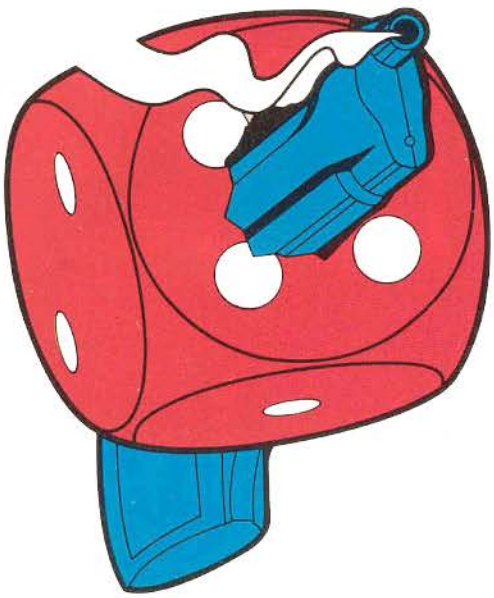


LOADED DICE

If you're looking for a new FAI Pattern ship, here's one that's a proven performer.

By Terry Westrop

Following its publication in RCM, February 1988, the Akro Special development continued to progress culminating in the cowled version complete with new sections for the wing and stabilizer. Five examples were produced, all proving very effective during 1989 and 1990.

To maintain "change" and give a fresh look to the new design, a switch from the Razorback fuselage profile to a bubble type canopy was essential. To better serve the second FAI turnaround schedule introduced in 1988, Loaded Dice incorporates all the experience gained with Akro Special. The design configuration, basically long tail moment, naturally offers a much softer feel in pitch and yaw while roll efficiency remains unchanged and generous rudder area ensures good authority in stall turns. The long lean fuselage gives superb presentation especially along vertical sections of maneuvers. Though the airfoil sections are of the cleaner "faster" type, speed flexibility remains unquestionable and on landings, the tailwheel can easily be made to touch first.

Although design consideration in F3A Competition Aerobatics must be decided on flight requirements, for me, the airplane must be a "looker" and I hope you'll agree, Loaded Dice certainly is. Four Loaded Dice models have been built to date, and they have all exceeded expectations, weighing between 8 and 9 lbs., in lavish color schemes consisting of paint and film. It would not be difficult to reduce the all-up weight by 1/2 lb. In my past five National competitions, Loaded Dice has given me a 1st place, 2nd, 3rd, 4th, and 5th.

LOADED DICE

Designed By:
Terry Westrop
TYPE AIRCRAFT
F3A Turnaround Aerobatic
WINGSPAN
66 Inches
WING CHORD
13⅛ Inches (Avg.)
TOTAL WING AREA
870 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Symmetrical
WING PLANFORM
Double Taper
DIHEDRAL, EACH TIP
1⅛ Inches
OVERALL FUSELAGE LENGTH
61 Inches (no spinner)
RADIO COMPARTMENT SIZE
(L)16" x (W)3" x (H)2½"
STABILIZER SPAN
24 Inches
STABILIZER CHORD (incl. elev.)
8⅛ Inches (Avg.)
STABILIZER AREA
195 Sq. Inches
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
6½ Inches
VERTICAL FIN WIDTH (incl. rud.)
9 Inches (Avg.)
REC. ENGINE SIZE
.61 2-stroke
FUEL TANK SIZE
14-16 Oz.
LANDING GEAR
Conventional (Retractable)
REC. NO. OF CHANNELS
4-6
CONTROL FUNCTIONS
Rud., Elev., Ail., Throt., Ret., Mixture

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Foam & Balsa
Empennage	Foam & Balsa
Wt. Ready To Fly	132 Ozs. (8 Lbs. 4 Ozs.)
Wing Loading	21.8 Oz./Sq. Ft.

Almost any radio equipment can be accommodated; my preference is standard size accurate servos on rudder and elevator of the "coreless motor" type, as are the two aileron servos, but to allow these to be installed upright they must be of "mini" size. This will afford easy access for both servo removal or, if necessary, alteration of servo output arm in the case of differential requirement.

My radio equipment presently operated is the excellent PCM 10, generously supplied by J.R. Propo via these U.K. agents, MacGregor Industries. It has proven faultless in operation and provides an almost endless selection of "trimmer" function, allowing the pilot to iron out many aerodynamic problems or even some (dare it be said), building inaccuracies. A typical program for Loaded Dice on the PCM 10 would be:

Aileron differential 0%; elevator differential +25% down.

Pitch change in knife-edge flight, mixing program:

On left rudder, misc in 8% up elevator; on right rudder, misc in 3% up elevator.

To assist accurate controllable snap rolls I use rudder rate down to 60%, this will vary with each model, but more so depending on the final, total throw the pilot arrives at as their preference.

Power is provided by an O.S. .61 RFP, long stroke rear exhaust pumped engine of ABC type using I.F.M. (in flight mix) needle valve. This ensures optimum runs during flights, and is essential if only to eliminate lean runs, particularly when operating on synthetic fuel. Quiet pipes are now standard equipment on every competition model and are set up to run at ever **decreasing** rpm with larger high pitch props. In an effort to obtain the five point bonus at the judges' discretion, "non peaky" (wide band) types such as the Hatori pipes are employed. These generally allow the engine to perform well at around 10,000 rpm, on say, a 12 x 12 A.P.C. or M.K. prop.

The header pipe will require a "drop" of 2¾" to maintain a parallel run to the tuned pipe.

CONSTRUCTION

Basic structural design remains similar to Akro Special. I have found no method superior in speed, accuracy, and minimal work. Therefore, most procedures will be both familiar and welcome to those who have built my previous design.

