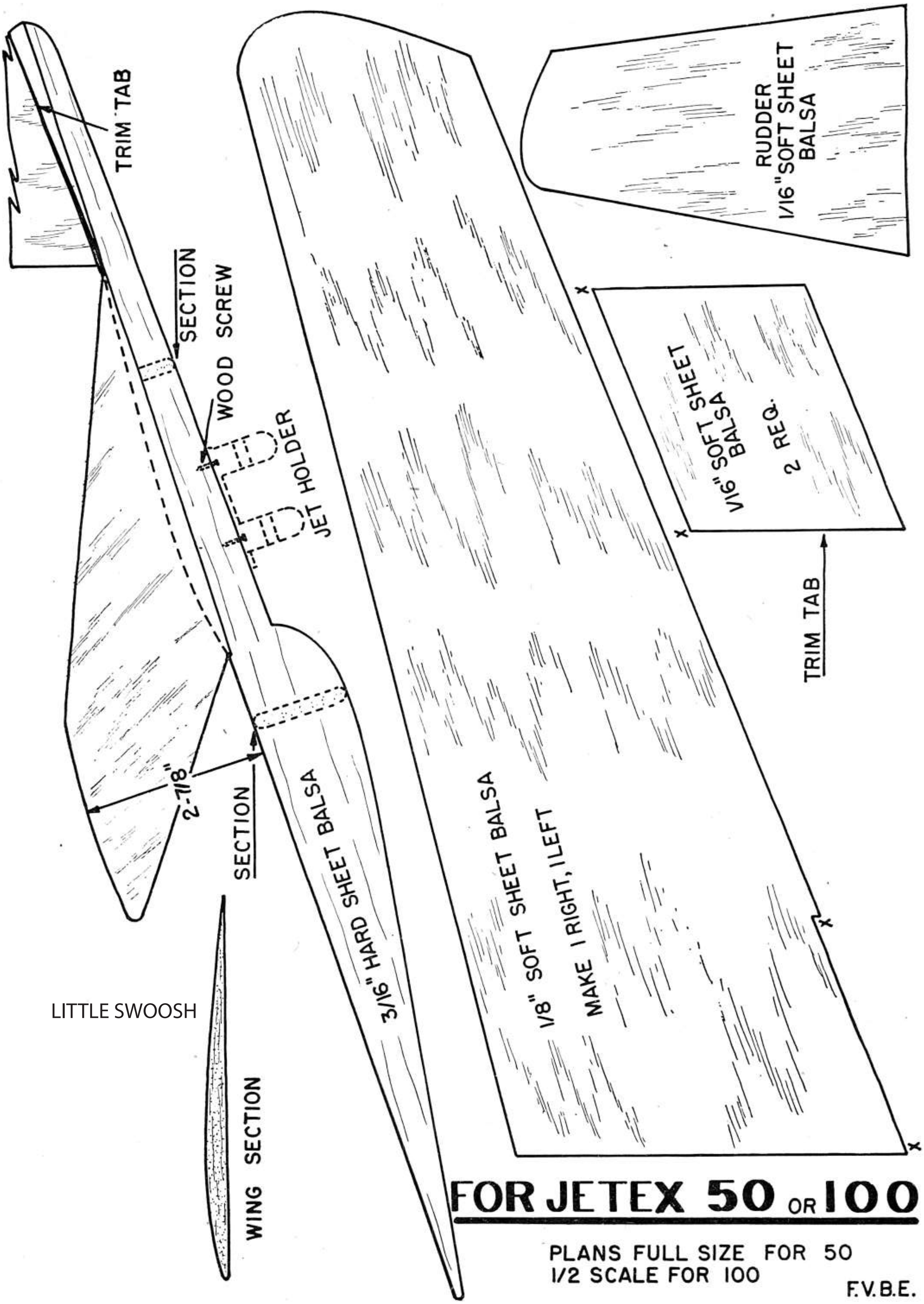
Conversion des unités impériales en système métrique mais adaptées au modélisme

en mm	Unités impériales	Dimensions du bois
0,396	1/64" =	4 à 5/10e
0,794	1/32" =	7 à 10/10e
1,585	1/16" =	15/10e
2,381	3/32" =	20 à 25/10e
3,175	1/8" ou 2/16"=	30/10e
4,762	3/16"=	50/10e
6,350	1/4" =	60 à 65/10e
7,973	5/16" =	80/10e
9,525	6/16" =	90 à 100/10e
11,112	7/16" =	110 à 120/10e
12,700	1/2 " =	130 à 140/10e

