DFH-21

MINI FAI PATTERN

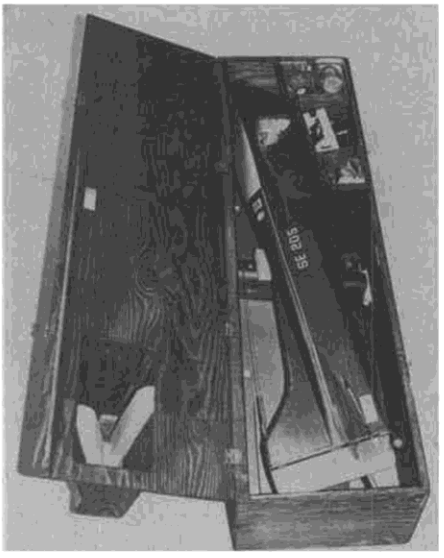
By BENGT LUNDSTROM

The author's "Den Flygande Hyvelbanken" (Flying Carpenter's Bench) FAI pattern ship in a .15 version. (See the 'DFH-18' in June '76 MB)

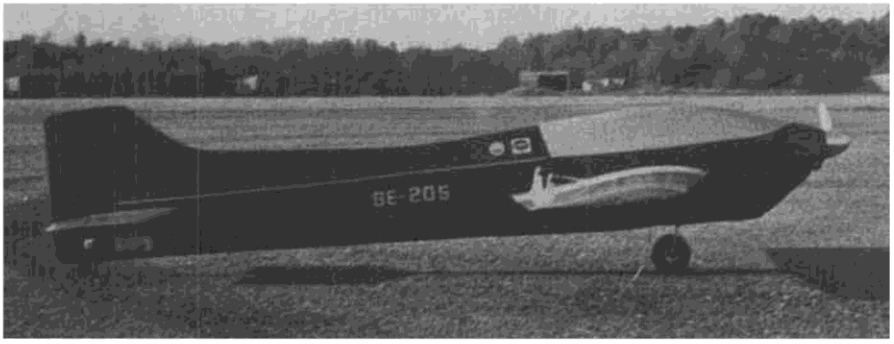
• I have taken part in international pattern F3A contests for several years. I have lived in a house, an apartment and I have traveled by air, train, bus, car and it has worked. But what a hell just because of the size of the .60 models.

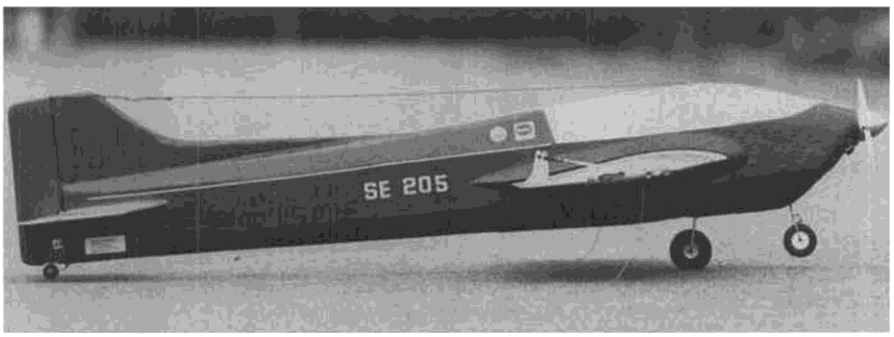
These .60 sized models fly great. And the still bigger jumbo models are easy to make to fly nicely. But haven't you also thought about the trouble with big models:

They take a lot of time to build,
They are expensive and complicated to build,
They take a lot of space to store,
They are very difficult to transport,
A crash or even a hard landing is a disaster,
They consume a lot of fuel,
They are often noisy and very dangerous,



All packed up and ready to go! Box carries model and everything you need to fly.





Single-wheel version (top) is fine for smooth runways, but if you fly off grass or a bumpy field, Bengt recommends the tandem wheel set-up to prevent nose-overs on takeoff.

And they need very large air fields.

I think people would take their models with them much more if they just were more easy to put in a small, protective box. We could bring the models with us on vacation or more often take part in faraway contests.

