EXCERPTS FROM . . .

The Fifth British Commonwealth and Empire Lecture

Inter-City Transport Development on the Commonwealth Routes

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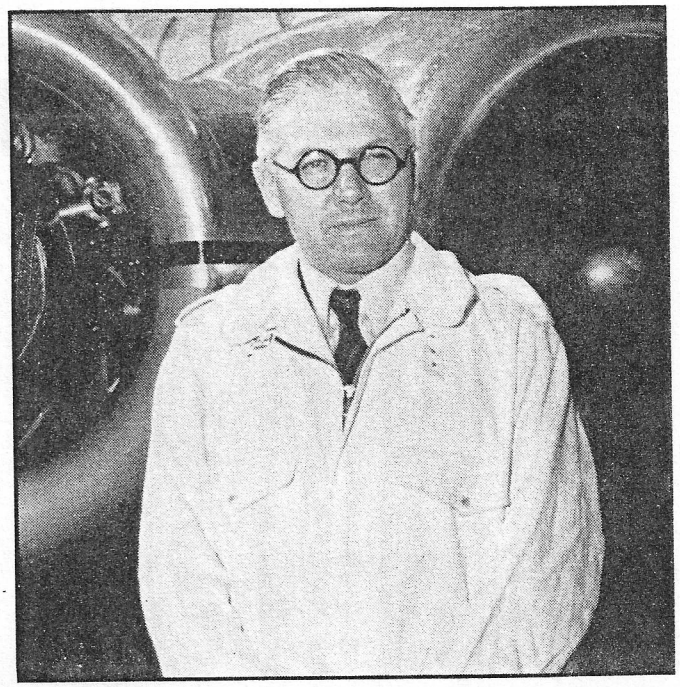

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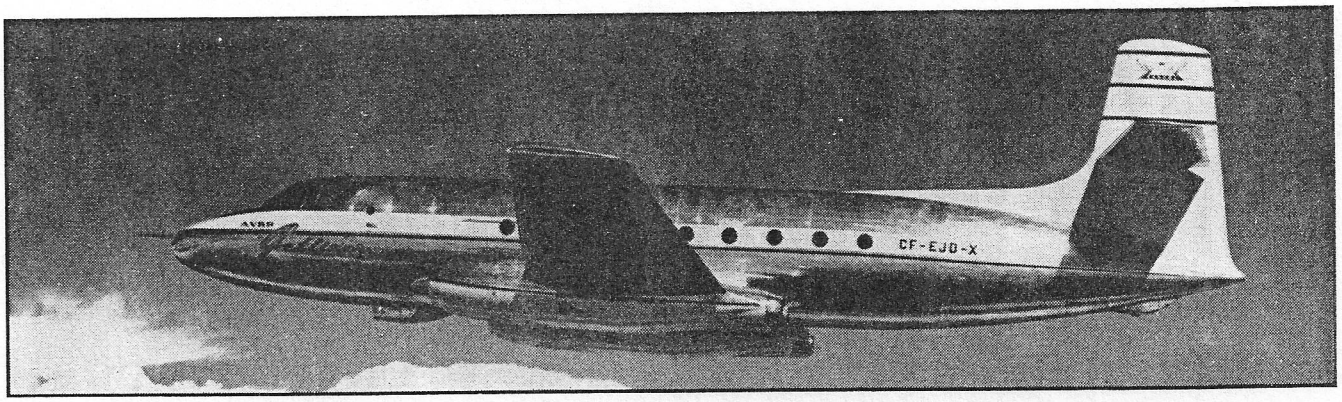


From an aircraft and traffic point of view, air transport appears now to be broadly divided into four categories: (i) Feeder Line Operation; (ii) Short Range or Inter-City Operation; (iii) Medium Range Operation.; (iv) Long Range Operation. These may be fairly closely defined as follows: (i) Up to about 250 miles; (ii) 250 to 1,000 miles; (iii) 1,000 to 2,000 miles; (iv) 2,000 to 3,000 miles and upwards.

