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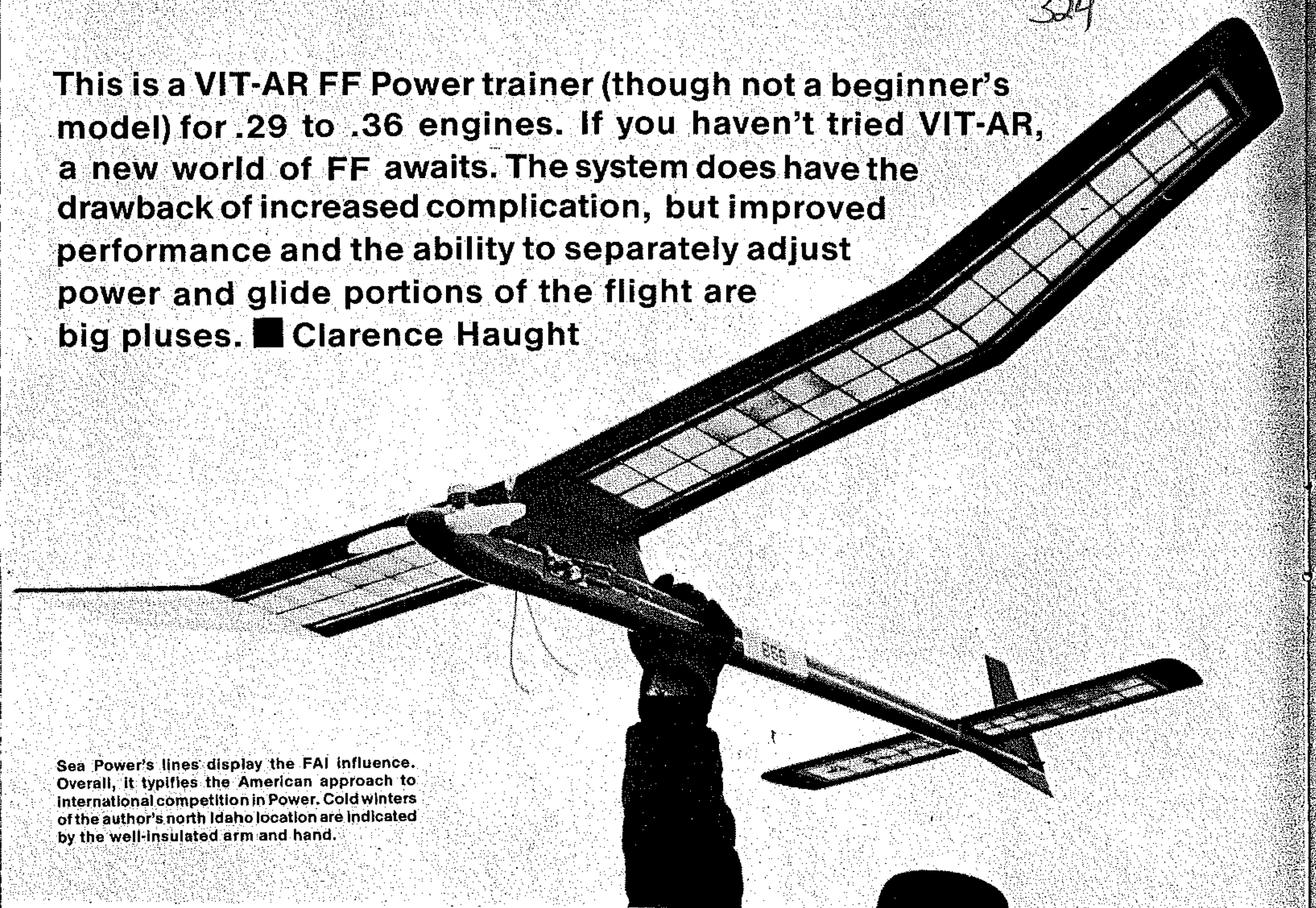
This is a VIT-AR FF Power trainer (though not a beginner's model) for .29 to .36 engines. If you haven't tried VIT-AR, a new world of FF awaits. The system does have the drawback of increased complication, but improved performance and the ability to separately adjust power and glide portions of the flight are big pluses. ■ Clarence Haught



Sea Power's lines display the FAI influence. Overall, it typifies the American approach to international competition in Power. Cold winters of the author's north Idaho location are indicated by the well-insulated arm and hand.

SEA POWER

IF THE "Free Flight Community" were to become organized and employ an outside study group to evaluate and report on the "State-of-the-Art" in Free Flight, we would likely be in for a surprise. Such a group would probably report that there is no state-of-the-art, but rather a giant spectrum spanning a 45-year period, more or less. If we were to narrow the field a bit, eliminate Old-Timer activity, and concentrate our study on competitive Power flying, we would still find an incredible variety of equipment in use. Everything from docile "Dusters" to automated futuristic "Bombs" grace the flying fields. But wait! Isn't this what makes Free Flight great? The fact that *any* well-trimmed model, put in the right air consistently, can finish in the winner's circle is what keeps us coming back for more.

