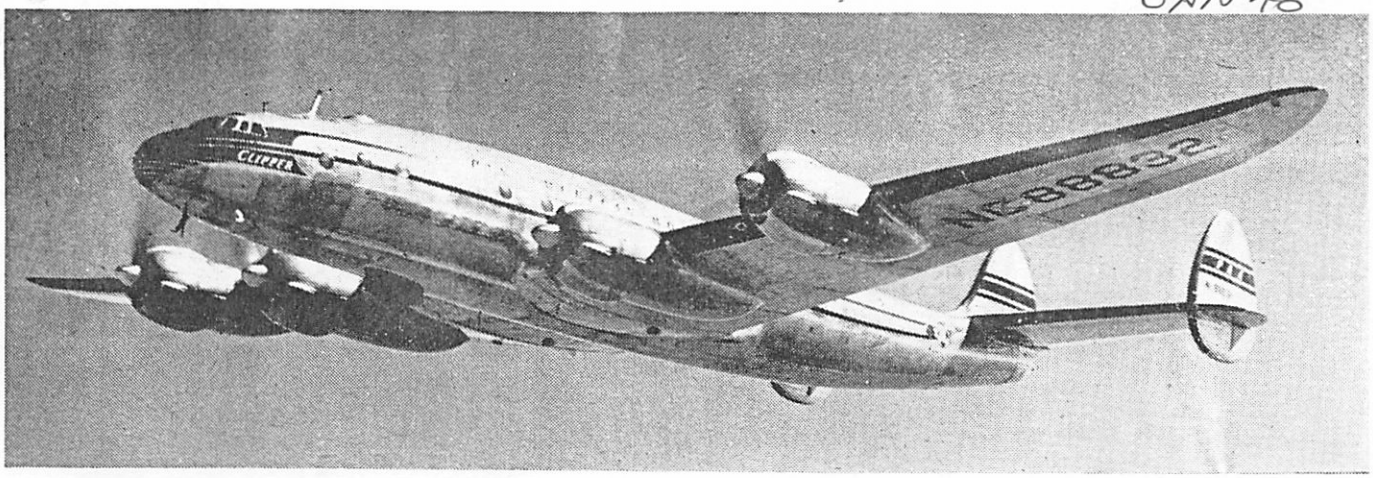
JAN 48



WHAT'S WRONG WITH OUR AIRLINERS ?

By James T. Bain

Director of Engineering, Maintenance
Trans-Canada Air Lines

IN common with all airline men, I have not the slightest doubt that aviation will develop into the major method of transportation. Everything is in its favor. Already it is the fastest known mode of conveyance; ultimately it will be the most comfortable, and finally it will be the least expensive. . . .

The picture of North American airlines is by no means a happy one. And it is one which I believe applies equally well to any one of the world's major airlines. From that picture there are lessons to be learned; lessons of inestimable value to those countries who have yet intensively to develop their airlines.

For the past two years the airlines have done more business yet made less money than ever before in their histories. Passenger revenues have gone up by leaps and bounds, but the gain has been completely offset by the even more spectacular leaps and bounds of operating expenses. There are many empty seats on the airlines these days, and at the same time air mail and air cargo revenues have fallen off badly in their proportions of the total. . . .

The reasons for this dilemma of poverty in the face of increased revenues are many and varied, but outstanding amongst these reasons is the fact that **the present airline aircraft is basically unsuited for any greatly expanded and accelerated job.** . . .

PRESENT AIRLINE AIRCRAFT—During the war, the world's airlines did a magnificent job in the face of many difficulties. Considering the shortages of aircraft, equipment, ground facilities and personnel, the standards and volume of airline operations were excellent. Schedules were increased to the maximum with perhaps some sacrifice of passenger convenience and comfort, but the record proves there was no relaxation of maintenance and flight operations standards.

This great job was done with the same aircraft which had already served some years as standard airline equipment; aircraft already old in design and about to be replaced by more up-to-date and larger types.

The same period saw the formation and mushroom growth of the great Allied Air Transport Commands; organizations which in large part were built up and operated by airline men seconded to military service for the duration. The equipment used by the transport commands consisted of commandeered airline equipment, converted military types and the airline aircraft which were in the final design in 1939. These later types were rushed to completion in military garb and ultimately became the backbone of all transport command services.

ABOVE: Even the 300-mph Constellation, such as the PAA clipper leaves much to be desired, from the airline's viewpoint according to the author of this article.

