The Douglas Dolphin taking off from the Royal AFB, Strubby, England, May 9, 1971.

With all the big time scale builders going for rule-fitting low wing light planes we are in danger of going stale. There is not much inducement to do the "way out thing" as contest rules stand at this time. I seldom enter contests anyway, being a member of that select class of scale buff who builds what he likes, when he likes, just for fun. There is a wonderful world of aviation in that golden era of the 1930's, when men made them fly with guts, and designs were modified in chalk on the hangar floor. When they stopped using wood and dope, all the glamour went out of flying.

I have had a go at most things, even to taming a .61 powered Hellcat into a week-end sport job, and my mind went back over and over to the multi engine ship. I had to get it out of my system, so I decided on a twin. Reading up on all the trials and crashes in the magazines, I wondered why they were all so big and heavy, needing two .61's to get airborne. The cost of feeding two such beasts, and the expense of crashing all that wood at one go, paled me into thinking in terms of a smaller twin. It did not appear to have been done, but there was no reason why it couldn't be accomplished. I figured a 60" sport job weighing up to 17 lbs. would fly with .40 power. Two .19's, working out on the wings in clean air should be ample. This was my basic formula. After a lot of study, I chose the British Short Scion as a prototype. It was a six seater using two 90 h.p. engines, and flew very slow and safely. With a wingspan of 63" I matched every part, using hard wood for the essential load carrying frame, and light wood for the scale superstructure. The result was 6½ lbs., even with seats and pilot added, and the two O.S. 19's were more than enough to fly it. In fact, it is best to takeoff at reduced power, even then the ship is soon too high and needs throttling back. I learned a lot with the Scion. Sooner or later one engine is going to stop. There is a lesson to be learned here. Whether it flies on one or not is dependent on the flying speed. At high angles of attack, on full power, near the stall, is the most dangerous place to lose an engine, and the port is the worst one to stop, as you have torque, as well, working against you. I was playing to the crowd with a steep climb out at full throttle when the port engine quit. The single remaining .19 snap rolled the 6½ lb. airliner four times before I could shut my mouth. Fortunately, the resulting crash was not too serious, and I was soon flying again. I learned to take much more care in setting up the engines, tuning with the tanks only half full to allow for the leaning out process as they emptied. I learned to set slightly rich, which meant that, at half settings, there was a strong risk of the plugs going cold on the low grade fuel used, necessitating up-grading to 15% nitro to prevent sudden failure. I learned to set up the ailerons to give a two up to one down differential throw, allowing a single engine flight to be made using ailerons only (holding in rudder as well is very tricky) and I found that as long as I flew high, there was plenty of time to throttle back after an engine failure, and fly it in on one. More often than not single engine landings were the rule.

DOUGLAS DOLPHIN

TYPE	Amphibian
SCALE	1" = 1'0"
SPAN	60"
POWER	(2) O.S. .19
WEIGHT	6½ pounds
CONSTRUCTION	Wood
LANDING GEAR	Steel Tube
NACELLES	Fiberglass

Elated by my success with such a comparatively small twin, I started looking around for another fence to jump. Among my collection of rare plans I found the Douglas Dolphin, used by the Army in the early '30's, and later by the Navy in small numbers. It was pressed into service during the last war, and the Coast Guard also used them so there is plenty of scope for the paint job. Even a civil one was used in Australia, later pressed into R.A.A.F. service in the war, so red, white, and blue roundels are also correct. The part that grabbed me was the position of the engines. The two 9" props on a 60" model met at the middle with only ½" between them. This was the ultimate in twins for one engine flying and I guessed that the swing would be minimal. They were also well forward for c.g. and, in clean air, with a sub wing added for smoothing out torque, as well as stiffening the nacelles against vibration. The problems included hiding the engines in the dummy Whirlwind engines, and getting enough tankage in the tear drop nacelles. Twins want plenty of running up on the ground, and small tanks are a danger. I got over this by using fiberglass with a custom made tank in metal fitted snugly inside. The engine mounts are very rigid. I had a rough landing which tore out the wing fixing, but the engines were untouched by the

