Radio Controlled Soaring Digest

July 2009 Vol. 26, No. 7

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Front cover: Dave Beardsley's High End passes overhead during its maiden flight at 60 Acres South. Photo by Bill Kuhlman
Konica Minolta Maxxum 7D, ISO 100, 1/500 sec., f8.0, 500mm

Back cover: Fred China prepares one if his museum quality models for flight. Photo taken at the Yakima Aerotow, 15 May 2009, by Sanders Chai.
Canon Powershot S45, 1/250 sec., f8.0

R/C Soaring Digest

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In the Air

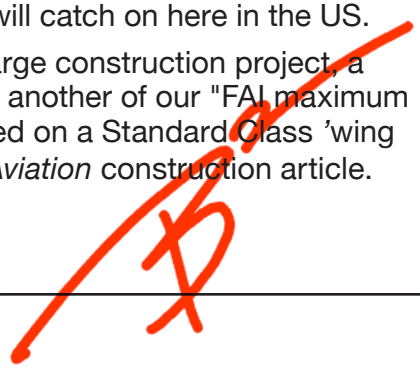
We hope you find the articles in this issue as exciting as we do.

Sherman Knight starts things off with a comparison of the Supra and the new Supra Pro. Our thanks to Michael Knight and Brendon Beardsley for launching and flying the Supra Pro for the photo shoot. Next, Lothar Thole wraps up his review of three oscillating tools and Peter Carr describes a few examples from his collection of sailplane transmitters.

Competitions for full size gliders consist of racing around a predetermined course with fixed turn points. Sailplanes are timed from starting gate entry until passage through the gate upon completion of the course. Similar contests for scale RC sailplanes have been held in Switzerland for the last two years, and now *Aufwind* magazine (Germany) and TUN-Modellbau of Switzerland are sponsoring a full calendar of events known as the GPS-EuroCup with the intent of fostering international competition with a ranking list and a trophy for the season winner. We've included introductory information and the current rules in this issue. Full size soaring competition in model form... What could be better than that? Be sure to check out the Icare web site <http://www.icare-rc.com/skynavigator.htm> for the necessary electronics. We hope this event will catch on here in the US.

Lastly, we've finally started our large construction project, a Ken Bates' Windlord. This will be another of our "FAI maximum wing area" sailplanes and is based on a Standard Class ’wing originally published as a *Model Aviation* construction article.

Time to build another sailplane!



SUPRA PRO

by Sherman Knight, DUWorm@aol.com

A great Thermal Duration or F3J plane is one that simply helps you win contests. The basic winning strategy is really quite simple. He/she who makes the fewest mistakes, WINS. So a plane that will hide your mistakes is a great thing.

Up in the Pacific Northwest, a contest might start with a thousand foot cloud cover, 65 degrees and a slight drizzle. The plane that wins in this weather must do two things very well (putting aside pilot skills). First, it must float like its life depends on it and to do that, it needs the lightest wing loading at the contest. Second, it must out launch all the other planes. Unfortunately, building it light and at the same time strong enough to withstand a gorilla launch is impossible. So, compromise is inevitable.

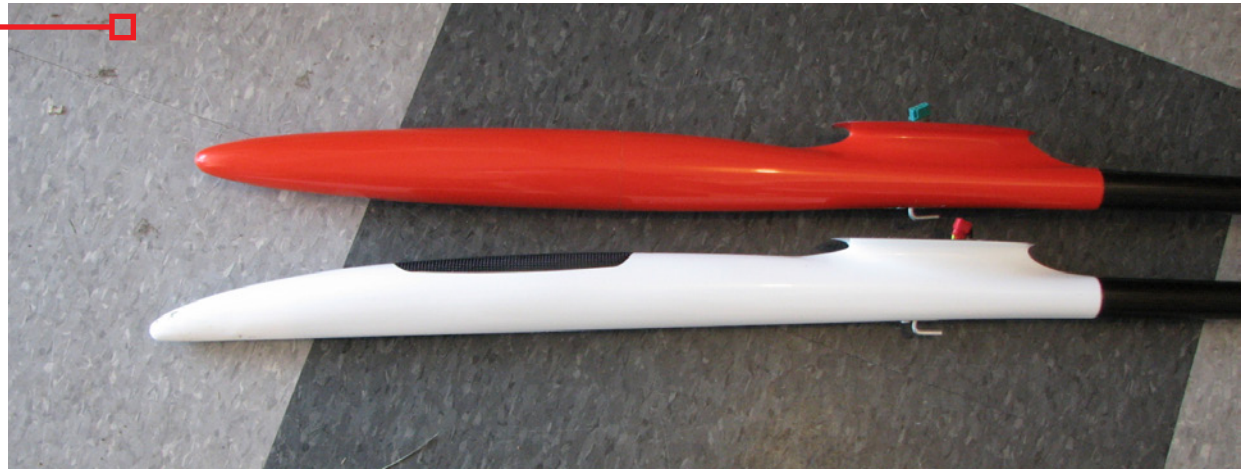
One of the few planes that finds a great compromise is the Supra, designed by Dr. Mark Drela, currently being built by Vladimar's Models (http://airplane-model.com) and distributed in the United States by Kennedy Composites (http://www.kennedycomposites.com). There are five versions of the Supra, the lightest one is as light as the current crop of molded sailplanes come. All five come with a thin but strong wing allowing it to penetrate and zoom very well.

The newly released Supra Pro adds a third, critical item to the mix. With its new drooped nose, sticking spot landings just improved dramatically. Holy cow! Floats like a butterfly, zooms like an ICBM and now lands like a lawn dart. Is this cool or what!

I own several Supras, and now a new Supra Pro. This article only discusses the differences between the two.

Michael Knight prepares to launch the Supra Pro from the landing practice bungie. That's Brendon Beardsley at the transmitter.

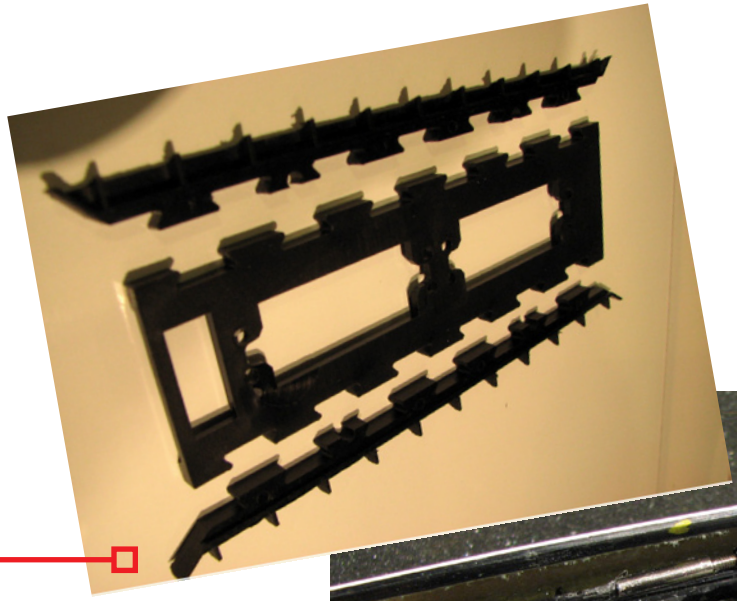
Nose Cone



The Supra has a nose cone. I really like nosecones. Generally, they provide more room for my fat fingers to install servos and other hardware. The Supra has a servo tray that is simply part of the inner nosecone, resulting in a stiff servo tray and something that could never break loose. Unfortunately, the shape of the nosecone, although aerodynamically perfect, required a real lawn dart maneuver or a three inch nose skeg to obtain landing points. If it does not stick, the plane will slide very easily.

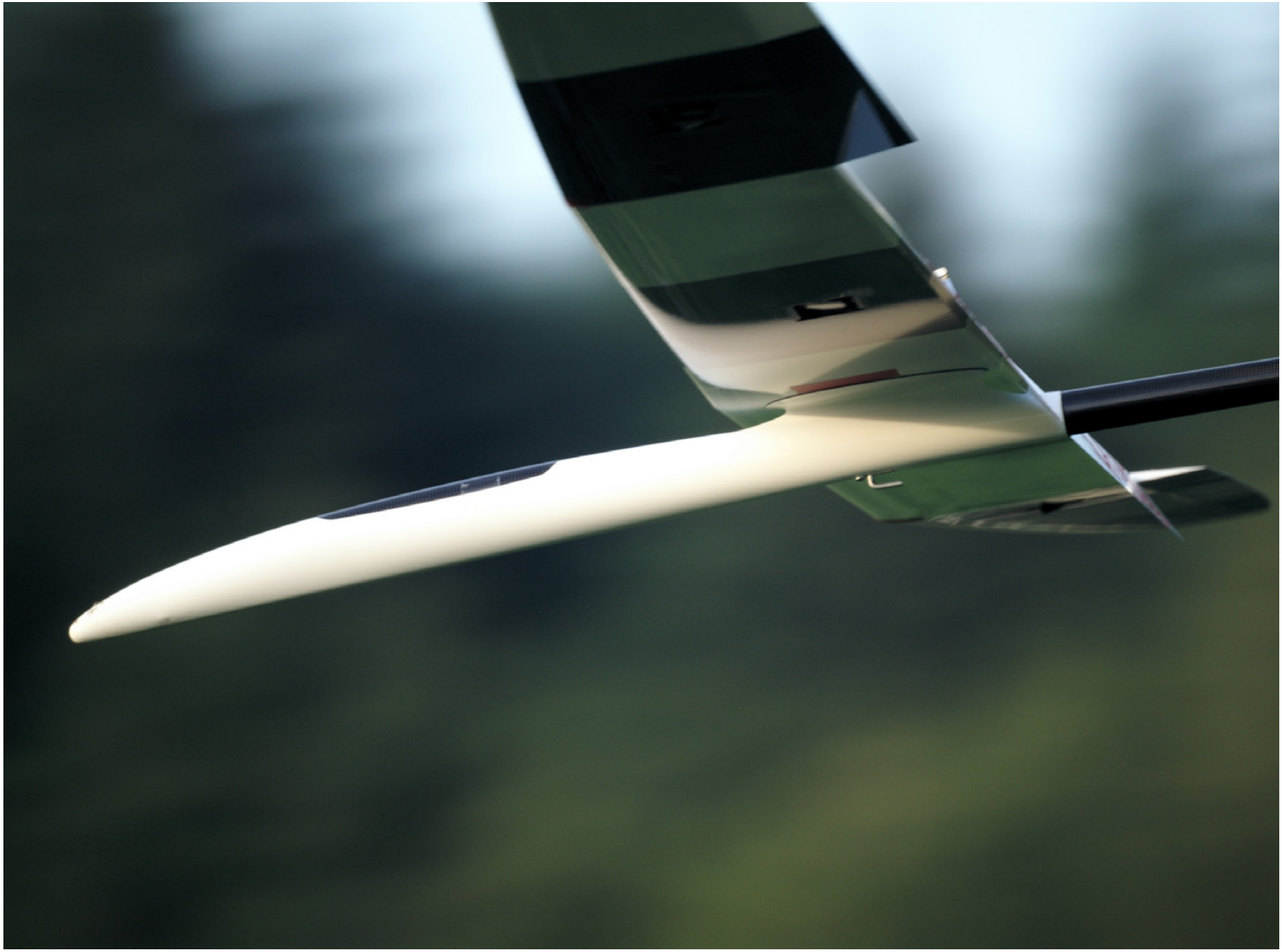
The Supra Pro no longer has a nose cone. It now comes with a drooped nose with a canopy. The new nose goes a long way toward reducing the landing angle necessary to “dork” the plane and if it does not stick the drooped nose creates more drag than the old shape, slowing a sliding plane more quickly. Unfortunately, the canopy is small and the nose is a tight fit for all the stuff you need to cram in there.