Wing:

Edge the veneered (sheeted) panels with 1/4" and 3/8" balsa, and use 1" for the tips. Cut out the retract and servo bays to suit the equipment being used and bore the 1/2" cable access holes at this stage. If the intended servos are of the standard size rather than the mini type, the cut-out can be widened to allow flat installation. Epoxy in place the U/C retract bearers and 1/32" ply lining. Cut out 3/32" well floor and install at a depth suitable for clearance of the retract units.

Fuselage:

Produce the 3/16" balsa sides (left and right), fix all longerons and doublers and make frames 3 and 4.

Stab (Tail):

As per the wing, these panels are edged in 1/4" balsa with 1/2" tips.

Wing:

Sand the entire wing panels marking exits of 1/2" access holes at center for future reference. Sand the roots carefully to give a total of 2¼" dihedral. Groove L.E. and cores to accept a 5/16" location dowel and epoxy panels together carefully checking alignment.

Tail:

Sand all edging and roots for zero dihedral and join with epoxy taking as much

Materials List

Fuselage Sheet
4 — 3/16" x 4" sides
3 — 1/2" x 3" top, fin, and rudder
2 — 3/32" x 3" bottom and facings
1/32" ply x 12" x 18" wing fillets and U/C lining
1/64" x 6" x 6" servo well lids

Fuselage Sticks
3 — 3/4" triangular longerons and brace
2 — 1/2" triangular longerons
2 — 3/8" triangular bottom longerons
1 — 3/8" square elevator "Y" rod
1 — 1/2" x 1/2" hardwood U/C bearers and bolt blocks
1/4" ply x 6" x 6" firewall
1/8" x 6" x 12" F1, F3, wing bolt plate and horn plates

Wing & Tail Veneered Foam
1 — 3/8" x 3" L.E.
2 — 1/4" x 3" all other edging
1 — 1/8" x 3" facing
1" x 4" x 12" wingtip
5/16" dowel x 6"
3" x 33" glass tape

care as with the wing alignment.

Fuselage:

Carefully fit formers 3 and 4, keeping the sides at equal angles to them. Make F2 to suit engine and mount, drilling for throttle, mixture (if fitted), and tank feeds.

Wing:

Make up the pipe anchor and wing bolt plates; recess in the wing and epoxy in place. Sand flush.

Fuselage:

Install F2 incorporating appropriate side and downthrust.

Tail:

Cut elevators from the panels and attach 1/4'' facings.

Wing:

To reinforce the center section, I use 3'' tops and 1/4'' sheet and soft nose/cowl block.

Fin & Rudder:

Select some of your best, straight medium soft, light 1/2'' sheet, and section carefully thinning out to a minimum of 1/4'' at the tops.

Fuselage:

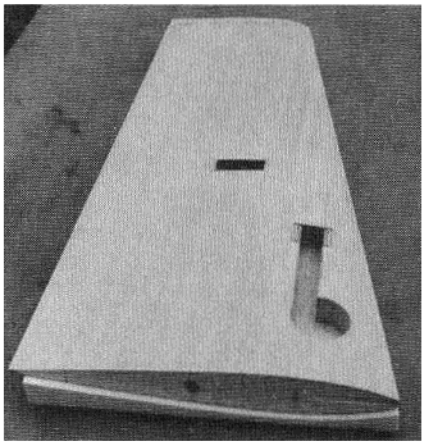
Roughly shape up the whole unit and add 3/32'' cockpit facings along with the hardwood wing bolt blocks.

Wing & Ailerons:

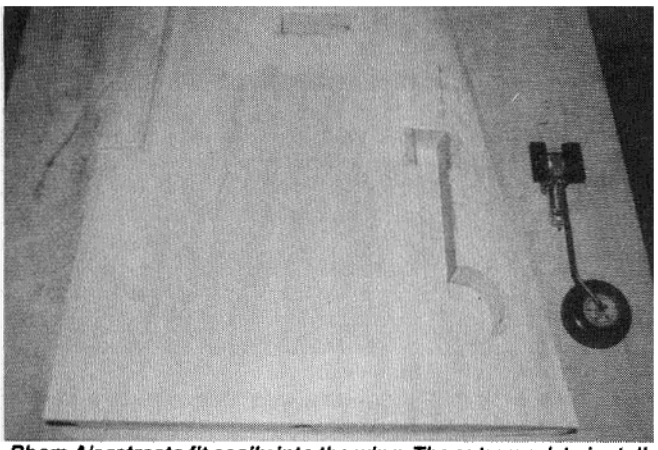
Sand all edgings, recess and install 1/8'' ply horn plates and attach 1/8'' end facings and 1/32'' ply tip inserts.

