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Embrace Asymmetry with the PARALLAX

Although it looks unorthodox, the Parallax behaves normally in flight.

BUILD THE PARALLAX

Exploring asymmetry with an unconventional configuration

by Terry Dunn

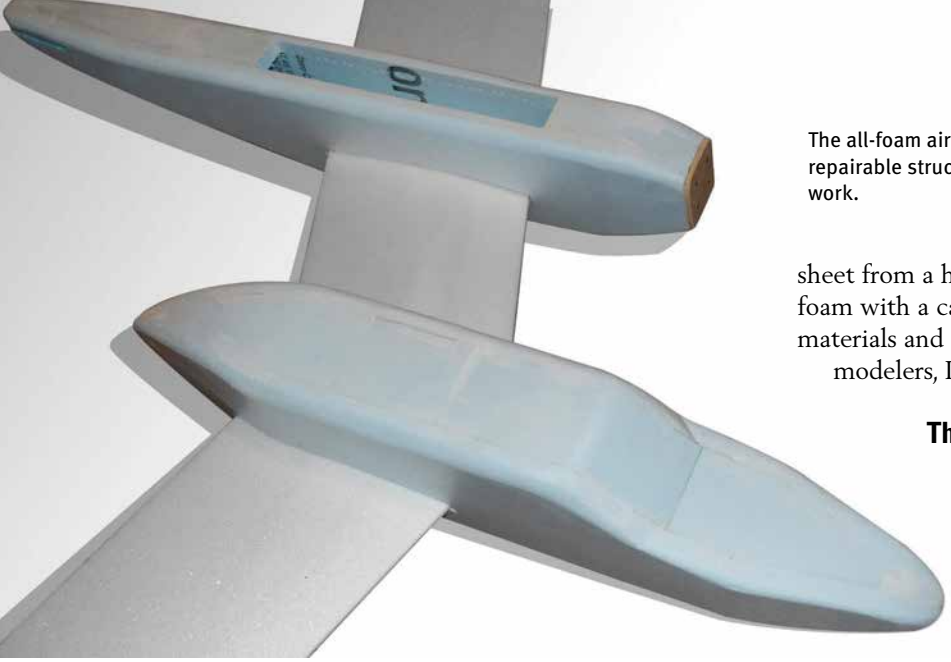
I recently set out to expand my understanding of asymmetric aircraft. When I began this quest for knowledge, I had the classic examples of asymmetry in mind—namely the Blohm und Voss Bv 141 and Rutan Boomerang. Both of these designs are proven successes, yet their unconventional configurations make one question how they can even fly in a straight line.

My breakthrough came when I realized that nearly all propeller-driven airplanes are asymmetric to some degree. With one or more propellers generating a spiraling slipstream, torque effects, gyroscopic forces, and sometimes uneven thrust (P-Factor), it's a wonder that any propeller-driven airplane can fly in a straight line! Yet, straight and level flight was mastered a long time ago.

The destabilizing effects of a spinning propeller are often mitigated by introducing subtle asymmetries to the airplane such as right thrust on the motor, right rudder trim, or maybe right rudder as you power up your tail-dragger for takeoff.

The Bv 141 and Boomerang must contend with those same destabilizing forces. What makes them appear so radically unconventional are the unique ways in which those forces are addressed. Instead of right thrust, the Bv 141 has the motor offset to the left of the airplane's lateral centerline. The effect is the same as right thrust, but the visual impact is abstract and disarming.

After I realized that asymmetry is the norm rather than the exception, my question changed from "How do asymmetric airplanes work?" to "How much asymmetry can be tolerated?" I started with one confidence-building asymmetric kitbash of a Flyzone Red Hawk (see "The Joy of Kitbashing" in the August 2012 *MA*). Next, I set out to design an asymmetric model that would appear radically unconventional, perhaps even unairworthy to some, yet would have stable and predictable flying traits. The Parallax is the result of these efforts.



The all-foam airframe of the Parallax produces a lightweight and easily repairable structure. This unit is ready for a coat of paint and finish work.

The fuselage and pod are constructed of 1/2-inch-thick blue foam, which negates the need for internal formers. Several Parallax components were built assembly-line style.

The Parallax is slightly more than a modern adaptation of the Bv 141. I make no claims that any aspect of the airplane's performance is enhanced by its asymmetry. My position is that little is compromised *despite* its asymmetry. This airplane is the foam-and-LiPo embodiment of the notion that airplanes don't necessarily have to look right to fly well.

