When not committed in missions directly assigned by the High Command of the Air Forces of the Soviet Army, long-range air reconnaissance regiments were assigned tactically and administratively to the air armies and were employed in tactical reconnaissance missions within the scope of the appropriate air army in precisely the same manner as the tactical air reconnaissance regiments. Each air army had one long-range or one tactical air reconnaissance regiment; when committed in an area of main effort it sometimes had two or more reconnaissance regiments.

Like the long-range air reconnaissance regiments, the tactical air reconnaissance regiments normally assigned to air armies had, as a rule, three squadrons. Of these, however, two were usually PE-2 squadrons and one had either fighter or ground-attack aircraft. In aircraft strength the tactical air reconnaissance regiment approximated the long-range air reconnaissance regiment of three squadrons, as described above.

In May 1944 German intelligence had identified 21 Soviet air reconnaissance regiments, 9 of which were long-range, and 12 of which were tactical. In September the total number identified was 31--10 long-range, 18 tactical, and 3 naval air reconnaissance regiments. On the whole, this strength remained unchanged up to the end of the war.

B. Soviet Air Reconnaissance Operations

Luftwaffe field commanders and other sources[19] are in agreement that even in the last years of the war the Soviets restricted their efforts primarily to tactical air reconnaissance or, strictly speaking, to tactical and battle field reconnaissance, and that in this area they operated very much in accordance with German principles. The aircraft most often used for long-range and at times also for close-range tactical reconnaissance remained the PE-2 model, whereas battle reconnaissance in the stricter sense was still performed by the IL-2 ground-attack units, as had been the case in the first part of the campaign, and in a growing measure by fighter aircraft, primarily of the Yak-9 model. Owing to the relatively weak German defenses, these aircraft were quite capable of executing their missions.

No important new features were observed in the tactical

execution of reconnaissance missions by the Soviets, except that the number of such missions, during both the day and night, was steadily increasing. Efforts were directed primarily at obtaining information on the following points, all relating to targets within the main battle areas: the location of the forward German lines; German strongpoints, pockets of resistance, mortar and artillery firing positions, and antitank defense lines; supply movements; rail and road movements close behind the German main line of resistance to ascertain the nature, direction, and volume of such movements; motor vehicle and armored concentrations; settlements occupied by German troops; airfields, supply depots, defense installations, river crossing points, and the location of higher level headquarters staffs. Main emphasis was on overall reconnaissance of the assigned combat area, with less stress on the detection of individual targets. Air photos were always taken of airfields and rail depots and settlements; panorama photos of rail routes or roads were made only rarely. With very few exceptions the maximum depth to which long-range reconnaissance penetrated behind the German lines was approximately 180 miles; the average depth, which was maintained with remarkable regularity, was 120 miles. In tactical and battlefield reconnaissance the maximum depth was around 36 miles, the average around 24 miles.

In carrying out their reconnaissance missions, Soviet airmen adhered to the same principle as their German opponents: they avoided air combat if at all possible. Right up to the end of the war Soviet air reconnaissance units showed a marked respect for German fighters; on encountering German aircraft they almost invariably endeavored to escape by nosing down, if at all possible eastwards. The Soviet reconnaissance forces developed no specific tactics for defense against German fighters. Seasoned crews had their own methods of combat, developed from their personal experience. The normal procedure for Soviet reconnaissance airmen under attack was to open fire with their machine guns at a range of approximately 550-660 yards, with their rockets--directed to the rear--at ranges between 660 and 1,300 yards; occasionally they would drop parachute fragmentation bombs against an attacker coming from below and rear.

In the last phases of the war it was a great advantage for Soviet reconnaissance units that German fighters no longer could be committed against single planes operating at high altitudes,

because of the shortage of ammunition and fuel on the German side.

In reconnaissance over targets strongly defended by anti-aircraft artillery, Soviet reconnaissance aircraft usually made their approach run at the highest possible altitude from the direction of the sun, gliding in with engines throttled down. The moment German antiaircraft guns opened fire the Russians would nose down and, after flying over the reconnaissance target, would then regain altitude at top speed. While over the target area the planes never changed their course. If they encountered unexpected but poorly aimed defense fire, they usually carried out no evasive maneuvers, although sometimes they immediately changed their direction, altitude, and speed.

At the highest command level, missions were assigned in the form of reconnaissance programs established by the Operational Staff of the Air Forces of the Soviet Army. These programs were issued at irregular intervals as a broad general directive to the air armies, which were allowed a lot of latitude in carrying them out.

Based on these directives and on the requests from the appropriate army group headquarters, the intelligence officer of the air army concerned assigned the daily reconnaissance missions to the subordinate air reconnaissance regiments. It should be noted here that as a rule the army group addressed its desires and requests to the air army, and only in very rare cases directly to an air reconnaissance regiment.

The mission assignment allowed the regimental commander wide scope for personal initiative in its execution. In areas where the front was stable, missions were assigned in very broad outline. During an attack, in contrast, or in other cases when the front was fluid, reconnaissance missions were assigned in great detail, mentioning each individual target to be covered.

After receiving his mission assignment the regimental intelligence officer, or the regimental commander, prepared the detailed orders accordingly and assigned missions to his individual squadrons, and only in special circumstances directly to the individual aircraft crews. The officer preparing the detailed orders was required to consult the regimental weather reporting unit, most of which

are said, by prisoners of war, to have performed unsatisfactory work. For this reason more reliance was placed on the weather reports turned in by returning aircraft crews.

As a rule the squadron leader oriented his individual crews on the basis of maps with a scale of 1 : 200, 000, in which all details known concerning the enemy were marked, including the positions of antiaircraft batteries or single guns. General discussions between participating crews were the exception rather than the rule, and by German standards preparations for the mission were frequently somewhat superficial. The individual crews usually were allowed to select their own operating altitudes and their routes.

To facilitate the transmittal of information and contact in general, the air reconnaissance regiment always had its headquarters in the vicinity of the headquarters of the air army, while the squadrons were based on various airfields distributed along the line.

In the reporting system radio played a significant role, with a constant flow of messages taking place between reconnaissance planes and the regimental radio station. As a rule, reconnaissance planes were not allowed to operate unless radio contact existed. Air-to-air radio communication was also maintained with escorting fighter aircraft. Long-range reconnaissance was controlled by wireless telegraphy, tactical reconnaissance by voice radio. Air army, army group, and frequently army and tank force headquarters were tuned in to receive messages on the main channel used by the reconnaissance units.

In the last phase of the war radio messages were transmitted in the clear with increasing frequency, but weather reports and special messages on technical matters were always sent in special codes.

During their approach flight reconnaissance planes always reported when they were crossing over the front lines; while over enemy territory they transmitted only particularly important messages; and as soon as they were over friendly territory on their return trip they turned in a summarized report of their findings. Each reconnaissance pilot reported orally and in writing to the appropriate command post after his return from a mission.

The regimental photographic section was responsible for

the development and initial interpretation of aerial photos; the detailed interpretation and all major work was handled in the photographic staff section at air army headquarters.

The Soviets continued to attach great importance to air photo reconnaissance, but obtained by this means intelligence which was far less precise than that obtained by the German air photo reconnaissance units.

The regimental intelligence officer reported in writing to air army headquarters on the day's reconnaissance operations and the results obtained, thus rounding out the day's reconnaissance findings.

1) Long-Range Reconnaissance. The few reports available on Soviet long-range reconnaissance activities reveal that operations of this type increased during the last years of the campaign, but that the methods employed remained unchanged.[20] As previously mentioned, long-range reconnaissance was an exclusive responsibility of the strategic reconnaissance regiments--controlled directly by the High Command of the Air Forces of the Soviet Army--which were distributed along the entire line and committed within the zones of the individual air armies.

The Soviet Air Command, in their references to long-range reconnaissance, differentiated between what they called strategic reconnaissance and what they called operational reconnaissance. Strategic reconnaissance was carried out exclusively by the long-range air reconnaissance regiments of the High Command of the Air Forces of the Soviet Army. Their aircraft penetrated beyond 240 miles into enemy territory. In daylight types PE-3 and Tu-2 planes were used, at night types B-25 and IL-4. By way of contrast, the reconnaissance regiments attached to air armies were to furnish the main forces for operational reconnaissance, up to 240 miles, which was to be carried out by PE-2 planes. In practice, however, air armies paid hardly any attention to long-range reconnaissance, restricting their efforts primarily to tactical and battlefield reconnaissance.

In the last years of the war the main target categories assigned to long-range reconnaissance units remained the same as they had been before. As a rule these missions were flown

without fighter escorts. The intensity and regularity of Soviet long-range reconnaissance increased steadily as the fronts moved westward and farther away from Soviet-Russian territory. This tendency became increasingly evident from August 1944 on and at the end of 1944 and early 1945 took the form of a close-meshed, wide-area air patrol activity which was repeated frequently and concentrated chiefly against rail and road routes, and airfields in the Government General* and the Courland areas, East Prussia and West Prussia,/ the area adjoining the Warta River, Upper and Lower Silesia, and finally westward across the Oder River.

In some cases these reconnaissance operations were carried out with a regularity and obstinacy by no means suited to the purpose. For example, in April 1944 a Soviet PE-2 reconnaissance plane--jokingly called the reconnaissance duty officer because of its regularity--put in an appearance every morning without fail between 0700 and 0800 hours over Duenaburg,// at the time about 150 miles behind the German main line of resistance; invariably it approached from the German rear at an altitude between 13,000 and 16,000 feet and departed in the direction of the front lines; its reconnaissance targets unmistakably were the Dvina River crossing points, rail traffic, and German airfields. No successes by German antiaircraft artillery are recorded against long-range reconnaissance aircraft of this type.

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* Editor's Note: The central section of Poland which remained after German and Russian annexations of Polish territory in World War II. The Government General was occupied and administered by Germany.

/ Editor's Note: Prior to World War I West Prussia was a Province of Prussia located roughly between Pomerania and East Prussia. The Treaty of Versailles ceded most of this territory to Poland and it then became the Polish Corridor. In 1939 it was annexed to Germany and now it is again a part of Poland. West Prussia, together with East Prussia, which after the War was divided between Poland and Russia, constitute what Germans today refer to as East Germany. What is popularly called East Germany in America is, by contrast, termed Middle Germany by Germans.

// Editor's Note: Duenaburg is located in Southeast Latvia on the Western Dvina River. In Latvian it is called Daugavpils, in Russian, Dvinsk.

To what extent Soviet long-range reconnaissance units showed any real improvement in the execution of their missions is a subject German field commanders were unable to judge. From the measures taken by the Soviet Command in the last two years of the campaign it is safe to assume, however, that the command on the whole received a relatively accurate report on conditions in the German rear from its long-range reconnaissance forces.

2) Short-Range Reconnaissance. All sources available at writing[21] agree that in the last years of the campaign Soviet short-range air reconnaissance activities were more intense than before, that stronger and better qualified forces were employed for the purpose, and that on the whole the results obtained substantially aided the Soviet Army.

The categories of target reconnaissance remained practically unchanged. A difference was noticeable, however, in the priority of the various categories, which changed according to the current tactical situation.

Also noticed was the increasing use made of normal reconnaissance planes for general tactical reconnaissance and of fighter and ground-attack planes for specific battlefield reconnaissance. Nevertheless, this was only the general rule, as these two types of missions frequently overlapped. Thus, fighter and ground-attack planes sometimes engaged in general tactical reconnaissance, particularly in unfavorable weather and when the cloud ceiling was low. As a rule, however, the division of missions was noticeable.

Normal reconnaissance planes were employed primarily on air photo reconnaissance missions while fighter and ground-attack planes had to rely largely on visual observation.

The plane most frequently used in daylight tactical reconnaissance was the PE-2, with Boston III planes used in individual plane reconnaissance missions. The first plane took off in the early morning and had the added mission of carrying out weather reconnaissance. Other planes followed at intervals throughout the day, with main emphasis on the forenoon. In order to avert too pronounced a regularity in their operations, the planes took off at varying times and frequently changed the point at which they crossed the front lines, making efforts to select weakly defended German sectors. Operating

altitudes were usually between 16,000 and 26,000 feet, descending to just beneath the clouds when the cloud cover was heavy, but rarely below 4,000 feet, for which reason tactical reconnaissance was primarily an air photo operation. During the approach the planes changed their course frequently, and after executing their mission returned by a different route.

On an average, PE-2 planes flew missions lasting two and never more than two-and-three-quarter hours. Douglas Boston planes, which could operate only when the cloud ceiling was at least 6,600 feet up, carried out missions lasting approximately three-and-one-half hours. Air photo mosaics were taken only in the proximity of the main line of resistance, and the interval between the operations of the individual planes participating increased in proportion to the strength of the German defenses encountered. Whether one and the same crew was committed repeatedly in succession or a number of crews were employed for the purpose depended on current circumstances.

When on photo reconnaissance missions in the near front areas, Soviet reconnaissance planes were usually escorted by fighters. This also applied to all missions flown at altitudes below 16,500 feet.

Other short-range reconnaissance was performed by IL-2 ground-attack planes on normal tactical reconnaissance missions, usually during morning and evening dusk or in unfavorable weather conditions. These were, for the most part, visual observation missions, with occasional oblique photographic operations. Operating altitudes varied between 160 and 6,600 feet.

What has been said above concerning the tactical reconnaissance missions of ground-attack planes applies equally to fighters. One occasion on which fighters were employed in a mission of this type was in April 1944, when Soviet fighters singly or in pairs flew daily reconnaissance missions[22] at an altitude of roughly 3,300 feet over the Idritsa airfield, 18 miles in the German rear. Similar observations were made time and again in other areas, and it was noted that the information these reconnaissance units can be assumed to have gathered in many cases was translated speadily into fire action. A striking example of this occurred at the few airfields still in German hands in East Prussia: each time work was just about completed on repairing the runways, the Soviets attacked them with aircraft and long-range artillery. On one occasion a pair of Soviet

reconnaissance planes observed a German fighter group arriving on the Orsha airfield early on 25 June 1944, and at midday the fighter group came under attack by Soviet bombers.[23] A similar incident occurred on 16 October 1944 in Trankein.

Battlefield reconnaissance was carried out principally by fighter and ground-attack units. Experience having shown that the assignment of dual missions--combat plus reconnaissance--to fighter and ground-attack units did not produce satisfactory results, the Soviet Air Command from the spring of 1944 selected, in an increasing measure, the best pilots from these two arms for exclusive use and specialized training in reconnaissance operations. This practice was applied more frequently in the case of fighters than in that of ground-attack units. Thus, according to available reports,[24] approximately 60 percent of all Soviet fighters and about 35-40 percent of all Soviet ground-attack units received reconnaissance missions in addition to their normal activities.

When employed on reconnaissance missions, fighters operated primarily for the various headquarters staffs of the air commands, while ground-attack units also performed frequent reconnaissance missions for the Army. Both types also flew weather reconnaissance.

No difference was noticed between the reconnaissance targets assigned to fighter or ground-attack units.

Fighter units committed in reconnaissance missions avoided air battle and also did not attack ground targets. At most they would attack German transport or courier planes if the attack did not divert them from their mission. They operated most frequently in pairs, less frequently in swarms of about five. Approximately 50 percent of their missions involved air photography. They penetrated to a depth of about 36 miles, approached at altitudes between 16,500 and 18,000 feet, dived steeply to between 6,600 and 10,000 feet over the target area, and returned to their bases at altitudes between 5,000 and 6,000 feet or even at ground level.

Ground-attack units, in contrast, almost invariably carried out armed reconnaissance and attacked worth-while ground targets. They operated most frequently in swarms of 4 to 6 planes, the unit leader being responsible for reconnaissance of the assigned ground targets while the rest of the planes observed the air and were responsible

for the protection of the lead plane. In most cases the activities of such units included air photo reconnaissance. They penetrated to an average depth of 24 miles and usually carried out their reconnaissance missions at low altitudes. They preferred to operate without escort fighters, fearing that these would betray their approach. When operating at altitudes above 3, 300 feet, however, each IL-2 swarm was given an escort of two to four swarms of fighters.

Both the mission assignment and reporting systems for fighter and ground-attack units employed in reconnaissance were approximately the same as those of normal reconnaissance forces. The only real difference was that the regimental commander or regimental intelligence officer gave the participating crews a more detailed briefing and did not allow them as much initiative in the execution of their missions. Very often such items as the approach and return routes, the direction of target approach, and the altitude were prescribed.

As a rule the air regiment dispatched units on reconnaissance twice daily, once in the forenoon and once in the afternoon, the take-off time varying from one to two hours. Then, during their return flight, the planes usually sent in a brief radio message, making their full report orally to the regimental intelligence officer after landing.

Radio communications by fighter and ground-attack reconnaissance units remained a weak point up to the end of the war. Usually the units maintained communications while airborne through their air directing team on the ground or through an advanced division or corps command post, but contact was frequently lost when the planes penetrated to a depth of more than 18 to 30 miles. Radio communications were usually in the clear and the messages sent mentioned reference points and target numbers.

The regimental photographic section handled the development of air photos, but it remained uncertain whether photo interpretation was handled at the regimental, division, or air army level. It seems safe to assume, however, that the regimental photographic section interpreted only the more important features, leaving the detailed interpretation to the air division or air army.

Night reconnaissance and artillery target spotting were fields

of endeavor which had their appropriate share within the scope of tactical and battlefield reconnaissance, indicating the general improvement in Soviet air reconnaissance activities. In March 1945, for example, an IL-2 plane, from an altitude of about 6,600 feet, directed night artillery fire against the German airfield at Pillau.* In another case artillery spotting planes even directed the fire of long-range artillery at night.

Night reconnaissance activities by Soviet nuisance-raider planes continued to increase, but played only a minor role in the overall pattern of Soviet air reconnaissance up to the end of the war.

In contrast, the Soviets made remarkable progress in tactical air reconnaissance during bad weather. Thus, Soviet planes, usually fighters, were observed on reconnaissance over the battle area during weather conditions so bad that all other air operations were called off. However, reconnaissance of this type failed to produce really worth-while results.

3) Appraisal by German Army and Navy Field Commanders. Reports by German Army field commanders, which time and again stress a considerable increase in Soviet air activities, strangely enough make very little mention of Soviet air reconnaissance.[25] Reports on operations in the Crimea, Courland, East Prussia, and Hungary, for example, contain practically nothing on Soviet air reconnaissance. This applies also to military writers who have published accounts of the Russian campaign.

This can be explained partly by the fact that, owing to the nature of air reconnaissance activities, such operations were far less spectacular than those of, for example, the fighter forces. Nevertheless, it must be pointed out that in 1944-45 Soviet air reconnaissance had not attained the degree of importance which would have been appropriate within the overall pattern of the Soviet

* Editor's Note: Baltisk, formerly a part of East Prussia and called Pillau by the Germans, was the port through which supplies for Army Group North passed. In March and April of 1945 the area between and adjacent to Baltisk and Kaliningrad (Koenigsberg) was the scene of heavy fighting.

military endeavor.

While the Soviets undoubtedly had made progress in the field of cooperation between air reconnaissance and operations on the ground, deficiences were, nevertheless, frequently apparent. Thus, owing to inadequate reconnaissance results, the Soviet air force frequently failed to attack at the most appropriate time; for instance when the withdrawing German forces had only a few roads and bridges available for their movements. This is the reason German Army field commanders, even during the last phase of the war, did not consider Soviet air reconnaissance as a serious hazard for the German ground forces. It should be noted in this connection, however, that it was exceedingly difficult for Army field commanders to form an appropriate opinion concerning the effectiveness of Soviet air reconnaissance.

Available German sources[26] reveal an unmistakable improvement in 1944-45 in Soviet air reconnaissance for the Soviet Navy and against the German Navy and its installations, as well as against German shipping. Main emphasis in Soviet naval air reconnaissance was on the detection of German convoys and shipping movements in ports, on air photo reconnaissance before and after attacks against seaborne targets and German ports, and on weather reporting. In the summer of 1944, for example, a certain degree of regularity was observed in Soviet naval air reconnaissance. On the Polar front this regularity took the form of daily long-range reconnaissance over the areas off the German-held coastline between Petsamo /Pechenga/* and North Cape to the west (and occasionally extending farther west), and north as far as Barents Island. The recomaissance flights were followed up by Soviet air attacks against submarines, E-boats, and shipping in general, particularly when shipping was lively or when Allied incoming or outgoing convoys were on the approach.

In the Baltic, Soviet long-range air reconnaissance concentrated on the Gulf of Finland, and increased its activity in the Bay of Danzig and in the middle reaches of the Baltic only shortly before Germany's collapse. In the western parts of the Baltic, the Soviets carried out no organized naval reconnaissance.

In the Black Sea the Soviets maintained lively long-range

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* See note above, p. 128.

air reconnaissance. During the German withdrawal from the Crimea these activities were directed continuously at the Rumanian coastline, with main emphasis on the area between Constanta and the mouth of the Danube River, and served the purpose of providing data for the preparation of air attacks against German retrograde transportation shipping between Sevastopol and Constanta. Once they detected German convoys or other floating targets, the Soviets left contact planes in the area to transmit to the bomber or torpedo bomber units the required data for the setting of their bombing sights. Communication with the ground was by means of wireless telegraphy. Soviet reconnaissance planes, in addition to directing bombing and torpedo bombing attacks against German convoys, directed attacks against ships traveling alone.

Soviet naval air reconnaissance cannot be described as perfect. The arm had made, however, indisputable progress against its former performances in spite of still evident weaknesses. This cannot disguise the fact that the Soviet Command, in its general disregard for naval warfare--something which, incidentally, it shared with the German Command--hampered the development of the Soviet marine air reconnaissance arm and other air reconnaissance over the sea and coastal waters.

C. Aircraft Types, Weapons, Other Equipment.

As was the case throughout the Soviet air forces, the principle in air reconnaissance was to develop and perfect the existing types of aircraft instead of adopting entirely new models.[27]

Right up to the end of the war the previously mentioned and generally satisfactory types of aircraft were retained in operations. These types were as follows: PE-2, PE-3, Tu-2, B-25, Boston III, and IL-4 for long-range reconnaissance (IL-4 exclusively for night reconnaissance); PE-2, Boston III, IL-2, Lagg-3, La-5, Yak-7, Yak-9, and U-2 for general tactical and battle reconnaissance (U-2 exclusively for night operations); Boston III, IL-4, PE-2, PE-3, Yak-9, Spitfire, and Kittyhawk aircraft, MBR-2, and GST (Consolidated) seaplanes for naval reconnaissance.

They can be considered generally to have met the requirements for which they were intended. This applies particularly to the Tu-2 planes employed in long-range reconnaissance, and the

PE-2, Yak-7, and Yak-9 planes employed in general tactical and battle reconnaissance.

In the last years of the war no major changes occurred in the weapons mounted by Soviet reconnaissance aircraft, light and heavy machine guns still being the standard armament. Reconnaissance planes also frequently carried four rockets suspended under the wings. These rockets had a rearward line of fire and an effective range between 1,900 and 4,000 feet. Use was also made of parachute-suspended fragmentation bombs (AC-2). The bombs were released from a container holding ten. They had a weight of 3.3 pounds, were released two at a time and detonated three seconds after release, approximately 1,000 feet behind the releasing plane. No case is on record of reconnaissance planes armed with cannon, and even the fighter aircraft employed as reconnaissance planes usually carried cameras instead of cannon.

Strenuous efforts were made to improve photographic equipment. Thus, fighter regiments employed in reconnaissance missions received three sets of photographic equipment of the model IL-2, intended for oblique and vertical photography.*

In March 1944 the Soviets were found to be using a new type of pendulum camera, which they called Nachalka, Russian for "swinging." Through a pendulum movement while in operation, this camera covered an area six times as wide as that covered by a rigidly installed camera, with an overlap varying between 30 and 60 percent. Owing to the inadequate lenses available to the Soviets, however, the results obtained were not quite satisfactory. In order to obtain

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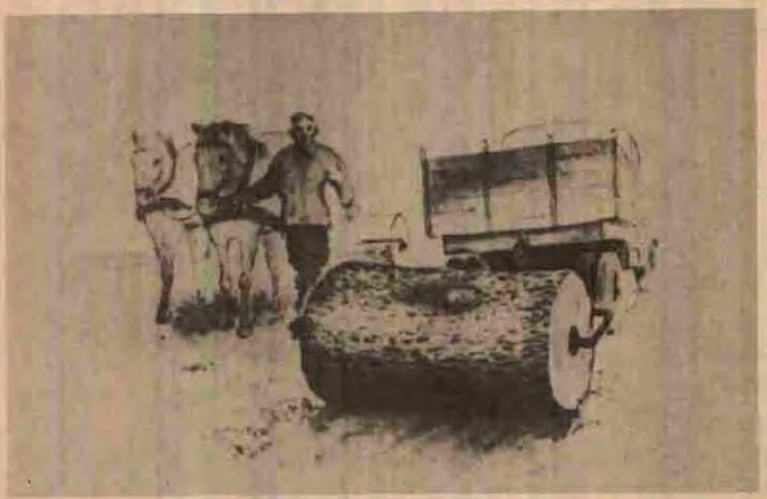
* The types of photographic equipment most frequently in use were the following:

Type	Focal Length	Lens	Purpose
AFA-1	F=30	1:4.5	Panorama photos
AFA-13	F=30	1:4.5	" "
	F=50	1:5	
AFA-27	F=21	1:4.5	Hand camera



Improvised rollers fashioned from tree trunks, used by the Russians in airfield construction

A Russian parachute bomb container which releases small caliber fragmentation bomb

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clear photos, planes using the camera had to operate at altitudes between 13,000 and 16,000 feet, an altitude at which they were particularly exposed to fire from the ground. This naturally had adverse effects on the results obtained.

In a steadily growing measure fighter regiments, and less frequently ground-attack regiments, were assigned photographic sections to enable them at least to develop their air photos and carry out the initial interpretation.

An item of standard communications equipment was the RSB radio instrument, with a telephonic communication range of 360-420 miles. On the whole this instrument was found satisfactory, which also can be said of the RPK radio target finding instrument.

The maps most frequently used were color prints with a scale of 1:500,000 or 1:200,000 and grid squares. With the exception of photographic instruments, fighter and ground-attack regiments employed in reconnaissance missions had the same equipment.

D. Evaluation of Soviet Air Reconnaissance Activities

In an overall critique of Soviet air reconnaissance activities in the last two years of the war, the information available from German field commanders and other sources make it clear that strenuous efforts by the Soviet Command to promote and develop its air reconnaissance forces in training, tactics, and technology were very successful. To the end of the war Army support remained the primary mission of the reconnaissance arm but large area and long-range reconnaissance increased. One feature was the great use of fighter and fighter-bomber units to conduct battlefield reconnaissance. As before, night air reconnaissance was of minor importance.

In conclusion, the improvement of Soviet air reconnaissance, which commenced in 1942-43, continued on an increasing scale. As a result, Soviet air reconnaissance units were able, usually, to execute their missions, although they did not achieve the high standards of performance of their German opponents or of their Western Allies.

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Section VII: The Fighter Arm[28]

Apart from a few inconsequential differences of opinion, German air commanders in the field unanimously express more or less the following opinions on the Soviet fighter forces during the last years of the war:[29]

The Soviet Command continued to concentrate on building up its fighter arm and developing it to a high standard. Therefore, the arm had a privileged position, both in respect to its numerical increase and the attention it received, and could be considered as the favorite of the Soviet air forces. Numerous fighter corps, divisions, and regiments were awarded the honor title of "Guards Fighters" and most of the air force personnel awarded the title of "Hero of the Soviet Union" were from the fighter arm.

The best aviation trainees were drafted into this arm for training. Too, a steadily improving training program, the adaptation of operational principles to western patterns, and a marked progress in the development of fighter aircraft models did much to develop the fighter arm into an especially strong member of the Soviet air forces.

Fighter forces were committed in consonance with the main effort in operations on the ground and were designed primarily to provide protection for the Soviet attack armies during their assembly and breakthrough operations, and to protect other types of air forces supporting the operations on the ground. The scope of fighter operations was, therefore, primarily tactical, so that their action had an indirect rather than a direct impact on the German ground forces, with the exception of the fighter-bomber attacks which were developed later.

Owing to the continuous expansion of the fighter arm the Soviet Command, from the summer of 1944 on, was able to make adequately strong fighter forces available in all sectors of the front and thus gradually to achieve and maintain general superiority in the air.

It should be stressed, however, that the improved and in some cases very good results achieved by the Soviet fighter arm would not alone have sufficed to achieve air superiority for the Russians. A simultaneous reduction in the number of Luftwaffe forces committed in the Eastern Theater, because of excessive requirements in other theaters, contributed substantially to this

situation.

In 1944 the German fighter forces available still were able to cope with their Soviet counterparts, but in 1945 the success achieved by individual German fighter units no longer constituted a serious hazard to Soviet fighter forces.

From the summer of 1944 on the numerical superiority of the Soviet fighter forces became more and more noticeable. For example, Soviet fighters commenced to appear much more frequently and in heavier concentrations along the approach route and over the target areas of German bombers, and created a situation in which German Ju-88 and He-111 bomber units could no longer be committed in daylight missions. German air reconnaissance units also were able to execute their missions only within a restricted scope, operating, from the autumn of 1944 on, [30] "like hunted hares," as a German squadron leader puts it.

German ground-attack and dive-bomber units on every mission they undertook during this period encountered strong Soviet fighter forces, which displayed continuously improving flying ability, tactics, and combat morale.

In their efforts to create a more closely meshed air defense in all fields, the Soviets also made strenuous endeavors to develop and make more use of their night fighter arm. However, they achieved only modest results.

Work proceeded uninterrupted on improving the training of fighter airmen, and by mid-1944 the Soviets created conditions which put an end to their period of experimentation. Approximately 36,000--over 50 percent of the total number--of the trainees in aviation schools at the time were in fighter training establishments. The motivating idea here was to create a corps of versatile, aggressive, and well-disciplined fighter personnel who would be proud of their arm and eager for action; a goal which the Soviets were only partially able to achieve. Because of existing weaknesses, the capabilities and performances of the individual Soviet fighters continued to vary widely up to the end of the war. For example, in spite of the large number of fighter units in existence, very few Soviet air aces became known. This circumstance, however, cannot obscure the fact that on the whole the behavior and the performances of Soviet fighters

improved considerably.

The above development of the Soviet fighter arm from the summer of 1944 on is described by Captain von Reschke, who, in his report[31] on operations in the northern area of the Eastern Theater, states that in August 1944 the Soviet Fighter Command committed strong fighter forces to screen off the areas east of the Vistula River. In contrast hardly any defense by Soviet fighters was encountered over the Baranow bridgehead* or over German territory.

