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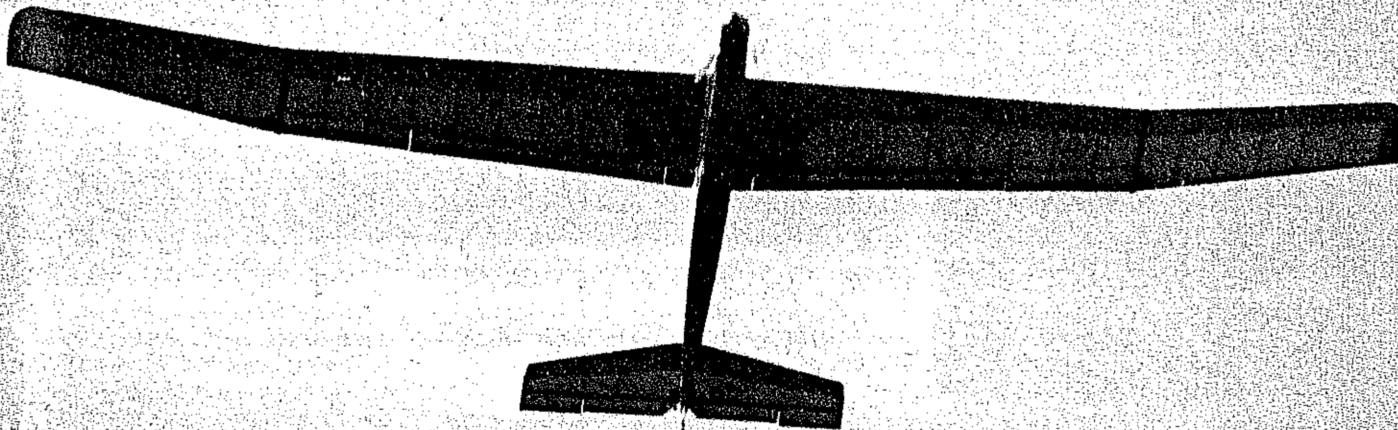
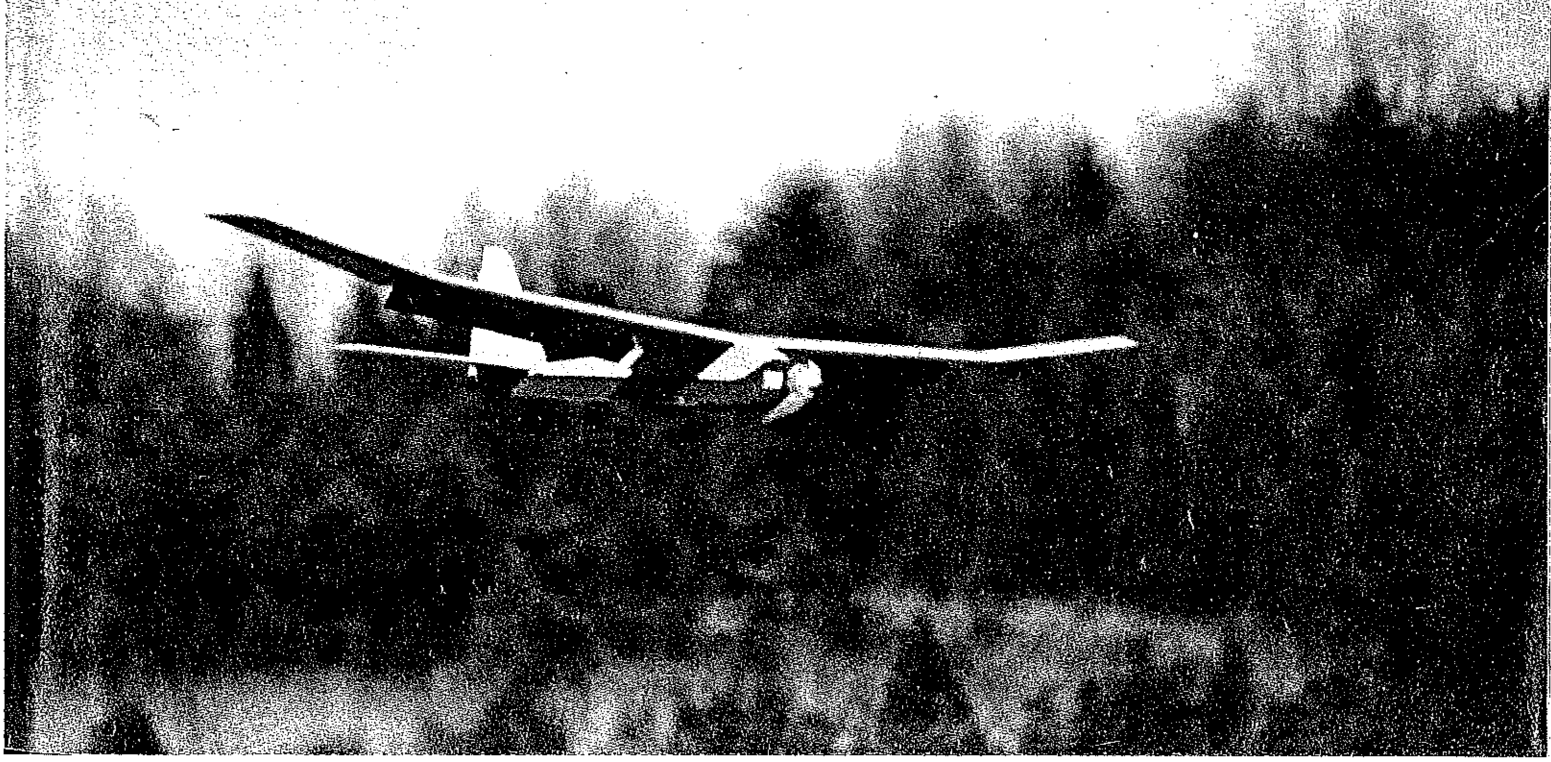
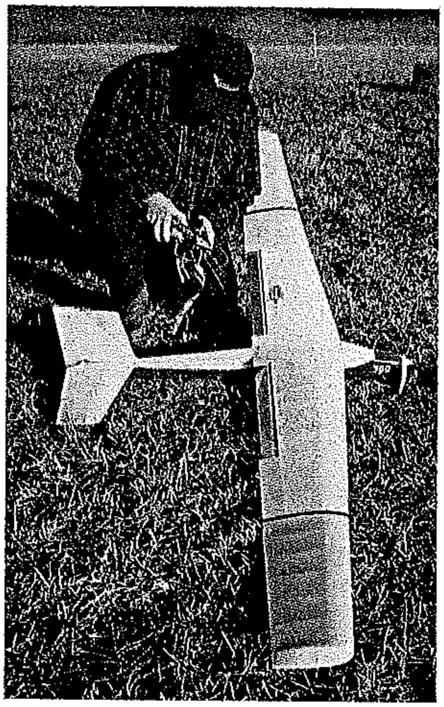
ARIA: The Long Wing

