

AVIATION

Wings Over Water

Atlantic Clippers, Now Going Into Service, Have Long History of Pioneer Efforts Behind Their Shining Wings

By LEONARD H. ENGEL

TWENTY YEARS of unremitting effort will reap their due reward this spring with the opening of the first passenger-carrying airplane line across the toughest ocean of them all—the North Atlantic.

That is how long it has taken the youthful aviation industry to conquer this richest of all the world's trade routes.

For nearly four years Pan American Airways has been flying its great Clipper ships 9,000 miles across the Pacific from San Francisco to Manila and Hongkong. Air France and Deutsche Lufthansa have been spanning the 1,600-mile gap between Africa and South America with airmail. Until now, however, no heavier-than-air service has been operated across the North Atlantic.

Behind the brilliantly routine fashion in which today's flights are carried out is a history of not only daring airmen who risked their lives to show it could be done, but of accomplishment and training in other quarters of the earth which have made the America-to-Europe airline possible.

First Flight

It is more than a score of years since a memorable day in 1918. The Aircraft Committee of the Navy, wondering at the close of the World War what to do with the long-range seaplanes it had developed to combat the submarine menace, decided to show the world the Atlantic could be flown. So it was done—for the first time.

From that decision sprang the May, 1919, flight of the NC-4. Less than 72 hours were spent in the air between Long Island and Plymouth, England. There was trouble a-plenty on that journey, which included stops at Trepassey, Newfoundland, the Azores, and Lisbon. Two companion flying boats, the NC-1 and the NC-3, started out but never completed the trip.

Two weeks later, two British airmen won a \$50,000 prize offered by the London Daily Mail for the first non-stop flight across. Capt. John Alcock and Lieut. Arthur Brown, piloting a twin-

motored Vickers-Vimy bomber, went from St. John's Newfoundland, to Clifden on the Irish coast in 16 hours.

So great were their difficulties and risks, however (their plane, though it was one of the finest then in the air, was extremely crude by present standards) that their success was followed by few similar attempts for many years. Better aircraft and better engines first had to be developed by the engineers.

"Lindy" Flies

It was not until May 21, 1927, that Lindbergh put transatlantic flying on the map with his 33-hour solo flight from New York to Paris in the Spirit of St. Louis.

Two other flights were made that year by men who, like Lindy, were after the \$25,000 prize offered by a Paris hotelman, Raymond Orteig, for the first non-stop journey between New York and Paris.

Clarence Chamberlain and Charles A. Levene, his backer and passenger, reached Kottbus, a small town in Germany, in one hop from New York. Adverse weather prevented them from reaching Berlin, their destination. Admiral Richard E. Byrd added to his polar laurels a flight in the America. He reached Paris although fog forced him to turn back to the coast. And in later years, successful flights became commonplace—so commonplace that even a fiery Irish lad, Doug Corrigan by name, was able to make it in a small Curtiss plane without knowing quite where he was going.

In the 18 years between Brown and Alcock and the summer of 1937, engineers and inventors had taken giant strides. So, in that year, half a dozen countries began devoting serious attention to conquering the last ocean and tapping the richest trade route in the world.

Pan American's survey flights, half a dozen in number, were carried out in the Clipper III, a 21-ton Sikorsky flying boat which now plies between Baltimore, New York and Bermuda under the name Bermuda Clipper. To these flights, Panam brought the experience it had accumulated not only over the

Pacific, but above the Caribbean and down the long east coast of South America, where the bulk of its 50,000,000 over-water miles have been piled up since it started ferrying passengers between Miami and Havana a dozen years ago.

With passenger flights due to start within three months, Pan-American Airways expects to provide transatlantic air service four times a week at a total yearly cost of at least \$4,000,000 to the government in the form of postal subsidy.

Two flights in each direction each week will leave from New York or an alternate American port for Southampton. Two round trips a week are to be made between New York and Marseilles, according to a schedule of operations expected to be in effect by the end of the first year of operation.

Mail Trips

Panam officials anticipate making only one survey flight preliminary to scheduled mail and cargo trips, several of which are to be made before passengers are carried.

