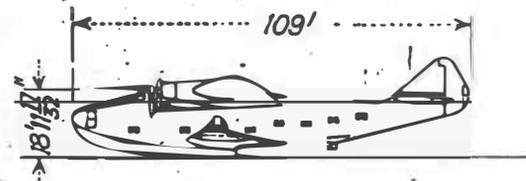
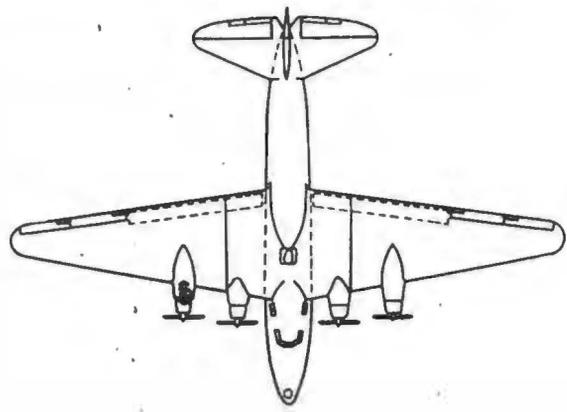


OF 1938



Boeing 314

Largest American-built flying boat designed to carry 10,000 lb. payload for 2,400 miles at 150 m.p.h. Test flown in Puget Sound.



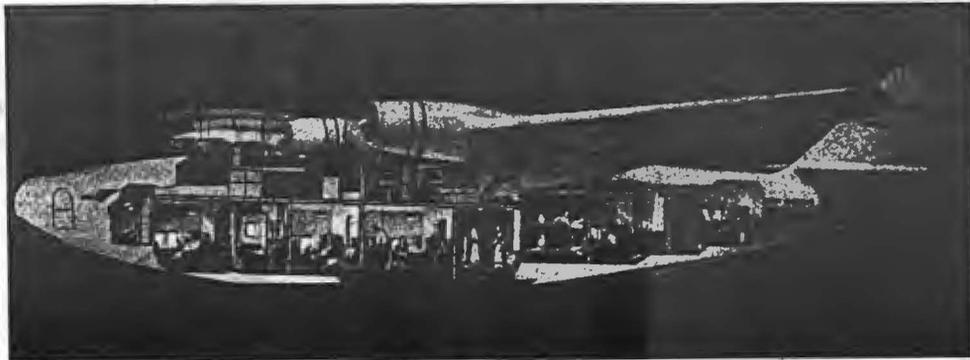
ALTHOUGH PAN AMERICAN AIRWAYS successfully pioneered both the Atlantic and the Pacific air routes with flying boats that seemed huge at the time of their introduction, it has since become apparent that they would have to move into a much larger class than the original Clippers to handle reasonable payloads over extremely long ranges. The new 41-ton Boeing described herein is another step in the direction of the really large ships of the not too distant future. It is an extremely interesting and important project, as it pushes the boundaries of airplane size beyond anything heretofore known in America.

The 314 is an impressive airplane from every angle, large, well appointed, rugged. It is a business-like airplane, not only for the steady way in which it rides the waves at rest, or while taxiing, but in the execution of the manifold mechanical and crew

functions which surround and attend its operation.

In structure, the design goes back to the famous Monomail, with its two-spar cantilever wing and monocoque fuselage. In aerodynamic design the 314 uses the same wing which has proved successful on the greatest

(Turn to page 32)



Big ship, little pilot. Edmund T. Allen (right) pilots clipper's first flight (below).





Boeing 314

Story continued from page 21

Army bomber, the XB-15. This wing is notable for its high taper ratio, (four to one from root to tip) and for its symmetrical airfoil section varying from the NACA 0018 at the root to the NACA 0010 at the tip. This airfoil provides constant center of pressure, minimum profile drag with flaps up and high maximum lift with flaps down.

Six of the 314s are now building for Pan American. The first, now undergoing flight tests, will go into regular service late this summer, and other planes will follow at intervals of about two months. The structure of No. 2 is now virtually complete and early in July she will be wheeled out into the open for attachment of wing panels, fitting of power plants, and final adjustment.

Gross weight of the 314 is 82,500 lbs. Wing span is 152 ft., and wing area 2867 sq. ft. Maximum passenger capacity in normal operation as a day-plane is 74 and as nightplane 40, with crew of eight in each case. Range with 40 passengers, in still air, 4,000 miles.

The 314 is the largest plane of any kind ever built in America. It is equipped with the most powerful radial engines yet produced—four 1500 horsepower two-row Wright Cyclones, and is propelled by the newest Hamilton Standard Hydromatic (full-feathering) three bladed propellers of 14 ft. diameter. It is the first passenger airliner with engines accessible in flight.