The checkmark-shaped wing is an unnecessary deviation that I felt would add character to the design without presenting much more complexity. My prototype Parallax and one of the subsequent test models use a canard for pitch control. After testing the canard versions and those with a standard horizontal stabilizer/elevator, I prefer and recommend the standard route (not something I often admit).

My method for scratch-building is a process I call "stressed foam." With this process, there are no wing ribs or fuselage formers. The external foam structure is all there is. This makes prototyping new designs simple and quick.

The plans have detailed assembly steps for the airframe. I will review the basic makeup of the Parallax. The fuselage and cockpit pod are built with 1/2-inch-thick blue foam sheet from a home improvement store. I use Depron foam with a carbon-fiber spar for the wings. Although the materials and assembly techniques may be new to many modelers, I think most will find the building process easy.

The Outer Limits

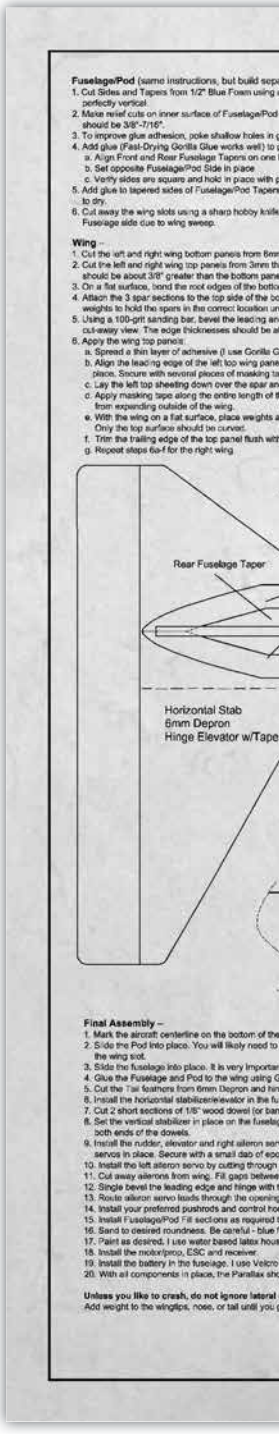
As I write this, I have built five Parallax models, including the prototype. Although built from the same plans, all of them have subtle differences that make them unique. Why would I want five of the same airplane? If you decide to build a Parallax, I encourage you to add your own touches. Because this is an unconventional model, I thought it would be best to guide you on which modifications are acceptable.

Similar to the Bv 141, the Parallax's motor is mounted to the left of the aircraft's centerline. The position shown on the plans has proven to be the most benign. If you move the fuselage any closer to the centerline, it will likely be difficult to balance the airplane laterally (right to left).