Servo Tray



The Supra servo tray is simply part of the inner nose of the fuselage. You cut out what you need for your equipment, install it, and you are done.

The Supra Pro comes with a removable servo tray. That’s right, a removable servo tray. It arrives in three parts — a center section and two side rails. The




CHAINSAW
SUPRA


CHAINSAW
SUPRA


CHAINSAW
SUPRA

side rails and the center section fit together with simple dove tailing and are held together with four screws. The side rails have already been sanded to the sloping sides and the front to back taper of the interior of the nose. Slide the whole assembly in with a little glue and let it set up. Then pop the four screws and the center section is easily removed. Insert the battery and receiver, connect the wiring, install the servos in the tray and slide the center servo tray section back into place, insert the four screws and it's done. It is really that simple.

Wing Saddle

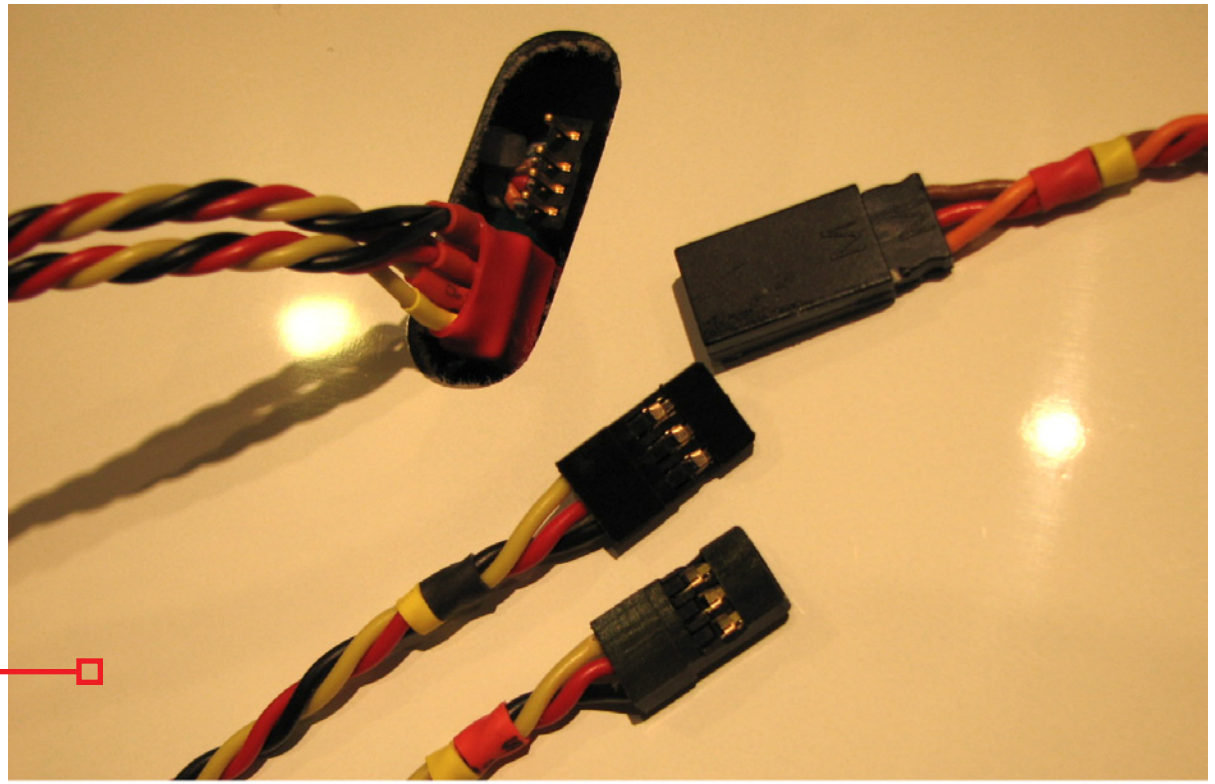
The wing saddle remains unchanged. Old wings will fit on the new fuse. I have small hands and the new fuse in the area of the saddle is much easier for me to hang onto during a launch.

Wiring Harness

Unless ordered otherwise, the wing now comes with a built in wiring harness using light weight connectors. If you are a real weight weenie, you could save some weight by installing your own harness. The insulator used on the harness has a large diameter, making it a little heavy.

Tow Hook

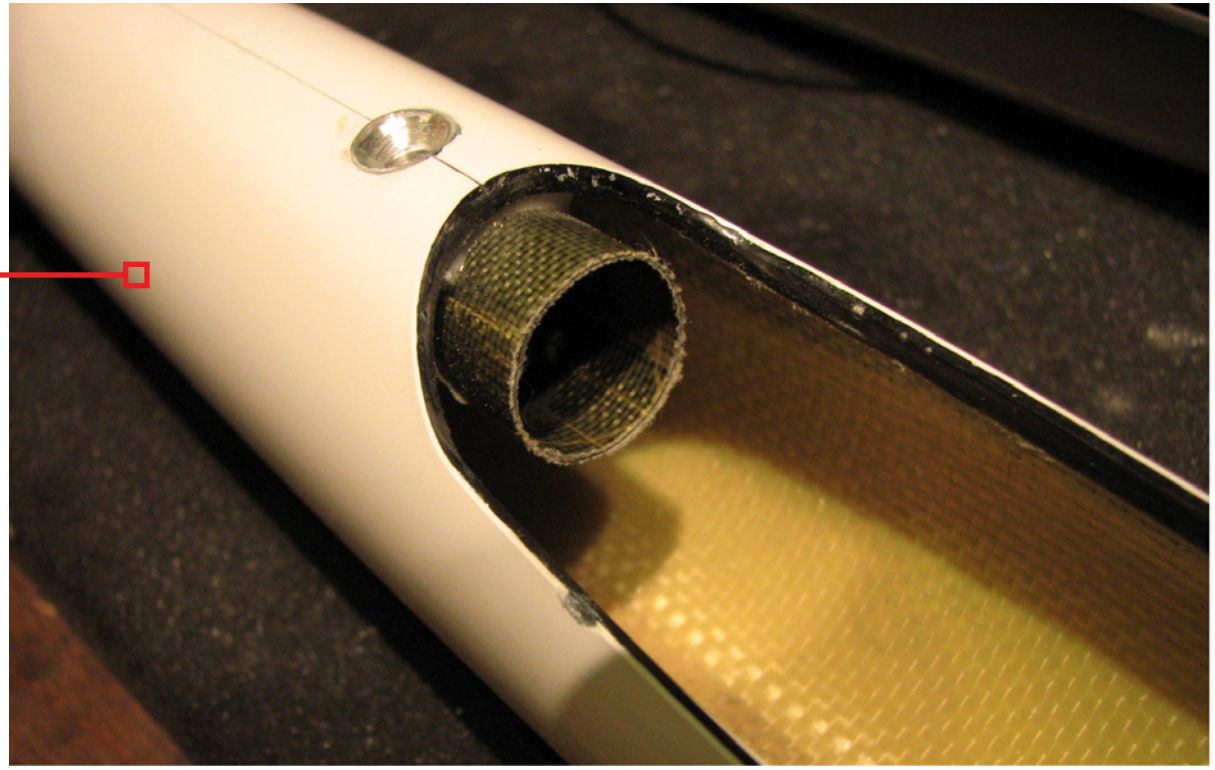
The Supra Pro comes with the tow hook already installed.



Ballast Tube

The ballast tube could be left out of the Supra, but if you land hard you really should install it.

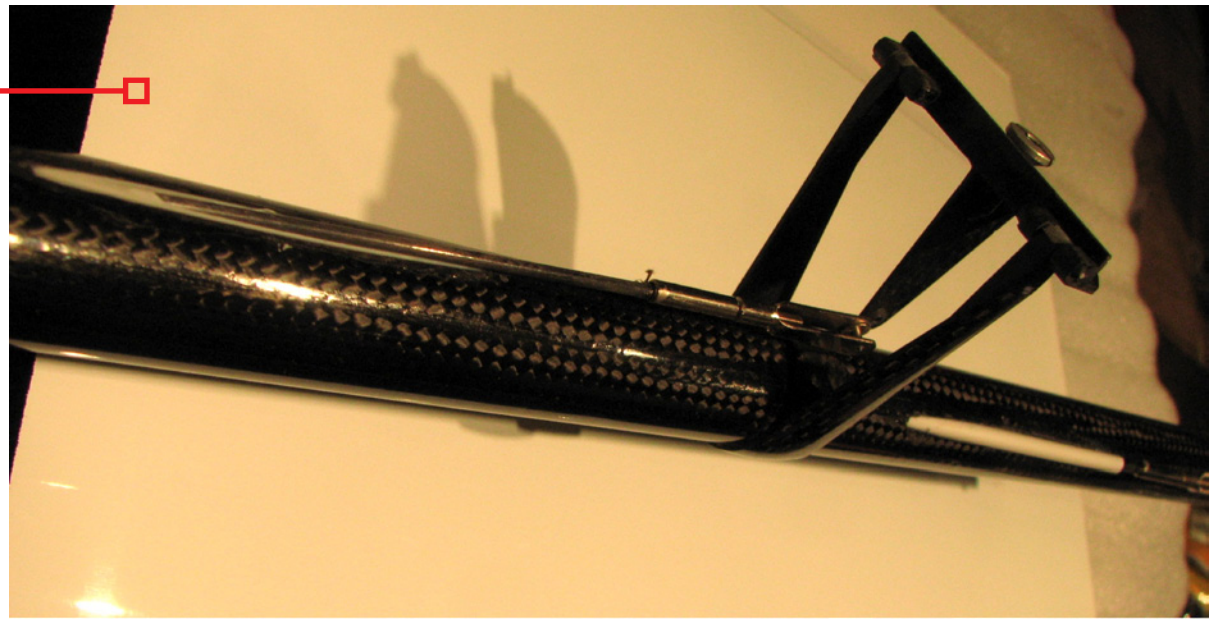
The ballast tube comes already installed in the Supra Pro, along with its ballast lock down screw and aluminum backing point.



Boom

The original Supra plans show the push rods installed on the outside of the pod and boom. Easy, but something only an engineer could appreciate. Many of us started installing the control rods on the inside. Looked good, but difficult for our hobby's rapidly diminishing modeling/ building skills.

The new Supra Pro has the control rods already installed on the inside of the boom. You still have to glue the pod and boom together, and getting the pushrods installed so they operate smoothly is still somewhat difficult, but WAY simpler than it was before. The rocker assembly for the elevator is also pre installed.