Free Flight has changed and will continue to do so. This promise of change provides the challenge which keeps many fliers interested. Shrinking flying sites have brought about many of these changes, and new rules had to be written for Category I, II, and now III. Since performance is the name of the game, in Free Flight, new design concepts were developed to match ever-shortening engine runs. Smaller, faster models, with more powerful engines, have emerged. The large slow-climbing floaters have given way to higher climbing designs which depend on altitude and good air to attain maxes. These design parameters have created their own special problems.

The typical Free Flight model of today is a compromise. To maintain a suitable glide requires sufficient angular differences between wing and stabilizer. This longitudinal dihedral creates a problem during the high-speed power portion of the flight. The model tends to climb in an up arc which, if allowed to continue, would result in a disastrous loop. This condition is typically controlled by inducing turn, which (usually) transforms the loop into a spiral climb. This turn also helps alleviate the potential stall at the end of the engine run, providing a smooth transition from power to glide. As more powerful engines are installed, on smaller and smaller airframes, this condition becomes more difficult, or impossible, to control.

The British have dealt with small-field conditions for years, and have experienced many of the same problems. One successful approach to this challenge is demonstrated by the classic Dixielander. This 350 sq. in. design, for Class A and small B engines, utilizes a huge stabilizer, and operates with the center-of-gravity (CG) one inch behind the wing trailing edge! This ship has a very high pylon, and employs no downthrust. Such a force layout enables one to control high power quite well, but it still has its limitations.

Another approach is the variable incidence tailplane, or VIT as it is commonly referred to, combined with auto rudder (AR). This system, standard equipment on the typical FAI Power ship, allows separate stabilizer and rudder settings for the power and glide portions of the flight. This means, of course, gadgetry and multifunction timer—and the potential of malfunction. Proper installation, careful maintenance and pre-flight checks will minimize this hazard. The VIT-AR system actually alters the Free Flight concept somewhat, as it allows pre-programmed flight.

At first glance, it would appear complicated to fly with VIT-AR, but models which are so equipped are actually easier to trim, and they have a better chance of surviving those crucial first flights. This brings us to the subject at hand.

Sea Power (if you use a .29 engine, call it Bee Power) was designed as a VIT trainer. I wanted a model that would perform spectacularly and, at the same time, allow me to gain experience with programmable tail feathers. This model was to tell me if I should eventually become involved in the FAI Power class. Sea Power has opened new horizons for me in Free Flight power. It typifies, to me, the "state of the art" if indeed one exists.

While Sea Power is a "trainer," it is definitely not a beginner's model. Due to this, we will not be offering the glue-stick-A-to-former-B construction sequences. Rather, we will mention a few particular points, and spend the remainder of our space on trimming and flying techniques.

You will note an abundance of wood in the wing and stabilizer structures. Weight is a vital factor in Free Flight construction, but not at the expense of structural strength. This model really moves out under power. The added structure is essential to prevent flutter at high speeds and to withstand dethermalizer (DT) loads at the end of the engine run in testing. Similarly, plastic covering materials, are not recommended. GM-grade silkspan on the wings and 00-grade on the stabilizer provide the necessary rigidity.

The pylon is laminated for resistance to flexing, and has a hardwood insert for attaching the aluminum wing mount. If you have trouble locating round aluminum stock for the wing mount anchor nuts, saw a couple lengths off your small X-Acto knife handle. The aluminum rest and quarter-circle plywood wing-key system works great. The twin landing-skid system is useful when the model is sitting on the ground in preparation for pre-flight servicing; it helps avoid punctures in the covering upon landing or dethermalizing.

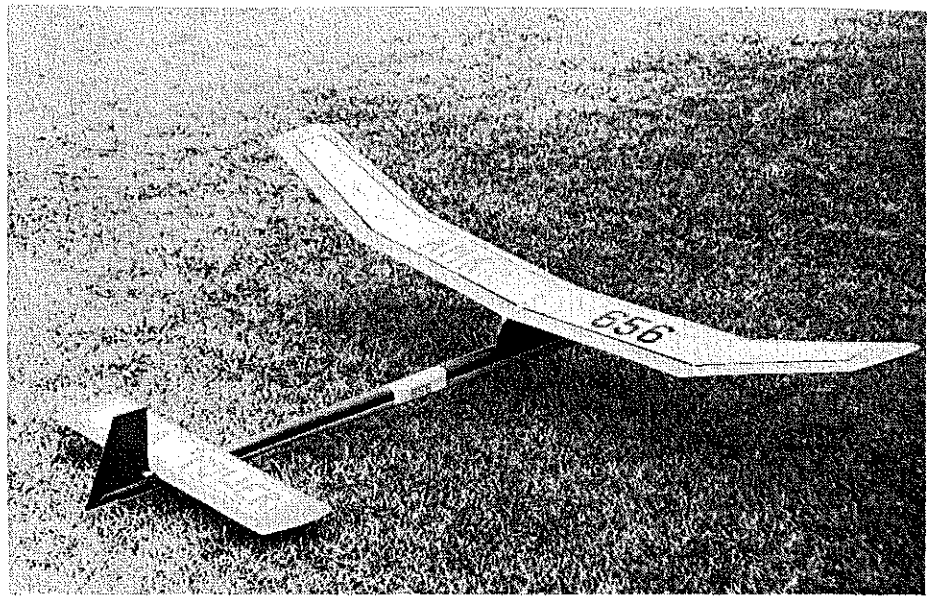
Two nose styles are shown on the plan. The faired-in wood engine mount system used on the original is durable and attractive, but is a lot of extra work. The alternate commercial mount bolted to the firewall is much simpler, but it does create more drag.

