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HATZ BANTAM

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»»» HATZ BANTAM

Mark Marino makes a new aircraft out of a familiar design

GREG LASLO

Mark Marino had all the usual reasons to be anxious before the first flight of his homebuilt. As he strapped himself into the North American Flyer, and moved his hand toward the starter, he paused, looked everything over, then looked it all over again, expecting something to tell him today was not the day. ¶ This was a new sensation. Taxi tests had gone well. Even with the tail up, his nerves purred along, smooth as the new engine in front of him. But now he would fly, and all the extra reasons he had to be anxious began to percolate. ¶ Glancing at the airplane as it sat on the ramp it'd be hard to tell anything was different about Marino's Hatz biplane. Look closely, though, and the cowl appears more delicately carved than even that of a 100-hp CB-1. And since you know a thing or two about Hatzes, you might notice the airplane looks a little trimmer, certainly more so than a grumbling Hatz Classic, with its faired-out fuselage. Now, maybe, you'd understand the reason for his case of the nerves.

As he pushed the throttle forward, Marino's Hatz Bantam, his one-of-a-kind light-sport biplane, jumped off the asphalt at Sky Harbor Airport (KDYT), in Duluth, Minnesota. And by so doing, it left all of his concerns behind.

"If it had been a straight CB-1, I don't think there would have been as much anxiety," he said. "I knew it would fly, but I didn't know how well it would fly. I worried about ruining a perfectly good airplane."

That can happen when you tweak the design of one of the most popular plans-built biplanes ever drawn. So if you're going to do it, you'd better have a pretty good reason. As it turns out, he did—he wanted to update the design to reduce and shift weight to meet the light sport aircraft standards, and also to change the way

a plans-built aircraft is built. When it flew, and flew well, three years of work struck gold.

"By the time I was at 50 feet, I was having a blast," he said. "The anxiety turned into fun—with the same intensity."

»»» Old Design

The story goes back to the Lycoming O-290D engine Marino intended to put on his CB-1, which he'd already had umpteen-hundred hours invested in building. You could go even further back to the Citabria he restored and how frustrated he was that he couldn't change things that were done 30-odd years ago, things that even the manufacturers don't do anymore.

But really, you might as well stop at the



Mark Marino and his wife, Sandra Ettestad took home the Grand Champion Experimental Biplane trophy at the National Biplane Expo.

PHOTOS BY BONNIE KRATZ AND PHIL HIGH



»»» SPECS

Aircraft Make & Model: Hatz Bantam
Certification: Amateur-built experimental
(FAA-approved, 51 percent kit)

Length: 19 feet, 11 inches
Wingspan: 23 feet, 6 inches

Maximum Gross Weight: 1320
Empty Weight: 780
Fuel Capacity: 18 gal. main; 5 gal. aux
Seats: 2

Powerplant Make & Model: Jabiru 3300
Horsepower: 120
Cruise Speed/Fuel Consumption:
105-110 mph/ 5gph
Wing Loading: 7.7 lbs/ sq. ft.
V_{SO} 27 mph

For more information:
mark@hatzbantam.com
or call 218-310-2333

engine. "I thought, why am I building a brand new aircraft with an engine that's not supported? I wanted a new engine, and the Jabiru was the one I liked."

So here was his problem: at about 180 pounds, the brand-spanking-new, state-of-the-art Australian six-cylinder, 120-hp engine he wanted weighs roughly two-thirds of what the 1940s-era Lycoming does. Immediately, he had a weight-and-balance issue.

He figured he had little choice but to start over, pulling the plug on the 1,300-hour project that yielded a half-built CB-1. "Modifying it to change from the Lycoming to the Jabiru was too much," Marino said. "It did hurt a little to think about starting another one, but thinking about what I really wanted took over. You become so obsessed, you forget about it."

He sold the old airframe, figuring he'd never go back to it, and looked for ways to balance the airplane. "I spent a lot of time weighing parts," he said. "Not to make the airplane light, but in relation to the center of gravity. I wanted more weight forward, without adding weight to the nose."

Except that, everything he did to lighten the aircraft further changed the weight and balance, which meant he had more changes to make. In the end, the "new" airplane he was building himself really did become a *new* airplane. Before he was done, he changed the wings, the fuselage, and most of the components, all the while keeping the flying personality that's made the Hatz a popular design.

