

ROLE OF HIGH PERFORMANCE AIRCRAFT IN DEFENCE

by

V. M. Ghatage

Hindustan Aircraft Ltd., Bangalore.

Development in guided missiles has led many to believe that days of high performance military aircraft are over. In fact, some countries openly declared that as a policy they would not spend large amounts of money in the design, development and construction of modern high-speed fighters and bombers and concentrate on the development of long and short range guided and ballistic missiles. The intention obviously is that if sufficient advance information of attacking aircraft is obtained, they could be intercepted and destroyed by a set of suitable ground to air missiles. Present day supersonic interceptor fighters require highly trained and skilled pilots and the amount of money that is considered necessary to equip these planes as a weapon-system, and train such pilots appears to be excessive. If the results could be achieved without their use, as indicated above, a good deal of trained man power and money could be saved. It is worthwhile to examine whether the role played by aircraft hitherto could now be successfully taken over by guided or ballistic missiles.

Let us first analyse the defensive and offensive use of aircraft in order to see what are the circumstances and what the air weapons are supposed to do. In the defensive role, the fast and highly manoeuvrable aircraft such as interceptors, fighters and bombers of different fire power and different flight endurance would play a major part. In the case of an offensive attack, fast and medium speed bombers with or without fighter protection would mainly be used. In both cases the tactics would differ according to conditions existing in the conflict considered.

If a major war between two very powerful groups of nations equipped with atomic and thermonuclear weapons capable of being delivered on each other's territory either by inter-continental ballistic missiles or by high altitude long-range high-speed bombers is considered, the problem becomes one of the world conflict where the possibility of destroying a very large portion of human race arises. As such a case is of vital interest to all nations and as the existence of human race is involved, we can safely assume that the problem will be solved without taking recourse to such drastic action. However, a conflict on a smaller scale which may not be resolved immediately by peaceful means with the help of other powers may arise. In such a case the country so attacked has to think of ways and means of defending herself. A speedy and effective offensive that would be expected, is an air attack by bombers and fighter bombers operating from suitable places, near ones own territorial border. It would be necessary to analyse the possible ways in which such an attack could be expected and method of defence to be used in each case.

If the attack is made by bombers from a high altitude a reasonable time would be required before the attacking aircraft reaches its target. This

naturally depends on the speed, climb performance and the distance of the target from the aircraft base. Taking this distance as 500 miles and assuming the speed as 600 miles per hour and an average rate of climb 8000 ft/minute, the aircraft would require approximately 35 to 40 minutes to reach the target at a height of 35,000 ft. from the start. If suitable radar detection is available, a warning of 10 to 15 minutes could be expected in which interceptors or ground to air guided missiles could be directed against the aircraft. Anti-aircraft guns could also be got ready for action in case the aircraft could be visibly followed. It is also possible that the attacking aircraft may use air to ground missiles aimed and released at the target some distance from it.

However, if the attacking aircraft chooses to fly at a low level, say, about 500 ft. from ground when it comes within a reasonable distance from the target, both radar detection and destruction from ground anti-aircraft weapons would become very difficult. A method of defence against such an attack is not yet very well worked out. It is also true that such low flying by high speed and heavy aircraft is very hazardous and to accomplish such a plan successfully, one must have a very accurate and detailed knowledge of the terrain around the target. Sudden changes in the attitude of the aircraft at high flying speeds become impossible even if protective devices against high accelerations are incorporated. If explosives are dropped from such low heights, the blast effect is likely to affect the flying aircraft itself due to its proximity to blast. It may be necessary in some cases to see that there is a definite time lag between the actual explosion and the reaching of the explosive on the target. In spite of all such difficulties, an air attack of this type is perfectly possible. Whether guided missiles could be used against such an attack when it actually takes place would require a very careful consideration. For this purpose, it would be worthwhile to see the types of guided weapons that are available today. As information about these is rather restricted for obvious reasons, details given here will only be of general character.

There are surface to air missiles ranging in speed from 1.5 to 3 Mach and weights varying from 800 to 10,000 lbs. The guiding system also differs in many cases, all methods like active homing, beam guidance with or without proximity fuses, are used. The range or ceiling of such missiles also differs from about 10,000 yards to 45 nautical miles.

Air to air missiles have a speed range from 1.5 to 3 Mach and the weight varies from 50 to 350 lbs. They use either beam or radio impulse guidance, infra-red or optical homing, depending upon the purpose for which it is used.

Air to surface missiles have speed range of 0.7 to 2 Mach and the weight varies between 600 to 13,000 lb. Active homing or special guidance systems are used.

Surface to surface tactical missiles are used for varied purposes. They comprise of small gadgets of 25 lbs. weight and a speed of 0.2 Mach used against tanks and armoured vehicles as well as bodies of 40,000 lbs. weight and a speed of 5 Mach. The guidance system also differs and methods such as wire command guidance to inertia guidance of complicated design are used. To this must be added the special class of weapons of the I.R.B.M. and I.C.B.M. class with weights varying from 20,000 lbs. to 100,000 lbs. and incorporating special navigational and guidance systems.

A word about the guidance system and its accuracy would not be out of place. In the case of very short range work, the guidance can be accomplished by transmitting commands by small electric wires but when such a simple and reliable system becomes impracticable, complicated systems consisting of a number of components have to be used. Even if the reliability of each component by itself is high, the combined reliability of a number of them working together to give a system of guidance becomes surprisingly low. 40 such components each of 98% reliability would give a combined overall system reliability of approximately 48 per cent which means that only half the weapons could be expected to reach their target when such systems are used. Radar control can be made ineffective by interference, jamming and use of decoys. Infra-red homing devices could not be jammed but it is not secured against diversion by heated decoys. The inertia guidance which depends on a process of integrating linear and angular accelerations of the missile to determine its position in space is of course more reliable but suffers from accumulating system errors. Naturally as these systems improve due to general progress in these techniques, the overall reliability would also improve.