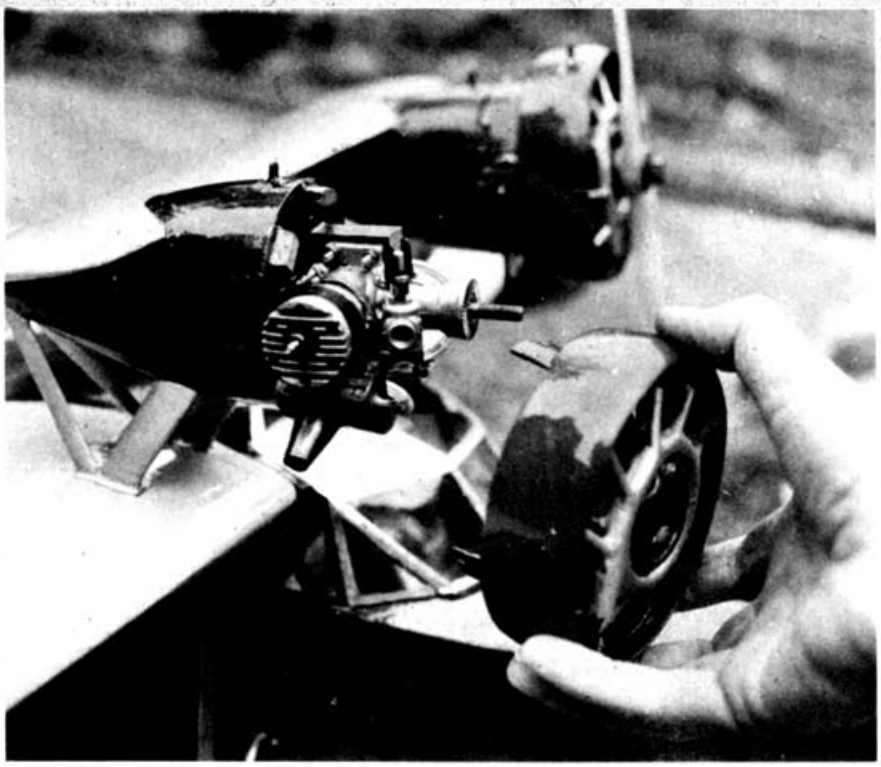
jolt. The dummy engines were made from ¼" ply, half rounded, and epoxied to the front part of the fiberglass nacelle which is removed for access to the engines. The Townend rings are 1/16" ply wrapped round the engine profile, after which is added 1/8" cross grained balsa fairings. I chose the Whirlwind engines rather than the later Wasps because the front exhaust ring, made from nylon tube, hides the cylinders so well that it is not necessary to fit fins or elaborate detail, saving a lot of time and extra weight. The O.S. engines just fit in the Townend rings, protruding a little at the rear, but as they are side mounted, are unnoticed. You could fit them inverted, but starting is not too easy this way, as I found on the Scion. When one engine is howling, it's not easy to hear or 'feel' if the second is right, and flooding is all too easy. This means out with the plug, all of which becomes very frustrating.

The main rule for twins is, "keep up the flying speed well above the minimum necessary for the particular model you are flying." At high speed and in straight flight, the loss of one engine can be unnoticed. Slower flight gives a sudden swing, calling for immediate correction, and a throttle reduction on the remaining power plant. Do not chop the engine right off since the model will lurch about like a lame duck, losing a lot of height which you may not have enough of, if you see what I mean!

During slow flight, near the stall, loss of one engine can mean a write-off. Low passes for the photographers have killed off more twins than anything else! When you throttle down, commit yourself to a landing. If you must open up again, do it gently, not suddenly, and set up the throttles exactly the same. I use piano wire for a feeler gauge to get the throttle opening the same on both sides. After a prolonged idle, the smaller engines don't always open up clean. In the case of the Dolphin all the above problems are halved. The close-in engines make it almost up to a single engine in power swing, and the loss of one is not nearly as serious, with any reasonable pilot being able to cope with the situation. I have taken off on one engine, using full rudder until the speed built up. I cut the throttles after the wheels left the ground, however, being a chicken hearted pilot. On it's first flight I got into trouble because it was too stable! It was flying away so straight, and ailerons would not answer at all. I had set the throw low as they were almost full span and looked frightening. I know why, now! Forced to a landing way upwind, my eyes failed me, and I had to down it as best as I could, luckily with only a little damage. The ailerons were soon altered to the throw shown on the plan, where they answer smartly when applied.

