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Detailed description of flight deck.

Subject: Control Room of Boeing Clipper

Indicating tremendous strides in the development of airplane "cockpits," Boeing Aircraft Company engineers today released a full description of the elaborate control quarters of the 74-passenger Boeing 314 Pan American Clipper.

A far cry from the old style cockpit that was little more than "a place to put your feet," the Clipper's control room has an interior volume nearly thirty times as great as the cockpit of the Boeing 40-A mail-passenger plane of 1927, which inaugurated the nation's first transcontinental air transport operations. The 40-A cockpit, accommodating a single pilot, had a volume of 37 cubic feet. The Clipper's control room, designed for a flight crew of six, has a volume of 1,078 cubic feet, or approximately five times as much room per individual crew member.

The Clipper's control room is, in fact, fifteen times as large as the two-man cockpit of the Boeing 247-D twin-engine transport, and it has more than twice as great a volume as the entire passenger deck of the 247-D.

Described as unprecedented in size, roominess, and convenient arrangement, this "super-cockpit" is considered one of the most outstanding features of the fleet of six giant flying boats Boeing is producing for Pan American Airways' transatlantic and transpacific service. The room occupies the entire forward portion of the Clipper's upper deck, and measures 21 feet 4 inches long by 9 feet 6 inches wide, with full head room throughout.

Were it not for the panels of instruments and technical devices, and the absence of pictures on the walls, the room might well be mistaken for a parlor -- all chairs and arm rests are deeply upholstered, the floor is covered with deep-piled carpet, and walls have attractive lining over thick soundproofing and

safety of operations by cutting down on
convenience in flying procedure."

The six posts of duty in the room are, first and second pilots' stations at the forward end; navigator's and radio officer's stations at left center and right center, respectively; master's "office" in the left rear portion, and flight engineer's station in the right rear section.

In brief, the duties of these various officers are as follows: the master, or watch officer, correlates the functions of the other crew members. The pilots control the flight in a given direction at a given altitude and speed in accordance with data furnished by the navigator. The flight engineer is responsible for the proper functioning of the power plants, including the calculation of power and fuel required to fly under the conditions set by the navigator and the pilot. The radio operator maintains contact with the ground stations and furnishes radio bearings to the navigator.

For relief members of the crew off duty there are crew's sleeping quarters in an aft compartment of the upper deck and forward and below in the bow compartment, which also carries anchor and mooring equipment.

Most noticeable feature of the first and second pilot's stations is their simplicity. Each pilot has scarcely more equipment to concern himself with than the pilot of a small private plane. This is because many of the functions ordinarily assigned to pilots are handled in the Clipper by other crew members, most notably the flight engineer, who has charge of power plants.

Each pilot has in front of him an identical group of six flight instruments: altimeter, airspeed indicator, rate of climb indicator, bank and turn indicator, artificial horizon and directional gyro -- the "a.b.c." instruments of piloting. Between these two groups is the gyropilot, and above it are the only engine instruments on this board: two dual tachometers and two dual manifold pressure gauges. The other instruments on the board are two compasses, an outside air temperature indicator, a flap position indicator, a clock, two pressure gauges for the gyro pilot, and an instrument vacuum gauge.

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A control stand to the left of the first pilot's seat, and an identical one to the right of the second pilot, contains elevator, aileron and rudder trim tab controls, with indicators for each, four throttles, a master control for fuel mixtures, a master control for the automatic manifold pressure regulators, and a master propeller speed switch. The latter is mounted ingeniously on one of the throttle levers, so that the pilot, with his hand on all throttles, may easily operate the switch in either direction with his thumb. All the engine controls except the throttles are master controls, functioning on all engines simultaneously. The finer adjustments of engine synchronization are left to the flight engineer.

Test flights have shown that, when flying the airplane manually, either pilot can handle the $41\frac{1}{2}$ -ton giant with but two fingers on his control column and with less force on the rudder pedals than normally used in driving a car. When flying with the automatic gyro pilot it is still easier: remote controls for the gyro pilot are mounted at a convenient position beside each pilot in the form of two little wheels at right angles to each other, one for making turns and one for operating the elevators. With the gyro pilot in operation, either pilot may sit back and may, for example, turn the ship any number of degrees to the left or right by simply rotating the turn wheel. A mechanical device accomplishes this result by rotating the "follow-up pulleys" of the gyro pilot on their shafts.

