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THE LONG AND SHORT TERM EFFECTS
OF THE ENEMY AIR WAR ON CENTRES
OF GERMAN WAR PRODUCTION (1943).

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The long and short term effects of the enemy air war on
centres of German war production.

I. Heavy industry

In British planning the starting point for any attempt to weaken Germany's war potential was the offensive against the so-called "basic industries". About the middle of 1943 there was a concentration of British and American attacks on the industrial regions of the Rhineland and Westphalia. From the enemy's point of view, the results were surprisingly poor. Even during a series of uninterrupted and heavy attacks, anthracite coal production in the Ruhr fell by only 4 - 7%, while the production of foundry coke dropped by 10 - 13%; this constituted a fall of 1 - 3% and 9 - 12% in the average for the Reich; in the north-western region the decline in steel production was rather higher - 15 - 22%, but even then it was only 7 - 11% below the average figure for the Reich. Since then the losses in production as a result of air attacks have been as follows: anthracite coal - less than 1%; - foundry coke - 5%; steel - 6%. It should be remembered that these losses were not a result of direct damage, but rather a result of the interruptions caused by air raid alarms. It was thus proved that even when subjected to concentrated enemy attacks, the heavy industries suffered relatively minor damage, which in a long term view was in no way decisive in weakening the German war potential.

The interference with the supply of high-grade steel (the basis of the armaments industry in the narrowest sense of the word) must be regarded as more effective from the point of view of the British and Americans in their conduct of aerial and economic warfare. Admittedly some of the principal metals used in the refining of steel have become interchangeable as a result of technical developments (manganese, nickel, chromium, wolfram, molybdenum and silicon), but they are all required for the production of steels to be used for machine tools and for building purposes (for engines, guns, armour-plating and for armour-piercing projectiles): these steels must be of a certain hardness and temper.

The enemy held the belief that the loss of Nikopol, whence more than 60% of the German supplies of manganese had been drawn, would lead to an almost critical situation in the manganese supply situation, but since adequate reserves were held, the Reich's supplies of manganese have been assured for a long time to come. Even if supplies from the Balkans (Slovakia, Hungary, Bulgaria and Rumania) came to an end - and they constitute 15% of Germany's requirements - Germany's needs could be completely satisfied by her own production and from reserves, at least until the spring of 1945.

As regards nickel, the situation is less favourable. About 85% of Germany's needs are met by shipments from Finland, while a further 10% comes from Norway. If these supplies were cut off (by an increase in the pressure on Finland to break away from the Axis) it would have a significant effect on the German production of alloy steel; the effect would not be immediate as there is a reserve sufficient for nine months, but the loss would eventually have serious consequences, since chrome and nickel steels are essential ingredients of our hard steel.

The same applies to supplies of chrome. About 60% of present requirements is met by deliveries from the south-east (Bulgaria, Serbia, Albania and Greece) while the remainder is covered by deliveries of Turkish chrome ore. The first trade agreement with Turkey provided for a reserve to be built up, sufficient for four months, while the second agreement aimed at securing a whole year's reserves. If these deliveries take place in accordance with the provisions of the agreements, Germany will be able to build up her stocks considerably. But the influence of the British and Americans in Turkey is making itself felt: for some time past supplies have been delayed and they are inadequate to fulfill the provisions of the agreements. In the current year, almost a quarter of the reserve will have to be used to meet the demands, and that means that supplies will only be sufficient to last until the middle of 1945. Should the enemy succeed in persuading Turkey to stop deliveries

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completely, that would mean a considerable deterioration in the supply situation for chrome, even though the effects would only be felt after some time. If supplies from the south-east, and in particular from Bulgaria, were cut off, there would be an immediate effect, and almost all supplies would be exhausted by the autumn of 1944.