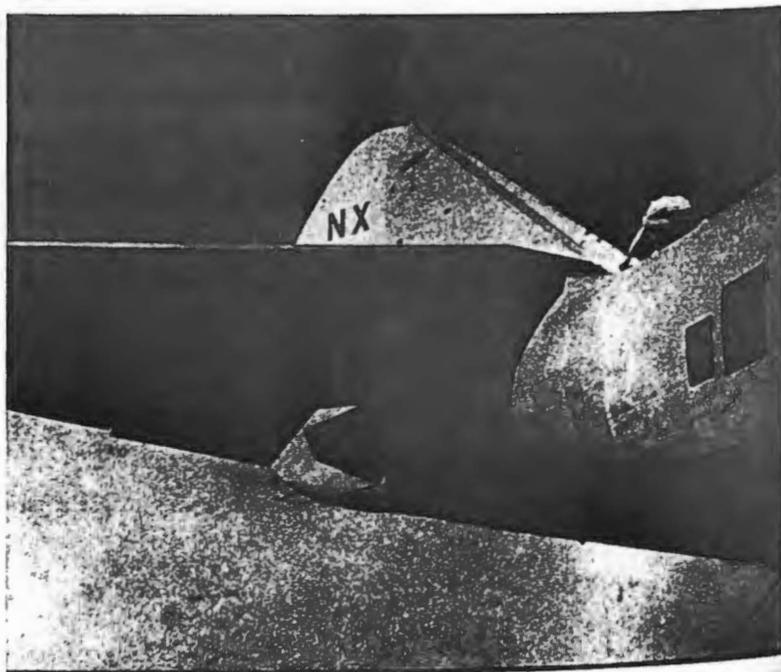
In general design the 314 is a high wing monoplane flying boat with a single hull, hydro stabilizers for stability on the water, and full cantilever surfaces throughout, including the sponsons. The wing and tail structures are internally braced, highly tapered. Structurally the plane is all-metal, except that the trailing edge of the wing, and the moveable control surfaces, are fabric covered. The hull

is of the semi-monocoque type, major truss framing being confined to lateral bulkheads except for the longitudinal keel and bottom stringers. The wings are of two-spar design using heavy truss construction and employing stressed skin covering to the rear spar to take torsion and drag loads. Dural tube and sheet is the major structural material, although stainless steel fittings are freely used throughout the hull, and steel tubing is employed in the engine mounts and wing center section. Of special interest are the four monocoque engine nacelles, which permit complete freedom of movement by the crew in approaching engine accessories, etc. Also of interest is the careful use of rugged tube sections in all trussing. These tubes in some cases are of approximately rectangular external form yet round internally, combining the structural advantages of the round tube with the assembly features of the flat sided tube for greater ease of riveting or bolting. The external alclad sheet material with which the fore part of the wing is covered is first formed into a single integral piece by spot welding standard size sheets together.

This sheet is then anodized for extra corrosion protection and to improve paintability of the metal, and is applied in one piece to the wing by riveting. Major production economies are effected by this method and the finished wing is smoother, as all riveting at the sheet joints is eliminated.

Fuel tanks are built integrally with the sponsons, each sponson carrying 1500 gallons of fuel in two compartments. A single 600 gallon fuel tank is located back of each inboard engine in the center section.

All controls are operated by cables. Following the Boeing system developed for large aircraft, the 314 is operated by means of manually operable tabs on all surfaces. For normal flying, stick forces amount to only 50 lb. If extreme control surface movement is necessary in emergencies, the tab control mechanism is arranged to "bottom" against stops and the control force is transferred directly to the control surfaces. In all flying done with such controls to date, however, there has been no case in which the tabs failed to handle the control surface. A second tab is used to balance each control surface. Static balance of rudder and elevators is provided by lead weights swinging within the tail of the hull on lever arms. Locks are provided at each control surface to prevent damage by wind while the plane is at rest. The locking pins are provided with safety springs which force them out to free the locked surface if the lock control cable should break. Ailerons are of Frise type, with 17½ degrees down and 22½ degrees up travel. Operation is by cable acting on a semi-irreversible worm gear which serves as protection against aileron flutter. Flaps are



The tail looks small until you put a man near it

of split trailing edge type, electrically operated to 60 degrees.

The power installation is designed for minimum change time. This is largely accomplished through careful manifolding of all hydraulic lines at the point of engine attachment to the nacelle structure. Due to the roominess of the nacelle it is possible for mechanics to make and break engine connections very quickly. As a result of the large size of the plane, together with the open truss structure of the wing, all control cables, electric conduits, and hydraulic lines are open for easy inspection and servicing at almost all points throughout the plane. The same is true of the structure of the plane proper.

Interior arrangements of the hull are well planned. Entrance may be made over either seawing through large rectangular doors into the main lounge in the approximate fore-and-aft center of the hull. This room is about eight feet high, twelve feet wide and fifteen feet long. Forward of this lounge are two large passenger compartments separated by the galley, men's room and spiral stairway to the upper deck. Forward of this, and separated from the main deck by a water tight bulkhead, is the bow compartment with seamen's quarters, anchor gear, etc. Aft of the main lounge are five passenger compartments, the rearmost of which is a private cabin suite. The ladies room is also aft of the lounge. Above the main deck is the flight deck, reached by the spiral stairway. The forward end of the flight deck is occupied by the control room, measuring 12½ by 21 ft. and having the bridge, or pilot's cockpit at the front, with the navigator on the port side and the radio operator on the starboard side. Back of these two

stations is the master's desk and chair, with a second chair for conferences with crew members. The rearmost station on the starboard side is occupied by the flight engineer. With a flying personnel of six and two stewards the normal working crew is eight.

