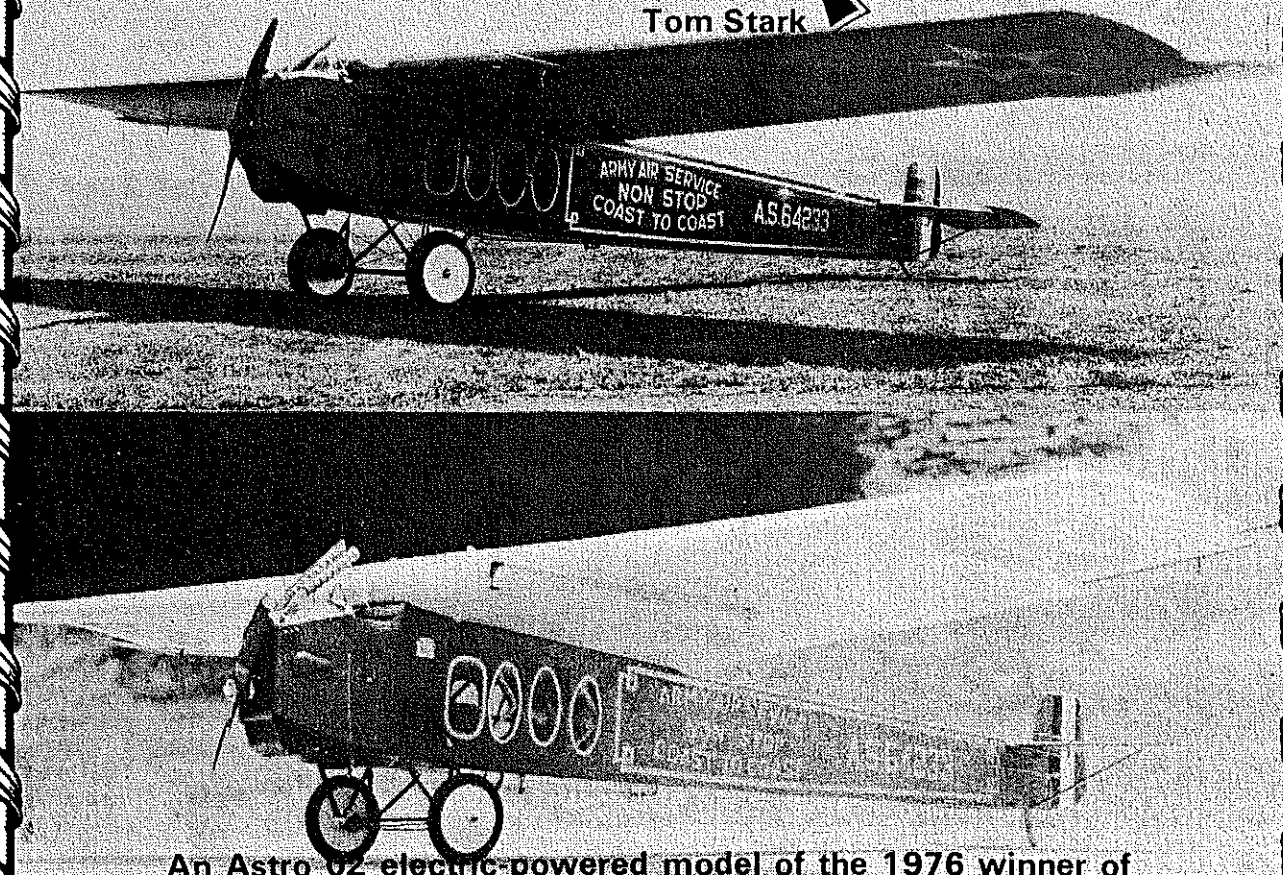
THE FOKKER T-2

Tom Stark



An Astro 02 electric-powered model of the 1976 winner of the Nationals Free-Flight Scale event.

Top: The Liberty-engined Fokker IV just before its approximately 27-hour trip from Roosevelt Field, N.Y. to San Diego. Note cockpit position—alongside the engine. The pilot must have been deafened by the time they reached the Coast. Above: Model before its Nats win.