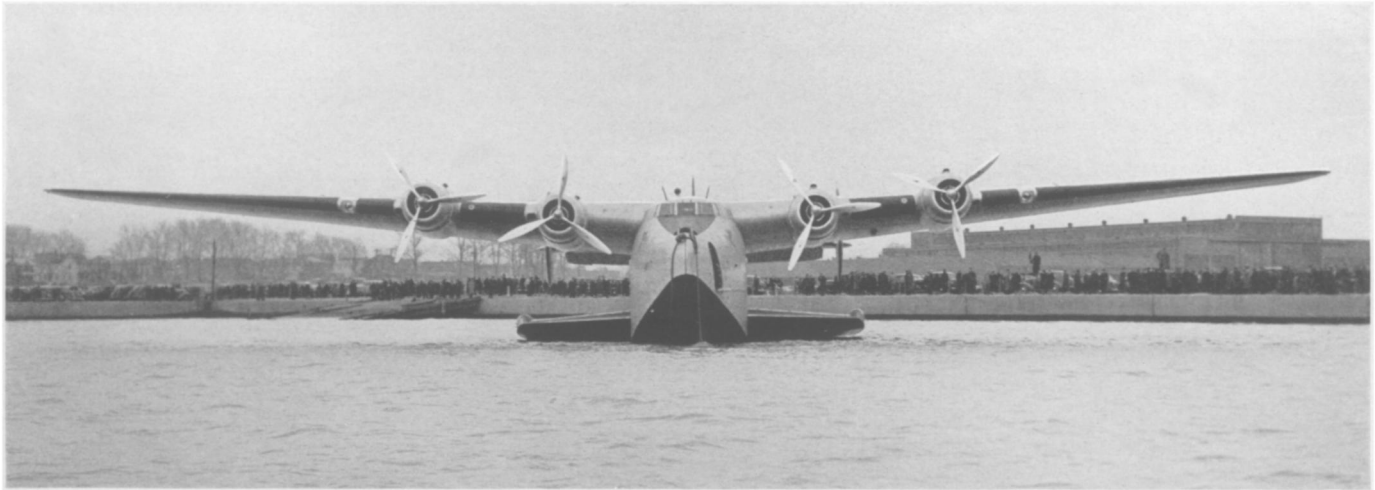
New York-London service by the northern route in the Clippers will take twenty-four and a half hours. The return trip will take slightly longer because of prevailing winds. It will be flown over the northern route, via Newfoundland and Ireland, only during the summer months.

The southern route, via the Azores and Lisbon to Marseilles in the summer, and to London as well in the winter, will take 43 hours. On this route, an overnight stop will be made at Lisbon.

American supremacy on the European run will ride the greatest airplanes ever built.

Nearly three years have elapsed since a July day in 1936 when representatives of the Boeing Aircraft Company and Pan American Airways, who had spent some seven years actively planning for their transatlantic route, signed a contract for six 82,500-pound flying boats which, when completed, would be the first carriers of air commerce on the new and larger style.

Four have now been delivered. The last of the six will be in the airline's hands by the middle of May. In the three years, the world's largest commercial airplanes



have passed from drawing boards to mock-up or wooden dummy through the biggest jigs in any aviation factory. Hulls completed in one building, and wings in another, they have been successively assembled outdoors, where there would be room to work on wings that stretch for half a city block and a hull that is 109 feet long. They have tasted the waters of the Duwamish River and of Puget Sound and have then been flown over to Lake Washington for trial.

Thick Wings

Wings are thick enough for a stooping man to walk through and reach the four full-height nacelles in which the engines are housed, for repairs in flight. Engines had never been accessible while aloft, before the Boeing engineers built the Super Clippers and the Super Flying Fortress, the Army's experimental giant bomber, which has the same wing.

There is no bending over near cabin walls on the passenger deck of this two-decked airplane, or on the flight deck either. Ceilings are full-height, walls square. The six or seven men who will be on duty at one particular time have as much space to work in as all 21 passengers on the largest domestic airliner now have to lounge in.

By day, 74 passengers, plus crew, can be carried. Forty can be accommodated on overnight flights either to Europe or over the broad stages of the transpacific airway. If gasoline for only an hour were loaded, the plane would be able to take off with upwards of 215 people.

There are seven passenger compartments—five regular passenger compartments, a big one in the center that is used as dining room, cocktail lounge, recreation room and entrance hall all in one, and a bridal suite for two back in the tail. Each is done in a different

color scheme. One is beige and rust, another turquoise blue and light green. Even the flight deck, where the crew is stationed, is heavily carpeted, and the seats are upholstered in leather.

