BOB BOUCHER'S MONTEREY

by Bob and Ronald Boucher

I INTRODUCTION

The design of the Monterey started out in the Fall of 1969, when Bob built a set of 100" span 1/32" plywood wings for his Malibu. This super Malibu included ailerons which were later removed since they were rather ineffective. Although the sheet plywood wing proved much too heavy for general flying, the glide ratio was great and many times he had the ship climbing during consectutive loops at Hughes Hill in Culver City, California.

Variations of this design using all balsa sheet construction, ala Malibu, were built and successfully flown in various contests in Southern California. With the advent of the AMA provisional rules, and the very successful LSF Contest in August 1970, it was proven that a 100" span aircraft could compete with the monsters in thermal contest. The successful 76" Malibu's and Peregrine's had already shown that smaller models could be extremely successful in pylon racing. Further design refinements were made to maximize the ship's performance in thermal Class A events.

In all, about 8 variations of the Monterey were built by members of the Soaring Associates AMA Club at Culver City, California. Those contributing to the design include Tom Mead, Eddie Phillips and Dan Horwood, as well as the authors.

The general specifications were:

1. Total wing and stabilizer area – less than 750 sq. in.
2. Wing span – 100", two piece wing (to fit in small automobiles).
3. Fuselage length – no more than 44" for same reason.
4. Weight – to be minimized, and a goal of 32" looked reasonable.
5. Two channel radio gear.
6. A minimum sink speed of 1 ft./sec. to achieve a 3 min. still air time.
7. A L/D as close to the "Cirrus" as possible.
8. All balsa sheet – easy construction at modest cost.

In summation, we wanted a competitive model under LSF and AMA Class A rules that was easy to build, easy to fly, and would fit in a Porsche 912!

II WING DESIGN

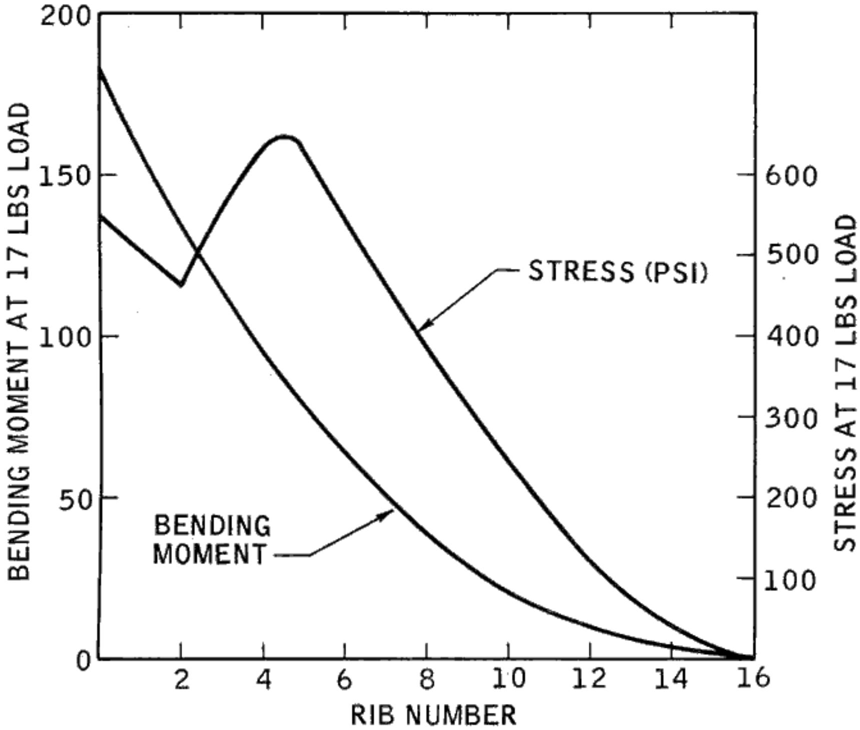
The Monterey wing is constructed with a tapered D spar supporting bending loads for most of the span and a transition to a fully sheeted wing at the center section to take out launch and landing axial loads. The transition in the center sheet was designed to keep skin stress at a maximum of 60% of the bulking limit at a wing loading of 17 pounds (¼" dia. Hi-start max. tension). The method of fuselage attachment is by a single 0.190 dia. steel rod at 25% chord with a 3/32" dia. aft pin to provide incidence alignment. Bending stress in the steel pin is 31,000 RSI at the 17 lb. load: A mild steel was chosen for the pin to prevent wing damage on hard tows. The pin will yield and pick up a permanent set before wing fracture occurs. If this occurs, it can be easily removed from the aircraft and straightened in a vice to re-establish the proper dihedral. Maximum stress in the balsa skin occurs at Rib #5 reaching a peak of 650 psi at the 17 lb. load level. Figure stress – show the stress along the wing and the bending moment which produces it.