1/16" square = 2 x 2
3/32" square = 3 x 3
3/16" x 1/16" = 5 x 2
5/16" x 1/16" = 8 x 2

hardwood = bois dur
plywood = contreplaqué
balsa = balsa

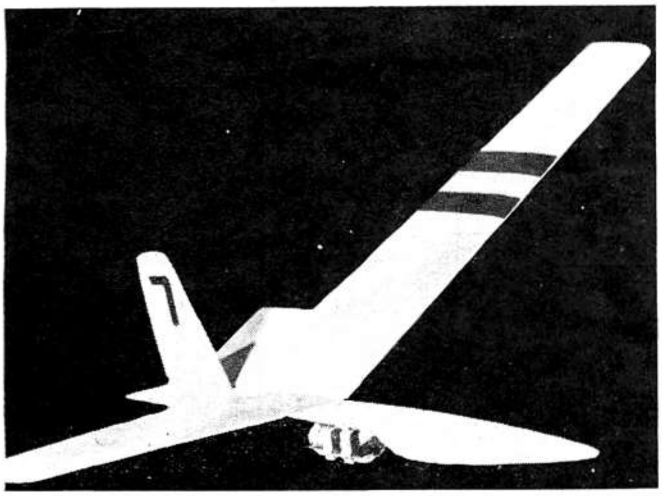


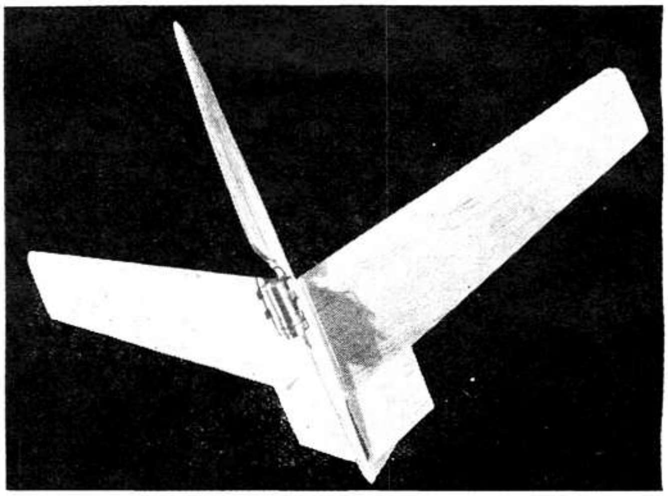
LITTLE SWOOSH

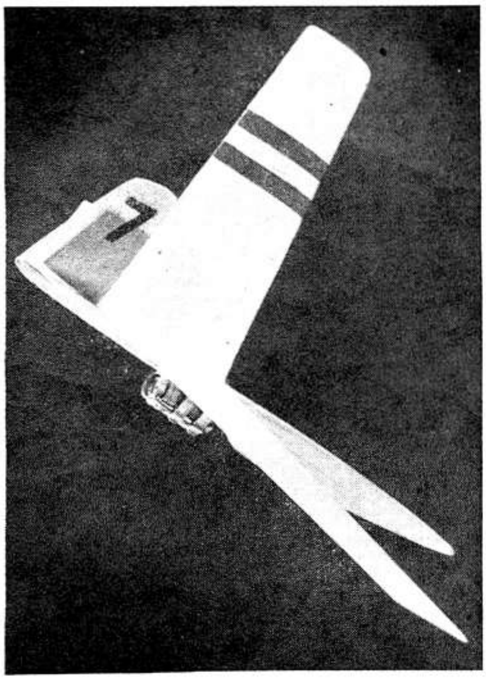
FOR JETEX 50 OR 100

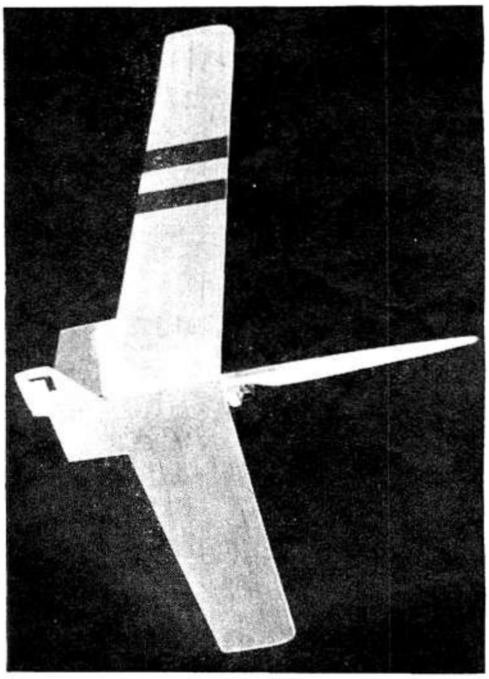
PLANS FULL SIZE FOR 50
1/2 SCALE FOR 100

F.V.B.E.









little swoosh

by FRANK EHLING

WITH the *Jetex 50* now available, a new class of models will make its appearance. These models are small and can be built in a short time. With the use of the *Jetex*, the extras such as props, fuel tank, batteries, fuel shut-off, and timers, can be eliminated; thus the actual time you can spend flying will be increased. *Jetex*-powered models are fun! However, the power of these units should not be underestimated, for the thrust increases as the flight progresses.