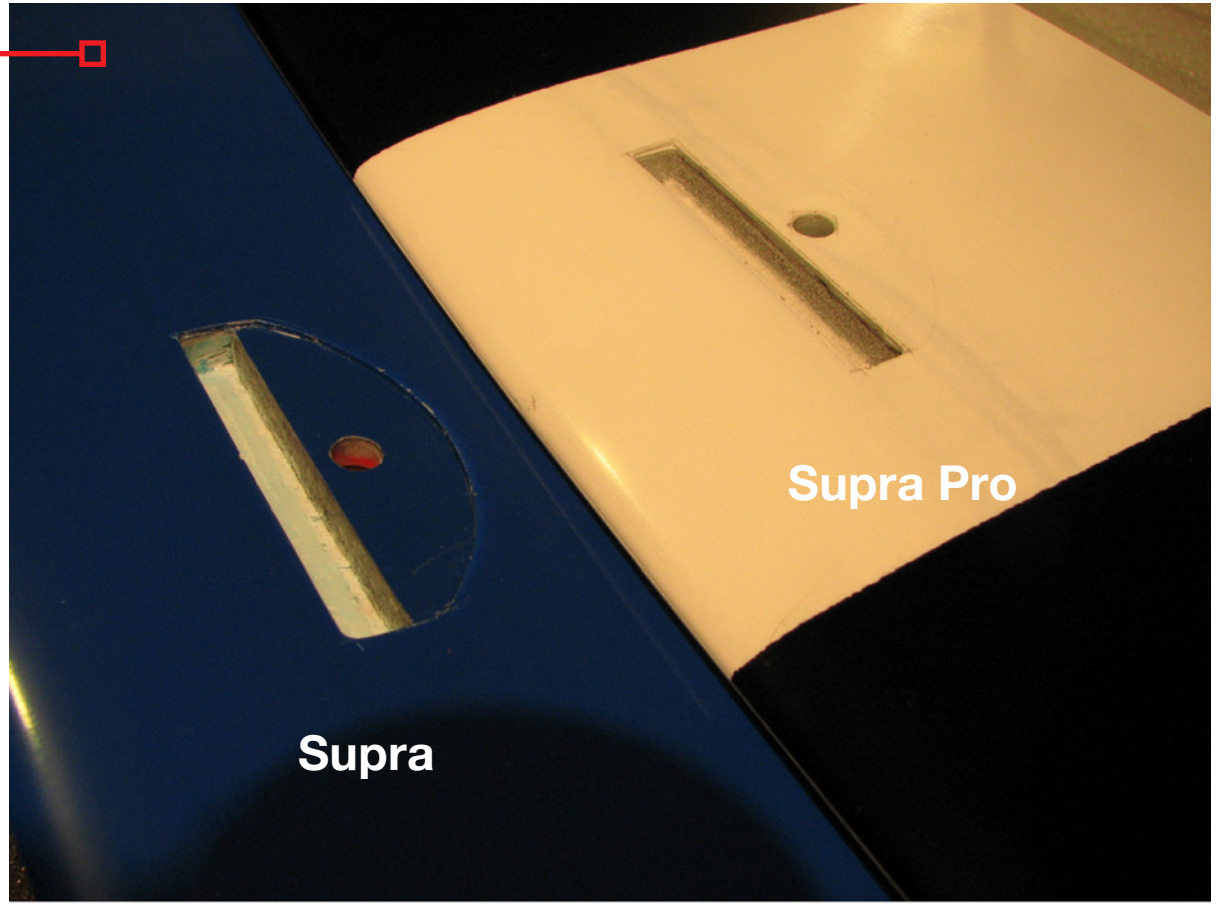


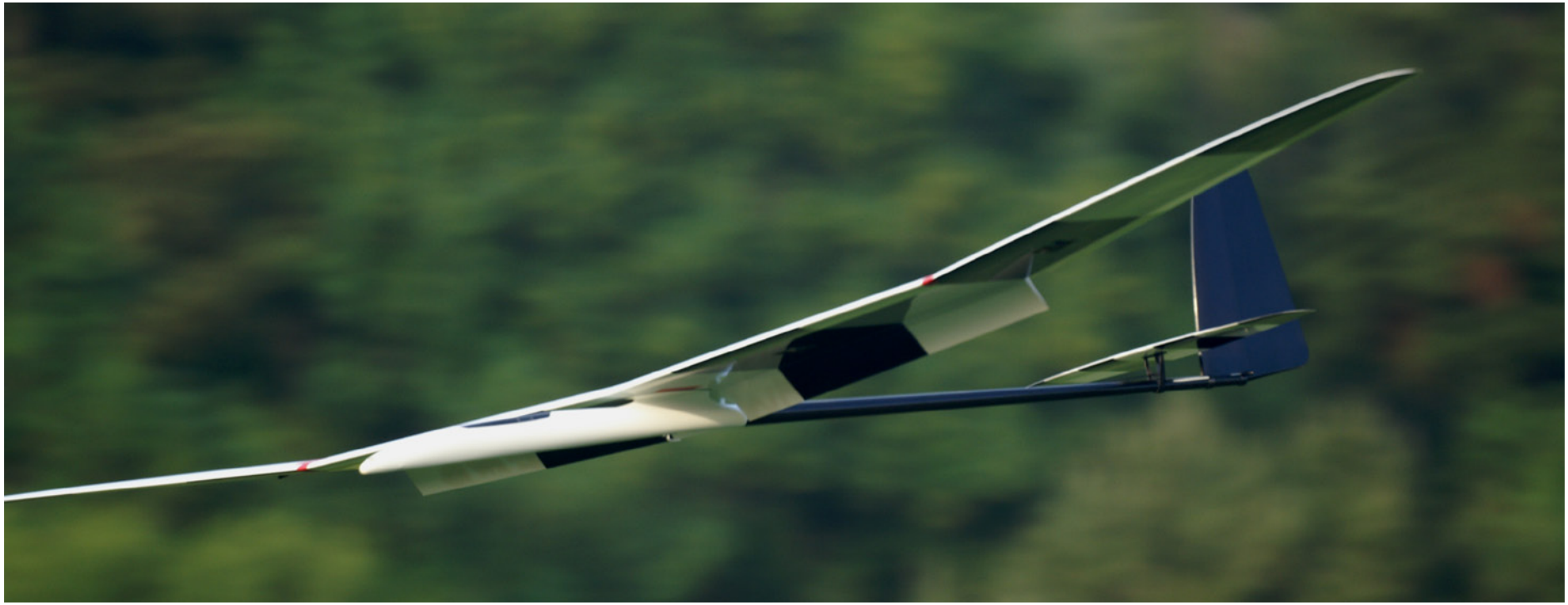
Elevator

At the F3J World Championships, several Supras suffered elevator failure. I was there and actually helped rebuild some of the damage.

The winds were high, (many planes were lost down wind and never recovered) and the USA Team towers were incredibly strong (the guys towing for the US Junior Team also towed for Team New Zealand and crumpled the fuselage on a Carbon Pike Perfect on launch) resulting in conditions that will not be repeated any time soon. Unless you have seen an F3J World Championship event, it is virtually impossible to comprehend the violence of an F3J launch under these conditions. In other words, if you have a Supra, unless you want to launch in a 20 mph breeze with two monster towmen your elevator is just fine.

In response to these conditions, the elevator now sits on top of the rocker assembly. The rocker assembly used to sit inside the elevator. By moving it to the outside, there is a reduction in the stress riser in that location. Also, the new elevator is a little more flexible along its length, again reducing the stress riser where the elevator bolts to the rocker assembly.





The Supra was already a great plane. In an effort to make the Supra one of the best TD or F3J planes available, the Supra Pro was created. Every plane out there has something that can be improved. Vladimar listened and made a great plane better.

The Tool Room

by Lothar Thole, lothar.thole@gmail.com

Oscillating Tools — Part 4, Comparison

This is the last in a four part series reviewing three multi-purpose oscillating tools. Part 1 brought you an introduction to oscillating tools and a review of the Bosch PMF-180 E, available in Europe and Australia. Part 2 covered a review of the Dremel 6300 Multi-Max, available in the USA only. Part 3 covered the Fein MultiMaster FMM 250 Q, which is available internationally. This final part will cover a comparison of the three tools.

As a quick summary, oscillating tools are primarily designed for sawing soft metals, wood and plastics, for dry sanding of surfaces, corners and edges, for scraping, and for grout removal using the applicable accessories. The tools do their work by imparting a high-speed rotary oscillation through a small arc of around 3 degrees to the cutting blade or

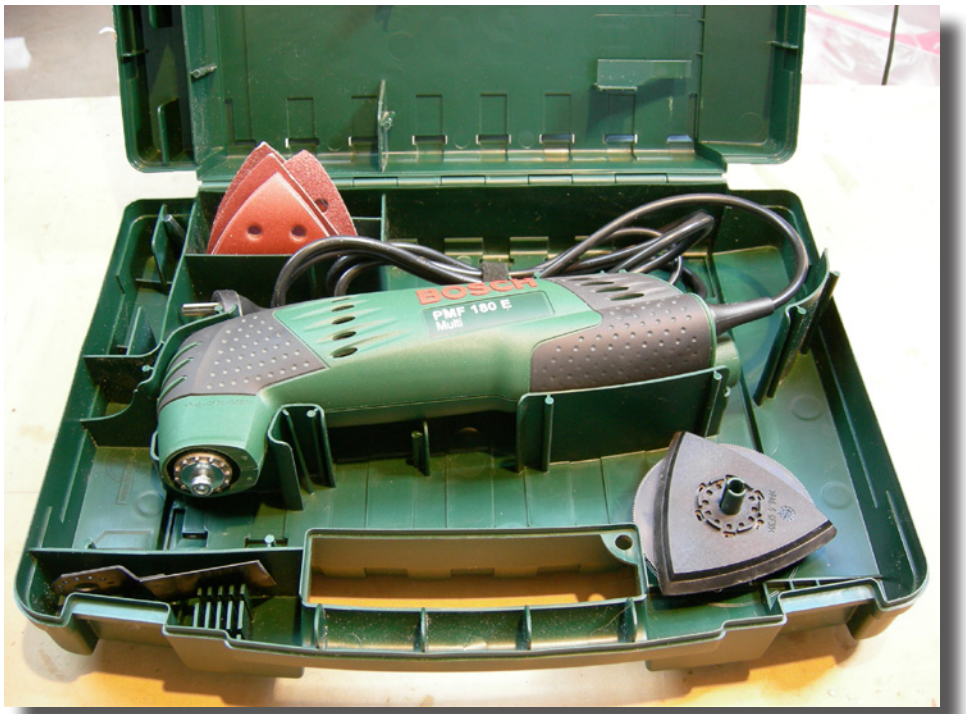


Photo 1. Bosch PMF-180 E,

Photo 2: Dremel 6300 Multi-Max

Photo 3: Fein MultiMaster FMM 250 Q

sanding disc. This makes it much safer to use than circular or reciprocating saws, whilst also allowing more accurate control of the cut.

The saw blades have an offset, making it possible to make flush cuts, and saw close to edges, in corners and hard to reach areas. Another advantage is that it is easy to make a plunge cut through the material without first having to drill an access hole for the blade.

It is important to let the tool do the work, which also makes it easy to guide the tool. This results in smooth cuts and minimal 'fringing' when cutting across the grain. Excessive pressure will result in poor handling and vibration.

Fein pioneered the oscillation technology, and has been refining it over that past 40 years. As a result, the Fein range of accessories is vast. For example, it includes a table and drill stand support which allows you to clamp the tool to a table or workbench, or alternatively allows attaching the tool to drill stands with a standard 43mm collar diameter. Another useful accessory is the depth stop, which allows the depth of the cut to be more easily controlled.

The Fein Multimaster FMM 250 Q tool is heavier than both the Dremel 6300 Multi-Max and the Bosch PMF-180 E. It is aimed at the tradesman and more heavy duty use, and therefore also more expensive. The vast range of accessories available also ensures that the tool can do a multitude of tasks. For example, the fine cutting set is great for hobby projects requiring smaller plunge cuts and narrower filing than is possible with the Dremel and Bosch attachments reviewed. However, both of these models were only introduced fairly recently, so more attachments can be expected.