Pilot comfort is provided by deeply upholstered seats adjustable as to height, fore and aft position, and angle of back. Upholstered arm-rests may be swung out of the way for easy entry. Another interesting comfort detail is an adjustment feature on rudder pedals -- not only may they be moved fore and aft for long or short pilots, but the angle of the pedal faces is also adjustable. Maximum visibility for the pilots is provided by windows encircling the forward end of the control room.

Between the two pilots is an entrance-way to the anchor room in the bow of the ship. Behind the second pilot's seat is a spiral staircase leading to the passenger deck below. Just aft of this stairway is the radio operator's station, equipped with a deeply upholstered swivel chair and a table upon which is mounted

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a portion of the radio equipment. In all, the radio officer has three transmitters and three receivers. Overhead, just to the left of the radio station, is the control dial of the radio direction finder.

The officer occupying the post of flight engineer sits in a swivel chair in front of a sizable desk just aft of the radio station. On the wall before him is a large shock-mounted instrument board carrying 26 instruments that provide him ready information on power plant operation.* Actually the 26 instruments serve the function of 62 different indicators: 21 of them are dual indicators each registering from two different engines and one is a precision potentiometer connected with a rotary switch to give temperature readings from 16 sources -- the heads and bases of the two master cylinders on each engine.

To the left of this instrument board is a panel carrying a bank of warning lights, engine priming buttons, and electrical switches which are to be operated by the flight engineer. Immediately before him the engineer has individual controls for each engine. These are mixture controls, automatic manifold pressure regulator, cowl flap controls for engine cooling, propeller feathering controls and propeller speed controls. By means of the latter, the engineer synchronizes engine speeds, keeping his eye on a "synchroscope" which shows by a signal light when the engines are "in rhythm." Beneath the desk are handles for the auxillary hand-operated fuel pumps.

To the right of the instrument board are six large hand wheels by means of which the flight engineer controls the fuel systems. Nearby are an indicator to show if water is present in the bottom of fuel tanks, a readily-accessible
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* Instruments on flight engineer's board: Autosyn instruments -- 2 dual tachometers, 2 dual manifold pressure indicators, 3 dual fuel quantity gauges, 2 dual fuel flow indicators, 2 dual fuel pressure indicators, 2 dual oil-in temperature indicators, 2 dual oil-out temperature indicators, 2 dual oil pressure indicators; other instruments -- 2 dual air-fuel ratio indicators, 2 carburetor air temperature indicators, 1 potentiometer indicating temperatures at two cylinder heads and two cylinder bases of each engine, 1 carbon monoxide indicator detecting any presence of CO in the heating system and automatically shutting off the system, 1 clock, 1 gyro pilot pressure gauge, 1 vacuum gauge.

electric fuse box and controls for the power plant pressure fire extinguisher⁵ system. Also to the engineer's right is a door to the wing passageway leading to the engines. This accessibility of power plants during flight is considered by engineers as one of the most outstanding safety features of the new plane. The Clipper can fly on any two of its engines while the other two are being attended by mechanics.

Across the room, on the port side behind the first pilot's station, the navigation officer has a 7-foot by $2\frac{1}{2}$ -foot chart table on which he can lay out two full size navigational charts. The table contains two large chart drawers, and beside it is a cabinet with six compartments for stowing instruments, reference books and supplies. Navigation instruments permanently mounted include an aperiodic compass, chronometer, altimeter, airspeed indicator, outside air temperature indicator, and a Gatty drift indicator.

The navigator's secondary post is an observatory in the center of the wing back of the control cabin, where he can make celestial observations through a streamlined overhead turret. The navigator also has two drift sight stations on the under side of each wing, for taking wind drift measurements.

Constituting the post of final authority in the control room, the master's office, an innovation in airplane crew arrangements, is just aft of the navigator's station. At his desk the ship's captain has a second chair alongside for conferences with the navigator or other officers. Beside this station is the door to port side engines, corresponding to the door to starboard engines next to the flight engineer's post.

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Harold Mansfield