Our model of a flying wing is easy to adjust; the trim tabs are at the center of the wing (not on the tips as with the conventional sweptback type) and the adjustments need not be as accurate as when the wing is sweptback, since in this latter case the trim tabs are so far out from the center of the wing that a slight misadjustment will quickly throw the ship into a spin.

While there isn't much to be said about this design, let it be mentioned here that the usual care should be exercised if the best performance is to be expected. Be sure to get both wings alike in weight and cross section. Cement all parts well, and check while drying to see that the parts don't warp before the glue hardens.

To start work, select a piece of straight-grained wood and cut the fuselage to shape; sand it to the cross section shown on the plan. Dope the fuselage and when dry, sand well so that the wood won't pick up dirt. The *Jetex* holder can now be screwed in place, and be sure that this is lined up and true. This operation is much the same as drilling a hole in the nose block of a rubber job, and careful work is just as essential here.

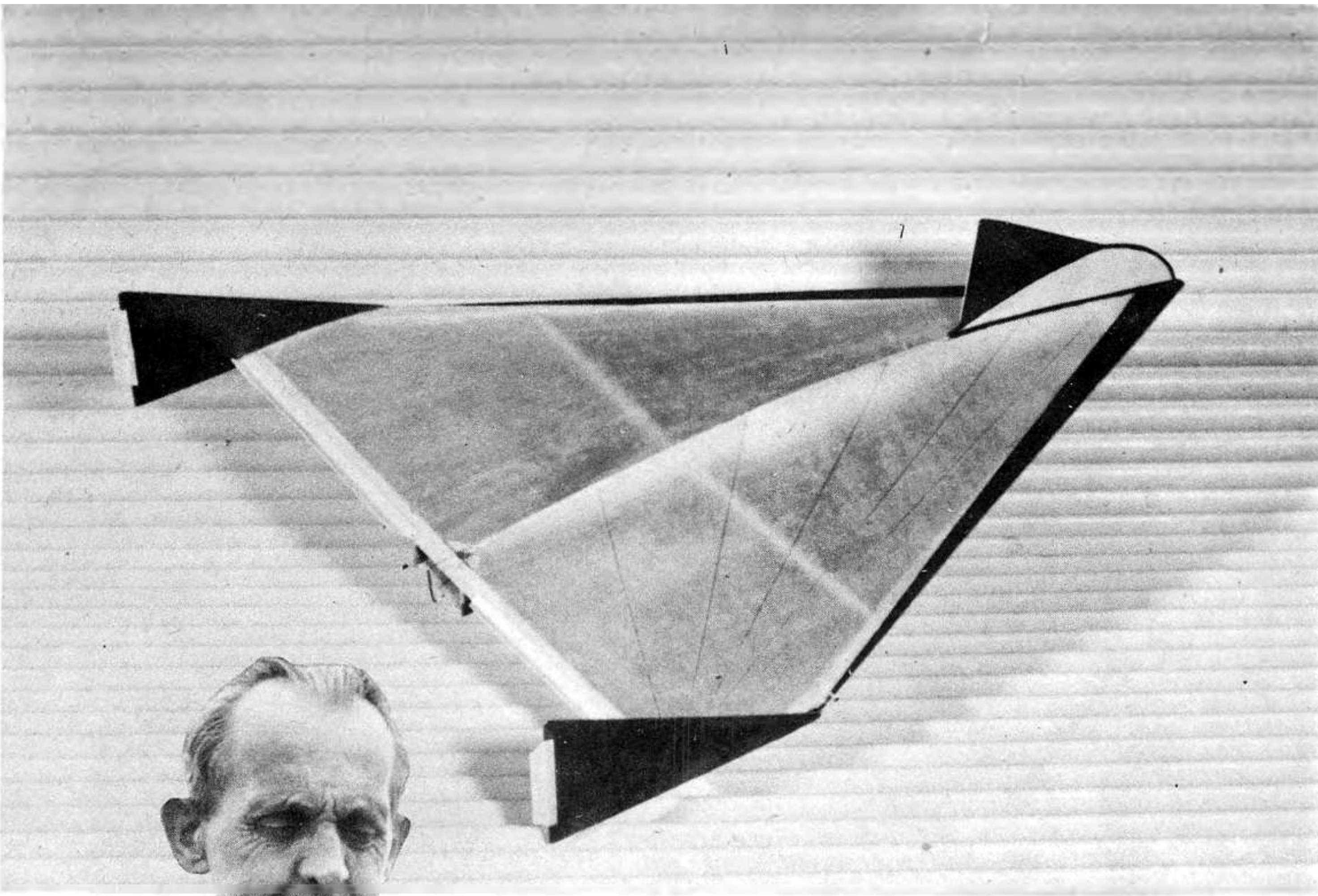
The wing is next, and should be cut out of soft balsa, using the drawing as a pattern. Sand the wing to the section shown, but be sure that you make one panel right and the other left. Bevel the ends and cement the panels together with the correct dihedral. At this joint an extra coat or two of cement should be added. Dope and sand the wing as you did the fuselage, then cement the wing in place and check to see that it lines up true with the fuselage.