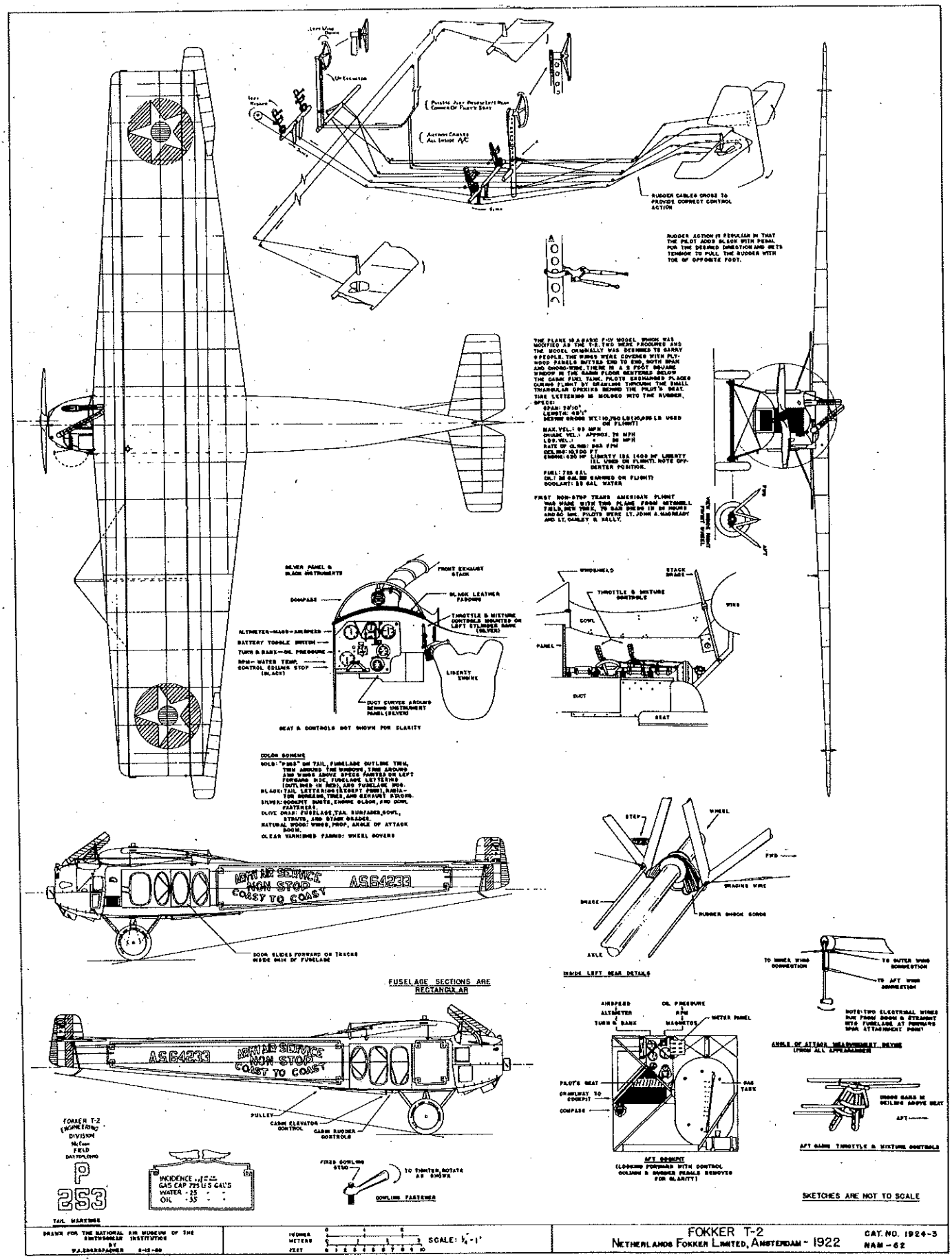
ONE OF the most significant milestones in American aviation history was the first nonstop coast-to-coast airplane flight. It was made on May 2-3, 1923 by Army lieutenants J. A. Macready and O. G. Kelly. They left Roosevelt Field, New York on May 2 at 11:36 a.m. and arrived some 26 hours and 50 minutes later at San Diego, California. To appreciate the technical skill and bravery exhibited by Kelly and Macready's flight one must realize that it was done without electronic navigation aids, aeronautical maps and against the prevailing West to East winds.

