The Air Offensive Against Germany

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WE now have a good idea of the effectiveness of Allied strategic bombing on German war industries and population centers. By field surveys in Germany, by interrogation of German industrial leaders and governmental officials, and by analysis of captured records and documents, it is possible to focus the brilliant light of hindsight on that large portion of our war effort. The findings are significant, not as a basis for criticism of the conduct of the war against Germany, but as a means of studying the way in which a modern industrial economy stands up under such attack.

As a summary observation, three facts stand out: 1) Allied bombing wreaked terrific physical damage on Germany, including its industrial targets; 2) Industrial production, especially of war goods, increased significantly during and immediately after our heaviest bombing attack; and 3) German industry eventually did collapse, but not until so late that the breakdown could well be attributed in large measure to the arrival of Allied troops. These conclusions are an urgent challenge to determine just what happened. The lessons are important, not only for purposes of historical reference, but because they throw light on our own problem of industrial planning in a world of nations that have not yet learned to live together in peace.

THE AIR OFFENSIVE AGAINST GERMANY

The Combined Bombing Offensive by the American and British Air Forces, planned soon after the 1940 blitz on Britain, was officially ordered by Churchill and Roosevelt at their conference at Casablanca in January, 1943. The offensive had two parts: the bombing of cities to reduce the will of the German people to continue the war, and the bombing of war industries to reduce Germany's ability to continue the war. This use of the air arm of the military services was known as "strategic" bombing; it was differentiated from "tactical" operations which covered fighter and bomber support of ground forces. The activities of the Eighth and the Fifteenth Air Forces, based in England and in the Mediterranean, respectively, were predominantly strategic; the Ninth Air Force, based first in England and later in France, was predominantly tactical.

The United States and Britain split the strategic bombing assignment between them. The A.A.F. undertook the precision bombing of German industry principally by day, and the R.A.F. undertook the area bombing of German urban centers by night. By the summer of 1943 enough of our four-motored bombers had been based in Britain to permit the beginning of heavy attacks. The raids rose gradually in size and in frequency; a wide assortment of targets was hit. The ratio of planes lost varied with types of targets; in the early months the A.A.F. refrained from concentrating against certain targets, such as synthetic oil, because it was not willing to take the heavy losses that would be suffered. In October, 1943, however, a heavy raid was made on the ball-bearing center of Schweinfurt; over 20 per cent of the planes were lost. Beginning on February 20, 1944, there were the famous five days of intensive concentration on bombing out fighter airplane production. By that time the range of our fighter escorts had been increased so that they could defend the bombers all the way to their targets and return.

A good deal of bombing was not strategic in the strict sense. Tremendous tonnages were dropped on the submarine pens along the French Coast, on airfields, and, later, on V-weapon launching sites. Field Marshal von Rundstedt stated to interrogators that the use of heavy bombers by the Allies in the St. Lo break-through was the most impressive use of such air power that he had ever seen. But before and after D-Day, both the American and British Air Forces placed principal emphasis on the bombing of German cities and war industries.

The apparent success of the Combined Bombing Offensive is attested by the wholesale ruin of practically all of Germany's larger cities, and by the heavy damage done to those industrial installations selected as targets. Our precision bombing proved not to be so very precise, but the Germans bear emphatic witness that targets marked for destruction eventually were destroyed.

THE GERMAN DEFENSE AGAINST STRATEGIC BOMBING

The Nazi high command, immediately it came into power in 1933, had undertaken to build and expand Germany's war industries. Because of obvious geographical factors, at least two policies were adopted relative to the possibility of bombing attacks against German industry: a deliberate expansion of heavy industry in central Germany to reduce the dependency of the nation's economy on the Ruhr district, and the adoption of the principle of local dispersal in the erection of new war plants, especially those to be used for aircraft manufacture. In accordance with this principle, no factory structure was to cover an area of more than 75,000 square feet; the airplane plants that were built were an aggregation of several separate structures sufficiently far apart to isolate bomb damage. Air raid shelters were provided for these new plants even before 1939. Most of the aircraft plants were highly integrated. The work characteristically was laid out to provide two production centers for each part or subassembly as insurance against a bomb hit. No blackout-type structures were built.

