requests for He-177s.

172. Trial of The Major War Criminals Vol. IX 60, Milch's testimony. Homze Arming 223 says that 85% of the world's aviation fuel would be needed for the proposed force.

173. Mason 250.

174. Overy "German Pre-War" 786, Overy "German Air Strength" 470, and Homze Arming 226-229. Homze is quite thorough

in his dealing with the five-fold plan, and provides figures directly from original documents as does Overy. The source of their figures is important since the documents themselves are not easily accessible to most researchers.

175. Overy "German Pre-War" 789, 792.

176. R.J. Overy, "Mobilization for Total War in Germany 1933-1941," English Historical Review 53 (1988): 635.

177. Homze Arming 262-265.

178. Trial of The Major War Criminals Vol. IX 204.

179. Mondey 70-72, 95, 101, 181, 184-185.

180. Trial of the Major War Criminals Vol. IX 202-203 and Baumbach 33-34.

181. Suchenwirth Development 157 provides 3,958 figure, Schliephake 53-54 says that 3,646 of 4,093 were ready to deploy, and Mason says 2,000. Several sources give a break down of number of types, though figures vary only slightly:

	Suchenwirth <u>Development</u> 157	Schliephake 54
He-111	787	787
Do-217*	331	371
Ju-88	18	18
Ju-87	366	366
Hs-123	40	40
Me-109	1056	1056
Ar-68	28	28
Ju-52	552	552
Hs-126	275	275
He-46	67	65
He-45	14	14
Do-17	257	257
Naval	167	167
Me-110	N/A	95

* The Do-217 was an improved Do-17.

182. Mason 292. Lee German 48 says the Poles had 500

craft.

183. Trial of the Major War Criminals Vol. IX 29 for Bodenschatz, Vol. IX 56-57 for Milch. Baumbach 30, 38-40.

184. Practically unanimous, though Lee German 17 says the Luftwaffe was ready, but not for the war that emerged. Cooper German 92 says "For the German Air Force, war had come too soon." Schliephake 58 says the Luftwaffe was destined for defeat "unprepared." Whaley says 1939 found Germany as a whole unprepared for war.

185. Baumbach 31, and supported by actual figures from Pierre Cot, "The Defeat of the French Air Force," Foreign Affairs 19 (1941): 791. Cot's article has mixed value in that he seems to be quite pro-French and may not always be objective.

186. These were the main problems facing the Germans in their attack on France. Hans Dieter Berenbrock The Luftwaffe War Diaries (Garden City, N.Y.: Doubleday, 1968) 142-143 gives good conclusions about the attack. Charles Burdick and Hans-Adolf Jacobsen, Editors, The Halder War Diary 1939-1942 (Novato, Ca.: Presidio, 1988) 133-218 provides an insightful and invaluable day-by-day account of the invasion. Andre Ausem's "The Luftwaffe Airborne Losses in May 1940: An Interpretation," Aerospace Historian 32 (1985): 184-188 deals somewhat with aviation losses but mostly with paratroop operations.

187. Suchenwirth Historical 65 breaks down strength as follows:

<u>Bombers</u>	
Actual strength	1,458

Available	700-800
<u>Dive Bombers</u>	
Actual strength	446
Available	343
<u>Fighters, two-engined</u>	
Actual strength	310
Available	230
<u>Fighters, single-engined</u>	
Actual strength	1,065
Available	760

Halder's diary, page 236, says that in late July, Britain had 900 planes, while Germany had a total of 1,075 fighters and 1,350 bombers available. The diary reveals a very thorough and detailed analysis of Britain's strengths and weaknesses; notes also that the British were "sports!"

Air Ministry 76 provides the following figures for the Germans:

Bombers	1,200
Dive Bombers	280
Fighters	980
Others	140.

188. Alfred Price, Battle of Britain: The Hardest Day 18 August 1940 (N.Y.: Charles Scribners' sons, 1980) 16. The quote is actually hard to locate, as famous as it is.

189. Suchenwirth Historical 69-71, Air Ministry 87, and Berenbrock 182-183. For background on the Battle of Britain, Roger Parkinson's Summer 1940 The Battle of Britain (N.Y.: David McKay, 1977) suggests that the R.A.F. was never on its last legs as many have suggested, Len Deighton's Fighter: The True Story of the Battle of Britain (N.Y.: Alfred Knopf, 1978), and Richard Collier Eagle Day The Battle of Britain (N.Y.: E.P. Dutton, 1966)

were examined. Most are popular in flavor.

190. Deighton 230. Suchenwirth Historical 65-66 says that 1,733 bombers and fighters were downed between July and October 1940.

191. Suchenwirth Historical 66.

192. Karl Koch, Jr., "The Luftwaffe and Malta: A Case of "Hercules" Chained," Aerospace Historian 23 (1976): 94 and Berenbrock 202, while Baumbach 99-103 notes the lack of overall importance of the occupation of Crete.

193. R.J. Overy "Mobilization" 629.

194. Mondey 68-73, 172, 180. By comparison, the Me-109 could fly up to 385 mph and the Me-110 about 342 mph.

195. Suchenwirth Command 167-168 tells of Goring's opposition to Operation Barbarossa. Suchenwirth Historical 72-74 notes problems of Luftwaffe before Russia. For a newer perspective, Russel Stolfi's "Barbarossa Revisited: A Critical Reappraisal of the Opening Stages of the Russo-German Campaign (June-December 1941)," Journal of Modern History 54 (1982): 27-46 and Lonnie Ratley's "A Lesson of History: The Luftwaffe and Barbarossa," were used.