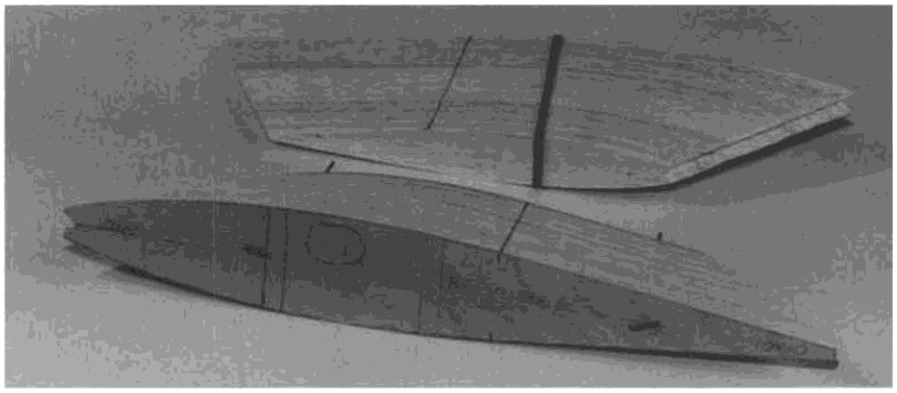
Admittedly, the smaller models do not fly as smooth and gracefully as the big ones. But by working hard, the difference is not so big, and why must everything be so easy? The hi-jumper does indeed jump above the cross-bar and not just walk under it.

Therefore, I looked for:

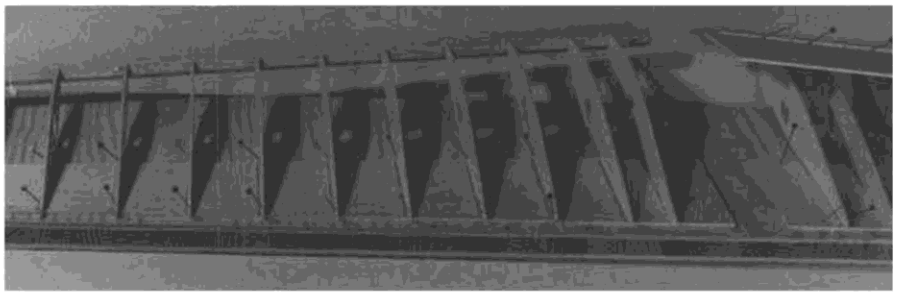
A) The biggest box that could be transported easily.

B) The smallest pattern plane possible to use in contests exactly like those we have today.

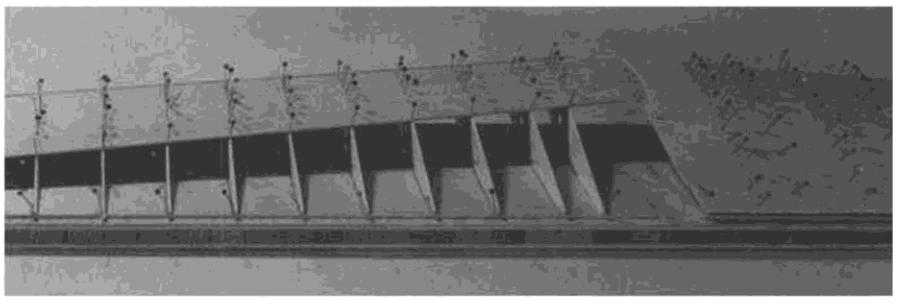
The box size, of course, depends upon where you live and fly, and your habits. But there is one size limit nowadays for



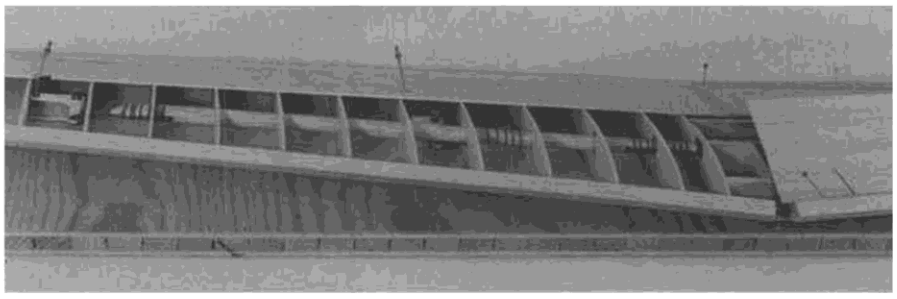
Wing ribs carved and sanded. Set in foreground still has plywood templates attached. Pencil line across ribs indicates transition between straight and curved part of rib.