THE POSTWAR "INTERIM" AIRCRAFT—Throughout the war the airlines were desperately short of aircraft, so it is understandable that, with the close of the war in Europe, an immediate clamor arose for more aircraft for the airlines. With the release for sale or rent of some of the older transport command aircraft, there was a rush to reconvert these types and get them into service. Airline fleets were quickly amplified, and there followed a tremendous expansion of airline routes and frequencies plus a mushroom growth of nonscheduled operators who were trying to get into the big money.

Some idea of the expansion of the airlines (excluding the nonscheduled operators) can be obtained by comparing the published figures of the United States operators. In 1946 the total revenue passenger miles flown was 270% of the totals for 1944. In 1947 a conservative estimate places the expansion at 450% of the same datum.

Remarkable as these figures are, they still do not tell the whole story. The estimated 456% represents passengers who will actually be carried, but in 1944 the payloads were about the maximums which can be achieved in operation; almost universally they were in the region of 90%. Today the average payload factors are closer to 60%. From this we can deduce that the passenger miles available in 1947 show an increase of 610% over 1944.

This figure gives some indication of the increase of capital equipment on the airlines.

Until the postwar aircraft became available these tremendously expanded airline fleets were composed entirely of makeshift conversions of military aircraft or venerable airline

aircraft for which the basic designs were laid down between eight and 13 years ago. They are the same aircraft on which our prewar airline industry was built, or are the aircraft which were in the process of manufacture to meet prewar airline requirements.

THE "NEW" AIRCRAFT—Let us now go one step further and examine the origin of the so-called new aircraft which are slowly finding their way into service on the airways.

In the latter months of the war the over-zealous publicity men in and out of the aircraft industry promised the world great new fleets of wondrous luxury aircraft which were apparently going to materialize overnight. They did a good job of it—these publicity men; so good a job in fact that they completely succeeded in making even the leaders of the aircraft industry believe in their rosy predictions. These dreams of 1944 and 1945 have now completely vanished and reality shows us the anticlimax of rehashed versions of prewar designs or new models built along the same old design principles.

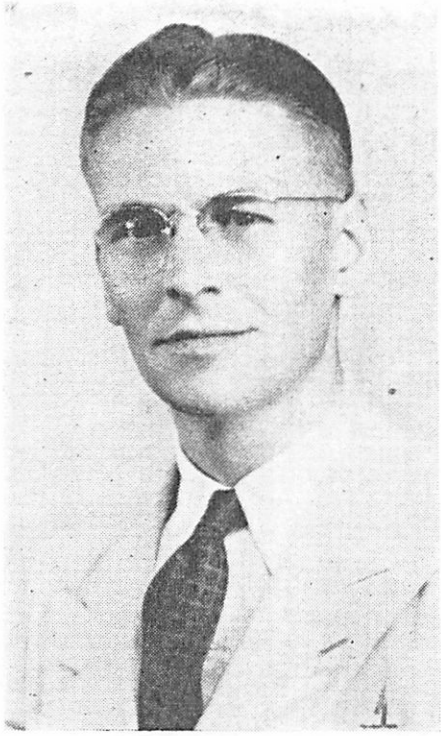
Stampede for Equipment

Two major factors have contributed to give this result. First, the stampede of the airlines to buy additional equipment forced the manufacturers to promise to produce new aircraft quickly. This they were glad to do in order to retain enough business to keep their doors open. Secondly, the manufacturers, faced as they were with the airlines' demands for the speedy production of new aircraft, did the best they could to take full advantage of the tools and designs already in their plants.

They did not take time to restudy the new airline pattern that had leaped into being after the war. They did not study the operational result which would attend the expanded fleets of larger aircraft when placed in operation on the existing airway facilities; airway facilities which, with but minor establishments, are the same today as they were before the war.

I wish to repeat my statement on the "new" aircraft. They are, by and large, rehashed prewar designs, conversions of military aircraft, or are new versions built to meet the same old design principles. They are new only in terms of production date.

These aircraft now on order or going into service on the airlines have been purchased with the pious hope that the product of increased speed and capacity will give the revenues with which to meet the inflated costs of operation. I hope this proves to be correct, but, when one considers the new regulations under which these new planes will operate . . . it is hard to believe that the latest additions to the airline fleets will meet their purchasers' requirements.



