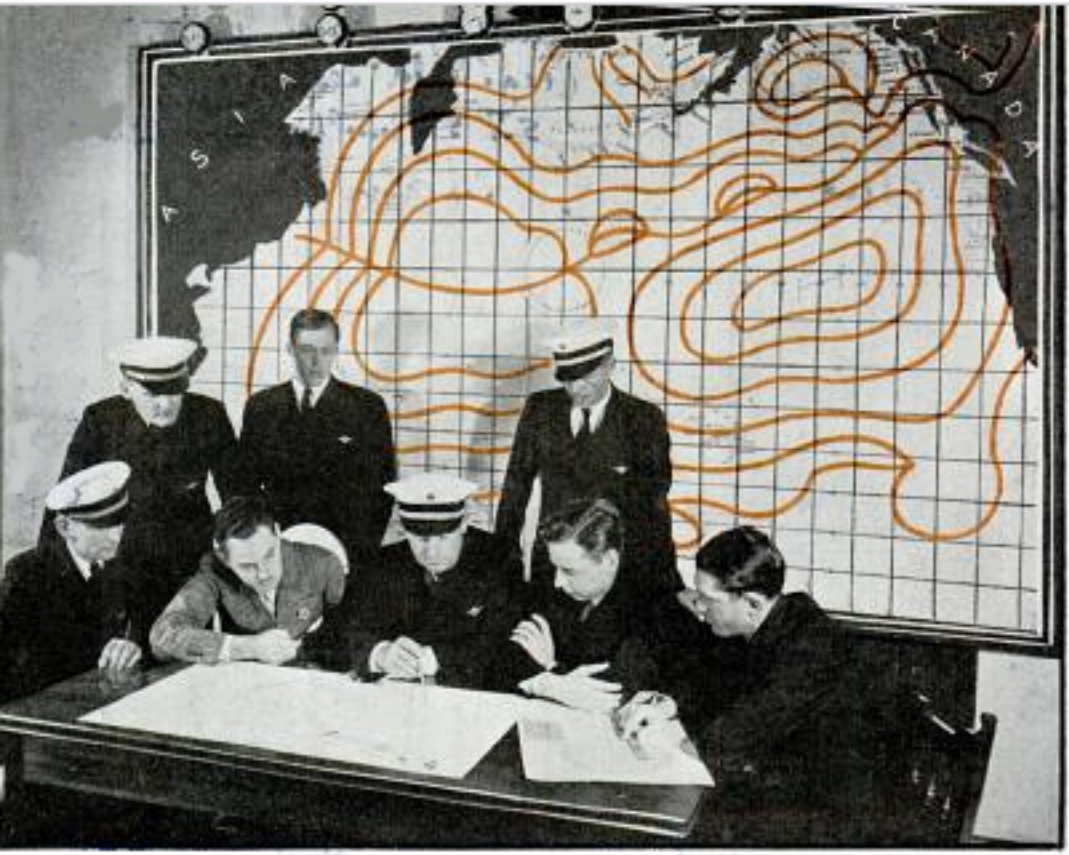


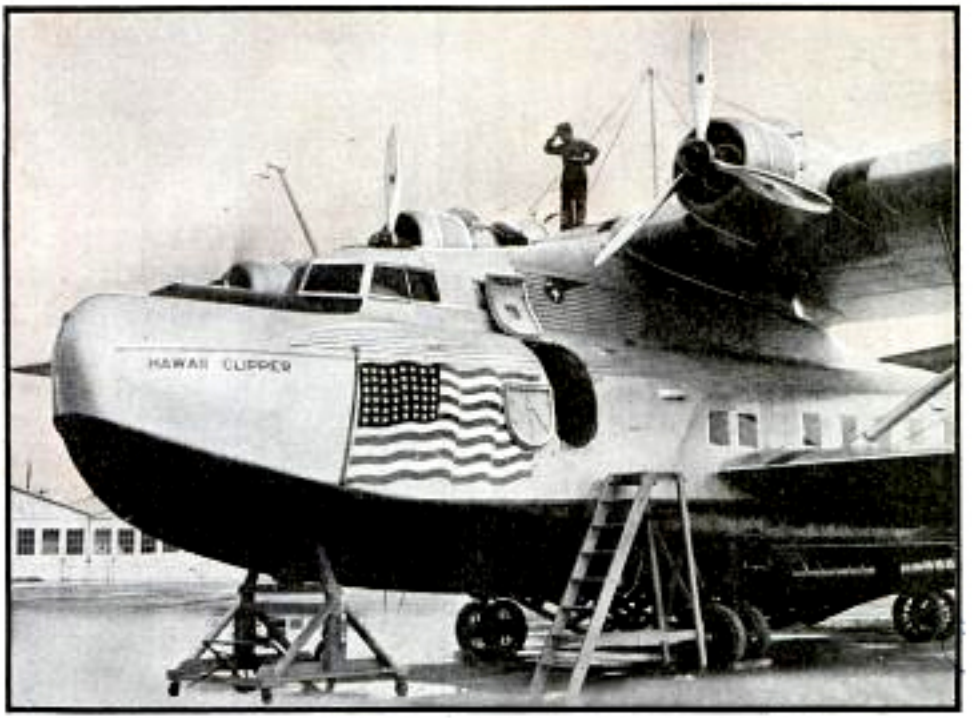
How FLYING CLIPPERS

Top, conferring on flight. Note weather map. Bottom, ship officers gather weather data.