The Boeing-type Super Clipper, first large flying boat to be built by the Seattle firm, is the latest item in a young, but already lusty, American tradition for multi-engined flying boats.

Clippers go back to 1930. Pan American Airways and the lines it was busily consolidating in expanding its network were flying 20,000-pound Consolidated Commodores. But Sikorsky, working hand in hand with Pan American's operations engineers in the production of overwater aircraft, was ushering in the Clipper era with the S-40, 34,000 pounds of four-motored air boat. Pacemakers in their day, they were outmoded in 1934 by the S-42, 40,000 pounds in gross weight and able to carry 32 passengers.

Airway Blazed

A year later the first Martin Ocean Transport roared its way across the Pacific to blaze the airway to Manila, and the 52,000-pound boat proved it was the ruler of them all. But it was not large enough for transatlantic service, so the next step, to the 82,500-pound Boeings, was taken. In the meantime, a 63,000-pound Martin transport was completed and sold to Soviet Russia. It added more luster to the American aerial shield.

Big as it is, the Boeing-built Super Clipper (B-314, to its builders) is not the largest ever built. Back in 1929, a daring German designer, Dr. Albert Dornier, built a 46-ton "white elephant"—the DO-X. Powered by 12 engines, it flew across the Atlantic and back, but it never got anywhere. Like the colossal steamship of 1858, the "Great Eastern," it was years ahead of its time. It was

YANKEE CLIPPER

Bearer of a glamorous name, the great ship of the air attracted the awed attention of thousands of people as it rested on the water, ready for its pioneering flight over the Atlantic.

inefficient—neither materials, nor engineering skill, nor engines to make it practical existed. There was no traffic to justify it.

Novel features galore mark the Yankee Clipper, first to reach the Atlantic, and her sister ships. Her triple rudder, which replaced a single fin which experience showed did not provide enough tail surface for taxiing on the water, has not been seen on any but comparatively small-sized airplanes. More like a ship in many respects than a plane, the Yankee Clipper carries an 80-pound stainless steel anchor.

The Clippers, declares Capt. Harold E. Gray, who flew the first one across the continent, handle extremely easily and lightly. Two unusual engineering features account for this. A patented "booster" tab system on the control surfaces boosts the forces exerted by the pilot on ailerons, rudder, and elevators. The plane's wing loading (gross weight divided by wing area) is low, about 28 pounds per square foot. The 42-ton Clipper may be said to "float" up there in the sky.

Seemingly effortless, their million-mile journeyings will have behind them a complex organization of men and materials on the ground to make their performance possible. Already, this organization has taken very nearly its final shape. Hidden behind a facade of smooth operation, it escapes the eye. Without it, not one of the aluminum birds would fly. (Turn to page 219)

MATHEMATICS

Old Mathematical Puzzle Still Intrigues Science

ONE of the great mysteries in the history of mathematics is known as Fermat's last theorem. In the year 1637 brilliant Pierre Fermat, great French mathematician, wrote in the margin of an algebra book this statement:

"If n is a number greater than two, there are no whole numbers, a , b and c such that a^n plus b^n equals c^n . I have found a truly wonderful proof which this margin is too small to contain."

Unfortunately after Fermat's death in 1665 an examination of his papers showed that he never wrote out this "wonderful" proof. And in so doing Fermat left a mystery which probably every first rate mathematician since his time has puzzled over at least once.

Many of Fermat's mathematical followers spent entire lives on the problem and at least three large cash prizes (one in 1907 amounting to nearly \$25,000) have been offered for a solution to Fermat's moment of inspiration. Like some modern movie or cigarette contest these prizes produced a veritable avalanche of "solutions", mostly from amateur mathematicians, and all false proofs. The present status is that the theorem has been proved for values of n less than 617.

