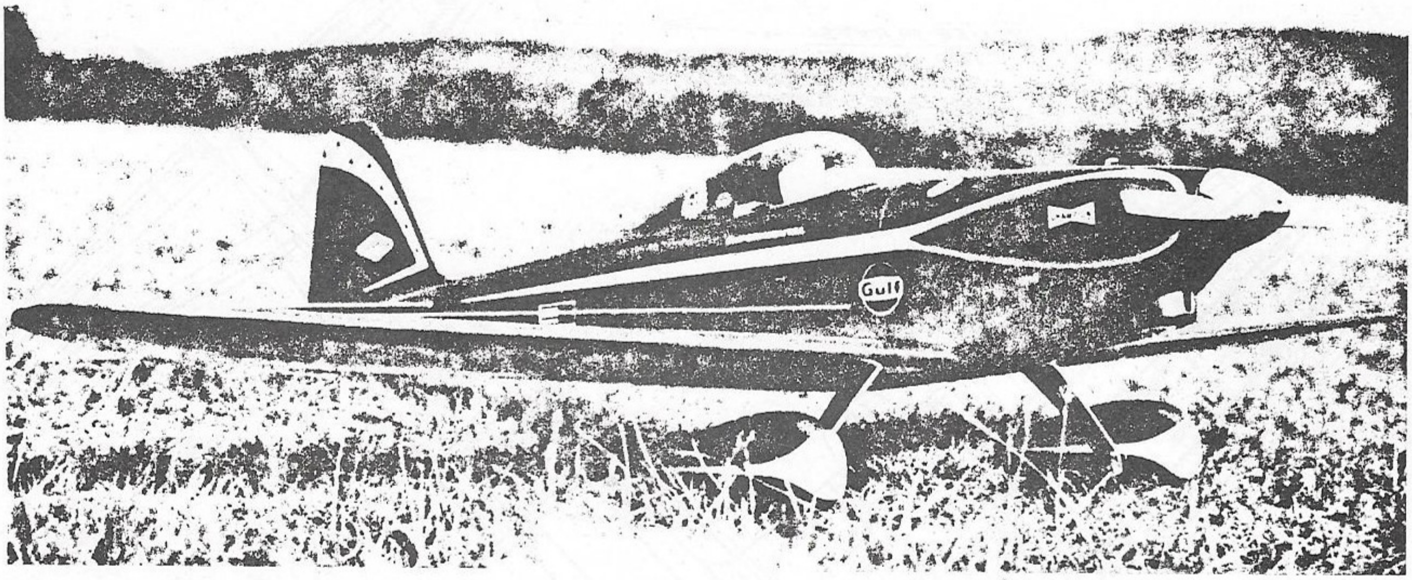
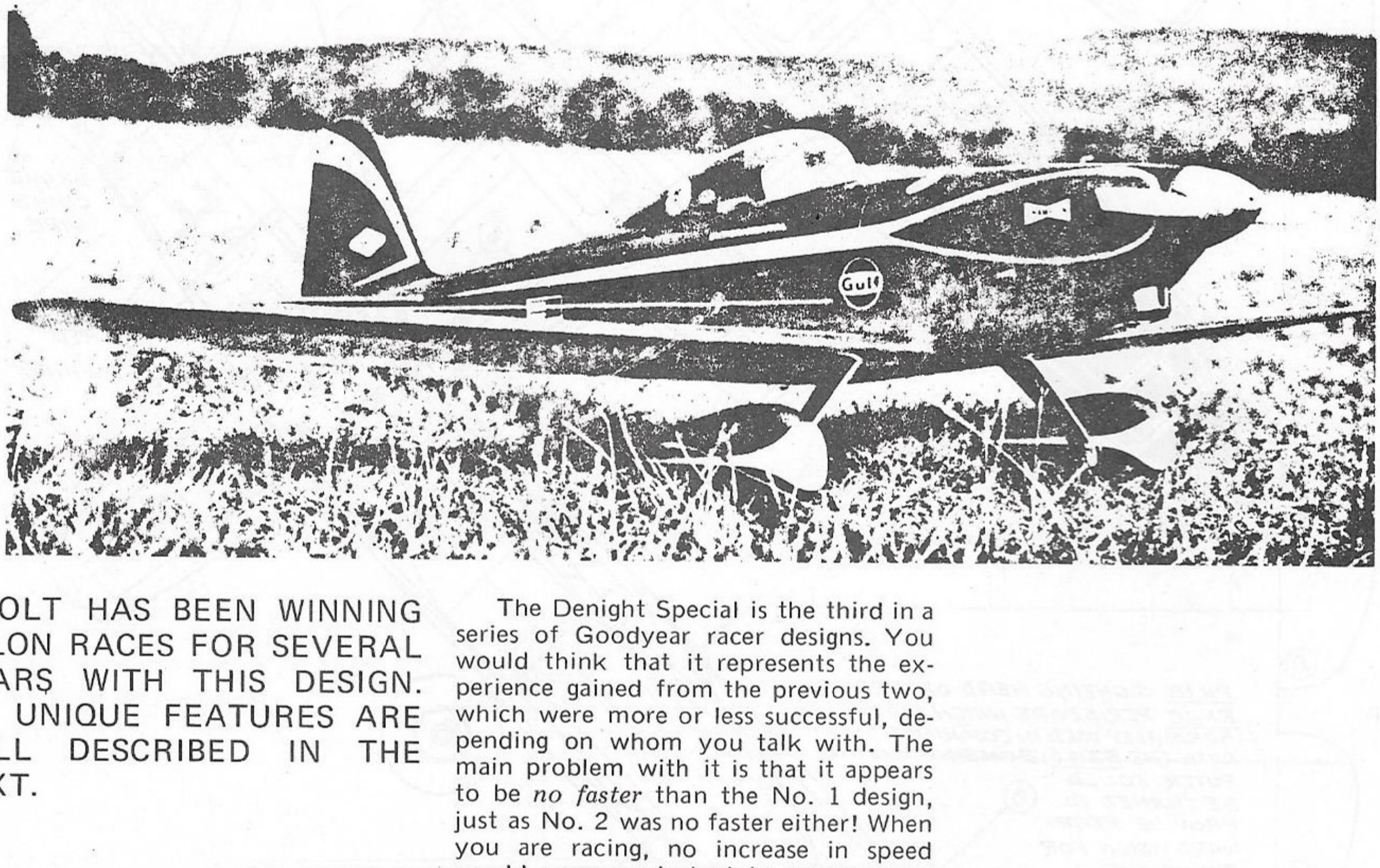