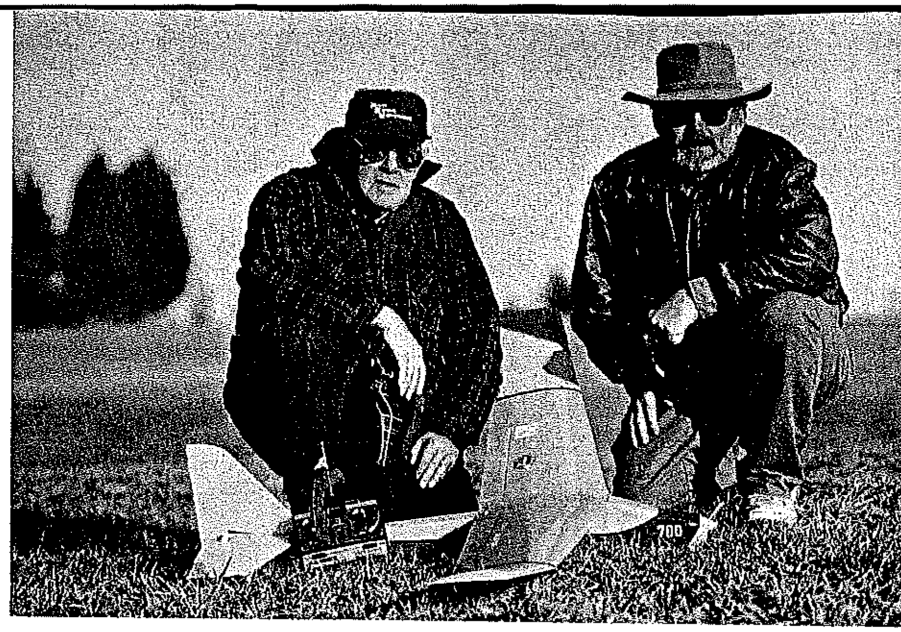


Aria goes soaring with its new, longer wing.
■ Bill WInter with John Hunton

THIS SEQUEL to the Aria article was only a gleam in the designer's eye when we wrote the article on the basic short-wing Aria in the September 1992 *Model Aviation.* We now know that the longer wing is completely successful, particularly in its own elements—calmer air and weak lift. Along the rolling foothill slopes of rural Virginia, the longer wing rides the river of air, as Dave Thornberg would say, with the turkey buzzards.

