Convair XP5Y-1 model is raring to go, with its four engines turning over at high speed. At the proper radio signal, operator will release craft which will take off, fly, and land under electronic control.

THE Navy's Flying Midgets

By JARED HAMILTON

Scale models aid design of big new Convair flying boats

MODEL PLANES such as even the most fanatic amateur builders never dreamed of are flying out of the Convair shops at San Diego, Calif., in a number of new designs, some of which are still covered by security. But they are not toys. They are one of the most practical shortcuts yet devised to take the bugs out of full-sized planes long before they are built.

Wartime developments in remote electronic control have made them possible. They are radio-controlled models that can take off, maneuver, and land as easily as if they had miniature humans aboard. In fact, they can be put through paces that human pilots would never dare risk, even under an accelerated test-flying program. Their flight characteristics accurately predict how the finished design will fly. If there are bugs in them they can be corrected at minor cost without having to wash out an enormously expensive prototype.

The models, in short, accurately duplicate the motions and forces of the full-size planes and graphically demonstrate the performance which may be expected from them. When the results of the tests are multiplied by the proper scale factor, the characteristics of a projected full-size design can be predicted precisely long before its construction is even started.

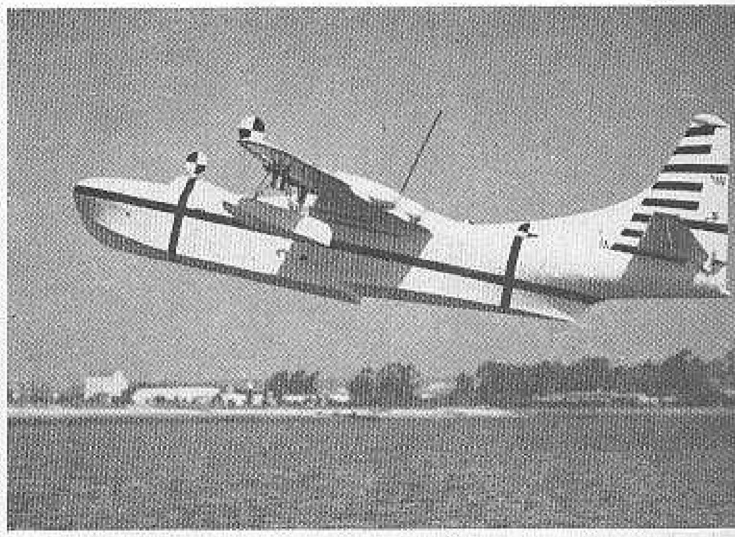
The flying miniatures are the product of Convair's Hydrodynamic Research Laboratory, a foremost research organization. The Laboratory calls them "dynamically similar models." So far they have been used only on water-based aircraft designs, but they could be adapted equally as well to any type airplane.

One of the greatest advantages of the flying models is their superiority to models tested in wind tunnels. They are not tied down to anything, are not subject to variable flows encountered in wind tunnels, and are subject to all dynamic forces that affect a real plane in subsonic flight. They not only are built to exact scale but their weights and performance, as well as these dynamic forces, act on them to scale.

Four typical models built so far vary from ⅛ to 1/15 scale, and weigh from 90 to 160 pounds. Their wing spans vary from 13 ft. 9 in to 21 feet with all other dimensions to scale. The powered models carry from two to four engines. One research model built to 1/15 scale has no power and is catapulted in simulated flight attitudes.

They are powered by either Ohlsson & Rice 1½ h.p. engines or Bantam two-h.p. engines. Models are constructed of balsa, mahogany and spruce woods, tissue paper, aluminum, steel and plastics. Construction is rugged and highly resistant to deterioration from weather and even salt water. Design weight and mass distribution is achieved by locating ballast and operating equipment on rails within the hull. Proper c.g. and pitching moment of inertia are obtained by adjusting the ballast and equipment fore and aft. Items subject to crash damage are designed to break away intact at given impact loads.