Of course, the flight could not have been possible without the excellent performance of the Fokker F IV airplane and the Liberty V-12 engine. The F IV was one of the early aircraft in a long line of Fokker transport airplane designs. The Army took delivery of two F IV airplanes in 1922, designating one the T-2 for transport and the other A-2 for ambulance. The T-2 followed a successful Fokker design formula that featured an all-wood, cantilever wing and a welded steel-tube, fabric-covered fuselage and tail. These features evolved in the successful fighter plane designs that Fokker produced during World War I. The wing of the T-2 is said to be an enlargement of the wing on the Fokker D VIII fighter plane which was just entering German service when the war ended. Much of the credit for the design must go to Reinhold Platz who was Fokker's chief designer. However, Anthony Fokker was the chief test pilot and severest critic of his own company's designs. Consequently, Fokker airplanes were known for their excellent handling, rugged dependability, and excellent performance.

With the introduction of successful electric powerplants for model airplanes I became very interested in their application to free-flight scale. They promised some outstanding advantages, such as instant starting, no exhaust mess, and no cooling air requirements. Several unsuccessful electric-powered models were tried and I learned a number of valuable lessons. First, unless you love to tinker, stick with

the powerplants on the market. They are well engineered and will give the performance promised in their advertisements. Second, don't take short cuts with the battery charging system.

While a dry lantern battery will charge the flight batteries, the full potential of the powerplant won't be realized unless a wet-cell battery charging system is used as recommended in the instructions. Lastly, electric powerplants do not have the power-to-weight capabilities of regular



glow-plug engines. Construction techniques that are perfectly satisfactory for an .049-powered model are probably too heavy for an electric-powered model. Generally, electric powered models should be built more like rubber-powered models, which can pose a problem in a free-flight scale competition.

The scale judging rules in free-flight scale demand a very detailed model with colored dope and interior details, which means a relatively heavy model. However, a few real airplanes are suitable for electric free-flight scale and they generally fall in the category of ultra-light airplanes, pioneer airplanes and early, very long-range airplanes. All of these airplanes had high power loadings, i.e. a lot of weight for the horsepower available. The Fokker T-2 falls into this category.

It also has another distinct advantage which is availability of proof-of-scale material. The book, "Smithsonian Annals of Flight, The First Nonstop Coast-to-Coast Flight and the Historic T-2 Airplane" by Louis S. Casey is still available from the Government Printing Office. It contains excellent 3-view drawings and photographs plus a complete history of the flight and the airplane's development. After the historic flight, the T-2 was flown to the Smithsonian where it is currently on display. Numerous other books and magazines contain photographs, drawings and text on the T-2 and its historic flight.

One thing bothered me about the T-2 as a subject for free flight and that is its very small stabilizer. Consequently, I built a small glider scale model of the T-2 to determine the minimum tail size that would work. Although a completely scale stabilizer is too small, only a slight enlargement was necessary for stable flight. The glider model also demonstrated that the basic T-2 design had considerable spiral stability, and near scale dihedral is adequate.

Prior to the 1976 Nationals, the model T-2 was flown about 50 times so it contained no surprises. I've flown in most of the free-flight scale events at the Nationals since the late 1960's and the 1976 event had to be the worst conditions ever. Not only was it raining most of the time, it was windy and getting dark as the event was flown in the evening. My first flight was a hand-launch between rain showers. The T-2 performed very well and got a high enough flight score to secure first place. Subsequent attempts to takeoff were not successful due to the wind; lift off was fine but the first turn resulted in the wing tip dragging on the ground. The 1976 Nationals free flight scale event received very little coverage in the modeling press. It is a shame since there was a good field of models and there was some good flying under some of the worst conditions ever.

Construction

The construction follows that of the real airplane closely. The wing is all sheet balsa while the fuselage and tail are built up and tissue covered. It is built to a scale of one half-inch equals one foot and weighs about 12 ounces ready to fly.