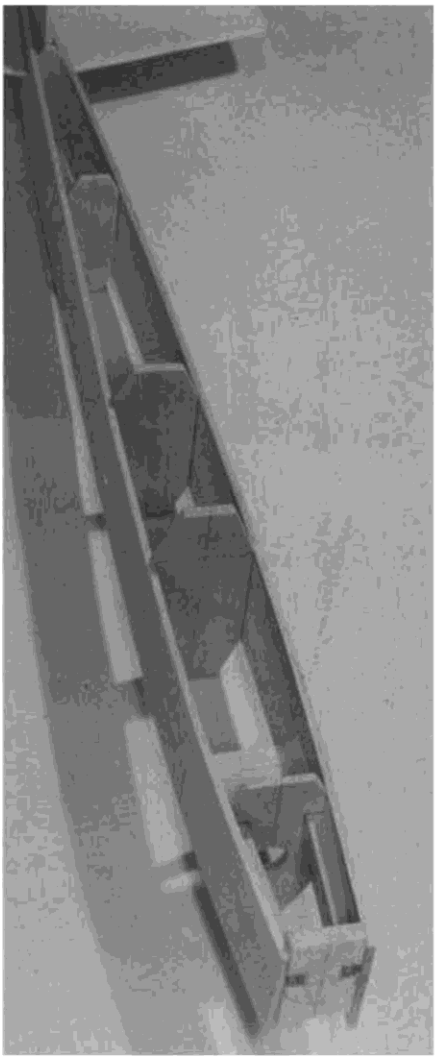
Start of wing construction. Wings are built upside down. Balsa sheet pinned to the board is top t.e. sheet.



Gluing the bottom sheeting in place. Be sure the sheeting is glued well to each rib, as there are no spars in the wing.



Aileron controls are installed before finishing the top wing sheeting. As on the DFH 18 (MB, June '76), the DFH 21 uses differential ailerons.



Start of fuselage construction. Use light wood, particularly in the tail.

transatlantic flights: The sum of length, width, and height must not exceed 62 inches. The box must also house fuel, transmitter, and tools . . . *all* you need for flying.

The model size I chose depended upon the availability of well-developed and powerful engines. The .15 size (2.5 CM^3) engines are the highest developed of all sizes. The choice was obvious. The model size finally became: span 41 inches, length 42 inches. The box dimensions will then use: 41.7 + 11.8 + 8.7 inches = 62 inches. However, one half of the stabilizer would not fit inside the chosen dimensions. I had to "hide" it in the handle. This was probably not what the airlines intended with the 62 inches. I hope they won't be too hard against us for this illegality!

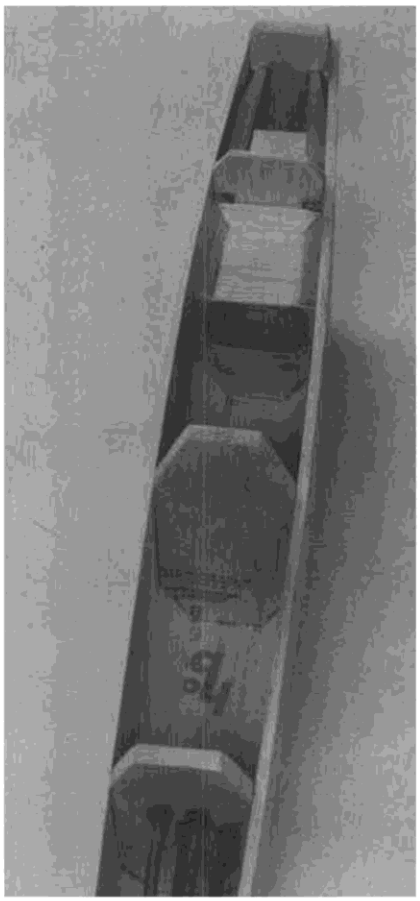
When you make a smaller pattern model, you have to make it a little more advanced to compensate for its size handicap. That's why you find: A mid-wing concept with high side area for knife-edge flight . . . low weight by all built-up balsa design . . . a top .15 engine (Rossi, Super Tigre, Cox Conquest) . . . a long tail for smooth elevator action . . . twisting ailerons to compensate for the small span . . . dual sensitivity on all control surfaces . . . double push-pull rods to get rid of play completely . . . use of racks on elevator for a smoother response around neutral . . . a U-2 type single or double-wheel landing gear.