196. Most sources deal with these factors in some fashion; they are obvious given all the considerations, however.

197. Cooper German 219, 259-260.

198. Cooper German 262. Baumbach 211 provides the following outline of combat plane output:

	<u>1940</u>	<u>1942</u>	<u>1943</u>	<u>1944</u>
Bombers	2,852	4,337	4,649	2,287
Fighters	2,746	5,515	10,898	25,285
Battle				
Aircraft	603	1,249	3,266	5,496
Recon.	971	1,067	1,117	1,686
Transports	388	573	1,028	443
Naval	268	238	259	141
Jets	-	-	-	1,041
Other	2,418	2,431	3,590	4,214
TOTAL	10,247	15,409	24,807	40,593

199. Baumbach 161-163. The Fw-190 would, in fact, be the only major new aircraft introduced by the Luftwaffe during the war!

200. The jet controversy and its outcome is perhaps the largest mistake of the Germans relating to aviation save the lack of a heavy bomber. Suchenwirth Historical 119-126, Cooper German 326-327, Mason 371, and Air Ministry 369 all relate the controversy.

201. Mason 371 and Monday 18-20 give information on the Arado bomber. Its main disability was its immobility on the ground; it had no landing gear. There was a Messerschmidt bomber ready for production as well. Monday 93-94 details the Salamander, while 181-184 tells of the Me-163.

202. The strategic bombing of Germany is held by some to have had less impact than has long been asserted. Kenneth Werrell "The Strategic Bombing of Germany in World War II: Costs and Accomplishments," Journal of American History 73 (1986): 702-713 points out that German morale did not crack, nor was industry affected immediately, and these were the two main goals

of strategic bombing. Werrell insinuates that the diversion of German manpower to deal with the strategic bombing and its effects was more vital. Berenbrock 361-362 points out the drastic effect of new American long-range escorts (though he neglects to identify these as the P-51 Mustang and the P-47). Albert Speer, largely responsible for the heightened industrial production near the end of the war, remarks in his Inside the Third Reich: Memoirs (N.Y.: Collier, 1970) 350 that by July 1944, however, 98% of Germany's aviation fuel plants had been knocked out by heavy bombing.

For more detail on the Allied Strategic Bombing of Germany, the better sources seem to be The United States Strategic Bombing Survey (N.Y.: Garland, 1976), a ten volume, extremely detailed series which seems to be rather objective, and Larry Bidinian's The Combined Allied Bombing Offensive against the German Civilian 1942-1945 (Lawrence, Kansas: Coronado, 1976). A personal account, The Strategic Air War against Germany and Japan: A Memoir by Haywood S. Hansell, jr. (Washington, D.C.: Office of Air Force History, 1986) and the popular Battle Over The Reich by Alfred Price (N.Y.: Charles Scribners' sons, 1974) are also useful. Finally, editor Wes Craven's The Army Air Forces in World War II (Chicago: University of Chicago Press, 1964) is the most extensive treatment of its subject. For the British role, Charles Webster and Noble Frankland's multi-volume official The Strategic Air Offensive against Germany 1939-1945 (London: Her Majesty's Stationary Office, 1961) is by far the best, and is

also quite enjoyable to read.

203. Lee German 191-192 and Air Ministry 389-392.

204. Lee German 192, Air Ministry 392, though Cooper German 376 says 3,500.

205. Speer's memoirs talk at length about this, and Baumbach 190 calls Speer a "Knight without Fear or Reproach."

Notes for Chapter Three

1. J.W.R. Taylor and P.J.R. Moyes, Pictorial History of the R.A.F.: Volume I (N.Y.: Arco, 1968) 5-7 and Maurice Dean, The Royal Air Force and Two World Wars (London: Cassell, 1979) 6 both tell of the inglorious life of the group.

2. Malcolm Cooper, Birth of Independant Air Power: British Air Policy in the First World War (London: Allen and Unwin, 1986) 4 tells of the few governmental contracts, while Taylor and Moyes Vol I 9 points out Germany's growing militarism.

3. The Flying Corps of 1912 is mentioned in Malcolm Cooper's "Blueprint for Confusion: The Administrative Background to the Formation of the Royal Air Force, 1912-19." Journal of Contemporary History 22 (1987): 437, Dean 7-8, and Taylor and Moyes Vol I 9 and 10. Most sources of any detail make a mention of it. Taylor and Moyes provides the monetary figure.

4. The specific missions of each branch are explained in Cooper Birth 14-15 and Dean 9. The overall division is pointed out in these and many other sources.

5. Cooper "Blueprint" 439. Later, public complaints would only heighten the tension.

6. Christopher Cole and E.F. Cheesman, The Air Defence of Britain 1914-1918 (London: Putnam, 1984) 5 and 8. The work provides a nearly day-by-day listing of sorties flown in direct

defense of Britain. Very detailed indeed.

7. Dale L. Walker, "The Great Warbirds 1914-1918: Part II: Great Britain." 6 (1980): 153 says 179, with 90 being in the Naval air service. Walker, Taylor and Moyes Vol I 12, and Dean 9 all agree that the B.E.F. took with it 63 planes.

8. Walker "Part II" 153 and Dean 10.

9. "History of the R.A.F." Flying 31 (1942): 177 and Cooper Birth 27.

10. Taylor and Moyes Vol I 12.

11. Dean 11.

12. Cooper Birth 29 and 19. Cole and Cheesman 6-9 tell of some of the problems with mounting machine guns on the early models.

13. D.H.-2 and Pup information from Walker "Part II" 158 and 164. Cole and Cheesman 188 notes the arrival of the first Pup at a home defense squadron.

14. The Battle of the Somme is detailed in many general sources, such as Cyril Falls', The Great War. Sir John Slessor's readable and definitive memoir The Central Blue (London: Cassell, 1956) mentions Allied air superiority, while Dean 11 and Cooper Birth 31-33 also deal with the battle.