I won't bore you with a lot of detailed building instructions. If you

Author Eric Fearnley with his R/C version of the 1930 vintage U.S. Army Douglas Dolphin amphibian. Full scale model used two Wright Whirlwind engines.



Close-up of the silencer detail for the O.S. Max .19's. Note pressure pipe.

cannot read the plans, then do not attempt it. It is essential that you have some experience in flying Scale models before trying this job. With "Plank" flying models, stability is automatic. The scale model flies like the real one, and needs the pilot's hand on it the whole time.

GENERAL CONSTRUCTION

There is nothing difficult about the construction, but some accuracy is required to prevent having to fight the warps, etc., when the time comes to fly.

The hull is built on a marine ply keel, with plywood formers. The 1/8" sides, with stiffeners of ¼" x ¼" are added, and the chine to keep fitted as well as back end sheeting, etc. The steerable tail wheel is coupled before the top is finished. If you are water bound, a small metal rudder could be added to the tail wheel for water control at the beginning of the take-off. The back end is near the waterline at the stationary position, so watch the rudder outlet control. I used a nylon tube with wire, but if you do, put some silicon grease in it to keep out the water. Fly off sea water at your peril, as the corrosive action is very dangerous. Be sure to seal off the hull well. It is surprising how it can leak after coat upon coat of dope.

The wings are easy, but the fitting of the nacelles is tricky. Cover the wings before finally fitting the struts. I set the struts into the open nacelles with plenty of epoxy, holding them until set on the wing through the retaining holes, but not gluing them as yet. A balsa jig was pinned to the wing to find the exact position for the engines until set. They were then removed for the time being, and the front ply radial mount, tank, and engine control fitted and epoxied in position.

After the wings are painted, the whole unit can then be epoxied to the beams, ready drilled to take the struts. The control cable has to be taken through the wing to the forward center section, ready for the servo. The wings must be very fuel proof, since they receive most of the exhaust residue. I used plastic covering over the sheet, and then a coat of enamel yellow and, finally, fuel proofer. This should keep out the worst!

The landing gear fits onto the hull sides with king pins into brass fittings epoxied to hardwood cross bearers. The internal sprints of 18 gauge wire have only a limited use, as the hull soon bottoms on the keel, having only a couple of inches of ground clearance. The scale undercarriage could be wound up by hand only when the aircraft was in the water, never in the air. If you are contest-minded, it could offer a nasty little problem to the judges over marks!

For simplicity, it is possible to remove the pin and raise the u/c for water takeoffs. This is not strictly scale, but near enough for a practical flying enthusiast. If you want the real thing, good luck to you.

The whole design concept was based on the valuable experience gained with the Short Scion, and I realized that the complication of the nacelles and struts would most likely put up the a.u.w., however, the Short had a good reserve of power, so I was not too worried on that score. To offset the extra plywood in the hull, and other excess weights, I thought it prudent to watch the finish, so the hull, which I knew from free flight experience splits easily, was nylon finished, while the wings were Solar-filmed over the 1/16" sheet. The resulting colour was not right, so a coat of enamel was added. The insignia was matt enamel for maximum cover, and as the fuselage, sorry, hull was cellulose, the only known proofer was Tufkote.

There is a problem of priorities. The nacelles have to be finished, tanks fitted, and throttle cable added; then the ¼" ply firewall and radial mount slipped into the front of the rear half of the nacelle only **after** the struts of 10 gauge wire are epoxied in place in the nacelles, using plenty of resin on the insides. I used a balsa jig to hold the nacelles in place on the wings while the struts set. They were then faired with spruce, and removed from the wings. The fuel seepage on the wings is considerable so it is now necessary to cover the wings, sealing off everything carefully. The enamel finish helps to seal the edges of the film. The nacelles are finally epoxied in place, but now the problem is to get the motor control through the wing to the center section. With everything jigged up as straight as possible the sub wing is added and faired with fiber-glass filler. The sub wing not only strengthens the whole against vibration, but smooths out the airflow and reduces torque effects. It also makes a useful carrying handle!