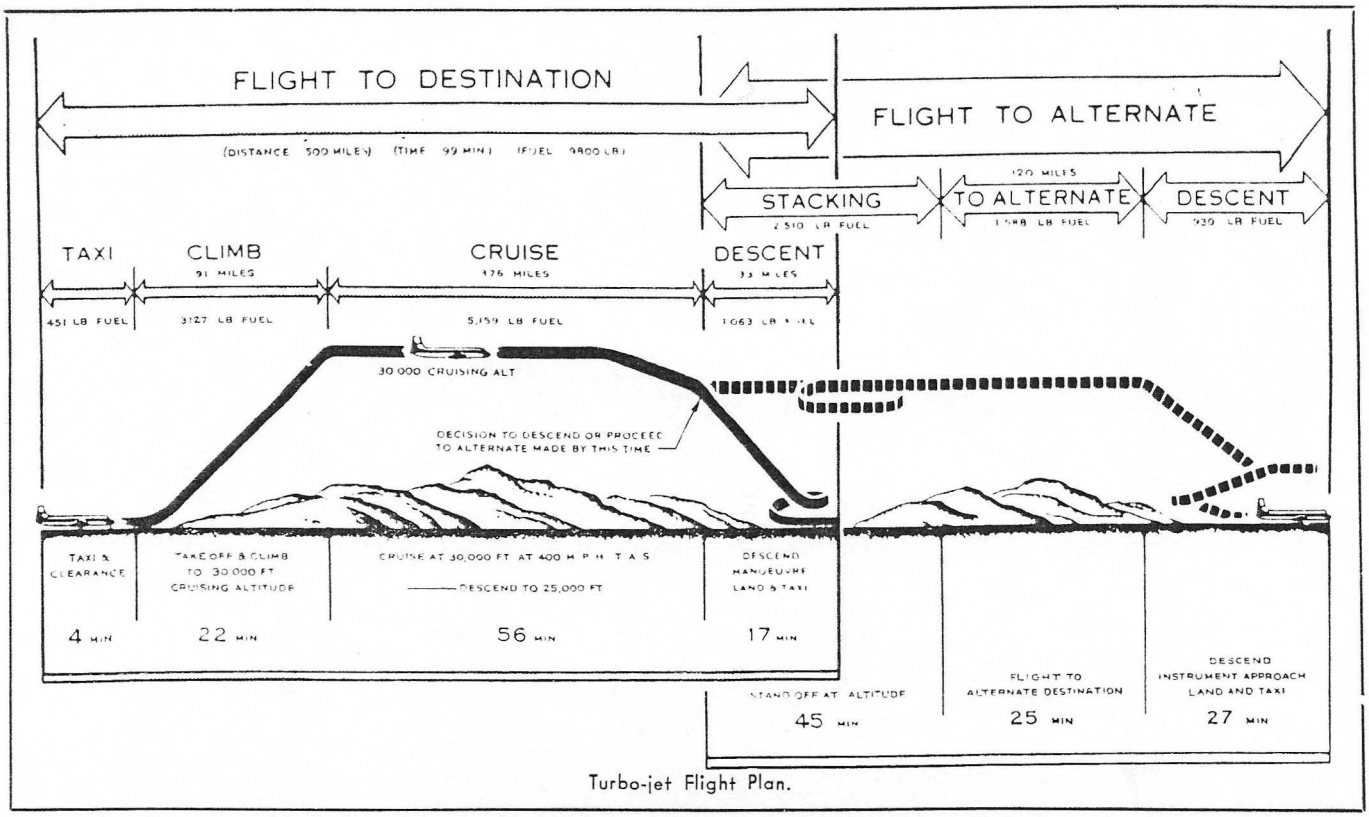
These pretty well define the aircraft types which are required for world-wide air route pattern and will continue to do so for some time to come. In the first group we are, to a great extent, still dependent upon the veteran DC-3 which is being followed by newer types. This entirely excludes the helicopter or the small executive aeroplane operated by companies or on a charter basis and which have played such a great part in the opening up of the Canadian north and other countries in the Commonwealth. There is no doubt that the opening up of the immensely rich mining areas of Northern Canada has been made possible by aeroplane.