Most of us are used to fabricating built-up profile fuselages. Sea Power uses a built-up box. Start with the bottom sheet cut to size, with lower stringers attached. Pin this to your building board. Cut out sides, and install upper stringers. Glue sides to bottom, and install formers and pylon. Add top sheeting.

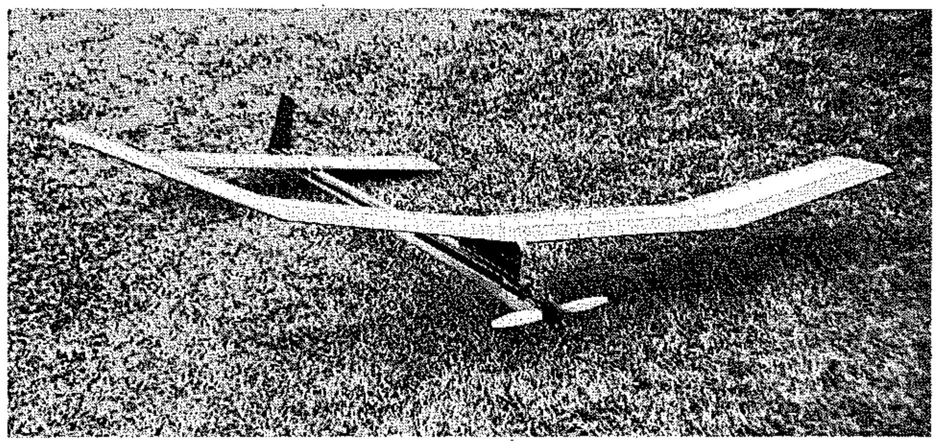
Most any Class C or strong Class B engine can be used. I fly my ship in C with a good Fox .36X Combat engine and a 10-4 prop. For Class B events, I had a special .29 piston and sleeve fitted to a Fox .36X case and crankshaft, tuned to turn the 10-4 prop the same rpm as the .36.

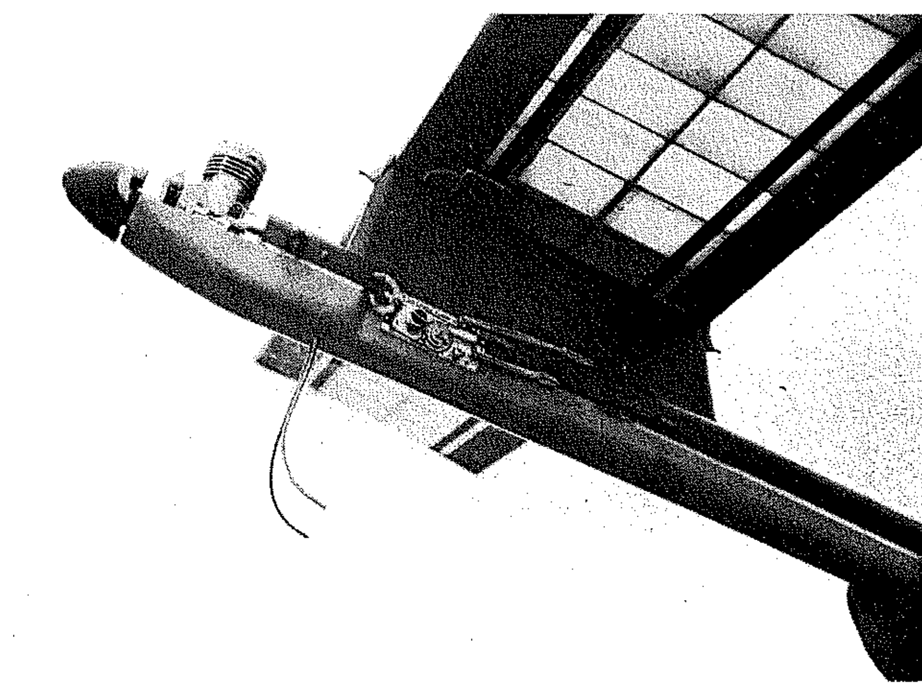
There are several good VIT-AR systems in use today. To explain them all would be beyond the scope of a construction article. All have some advantages and disadvantages. The system used on Sea Power is typical. It could be altered to suit individual tastes without affecting performance. Basically, what is needed are devices to retain the stabilizer at a low incidence angle for climb, a means to increase this angle for glide, and finally, provisions for dethermalizing. Auto-rudders merely provide two adjustable settings, one for climb and one for glide.