What you have to sacrifice? The power/weight ratio is smaller than on a .60 ship . . . the span is a little short.

In the air the "DFH 21" has an elevator and rudder response like a .60 ship. The ailerons feel a little more nervous because of the much shorter span. You can't make as many climbing rolls. This is much improved with dual sensitivity on ailerons and other surfaces. The "DFH 21" is the best plane I have flown for easy-to-make, easy-to-control snap rolls, in spite of the small size.

I have taken part in some (1979 program maneuvers) F3A contests with this much smaller ship. I will never be able to place at the top, but the score up to now is about 70% from the top. I think I can reach a 50% position with more training, but hardly better as long as the other guys have top .60 models (four times as big).

Could there be a "quarter pattern" contest? I hope so. They say "big is beautiful", but I feel "smaller is much smarter".



Fuselage construction shot shows double push-rod tubes to both the rudder and elevator.

BUILDING OF THE MODEL

Build it light, particularly in the tail.

WING

The airfoil chosen has one very critical feature: The rear third of it is completely flat from tip to tip. Therefore, the wing can be built on a flat building board and you will easily get a straight and warp-free wing, even with a complicated built-up type design. You must follow this sequence:

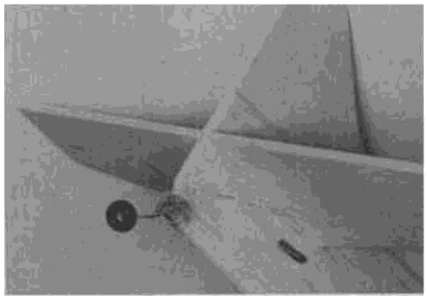
A) Build each wing half upside down on the rear, upper flat portion.

B) Fit all sheets to the wing bottom.

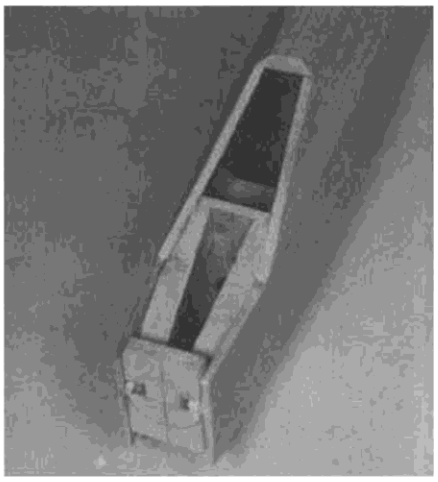
C) Remove the wing halves and fit the rear "spar".

D) Make the long pushrods and fit their cranks.

E) Having the wing right side up, join the wing halves with the pushrods fitted. Now the bottom of the whole wing is pinned to the building board. There is no dihedral.



Tail surfaces. Use the lightest wood available.



Fuselage construction complete with exception of top nose block.

F) Complete the upper sheeting.

G) Put the epoxy and fiberglass reinforcement in the center, after the wing is ready.

Building this way is much easier than you think, if you are accustomed to foam wings. And you will have a much lighter and better wing.

FUSELAGE

Again, avoid all unnecessary weight in the tail.

A) Make the two vertical sides of equal hardness.

B) Make a subassembly of the bulkheads No. 1 and 2 with the hardwood engine bearers.