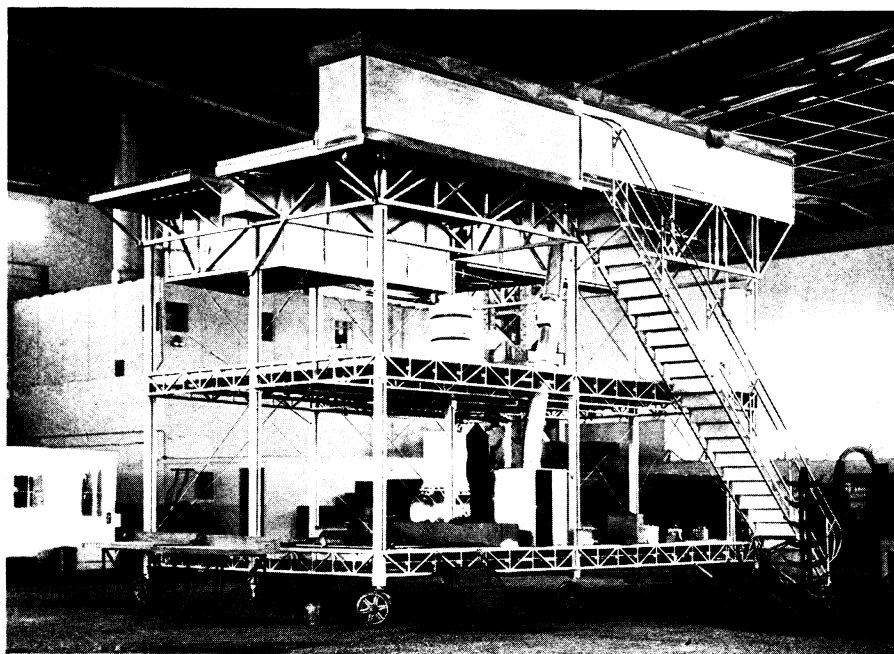
Reporting recently to the American Mathematical Society, Dr. J. Barkley Rosser of Cornell University described a method of treating a special, simplified form of Fermat's famous theorem so that many values of n can be handled at once. With this method he has proved this special case for all values of n less than 8,332,403.

This special form puts on the restriction that the number n must not divide a , b , or c . Previously Dickson in 1908 had proved this case for numbers up to 7,000 and in 1925 Beeger did it for numbers up to 14,000. By comparison Dr. Rosser's contribution is enormous.

Science News Letter, April 8, 1939

● RADIO ●

Prof. E. O. Lawrence, Director, Radiation Laboratory of the University of California, will be the guest scientist on the Science Service "Adventures in Science" program over the coast to coast network of the Columbia Broadcasting System, Saturday, April 15, 6:15 p. m. EST, 5:15 p. m. CST, 4:15 p. m. MST, 3:15 p. m. PST. Listen in on your local station. Listen in next Saturday.



"HOUSE ON WHEELS"

To give mechanics adequate working space while they are conditioning the huge planes between flights, this moveable double-decked staging has been constructed in Baltimore.

From Page 215

Its invisible strands reach out from a stately New York skyscraper, where Juan T. Trippe and his busy fellow-executives may on a bright day see almost to the Long Island operations base from which the Clippers point their streamlined snouts eastward. The threads stretch out, too, from a building of immense proportions on a fill of land jutting into Chesapeake Bay just below Baltimore.

The crews of the four Clippers earmarked for the Atlantic service will total between 40 and 50 men. But to keep them in the air and to fill their compartment with passengers and freight a regiment of at least 500 will be required. A hundred professions are represented. Men trained in widely varying fields of work will be at their appointed stations on the day the first plane takes off. Radiomen who will keep in touch with the plane in flight will be there, at New York, Bermuda, Horta, Lisbon and other strategic points. Skilled meteorologists are already at work plotting the Atlantic weather. Even "front office" men have their appointed place in the detailed organization—to persuade you, the traveling public, to part with approximately \$325 one way or \$585 round trip; to satisfy your individual wants and desires; to plan cruises and European tours.

The complicated network on the At-

lantic itself has been formed only during the last few years. Methods and organization were learned on the Caribbean and proved across the Pacific. In that time, Panam has learned aviation's lesson; the price of safe, regular operation is strict attention to the most minute details.

A transatlantic flight may take 25 hours to the passenger, but to the band of 100 men who will participate actively in its execution, it will last more than twice that length of time.

Twenty-four hours before the first passenger appears, skilled weathermen and air operators will already be at work laying the groundwork for a sheet of paper on which the plane's safe journey will largely be guided. It is the flight plan or flight time analysis—traffic department guide, crew bible, ground flight watch manual—more responsible for the great safety advances of the last decade than any other single contribution.