Any attempt to replace nickel or chrome alloy steels by wolfram or molybdenum is doomed in advance, owing to the strained supply situation with regard to these two materials. Three quarters of the wolfram needed is derived from supplies from Portugal and Spain. Great Britain has intensified her efforts to cut off these supplies and it is to be feared that in certain circumstances deliveries from Portugal will cease entirely, while those from Spain will drop by a half. Although the current year's demand is 15% below that of 1943, that would mean that there would have to be recourse to the reserves on a large scale. If wolfram supplies from the Iberian Peninsula were cut off entirely, it would not be possible to satisfy the demand up to the end of the year.

Between 25% and 30% of the supplies of molybdenum is drawn from the Knabengrube in Norway, while the same amount is derived from a German source at Goslar. As a quarter of the current year's demands will have to be met from reserves, the consequences of the disruption of these two sources of supply would be fatal. It should be added that a further 15% of the requirements is met by shipments from Finland. If this source were also cut off, there would be a proportionate short term effect, as all available reserves would be consumed by autumn 1944.

Silicon alloys are becoming more and more important as they are used as a substitute for other materials in the production of alloy steel. 60% of Germany's silicon is derived from supplies from Norway, 8% comes from Sweden, and 12% comes from Croatia and Slovakia. Should the Norwegian - and possibly the Swedish - supplies be cut off, there would be the most serious consequences, even before the end of 1944.

It is thus possible for the enemy to weaken the German steel industry significantly and seriously by interfering with the supply of materials used in steel refining. Such a result would not be achieved principally by aerial warfare, but by economic methods (e.g. by the application of political and economic pressure on the neutrals - Portugal, Spain, Sweden and Turkey); this could be coupled with offensive operations or possibly with an increase in guerilla warfare in the Balkans and an offensive in the north (Finland and Norway), or with the blockade of supplies coming across the Baltic.

If shipments across the Baltic were prevented, there would be an immediate effect on crude steel production, since shipments of iron ore from Norway and Sweden would be stopped. Although the recent German-Swedish trade agreement stipulated that deliveries should be decreased by 30% of the requirements for the current year, 20% of the ore used in German crude steel production will still be of Scandinavian origin. If supplies were cut off, the result would be twice as serious as that caused by the very powerful air attacks on the iron and steel industry. The Scandinavian ores with their low phosphorus content are of particular value in the production of high grade Siemens-Martin and electro-steel.

II. Chemical industry

Of all the important branches of the chemical industry, that concerned with the production of synthetic rubber is particularly vulnerable to air attacks. In the past, this form of production has been based on three centres (Ludwigshafen/Oppau, Huels and Schkopau): a new factory (at Auschwitz) will go into production about May. More than half of Germany's synthetic rubber has come from Schkopau in the past, and a further 30%

came from Huels. The destruction of these two factories therefore had a most serious effect on German synthetic rubber production; even when the new factory is in full production, these two works would still be responsible for two thirds of the total production. Attempts had already been made to paralyse the German synthetic oil industry by attacks on Huels and Oppau. In view of the reserves available, the effects of the complete loss of production at the main centres would only make themselves felt after a period of time. To achieve the short-term crippling of the German rubber industry, attacks would be more effective if directed against the centres of tyre production (especially Hannover).

Nitrogen supplies are of extreme importance in the production of explosives. The main centres of production are at Leuna and Oppau; (these two works provide 60% of the total production). Another 15% comes from three factories in the Ruhr (Viktor Rauxel, Holten Ruhrchemie, Hibernia). A total loss of production at these three works would not have any immediate effect on the powder and explosive industries, which only consume one third of the nitrogen produced in Germany, but from a long-term point of view there would be catastrophic consequences, particularly for agriculture, which requires for artificial fertilisers the remaining two thirds of the nitrogen produced; at the moment, supplies of nitrogen being made available for agricultural purposes are in danger, as large amounts of nitrogen have been diverted to industries engaged on manufacturing explosives.