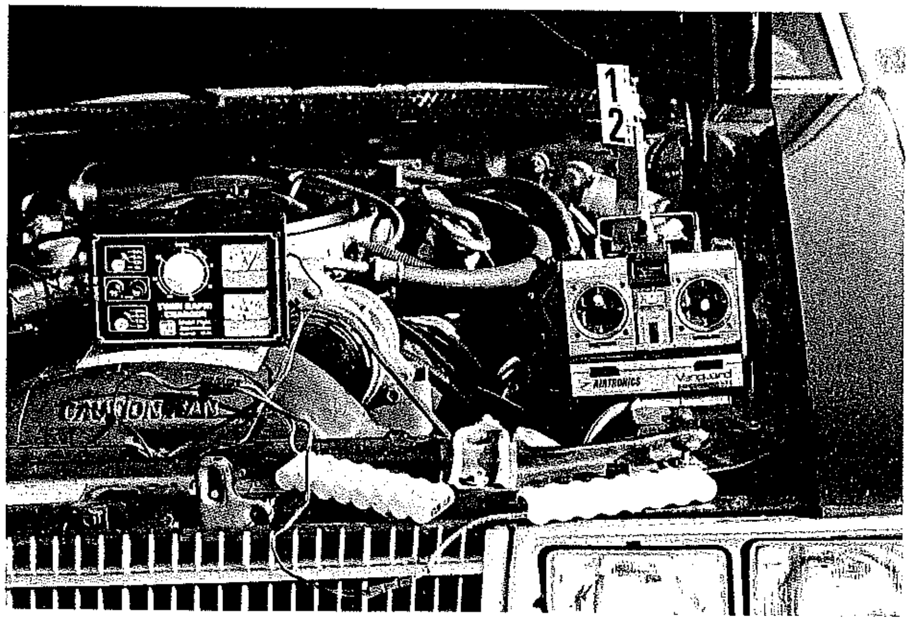






Above: Bill Winter and John Hunton with the long-wing version of the Aria after a satisfying afternoon of silent flight.

Left: Bill Winter checks the flaps on Aria. The flaps seem to be more effective in killing lift and bringing the model down quickly on the long-wing version even though they have the same area as those on the short-wing model.



A charging setup for eight-cell packs. The Double Field Charger from Hobby Lobby has dual ammeters and can charge two Ni-Cd packs simultaneously.

To recap the September 1992 article, Aria is an all-around design intended to climb, glide, and soar well in a variety of conditions. The short-wing basic version provides a good transition model from gas power. It also provides for good, crisp handling and maneuvering; it performs well in windy conditions with moderate lift. The long-wing option emphasizes soaring capability and exploits the faintest lift.

Both versions incorporate boomer escape capability with the wide flaps deflected 45°, which allow steep dives (with appropriate *down* elevator) without exceeding redline. Moreover, the flaps can be used to fine-tune the glide to attain maximum lift-to-drag ratio (L/D)—better than with elevator trim alone. They also allow steep airliner-type

John Hunton launches Aria. After you get used to the model, climbout is accomplished with trim, using slight rudder control as needed for accurate steering.

John Hunton is intent on finding a thermal to prolong the flight. Aria will respond even to modest lift.

approaches followed by slow touchdowns with little runout.

Both versions benefit from using the economical Hobby Lobby Graupner Speed 700 Turbo electric motor, which was tested in both plain and ball-bearing versions and with 8- and 10-cell 1,200-mAh battery packs. This brute of a direct-drive motor is much larger and more powerful than others of the Speed family, but it weighs 11½ ounces bare. Perhaps the weight daunts some people, which may be why the Turbo 700 is a sleeper.

This direct-drive motor generates excellent thrust on 10 x 6 and 11 x 6 Graupner Scimitar folding props for run times of three to four minutes (actual air time), depending on our prop/battery combinations.

Since thrust and rpm change in the air when the propeller is in an unloaded condition, the static thrust and rpm shown in the September issue are only valid for comparative purposes. In the September issue, we reported using a 25-amp fuse for 8-cell packs and a 30-amp for 10 cells. Most recently, we have begun using a 30-amp fuse for both 8- and 10-cell packs for the sake of commonality. The motor and model can handle 12 cells too, but performance on 8 and 10 is all anyone could want with the on-off motor controller.

Flight times could consistently exceed power available from the battery eliminator circuit (BEC), so you should set glide-time limits (example: 10 minutes) or use a separate battery pack for the receiver (which is what we recommend). Considering both sizes of the Aria, performance capability seems comparable to models with 15- and 25-size cobalt motors.

The short-wing version is maneuverable and fast enough to fly with the gas models—as we had to during early tests, sometimes going up with four other models. Because of its crisp climb capability and enhanced approach and landing regimes with the big flaps, it can operate out of the smallest schoolyards. Even the long-wing version is more maneuverable than the ultra-high-aspect-ratio ships, and it lands better than garden-variety floaters.

The two versions of Aria are identical except for the wings. The short-wing Aria spans 69 in., has an area of 580 squares, weighs 60 oz., and has an aspect ratio of 8.1 to 1. The long-wing Aria spans 99 in., weighs three ounces more, has an area of 840 squares, and an aspect ratio of 11.6 to 1. The above numbers are based on using eight-cell battery packs.

■ John Hunton ...reports on flying the long-wing Aria.

Recalling the first test flight of the short-wing Aria and all the questions of that flight, it still seems amazing that the original Aria climbed boldly into the sky and needed no trim at all. Testing the long-wing version held far fewer questions, for it would certainly fly and the center-of-gravity (CG) should be close to where it belonged.

How would the excellent controllability of Aria be affected? And stability? The purpose of the long wing was to increase L/D and thus maximize soaring ability. But at what expense to climb performance and to handling?

