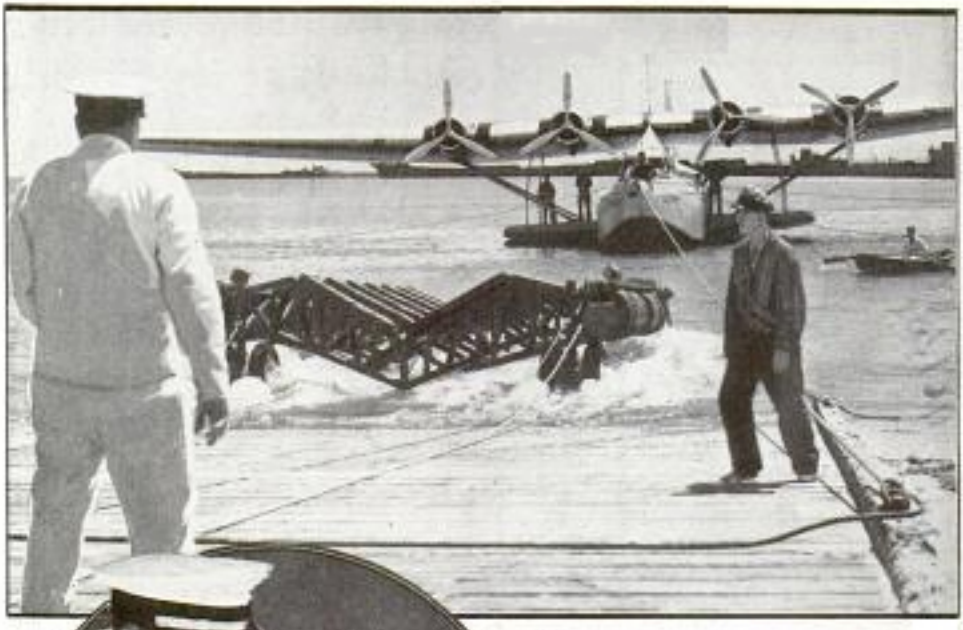


Top, launching the beaching gear for clipper to be brought ashore. Bottom, Guam airport manager preparing clearance papers for clipper about to depart

FLYING

port job that "couldn't be done." Now regular passenger schedules are being maintained across the world's greatest ocean through all four seasons of the year. More than 2,000 passengers and half a million pounds of ocean air mail and cargo have been carried across the Pacific.

NINE thousand miles to China and less than six days to get there!

Two years ago that was an impossible trip. Today you can cross the Pacific in less than a week, flying in safety and comfort and sleeping ashore every night but one on the islands that dot Pan American's trans-Pacific route. It's five days and five hours to Asia this year, sixty hours of flight time.

Not so long ago this was the air trans-

To conquer the Pacific, Pan American first used its Caribbean lines as a laboratory in which to perfect men and methods. Four-engined flying boats larger than ever used in regular service before were built and tested. Then, while the mid-Pacific bases were still under construction, flight after flight was made to Honolulu, to Midway, then to Wake, then to Guam. Nearly a half million miles were flown before the airway was opened to passengers.

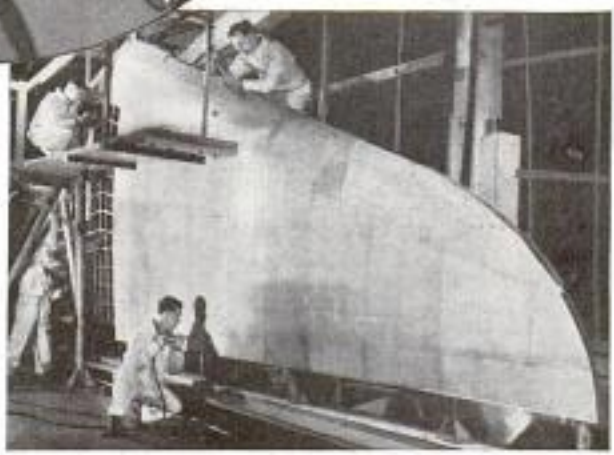
the CHINA CLIPPERS

Flying the ocean is an entirely different art from ordinary transport flying over land. Crews have to be trained mariners as well as airmen. The pilot in charge is officially the captain and the cockpit is called the bridge.

Pan American operates on the principle that when one of its clippers goes to sea it must take care of itself as ably as a big liner. The flying boat has to be both airworthy and seaworthy, able to make a landfall without outside aid. The great clippers are navigated over the ocean exactly the same way as are surface vessels. The captain uses dead reckoning, celestial observations, radio bearings, and combinations of these methods for making his way across the sea. There is no flying the beam on the ocean.