The stabilizer on Sea Power is held down, at the trailing edge, against a plywood incidence shim by an aluminum arm mounted on the left side of the fin leading edge. A nylon line is routed through aluminum tube guides to the timer arm used to control stabilizer incidence. When this line is released, the stabilizer rises, by rubberband



Three-quarter rear view emphasizes long tail moment arm. This allows minimal area in the stabilizer, while providing precise model control. Rear fuselage has no formers, allowing free passage of lines to operate VIT-AR. Author's model is set up for right-handed fliers. Engine exhaust on left helps keep timer mechanism free of oil. Left-handed fliers will want to reverse the system. Make special effort to keep the timer clean and working properly—malfunction is disaster.





Twin skids help prevent damage while model is on ground. Wing rest is made from aluminum sheet; quarter-circle plywood keys maintain wing alignment. Seelig multi-function timer controls engine run, stab incidence and rudder settings—for power and glide, as well as dethermalizing. Rubberband tension is critical, as too little allows unwanted control movement, too much causes timer to malfunction. A pre-flight check of all systems is absolutely essential—a good habit in any case.

tension, until it contacts the glide arm mounted on the right side of the fin. This arm has a precise adjustment in the form of a stop-screw with lock-nut. The glide arm is retained by a line to the dethermalizer arm of the timer. When this line is released, the stabilizer pops up to the DT position. DT angle is limited by a line passing through an aluminum tube into the fuselage.

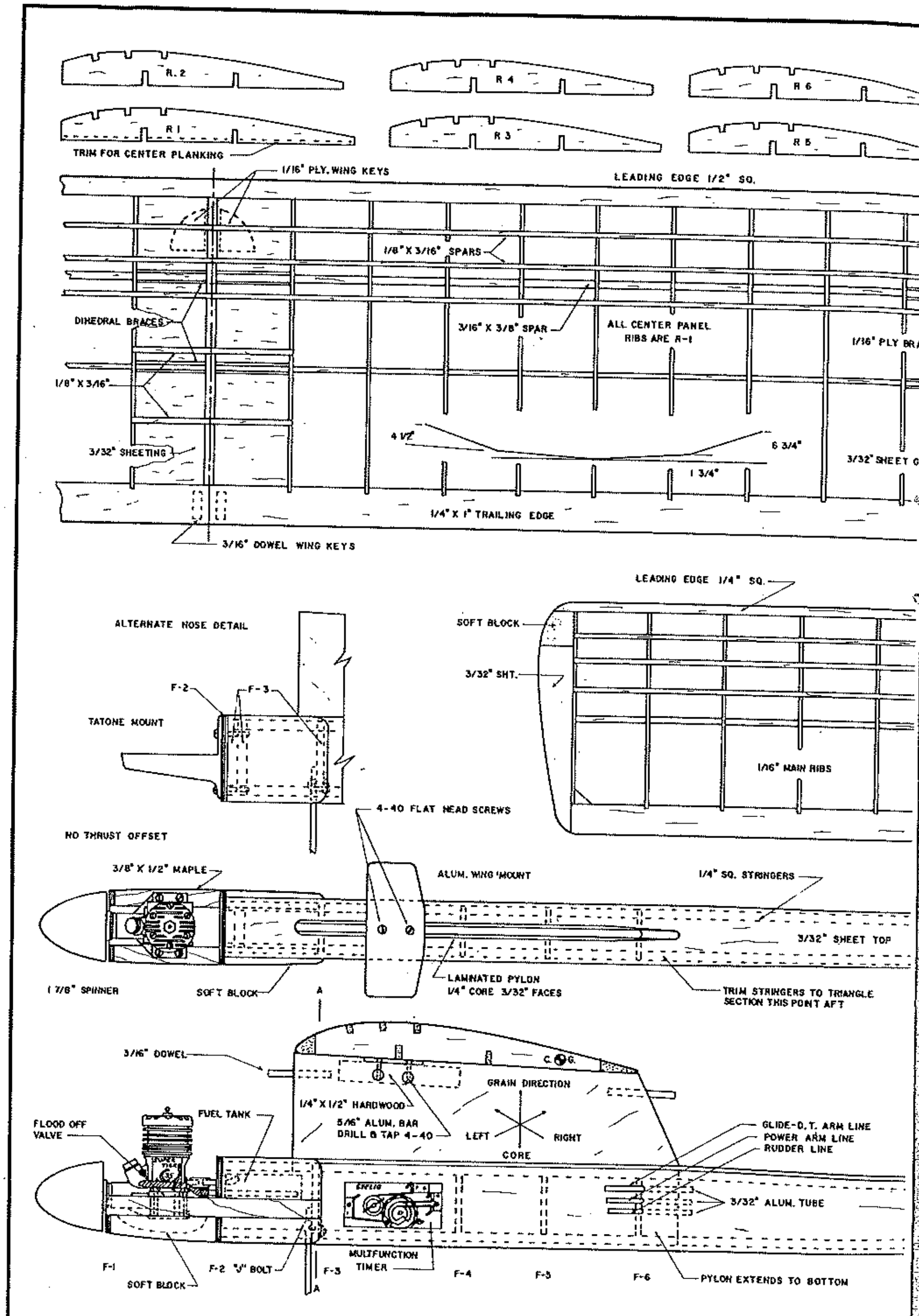
The auto-rudder is simply held against the climb stop, against rubberband tension, by a line to the timer. When this line is released, the rubber tension pulls the rudder over against the glide stop.