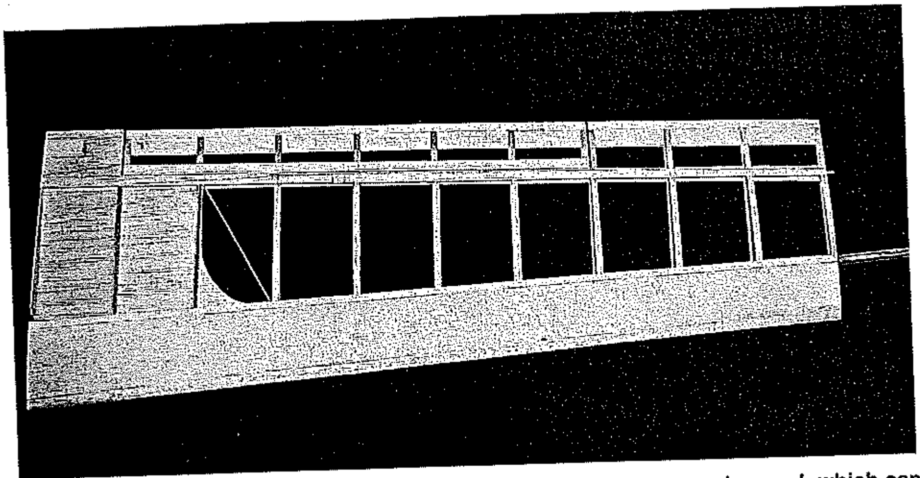
On test day we put up the short wing first to trim Aria out. With the pull-pull control system, which seems to be dimensionally stable, it needed no trimming and flew just fine. Now for the long wing.

The long wing did not look disproportionate, just more gliderlike. We had no agenda for the flight except to check trim changes and handling characteristics. The long wing only added three ounces to the weight of Aria, bringing total weight to 63 ounces. This additional weight should have had little effect on climb capability.

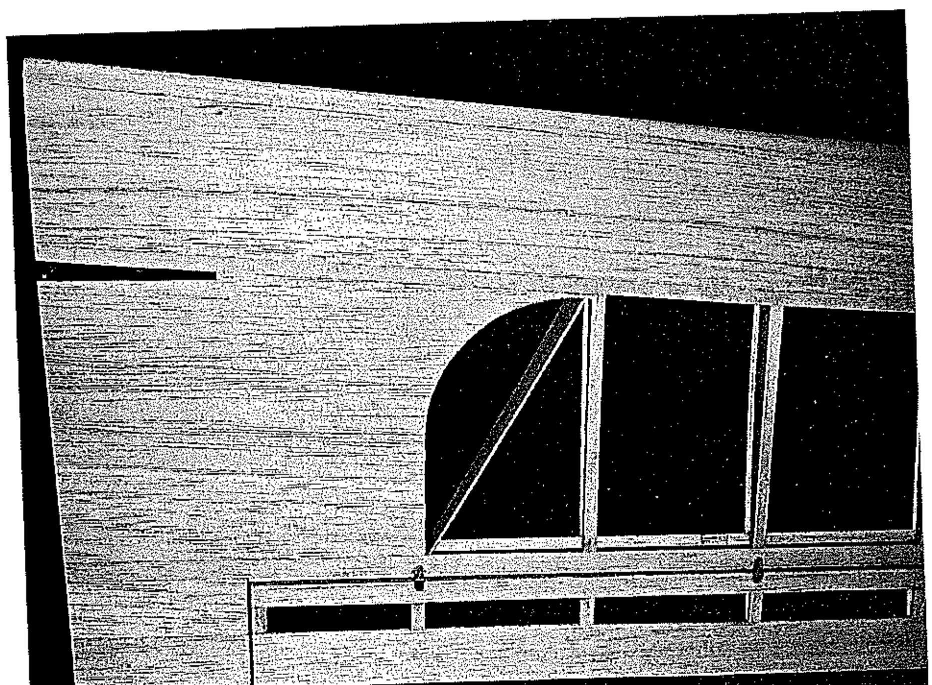
We now had the ball-bearing Speed 700 Turbo motor in Aria, still with only eight cells.

Power on. Launch. Aria climbed out briskly. As in the very first test flight, it soon became apparent that no trim was necessary. In retrospect it seems that needing no trim on a first flight was not just a lucky fluke, but may have occurred because the model has a very wide range of acceptable balance and control parameters. The only noticeable differences in controlling the long-wing Aria are that the longer wing has greater inertia about the vertical axis and slightly more rudder input is required for turning.

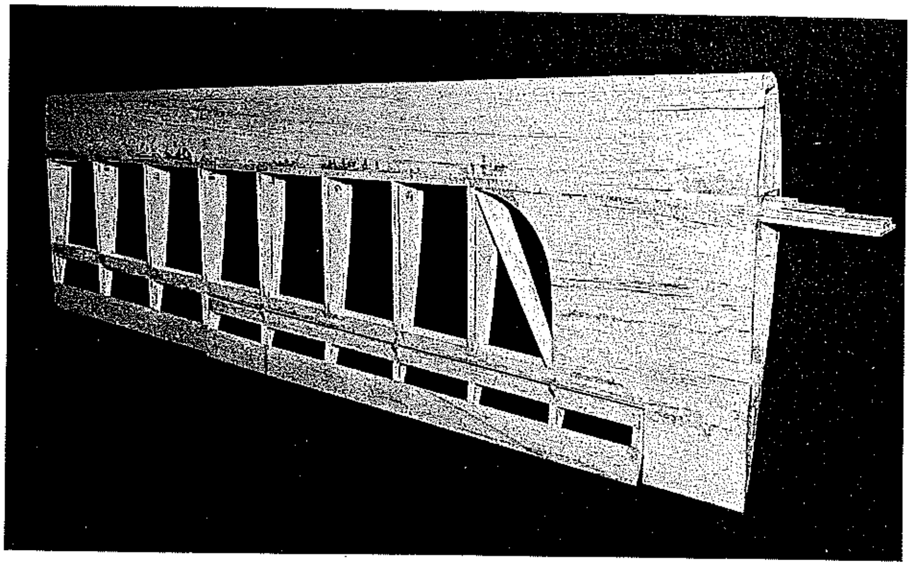
Since the first flight needed no trim, we continued the flight to check climb rate and



