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BASIC PRINCIPLES UNDERLYING THE TECHNIQUE OF AIR WARFARE. WITH ILLUSTRATIONS FROM EXPERIENCES BETWEEN 1939 AND 1944.

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Basic principles underlying the technique of air warfare, with illustrations from experiences between 1939 and 1944

I.

The development of equipment.

1. The development of equipment, and especially that of aircraft equipments, must be planned on a long-term basis. The time which elapses between the original placing of an order and the moment when the equipment is fit for operational use, is frequently under-estimated.

The development of engines is usually a longer process and the ultimate result is more difficult to foretell than in the case of aircraft. We must therefore aim at designing new types of aircraft for which already developed components, particularly engines, can be used.

The He.177 is a particularly striking example; it was designed for two new types of twin-engines which were eventually found to be incapable of acquiring a sufficiently high degree of safety, one of the most important reasons for the continual postponements in the production of this aircraft. After a long time, the He 177 was converted to 4 single engines.

2. All new developments must be influenced by nothing but the ultimate military purpose of the equipment.

The strategic policy of the air/war, which in turn depends on political, economic and geographical conditions, determines the nature and scope of the air armament industry. It makes certain demands on the air armament industry which in turn decide the technical conditions for future operations and tactics. Individual requirements, which are irrelevant to the general plan, are to be disregarded. Even with regard to minor technical developments, this principle must be followed.

On the other hand, development must not be carried out on over-rigid lines. Only very rarely can the solution of an armament problem be categorically laid down at the beginning of the development stage, and the exact line of future development foreseen. Various methods will therefore have to be tried before successful results can be achieved.

The dive or ordinary bombing attack delivered by a close and horizontally flying formation offer operationally and on tactical missions various chances of success. Thus the excessive preoccupation with dive bombing attacks and insufficient appreciation of the results obtainable by ordinary horizontal bombing, leading to reduced development of the heavy long-range bomber, did not correspond to strategic needs.

A similar course of action was adopted with regard to the question of whether bombs or torpedoes should be used in air attacks on shipping.

The very complicated action of a bomb penetrating a ship at various angles of impact, and its destructive power, must, like all similar questions, be carefully studied so as to prevent an over-optimistic estimation of results. On the other hand, the value of the torpedo must not be under-estimated, nor the further development of its efficacy neglected. When in 1941 the possibilities of the torpedo became clear, its development had virtually to be begun from scratch.

If however for any reason any line of development seems to promise some substantial result, other possibilities must not be altogether abandoned in favour of the course of action that has been chosen. New technical improvements may alter the course of development, on lines previously thought unprofitable. The process of development is unlimited, and tests and trials

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must therefore never cease.

3. Technical development on a broad basis and the endeavour to provide several solutions for each problem and to find new answers to various questions must not be permitted to lead to any inconsistency in the general plan of development. It may lead to a variety of different types, series of aircraft and armament standards that our industry is not in a position to maintain. Such a situation occurs whenever an immediate requirement is given preference over long term planning. An instance of this is the Me 110, originally planned for use as a long range fighter. Then it was fitted out with bombs and used on bombing missions, and also in many cases for dive-bombing attacks. Finally, it was converted to a night fighter, owing to the non-existence of a specially developed aircraft for this purpose.

A similar case occurred in 1940 when it was suddenly decided to produce one type of aircraft and use it both as a dive bomber and as a T.E. fighter; this type was probably intended for attacks against England. The Me 210 was created for this purpose and was intended as a replacement for, or at least an improvement on, the Me 110 and the Ju88. Later it did however not come up to expectations and was further developed in the form of the Me 410, for use partly as a bomber and partly as a day and night fighter.

II.

The planning of production.

1. The fundamental law governing all production may be stated thus: "the fewer the interruptions, the higher the output."

The attacks on our armament industry which began on a large scale in 1943, forced us to move a number of industrial plants, and production fell accordingly. Even in the preceding years, between 1939-1942, production was frequently disturbed by continual changes, and conversions in production policy and armament. Thus the production of the He 111 was frequently abandoned only to be resumed after a short time.

Such disturbances also had an unfavourable effect on the Me 110, the production of which was abandoned in favour of the Me 210. Later when the production of the Me 210 suffered a set-back, there seemed to be no aircraft reinforcements for the Me 110 units until the production of Me 110's was resumed.

Innumerable changes in the individual types of armament of the various aircraft series placed a heavy strain on production, supplies and training. Such changes are so fundamentally opposed to the basic principles governing rational production, that their influence on the operational readiness of arms, aircraft and on the Air Force generally must not be under-estimated.

2. In the interests of maximum and uninterrupted production, it is essential to introduce instruments and weapons which will maintain their operational value for as long as possible. For example; the Me.109, Me.110, He.111, Ju.87, and Ju.52, have followed their original design for many years, and only new series have been produced. On the other hand, the FW 189, the He 129 and the Me 210 represented fundamentally new types and their operational use was short lived.