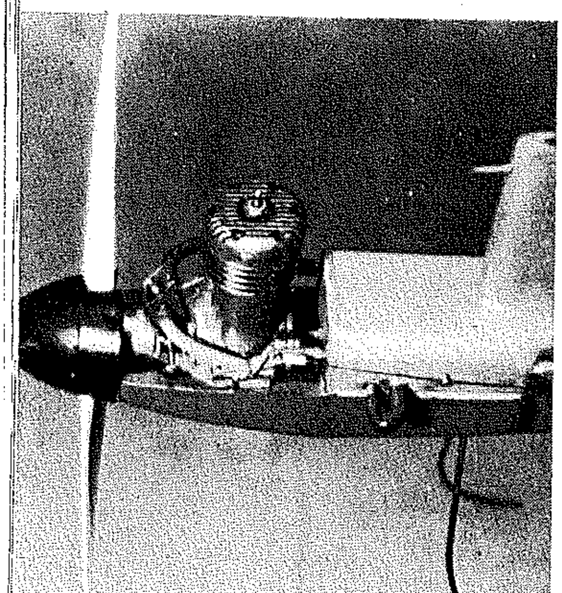
The same timer that controls the flight pattern is used to shut down the engine at the end of the power run. This is accomplished by use of a flood-off valve, which dumps fuel under pressure into the engine's intake. To accomplish all this requires a timer capable of four separate functions.

I first flew Sea Power with a homemade timer fabricated from a K-Mart camera timer. This timer allowed three functions: engine flood-off, auto stab, and auto rudder. Dethermalizing was accomplished by fuse. Because of the stubby output shaft of the timer, all functions were controlled by a single disk. This feature eliminated the possibility of easily varying the timing of the various functions, negating one of the most desirable features of the VIT-AR system. I highly recommend that you invest in a Seelig timer for your venture into programmable Free Flight. Its cost will be repaid in the ease of trimming during the potentially risky initial flights.

Prior to going to the flying field, several final checks are in order. Check the center-of-gravity as indicated on the plans, and add ballast, if necessary, to achieve proper balance. Check the timer to ensure that the arms are riding on the bottoms of their grooves. These wire arms have been known to jump out of their grooves under tension. If the rudder arm were to do this at the instant of launch, you can imagine what the ship would do under power—with the rudder in glide position. I think you get the picture! Also, be sure the notches in the timer disk are deep enough to allow the release of the timer arms at the proper time. If they are not, file them deeper. I had to learn both of these lessons the hard way during my later initiation to FAI Power.

Assemble the model with the same number of rubberbands that you will use in flying. Check to





Close-up of flood-off system. Line to timer is CL cable. Wire arm on flood valve acts as spring tension for line. Looped line is for filling tank. Better system is to fuel through engine feed and flood lines. Goes best on 10-4 prop.

be sure that the wing and stab are adequately secure, keeping in mind that this is a fast model. The VIT and AR arm lines terminate in loops. Rubberbands are tied to these loops to complete the hookup to the timer arms. Be sure the rubberband tension is enough to resist flight loads. Stabilizer trailing edges tend to rise under power, so be sure enough tension is used. This same tension will affect seating of the timer arms in their grooves. Check, check and double check! Operate the timer and control functions many times, to be sure everything is in order before going to the field.

The first step at the field is to determine approximate control settings for glide. Hook the *glide* arm line to the timer. The power arm and rudder line should not be connected. As a starting point, adjust the glide arm screw to allow the stab trailing edge to be 3/16-in. to ¼-in. above the fuselage, and the rudder to have approximately ⅜-in. right offset. Test-glide the model, and make appropriate adjustments to obtain glide settings which are roughly correct.