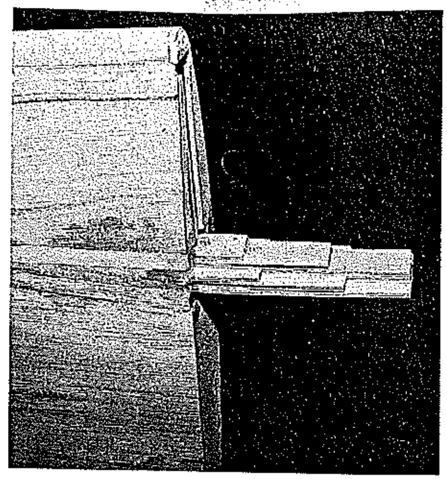
Top view of inner wing panel. Spar joiner, right, inserts into outer poly panel, which can detach for transit. Tape over seam locks panel in place. Center section sheeting will be applied after main spar transition assembly (joiner) is installed.



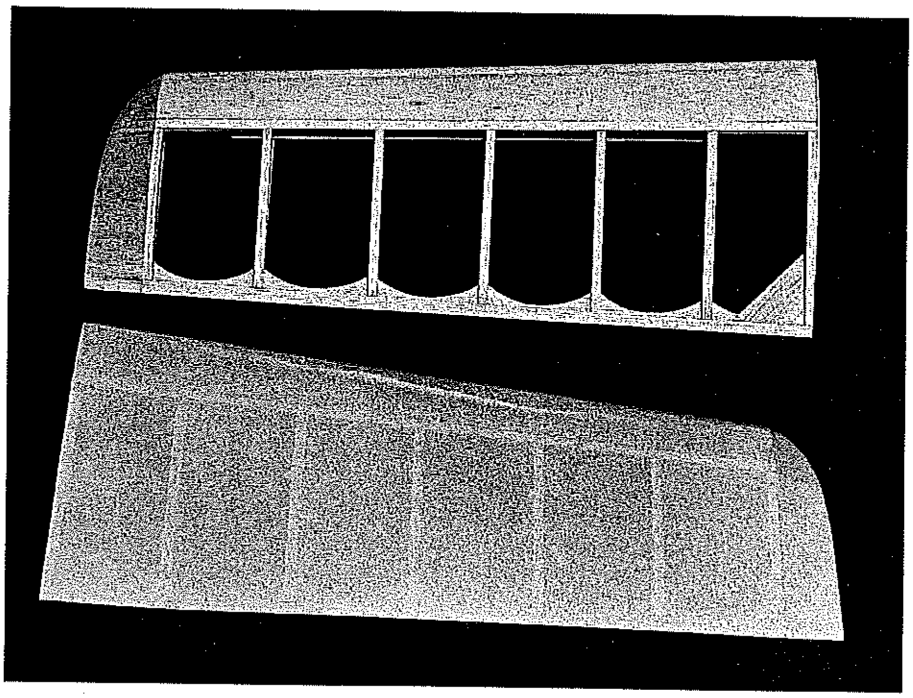
Close-up of portion of bottom of main wing panel shows opening provided for spar transition assembly (laminated ply joiner detailed on plans). Panel is ready to slip onto spar-transition. Note that flap hinges are on bottom of panel.



The bottom view of main panel is shown ready for center joining with the transition assembly in place. Flap installed with three Robart one-inch hinge points.



While this spar transition assembly looks complex, it is made of only five pieces and goes together easily.



The completed left tip panel and covered right tip panel. Note weight-saving scallops on trailing edge.

gliding capability. Both characteristics are unmeasurable with our equipment, but we felt that the slightly greater weight of the long wing is offset by additional lift and the climb rate is not perceptibly changed. As for glide, the long wing definitely has an increased L/D and a very low sink rate.

We found that the long-wing Aria would respond even to faint lift. While Aria was trimmed to fly straight ahead from the start, it would tend to turn either way into lift on its own. This may be a subtle indication that stability was slightly reduced by the long wing. This model is an aggressive soarer and a thermal seeker.

Another small difference in flight characteristics is that the long wing tends to make flatter turns than the short-wing version. Mulling on this later, Bill and I concluded that the bigger wing flies more slowly because it has both more lift and more drag, though the sink is less than with the short wing. The lower bank angle in turns is another factor in increased flight time. "Wheeling like a sea gull," Bill remarked.

Not wanting to exceed BEC time we decided to bring this first flight down within 15 minutes, testing the flaps on the way down.

Flap full on, pitch over. This time the model pitched over almost to the vertical on full *down*. Increased elevator effectiveness with the proportionately smaller empennage probably accounts for the steeper descent than with the short wing. Caution: Recovery from such dives must be made smoothly and gradually. Level out first, then reduce flaps if desired. Do not do a steep dive intentionally without flaps. Landings are the same as for the short-wing version—compact.

Although the model is both forgiving and nice to fly, it is not a trainer. Best flights are attained by trimming the model in climb (under power), then by steering with slight rudder pressures only.