The rudder is cut out and sanded, and can then be cemented in place, checking to see that it does not warp. The trim tabs can now be cut and cemented in place; these should be cemented lightly until a flat glide is obtained, and then cemented firmly in place.

The entire model can now be given a coat of glider polish and resanded, as this will assure a better flight and glide.

To start flying, the model should be glided and the trim tabs slightly readjusted until the glide is as flat as possible without

(*Turn to page 44*)



Above—This model with the Jetex mounted underneath did not perform as well as models with the power unit installed on the top.

DR. LIPPISCH'S deltas

▼.

by Dr. A. M. Lippisch and Lawrence Conover

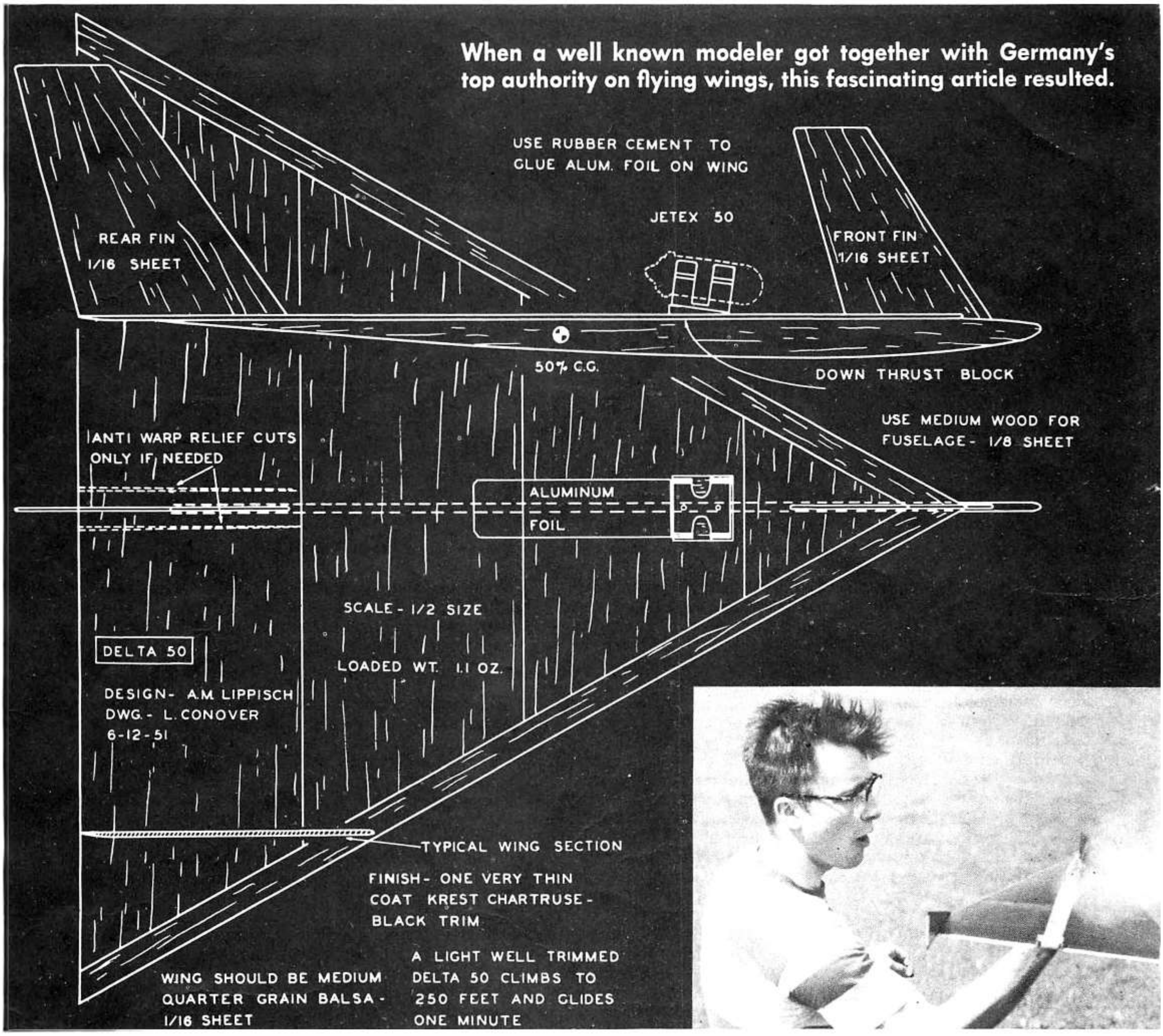
Nearly a decade after tests of *Me-163*, Dr. Lippisch experiments with *Jetex* deltas. A front fin was found to prevent spiral dives.

