METEOROLOGY

Conquering the Weather

Bomber's moons, thunderstorms, fog and ice are our allies as well as our enemies, ruthless as gunfire and often harder to out-maneuver than enemy pilots.

By ROBERT N. FARR

➤ BOMBER'S moons, thunderstorms, fog and ice aren't things that just "happen." They are part of a definite, predictable pattern of weather all over the world. They are our allies, and our enemies as well, ruthless as gunfire and often harder to out-maneuver than an enemy pilot.

Weather plays an important part in any war. The evacuation of Dunkirk was successful because fog was on the side of the Allies during a time when the Luftwaffe was trying to break it up. When the Japs raided Pearl Harbor, they rolled in behind a combination of rain, lightning and intense icing conditions that obscured their movements and contributed to their initial success. The Nazis used a blanket of bad weather last December to hide the movement of their troops as they prepared to push back Allied forces in Europe.

Many a strategic air and ground operation has been intentionally timed to conform with weather favorable to the tactical situation. The raid on the Gilbert and Marshall Islands was so planned that our planes left their carriers, made the raid and returned to their flat-tops under favorable flying conditions. The last plane had hardly been caught on the deck of its carrier before bad weather, which had been anticipated, set in and protected the carrier fleet from aerial reprisals until it was safely out of the combat zone.

Important Weapon

To our military leaders weather is as important a tactical weapon in war as an armada of bombing planes or a battery of fast-moving tanks. From Eisenhower, MacArthur, Patton, King and Nimitz straight down the line, our military and naval leaders know what weather is, what causes it and what influences it. Aerology, the science of meteorology applied to the upper air, is essential knowledge as long as men fly or fight.

Aerology is a difficult science because it is impossible to produce weather phenomena in a laboratory, even on a small scale. World War I was a proving ground for many new aerological theories, one of the most important of which is the polar front method of weather map analysis, used to advantage every day where Americans are in action.

The atmosphere is like an envelope of gas extending nearly 200 miles above the surface of the earth. Through it move deep masses of air, like the currents in an ocean. Our lives depend upon this gas, because it contains the air we breathe. Flight also depends upon it, for it is the action of the wings of the airplane within this envelope of air that provides life which makes flying possible.

The atmosphere is composed of about 99 per cent oxygen and nitrogen, the rest being made up of minor gases, one of which is water vapor. All factors that make up weather, including clouds, rain, snow and ice, occur in the segment of the atmosphere nearest to the earth.

In the zone of weather there is a general flow of air over the earth's surface which follows a definite and fixed pattern. Cold air masses travel from the polar regions. Upon being warmed up by contact with the surface of the earth, the air develops vertical currents, which give a pilot a bumpy ride in rough air. Warm air masses spread out from the area around the equator. A pilot flying in a warm air mass will encounter stable air.

When warm air and cold air meet, they do not mix readily. Each air mass tends to remain intact, with the cold air sliding beneath the warm air, or the warm air advancing over the cold. Warm air never crowds out cold, because of their relative densities, but it may replace cold air as the cold mass moves out. The sky becomes a battleground as clouds are formed which often result in rain or snow.

Warm air rises around the equator and cold air sinks at the poles, so that a "polar cap," an accumulation of a mass of cold air, builds up in the polar regions of the earth. When the pressure of this mass of air becomes great enough, the polar front is pushed down and begins to travel south. The leading edge of this polar front is a cold front, a boundary line between the cold and warm temperatures. This cold front is a weather factory which makes all kinds of weather and is very dangerous, although the

DIFFICULT FLYING—Clouds, clinging to air pockets between snow-capped mountains, make it hard for pilots to see the valleys below.

Do You Know?

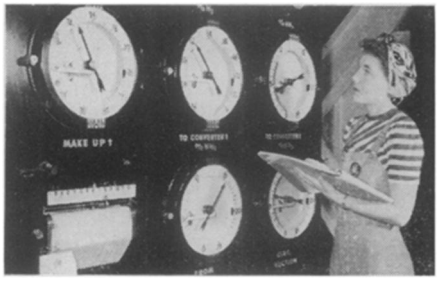
Sulfanilamide fed to laying hens resulted in many eggs without shells; sulfapyridine had no similar effect.

Sweden plans a new *airfield,* located near Stockholm, for transatlantic traffic; it will have four runways each two miles long.

Shrimp, as taken from the water, look like small lobsters, but unlike lobsters have edible meat only in tail and abdomen; their tiny claws hold too little to be worth recovering.

The earliest *tin* object yet known was found on Lesbos island off the northwestern corner of Asia Minor at the entrance to the Dardanelles; it is a bangle of pure tin probably 4,500 years old.

Bagasse, or what is left of sugar cane when the juice is extracted, can be used for fuel, building and insulation material, raw material for alpha-cellulose, plastics, decolorizing char and other industrial purposes.



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warm front presents many tough operating problems such as poor visibility, low clouds, freezing rains, over a large area.

The safest place for an aviator in a cold front area is at home reading a good book. But frequently a war mission calls for flying in a cold front area. Pilots in the Aleutian Islands sometimes pass through half a dozen cold fronts on their way out in a day's patrol, and pass through them again on their return to their base.

Storms scattered along the entire cold front, sometimes 2,000 miles long, are the meanest kind. A cold front is much longer than it is wide. It may be 50 to 100 miles wide. The trick of flying a cold front, therefore, is not to fly the long way, parallel to the front, but straight through it. Pilots say that if you are flying in a cold front more than 30 minutes, you are flying it the wrong way, since even in a low-powered plane you can cover about 50 miles in that time. The best way to recognize the presence of a cold front is to note when winds become gusty, the barometer jumpy and the temperature dropping with a bank of threatening clouds appearing on the horizon.