After transition to glide, you will want to add flap angle proportionate to the type of day you have—slight deflection for gusty conditions and good penetration, and up to half flaps for light winds and light lift. Some *up* elevator trim may be necessary to adjust to ideal glide velocity.

Again, with the model trimmed, only slight control pressures are required for steering. Exaggerated control input only increases drag and shortens the flight.

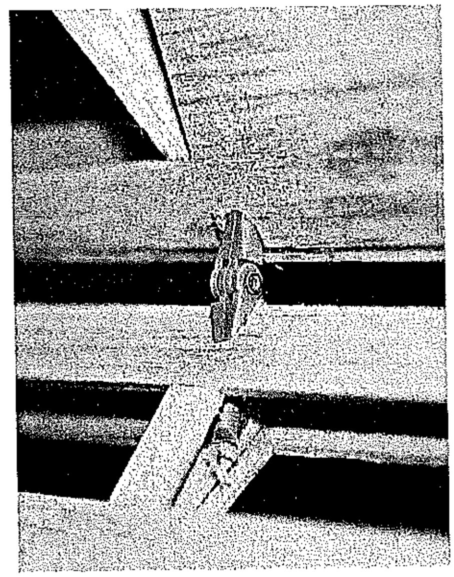
This short preflight checklist (refer to the "RC Aria" article in the September 1992 issue of *Model Aviation* for points 1 and 2 below) should help you increase consistency and maximize enjoyment:

1) Flap control to *down* (throttle stick toward you. . .motor off safety).
2) Check and set trims with throttle trim toward you to low (trim may vary from pilot to pilot).
3) Transmitter on.
4) Receiver on.
5) Check control motion and direction (always. . .in this world of instant-reverse servos).
6) Assume launching position.
7) Flaps up (throttle stick away from you).
8) Check wind and other models.
9) Motor on and launch (flaps go to full up when motor comes on).
10) Upon landing, keep flaps down for safety, and reset throttle trim to low.

Safety note: Always stay clear of the propeller, switch on or off.

When flying with the dual action on the throttle, remember that the flap must be full up for the motor to be turned on with throttle trim. This is a built-in safety feature. (The basic Aria article gives greater detail about the motor-control/flap/throttle interlock.)

Detail of typical wing spar web (short wing shown here). Note that vertical-grain webs glue against rear face of spars, but are not flush with top or bottom surfaces.



Close-up of Robart hinge point shows penetration of corrugated hinge point diagonally through flap spar.

Construction:

Construction of the long wing is basically the same as for the short wing described in the September issue, with the exception of some additional ribs and different thickness for the plywood spar-root transition parts. Using the removable wing tips is highly recommended for the eight-foot-plus wing.

Assuming that some would want removable tip panels for easier transportation, we elected not to break the wing at the root, a more complicated and heavier detail (for example, Aria does not need heavy metal wing rods). Little needs to be added for construction procedures except for how to mate a second wing to the existing wing seat. This does need some explanation.

Do not drill the hole for the ¼-in. dowel in the leading edge plywood part until after the wing is fully assembled, sanded, and covered. Do not drill the trailing edge hold-down screw holes.

Fit the new wing fore and aft to the seat carefully before covering.

After covering, put a small plug of modeling clay into the wing hold-down dowel hole in the fuselage former. Put a dab of cyanoacrylate glue on the wing leading edge plywood, then shove the wing into place on the seat. Allow a little time for the glue to adhere, then remove the wing. You should have a perfect impression of the dowel location stuck to your leading edge. Mark this hole and drill it, then install the dowel.

Use the same method for the rear hold-down holes. Put the dab of clay on the holes; use cyanoacrylate glue (CyA) on the wing, and—this time checking alignment carefully—mate the parts; then part and drill.

Check alignment carefully from the front. Be certain that the wing is level with the stabilizer. Shim or trim as necessary for good accuracy.

Covering: For the long wing I had the opportunity to try Coverite's 21st Century Space Age Film. This material is different from what most of us are used to working with. It is easer to use than Coverite's Micafilm, handles curves better, and has a brighter, more solid appearance. Follow printed directions carefully, and you will get excellent results.

Final shrinking of the material is decidedly different; when you add heat it reacts very slowly and initially *loosens*. But stick with it, and it will work. Our long wing has already been through some drastic temperature changes and has not needed any retightening.

Motors/Batteries:

The Graupner Speed 700 Turbo motors open many doors. The performance of Aria with either wing on the plain-bearing motor and one eight-cell pack is just fine, and this is the most economical way to go.

If you want to get to maximum altitude more quickly, get the ball-bearing motor that has the internal cooling impeller. Quicker yet, go to dual five-cell packs or even try two six-cellers in series on either motor, but we saw no compelling need for such power.