The Hydrodynamic Research Laboratory developed its model-building techniques out of years of experimentation. When they turned their attention to the problem, the laboratory's scientists found they would have to produce a radio receiver capable of operating seven controls with an accuracy within 1.25 per cent—and still weigh less than 20 pounds including battery pack—a feat never previously accomplished. Both had to be designed and built especially for the program. Engines had to be produced capable of turning out 1½ to two h.p. and weighing only three to four pounds. One two-cycle twin-cylinder opposed piston job had to reproduce exactly the scale power and r.p.m. of the Pratt & Whitney 2,100-h.p. R-3350 engine which was planned for the full-scale airplane. Propellers were machined and adjustable in pitch, as in the full-scale plane. Wind spars were Metl-bonded.



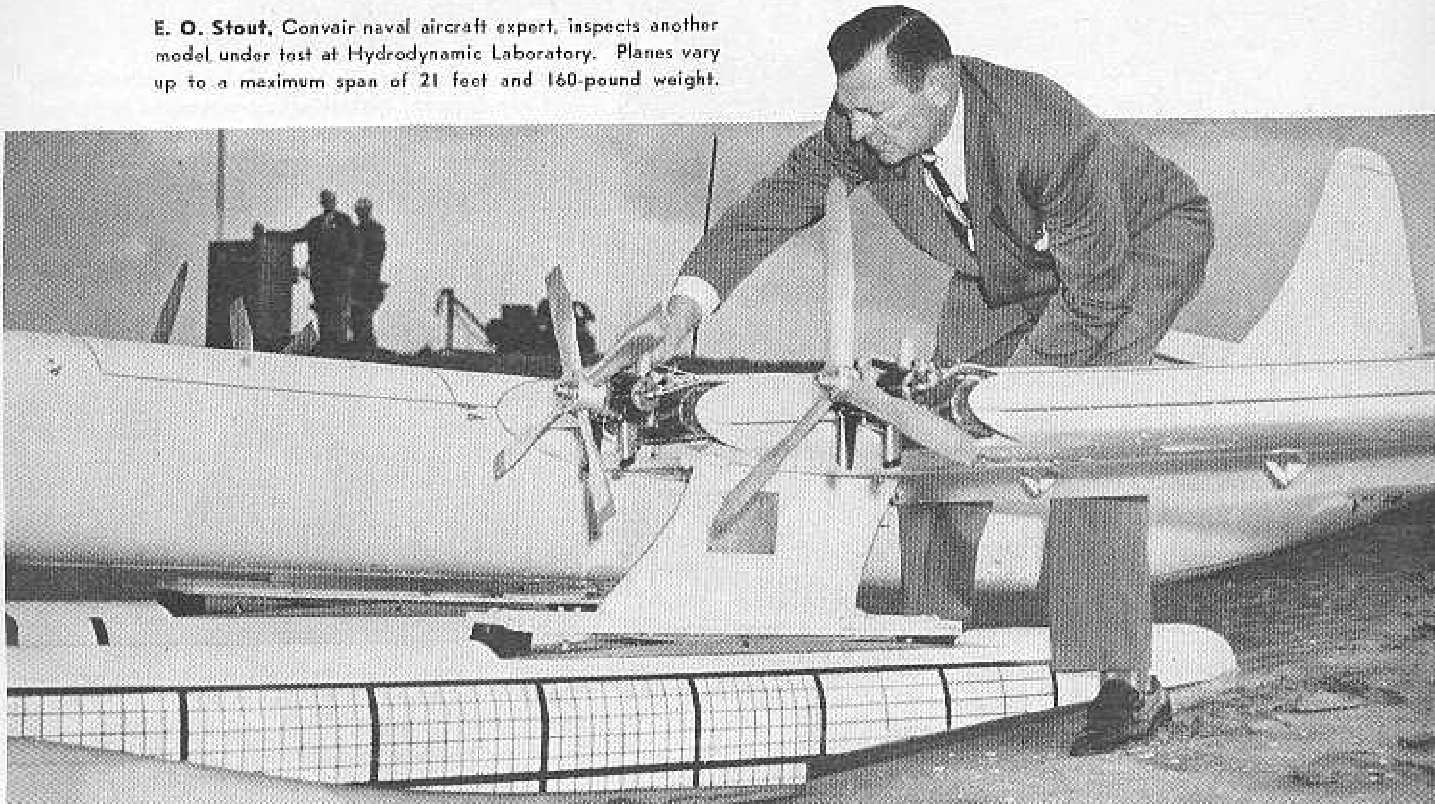
In flight, the XP5Y-1 looks like a full-size airplane. It is built to exact scale and weighs 123½ pounds with 1½-h.p. Ohlsson & Rice engines.