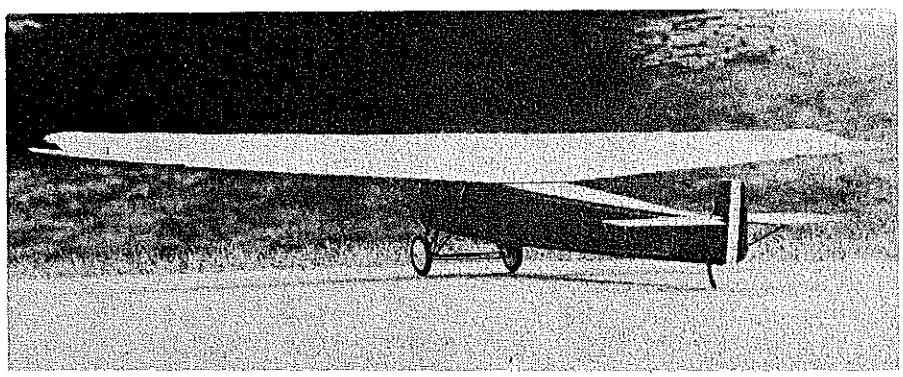
Andrew holding Dad's faithful copy of the historic Fokker. Although the tail surfaces appear tiny they are slightly enlarged from scale—for sport flying probably should be modestly enlarged again. Real cantilevered wing is said to have been enlarged from wartime Fokker D-VIII.

Wing: The thing that strikes one first about the T-2 is its massive wing. To a large extent it was the wing that set the Fokker T-2 apart from its contemporaries in performance. It was made primarily of thin plywood sheets that formed multiple structural cells. The root airfoil was thick and flat-bottomed which progressively changed to a thin, undercambered section at the tips. The model's wing is made much the same way, although the quantity of ribs is smaller to save construction time and weight.

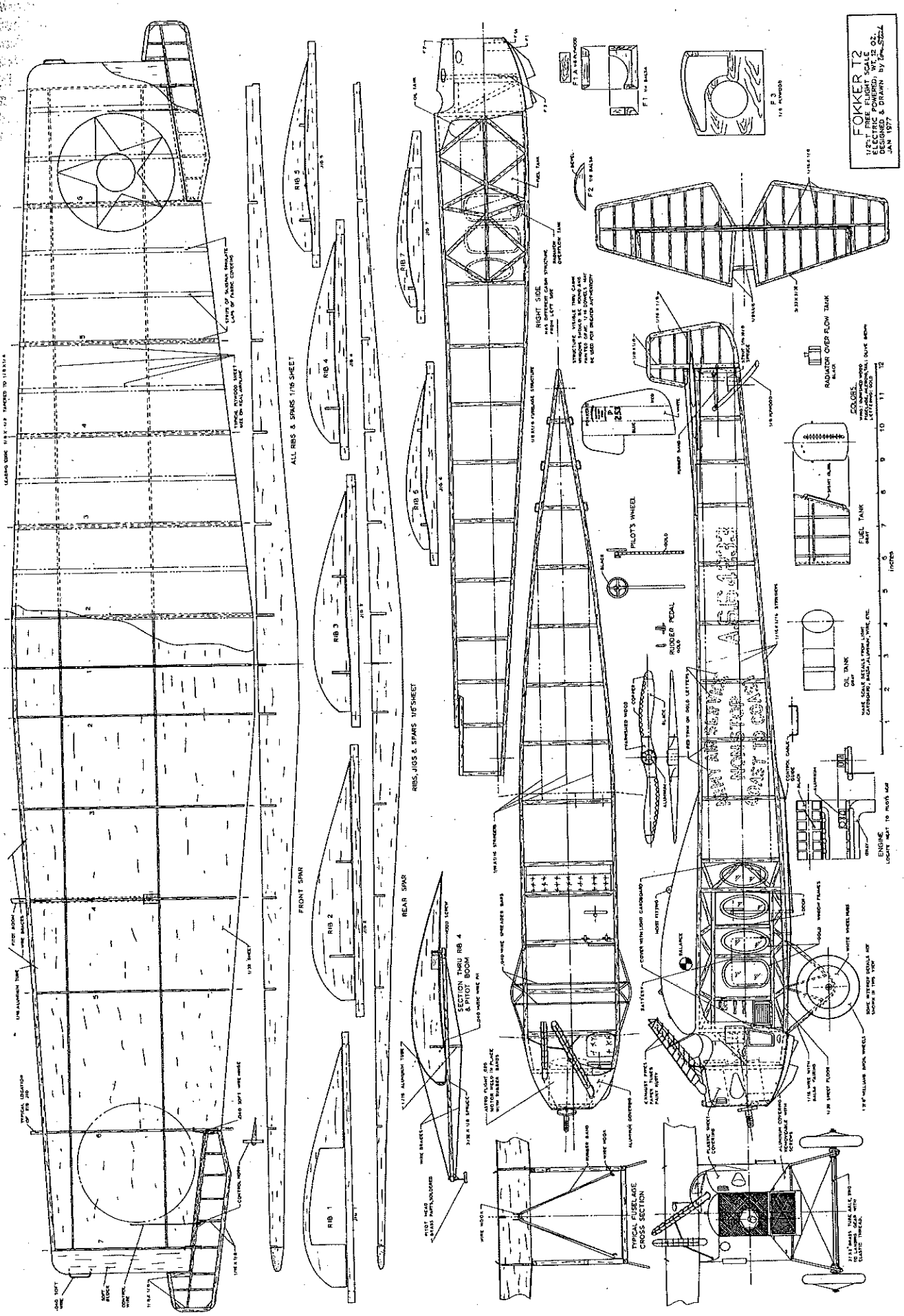
Begin by making the bottom wing skins out of medium 1/32 balsa. Since the wing is quite broad, two or more sheets of balsa will have to be butt-glued together to form the wing skins. Now cut out the wing ribs and the jigs from 1/16 sheet balsa. The jigs are pinned to the plan and work board in the locations indicated. Pin the lower wing skin to the jigs and cement the ribs in place. Add the spars and leading edge, then cover the top of the wing with 1/32 sheet balsa. Build one wing panel at a time because the spars won't allow the entire wing to lay flat on the plan. The spars are shaped to insure that the correct dihedral is built in. The ailerons are built over the plan in the conventional manner.