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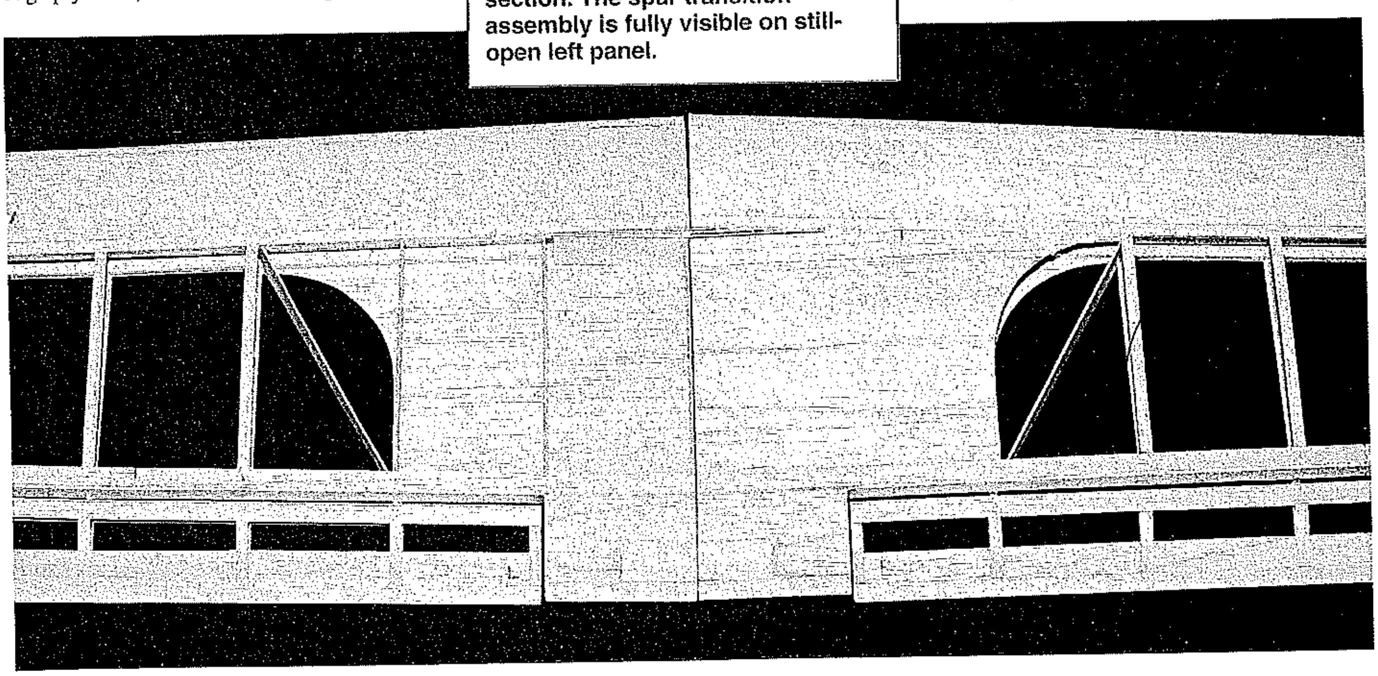
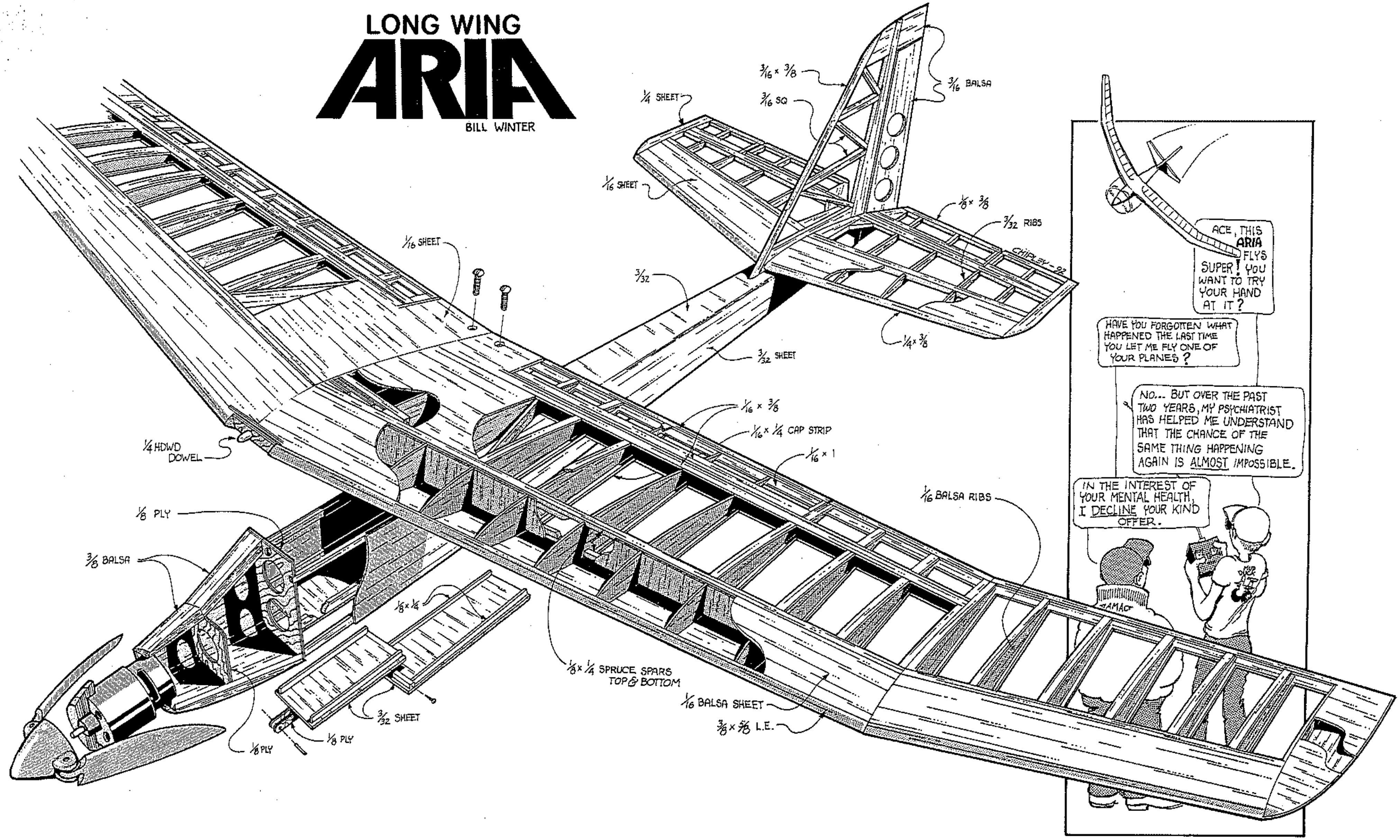