15. Cooper Birth 53.

16. Dean 22 is one of these.

17. Dean 22-23, Cooper "Blueprint" 441, and Cooper Birth 56-68. Cooper is the main advocate of Curzon's board, it would seem; most others place only passing value in it. Cooper also

says that the Navy was less of a hinderance after Curzon's board.

18. As pointed by especially by Cooper Birth 73.

19. Cooper Birth 73, 79, and 81, Dean 11, and Slessor 19 all point out this "see-sawing" of air superiority.

20. Dean 23 calls the spring of 1917 "Bloody April," as April was the worst month for casualties.

21. The Gotha raids have been the subject of much research, and several works, such as C.M. White's The Gotha Summer (London: Robert Hale, 1986) are devoted to the raids exclusively. Information here is from Cooper "Blueprint" 440, Cole and Cheesman 215-217, and Barry D. Powers Strategy Without Slide-Rule: British Air Strategy 1914-1939 (N.Y.: Holmes and Meier, 1976) 52-68. Powers' work is a fair source on the Gotha raids, the previous zeppelin attacks, and the early years of British air doctrine.

22. Cooper Birth 100.

23. Cooper "Blueprint" 443.

24. The Smuts report is discussed in Cooper Birth in great detail, and is also examined in Powers 68-96, Dean 24-31, and Taylor and Moyes Vol I 12. Churchill's support is noted in a speech he gave to the House of Commons in 1916, found in editor Robert Rhodes James' Winston S. Churchill: His Complete Speeches, Volume III, 1914-1922 (N.Y.: Chelsea House, 1974) 2417-2428.

25. Cooper Birth 107 and Dean 25.

26. Cooper Birth 109.

27. D.H.-9 information is from Walker "Part II" 158 and

Cooper Birth 94 and 132. The information on fighters is from Cooper Birth 162 and 164, and the Camel was also mentioned in Taylor and Moyes Vol I 17. Cole and Cheesman 213-216 mentions the first appearances of the two fighters in home defense and strategic bombing roles.

28. "History of the R.A.F." 180 and Powers 99.

29. Cooper "Blueprint" 447.

30. Taylor and Moyes Vol I 17 says 188 squadrons to only 33; these would not account for the full 22,000 unless each squadron had over 100 planes, which is unlikely. Cole and Cheesman 461 say 22,647 airplanes, while Cooper gives only "almost 200" squadrons down to 33.

31. Cooper Birth 154-155 and Cooper "Blueprint" 450. Dean 33-37 devotes some more detail to the troubles immediately following the war.

32. Robin Higham, Armed Forces in Peacetime; Britain, 1918-1940, a case study (Hamden, Conn.: Archon, 1962) 147 and 148.

33. The Somaliland incident is related in the article "Mad Mullah Overthrown," New York Times 25 Jan 1921: 32:2 and Taylor and Moyes Vol I 29.

34. The R.A.F.'s exploits in the Middle East are addressed in Brian Bond's British Military Policy Between the Two World Wars (Oxford: Clarendon, 1980) 85, as well as in Taylor and Moyes Vol I 23-30. Slessor 52, 57-58, and 63 provides a personal account of Slessor's own duty in the Aden Protectorate, detailing the transference of control and showing what things were like

there for a flight officer.

35. Higham Armed Forces 157, 160, and 163. Slessor 33-37 also explains the poor state of the air force in India, and follows his account with humorous tales of his stay there.

36. Basil Collier, The Defence of the United Kingdom (London: Her Majesty's Stationary Office, 1957) 13, and invaluable source, and Powers 186.

37. Robert J. Young, "The Strategic Dream: French Air Doctrine in the Inter-War Period, 1919-39," Journal of Contemporary History 9 (1974): 59 tells of the French strength at the time.

38. Among them John Ferris in his "The Theory of a 'French Air Menace', Anglo-French Relations and the British Home Defence Air Force Programmes of 1921-1925," Journal of Strategic Studies 10 (1987) and Powers 186.

39. Ferris 77, Dean 38, Powers 186, and Collier Defence 14-15, who calls the disparity between the French and British air forces "menacing."

40. Peter Fearon, "The British Airframe Industry and the State," Economic History Review 27 (1974): 243, and Higham Armed Forces 165.

41. "Britain's Growing Air Force," Literary Digest 21 Mar 1935: 19 provides the monetary figure, while Collier Defence 19 and Dean 38-39 talk of the postponement. Dean 38-39 points out the reasons:

-French threat had diminished, and no other major power prepared to attack England;

- Locarno, signed in 1925, guaranteed peace;
- Financial concerns.

42. Fearon 243.

43. Collier Defence 19, Robert Paul Shay British Rearmament in the Thirties: Politics and Profit (Princeton, N.J.: Princeton University Press, 1977) 20, and C. Longcroft's "The Air Force Requirements of Great Britain," The Nineteenth Century and After Feb (1932): 206. Others note the decline as well; only Longcroft seems to know the other countries, however.

44. Information on planes comes from Dean 39 and some also Taylor and Moyes Vol I 42-44.

45. Longcroft 199.

46. Sir Charles Webster and Noble Frankland, The Strategic Air Offensive Against Germany: 1939-1945: Volume I, Preparation (London: Her Majesty's Stationary Office, 1961) 59, though many other sources deal with the meeting. For general background, Peace without Promise: Britain and the Peace Conferences, 1921-23 (Hamden, Conn.: Archon, 1981) by Michael Dockrill and J. Douglas Gould and G.M. Gathorne-Hardy's A Short History of International Affairs 1920-1939 (London: Oxford University Press, 1968) were consulted and are both good sources.