Denight Special

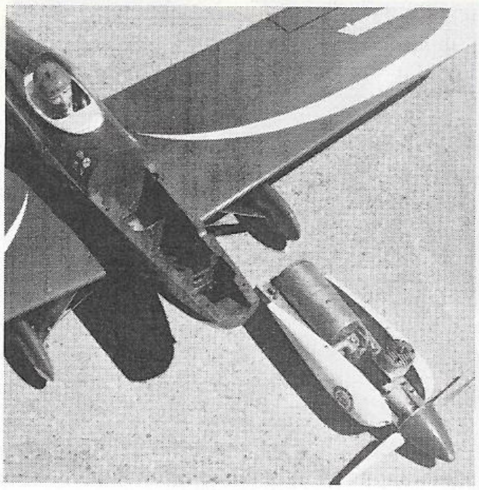


deBOLT HAS BEEN WINNING PYLON RACES FOR SEVERAL YEARS WITH THIS DESIGN. ITS UNIQUE FEATURES ARE WELL DESCRIBED IN THE TEXT.

by HAROLD deBOLT

The Denight Special is the third in a series of Goodyear racer designs. You would think that it represents the experience gained from the previous two, which were more or less successful, depending on whom you talk with. The main problem with it is that it appears to be *no faster* than the No. 1 design, just as No. 2 was no faster either! When you are racing, no increase in speed would seem equivalent to no progress. However, in this case a little tempering is in order. No. 1 design turned race times which are just now being seen by other models. What has No. 3 got going for it that No. 1 did not have? First of all, No. 1 is no longer legal—it fell under the "prototype category." Thus, No. 3 is as close as we can come to the first one and still be legal. It is also improved and a much more usable model, especially as far as maintainence is concerned.

With the Denight the big effort was



Shown are several unique features: Tank is grommet mounted, engine inverted and fully enclosed, air ducting through cowl to carb, and the removeable engine pod itself.

Close up of the engine pod proves a point—it is serviceable.

to make it "more scale" than any other Formula I design. You need the handicap in your favor to win today. The main problem is obtaining *accurate* drawings of the original airplane. Frankly, most of the drawings available vary as greatly as the draftsmen who drew them. One racer which was built in this area serves as an example; luckily, the builder is still around and had the original paperwork from which he built the airplane. But how do you come up with drawings to build a model from, when all he used were some dimensions on a scratch pad and chalk lines on a hangar floor? Yet, three views of this airplane have appeared—all profess to be authentic. Such is the case with most of the Goodyear designs available to us.