Marino started moving weight, first in the tail section. He shortened the fuselage 4 inches by moving the last station of the fuselage, which has the fittings for the tail parts, forward, bending the longerons to taper to that point. With roughly 30 pounds of steel tubing shifting locations, that moment arm is not at all insignificant. The original Hatz CB-1, *Happiness*, had a tail 6 inches shorter than the current drawings,

so this didn't cause him any great concern—and moved the wings back an inch-and-a-half. Slowly, the center of gravity crept forward.

Next, he moved the fuel tank from the top wing center section to

»»» **HE WANTED TO UPDATE THE DESIGN TO REDUCE AND SHIFT WEIGHT TO MEET THE LIGHT SPORT AIRCRAFT STANDARDS, AND ALSO TO CHANGE THE WAY A PLANS-BUILT AIRCRAFT IS BUILT. WHEN IT FLEW, AND FLEW WELL, THREE YEARS OF WORK STRUCK GOLD.**

under the cowl, like a J-3 Cub, to take advantage of space and to get some weight forward of the center of gravity. By removing the plywood support for the old tank, he shed another 9 pounds, and he said the old tank itself was nearly 20 pounds, if his memory serves right. While the new tank is simpler and lighter, it also uses a trick of design to keep the weight forward as fuel burns—the back side of the tank and the bottom are slanted toward the front like a snow shovel. He said he weighed a lot of fuel tanks to come up with this design.

He got to the point where he wondered if the airplane was getting too light, too kitey, with lighter-than-designed wing loading. To nip that in the bud, he shortened the wings by one rib, or 12 inches, on each side, which resulted in wing loading almost identical to a CB-1. The internals of the wing stayed the same—the dimensions of the spar, the attachment fittings, and so forth—except he attached stamped aluminum ribs to the wood spar instead of stick-built wood ribs, to



EAA SPORTPILOT

THE HATZ BANTAM is a sport-pilot-eligible design, which means it meets the definition of a light-sport aircraft:

- >> Maximum gross takeoff weight—1,320 lbs.
- >> Maximum stall speed—51 mph (45 knots)
- >> Maximum speed in level flight with maximum continuous power (Vh)—138 mph (120 knots)
- >> Single- or two-seat aircraft only

If flown by a sport pilot, the necessary medical certification is a driver's license or a third-class medical certificate.

To learn more about flying as a sport pilot visit: www.sportpilot.org

In Marino's design, the Bantam refers more to weight than size, and the plane ended up as sort of a clipped-wing version of the familiar Hatz.

save time and eliminate the need to rib-stitch. The metal ribs can be riveted to the wing covering.

"Having gone through the process of building wing ribs, it was time-consuming; even if it was a lot of fun, I hated to do it again," he said.

He braced the wings with aluminum compression tubes—again, lighter than traditional steel, and tons easier to work with—and removed the ailerons from the top wing. "A lot of Hatz builders do that," he said. To keep the airplane's classic lines with shortened wings, he moved the wing struts inboard.

"I ended up with a clipped-wing Hatz," he said. "That's where 'bantam' came from—it's a slightly smaller version of the standard breed."

In the finished airplane, "bantam" refers more to its weight than its size. The wings are about 22 inches shorter than the CB-1, the extra couple of inches thanks to the wingtip selection Marino chose. Instead of a rounded wingtip, where the bow spans the centerline of the rib, with the top and bottom of the wing tapering down, he used what is essentially half a rib throughout the tip—that is, the top of the tip maintains the Clark Y airfoil, while the underside bevels upward. That's a 4130 steel bow in there, supported by aluminum bracing. "My theory was that if [it] had an airfoil all the way out to the

tip, it's doing more than if it's taped down."

But when you take a couple of feet of wing off, you're reducing the airplane's weight even further. "Before long you've got a different category aircraft," Marino said. A light-sport aircraft, actually.

"When the LSA category changed to 1,320 pounds, I had to do that," he said. "There was so much buzz about the LSA industry, I said, 'What the heck, let's see if it works,' and it did."

With its lighter weight, the Bantam could use some of the less robust LSA parts instead of full-sized airplane parts. That shaved more weight. For example, Marino uses a new style of 6-inch LSA wheels from Matco instead of standard category wheels. He also stops the airplane with lighter Matco brakes designed for LSAs, choosing—again—to shave weight by ditching the "heavy-weight" Cleveland brakes.