AUTHOR

James T. Bain, author of this article, is TCA Director of Engineering and Maintenance. This article is based on Mr. Bain's paper delivered before the Royal Aeronautical Society in London, England, recently.

My own opinion is that the new aircraft are little, if any, better than the old, and the necessary improvement in the financial results will not materialize.

As a vehicle, the present airline airplane is sound and is capable of reasonable success when carefully operated within its limitations. If an airline is prepared to continue operation with strictly limited density of traffic, to spend a lot of money counteracting the irritations of poor regularity, and can still make enough money to stay in business, the present airline aircraft are perfectly satisfactory for their purpose.

To sum up: Handled properly on routes which provide the proper latitude, these tried and proven aircraft of vintage design will do a fair and reliable job; but, improperly handled in an attempt to carry expanded and greatly accelerated traffic, these same aircraft are basically unsuited for the job.

IRREGULARITIES OF FLIGHT OPERATIONS—**The greatest of all evils in airline travel is, undoubtedly, the lack of ability to maintain schedule.** Against this major defect all others become minor in importance and relatively easy to correct. Indeed, with only a brief study, it becomes clear that regularity is almost an all-embracing term.

There are few functions in airline operation which do not in some degree affect regularity of operation. It certainly is true that every factor which affects regularity of operation is closely related to the development of a satisfactory aircraft specification.

Aircraft must be built to meet the particular requirements of the route, the traffic and the type of operation.

Speed of Flight—Speed is the airlines' stock in trade. Without it they have nothing. With other things remaining equal, the more the speed of airline travel the greater will be the reward.

In a recent trade paper I read an editorial with the title "Speed Obsession." It was representative of much nonsense that has been written by the "speed is already great enough" school of thought. The usual line of attack by these slow, easy and comfortable people runs something like this: Speed is dangerous. Speed is expensive. Speed adds a lot of complicated gadgets and accessories, or, from the passengers' point of view, there is not much gain in increased speed unless something is done about the all-inclusive journey time. With these pessimists I entirely disagree.

Speed and Distance

Over areas adequately served by surface transportation, the speed advantage of the aeroplane decreases with the journey length. For example, while three and a half days can be taken off the train journey time from Montreal to Vancouver (2,579 miles, there is little, if any, time advantage in flying from Montreal to Ottawa (92 miles). In spite of this, no minimum airplane journey length can be arbitrarily set as this is governed entirely by the local stage to stage conditions.

Trans-Canada Air Lines domestic routes total 8,183 miles, but the length of passenger journey averages only 536 miles. For every passenger who flies from Montreal to Vancouver there are 14 who fly between Montreal and Toronto. It can be readily shown from statistics that the greatest demands for transportation are over the short distances between adjacent populated areas, and it is for these short distances that the present airline is of least value.

To Be Continued

WHAT'S WRONG WITH OUR AIRLINERS ?

Continued from January

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IT HAS been argued that increased speed over these short distances is of little benefit to the airline passenger in the total elapsed time from his own office desk to a downtown office at his destination. This is admittedly true, but it must be remembered, when examining all-inclusive journeys of this nature, one is making a study of minimum journey lengths and not of the speed of flight. Aircraft speed is only one factor among many in such studies.

Advantages of Increased Speed—Here are some of the advantages which will accrue to the airline operator from increased speed:

1. The faster an aircraft can fly, the more units of work it can produce for every hour in the air.

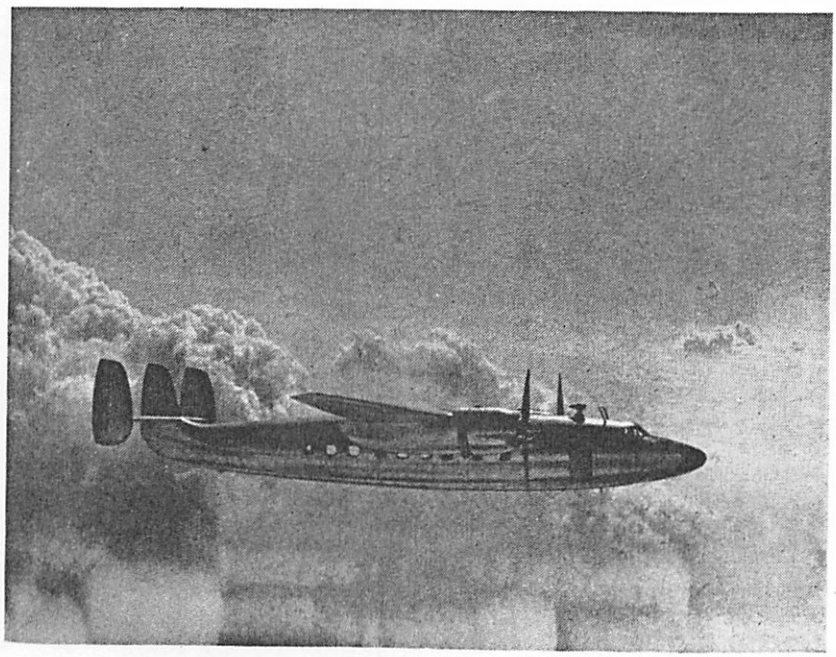
2. By increasing the units produced per hour flown, fewer aircraft will be required. Thus, an increase in speed will save on initial capital expenditures.