A STRONG west wind at Manila, a storm far at sea, a twenty-mile wind 10,000 feet above San Francisco—unrelated bits of weather information like these govern departures and arrivals of trans-Pacific flying clippers.

What the weather happens to be in Hawaii influences the hour at which one of the big flying boats will leave its base at Alameda on San Francisco bay. The weather regulates the amount of cargo that the plane can carry and even fixes the hour that it will arrive in Honolulu.

But far from allowing the weather to run the airway, Pan American's meteorologists have almost reversed the process. Instead of running the weather, they have put it to work. By getting an upper hand on the elements they are able to maintain transoceanic flights as regular as steamship schedules. No matter in which direction a plane is bound they usually find a tail wind to boost it along.



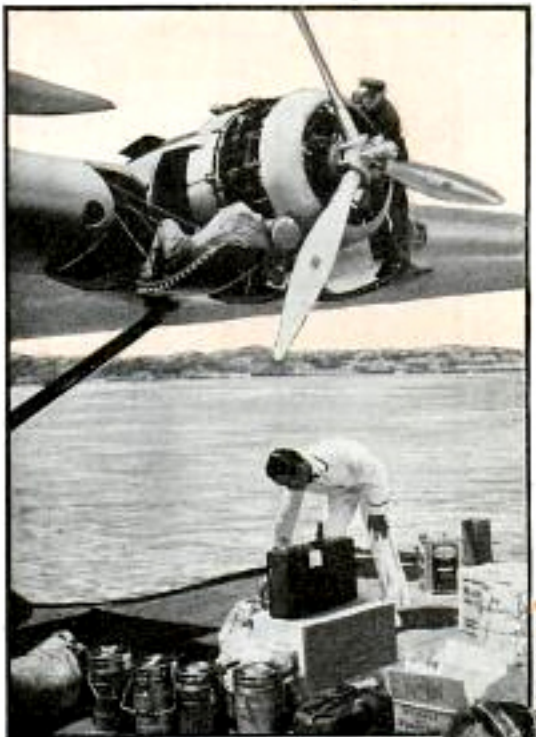
DODGE STORMS

There is always rough weather somewhere on the Pacific. On the 9,000-mile airway to China there is hardly a day when the weather everywhere is perfect. Instead of waiting for storms to die down the meteorologists have worked out ways of putting them to use. So competent have they become that during the past year Pan American has lost the equivalent of only one round trip in delays due to weather.

At Alameda the Pan American Airways Pacific division meteorologist outlines the way that the clippers take advantage of the elements. On the desk in front of him he has a large map on which storm centers and wind directions on all parts of the Pacific have been marked. He has just finished the forecast and flight-time analysis for the last leg of Trip 160, the Honolulu-Alameda jump marking the completion of the eightieth round trip across the Pacific.

"Data for this map were gathered at four o'clock this morning," the meteorologist

Top, inspection before flight. Bottom, releasing balloon to study wind direction and speed.



Top, steward checking supplies and baggage while mechanics inspect clipper engine at Midway island. Bottom, radio operator at Alameda base

way between the coast and the islands. There's a twenty-knot east wind blowing toward Honolulu from the storm center. That means head winds half way across and the chance of running into rough weather on the direct great-circle course. On this direct route, figuring from the present weather conditions, today's flight would require twenty-two hours.

"But north of this storm center we find some arrows showing a westerly wind with speeds of up to twenty-six knots. That means a tail wind instead of a head wind. Obviously, we are routing the eastbound clipper over the northern route. The boat will fly 250 miles farther and get here quicker.

"Continuing this analysis of the weather, the wind flags on the map indicate that at 4,000 feet the

explains. "The clipper will not leave Honolulu until two o'clock this afternoon but already we can tell what the weather is going to do in the meantime and what the conditions will be while the plane is in the air.

"It's 2,400 miles to Hawaii. Over such a long distance one might usually expect to encounter a storm or strong head winds. So there are three alternative routes that the clippers can fly. First is the short great-circle route used by steamships. Next is a northern route, 250 miles longer, that takes the clippers considerably north of the steamer track. Then there is the southern route, also consisting of two legs, on which a San Francisco-bound clipper flies directly toward Mexico for half the hop, then heads up toward its destination.