47. Malcolm Smith, "The Royal Air Force, Air Power and British Foreign Policy, 1932-37," Journal of Contemporary History Jan (1977): 156.

48. "British Consider Plan to Double Air Force," Literary Digest 16 Jun 1934: 8.

49. The various schemes undertaken by the British to rearm

their air corps are somewhat confusing. John Terraine does an admirable job of simplifying the picture in his A Time For Courage: The Royal Air Force in the European War, 1939-1945 (N.Y.: Macmillan, 1985) with pp. 25-31 addressing Scheme "A." Two of the official histories, Webster and Frankland Vol I 67 and 108-109 and Collier Defence 28-31, are good, while N.H. Gibbs' official Grand Strategy I: Rearmament Policy (London: Her Majesty's Stationary Office, 1976) can provide a nice framework for the programs.

50. Higham Armed Forces 176-177.

51. Ferdinand Kuhn, jr. "Britain Will Build Her Aerial Forces to Size of Reichs," New York Times 2 May 1935: 1:3+.

52. Terraine 33.

53. Webster and Frankland Vol I 70 and Gibbs 561.

54. Collier Defence 31 says that of about 500 bombers in Scheme "A," 300 were to be light bombers, while 360 out of around 800 under "C" were to be light, a fact also pointed out by Webster and Frankland Vol I 67-68.

55. Collier Defence 32, Fearon 245, and Taylor and Moyes Vol I 133, 137, and 163.

56. Lauren Lyman, "Big Bombers For Britain," New York Times 13 Oct 1935: X 8:2 and Taylor and Moyes Vol I 147 and 157.

57. Terraine 33.

58. Shay 52.

59. Gibbs 562, Terraine 34, and Dean 66-67.

60. Gibbs 562, 564-565.

61. The new arrangement was announced in "Britain Replans Air Units," New York Times 18 Jun 1936: 13:4 and is described in Higham Armed Forces 179, Dean 66, 69-70, Taylor and Moyes Vol I 57, and Webster and Frankland Vol I 82-84. A Maintenance Command was set up later, as was a Transport Command.

62. Sholto Douglas, "Fighter Command," Flying 31 (1942): 62.

63. Philip B. Joubert, "Coastal Command," Flying 31 (1942): 70-75, Webster and Frankland Vol I 83, and Collier Defence 36 and 55 all address various aspects of the Coastal Command.

64. Mostly Webster and Frankland Vol I 101-102, but also Higham Armed Forces 179.

65. Basic Spitfire data is from Terraine 20 and John Crossland "Britain's Air Defences and the Munich Crisis," History Today Sep (1988): 42-43. Terraine 29 refers to the Hurricane in the favorable quote. Taylor and Moyes Vol I 56 provides performance figures for British models.

66. Andrew Hendrie "A Converted Airliner at War: The Lockheed Hudson Aircraft as Operated by Coastal Command, Royal Air Force," Aerospace Historian Dec (1984): 234 tells of the Hudson purchase, while "U.S. Firm in Canada Gets British Order for 300 Airplanes," New York Times 23 Oct 1936: 1:3+ mentions further acquisitions.

67. While others discuss the plan, the mention of it here is courtesy of Gibbs 656-566.

68. Gibbs 566 and Webster and Frankland Vol I 72-75.

69. Terraine 51.
70. Gibbs 569.
71. Webster and Frankland Vol I 77, Gibbs 579, and Collier Defence 48 all talk about "L."
72. Collier Defence 63-65 does an excellent job of describing "L."
73. "Britain is Seeking War Planes Here," New York Times 14 Apr 1938: 1:3+ and "Britain to Send Experts," New York Times 15 Apr 1938: 4:3.
74. Ferdinand Kuhn, jr., "Britain Now Seeks Bombers in Canada," New York Times 14 Jul 1938: 11:1.
75. Background on Munich found in A.J.P. Taylor The Origins of the Second World War (N.Y.: Atheneum, 1964), Francis L. Loewenheim, Peace or Appeasement? Hitler, Chamberlain, and the Munich Crisis, and Telford Taylor, Munich: The Price of Peace. Terraine 69 also consulted.
76. David Dilks, editor, The Diaries of Sir Alexander Cadogan (N.Y.: G.P. Putnam's Sons, 1972) 123.
77. Martin Gilbert, Winston S. Churchill: Vol. V: The Prophet of Truth (Boston: Houghton Mifflin, 1977) 999.
78. Terraine 57, 69, 70.
79. Terraine 58 and 59 and Collier Defence 68-69, though some others note the concerns. Taylor and Moyes Vol II 9 makes mention of the Spitfire/Hurricane troubles.
80. R.J. Overy, The Air War: 1939-1945 (N.Y.: Stein and Day, 1981) 23 and Terraine 57, who gives the quote.

81. Gibbs 587-589, Collier Defence 68-69, and Webster and Frankland Vol I 80-81.

82. Taylor and Moyes Vol II 9 gives the 660 fighter figure as of late 1938, while the other figures are as of March 1939 and are from Gibbs 584.

83. Not an entirely reasonable assessment from "British Air Force Praised," New York Times 19 Dec 1938: 3:3.

84. Liddell Hart, "The European Crisis and Britain's Military Situation," Contemporary Review 155 (1939): 32.

85. These unfortunate realizations facing Bomber Command are made clearest in Webster and Frankland Vol I 129-131.

86. Chruchill's quote is from James Vol V 5325.

87. James Vol V 5341.

88. Shay 43.

89. Shay 95-103.

90. James M. Spaight, The Sky's The Limit (London: Hodder and Stoughton, 1940) 28-31 and Collier Defence 41 and 68.

91. Collier Defence 41.

92. Shay 120-121.

93. Shay 145, while the quote is from James Vol VI 5828.

94. Shay 190-196.

95. Early to mid-thirties figures are seemingly impossible to find. Figures here are from Dean 76 and Terraine 69. The quote is from, and the tension is noted in, Shay 205-209.