"I lopped off 10 pounds—it just kept going," he said. Now, the aircraft sits empty at 779 pounds, with about 540 pounds' useful load.

»»» New Airplane

This, of course, created his second problem. "You know how this works; you change one thing, you end up having to change a hundred," he said.

And that, in turn, resulted in his second solution—this time, the one that changed everything. He put the project on hold to take a 13-week AutoCAD computer drafting class. With that knowledge, and his own version of the software, he started redrawing the plans electronically. This is where things get interesting. This is what makes this more than just a guy-builds-an-airplane story.

There are worse places to live than Duluth (home of Cirrus Aircraft) if you've got a digital set of plans for an airplane you're trying to build. Turns out, there's a lot of technology floating around the city, including water jets and CNC milling machines that cut out parts like scissors in a kindergarten art class.

"The tooling is mostly on a disk," Marino said. "There's a cottage industry in Duluth, thanks to Cirrus. I can e-mail a drawing of a wing rib, and that afternoon, they'll build the part."

For example, to build the seat pans, he drew out the parts' dimensions, adding details like 12 tabs along the bottom of a seat back that make it look like a dull two-man lumberjack saw. These, of course, are the rivet tabs that bend over the bottom of the pan once the seat is folded into a three-dimensional structure. "You draw it the way you want it," he said. "All the holes are there. All you do is Cleco it together."

The gear-leg axle assembly is another technological coup for Marino. The piece is a chunk of billet 2024-T3 aluminum milled to allow one gear strut to fit through it while another bolts onto it. "Instead of welding, you just stick it on the gear leg and bolt it on," he said. "I drew it like I wanted it to look if I didn't have to build it myself.



The captain's seat sports a Dynon primary flight display, but is otherwise spartan, as befits a craft intended for VFR, day-only flying.

I took it to a local shop, and they said, here's how you do it."

The computer-aided design paid for itself in spades when it came to measuring for the flying wires—a notoriously gut-wrenching process, given the price for the made-to-fit parts. Instead of taking tape measure to wire tabs, he took the measurements off the CAD drawings. He mocked up the wires with mild steel, cut them to fit, and installed them on the airplane. "When I put them on, there was no change in the fit, so I ordered my wires off that," he said. "I didn't have to do anything."

Dial-up custom parts are handy, but if you're redesigning an airplane, the biggest advantage to AutoCAD is the program's ability to update the entire airplane at once, Marino said—kind of like finding and replacing words in a word-processing program. If he makes one change to, say, the vertical stabilizer to move it forward, all linked changes are made as well. On paper, he'd have to find every mention of the parts to make changes there, too. "You see changes in the whole airplane," he said. "When you compare one page to the next, you overlook so many things."

All told, the design and rebuild—"I tell people I've built three Hatzes so far; two of them I threw away"—took about three years, a pace aided significantly, no doubt,

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by the parts-on-demand outsourcing and by building jigs and fittings. "It's not an old airplane; it's a new one," he said. "If you have the technology to build a new airplane, use it."

If it doesn't quite look like it on the outside, it certainly does on the inside, particularly in the captain's seat. Right in front is a Dynon primary flight display (PFD).

Let's mull on that for a minute: this is a glass-cockpit biplane.

"I don't need it, but it gives you a lot of information for a low cost," Marino said. "New gadgets are fun and inexpensive—why not use them? It's a new airplane." Indeed. In that sense, the PFD is a hint at the machine-cut parts that lie beneath the airplane's skin.

Speaking of making it a new airplane, there is, of course, the new engine. With the Jabiru, the airplane climbs at about 1,100 fpm at 65 mph with both seats filled, and the redesigned airplane maintains the CB-1's mild-mannered behavior, Marino said. Even stalls are a gentle mush, indicated more by a descent rate approaching 800 fpm—there's a lot of wing out there, after all, even if it is made out of aluminum—when speeds drop below 27 mph rather than any unfriendly break. But ease

the stick forward, and it'll start flying again, Marino said.

The common comparison for both the CB-1 and the Bantam is the J-3 Cub. Compared to it, the Bantam is downright spunky, Marino said, with snappier rolls, better climb, and, well, that other set of wings.