Strong fighter forces supporting the Soviet drive on East Prussia in October 1944 secured air superiority and almost completely precluded German air reconnaissance. Soviet fighters also appeared over the German rear, while German air units were able to operate almost without interference in the Soviet rear outside the areas of main effort.

From February 1945 on German fighters were even unable to prevent the Soviets from maintaining constant fighter patrol, combined with fighter-bomber attacks, over the German airfields in East Prussia. Reaching their aircraft on the ground or taking off or landing were all bigger problems for German personnel than their combat mission once they were airborne. The era of Soviet air superiority thus had arrived.

H. E. Schlage gives a very similar account of conditions in

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* Editor's Note: The Russian bridgehead across the Vistula at Baranow (Baranow Sandomierski, about 110 miles south of Warsaw) was one of several important bridgeheads they secured in the summer of 1944 and from which they would launch their massive offensives after the turn of the year. Through hard fighting the German 4th Panzer Army managed to contain the Baranow bridgehead during the late summer. But on 12 January 1945 Marshal Konev's First Ukranian Front (consisting of 60 guard divisions, 8 armored corps, 1 cavalry corps and 8 independent armored units) burst out of the Baranow bridgehead, overrunning not only the 4th Panzer Army but also some strong German mobile reserves behind the front, and headed towards Breslau and the Upper Silesian industrial area. By this time Upper Silesia was the last, intact, German industrial area (the Ruhr had been badly crippled by Allied air attacks) and therefore constituted a strategic target for the Russian forces.

the central areas of the Eastern Theater.[32] According to him, the numerical superiority of the Soviet fighters began to make itself felt in this area at the beginning of the winter battles of January 1944 and increased by the end of the war to a crushing superiority. Schlage considers the summer of 1944 as the turning point in the history of the Soviet air forces, and adds that in the winter and summer offensives of 1944 clearly defined areas of main effort were discernible in Soviet fighter operations. In order to develop these concentrations of power, adjacent areas were stripped of fighter support. As time passed the picture changed completely until the Soviets were able to maintain fighter activities in practically all areas simultaneously, culminating in the last few weeks of warfare during which Soviet fighter superiority was at a ratio of 50 to 1.

From the summer of 1944 on the Soviets apparently had no supply and replacement problems. Schlage's impression was that they had adequate numbers of suitable fighter aircraft and well-trained pilots, as well as sufficient weapons and ammunition.

In Schlage's judgment, fighter pilots seemed to have improved in training, but it remained an open question whether this was due to Soviet accomplishments alone or to Allied assistance. Be that as it may the fact remains that Soviet fighter pilots now were highly qualified personnel. This was a development which the German command had expected and feared, and in view of the other changing circumstances in the Soviet fighter arm it caused no surprise.

In connection with the above, a report[33] addressed to Goering by the Commanding General, Sixth Air Fleet, on 8 January 1945 concerning fighter operations in the Eastern Theater reveals that not only German fighter pilots but even the highest levels of command in the Eastern Theater still were convinced in the spring of 1945 that, in spite of the crushing numerical superiority of Soviet fighters, they could beat their Soviet opponent if only a reasonably adequate number of German fighter units and the necessary fuel could be made available.

Only very few and incomplete accounts are available from German army field commanders on the effectiveness of Soviet fighter action during this period.[34] These accounts state that Soviet fighter operations had no decisive impact on military events, and that no signs were evident of Soviet fighter power concentrations or of Soviet fighter action in the German rear. This assessment can be considered too general and therefore does not do justice to the Soviet

fighter arm in the final phase of the war. It is probably due to the fact that--with the exception of fighter-bomber activities--Soviet fighter action as a rule had no direct impact on the German ground forces.

A. Organization, Chains of Command, Strengths, and Distribution

According to German field commanders and other sources,[35] no significant changes occurred in the organization and chains of command of the Soviet fighter forces during 1944-45. As was the case with the other arms of the Soviet air forces, the fighter arm had a Chief of Fighter Forces within the Inspectorate General of the Air Forces of the Red Army at the Central Administration of the Air Forces of the Red Army. Besides exercising supervision over the training of the rising crop of fighter airmen, this officer was required to inspect the training status, operability, and combat morale of the fighter units and their appropriate commitment, and to assure the existence of good relations between the tactical command staffs and their fighter units. He exercised a considerable influence on appointments to command positions in the fighter arm, submitted recommendations for the activation of new units, the rehabilitation of depleted units, the equipment or reequipment of existing units, and similar matters. However, he had no direct influence on the actual employment of fighter forces and was able to make his influence felt only indirectly by means of his reports and recommendations to the Inspector General.

The several Fighter Corps, as the highest level of command within the fighter arm, received their operational directives from the air armies. An attempt was usually made to keep the two to four divisions and regiments assigned to a fighter corps headquarters together with the headquarters when it was necessary to transfer them from one area of the front to another. Corps headquarters were organized specifically as tactical command staffs and were kept as small as possible. They were relieved of all responsibilities in the fields of supply and replacement and ground service organization, the latter being a responsibility of the air armies.

At the next lowest echelon were the fighter divisions, which were approximately equivalent in strength to German fighter wings and consisted exclusively of fighter units. They were assigned

directly to fighter corps or to air armies. Under directives from either fighter corps or air army the division committed its regiments in action closely integrated with that of the ground forces or of bomber, ground-attack, or air reconnaissance units. Fighter division headquarters also had no organic administrative or supply and replacement sections. Their supply and technical requirements were an exclusive responsibility of the air armies.

The distribution of responsibilities within the headquarters staff of a Soviet fighter regiment* approximated that customarily within the headquarters of a German fighter wing headquarters, the only real difference being that the Soviet staff had a considerably larger number of officer personnel.

Of these, the deputy regimental commander, a post which did not exist in German fighter wing headquarters, played an especially important role. Besides having full authority to act on behalf of the commander, this officer had the responsibility, as his main mission, of combat orientation for pilots newly assigned to his regiment and of giving their training the final touches. Newly arriving crews could not be committed in combat action without his prior approval and they carried out their first few missions under his supervision.

The technical personnel, of whom only an irreducible minimum were assigned to fighter regiments, were experienced and capable. They performed only first echelon maintenance and very minor repairs, all major repairs being a responsibility of the mobile repair platoons of the appropriate airfield operating battalion. Because of the system of fixed ground service organizations and because Soviet fighter regiments had so little technical and aviation equipment, they were extremely mobile.

As the output of the Soviet aircraft industry grew and Soviet combat losses decreased, unit strengths in the Soviet fighter arm increased steadily. It is estimated that the fighters on line in February-March 1944 totalled 4, 543 or 37 percent of the overall strength of the entire Soviet air forces. Of these fighter aircraft, 485 were

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* See Figure 6 , Organization of a Soviet Fighter Regiment Headquarters Staff, Status 1 July 1944.

older models, 3,228 were new types from Soviet production, and 830 were from the Western Allies. The estimated strength in September 1944 and in the spring of 1945 was approximately 8,000 fighter aircraft. This considerable increase in the number of fighter aircraft available resulted on the one hand in increased actual strengths available in regiments--the average in August 1944 being 37 aircraft per regiment--, and on the other hand in the arrival of newly activated or rehabilitated fighter regiments at the front. According to available reports there were 197 Soviet fighter regiments in July 1944, 223 in August, and 290 in September. These figures include the fighter units allocated to the Home Air Defense Command (PVO) /Protivo-Vozdushnaia Oborona/, which contained approximately 1,500 fighter aircraft, some of which were stationed deep in the rear of the combat areas and some even close to the fighting front.

In September 1944 German intelligence identified 16 Soviet fighter corps and 60 fighter division headquarters. The mounting strength of the Soviet fighter arm also was reflected in Soviet aircraft losses. Even as late as in 1943 these totalled 8,500 fighters, against only 6,200 fighter aircraft lost in 1944.

Whereas the actual aircraft strength in a fighter regiment totalled 35 and sometimes more in the autumn of 1944, the authorized strength remained 30 fighter aircraft plus 1 liaison and 1 training plane per regiment. Measures to increase the authorized strength were under consideration but were not introduced formally. The average actual strength of the Soviet fighter squadron varied between 6 and 8 fighter aircraft.

Nothing was changed in the assignment of night-fighter forces[36] to the Commander of Home Air Defense Forces. It seems, however, that there was a division between those night-fighter units in the operational zones and night-fighter units in the Zone of Interior. The PVO or Home Defense Air Armies, as higher level headquarters, controlled night-fighter corps, antiaircraft artillery corps, or divisions including both of these arms, and in addition sometimes also had temporary control over antiaircraft searchlight, barrage balloon, and aircraft reporting units if the situation required such control. The fighter corps and divisions of the Home Defense Command contained daylight and night-fighter units. What percentage of the overall fighter strength was represented by night fighters is not known. At the time only night-fighter regiments or squadrons had been identified as

SOVIET FIGHTER REGIMENT HEADQUARTERS STAFF

1 July 1944

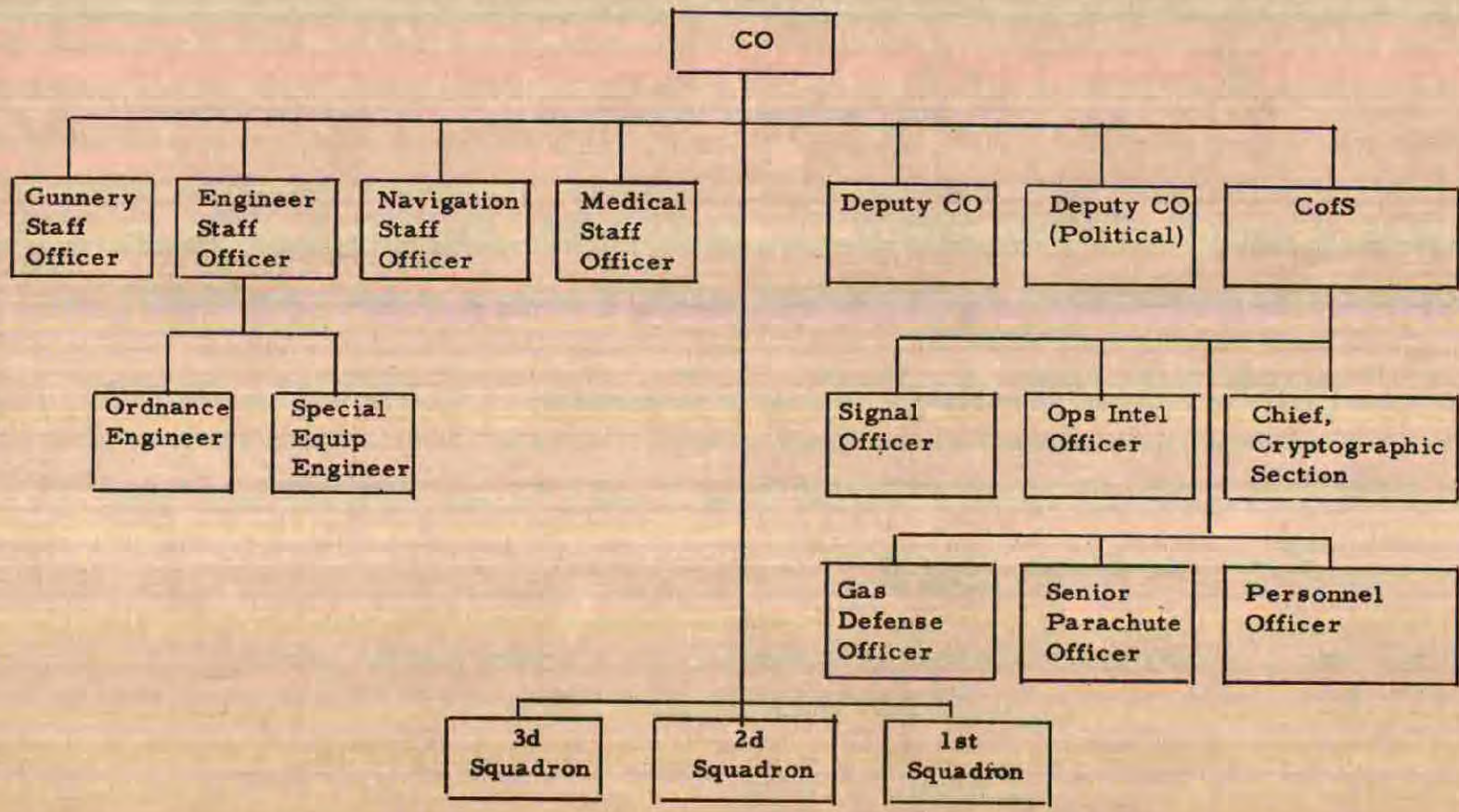

Figure 6

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specific night-fighter units, some of them being permanently assigned to specific localities. The system of holding night-fighter units under constant alert at replacement and training regiments was retained.

The distribution or concentration of fighter forces was always in accordance with the areas of main effort in the tactical situation on the ground and in the air.

B. Fighter Forces in Operations

1) Personal Behavior. German field commanders differ on the subject of the personal behavior of Soviet fighter pilots in 1944-45. However, the majority report a considerable improvement in combat morale.

Those reporting adversely on Soviet fighter pilots[37] state that they were not very aggressive nor persistent enough in attack, that they lacked spirit in their attacks and only attacked when in superior strength. They also contend that Soviet ground control stations, by radio, accused their fighters of cowardice. Fighter pairs or flights, according to these same sources, only followed in an attack if their squadron leader led the way with determination, and the failure of a unit almost always was due to the personal failure of the unit leader. It was thought that the reason for the relatively small success achieved by Soviet fighter forces resided in a characteristic feature of the Russian personality, the habit of not carrying an undertaking through to its logical conclusion.

Those sources which report[38] favorably on Soviet fighter pilots emphasize that from 1944 on Russian fighter airmen displayed a completely different attitude, that they were determined in combat and disregarded danger to the point of self-destruction. They even broke through well placed defensive fire, and, with all guns blazing, flew in to close range of their opponents. In spite of heavy losses their personal aggressiveness and combat morale improved steadily because of their constantly growing numerical superiority and their achievement of technical parity, because of their improved training, and, last but not least, because of propagandistic influences resulting from reports on the inferiority of the German Air Force and the imminent final victory of Soviet Russia in her "patriotic battle" for liberation of the homeland from the German conqueror. These, it is considered, were the factors which contributed to impart to Soviet fighter pilots--who were the cream of Soviet air personnel, and who

were being trained in an ever increasing measure to act independently--the feeling that they were masters of the heavens, a feeling which received no small measure of encouragement from the fact that German opposition was almost non-existent.

There can thus be small doubt that, in spite of certain individual weaknesses and failures, and in spite of the varying quality of individual units, the Soviet fighter arm had--at least from the summer of 1944 on--made marked progress insofar as the performance and attitude of its members were concerned and had developed into a serious opponent.

2) General Operational Principles. The improvement in the command and operations of fighter forces which had been noted in 1942-43 continued steadily during the last two years of the war. In general, Soviet fighter operations were characterized by the following features.

a) Aggressive conduct, with main effort over the front lines and in the near front areas.

b) The commitment of large masses of fighters in roving and patrol missions to completely seal off the battle area during major offensives on the ground.

c) Increasingly frequent penetrations into the German rear by growing Soviet fighter forces. These culminated in air superiority for the Soviets in the spring of 1945.

d) Concurrently with the above missions fighters flew strong fighter escorts for bomber and ground-attack units and later also for fighter-bomber units.

e) Increasingly frequent commitment in fighter-bomber missions from mid-1944 on.

f) Appropriate operations which were tailored to appropriate tactics. The units were directed in accordance with plans by ground control stations.

These findings are confirmed by Luftwaffe field commanders.[39] Soviet airmen, however, could not be considered genuine fighter pilots in the German or Anglo-American sense; the actions of all

Soviet fighter units were at all times subject to current expediencies, which occasionally included the tactical evasion of combat with German fighters.

The sudden appearance of a fighter corps in a focal area of attack was for the purpose of consolidating, under uniform direction, the efforts of all fighter forces present and was almost always the sign of an imminent Soviet offensive.

During offensive operations the fighter forces--in pronounced concentration over the immediate front and the close rear--assumed responsibility for the protection of the Soviet assembly of ground and air forces, the units spearheading the attack--usually armored forces--, and for sealing off the battle area during major engagements. This latter part of the mission was accomplished by fighter patrols and by fighters assigned roving missions at all altitudes up to 20,000 feet. The fighters participating were relieved on station, thus maintaining a constant and almost complete canopy over the entire area of attack in ground operations. This type of fighter support operation was carried out by individual squadrons or by regiments and extended either parallel with the main line of resistance or at right angles to the front for a distance of approximately 12 miles. When a number of regiments participated each regiment had its assigned zone. Towards the end of the war, operations of this type enabled the Soviets to achieve mastery of the air not only over the immediate front areas but even far into the German rear, with Soviet fighters engaging in pursuit actions which frequently carried them as far as German airfields heavily defended by antiaircraft artillery. In the meantime, Soviet rear-area air defenses became a secondary consideration and resembled the quiet sectors of the front where Soviet fighters behaved in a markedly passive manner.

In addition to sealing off the front and near front areas, Soviet fighters were assigned the important concurrent mission of providing escorts for ground-attack, bomber, and fighter-bomber units. With growing frequency the Soviets committed massed bomber and ground-attack units under fighter escort. In East Prussia in the spring of 1945, for example, such attacks were repeated several times daily. The tactics employed were practical and with the steadily increasing technical performances of their aircraft, Soviet fighters adhered more and more closely to these tactics.

The direction of fighter operations by radio became the

general rule, particularly in areas of main effort. In numerous cases fighters and fighter-bombers were guided by radio to a meeting point and then employed in a joint operation.

3) Execution of Fighter Operations. Although field commanders of the German Air Force differ, according to their personal experience, on some points concerning the execution of Soviet fighter operations, their general opinion is that by 1944-45 Soviet fighters had adapted themselves to the requirements of modern warfare and had learned much.[40]

Usually, fighter units conducted their operations cleverly, although frequently they still became scattered after only brief combat action and were rarely observed reassembling over Ger man held territory. They had adopted the western flight formations of pairs, flights, and squadrons, but occasionally were still observed operating in large, loosely organized, and unsteady formations.

Fighters usually operated in units of eight to ten aircraft, which were combined to form an attack group approximately 30-50 strong.

The approach was usually at medium altitudes but occasionally also at altitudes up to 23,000 feet.

The defensive circle was still the favorite formation. From it, the fighters would emerge singly at brief intervals in order then to attack the hostile aircraft from all sides.

In air combat Soviet fighters still made the mistake of opening fire at excessive ranges, but gunnery training, including the subject of fire discipline, had improved markedly.

Generalmajor Uebe[41] gives a highly graphic account of the flight behavior of Soviet fighter pilots in the last two years of the war.

According to his description, Soviet fighter units operating in strengths of more than 30 aircraft under a single command and uniformly directed were a rare occurrence. In areas of main effort as many as 100 fighters were committed at times, which equalled the strength of three air regiments. In such cases, however, the attack and defense groupings were only loosely linked, and the

individual planes roved singly within the assigned area without direct mutual contact. The combat formation in 1944-45 was based on the pair system, as was the case in the German fighter arm. The flight of two pairs flew in relatively loose formation with a frontal spacing of 500 to 600 feet between planes; lateral and altitude spacing between the elements of the normal operational units--consisting of seven to eight flights and thus of approximately thirty aircraft--depended on weather conditions. Very frequently a lone plane followed in the rear of the Soviet fighter unit, obviously with the mission of maintaining rearward and upward observation. This plane was jokingly referred to by German airmen as the "wooden eye" of the unit.

Late in the war the Luftwaffe adopted a basic flight formation of three aircraft for units with a cruising speed of more than 300 miles per hour in order to secure flexibility. This system was not adopted by the Soviets.

A certain measure of nervous jerkiness remained a characteristic feature of Soviet fighters up to the end and made it possible to identify an approaching fighter unit as such even at extremely long ranges. Soviet fighters also favored the forming of a defensive circle before attacking. Fighter operations by independent pairs or flights of aircraft taking advantage of hazy weather, sunrise or sunset were a rare occurrence. When on escort missions Soviet fighters remained in the immediate vicinity of the escorted unit as long as possible.

4) Soviet Fighters in Combat against German Fighters. All field commanders of the German Air Force unanimously emphasize that German fighters had to the end a feeling of superiority in air combat,[42] in spite of the growingly unfavorable numerical ratio and in spite of certain technical advantages of the Soviet fighter aircraft over German models in the last year of the war. There can be no doubt that the German fighter units had a better command, wider combat experience, and greater tactical ability, factors which proved decisive in air combat. This fact was admitted by the Soviets. A captured Soviet lieutenant from a guards fighter unit for example stated as follows: "The fighters from the (German) 54th Fighter Wing are usually in the minority in combat. But when they are present things get hot. All of them are aces."[43]

The individual superiority of the German fighter, however, was not enough to prevent the gradual achievement of air superiority by

the Soviets through their crushing numerical superiority. This development also was favored by the fact that German fighter operations became less and less frequent, while German losses, particularly in new fighter personnel, mounted steadily.

Their strong numerical superiority and their modern aircraft gave Soviet fighter pilots an advantage over the German fighter arm. This knowledge in some cases made them over-confident, intrepid, and obstinate, at times even stupid. While in combat they would give an exhibition of acrobatic flying in order to display the maneuverability of their planes.

The maneuverability of the German FW-190 was superior to that of the Soviet Yak-9, and the Soviet La-5 was better than the German Me-109. The German FW-190, however, was superior to the Soviet Yak-3.

In combat against German fighters, Soviet fighters were occasionally not ruthless enough in the attack. On the other hand, they would fire continuously even though they had no targets in their sights.

The above observations, however, cannot obscure the fact that the Soviet fighter arm had improved considerably its performances against German fighters, and that the command made proper use of its great numerical superiority.

A typical example of Soviet fighters in operations against German fighters near the end of the war is given in an account of an air battle at Zinten,* East Prussia, in February 1945.[44] The description is an example of numerous such encounters:

The lead plane of a German BF-109 flight attacking a formation of Soviet ground-attack aircraft came itself under attack from the rear and below by two Soviet Yak-3 fighters and had to break off engagement because of hits in its engine and steering gear. Flying alone the German fighter again came under attack by two Yak-3 planes, this time from above. One of the Soviet planes passed the crippled German fighter and, coming into its sights immediately ahead, was shot down almost simultaneously with the downing of the second

* Editor's Note: Now Kornevo.

Soviet plane by the rest of the German BF-109 flight, also on their return trip by this time. Whereas the crippled lead plane of the German flight was forced to make an emergency landing, the leader of the pair which had shot down the second Soviet plane was pursued and shot down by another six Yak-3 planes.

At the time of the above air engagement approximately 40 Soviet fighters and 20 Soviet ground-attack aircraft were in the air in the Zinten area against only one swarm and one pair of German fighters. Of the German airmen involved the only one to survive was the swarm leader, who reached his squadron base safely after his emergency landing; all others were killed in action.

The above example offers a striking illustration of the terrific Soviet superiority in fighters towards the end of the war. It also reveals how this superiority resulted unavoidably in intolerably heavy German losses in fighter pilots, losses which could not be replaced.

5) Fighter Operations against German Bombers. From available reports[45] it is evident that Soviet fighter attacks against German bombers, which had commenced in 1943, continued on an increasing scale in the following years.

The impact of these fighter attacks in the summer of 1944 precluded any possibility of committing the older German He-111 and Ju-88 bomber models in daylight operations. Even Ju-188 bomber units came under persistent attack at altitudes of 30,000 feet and above. Only He-177 bomber units above flight strength and in close formation were safe, because of their very effective defensive fire power, from Soviet fighters. Still, it is remarkable that Soviet fighters did not even attempt to attack such units. It seems almost as though they had instructions to attack He-177 units only in exceptional circumstances or not at all. In spite of their heavy defensive firepower, however, He-177 planes flying alone invariably were shot down by Soviet fighters.

In this connection Lieutenant Colonel von Riesen[46] even reports what was unmistakably a simulated attack by Soviet fighters against an He-177 bomber group, 18-20 aircraft strong, in the Minsk area in the summer of 1944. A formation of some thirty Soviet fighters curved in a wide sweep from starboard to the rear of the He-177 group, which was flying in close formation.

Instead of attacking, however, the Soviets passed over the German group some 6,000 feet higher up after firing with all guns into empty space. At such an altitude an observer on the ground must have gained the impression that the shells from the Soviet planes were exploding among the German planes. After carrying out this maneuver, the Soviet fighter formation descended in a steep dive far ahead of the German planes.

The above description of a simulated attack is the only one on record. In general, reports emphasize time and again the tenaciousness of Soviet fighters in their attacks against German bombers. This was particularly true of those fighter units led by a determined commander. It was by no means rare for two or even three squadrons to attack simultaneously. In spite of all this, however, the losses due to Soviet fighter attacks remained small when the bomber unit was flying in a close, properly echeloned formation, and if the bomber unit protected itself with well-aimed, sudden defensive fire. In such cases the Soviet fighters usually failed to repeat their attack.

Soviet fighters were committed against German bomber formations either as a result of air situation reports or as a natural outcome of regular fighter patrols, as was the case above the Kerch Peninsula, where fighter patrols were employed to prevent the bombing of Soviet amphibious operations.

In evaluating Soviet fighter operations against German bombers it should be borne in mind that such action was hardly possible after September 1944, because from then on, the Luftwaffe, faced with absolute Soviet numerical superiority, was rarely able to employ its bomber units.

6) Soviet Fighter Operations against German Dive-Bombers. Soviet fighter action against German dive-bombers continued to increase considerably in the last two years of warfare and seriously complicated the execution of dive-bombing missions.[47] Dive-bomber units were a highly favored target for Soviet fighters and the losses they suffered were by no means inconsiderable, particularly late in the war when they frequently had to operate without fighter escorts because of fuel shortages.

Soviet fighters not only flew patrols over the battle areas but also endeavored to intercept German dive-bomber and ground-attack units while still on the approach over the German rear and drive them

off before they could even reach their assigned target areas. In these operations Soviet fighters preferred to operate in a formation based on pairs, strongly echeloned in altitude--between 6,600 and 20,000 feet--while cleverly exploiting weather conditions and the sun. Frequently, they were able to attack German dive-bombers by surprise, approaching simultaneously from various directions and various altitudes.

When in a favorable position Soviet fighters during this period always sought combat and in most cases no longer gave evidence of fearing the German FW-190 aircraft, especially when they identified them as bombers.

As long as the German units remained in a well closed formation, Soviet successes remained within modest limits. The strong Soviet fighter defenses compelled German dive-bomber and ground-attack units to approach at very high altitudes and descend at high speeds when close to their targets in order to break through the Soviet fighter defenses, a tactic which was usually successful. It is only natural, however, that the precision and effectiveness of the German attack suffered as a result.

The general experience outlined above is confirmed in all points by Colonel Rudel[48] on the basis of his highly diversified experience during the last two years of the war. Rudel writes that in endeavoring to execute their missions, German dive-bomber units found themselves almost hopelessly outnumbered by opposing Soviet fighters. Air battles between flight or at most squadron-sized German dive-bomber units and Soviet units or 15 to 30 Airacobras, La-5, or Yak-9 fighters were by no means rare; on the contrary, they were a daily occurrence. In these engagements Soviet fighter pilots as a rule were extremely aggressive and showed far better performances than in former years. They had mastered both the aviation and combat aspects of their job.

In these air engagements, which frequently developed into fantastic battles of maneuver down to tree-top levels, the Soviet pilots pressed their opponents mercilessly, attacked from all sides, and were relentless in pursuit. Rudel states that he hardly ever returned from a mission without at least one hit in some part of his plane, and reports on one air battle in the spring of 1944 in which his plane was literally riddled with 20-mm and 37-mm missiles. The German Ju-87 was a relatively slow and somewhat cumbersome

plane and, particularly after the appearance of the Yak-3 model, could no longer be considered a match for the modern Soviet fighters; when loaded, it was inferior in every respect. The only chance of success was in a maneuver of close curves, in which the Soviet's speed carried them too far outward and robbed the pilot of his fire power.

Dive-bombers which became separated from their formation were invariably shot down by Soviet fighters. Losses remained relatively small, however, as long as dive-bombers kept their formation.

The reequipment of the dive-bomber units with FW-190 aircraft improved the situation somewhat, and units of these aircraft even succeeded in shooting down a considerable number of Soviet fighters. However, operational conditions for the dive-bombers deteriorated steadily in the spring of 1945. Whenever a unit left the ground on a combat mission it found American fighter units waiting on the West and Soviet fighter units on the East and the unit had to "run the gauntlet" in the truest sense of the word as long as it was in the air. The air was swarming with hostile fighters, and continuous air combat during the approach flight, during the attack within the target area, and during the return flight, was the order of the day. Units returning from combat missions had to fight their way home through fighter patrols and on reaching their bases could not land until antiaircraft guns cleared the air of Soviet fighters.

7) Soviet Fighter Operations against German Air Reconnaissance Forces. Soviet fighters in 1943 already proved a serious impediment to German air reconnaissance activities. According to the unanimous opinion of all German air commanders consulted, the effects of Soviet fighter operations on German air reconnaissance increased steadily and in the spring of 1945 brought German air reconnaissance to an almost complete standstill. [49]

In the first few months of 1944 German air reconnaissance units as a rule still succeeded in executing their assigned missions, although with growing difficulty. Above all, encounters with Soviet fighters were not too frequent in the Soviet rear or in quiet areas of the front. Heavily outnumbered, German reconnaissance units had no chances of success in air combat against Soviet fighters, but experienced crews usually managed to repel Soviet fighter attacks and return safely to their bases. It was only on rare occasions that

German reconnaissance units succeeded in shooting down Soviet fighters, and this took place only in the far rear areas. The Soviet fighter patrols, under constant alert in these areas, apparently were manned by inexperienced and not very well trained crews. In areas of main effort at the front and at well established penetration points, German reconnaissance units were always seriously hampered in their operations by Soviet fighters on permanent patrol or roving missions.