The Dremel tool is smaller than the Bosch and Fein Multimaster, and therefore easier to control. It also vibrates less and makes less noise. These factors make it a good choice for finer work.

Both the Fein and Bosch offer dust extraction. This is built-in on the Bosch, allowing a shop-vac to be simply attached to the extraction port at the rear of the tool. On the Fein the dust extraction attachment clips underneath the tool. Both tools have holes in their sanding pads to facilitate dust extraction while sanding.

The Q versions of the Fein range have a quick release action making it very quick and easy to exchange accessories. Flipping the quick clamping lever forward over the tool releases the fastening pin/ element, which then just slides out. The accessory is secured by reinserting the fastening pin through it, aligning the accessory on the star-shaped tool holder, and flipping the quick clamping lever back over the tool. This action clamps the accessory securely. The Dremel has a semi quick release, whereby the accessories have a 'C'-shaped opening allowing them to be exchanged without fully removing the Allen bolt which secures them.

Although not reviewed, both Bosch and Fein have cordless models in their range.

In conclusion, I hope that the reviews in the first three parts of this series and the summary above will make it easier for the reader to choose the tool most suited to their needs. If budget is not a constraint, and you need the large range of accessories that the Fein offers, or a heavy duty tool, then the Fein is for you. Both the Dremel and Bosch are aimed more at the hobbyist / home handyman and therefore less expensive. No doubt the range of accessories being offered by these two will increase, especially considering that Dremel is known for it's extensive range of accessories for its tools. Oscillating tools are amazingly versatile while being much safer to use than tools with rotating or reciprocating attachments and allow a much greater degree of control. Every hobbyist should have one!

Technical Data

	Bosch PMF-180 E	Dremel 6300 Multimax	Fein Multimaster FMM 250 Q
Rated power input	180W	~180W	250W
Output power	73.5W	(Not available)	130W
No load speed	15,000 — 21,000 rpm	10,000 — 21,000 rpm	11,000 — 20,000 rpm
Oscillation angle, left/ right	+/- 1.4 degrees	+/- 1.5 degrees	+/- 1.6 degrees
Weight	1kg, 2.2 lbs	~900g, 2 lbs	1.2kg, ~2.6 lbs

AN INCOMPLETE HISTORY OF RC RADIOS

by Pete Carr WW3O, wb3bqo@yahoo.com

Back in the mid Sixties I attended a sailplane contest at Foustown Park near York Pennsylvania. The impound area was very large and contained just about every transmitter I'd seen advertised in model magazines. In those days, American manufacturers ruled the hobby. These were the latest and greatest of the RC world and the sight of all those wonderful transmitters is still fresh in my mind.

Many of the transmitters of the day had stick assemblies that were originally developed for the military as controls for radar sets. These early sticks were mechanically poor and the variable resistors used with them were not reliable.

As things progressed the question of servo resolution became a critical issue. Some resolution problems were traced to play in the stick assemblies and some had to do with noisy carbon potentiometers.

It quickly became clear the ProLine radio had the best sticks in the business. In my personal opinion and 40+ years later, I still feel that they are tops.

Obviously, servo strength and centering also improved dramatically, which also helped the resolution issue. Still, it was the Proline and the way it felt in your hands that inspired flying confidence.

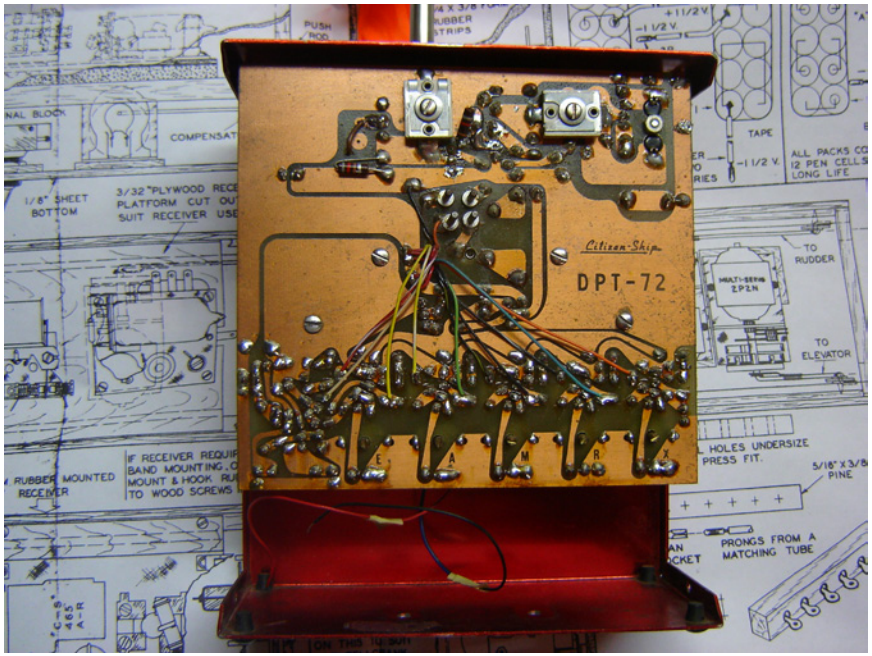
I actually started out in RC with a 4-channel Citizenship radio that was of the reed/tone type. This multichannel rig used different audio tones controlled by switches on the front of the transmitter case. These tones keyed a reed relay in the aircraft to activate servos.

For example, one tone was "up" elevator and moved the elevator servo to full up position, another tone would be "down" elevator and so on.

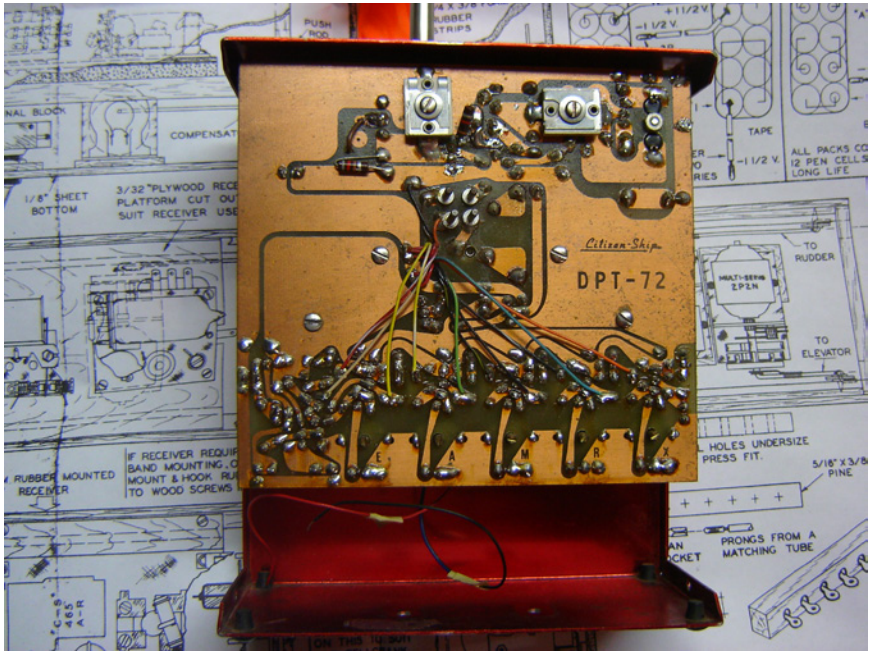
Pilots of the day could be seen pulsing the switch of the transmitter to step a servo partially toward full deflection. It took some fast fingers to be smooth in the air.

My transmitter had a switch that controlled a separate elevator trim servo which was mechanically connected to the elevator.

All these servos were the size of a pack of cigarettes and it took four of them to operate a "three" channel aircraft. From these humble beginnings it's easy to see how amazing the equipment in that Impound area was to me.



This is a Citizenship digital proportional transmitter that works. The sticks are very sloppy and the trims have very little throw but it was a big step up in performance from Reed control. Servos were about the size of a pack of cigarettes and were linear with wire wound position pots.



The circuit board of the Citizenship had trim caps to adjust RF output to the antenna and Master Oscillator-Power Amplifier (MOPA) RF stage tuning. Otherwise there isn't much to tweak.

After the visit to York I graduated to a World Engines 5-channel radio. At the time there was no 72/75 MHz RC band. You either flew on Citizens Band or got a Ham ticket and operated on 6-meters (53.xx MHz).

I got a ticket and purchased the Expert on 53.3 MHz. There was no Frequency Modulation (FM), so everything used Amplitude Modulation (AM). The World Engines servos that came with the radio were amazingly small and light. I was sure that RC systems had reached their limit and could not possibly get any better! Wrong!

I still fly quite a bit of stuff on AM modulation. In range tests I've found that AM has decidedly better range than FM. Most pilots don't need that amount of range, but it's nice to have. Right now the limits of my sailplanes' range is related to vision, not radio, so I just go and build bigger sailplanes.

Kraft radios were the favorite of the Pattern people and there is no doubt that the reputation was well deserved. From time to time I would notice older Kraft transmitters on Ebay that used the old 72 MHz band plan frequencies (pre narrow band). I bought several and converted them to 6-meters with Ace Silver Seven receivers. They are still operating today and are a joy to fly.

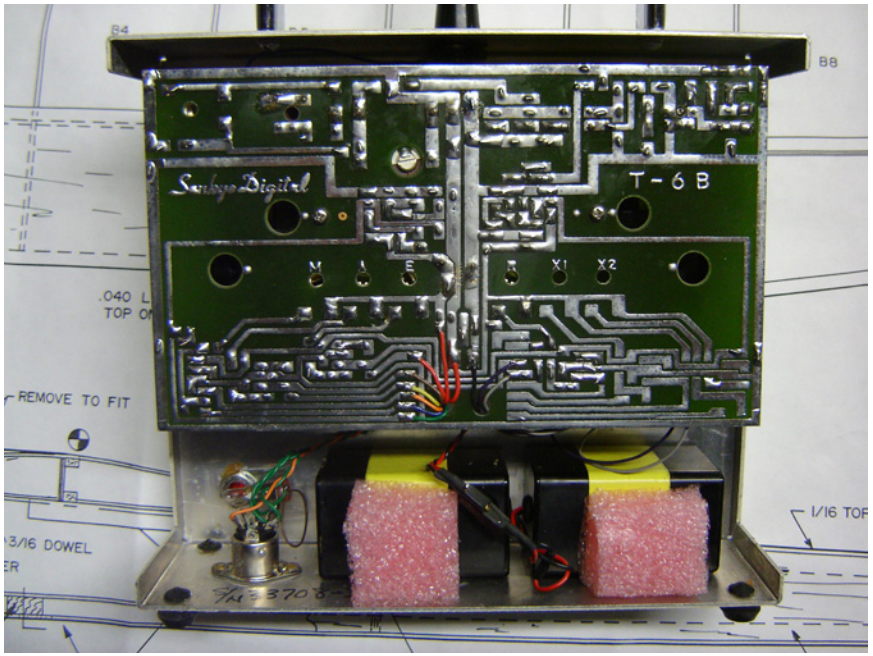
Curiously, there is a resurgent interest in single stick transmitters. Many of the

people who are Yahoo MP8K Group members are building transmitters with modern mixing encoders and single stick assemblies. It was my impression that the purpose of the rudder knob was to allow mixing of rudder with aileron for Pattern and general flying before mixing became available. With today's mixing options it would seem that single stick rigs would not be useful. I also remember that the weight of the knob combined with the low tension springs of the day would allow the stick to flop around if you let go. Anyway, these builders are having a ball with these rigs which show amazing quality of workmanship.