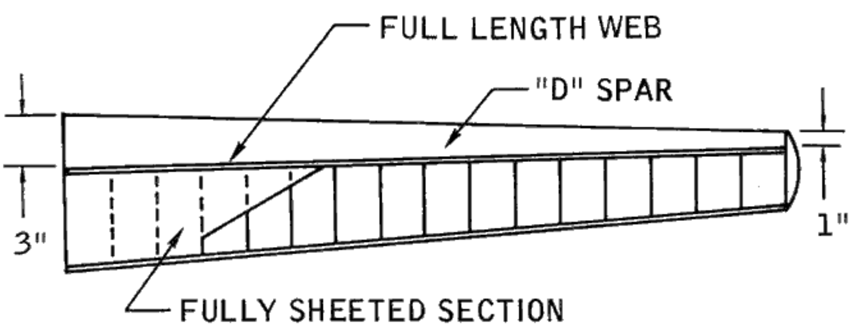
Wing Profile

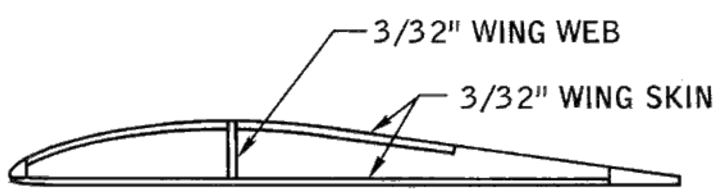
The Monterey wing was designed to meet AMA Class A R/C Glider area requirements of 750 sq. " and to use 4 foot plug-in wing panels, resulting in a total span of 100 ". This span permits building each wing panel without splicing spars or sheet. This length wing is near the maximum that can be transported in the trunk of many compact cars. A total area of 725 sq." was chosen to leave a margin for measurement error at contest check-in and, with a 16% stabilizer area, the wing comes out at 625 sq. in. and 16:1 aspect ratio. A 50% tapered platform was chosen to improve aerodynamic efficiency and strength. This taper permits the wing to operate at a Reynolds number of 47,000 at the tip to the 98,000 at the root, well above the critical value of 40,000 where the L/D ratio of most airfoils degrade rapidly.

Airfoil Selection

The airfoil used in the Monterey was selected on the basis of providing low sink speed while in thermal flight and the good penetration required for LSF speed/distance events. The Reynolds number in thermal flight is 69,000 at the minimum sink speed of 14 mph (CL = 0.9) and 147,000 at a penetration speed of 30 mph (CL = .196). The airfoil choices considered and their







WING CROSS SECTION IN TRANSION SECTION

performance are shown in Table 1.