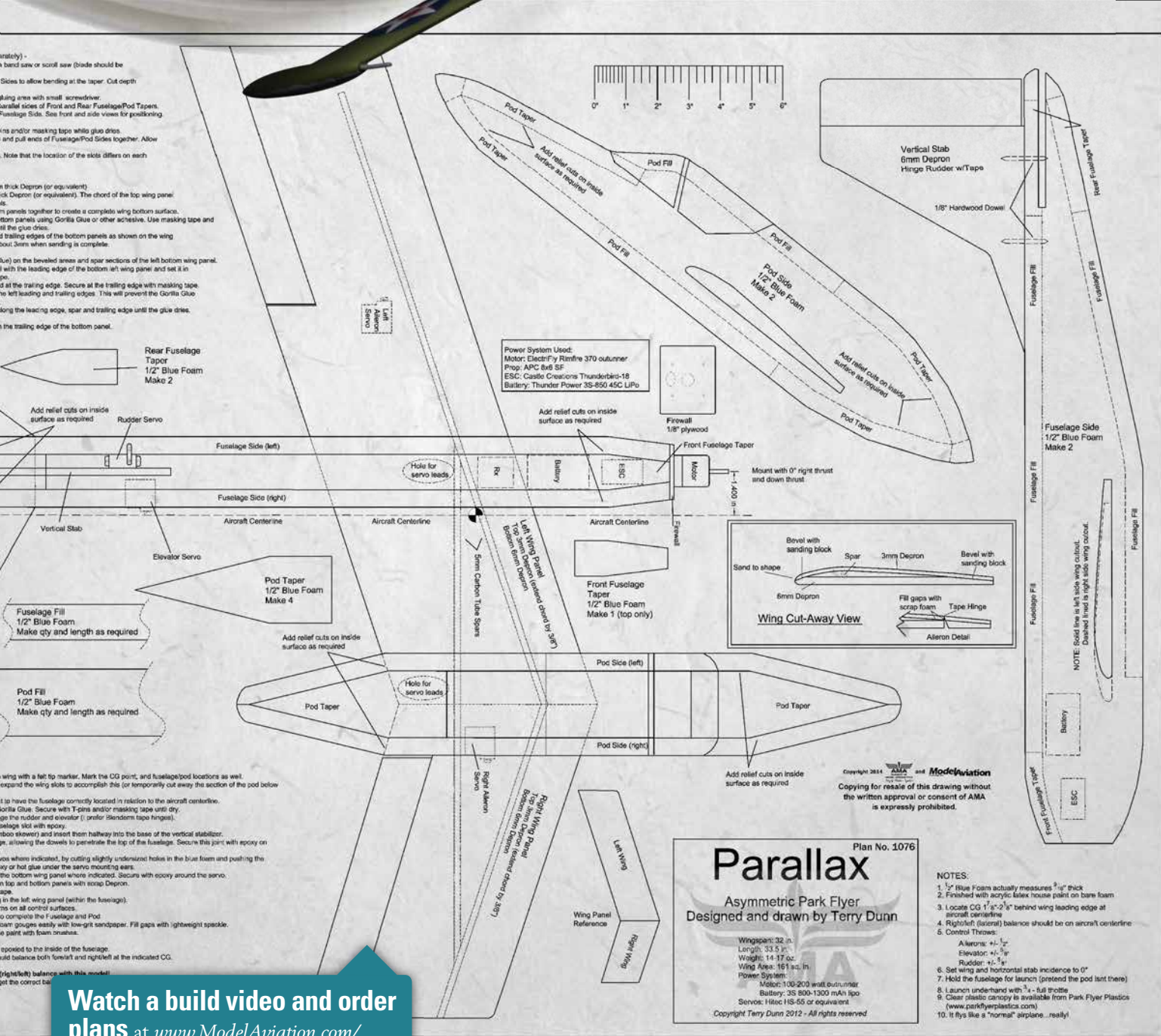
If you move the fuselage farther from the centerline, the effect of the offset thrustline will soon overshadow the propeller effects that the offset is intended to negate. You'll be stuck with an airplane that prefers to turn right. I suggest you stick to the location shown on the plans.

One of my Parallax models is a mirror image of the configuration shown on the plans. The fuselage is on the right side and the cockpit pod is on the left. In this case, I use a reverse-rotation propeller to balance all of the forces, which works well.

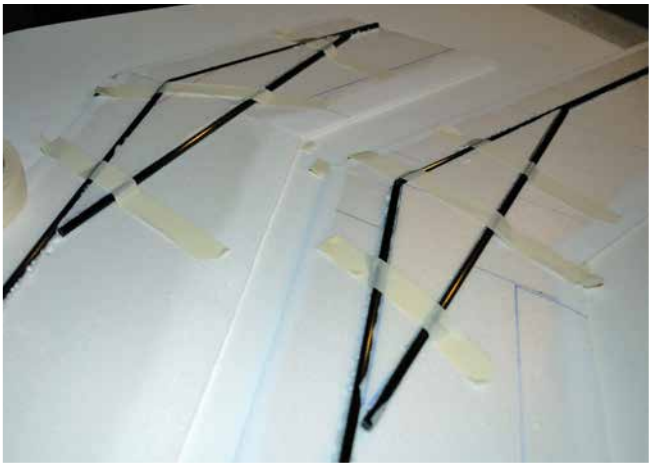
A fundamental design aspect of the Parallax (as with any airworthy aircraft) is that there is equal lifting area on either side of the aircraft's centerline. Any part of the wing that is obscured by the fuselage or cockpit pod does not provide lift and is irrelevant for this analysis. For the airplane to properly fly, it must be laterally balanced along the centerline.



This late 1930s-style Parallax is an example of how diverse themes can be achieved with subtle differences in shapes and colors. Note that the motor is on the right side, necessitating a reverse-rotation propeller.



Watch a build video and order plans at *www.ModelAviation.com/parallax* and in the digital edition.



The Parallax is built with Depron foam and requires no ribs. Here, the carbon-fiber spars are being glued into place before adding the top sheeting.