A second consideration which explains further the ability of German industry to maintain output in the face of Allied bombing was an installed over-capacity in many important industries. This permitted such industries to operate on a single shift, or at something less than full capacity, until the last year of the war. This situation was especially conspicuous in aircraft manufacturing capacity. Leaders of Germany's aircraft program estimated that the heavy February, 1944, raids on fighter plants destroyed 75 per cent of those facilities by 75 per cent, with a consequent 50 per cent reduction in scheduled output for a period of about two and a half months. But the rapid repair of the least damaged of those facilities, and the establishment of multiple shift operations, with incentive rations to workers who put in long hours, resulted in no loss of production the following month. The production of single engine fighters

increased by 30 per cent in March, and by September, 1944, it had trebled.

The under-utilization of the full productive capacity of the German industrial economy in the first three years of the war is one of the astounding revelations that have come with the end of the war. An important aspect of this situation appears to be the arrogance of the Nazi leaders in assuming that they could conquer the world without an all-out effort. Hitler was convinced in October, 1940, that Britain was out of the war and it was a minor question as to when she would sue for peace. In October, 1941, he was similarly convinced, with his armies at the gates of Leningrad and of Moscow, that Russia was defeated. Even after Stalingrad, the key Nazi leaders were confident that they could trade space for time until the German armies could be re-equipped and reinforced. Hitler had supreme contempt for the United States; in spite of warnings from some of his subordinates, he took no notice of the great bombing offensive being mounted against Germany, until the latter half of 1943.

THE DISPERSAL OF GERMAN INDUSTRY

Before 1939, it has been noted, German war industries had been expanded with an eye to possible bombing attacks. During the war it became necessary to take further emergency steps in this direction. The pattern was first to disperse, then to concentrate underground, and at the end of the war great above-ground, bunker-type structures were being erected to house certain vital industries.

It is important to note the timing of this emergency action. Industry and government leaders estimated that Allied bombers would not have enough range to carry heavy loads into the central and eastern areas of Germany, and some officials, especially Hitler, were contemptuous of the effectiveness of the bombing offensive to be mounted from Britain. Late in 1941 Focke-Wulf decided to remove its aircraft manufacturing operations from Bremen because this city was within range of heavy bombers. It selected Marienburg in East Prussia, Posen in Poland, and Sorau and Cottbus, southeast of Berlin. The moderate amount of new construction that was carried out during the war was located in the strategic interior, including Czecho-Slovakia and Austria, partly for protection against bombing attacks and partly for more convenient location with reference to labor resources.

In the summer of 1942 responsible governmental agencies prepared plans for the emergency dispersal of certain war industries. An order was issued to disperse inventories of materials and supplies in warehouses within a few miles of the manufacturing plants. Steps were taken to have more than one source for all components. It is important to note, however, that no general order to disperse important war industries was issued until late in February, 1944. Prior to that time dispersal had been a spotty matter.

The morning after the great raid on Schweinfurt in October, 1943, Reichsmarshal Goering called an emergency meeting in Berlin. He began by asking in great anger why the ball-bearing industry had not been dispersed. He was quieted by being reminded of his promise that the Luftwaffe would protect the Fatherland against such air attacks. The incident reveals the status of critical industries as to dispersal at that late date. Emergency steps were taken immediately to disperse the ball-bearing industry, but it should be repeated that the general order was not issued until February, 1944.