Methanol is of considerable importance, as a prerequisite in the production of synthetic rubber and explosives (toluol, hexogen): it is also used in the production of high-grade fuels. Production was formerly centred at one factory (at Leuna), but recently it has been extended to two other factories (Oppau and Heydebreck); in about three months time, there will be a fourth centre of production at Auschwitz. Production will then be split up as follows; Leuna - 50%, Oppau - 10%, Heydebreck - 20%, Auschwitz - 20%. All these factories are in a position to switch over from the production of nitrogen to petrol or methanol, or vice versa; this means that to some extent one product can be manufactured instead of another. Therefore any loss of production in these factories would cause particular difficulties.

Within the framework of Germany's fuel supply, the industry most vulnerable to air attack is the one concerned with the production of aviation spirit: four fifths of the total production is derived from four major factories (Poelitz and Leuna each provide 25%; Gelsenberg and Schloven are each responsible for 15 - 20%). The production centres for other types of fuel and lubricating oils (hydrogenation plants, synthetics plants and refineries) have been so extensively decentralised that no single factory is responsible for more than 5% of the total production. Therefore if the four major concerns mentioned were destroyed in attacks on aviation fuel production there would be some relatively short term effects, (at the moment, the reserves of aviation fuel are sufficient to last for a full three months); but - from the enemy's point of view - attacks on fuel production generally, leading to the destruction of individual factories, promise less success. In view of the strained supply situation the interruption of deliveries of oil and fuel from Rumania would be of considerably more consequence. This would appear to be the aim of the Russian offensive in the south. (Rumanian production accounted for more than a quarter of Germany's requirements.)

As far as the chemical industry is concerned, the most valuable targets for the enemy's air attacks would be Ludwigshafen/Oppau, Leuna, Auschwitz, Heydebreck, Holten, Schloven and Rauxel; if these plants were put out of action there would be serious and immediate short term interference with the production of synthetic rubber, nitrogen, methanol and aviation spirit. Should Oppau be destroyed it would mean the loss of the only major concern employed on the production of urea; the whole of the German glue production (for use in aircraft, plywood and munitions) depends on the supply of this substance.

III. Electricity

Although electricity is the basis of a major part of the metallurgical and chemical industries, and in spite of the fact that it is of particular importance in industrial production, there were no systematic large scale attacks during 1943 on German electricity-producing centres, nor were there any attacks on the distributive system. The British and American attacks essentially took the form of a number of minor pinpricks; numerous cables and mains were damaged, but there were only a few concentrated attacks on major industrial power stations or transformer stations; the only other extensive damage was to municipal power stations which were hit in large scale raids on whole towns and cities. Damage and destruction caused to individual power stations, transformer stations and cables was therefore relatively slight; the average drop in production was roughly 5% of the total amount.

The Achilles heel in the German electricity system is in the distributive system. The high tension grid provides the connecting link between the main centres of production and consumption and joins up such important producing areas as western Germany - anthracite, south Germany - water power, and central Germany - brown coal. If the enemy wanted to cripple effectively the whole of the German electricity system there would be two possible methods;

- (1) By the destruction of all the important transformer stations, thus interrupting the supply of current from the generating stations to the main centres of consumption,
- (2) The elimination of the grid, by means of attacks on its main points (the principal transformer stations); these attacks could then be followed by attacks on the individual generating stations.