From this basic setting, lower the stabilizer trailing edge about 3/32- to ⅛-in. for the initial power setting. Place shims under the stab to provide a seat for the power arm to hold the stabilizer against. Set the rudder amidship (straight) for the initial test flight.

Hook up all control functions, start the engine, and check for proper flood-off and timer operation. Flood-off must be positive. If the engine does not stop instantly, you may "fly through" the timer functions and resultant control surface changes; this gives disastrous results. If your engine does not stop instantly, you may need to drill out your flood-off fitting to allow more fuel flow. But don't drill it out so large that the fitting is weakened. If this becomes a problem, use a

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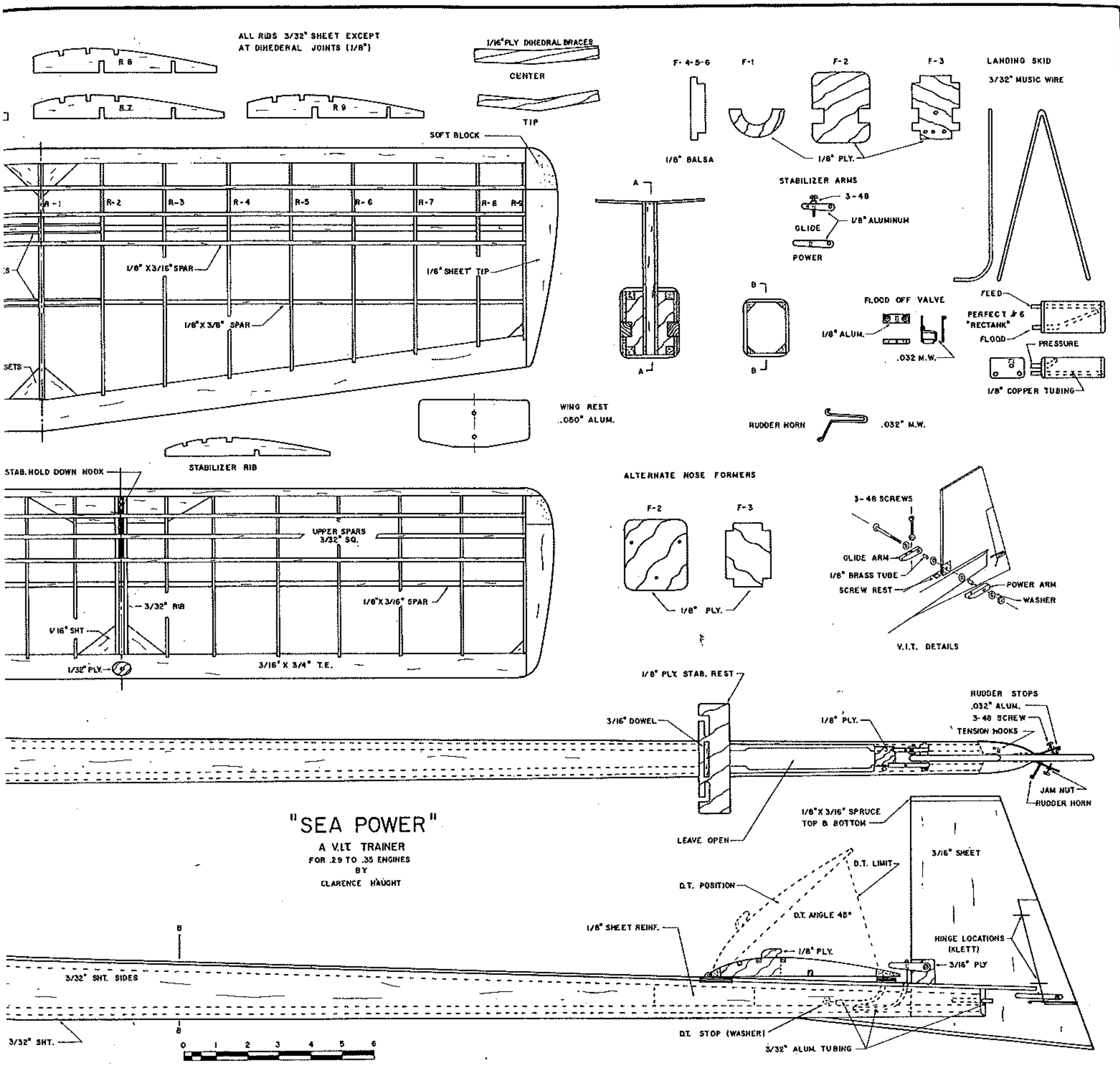
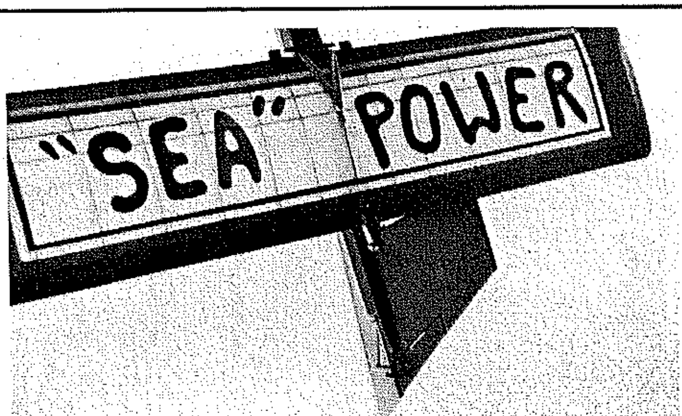
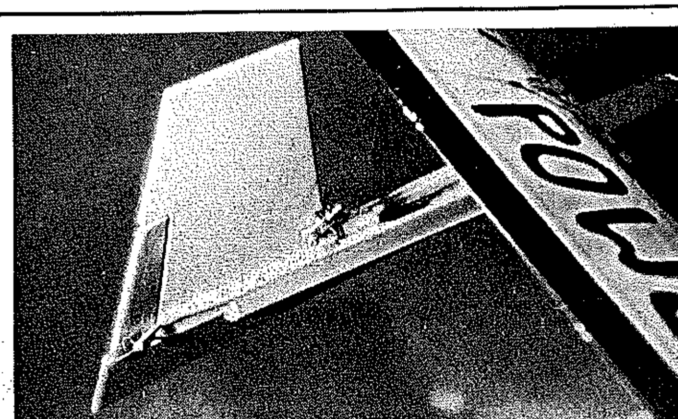
FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 128