Fuselage:

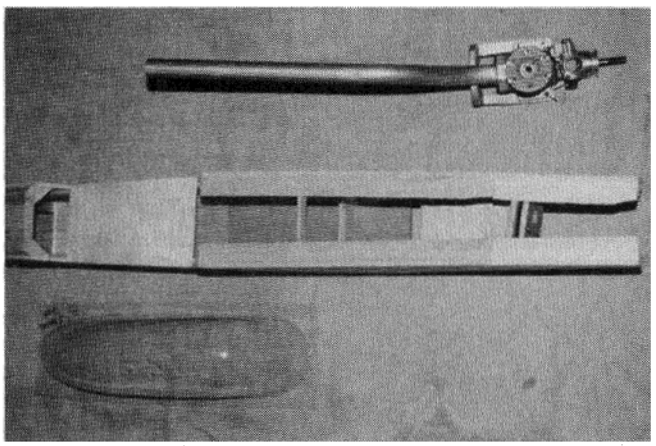
Carefully mark and drill F3 for the wing dowel. Insert 5/16'' dowel into wing recess



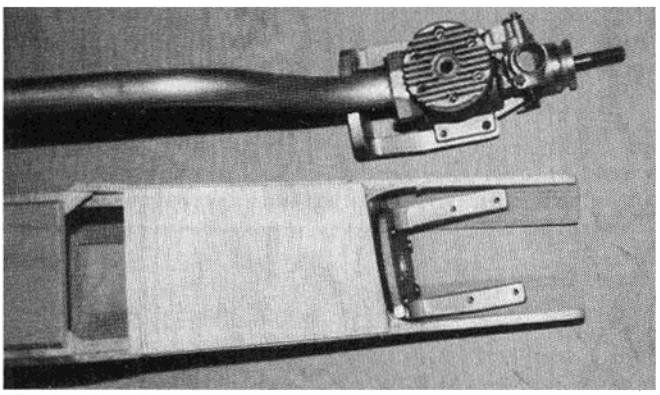
Completed wing panel ready to join. Don't forget the 1/2" access hole and recess for the 5/16" dowel.



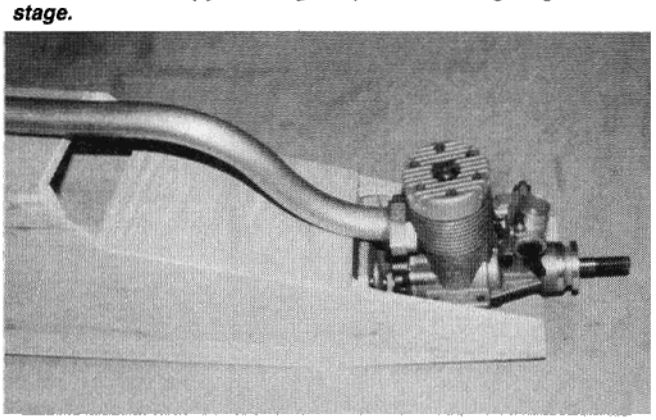
Rhom Air retracts fit easily into the wing. The extra work to install the "canted" leg is well worth the effort, particularly if flying from a grass field.



Top sheeting omitted from fuselage to show tank bay and engine side thrust. Canopy decking keeps the fuselage rigid at this stage.



Engine bay has enough room for the O.S. .61 Pumper, and considerable side thrust.



Everything fits nicely in the nose area prior to installing the top sheeting and nose ring. Don't forget to drill firewall for throttle/mixture linkages and fuel lines.

tape with polyester finishing resin and micro-balloons as adhesive, and to fill the weave. Two coats (sanding between each coat), should give a super smooth, ''no see'' joint.

Fuselage:

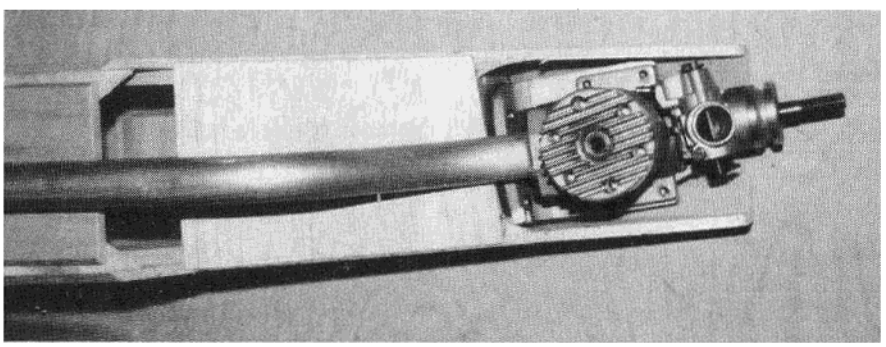
Join at the tailpost ensuring a straight run. Produce nose ring F1.

Wing:

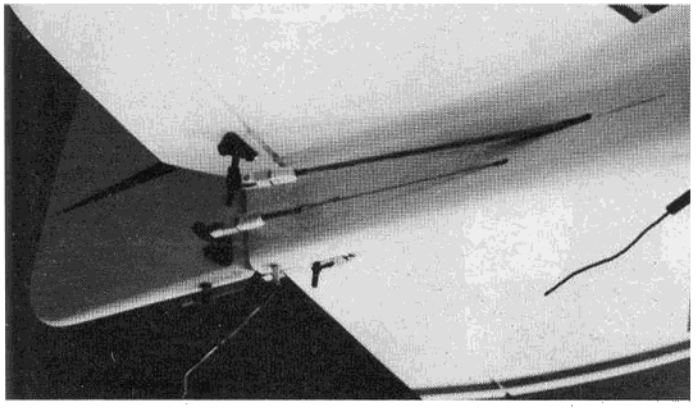
Remove ailerons from panels and attach 1/4'' facings.