Choosing the Denight Special as the airplane to copy neatly solved this nasty problem. This racer was designed, and its construction supervised by Nicholas E. D'Apuzzo of Ambler, Pennsylvania—the Bristol area where the airplane was built by the Denight Aircraft Associates. Nick is one of those wonderful people who seem to realize the peculiar problems which we modelers can have. During the course of my research into the Special, I had nothing but unlimited cooperation from him; the result being authentic factory drawings of the original airplane. Then, as luck would have it, D'Apuzzo attended the Philly Nationals and had the chance to observe first-hand the three examples of our Denight model which were there. The Denight is but one of several highly successful full-scale machines which D'Apuzzo has developed, including the PJ-260 aerobatic bipe.

With the scale angle taken care of, the next chore was to be sure our model would be the quickest and most usable our experience could provide. The basic features of the Denight are not run-of-the-mill or taken from all other successful racers, by any means. However, these features were proven very well in our No. 1 Goodyear, the deBolt Special. Fundamentally, the concept involves absolutely clean lines, low-drag progressive laminar airfoil, solid stability and a minimum of frontal area. The greatest change in the Denight was reduction to the minimum size required by the rules. No. 1 was nearly 10 percent oversize.

One new aerodynamic principle is the use of a single aileron for lateral control. The "why of it" can easily be seen: obviously, one is easier to install than two when both are not necessary. In addition, it is a simple search for more speed and ease of flight. NACA data indicates that a considerable portion of the wing drag comes from the openings around the ailerons. If you cut the number of ailerons in half, you are bound to have less drag (from the openings) by a factor of 50 percent.

Remember that the one remaining aileron still creates drag, especially when it is moved from neutral. If you place the one aileron on the right-hand wing panel, this panel will be on top when flying a left-hand pylon turn. Theoretically you use aileron to enter the turn; the off center drag as the wing is forced to perpendicular causes the airplane to yaw to the right as you enter the turn. What this means is that you can fly into the turns much harder with the nose down and yet the reaction from the single aileron will keep the model level as it progresses through the turn.

In actual usage this system can shake you up when you first shift to it from a dual-aileron system. Basically it works just as planned, except for two things: First, it takes a lot of guts to fly into the turns nose down, when all your past experience tells you that this is suicide. Secondly, you find that lateral control is quite dead around neutral on the control stick. Actually, the latter proves to be an asset as the model really grooves when our normal stick antics are not as effective! A bit more aileron movement is required for maneuvers; response from drastic stick actions is quite normal.

The big new thing about the Denight is the use of a power unit for the first time in an RC racer. The history of it is quite simple. All the ideas which I developed for control line speed years ago

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were applied to this RC design. RC racing has progressed so fast, yet simultaneously with other types of RC, that many of us have done things which we knew were not the ultimate, expediency being the excuse. Hanging an engine onto a racing model in the same way we do a sport job is not the best way if you are looking for the ultimate in performance from the engine. The Denight uses all the cute control line tricks for its power unit and, happily, they have all proven successful. However, you have to understand them to appreciate what they are intended to accomplish.

All of my Formula I models have been considerably underweight according to the rules requirement. I am of the "balsa flies better" breed and find it hard to accept a rule which forces us to add ballast to an otherwise perfectly acceptable machine, just so that those wishing to use different materials will have competitive models. Anyhow, having a half pound of weight to play with, an attempt was made with the Denight to put it to good use. The current scuttlebutt is that an engine's efficiency is proportionate to the solidity of its foundation. So, the Denight makes extensive use of plywood and good hard maple in and around the engine department. Use of these heavy materials is actually an asset, for without them the removable pod would be highly impractical. The pod has proven to be a distinct asset for maintainence and experimental purposes. When it lifts off, you have the entire power unit out of the airplane and any changes desired become much easier to accomplish. Both the engine and fuel tank, with the associated plumbing, are fastened to the heavy maple crutch.

The full-scale Denight, at various times during its life span, used an air intake scoop on its lower engine cowling. This was just the excuse we needed to put another trick to use—one which should provide better engine performance and add to the efficiency of the model itself. Basically, this pressure cowl requires that the cylinder and head be completely enclosed in a tight-fitting ducting in such a way that air is rammed through the cooling fins. With the inverted engine configuration and the full-scale Denight carburetor air intake scoop, the necessary requirements were there to use a pressure cowl on our model.

The pressure cowl principle takes what once was a detriment to aircraft and turns it into an advantage. Before it was developed, any sort of ducting used to accomplish heat exchange (engine cowlings, oil coolers, radiators, etc.) simply added to the drag of the aircraft. With the advent of the pressure principle, this drag was nullified or, in optimum cases, actually reduced the overall drag of the machine. Fortunately, it has proven to do the same for our models!

The principle is this: the source of heat is sealed in a duct work so that the only leak is an air intake and an exhaust. The intake is purposely made 25 percent larger than the exhaust. The angles of the walls of both the intake and exhaust ducting—from entrance to exit of each duct—is never below a minimum of seven degrees so that back pressure in the ducts will not be created.