Auto-rudder detail showing rudder horn and stop. Wire horn provides some spring tension to line, forms tension hook on opposite side. Stab platform allows give to alleviate damage. LE stop assures operation uniformity.



Stabilizer in dethermalized mode shows glide arm and adjustment screw on right side of fin. DT line limit is housed inside fuselage during flight. Rudder shown in glide pattern, against adjustable stop.

Spearfish designed by Leroy Cordes to fit the planform and moments of Harry Higley's MoHo.

The models were averaging around 350 sq. in. of wing area, with a maximum of 380 and very few at the 300 sq. in. minimum. The Profile-class models also seem to be getting heavier. The maximum was 48 oz. The lightest was a Guardian by Les Pardue, which weighed in at 28 oz. with a TWA engine. The average seemed to be 34 to 35 oz., with Supertigre engines, and three to four ounces heavier for the specialty engines. The top seven airplanes averaged just under 38 oz., while the average for all entries was a little over 35 oz.

At the Navy Carrier Society dinner following the Nats competition, there was a discussion of rules. There were 25 Carrier fliers there, and the opinions expressed were rather different from those obtained a year ago. More important, the decisions reached were either unanimous or very close to it.

Everyone seems resolved to the inevitability of specialty engines, and all are concerned about the rising cost of these powerplants and their limited availability. In a reversal of last year's survey, the fliers voted to recommend a change to ball-bearing engines for 1982, keeping all other engine restrictions.

A change proposal has been submitted to AMA that would combine Class I and Class II, adopt the equivalent of a Class I Profile event with no engine restrictions, and set up a Junior/Senior Profile event with no auxiliary surfaces, sliders, etc., and stock plain bearing engines (CL-82-7). The group unanimously opposed such a change. The consensus was that any such radical changes may be acceptable on a local basis, but that national implementation would be disastrous!

Profile bonus points were discussed at length, but no suggested changes to the current rule were agreed upon. The majority favored rather loose interpretation of the rule as it new stands.

Specific proposals were published in the Competition Newsletter section for October, November, and December 1980. Review them and submit any comments you may have to the NCAC and CLCB either directly to your representatives or through AMA HQ. *(Ed. note: The process is speeded up if you send them directly to your AMA district CLCB member! RBM.)*

Richard L. Perry, 416 Woodhill Drive, Goldsboro, NC 27530.

Sea Power/Haught

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larger #6 fitting. Take note that thread failure at the flood-off fitting will allow the engine to run until the fuel is exhausted. Repeat the engine cut-off test several times, and observe the effects of engine vibration on timer functions. If all is well, you are ready for flight.

The first flight will have an engine run of no less than two nor more than three seconds. Set the power arm (stabilizer) timer disk for ½- to 1-sec. delay after engine cut. Hook power arm to timer, but do not hook glide arm to anything. Set rudder disk for 3-sec. delay after stabilizer releases. Hook up rudder and timer arm. This setup will provide instant DT after engine cut, as the glide arm is not held in place. Test-run timer to ensure adjustments are correct. Hook up lines again, and make a visual inspection of all hookups and control positions. Make this a rigid rule prior to *every* flight. Ensure that the timer is *fully* wound.