Fuselage:

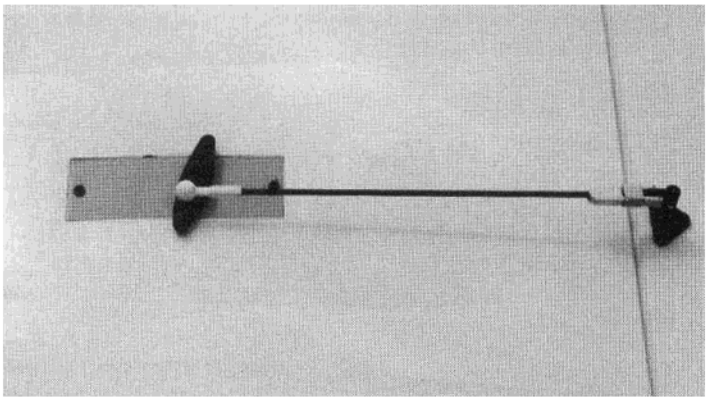
Fit the 3/4'' triangle stock firewall reinforcement, temporarily install the engine, align and fix nose ring. When secure, remove engine and attach 1/2'' sheet



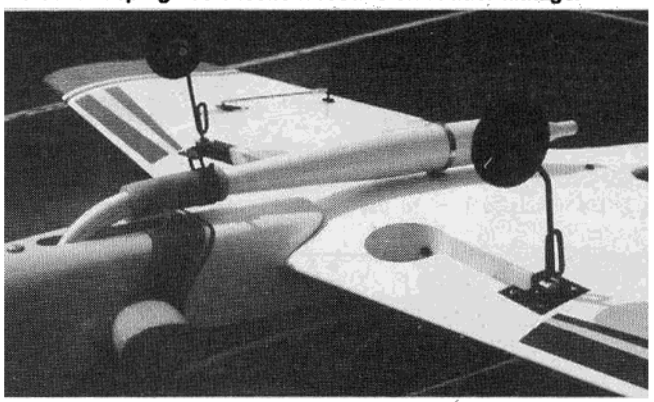
Header should have sufficient offset for side thrust, and to meet the tuned pipe on the centerline.



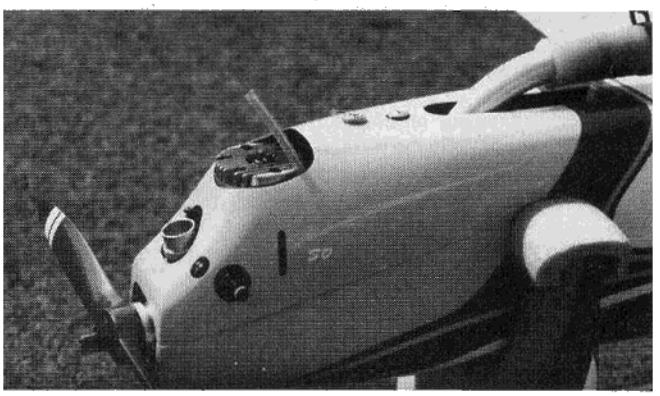
Split elevator linkage for positive response and fine adjustments. "Closed loop" gives excellent results on rudder linkage.



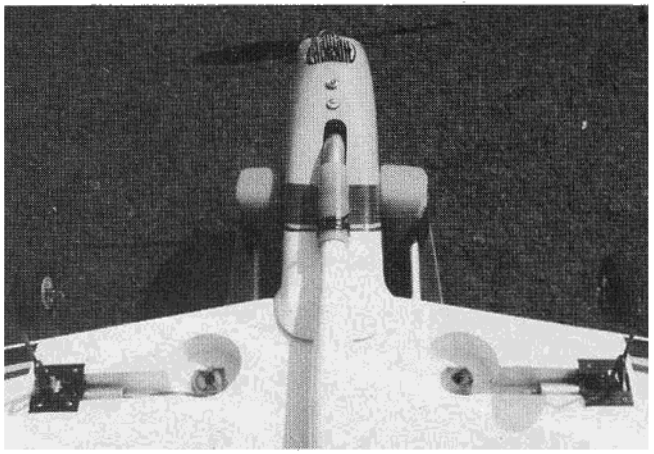
Not much showing above the surface. Keep a tight fit between all hinged components.



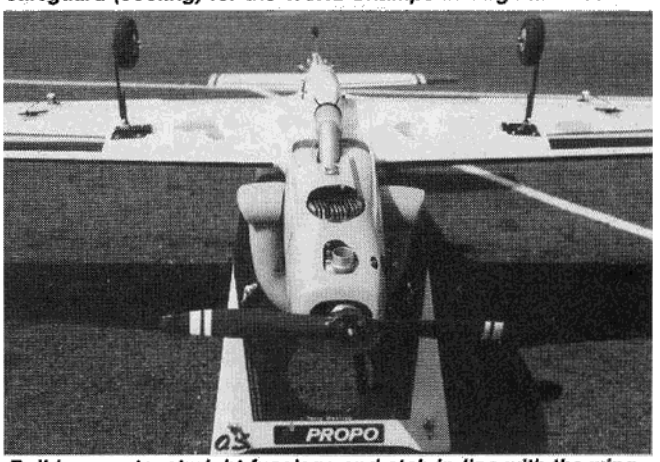
Canted wheel legs resist bending on heavy landings. Keep pipe to header straight, it looks neater!



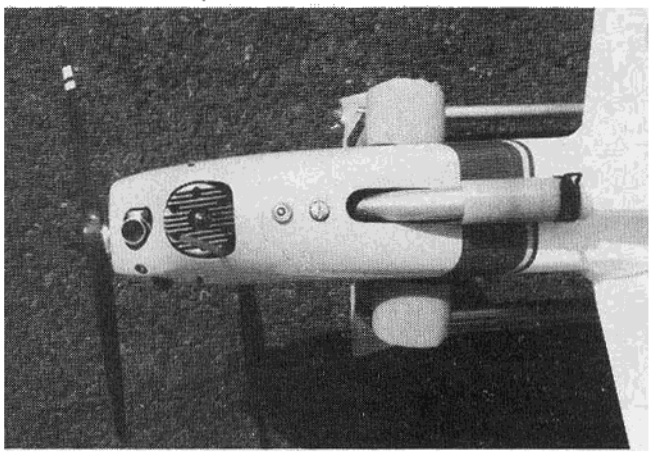
Neat and practical cowling. Vertical "slots" were introduced as a safeguard (cooling) for the World Champs in Virginia in '89.



