

DEVELOPMENT OF AIRCRAFT INDUSTRY IN INDIA*

By Group Captain M.S. Chaturvedi, Director of Policy & Plans, Air Headquarters.

The object of this paper is to discuss certain problems regarding the development of aircraft industry in the country and suggest means to overcome them. I propose to discuss these problems as we see them and encounter them almost everyday in Air Headquarters. As a result most of them are organisational rather than those which are faced by men engaged on this kind of job due to general lack of industrialisation in the country.

It is axiomatic that India requires to be self sufficient in the design, development and production of aircraft both for civil and military use, and not, as she is at present, remain entirely dependent on foreign sources. This requirement is keenly felt in the field of defence, since it is appreciated that the growth of the Armed Forces of a country, in fact their very existence in peace and war, is in modern times directly related to the industrial potential of that country to produce weapons of war. If the two are not properly balanced the Armed Forces would be quite ineffective in fulfilling their role of defending their country in time of emergency. The atomic bomb and the supersonic jet have not changed the theory behind General Nathan D. Forrest's observation on how to win wars—"Get thus fastest with the mostest". In the past it meant plenty of horses and forced marches, today it means a lot of things among them "industrial mobilization".

Before I go any further it would be worthwhile taking stock of our present assets in this connection. Civil and Service Organisations exist in India for repair and overhaul of aircraft, aircraft engines and their related ancillaries. The H.A.L. at Bangalore is already building aircraft under licence. It has also produced designs for a number of different types of aircraft for Civil and Service use and has undertaken certain specialised design, development and production jobs for the I.A.F. It has been given initial approval by the Government to go ahead with two prototypes—one a single engined light trainer and the other an advanced trainer for use by the I.A.F. The former called the HT-2 (HT presumably stands for Hindustan Trainer) is being flight tested and, it is hoped, will be put on production line in the very near future. The latter, designated by the firm as the HT-10, is in the mock-up stage.

Apart from the H.A.L. the I.A.F. has got a finely equipped Base Repair Depot capable of repair and overhaul work of all types of aircraft and engines including jets. There are also several other repair and overhaul workshops—some of them having good capacity for undertaking this type of work belonging to various civil Airline Companies.

So much for the existing technical and industrial capacity of the country. As regards availability of technical manpower, we have relatively large number of young technically minded men in the country who have studied aircraft design, development and production in America, Great Britain and other countries of Europe. These persons are keen to take their place in an Indian Aeronautical Industry but as yet they have no positive outlet to give them the essential practical experience they require.

From what I have said above we conclude that potential capacity to commence design, development and production of aircraft exists in the country.

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It needs able leadership and organising capacity to bloom into full fledged aircraft industry which will serve the civil and defence requirements of the country.

To my mind there are two main reasons of the slow progress in this direction—

- (1) No Central Government Organisation exists to control and direct the aeronautical industry in the country. In other words the executive agency is completely missing.
- (2) The amount of materials, accessories etc., which could be supplied from sources within India is almost negligible.

In the United Kingdom the aviation industry is controlled by the Ministry of Supply. It must be remembered that this Ministry is NOT analogous to the Ministry of Industries & Commerce (formerly called Industries & Supply) in India. The Ministry of Supply controls two very important organisations called the Directorate of Technical Development (Air) and the Aeronautical Inspection Directorate. The D.T.D. (Air) is an organisation consisting of civilian technical specialists in aeronautical research, design and development. Officers from the Services are attached to this Organisation on an "as required" basis in an advisory and liaison capacity. The function of the D.T.D. (Air) is to provide an independent body directly under the government, to cross-check and issue Government approval to aeronautical industry, thereby ensuring that the recognised standards of safety and efficiency are achieved.

In order to bring out the importance of the part played by this organisation it is essential to understand the process of originating and progressing aircraft design and production. In the first stage of design and specification, the Operational Requirement Section in the Air Ministry lays down the operational requirement of the aircraft. These are passed to the D.T.D. (Air) who compile them into "Requirement Specifications." This official document is then issued to the various Aeronautical Engineering contractors. The "aircraft design specifications" made out by constructors are submitted to the D.T.D. (Air) again who in conjunction with Air Ministry accept or modify them as necessary.