The clippers use the same basic princi-

Top, testing engine. Bottom, releasing aluminum powder bomb. Drift indicator on window is used to sight the bright spot the powder makes on water



Top, clipper navigator demonstrating use of octant. Bottom, workmen busy on tail surfaces of new clipper

To get an idea of what flying the Pacific is like, let's put ourselves on board the Philippine Clipper, eastbound out of Hawaii. It is four o'clock in the morning and the passengers who left Honolulu yesterday afternoon are asleep in their staterooms. The clipper is flying at 7,800 feet and is due to land at Alameda on San Francisco bay in another five hours.

In the subdued glow of the instrument lights on the bridge, up on the flight deck, the chief officer and his junior officer are sitting at the controls as the plane flies under the guidance of the automatic pilot. The plane is hundreds of miles from the nearest land. Right now it is nearly time for the hourly radio report and every officer on watch is busy preparing for it.

The engineering officer at his post up under the wing has just inspected his four

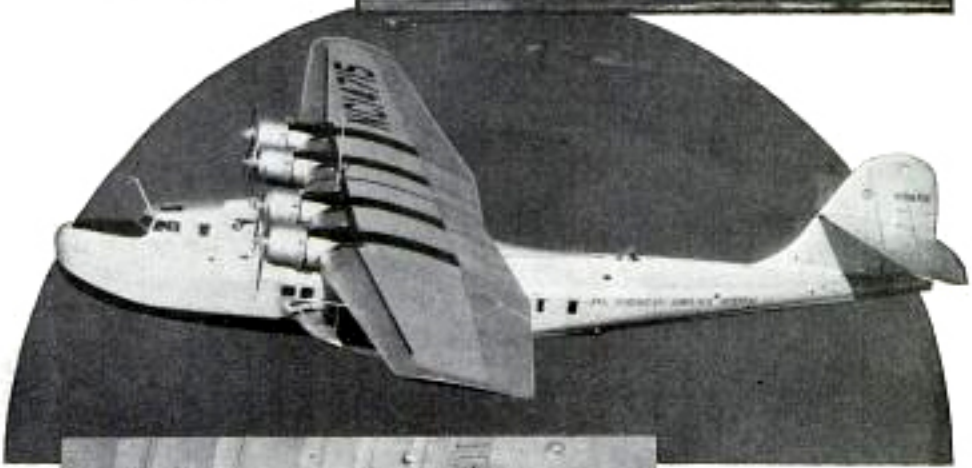
ples of celestial navigation that were used in the old days of the sailing clippers, simplified for convenience in the air. The navigator often combines this art with radio in a number of ways, such as crossing a radio bearing with a sun line to get his position or by taking a radio bearing on a near-by ship whose position is known. If all radio communication should fail the clipper could make its way home.

Between San Francisco bay and Manila the airway uses three twenty-six-ton Martin flying boats, the China Clipper, the Hawaii Clipper, and the Philippine Clipper. The great ninety-foot hull of one of these boats is divided into six watertight compartments, any two of which could keep the plane afloat if necessary. A clipper can cruise and climb on any three of its four engines. At Manila you transfer to a four-engined Sikorsky for the final five-hour jump to Asia.

engines with a flashlight. This is simply a safety check because the light blue exhausts, the steady drumming of the power plants, and the needles of his instruments tell him that all is going well. Right now he is checking over most of his 181 instruments and levers before writing up the engineering log.

The navigator has just returned to the chart room on the lower deck after making a celestial observation. To do this he walked through the plane to the after companionway where he slid back the hatch and obtained a "star fix" by sighting the star through the eyepiece of his octant and bringing it down to the level of his instrument's artificial horizon. The master compass and chronometer in the chart room, as well as air speed indicators and altimeters duplicating those on the bridge, will help him work out the problem. The clipper's

(Continued to page 118A)



Top, crew going aboard a clipper. Center, Pan American clipper departing on overnight hop to Honolulu. Bottom, passengers at table in main saloon of the clipper as it wings its way across the Pacific

Flying the China Clippers

(Continued from page 503)

captain, sitting in his office off the chart room, is writing up the ship's log and is assembling data for the coming radio report. Meanwhile the radio officer at his panels right behind the bridge has just contacted Alameda and has been given a bearing from the shore station.

The report that the radio officer will pound out on his key will include the temperature and altitude, wind velocity and turbulence of the air, latitude and longitude and how the position was ascertained such as by dead reckoning or by a line of position crossed by a radio bearing, the

First officer and junior flight officer at the controls of clipper in flight

ground speed in knots, the general state of the weather, the intended course for the next half hour, kind and height of cloud masses, and condition of the sea if visible. Half an hour later, with the clipper continuing to close in on the coast, the captain will prepare an abridged report so the land bases can keep exact track of the plane.

If the navigator finds that a cross wind is setting him off his course he tosses a glass bomb filled with aluminum powder out of a cabin window. Shattering on the surface, the bomb spreads the light powder out into a shimmering spot and this can be followed by means of a drift indicator set up in the window. After dark a chemical that flames on the water, instead of aluminum powder, is used. When he has estimated his drift, the navigator can calculate a course that compensates for the cross wind.