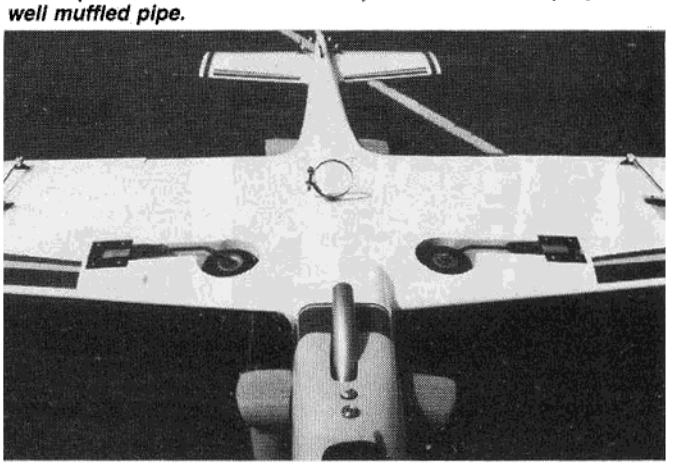
Header should meet tuned pipe on the centerline of fuselage, ensure that it runs parallel.



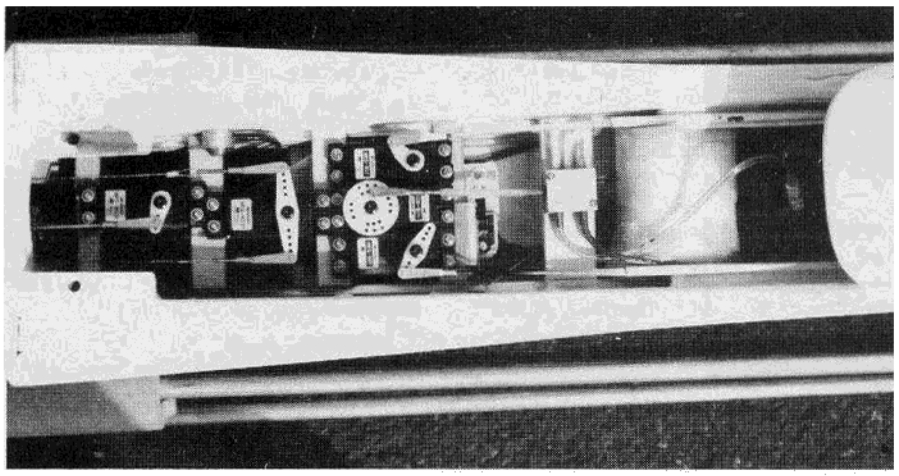
Build accurate, straight fuselage and stab in-line with the wing. Quiet operation is achieved with a special carbon fiber prop and well muffled pipe.



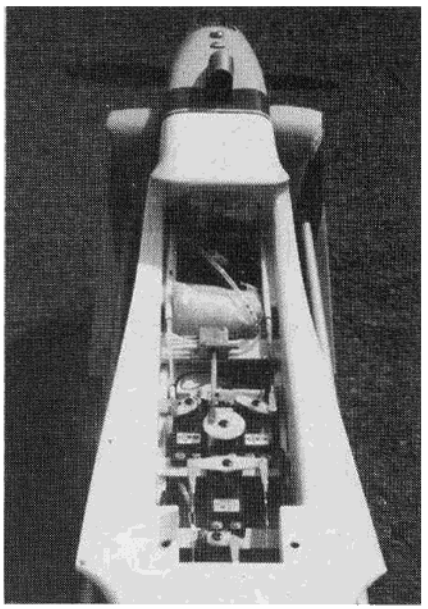
If soft mounts are used, more clearance will be required.



A "clean" airplane makes for easier flying in rough weather. Install pipe close to wing.



"Tandem" elevator and rudder servo installation, followed by in-flight mixture control, retract valve, and throttle, with ample room left for the receiver and battery.

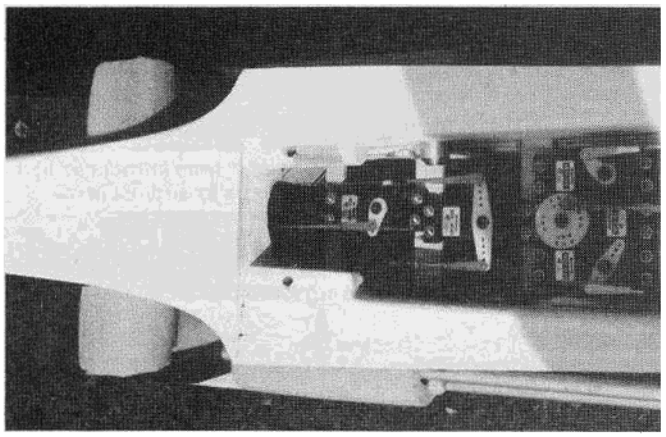


This installation allows very easy access to the fuel tank, just remove the rx and NiCd.