Up to mid-1944 the Me-109 planes employed in reconnaissance were able to escape the Soviet fighters then committed at the front. The fighters were faster than the Me-109 in a short steep climb, and just as fast in a dive, but in a gradual long climb at a top speed of 180 miles, the Soviets as a rule gave up the chase at an altitude of around 20,000 feet. Captain von Reschke[50] reports how his pair of Me-109 reconnaissance planes on one occasion came under a surprise attack by eight Soviet fighters striking through a thin veil of clouds. The reconnaissance planes were cruising at an altitude of about 13,000 feet and immediately turned in on the Soviet fighters with their guns blazing. The fighters scattered at once and made no effort to follow the two German planes in their gradual climb.

In the summer of 1944, with the appearance of the new Soviet fighter models, particularly the Yak-3, the use of tactics of the above type was at an end. From then on it was impossible, because of the heavy losses incurred, to employ the FW-189--the standard German reconnaissance plane--in daylight missions. It had to be replaced in part by the single-seater Me-109 and in part by the twin-seater Me-110. Gradually it even became impossible to employ the FW-189 with fighter escorts.

Another modification which the introduction of the fast and modern Soviet fighters made essential was the removal of bombing equipment from German reconnaissance planes and its replacement by longer range instruments for panorama photography. This was necessary because reconnaissance planes now were forced to operate at higher altitudes: above 20,000 feet on strategic reconnaissance missions, and between 13,000 and 16,000 feet on tactical reconnaissance missions.

Soviet interception of German reconnaissance planes increased steadily from the summer of 1944 on. Almost all German reconnaissance units found themselves involved in air battle whenever they reached

their target areas. This shows that the Soviet aircraft reporting service identified the German planes while these were crossing the front areas. Soviet antiaircraft directional fire, used to indicate approaching German aircraft, usually brought speedy intervention from Soviet fighters on patrol in the area.

During major offensive operations the Soviets employed such strong fighter forces to screen the front areas that German battle reconnaissance near the front was practically impossible, even over German-held terrain. The only possible tactic here was what was called "pin-point reconnaissance," in which the plane would approach its reconnaissance target at a great altitude from the Soviet rear. Flying at top speed it then would dive down through the Soviet fighter screen and return to the German lines at practically ground level. Naturally, the results obtained by such means were not very satisfactory.

A certain relaxation in the Soviet fighter effort was noticeable only during periods of quiet in ground operations or for brief intervals when fronts had become fluid and properly integrated fighter patrol operations had not yet been reorganized.

In their encounters with German reconnaissance planes, Soviet fighters fought with the utmost determination at any altitude, and occasionally even tried to ram German planes under attack.

If German reconnaissance planes were operating with fighter escorts, the Soviet fighters would engage the German fighters in combat in order then to shoot down the reconnaissance planes.

From the accounts given by German reconnaissance airmen concerning their air battles against Soviet fighters it is obvious--and this is substantiated by all available sources--that Soviet fighters usually operated in squadrons or flights. For the actual attack run the flight would scatter and then approach the target from all sides, including the front. Adopting the German tactics of attack, they would fly to within the closest range of the German reconnaissance plane with all guns firing, and would pursue it persistently as far as and even beyond the front lines. Attacks by units of 10 to 15 Lagg or Yak fighters were by no means rare. The number of reconnaissance planes damaged by enemy fire, and also the number of planes lost, together with their crews, increased alarmingly in the second half of 1944.

Soviet fighters also displayed a remarkable ability to adapt themselves to current circumstances in the battle against the German air reconnaissance arm. Thus, He-111 planes in September 1944 had succeeded in the execution of photo reconnaissance missions at altitudes between 20,000 and 23,000 feet. As soon as this became known to the Soviet Command it dispatched fighters on missions calculated to prevent any repetition of such German reconnaissance operations. No Soviet fighters remained at these altitudes once these German reconnaissance missions ceased.

From early 1945 on the numbers of Soviet fighters committed in patrols over the focal points of battle were so overwhelmingly superior that German air reconnaissance activities were suppressed to the point of insignificance, and finally the situation was so bad that reconnaissance planes were being intercepted just after taking off for their missions.

Conditions in East Prussia during this last phase of the war are described in their full, tragic implications by Captain von Reschke[51] according to whom Soviet fighters and fighter-bombers were the first aircraft in the skies over the German airfield each morning. They remained posted over the airfield virtually throughout the day, keeping it under such close observation that it was absolutely impossible for reconnaissance planes to take off except during the very early morning dusk. The returning planes came under attack by Soviet fighters and fighter-bombers immediately after landing, and in some cases were shot into flames even before they had taxied to a standstill.

At times airmen based near the Baltic found it less hazardous in the air than on the ground at their own base. If a pilot succeeded in taking off, he first flew out to sea a distance of approximately twelve miles at ground level. At sea he climbed to cruising level and then flew at top speed to his assigned reconnaissance area, where he was relatively immune from interference, but only while operating at extreme altitudes. Reconnaissance units rarely succeeded in executing their mission without becoming engaged in air combat, and the results they obtained were relatively insignificant.

8) Soviet Fighter Operations against German Airlift. No new features of any great significance are reported concerning Soviet fighter operations against German air transport in 1944-45.

Major Brunner[52] reports that already in the summer of 1944

the Soviet fighter defenses had become so effective that He-111's no longer could be employed in daylight air transport missions. For this reason all airlifts had to be restricted to the hours of dusk, primarily in the evenings, and air drops were made from altitudes of between 500 and 700 feet in single plane missions. These circumstances presented exceptionally favorable opportunities for intercept action by Soviet fighters, who, for inexplicable reasons, failed to exploit these opportunities. The constant recurrence of the air drops at known points and at regular times plus the vulnerability of the He-111 plane when operating alone should have facilitated Soviet fighter attacks greatly. Possibly the Soviet fighter pilots were reluctant to accept the risks of landing at night after the attacks.

9) Night-Fighter Operations. The efforts of the Soviet Command, noticeable at the end of 1943, to expedite the development of its night-fighter arm continued on an increasing scope in 1944. Some measure of success was achieved in the field of illuminated night fighting, but dark night fighting did not progress beyond the incipient stages up to the end of the war. From the autumn of 1944 on, however, the subject of night fighting again became one of minor importance for the Soviet Command as German night air attacks against targets in the Soviet rear became less and less frequent and finally ceased altogether.

Major Brunner, [53] who commanded a bomber group of the IV Air Corps in night bombing attacks in the Eastern Theater during the summer of 1944, reports that up to the summer of 1944 Soviet night-fighter activities increased week by week. In the beginning, the effects of these activities were noticeable only in the target areas and occasionally along the approach and return routes. From May 1944 on, however, Soviet night fighters were encountered throughout the entire combat areas west of the Dnieper River, particularly during moonlit nights.

The aircraft employed in night-fighter operations were chiefly single-engine day-fighter models, such as the La-5, but twin-engine PE-2 fighters were also encountered occasionally. Combined twin- and single-engine night-fighter operations also were observed several times. A refinement of tactics and efforts to operate by flights or pairs soon became noticeable.

As a rule Soviet night fighters attacked from various

directions while climbing. The approach was from the rear and above, and at the proper moment the night fighter would move into position below the German bomber in order to climb with guns firing.

Flares were dropped in efforts to light up the surroundings and thereby make the attacking German bombers visible.

Soviet night-fighter activities were directed primarily at German pathfinder and target marking planes rather than at the actual bomber formations. German planes flying singly were pursued persistently and on some occasions Soviet fighters were observed repeating their attack run as often as five times.

In some cases Soviet night fighters awaited the German bombers as far forward as the light beacons, thus forcing the Germans to fly without position lights even while over German held territory. In a similar manner fighters endeavored to intercept German bombers at turning points in their course marked by light flares.

It can be assumed that the Soviet system of directing night-fighter operations still relied primarily on visual and optical aids plus voice radio, and was not supported by the use of radar. This seems obvious from the fact that the night fighters often passed German bombers in the dark and made futile efforts to find them, sometimes even employing airborne searchlights. The assumption is also substantiated by the fact that bombers were able to escape weapons fire through evasive maneuvers.

Considerable progress was made in organizing the direction of night-fighter operations from the ground, use being made of directional searchlights, together with lamps of various colors and in various color combinations, as well as specific light signals of all types. The various optical signals and aids presumably served the dual purpose of providing reference points for ground orientation--particularly during very dark nights--, and of signalling the approach and direction of German bombers.

All of the above were signs of the Soviet effort to improve their night defenses. No appreciable results were achieved, and Soviet night fighters did not make any great impression on German air crews. Nevertheless, it must be admitted that the Soviet's development of their night-fighter arm was correct, logical and

methodical.

In August 1944 the 55th Bomber Wing flew its last night missions against the Soviets. In the four months from May to August the wing had lost a total of fourteen aircraft over hostile territory during night attacks. How many of these planes were lost to Soviet night fighters, AA fire, or because of engine or other technical failures is unknown.

The above observations by an experienced bomber group commander, whose units in the summer of 1944 executed numerous night bombing missions in Russia, are confirmed in all essentials by other available sources. [54]

From these additional sources, the organization of the Soviet night-fighter service can be roughly determined.

The air defense zones were sub-divided into quadrilateral areas, which were allocated night-fighter regiments as the situation required. These zones committed their forces by squadrons or flights in their sub-areas in accordance with a standardized plan. Each such defense unit included a ground-control station, a light beacon, and a searchlight.

The control center of Home Air Defense Headquarters issued orders for the aircraft to take off, and the operations of the air units thus committed were directed individually by the ground-control station of the sub-area concerned by means of voice radio. The ground-control station, as well as the aircraft reporting service, received their orders from the control center of Home Air Defense Headquarters. The aircraft reporting service was organized in aircraft reporting companies controlling individual reporting posts, and had improved its performances considerably through the use of radar.

The Soviets also differentiated between illuminated and dark night-fighter operations. In dark night-fighter operations they did not progress beyond the beginning stages during the war and therefore achieved no particular success. The use of radar to guide fighters to their targets and of radio direction finding apparatus to track targets remained in the experimental stages.

For the above reasons Soviet night fighters were employed

almost exclusively in illuminated night-fighter operations. The fighters were guided to their targets either by forward ground control stations using voice radio or by an optical system employing light beacons--coupled with searchlights--, and vari-colored lights and signals to indicate the direction of the German bombers. At the control center of the Home Air Defense Headquarters all reports received from the aircraft reporting service concerning penetrations by hostile aircraft were posted on a master air situation map. The speeds of German aircraft were given on the situation map, thus enabling the control center and the various ground-control stations to keep track of the movements of the German bombers within margins of error tolerable for operational purposes. At regimental headquarters the navigational staff officer kept the air situation map currently posted on the basis of the computed courses and altitudes of hostile and friendly aircraft and thus provided the necessary data to guide the night-fighter units to their target by means of voice radio messages.

Night fighters usually were committed in action over the target area, advantage being taken of moonlight, searchlight illumination, and the light from German flare bombs, since any of these sources of light served to reveal the attacking German bombers clearly.

Soviet night fighters, usually single-engine Yak-1 and La-5, but also twin-engine PE-2 planes, operated in some cases with position lights burning. Even when this was not the case they were visible at a great distance because of their exhaust flames.

No clearly defined attack tactics were developed for night-fighter operations. Owing to the lighted condition of the ground the fighters frequently made their attack run from the rear and above; when the target was illuminated by searchlights or on very dark nights they also sometimes attacked from the rear and below, adapting their speed to that of the plane they were attacking.

As a rule the attack was flown by a single plane, less frequently by a pair of fighters. At times, but only rarely, they were observed attacking in flight formation echeloned to the right.

If a Soviet night fighter ran into the line of fire of friendly antiaircraft artillery fire, he immediately banked down, giving

the identification signal. On one occasion it was observed that Soviet night fighters used signal lights and searchlights mounted under their wings, together with other identification signals, to request specific limitations of antiaircraft artillery fire.

Besides these night-fighter operations within target areas, cases are also on record, although on very rare occasions, of night fighters attacking German bombers during their approach or departure, and in some cases for short distances over the German lines. The Russians showed a preference in these attacks for German bombers flying with position lights. In such cases the night fighters would, from the outset, take up stations at altitudes known to be used by the German bombers.

No case is on record of Soviet intruder planes infiltrating German formations during night operations. In contrast, it was noted occasionally that PE-2 night fighters were committed as contact planes even at great distances from the defended target area with the mission of transmitting radio messages guiding the single-engine night fighters to their target. On reaching the night-fighter zone these contact planes dropped flare bombs enabling the other night fighters, who had meanwhile arrived on the scene, to engage in illuminated night-fighter operations.

In the last few months of warfare Soviet long-range night-fighter operations gained some measure of importance. In the summer of 1944 the Soviet Command had organized a number of what were called long-range night-fighter patrol regiments as part of the existing long-range bomber arm. The majority of these regiments were equipped with Boston-A-20-G planes, some of them temporarily with B-25's and IL-4's. These units were not intended for escort purposes but for specific offensive actions supporting the Soviet night-bomber units in the execution of their missions.

The missions of the newly created night-fighter patrol regiments were more or less as follows: a) to neutralize German night-fighter bases while Soviet bombers were carrying out their attacks. For this purpose the regiments involved maintained patrols over the German night-fighter bases around the target area starting ten minutes prior to the scheduled time of the bombing attack and lasting as long as circumstances required. The patrolling planes were to attack all German planes taking off and were to bomb the airfields; b) to carry out low-level attacks, using weapons fire and

bombs, against German AAA and searchlight positions within the target area. For this purpose units had to maintain observation over the entire target area and immediately eliminate all firing batteries and searchlights which went into operation; and c) to carry out low-level attacks against moving targets. For this purpose units were assigned roving missions with instructions to attack with weapons and bombs all German movements detected on rail and road routes.

In executing these missions the night-fighter patrol units operated at altitudes between 330 and 1, 300 feet. The results achieved were extremely modest.

The experience gained concerning the training status of Soviet night-fighter personnel was very moderate. The bulk of the personnel assigned to the new arm came from the instructor staffs of the various replacement and training regiments with a sprinkling of newly trained personnel considered particularly capable. In the last years of the war pilots considered to be aces were also withdrawn from the fighting front for employment in night-fighter operations.

There can be no doubt that the capabilities and performances of Soviet night fighters had improved, although they by no means equalled those of their German counterparts or of their counterparts in the night-fighter forces of the Western Allies.

On the basis of these very detailed and exhaustive reports the Soviet night-fighter arm in the last years of the war can be evaluated approximately as follows: a) The Soviets succeeded, by the summer of 1944, in achieving a relatively high standard of performance in illuminated night fighting, but in the field of dark night-fighter operations they did not progress beyond the first stages of development. b) The direction of night-fighter operations remained restricted primarily to the use of voice radio and optical aids. For this reason, and because of the still very imperfect performances of the Soviet aircraft reporting services, the results obtained in night-fighter operations necessarily remained within modest limits and had no noticeably retarding effect on German night-bombing attacks. c) In the final phase of the war the Soviets also committed long-range fighters in support of their night-bombing attacks. There are no records, however, of any particular success achieved by the Soviets in this field.

10) Soviet Fighter Cooperation with Other Elements of the

Soviet Air Forces. German field commanders[55] express the opinion that, as the war progressed, cooperation between the Soviet fighter arm and the rest of the Soviet air forces improved. It is necessary to distinguish between two fundamentally different types of operation a) the escort mission, and b) the combined combat mission.

Escort missions were executed either in the form of unit escort duties or in the form of air patrols maintained over the area in which the protected units were to operate.

If reconnaissance units required escort protection, the escort fighters either joined the escorted unit over the fighter base, which the reconnaissance unit was required to cross on the way to its target area, or the reconnaissance unit made a stopover at the fighter base to pick up its escort. It was only on rare occasions that the juncture was made en route at some predetermined spot.

As a rule Soviet ground-attack and bomber forces during the last two years of warfare always operated under fighter escort. It was only in exceptional cases and in very quiet areas that Soviet ground-attack or bomber forces were observed operating against the German communications zone without escorts.

When escorting ground-attack or bomber units, fighters usually remained as long as possible in the immediate vicinity of the protected unit but at higher altitudes, varying between several hundred feet and 7,000 feet. Thus, in the autumn of 1944 ground-attack formations of 60 to 80 aircraft were escorted by fighters in equal strength. The latter restricted their action to the execution of their escort missions and made no effort to dive down and join the attack. In other cases it was observed occasionally that the escort fighters remained over the target area after the attacking Soviet bomber formation had departed.

Soviet fighters had learned the art of properly escorting bomber and ground-attack units during offensive operations and of protecting them against attack by German fighters, functions in which the Soviet fighters were favored greatly by their crushing numerical superiority.

Combined combat action, in which bombers, ground-attack units, and fighters--usually the fighter-bomber type--were assigned separate attack missions within separate target areas, became

increasingly frequent in the last years of warfare, and particularly so in the spring of 1945. As a rule these attacks were well integrated in timing and area and in some cases produced decidedly adverse effects on the German ground forces.

Coordinated action between fighter and bomber units was also observed repeatedly in attacks against German reconnaissance planes. It was by no means rare, for example, for a pair of La-5 and a pair of IL-2 planes to combine in action against German reconnaissance planes.

11) Fighter-Bomber Operations in Coordination with the Army and the Navy. In the last years of the war Soviet fighters were committed more often in direct support of the Army and in fighter-bomber missions than previously. This development became more and more pronounced as the gradual cessation of German air activities released Soviet fighters from their normal missions, a fact which is emphasized unanimously by field commanders of the German Army and Air Force.[56] Here again it is necessary to differentiate between defensive or protective and offensive missions.

The protective mission of Soviet fighters in cooperation with the Army called primarily for large-scale fighter attacks to seal off the approach, regrouping, assembly, attack, and break-through areas in major offensives so effectively that operations on the ground would be largely secure against German air attack.

Special importance was attached to air support for those units--particularly tank units--which spearheaded an offensive; in consequence, German dive-bomber and ground-attack aircraft found it exceptionally difficult and at times completely impossible to subject such units to effective attack. It was by no means rare during such operations for Soviet fighter units to be assigned tactically to the tank units and controlled by forward air direction teams. In operations of this type the supporting fighters usually were assigned roving missions or patrol missions with main concentration over the main line of resistance, extending approximately 12 miles in depth on both sides of the front. From the spring of 1944 on Soviet fighters were employed in missions of this type with increasing frequency and on a steadily increasing scale. The attacks were directed chiefly at such targets as German forces spearheading an attack, centers of defense, individual and pinpoint targets of all types, vehicles and concentrations

of all sorts, near front supply installations and supply routes, road traffic installations--with emphasis on narrow road sections, culverts, rail traffic, rail installations, locomotives, and other rolling stock left standing in shunting yards.

Although Soviet fighters at no time achieved the high degree of perfection attained by their western allies in operations of the type discussed above, their attacks in the main areas of military action towards the end of the war produced results which completely stopped German road traffic and almost all other traffic during daylight as far back as 12 miles in the German rear. During the battles for Pillau, for example, all avenues of traffic to Pillau /Baltisk/ led through Fischhausen /Primorsk/. * On the first day of the Soviet attack, massed Soviet fighters and fighter-bombers subjected Fischhausen to such heavy and continuous attacks that the whole town very soon was reduced to rubble and was completely impassable to traffic of any type. The result was that all German troops committed forward of Fischhausen had to leave all vehicles and heavy weapons behind in their withdrawal and only with extreme difficulty and at the expense of heavy losses did they manage to escape with their lives.

Through action of the above type Soviet fighter-bombers seriously affected the morale of the German troops and inflicted considerable losses in men and materiel.

German airfields now also came under frequent attack by Soviet fighter-bombers. Cleverly exploiting terrain cover and the cover afforded by built-up areas at the airfields, the fighter-bomber units even succeeded in breaking through strong ground defenses by light and heavy AA guns and in numerous cases inflicted heavy losses.

In attacking airfields Soviet fighters and fighter-bombers often began by circling around the airfield at an altitude of approximately 5,000 feet--outside the range of light antiaircraft guns--in order then suddenly to dive down, individually or by pairs or flights, to attack the airfield with weapons fire and bombs and then immediately climb back to a higher altitude.

In operating against traffic targets, the planes made their attack run lengthwise along, at right angles to, or obliquely across

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* See note above, p. 293.

the route according to the local situation, weather conditions, and the position of the sun.

In 1944-45 the Soviets also made increasing use of fighter forces in support of naval operations, primarily in the form of protective missions.[57] The primary missions were those of providing air defense for naval units, convoys, port installations and other important naval targets, as well as for bomber, ground-attack, and torpedo bomber units employed at sea.

Some of the fighter regiments committed in operations such as those described above were equipped with modern Soviet aircraft models, such as the Yak-7 and Yak-9, others had American Airacobra aircraft.

When on escort missions at sea one formation usually flew close escort in the immediate vicinity of the escorted unit while another formation maintained station 2,000 to 2,600 feet higher up and to the rear, echeloned either towards the sun or towards the shore, ready to engage German fighters which might attempt an attack. On approaching the target, the escort fighters if at all possible remained beyond the range of hostile ships' or port antiaircraft guns in order again to take up escort stations with the attacking bomber or other unit after it had released its bombs.

In addition to their protective missions, Soviet fighters were employed in attack missions integrated with Soviet naval operations. These missions were either fighter-bomber attacks against ships or port targets, or attacks against German airfields. In attacks against ships or port targets, the fighter-bomber usually made its attack run in a glide from an altitude of between 1,300 and 2,600 feet, and released its bomb--usually of the 550-pound type--at an altitude of 1,000 feet. The approach and departure were at low levels as a rule and, if circumstances required, the bombing plane was escorted by other fighters. The attacks against German airfields occurred during large-scale attacks against convoys and served the purpose of preventing the take off of German fighters or of intercepting any which had succeeded in taking off.

Night-fighter support of naval operations was observed in only a few isolated cases. Presumably the aircraft involved were day fighters temporarily employed in night operations. No records are

available on the existence of night-fighter squadrons or regiments with the Soviet Navy.

12) Soviet Fighter Operations under Exceptional Weather Conditions. The few reports available from German field commanders[58] concerning the behavior of Soviet fighters during unfavorable weather produce a somewhat contradictory picture, similar to that of previous years.

Whereas some sources maintain that neither cold nor any other conditions of weather--with the exception of fog--could prevent the operations of Soviet fighters, other sources emphasize that bad weather operations were unpopular with Soviet fighter pilots, that a certain measure of reluctance to operate was noticeable during spells of bad weather, and even that there was definitely no risk of encountering Soviet fighters during periods of really unfavorable weather. In like manner, these sources maintain that Soviet fighters if at all possible avoided missions during morning and evening dusk.

In contrast, Soviet fighters could always be expected in the air when there was a cloud ceiling of up to 5/10 at an altitude between 2,600 and 3,300 feet with solid clouds higher up.

The evaluation of former years, namely that the behavior of Soviet fighters under exceptional weather conditions was an individual matter of training and approximated the behavior of German fighter pilots under similar circumstances, can therefore be considered to apply equally to the later phases of the war, with the possible reservation that, in line with their general improvement, Soviet fighters now operated on a larger scale during bad weather than had been the case formerly.

C. Fighter Aircraft Types, Weapons, Other Items of Equipment

The efforts expended by the Soviet Command during the last years of the war to develop existing types of fighter aircraft and their armament and other equipment, together with the measures taken at the turn of 1944-45 to reequip the fighter arm with the most up-to-date types of aircraft show the extreme importance which the command attached to this arm and its expansion. As a result, Soviet aircraft models became gradually more noticeable than the aircraft supplied

by the Allies. This is confirmed by practically all German sources available at writing, and is supplemented in some detail:[59]

The fighter models produced by the Soviets in the last two years of the war were good on the whole, and in some ways better than those received from the Western Allies under the Lend-Lease Agreement. Soviet fighter types had excellent maneuverability and great climbing power at lower altitudes. Performance dropped off at altitudes above 20,000 feet, however, and they were a little too slow in horizontal flight.

As such, the Soviet fighter aircraft in the field by the end of 1944 were equal in quality to the German models then in use. In fact, the Soviet Yak-3 must be considered as superior to the German Bf-109-GVI and the FW-190, although this did not become so clearly evident because of the small numbers of Yak-3's that were committed at the front.

The models most preferred by Soviet fighters during this period were the La-5, the Yak-7 or Yak-9, and the Airacobra. Units equipped with these types proved serious opponents in combat: the planes were highly maneuverable and fast and had generally good flight characteristics. They were very rugged, relatively insensitive to weapons fire, and did not catch on fire easily. Whereas the German Bf-109-G and FW-190 models were equal to any of the above Soviet models in all respects, this can not be said of the Soviet Yak-3 (initially designated Yak-11) which made its first appearances at the front in the late summer of 1944. This plane was faster, more maneuverable, and had better climbing capabilities than the German Bf-109-G and FW-190, to which it was inferior only in point of armament. The same applies to the Soviet La-7.*

The aircraft models encountered as night fighters in the summer of 1944 included Mig-3, Lagg-3, La-5, Spitfire V (single-engine model), PE-2, and in some cases a twin-engine version of the Boston III in the front areas, and Yak-2,† Yak-7b, Mig-3,

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* Editor's Note: The La-7, which was developed from the La-5 in 1944, had a more powerful engine (2,000 h.p.) than its predecessor and an additional 37 mm. cannon.

† Editor's Note: No data currently available on this model.

Lagg-3, Hurricane and, only rarely, Airacobra and La-5 planes in home defense areas. It seems that the Soviets had made progress in the development of modern planes for use as night fighters, and it is alleged that the Mig-5* and TU-2 showed good performances as such. However, by the end of the war nothing indicated that these aircraft types were in serial production.

The weapons and ammunition of the Soviet fighter arm were not up to date. As an example, it was a long time before they developed a really serviceable aircraft cannon. When a cannon finally was introduced its rate of fire was too slow. The effects of the armor-piercing shells used were by no means impressive, but the explosive shells caused very serious wounds. All in all, however, the armament of Soviet fighters with machine guns and cannon participated in the general progress made, and the weapons in use were commensurate with the requirements of air warfare in the Eastern Theater.

In all other points fighter equipment had improved considerably. Especially the personal equipment of fighter personnel must be considered excellent; this applies in particular to the fur and leather clothing issued.

D. General Appraisal of the Soviet Fighter Arm in 1944-45

On the basis of data available at writing the Soviet fighter arm as it existed in the last two years of warfare can be evaluated as follows:

1) Continued technological development, additional combat experience, and above all a quickly mounting numerical superiority all contributed to bring about a steady increase in the preponderance of Soviet fighters in 1944, culminating in 1945 in the achievement of an air supremacy which from then on was rarely jeopardized.

2) The development of Soviet air power and the increasing successes of Soviet arms had a favorable impact on Soviet fighter personnel. Towards the end of the war, the average Soviet fighter

* Editor's Note: The Mig-5 was the first twin-engine, single-place fighter built in Russia.

pilot was a worthy opponent.

3) The aggressive trend, already noticeable in fighter operations in 1943, became increasingly evident. In addition to the concentrated commitment of fighter forces over the main battle areas and the near front areas (to prevent German air attacks and German air reconnaissance), and the assignment of strong fighter escorts to attacking Soviet air formations, fighter-bomber attacks and fighter penetrations into the German rear gradually mounted in significance. On the whole, the tactical principles, the behavior of the units while airborne, and the fighter operational control were sound.

4) The original Soviet technological inferiority had been reversed. The latest Soviet fighter models were in some respects superior to the German models in the field at the time. From the summer of 1944 on the numerical superiority of the Soviet fighters became overwhelming.

5) No important changes took place in respect to the organization, chains of command, unit strengths, or distribution of forces in the fighter arm apart from a steady increase in the number of units in existence.

6) Soviet fighters conducted their operations against the German fighter arm aggressively and with determination. Although still tactically inferior in individual air combat to their German opponents, their great numerical superiority enabled them to decrease their own losses and simultaneously increase the number of German planes they downed.

7) Soviet fighters finally made it impossible for the older types of German bomber aircraft to engage in daylight missions. German bombers flying in unit formations, however, incurred only small losses.

8) Fighter action against German dive-bomber and ground-attack forces was conducted with the utmost rigor and produced better results. Towards the end of the war the Soviet's crushing numerical superiority in fighters almost completely prevented missions by German ground-attack and dive-bomber forces.

9) Fighter action against German air reconnaissance

hampered such activities more and more, finally creating a situation in which all possibilities of German air reconnaissance in areas of main effort at the front were practically eliminated.

10) Fighter action against German air transport made it practically impossible for transport aircraft to operate during daylight, so that German air drops had to be made during morning or evening dusk or during the night.

11) Everything possible was done to develop night-fighter capabilities. Modest success was achieved in illuminated night-fighter operations, but dark night-fighter operations did not progress beyond the initial stages. Toward the end of the war the Soviets initiated long-range night-fighter operations, which did not, however, attain any significance by the end of the war.

12) In cooperation with other elements of the Soviet air forces, the fighter forces successfully executed both protective and, with growing frequency, aggressive combat missions.

13) Fighter operations to protect army operations against interference and fighter-bomber operations in support of army action increased steadily, both in scope and frequency, and often produced telling results, especially towards the end of the war. The same applies, in far smaller measure, to fighter cooperation with the Soviet Navy.

In conclusion, the strength of the Soviet fighter arm grew at a steadily increasing rate. In the interplay of all military arms, the fighter's contribution toward the overall successes achieved was by no means small. From the summer of 1944 on the Soviet fighter arm achieved a numerical superiority which was fatal to the German side and which finally resulted in Russian air supremacy. Only by means of increasingly rare concentrated fighter attacks was the German Command able to obtain air superiority of a temporary nature in locally restricted areas.

Section VIII: The Soviet Ground-Attack Air Arm in 1944-45[60]

Apart from minor deviations due to local circumstances, field commanders of the German Air Force almost all agree in

their evaluation of the Soviet ground-attack air arm in the last years of the war. Their opinions can be summarized as follows:[61]

In 1944-45 the Soviet Command continued its vigorous development of ground-attack aviation, which made further sound progress. The number of ground-attack units in existence steadily increased. With a few technical modifications the IL-2 /Stormovik/ was retained as the standard ground-attack aircraft model.

The main purpose for which ground-attack units were to be committed--support of army operations on the ground--remained unchanged. This meant that ground-attack units were directed primarily against all manner of targets within the main line of resistance and the immediate vicinity. An example of this was the Soviet Crimean offensive of April 1944. There the Soviet Command sought to force a decision and strong ground-attack forces were committed against the German front line troops, but not against the retreating German columns.