Years ago I was drooling over ProLine radios on Ebay and wishing that I knew how to reverse their pulse polarity to work with Ace SS receivers. About that time I was given an Ace MicroPro 8000 transmitter that had burned up. The original owner, who shall remain nameless, had dropped a jewelers screwdriver into the open back of the box and the NiCad had gone Nova.

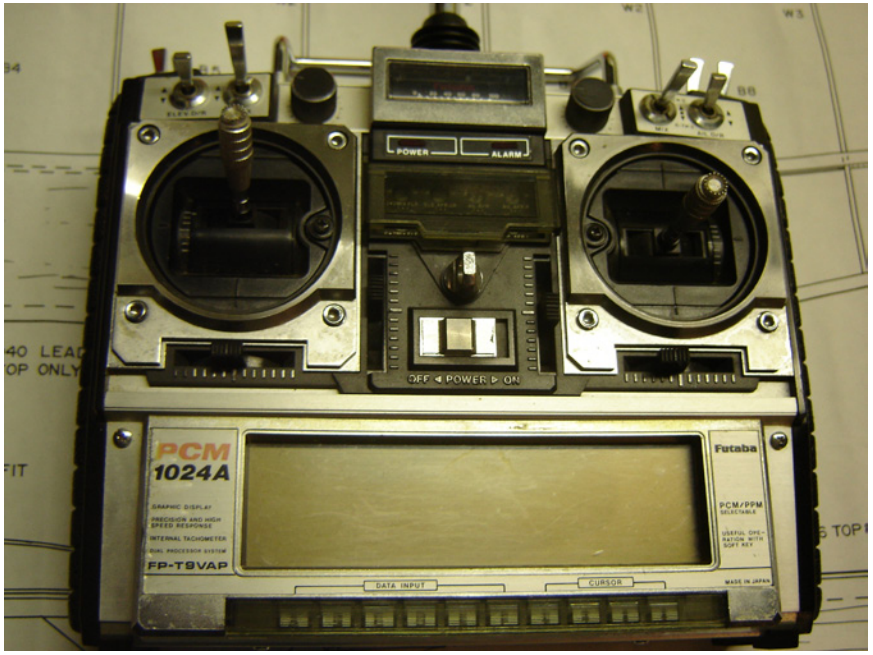
I put out a call on the internet for info and schematics and Skip Schow of the Washington DC area sent me some original manuals. Skip, a pioneer RC pilot and all around good guy, also hosts the Cumberland Soar-for-Fun each Fall at Cumberland, MD.

By comparison this is the circuit board of a Royal Apollo transmitter. There are throw adjustments as well as RF tuning. The layout is similar to the Citizenship except that the 4-pin connector of the on-board charger of the Citizenship is missing on the Apollo.



The Royal Apollo was the first plastic clad transmitter case I remember. The layout of the controls are similar to the inexpensive Krafts and the sticks are still very good. This example operates on (Green) 27.195 MHz.

This is a Series 73 Kraft transmitter that is similar to the Apollo in controls placement. This example has been stripped and houses a MicroStar 2000 encoder with FMA RF deck on 50.960 MHz. The very long antenna combined with very careful tuning of the RF gives this transmitter exceptional range.



This is a Futaba 9VAP. It claimed a 1024 resolution for the system which the Pattern people appreciated. It was my first FM rig and is still in front line service today. Futaba had trouble with the paddle switches breaking off and I've replaced two over the 20 years since this old workhorse came to my hanger.

I learned a lot from working on the MicroPro, including the pulse inverter IC chip that could make a ProLine transmitter work with Ace SS receivers. The MicroPro is still a legend today for its ease of programming and exceptional sticks.

Because of AM modulation, larger sailplanes had to use an "ACE Noise Trap" to keep long servo leads from bringing interference back into the receiver. The IC chip would invert the pulse polarity going toward the servo and then invert it again. Signals coming toward the receiver were blocked by the chip.

I adapted the chip to invert the polarity just once and installed it between the encoder and the RF deck in the ProLine. That set up the ProLine to operate with Ace receivers and servos. Later, there was a chip called a Miller Integrator that did the same thing.

After solving the pulse issue I set about rebuilding several ProLine transmitters. Some had open gimbal sticks while others looked sort of like the cheaper Kraft units. Some had separate RF decks while others had the electronics all on one board.

Some of these transmitters were converted to use Ace SS encoders and RF decks while others were switched to 6-meters by changing the RF section inductors and caps and replacing the

crystal. In these cases it was possible to feed the antenna with a blistering 0.6 watts of RF.

Another nice feature of the Krafts were their very long antennas. Hams will agree that there is no substitute for metal in the air when it comes to range. In fact, when it came time to build a MicroStar 2000 encoder I chose a Kraft case with its 48 inch antenna and FMA FM RF deck on 50.960 MHz to use with it. The range of this system is better than any I've ever flown.

About 20 years ago Futaba was giving out half-off certificates to be used as contest prizes. I was fortunate enough to win one and promptly ordered a 9VAP system. This was my first FM radio and I was prepared for some range trouble. It didn't happen. I also noticed that the 600 mAh battery in the 9VAP would last about half as long as my other rigs. The current draw of the 9VAP was over twice as much as non-computer radios. I suspect that the early model computer chips draw a lot of that power but also suspect that the RF module has a stronger output.

In any case, I am very pleased with the sticks and the switch positions. I am not very pleased with the programming after working with the Ace MicroPro.

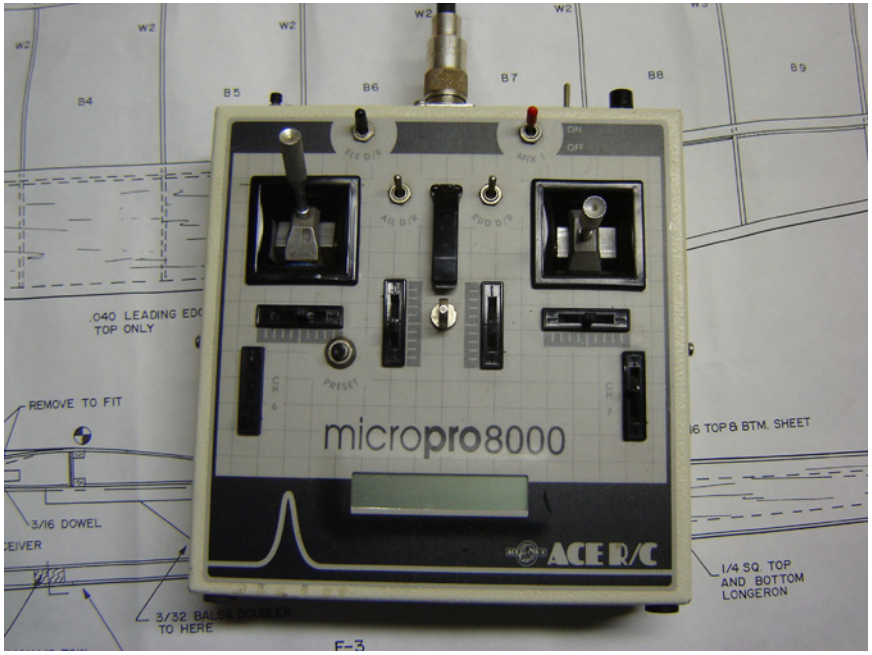
Whole books have been written about how to program the 9VAP for CROW

A World Engines Expert Transmitter with more than 4 channels! The RF output was quite low and I would regularly fly my Sailaire out of range with the W.E. on board. It is on 53.3 MHz and is easy on the battery because of the low RF. It still performs well if used in smaller ships where range isn't a problem.

This is a Kraft Series 80 with the open gimbel sticks. Comments on Yahoo Groups for MP8K mentioned that the stick plastic would break over time. I'm still waiting.

This example was bought on Ebay and converted to 53.4 MHz AM. It performs exceptionally well with electric powered sail-planes using an ACE Silver Seven receiver.

This Kraft Series 78 transmitter is a 6 channel unit with the dual meters. It came from Ebay in very poor condition but the sticks were fine. It now has an ACE Silver Seven encoder with ACE RF deck on 53.5 MHz AM and a Silver Seven receiver. It's currently operating in a Spirit of Yesteryear electric sailplane with brushed motor.



This MicroPro 8000 transmitter was my first computer radio. It came to me from a fellow modeler who had fried the innards. I rewired the damage and have learned a lot about mixing from its excellent manual. It runs on 53.3 MHZ AM with several Silver Seven receivers.

and such. I still fly the 9VAP, but dread setting up a new ship to operate with it.

There are radios that I never got to fly, such as the Simul-Logic, the DeBolt Propo rig, and one from C&S in a green case.

The man-sized parts, through-hole construction and beefy circuit board traces gladden my heart.

A vigil is maintained on the various web sites in hope that an example of these radios will appear. Each one would fill a hole in my incomplete history of RC radios.

At present I'm building a DeBolt Champ for electric power that will be guided by the Royal Apollo rig on 27.195 MHz. The plans for the Champ are the backdrop for many of the pictures in this article. Of particular interest are the diagrams for the radio installations of the day (1955), both single and multi-channel. The plans indicate that *radio* weight should not exceed 32 ounces! The plans came from Tom Dixon Plans Service and are available by mail.

The Proline Competition Series transmitter was a top shelf unit in its day. The metal sticks were the best in the business. I like flying this unit except for the trims at the case corners. That's where I grab the transmitter to pick it up and bump the trims. They are wheels so I need to carefully reset them before each flight.

This Proline 5-channel was modified with a pushbutton for spoilers. Since there is no mixing I found that deploying spoilers by a switch rather than throttle made elevator adjustments more predictable. I also added an LED above the on-off switch so I'd be prompted to turn the transmitter off.

References

Yahoo Groups:

ACERC; devoted to any of the ACE R/C products and kits.

ClassicRC; devoted to single channel, pulse, galloping ghost and reed systems.

MP8K; devoted to the MicroPro 8000 and MicroStar 2000 encoders and homebuilt transmitters.

AUFWIND TUN GPS-EuroCup

<http://www.gps-eurocup.ch>

This contest is known for two years in Switzerland as the RCS-GPS Swiss Cup and is now extended to any country where we can find people willing to organize triangle flight contests.

The ranking list will be international and the companies AUFWIND Magazine and TUN Modelling Switzerland have provided a beautiful trophy that will be assigned for one year to the winner of the season.

The Goal of the GPS-EuroCup is to establish an international ranking list of all triangle contests in Europe.

This will improve the fellowship among pilots as well as the attractivity of such contests.

Any pilot of a large scale model glider may participate at the GPS-EuroCup through taking part at one or more contests of triangle flight as described on this Website.

For each participation at such a contest there will be points assigned to the pilot depending on his ranking and the numbers of flights with 1000 points. The pilot with the the best flight of the day will get additional points. Assigned points are depending on the number of participants per contest.

The calculation of the international ranking list is done according to the documentation in the rules section of this site. Per pilot the best three results of one season are taken into account to determine the annual ranking list.

The winner will hold the „GPS-EuroCup“ for one year. This Cup is sponsored by the AUFWIND Magazine <http://www.aufwind-magazin.de> and TUN-Modellbau Switzerland <http://www.tun.ch>.

NOTE: The Skynavigator GPS and other electronics for this event are available from Icare Sailplanes and Electrics <http://www.icare-rc.com/skynavigator.htm>, sales@icare-rc.com.