With this general information about guided weapons, one can think of a suitable surface to air missile directed against the attacking aircraft if it is at a sufficient altitude. Even if the missile is fitted with some homing device and proximity fuses, it is necessary to direct it in the general direction of the target so as to bring it within the homing range of the device used. It is also true that the speed of these missiles is greater than the transonic—supersonic aircraft but the difference in speed is not large enough to give enough margin for correcting large errors in aiming these missiles unless the range at which they were released is very small.

Radar detection can hardly give a time of 2 to 3 minutes as a warning in the case of a low flying aircraft if the radar station is situated at ground level. If a larger interval is required only an airborne radar can make it possible. In the case of an attacking aircraft at an height of 35,000 ft. a detection time of nearly 20 minutes can be expected and naturally an airborne radar at a similar height can give a similar time interval as a warning.

Even if time for preparation is assumed to be available by these methods a surface to air missile can hardly be utilised for defence in the case of a low level attack. The only possibility is to get fast interceptors equipped with missiles having infra-red or optical homing device, climb to a height of at least 20,000 ft. as quickly as possible so as to get the attacking planes on the radar screens when they are away from the target and then coming down on them to a safe range of the homing device of the missiles and launch them in sufficient numbers to score hits on the enemy planes. This naturally assumes the use of high performance planes, capable of very good speed and high rate of climb, equipped with radar detection and suitable missiles in good numbers. In order to make such an operation possible, the fighter would have to be a two seater and, would require to have a fairly large radius of action.

An airplane of this type should have about 800 miles radius of action, should be able to climb to 35,000 ft. in 3 minutes and should have a top level speed of 1.5 Mach at that altitude. Naturally such a plane would weigh about 20,000 lbs. fully equipped and would cost in the neighbourhood of Rs. 30 lakhs each on a large scale production. Such an aeroplane can also be used for ground

attack role when needed. The two seats are not required for this role but, the space for the second seat can be used for additional fuel and ammunition or rockets for air to ground use. If this purpose is kept in mind at the time of the design of the plane, the conversion can be made with ease and in short time without the use of elaborate workshop facilities. If the endurance could be increased at high subsonic speeds of the same plane, and some of the armament is replaced by scanning radar, a version of this type can be utilized for radar detection of attacking planes for early warning.

Cost estimates of a system where high performance aeroplanes equipped with suitable small range guided missiles are used as indicated before, can be made if the estimated number of such planes is assumed to be known. However, the cost of equipping the entire defence with guided missiles of different type to suit every form of air attack is rather difficult to make, mainly because it is difficult to determine what type of defensive weapon is required in all possible cases. It is believed that no suitable missile exists which can destroy aircraft which is doing low level attack and is reasonably fast, even if detection of such aircraft is done fairly early.

No attempt is made in this short paper to deal in detail all possible uses of aircraft and missiles, nor is such a task easily possible. It is intended to put a point of view to this conference which might stimulate thought in this direction. There may be many assumptions which may not be valid but that need not prevent us from critically examining the problem and determining whether airplanes of the type mentioned are necessary in the immediate future for the defence of a country.

Discussion

In initiating discussion Dr. Kothari mentioned that the role of high performance aircraft should be considered in relation to the radar environment. Depending upon the type of defence required—'attrition' or 'annihilation'—the performance of the aircraft had to be suitably adjusted. Another important consideration was whether defence was required in depth or only restricted to the frontiers.

Dr. Bhabha wanted to know whether the lecturer had considered the problem of defence against an atomic attack. Dr. Ghatage answered that only conventional (non-atomic) weapons had been considered and he indicated that the performance of the defending aircraft envisaged, was a maximum level speed of the order of 1.5 Mach number and radius of action 800 miles.

Air Marshal Mukherjee explained that the pattern of defence in this country would be different to that adopted in European theatres and it was in this context that the design of a high performance aircraft in India should be considered. The question of the relative merits of aircraft and guided missiles had to be studied further.

A/Cdr Arjan Singh mentioned that there was a definite case for the employment of a high performance aircraft for defence in this country. Even in the European theatre there was a requirement for this type of aircraft.

Need for the design of high performance aircraft was further stressed by Dr. Nilakantan who said that high performance aircraft could be designed with

sufficient flexibility for operation in the ground attack role besides the interception role. Analysis of the design of several high performance aircraft, showed that the weight of fuel and warload was in almost all cases about 44 per cent of the all up weight. By adjusting the proportion of fuel and warload a considerable degree of flexibility could be achieved. Dr. Nilakantan further pointed out that adequate radar warning was available for important targets within the country by high performance aircraft against enemy bomber attacks.

A/Cdr Goyal pointed out that even with existing high performance aircraft there was a considerable strain on the pilot flying at low level. When considering a further improvement over current performance due account will have to be taken of the human element and suggested that the flight pattern should be such that maximum speeds in low level flight should be restricted in duration.

Dr. Ghatage in summing up the discussion stated that the high performance aircraft envisaged by him would be able with very simple modifications to meet the following roles:—

- (a) A two seater aircraft for interception (Pilot and radar Operation).
- (b) A single seater ground attack aircraft.
- (c) Single seater early warning aircraft for radar detection of enemy bombers.