TABLE 1

	Thermal		Penetration 30mph	
Section	L/D	h fps	L/D	h fps
6412	20.3	0.97	6.2	7.1
4409	23.8	0.93	8.8	5.0
E387	20.5	0.96	10.7	4.1

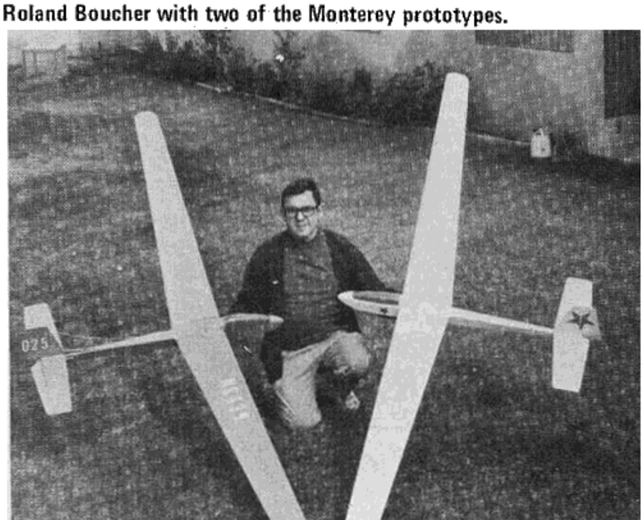
While any of these airfoils will give good thermal characteristics the E387 is significantly better than the others in penetration capability. The Eppler 387 was chosen for the Monterey wing section. Its performance as a function of flight speed is shown in Figure 2.

III CONSTRUCTION

Step 1: Tape plan to building board with masking tape and cover with one layer of wax paper. Waxed paper is used to prevent gluing model to the plan. Lay all balsa wood parts on the plan in appropriate locations.

Step 2: Construction of the wing frame. Pin the 3/32" balsa wood sheet which will form the bottom wing skin to the plan directly over the wing outline. Glue the ¼" square leading edge spar down on top of the sheet. Use liberal amounts of glue. Some glue will run out of the

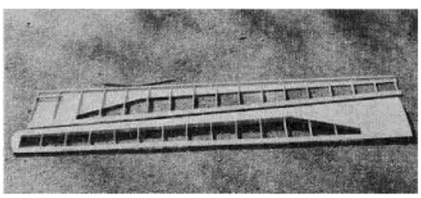
Roland Boucher with two of the Monterey prototypes.



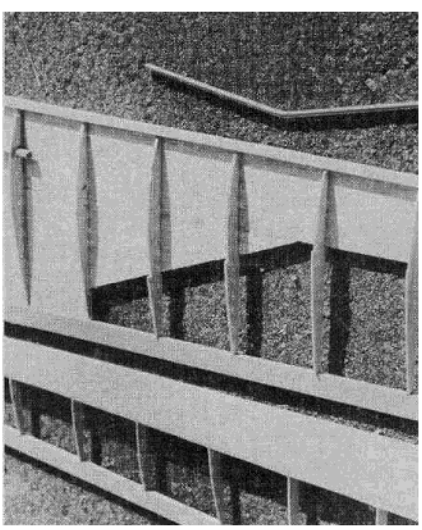
Bob and Roland Boucher prepare to launch the Monterey during an invitational RCM soaring session.

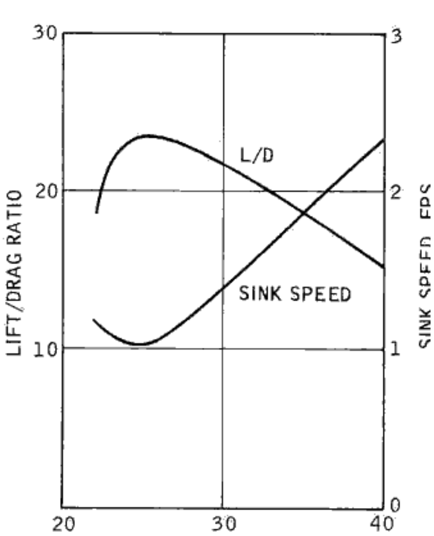
seam on the outside. Wipe it off with a damp sponge now. It is much more difficult to remove when it is dry. **Glue wing ribs and trailing edge in place and let dry overnight.**