96. Webster and Frankland Vol I 79 and Shay 211.

97. Shay 216. Another plan would have undoubtedly taken

its place however.

98. Shay 241-242 and 278.

99. Overy Air War 23 and Eric Hart, "Research Project No. 7424; Hawk Eighty-One," Journal of the American Aviation Historical Society Spring (1980): 24.

100. Young "Strategic Dream" 65-69.

101. U.S. information taken from Wesley Craven and James Cate, The Army Air Forces in World War II: Volume One; Plans and Early Operations, January 1939 to August 1942 21, 49, and 66, and Overy Air War 21.

102. Webster and Frankland Vol I 134 refers to it in this fashion.

103. Collier Defence 88 and Sir Edmund Ironside, Time Unguarded: The Ironside Diaries, 1937-1940 (N.Y.: David McKay, 1963) 142.

104. Gibbs 599 breaks the 1,660 and 2,200 figures down as follows:

	<u>First Line</u>	<u>Reserve</u>
bombers	536	1,450
fighters	608	320
others	<u>516</u>	<u>430</u>
	1,660	2,200

Higham Armed Forces accepts Gibbs' numbers. Slessor 180 gives a figure of 640 fighters, which would seem to support, approximately, the figures above. Collier Defence, another official source like Gibbs, gives the exact same figures, not surprisingly.

105. Collier Defence 156.

106. Jonathan Brewster, "London in the Blitz," British Heritage Feb/Mar (1987): 30.

107. Most assuredly an overabundance of sources on the Battle of Britain. Collier Defence 147-228 and 442-494 is perhaps the best official one. The information in J.R.M. Butler's Grand Strategy: Volume II (London: Her Majesty's Stationary Office, 1957) is limited to only 286-289 and 392, while Webster and Frankland Vol I focuses on bombing aspects but does give a decent description in 151-155. Terraine, who often utilizes the official sources, goes into great detail about the battle. Other sources consulted for this section include Roger Parkinson, Summer 1940: The Battle of Britain and Peter Townsend's popular Duel of Eagles.

108. Overabundance of sources again, which can not really be considered a problem. Terraine 223-259 is a good show, and Webster and Frankland Vol I is important too. Butler 465-477 and Collier Defence 285-300 and 318-319 also contribute. A popular, fun work, Terry Hughes and John Costello's Battle of the Atlantic (N.Y.: Dial Press, 1977) gives a nice overall picture of all the factors involved including such issues as the evacuation of children to the U.S., the home front, and so on.

109. Gibbs 587.

110. Beaufighter information from Terraine 243 and Taylor and Moyes Vol II 46-47.

111. Dean 206-212. More detail is provided in I.S.O. Playfair's official The Mediterranean and the Middle East,

published by Her Majesty's Stationary Office. Slessor memoir gives some insight into the campaign.

112. Taylor and Moyes Vol II 67.

113. Terraine 280-281 and Dudley Seward's Bomber Harris (Garden City, N.Y.: Doubleday, 1985) 47, 54, and 82-83.

114. Webster and Frankland Vol II 25 and Terraine 281.

115. Seward 194-195, Terraine 281-282, Webster and Frankland Vol II 93 all sing the praises of the Mosquito. Collier Defence 312 notes a night-fighter version of the Mosquito which proved quite capable of night bombing defense. According to sources, it had the lowest loss rate of any aircraft with Bomber Command.

116. Information on the Typhoon is from Taylor and Moyes Vol II 81, Terraine 389 and 605-606, Webster and Frankland Vol II 75-76, and Collier Defence 312.

117. Tempest info. in Terraine 606 and Collier Defence 374, while Meteor is found in Terraine 606-607, Taylor and Moyes Vol II 69, and Collier Defense 395 and 394.

118. Taylor and Moyes Vol II 110.

Notes for Chapter Four

1. Andre Van Haute, Pictorial History of the French Air Force: Volume I 1909-1940 (London: Ian Allen, 1974) 8-11. Van Haute's work, while basic, is a good source of information on surprisingly specific subjects.

2. "Aerial Fleet For France," New York Times 17 Feb 1910, 6:4 and William Green and John Fricker, "The French Air Force," The Air Forces of the World (London: MacDonald, 1958) 95.

3. Green and Fricker "French" 95 and Dale L. Walker's "The Great Warbirds: 1914-1918. Part I: France," Aviation Quarterly 6 (1980): 13. Green and Fricker also supply the figures of November 1.

4. "Progress of Aviation," New York Times 25 June 1911, IV 2:1 provides the probably exaggerated figure.

5. Green and Fricker "French" 95 and "Value of Aeroplane For War Purposes," New York Times 1 Oct 1911, IV 7:4. According to the article, several hundred thousand Pounds had already been allotted for aviation.

6. "Prepares for War in Air," New York Times 28 Jan 1912, III 1:1 gives \$4 million figure, though "Supremacy in Air Arm aim of all France," New York Times 16 Feb 1912, 4:3 tells of the subsequent increase in the aviation allotment. "Big Lottery to Aid France to Rule Air," New York Times 17 Mar 1912, III 3:7 insinuates that the lottery was already a reality despite the

fact that it was only a suggestion made by an aviation figure.

7. "Chain of Aviation Depots," New York Times 23 Mar 1913, IV 1:1. The same article also says that half as much again was promised by various other organizations. Most of the subscription was reserved for use by local aeronautical groups.