3. With each improvement in speed, so will the speed of disposition be proportionally improved. With better speed of disposition, fewer spare or stand-by aircraft will be required, thus again saving on initial capital expenditures.

4. The faster an aircraft can travel from point to point, the greater the accuracy of weather forecasting. If the speed of the aircraft is doubled, the possibility of weather delay due to inaccurate forecasting is very appreciably reduced. Thus can be obtained an immediate and substantial improvement in regularity. Greater regularity will, in turn, induce more traffic and permit a higher percentage of direct flights. This could only result in increased revenue and decreased operating costs.

5. The shorter the time to complete a journey, the less will be the many incidental costs of meal services, hotel accommodations for delayed passengers, crew layovers away from base, etc.

6. The combination of increased speed of disposition, greater regularity and the potentially greater traffic volume will bring the airlines closer to the possibility of eliminating the necessity of reservations for single-stage journeys.



LEFT: The Airspeed Ambassador.

Without attempting to get into summer and winter seasonal traffic flows and the many other elements which affect airline operating costs, I should like to demonstrate **the effect of speed increase on the costs of operation.**

For my purpose I shall ask you to accept a rough formula for direct operating costs as being those which are directly proportional to the number of hours flown (such as fuel, oil, flight crew, overhaul, etc.) and for indirect costs as being those which remain constant regardless of the number of hours flown (such as depreciation of aircraft and ground equipment, hangars, traffic department, etc.).

With existing airline aircraft the direct and indirect operating costs are each roughly 50% of the total operating costs when the utilization of the aircraft is about 10 hours per day.

If the rate of producing work of the aircraft is doubled by the process of doubling the speed, the original amount of work can be produced by half the number of aircraft. By halving the number of aircraft, the major portion of the indirect costs is also cut in half. This means that the same amount of revenue can be produced at a lower total operating cost.

Regularity and Safety—Last winter saw a series of major airline accidents which gave both the travelling public and the airlines plenty to think about. These tragedies touched off a veritable spate of commentary and publicity which, in the minds of thousands of potential air travellers, left the indelible impression that flying is not safe.

Each accident is wrapped up in a shroud of secrecy which is not removed until the incident has faded completely from the public mind. If free and open discussion of the cause of the accident and the correction which had been applied were released while the incident was still fresh, the airlines would have gone a long way toward giving their customers the necessary reassurance that, when properly operated, the aeroplane is as safe as any other transport vehicle.

Powerful investigation committees, set up at high Government levels, have succeeded in effecting a little housecleaning. There is no doubt that such investigations will result in a further decrease in accident rate, and it is probable that some of the causes of air accidents will be eliminated completely.

Whether or not the correction being

made will meet the case will be proven only by the future record, but my own opinion is that, if the committees continue their investigations along the same lines as at present, their digging **will not get down to the real roots of air accidents.**

There can be no true regularity unless it is regularity with safety. It is failure to recognize this basic principle which keeps regularity indifferent and the accident rate too high. I shall have to go back a little in airline history to make my point.

In the early days of scheduled flying the airplane was by no means the complicated mechanism we know today. Everything about it was rudimentary, and flying was stopped when it was not possible to see the ground and follow the course of the flight on a map.

The succeeding years saw the rapid development of the first true airline airplanes. Great strides were made in the reliability of engines and airframes which increased the scope and reliability of operations. The development of radio and precision instruments made it possible to navigate without visual contact with the ground.