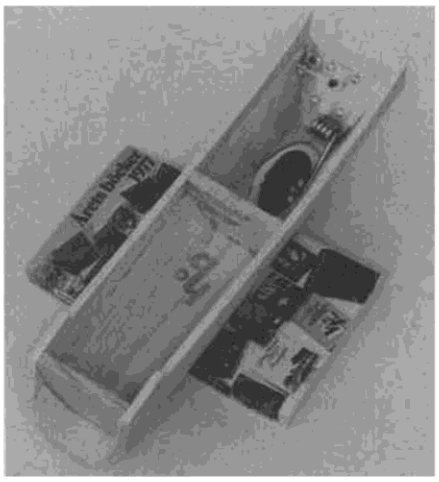
C) Glue the fuselage sides to the subassembly and join them in the back. This must be done with a symmetrical curvature. If not, pull them apart and glue again.

D) Fit the rest of the bulkheads, the stabilizer, and the fin. Fit all pushrod tubes and make the tank compartment.

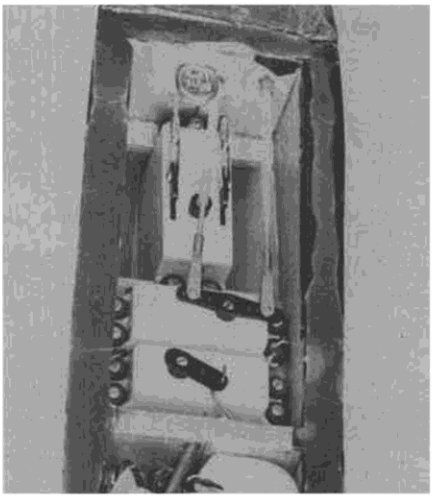
E) Fit the lower inclined fueslage sides and the bottom. If you will use two-wheel gear, put in the nose gear now. You can make it on a finished model, too.

F) Using spare blocks, make the engine bay.

G) Fit the top inclined fuselage sides and the top.



Bottom fuselage section before gluing to wing.



Radio installation. Note double push/pull rods to rudder and elevator.

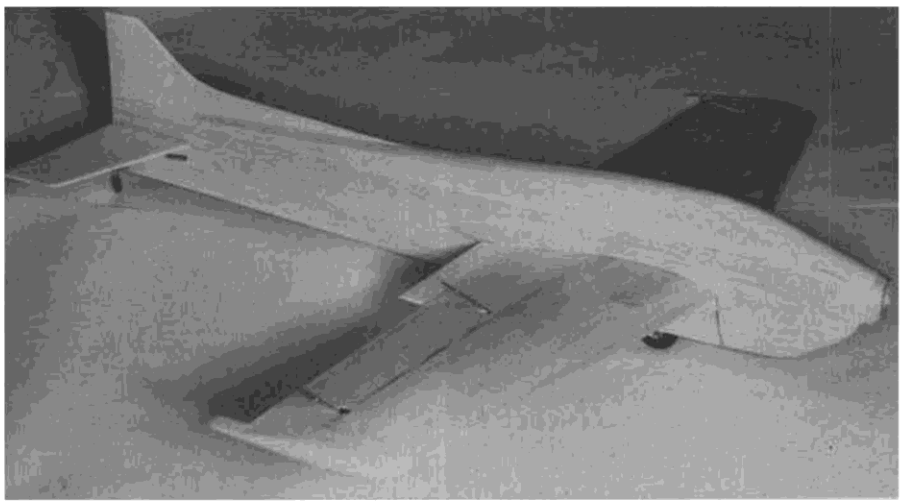
H) Cut out the wing hole and the belly pan. Glue the wing bed balsa reinforcement above the wing.

I) Fit the landing gear to the belly pan and mount the belly pan to the wing. Fit all wing attachment details.

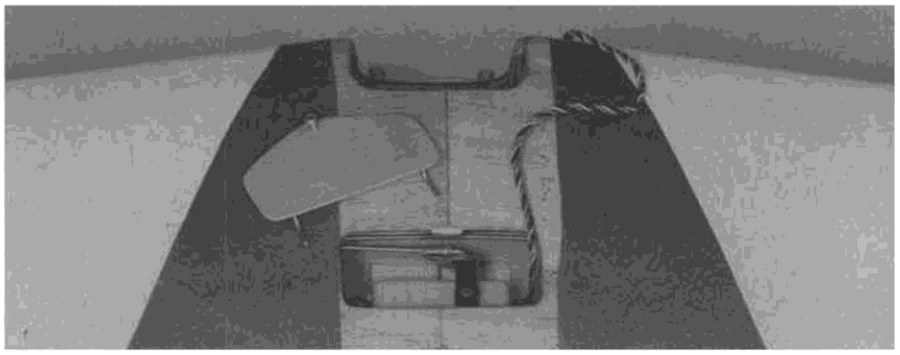
J) Apply epoxy and fiberglass to the fuselage and wing-belly pan assy.