During design and erection of the mock-up, the specialist branches of the D.T.D. (Air) and Air Ministry meet at contractor's works from time to time to ensure that the mock-up of the aeroplane is designed and built to the satisfaction of all parties concerned. After this, Wind Tunnel tests are carried out on a Wind Tunnel model and accurate and concise records of the result of individual test in the wind tunnel are compiled.

The structural testing is the most important part of the design and production of an aircraft. During these tests the D.T.D. (Air) and the contractors meet and discuss and itemise the list of structural test specimens to be designed and manufactured at periods closely following behind the various stages of mock-up design and construction. The time lag between mock-up, sectional clearance and test specimen should be so close as to be almost concurrent.

The following are some of the parts of an airframe structure which must be manufactured in final design materials for "destruction" structural failure testing for all types of aircraft other than the two seat primary trainer—

- (a) complete wing tip to tip specimen with a short section of central fuselage attached ;

- (b) complete fuselage including the fin and tailplane with a small section of wing centre section ;
- (c) one wing root attachment fitting ;
- (d) wing section panels ;
- (e) fuselage section panels with typical frame and longeron joints.

All test specimen undergo a complete range of structural tests including complete final destruction in order to ascertain the final breaking load as compared with the design load. All stressing calculations in connection with test specimens are submitted to the D.T.D. (Air) for cross-checking. In certain cases the D.T.D. (Air) may require some parts to be made up and tested independently of the contractor.

Finally, when the prototype has been constructed and flight tested by the manufacturers, the final acceptance trials of the aeroplane are undertaken by an independent body at an Aircraft Experimental Establishment (Boscombe Down) under the control of D.T.D. (Air). This series of flight trials will include many which are positively dangerous as the aeroplane is deliberately wrongly loaded in order to check every possible condition that might be met with under operational service. Lately the D.T.D. (Air) have insisted on the installation of an "Automatic Observer" in all prototype aircraft. This is a highly complicated installation and necessitates a duplication in an enclosed compartment of every instrument which will indicate wing, aileron, elevator and rudder loads under varying conditions of flight. This compartment is completely enclosed and contains cine camera recording apparatus. Thus an incontrovertible photographic record of instrument loading is taken throughout all series of flights.

The final task of the D.T.D. (Air) consists in compiling, in conjunction with the manufacturers, the following items of supporting literature which are so indispensable for all those who use the aeroplane—

- (a) Service instruction schedules ;
- (b) Design instruction schedules ; and
- (c) Technical publications.

Thus the real controlling organisation for the design and manufacture of aircraft is the D.T.D. (Air). A fully equipped organisation of this type does not, at present, exist in India, although efforts are being made to start it in a nucleus form, under the Ministry of Defence. However, in order to achieve efficient technical control of aeronautical design and development, we shall have to set up a D.T.D. (Air) to cover both Service and civil needs having under its control the following main organisations :—

- (a) Aeronautical Research Laboratory. The equivalent of this in the U. K. is the Royal Aeronautical Establishment, Farnborough.
- (b) Aircraft Experimental Establishment for all flight testing. The equivalent of this in the U. K. is the Aircraft and Armament Experimental Establishment, Boscombe Down.
- (c) Aeronautical Research Training College. The equivalent of this in the U. K. is the College of Aeronautics, Cranfield.

It must be appreciated that the aircraft industry, perhaps more than any other, depends to a large extent upon numerous basic industries. This is because each item of equipment of an aircraft represents the height of design and production technique in its particular sphere. It is not often realised that the aircraft manufacturers normally only produce the airframe which in

general terms only represents 1/8th of the aircraft. The aircraft factory produces the design of the aircraft after which the "manufacture" becomes essentially an assembly operation relying upon other industries and firms to produce specialised materials, components and equipment. The broad breakdown of these divisions is as follows:—

- (a) Airframe.
- (b) Engines.
- (c) Instruments.
- (d) Electrical equipment.
- (e) Signals equipment.
- (f) Specialised components *e.g.*, under carriages, rubber items, etc.
- (g) Engine ancillaries.
- (h) Airframe ancillaries.
- (i) Armament equipment.
- (j) Special aircraft materials.

All the above require specialised manufacturing technique. They cannot be undertaken economically by the aircraft manufacturers as the total requirement is relatively small. At the same time such equipment can only be developed economically and efficiently from a normal basic industry already in existence, *e.g.*, aircraft tyres by firms in the basic rubber industry, signals equipment by normal commercial radio firms, etc. This is particularly so in the case of the specialised materials for aircraft which must be the logical development of the basic industry. Steel is a typical example in this case.