▶ Our first *Jetex* delta wing model—a balsa framework covered with *Silkspan*—was flown late in 1950. The *100* flew it quite well despite a wing area of 175 square inches and a weight of three ounces. During the winter of '51 we flew a *Jetex 350* powered delta with a 24 inch span. It was a hot airplane, many of the flights being either loops or series of vertical banks.

Early in the spring we started building with vigor. An early model of the *Delta 50* was cut from 1/8 sheet balsa. It was heavy but very consistent. High fins were used on both tail and nose. We found that one of the best stability features on our delta wing models was the front fin. It keeps the nose up in a bad turn.

We had been using normal fins mounted on the center line of the fuselage but had never tried tip fins. I checked with Dr. Lippisch on this and it seemed that they might be an advantage. He had used them on the rocket models as early as 1928. We blamed some of our present stability problems on tip stalling because of the pointed wingtips. The result

When a well known modeler got together with Germany's top authority on flying wings, this fascinating article resulted.



Delta 50. **Part of longitudinal stability obtained by sanding the trailing edge on bottom only for a reflex section. Increased deflection is warped in during tests. The author waits tensely to launch the *Delta 100* job. Note the control vane (effective under power) similar to that of the *V-2* rocket.**

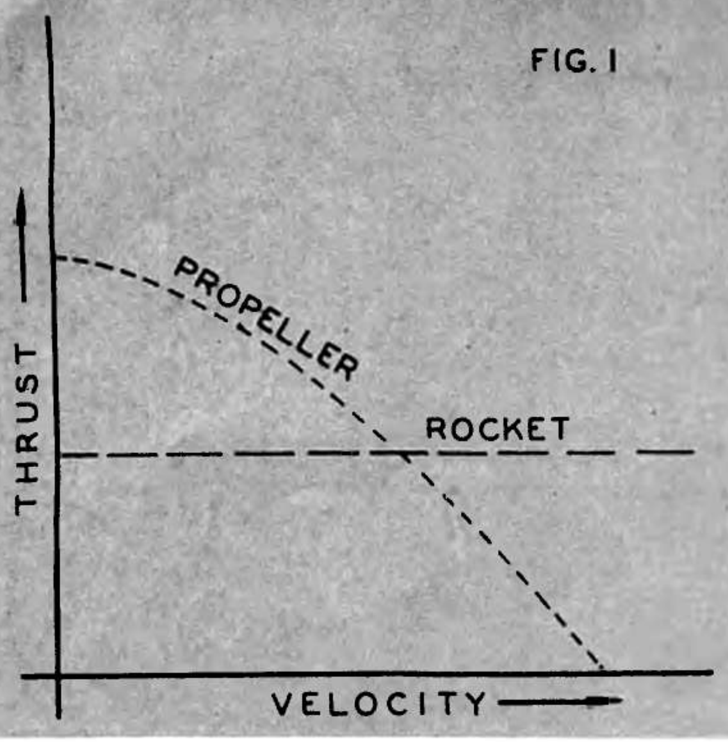
of this discussion was an ultra light model designed for the *100*. To make construction easier we decided on simple flat-bottomed airfoil sections. The finished model had large kite-shaped tip fins, and a long nose with a profile cabin. First the nose broke off when it looped in. We trimmed it and retained a short fuselage. Many stability problems showed up because the model was overpowered. The motor was mounted on the bottom of the wing causing extreme nosing up tendencies. There was too much fin area in the rear. The motor was moved to the top of the wing and the lower half of each tip fin was cut off, leaving all the lateral area above the center line (except the fuselage). The celluloid profile cabin was removed and a large front fin added in its place. The model didn't loop but it did beautiful slow rolls. Sometimes it didn't roll all the way around but just paused inverted, then recovered in an upside down immelman. Fun to watch but it didn't provide much altitude or duration. "Too much fin in front," Dr. Lippisch said.