Apply liberal amounts of glue to the leading edge and forward parts of the ribs, and glue the tapered 3/32" forward wing skin in place. Place pins along the leading edge and in each rib. **NOTE: It is important that the wing skin touches the ribs everywhere. If the skin has any bubbles in it, these should be taken out NOW by driving in enough pins to hold the skin down!** If the skin seems a bit difficult to bend, brush a little water to the top side. This will cause the sheet



The Monterey wing panels.
Close-up of wing framing.





to curl concave side down. Sponge off any excess glue that comes out of the seams. Epoxy the ¼" OD fiberglass wing spar to plywood formers F1, and F2. Cut shear web from 3" sheet and glue in place. Complete wing structure by attaching the upper triangular-shaped wing skins.

Step 3: Completing the wing. The wing panels should be removed from the plan and sanded to the approximate airfoil and shape down on the plan. This can be done using a sanding block and placing the wing section against the edge of the building board. To form the center section, join the three 3 " by 4" sheets of balsa forming the lower wing skin center section on the board. Glue the center section leading edge and wing formers in place as shown using dihedral gauge for proper angle and let dry. When dry, glue the center section upper wing skins in place.

Step 4: Construction of the fuselage frame. Place the 1/8" balsa fuselage bottom sheet over the plan and pin it down. Make certain it is centered over the plan at the nose and tail. Glue the fuselage formers in place vertically on the bottom sheet. The formers are ¼" narrower than the bottom sheet to accommodate the 1/8" sheet fuselage sides. Make sure that the formers are centered to leave 1/8" of bottom sheet on each side. Glue the ¼" x 3/8" servo mounting blocks to formers C and D before mounting these formers on the bottom sheet. The position of former C as shown on the plan is designed to accommodate a KPS-10 servo. If other servos are used, move former C to suit. Glue the nose block against former A now, also notch tail block and glue in place. Let glue dry for 1 hour. Glue the 1/8" sheet fuselage sides to the fuselage frame. Wipe off excess glue that seeps outside of the fuselage with a damp sponge. It is a lot easier to sponge it off now than to sand it off later. When dry, trim tail block to shape.

Step 5: Construction of the tail section. These are of simple all-sheet design and need only be sanded to approximate airfoil shape, and the corners rounded. Leave the elevator in one piece and drill two 3/32" diameter holes for the torsion bar. Glue the torsion bar in place and slit both elevator and horizontal stabilizer for nylon hinges. Assemble the stabilizer and elevator and make certain that the elevator moves freely without binding. When properly aligned, drill 1/16" holes through the balsa and hinge as shown on the plan, and glue in a round toothpick rivet. Cut the elevators free and sand smooth. Repeat the above process for the rudder and vertical stabilizer assembly.

Prepare the pushrod assembly by cutting the ¼" square balsa strips to length, and secure the wire ends to them with glue and thread. The forward ends are left straight and are to be trimmed to match the particular servo installation used. Drill pushrod exit guides in the fuselage sides and then install the pushrods. Glue the tail surfaces in place and check for proper alignment of the surfaces and for proper positioning of the pushrods and free movement. If all isn't right, fix it now – it's much more difficult when the top of the fuselage is in place.

Step 6: Completing the fuselage. Glue the wing center section in place (use plenty of glue). Remove all pins from inside the fuselage, then install the fuselage top sheet, trimming it in length to just fit between the wing center section and the horizontal stabilizer. Next, glue the turtledeck skin against the wing center section and former D and install the hardwood doubler in the cockpit area.

The canopy can now be constructed by placing the canopy fore and aft formers against the nose block and former D respectively. Use 1/8" balsa sheet for the canopy bottom. Use some wax paper between this assembly and the fuselage to prevent gluing them together. When assembly has completely dried, remove from fuselage. Next, trim the plastic canopy supplied to fit over the canopy frame. The plastic canopy fits small end forward. It should be trimmed with scissors to approximate shape and glued to the frame.