I installed an ElectriFly RimFire 370 motor in my warbird variant of the Parallax. This little motor provides plenty of power. Resist the urge to install larger, heavier power systems.

The Thunder Power 3S 850 45C battery is a cozy fit in the fuselage. Velcro keeps it in place. I left the battery area of the fuselage open for easy access and good cooling.

If you alter the width of the fuselage or the pod, you will also alter the effective wing area and centerline. The fuselage location must reflect this change as well.

Although lateral balance of the Parallax is not any more critical than on other airplanes, this model's unique configuration means it can easily get out of whack if you aren't paying attention.

You may want to add details to the cockpit pod. If you do, keep it light. Because the pod is offset from the centerline, any weight you add to the pod must be offset by weight in the opposite wingtip.

You can alter the shape of the tail feathers, as long as you maintain approximately the same proportions and area. You also have many choices when it comes to finishing the model. I prefer to paint mine with water-based latex house paint. It is inexpensive, goes on well with a foam brush, and can be thinned with water for airbrushing.

I've flown my Parallax test fleet with a variety of power systems. I found that I prefer smaller, lighter setups to more powerful ones. Roughly 125 watts is perfect for my taste. The ElectriFly RimFire 370 motor and Castle Creations Thunderbird 18 ESC noted on the plans reflect this choice.

With an 8 x 6 APC propeller and a Thunder Power 3S 850 45C LiPo, I get a lightweight system that balances the airplane well and provides plenty of power. All of my Parallax models have used either Hitec HS-55 or E-flite S-75 servos on every control surface.

Flying the Parallax

You may not believe it until you see it, but the Parallax flies normally. As long as you've kept it lightweight and stuck to the plans (or the allowed deviations), you should have a well-mannered sport airplane with aerobatic capability.

I prefer to start my flights with an underhand toss by the fuselage, never by the pod. It's a good idea to have someone launch it for you until you get it trimmed out. When in the air, you'll discover that the Parallax presents a unique profile in the sky.

Orientation can be challenging if the sun is low and you're not accustomed to the airplane's shape. Don't let that scare you. You'll quickly get used to it, and that unique shape is the purpose of this endeavor.

Elevator authority is good for tight loops and casual inverted flight. The rudder is not necessary, but it's fun to have for additional maneuverability. I can hold knife-edge flight on the left side with slight pitch coupling toward the canopy. Knife-edge on the right side has proven to be challenging, with excessive pitch coupling. If you master it, please share your secret with me!

The ailerons are effective throughout the entire

This version of the Parallax features a fall camouflage pattern that was created with water-based house paints.

SPECIFICATIONS

Type: Sport model
Skill level: Intermediate
Wingspan: 32 inches
Length: 33.5 inches
Weight: 14-17 ounces
Wing area: 161 square inches
Power system: 100- to 200-watt outrunner; 3S 800 to 1,300 mAh LiPo battery
Construction: Foam

Photos by James Lemon, Lee Ray, and Fitz Walker

speed range. Rolls are close to axial, but don't appear that way because neither the fuselage nor the pod is along the centerline. Both parts take corkscrew paths through the roll and make the maneuver seem more dramatic than it is.

When the airplane is upside down, the carefully measured left motor offset becomes right offset, but the propeller is still spinning in the same direction. Instead of neutralizing the propeller's destabilizing forces, they are exaggerated! The same is true of airplanes with right thrust.

You likely will notice a tendency to yaw to the left during inverted flight. Hold a little right rudder to compensate.

With the RimFire 370 motor spinning an 8 x 6 APC propeller, the Parallax has plenty of power for quick climbs and vertical maneuvers. Hammerheads to the right are easy because the offset motor provides extra yaw authority. Top speed is only moderate, but it's well suited for park flying.

I'm still amazed by how slowly the Parallax flies under full control. None of my other aircraft have snapped on me when I got too slow. They simply drop the nose and keep going. The Parallax is nothing more than a funny-looking sport airplane. Don't let its unorthodox looks scare you.

Conclusion

My adventures with the Parallax have satisfied my intent to learn more about the intricacies of asymmetric airplanes. I have also realized that understanding and utilizing asymmetry opens countless new and exciting possibilities for unique designs.

I am far from finished with this foray into a seemingly untapped genre. If you'd like to join me, I think you'll agree that the Parallax is a good place to start.

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SOURCES:

Castle Creations
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E-flite
(800) 338-4639
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ElectriFly
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