Cold fronts are most intense in the late fall, winter and spring, because at these seasons there are the sharpest contrasts in temperature between the masses of cold and warm air. The three principal dangers of flying through a cold front are visibility, turbulence (which may be violent enough to shake a plane out of the pilot's control and frequently is accompanied by a thunderstorm) and icing.

In the air, a thunderstorm looks like a head of cauliflower with an anvil on top of it. It is the color of dirty cotton. Some thunderstorms are 30,000 to 60,000 feet high, a towering mass of clouds containing ice mixed with rain, and sometimes hail. Lightning flashes, issuing from the most violent part of the storm, are a frequent first warning to pilots.

The anvil top, above the turbulent activity of the storm, is made up primarily of ice crystals. Hailstones, ranging in size from a pea to a baseball, form in the "chimney" of the thunderstorm. Experience has taught pilots that the best thing to do is to fly around a thunderstorm. If conditions prevent this, the next best thing to do is to fly above or below it. Finally, as a last resort, they fly through it.

Ice ordinarily exists in the air in cloud formations. The best rule for pilots is to stay out of clouds. The danger signal is the first trace of ice on the windshield. Ice forms in the air only when two things happen at the same time: when moisture is present in liquid form, and when the temperature is at freezing or below.

There are two kinds of ice that may form on a plane and they are more deadly than a Zero or a Messerschmitt. One is clear ice, the kind that forms in the trays of your refrigerator. It is hard, glass-like, and difficult to break loose. The other is rime ice, the kind that forms on refrigerator coils. It is white, granular and can be flaked off. Nonturbulent clouds contain rime ice, or small ice crystals. Turbulent clouds contain clear ice made from droplets of water. Clear ice forms more quickly and sticks more tightly than rime ice. Usually a combination of the two are encountered in flight. (*Turn to page 158*)

PHYSICS

Shortage of Physicists

➤ A 12-YEAR shortage of the most essential scientists for war and industrial research as the consequence of the non-technical use of scientists and science students in the fighting forces is forecast by Dr. Gaylord P. Harnwell of the University of Pennsylvania, writing as editor of the *Review of Science Instruments* journal.

In this war with radar, airplanes, and other such devices, the nation's technical superiority is due to research in the field of physics, Dr. Harnwell points out, although chemistry played the chief role in the first World War. Figures show, however, that the number of physicists in training in this country has dwindled alarmingly.

The number of physicists who were granted the doctor's degree has dropped markedly in the war years, with only 55 in 1944 compared with a peak of 191 in 1941. Dr. Harnwell takes 26 as the average age at which a doctor's degree is received, 1941 as the last year in which a normal number of degrees were awarded, and finds that even with a revival of training of 18-year-old students in 1945 there will be a gap of 12 years during which very few physicists will be available.

The nation will be short 1800 graduate physicists in 1953, compared with present 2833 Ph.D. physicists listed in the National Roster of Scientific and Specialized Personnel. The situation is made worse by the demand expected for physicists to conduct researches for industry in the postwar era.

Unlike colleges in the United States, British and Soviet technical schools have been allowed to keep up their enrollments as a war and postwar measure. An authoritative British report states that their output of engineers and physicists has more than doubled during the war.

Because many professors have been drawn away from the colleges for war research, the problem now and in the immediate future is not merely a matter of getting students into the colleges, but of reorganizing the teaching staffs to teach them.

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Ice forms on the leading edges of the wing, propeller blades, on the radio antennae, on the windshield and on the air-speed indicator as well as in the carburetor of the engine. If ice forms at any of these points it will affect the flying performance of the plane, and in some cases render it unfit for flight. Today aircraft are equipped with mechanical devices such as rubber boot de-icers for the wings, de-icing fluid for propellers and windshield, and heaters for the air speed indicator. In the final analysis, however, the knowledge and judgment of the pilot are the greatest factors in determining whether he will beat the ice or crash.

The most dangerous of all icing conditions is caused by freezing rain. We are all familiar with ice storms on the eastern seaboard when tree branches break and power lines snap under the sheer weight of ice that adheres to them. A plane can ice-up just as heavily, and naturally it won't withstand the ice load. In a freezing rain the trick of outsmarting this dangerous adversary is to go up higher, where warmer temperatures protect the plane from icing.

Military flyers taught to be weather experts know how to avoid these bad weather flying conditions and at the same time how to accomplish their missions in spite of them. Weather service bases are located in the far corners of the world, in the arctic and tropics where weather is born. Reports from these stations are transmitted to Washington D. C., where military weather maps are drawn and sent to our armed forces all over the world.

Weather servicing units accompany every military force, to provide on-the-spot short-range forecasts on which commanders base their tactical operations. Often these weather stations are mounted on vehicles. At Salerno a jeep fitted with weather observing equipment was one of the first units to land. Airplanes, fitted as weather laboratories, fly long distances to gather weather data before military or aerial operations are undertaken.

The uncanny ability that these weather men in our armed forces possess is illustrated by an attack on Wewak, New Guinea. Our planes were based at Port Moresby. Between the base and the target lies the towering Owen Stanley Range of mountains, usually crowned by 40,000 foot thunderstorms which blocked the way for our attack. The commanding general ordered the weathermen to predict a cloudless, stormless day. About 24 hours in advance of proper conditions, the weathermen issued a favorable forecast. Our attack, timed precisely to the forecast, enabled us to bag, at one time, 309 Jap planes without losing a single one of our own planes to our other enemy, bad weather.

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The stinging nettle, a weed, is a potential source of commercial *chlorophyll.*