8. Green and Fricker "French" 95 gives number of escadrilles, though "France wants more Airships," New York Times 6 Apr 1913, III 3:2 says that the French had 600 planes.

9. Walker "Part I" 13 says that France had 21 escadrilles of two seaters, along with 4 single seat escadrilles of 3 planes each, for a total of 138 planes. Green and Fricker "French" 96 includes overseas planes in their total; 136 airplanes is the adjusted figure for France proper. Foreign estimates, which would become notorious for incorrect guesses, suggested France had 1,200 planes, as detailed in "Battles in The Air to be War Feature," New York Times 5 Aug 1914, 7:6.

10. Basil Collier, A History of Air Power (N.Y.: MacMillan, 1974) 50.

11. Alan Clark, Aces High (N.Y.: G.P. Putnam's Sons, 1973) 25, Van Haute 30, and Green and Fricker "French" 96, amongst others, tell of the first aerial victory, while Clark and van Haute specifically discuss the reconnaissance aspects.

12. Clark 24, though this is an oft-stated dilemma for the French in WWI.

13. Walker "Part I" 12 and Clark 39 and 55.

14. Walker "Part I" 13. Information on the G-4 is sparse,

though its claim to fame seems to be that it was one of the first planes flown by members of what would become the Lafayette Escadrille.

15. "New Air Fleet for France," New York Times 28 Oct 1915, 3:3. Green and Fricker "French" 96 provide the bomber statistics.

16. Not an exclusive idea of Collier History 53-54, but taken from there. Robert J. Young's "The Strategic Dream: French Air Doctrine in the Inter-War Period, 1919-1939," Journal of Contemporary History 9 (1974): 57 points out France's efforts towards tactical support, which was becoming quite common in most air forces at the time.

17. Van Haute 40-46 provides a decent overall account of 1916, Green and Fricker "French" 97 mentions the heavy losses at the two battles, while Clark mentions both battles in considerable detail despite being a somewhat popular work.

18. Edwin C. Parsons, Flight Into Hell: The Story of The Lafayette Escadrille (London: John Long, 1938) 16-19. The author was a member of the Lafayette Escadrille.

19. "Laud American Airmen," New York Times 19 Jan 1916, 3:8 gives an excerpt of a statement by the French Aviation State Secretary applauding U.S. pilots and announcing the formation of a separate squadron.

20. Van Haute 48 and 51 tell of the name change, while Philip Flammer's two works The Vivid Air: The Lafayette Escadrille (Athens, Ga: University of Georgia Press, 1981) ix and

"The Myth of the Lafayette Escadrille," Aerospace Historian 22 (1975): 23 detail the difficulties with the press. The article seems to have been groundwork for the book, but most of the information in the former appears in the latter.

21. Flammer Vivid 184.

22. Victory figures are those of Parsons 255, while most sources that mention the squadron also note the transfer. There are several memoirs written by Lafayette members, of which Parsons' is the most noteworthy. Others, such as Charles J. Biddle's The Way of the Eagle (N.Y.: Charles Scribner's sons, 1919) and One Man's War: The Story of the Lafayette Escadrille (N.Y.: Henry Holt, 1929) by Bert Hall and John Niles provide little information and are only of passing interest. An article, "The Apprenticeship: How the Allies Trained the American Air Service," American Aviation Historical Society Journal 28 (1983): 22-31 by Geoffrey Rossano, is decent.

23. Information on the Spad VII's troubles is from Van Haute 46, though found in other sources. The Spad XIII details are found in Walker "Part I" 5 and Clark 90-92.

24. Walker "Part I" 5 and Clark 184-187. The Spad XIII handled "like a brick," however, according to some.

25. As suggested by Van Haute 59 and supported by approximately the same figures elsewhere.

26. Clark 169 says "over 3,000" while Van Haute says 3,222 planes. By comparison, Clark places British strength at 1,799 and American strength at 740. Robert Krauskopf's dissertation

"French Air Policy 1919-1939," diss., Georgetown University, 1965, 1, a valuable source, says that France ended the war with 4,398 aircraft, a high figure which probably includes some second line craft.

27. Young "Strategic Dream" 59 and Van Haute 71-78.

28. The quote is from Krauskopf 22, while the description and aircraft are from both Krauskopf and Green and Fricker "French" 98. Van Haute 71-78 mentions the Syrian and Tunisian exercises.

29. Barry R. Posen, The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars (Ithaca, N.Y.: Cornell University Press, 1984) 105.

30. Krauskopf 3-4 and 18, and Young "Strategic Dream" 60.

31. Krauskopf 19-22. The dissertation explains in detail the theories and actions of the air force in the twenties, which few other sources do. Posen's Sources provides a brief overview of French military planning during the period in general. Judith M. Hughes' excellent To the Maginot Line: The Politics of French Military Preparation in the 1920's (Cambridge, Mass.: Harvard University Press, 1971) mentions the air force only in passing, rather focusing on political aspects of 1920s French military work. Pages 81-100 and 159-178 are especially good as a background.

Young's "Strategic Dream" 60-61 suggests that the army's grudging support of multi-purpose craft amounted to a moderate build up of a French bomber force, because the Bleriot 127 was in

actuality a heavy bomber.

32. A gap in British aviation history is filled nicely by John Ferris' article called "The Theory of a 'French Air Menace', Anglo-French Relations and the british Home Defence Air Force Programmes of 1921-1925." Pages 65-67, 70-71, 75 provided the information used most for this discussion, complemented by the disparity figure courtesy of Krauskopf 26-27.

33. Noted by Van Haute 67-68:

Division
Brigade
Regiments
 3 Groups
 3-4 squadrons

34. Krauskopf 5-6.

35. Robert J. Young, In Command of France: French Foreign Policy and Military Planning, 1933-1940, (Cambridge, Mass.: Harvard University Press, 1978) 19.