Aft of the control room is the main cargo room, which extends out into each wing stub. Aft of the cargo room are the crew's quarters, with luggage holds still further aft. An observation turret for navigation is located in the top deck over the cargo hold and may be raised to serve as a loading hatch. The seaman's compartment forward is reached by a stairway from the control room, and it has a bow hatch for handling mooring lines and anchor gear, and a side hatch for crew entrance and exit. Doorways lead from the control room into each wing where catwalks provide access to the engine compartments.

The pilots have a simplified control board, practically all engine instruments and controls being handled by the flight engineer. The instrument installation is a story in itself. Generous use has been made of the new auto-syn type instruments with dual indication. Thus 13 indications are taken from each engine for a total of 52 engine readings from only 19 instruments. Including other instruments a total of 62 readings are taken from 26 instruments on the flight engineers board.

Indicative of the complete equipment of the plane is the annunciator system, with 54 stations and twelve lights.

Test flights are in charge of Edmund T. Allen, veteran test pilot and consulting engineer. With Allen on

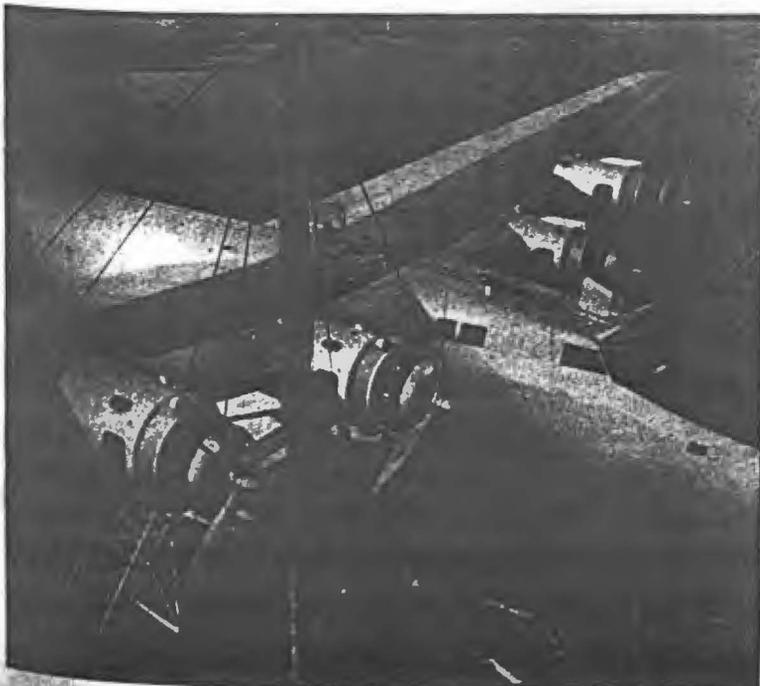


Platforms open from sides of nacelles

the first, and succeeding flights, were Earl Ferguson, co-pilot; Mike Pavone and Bud Benton, flight engineers; W. C. Lundquist and Frank J. Wiegand, Wright Aeronautical Corporation. Wellwood Beall, Boeing project engineer, also accompanied this crew on much of the preliminary testing.

Specifications on the 314 as supplied by the manufacturer follow:

Engines.....	Four Wright twin-Cyclones
Propellers....	Hamilton-Standard Hydro-matic, 14 ft. diameter
Wing span.....	152 ft.
Length.....	109 ft.
Over-all height.....	28½ ft.
Hull beam.....	12½ ft.
Draft.....	.48 in.
Wing area....	2867 sq. ft. (not including sponsons)
Incidence.....	4½ deg.
Dihedral.....	4½ deg.
Wing chord—	
root.....	29 ft. 1 in.
tip.....	7 ft. 4 in.
Aspect ratio.....	8.05 to 1
Weights:	
Bare.....	41,680 lb.
Empty.....	48,727 lb. (as 74 passenger dayplane)
Gross.....	82,500 lb.
Wing loading....	28.8 lbs./sq. ft.
Power loading....	13.75 lbs./h.p.
Top speed.....	200 m.p.h.
Cruising speed....	150 m.p.h. @ 10,000 ft. altitude @ 50% power
Range.....	2400 mi. with 10,000 lbs. payload against 35 m.p.h. head wind with 40 minutes reserve fuel
Stalling speed.....	69 m.p.h.
Take-off.....	60 sec., full load
Ceiling.....	24,000 ft. (absolute)



It's a long walk along the clipper wing span