In the third and fourth groups, dominated by the DC-6, DC-4, DC-4M2, Constellation, and Stratocruiser, we have longer Empire routes and the Pacific and the important North Atlantic prestige route.

Nevertheless, from a traffic volume point of view, group (ii) covering the shorter range Inter-City stages is by far the most important. The ratio of domestic to international traffic in Canada for 1947 was approximately 4.5 to 1 and in 1948, 5.6 to 1: while the ratio of domestic to international and foreign traffic for the U.S.A. was 3.6 to 1 in 1947 and 3.8 to 1 in 1948. Apart from this it is the field in which air travel is most practical and where real and obvious advantages can be offered to the passengers without the insuperable strain and habit disturbances of long distance air travel.

No one can honestly pretend that at the present time trans-Atlantic air travel is other than 3rd class travel. The only thing one can do is make it as short as possible so that the effect of catching up with, or running away from the sun, can be mitigated as much as possible by completing the journey in the normal waking day, preferably, or sleeping night.

Inter-City travel, particularly if done quickly, has almost all the advantages and none of the disadvantages of surface travel.



Turbo-jet Flight Plan.

We are rapidly approaching the time when the return journey of 1,000 miles between Toronto and Winnipeg can be made within say, 12 or 14 hours, waking time, and leave ample time between the trips for three or four hours' business without having to sleep away from home.

In addition to this, it is the group in which aircraft and air traffic control development can most naturally take place first.

Up to this time only two modern postwar inter-city transports have appeared on the scheduled routes, the Convair 240 and the Martin 202, capable of taking a maximum pay load of about 9,000 lb. including up to 40 passengers. A number of operators are using these aircraft but then again a number, realizing, that in this stage range the effect of aircraft and engine development will be earliest felt, have refrained from committing themselves to the immediately available new types, fearing that they may become at a disadvantage when more advanced and faster types appear. For the time being, therefore, many operators are carrying on with DC-3s, DC-4s and even DC-6s on stage lengths for which these aircraft are untirely unsuited, to the detriment of operating economy, until the new aircraft arrive.

Regions Favorable to Development: The degree to which conditions exist favorable to the introduction of advanced types of aircraft, particularly the turbo-jet, vary greatly in different parts of the Commonwealth. This, it seems, colors very much the outlook as to when the time will be ripe for the introduction of the jet, and as to whether the turbo-prop stage is worth while.

Although I have tried to be as unbiased as possible it is gratifying to note that it is not now so much a question of "whether" or "no" but rather "when" in talking of the turbo-jet.

Careful Consideration

From this some indication can be obtained of the justification, if any, for the intermediate turbo-prop stage. This requires careful consideration as it would inevitably saddle the operator once again with equipment with which, while more rapidly obsolescent, he would be loth to part in view of his financial investment.