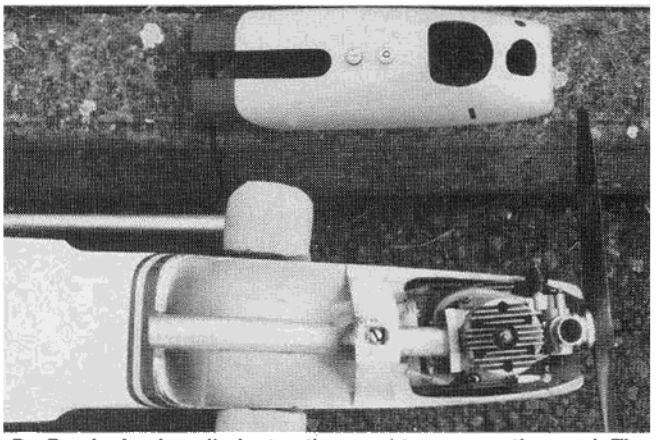
and check alignment on assembly, in **all** directions, particularly the incidence which should be at least 1/2 degree positive. When satisfied, drill through the assembly for 1/4'' bolts.

Tail & Elevators:

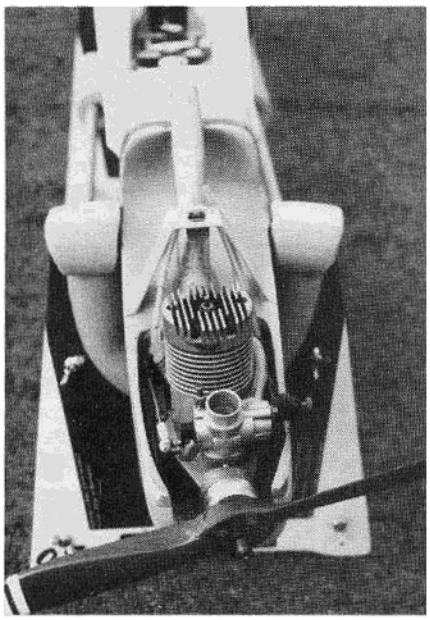
Sand all 1/4'' facings, recess for the 1/8'' ply horn plates and attach 1/8'' ends and

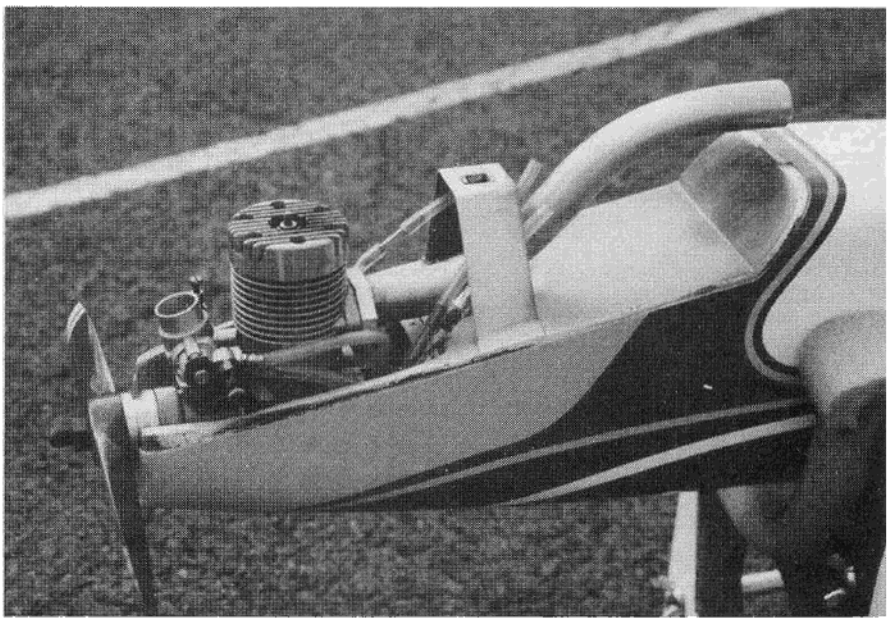


Air tank is above and behind the elevator servo, at the rear of the canopy.

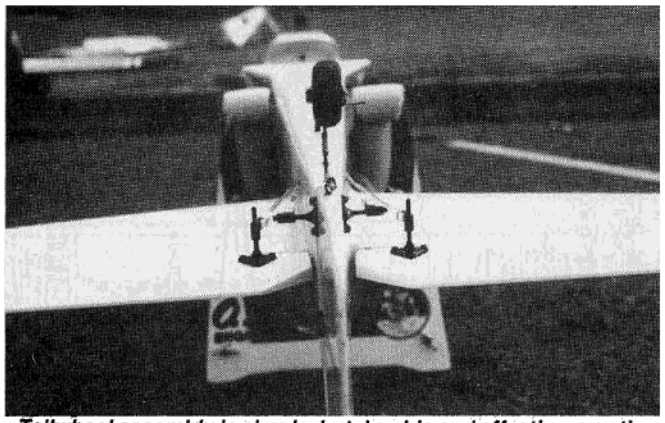


Du-Bro fuel valve eliminates the need to remove the cowl. The large slot in the cowl is not only for the header exit, but for the hot air extraction as well.



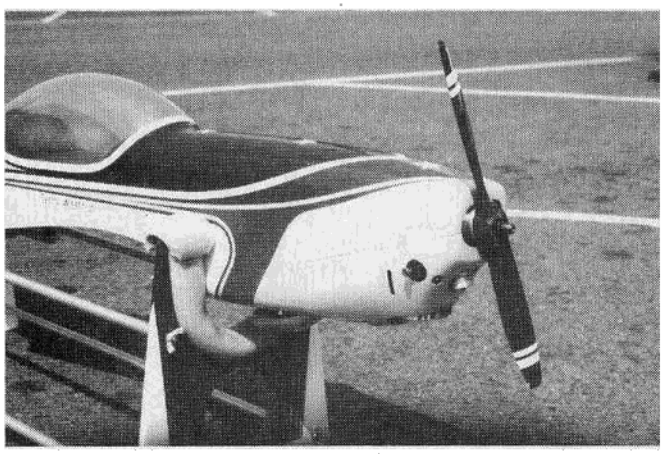


A single "DZUS" fastener allows quick cowl removal.