Inner panels slipped together for trial. Additional trimming is required to mate center ribs tightly. Left panel not yet sheeted at center section. The spar transition assembly is fully visible on still-open left panel.

LONG WING ARIA

BILL WINTER



Aria/Winter and Hunton

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Aria gets the job done on eight cells. For the dual packs we use a Hobby Lobby dual charger, which charges two packs simultaneously (it has dual ammeters with a variety of rates available). After selecting the plain or BB motor, a variety of battery packs is useful for various occasions; more cells for a windy or hot day, for example.

Perspective:

The short-wing Aria is more compatible with power models at the typical mixed-use flying field. This version is excellent for transitioning from power to electric. It will penetrate and handle strong wind with no problem. We flew the short wing at the club field on a Sunday when no one else would fly because of the wind. It will also react to thermals. The excellent flight characteristics help greatly in adjusting to electric, where much of the flight regime is out, high, and far away from the flier.

After you have made the transition from power to electric and are looking to expand your experience and capability in soaring, the long wing will provide better response to even weak lift and give you extended flights, sometimes seeming to last as long as you wish. Because BEC becomes a time-limiting factor, you need at least a 250-mAh battery pack for the receiver to exploit Aria's full potential.

Build both wings, and you have the optimum for all occasions and moods: interchangeable wings and battery packs.

Either Aria can be flown out of and back into a pea patch and will give you plenty of solid, environmentally compatible enjoyment. ✈

Letters to the Editor

Continued from page 5

(even when a dryer is used). These tanks have no provision for draining water.

A receiver should be drained daily to prevent rust. *Many people have been killed or severely injured over the years by air tanks that have exploded because of a fracture propagating from a severe rust pit in the tank wall.* You must know the pressure rating of the intended tank, and ensure that the safety valve is set at or below this pressure. Most tanks of the Freon and propane variety are not even marked concerning pressure. All systems that are commercially available in the U.S. have tanks constructed under the auspices of the ASME and are rated and code-stamped by licensees of that organization. If you must build your own compressor, you should obtain an ASME-coded tank with a petcock drain. Probably the easiest way to do this is to get a portable air tank, such as you would take to the service station to get air. Sears and various auto parts stores sell these.

While not quite as hazardous as the valve and tank issues, I encourage the user to use proper pipe and fittings for the pressures involved. Check the pressure rating of every fitting and pipe or hose you intend to use. *Soldered joints should not be used.* An adequate belt guard is a must, also.

Compressed air is a wonderful and versatile power source, but it can be deadly in the hands of an uninformed user. I have had the unpleasant task of sorting through gruesome accident scene photos more than once during my career. Each one was the result of carelessness with this usually friendly medium. Compressed air can kill in a heartbeat, believe me.

To summarize, I believe our members who need compressors would be much safer and more satisfied if they purchase a properly engineered and manufactured commercially produced compressor. I realize they can be expensive new, but alternatively you can readily find used units for sale in the swap- and trade-type papers. Many such units have more than enough life left in them to serve the modeler and homeowner well for many years.

If you want a new one, you will have to go to one of my competitors, as my company stopped making the small homeowner-type units a couple of years ago. I don't want to sell you a unit, and the only ax I have to grind is to help ensure that our members' experience with compressors is a safe and productive one.

Randy Little
Mocksville, North Carolina

More Input on Junk Box Air Compressors

I am forced to write in regard to your article "Junk Box Air Compressor" by Joel Hamm published in the November 1992 issue of *Model Aviation*, page 188.

This article certainly slipped past your safety committee! I was horrified to see such information and examples displayed and promoted in a safety-conscious publication such as *MA*. Please, please, please! Print a retraction and/or safety warning to your readers.

My highest concern is the use of a discarded Freon can. It is absolutely illegal (federal law) to reuse these cans for *any* purpose involving internal pressure of liquid refrigerant. The can design does incorporate a safety *blow-out patch* in case the can becomes involved in extreme pressures, such as in a fire.

The problem is this device is actually a can, not a heavy, certified (read expensive) pressure vessel. The sidewalls are very thin stamped steel. Air compression creates moisture condensation as admitted in the article by the need of the dryers in the system. This moisture collects in the can. Certified compression tanks have a valve to drain this collected moisture. The Freon can does not.

This collected moisture *will corrode* the very thin walls and seams of the Freon can. Thus at some point in time, failure will result. Most likely a slow leak and rusty

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