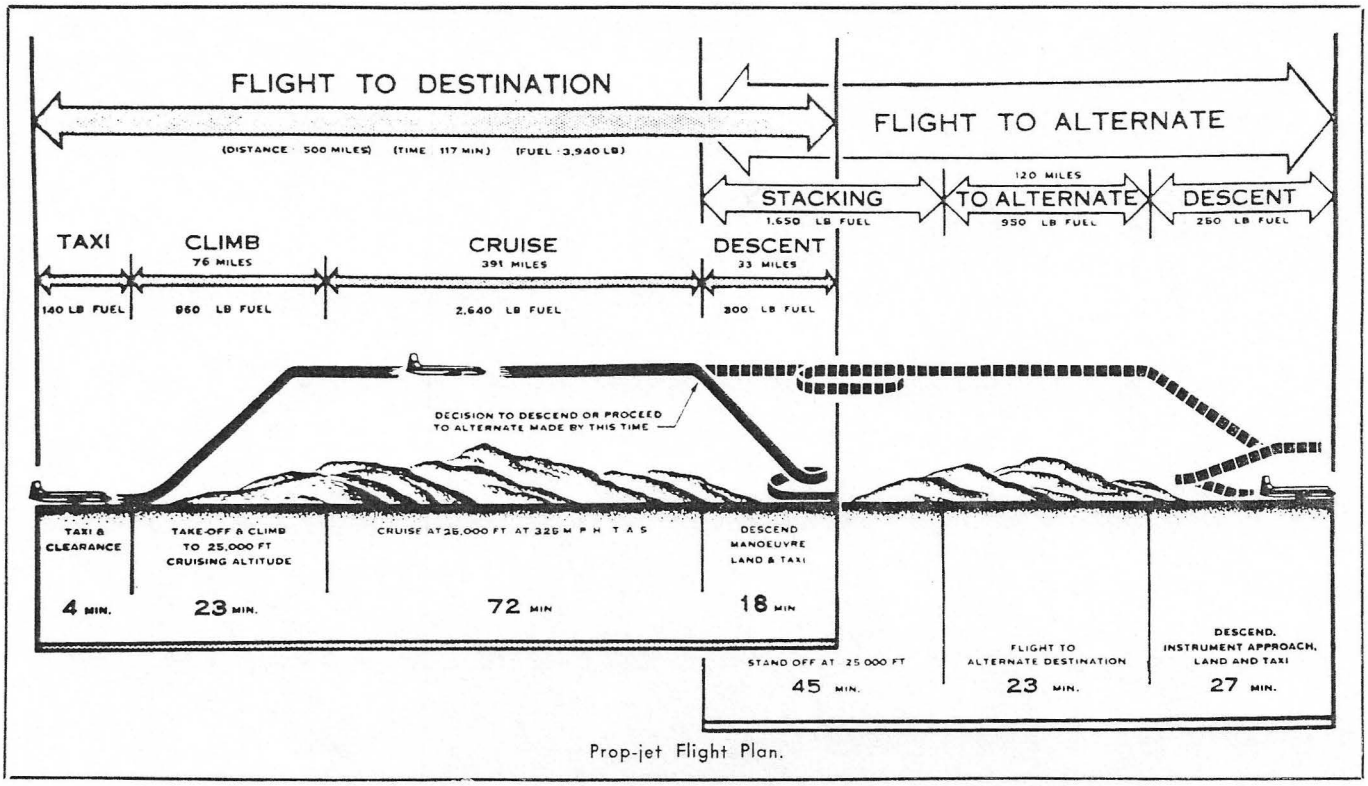
Availability of More Advanced Types: Turbo-prop aircraft with a cruising speed of 300-350 m.p.h. and turbo-jet aircraft with a cruising speed of between 400 and 500 m.p.h. will be available shortly. Prototypes with adequate operational ranges up to 1,000 miles and payloads up to 11,000 or 12,000 pounds are already flying. It may be assumed therefore that they are technically feasible and that it remains to demonstrate their economic soundness and competitive qualities in relation to existing reciprocating engine types.

Speed: The one factor which generally brings the biggest return to the operator is speed. This is because it gives more tonnage or passenger miles per 1,000 hours of annual utilization, and so reduces the indirect operating costs of the air line, which are equal in importance to the direct cost.

A first step towards this can be made by combining direct and indirect costs. In this way a much more accurate picture can be obtained of operating economics and it can be shown that, while the higher speed of the jet may have no lower direct costs, the indirect costs will be considerably less, resulting in a net reduction in total costs.

It should be quite clearly appreciated that speed enables the operator to make more money, quite regardless of whether or not anything is done to improve the time to transport the passenger to and from the city office to the airport. On a short journey the overall saving in time may be small, but it is the saving on the time in the aeroplane that counts.

Increased speed of operating, however, brings with it its own problems of traffic control and ground handling of aircraft passengers and it is important that the designers and operators cooperate on these and work out solutions



Prop-jet Flight Plan.

together.

Types of Aircraft: Of the types of aircraft which may be considered for the future inter-city routes may be mentioned: (a) Reciprocating-engined transports. (b) Turbo-prop power plants. (c) Turbo-jet power plants. (d) Compounded reciprocating transports.