36. Anthony Adamthwaite, France and the Coming of the Second World War, 1936-1939 (London: Frank Cass, 1977) 4 and 20 discusses France's poverty in natural resources and the Franc's decline, while Krauskopf 14-15 talks of the resurgence of the French aviation industry.

There has been little written about French industry in the 1920s, and much less about the French aviation industry in general. The period needs more extensive research, for it is from within that began the development of what would prove an inferior industry by the mid-1930s.

37. Krauskopf 16-18.

38. Van Haute 80 and Krauskopf 33.

39. Krauskopf 36.

40. As suggested by Farris Kirkland's interesting piece, "Anti-military Group-Fantasies and the Destruction of the French Air Force 1928-1940," Journal of Psychohistory 14 (1986).

41. Van Haute 81-85 and Young In Command 35.

42. Kirkland 31-33 and also dealt with somewhat in the hard to follow "Military Origins of the Fall of France," Military Affairs 7 (1943) by A.F. Kovacs.

43. Krauskopf 232 and 237, "Nationalizing the Aeroplane Industry," Current History 45 (1937), and Van Haute 113.

44. Young In Command 173 says 1,200 first line planes in June 1936. Van Haute 108 gives a total of 4,353 in January 1936, while Krauskopf 240 points out that only 470 planes were produced in 1937. Jeffrey Clarke's "The Nationalization of War Industries in France, 1936-1937: A Case Study," found in the Journal of Modern History 49 (1977) is a fairly decent attempt but mentions little of aviation interest.

45. Young In Command 54-58 and 185, and Krauskopf 51, 189-190.

46. Young In Command 177 and Krauskopf 243-244. Issue of funding (or lack of it) is also addressed in Maria de Blasio's "Why French Aviation Failed: An Exclusive Interview with Michel Wibault," Flying 31 (1942).

47. Van Haute 113 and Green and Fricker "French" 98. Van Haute says the following types were the main models: Bloch 200,

Dewoitine 500, Morane 315, Mureaux 117, and others. Many sources tell of Plan V, Van Haute 119 and Kirkland 33 among them.

48. Adamthwaite 71-72, Krauskopf 242-243, and "France's Search for American Military Aircraft: Before the Munich Crisis," Aerospace Historian 25 (1978): 142 by John McVickar Haight.

49. Young In Command 164 provides the following figures:

End of 1937;	
German	1,737
French	1,195

January 1938, French figures;	
German	2,268
French	1,350

Adamthwaite 161 says that in 1937, France had 1,380 planes to Germany's 1,233 and England's 1,550, but by 1938 the figures had changed drastically:

France	1,454
German	3,104
England	1,606

Vuillemin's remarks come from Young In Command 210 and Adamthwaite 239-240.

50. Krauskopf 257-258, 261-262, and Kirkland 33. Production did in fact increase, from only 40 planes per month in early 1938 to 640 per month in 1940.

51. Van Haute 120-131 gives a fairly comprehensive look at newer types, while Haight "France's Search" 145 also mentions some of the newer types. Krauskopf 264 points out that the Loire 45 would not be ready for production until 1939, while the Morane 406, Bloch 150, and Potez 63 were all ordered into production immediately.

52. As much has been written about American aid to France as has been written on the French air force in general in English. John McVickar Haight's American Aid to France, (N.Y.: Atheneum, 1970) is not an exciting work, but gives some detail and more of the political story than the military. Haight's article "France's Search" is perhaps an easier undertaking. Green and Fricker "French" 99 also mentions the arrangement, while "Research Project No. 7424. Hawk Eighty-One," Journal of the American Aviation Historical Society Spring (1980) by Eric H. Hart addresses the specific arrangements and specifications of the P-40.

Marjorie Anne Rowe's "Warplanes for France: An unsordid Act or Pursuit of Self-Interest?" Michigan Academician 15 (1982) discusses moral issues behind aid to France such as profits sought by U.S. companies on French orders which, in effect, caused more French lives to be lost in the delay.

53. Adamthwaite 248 and Young In Command 186-187.

54. Adamthwaite 340.

55. Krauskopf 391-400 provides the best overview of the state of French aviation just before the war, and breaks down the total of roughly 3,600 planes on page 393 as follows:

-1,240 modern planes, from Plan V: 3/4 fighters.

-1,550 obsolescent types, built under previous plans, making up nearly all of the bomber force. Alistair Horne's To Lose a Battle: France 1940 (Boston: Little, Brown, and Company, 1969) points out that few of the bombers had radios.

-850 obsolete planes, built between 1928-1934.

56. Krauskopf's figures suggest 1,730 while David E. Griffin, in his "The Role of the French Air Force: The Battle of

France 1940," Aerospace Historian 21 (1974) 144 says 2,441.

57. Griffin 144-145 and Robert Jackson's Air War Over France: May-June 1940 (London: Ian Allen, 1974) 139-149 detail the airplanes available to the French. The best fighters stood, statistically, as follows;

Bloch 152	316 mph
Curtiss Hawk	311 mph
D-520	326 mph
Ms-406	301 mph
Potez 631	275 mph

By comparison, German types were as follows;

Bombers:	He-111	258 mph
	Ju-87	242 mph
	Ju-88	269 mph
Fighters:	Me-109	357 mph
	Me-110	336 mph

Thus, it is clear that the D-520 was still 30 mph slower than its German counterpart, and even slower than the Me-110.