Thus the main point when considering the setting up of aircraft industry is not entirely the aircraft factory itself but the need for expanding, developing and subsidising if necessary, numerous other industries which are essential for a country to be self-contained and self-sufficient in the production of aircraft. To illustrate this point it would be interesting to note that there are 64 sub-contractors involved in the production of Vickers Valleta, a British twin engine Service transport.

All manufacturing firms associated with the design, development and production of aircraft and airborne equipment require an efficient research and development organisation behind them. This is necessary to give adequate technical backing and to centralise research and development personnel, equipment, data, etc., so that it is readily available for use. It also provides double check on aircraft design and development work which is considered by all countries producing aircraft as essential for safety, efficiency and economy. Such organisation, however, is very costly and as such individual concerns are not in a position to afford them. In all countries, as a result, they are Government controlled and Government financed. Before we make a serious attempt at building an aeronautical industry in the country, it will be necessary to ensure that a Government aeronautical research and development organisation is built up in parallel.

I have said before that in the U. K. the D.T.D. (Air) comes under the Ministry of Supply. This is an ideal arrangement in that it satisfies two essential conditions, viz., the D.T.D. (Air) must be divorced from the user (*i.e.*, in U. K. the Air Ministry and the Ministry of Civil Aviation) and be separate from, but work alongside of, the manufacturer. In India the Ministry of Defence controls the H.A.L., the embryo aircraft industry, and it should, in my view, also control the D.T.D. (Air). India's total requirement in this sphere are at present

very small ; that of the civil aviation are almost negligible. It is not practicable, nor is it economical, to have a separate Ministry for this purpose like the Ministry of Supply in U. K. The only Ministry, therefore, which is capable of controlling the aeronautical industry and which is directly interested in it is the Ministry of Defence. When the new industry has been sufficiently nursed and it is strong enough to take its place alongside the older established industries, then the question of transferring it to some civil Ministry might be considered.

The functions of the D.T.D. (Air) do not include responsibility for progressing production. In our country at this stage of development of aircraft industry, there is an acute need for some responsible agency to undertake this job. This agency can take the shape of a small section in the Ministry of Defence and its task would be to progress production of aircraft in the country and to work in liaison with the D.T.D. (Air), A.I.D., respective Directorates of Air Headquarters and the Ministry of Industries and Commerce. It would decide what items could be ordered on indigenous firms and would follow up their production with special attention to the quality of the finished product.

Finally, to weld the work of the various organisations mentioned above, and to permit the Defence Secretary to direct the development of the embryo industry there should be a " Controller of Aircraft Production " in the Ministry of Defence. This individual must have wide experience of aeronautical industry in foreign countries.

I am perfectly aware that the suggestions made in this paper carry with them substantial financial liability. But I am afraid there is no cheap or short cut answer to success in this matter. The higher direction must, if the industry is to grow to its proper stature, be organised correctly and be well staffed from the outset. Such a course, I am sure, will also lead to economy of both men and money in the long run since it will avoid duplication and co-ordinate the efforts of various agencies to the best advantage. Any other course invites mediocrity at best, but more likely failure.

To sum up—

- (a) Nucleus of Technical & Industrial power for aeronautical industry exists in the country. So also does the technical manpower although highly experienced persons are, to a certain extent, lacking.
- (b) To develop the industry properly it needs—
 - (i) a good sound organisation controlled by the government ; and
 - (ii) development of basic industries.
- (c) In the present context of circumstances, the control of the industry should continue to be vested in the Ministry of Defence which should have a Controller of Aircraft Production controlling—
 - (i) D.T.D. (Air), Aeronautical Research Laboratory, Aircraft Experimental Establishment and Aeronautical Research Training College.
 - (ii) A.I.D.
 - (iii) Aircraft production co-ordinating section to liaise with the D.T.D. (Air), respective Directorates of Air Headquarters and the Ministry of Industries & Commerce.
- (d) It is high time we took steps in these directions if the country is not to remain dependent on foreign sources for all times to come, in this sphere. Purely from the defence point of view the delay can prove dangerous, sometimes even fatal.