New Problems Studied

With each advance of specialized equipment, the regularity and the safety of scheduled operation were improved. New problems such as icing, static and storm were studied, understood and beaten by additional equipment or advance of the associated sciences. Scheduled flying became possible through all but the worst weather conditions.

This was roughly the status in 1940. But somewhere along that road of progress an essential turning has been missed. We are not progressing any more.

Some months ago I was talking to an old and thoroughly experienced airline captain who had just completed one of his periodic examinations of the airline's flight procedures and techniques. During our conversation on this subject of safety and regularity he made what is, I believe, a very significant remark. He said:

"With anything approaching minimum weather conditions, flying into LaGuardia these days is a full-time job for two men working independently."

What he said in effect was that the airline procedures which have been developed to give regularity of operation had gone beyond the point where regularity and safety went foward together or, to put it another way, **we now are striving for regularity at the expense of safety.**

When first a sensitive altimeter was installed in an airplane the pilot of the aircraft was given an instrument which permitted him to operate with safety into lower minimums of cloud height than ever before. Thus, in this elementary case, regularity and safety both were improved, but in the course of developing the airline airplane, they have added new techniques, procedures and additional gadgets beyond the ability of any human being to act as the interpreting or controlling medium.

A glance at the record of accidents gives strong support to this contention. If the contention is accepted, it must be quite obvious that no further addition of procedure or gadget can correct the condition, nor can additional crew members relieve the situation.

To get back on the correct road **we must eliminate the human element** with its limited and slow power of co-ordination from the purely mechanical job of flying and controlling an airplane.

Look at the same question another way. With the expansion and acceleration of airline traffic which has already taken place at some of the major cities in the USA, each minor weather delay causes the "stacking" of flights above the airport sometimes for hours awaiting their turn to land. A major deterioration in weather will ground flights for a considerable radius for periods of time which force cancellations of schedule, with all the attendant expense, complication and loss of goodwill.

". . . Hello Flight Seven . . . you're coming in low! . . . you're coming in too low!! . . . YOU'RE COMING IN . . . &!!*!$%!@"!.."

If regularity has already depreciated in the congested areas, what will be the effect of the still greater increases in traffic density which have been so prolifically forecast?

Complete automatic control is not impossible. Wartime expenditures have already provided the basic information from which can be obtained the answers to the remaining problems. This fact has already been amply demonstrated by the remarkable record of the "All Weather Airline" group of the United States Army Air Forces.

If the airlines and their respective Governments would adopt the principle of automatic flight control and pursue it aggressively with complete achievement their goal, the improvement in both regularity and safety would repay their investment many times over by increased operating revenues.

The air traveller's point of view—

The majority of air travellers are provided with the fast transportation they pay for, but it is, unfortunately, true that for many a passenger air travel has lost its erstwhile glamour of blue skies, silver wings and flashing speed.

The air traveller of today is becoming more and more impatient with the multitude of irritations and delays which may beset his journey.

The complicated reservations systems, the annoyance of picking up the ticket far ahead of departure time, the fuss over baggage and checking in, the overcrowding of the wild bus or taxi ride to the airport, the waiting for the departure, the service delays, connection delays, loading delays, weather delays, and mechanical delays, the supreme affront of cancelled flights or the final bogging down at some alternate airport miles from the proper destination all add up to account for quite a percentage of the empty seats on the airlines.

When these basic evils are accompanied by the minor annoyances of inadequate and crowded terminal buildings, no place to sit or eat in comfort, poor ventilation, poor lighting, the incessant unintelligible blare of loudspeakers, the perishing cold or the blistering heat, or the mad dash through the rain to the waiting aircraft which seems to park invariably in the middle of a huge puddle, it is no wonder the poor air traveller is

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Airliners

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given seriously to think when his magazine or billboard says, "Relax! Next time take the train."

One could become very despondent about the future of the airlines if it were not for the statistical fact of the yearly increases in air traffic, which prove what can be expected when the bad conditions are corrected —and corrected they most assuredly will be.

The Aircraft on the Ground—It has long been a desire of mine to have one of the designers of airline aircraft spend just one week on the departure ramp at an airline station. I am quite sure that at the end of that short period he would thoroughly appreciate that it takes more than a knowledge of aerodynamics to design a good airline aircraft.

He would soon understand why the facilities of the aircraft for ground handling can destroy the value of excellent flying characteristics.