The first method would demand the elimination of approximately 30 important transformer stations (including Burgweiler, Kelsterbach, Rheinau, Hoheneck, Bludenz, Ludersheim, St. Peter, Hessenberg, Remptendorf, Lehrte, Bitterfeld and Hennigsdorf); if these attacks were all made within the course of a few days or nights, they would achieve the immediate paralysis of the entire electricity supply system; the damage could not be repaired for a long time. The second method would have more far-reaching consequences, but the effect would not be so immediate. It would first of all imply the breaking of the main connecting links between the north-west and the south, between southern Germany and central Germany and between north-west Germany and central Germany by a series of concentrated attacks against the most important points in the system, (e.g. Brauweiler, Erbsthofen, Ludersheim and Lehrte). After the main grid system throughout the country had been put out of action, there would then have to be a series of attacks on 50 important generating plants, district by district; these plants between them account for two-thirds of Germany's electricity supplies, and they include Huels, Hibernia, Koepchen-Werk, Hattingen, Goldenberg-Werk, Fortuna, Mannheim, Homburg, Seen-Werk, Kembs, Schluchsee, Laufenburg, Waldensee-Werk, Achensee-Werk, Iser-gruppe, Inn-Gruppe, Enz-Gruppe, Huette Linz, Simmering, Waldenberg, Hindenburg, Koenigshuette, Kraftborn, Wartenstedt, Elbe-Werk, Zschornowitz, Boehlen, Esperhaim, Lauterbach, Hirschfeld, Klingenberg, Finkenheerd, Luebeck, Tiefstack, Neuhoef and Farge.

In addition to the direct effects of raids on power stations, the position is made more difficult by the fact that there is an acute shortage of transformers. The situation would be catastrophic if the transformers were destroyed in the power stations and transformer stations and if the major centres of transformer production (AEG, Siemens, BBC) were put out of action.

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If there were a long or short term crippling of the electricity supply system, the light metal industry would be decisively affected; in 1943 there was a drop in production in this industry of 10 - 15%, caused by lack of electricity (this shortage was occasioned by the extremely unfavourable water supply situation during the dry period of summer and autumn that year). In the long run it would be easier to deprive the light metal industry of its electricity rather than to set about the individual destruction of the six most important aluminium works (Lauterbach, Ranshofen, Toeing, Bitterfeld, Luenen, Rheinfelden) and the four magnesium works (Stassfurt, Aken, Heringen, Bitterfeld).

IV. Transport

During 1943 the effects of the enemy air attacks on the German railway system became more and more marked - particularly during the latter half of the year. The attacks ranged from individual targets (trains, individual railway stations, repair shops and centres of production) to raids causing extensive damage and destruction to complex rail systems; these latter attacks were carried out within the framework of the mass attacks on cities and industrial centres. The average figures for rolling stock lost during the year were as follows: engines - 6%, goods waggons - 2%, and carriages - 8%. The monthly average was seven times as high at the end of the year as it was at the beginning. Repair works were overburdened, others were permanently or temporarily put out of action, and some sections of the repair industry had to be turned over to the production of new material; engine-building works were destroyed (Krupp-Essen and Henschel-Kassel), as were coach-building works (Westwagen-Koeln, Talbot-Aachen, Crede-Kassel, Nuernberg-Fuerth); all these facts contributed to a drop in production of 16% for engines and 4% for coaches. These losses, together with the damage to and destruction of principal stations and marshalling yards meant that the time required to complete deliveries was considerably increased. Other contributing factors were the damage to communications stations and engine sheds, which meant that diversions had to be made, resulting in loss of time. The difficulties were increased when there were continual interruptions of night-time loading, caused by air raid warnings, which meant that all lights on goods stations and marshalling yards had to be extinguished. These indirect results increased more and more as enemy aircraft flew more often over Reich territory. All these circumstances led to an increase in the time required for a particular delivery; the number of waggons which could be made available each day fell by 25% and the performance of the railways (measured in tons per kilometre) fell by about 15%.

The most significant results as far as the railways are concerned have thus been achieved by the destruction of engines and the blocking of stretches of track. If immediate effects are desired, the enemy is likely to attempt to interrupt traffic by attacking stretches of track, junctions and other important targets (the bridges over the Rhine and Elbe!); extensive interference with night-time goods traffic would contribute to indirect effects. In this way, rail traffic would be subjected to many delays and there would be a corresponding delay in the turn-round of waggons. In the long run, this effect would be directly increased by the destruction of rolling stock, (especially of engines); it would also be made impossible for traffic to carry on, as repair works would be damaged or destroyed and the arrival of new material would be prevented by the destruction of the large factories concerned with the production of new equipment.

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