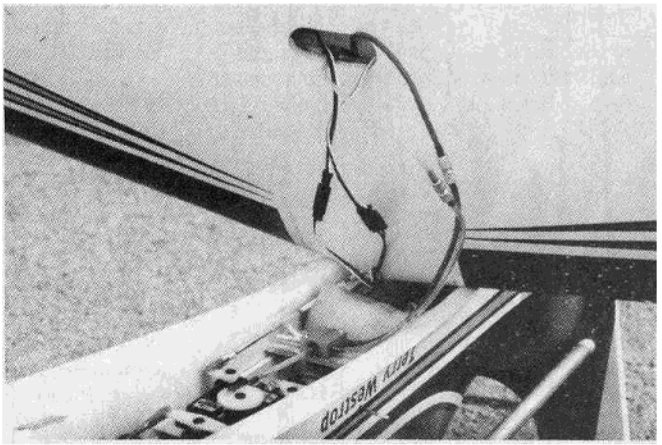


Tailwheel assembly is simple, but durable and effective, exerting little force on the servo.

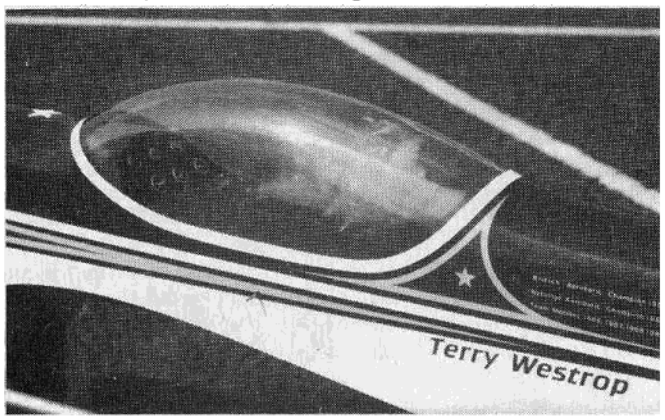
Both the canopy and wing fillets are blended using epoxy and micro-balloons. I use matt or satin color in the cockpit.



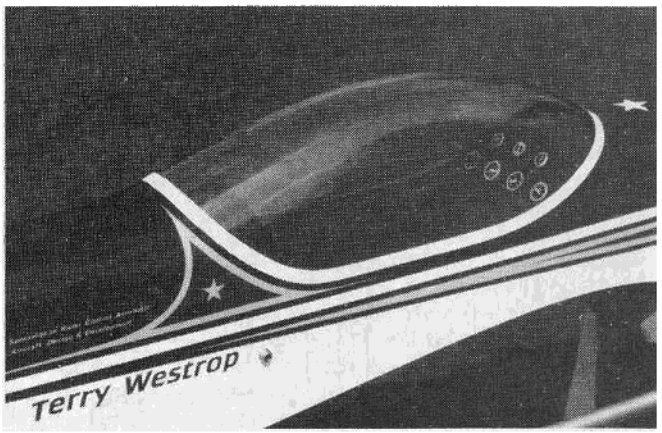
Propeller is "own design" 11½ x 11 carbon fiber, static rpm 11,000, to cope with FAI noise regulations.



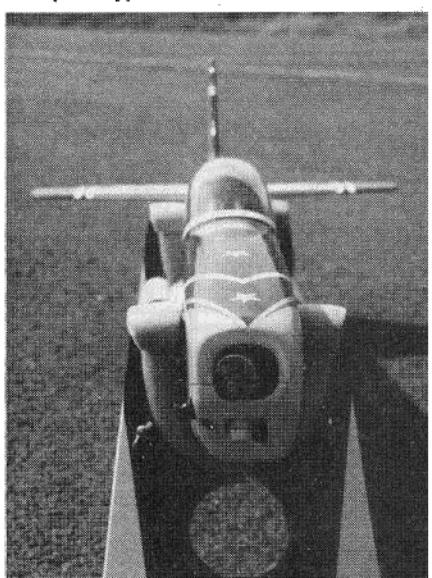
All plugged in and ready to bolt down.



Model #2 with a slightly smaller canopy, but finished exactly as the prototype.



1/8" & 1/4" fine line masking tape is used to achieve this effect.



Just a "touch" of side thrust.

1/32'' ply inserts.

Wing:

Root through the center sections for 1/2'' access to the retract and servo lines. Make servo box lids from 1/64'' ply.

Fuselage:

Protect the wing center section with plastic sheet or tape, and bolt to the fuselage. Add 3/32'' bottom and build up the wing fairing using 1/32'' ply and soft balsa, ensuring an excellent joint between wing and fuselage. When completely dry remove wing and finish sand entire fuselage. Mark out and remove the cowl assembly from the fuselage, add the 3/32'' tank bay floor with 1/4'' runners. Make up the cowl retainer from soft aluminum and bolt in place on the 1/8'' ply plates. Install engine and header, recessing the cowl where necessary to clear carb, cylinder head, and needle valve, etc. Additionally, to cope with hotter climates, a 1/8'' x 3/4'' slot adjacent to the cylinder head, vertically on each side, could be added. This should be carefully chamfered to allow good airflow using a needle file or very sharp knife. Assemble the wing back on the fuselage and attach tail feathers, again taking great care in alignment.