Before any commercial airplane flight leaves today, the pilot and dispatcher, if on a land line, or the master and operations manager, if on an overwater route, such as the airline across the Atlantic, will know, almost to the minute, what the duration of the flight will be. They will know the quantity of fuel that must be loaded to insure a safe margin, one-third more than should be required, and how it must be used; how many passengers and how much cargo may safe-



SPARES

Three of these blades make one propeller. Many of these spare blades are kept in each of the servicing bases.

ly be carried. The plan will contain data and instructions for every man in the multiple flight crew aboard the giant flying boat.

Weather maps will be drawn four times daily, to facilitate laying of flight plans. Even while Pan American Airways meteorologists keep a sharp watch on their own stations and on ports of call, they will also watch the district to the north and west of the departure point, and the area between Canada, Greenland and Iceland. In this way, they will be able to foresee coming weather at the start and along the way, for weather in the northern part of the western hemisphere comes in, generally speaking, from the north and west.

If adverse winds are exceptionally strong, the payload will be cut accordingly; if they are phenomenal, the flight may even be cancelled. The Clipper must always have aboard at take-off enough gasoline to take her one-third farther than her destination. And it is required to land at its destination with that reserve intact, to be used only in emergency.

Should weather conditions change, the master and the operations manager, kept in contact by radio, can naturally change the plan in flight. Pan American Airways pilots in general will not pay particular attention to conditions at their destinations in Europe at the time they take off. "A lot can happen to the weather in 24 hours," Allan C. Clark, division

meteorologist, explained. "It may be terrible in Southampton when a plane clears Baltimore and New York, and still be nearly ideal by the time the ship reaches the other side.

"Besides, in a couple of thousand miles across the Atlantic, you have plenty of room for turning slightly and heading for an open port."

At last the flight time analysis has been approved by the captain and Operations Manager Clarence H. Schildhauer. The last passenger and letter is aboard. The flight plan is in action.

But it doesn't end here.

A continuous record of the ship's passage is kept ashore as it wings its way across the Atlantic. Every half hour, a radio operator aboard the plane flashes back to the home port the Clipper's position and a weather report.

Exact fulfillment of the flight plan, the be-all and end-all of airline operation as the surest means to safety, is

facilitated by the careful subdivision of activities on the flying Clippers.

Much too large for the three-man crews familiar on the domestic airliners, the flying Clippers will be manned by Pan American's basic five-man crews, plus several junior flight officers. Though the passenger may see only two stewards, above him on the flight deck will be working at least six or seven men at a time.

Engine performance, in accordance with the flight plan, will be watched by a flight engineer and one or two assistants. Navigation is the duty of the pilot members of the crew, with principal responsibility delegated to one man; operation of the Morse radio transmitters and receivers is the duty of a specialized radio officer. Two pilots will be up front. Coordinating their activities is the master. And his primary job is to bring his ship home—in line with the flight plan.

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PSYCHOLOGY

Old Folks Need Clubs For Happy Adequate Life

THE THREE ages of man are childhood, the working and child rearing years, and old age.

In the world's handling of the first three score years, striking progress has been made. School and home take care of about the first twenty, and there is prospect that in the coming years, nursery schools for those 2 to 6 will find wide usage to preface happily the schooldays of the present. For adults, social security is being attempted and parenthood is being made more intelligent.

With the coming of the pleasant evening of life, the years that begin at 60, 65, or 70, depending upon circumstances, perhaps the most difficult period of life begins, an interval for which our community is not well equipped.

Old age is a new phenomenon on today's scale. When mankind was young, a person of 40 was old. The rigors of life, disease, war and privation solved the old folks problem. Never before in history were there so many above 60 as now. And our population is aging. In ten years more than a tenth of our population will be over 60. There will be more of these old folks than children under six.

A critical time of life comes when the children leave the parental nest to

establish their own homes. How disappointing it often is to achieve affluence, build the dream home, only to find that with the children gone they do not need it. Nor is financial security the complete answer. Prestige and desirable social setting are more important.

What the world really needs are clubs for old folks, not institutions like the average home for the aged and poor farms, but voluntary residences as respectable as Florida and California havens for the elderly rich. They should be much more socially and intellectually adequate, tuned to after-sixty problems as scientifically as nursery schools handle the preschool problem.

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