While (a) is current, (d) may be discounted for short range operations, hence discussion should centre around (b) and (c) by comparing both with (a).

Aircraft Size: Aircraft size is an important parameter.

In the past entirely misleading comparisons have been made by taking the wrong size of aircraft. If, say, a twin-Derwent transport of 28,000 lb. gross weight is studied, the conclusion will undoubtedly be reached that only the most meagre (or alternatively, most optimistic) emergency allowances will show the aircraft to be able to fly 500 or 600 miles. If, however, one studies an aircraft twice the size (and power) it will be found to be able to fly 500 or 600 miles with reasonable allowances.

It is now proposed to compare in detail the turbo-prop and turbo-jet transport aircraft of the near future and to relate them to the current reciprocating engine types.

For the purpose of comparison, it is reasonable to take aircraft in the short range field of 40,000-60,000 pound all-up weight range, or in other words, the 40-60 passenger aircraft or again, the 8,000 to 12,000 pound payload, short range or inter-city aircraft.

It is felt that short range aircraft in this bracket will fill the needs of operators for some years to come. The increasing traffic densities in Canada and the U.S., as well as in other parts of the Commonwealth, indicate that the 40-60 passenger aircraft will give the best compromise between aircraft size and traffic frequency.

Fuel Allowances: Keeping in mind what I have said about the effect of aircraft size on fuel allowances, I would like to review the much discussed question of allowances and the ability of the three types to carry them. The four debatable allowances are: (i) Taxi-ing allowance; (ii) The stacking allowance; (iii) The alternate allowance; (iv) The descent allowance before going to alternate.

New Conception

With the exception of (i), these are in the emergency category and are distinct from the fuel requirements which are common to all types of aircraft.

It will not be possible to tolerate protracted taxi-ing and run-up times prior to actual take-off. Hence a new conception of aircraft handling will be required. Fortunately the jet engine does not require any appreciable warm-up time so that the dispersal of the aircraft adjacent to the take-off point is the most practical answer. The engines then need only to be run immediately before take-off.

This was proposed by a senior member of a well-known air line who considers that specially designed vehicles can take the passenger from the airport building to the aircraft. In this way wastage of fuel prior to take-off will be eliminated.

The stacking allowance, which is pretty well directly proportional to shortcomings in operating "know how", is well known to be the biggest handicap on the jet and the least on the reciprocating engine, the turbo-prop being in between. The jet aircraft, while taking a penalty, does not suffer unduly. It will be seen that it gains much more relatively, than the reciprocating engine and the turbo-prop by improvements in engine economy.

Alternate allowances must obviously be carried by all aircraft for some time to come, but there is part of the alternate allowance which is worthy of separate consideration. This may be described by (iv) and implies important changes in operational control technique. This is because the omission of the pass at the primary destination means direction of the pilot by the ground organization which must decide for themselves as regards landing conditions. Pending improvements in

visibility assessment methods, such a change undoubtedly means conservatism on the part of the ground control and consequently more diversions after departure. Nevertheless, the reduction in block to block time for the inter-city aircraft will ensure more accurate weather prediction for a shorter time ahead and thus, fewer actual diversions.

Necessary Diversion

When diversion is necessary it is unreasonable to bring a turbo-prop or turbo-jet all the way down from 20,000 or 30,000 ft. in case of doubt in order to look at the airport. If the weather is bad it is then necessary to consume large quantities of fuel climbing again to height before going to the alternate.

Flexibility of Operation: There is also the question of the flexibility of operation of the jet which is so often quoted as one of the biggest difficulties of jet transport operation; the view is prevalent that the jet aircraft (and to a slightly lesser extent the turbo-prop aircraft) suffers from severe inflexibility of cruise and altitude operating conditions; this is very much exaggerated, as an investigation of four, three and twin-engine operation at various altitudes indicates. By using the right number of engines for the altitude, the jet can stack at any altitude without a penalty on fuel economy. This is quite apart from any improvements in the slow running economy, etc., arising out of intake area control, or variable nozzle control, which are bound to emerge from the work which is being done in this field now.