Later in the war, however, ground-attack units extended their operations to include targets in the German rear, particularly such targets as rail and road traffic, supply and traffic installations of all types, and the ground service installations of the Luftwaffe. These attacks in the German rear, which were aimed primarily at targets directly effecting land operations, began, in the autumn of 1944, to increase in both scope and frequency.

By 1945 all troop movements and all military installations in the near German rear--including shipping in the Bay of Danzig and across the Baltic--were raided daily by Soviet ground-attack units from morning to night. An evident lack of proper planning, however, lessened the effectiveness of these raids.

As long as German fighters could mount fighter missions in adequate strength against the Soviet ground-attack forces, the latter suffered considerable losses. These losses were increased by German medium and heavy antiaircraft guns. As a consequence, the results achieved by the Soviets remained small. The ratio of German defensive fighters to attacking Soviet ground-attack aircraft, however, became less and less favorable to the Germans. Thus, approximately from the end of 1944 on, the Russian ground-attack units were able to secure more effective results.

Soviet ground-attack aircraft frequently employed deceptive

tactics designed to out-maneuver their German opponents. They executed their main attack, for instance, when the German fighters were already departing or were engaged in other sectors of the front. One factor militating in favor of the Soviets here was the German shortage of fuel, which was beginning to become acute.

In spite of all German defensive measures, the Soviet ground-attack air arm steadily improved in the last two years of warfare, although it lagged far behind its Anglo-American counterparts in the scope and effectiveness of its attacks. One reason for this was probably the inadequate training given to newly assigned personnel.

An Army spokesman, Generalleutnant Huffmann[62] confirms the above findings, adding that the IL-2 was always available in adequate numbers in spite of the large numbers lost.

The large majority (and the most impressive) of all air attacks executed in support of operations on the ground were flown by the Soviet ground-attack air arm. Its numerical strength was increasing continuously so that at the end of the war it was frequently able to commit as many as fifty planes, or even more, against a single target.

A massed commitment of ground-attack air units in action coordinated with the army was always observed at those points where the Soviet Command was seeking to force a decision, while only small forces were committed in areas of secondary importance. Nevertheless, in most cases the effects achieved were of a psychological rather than a material nature.

In all justice to the Soviet ground-attack air arm, and in spite of the indisputable results it achieved, it at no time during the war played a decisive role.

A. Organization, Chains of Command, Strengths, and Distribution

From available data[63] it appears that no basic changes occurred in the organization and chains of command of the Soviet ground-attack air arm in 1945.

Ground-attack air corps were assigned to air armies, ground-attack divisions to air armies or to ground-attack air corps

headquarters, with ground-attack air regiments and squadrons retained in the original form and with the original strengths.

The repeatedly reported intention to give ground-attack regiments an authorized strength of two ground-attack squadrons plus one fighter squadron was not put into effect.

On numerous occasions ground-attack air units were assigned directly to army headquarters during decisive phases of a battle, and particularly to tank commands responsible for the execution of clearly defined combat missions. In such cases the operations of the ground-attack air units thus assigned were usually directed by liaison officers at advanced command posts.

At the beginning of April 1944 the Soviet ground-attack air arm had an estimated strength of 2,683 aircraft, the large majority of them modern ground-attack models. In mid-September 1944 it was known that 7 ground-attack air corps, 35 ground-attack divisions, and approximately 130 ground-attack air regiments were in existence; by the end of the year these figures mounted to 11 corps, 41 divisions, and approximately 160 regiments. Losses in action totalled approximately 7,300 as against approximately 6,900 in the previous year. Weighed against the increased numbers of aircraft available and the increased commitments in 1944 the increase in losses appears relatively slight and provides further evidence of the mounting Soviet air superiority.

In distributing its ground-attack air units, the Soviet Command adhered to its established principle of basing the bulk of the units on airfields close to the front as soon as these airfields were developed, so that the units would be as close as possible to their targets.

B. Ground-Attack Air Forces in Operations

1) Personnel. As was the case with Soviet fighter personnel, German field commanders are not quite uniform in their appraisal of the conduct of Soviet ground-attack airmen in the last years of the war.[64] Here again, however, the positive opinions are in the majority.

As captured Soviet airmen put it, Soviet ground-attack personnel considered themselves as the "cannon fodder" of the Soviet air forces, and had no desire to be shot down just "before

the victorious end of the war." This apparently general attitude--and the fact that flight personnel punished for cowardice were afterwards transferred as gunners to ground-attack air units to rehabilitate themselves at the front--had in some cases unfavorable influence on morale and thereby on the personal behavior of ground-attack personnel.

On the whole, however, the unexpected success achieved in the large offensives and breakthrough battles had done much to improve morale so that ground-attack personnel were carried along by the general current of elation in the summer of 1944. They executed their missions purposefully and with determination, displaying courage and aggressiveness, qualities which are especially emphasized by German army field commanders.

It can thus be said that the Soviet ground-attack air arm proved a robust and worthy opponent, which admittedly produced no surprises up to the end of the war. Performing its missions without much shouting or ado, the arm remained what might be called the "infantry of the skies."

2) Commitment. The basic principles governing the commitment of Soviet ground-attack air forces in former years remained practically unchanged in 1944-45. For the most part these principles coincided with German views, and they were applied practically, logically, and with due consideration for current circumstances.

The main feature was the employment of ground-attack forces in extremely close coordination with army operations, primarily against targets in the main battle area, but, with increasing frequency as time went on, against targets in the German rear. Adherence to the doctrine of power concentration, to the rule that ground-attack units should operate with fighter escorts, and to the pattern of attacks integrated with the action of bomber and fighter units, remained unchanging ingredients of the Soviet concepts for the conduct of ground-attack air operations in 1944-45. All of this is confirmed by German field commanders.[65]

In the employment of ground-attack air forces, the basic trend of Soviet conduct of air warfare became most clearly evident. In the execution of the arm's primary mission--that of supporting the army through air strikes against near front targets--the main emphasis was on extending the effective range of the ground-based weapons and

eliminating hostile resistance in areas of terrain closed to observation from the ground.

No matter what the circumstances were, first priority was always given to operations in the main battle area against such targets as tanks and assault guns, heavy infantry weapons, infantry positions and field-type fortifications, troop movements and assemblies, unit headquarters and command posts, and shelters. It was only as a secondary consideration that attacks were directed against targets in the rear areas, such as rail traffic and installations, vehicle and troop columns on the march, detraining, detrucking, and assembly movements, supply and service installations, and airfields.

The failure to conduct systematically planned attacks against German withdrawal movements remained an almost incredible flaw in the Russian exercise of command in 1944-45.

At sea the targets most frequently selected for attack by ground-attack air units were outpost patrol boats, small merchant vessels up to 1,000 tons displacement, and light naval units.

Initially the trend was to support the ground forces by means of a few concentrated air strikes. Early in 1944, however, the Russians began to commit small units in continuous--if possible, overlapping--consecutive waves designed to wear down the German resistance and silence or drive under cover the hostile infantry.

Soviet ground-attack air formations smaller than group size were rarely observed, although the squadrons or flights within the group attacked separately.

The timing of attacks varied--according to the current situation and the assigned mission--from early morning to late evening. Efforts were made to avoid areas protected by antiaircraft guns. During major offensives, however, the first strike was launched against previously detected and reconnoitered AA positions. In other attacks, a special pair of planes was detailed with instructions to keep the target area under observation and take immediate action against antiaircraft guns which opened fire.

Ground-attack air forces were committed in line with the principle of power concentration. The transfer of a ground-attack air corps or of ground-attack air divisions therefore usually indicated

a Soviet decision to develop a new area of main effort in ground operations.

While airborne, ground-attack air units received their instructions by voice radio from air liaison officers attached to the appropriate command posts of the ground forces or from special air directing aircraft.

3) Flight Conduct of Ground-Attack Air Units.[66] The methods applied by the Soviet ground-attack air forces in 1944-45, although modified and improved in some respects, differed very little in their essentials from those of 1943. Unit formation, tactics of attack, and mode of approach and departure remained essentially the same. Thus, the procedure in the commitment of Soviet ground-attack air forces, whose excellent maintenance of unit formation while airborne is stressed repeatedly by German commanders, was approximately as described below.

Units were assigned their targets before the take off, or air directing teams established far forward transmitted them their target data by voice radio while they were on the approach. On the approach route the units usually travelled at altitudes between 3, 300 and 5, 000 feet and echeloned to right or left, less frequently echeloned by flights, according to weather conditions, the cloud ceiling, terrain features, and the resistance expected. The unit did not always adhere rigidly to the formation assumed immediately after take off.

On arrival in the target area, the actual attack run was carried out in an oblique dive from the approach altitude of between 3, 900 and 5, 000 feet or, if the approach was at low levels, from altitudes between 1, 000 and 1, 300 feet, to which altitude the planes first climbed. For the attack run spacing between the individual planes was increased to between 160 and 660 yards, so that each plane could aim its bombs individually.

The strength of attacking formations varied between 25 and 60 planes and the attack run was carried out in waves of 4 to 8 planes or, in unfavorable weather, by pairs. On a few occasions an entire unit was observed diving in a concentrated attack on the target.

Using bombs, rocket projectiles, and weapons fire, the unit repeated its attack run persistently until the target was eliminated,

and it was noted in many cases that even highly effective defensive fire from the ground and heavy losses failed to deter the unit in the execution of its mission. After the attack, the planes usually departed at low levels and in a straight line back to the front.

Navigation, habitually visual and by dead reckoning, was an exclusive responsibility of the individual pilot. For this purpose various orientation marks, such as visual signals, smoke, and light beacons were used. In unfavorable weather the pilot depended on his radio direction-finding instrument and sometimes oriented himself by extraneous information picked up in his voice radio.

As time passed Soviet ground-attack airmen made noticeable progress, both in the clever exploitation of cover during the approach to the target and in the finding of the target. They were highly flexible in the execution of their missions and very observant in their search for suitable targets.

Even during the last years of the war Soviet ground-attack units, when pursued by German fighters, endeavored to escape at ground levels, firing rocket projectiles rearward, rigidly maintaining their unit formation, and relying largely on the protection afforded by their heavy armor plating.

Although inferior to German fighters in air combat, their clever flight performances, exploitation of cover, and strong protective armor enabled them to resist attack for a long time, so that the only really effective tactic for a German fighter was to attempt a surprise attack.

For passive defense against lively fire by antiaircraft guns, Soviet ground-attack units repeatedly changed their course and employed other evasive maneuvers. These took the form of short, sharp curves, side-slipping at top speed--carried out either by individual planes or by the entire attack wave if not in too close formation--and similar maneuvers. Massed fire by medium and light antiaircraft guns, or by heavy infantry weapons at lower altitudes, frequently forced Soviet ground-attack forces to climb to higher altitudes and thereby lessened the effectiveness of their attack.

In summary, then, the flying conduct of Soviet ground-attack units in 1944-45 were marked by the following features:

a) The existing principles and methods of approach, attack, and departure for ground-attack air forces were retained and improved.

b) Multi-wave attacks by large units became increasingly frequent in place of the former squadron-size attacks.

c) Attacking units exploited weather and terrain conditions appropriately, and found their targets more easily.

d) Soviet ground-attack aircraft avoided combat with German fighters and, as far as possible, avoided massed fire by antiaircraft guns.

4) Ground-Attack Units in the Battle Area in Cooperation with the Army and the Navy. The principles governing the commitment of ground-attack air forces in action integrated with army operations during 1944-45 remained unchanged. The ground-attack air arm's increasing strength, however, did affect the form and frequency of its operations. The following is offered from accounts by field commanders of the German Army[67] to supplement what has been said in previous chapters.

A good example of the employment of ground-attack air forces in support of the army in an attack with limited objectives is found in the battles around Sevastopol in the spring of 1944. *

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* Editor's Note: On 8 April 1944 elements of the Fourth Ukranian Front managed to cross the Sivash or Putrid Sea and gain entry into the Crimea. This maneuver made German defensive positions on the Perekop Isthmus and the Kerch Peninsula (see notes above, pp. 86 and 120) untenable and forced the German and Rumanian forces to retreat to the Fortress of Sevastopol. The operations described here by the author were costly to the Germans as well as to the Russians. Of approximately 200, 000 men at the beginning of April, the Germans and Rumanians lost over 60, 000 before the evacuation of the Crimea was ended. In addition, 10, 000 men who defended Sevastopol during its evacuation had to surrender to the Russians. Russian ground-attack air operations figured significantly in this German defeat. See Kurt von Tippelskirch (1959 ed.), pp. 378-79 and Wolfgang Pickert, Vom Kuban-Brueckenkopf bis Sewastopol, Kurt Vowinckel (Heidelberg, 1955).

During the first phase of the battle--a Soviet surprise advance in an attempt to enter the fortress while the German troops withdrew--no ground-attack air forces were committed. During the second phase--a Soviet attempt to take the fortress in a brief battle--attacks by strong ground-attack air forces were restricted to the foremost German line of defense, the targets being fortified positions, and battery and antiaircraft gun firing positions. No attempt was made by the aircraft to attack the German rear. No cooperation with Soviet fighters was evident and as a result the Soviet ground-attack air forces suffered considerable losses. It was only at the beginning of the third phase--the opening of a thoroughly prepared attack after a proper build-up on the ground--that ground-attack air forces had adequate fighter protection. In the first few days of this phase, ground-attack strikes remained restricted almost exclusively to the front areas, and it was only when the decisive all-out attack opened early on 8 May that the ground-attack aircraft extended the range of their operations to include all jetties in the port. In spite of the large number of Soviet planes downed--German fighters downed 90 and German antiaircraft fire another 30 on this one day alone--it was no longer possible to cope with the vast numerical superiority of the Soviet forces. In the final phase--German evacuation of the fortress and withdrawal of the German troops across the Black Sea--the departure of the last German fighter group left the entire area defenseless against Soviet air attack except for fire from some antiaircraft guns. Then the Soviet ground-attack air forces directed their effort against the departing German convoys, achieving numerous hits but failing to sink any of the ships. Smaller ships, particularly the naval barges with their strong antiaircraft defenses, were rarely hit. Nevertheless, the continuous massed attacks by Soviet ground-attack aircraft inflicted exceptionally heavy personnel losses.

As the war continued, cooperation between the Soviet ground-attack air arm and the Soviet army improved steadily and, during major offensives, produced correspondingly good results.

Above all, the use of ground-attack air units to support tank forces and to repel German counterattacks increased significantly. Frequently, in order to secure the closest possible cooperation, ground-attack units were assigned tactically to the appropriate army headquarters.

Finally, the numerical superiority of the Soviet ground-attack

forces reached such proportions that Soviet attacks and breakthrough operations on the ground received almost ceaseless support of this type. The ground-attack units concentrated on targets within the main battle area, but as time passed they also, with increasing frequency, penetrated as far as 36 to 42 miles into the German rear. In these attacks the Soviet ground-attack forces gradually attained high standards of performance and inflicted significant losses on their German opponents.

In spite of this, many large-scale daylight German troop movements, which could not be concealed, occurred right up to the end of the war without interference from Soviet ground-attack forces. A case in point was the retreat across the Western Dvina River at Riga, in which German troops crossed the river by only two bridges in dense masses moving ceaselessly for five days and nights.*

Luftwaffe field commanders[68] express opinions similar to those of German army officers above concerning the employment of Soviet ground-attack forces in the battle area.

Anti-tank air operations, a field of activities hitherto badly neglected by the Soviets, began to receive attention early in 1945, and from then on the Soviet ground-attack air forces engaged in this form of action on a steadily increasing scale and at times achieved good results.

In former years there had been no evidence of ground-attack air forces cooperating with the Soviet Navy, but this changed in 1944-45. In addition to the previously mentioned operations against German ships during the battle for Sevastopol, Soviet ground-attack aircraft operated against convoys and other naval targets at sea and in ports, both in the Black Sea and later also in the Baltic, although such operations were never on a very large scale.[69] The units assigned to support the Navy also had IL-2 aircraft and employed very much the same tactics as those used by units supporting the Army: approach in unit formation echeloned far forward, with planes closely interspaced, at low altitudes or behind cloud cover; ascent to

* Editor's Note: This occurred in September 1944. Russian operations in this area gradually drove a wedge between German forces in Western Courland and East Prussia. See note above, p. 269.

altitudes of between 1, 300 and 2, 000 feet just before the target was reached; attack run if possible from direction of the sun in successive waves at intervals of between 2, 000 and 2, 300 feet--this repeated several times--each plane diving individually to attack with 55 to 220 pound bombs, rocket projectiles, weapons fire, and occasionally phosphorous spray equipment. In operations of this type the attacking air units always had fighter escorts.

To summarize, the employment of Soviet ground-attack air units in the battle area on the ground and in cooperation with the Army and Navy in the last years of warfare was marked by the following specific features:

a) Action in close and direct support of the Army remained the primary mission and towards the end of the war resulted in a crushing Soviet superiority on the field of battle. As a part of this mission, cooperation with tank forces was given first priority.

b) Although main emphasis was placed on targets within the central battle area, attacks also were launched with increasing frequency at targets in the German rear.

c) The tactical principles and the methods of operation remained practically unchanged and were adapted to the requirements of current situations.

d) During this period ground-attack forces were observed for the first time in operations integrated with those of the Soviet Navy, but these activities were of minor scope compared to those in support of the Army.

5) Operations of Soviet Ground-Attack Air Forces in the German Rear. The opinion of practically all German field commanders[70] is that in the last two years of warfare the operations of Soviet ground-attack air forces against targets in the German rear, and particularly against service installations of the Luftwaffe, increased in scope, but at no time achieved anything like the significance of their operations in the battle area. Still, these attacks against supply and traffic installations, shelters and command posts, and other important rearward installations and establishments frequently produced very noticeable results. In some cases these operations proved exceedingly costly to the German Army, as for example at the time of the collapse of German Army Group Center (June 1944),

when Soviet ground-attack forces attacked traffic bottlenecks in the German rear, such as the bridges over the Berezina River.

Attacks against moving German trains and vehicles were, as a rule, only effective in the absence of defensive antiaircraft guns, the presence of which had, at all times, a markedly deterrent effect on Soviet ground-attack aircraft.

Operations against German airfields were still a relatively rare occurrence in early 1944 but increased as time went on, culminating in the spring of 1945 in Soviet ground-attack forces raiding the few airfields still available to the German side almost daily. Units of 40 to 60 aircraft, escorted by fighters in equal strength, used light and medium weight fragmentation bombs, rocket projectiles, and weapons fire to attack buildings, taxiways, runways, and aircraft on the ground. These attacks disrupted servicing activities and inflicted considerable losses on flight and ground service personnel and materiel. As a result, the operability of German air units steadily declined.

In the final phase of the war, when ammunition shortages compelled the German side to restrict antiaircraft fire by light and medium weapons to aircraft targets within a range of 550 yards, Soviet ground-attack aircraft frequently began to attack from higher altitudes, where they could operate without interference. Such an attack by Soviet ground-attack aircraft against Littausdorf airfield (in the Warta River bend) April, 1945, resulted in the destruction of 72 out of 78 aircraft on the ground.

6) Night Operations by Soviet Ground-Attack Air Forces. In 1944-45 Soviet ground-attack units equipped with IL-2 aircraft were not employed systematically in night operations. According to German field commanders,[71] such employment was unnecessary, since the special U-2 harass-bomber units created for the purpose took care of night-nuisance raids, and other night attacks were carried out on an adequate scope by normal bomber forces. Some reports indicate that in a very few cases IL-2 aircraft were observed in night operations and that some IL-2 units received special training for such operations.

7) Operations under Exceptional Weather Conditions.[72] The operations of Soviet ground-attack aircraft under exceptionally unfavorable weather conditions in the last two years of warfare

were similar to those in previous years. According to German field commanders, unfavorable weather conditions did not prevent the employment of ground-attack air forces, although conditions of rain, low-hanging clouds, heavy snow storms, fog, and haze did reduce their activities considerably. This applied in particular to strikes in the German rear and against German airfields. Closer to the front, in contrast, unfavorable flying weather brought no relief for the German troops, since Soviet ground-attack air units continued to operate.

In the mountainous Carpathian and Beskid regions, the Soviets profited from meteorological conditions, since the weather was usually favorable for aviation east and very unfavorable west of the mountain ranges.

8) Employment in Cooperation with Other Elements of the Soviet Air Forces. Cooperation with the other air arms continued to improve in 1944-45. The scope of such operations grew considerably, particularly when the war was drawing to a close, although, according to German field commanders,[73] no essential changes occurred in the methods employed.

Coordinated action with fighter forces was primarily in the form of operations under fighter escort, as previously described. It had become a standing rule to assign fighter units to protect ground-attack forces against interference from German fighters. The ratio of ground-attack to fighter escort aircraft varied between 2 to 1 and 1 to 2. As in former years fighters occasionally were assigned what could be called an extended, protective mission besides their normal escort mission; in such cases a fighter assault group was dispatched ahead of the ground-attack force to neutralize the German defenses in the target area.

When fighter-bombers and IL-2 units engaged in a joint mission, the fighter-bombers assumed the role of escort fighters in addition to their corollary mission of bombing. Over the target the fighter-bombers usually first carried out a dive-bombing attack, the ground-attack aircraft following up with low-level attacks.

Combined bomber, ground-attack, and fighter-bomber attacks increased considerably in scope, frequency, and effectiveness towards the end of the war. If the strike was against a single target area, the IL-2 units attacked the antiaircraft gun positions to enable

the bomber units to make their attack run without interference. Frequently, however, the targets assigned in such joint operations were distributed within a larger area, particularly during German retrograde movements. In Samland, for example, during operations on the attenuated Fischhausen-Pillau Peninsula* (April 1945) Soviet bombers were assigned a 1,600-yard zone immediately behind the German main line of resistance, the next zone of 1,600 yards was assigned to ground-attack units, and a third zone, also 1,600 yards deep was attacked by fighter-bombers. Within their separate zones the three air arms used bombs and all other weapons available in practically nonstop attacks against the German troops, concentrating their efforts primarily against troop concentrations and pockets of resistance. After one to two hours, the fighter-bombers shifted farther forward to attack a new 1,600-yard zone, their old zone being taken over by the ground-attack units, whose old zone, in turn, was taken over by the bomber units. The combined attack was maintained in this form from early morning to late evening, inflicting considerable losses. One factor which contributed to increase the German losses here was that the congestion in the German withdrawal movements was further complicated by the constant stream of refugees.

C. Aircraft Types, Weapons, Other Equipment[74]

The two-seater model IL-2 remained the standard ground-attack aircraft of the Soviet air forces in the last phase of the war.

The technical and combat features of the IL-2, already discussed in Chapters 2 and 3, underwent only slight improvements and modifications and proved adequate for the conditions of air warfare in the Eastern Theater. It remained a relatively clumsy plane and was correspondingly vulnerable to fighter attack. It could, however, be considered adequately maneuverable and its excellent protective armor largely compensated for its other weak points.

Only slight changes were made in the calibers and mountings

* Editor's Note: The Pillau (now Baltisk) Peninsula is on the eastern edge of the Gulf of Danzig--now the Kaliningradsk region of the U.S.S.R. (formerly East Prussia). The Pillau Peninsula extends southward along the Vistula Lagoon from Samland, a peninsular area between the Courland and Vistula Lagoons. See note above, p. 293.

of the machine guns and cannon and the ammunition used. The re-equipment of some units with 37-mm recoil-operated guns--in place of the former 20-mm and 23-mm blowback-operated guns--which commenced in the spring of 1944, introduced a new feature. The guns were on rigid mounts under the wings, and 55 to 80 rounds of ammunition were carried for each gun. The rate of fire was approximately 6 rounds per second. Planes with this type of gun, however, were not popular with Soviet airmen because the plane was too awkward to handle, and the recoil gave the plane a swaying motion. Furthermore, the bombload was reduced to 110 pounds and such planes were unable to carry rocket projectiles. For this reason plans existed--but were not carried out--to replace the two 37-mm guns by four 23-mm guns. No noticeable changes occurred in the types of bombs, rocket projectiles or ammunition carried, nor in the methods of loading and use. The authorized payload was exceeded quite generally by up to 100 percent.

The most frequently used aiming device was the WW-1 ring sight. The rigidly installed weapons were adjusted to a range of 440 yards, the rocket projectiles to a range of 880 yards.

Radio equipment had progressed so far that each plane had an RSI-4 receiver, and each swarm leader a RSI-3 transceiver. Only lead planes were equipped with radio locator instruments (Type RPK-10), and the last plane of each tactical wave carried an AFA-12 camera to photograph target results. The planes also had, for example, adequate panel instruments, oxygen equipment, and auxiliary equipment for night landing.

When necessary, IL-2 units carried equipment for smoke screening--two planes could lay down a smoke screen in an area 3,000 by 200 yards that would last for fifteen minutes in a slow wind--which could also be used for emitting phosphoric gas sprays.

D. Summary Appraisal of the Soviet Ground-Attack Air Forces

Sound development and logical employment by the Soviet Command, combined with the steadily increasing numerical superiority, enabled the ground-attack air arm to operate with ever improving effectiveness in 1944-45 and thereby make an important contribution to the overall Soviet victory.

Section IX: Soviet Bomber Forces[75]

Although on a much smaller scale than fighter and ground-attack aviation, the Soviet bomber arm participated in the general progress of the Soviet air forces in the last two years of warfare. It appears that various factors contributed to retard the growth of the bomber arm in comparison with the other two air arms. First, the Soviets apparently were unable to promote all arms of the air forces simultaneously and with equal vigor; secondly, the expansion of the bomber arm presented especially difficult problems. In the third place, the ruling views of the Soviet Command exercised a decisive influence in the matter; in view of the paramount importance of land warfare in Soviet military doctrine the development of a bomber arm was consciously given less priority than the fighter and ground-attack air arms and no provisions at all were made for strategic air warfare, a concept which was proved to be sound by the progress of military events in the Eastern Theater. Finally, the Soviet Air Command was able to dispense with the development of a strong bomber arm because it could depend on support from the Western Allies in this field.

Thus, the Soviet bomber arm was far behind the fighter and ground-attack air arms in 1944-45. While stating these limiting factors, German field commanders[76] nonetheless agree unanimously that the Soviet bomber forces made remarkable progress in the last two years of warfare and in doing so were able to take advantage of the gradual decline in German fighter defense activities.

In 1944-45 Soviet bombers still had as their primary mission the support of army operations on the ground. Continuous, concentrated attacks in the near German rear at points of main effort in the various offensives and breakthrough battles played a major role. As time passed, however, operations were stepped up considerably against German Air Force installations and other targets in the far German rear.

Even during the final phase of the war the use of Soviet bombers in quasi-strategic* missions was a rare occurrence. On the whole no

*Editor's Note: "Quasi-strategic" is used in this section to translate the German operativ, which sometimes indicates an intermediate degree of importance between strategy and tactics. For a discussion of the terms Strategie, Operationen and Taktik see Albert Kesselring (Generalfeldmarschall a. D.), Gedanken zum zweiten Weltkrieg, Athenaeum-Verlag (Bonn, 1955), p. 44.

significant changes were noted in the Soviet commitment of bomber forces right up to the end of the war.

Within the limited scope of their pattern of air warfare, the Soviets made sound use of their bomber forces, and thus increased the scope of their victories on the ground. The technical equipment of Soviet bomber aircraft was adequate for such limited employment.

German losses due to Soviet bomber attacks increased as the effectiveness of German fighter and AAA defenses was impaired by strong Soviet fighter escorts and the higher altitudes at which Soviet bombers operated.

The Soviet long-range bomber arm (ADD) also had to adapt its operations to the basic concepts of the Soviet Command on the use of bomber forces. Originally established as a strong force independent of the army and designed for the purpose of conducting quasi-strategic air warfare at night, plans for this use of the arm had to be abandoned at an early stage because of technical and training difficulties and probably also because of the fundamental views of the Soviet Command.

The Soviet long-range bomber arm was committed almost exclusively in missions of direct and indirect support for the army. These missions included targets at the point of main effort, targets in the central battle area, and such targets as German traffic installations, supply establishments, and the ground service organization in the German rear. Accordingly, the long-range bomber corps, which for a long time remained stationed in the general area of Moscow, was later distributed all along the line and employed in concentration in those areas in which the Soviet Command launched its major attacks. This use of the bomber arm became evident at the opening of the Soviet offensive on 22 June 1944. The offensive received support from very strong bomber forces, which had hitherto generally been held in reserve.

A few night attacks carried out against Koenigsberg /Kaliningrad/, Berlin, Bucharest, and other large cities with explosive and incendiary bombs showed features of strategic operations and could be considered as exceptional performances. Frequently, however, only one-third of the aircraft dispatched on missions of this type reached the target area, and the results achieved were insignificant. This applies also to the terror attacks launched against Finnish towns, particularly Helsinki, Turku, and Kotka, in the spring of 1944, which were designed

to serve political purposes.

Because of the lack of long-range escort fighters, the Soviet long-range bomber arm carried out no long-range daylight attacks, but the bombers were used largely in supply missions.

During the last two years of warfare, Soviet bomber operations against German seaborne supplies and port installations in the eastern parts of the Baltic as well as in northern waters grew to such proportions that in some cases German shipping was seriously affected.

On the whole, Soviet bomber aviation thus can be considered to have made some progress in 1944-45. However, intentional neglect of the arm, inadequate training, inadequate measures to equip the units with modern bomber aircraft and other materiel, and, last but not least, the limited use made of bomber forces, all contributed to prevent the Soviet bomber arm from achieving the standards and importance of the Soviet fighter and ground-attack air arms.

A. Organization, Chain of Command, Unit Strengths, Distribution

According to available sources,[77] the chain of command of the Soviet bombers forces in 1944-45 remained approximately what it had been the year before. This applies both to the support bomber forces assigned to air armies and the long-range bomber arm (ADD) controlled directly by the Soviet Supreme Command.

The consolidation of divisions under corps headquarters became the general rule and was applied with particular firmness to the forces intended for long-range operations. Each long-range bomber corps had as a rule two divisions, each consisting of two (later three) regiments. In the case of the bomber forces assigned to air armies, the number of divisions per corps varied according to the current situation. Each of these divisions usually had three regiments. Towards the end of the war plans existed, but were not put into effect, to establish a new unit, the Eighteenth Air Army, consisting exclusively of long-range bomber corps.

The numerical strength of the Soviet bomber arm in March 1944 was estimated at 4,561 aircraft, broken down as follows: 530 aircraft from Allied deliveries (45 DC-3, 100 B-25, 385 Boston III);

2,213 aircraft from Soviet production (68 TB-7, 309 PS-84, 543 DB-3F, 1,293 PE-2); 1,818 night harassing planes from Soviet production (70 SB-2, 1,624 U-2, 124 other models).