Plexiglas fittings were used wherever it was possible.

The result was a model of the Convair XP4Y-1 which was an exact geometric duplicate of the full-scale plane except for leading edge wing slots necessary to duplicate the lift characteristics of the full scale wing. Latest design is the XP5Y-1, representing a super-performance flying boat with long, narrow hull lines. Two full-scale XP5Y-1's are now being built for the Navy at Convair's San Diego plant.

The completed model is equipped with a special 16-mm. moving picture camera, trim indicator, speed indicator, sweep-second timer, accelero-meters and electric contacts which give a time history of the (*Continued on page 74*)

E. O. Stout, Convair naval aircraft expert, inspects another model under test at Hydrodynamic Laboratory. Planes vary up to a maximum span of 21 feet and 160-pound weight.



Jet Lightplane

(*Continued from page 14*)

has been developed by the same hard process of practical trial. It is claimed by the makers that the problem of starting—which presented difficulties at first—has been overcome. They believe the engine will be capable of being restarted in the air without difficulty or risk.

As for the aircraft, it is being developed by a small French firm which has a very good record. The firm of Castel-Mauboussin has its works at Aire-sur-l'Adour, where I recently inspected the factory. They have been concentrating on production of wooden aircraft and have built the CM-100—an excellent light freighter and general purpose machine. A long line of successful gliders and sailplanes also has come from this factory.

Although small, the factory is up-to-date, not only in its equipment and manufacturing methods, but in its staff and welfare arrangements.

At the moment the company is unable to fix the price at which the aircraft will be sold. Nor can a figure be given for the price of the Turboméca jet unit.

France has always been the happy hunting ground of the individualist. While the rest of the world thinks only of military aircraft, or large transports or conventional personal airplanes, France experiments with new types. She is trying not only to offer something technically new, but also something cheap. Several French companies are putting aircraft into production which have been designed primarily for cheapness. Thus the Starck *New Look* is going to sell—the makers hope—at about $700 without engine. The *Cyclone* is, therefore, merely one manifestation of the revival of the French individualist and pioneering spirit.

The Turboméca 011 is not the only small engine that the French are developing, though it is the only plain jet of so small a size. The little four cylinder, 75-h.p. Minié engines, one model with direct fuel injection, are additional examples of the interest the French take in producing something for the man in the street who has little money.

But the *Cyclone* gives France an opportunity for a real aeronautical triumph. If it works, it should find a market in both the U.S. and Britain. In Britain, there would be a large demand market for a miniature jet aircraft. No doubt restrictions would be placed upon the importation of French engines but if the demand were sufficiently strong they would probably have to be removed. The French buy a certain amount of British air equipment and they could retaliate if the attempt were made to refuse importation of something likely to sell in the United Kingdom.

There are not many personal flyers who do not hanker to fly a jet. If they were given the opportunity of owning a useful little jet airplane, nothing would stop them. END

Flying Midgets

(*Continued from page 39*)

step, bow and sternpost contact with the water. The camera is connected with the starboard throttle and can be operated at will to give continuous flight photographs of the take-offs and landings.

Complete with engines, propellers, fuel, instruments, receiver, battery pack of B, C and 14 volts of wet cell A batteries, the final weight of the XP4Y-1 model was 83 pounds compared with 42,500 pounds for the full-size plane. The scale gross weight is about 90 pounds, permitting six pounds of lead ballast to be added to balance the model to scale.