Therefore, provided that an aircraft which is stacked for any length of time is definitely being brought in to the scheduled destination, there is complete flexibility of altitude and no penalty in economy.

As far as restarting in the air is concerned this can be accepted as a reasonable procedure.

Operating Economy: The crucial test of an aircraft is its ability to earn money for the operator. In this regard the narrowly technical definitions of efficiency are materially modified by the economic considerations of airline operation.

Although it is sometimes said that one can prove anything by generalized operating cost analysis, nevertheless, comparisons using the operating cost data of an actual air line or number of air lines should be true. Furthermore, the comparison of actual air line data with generalized formulæ, such as the ATA or the newer SBAC method gives surprisingly close results.

Conclusions: The turbine-propeller and the turbine-jet aircraft which are now in the prototype stage and represent the next breed of civil transports even now, under reasonable operating conditions, are economically competitive with current types. With the improvement of the jet engine this advantage will be greatly increased. The turbine-jet aircraft stands to gain relatively more than other types by advances in engine fuel economy and offers the greater scope for development over the next few years.

The full and complete replacement of the present and current types of inter-city and medium range aircraft by the turbo-prop and turbo-jet aircraft of the near future, requires the introduction of novel methods of airline and aerodrome traffic control. This has lagged sadly behind aeroplane development and while the new types are just around the corner, the traffic control authorities and aeronautics administration authorities both in the U.S., England, and Canada are only just beginning to face up to the problem involved.

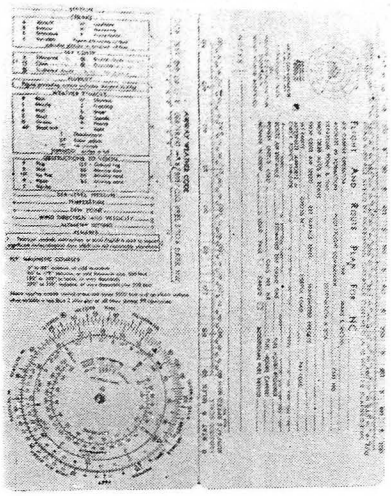
Revolutionary Phase

Both for this reason and also, because it must be so with all new equipment, there will be a period of operational experimentation preparatory to the full scheduled operation of the jet transport.

In this phase the Empire air routes are, if not uniquely, at any rate particularly, suitable for this development period.

As far as the preponderant internal inter-city systems are concerned, the distances, and weather are suitable. In addition the basic simplicity of the systems obviates distracting complications. The absence of frequent international frontiers, the language problem, and the stacking problem are important factors. Canada and Australia are particularly favorable in these regards, compared with Europe.

The rapidly developing members of the Commonwealth therefore can play a significant part in this new and revolutionary phase in air transport development, and indeed all branches of aeronautical development.



Coairdinator

Two new computors designed to simplify flight planning and cross-country navigation for private pilots are being produced by the Halpin Coairdinator Company of Washington, D.C. The pocket size computors are designed to enable a private flyer to solve his typical flight problems without the need for complex calculators of the type required for air transport pilotage. The Flight and Route Plan Coairdinator (both sides of which are shown above) is a basic navigation device, while the Air Distance and Magnetic Bearing Table (not shown), with a supplementary time-distance Coairdinator ruler, provides a cross reference index for flying between cities.

The Flight and Route Plan Coairdinator includes scales for use with aeronautical charts for direct reading of ground speeds, time intervals, off-course errors, and route planning. The flight plan side (right) of the unit provides space for all the information that the pilot would need on a flight. Notes may be made on the frosted plastic surface with a pencil and later removed with an eraser. The reverse side of the Flight Coairdinator (left) includes a code analysis plan for reading teletyped weather reports and a precise disc slide rule for solving problems of time, fuel consumption, speed, and conversion of units of measure. The instrument measures 7½ by 3 inches.

The Air Distance and Magnetic Bearing Table is at present only applicable between cities in various U.S. regions.