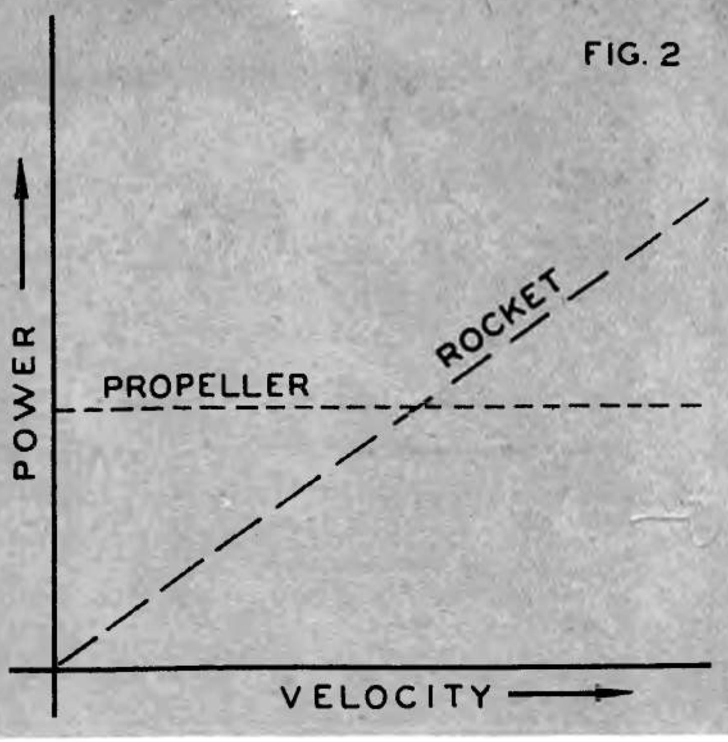
We cut some front fin off and the rolling stopped, but the delta used the last five seconds of power in loops. We could see that with the *Jetex* placed in front of the C.G., the model assumed a nose heavy attitude when loaded. When most of the fuel had burned and the extra power of the last part of the run took over, the low angle of climb changed quickly to well-executed loops. How could we control this over abundance of power?

Dr. Lippisch explains this phenomenon.

"Everybody who tries to fly a model with rocket propulsion will be quite astonished to see that even with a thrust of one ounce or less the model seems to be overpowered. If you adjust the model for a nice, steady, flat glide the flight with thrust will end up in continuous loops or tight spirals. To get the model into a good safe climb you have to adjust it so that the glide without thrust is much steeper and faster than you would like. By doing this you would diminish the looping tendencies but the total duration of the flight would be cut down. You might wonder what causes this unusual behavior. Let's explain this a little bit.

"Your *Jetex* rocket engine produces thrust by throwing out the burned fuel as hot gases with high velocity (about 1200 feet per second). Since this thrust is then produced by an internal combustion where no outer air is needed,





At low speeds gas engine and prop give large thrust but at some speed prop gives no thrust. Constant thrust rocket becomes efficient at high speed.

the thrust of a rocket engine is independent of your flight speed. That means you have an engine with constant thrust. The power is Thrust Velocity and so the faster you fly the more power you have available. You reach a practical limit in the atmosphere because of air resistance. The power of the gas engine depends on the rpm's you have and once turning at top revs it will give only a fixed amount of power. The thrust of the prop is therefore decreasing with the increasing velocity of the model.

"Figure One should give you an idea of the thrust characteristics of a gas engine and a rocket engine. At the lower speeds the gas engine and propeller give a large amount of thrust, but there is some high speed limit where the prop ceases to give thrust. So for best efficiency you choose a prop which is in accordance with your flight speed. With the rocket engine you have at any speed the same thrust. Therefore when your *Jetex* puts out only one ounce of thrust at low speeds and high angles of attack the power is low. But the faster you fly the more efficient the rocket engine becomes. The thrust remains the same but the speed keeps increasing. This is somewhat like coasting down a big hill. The thrust is gravity and its force remains the same all the way down. However you keep accelerating during the entire run and at the bottom of the hill you are moving much faster than when you started.

"Figure Two is the power-velocity diagram. It shows that at zero mph the rocket engine has no power, because it is doing no work. The gas engine is working at this point because the propeller works on the air and gives static thrust. Calculations show that at 50 mph the *Jetex 100* has 1/120 hp. At 6000 mph it would develop one hp. Power is thrust times velocity."

The trick to successfully fly a rocket model is to adjust the power-on flight for high speed and the power-off part for low speed and best gliding. There are a number of ways to accomplish this. You must suit the method to a particular design of airplane since each has special flight characteristics. Downthrust is one of the easiest ways. Remember that the C.G. is the axis for all thrust adjustments. With the motor mounted in front of and above the C.G. the exhaust must have an angular deflection upward. A similar effect can be obtained by raising the *Jetex* higher above the centerline. This introduces a pitching moment forward and down. If you want to get fancy you can use the method we did in the *350* model. We mounted the engine on a sliding platform under the wing. When the rocket pushed forward, engine and platform slid ahead on small runners. This moved the C.G. in front to a position where looping was prevented. Rubber bands with just the proper amount of tension pulled the unit back as the power stopped and the model went into a normal glide. This high powered delta climbed to 1000 feet directly into the wind with this arrangement.