Flying the model XP4Y-1 is hardly a routine matter. Operations require a ground crew to handle the model, a boat crew to retrieve it, a test director, a cameraman, and a "VHP" at the transmitter. Convair says "VHP" means "Very Hot Pilot"—an apt description when it is realized that everything happens three times faster than in a full-size plane.

If the plane should get into an impossibly bad attitude, the VHP cuts a carrier signal and the controls automatically revert to a predetermined position. The model must be flown within a 3,000-foot range for practical operation. If it should fly out of range, the reduction of the signal will throw the model into a gradual left turn until it returns within range. So that models can be kept in sight, one wing tip and the rudder are painted a bright orange and the same color scheme is applied to the corresponding controls of the ground transmitter.

Engines are started by hand from a booster battery. The fuel-air mixture is also manually adjusted and when all is ready, the booster is disconnected, the radio switched on and the model turned over to radio control. Sometimes the models are launched by catapult to reduce the burden on radio equipment and simplify personnel requirements.

When Convair first sent its models to sea there was considerable trouble with the engine stopping. The carburetion was faulty and salt spray often shorted out the ignition system. These problems were overcome by using a fuel injection system and redesigning the shielding.

The radio remote control system is the only one of its kind in the world and was developed for the Laboratory. The six-channel transmitter has 63 watts of power and relays the VHP's signals to the receiver in the plane, which in turn actuates the tiny plane's flight controls.

The control panel itself has a wheel control column, rudder pedals, and two throttle control levers. The instrument board has radio instruments, an elapsed-time clock, flap and ignition switches, and control surface trim adjustment knobs. Even the seat is adjustable for the VHP's comfort. The control transmitter has trimming knobs which trim the zero positions of rudder, elevator and throttles in case of variation.

An autopilot was developed for the models which weighs only about five pounds. Elevators, rudders, ailerons, flaps and independent throttles are operated by small servo motors which are actuated either by the autopilot or by the overriding signals from the VHP.

Convair has found that the free flight model has at least two advantages over a towing basin system for testing plane designs. In the basin, models can only pitch and rise, and their speed is limited to that of the 16-ton towing carriage to which the model is attached. Acceleration effects accompanying the reduced power loading of modern seaplanes have an important effect on spray and stability. With the scale model, however, Convair can duplicate all effects which free flight could put on the actual plane.

The equipment has also been extremely valuable in all forms of hydrodynamic research, such as hull forms, high lift devices, and so on. Effects of modifications to existing flying boats can be determined quickly and accurately, and with a great reduction in cost and time. When undesirable reactions are obtained, changes to the model may be made quickly and inexpensively and retested until satisfactory performance is shown.

The enormously costly cut-and-try alterations to a full-size experimental product can be eliminated. When complete failure does occur, the models will uncover the causes with minimum risk to personnel and provide the information to prevent a recurrence of trouble in future designs. END

"And There I Was . . ."

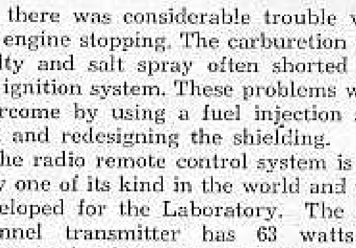
MINUS ONE STEARMAN

During the war, a Navy cadet at the Norman, Okla., primary base returned from his first solo flight, minus his N2S-3 Stearman.

His instructor eyed him coldly. "Okay, Dilbert, what happened?"

The cadet, standing stiffly at attention, replied:

"Well, sir, it was like this. I was doing fine until my motor quit. I was pretty low and didn't have time to pick out a good spot for an emergency landing.



"Well, sir, I came on down and tore off a bit of telephone wire with my wheels. Then I knocked off the top of a stone wall. And then my wings were torn off by a clump of trees.

"And then, sir . . ."

The instructor threw up his hands and roared, "My God, and *then* what did you do?"

The cadet reddened. "Why, then, sir, I lost control of the plane."

A. F. KITCHEL, JR.