When dispersal was ordered, it applied only to high priority war industries. The aircraft industry, which in the German classification system included anti-aircraft, and comprised between 40 and 45 per cent of German war industry, was most affected by the dispersal order. During March and April, 1944, 27 aircraft plants were dispersed to 329 scattered locations. The radius over which they were dispersed varied from a few to several hundred miles. The action was facilitated by the dispersal plan which had been prepared by the Air Ministry in 1942. It was made possible by the establishment of an emergency priority as to transportation services and as to the commandeering of plants. Manpower controls were already adequate to permit the mandatory transfer of workers, German as well as foreign, to the dispersal locations.

Dispersal seriously reduced the quality of targets for Allied bombing, and in this regard undoubtedly was successful. It brought on exceedingly great operating difficulties, however, and within a few months there was an insistent demand that facilities be provided underground which would permit re-concentration of operations. It was not too difficult to disperse machines, tools, and manpower, but the dilution of supervisory personnel required by dispersal presented an impossible situation. The maintenance of adequate inspection also became most difficult. A serious problem existed because of the inadequacy of transport facilities serving the dispersed locations. It has not been clear, in studying the dispersal of German war industry to avoid the consequences of Allied strategic bombing, whether the program was undertaken as a temporary expedient until underground facilities had been prepared, or was regarded as permanently feasible.

UNDERGROUND OPERATIONS

The first substantial underground operation was that set up in the tunnels near Nordhausen for the production of the V-2. The decision apparently was made in the fall of 1943, and production operations were removed there directly from the Army Artillery Park at Peenemunde, where the weapon had been developed. The V-1 had been put into production in conventional facilities at first, but during 1944 it, too, was moved into the Nordhausen tunnels. When the war ended, in addition to the V-weapons, a jet airplane power plant was being produced there.

It was not until the summer of 1944 that an all-out effort was made to put as much production underground as possible. Weapons with the highest priority were taken care of first. Following V-weapons came aircraft engines, especially for the fighter types. It was not practical to put the assembly of aircraft underground, but considerable progress was made with critical parts and components.

The Nordhausen tunnels, which afforded about 1,000,000 square feet of productive working space broken down into two long tunnels and about fifty cross tunnels, were built for the purpose and were reasonably satisfactory as a place in which to carry on manufacturing operations. There were four level entrances from the outside, temperature and humidity conditions were not bad, and the anhydrite formation was neither corrosive in its effect on machines nor did it release an undue amount of dust. Many of the other underground facilities, however, did not work out at all satisfactorily. Several salt mines were used. In few cases were the shaft entrances adequate for the circulation of workers, materials, and products; ventilation was difficult and the corrosive effect on machines was serious; draughts frequently were a problem. In no cases were operations

completely integrated in these underground facilities. All were vulnerable as to their supplies of electric power and as to transport connection with suppliers and others upon which they were dependent.

FOREST PLANTS

Underground operations were not the only way in which protection from Allied bombing was sought, although quantitatively they were the most significant after simple dispersal proved unsatisfactory. Several concerns, Messerschmitt in particular, were successful with the operation of forest plants. These were small, narrow, wooden structures in dispersed clusters along the autobahns* in the same general district. They were cheap to erect, and working conditions were good. Not one was bombed. Fighter-type aircraft were small enough to use such restricted production space. Level stretches in the autobahn were used for testing and fly-away; this fact was detected by aerial reconnaissance, but not a single photograph located the hidden plants where production operations were being carried on.

Eleven great bunker-type plants had been planned, five had been started, and two at Kaufering and Muhldorf-am-Inn were approximately 50 per cent completed when the war ended. Each was to provide about a million square feet of production space, on several levels. They embodied the submarine pen idea: heavy reinforced concrete construction in the shape of a tortoise shell. A hill with the right dimensions was selected, it was covered with concrete, and then the earth was removed. A shortage of steel and the time factor explain the fact that these bomb-proof facilities were not completed before the end of the war.