The long-range bomber arm was estimated at 860 aircraft in February 1944, 1,100 in June, 1,300 in August, and 1,400 in September of the same year, and at 1,600 in January 1945, so that it had almost doubled its strength within one year.

In mid-September 1944, 6 bomber corps, 30 bomber divisions, and 110 bomber regiments were known to exist. Towards the end of the year these figures had increased to 7 corps, 35 divisions, and 135 regiments. The comparative figures for the long-range bomber arm in mid-September 1944 were 9 corps, 18 divisions, and 48 regiments; no changes occurred here in the number of corps and divisions, but the number of regiments increased to 58 by the end of the year.

As a rule the actual aircraft strength per squadron at the end of 1944 exceeded the authorized strength of 33 by 3 to 5 aircraft; in addition, most squadrons had a number of crews in reserve.

Approximately 70 per cent of the crews were old personnel and the aircraft in the units were the same models as in previous years, but with some technical improvements.

Bomber aircraft losses totalled 5,100 in 1943 and 5,200 in 1944. This slight increase in the number of planes lost was completely out of proportion to the large increase in numerical strength and provided proof of the improvement in Soviet bomber aviation.

The distribution of Soviet bomber forces depended largely on the current areas of main effort in ground operations. This applied not only to the units assigned to air armies, but also to the long-range bomber arm. Whereas most of the long-range bomber units at the beginning of 1944 were still concentrated in the northern areas for their attacks against Finland, from April 1944 on more and more of them were transferred to the southern areas. There they were placed under six long-range bomber corps headquarters and from June on they operated from airfields in the general area of Kiev in support of army operations. During the summer, these forces were employed in concentrated attacks in the southern and central areas, and in the autumn almost all of them moved north

for action against German Army Group North.

All of the above changes in the distribution of long-range bomber forces were due to the requirements of the army on the ground and not to any planning for strategic air warfare.

B. Soviet Bomber Forces in Action

1) Combat Behavior of Bomber Personnel. The somewhat reserved opinions expressed by German field commanders in former years concerning the Soviet bomber forces remained unchanged in 1944-45.[78]

On the one hand it was admitted that in many cases Soviet bomber crews executed their missions with persistence and determination, even at the cost of heavy losses; on the other hand, it is maintained that they were over-cautious in the execution of attacks, that they released their bomb loads prematurely when they encountered antiaircraft fire, and that they lacked aggressiveness and confidence in their own capabilities.

The growth of the Soviet bomber forces was still overshadowed by the build up of the fighter and ground-attack forces, and bomber units were not receiving the best personnel. There can be no doubt that these factors and the frequently noticed inadequate intellectual capabilities of bomber personnel had an adverse effect on the combat morale and aggressiveness of the force as a whole.

It is generally agreed, nonetheless, that bomber personnel improved in combat morale and self-confidence as a result of the weakening German defenses and the increasing scope of Soviet victories. As time passed this impression was confirmed by the behavior of the captured crews of downed Soviet bombers; they displayed considerably more self-assurance than formerly and were firmly convinced of a final Soviet victory.

2) General Principles of Commitment. According to available sources,[79] the general principles governing the employment of Soviet bomber forces remained essentially unchanged up to the end of the war. This means that the bulk of all bomber forces, including the units of the long-range bomber arm, still were used to support the operations of the army on the ground by bombing targets in the near German rear and deeper in the German communications zone,

while bombing missions of a quasi-strategic nature remained the exception.

In contrast with the above, bomber units attacked targets in the German rear with growing frequency, insofar as such targets were related to operations on the ground.

Close cooperation with the army on the ground resulted in a steadily increasing commitment of bomber units and in more firmly controlled missions. Air strikes by bomber forces, during the last two years of the war, were rarely under regimental strength, with the regiments following one another into the attack at brief intervals.

Bombers in operation were always protected by fighter escorts or, if they were executing missions in the near front areas, by fighter patrols.

Because the Soviet Command considered that a quasi-strategic use of its long-range bomber forces would have no important impact on military developments, no basic changes occurred in the tactical or technical methods of operation. Nevertheless, the methods of attack were gradually refined and improved. Bombers now carried out night attacks in sizeable units, with the individual strikes following successively at shorter intervals than formerly, and in accordance with more modern concepts.

The types of missions executed by the long-range bomber forces included night harassing attacks over the German main line of resistance area, which were usually carried out by single planes, strikes by complete units against targets in the German rear, and supply missions. As a rule, night operations, particularly long-range night missions, were executed only during good weather.

In other points, the principles governing the employment of Soviet bomber forces, as already described in Chapter 3, applied equally in 1944-45.

3) Flight Conduct in the Execution of Missions by Soviet Bombers.[80] No notable changes occurred in this field in the last years of warfare. What has been said in Chapter 3 on the subject of formation during the approach, attack, and departure; cruising and attack altitudes; execution of attack missions; and behavior in unit formation and in air combat therefore can be considered as generally applicable here.

Attacks were usually carried out in waves of regiment strength--the squadrons following each other at brief intervals within the regiment--at medium altitudes of between 6,600 and 13,000 feet. The unit generally flew in close formation and all planes released their bombs in horizontal flight on receiving the appropriate order from the lead plane. On the whole, the accuracy and effectiveness of bombing showed signs of improvement. Very often the attacking unit approached the bombing run in such a way as to be able to fly off towards the front lines immediately after the bomb release.

As the German defenses weakened towards the end of the war, Soviet bombers attacked at lower levels with increasing frequency. The awkward and clumsy behavior of Soviet bombers in air combat had not been quite surmounted, but this behavior no longer had decisive results because of the growing numerical strengths of the individual units and the decrease in German defensive fighter activities.

In the spring of 1945 Soviet bombers carried out morning and evening dusk attacks against targets in East Prussia. These attacks were executed by twin-engine, long-range bombers, each plane approaching individually at altitudes of between 2,600 and 3,300 feet and at intervals of five minutes for a stick bomb release of three or four 550-pound bombs. These attacks were not very successful, however, because of the effectiveness of the German fighter and AAA defenses in this area.

The only real difference noticed was in the execution of night missions. With the exception of night harassing raids (still carried out by single aircraft), bombers now commenced operating in larger units in accordance with more modern principles. In cases where attacks were still carried out by single planes, the tactics previously described were employed.

Thus, Soviet bombing operations in 1944-45 were marked by the following characteristic features: a) the existing tactics were retained and improved in respect to formation, cruising and attack altitudes, approach, bombing run, departure, formation flight, and air combat, but nothing essentially new was introduced; b) bombing attacks during daylight were carried out by increasingly large, closed units with fighter escorts; c) night bombing missions, with the exception of harassing operations, were no longer carried

out by single planes but in a growing measure by complete units in accordance with western patterns.

4) Bomber Operations within the Battle Area on the Ground and in Cooperation with the Army and the Navy. Soviet bomber activities over the battle areas on the ground and in coordination with the army in 1944-45 were similar to those of 1943, the only difference being that they gradually became more frequent, more powerful, and more successful.[81] Both in timing and location of attacks, the Soviets adhered to the principles of power concentration. Therefore only little remains to be said in addition to that which has been stated in Chapter 3.

During the battles in the Crimea and for Sevastopol in the spring of 1944--previously mentioned in the discussion of Soviet ground-attack air forces*--Soviet bombers operated in a manner similar to that of the ground-attack units. In the first phase of the operations on the ground--the German withdrawal to Sevastopol and the Soviet attempt to enter the fortress in a sudden surprise drive--bombers did not participate at all. In the second phase--the Soviet attempt to take the fortress in an immediate assault--Soviet long-range bomber units operated from airfields in the general area of Kiev in day and night attacks against targets deep inside the fortified area. Bomb aiming was poor in these attacks and the German losses were correspondingly small. In the third phase the bombers carried out similar, preplanned attacks against the fortress, extending their operations to the German airfields. In the fourth phase--German evacuation of the fortress and withdrawal of the German troops across the Black Sea--the Soviet bombers directed their attacks primarily against embarkation operations and troop transports in the port of Sevastopol. Here they achieved considerable successes, sinking the Totila and the Teja, each of 3,000 tons displacement, and a number of ships in the 1,000 ton class, and inflicting heavy casualties.

In the period which followed, the commitment of bombers increased steadily--frequently in cooperation with ground-attack and fighter-bomber forces--in support of army operations in areas of main effort during offensive actions. The attacks here were directed against targets within the main battle area and in the

* See above, p. 340 ff and note, p. 340.

German rear. Like ground-attack forces, the Soviet bombers rarely, and never in systematically planned operations, attacked the withdrawing German columns.

It can be said both of the establishment of the German defenses in Courland* and of the German withdrawal from Estonia to Riga, that continuous attacks by Soviet bombers in appropriate strength could have seriously jeopardized the German operations involved. During the withdrawal to Riga, for example, a complete German division in the autumn of 1944 crossed the Dvina River between the Baltic and Riga by ferries and boats on a clear sunny day without any interference by Soviet air forces. Later, Soviet bombers attacked Libau /Liepaja/ innumerable times without achieving any really effective results.

Even as late as in the spring of 1945, Soviet bombers attacking Bromberg /Bydgoszcz/, a fortified city, unloaded their bombs indiscriminately on residential quarters, while no attacks were flown against the German command post in the local barracks or against the electric power station, the gas works, or the bridges across the Brahe /Brda/ River. Even later, when the German garrison fought its way out of Bromberg, the troops completed their march northward without interference from Soviet air forces.

Single bombers and harassing planes continued to be the only planes committed in night operations in the near front areas.

Thus, the employment of Soviet bombers in cooperation with the army on the ground increased and achieved some measure of success during the last years of warfare. Bomber operations per se, however, did not achieve decisive importance, even though they no doubt could have in view of the Soviet numerical superiority and the declining effectiveness of German resistance in the air. Apart from the lack of system, inadequate training, and insufficient experience, this may have been due to the way in which the Soviet Command had continually neglected its bomber arm in the past.

German commanders agree that Soviet bomber activities in cooperation with the Navy increased quite considerably in the last two years of warfare.[82] In 1943 the Black Sea was the only area

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* See note above, p. 269.

where Soviet bombers attacked German shipping and port installations, but in 1944-45 these activities were extended to the Baltic and the Arctic Ocean. The attacks were directed primarily against seaborne transportation, such as convoys, supply ships, and troop transports, and less frequently against naval units, or naval and supply installations in ports.

Specific targets attacked included seaborne supplies en route from Odessa and Constanta to the Crimea; convoys off the Norwegian coast; seaborne withdrawal movements during the German evacuation of the Latvian coast; German and Rumanian naval units off Constanta; German mine sweepers operating in the eastern parts of the Baltic--the operations of which were seriously hampered by these attacks; port installations at Odessa, Constanta, Rīga, Windau /Ventspils/, Libau /Liepaja/, Koenigsberg /Kaliningrad/, Danzig, and other ports.

In the beginning, attacks of the above types were characterized by a dispersal of effort and poor planning, so that they were not very effective. Towards the end of the war they were carried out on a larger scale and with more system and reached the apex of effectiveness in the very last phase of the war, when German shipping was practically undefended.

Naval bombers operated in regiment, squadron, or flight-size units according to the nature of the target. The usual approach and bombing run was at altitudes of between 10,000 and 13,000 feet, and the most usual form of attack was that of horizontal area bombing. In rare cases, PE-2 units carried out low-level or dive-bombing attacks at a dive angle of approximately 60 to 70 degrees. The individual planes of each flight followed their flight leader and released their bombs--usually of the 330 to 550-pound category--from an altitude of 3,300 feet. Units engaged in these operations always had strong fighter escorts and carried parachute fragmentation bombs for their own defense.

Towards the end of the war, torpedo bombers, as a rule IL-4 or Boston A20G planes, also began operating at night and were employed in mine-laying missions. Such missions, formerly rare, increased in frequency and scope and were directed at off-shore shipping routes, port entries, anchorages, and in some cases at river estuaries and navigable rivers. The mines were laid at night or during bad weather by single planes or small units. The drop

altitude depended on the type of mines used, some of which were British ground mines of the magnetic type, while the others were from Soviet production. In a very few cases, towards the end of the war, Soviet bombers were observed using depth charges in anti-submarine operations.

Operations against German convoys were tightly integrated in timing and were carried out simultaneously by bomber, torpedo-bomber, ground-attack, and fighter aircraft together with submarines. Immediately prior to the bombing run the attacking units separated to attack their targets simultaneously in small groups from various altitudes and directions, using bombs, weapons fire, air torpedos, and in some cases phosphorus bombs. A reconnaissance plane posted over the target area kept the command post directing the air attack currently informed by means of a running report on such items as bomb aiming, the effects achieved, mistakes made, losses incurred, German fighter and antiaircraft artillery action, and personnel in distress at sea. This enabled the air command to take immediate and appropriate action as required. During operations of this type, the Soviets usually directed simultaneous holding attacks against German airfields.

Although the Soviets committed very strong air forces, they achieved relatively small results in their attacks against German convoys. Losses due to German fighter action proved seriously discouraging and occasionally resulted in a premature cessation of the attack. For example, on 17 June 1944 a force of approximately 100 Soviet aircraft (Boston, IL-2, P-40, Yak-9, and Airacobra (P-39)) attacked a German convoy of 10 transport ships and 20 escort units off the Norwegian coast. The attack was carried out in four waves and lasted altogether 25 minutes. Losing 40 aircraft themselves, the Soviets downed two German fighters, sank one transport ship with a displacement of 1,600 tons, and damaged one merchant vessel.

In the light of what has been said, Soviet bomber operations over the battle area and in cooperation with the army and the Navy in 1944-45 can be said to have been marked by the following features:

a) Soviet bomber forces, including long-range bomber units, were employed in concentration to support the army on the ground, achieving growing successes, but never on a scale which could have decided the outcome of the battle.

b) They attacked targets within the main battle area as well as targets in the German rear. Right up to the end of the war, however, their inadequate air action against German retrograde movements remained an inexplicable error of omission of the Soviet Command.

c) Combined bomber, ground-attack, and fighter strikes in support of the army on the ground gradually became the most important feature in bomber operations.

d) Bomber operations in support of the Soviet Navy gained considerably in significance and were extended to include northern waters and the Baltic Sea. Besides bombing and air torpedo attacks, bombers engaged in mine-laying operations on a steadily growing scale. The operations of Soviet bombers, however, did not interfere seriously with German naval operations.

5) Soviet Bomber Operations in the German Rear. With very few exceptions bombing operations in the German rear were directed against the German Air Force ground service organization or against targets in direct or indirect support of Army operations. The unanimous opinion of German field commanders[83] is that no important changes occurred in this field in 1944-45 except that the attacks were more frequent, were carried out with stronger forces, and were more effective than in former years. In planning and execution, however, they differed little from the operations described in detail in Chapter 3.

Soviet bomber operations in the German rear began to increase in 1943 and continued until they reached a peak in the spring of 1945. Ceaseless bombing during daylight, and sometimes also at dusk and during the night, directed at the last German airfields still in operation in East Prussia finally had a serious effect on German air operations and periodically prevented German air activities altogether. The same can be said of Soviet bombing attacks against port installations and other targets in the Baltic ports.

It is probably due alone to their wariness in this new field of endeavor--i. e. operations in the German rear--that the Soviet bombers did not achieve even more effective results. Occasionally, in attacks of this type a Soviet plane would appear at a very high altitude for last minute reconnaissance followed by a small bomber unit dispatched for the purpose of drawing the German fighters into air combat prior to the arrival of the main body of bombers. The

latter approached on a different course, waiting to exploit the situation and attack at the most favorable moment. Tactics of this type, however, were relatively rare.

6) Night-Bombing Operations. In 1944-45 harassing bombing and attacks against tactical targets in the zone of army operations still played the major role, but two new features were noticeable: strikes against quasi-strategic targets, and attacks by complete units in accordance with western patterns.

No changes occurred in the planning and execution of night harassing attacks,[84] already described in Chapter 3. They remained the most frequent type of Soviet night air operations in stabilized front areas. Most of these harassing attacks were carried out by U-2 planes. Apart from a certain impact on supply and replacement movements, the main effect of these attacks was through their continuous disturbance of the troops, who were subject to severe psychological strains anyway because of the uninterrupted combat in which they were engaged. In the last years of warfare it was still impossible to find an effective remedy against these nuisance raiders.

Night bombing attacks against tactical targets gained in significance.[85] They were designed to support army operations on the ground and were directed against such targets as traffic, supply and servicing installations, billets and shelters, bridges and other river crossing points, airfields, and unit headquarters. In this way, for example, the Soviets directed attacks against the headquarters of Provisional Army Group Heinrici in Northern Hungary in mid-December 1944, and, early in 1945, against the headquarters of I Air Corps and those of Air Administrative Area Command Hungary in Veszprem, Papa, Oedenburg /Sopron/, and Steinamanger /Szombathely/. The bombs were not badly placed in these attacks, as the present author can testify from personal experience of the attacks at Steinamanger, but the results were relatively insignificant.

In support of current operations on the ground, the Soviet bombers directed numerous attacks of this type against a large number of towns, including Sevastopol, Lvov, Riga, Dvina, Libau /Liepaja/, and later in the war against Koenigsberg /Kaliningrad/ and Danzig. At the same time the frequency and scale of attacks against German airfields in the near front areas and also farther in the German rear grew. In September 1944, for example, 17 bombing attacks involving approximately 3,200 bombers, plus 12 penetrations by approximately

200 planes engaged in partisan supply operations are reported, excluding operations within the area of the main line of resistance. The effects of these attacks varied, but on the whole they became increasingly effective.

Some of these missions were flown by individual planes, others by complete units, which tried to increase their effectiveness by concentration of their force. Individual planes usually attacked targets near the front, while complete units hit targets in the German rear, but exceptions to this rule were noted occasionally. Towards the end of the war unit attacks increasingly took the place of attacks by individual aircraft.

An increase in the frequency and scope of night attacks against quasi-strategic (or political) objectives[86] is reported for the first time in 1944-45. In the spring of 1944 such attacks were directed against towns in Finland and were designed to break the morale of the Finnish population. Later they were directed against Koenigsberg /Kaliningrad/, Budapest, and other densely populated cities and centers of government and administration.

These attacks, which were an exclusive mission of units of the long-range bomber arm, were carried out as a rule by complete units and not by individual planes. Compared with the night attacks by air forces of the Western Allies, the results achieved were not impressive. They did show, however, a considerable improvement over operations in former years. Nevertheless, right up to the end of the war the Soviets did not succeed in removing the existing deficiencies in organization, training, and combat experience.

Insofar as night harassing and single-plane operations are concerned the reader is referred to the description given above in Chapter 3.

Night-bombing missions by complete units corresponded largely to the western pattern for such operations and in general were executed in the manner now described:[87]

The sub-units participating in the operation took off from various bases widely distributed along the front, navigating by their own radio bearings supplemented by dead reckoning and orientation by ground features, and following as direct a course as possible to their assigned target. The entire unit did not

assemble prior to the attack nor were diversive or deceptive maneuvers employed. The individual attack waves were directed at the target concentrically and in closed formation. The direction and altitude of attack were prescribed by orders for each participating sub-unit. As a rule the attack altitude was between 13,000 and 17,000 feet, the departure frequently as low as 6,600 feet. The prescribed duration of a division-size attack was approximately twenty minutes, but the attack often lasted longer. The regimental marker planes had orders to light up the target one minute prior to the bombing run, and to drop new marker flares at intervals of three to four minutes. The use of pathfinder planes with special Rotterdam type equipment /airborne navigational and blind flying set/ was not observed.

The type of bomb used depended on the kind of target under attack, but preference was shown for 110- and 220-pounders, and only a small quantity of 550- and 1,100-pound bombs were carried. The usual method of bombing was by stick release, which meant that a plane carrying ten 220-pound bombs released at intervals of one to two seconds could cover a strip 330 to 1,150 yards long.

Well placed defensive fire by antiaircraft guns frequently resulted in a premature bomb release. To evade such fire Soviet bombers pushed down their noses, losing as much as 3,300 feet in altitude, or held their altitude and flew in curves. Long-range bombers had no night-fighter escorts in 1944, but were supported by fighters on patrol missions over their home bases, both during their take off and their subsequent landing.

According to the nature of the target and the distance involved, the attacks were sometimes repeated. However, the repeat attacks were not flown by the entire unit but by individual planes at irregular intervals, which took off as soon as they had refueled and taken on a new load of bombs. In such cases the duration of the mission for individual crews sometimes lasted eight to twelve hours. Operations of this type were carried out on light and dark nights but not when weather conditions were really bad.

Apart from a few isolated torpedo bombing attacks and mining missions, Soviet bombers were not observed in night operations at sea.

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On the basis of available data Soviet bomber operations at night in 1944-45 can therefore be evaluated as follows:

a) They consisted of harassing operations, attacks against tactical targets and--in contrast with former years--attacks against quasi-strategic targets.

b) The methods employed in night-harassing operations and night attacks against tactical targets remained the same as in former years, but were executed with stronger forces and increasing success. These attacks constituted the bulk of night operations carried out by bombers.

c) From the spring of 1944 on Soviet bombers engaged in night attacks against quasi-strategic targets, but not on any appreciable scale. Although properly planned, the attacks were not strong enough.

d) Besides single-plane missions, attacks by complete units in accordance with western patterns--particularly when committed for quasi-strategic purposes--played a role of steadily growing importance.

e) Inadequacies in training and combat experience, coupled with the former hesitancy to commit bomber forces in night operations, produced results which were not commensurate with the amount of effort expended.

7) Bomber Operations under Exceptional Weather Conditions. * The few reports available on the subject[88] show that even in 1944-45 Soviet bomber forces avoided missions during really bad weather, showing a marked preference for fair to medium-fair weather, that they were no longer hampered in their operations by very dark nights, and, above all, that they carried out their missions in the same manner in winter as in summer. Nigh harassing raids and missions in the immediate vicinity of the front were executed in practically all weather conditions.

* What has been said on this subject concerning 1942-43 in Chapter 3 applies equally to the 1944-45 period.

8) Bomber Operations in Cooperation with Other Elements of the Air Forces.* In the last years of warfare cooperation between bomber forces and other elements of the air forces improved markedly, and was characterized by the following features:

a) In cooperation with daylight fighters, Soviet bombers always received adequate protection in the form of direct or indirect escorts. The attacking formations maintained unit cohesion even when attacked by German fighters.

b) Soviet bombers engaged in night operations received night-fighter protection while taking off from the bases and while landing. Towards the end of the war night fighters also patrolled over and attacked German night-fighter bases in the vicinity of the bombers' targets, and also attacked German antiaircraft artillery and searchlight positions within the target area.

c) In cooperation with ground-attack and fighter-bomber forces, combined bomber attacks increased in frequency, concentration, and effectiveness.

C. Aircraft Types, Weapons, and Other Equipment

Reports on the types of bomber aircraft and their weapons and equipment in use in 1944-45 are not very numerous,[89] but all agree that no innovations worthy of note occurred in these fields.

As in the past, the plane used most frequently in night harassing raids was the U-2. It was admirably suited for such use because of its easy handling in flight, the small amount of servicing and maintenance it required. In addition, its ability to take off and land at very small emergency air strips, made it possible to dispatch it several times in the course of one night.

The planes used in normal bombing missions were the Li-2, IL-4, PE-2, TB-3, TB-7, Mitchell B-25, Douglas A-20

* Bomber cooperation with fighters--including night-fighter, ground-attack, and fighter-bomber forces--has been already treated in the present chapter so that no further discussion is needed here.

(Boston III) and, as the only new Soviet-produced model, the TU-2. Of these types, the TB-3 and TB-7, being outdated models, were dispatched only on night-bombing missions, while the Douglas-Boston was committed primarily in night-fighter missions. The planes available in the largest numbers were the IL-4, Li-2, PE-2, and Douglas-Boston.

The above types of aircraft were adequate for use as medium bombers in the execution of tactical bombing missions. They were too light for strategic purposes.

The modern TU-2 was faster and had a greater maximum operational altitude than the IL-4. It appears to have been adequate for requirements in the Eastern Theater, but was not in evidence in large enough numbers to permit a definite appraisal. Soviet experts also were not uniformly in favor of this model.

Soviet bombers in the last two years of warfare did not achieve the results expected of them. This was probably owing in part to the types of bomber aircraft in use, which were not in all respects suitable under conditions of modern warfare.

No important changes are reported in the types of bombs in use in 1944-45 or in the methods of their use. In some cases the Soviets were observed using captured German 2,200-pound bombs in night attacks, having equipped Li-2 planes with special bomb clips for the purpose. The authorized bombloads were frequently exceeded. Detonators seem to have improved, since the number of duds declined. Soviet long-range bombers frequently used a rotating bomb container. This was a container filled with small caliber bombs which were ejected from the container (known as the PRAB) some time after the release. One innovation was a projectile similar to a rocket projectile, released in night raids by U-2 planes at altitudes of between 1,600 and 2,000 feet. It left no fire trail behind and was released with a faintly audible report.

D. Summary Assessment of the Soviet Bomber Forces in 1944-45

A final evaluation of the Soviet bomber forces in 1944-45 can be stated as follows:

1) The Soviet bomber arm showed considerable improvements in the execution of missions and general performances but was unable to catch up to the fighter and ground-attack air arms.

2) Soviet bomber personnel still showed a few defects, but on the whole their combat morale, aggressiveness, and self-assurance were improved.

3) The organization and chains of command in the arm underwent only small changes, unit strengths increased steadily, and the distribution of forces--including the units of the long-range bomber arm--was predicated on the current areas of main effort in operations on the ground, and on the principle of concentration of forces.

4) The primary mission of the Soviet bomber forces remained that of supporting army operations on the ground by bombing targets in the near front areas and in the German rear. In the execution of this mission those tactical principles which had proved to be sound in the past remained in force. This use of bomber forces in proper cooperation with the ground forces and on a steadily mounting scale resulted in growing successes.

5) The employment of bombers against German naval units and other seaborne targets also increased in the Baltic and in northern waters, and towards the end of the war proved fateful to weakly defended German transports in the Baltic.

6) Bomber attacks against the German ground service organization hampered German air operations considerably, and helped to bring about the paralyzation of the German Air Force in the spring of 1945.

7) Soviet bombers rarely flew quasi-strategic daylight missions. At night, however, they carried out such missions with increasing frequency and power, but without achieving any appreciable measure of success. Such attacks were directed primarily against large towns considered important because of the size of their population or because of their functions as administrative centers.

8) Night harassing raids and night attacks against tactical targets increased in scope and effectiveness.

9) Cooperation with other elements of the Soviet air forces advanced considerably. The fighter escort system functioned smoothly, and combined attacks in which bomber, ground-attack, and fighter-bomber forces participated were carried out with greater concentration and more effective results.

10) In the field of aircraft types, weapons, and equipment no appreciable progress was achieved. This was one of the reasons why the success of the Soviet bomber forces remained limited.

In conclusion, during 1944-45 Soviet bomber aviation showed considerable progress, both in daylight and night operations. That the Soviets did not achieve results equalling those of their Western Allies in this field is, among other reasons, primarily owing to the way in which the Supreme Soviet Command had for many years neglected the development of bomber aviation.

Section X: Special Air Missions[90]

Little information is available concerning special air missions. What is available indicates that operations in this field continued to improve. Signs of this were the successes and constant growth of the partisan movements, made possible by special air-support missions.

A. Air Transportation

No spectacular changes were observed in this field.[91] The use of units of the Long-Range Air Force for transport operations continued to increase. Reports confirmed both the existence of a 3-regiment air transport division within the Long-Range Air Force and the use of twin-engine aircraft in transport missions. Units of the Long-Range Air Force supplied surrounded army units by air-drop in night operations. The drop sites were marked by light signals, and the supplies were dropped by aircraft flying singly at altitudes of between 1,000 and 1,600 feet. Transport aircraft rarely landed inside a pocket.

In addition to supplying surrounded units, the Soviets succeeded in keeping their troops supplied by air when rail and road routes were damaged and when mud conditions made transportation on the ground impracticable.

B. Courier, Liaison, and Command Planes.

Soviet courier and liaison operations[92] in 1944-45 were not marked by any special features. Courier traffic was, nevertheless, quite lively. In Courland* in the spring and summer of 1944, for example, heavy courier traffic was necessary to secure cooperation with the many partisan units in the areas around Dvina. While on courier missions of this type, Soviet pilots occasionally lost their way and fell into German hands.

The same principles of organization which governed courier planes in 1943 applied in 1944-45. The commitment of these planes, largely U-2's, and their organization into separate units attached to air armies followed the already established patterns.

Airfields were detected which were reserved exclusively for use by liaison units. In December 1944 Soviet liaison planes landed at special ice air bases on frozen lakes in East Prussia.

C. Partisan Supply Operations

Closely linked to large-scale Soviet offensive operations on the ground, the air movement of supplies to partisan groups[93] increased considerably in 1944. With increasing frequency, transport planes penetrated the German rear areas carrying weapons, ammunition, explosives, medical supplies, and command personnel to the partisans. In the zone of German Army Group Center, for example, several hundred Soviet planes were reported in the German rear flying such missions nightly prior to the Soviet offensive of 1944. This is the only explanation which can be found for the ability of the partisans to blow up railroad tracks at approximately 4,000 points during the two nights preceding the opening of the June 1944 offensive against Army Group Center. Operations on such a scale would not have been possible without support from the Soviet air forces.

In order to supply the partisans, the Soviets used makeshift airstrips secluded in vast, forest covered areas. Supplies were usually brought in at night by either powered aircraft or cargo gliders. Improvised lighting made landings, or in some cases air

* See note above, p. 269.

drops, possible. The magnitude of these efforts can be judged by the results of a large-scale German counter-partisan operation near Lepel. On one of the partisan airfields in the area German troops found more than one hundred cargo gliders. The air drop points, of which only very few were detected by the German forces, were marked by special signals, usually open fires, the number and pattern of which changed daily in accordance with a pre-established plan.

Units of the Long-Range Air Force also participated in these nightly supply operations. On long-distance missions they usually flew in formation, crossing the German lines at an altitude of about 13,000 feet. When they reached the target area they were guided either by radio signals or light beacons.

Besides flying supplies to the partisans, Soviet air units flew in large numbers of paratroopers, who gave direct support to the partisans, thereby increasing their combat strength.