Seal and strengthen the tank and engine bays with resin and glass fibers.

Canopy:

Finish the cockpit area as required. My preference is a satin color and a few instruments. The canopy is fixed in place using epoxy and completely masked up for protection. For "blending" in the canopy to the fuselage, polyester finishing resin and micro-balloons have proved successful.

Finishing:

I have carried out numerous experiments in an attempt to save weight, but retain the style of finish to which I am accustomed. The format, however, always remains the same, i.e., paint fuselage and film covering for the wing and tail, giving the best all around effect while keeping the weight to a minimum.

Although I still believe that the traditional tissue, dope, and sanding sealer gives the most durable finish prior to painting, naturally it must be a heavier method than lightweight glass cloth with a two-part adhesive as this limits the amount of impregnation into the structure, more or less producing a "shell" on the balsa. I have tried many adhesives in an atempt to reduce weight and work time, and there seems to be no ideal adhesive. The two extremes I find are: two-part primer such as K&B well thinned on the first application with the glass cloth is very quick and light, but not so ding proof. Polyester finish resin, again, well thinned on the first application, is a little heavier, longer process, but appears to produce a harder surface on which to apply the prime and paint. Whatever type primer is used, allow time, depending on the temperature for the surface to totally dry and "settle down" before cutting back. After sanding off most of the first stage primer, I follow up with a light covering coat as a base ready for the color.

If you intend to use high nitro fuel it would be wise to use a two-part color finish or, alternatively, two-part clear coat over the color finish. Wing and tail are covered in Solarfilm iron-on, with Solartrim stick-on as decor. Use a clear lacquer to seal all edges to prevent the film and decor from lifting. Mylar fixed with CA has proven perfectly adequate, especially so for that "gapless" requirement to promote good airflow over moving surfaces. If any doubt remains concerning the durability of mylar, they can be pinned using cocktail sticks or 1/16" dowel and CA.

The tailwheel is unchanged from the Akro Special. Bind and solder the wires thoroughly and it will give excellent service exerting little pressure on the rudder and servo, yet is quite positive in ground operation. I have found that canting the main legs forward for Loaded Dice has achieved an equalizing effect, to some extent, when operating from grass; beats holding your breath and closing your eyes while rebending legs (in the model) between flights.

Gear Installation:

If air retracts are used, the air tank is placed in the top of the fuselage at the rear of the canopy using liquid silicone. The elevator "Y" rod can now be installed along with the rudder closed loop linkage. The servos for these can either be installed side by side or tandem fashion, as I have done depending on servo size and amount of rudder throw preferred. I set up with maximum rudder movement and, therefore, require the large output arm which cannot easily utilize the side by side layout.

Snake linkages are adequate for throttle and I.F.M. control and should be fitted prior to the fuel tank. Receiver and NiCds are placed at the rear of F2. Install the aileron servos just low enough to clear the ply covers.

Surface Throws & Flying:

Provisionally set deflections at aileron ±1/4"; elevator +1/2"-5/8"; rudder ±2½".

Once ready with the new model, don't become so dazzled by the looks that a thorough check is forgotten. If the building is accurate, Loaded Dice will be extremely simple to fly and requires little trimming to obtain a competition ready airplane.

If, like myself, you require a model to stay exactly where directed (quite beneficial with competition flying), then perhaps these basic procedures may be helpful.

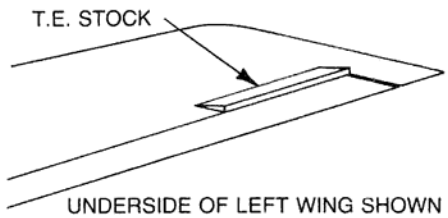
(1) Obtain the best, consistent performance from the engine.

(2) Set control movements to personal requirement.

(3) Vertically down (engine off, naturally). If the model tends to pull out uncomfortably (they all pull out a little) check the wing incidence in relation to the tail, which should read at least 1/2 degree positive, and the C.G. is near the plan position.

(4) Pull vertical. If the model requires noticeable right rudder input, increase the sidethrust, if down elevator is needed, increase downthrust assuming check (3) is good.

(5) If in either (3) or (4), the model rolls of its own accord, check for warps. If the roll amount is quite small, rectification may be possible using trim tabs in the form of trailing edge stock of, say, 3/16" x 1/2" x 6" long, e.g., if right aileron is required to connect, the tab should be placed under the right wingtip and adjusted for size until satisfied.



UNDERSIDE OF LEFT WING SHOWN

(6) Now check the wing balance with loops or sharp corners. I prefer negative loops or corners, it appears to show up problems sooner. If the model consistently requires, say, right aileron input on outside loops, add weight to the left wingtip. I still do not static balance an airplane. To obtain an optimun setting it is often required to make alterations to the trim tab while adjusting wing weight.

(7) Aileron differential. I have still not experienced as a problem, quite probably the efficiency of design is a substantial factor, but in the event that you wish to experiment with roll response, once again here it is. If heading is lost during successive rolls (not slow roll), e.g., right rolls result in a left heading change, increase the amount of up going aileron movement. With upright mounted servos the output horn can be adjusted easily or, alternatively, as many pilots are aware, the servos can be plugged into separate channels and the differential amount adjusted from the transmitter.

Whether you prefer to fly for fun or sport, Loaded Dice is absolutely delightful, its flexibility and looks make it a winner anytime. Remember the more you put into a model, the more you get out.

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