I shall list just a few of a host of things our designer would learn:

1. With present designs of cargo compartments, it takes a three-man crew 14 minutes to off-load 1,000 lb. of cargo, and it may take twice as long if it is a mixed cargo of mail, express and baggage, which needs sorting out. To correct this on domestic aircraft we must have roomy cargo compartments which are accessible in flight to permit pre-sorting of the off-load for the next station.

2. Centre-of-gravity travel is altogether too critical with present designs and a much wider range must be provided to facilitate loading.

3. One cabin entrance door is not sufficient through which must be handled the off and on loading of passengers, the commissary and food service and the cabin cleaning crew.

4. It must be made unnecessary to work through any cargo or other compartment to get at the radio, electrical, instrument or accessory equipment. These must be immediately available by the simple removal of a covering panel and must be arranged to permit easy removal and fast replacement of a defective unit.

5. The fuel tanks must be capable of accepting high rates of flow. The oil tanks must be easily filled without complicated, dirt-catching filler funnels. Facilities for the flushing of toilets and replenishing of water, alcohol, oxygen, fire extinguisher and hydraulic supplies must be suitably arranged for external servicing.

6. Provision must be made for complete cabin air-conditioning by the use of an external power source.

These are just a few items which must receive thorough examination before the aircraft's design even reaches the drawing office. Lack of proper aircraft facilities for ground handling represents a major operating cost increase which can easily be eliminated by thoroughly understanding all the details of the proposed operation before even the writing of the specification commences.

Conclusion—In this article such major factors as aircraft maintenance and overhaul practices or the effect of airport have been omitted but, somewhat sketchily perhaps, I have outlined some of the principles and opinions wihch are the sources of discussion in Canada. That I am not alone in these opinions can be illustrated by example.

In 1942 TCA started the preparation of a specification for postwar air transports. Today the preliminary version of an aircraft built to that specification has seen several highly

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successful months of service on the North Atlantic.

Because of a lack of design ability then existing in the manufacturing plants in Canada, we were unable to start from scratch and build the airplane we wanted; however, we have succeeded to a degree in applying some of the principles I have discussed in this talk.

I have discussed simplification of the pilots' duties and automatic control. In the North Star we have taken this principle as far as present airway facilities will permit. One example of this is the Rolls-Royce power plant with which the North Star is equipped. With the co-operation and guidance of Rolls-Royce Limited, we have succeeded in making all engine controls entirely automatic, thus greatly simplifying the cockpit control.

The propellers are controlled by a single lever, and provision has been made for hooking up eventually the automatic pilot, the aircraft controls and the power plants for operation by radio control.

The success of these innovations would be endorsed by any of TCA's transatlantic flight personnel, and is proven by the record of 100% completion of all schedules. At the same time we are finding the maintenance and overhaul costs in both man hours and materials are appreciably lower than our most optimistic estimates.

Canadian Developments—In the development of her national airlines, Canada is "making haste slowly," yet with great ambition. Our internal domestic and trans-border flight equipment at present comprises well-known, tried and proven aircraft which will easily maintain Canada's competitive position. With this we still are not satisfied.

After careful consideration of all the practical and economic factors involved and after thorough and searching comparison with existing and proposed types, a development program for an advanced passenger transport is in process, and construction of the prototype is now well advanced at the Toronto plant of A. V. Roe Canada Limited.

Details of the design specification have not yet been publicly released, but it can be said that, if and when that aircraft flies, it will bring to fruition years of work on the necessities of successful airline operation. It will be fast. It will be simple to operate. It will demonstrate real progress along the road of regularity and safety, and last but not least it will, I believe, be more economic by any analysis than any existing airline aircraft.

We of the airlines all look forward to and strive to bring closer that day when, with clockwork regularity and in supreme safety, our aircraft will carry the air cargoes of a united world. Our convictions differ widely on how to attain it, but nevertheless that day inevitably will come.

Airborne Troops

(Continued from page 21)

to "wings" standard by the RCAF; will later go to Dartmouth for conversion training. Here they will concentrate on "ADDLing" (Airdrome Dummy Deck Landings) and must become thoroughly proficient in the naval technique of dropping onto the deck before they will be allowed to test their skill aboard a carrier. There is a strong possibility that the gap between Harvard and Sea Fury will be filled by the Firefly trainer, although none of this type has been delivered yet.

All told, naval pilots will log about 360 hours before their first carrier landing—almost twice the time allowed during the war. And even trained pilots will be required to get