THE RECORD OF GERMAN INDUSTRIAL OUTPUT

The rapid increase in production of airplanes, especially of the defensive fighter types, during and after the heaviest Allied bombing raids, has already been mentioned. This misfire of the expected cause and effect relationship is not surprising when it is realized that German industry had not yet been given an all-out assignment by Hitler, and national survival depended on the production of greatly increased quantities of weapons. The immediate answer to the great raids by Allied bombers was to put more defensive fighters into the air, and the accomplishment of this objective became an urgent national project. In spite of the great destruction done to aircraft production facilities during the February raids, and in spite of the disruption caused by emergency dispersal during March and April, the German aircraft industry increased its production of fighters in a remarkable fashion. If Allied Intelligence had not grossly underestimated German fighter plane production in the months before D-Day, one wonders if the invasion would have been carried out as scheduled.

Responsible German officials formed an emergency organization late in February, 1944, to meet the disastrous situation resulting from the heavy raids on airplane plants. It was called the "Jagerstab" (Fighter Staff), and combined the forces of the Air Ministry and the Armament Ministry (Speer). Otto Saur, one of Hitler's close associates, was made its Chief. His method principally was to give the aircraft program top priority, but he leaned heavily on terrorizing industrial managements. The Jagerstab did get results, and in August, 1944, it became a "Rustungstab" (Armaments Staff) with Saur at its head. The same techniques were employed to get greater production of tanks, ammunition, etc., as had been found successful with fighter aircraft.

*An "autobahn" is a road with double traffic lanes in each direction separated by a park strip.

The average production of various types of munitions in 1944, as compared with January-February, 1942, was as follows:

Tanks	5	times increase
Weapons	3	" "
Ammunition	3	" "
Aircraft	2½	" "
Tractors	2½	" "
Warships	1½	" "
Vehicles	1½	" "

The general index of munitions production reached its maximum in July, 1944, but it did not collapse until March, 1945.

Shortage of oil was the most serious single factor in the collapse of Germany. It did not become so acute as to affect military operations directly, however, until September, 1944. The loss of the Roumanian oil fields was a serious blow. The synthetic oil plants of Germany, it has been noted, were so well protected by anti-aircraft and fighter defenses that the Allied bombing forces at first could not afford to attack them because of the losses which would be incurred. Even after long-range fighter escorts had been provided these bombers, and the plants at Merseburg, Leuna, and other centers were attacked, Allied losses were heavy. German officials stated that had the bombing attacks on their synthetic oil industry been initiated a year earlier, the war would have been a year shorter.

CONCLUSION

The strategic bombing campaign, it can now be observed, overlooked the opportunity to paralyze German industry by attacking its electric generating installations. Allied Intelligence had accepted the theory that an elaborate grid system existed in Germany which could handle any emergency created by loss of, or damage to, an occasional generating plant. The capacity of the grid system proved to be very low in most cases; late in the war, when saturation bombing of German urban centers was carried out, more especially by the R.A.F., a good many sources of electrical power were put out of commission. The grid system was so inadequate that large sections of German industry had to be rationed on consumption of electricity.

Transportation targets occupied an important place in the Combined Bombing Offensive. Assessment of the damage done to these targets is made difficult by the fact that much, if not most, of the visible ruin done to bridges, equipment, terminals, and marshalling yards was the result of tactical operations in connection with the advance of the ground forces. Strategic bombing of transportation targets appears not to have been especially successful. Large groups of workers could be mobilized on short notice to repair damage done to marshalling yards. The Ardennes Offensive was mounted in December, 1944, by putting more than a thousand trains through some of the worst bombed marshalling yards. Civilian goods traffic was sacrificed.

This account gives a discouraging picture of the effectiveness of Allied strategic bombing. No question is raised as to the fact that tremendous tonnages of bombs were dropped on industrial and urban targets in Germany. The accuracy with which they were dropped could scarcely be described as "precision", but the German people were impressed by the fact that when a target was selected for destruction, sooner or later it was destroyed. What was lacking in accuracy was made up for in quantity.

The error made in ordering the Strategic Bombing Offensive was a fundamental one. Churchill and Roose-