

These airplane machine guns are bad medicine, but naval aviators have found that "hell-diving" is a sure way to escape them



**Head Straight for  
Mother Earth From  
Three Miles Up, Shoot Downward  
Through Space at Sickening  
Speed and Then Pull the Old Boat  
Up Sharp Just in Time to  
Avoid a Crash—That's the  
Way Uncle Sam's Boys Test Out  
New Fighting Planes!**

By John L. Coonitz

FIFTEEN thousand feet above the Anacostia Naval Air Station a tiny plane hangs for a second in the limpid blue. Then suddenly, as if toppled from its sky pinnacle by some unseen hand, it shoots earthward at sickening speed. American naval officials gasp. For 18,000 feet the plane roars downward like some hissing demon from hell, fighting and gasping for life.

At 5000 feet the pilot pulls back the "stick" and shoots the plane upward. For a moment it threatens to collapse. The wings groan in agony and the rushing winds sing a dirge through the taut ailerons. But the sturdy little craft withers the challenge. It withstands the enormous pressure of air on its wings and the terrific strain on all its parts nobly. In a few minutes it rests beautifully upon the earth after a long, graceful flight which has something of a song of victory in it.

Such is "hell-diving" for the United States Navy as practiced by William Crosswell, test pilot, demonstrating a new type of combat plane for that branch of the Nation's fighting service.

VERTICAL power diving is now a part of the United States Navy's requirements of its fighting planes. It is specified as a test in all aircraft contracts following new methods of air attack developed by the navy—dive bombing. These tests call for the terminal velocity of a plane—as fast as it will go in a vertical, straight downward dive and come out. Hence the apt description, "hell-diving," for anything may happen during one of these dives. The wings may fly off, the engine may disintegrate, the pilot may lose consciousness and crash.

These dives range in length from 3000 to 10,000 feet or more," says Crosswell. "It generally takes about 3000 or 4000 feet to reach the terminal velocity of a plane. Preliminary to executing one of these dives, a climb to 15,000 feet is made.

"The method of going into a vertical dive may be one of several, namely: a half-roll to an inverted position and then nosing down to the vertical or a loop and, instead of pulling out of this maneuver, allowing the plane to remain in a vertical attitude; or simply to nose the plane vertically from a horizontal position.

"The pullout from a vertical dive is probably the most severe test on a plane. Here the centrifugal force of the plane changing direction from the vertical to the horizontal or angle of ascent causes it, in effect, to weigh many times its normal weight. This tremendous weight increase plus the pull of gravity must be sustained by the wings.

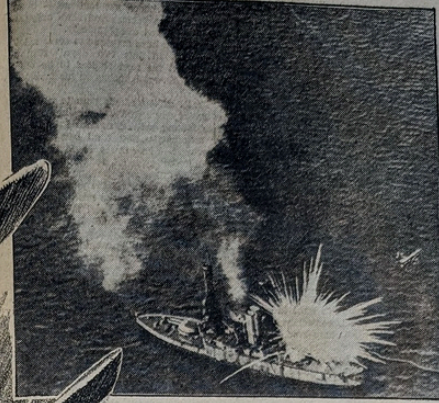
"The pullout is effected merely by pulling back on the 'stick.' The degree of the pullout is largely regulated by the ability of the pilot to withstand the forces of nature to which he is subjected.

"The pilot is likewise subjected to centrifugal force which, if great enough in proportion (five or six times his own weight), causes his blood to rush to his head with resulting loss of vision and, if continued, loss of consciousness. This is generally termed 'going black' by pilots. The pilot recovers his vision and consciousness after the plane assumes flight along a straight line, which it usually does if he will ease off his pressure on the 'stick.' Complete loss of consciousness accompanies only a very few trials. "In some of these dives this vision, have left the plane. This is serious,



William Crosswell stands airplanes on their noses while 10,000 feet in the air

# NAVY Goes in for a bit of "HELL DIVING"



Here's what a "hell-diver" in action does. This picture shows a direct bomb hit on an obsolete vessel used in airplane bombing maneuvers

of flight. Of course, the airspeed meter reading becomes constant when "terminal velocity" is reached.

It must not be thought, however, that the "hell-diving" test is the only severe test required by the navy of planes offered it for sale by manufacturers. In addition to being able to do a vertical dive satisfactorily, planes, if they are of the fighting and training type, must be nimble at acrobatics, be able to turn somersaults and cut other unseemly capers in the sky, such as the barrel roll and leaptail.

All types of planes must meet certain rate-of-climb specifications, undergo fuel-consumption tests, speed tests at surface and at various altitudes and surface ceiling tests. In addition to these, all combat planes must undergo gunnery-gun tests. In other words, airplanes are built for the navy in accordance with the terms of a contract which specifically guarantees certain weights, performance and suitability.