The real airplane's wing was covered with numerous sheets of plywood then covered with fabric and varnished. To

Continued on page 84



The massive wing leaves the most dominant impression of the T-2. Like the real plane, model's wing is made of thin sheet wood , drawing its strength from multi-cell design. Through glider tests prior to building model, Tom confirmed that near scale dihedral would be sufficient.



FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 96

outboard bevel the length of the tank. Outside cross-section dimensions are one by two inches. With this design the length of the tank equals the capacity in fluid ounces. Les McDonald (uniflow), Rabe and Gieseke all prefer this type of tank with the long bevel. The Randy Hancock tanks are rectangular in shape, 1 × 2 in., with a small bevel starting approximately 2 in. from the back end. A tank 4⅞ in. long holds approximately 5 oz. of fuel.

For today's pattern the Fox 35 needs four oz. of fuel (5 percent nitro). Same for the Max. The Supertigre 46 with a .275 venturi and 10% nitro fuel needs approximately 5.5 oz. of tank capacity. Using 5% nitro usually works better with a .280 venturi, and you need about 5.25 oz. of fuel, or maybe just 5 oz. By the way, replacement venturi are available from Bob (no. 1) Hunt at C.S.C. Now I know that there will be 14 different opinions on some of the above specs but these are good starting points until you can see what works for you.

Bill Werwage likes tanks that are only 1¾ or 1⅝ in. wide in the fuselage, feeling that they have more fuel head pressure to feed the pickup tube. For a 46 this means that you need a tank that is about six inches long. If you try to make the tank thicker than one inch you may have spray bar-pickup tube problems, although Bill has used tanks 1⅛ in. deep. Bill was flying his HP 40 in the Ares size last summer using a 5.5- or 5.75-oz. uniflow tank. With the Fox 35 and ST 46 he uses straight muffler pressure on the old-fashioned suction type tank. He alternates between using both vents hooked to a "Y" fitting and using just one vent to the muffler.