One of the worst problems was the wheels. Why do we have so many hopelessly out-of-scale fat wheels on the market? Slim Williams smooth contour were too modern. Vintage wheels are too big and too old. I was lucky to find a pair of American Universal wheels, with alternative spokes – exactly right for a Mustang

or Hellcat, or the cover discs which I used on the model. They may not be perfect, but they look right, and they are thin, as scale wheels should be. How about some better designs from the firms instead of the copycat "doughnut" types we have in many makes?

And, so, at the end of a long hard winters work, the finished model. All my armchair confidence gave way to wondering, "Will it work?"

I spent a whole afternoon taxiing it up and down, and got the impression that it lacked a little directional stability, so as a precaution, added a little to the fin area away from true scale. My almost unflyable Hellcat was turned into a sport model by adding extra fin – snap rolling is caused by lack of fin area, not tip stalling as so many say. Washed out wing tips hold off the snap a bit, but it's the stalled tail with too much elevator applied against a small fin that causes the break.

FLYING THE DOLPHIN

In common with any twin scale model, there are certain pre-flight checks that just have to be made. Small .19's are O.K. at full throttle, and have a good idle, but they do not like prolonged running at partial settings. This is too bad as this is a likely way they will be run in practice. I found that by fitting Fox Idle Bar plugs (with an extra washer in to clear the piston top) and using the best 15% nitro fuel, the engines are well-behaved. On the wrong plugs and poor fuel, one click of the needle, and we have a rough engine. I fitted clear tubing to the fuel line. Any sign of air bubbles in the line, and you will have trouble. A brass pipe is fed off the silencer to pressure feed the tank. The remaining vent has to be plugged, of course. This gives even fuel feed, and allows lean settings to be used without the fear of a flame-out at lower tank levels.

Every prang, or bad landing I have had on twin scale has been the result of one engine going sick at low altitude, usually after a long run at intermediate settings on the carbs. Do not throttle down the engines if the model is climbing too much. It's much better to add down trim and keep the flying speed up. Speed is safety. A spin, following a stall, cannot be corrected at low altitude. Fly high and fast, and if one engine goes out you will not only minimize the swing at speed (the tail is working well when fast) but you also have altitude to give you a fighting chance. There is a lot to be said for having the engines "stoppable" at the low setting. You can then kill the remaining engine and glide in from a height safely. If you have a classic snap roll, the result of a stall, loss of speed, and too much elevator, and a sick motor thrown in, the only cure is to put the nose down, gain speed, and when the tail areas are working again, ease out with a little elevator. This needs altitude, so once again, don't fly low, even if the photographers are calling for low passes. If you must do a low run, do it at full throttle, and down elevator, never letting the speed off. The Dolphin relies a good deal on the prop blast on the tail to maintain stability. If you lose the engines, don't be afraid to keep the nose down, and speed up, since this is your safety line. Takeoffs are easy. If your engines are in sync., the run will be dead straight. A little up-elevator to hold the nose off the ground – it may skid on it's keel if your wheels are not too free. If there is a strong swing, and your u/c is O.K., then check the engines since you have probably got a rough one on one side. If it goes straight, ease it off, and it should soar up at a good rate of climb. It is a good idea to test fly without the Townend rings on. The engines may want attention, as they will probably become loose, and the extra power will help. The overall weight must not exceed 7 lbs. in order for the .19's to have a little reserve power.

I had a little vibration trouble when the cowls were removed which is hard to understand. This was cured by trimming the prop blade on the piston side about 3/8" to counter the unbalanced engine. I have not tried it on water yet. Based on land experience, it has enough power, but I would guess that a bigger fin to stop early swinging would be a necessity, or a water rudder which could be easily fitted.

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The O.S. Max .19's are almost completely hidden by the Townend rings.