Another effective method of power control is the exhaust vane. We tried this first on the *Delta 100*. The idea actually dates back to early rocket experiments in Germany. The control vane is useful only while the exhaust stream is flowing over it. The air is moving at a high velocity over the small surface and creates a strong tail lifting force. When the rocket stops blowing, the vane has very small lift and allows the ship to glide properly. The angle of incidence of the control vane can be varied to meet the requirements of the model.

One of the very important things we found out was the effect of Reynolds Number on some of these small models. RN is a proportional measurement of the effect of air moving around a surface. The size of the model and its velocity determine this number. Our delta wing models attain fairly high RN values for models because the wing chord is large and the rocket provides speed. Ordinarily you don't pay much attention to this factor on your models. We found that there are special times when you must. We had troubles adjusting the lighter models for the *Jetex 50* but we attributed this to the flat-plate section of the sheet balsa wing. They also seemed to be overpowered. The real trouble showed up when we decided to test a new model of the *Delta 100*. We installed the *50* so that it would be easier and safer to check out for adjustments. The new model had a few experimental changes. The leading edges were thicker and more rounded. High tip fins were used. Our problem started with the first glide. The nose kept plowing into the ground. Finally by taking out some warps and using our standard full length elevons the nose came up. But it didn't stop. Now all the thing did was stall.

No matter what we did it either stalled or nosed in. It wouldn't even fly on its back, which had happened on some earlier models. First we suspected the rounded leading edges. We knew that their shape was a problem on full-scale delta wing aircraft. We tried the most sensible thing and sharpened them with masking tape additions. No good! It still executed that beautiful slow approach stall so characteristic with delta wing designs. We tried turbulator strings on the wing, and turbulence wires in front of the wing. (*Continued on page* 51)

Conical camber shows in pic, drawings. If Miss Donna Hubbard seems to approve it's because she is an Aeronautical Engineering student at University of Minnesota. Jetex 50.

delta dart

by DON MONSON

Conical camber works on a model, too! Hand-launched glider and Jetex versions fly better. What is next?

► When Convair engineers tested the prototype of their delta-wing F-102, they were surprised to learn that it wouldn't go supersonic even with afterburner, especially since wind-tunnel tests showed that the delta wing had less drag than the swept wing while it was passing through the sound barrier. The main cause of this effect was the excessive interference drag between the wing and fuselage.

About the same time, two new aerodynamic discoveries were divulged by NACA scientists: (1) a reduction in interference and wave drag by application of the "area rule," popularly referred to as the coke bottle design, and (2) a reduction of the induced drag, i.e., the drag due to lift, by use of "conical camber."

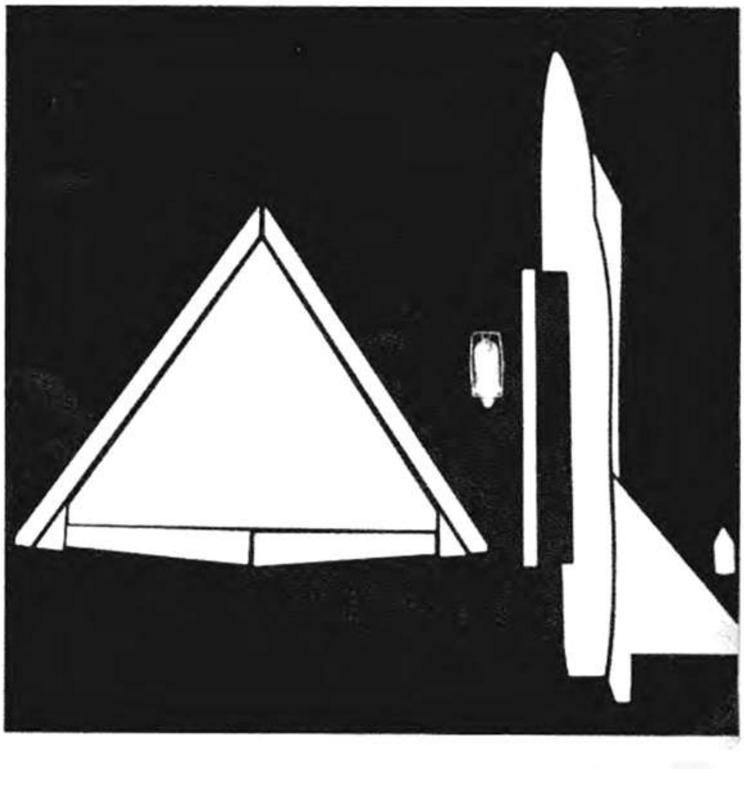
"Conical camber" means that the leading edge of a delta wing has a progressive downward camber increasing in radius of curvature as it passes from root chord to tip chord (Ref. 2). Theory and experiment show that both area rule and conical camber have maximum effectiveness in the transonic range, i.e., the transition between subsonic and supersonic flight, with conical camber being effective also at high lift co-efficients; and when Convair applied these modifications to their F-102, the result was the highly successful supersonic F-102A that you see flying today.