Partisan operations were combatted (as in 1943) by committing strong German fighting forces in countermeasures. These, however, produced only partially effective results. It was not until the war moved into German territory that these partisan activities and the concurrent Soviet air-support operations ceased. Up to then, however, the Soviet air forces contributed very largely to the success achieved by the partisans.

Section XI: The Ground Service Organization of the Soviet Air Forces; Soviet Air Force Technology; the Supply Services [94]

As in 1942-43, the Soviets were undemanding, extremely adaptable, and able to master problems as they arose with the simple means available. No spectacular innovations were noted, but the application and continued development of tried and tested principles made it possible to meet the requirements of the troops.

A. Ground Service Organization

In the opinion of German field commanders, [95] the Soviet ground service organization was more flexible, more adaptable, and thus performed better than its German counterpart under existing conditions in the Eastern Theater. Repeatedly, the Soviets

established airfields in a surprisingly short time in terrain considered by the Germans to be completely unsuitable for even make-shift type airfields. The Soviets did have the advantage, however, that their aircraft were, in general, lighter than those in use by the Germans.

The Soviet system, observed already in 1943, of dispensing with permanent type air bases in favor of an extensive network of temporary airfields--to which they constantly added new fields while moving the network closer to the front--was continued and intensified in 1944-45. In the zone opposite German Army Group Center in the summer of 1944, for example, only two of the sixty-four airfields detected were of the permanent type and these were at Smolensk North and Smolensk South.

In the development of the Soviet network of airfields, the organization, scope, speed of operations, and sequence of the various construction phases, provided reliable indications on the location, and frequently on the timing, of impending, large-scale offensives. This was found to be the case time and again in Courland, Hungary, Poland, East Prussia, and Silesia, in fact, in all areas of the Eastern Theater. Air units moved on to the airfields only shortly before the opening of the actual attack.

Difficulties in the development of the ground service system during rapid forward movements, or in the quick transfer of air units to airfields closer to the front, were hardly noticeable. What has been said here, also applies very largely to the progress made in ground organization facilities for night operations.

As time passed, the Soviets overcame their reluctance to use former German airfields. When they entered German territory, they found numerous airfields available, which they immediately put into operation. Frequently, however, Russian carelessness made it possible for German air units to achieve good results right up to the end of the war by attacking these overcrowded fields.

1) Operational Principles, Organization, Chains of Command. By rapidly extending their system of advance airfields, the Soviet air forces were able to provide the necessary air support for the units spearheading the attack on the ground. Furthermore, the resulting dispersion of the Soviet air units made them less vulnerable to attack. During Army advances, Soviet air forces operated almost exclusively from these temporary airfields. Their construction and expansion

was indicative of the increased capabilities of the ground service forces. Opposite German Army Group Center, for example, it was observed in September 1943 that 290 airfield construction battalions established 183 airfields; in July 1944, in contrast, it took only 211 airfield construction battalions to construct 310 airfields within an area of the same size. This means that each airfield construction battalion on an average completed one-and-one-half airfields in one month. The large overall performance was due to the existence of numerous airfield operation, airfield construction, technical, and transport units. The total number of new airfields constructed in August 1944 was 506, quite a commendable performance.

Prior to the opening of the summer offensive against German Army Group Center in June 1944, the Soviets had more than 64 airfields in the area, 62 of them of the temporary type. Of these, only seven were not in operation at the time. These seven fields, less than nine miles from the front lines, were put into operation immediately after the offensive began. Of the remaining 57 fields, 42 were between 9 and 27 miles from the front and each had between 25 and 30 aircraft (i.e., one air regiment).

The organization and chains of command within the ground service system remained unchanged. Each air army was assigned an average of four regional air bases, the number varying according to the mission and the current situation. Each regional air base, in turn controlled a number of airfield operating and airfield construction battalions, besides airfield technical companies, motor transport battalions, captured materiel salvage companies, and signal companies.

In addition to the above, each air army had a number of station-type and mobile aircraft repair shops, station-type and motorized motor vehicle maintenance shops, independent technical companies, and terminal supply depots. The functions of these various establishments were as follows:

Regional Air Bases were responsible for the proper employment of its assigned units, for the allocation of supplies, and the execution of unit transfers.

Airfield Operating Battalions were responsible for the maintenance and operation of their assigned airfields. This included

the refuelling and loading of units, housekeeping and medical services for the air units stationed on the field; transportation, guard, weather, and radio and wire communication services.

Airfield Construction Battalions were responsible for the construction and repair of airfields.

Airfield Technical Companies were responsible for the maintenance of the technical installations at existing airfields and for the technical equipment of newly constructed fields.

Captured Materiel Recovery Battalions handled the identification, sorting, and evacuation of captured enemy air materiel.

Signal Companies established and operated the wire and radio installations required for ground communications.

Motorized Aircraft Maintenance Shops handled the overhauling and general maintenance work which exceeded the capabilities of the technical personnel assigned to the air units.

Station-Type Aircraft Maintenance and Repair Shops repaired aircraft damaged beyond the repair capacity of the motorized aircraft maintenance shops.

Motorized and Station-Type Vehicle Maintenance Shops performed the same services for motor vehicles as the aircraft maintenance shops did for aircraft.

Independent Technical Companies were responsible for the installation and improvement of navigational aids.

Terminal Supply Depots handled the supplies intended exclusively for the air forces.

Air units assigned to the Navy were serviced by naval air bases, the responsibilities and functions of which approximated those of the regional air bases of the air armies. There was, however, one important difference: the naval air bases were organic to the units they serviced. In general, they came under an air regiment for tactical control, while administratively and in matters of supply they were directly subordinate to an air division.

In the Home Defense Area the air force ground organization was of a locally permanent type, in contrast with the organization at the front which changed with the military situation. Thus, the various units were permanently attached to replacement air units and aviation schools.

2) Airfields and Their Equipment.[96] In 1944-45 the Russians gave renewed proof of their ability to construct and place in operation airfields of the simplest type within an incredibly short time. By making use of labor and machinery from the civilian population, particularly from nearby collective farms, and by employing tractors and special levelling vehicles, they were able to construct a runway with the essential subsidiary installations within ten to fourteen days. As soon as a runway 330 yards wide was ready, it was placed in operation. It is only natural that the airfields constructed in this manner were extremely makeshift and primitive, but they served the purposes for which they were intended.

The Russians were equally quick to repair demolished former German airfields and to improvise what were called ice airfields, which could be used by the heaviest types of aircraft.

Through the clever adaptation of their airfields to the surrounding terrain, and through the use of dummies and the creation of dummy airfields, the Russians again proved that they were masters in camouflage of all types.

In general, Soviet airfields and airfield equipment in 1944-45 differed little from the description given for 1943 in Chapter 3. The same applies to the defense of airfields by antiaircraft artillery.

No new experience was gained on the subject of the personnel employed in the ground services of the Soviet air forces.

B. Soviet Air Force Technology[97]

Only very little insight could be gained in 1944-45, as was the case in former years, into the field of Soviet air force technology.

The Soviets proved to be extremely good in the art of technical improvisation. They were quick to master the technicalities of captured German materiel, using German bombs, for example, with excellent results. The use of rollers and piles made

from tree trunks, wooden rafters, planking, twigs, sawdust, and tree trimmings in the construction of runways, and the use of truck motors to start aircraft engines in winter--by transmitting the truck engine power to the propellor hub via the drive shaft and some pulleys--are examples of the primitive but highly useful improvisations and inventions employed by the Russians. In any case, technology as applied in the Soviet air forces in 1944-45 was equal to all requirements.

C. Supply Services[98]

In 1944-45, the supply situation of the Soviet air forces was improving steadily, supplies of all types seemed to be plentiful, and no shortages were evident. Apparently, the need for support from the Western Allies, in the form of air force supplies no longer existed.

The Russians used rail transportation to move various aircraft parts separately to air bases in the field for assembly on the spot. Among the parts thus moved forward were fuselages, wings and engines.

Being content to adhere to the proven methods of the past, the Russians introduced no changes in the organization and operations of their air force supply and replacement services during the last two years of warfare.

Section XII: Air Signal Communications[99]

Sources available reveal that the Soviets made further progress in this field. By cleverly applying foreign experience to Russian conditions, they succeeded in bringing about a general improvement in capabilities, particularly in the field of radio communications. The over-all structure of the air signal services assumed forms approximating those of an independently functioning Air Signal Corps. This development, however, was not quite completed by the time the war ended.[100]

In the organizational field,[101] the most important and most incisive measure was taken in mid-1944: the air signal units were removed from Army Signal Corps control and placed under the Administration of Signal Communications Services of the Air Forces

of the Red Army. This established an independent air signal force, a development which resulted in a general expansion of radio communications and a reduction of wire communication facilities.

Up to the end of the war there were no clear signs that the aircraft reporting, air traffic control, and radio intercept services would be incorporated in the new signal communications services.

The air signal services were headed by a Chief of Air Signal Troops of the Air Forces of the Red Army, who at the same time was Signal Staff Officer to the High Command of Air Forces of the Red Army.

The air signal troops were organized into air signal regiments controlled by the air armies, and air signal regiments controlled by the High Command of the Air Forces of the Red Army.

An air signal regiment comprised one headquarters company, one telephone operating company, one radio operating company, one telephone construction company, and one telephone-cable laying company.

Each air corps, each air division, each regional air base, and each airfield operating battalion was assigned an independently operating air signal company consisting of: one headquarters platoon, one radio platoon, one telephone platoon, and one telephone construction platoon.

In September 1944 the overall strength of the air signal forces--excluding those signal units in the Long-Range Air Force, those serving with naval air forces, the signal troops of the Home Defense Command and those of the High Command of the Red Army Air Forces--was approximately 90,000 personnel.

The signal officer of each air unit was subordinate to the chief of staff of the unit. He received his orders from the chief of staff as well as from his next superior air signal officer. He was responsible for the proper employment of the assigned air signal personnel and the use of signal equipment, as well as all unit signal operations.

Each headquarters was responsible for the establishment

and operation of communications with the next lower echelon. This responsibility included the establishment and operation of communication centers (at headquarters), radio communications, wire communications, and other signal devices (optical and movable).

In contrast with the German use of wire communications--which played a primary role in their exercise of command--the Soviets attached major importance to radio.[102] The scarcity of permanent telephone lines in Russia and the enormous distances compelled the Soviet Command to such wide use of radio communications, which thus became the main medium for air-to-air communication, for the direction of operations, and for transmission of reports on the air situation.

In contrast to the German side, the Soviet radio warning service and the radio directing service included the radio installations of the Army. The establishment of radio networks and radio channels, however, corresponded to German usages. Ground-attack, bomber, and escort fighter units participating in an operation, and the radio stations on the ground, all used the same frequency. Only the unit lead planes maintained contact with the ground. Once a unit was outside the normal range of radio communication--if operating at an altitude of 3,300 feet, approximately 30 miles--no further efforts were made to exchange messages with the ground station. Radio traffic was usually in the clear, the risk of interception being considered the lesser of two evils compared with the possibilities of error and loss of time resulting from communications in code. Reconnaissance aircraft conducted their radio communications in the same manner as described above.

By the spring of 1944 the Soviets used radar[103] to detect German aircraft and to guide their fighters to within close range of their targets. No information is available, however, on the nature of Soviet radar units and their control. In the field of high frequency radio technology the Soviets still were in the initial stages of development. Therefore, all radar instruments known to exist throughout Russia, even as late as in the autumn of 1944, were ground-based instruments of British manufacture or instruments copied in the Soviet Union from British models. Although the existence of airborne radar instruments was not established at the time, there was unmistakable evidence that radar was being used in the control of fighter operations.

No new information of any significance was obtained concerning the Soviet radio intercept service.

As for wire communications,[104] lines of the existing basic network were generally used in the establishment of command communication channels. Only an exceedingly wide-meshed wire network was available for long-distance communications. The Russian Air Force, Army, and Navy all had to depend on this one network because no separate networks existed for the individual services. In establishing wire communication lines, the air signal service, when possible, took advantage of existing networks of the civilian postal services and of the various Army headquarters, thus reducing construction work. Women were employed with particular frequency in the wire and radio communications services.

No new information of any importance was obtained in the last years of warfare concerning other mediums of communication or concerning the signal equipment in use. The signal equipment used by the Soviet air forces was not equal in quality to that produced in western countries. This can be assumed with particular certainty since the standards achieved by the Soviet radio industry were far lower than those reached in other fields of technology in the Soviet Union. Nevertheless, the equipment available was, no doubt, adequate to the none too excessive demands of the Soviet air forces.

In an overall evaluation of the Soviet air signal services in 1944-45 approximately the same features prevail as in 1942-43: progress in the field of organization towards the establishment of an independent Air Signal Corps; notable improvements in the field of radio communications; and adequate capabilities in the fields of radar, wire communications and equipment. This means, essentially, that the Soviet air signal services could meet the requirements of the Soviet air forces, although they by no means could have met western standards or coped with conditions in the West.

Section XIII: Training Activities[105]

In the last phase of the war, as in the earlier phases, German field commanders gained no direct insight into the training of Soviet air forces. Instead, in forming their opinions they had to rely on deductions based upon the behavior and performances of Soviet airmen. These performances, however, clearly indicated that the training

standards of the Soviet air forces had improved considerably.

In the training of aviators the Soviets adhered to their existing system, under which trainees progressed in succession through an Aeroclub, elementary aviation school, service school, replacement training regiment (air), air training regiment, and finally to a front-line unit. This program was extremely flexible and was adapted to current circumstances.

The training program was well thought out and systematic, but the results achieved remained far below German or Anglo-American standards. Since they had no manpower problems--the increase in pilots exceeded the output in aircraft considerably--the Russians were able to extend the training period again, and thus give longer training to pilots who proved less capable than the average. This was an important advantage over the Germans, who could not afford to spend so much time in training, and who had no such reserves in personnel.

After the reverses they suffered in the first years of the war, the Soviets shifted the main responsibility for flying training from the flying schools to the replacement air units. This measure was reversed in the summer of 1943. In like manner it was noticed that the flying schools, transferred into the Russian interior after 1941, began to move back to the west in 1943.

The length of the preliminary flying training course in the aeroclubs was curtailed seriously during the war, and the course did not have nearly the importance it had had prior to the war. For this reason flying training now began in earnest in the primary flying schools, of which there were 130, and lasted on an average of from nine to twelve months. The trainees then entered the service schools, of which there were 60 for the fighter forces, 30 for the bombers, 30 for the ground-attack force, and 8 for the long-range bombers. Training in a service school lasted between twelve and fourteen months. In addition there were service schools for naval aviation, night flying and instrument navigation, as well as special schools for navigation and bombing.

The number of trainees at the individual schools varied widely, from as few as 200 to as many as 2,000. In fighter schools the average number of trainees was 750.

Apart from service schools for flight personnel, schools

existed for airborne radio operators, air gunners, ordnance, photographic, and other highly specialized personnel. The organization within the school system was very flexible and frequently brought about the fusion of schools from the various services.

After leaving the service schools, trainees spent two to six months in a replacement air regiment. These regiments consisted of from two to six squadrons and gave advanced training, refresher courses, and complete crew training. Another responsibility of the replacement air regiments, at least fifty of which were identified, was to refit existing front-line units, activate new units, and rehabilitate worn out units.

Training in a replacement air regiment was frequently followed by assignment, lasting between one and four months, to an air training regiment. One of these was assigned to each air army. The main mission of the air training regiment was to retrain and familiarize personnel with the types of aircraft being used by the air army to which it belonged. The regiment usually contained five squadrons, two of them equipped with fighter, one with PE-2, and one with IL-2 aircraft. The fifth squadron was reserved for the training of flight leaders. Towards the end of the war some of the air training regiments were disbanded, their functions being assumed by the replacement air regiments.

Flying personnel received their final training in front-line units, before being sent into action. This phase, lasting from one to three months, was rigorous and intensive, every effort being made to simulate actual combat conditions.

The training of the Soviet air forces was well organized and certainly provided adequate time to give flight personnel a thorough preparation for their coming duties. This was reflected in a general improvement of training standards.

Section XIV: Airborne Forces[106]

The overall organization of the Soviet parachute and other airborne forces remained practically unchanged in 1944-45, these troops still being organized in what were called airborne brigades. They were intended exclusively for use as paratroopers, and the brigades still had no organically assigned air transport.

Within the brigade itself, in contrast, a number of changes occurred which will now be enumerated.

Each airborne brigade was assigned a light tank battalion (with Model T-26 tanks); an artillery battalion of two 76.2-mm gun batteries and one 120-mm howitzer battery; and one light AA battalion of one 37-mm gun battery and two antiaircraft machine gun companies. In addition, the existing antitank battalion was increased in strength from two to four batteries. The strength of the brigade thus increased from 3,500 to approximately 4,200 combat personnel.

It was estimated in mid-1944 that the Soviets had a total of 23 airborne brigades, most of them concentrated in the Moscow area. This represented a combat strength of approximately 100,000 combat troops.

No reliable information was obtained concerning transportation methods. Plans existed to use gliders and PE-8* and Li-2 powered transportation aircraft for the purpose. Soviet paratroopers were armed with the most up-to-date small arms (submachine guns and carbines). Their jump training was very thorough, but allegedly was restricted to daytime practice jumping.

The well-equipped and well-trained airborne brigades represented a considerable power factor for use in airborne and conventional ground combat. However, in 1944-45, as in former years, they were not committed in airborne operations on any appreciable scale.

The failure to employ these troops in airborne operations may have been due to the Soviet Command considering difficult and costly operations of this type inappropriate, to a reluctance to undertake such operations because of a lack of adequate experience, or to other reasons.

The only fairly large scale use made of paratroopers was to reinforce partisan forces. Thus, as many as 300 paratroopers were landed in some of the daily drops within a large area in the central sector in the summer of 1944.

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* Editor's Note: Previously designated as the TB-7, the PE-8 was a four-engine bomber which was later employed as an air transport plane.

Section XV: Air Armament Industry, Military Economy, and Transportation [107]

What is known concerning developments in these three fields has been gathered from diverse sources, and the account which now follows is not based on information from German field commanders, who had no insight into such matters.

The Air Armament Industry.[108] The Soviets continued their program for the rapid expansion of their air armament industry in 1944-45. Their output in aircraft per month increased from approximately 700 at the time when they evacuated the western territories in 1941-42 to 1,900 by early 1943, 2,400 by early 1944 and 3,400 by the autumn of 1944. In September 1944, as an example, they produced 1,450 fighter, 1,025 ground-attack, 460 bomber, 150 transport, and 390 training aircraft. These overall figures remained practically unchanged up to 1945.

To increase production, the number of types was severely restricted. Special stress was placed on the production of single-engine and thus on fighter and ground-attack aircraft, which made up approximately 75 percent of the entire output in aircraft. Most fuselages constructed for single-engine planes were of mixed construction /metal and wood/, those for multi-engine planes were all metal. The aircraft engines produced were almost exclusively of the carburetor type. By mid-1944 the existence of nine aircraft engine factories was established. It was also known that 21 fuselage factories existed, of which 8 produced fuselages for fighters, 2 for ground-attack aircraft, 5 for bombers, and 6 for training or transportation aircraft. Other factories were still under construction.

The lack of skilled labor was a serious problem for the Soviet aircraft industry. All in all it was estimated that the industry employed roughly 500,000 personnel, the majority of them women and children. All factories were producing at top capacity.

The main factors contributing towards the favorable development of the Soviet aircraft industry were: 1) the progressive expansion of existing factories; 2) the importation of the most up-to-date installations for serial production; 3) the establishment of new factories plus the reestablishment of evacuated factories in their former locations, after the retreat of German forces from the western territories (thus the Moscow area again became a center

of the aircraft industry); and 4) the fact that the industry was able to function without any interference.

The large-scale expansion of the air armament industry not only enabled the Soviets to replace, within a relatively short time, their at times exceedingly heavy losses, but it enabled them to increase steadily their current strength in aircraft and completely modernize their entire air force. For quite some time the Soviet industry had been producing more than enough aircraft to replace its losses, so that the Russians no longer had to depend on Allied deliveries.

The Military Economy. In 1944-45 the entire Soviet military economy was also making steady progress towards the stage at which it would be able to meet all requirements for the conduct of the war. The main emphasis was on Army ordnance, with air force requirements taking second place.

The output in steel increased from 10 million tons in 1943 to 11.8 million tons in 1944 and 12.3 million tons in 1945. This was sufficient for the manufacture of 30,000 armored vehicles, 40,000 aircraft, 120,000 artillery pieces, 450,000 machine guns, 2,000,000 submachine guns, and 100,000 mortars, plus the necessary amounts of ammunition.

In developing their armament industry, the Soviets displayed a genius for improvisation on a scale which German authorities would have considered inconceivable. Thus, complete factories were dismantled within a few days, loaded for transportation--together with the necessary workers--, shipped to a new location, re-established there and placed in operation within an incredibly short time. Once reestablished the factories very shortly not only achieved their former production capacity but in addition were able to make up for lost time and increase their output considerably.

In recaptured towns where the power plants had been destroyed prior to the German evacuation, the Soviets moved in complete power stations mounted on railway trains. Moving right up to the spot where electricity was required, these mobile power stations made it possible for the industries to resume operations almost immediately.

In any case it must be said that the Soviet armament industry was capable of meeting requirements during the last years of the

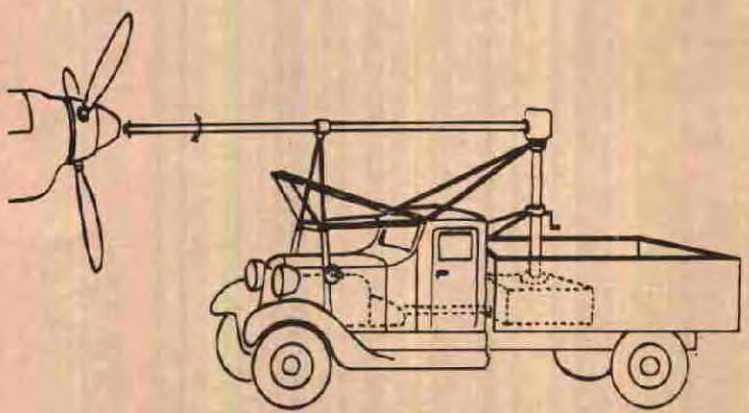
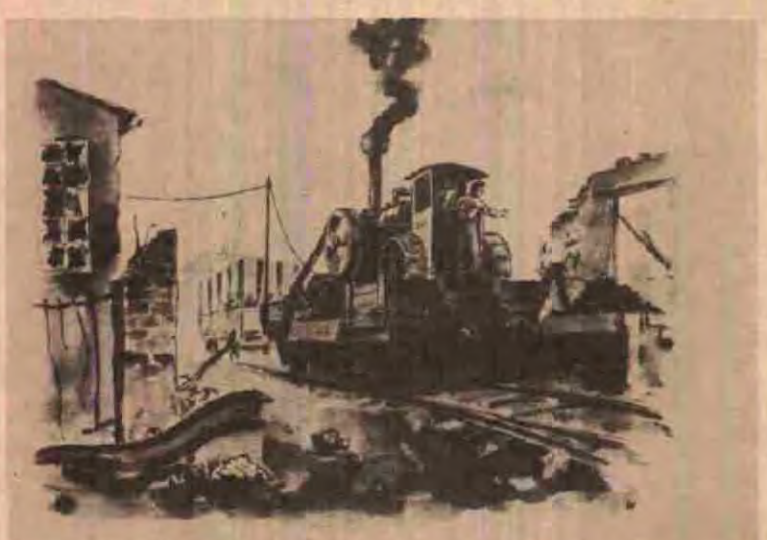


Diagram showing how the Russians used truck motors to start aircraft engines in winter



Drawing showing a mobile power station. These were used by the Russians to supply electricity to damaged factories.

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war, and the hopes which the German military command had harbored that the Soviet industry would slow down or even come to a complete standstill were not realized.

Transportation. No major changes in the Soviet transportation system were observed in 1944-45, and all difficulties which might have been encountered in this field were mastered by normal means. Even the rapid Soviet advances in 1944-45 were not hampered materially by transportation difficulties.

In line with the general developments of the past civil aviation had been made a part of the military force and no new features of any special importance were noted in this field.

It was thus evident that the air armament industry, the military economy as such, and transportation and communications met all requirements of the Soviet command and forces and thereby made a large contribution to the overall Soviet victory.

Section XVI: Allied Support [109]

Allied assistance to the Soviet air forces continued to play a considerable role in the last third of the war and took the form of direct and indirect support. Direct support was primarily in the personnel field, indirect support in the field of materiel supplies.

One measure of direct support was that of the employment of French fighter forces. [110] Up to the summer of 1944 the French Normandie Fighter Regiment and the "Lorraine" and "Bretagne" squadrons were known to be in action. The Normandie Regiment, originally equipped with Yak-1 and later with Yak-9 aircraft, proved quite a problem to German fighter pilots, and was considered almost their equal. Fighter-bomber attacks by this unit against German airfields in East Prussia in the spring of 1945 were carried out very cleverly, efficiently, and with determination. French ground service personnel had proved less satisfactory and allegedly had been replaced by Soviet personnel and returned to Britain.

Another form of direct support was by American bomber and fighter formations flying from airfields in Italy and Britain to Soviet Russia. [111] After the establishment of an appropriate

ground service organization in the Poltava area,* the first American bomber and fighter units landed there from Italy on 2 June 1944 to return to their Italian bases on 11 June. Very soon units flew the first triangular route, in which 200 bombers from Britain flew to Soviet Russia, where those notdestroyed by German counteraction on the way landed on 21 June 1944 to take off for Italian bases five days later.

The small use made of the Anglo-American air bases established in the Soviet Union for operations against Eastern Germany and the Balkan area gave rise to the assumption that the whole arrangement was tailored to political propaganda rather than military purposes. It must be admitted, however, that some of the attacks carried out under the arrangement did have seriously disturbing effects, as was the case with the missions flown by U.S. fighter forces from bases in the Poltava area against German airfields in Poland.

Another item of personnel support which merits mention is that of the training given Soviet personnel in the air forces of the Western Powers. The changes in the Soviet air forces, which became increasingly marked from 1944 on, seemed largely due to this training assistance. It would be difficult, however, to determine to what extent this assumption is correct.

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* Editor's Note: Bases were also established at Mirgorod and Piryatin. One of the factors which discouraged more extensive use of these bases by American aircraft was the Russian failure either to provide adequate defenses for the bases or to allow the Americans themselves to defend the bases. The indirect result was a brilliant night-raid (22 June 1944) by the Luftwaffe on the Poltava base which resulted in the destruction of 43 B-17's, 15 Mustangs and some miscellaneous Russian aircraft and the damaging of 26 additional B-17's. Also destroyed by the raid were quantities of American ammunition and 450,000 gallons of gasoline. After the war, General Spaatz told prisoner Hermann Goering that this was the best attack the Luftwaffe made against the Army Air Forces. For an interesting account of this attack, American shuttle bombing between Italy, Russia, and England and the problems connected with the American bases in Russia, see, Craven and Cate (eds.), The Army Air Forces in World War II, Vol. III, Europe, Argument to V-E Day, University of Chicago Press (Chicago, 1951), pp. 308-319.

Indirect support assumed a far greater scope than direct support.[112] This indirect support was in the form of materiel supplies. Intended originally only as an emergency measure to relieve a temporary shortage in military equipment, the assistance program was expanded to compensate for shortcomings in the Soviet program of production and the deliveries made under the program did much to enable the Soviet Union to continue resistance and later assume the offensive. Gradually, emphasis in the materiel support program shifted from the delivery of specific military materiel to the delivery of supplies needed indirectly for the conduct of the war.

Aircraft constituted the most numerous item in the supplies delivered under the assistance program.* Monthly deliveries in aircraft averaged 150 in 1941, 300 in 1942, 500 to 600 in 1943 and the first half of 1944, and then fell again to an average of 300 per month. By 1 January 1944 Soviet Russia had received from the Western Allies a total of approximately 10,000 aircraft, consisting of 6,000 fighters, 2,600 bombers, 400 transports, and 1,000 training aircraft. Of these deliveries, 60 percent came from the United States and 40 percent from Great Britain, or, to be more precise, 6,003 aircraft from the United States and 4,101 aircraft from Great Britain. By 1 October 1944 the Soviets had received from the Western Allies a total of approximately 14,700 aircraft--8,734 from the United States and 6,015 from Great Britain. The total of 14,700 aircraft consisted of 8,200 fighters, 3,600 bombers, 100 reconnaissance planes, 1,200 transports, and 1,600 training aircraft. Losses during transportation amounted to an average of 20 percent. Britain halted deliveries in the summer of 1944.

During the time in which these deliveries were made, the Soviet industry produced 97,000 aircraft, so that Allied deliveries amounted to roughly 15 percent of the overall Soviet output.

Aircraft delivered, in the order of their numbers, were: Airacobra, followed by Spitfire, Hurricane, Kittyhawk, and Mustang fighters; Douglas Boston III, Mitchell, Marauder, and Hampden

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* Editor's Note: The approximate total of American planes given to Russia during the war was 14,612, according to Craven and Cate (eds.), The Army Air Forces in World War II, Vol. VI, Men and Planes, University of Chicago Press (Chicago, 1955), pp. 352, 405.

bombers; Catalina seaplanes; and Douglas C-47 transports. Only a small number of four-engine planes were delivered.

Next in importance to aircraft were Allied deliveries of specialized machinery and high-octane aviation gasoline. The latter item in particular could not be produced in adequate quantities within the Soviet Union. After the Western Allies, in 1943, had supplied the necessary technical installations for a number of refineries, it was to be assumed that Soviet industry soon would be able to cope with these bottlenecks.

The routes used by the Western Allies for the movement of deliveries to the Soviet Union are generally known and also have been mentioned previously in this study. The northern route through Murmansk and Archangel lost steadily in importance to the Persian Gulf route. The sea routes to Far East ports, and the Alaskan route for the delivery of aircraft by air gained steadily in importance.

From what has been said no doubt can exist that in 1944-45 Allied support in terms of materiel and, to a lesser degree, personnel, again proved to be invaluable to the Soviet air forces and made a decisively important contribution to their successes.

Section XVII: Summary

The opinion of German field commanders concerning the Soviet air forces in 1944-45 resulted, among other things, from constant encounters with those forces in the air. In its essence, that opinion can be formulated as follows:

1) The shift in power ratios in favor of the Soviets commenced as early as 1943 and accelerated steadily during the last third of the war. Soviet successes on the ground and in air warfare, Soviet numerical superiority, progress in the field of technology, and the increasing combat experience of Soviet airmen all contributed to bring about a gradual overall strengthening of the Soviet air forces.