Dan Shafer, Dayton, Ohio, using the HP 40, reports that he uses uniflow with muffler pressure, a 5.75-oz. tank with the small wedge at the rear, a .280 venturi, 10% nitro fuel and makes his tanks 1¼ in. high by 1¾ in. wide.

For information on PAMPA or comments contact:

Wynn Paul, 1640 Maywick Dr., Lexington, KY 40504.

Fokker T-2/Stark

continued from page 40

simulate the different shades of coloring of the plywood sheets the wing can be lightly stained in a random pattern of rectangles that are the scale plywood sheet size. Now dope on thin strips of Silkspan where shown on the plan to simulate the lap joints of the real airplane's fabric covering. The entire wing can now be covered with white Japanese tissue and given two or three coats of clear dope.

Fuselage: Construction is old-time built-up but with a few unusual wrinkles. First of all, the two sides aren't identical. The basic structure of the real airplane is visible through the large windows, so to preserve the scale appearance the model duplicates the location of the structural members. Instead of building one side directly on top of the other, as is traditional, each side is built separately on different plan views. Also, since the real airplane was built of steel tubing, the model structure in the cabin area, visible through the windows, should be round and painted gray. Rounded ⅛ sq. balsa was used in the original model. While the visual effect is good, it could be improved by using 1/16 hardwood dowels for the uprights and other structure in the cabin area—but not the longerons. After the sides are completed, join them at the rear and add the cross pieces. Kraft C clamps are excellent for this purpose and they help insure squareness.

The nose is built primarily of sheet balsa with thin aluminum covering on the top and bottom. The bottom covering is installed with very small wood screws so that it can be removed for access to the motor. A charging jack and switch can be installed in the bottom covering. Suitable aluminum for this purpose can come from clothes-drier ducts which are available at most hardware stores at a modest cost. The front radiator piece is thin plywood, held in place by a lip on the bottom cowl covering. The Astro 020 motor is held in

place by rubberbands that are held by hooks attached to the inside of the nose balsa side pieces. If a VL motor is used it can be screwed to former F3 but the hole in the former should be made slightly smaller to fit the motor.

The sides of the cabin area are covered with light cardboard, such as file folder or notebook separator material. The windows are cut into the cardboard covering. The fuselage should be covered with Silkspan tissue. On the real airplane the cowling was covered with metal. The sides of the cowling should be covered with thin plastic sheet, such as celluloid or clear plastic sheet about .010 or .015 inch thick. When painted, this makes an excellent simulation of metal covering. The cabin has a 1/32 sheet balsa floor which is stained wood color. The rest of the cabin area is painted light gray. The Astro Flight battery pack should be painted gray and set in a balsa box on the cabin floor. It is held in place with rubberbands attached to hooks on the cabin sides. In this location the battery approximates the size and location of the cabin fuel tank in the real airplane.

The landing gear is made of .064 and .040 music wire and is quite rigid. The spring action comes from the 3/32-in. brass tubing axle which is bound to the landing gear with white elastic thread. This springing is the same as used on the real Fokker T-2 and many other airplanes of that era. The landing gear built in this manner is not only realistic but has proven to be rugged.

The wing is held to the fuselage by rubberbands inside the fuselage. The fuselage section view on the plan shows how. There should be a hook on both wing spars and matching hooks attached to the fuselage structure. Split ⅛-in. dowel keys should be cemented to the wing and notches cut in, in appropriate places, on the top fuselage longerons so that the wing location does not shift. This method of wing attachment avoids any externally visible mounting parts and allows for wing movement on impact. It has proven to have been very trouble free in this model.

The tail surfaces are ordinary stick construction built on the plan and covered with Japanese tissue.

Finish: The fuselage and tail are given enough coats of clear dope to just fill the tissue and give a relatively smooth finish. Then they are painted olive brown. Although the color is specified as olive drab, airplanes of this era were much more brown than the greenish olive drab of World War II airplanes. To obtain a suitable color you can mix two parts of Aero Gloss camouflage tan with one part of earth brown.