The model version of this plane originated when we began to wonder what the effect of conical camber would be on a paper glider. A few hours and several gliders later, living room tests showed a noticeable decrease in the glide angle of the glider with conical camber over the one without camber. Further glide tests in a gymnasium where more conclusive tests could be (*Continued on page* 46)

FULL SIZE PLANS NEXT TWO PAGES

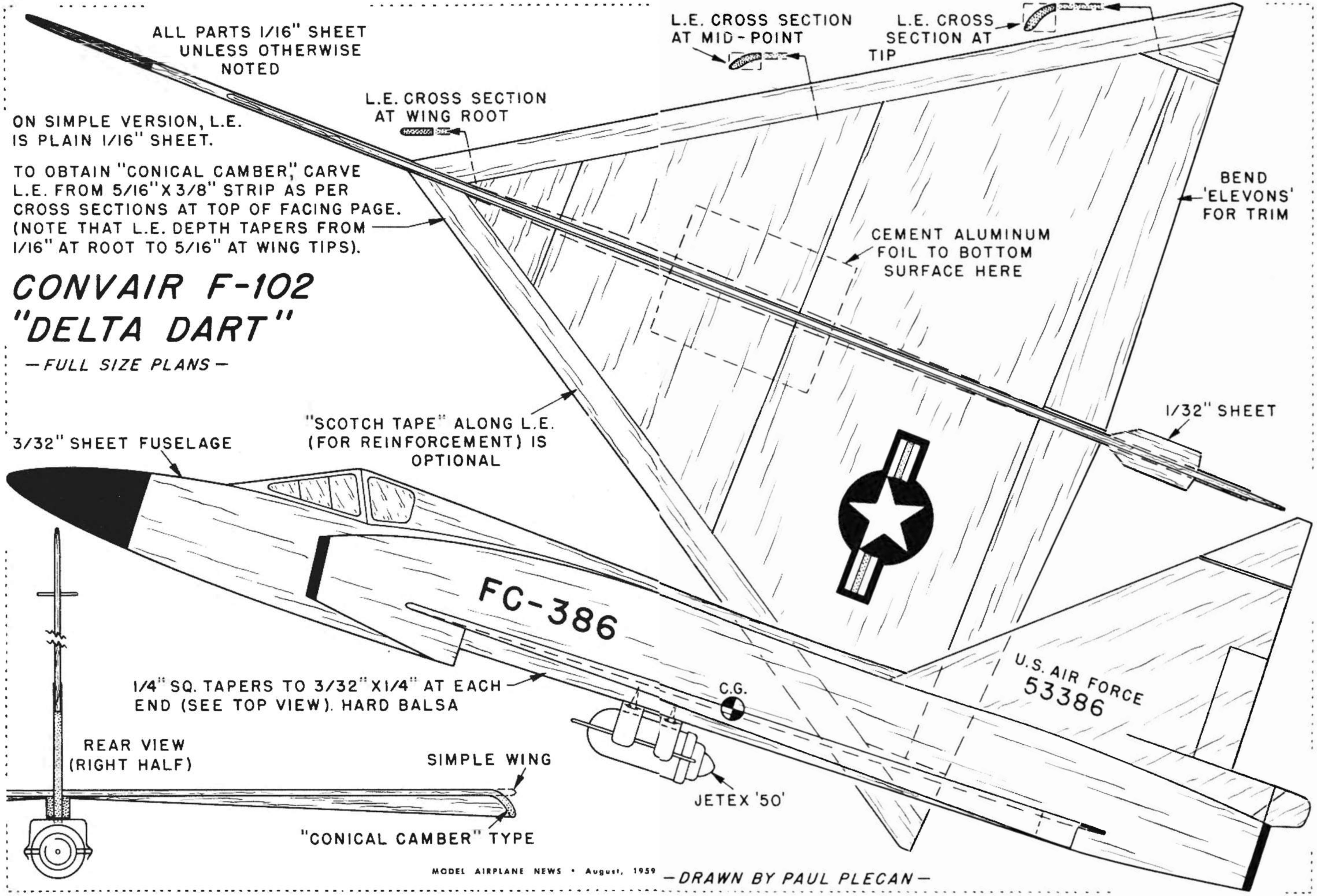
For quickie, make flat-wing version—two top models. Others use conical camber; leading edge curls down progressively toward tip.

The whole is equal to the sum of its parts—and the parts cinch to slice from nice, white balsa. The Jetex 50 engine clips on easily.



CONVAIR F-102 "DELTA DART"

—FULL SIZE PLANS—



—DRAWN BY PAUL PLECAN—