AUFWIND Das Modellsportmagazin für Segel- und Elektroflug

TUN

GPS TRIANGLE Eurocup

F3

Rules for Triangle Flight with scale Gliders

RCS-GPS

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1. Definition of Triangle Flight with scale gliders

1.1. Purpose and goals

This kind of contest means a new challenge for pilots of scale gliders. After an aero-tow to any flight level, the task consists of attending not more than 500 m above ground and then soaring as many times and as fast as possible around a virtual triangle having an extent of 2.4 km within a time limit of 30 minutes. In order to raise the attractivity, one ore more flights can be declared as „one-round only speed flight“: all pilots will fly exactly one round with the highest possible speed.

The basic ideas of the contest are:

- A high degree of activities (aero-tow, landings, many gliders in the air at the same time)
- Each pilot should spend much time „in the air“ during a contest
- Attractive flying (speedy flights over target line)
- A broad range of tactical decisions to take
- Good teamwork of pilot and navigator
- Development of flying skills as well as performance of the gliders
- clear and simple rules of competition
- simple competition organization with only very few aids

1.2. General regulations

For the execution of the competition the technology of the satellite navigation with data communication from the model to the pilot is used.
Thus and using a datalogger the position of the glider can be determined and verified at any time. This simplifies both the flying operations and the evaluation of the flight.

Every pilot uses an equipment compatible to the commercially available system „Skynavigator Version 3“ with the software releaselevel 1.5.4.1.
The equipment must give information immediately after the flight about:

- Starting Time
- Task entry height
- Task entry speed
- Flight time (measured from the moment the glider crosses the starting line until the last triangle is completed
- Number of triangels
- Speed, at which the triangels were done

Additionally, the software must generate a checkcode. This checkcode is generated from the data above and will ensure there are no errors in copying the information from the Pocket PC to the flight card and from there into the PC doing the evaluation.

Per model only one navigation/telemetry system is allowed, the additional use of variometers such as Piccolario or Skymelody is prohibited.

2. Glider model and technical equipment

2.1. Definition of the scale glider

For this kind of competition each scale glider being in accordance to the specifications in 2.2 may be used.

2.2. Specification of the scale glider

Principle: the original airplane must be clearly recognizable.
Each pilot determines the scale factor of his model, this factor must not be bigger than 1:3 .

The following values are computed in relation to the scale factor indicated by the pilot; they must be true to scale within the indicated bandwidth:

Value	Max deviation in mm on model	Remark
Fuselage width	15 mm	Measured at the thickest point of the fuselage
Fuselage height	15 mm	Measured at the highest point of the fuselage
Wing chord	15 mm	Measured at the wing fearing, drawing an imaginary line from the trailing edge of the wing to the fuselage
Wing span	100 mm	The number of trapezoids of the wing must correspond to the original airplane

Although there is no building evaluation during the contest, each pilot must be able to prove that his model is in accordance to the above specifications. For this a 3-view drawing with measure indications of height and width of the fuselage, wing span and wing chord is sufficient.

2.3. Number of model gliders per pilot

During a contest each pilot may use not more than two gliders. These gliders, labelled A-Model and B-Model must have a unique identification label on them (for instance HB-xxxx). The labels have to be noted on the starting card and for each flight the pilot must check the plane used. The glider used for the Speed-Round must be used in a least one other, normal round. If this isn't the case, the Speed-Round will be evaluated with zero points.

Replacing, adding or removing of parts of the wings in between the rounds is not allowed. Adding weight (water …) is limited to 2 kg.

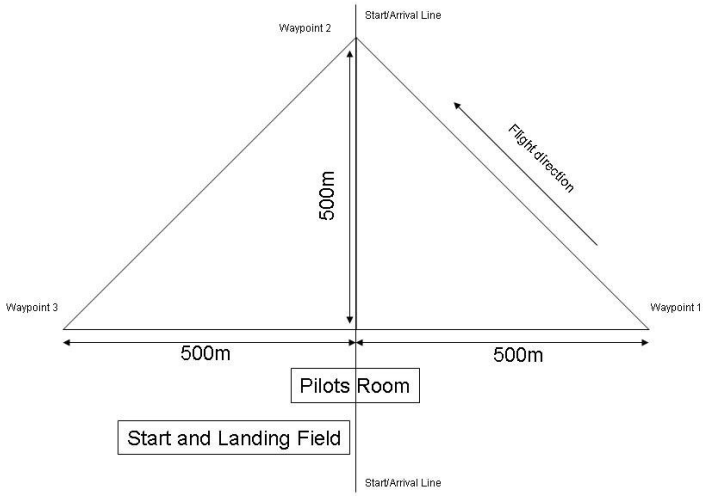
2.4. Navigation / Logger

Navigation during a flight is done using a system being compatible to „Skynavigator Version 3", software release 1.5.4.1 This system sends GPS-data at least twice per second from the model to the pilot or his navigator and fulfills the following additional conditions:

- The performance of a flight (number of triangles, entry height, speed over all triangles) can be determined immediately after landing using the receiver equipment of the navigator
- Additionally there is a logger in each glider being capable of delivering an IGC-compatible file for evaluating the flight. As an alternative, the logging can also be done on the pocket pc.
- It is not permitted to couple the GPS-receiving unit with the transmitter of the pilot
- The frequency range of the GPS-transmitter in the glider must be in between 433.875 and 434.650 MHz. It should be selectable in a 25 kHz step in order to avoid disturbance between pilots flying at the same time.

3. Flying field

The flying field with the virtual triangle is as follows:



There should be no obstacles within or near the triangle. Starting / arrival line must be on one end of the landing field.

4. Organisation of the contest

4.1. General rules

4.1.1. Contest organisator

The contest organisator provides the following personnel:

- Contest director: responsible for the whole contest
- Flight officer: responsible for coordination of departures and control of landings. Every pilot having finished the official task will announce his landing. The flight officer will confirm the correct landing procedure (see 5.4.2) on his controlling-list.
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- Evaluation officer: responsible for entering the flight results and establishing intermediate and final ranking lists
- Jury: three persons well knowing this contest rules and being able to decide in cases of doubt or problems.

Photos from the Krnov 21-24 May 2009 and Müswangen 24-25 May 2008 events, available from the GPS Cup web site <http://www.gps-eurocup.ch/Bilder/Bild.htm>

4.1.2. Pilot, Navigator, Aid
The participants of a contest are divided in groups of two.

Per group one competitor is called pilot „X“, the other is pilot „Y“. Such a group is considered being a “pilot / navigator team”: whenever X is flying, Y is his navigator and vice versa.
For preparing his flight every pilot may use an additional aid. The aid may prepare for the tow until the glider lifts off. From this moment the aid has to leave the takeoff / landing field and he may not stand in the pilots zone.
At any time only the pilot himself is allowed to operate the transmitter.

4.1.3. Radio frequency control
Only frequencies authorized by the local authorities may be used (Switzerland: BAKOM). The contest director is responsible for an appropriate frequency control system und takes care that the steps between channels used by the pilots are bigger than 10 kHz whenever possible. It is also adviced to control the used frequencies with a scanner device.

4.1.4. Navigation system frequency control
The contest director assigns a frequency to be used to each pilot/navigator team. The competitors are responsible of using only this frequency and it is recommended to do this according to a “4-eyes-principle”: pilot X controls the settings of his teampartner pilot Y and vice versa.

4.2. Flight process
4.2.1. Definition of the contest
An RCS-GPS contest consists of at least four runs, one of them being the Speed round. If there were more than four runs then the worst result of each competitor is not taken into account for the final ranking list.

4.2.2. Definition of a run
In each run any of the member of the pilot/navigator team is once flying and once navigating. For the flying pilot, a run consists of one or more tries according to 4.2.3 followed by the official flight.

4.2.3. Definition of an attempt
An attempt starts with the takeoff of the glider. The attempt is completed if the glider is aerotowed up to a height of more than 500 meters over ground level.

4.2.4. Repetition of an attempt
An attempt may be repeated if it could not be completed, this means if the aerotow was interrupted due to any reason in less than 500 meters over ground. There is no limitation about the number of repetitions, but after the first attempt nothing may be modified at the model. This applies to all mechanical and electrical components of the glider and the navigation system.
Pilots wishing to repeat their attempt muss announce this 15 seconds after interruption of the aerotow to the flight officer. The glider must land within 4 minutes and must immediately be put into the flight line after landing.

4.2.5. Definition of the official flight
Whenever the attempt is completed, the pilot must start the official flight by crossing the starting line in no more than 500 meters over ground. If the pilot crosses the starting line in more than 500 meters he may accept a penalty or re-cross the starting line in less than 500 meters.
Each pilot can do only one official flight per run.

5. Flight task and scoring

5.1. Preparation
The contest director assigns a departure time as well as an ending time per round (Flight Window) and communicates it at the briefing. All pilotes must cross the starting line within the timeslot the Flight Window defines, i.e. flights with a starting time after the closing of the Flight Window are not valid. The size of the Flight Window for a standard round is computed according the formula:

Flight Window size = (Number of Pilots X 2) + 30 Minutes

For the speed round the Flight Window size is:

Flight Window size = (Number of Pilots X 3)

Five minutes before departure time all pilots and gliders are ready for takeoff. The gliders are lined up in a flight line all ready for the aerotow. The navigators have initialised and tested their GPS-receivers.

5.2. Flight task and flight time
There are two types of rounds:

At least one round per contest is declared as the speed round. The task of the official flight consists of flying exactly one round with maximum speed. The flight director defines the number of speed rounds according to weather conditions.

All other rounds the task of the official flight consists of flying around the defined triangle as many times as possible within 30 minutes. The direction is always counter clockwise. The flight time of 30 minutes begins after crossing the starting line. The pilot should land his glider not more than 5 minutes after the end of the flight time.

5.3. Scoring
The score is computed following the number of completed triangles and the evaluation of the landing. A penalty resulting from crossing the starting line too high or too fast is deducted from the score.

5.3.1. Score per triangle

Every pilot gets 200 points per completed triangle. If there is more than one pilot in a round having the same number of triangles, the points for the last triangle are assigned as follows:

- Only the pilot with the highest speed over all his triangles gets 200 poins
- The pilot with the slowest speed over all his triangles gets 100 points
- All other pilots get points between 100 and 200 in accordance to their speed relative to the fastest pilot

This rules apply also to the speed round, where every pilot does exactly one round.

5.3.2. Landing score
For rounds declared as speed round there are no landing points.
For all the other rounds, the pilot gets 300 points for the landing if the following conditions are fulfilled:

- First touching point of the glider is on the designed landing field
- The point where the glider stands still is also on the designed landing field
- The model glider landed like the original: if the original airplane has a landing gear, then the model must land with the landing gear out.
- The model landed in the direction stated by the contest director at the briefing

If one of the above conditions is not fulfilled, the pilot is assigned 100 points for the landing. If there is more than one condition not being fulfilled or if the glider is not capable of flying without mechanical repair after landing, the pilot is assigned zero points. If the retractable landing gear fails while landing or if it does not pull out, then the landing is assigned 100 points provided the other 2 conditions are fulfilled

The contest director defines rules for the landing approach during the briefing. After crossing the target line for the last time, the pilot must fly a 180 or 360 degree turn and land in the appropriate direction. If a pilot does not follow these rules he may be assigned 100 points for the landing provided all other conditions are fulfilled.

If for security reasons the flight director told a pilot to land his glider outside the landing field, the two conditions regarding touching point and stand-still point are considered as fulfilled.