Hold completed canopy in fuselage with masking tape and carve nose block round fairing it into the canopy and fuselage outline. The masking tape will protect the canopy during sanding.

Step 7: Covering the model. We recommend Super MonoKote on the wings and dope or HobbyPoxy on the fuselage and tail group. **Be sure to warp in 3/16" wash out in each wing tip after covering.** This can be done by holding wing at each end, twisting it, and while twisted, passing it over a stove to shrink out wrinkles.

Step 8: Installing the radio control system. The radio control system consists of five items: a battery box, a switch, a receiver, and two servos. The battery should be wrapped with sponge rubber or paper towel till it fits snuggly into the compartment between former A and B. The switch can be installed on former B in the same compartment. The receiver is also wrapped with sponge rubber or paper towel and installed in the compartment between B and C. The servos are mounted with four screws and grommets on the servo rails in the compartment between formers C and D. The cutout in former C is to allow the servo cables to be connected to the receiver in the second compartment.

IV FLYING

Before test gliding the model, check for proper CG location, and check to see that the wing panels have proper washout (approximately ¼" per panel). See that neutral trim corresponds to neutral rudder and elevator position. The rudder should be adjusted to give maximum travel (inside hole on rudder horn, and elevator to give minimum travel – outside hole on elevator horn.) Try a couple of hand glides. Then if everything is okay get a hand tow or a hi-start.

We prefer a hi-start to a hand tow – even if you don't get quite as much altitude. On a calm day it saves a lot of running and on a gusty day it can save a set of wings, especially if you use 125 lb. test towline. Remember that, in a steep climb, the model will travel three and even four times the speed of the tow, and if full back stick is applied indiscriminately, aerodynamically the wing can pull 16G. Something is bound to give, usually the wing, but sometimes you're lucky and only rip out the tow hook. The photo shows what the wings look like at the maximum structural design limit, try to keep the bending below this level. We recommend a towline hi-start setup sold by Ray Smith, 811 Brantford Avenue, Silver Spring, Md. 20904. It consists of 160 ft. of ¼" dia. shock cord and 600 feet of heavy nylon line, and it works great. Get the feel of the model at altitude. Stalls are abrupt, but not much altitude is lost in recovery. If you have proper washout and no warps, the stalls will be straight ahead with no tendency to fall off on one wing or the other. With the minimum elevator travel loops can easily be performed, with the model losing only a few feet altitude in each succeeding loop. Many times on the slope, the Monterey has steadily gained altitude while doing consecutive loops!

Spot Landings

The Monterey has a 23:1 glide ratio so it floats a long way and it takes some practice to get a good spot landing. We find that the best method is to adjust the ship so that full up trim is used during thermal flight. In this way neutral trim gives a good but fast glide which helps wind penetration and you can use full down trim just before reaching the spot and the Monterey will descend smoothly and will usually stick without bouncing.

Distance and Speed Events and Pylon Racing

This design can help you win distance and speed events using LSF rules, but can be outflown by the super speed machines such as the Malibu and Peregrine in a pylon race. Nonetheless, one of our prototypes won 3rd place at the "Marks" San Bernardino pylon race against a field of 16 contestants. Both first and second place winners used special racing machines. For these speed and distance events add about 16 to 30 oz. of ballast to the belly. The easiest method is to use pieces of 1/16" x 2" x 16" sheet iron screwed to the fuselage bottom. Each such piece will weigh about 1 lb. If you align the trailing edge of the iron with the trailing edge of the wing the CG will move forward about the right amount for a fast trim setting.

Power Pod

The best method is to buy a plastic power pod from D & R Plastics and use a TD 049 or 051, a 6-3 prop and Red Can fuel. To fasten the pod, glue a hardwood block across the top center wing section at the high point and screw the pod down. This setup should give about 1000' climb on a full tank and add only about 2 oz. to the ship's weight.

HAPPY LANDINGS!

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