One hundred miles out from the terminal starts the meticulous work of making an accurate landfall. At the radio officer's request the naval radio compass stations at Point Reyes, Montara Point, and the Farallon Islands swing their loops to tune in his signals. They triangulate their bearings and radio back to the flying boat its exact position. At the same time Pan American's own direction-finding station takes a series of radio bearings on the plane and radios back the "on course" report. As long as the bearings remain the same, the captain knows that he is flying directly toward the direction-finding station. In thick weather the plane operator locks his key fifty miles offshore so that the air line's shore station can take continuous bearings until the plane arrives overhead, when the signal "R" is sent to the plane to indicate its position.

The radio operator stands watch constantly while the plane is in the air and he can receive and transmit on eleven different frequencies. He uses two receiving sets and two transmitting sets in which wavelength changes are made with fixed coils. He guards the 600-meter band and one of the short-wave bands with split receivers.

The equipment permits communication on twenty-four, thirty-six, fifty-eight and 100 meters as well as "working" waves for these frequencies. Six hundred meters are used for working ships at sea, and 183 meters and 800 meters are used for radio compass and directional signals. The plane also is equipped for communicating on 1,000 meters, the international calling band for aircraft. Like all other aircraft, the planes have call letters of five symbols. The China Clipper, for instance, is KHAGV and the Hawaii Clipper is KHABZ.

To insure the utmost reliability over long distances, the clippers communicate with dot-and-dash code instead of by voice. All radio work and, in fact, all operations work is based on Greenwich time.

Between Alameda and Honolulu the operator may contact as many as a dozen surface ships and exchange weather and bearings with them. Every fifteen minutes he radios a flight "O.K." to the terminal bases, sends a position report every half hour, and the complete weather and position report on the even hours.

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(Continued from page 118A)

The fifty-watt transmitters take their power from a dynamotor operating off the ship's batteries which are charged in flight by generators attached to the engines. A small gasoline motor provides a charging source for the batteries if the plane comes down on the water. The flying boat carries two fixed fore-and-aft antennas for short-wave work and a trailing antenna for 600-meter communication. A kite is carried for raising the 600-meter aerial into the air while the plane is on the surface.

Two operators are on constant watch at each of Pan American's land bases, one

Schedule board at the Alameda station shows movements of all the flying boats

guarding the communication frequency and the other standing by on the direction-finding set. Radio bearings are taken on an approaching clipper every half hour and these are stepped up to several bearings per minute as the plane approaches the station.

The captain of a clipper always knows the best altitudes at which to fly, the speeds that he is going to make, and even the exact time he will arrive at the next stop. This precise knowledge is made possible by studying the weather as far as a week in advance.

A few hours before a westbound flight, the chief meteorologist turns over to Operations the final weather map of the whole airway, together with a flight forecast and a flight time analysis. On the long 2,400-mile Alameda-Honolulu leg one of three optional routes will be selected, depending upon the forthcoming weather. These are a northern "Jones corner" route that has been used by sailing ships for hundreds of years, a shorter Great Circle course used by steamships, and a southern route. Frequently a plane can carry greater cargo and make faster time by flying one of the longer routes because favoring winds help boost it along.

Often the best time can be made by changing altitude to take advantage of local winds. Instructions may read: "Fly the first 700 miles at 7,800 feet, go up to 10,000 feet for 800 miles, and complete the balance of the flight at 7,800 feet." After such a calculation the operations department can tell to within a few minutes how long a flight should last. As soon as the experts know how long the plane will have to be in the air they can gauge the amount of fuel and oil needed, adding a reserve supply sufficient for six hours additional flight. This fuel weight, subtracted from the total permissible load, gives them the exact possible payload.

Next step is to phone the post office to find out how much mail is to be carried. Subtracting that poundage from the payload leaves a balance that can be used for passengers and express.

To command its aerial liners, Pan American has trained a corps of men up to the highest ranking possible in aviation. Each captain holds the rank of "Master of Ocean Flying Boats." To win such a ticket you start with nothing except a college degree and a transport flying license. You become an apprentice pilot, starting at Pan American's Eastern Division base at Miami. A flyer may need three to six years to climb to the highest rating. When he has gone to school all over again with Pan American and has served in the Caribbean coastwise service, he is given a junior pilot rating. After examinations he may be promoted to a senior pilot for coastwise flights. Then he is transferred to the Pacific for training on a trans-oceanic clipper in the capacity of junior navigator or junior flight officer. The next step is that of senior pilot, or first officer, on one of the ocean clippers.

Next he is transferred back to Miami and is given command of a Sikorsky with the rating of "Master of Coastwise Flying Boats." Next to the last step is a return to the Pacific where he becomes first officer on the permanent run. One more examination brings him the title of "Master of Ocean Flying Boats."