Start engine, and launch at a 60- to 70-degree angle—just to the right of the wind. Note climb angle, and turn tendency. Model should maintain launch angle, and show a slight tendency to turn right. Observe DT rate of descent. Correct the climb angle by adjusting height of stab shims. Increase height to steepen a climb or vice versa. Adjust rudder if needed. If DT is too fast, lower DT angle slightly. Continue 3-sec. tests until you are satisfied with climb angle and turn tendency.

When satisfied that the power pattern will be safe, readjust the timer power arm disk (stabilizer) for a 3-sec. delay after engine cut. This is to reduce wing strain as speed builds up in successive flights with longer engine run. Increase the engine run by one second, and fly model again. Continue to observe power pattern as the engine run is increased by 1-sec. intervals. Do not hurry this process. Make only one adjustment at a time, and keep them small. Do not attempt to transist into glide until you have attained a 7-sec. power run. You may increase the delay for DT if it appears to be putting a heavy load on the wings.

At this point, you should be getting a good steep climb (around 65-70 degrees) and about three-quarters of a turn to the right. You are now ready to work on the transition. Adjust the DT disk for 15 seconds, and hook up the glide arm line to the DT arm, as well as all other lines to their respective places. Watch the model closely as the engine cuts. Model should transist smoothly. Poor transitions are often due to improper rudder trimming. If the rudder is brought in (tripped) too early, it will cause the right wing to go down due to kicking the tail to the right. This results in a diving turn after engine cut. Bad news. Late rudder often results in stalling. Tripping the stabilizer too soon results in upward pitching and a stall. Releasing the stabilizer too late allows the model to dive. Hopefully, you can get a glimpse of the glide before DT. Remember, only *one* adjustment per flight—and go slowly. Sensitivity of the adjustments increases with speed. Increase DT time, and fine-tune glide until satisfied.

Sea Power is my contribution to the "state of the art" in Free Flight. I hope you enjoy your introduction to "programmable tail feathers."

FF Duration/Meuser

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hungry.

According to *Bat Sheet* (Strat-O-Bats, Washington, Steve Helmick, editor), Ken Bauer is producing electronic timers for Nordic Towline Gliders; perhaps a multi-function timer for Power models will come later. I haven't had a chance to check this information with Ken, or to get photos or drawings, but here are Helmick's comments on Bauer's timer:

"They look to me like they are *the* way to go for the "all-weather"A-2, if not for a calm-air (with zoom delay desirable) glider. How does it work? Basically, there's a steel plate fastened to the DT line, which is stuck onto an electro-magnet made from the coil from a relay. Some electronic wizardry (an IC chip) times the current flow to the coil, and shuts it down when DT-time comes. A row of tiny rocker switches sets the DT time . . they are assigned times of 10, 40, 160 and 640 seconds (for flyoffs), and they automatically add together . . . in other words, punch 40 and 160 for 200 sec. or if it is pretty windy, 10 and 160 for 170 seconds, etc. Punch them all and you get 850! The rockers have a hole in them so that you can slip a heavy monofilament pin through and lock in what you want, and lock out what you don't want. The first rocker switch in the row is just on/off. Also, there is a micro-switch that you put in front of the towhook, and this allows the timer to reset when you return to straight tow. When you go into circle tow, the timer starts, which means only one circle (or less!) on a 10-sec. setting. But the timer starts when the model goes into CT mode, and the neat thing about this is that if you drop the towline or if the line breaks, the timer starts, and the model comes down. If the battery goes dead, the model DTs. There is less chance of setting the DT too short, because there are no grooves to count, as with a Seelig, and the timer will not speed up as the weather gets hotter (my Seeligs lost about 20-30 seconds in the afternoon heat at Taft). Ken recommends a 9v transistor radio battery for power, and the weight is about 1¼ oz. with that battery. The timer itself is quite small and light, but the nose pod will probably have to be specially tailored to the Bauer timer. Oh, yes . . . $25, please."

If you are interested, write to Ken Bauer, 627 E. Monroe, Orange, CA 92667.

Now that Tatone no longer imports timers, there is a bit of a problem. Seelig timers are available, but expensive. Some English companies are having timers made in Hong Kong, but I don't know if they are available in the U.S. Some modelers in the Northwest are using the Tomy windup toy motors for engine cutoff (I'd like to supply details, but don't have them), but the running time is too short for DT actuation. According to *Aero Modeller* magazine, some English Free Flighters are extending the running time to two minutes by adding inertia to the escapement: heat the tip of a glass-head pin, push it into the plastic escapement and—presto!—two minutes. But that still doesn't solve the problem for Category I or II flying. Perhaps abandon the clockspring, and use a rubberband-string-and-pulley system. K-Mart timers are still available, and are preferred by many modelers over the Tatone type engine timers, but you have to manufacture your own faceplate and release mechanism. (See A.A. Lidberg's article in the