5.3.3. Penalty
If the glider crosses the starting line in more than 500 meters over ground or with a speed higher than 120 km/h, the pilot gets a penalty as defined:

- 50 points plus (height – 500) * 2 points + 2 * (speed – 120)

This penalty is deducted from the score of the corresponding flight.

5.3.4. Evaluation of the results
There is a separate evaluation for each round of each run. The evaluation is normalized to 1000, this means:

- The pilot with the maximum number of points per round gets 1000 points
- All other pilots of the same round get points in accordance to their result relative to the winner of the round

Score = (points of competitor * 1000) / (points of winner of round)

For every round there will be a ranking list on a base of 1000 points, i.e. the participant with the highest score (triangels + landing – penalty) gets assigned 1000 points.
The evaluation program separates the pilots automatically into groups according to their task starting time. Within one group there is not more than 20 Minutes of difference in the starting time; thus we make sure that all pilots of one group have the same weather conditions.

The winner of the group, where the most rounds were flown, gets 1000 points. All other pilots of this group get points according to the formula:

Evaluation = (Points x 1000) / (Points of winner)

The best pilot of the group having accomplished the second most number of rounds gets 950 points. The other pilots of this group get points according to the formula:

Evaluation = (Points x 950) / (Points of group winner)

All other groups created due to the time differences of the starting times are treated in the same way:

Evaluation in Group n =
(Points x (1000 – (n-1) x 50)) / (Points of winner of group n)

5.4. Intermediate score and final ranking list
The contest organizer creates an intermediate scorelist after each round. The addition of all rounds per pilot gives his final result. If there were 5 or more rounds, the worst round per pilot is omitted for the final evaluation.

WINDLORD XC

Ken Bates' Standard Class 'wing gains ailerons and is enlarged to 128"

Ken Bates presented his Standard Class Windlord in the March 1978 issue of *Model Aviatio*n, the US Academy of Model Aeronautics (AMA) magazine. The 100" span model utilized rudder and elevator controls with the option of lower surface flaps. Despite what some perceive as shortcomings inherent in the plank planform, Ken campaigned the Windlord for a full season and came in third in the point standings.

The *Model Aviation* construction article devoted nearly half of its text to explaining how the plank planform works and how Ken resolved the problems evident in the preliminary designs.

Ken recently posted a build thread for the original Windlord on RCGroups < http://www.rcgroups.com/forums/showthread.php?t=578473> and plans are still available from the AMA as set number 215D. If you are an AMA member, the March 1978 issue of *Model Aviation* is available for viewing and printing through the *Model Aviation* archives in the "Members Only" section of the web site.

We've had our set of Windlord plans for more than twenty years, and in fact did build a 2M version with ailerons immediately upon receiving the plan set. That was in the days when we were building small gliders.

We've wanted to build an enlarged version with the FAI maximum wing area for some time, and after completing a joint building project with our younger granddaughter decided to start construction. Our hope is to have this monster in the air well before the Visalia Fall Fest in early October.

As is usual with our construction projects, we'll be incorporating some modifications to the airframe from what's illustrated within the original plans and described in the construction article.

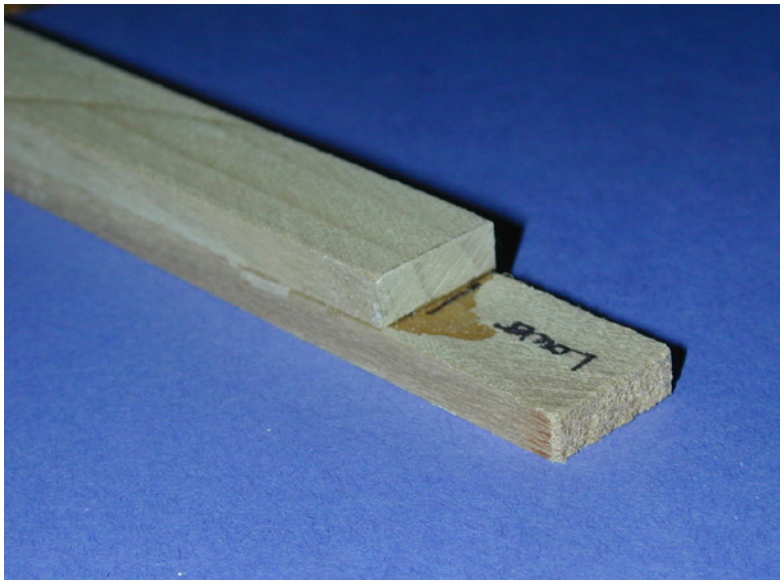
Following a suggestion by Ken in his RCGroups construction thread, the rudder horn will be eliminated. We did this on our 2M version without adverse effects.

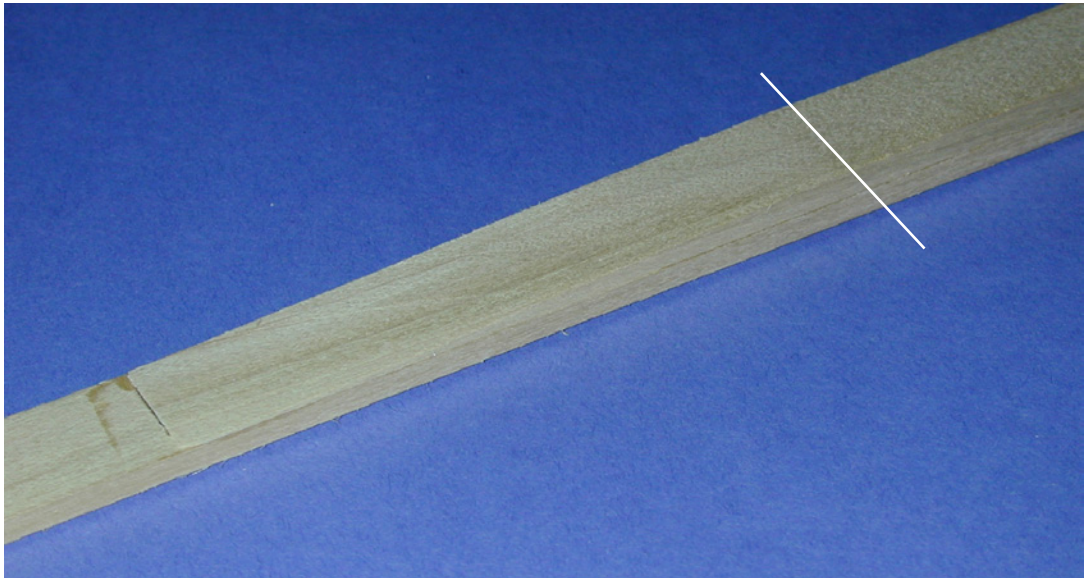
We'll be adding ailerons to this version of the Windlord as well, using the same proportional span as on the Windlord 2M. The elimination of some rudder area is going to make it more difficult to inhibit adverse yaw without increasing rudder throw, so we've increased the aileron chord slightly to accommodate a Frise-type aileron structure.

Because of the deep fuselage, a bridle and two wing-mounted tow hooks are recommended. In his RCGroups build thread, Ken notes that the various commercial releasable tow hook mechanisms are no longer available. Ken custom-made a mechanism for mounting inside the fuselage for his RCGroups build. We'll use wing-mounted releasable hooks made from extruded aluminum stock.

The rudder servo will be mounted in the fuselage; all other servos (elevator, aileron, flaps) will be mounted within the wings.

This installment will cover the beginning of the construction process, including fabrication of the spar caps, forming the wing joiner rod, cutting out the ribs, and





Example of typical spar cap. Left: The main spar is about at inch longer than the doubler glued to it. The extended length will be cut off, but will be used to fix the spar to the building board during construction. Right: The spar doubler is tapered over the last five inches to eliminate the stress riser. The taper starts in the area of the white line.

designing and building the releasable tow hooks.

Let's start with the spar caps. Because they are 56" in total length, hobby shop spruce is too short. We traveled to our local Home Depot and picked up a six inch width of one inch poplar six feet long.

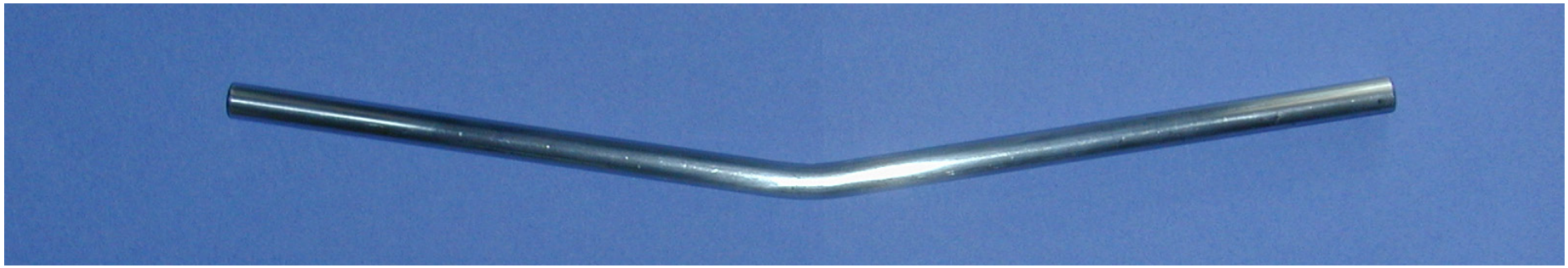
At home, we used various thicknesses of balsa sheet to set a slight angle into the board as it rest against the table saw fence. After running the board through the saw, we had a piece of wood 3/4"wide, six feet long and slightly greater than 1/4" thick at one end and tapering to near zero thickness at the other end.

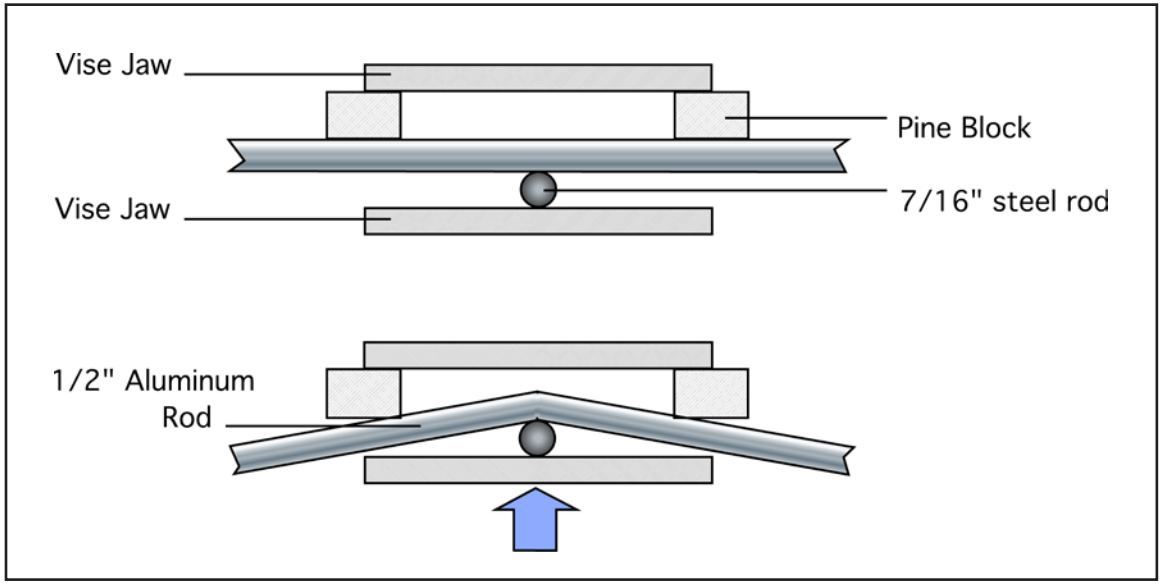
By taping this piece onto the edge of the board in the same orientation, we were able to cut a second spar cap of the same dimensions. By exchanging the orientation of that first spar cap appropriately, we were able to cut a number of fairly consistent spar caps quickly.