In operation, the air is rammed into the intake duct and a bit of back pressure is built up at the exhaust exit because of its smaller opening. Immediately in front of the exhaust exit, and in the back pressure area, is the source of heat—in our case, the engine cylinder. The air is held in the cylinder area momentarily, allowing it to raise in temperature and expand. The incoming air pressure being greater causes this expanded air to leave via the exhaust duct at a *greater velocity* than the air entering and the air flowing past the airplane. The result is a rudimental jet effect which adds thrust to the aircraft. A secondary advantage is that this system tends to create a constant operating temperature for the engine. It operates as expected in the air, with no problems; there is some tendency to overheat with prolonged engine runs on the ground. At first, this seemed a problem but the cure proved simple. If you anticipate an extended running period on the ground after you peak the engine

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and you are sure of the setting, you simply open the needle enough so that the mixture is rich. The excessive fuel flow is more than enough to keep it cool. You simply return the needle to its original setting when ready to go.

The ideal power package should provide a means of feeding the engine all the fuel it can use and clean, unpolluted air to go with it. Both come with the Denight package. The engine people supposedly have given us more power by means of a rear carburetor intake. Unfortunately this intake falls behind the exhaust, which emits carbon monoxide—a poison to most anything, including our engine. The solution on the Denight is the air intake passage through the cheek cowl. The air is taken in well in front of the exhaust and piped directly into the carburetor. Proof of the pudding is that the original Denight has a short cut intake which opened to outside air—potentially, exhaust fumes could get in on the ground. The engine was also difficult to adjust. Changing to the original specs and the forward intake proved to be the solution. Short cuts always leave you short-changed.

Walt Good ran some tests to prove the G loads our models encounter. His work was done years ago, using slow stunt models. He found that even those clunkers could build up 40 Gs in violent maneuvers. Wonder what a Formula I exerts on our fuel supply at over 150 mph in a pylon turn? Obviously, there are times in racing when our engines are starved for fuel and we would do well to even things out. Also, it would be nice to know that *however* we set or peak the engine on the ground, it would run exactly that way in the air, every time. With all our genius, one day someone will produce a fuel injection system which will compensate for all conditions and do exactly what we want. In the meantime, pressure fuel feed is the best method in use today. The system makes use of the pressure which is available in the engine's crankcase to build up a considerable amount of pressure in the fuel tank.

The system which I developed has become known as the Positive Pressure System and operates through the use of the engine's intake valving. In effect, as the piston comes down there is a time in the cycle when pressure is built up in the crankcase. It also tends to produce a vacuum during the upward portion of the cycle. My arrangement uses the rotary valve to time the crankcase pressure outlet so that it is only open during the downward, or positive pressure, portion of the cycle. The greatest amount of pressure possible is tapped with no possibility of pressure pulsing.

The tank pressure will vary proportionally to the rpm of the engine. The greater the engine speed, the greater the pressure. With more pressure in the tank, more fuel is forced to the engine—exactly what it wants as it goes faster. Pretty hard to fight an arrangement like that!

All the pressure in the world will do no good unless the fuel can get out of the tank into the engine with the model in any conceiveable attitude. Thus, the choice of fuel tanks is equally important. I prefer a metal tank which has an internal weighted swivel, located in the rear of the tank, and responds to exactly the same forces the fuel is subjected to. This swivel is the fuel outlet to the engine, assuring that the outlet will always be where the fuel is. The tank has two new items: one is a pressure inlet tube which runs to a small dome on the top outside of the tank, the purpose of which is to let pressure into the tank, at the same time making it difficult for fuel to get back into the engine through the pressure line. The second abnormal item on the tank always raises questions too. I have a difficult time convincing people that it is my gas cap! Obviously, to fill a tank you need to vent it or else. . . . The simple solution appeared to be an outsized filler tube; a small tube inserted into it leaves ample room for the tank to breathe and thus vent. The outsized tube must be sealed for the pressure to work, so provide it with a cap—a piece of a bolt which threads into the filler tube and, when tightened, makes a positive seal. The tank is also shock-mounted. It will not shake apart mounted this way, and the fuel will not tend to foam quite so easily. I fastened some brackets to the tank so I could mount it by the use of rubber grommets. If it's good enough for the servos electrics, it should be good enough for my fuel tank. Just between us pylon pushers, I have been very happy with the Denight's operation, so have Ed Keck and Hale Wallace. Ben Howard always labeled his airplanes DGA. . .this may not be a Howard design, but it still deserve his label of a "Darn Good Airplane."

Don't forget to scan through our long list of plans available through **SUDDEN SERVICE PLANS** on page 84 and 85. Send in for new plans today!