In the case of a new series of the same aircraft design being constructed, the effect on production, training and supplies is completely different from the effect caused by the introduction of a completely new type of aircraft.

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III.

The fundamental relations between technique and operations.

1. Uniformity in equipment makes for easier supply and training conditions and facilitates mass attacks, which are usually essential in air warfare.

This principle is of course in contradiction to a policy aiming at full production, which can now to a growing extent only be achieved by a process of specialised development. When planning armament production, the High Command is often faced with the problem of whether to decide upon uniform types having only average capacity or on a number of types with a specialised maximum top capacity.

It is therefore a fundamental principle that orders for the production of weapons and instruments should not exceed industrial potential. The question of how far production is to be restricted to a few types with the longest duration of operational value is determined by the limitations of the entire war potential.

This rule, of particular importance in total war, was often disregarded, and the number of different types of aircraft, engines, weapons and instruments in operational use at one time increased from year to year. Thus it often became impossible to supply the entire length of the front with sufficient spare parts and the use of express air transports became a daily necessity; while the demand for specialists and special aircraft units grew, the standard of operational readiness sank. An unnecessary diversity of types of bombs and fuses complicated operations, training and supplies, and muddles were frequent.

Whether the 5 types of gun (7.9-13-15-20-30 m/m) now in production are really necessary for normal aircraft armament, is a matter demanding some deliberation. In addition, the 2.3 - 3.7 - 5.0 - and 7.5 cm guns have been installed for specialised purposes. Each weapon also requires a number of different shells and cartridges.

Similar conditions are to be found in respect of all other aircraft instruments and components, including airscrews and tyres.

On the other hand, in order to attain the necessary performance it was perhaps inevitable to supplement the 4 existing types of aircraft fuel with additional means of propulsion, (Gm-1, and Methanoe) - to facilitate take off.

2. Captured weapons and equipment (French and Italian) were often not broken up to extract raw materials but were introduced into the German armament industry. This outwardly increased the equipment available, but actually lessened rather than raised our war potential, the added diversity of types having placed an additional strain on our supply system, training, organization, and operational strength.

The production of out of date types was continued for years because it was thought they might still be of use for some purpose. The ruthless destruction of such aircraft is often preferable to their maintenance in large numbers.

3. War developments have often led to the premature operational use of new types of equipment. In such instances, production had not reached the necessary minimum level, supplies had not been assured and personnel had not been suitably re-equipped and trained.

It is a fundamental rule that the premature use of new types of weapons not only fails to achieve any success, but may also lead to many mishaps.

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An example of this was the use of III/Z.G. 1, equipped with the new He 210 which was still in the experimental stage in the North-African theatre of war, which was exceptionally difficult to supply. Successes were negligible and the unit was virtually wiped out in a very short time.

The same applies to the employment of the He 129 in Africa, although even in Europe difficulties had been experienced with the overheating of the GNOME-RHONE engine.

Units often received new aircraft engines, propellors, etc. by supply aircraft, with no previous instructions for their use. As a result accidents and losses occurred even in transit, operational mishaps and failures were frequent, and general mistrust of the new equipment grew. Troops were equipped with new equipment without being instructed in its use, or before the required standard of perfection had been attained and this often led to unjustified criticism of its value.

4. A further fundamental principle is that the greater the performance of an aircraft, the more complicated and prone to disturbances is its mechanism. The necessary standard of perfection cannot be attained until an adequate number of tests and trials has been made. The strain which each type of aircraft can stand differs in every case.

This fact must be remembered when operational use of aircraft is planned. For example, the Ju 87 is in a more advanced stage of development and has greater powers of endurance than the FW 190 fighter-bomber, although the latter may be considered superior from the point of view of performance. A unit of FW 190's however, employed operationally to the same extent as a Ju.87 Unit, will soon lose its operational and numerical strength. Bomber units consisting of He 111's or Ju 88's or Do 217's or transport units with Ju 52's or S 82's would suffer a similar experience.

5. A further basic principle is that technical efficiency is entirely dependant on the ground organization and on the technical ground services, and that the mobility of a flying unit is limited by its technical resources.

As an example may be quoted the case of the German ground organisation which, originally intended for the internal defence of the Reich, had to adapt itself to a war outside the German frontiers. Thus the original plan for the allocation of flying units and Airfield Servicing Companies could not be adhered to, and the latter often became part of the integral strength of the flying units.

Mobile maintenance units were not established until their absence had been adversely felt in the campaigns in Poland, Norway and France.

During the course of the war, entire units or parts of units were repeatedly moved to airfields with totally insufficient technical equipment. This led to a decrease in the operational readiness and numerical strength of the flying units.

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