K) Make all servo installations.

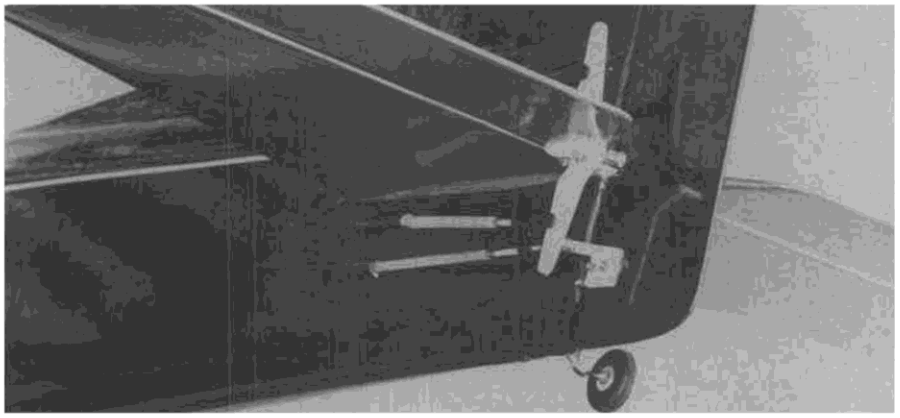
L) Make all ailerons, elevators, and



Basic framework complete, with the exception of the control surfaces. Huge fuselage side area gives good knife-edge flight characteristics.



Aileron servo installation. Servo cover hatch is not really necessary.



Tail surface details. Push/pull control rods to elevator are evident in this photo. This type of control set-up provides slop-free movement, important in a pattern ship.

the rudder. Note that they are a little thinner than the main surfaces, to soften up the response around neutral (I hope).

FINISHING

To save weight, use Solarfilm or Monokote instead of paint. The weight with empty tank must not be more than 1250 grams. This ends up with a surface loading of around 48 gm./dm^2.

FLIGHT TRIM

If necessary, add weight in the nose or tail to get the indicated CG position.

If you fly on a very good field, you can use the low single-wheel landing gear, but it will give quite long takeoff runs. The single wheel is also fine for hand starts (try that on your 8 lb., .60 model if you dare!).

If you have a grass field, I recommend the higher tandem wheel set-up, which will prevent tail-up accidents and gives shorter takeoffs.

A) Check the CG position with empty tank.

B) Adjust the aileron, elevator, and rudder throw as indicated. I recommend dual sensitivity on all surfaces.

Elevator: for normal flying, use movements as small as possible. This is very important. The bigger throw (shown in parentheses on the plan) is used for spin and snap rolls.

Ailerons: Adjust for three rolls in 5.6 seconds. The higher throw is used to get quicker rolls in vertical maneuvers. It is also some help in spin and snap rolls.

Engine installation and landing gear details. Original model used a Cox Conquest .15.

Rudder: Normal throw for all rolls except snap rolls. The higher throw is for Figure M, snap rolls, and spin.