WHEN a plane is first received by the navy at its Washington flying field it is generally given a single flight by the contractor's pilot. This is called the "contractor's demonstration," the purpose of which is to show the probability of the airplane being able to meet its guarantees and to prove that it is a reasonable flying machine.

If the plane passes its "demonstration" satisfactorily, it is turned over to the flight test section of the Navy Bureau of Aeronautics for trials.

A routine test begins with the weighing of the plane, empty and then fully loaded. This is done to determine the position of the center of gravity. The plane is then "photographed" or photographed, the photographing covering not only the airplane with all its equipment in place, but also any items of unusual interest or peculiar construction, which might be of future value. The machine is now ready for muscular tests in the air that shall demonstrate its worthiness as a fighting craft, training ship or bombing ship, and so forth. Climb, speed, stability and maneuverability now sit at the controls.

The information obtained from the speed trials is, first, the maximum speed; second, the minimum and landing speeds; third, data for the calibration of the air-speed meter for use in subsequent tests.

These speed tests are carried out over adjacent to the shoreline and at a very low altitude, so that no climbing and diving errors may be introduced. Time over the course and instrument readings are recorded by the pilot on a board strapped to his leg, on which is mounted a stopwatch timed to the tenth of a second.

For the climb tests two barographs are attached to the pressure recording of the pressure altitude, a stateoscope to establish level flight condition, a thermometer to indicate free air temperatures and in planes with a high ceiling, oxygen equipment for the pilot. So equipped, the plane is taken into the air and flown around at low altitude until the engine is properly regulated and warmed up. The machine is then brought low to the ground, the desired initial climbing speed is attained, the throttle is pushed wide open and the stopwatch started. From then on the pilot flies at an absolutely steady speed, varied slightly with change of altitude, and records the readings of his various instruments at fixed time intervals. This instrument is continued until the indicated rate of climb is approximately that of service ceiling, 100 feet per minute, at which point the climb is stopped.

The pilot now turns the nose of his

plane earthward, stopping at various altitudes along the way, as it were, to determine the maximum indicated speeds at these altitudes. The stateoscope, which indicates the very smallest change of altitude, insures that the plane is neither climbing nor gliding when these latter observations are made.

THE climb into the upper air, required of all small, high-powered fighting planes, is the classic of all tests. For it the pilot is bundled up like an Arctic explorer, wearing a heavy fur suit and boots, a full face mask and heavy gloves of leather and fur. An important part of his equipment is an oxygen tank. This is turned on at about 18,000 feet up and the outlet, in the form of a pipe stem, is held between the teeth.

From 18,000 feet up the pilot truthfully has his hands full. He must accomplish the following tasks continuously: watch his oxygen flow so that at all times he will have sufficient air to sustain himself; operate the mixture control of the engine in order that maximum efficiency may be obtained as he climbs; fly at exactly the prescribed speed for the indicated altitude; constantly observe all instruments and, every two minutes, without a moment's variation, record the indications of no fewer than seven instruments. And all the time the air outside the cockpit registers a temperature of about 40 degrees below zero!

In the gunnery tests the guns must be fired while the ship is in the air. There must be tests also of the bombing installation, and the radio installation must be tried in flight, and all miscellaneous equipment and appliances actually operated to establish the suitability for service use.

When a plane has gone through all its tests it is a fully qualified fighter or service plane of the type designed. Tests today are much more severe than formerly, due to the fact that much more is required of them now. During the war many planes failed materially. The object now is to build planes that will stand up under all conditions without being torn to pieces.

Dive-bombing is a new form of attack, the vogue of which dates only about five years back. The Bureau of Naval Aeronautics, of which Rear Admiral William A. Moffett is chief, may be credited with a large measure of the development of this type of combat attack. In the dive-bombing operation the bomb is aimed at the target by heading the plane directly at it.

The navy only recently completed its five-year program of plane building. It had until June 30, 1932, to put the planes under the five-year program in service. As a matter of fact, the last one was in service before June 30, 1931. Congress gave the navy \$85,000,000 for this program. The Bureau of Aeronautics finished it with \$22,000,000 left in its till.

THE recent Congress gave the bureau \$220,000 for high-speed plane development. With that money the bureau has just purchased seventy-five single-seat fighting planes more formidable than any now in use. Of this appropriation Admiral Moffett says:

"The recent appropriation by Congress of money for high-speed development will make it possible for the Bureau of Aeronautics actively to carry on a development which has been impossible heretofore, when funds were employed entirely for the provision of aircraft for active flying units. It is now possible to go into the actual procurement of high-powered engine, and, dependent on the results obtained experimentally, to determine in what degree modern naval aircraft with extremely high-powered engines might be useful in the naval aviation program."

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