The markings are applied now. Refer to the photographs for the location of the fuselage striping—which is gold. The lettering also is gold, as are the window frames. Vinyl self-stick shelf paper is an excellent material for making stencils for the lettering and the wing insignia.

Flying: My model balanced just about right without the need for ballast. However, if your model doesn't balance at the point shown on the plan, add ballast to achieve the correct center of gravity. Be sure that the tail surfaces are not warped. Set the control surfaces in the neutral position.

Hand-glide the model over tall grass and adjust the control surfaces as required for a smooth, straight, or slightly left turn glide. Next try a powered flight with a short battery charge that will give about ten seconds of full power. One different characteristic of electric power is that you get the same initial power regardless of the length of battery charging; the charging time determines the duration of powered flight.

The climb should be in a left turn. If the model stalls or turns to the right, adjust the thrust line and/or control surfaces to get a left turn under power. The ideal flight pattern for this model seems to be an open left turn under power and a straight glide or a slight right turn in the glide. Even though the T-2 has little dihedral it

can turn quite tightly under power, but such a tight turn isn't realistic.

While most of this article has described a competition type free-flight electric-powered scale model, the design is flexible enough for some other applications. For example, an .020 glow engine would work very well and would probably increase the performance due to its lighter weight. If you are not interested in contest flying the stabilizer could be enlarged about 15 percent for easier adjusting. The cabin area is quite roomy and could easily hold a radio control set. With an .049 glow engine and a light radio the T-2 would lend itself well to an RC for confined space flying.

Regardless of whether you build a duplicate of the electric-powered free-flight model, or one of the suggested modifications, you will be rewarded with a realistic flying replica of one of our most important historic airplanes. As the model cruises slowly but majestically overhead you will be reminded of one of the most inspiring feats in our American aeronautical heritage.

RC Soaring/Pruss

continued from page 25

"Who is $(SC)^2$? $(SC)^2$ is made up of nine soaring clubs: San Fernando Valley Silent Flyers (SFVSF), Soaring Union of Los Angeles (SULA), Pacific Soaring Association (PSA), Pasadena Soaring Society (PSS), Harbor Soaring Society (HSS), Torrey Pines Gulls (TPG), Silent Wing Soaring Association (SWSA), Model Aviation by Radio Kontrol Society (MARKS). (Note: only eight are listed here—DJP.)

"How does $(SC)^2$ work? Clubs who belong to $(SC)^2$ who desire to hold a contest are assigned a month to hold their contest. Usually, there are seven contests throughout the year. There is a standardized entry fee of $3.50 per contestant, $2.50 of which goes to the club hosting the contest, $1 to the $(SC)^2$ organization. The $1 is used for operating expenses, raffle prizes and year-end awards.

"How is the year-end champion determined? Each contest has a raw score of 3000 points. Then the entire contest is normalized to 1000 points. A cumulative total of the normalized scores is used for year-end championship points. A contestant's best five out of the seven contests are counted.

"What does the championship prove? The most obvious is that the person who wins the championship has flown the most consistently throughout the year. In 1976 the top three finishers flew the same plane all year. (Flying the same plane, and getting to know it, has been the key to other championship performances, witness Mrlik, Heithecker, Edberg, Rick Pearson, Mark Smith and current world champion Skip Miller—DJP.) They flew unmodified manufactured kits."

The above can act as a basis for the forming of other soaring groups. It should further remind those that think of the contest circuit only as a cross-country trek, that it can be more local if more local clubs would organize into groups. And if you are a newcomer to soaring and to this column, and if you think contests are only for those who have many thermals under their belts, may it be re-emphasized, the current World Champion, Skip Miller, started RC Soaring just a little over a year ago (kinda makes us all want to take up bowling).

Bumblebees cannot fly: Some years ago a group of aerodynamicists got together and "proved" that the bee could not fly because of its wing loading and a few other factors. But, it was explained, the bee didn't know that and the little hummer went out and flew anyway.

A few issues back this column reported the speed record for sailplanes as 188 mph. This was set by Werner Sitar of Austria. Many of us raised our eyebrows and, if one column ever got a reader reaction, it was that one. Among those that screamed foul