He's not measured a super-short takeoff roll, but he suspects 300 feet would do the trick. Cruise performance is fairly sporting, too. The Jabiru goes all day at 2850 rpm, where it'll pull a tad under 110 mph, or about the same as a Hatz Classic built around the Lycoming O-320. It'll do it at 5 gallons per hour, too, in case you care about those things.

"I didn't really want to go that fast," Marino shrugged. "But that's what it does."

Even so, the Jabiru pumps away smoothly and quietly, he said, and it lends the aircraft a distinctive sound as it turns the Sensenich wood prop. Incidentally, that's his second prop; the first, a 64-by-46 pitch that allowed him to cruise at 115 mph with an 800-fpm climb, was too heavy a club and kept the engine from turning anywhere near 3000 rpm (it redlines at 3400). With a 64-by-44, he can tap 3300 rpm, and wide open, it'll still hit 125 mph.

Marino's design fits light-sport parameters, and there aren't all that many biplanes out there that do.

"Big deal," he said. "I'm already going faster than I want, anyway."

Ironically, given the time and effort in designing a "new" airplane, Marino wasn't looking for anything other than a day VFR airplane—it is a light-sport aircraft. Besides the Dynon unit, the instrument panels are spartan. He's got a backup airspeed indicator in the front seat if he needs it, but he prefers to fly by feel more than formula. As he puts it, if the tach fails, he can always listen to the engine. If the altimeter goes, he can always look down. "As long as I can get back," he said.

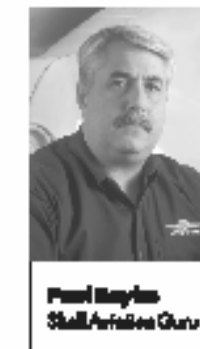
In the end, the moment of truth for all Marino's work came when he put the airplane on the aircraft scales. "The center of gravity came out right where I measured it," he said. Not that it was a huge surprise, since he had weighed nearly every part on a bathroom scale, but there was an element of theory-versus-practice to it. "I felt pretty comfortable most of the time that it was going to come out pretty good, but there was no way to prove it until I weighed it."

The last unexpected trouble he's



ANSWER COLUMN

Q: What can I do to protect my aircraft's appearance during winter storage?



Paul Baylis
Shell Aviation Guru

As To answer this detailing question using Flight Jacket products, I've asked Renny Doyle, a professional detailer and owner of Attention to Details, to help me out this month.

Renny: First, I always tell people to do their aircraft-cleaning tasks during the fall and winter months. Do not allow dust, bird droppings, bug splatters and other gunk to remain on aircraft surfaces. A simple wipe down with a Flight Jacket Micro Fiber towel and



Renny Doyle
Detailer & Owner,
Attention to Details

Touch & Go just once or twice a month can help prolong the life of the aircraft's paint. Leaving dirt and oil on an aircraft's belly can also permanently damage the paint and make future cleanings more difficult. Flight Jacket offers three useful products for cleaning the aircraft belly. Touch & Go is great for those that clean the belly area, because it leaves a streakless finish. Flight Jacket Oil and Exhaust Cleaner is great on fresh oil and exhaust. When followed by Touch & Go, this step will leave a clean and smooth surface. For those of us with little time to clean the aircraft belly, I recommend cleaning with Flight Jacket Oil & Exhaust Cleaner, followed by Flight Jacket Polish. Using a 100% cotton terrycloth towel, apply a half-dollar size amount of polish to the aircraft until a thin haze remains. Then simply wipe away the haze with a Flight Jacket Micro Fiber towel, which will remove every fuel and oil stain in a much safer fashion than using harsh chemicals.

Paul: Any comments on proper windscreen care?

Renny: Flight Jacket Plexcoat has become the favorite window product of many pilots for good reason. It was designed with windshields and windows in mind. Used in conjunction with the Flight Jacket Antistatic Havel Pad, Plexcoat not only cleans and protects, but can also remove minor scratches and discoloration.

Paul: Thanks for those great suggestions, Renny. In our upcoming Spring Answer Column, we will address questions about the use of canopy covers and protection of your aircraft's interior.

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had is engine cooling. The Jabiru's oil runs a little hot inside the cowling he designed. "I'm well within temperature range, but I live in Duluth," he said. "I'd like to be able to fly it to Oklahoma," to the Bartlesville biplane fly-in.