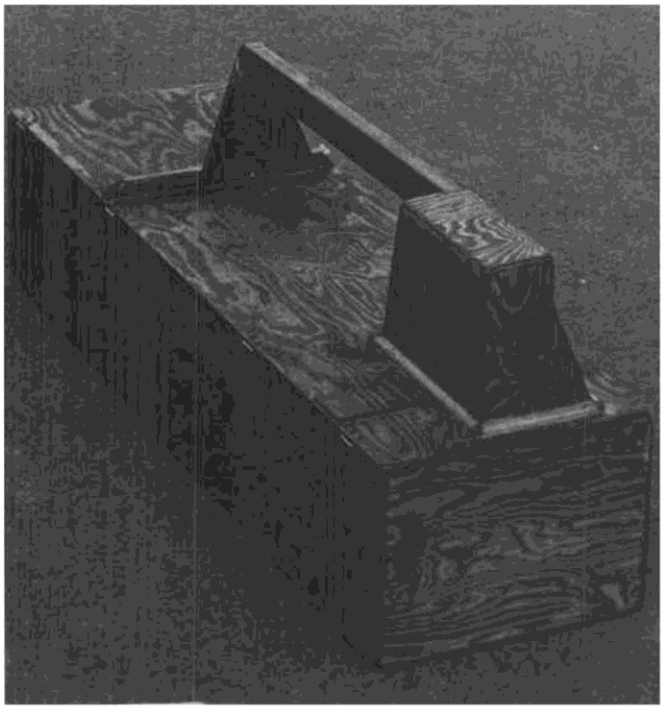
C) Check the wing tips to make them weigh even. If necessary, add lead (it is *always* necessary). However, in flight, you can still have serious problems with uneven weighing wings. This is very touchy.

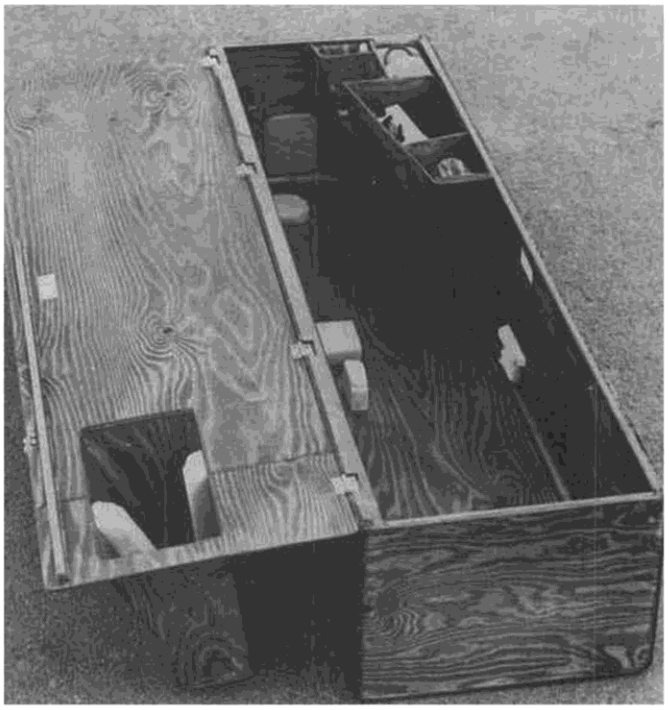
1) Trim the model straight and level and note if one wing drops. Then fly inverted and note which tip drops. If the same wing drops, this one is too heavy. If the other wing drops just give some aileron trim.

2) A much more sensitive method is to apply "G" forces by making several outside loops, assuming you first have the plane OK in straight and level flight. If the model rolls more to the right on the top than on the bottom, you have to put lead (2-20 grams) in the left tip.

Continued on page 22

Let's see you take your .60-size model to the field this way! Compact airplane/flight box makes good sense for those who do a lot of traveling and sometimes wish they had a model they could take with them to fly in their spare time.





Two views of the DFH 21 transportation/flight box. Fuselage lays on its side, over the wing, and half of the stab fits into the box lid. Box is designed to the maximum size that the airlines will allow.

That's because the "G" forces are adding to the gravity in the bottom of the loop, but the gravity is less on the top.

3) If you are confused, just put 5 grams in one tip and note what happens.

Don't listen to people who say it is impossible to make a warpy model fly OK. It is always possible to make a "bad" model fly fine if you just work with it. The only problem you may have to live with is that it stalls and spins more easily to one side than the other.

THE TOTAL CONCEPT FLIGHT BOX

To take full advantage of your DFH 21, I recommend building the box, too. As it is a tight fit, check to see that your wing and fuselage will fit before it is too late. You will have to modify the box to suit the size of your transmitter and fuel can.

The only bad thing with this box is that you can't change much on the model. Changes are, however, not needed as the DFH 21 really flies very good. •