These developments naturally culminated in Soviet air superiority. This air superiority, however, did not amount to absolute air supremacy of the kind established by the German Air Force at the opening of the Russian campaign. Whenever German and Soviet airmen encountered each other in air combat right up to the

very end of the war, and their equipment was technically equal, the superior intellectual and combat capabilities of the German airmen always decided the action in their favor, in spite of crushing Soviet superiority in numbers. Owing to the rapid disappearance of German air power, however, the possibilities for such successful encounters in the air became less and less frequent.

2) As had been the case in the past, Soviet air power served almost exclusively to provide direct or indirect support for the army on the ground and made a decisively important contribution to the final Soviet victory.

The salient features of the Soviet air forces in this phase of the war were their aggressive conduct of operations, their adherence to the principle of power concentration, and their retention of organizational and operational methods which had proved sound in the past.

In contrast with former times, the Soviet air forces engaged in strategic missions, although only on a moderate scale. However, the results achieved in attacks of this type, most of which took place in the night, were not impressive.

3) The personal behavior of Soviet pilots in this period is reflected in their increasing successes, their growing self-assurance, their mounting aggressiveness, and their improved combat morale. Nevertheless, right up to the end they were unable to surmount completely their feeling of inferiority to their German opponents. This was one of the fundamental causes for the failure of the Soviet air forces to achieve absolute air supremacy.

4) In addition to performing their former tasks, Soviet reconnaissance units were committed increasingly in wide area reconnaissance missions. Through systematic action and the intensity of their operations they produced results which were adequate for the Soviet conduct of operations.

5) The Soviet fighter forces increased their efforts and improved their performances and methods in all fields. These factors, coupled with their crushing numerical superiority, enabled them to achieve and maintain air superiority and thereby contribute greatly to the final Soviet victory.

6) The Soviet ground-attack air forces continued to adhere

to the tactical principles which had proved sound in the past. Through their persistent and successful attacks in support of major operations on the ground, they contributed a decisive share in breaking German resistance. The Soviet Command's continual emphasis of ground-attack aviation thus achieved the desired result.

7) Soviet bombers were more in evidence in this period than in the early years of the war, and they achieved a commendable measure of success in operations supporting the army on the ground. The effectiveness of night-bombing operations, by contrast, did not assume major proportions. In spite of its improvement, the bomber arm, right up to the end of the war, remained inferior to fighter and ground-attack aviation.

8) Fighter, ground-attack, and bomber cooperation with each other and with the army continued to increase and improve, and produced good results. Cooperation with the Navy, neglected in the past, also gained a certain measure of importance.

9) The employment of aircraft in special-type missions increased. Partisan supply operations, in particular, made a decisively important contribution to the success achieved in partisan activities.

10) The ground service organization, air force technology, and the supply services continued to adhere to their simple basic principles and participated in the general development of the Soviet air forces. They were able to meet all demands in their fields.

11) The air signal services gained a larger measure of independence and showed signs of becoming a separate air signal corps. Concentrating primarily on the development of radio communications, the service was able to meet all requirements of the Soviet air forces, although it did not achieve western standards.

12) In training activities the Soviets could proceed without interference and in accordance with a long-range program. As a result, they were able to assign well prepared personnel to their front-line units.

13) Paratroopers and other airborne troops were well trained and equipped, but were not committed in any sizeable airborne or ground combat missions; it was only in the field of partisan operations

that the employment of paratroopers played a significant role.

14) The Soviet aircraft industry, military economy, and transportation system were able to develop and expand without enemy interference and thus could meet all requirements for the conduct of the war.

15) Support from the Western Allies continued right up to the end of the war, particularly in the form of materiel supplies, which were primarily aircraft. This support was a large factor contributing to the final Soviet victory.

As in the past, the Soviets in the last third of the war continued to employ their air power primarily to serve the purposes of operations on the ground. The rapid decline of the German air power potential, the progressive development of the Soviet air forces in all fields, their growing combat experience, and their vast numerical superiority enabled them to make a vitally important contribution towards final victory.

At the end of the war Soviet air superiority was securely established. Although German airmen still had the advantage of superior operational and combat experience, their small numbers towards the end of the war prevented them from exploiting these advantages.

CONCLUSION

The Soviet air forces, inferior to the German Air Force in every respect except that of numerical strength at the beginning of the Russian campaign, were almost completely paralyzed in 1941 by the Luftwaffe's powerful blows and by the loss of their ground service system to the German Army. This resulted in temporary German air supremacy.

The decreasing frequency and power of German air attacks, however, and the undisturbed Russian Air Force training activities and aircraft production coupled with support from their Western Allies enabled the Soviet air forces to make rapid progress towards complete recovery in 1942-43. Their transition from a strictly defensive attitude to a fundamentally offensive one, and their mounting numerical superiority, finally enabled them to achieve

parity in air power.

In 1944-45, the progressive development of the Soviet air forces was accelerated. In spite of this, Soviet air power continued to be employed almost exclusively to support operations on the ground. The further decline of German air power and the concomitant increase in Soviet air power finally resulted in uncontested Soviet air superiority, which, in turn, became an essential ingredient of the Soviet victory.

World War II is the firm foundation upon which today's Soviet air strength rests. In response to German aggression and with decisive Allied support, the Russian Air Force, by the end of the war had grown into an arm of impressive proportions.

FOOTNOTES

Chapter 1

1. This section is based on: Contributions by Generalingenieur a. D. Otto R. Thomsen and Lieutenant Colonel a. D. Douglas Pitcairn (General Staff); Ingenieur R. Lusar, "Die Sowjetunion auf dem Wege zur Luftmacht" (The Soviet Union on the Road to Air Power), Militaerpolitisches Forum, Vol. 12 (Munich, 1953); Helm Speidel (General der Flieger a. D. Wilhelm Speidel), "Reichswehr und Rote Armee" /Reichswehr and the Red Army/, (hereinafter cited as RRA), Vierteljahresheite fuer Zeitgeschichte, Vol. 1 (Stuttgart, 1953); Asher Lee, The Soviet Air Force, Duckworth (London, 1952) (hereinafter cited as Lee). Unless otherwise noted, documents cited in this study are to be found in G/VI/1 through G/VI/9 (consisting of 29 German loose-leaf notebooks), Karlsruhe Document Collection, Archives Branch, USAF Historical Division, Maxwell Air Force Base, Alabama.

2. RRA.

3. Thomsen. General Thomsen spent three years at the Junkers plant in Fili, from 1924-27. His account is a valuable source of information on the early collaboration between German and Russian aircraft engineers.

4. Pitcairn.

5. This section is based on: Contributions by Generalleutnant a. D. Heinrich Aschenbrenner (pre-war German military attache in Russia), Generalingenieur a. D. Kurt Breith, Colonel a. D. Kurt Gottschling, Colonel a. D. R. von Heimann, Pitcairn, and Colonel a. D. Lothar Schuettel; Orientierungsheft Union der Sozialistischen Sowjetrepubliken (UdSSR), Der Oberbefehlshaber der Luftwaffe, Fuehrungsstab Ic/IV No. 3500/41 geh. (German intelligence digest on Soviet Russia, 1941, hereinafter cited as OUSS); OKL, Gedanken zur Beurteilung der Luftlage von 1939 (Luftwaffe High Command, Thoughts on an Appraisal of the Air Situation, 1939, hereinafter cited as GBL); Russische Luftwaffe 1941, a study of 8. Abteilung, Generalstab der Luftwaffe (Russian Air Force 1941, hereinafter cited as RL 41);

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"Ausbildungswesen" SU-Fliegertruppe, Luftwaffenfuehrungsstab, Ic/Fremde Luftwaffen Ost, No. 3000/44 geh. (A Luftwaffe intelligence bulletin on training in the Russian Air Force); Beurteilung der Nachrichtenquellen aus Sowjetrussland and Das russische Kriegspotential, F. Greffrath (appraisal of intelligence sources in Russia and the Russian war potential, both compiled by Lieutenant Colonel a. D. Greffrath from Luftwaffe High Command documents, hereinafter cited respectively as BNS and DRK); Beurteilung der sowjetrussichen Luftwaffe in 1941, Plocher (appraisal of the Russian Air Force in 1941 by Generalleutnant a. D. Hermann Plocher, hereinafter cited as BSL); "Die Luftgeltung der Sowjetunion" and "Die Luftwaffe der Sowjetunion," Handbuch der neuzeitlichen Wehrwissenschaften 1938, n. p., n. pub. (Russian air power and the Russian air force, hereinafter cited as HNWLS and HNWLW respectively); Annex F, Command and Employment of Air Forces, World War II and Korea, Air War College, Air University (Maxwell AFB, 1952); Georg W. Feuchter, Geschichte des Luftkrieges /"History of Air Warfare"/, Athenaeum Verlag (Bonn, 1954), (hereinafter cited as Feuchter); Adolf Galland, Die Ersten und die Letzten /Available in an abridged English edition, The First and the Last, Henry Holt & Co. (New York, 1954). Most of the English editions referred to in these notes are shorter than the cited, original German editions./, Schneekluth (Darmstadt, 1953), (hereinafter cited as Galland); R. L. Garthoff, Soviet Military Doctrine, The Rand Corporation (Santa Monica, 1953), (hereinafter cited as Garthoff); Lee; Trial of the Major War Criminals before the International Military Tribunal, (Nuremberg, Germany, 1947) hereinafter cited as IMT.

6. BNS; BSL, p. 4.

7. OUSS, pp. 71, 73-74, 81-82.

8. Ibid., p. 73.

9. RL 41.

10. 1938, n. p., n. pub.

11. Gottschling, p. 11.

12. Feuchter, p. 195.

13. OUSS, p. 64.

14. BSL, p. 21.

15. Lee, pp. 56-68.

16. OUSS, pp. 75-81.

17. GBL.

18. Breith and Heimann.

19. This section is based on OUSS.

20. OUSS.

21. This section is based on: Heimann and Schuettel; RL 41; OUSS; "Luftlandetruppen," SU Fliegertruppe, Luftwaffen-fuehrungsstab, Ic/Fremde Luftwaffen Ost, No. 39896/43 geh. (a Luftwaffe intelligence publication on Russian airborne troops, hereinafter cited as SUFL); Garthoff; Alkmar von Hove, Achtung Fallschirmjaeger ["Attention! Paratroopers"], Druffel Verlag (Leoni am Starnberger See, 1954); Lee.

22. SUFL, p. 9.

23. Ibid., p. 11.

24. OUSS, pp. 53-55.

25. This section is based on: Heimann, Schuettel and Thomsen; OUSS; BSL; Lee; HNWLS and HNWLW.

26. OUSS, pp. 106-9.

27. HNWLS, pp. 1-5.

28. Schuettel, pp. 14-15.

29. Ibid., p. 15.

30. Aschenbrenner.

31. Ibid.

32. Ibid.

33. IMT, Vol. IX, pp. 81-82.

34. Schuettel, p. 15; Aschenbrenner in a letter to the author (n. d.).

35. This section is based on: OUSS; GBL; BNS and DRK.

36. OUSS, pp. 104-06, 109-18.

37. BNS, pp. 7-8.

38. This section is based on: OUSS; BSL; HNWLS.

39. OUSS, pp. 118-27.

40. Ibid., pp. 84-87.

41. HNWLS, pp. 3-4.

42. This section is based on: Contributions by Colonel a. D. Freiherr (Baron) Hans-Henning von Beust (General Staff), and Pitcairn; Galland.

43. v. Beust, pp. 9-10.

44. OUSS, p. 82.

Chapter 2

1. This section is based on: Contributions by Colonel a. D. Freiherr Hans-Henning von Beust, Major a. D. Arnulf Blasig, Major a. D. Manfred von Cossart, Colonel a. D. Heinz-Joachim Jaehne, Captain a. D. Otto Kath, Lieutenant Colonel a. D. Helmut Mahlke (General Staff), Generalmajor a. D. Fritz Morzik, Captain a. D. Herbert Pabst (deceased), Generalmajor a. D. Horst Parrisius, Major a. D. Guenther Rall, Captain a. D. Volker Reschke, Lieutenant Colonel a. D. Horst von Riesen (General Staff), Major a. D. Hans-Egon Schlage, Major a. D. Egon Stoll-Berberich, General der Flieger a. D. Paul Deichmann; Generalleutnant a. D. Hermann

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Plocher, Erfolge deutscher Jagd-und Zerstoererverbaende gegen die russische Luftwaffe im Nordabschnitt der Ostfront bei Kriegsbeginn (German single and twin-engine fighter successes in the northern sector of the Russian front at the beginning of the war, hereinafter cited as JZGNOK); Generaloberst a. D. Hans Juergen Stumpff, Gedanken zum Kampf der deutschen Luftwaffe im Gebiet noerdlich des Polarkreises (Thoughts on Luftwaffe operations north of the Arctic Circle, hereinafter cited as GKLGP); Generalmajor a. D. Klaus Uebe, Der taktische Einsatz der russischen Luftwaffe zur Unterstuetzung des Heeres (The employment of the Russian Air Force in ground-support missions, hereinafter cited as ELUH); Kapitaen zur See a. D. Wilhelm Moessel, Einsatz der russischen Luftwaffe ueber See. Lehren und Folgerungen (Over-water employment of the Russian Air Force. Lessons and Conclusions, hereinafter cited as ERLUS); Vizeadmiral L. Buerkner, Sowjetische Seefliegeroperationen im 2. Weltkrieg einschliesslich Heeresfliegeroperationen zur Unterstuetzung von Marineunternehmungen (Russian Navy and Army air force operations in World War II in support of Russian naval operations, hereinafter cited as SSHUM); Auszug aus den Aussagen des Reichsmarschalls Hermann Goering vor den Alliierten am 1. Juni 1945 (Extract from Goering's interrogation by the Allies, 1 June 1945); Dr. K. Bartz, Als der Himmel brannte /Available in translation under the title, Swastika in the Air, W. Kimber (London, 1956)/, Sponholtz (Hannover, 1955), (hereinafter cited as Bartz); G. W. Feuchter, Geschichte des Luftkrieges /"History of Air Warfare"/, Athenaeum Verlag (Bonn, 1945), (hereinafter cited as Feuchter); Adolf Galland, Die Ersten und die Letzten /English edition bears the title, The First and the Last, Henry Holt & Co. (New York, 1954)/, Schneekluth (Darmstadt, 1953), (hereinafter cited as Galland); H. Knoke, Die grosse Jagd /Available in translation under the title, I Flew for the Fuerhrer, Henry Holt & Co. (New York, 1954)/, Boesendahl (Rinteln, 1952), (hereinafter cited as Knoke); Hans-Ulrich Rudel, Trotzdem /Published in English under the title, Stuka Pilot, Euphorion Books (Dublin, 1952)/, Duerer Verlag (Buenos Aires, 1949), (hereinafter cited as Rudel); Heinz Guderian, Erinnerungen eines Soldaten /In English published as Panzer Leader, Dutton (New York, 1952)/, (Heidelberg,

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1951); Erich von Manstein, Verlorene Siege /An abbreviated translation bears the title, Lost Victories, Henry Regnery (Chicago, 1958)/, Athenaeum Verlag (Bonn, 1955), (hereinafter cited as v. Manstein); Albert Kesselring, Soldat bis zum letzten Tag /In translation this appears as, A Soldier's Record, Morrow (New York, 1954)/, Athenaeum Verlag (Bonn, 1953); H. S. Koch, Flak, die Geschichte der deutschen Flakartillerie 1935-1945 /Flak, the History of German Antiaircraft Artillery"/, Verlag Hans-Henning Podzun (Bad Nauheim, 1954).

2. Orientierungsheft Union der Sozialistischen Sowjetrepubliken (UdSSR), der Oberbefehlshaber der Luftwaffe, Fuehrungsstab Ic/IV No. 3500/41 geh. (German intelligence digest on Soviet Russia, 1941).

3. Rall, p. 10.

4. v. Cossart, pp. 1-2.

5. Kath.

6. v. Cossart, pp. 8-9.

7. v. Riesen, II, pp. 1-5.

8. Pabst diary, p. 6.

9. Generalleutnant a. D. Hermann Plocher, Der Kampf um die Luftueberlegenheit bei Beginn des Russlandfeldzuges im Bereich der Luftflotte 1 (Battle for air superiority in the First Air Fleet area at the beginning of the Russian campaign), pp. 2-3.

10. Mahlke, p. 1.

11. ELUH, I.

12. v. Beust, pp. 11, 13-14.

13. v. Heimann, pp. 3-5.

14. Vernehmung des sowjetischen Fliegeroberst en Wanjuschkin (Interrogation of the Russian Air Force Colonel Vanyuschkin, hereinafter referred to as VSFW), pp. 9-10.

15. Jaehne, p. 2.

16. Bartz.

17. Rudel, pp. 37, 46-47.

18. v. Cossart, pp. 3, 7-8.

19. Rudel, p. 35.

20. Pabst diary, pp. 11, 20, 23, 27, 32-33.

21. v. Riesen, II, pp. 1-5.

22. Huffmann (compilation of Army officers' contributions), I, pp. 4-7, (hereinafter cited as Huffmann (compilation)).

23. Ibid., p. 20.

24. v. Manstein, pp. 225-26.

25. Huffmann (compilation), I, pp. 21-36.

26. Ibid., pp. 30-31.

27. Ibid., pp. 6, 34.

28. ERLUS.

29. SSHUM.

30. Rall, pp. 1-2.

31. Stoll-Berberich, pp. 1-3.

32. v. Cossart, pp. 4-5.

33. v. Beust, pp. 12-13.

34. Morzik, p. 1.

35. v. Heimann, pp. 3, 7; Jaehne, p. 2; Galland, p. 163.

36. v. Heimann, p. 3.

37. Reschke, p. 6.

38. ELUH, I., pp. 9-15.

39. Huffmann (compilation), I, pp. 4-6, 11-14, 20-36.

40. Jaehne, pp. 2-3.

41. The smallness of this number illustrates the effectiveness of the first German attacks on the Soviet air force.

42. v. Heimann, pp. 3, 8.

43. Galland, p. 130.

44. VSFW, pp. 2, 8.

45. Feuchter, p. 195.

46. v. Beust, p. 13.

47. Blasig, p. 1; Morzik, p. 1; Reschke, p. 3; Stoll-Berberich, p. 1; Jaehne, p. 4; Galland, p. 130.

48. Kath, pp. 4, 6.

49. ELUH, I, p. 2.

50. VSFW, p. 3.

51. This section is based on: Contributions by v. Beust, Generalleutnant a. D. Bruno Frankewitz, v. Heimann, Huffmann, Jaehne, Kath, Reschke, Lieutenant Colonel a. D. Fritz Wolff; ELUH; Generalmajor a. D. Klaus Uebe, Reaktionen und Haltung (Benehmen) der russichen Flugzeugbesatzungen im Gefecht (a questionnaire on the combat reactions and behavior of Russian air crews, dated 1 Feb 1950, hereinafter cited as RHRFG); ERLUS.

52. v. Beust, p. 16.

53. v. Heimann, p. 10.

54. Jaehne, pp. 7, 9.

55. RHRFG, p. 5.

56. v. Beust, p. 15.

57. Jaehne, p. 7.

58. Jaehne, p. 7; ELUH, II, p. 1; v. Heimann, p. 10.

59. Reschke, p. 1.

60. ELUH, II, pp. 1-2.

61. Huffmann (compilation), I, pp. 7-8.

62. Ibid., p. 24; Huffmann (contribution), pp. 1-2.

63. Frankewitz, pp. 2-3, 6.

64. ERLUS, pp. 5-6, 9, 14.

65. Jaehne, pp. 7-8.

66. This section is based on: Contributions by v. Beust, Blasig, v. Cossart, Frankewitz, v. Heimann, Huffmann, Jaehne, Kath, Morzik, Pabst, Parrisius, Rall, Reschke, v. Riesen, Schlage, Thomsen, Wolff; Major a. D. Joachim Joedicke, in a letter to the author; ELUH; RHRFG; Bemerkungen fuer den Einsatz der Luftwaffe Nr. 20, Luftwaffenfuehrungsstab, General von Waldau, 20. 1. 1942 (Bulletin no. 20 on air force commitment, hereinafter cited as BEL); Einsatzerfahrungen im Osten (Russland) Winter 1941/42, Kriegstagebuch des Jagdgeschwaders 54 (Combat experience in Russia, winter of 1941-42, an extract from the war diary of 54th Fighter Wing, hereinafter cited as EOW); GKLGP; Auszug aus Ausarbeitung des Generalmajors a. D. Walter Grabmann, 15. 6. 1953 (extract from a draft by General Grabmann, 15 June 1953, hereinafter cited as AAG); Major a. D. Arnulf Blasig, Die Luftschlacht ueber Kirkenes am 1. 8. 1941 (the air battle over Kirkenes, 1 Aug 1941, hereinafter cited as LUK); Taktische Erfahrungen im Kampf gegen russische Jaeger (tactical experiences from combat with Russian fighters,

66. (cont'd)
hereinafter cited as TEKRJ); UdSSR-Ausbringungs- und Einfuhrprogramm 1941 und 1942 fuer Jagdflugzeuge, in Anlage zu OKL Ic/Fr. Lw. Ost 1403/45 g. Kdos. und Der Chef des Generalstabes der Luftwaffe vom 8. 7. 1945 (Russian production and import program for fighters, 1941 and 1942, hereinafter cited as RAE); Knoke; Rudel.

67. For example, v. Beust, p. 17; RHRFG, pp. 1-3.

68. Jaehne, p. 10.

69. Morzig, p. 3.

70. RAE.

71. v. Beust, p. 17.

72. Blasig, p. 1.

73. Morzig, p. 1; v. Riesen, p. 1; ELUH, p. 8; EOW, p. 3.

74. v. Cossart, p. 4; GKLGP, p. 3.

75. RHRFG, pp. 1-2.

76. v. Cossart, pp. 4-5.

77. Reschke, p. 3.

78. Rall, pp. 1-2.

79. EOW, pp. 2-5.

80. TEKRJ, I, pp. 1-10.

81. Rall, pp. 2-6.

82. ELUH, I, p. 8.

83. v. Beust, p. 18; Kath, p. 5; Blasig, p. 2; Reschke, pp. 2-3; ELUH, I, p. 8; ELUH, III, pp. 2-4.

84. v. Cossart, pp. 3-9.

85. v. Beust, pp. 18-20.

86. v. Riesen, pp. 1-3.

87. Joedicke letter, pp. 1-3.

88. Rall, pp. 2-3, 6.

89. TEKRJ, I, pp. 4, 16-17; Morzik, p. 1.

90. BEL, pp. 16-17.

91. Pabst diary, pp. 8-11, 13, 33.

92. LUK, pp. 2-4; Blasig, pp. 1-2.

93. TEKRJ, I, p. 18.

94. Rall, p. 4.

95. Schlage, pp. 1-2.

96. Jaehne, p. 11.

97. Reschke, p. 2.

98. v. Beust, p. 19.

99. Jaehne, p. 11.

100. v. Cossart, p. 10.

101. ELUH, I, p. 8; III, p. 5.

102. EOW, p. 4.

103. Reschke, p. 2.

104. Rall, pp. 7-8.

105. Wolff, p. 2.

106. Frankewitz, pp. 3-4.

107. Huffmann (contribution), pp. 8-9, 22, 24, 29 ff.

108. Jaehne, p. 11.

109. Rall, p. 7; Blasig, p. 2.

110. TEKRJ, I, pp. 8-9.

111. v. Beust, p. 19.

112. Rall, p. 7.

113. TEKRJ, I, pp. 4-5.

114. Kath, p. 8.

115. Rall, p. 8.

116. Reschke, p. 2; Jaehne, p. 11.

117. Thomsen, p. 6.

118. TEKRJ, I, pp. 3-4.

119. Kath, p. 5.

120. Rall, p. 4; Reschke, p. 2; Jaehne, p. 11.

121. TEKRJ, pp. 5-6.

122. Rall, p. 8.

123. Jaehne, p. 11.

124. v. Heimann, p. 12.

125. Blasig, pp. 1, 4; EOW, p. 4.

126. TEKRJ, II, pp. 6-7.

127. ELUH, III, pp. 4-5; v. Heimann, p. 12; Reschke, p. 2; Rall, p. 9; Jaehne, p. 11; GKLGP, p. 3.

128. EOW, p. 5.

129. BEL, pp. 20, 22-24.

130. v. Beust, p. 20.

131. This section is based on: Contributions by v. Beust, Frankewitz, v. Heimann, Huffmann, Jaehne, Pabst, Reschke, v. Riesen, Stoll-Berberich, Thomsen, Wolff; ELUH; RHRFG; General der Flakartillerie Wolfgang Pickert and General der Flakartillerie a. D. von Axthelm (in supplements to ELUH), (hereinafter cited as: ELUH (Pickert supplement) and ELUH (v. Axthelm supplement)); EOW; General der Infanterie a. D. Hans von Greiffenberg, Taktik russischer Tiefflieger bei Bekaempfung von Erdzielen (tactics of Russian ground-attack aircraft, hereinafter cited as TRTBE); Rudel; v. Manstein.

132. v. Beust, p. 21.

133. v. Heimann, p. 13.

134. Jaehne, p. 13.

135. ELUH, II, p. 2.

136. Reschke, p. 4; Pabst diary, p. 18; Jaehne, p. 13; Stoll-Berberich, p. 4.

137. RHRFG, pp. 3-4; ELUH, I, p. 8.

138. Stoll-Berberich, pp. 2-3, 5.

139. Frankewitz, p. 7.

140. Huffmann (contribution), pp. 9-10, 13.

141. ELUH (Pickert supplement), p. 1.

142. Jaehne, p. 13.

143. Huffmann (contribution), p. 10.

144. ELUH, I, p. 9; ELUH, II, pp. 3, 6; RHRFG, pp. 3-4.

145. TRTBE, p. 3.

146. EOW, p. 4.

147. Reschke, p. 4.

148. Stoll-Berberich, pp. 3-4.

149. Pabst diary, pp. 17-18.

150. Frankewitz, p. 3.

151. Wolff, p. 3.

152. Huffmann (contribution), pp. 4, 9-13, 24, 30, 33-34.

153. TRTBE, pp. 1-3.

154. ELUH (v. Axthelm supplement), p. 6.

155. ELUH, II, p. 4.

156. Stoll-Berberich, p. 2.

157. Reschke, p. 4.

158. Stoll-Berberich, pp. 3-4.

159. Pabst diary, pp. 27-28.

160. Thomsen, p. 7.

161. Rudel, p. 20.

162. Jaehne, p. 13.

163. Huffmann (contribution), pp. 9-10.

164. Jaehne, p. 13.

165. Huffmann (contribution), pp. 9-10.

166. Reschke, pp. 4-5.

167. Huffmann (contribution), p. 11.

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168. ELUH, II, p. 6.

169. See above, pp. 101-02.

170. Jaehne, p. 14.

171. ELUH (Pickert supplement), p. 1.

172. TRTBE, p. 2.

173. EOW, p. 7.

174. Stoll-Berberich, p. 1.

175. Jaehne, p. 14.

176. This section is based on: Contributions by v. Beust, Blàsig, v. Cossart, Frankewitz, v. Heimann, Huffmann, Jaehne, Kath, Mahlke, Morzig, Pabst, Reschke, v. Riesen, Thomsen, Wolf; ELUH; RHRFG; ELUH (Pickert supplement); ELUH (v. Axthelm supplement); EOW, I and II; JZGNOK; ERLUS; Rudel; VSFW.

177. Huffmann (contribution), pp. 14-19.

178. v. Heimann, p. 14; Jaehne, p. 15; EOW, p. 16; Rudel, p. 20.

179. v. Beust, p. 23.

180. v. Beust, p. 24; Reschke, p. 8.

181. v. Heimann, p. 16.

182. v. Beust, p. 23.

183. Reschke, p. 8; Kath, pp. 1-3; Huffmann, p. 4; TEKRJ, I, pp. 11-12.

184. RHRFG, pp. 4-5.

185. Reschke, pp. 6, 8.

186. Pabst, p. 24, v. Beust, p. 25; v. Cossart, p. 12.

187. Mahlke, pp. 3-4.

188. Jaehne, p. 15.

189. v. Riesen, p. 3; v. Beust, II, p. 2.

190. Reschke, pp. 7-8.

191. Huffmann (contribution), pp. 17, 19.

192. Kath, p. 2.

193. Pabst, pp. 2-3, 17.

194. v. Heimann, pp. 13-14.

195. Kath, pp. 1-4; Thomsen, p. 8; v. Riesen, p. 3; Blasig, p. 3; v. Cossart, pp. 11-12.

196. EOW, p. 6; TEKRJ, I, pp. 11-12, 15.

197. ELUH, II, pp. 11-12.

198. ERLUS, p. 19.

199. v. Beust, pp. 23-25.

200. Frankewitz, pp. 6-7.

201. Wolff, pp. 4-5, 9

202. Huffmann (contribution), pp. 14-19, 24-25, 30, 36.

203. v. Manstein, pp. 225-26.

204. v. Heimann, p. 13; Reschke, p. 6; Pabst diary, pp. 2-3.

205. ELUH, II, p. 11.

206. ERLUS, pp. 7-8, 11, 16.

207. v. Beust, p. 25; v. Heimann, p. 13.

208. Kath, pp. 1-2; JZGNOK, p. 1.

209. Pabst diary, pp. 17-18, 21-27.

210. v. Riesen, p. 3.

211. v. Cossart, pp. 11-12.

212. Thomsen, pp. 8-9.

213. ELUH (v. Axthelm supplement), pp. 2-3, 5.

214. v. Heimann, p. 14; Morzig, p. 1; Mahlke, pp. 5-8; ELUH, III, pp. 8-9; ELUH (Pickert supplement), p. 1; Rudel, pp. 20-21.

215. Huffmann (contribution), pp. 4, 14, 19.

216. ERLUS, p. 20.

217. Reschke, p. 7.

218. Pabst diary, p. 34.

219. Thomsen, p. 9.

220. v. Beust, pp. 22, 25-26.

221. Huffmann (contribution), p. 18.

222. TEKRJ, I, p. 11.

223. ELUH, II, pp. 12-13; EOW, p. 6.

224. v. Heimann, p. 14; Reschke, p. 8; v. Beust, p. 23.

225. v. Heimann, p. 14; Reschke, p. 7; Kath, p. 5; Jaehne, p. 15; v. Beust, p. 23; TEKRJ, II, pp. 11-12; EOW, p. 6.