58. Griffin 148 and Jackson Air War 139-149. Stats for French bombers were as follows:

Loire 45	267 mph
Amiot 351	280 mph
Breguet 693	225 mph
Amiot 143	183 mph
Bloch 210	210 mph
Farman 221	202 mph
Martin 167F (US)	304 mph
Douglas Db-7 (US)	330 mph

The United States' bomber types were few, and none of the bombers used by the French had exceptional bomb loads.

59. Only Griffin 152 gives total loss figures. Griffin also does a concise and favorable job of describing the direct reasons for the failure of French aviation during the invasion of France. Jackson's popular, basic Air War Over France, on the

other hand, fails in that respect. Pierre Cot, in his article entitled "The Defeat of the French Air Force," suggests that the defeat of France's ground forces spelled victory for the Germans. His work, while saying that planning in the thirties was faulty, has to it an air of "I'm not at fault for the troubles."

Notes for Chapter Five

1. Dale L. Walker, "The Great Warbirds 1914-1918: Part IV: The Other Nations," Aviation Quarterly 6 (1980): 335.
2. According to "\$2,000,000 for Air Fleet," New York Times 17 Jul 1910, II 15:1.
3. "Airman drops Bombs on Turkish Troops," New York Times 2 Nov 1911, 1:3 notes the early November "raid." Walker "Part IV" 335 says that aviation maneuvers occurred in August but does not mention this attack.
4. "Turks Attacks Repulsed," New York Times 22 Nov 1911, 10:5.
5. "100 Aeroplanes for Italy," New York Times 2 Sep 1912, 4:1 notes the Aero League, donations, and also discusses factories, nearly all located near Milan. "To Give Army Aeroplanes," New York Times 15 Mar 1913, 3:6 addresses the other organization, the Italian Trans-Aerial Society.
6. Walker "Part IV" provides 1914 figures, while "Italy's Air Fleet Fourth in Numbers," New York Times 24 May 1915, 3:4 gives data on air force at beginning of Italy's involvement.
7. John Whittam, The Politics of the Italian Army (London: Croom Helm, 1977) 201 says that on May 12, 1917 the Italian air strength was "nearly" 4,000 military aircraft. Walker "Part IV" provides the other information.
8. According to Shephard B. Clough's The Economic History

of Modern Italy (N.Y.: Columbia University Press, 1964) 182. The text also points out that the runbber industry was partially carried by the air industry's demand for tires.

9. Robert W. Krauskopf, "French Air Policy 1919-1939," diss., Georgetown University, 1965, 82.

10. The economic troubles of interwar Italy are amply described in "Italy: the crisis and cooperative economy," Contemporary History 4 (1969) by Alberto Aquarone. Clough 202-230 also addresses the topic.

11. A very concise sketch of Douhet is given in Basil Collier's History of Air Power 91. Krauskopf 63-74 provides a better picture, and numerous other aviation sources deal to varying degrees with Douhet's theories. Claudio G. Segre's "Douhet in Italy: Prophet without Honor?" Aerospace Historian 26 (1979) discusses the generally favorable reception Douhet's theories received in his native Italy.

12. Krauskopf 70-71.

13. Collier History 91-92. 1923 was the year that independant status was given to the air force. The trouble with the competitions is related in Macgregor Knox's Mussolini Unleashed, 1939-1941: Politics and Strategy in Fascist Italy's Last War (Cambridge: Cambridge University press, 1982) 22.

14. Krauskopf 129-134 discusses Franco-Italian air conferences, while 134-135 deals with the falling out.

15. On the Ethiopian campaign, Mussolini as Empire Builder: Europe and Africa, 1932-1936 (N.Y.: St. Martin's, 1977) by

Esmonde M. Robertson 54, 112, and 123 is an excellent source. The number of planes that were ordered between 1935-1939 came from Knox 22.

16. Henry Adams Italy at War (Alexandria, VA: Time-Life, 1982) is a basic yet informative source on Italy's war effort and includes a good section on the air force. The information on the Ethiopian campaign and its psychological effects on the Regia Aeronautica are located on page 72.

17. Krauskopf 155-157. The liquid-cooled engine proved invaluable in the hands of German and British designers.

18. Industrial and economic details are given by Clough 261-262, Krauskopf 157-158, and in "Understanding Defeat: Reappraising Italy's role in World War II," Journal of Contemporary History 24 (1989) 32-34 by James J. Sadkovich.

19. Knox 23 provides information about the Cr-42, Fiat G-50, and the Macchi Mc-200 fighters, as does Adams 74-78.

20. David Mondey, Concise Guide to Axis Aircraft of World War II 26.

21. Knox 23 and Mondey 236-240 on the S.M.-79; Mondey 52-54 for the Br-20, 32-33 for the Z-1007, 242-243 for the S.M.-82, and 231-232 for the four engined P-108. Adams also gives some detail on these pre/early war types of craft.

22. Figures vary greatly. Clough 263-264 notes the report, which may have been influenced by interservice rivalries. Adams 12 says that half of the 3,000 planes were ready, and Knox 56 points out of between 2,200-2,300 combat ready aircraft only 841

were relatively modern, of which 240 were being repaired. The rest, says Knox, were "either museum pieces, or deathtraps like the Breda Ba-88," a particularly unsuccessful, unfavorable, and unsafe model.

23. Despite this and other shortages, Knox 31-32 says that with better governmental and better central authority, the supplies could have lasted much longer and been used more efficiently. Knox also gives the figure, on pp. 99-100.

24. Krauskopf 382-384 makes these observations.

25. The Mc-202, 205, and Fiat G-55 are discussed in Mondey 60-61 and 155-159, though a popular work, Roberto Gentilli and Luigi Gorena's Macchi C-202 in action (Carrollton, TX: Squadron/Signal, 1980) addresses the craft in outstanding and explicit detail.

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