"On today's map here you can see a high-pressure area centered about half

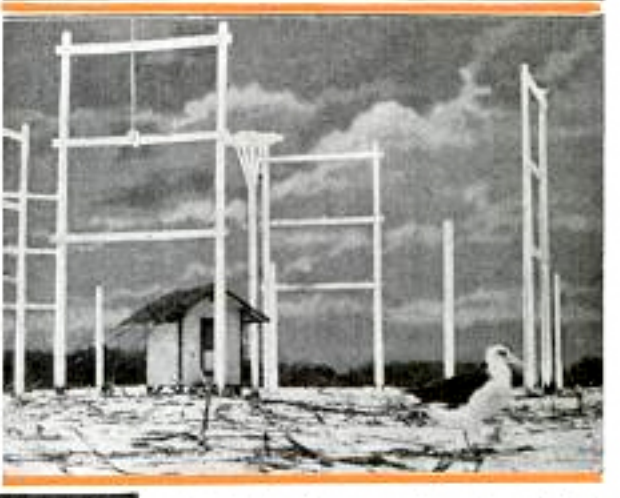
flight will take 19.9 hours. At 7,800 feet better winds would cut this time by an hour and a half. At 11,500 feet there are even stronger tail winds, permitting a flight of only 17.8 hours. But because of passenger comfort in the thin upper air the flight is going to be made at 7,800 feet. That will permit a saving of three and a half hours over the time possible on the shorter direct route. Incidentally, because less fuel

will have to be carried to fly the longer distance, about three-quarters of a ton more payload can be carried."

If there were a westbound flight due to leave San Francisco at the time this map was drawn, the plane also would have a fair wind under its tail even though it were going in the opposite direction, because the chief meteorologist would route it over the southern course where the map shows a strong east wind, there being a 180-degree difference in the wind track direction around the central high-pressure area. Each route is divided into four zones and the details of the weather in each zone are analyzed for the captain of the departing clipper.

This smart way of anticipating the weather and putting it to work is based on analysis of the major air masses that control the Pacific weather. The chief meteorologist and his four assistants at Alameda draw maps every day that show the weather at every point on practically half of the northern hemisphere from ninety degrees east longitude to ninety degrees west longitude and from the equator to the arctic circle. They make forecasts covering the airway as far away as Guam, 6,000 miles to the west, up to thirty-six hours in advance. Three men at Manila prepare similar forecasts covering the

(Continued to page 142A)



Top, copying radio message from clipper. Center, aerials of Midway's direction-finding station

Meteorologist preparing flight plan after studying weather indications

How Clippers Dodge Storms

(Continued from page 677)

route from Guam to China. So ably can the meteorologists gauge the weather that their estimates of flight time are always within one hour of the actual time made by a clipper and often the clippers land within a few minutes of the time predicted for their arrival.

With all of its storms, weather over the broad Pacific is not so difficult to follow and predict as weather over land areas. This helps to make up for the great distances that are covered in the forecasts. Lack of terrain to create friction and absence of the vertical turbulences characteristic of mountainous areas permit storms to follow more or less natural courses, allowing forecasts of extreme accuracy. The meteorological departments draw two maps per day of the Pacific, checking up on their own forecasts by weather reports sent in from ships at sea.

Simply as a safety factor, the clippers have flown thousands of gallons of excess fuel back and forth across the Pacific. This is because of the slight possibility that unanticipated weather changes might keep the flying boats in the air longer than expected. A clipper always carries enough fuel for the expected flight time plus a reserve for another six hours. If the weather analysis for the long hop to Honolulu shows that a flight would require longer than twenty-three and one-half hours to complete, the trip is postponed until the weather improves. Finally, if a captain gets half way across and finds that he has used half of his fuel, his instructions are to turn around and go back. The head wind that has run up his fuel consumption then will be on his tail and he returns in a hurry.

Pan American draws the information for making its maps and forecasts by fast radio service from about 400 different reporting stations. It maintains fifteen completely equipped meteorological depots on the Pacific and receives data from some sixty stations in the Orient, even the weather in Siberia having an important effect upon future conditions over the ocean. Weather in eastern United States also may have some effect and has to be considered even though the normal weather trend runs from west to east. An average of thirty

(Continued on page 144A)

(Continued from page 142A)

ships at sea report their local weather, two of the Matson liners on the Pacific conducting three upper air balloon runs every day and reporting wind directions and velocities at different altitudes. Radio reports from other ships consist of surface observations. In addition to all this, radioed weather reports from the clippers themselves are used for checking and correcting the maps.

Typhoons have been the bane of mariners ever since the oceans were first sailed, but instead of dreading them the captains of the clippers often welcome these violent circular storms. They offer no hazard to airway operation because they are so small in area that the fast flying boats can skirt them without trouble. Often a typhoon on the route simply means that a clipper will make better time than it would in still air. North of the equator the winds revolving around these storms move counterclockwise, so a westbound clipper sets a course to pass to the north of the storm center and thus gets a favorable tail wind. Bound east, the clipper flies south of the center and is boosted along by the same wind, which by now has circled the storm center and is traveling in the opposite direction.

For the past year Pan American has maintained a staff of forecasters scattered through the south Pacific, drawing weather maps and making forecasts in preparation for the projected airway from San Francisco to Australia.

South of the equator storms normally travel toward the southeast instead of toward the northeast and the circulation of wind around the storm centers is reversed from those in the northern hemisphere. Not a great deal has been known about the details of equatorial weather in the past. The present work is in the nature of valuable research and is leading toward real understanding of the formation of tropical air masses and of the formation and movement of typhoons. Eventually, this ocean meteorology work is going to contribute to the knowledge of world weather.

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