After sawing up the entire board, we went through the caps and picked out two pairs of two identical caps. One pair, very slightly thicker than the other, is to be used for the upper spar caps, the other pair for the lower caps.

We then went through the caps again and picked another two pairs which matched near the root. These four caps were cut off at a length of 20" and the last five inches tapered from the 1/4" thickness down to zero thickness. These serve as spar cap doublers at the wing root and are bonded to the full length spar cap with West System 105/206 epoxy using long steel blocks for pressure.

The original Windlord used a 1/4" music wire wing rod. This rod was straight and angled downward through the wing spar system so dihedral could be incorporated without bending the rod. For our XC version, the wing rod is a 16" length of 1/2" diameter ASTM-B-221 6061





Above: The formed wing rod. The bend is sharp enough that a 1/2" inside diameter brass tube slides to within 3/8" of the center.

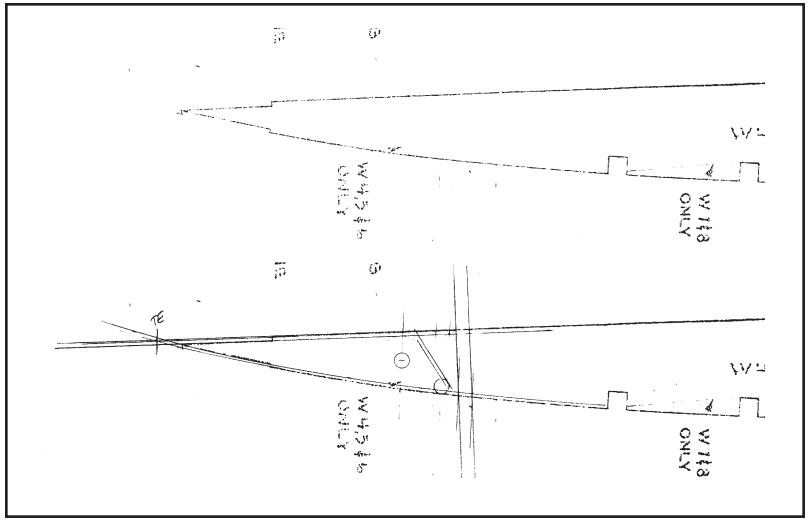
Left: Using a vise, pine blocks and a steel rod, the 1/2" 6061 aluminum rod is bent to the proper dihedral angle. Make sure the vise is of the "heavy duty" type, as pressing the angle into the rod takes a lot of force.

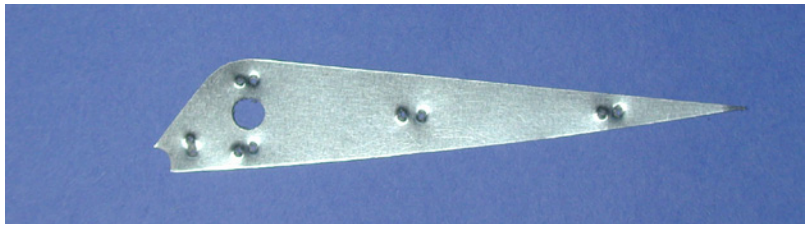
aluminum bent so the angle provides 3/4" height at a distance of 5" from the center. This angle was bent into the rod using 3/4" pine blocks, 7/16" steel rod and a vise. The resulting bend is sharp enough that 1/2" ID brass tubing slides to within 3/8" of the bend point.

We're planning to affix the wing rod within the fuselage with a latching system so it can be removed and replaced with relative ease. Within the wing, the rod is held by a 1/2" inside diameter brass tube which is a near match to the interior distance between the spar caps.

Unlike some of our other projects which required a large number of rib templates, there are only three different rib profiles for the Windlord. This makes rib template construction go quickly. The only additional wing part template is the one used for cutting out the ailerons.

All wing ribs are cut from 1/8" balsa sheet. The aluminum templates are notched for spar location, not depth, and so each rib will need to be notched for the appropriate spar cap depth. There are two sets of sub-spars — one which forms the trailing edge of the main wing panel in the area of the elevator, and one slightly forward of that which extends from the wing root out to the end of the aileron. The ribs located in front of the





Left: All of the wing ribs cut out — 22 "standard" ribs, two for the rib separating the elevator and aileron, a shortened rib for the wing tip, and the D-tube ribs which extend from the leading edge to the spar. Upper right: The initial sketch of the Frise-type aileron rib design. Lower right: The aluminum sheet aileron template.

elevator have a 1/8" vertical slot for the aileron spar.

The template for the ailerons is a fairly simple affair in that it matches the contour of the wing trailing edge with incorporation of a rounded upper surface which matches a wiper built into the wing, and an angled leading edge which extends below the wing surface when the control surface is deflected upward. A 1/4" diameter hole is drilled in a spot central to the upper surface curve for insertion of an aluminum tube which will act as the base for the hinge axle.

We built a small fixture out of pine blocks to assist in drilling the hole for the aluminum tube. This was set up in the drill press using the aluminum aileron template, then three or four ribs at a time were stacked up and drilled at the same time. Worked great!

The releasable tow hooks are being constructed using extruded aluminum channel normally used to edge 1/4" plywood. This aluminum channel is relatively easy to machine and provides an internal width sufficient for the bridle tow ring. The channel is machine screw mounted to an internal structure consisting of plywood pieces bonded to the root rib and the front of the spar.

The "hooks" are made of 1/8" music wire, slide in brass tubing mounted in the root

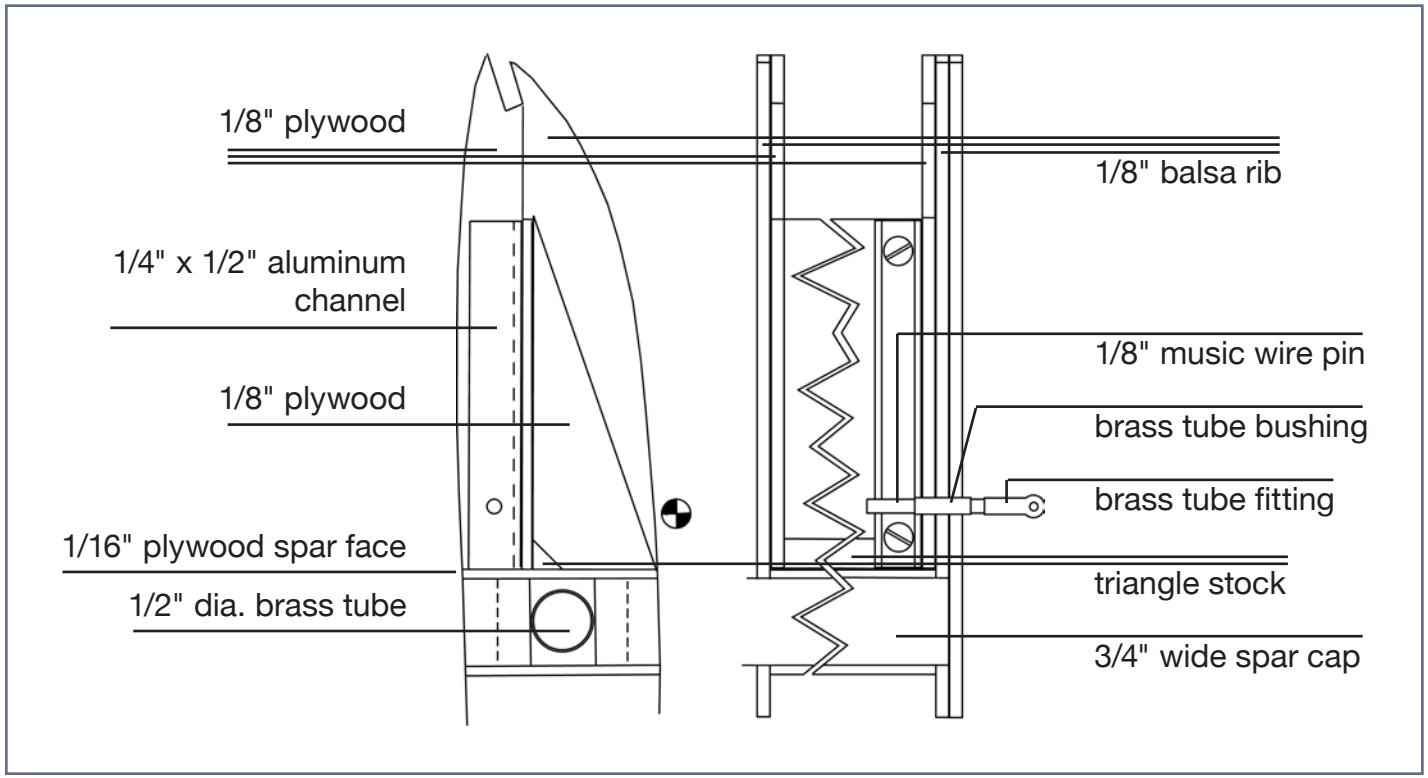
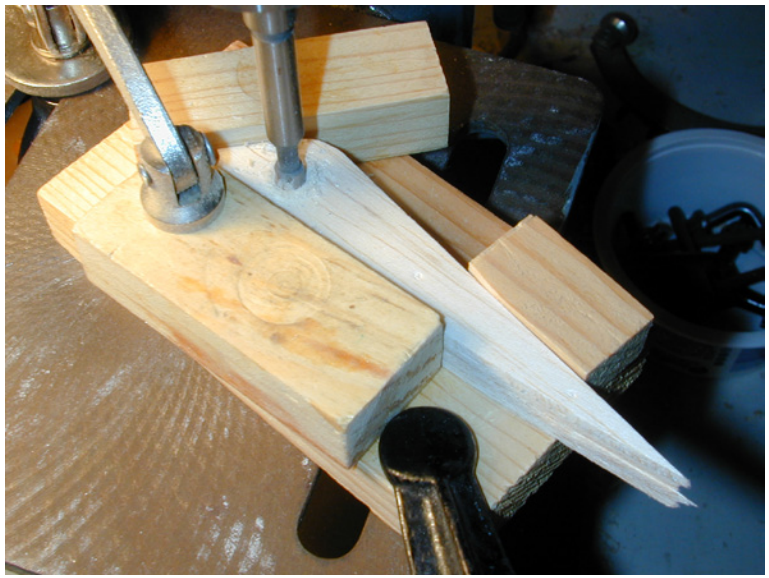


Diagram of the releasable tow hook. These units are mounted against the root rib on a plywood platform which extends across the bay to the second rib. The tow ring is released



Here's the aileron rib fixture mounted on the drill press and in use. It was set up with the metal template in place so the drill bit would hit the right spot. In this shot four ribs are being drilled at the same time. The consistency was worth the extra effort.

rib structure, and traverse the width of the channel to enter a hole on the other side. In use, the tow ring is inserted into the channel slot and a servo pushes the music wire "hook" across the channel and trapping the ring. The servo simply pulls the pin back toward the fuselage to release the tow ring,

We'll be able to start formal construction with the completion of a few more items — the plywood servo mounts and wiring passages need to be installed in the appropriate ribs, for example.

More next month!