226. RHRFG, p. 5.

227. This section is based on: Contributions by Blasig, v. Heimann, Huffmann, Mahlke, Reschke and Thomsen.

228. Thomsen, p. 11.

229. v. Heimann, p. 16; Reschke, p. 9.

230. Blasig, p. 3.

231. Mahlke, pp. 9-16.

232. This section is based on: Generalingenieur a. D. Kurt Breith, Major a. D. Bruno Meyer, Parrisius, v. Heimann, Huffmann, Jaehne, Kath, Pabst, Reschke, Thomsen; GKLGP; ELUH.

233. Breith and Parrisius in letters to the author; v. Heimann, p. 5; Kath, p. 3; Pabst diary, p. 6; Huffmann, p. 3.

234. Kath, p. 3.

235. v. Heimann, p. 15; Jaehne, p. 16.

236. v. Heimann, pp. 14-15; Thomsen, p. 12; Reschke, p. 9; Breith, p. 1; Pabst diary, pp. 13, 16; Parrisius, p. 1; Meyer, p. 3; GKLGP, p. 2.

237. Breith, p. 2; ELUH, II, p. 12; Jaehne, p. 6; Thomsen, p. 14; Parrisius, p. 1; GKLGP, p. 3.

238. Breith, p. 2; Jaehne, pp. 5, 9; Thomsen, p. 15; Parrisius, p. 1; v. Heimann, p. 4.

239. This section is based on: Contributions by Colonel a. D. Kurt Gottschling, Huffmann, Jaehne, v. Riesen, Stoll-Berberich.

240. Huffmann (contribution), p. 20; Gottschling, pp. 8-9, 15; Jaehne, p. 4; v. Riesen, pp. 1-3, 5; Stoll-Berberich, p. 4.

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Chapter 3

1. Contributions by: Colonel a. D. Freiherr Hans-Henning von Beust (General Staff), pp. 27-33; Major a. D. Richard Brunner, pp. 4-6; Major a. D. Manfred von Cossart, pp. 13-18; Major a. D. Heinz-Joachim Jaehne, pp. 18-22; Captain a. D. Otto Kath, pp. 7-11; Major a. D. Bruno Meyer, pp. 3-9; Lieutenant Colonel a. D. Horst von Riesen (General Staff), Part I, pp. 4-6, Part II, pp. 7-12; Major a. D. Hans-Egon Schlage, pp. 8-13; Major a. D. Egon Stoll-Berberich, pp. 6-7; Captain a. D. Dr. Karl-Heinz Wilke, pp. 2-7; General der Flieger a. D. Paul Deichmann.

Also: Captain Herbert Pabst (deceased), Pabst Diary, pp. 45, 59, 67, 75, 80; Generalmajor a. D. Klaus Uebe, Der taktische Einsatz der russichen Luftwaffe zur Unterstuetzung des Heeres (The employment of the Russian Air Force in ground-support missions, hereinafter cited as ELUH); Generaloberst a. D. Hans Juergen Stumpf, Gedanken zum Kampf der deutschen Luftwaffe im Gebiet noerdlich des Polarkreises (Thoughts on Luftwaffe operations north of the Arctic Circle, hereinafter cited as GKLGP); Russische Luftwaffe Ende 1943 (Russian Air Force, end of 1943), in Wochenbericht Nr. 6 der Presseabteilung der Kriegswissenschaftlichen Abteilung der Luftwaffe vom 31. 10. 1943, ObdL, Luftwaffenfuehrungsstab Ic, p. 1; Generalleutnant a. D. Herbert J. Rieckhoff, "Geheimnisse um die Luftwaffe der Sowjetunion" /"Secrets surrounding the Soviet air force"/, in Flugwehr und- Technik (Arme et Technique de l'Air), Huber & Co., Frauenfeld, Switzerland, No. 8, Aug. 1948, (hereinafter cited as Rieckhoff), pp. 182-85; K. W. Streit, "Der Flug aus der Hoelle" /"Flight from Hell"/ in Der Frontsoldat erzaehlt, 17 Jahrgang, Nos. 4, 5, 6 (1953), n. place, n. pub., (hereinafter cited as Streit), pp. 140-42.

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9. Contribution by Generalleutnant a. D. Helmuth Huffmann, Part II, pp. 2-5, 27-29, 42-44, 49.

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Chapter 4

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3. Reschke, pp. 1-2, 18-23.

4. Jaehne, pp. 28-29, 32.

5. Huffmann, III, pp. 4-6, 12-17, 24-27, 30-32; Frankewitz, p. 19; Tippelskirch, pp. 429, 613.

6. Feyerabend, p. 9.

7. SSHUM, pp. 2, 5-7; ERLUS, pp. 6-7, 10-17, 21-23; BKSUF, p. 3; FLO, No. 28, pp. 1, 6.

8. Brunner, p. 13; Schlage (Annex), pp. 8-13; Rudel, p. 169; LVKR, p. 2; BSNO, pp. 4-5.

9. Pitcairn, p. 8; Schlage, pp. 44-45; Wilke, p. 19; Rieckhoff, p. 184; RLKF, pp. 2-3; LLBO, 1 Oct 1944, p. 3.

10. Hoffmann, I, p. 4; FLO, No. 11, p. 13.

11. Schlage, p. 42; Hoffmann, I, p. 4; LLBO, 1 Jan 1944, p. 3; RLFOO, p. 1; SUFFF.

12. Schlage, pp. 46-47; Wilke, pp. 10, 30; LLBO, 1 Oct 1944, pp. 4-9; ARF, 25 April 1945.

13. Reschke, pp. 2-3, 8-9; Schlage, pp. 48-49; Wilke, pp. 31, 33, 39-41; Lusar, p. 32; RLFOO, p. 2; SUFFF; SUFV, p. 3.

14. Reschke, p. 25.

15. This section is based on: Contributions by Huffmann, Jaehne, Reschke, Schlage, Wilke; ERLUS, ELUH, FLO, Nos. 11, 22, 28, 38; Aufklaerungstaetigkeit der SU-Fliegertruppe im Monat September 1944 (Skizze), (Russian air reconnaissance activities in Sept 1944 (sketch), hereinafter cited as ASUF); "Verbaende im Fronteinsatz" in SU Fliegertruppe, Stand Mitte September 1944 (Russian Air Force units committed at the Front, mid-September 1944, hereinafter cited as VFE); LLBO, 1 Jan 1944 - 1 Feb 1945.

16. Jaehne, p. 29; Reschke, p. 3; Schlage, pp. 54-55; Wilke, pp. 23-24; FLO, No. 22 (I) pp. 3-5, No. 38, pp. 3, 23-24; ASUF; LLBO, 1 July 1944, pp. 1, 3, 1 Sept 1944, p. 1, 1 Oct 1944, p. 2, 1 Nov 1944, pp. 2, 7, 1 Jan 1945, p. 1.

17. Schlage, pp. 54-55; FLO, No. 38, pp. 6, 26.

18. FLO, No. 22 (I), pp. 6-11, No. 38, pp. 4-5; VFE, pp. 126-28.

19. Reschke, p. 3; Schlage, pp. 50-54; Wilke, pp. 20, 23; FLO, No. 38, pp. 6-13, 18-22.

20. Reschke, p. 10; FLO, No. 38, pp. 3, 17; LLBO, 1 Sept 1944, p. 1, 1 Oct 1944, p. 2, 1 Nov 1944, p. 2.

21. Reschke, pp. 11, 21, 23; Wilke, pp. 20-22; ELUH, II, pp. 1-2; FLO, No. 11, I, pp. 1-5, No. 38, pp. 3, 13-17, 22-25; LLBO, 1 July 1944, p. 1, 1 Sept 44, p. 1, 1 Jan 45, p. 1.

22. Reschke, p. 21.

23. Wilke, p. 22.

24. FLO, No. 38, p. 22.

25. Huffmann, III, pp. 40-42.

26. ERLUS, pp. 5-6, 14-15, 18; FLO, No. 28, pp. 4, 6-7, 16.

27. Schlage, pp. 52-54; Wilke, p. 23; FLO, No. 11, I, pp. 3-4; FLO, No. 22, I, pp. 11-16, No. 38, pp. 3-4, No. 28, pp. 6-7.

28. This section is based on: Contributions by Major a. D. A. Blasig; Brunner, Huffmann, Jaehne, Kath, Major a. D. B. von Maubeuge, Pitcairn, Reschke, v. Riesen, Schlage, Wilke; ELUH; BSNO; Die russische Luftwaffe, Auszug aus einer Arbeit der 8. Abteilung der Luftwaffe vom 15. 1. 45 (extract from a study of Branch 8 of the Luftwaffe General Staff on the Russian Air Force, 15 Jan 1945, hereinafter cited as DRL); FLO, Nos. 10, 11 (II), 16, 25 (I), 28 (I), 38; VFE; Kampffuehrung der Fernkampffliegertruppe, OKL, Ic, Fremde Luftwaffen Ost, 18 Feb 1945 (Luftwaffe High Command Intelligence report on combat command of long-range bomber forces, hereinafter cited as KFFT); SU-Fliegerausbildung

28. (cont'd)
(Russian air training, hereinafter cited as SUF); Ausbildung der Jagdflieger (fighter-pilot training, hereinafter cited as AJ); BKSUF; Jaegereinsatz im Osten, 8 Jan 1945, Luftflottenkommando 6 (fighter commitment in the East, a report of Sixth Air Fleet, hereinafter cited as JIO); LLBO, 1 Jan 1945 and 1 Feb 1945; Rudel; Bericht eines Staffelfuehrers ueber Luftkaempfe am 11 Feb 1945 in Ostpreussen, in Jaegerblatt, Nos. 7 & 8, n. place, n. pub. (report of a squadron leader on dog fights on 11 Feb 1945 in East Prussia, hereinafter cited as BSFL).

29. Brunner, pp. 11, 14, 17; Jaehne, p. 29; Pitcairn, pp. 6, 8; Reschke, pp. 4-6; v. Riesen, I, p. 6; Wilke, p. 33; ELUH, III, p. 1; BSNO, pp. 1-2; FLO, No. 25, I, pp. 3-4, 15.

30. Wilke, p. 33.

31. Reschke, pp. 14-17.

32. Schlage, pp. 56, 58, 64-68.

33. JIO, pp. 3-4, 8.

34. Huffmann, p. 43.

35. Schlage, p. 57; FLO, No. 25, I, pp. 5-14; VFE, pp. 12-27, 66-90; LLBO, 1 March 1944, p. 10, 1 April 1944, Annex: Flugzeugbestand (aircraft strength), 1 Sept 1944, pp. 9-10, 1 Jan 1945, p. 7.

36. FLO, No. 10, pp. 2-4.

37. Brunner, p. 12; Blasig, pp. 3-4; Rudel, p. 126; Huffmann, III, pp. 26, 42.

38. Pitcairn, p. 8; Schlage, pp. 56, 62, 64, 66; BSNO, pp. 2-3; BKSUF, p. 1.

39. Jaehne, p. 29; Kath, p. 12; Pitcairn, pp. 5-6; Reschke, pp. 4-5; Schlage, pp. 56, 66; Wilke, pp. 17-18, 31; ELUH, III, p. 7; FLO, No. 25, I, pp. 5-6.

40. Blasig, p. 3; Pitcairn, p. 6; Reschke, pp. 5, 15; Schlage, pp. 59, 65.

41. ELUH, III, pp. 1-4.

42. Blasig, p. 2; Huffmann, III, p. 26; Jaehne, p. 29; Pitcairn, p. 6; Reschke, pp. 4, 18; Schlage, p. 67; ELUH, I, p. 8; BKSUF, p. 2.

43. Kath, p. 13.

44. BSFL, pp. 1-2.

45. Brunner, pp. 11-12; v. Riesen, I, p. 7; LLBO, 1 April 1944, pp. 3-4, 8.

46. v. Riesen, I, p. 8.

47. Reschke, p. 4; BSNO, pp. 2-3.

48. Rudel, pp. 114, 127, 149-50, 115-59, 169, 185, 190, 193-95, 250-51.

49. Reschke, pp. 4, 11-15, 17; Schlage, pp. 56, 58-62, 67; Wilke, pp. 17-18, 30-33; BKSUF, p. 1; LLBO, 1 Mar 1944, p. 3, 1 July 1944, p. 1, 1 Oct 1944, p. 2, 1 Nov 1944, p. 2.

50. v. Reschke, p. 13.

51. Ibid., pp. 20-21.

52. Brunner, pp. 12-13.

53. Ibid., pp. 14-16.

54. v. Maubeuge, p. 1; v. Riesen, I, p. 7; FLO, No. 16, pp. 1-3; FLO, No. 10, p. 5, KFFT, pp. 5-6; LLBO, 1 April 1944, p. 5, 1 May 1944, p. 3, 1 June 1944, p. 3.

55. Huffmann, III, pp. 30, 43; Pitcairn, p. 7; Reschke, pp. 15-16, 22; Schlage, pp. 56-57, 63; ELUH, III, p. 4; FLO, No. 38, p. 7; LLBO, 1 March 1944, p. 5.

56. Huffmann, III, pp. 16, 26, 30, 43; Reschke, pp. 6, 16-17, 22; Schlage, p. 57; Wilke, p. 13; ELUH, III, pp. 5-6; LLBO, 1 April 1944, p. 9, 1 May 1944, pp. 3, 7, 1 June 1944, p. 3, 1 July 1944, p. 1, 1 Aug 1944, p. 1, 1 Sept 1944, p. 1, 1 Oct 1944, p. 2, 1 Nov 1944, pp. 7-8, 1 Dec 1944, p. 1, 1 Jan 1945, p. 1, 1 Feb 1945, p. 1.

57. FLO, No. 28, pp. 7-10.

58. Huffmann, III, p. 43; Schlage, pp. 57-58, 65; Rudel, p. 185.

59. Pitcairn, p. 8; Reschke, p. 14; Schlage, pp. 63-64, 66; ELUH, I, p. 3, III, pp. 4-5; BSNO, p. 4; DRL, p. 1; FLO, No. 10, p. 11; LLBO, 1 Feb 1944, p. 8, 1 Mar 1944, p. 10, 1 April 1944, pp. 12-13, 1 Nov 1944, pp. 7-8; BKSUF, p. 2.

60. This section is based on: Contributions by Blasig, Frankewitz, Huffmann, Jaehne, Pickert, Pitcairn, Reschke, v. Riesen, Schlage, Wilke; ELUH; General der Infanterie a. D. Hans von Greiffenberg, Taktik russischer Tiefflieger bei Bekaempfung von Erdzielen (tactics of Russian ground-attack aircraft, hereinafter cited as TRTBE); RLKF; Kampffuehrung der Schlachtflieger, OKL, Ic, Fremde Luftwaffen Ost, 19 Feb 1945 (Luftwaffe High Command Intelligence report on combat command of ground-attack aircraft, hereinafter cited as KSF); FLO, No. 11, V, No. 20, II, No. 28, I, No. 38; OKL, Fuehrungsstab Ic, SU Schlachtfliegertruppe, OKL No. 239 (Luftwaffe High Command Intelligence report No. 239, Russian ground-attack forces, hereinafter cited as SUSFT); VFE; BKSUF; LLBO, 1 Jan 1944 - 1 Feb 1945; Rudel.

61. Jaehne, p. 30; Pickert, p. 7; Pitcairn, p. 9; Reschke, pp. 7-8, 17-18, 23; v. Riesen, II, p. 14; Schlage, p. 69; Wilke, p. 38; RLKF, p. 4; LLBO, 1 March 1944, pp. 1, 5, 1 April 1944, pp. 3-4, 1 May 1944, p. 7, 1 June 1944, p. 2, 1 Sept 1944, p. 1, 1 Dec 1944, p. 1, 1 Jan 1945, p. 1.

62. Huffmann, pp. 27, 45, 49.

63. Schlage, p. 69; SUSFG, pp. 7-9; VFE, pp. 12-16, 28-32, 96-106; LLBO, 1 April 1944 (annex, Flugzeufbestand), 1 May 1944, p. 7, 1 Nov 1944, p. 8, 1 Jan 1945, p. 7.

64. Huffmann, p. 46; Reschke, p. 7; Schlage, pp. 71-72; ELUH, I, pp. 8-9; BKSUF, p. 2.

65. Reschke, pp. 7-8; Schlage, p. 71; ELUH, II, p. 4; RLKF, p. 4; KSF, pp. 2-4; SUSFT, pp. 21-23, 31.

66. Huffmann, III, pp. 14-25; Pitcairn, pp. 9-10; Reschke, pp. 7, 10; Wilke, pp. 36-37; ELUH, I, p. 9; ELUH, II, pp. 2-8; TRTBE, pp. 2-4; FLO, No. 20, II, pp. 1-2; KSF, pp. 3, 5.

67. Frankewitz, p. 16; Huffmann, III, pp. 5, 7-11, 16, 24-25, 29-30, 46; TRTBE, pp. 2-4.

68. Reschke, pp. 15, 21; Schlage, p. 70; Wilke, pp. 33-34; ELUH, II, p. 8; LLBO, 1 Sept 1944, p. 1; LLBO, 1 Nov 1944, pp. 7-8.

69. Konteradmiral a. D. Otto Schulz, in a letter to the author; FLO, No. 28, I, pp. 10-11.

70. Blasig, p. 4; Reschke, pp. 10, 16, 18-19; Schlage, p. 70; Wilke, pp. 35, 38-39; ELUH, II, p. 8; TRTBE, p. 4.

71. Huffmann, III, p. 47; Schlage, p. 70; Wilke, p. 35; KSF, p. 3; LLBO, 1 April 1944, p. 5.

72. Reschke, p. 23; Schlage, p. 70; Wilke, p. 36.

73. Huffmann, III, p. 17; Reschke, p. 22; Wilke, p. 38; ELUH, II, pp. 6-7; FLO, No. 38, pp. 22-25; KSF, p. 4.

74. Reschke, p. 8; Schlage, p. 71; FLO, No. 20, II, pp. 3-8; KSF, pp. 1-2; SUSFT, pp. 11-18; Ausruestung der IL-2 mit 3.7-cm Kanone (equipping the IL-2 with 3.7 cm canons, hereinafter cited as AIL-2), pp. 10-12.

75. This section is based on: Contributions by Blasig, Brunner, Major a. D. H. Franke, Frankewitz, Huffmann, Jaehne, Mahlke, Pickert, Pitcairn, Reschke, v. Riesen, Colonel a. D. H. Schalke (General Staff), Schlage, Schulz, Wilke, Deichmann; ELUH; ERLUS; SSHUM; Hoffmann; LVKR; VFE; BKSUF; KFFT; RLKF; Einsaetze der SU-Kampffliegertruppe im Monat September 1944 (Skizze), (commitment of Russian bomber forces, Sept 1944, (sketch) hereinafter cited as ESUKT);

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FLO, Nos. 16, 11, 28 (I, II, III); LLBO, 1 Jan 1944 - 1 Feb 1945; Ic Feindnachrichten No. 1, Auffrischungsstab Ost, 29 Feb 1944 (an Intelligence report on enemy information, Refitting Staff, East, hereinafter cited as FNAO); Rudel.

76. Brunner, p. 17; Jaehne, p. 30; Mahlke, pp. 3-4; Reschke, pp. 9, 12, 18, 21; Schlage, pp. 72-73; Wilke, pp. 18, 39-42; ELUH, II, p. 9; Hoffmann, III, p. 2; LVKR, p. 1; KFFT, pp. 1-2; FLO, 11, III, p. 6; RLKF, pp. 2-5; LLBO, 1 Jan 1944, p. 6, 1 Feb 1944, pp. 2, 5-6, 1 March 1944, pp. 1, 7, 1 April 1944, p. 3, 1 June 1944, p. 2, 1 July 1944, p. 1, 1 Aug 1944, p. 1, 1 Sept. 1944, p. 1, 1 Oct 1944, pp. 1-2, 1 Nov 1944, pp. 1-2, 5, 1 Dec 1944, p. 1, 1 Jan 1945, pp. 1-2, 5, 1 Feb 1945, p. 1.

77. Schlage, p. 73; Hoffmann, III, pp. 2-3; LVKR, p. 1; KFFT, p. 1; VFE, pp. 12-16, 33-39, 107-25; FNAO, pp. 203; LLBO, 1 March 1944, p. 10, 1 April 1944, p. 7 (Annex Flugzeugbestand), 1 May 1944, p. 5, 1 June 1944, p. 6, 1 Aug 1944, p. 6, 1 Sept 1944, p. 7, 1 Oct 1944, p. 7, 1 Nov 1944, p. 6, 1 Jan 1945, pp. 1, 7, 1 Feb 1945, p. 4.

78. Brunner, p. 19; SSHUM, p. 6; Mahlke, p. 4; Reschke, p. 20; Schlage, p. 47; BKSUF, p. 3; LLBO, 1 March 1944, p. 8.

79. Reschke, p. 9; ELUH, III, pp. 8-9; KFFT, p. 3; FLO, No. 16, pp. 1-2; LLBO, 1 Feb 1944, p. 7, 1 Oct 1944, p. 2.

80. Pitcairn, pp. 12-13; Reschke, pp. 9, 15, 17, 19; Wilke, p. 40; ELUH, II, pp. 9-12.

81. Franke, pp. 3-4; Huffmann, III, pp. 8-9, 12, 14-15, 25, 53-54; Reschke, p. 15; Konteradmiral a. D. Otto Schulz, in a letter to the author.

82. Schalke, p. 2; Schulz letter; ERLUS, pp. 7-8, 10-12, 16-17, 19; SSHUM, pp. 4, 6; FLO, No. 28, I, pp. 12-15, 18-23.

83. Brunner, p. 17; Jaehne, pp. 30-31; Pickert, pp. 7-8; Reschke, pp. 10, 12, 17-19; v. Riesen, II, pp. 13-14; Schlage, p. 47; Rudel, p. 202.

84. Brunner, p. 18; Pitcairn, pp. 10-11; Reschke, p. 7; ELUH, III, pp. 8-11; KFFT, pp. 3-4; LLBO: 1 April 1944, p. 4; 1 May 1944, p. 3.

85. Blasig, p. 4; Pickert, p. 7; Reschke, pp. 7, 10, 13, 21; Schlage, p. 73; Wilke, p. 41; KFFT, p. 4; ESUKT; LLBO: 1 April 1944, p. 4; 1 May 1944, p. 3; 1 June 1944, p. 3.

86. Mahlke, pp. 4-5; Schlage, p. 74; Deichmann, p. 5; FLO, 11, III, pp. 6-8; LLBO, 1 April 1944, p. 4, 1 June 1944, p. 3.

87. Pickert, p. 7; Deichmann, p. 5; FLO, No. 16, pp. 4-5; FLO, 11, III, pp. 6-8.

88. Wilke, p. 41; ERLUS, p. 19; FLO, 11, III, p. 5.

89. Reschke, pp. 8-9; Deichmann, p. 5; Hoffmann, III, p. 2; FLO, No. 16, pp. 7-8; KFFT, pp. 2-3; FLO, 11, III, p. 6; FNAO, pp. 8-10.

90. This section is based on: Contributions by Reschke, Wilke; General der Flieger a. D. Veit Fischer, Versorgung russischer Banden auf dem Luftwege (Air supply of Russian partisan units, hereinafter cited as VRBAL); KFFT; FLO, No. 11, IV; FLO, No. 16.

91. Reschke, p. 24; KFFT, p. 6; FLO, No. 16, pp. 1-2.

92. Reschke, pp. 16, 24; Wilke, p. 25.

93. Wilke, pp. 25-26; VRBAL, pp. 2-5; KFFT, p. 7; FLO, No. 11, IV, pp. 8-10.

94. This section is based on: Contributions by Brunner, Jaehne, Reschke, Schlage, Wilke; FLO, No. 25, I, No. 36; LLBO, 1 Jan 1944 - 1 Feb 1945; Russische Aushilfen und Findigkeiten, OKL Fuehrungsstab Ic, Fremde Luftwaffen Ost (Russian improvisations and ingenuity, an Intelligence bulletin of the Luftwaffe High Command, hereinafter cited as RA).

95. Brunner, pp. 15-16; Jaehne, p. 31; Reschke, pp. 12, 24; Schlage, p. 76; Wilke, p. 42; LLBO, 1 June 1944, p. 4, 1 Aug 1944, pp. 4, 7, 1 Nov 1944, p. 5, 1 Dec 1944, p. 5, 1 Feb 1945, pp. 4-5.

96. Reschke, pp. 12, 24; RA, pp. 8, 17; LLBO, 1 Aug 1944, p. 7.

97. Reschke, p. 24; FLO, No. 25, I, pp. 13-14, No. 36, pp. 15-18; RA, pp. 8-17.

98. Reschke, p. 5; Wilke, p. 43; FLO, No. 36, p. 19; LLBO, 1 March 1944, p. 10.

99. This section is based on: LVKR; FLO, Nos. 10, 38; SU-Luftnachrichtentruppe, Stand Mai 1944, Luftwaffenfuehrungsstab Ic, Fremde Luftwaffen Ost (a Luftwaffe Intelligence report on Russian air signal corps as of May 1944, hereinafter cited as SULNT); SUSFT; Dienstanweisung fuer die Organisation von Nachrichtenverbindungen bei den Fliegerverbaenden (OKL No. 122), (service regulations for the organization of signal communications by air force units, hereinafter cited as DONV).

100. SULNT, pp. 2-4.

101. SULNT, pp. 3-11, 13, 26-29; DONV, p. 7.

102. SUSFT, p. 33; FLO, No. 10, pp. 29-30, No. 38, pp. 19-20; DONV, pp. 2, 5, 32-33.

103. FLO, No. 10, p. 12; LVKR, p. 1.

104. SULNT, pp. 12-13, 29; DONV, p. 18.

105. This section is based on: "Ausbildungswesen," SU-Fliegertruppe, Luftwaffenfuehrungsstab Ic, Fremde Luftwaffen Ost (a Luftwaffe bulletin on Russian Air Force training, hereinafter cited as AUSW); SUF; AJ; SUSFT.

106. This section is based on: FLO, No. 11, IV; FLO, No. 14; "Luftlandetruppen" [airborne troops], in SU Fliegertruppe, Luftwaffenfuehrungsstab Ic/Fremde Luftwaffen Ost (hereinafter cited as SUFL).

107. This section is based on: ERLUS; RA; Verlagerung von Flugzeugwerken, Auszug aus einem Protokoll des Jaegerstabes vom 19. 5. 44 (extract from the minutes of the Fighter Staff for 19 May 1944, concerning the displacement of aircraft

107. (cont'd)
factories); SUFFF; SU Flugzeugausbringung und Gesamtverluste im Dezember 1944 und im Maerz 1945 (sketches showing Russian production and total losses of aircraft for Dec 1944 and March 1945, hereinafter cited as SUFG); Die Luftruestungsindustrie der Sowjetunion, Stand September 1944, Luftflottenkommando 6, Fuehrungsabteilung I/Ic (an Intelligence report of Sixth Air Fleet on the status of the Russian air armament industry in September 1944, hereinafter cited as LSSS); "Ruestungswirtschaft" /"armament economy"/, in Der Frontsoldat erzaehlt, No. 7, 1952, n. place, n. pub.

108. ERLUS, p. 30; SUFFF, pp. 1-2; SUFG; LSSS, pp. 3-5, 7-8, 12-14.

109. This section is based on: Jaehne, Reschke; Schlage; FLO, No. 25, I; LLBO, 1 Jan 1944 - 1 Feb 1945; LSSS.

110. Jaehne, p. 31; Reschke, p. 16; FLO, No. 25, I, p. 16.

111. LLBO, 1 July 1944, p. 2, 1 Aug 1944, p. 1, 1 Sept 1944, p. 2.

112. Schlage, p. 77; Rudel, p. 172; LLBO, 1 Jan 1944, pp. 14-15; LSSS, pp. 8-9.

Appendix 1

LIST OF EQUIVALENT LUFTWAFFE AND USAF GENERAL OFFICER RANKS

Reichsmarschall des Grossdeutschen Reiches (Goering's rank: Reichs Marshal of the Pan-German Reich)	No equivalent
Generalfeldmarschall	General of the Air Force (Army)
Generaloberst	General
General der Flieger (der Flak, etc.)	Lieutenant General
Generalleutnant	Major General
Generalmajor	Brigadier General

The initials a. D. /ausser Dienst/ given between an officer's rank and his name indicate "retired" status.

Appendix 2

LIST OF GAF MONOGRAPH PROJECT STUDIES

I. Published

Study No.	Title
173	The German Air Force General Staff
175	The Russian Air Force in the Eyes of German Commanders
189	Historical Turning Points in the German Air Force War Effort

II. To be Published at a Later Date

150	The German Air Force in the Spanish War
151	The German Air Force in Poland
152	The German Air Force in France and the Low Countries (including Airlanding Operations in Belgium and the Netherlands)
153-155	The German Air Force versus Russia on the Eastern Front
156	The Battle of Britain
157	Operation Sea Lion
158-160	The German Air Force versus the Allies in the West
161	The German Air Force versus the Allies in the Mediterranean
162	The Battle of Crete

Study No.	Title
163 & 165	German Air Force Close Support and Air Interdiction Operations
164	German Air Force Air Defense Operations
166	German Air Force Counter Air Operations
167	German Air Force Airlift Operations
168	German Air Force Air-Sea Rescue Operations
169	Training in the German Air Force
170	Procurement in the German Air Force
171	Intelligence in the German Air Force
172	German Air Force Medicine
174	Command and Leadership in the German Air Force (Goering, Milch, Jeschonnek, Udet, Wever)
176	Russian Patterns of Reaction to the German Air Force
177	Russian Use of Airlift to Supply Partisan Forces
178	Problems of Fighting a Three-Front Air War
179	Problems of Waging a Day and Night Defensive Air War
180	The Problem of the Long-Range Night Intruder Bomber
181	The Problem of Air Superiority in the Battle with Allied Strategic Air Forces
182	Fighter-Bomber Operations in Situations of Air Inferiority

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Study No.	Title
183	Analysis of Specialized Anglo-American Techniques
184	Effects of Allied Air Attacks on German Divisional and Army Organizations on the Battle Fronts
185	Effects of Allied Air Attacks on German Air Force Bases and Installations
186	The German Air Force System of Target Analysis
187	The German Air Force System of Weapons Selection
188	German Civil Air Defense
190	The Organization of the German Air Force High Command and Higher Echelon Headquarters within the German Air Force