He's tweaked the layout, including moving the oil cooler, but his latest solution took him back to the computer keyboard. He drew an aluminum baffle to direct airflow over a bigger engine cooler. Using a large-format plotter, he drew out a full-size template, cut the shape out of aluminum, and is fine-tuning the fit. It'll come; he's sure of it.

"It's a new engine in an airplane it's never been in before," he said. "It really is experimenting."

By now, he should be accustomed to that feeling. He's already started his second Bantam, the *Gitichigumi Flyer*, named after the Great Lake right outside the hangar door. Granted, this time, it shouldn't be quite the challenge of the first—and not just because he's already built jigs, or because he's already drawn the plans, or because the proof of concept is parked nearby. This time it will be different, because this time, it's *this* time.

"I remember thinking as I passed over the hangar that I'll never be able to do this again—make my first flight in my first airplane," he said, skipping a beat to think about the experience again.

"It was worth every minute of it," he said. 

Hatz Help

Digital parts will speed other builders' projects

After positive feedback on his Hatz Bantam design on homebuilders' websites and forums, Mark Marino has taken his digital approach to parts fabrication and run with it. His Bantam meets the 1,320-pound definition of a light-sport aircraft, and there aren't many biplanes out there that do.

He's just released the Hatz Bantam plans for sale, and he intends to fabricate parts for Bantams and CB-1s. A handful of parts are interchangeable, among them stamped wing ribs, computer numerically controlled (CNC) fuselage fittings, seats, flying wire lugs, and landing-gear springs.

"I want to make as many parts as possible and make them available to builders," he said. He'll also sell materials packages to accompany his plans, including wing ribs and completed fuselages. Thanks to the AutoCAD design software he used to redesign the Hatz, he's got a contractor in California who can deliver steel tubes custom cut and beveled, ready to fit in the jigs he's having fabricated. Same goes for the wing ribs—he even invested in a 50-ton press to stamp the rib blanks around a form.

"A wood rib weighs 5.6 ounces; an aluminum rib weighs 5.5 ounces," he said. "The major difference is the time. There's got to be pilots who don't want to spend 800 hours building wings."

He's currently talking with other LSA manufacturers about becoming a dealer, and by the end of the year he also wants to have a workshop built where customers can take their first assembly steps under the guidance of an expert builder.

For more information about Hatz Bantam plans, pricing, and availability, visit www.HatzBantam.com, e-mail Mark@hatzbantam.com, or call 218-310-2333.

Evolution of a Biplane

Bantam Hatz is one
in a line of modifications

Mark Marino wasn't the first builder to modify a Hatz to make it fit his particular needs when he designed the Hatz Bantam, a light-sport aircraft version of the airplane powered by a six-cylinder Jabiru engine. In fact, he's next in a line of builders who have modified the airplane to fit a variety of needs and powerplants.

Marino wanted to put a smaller, lighter, and—frankly—newer engine on the airplane, in effect taking a classic design forward. But the Hatz is a design that's inspired other changes since John Hatz first flew his, dubbed *Happiness*, in 1967, and Dudley Kelly completed drawings of the aircraft in 1970.

Since then, other builders have made several major—and not-so-major—changes of their own, mostly slipping back in time into 1930s-era radial engines, more in theme with the airplane than a newer one. Steve Lund modified his—an eventual Oshkosh Grand Champion—to accept a Kinner engine, while Ken Williams used a 90-hp LeBlond. The majority, though, are outfitted with the usual suspects—a host of horizontally opposed engines ranging from 85 to 160 hp.

The biggest modification came when Billy Dawson redesigned the Hatz into the Hatz Classic. The new design, Dawson's third Hatz, was "beefed up" with fuselage stringers to fill out its shape, more akin the 1930s-era Wacos that inspired Hatz. Underneath its skin, Dawson employed push-pull tubes in place of cables for the aileron and elevator linkages. He replaced the wood truss ailerons with ones made from aluminum, reclined the seats to allow more legroom, and permitted for larger engines—typically O-320 Lycomings. Judges named Dawson's Hatz Classic 1997 Grand Champion at Oshkosh.

For more information on any of the Hatz designs, visit the Hatz Biplane Association at www.WeBeastie.com/hatzcb1 or visit Billy Dawson's Hatz Classic website at www.HatzClassic.com.

—Greg Laslo