

DRONES KILLING DRONES: WHY IT WAS BOUND TO HAPPEN

SEPTEMBER 2017

Plane & Pilot

SHOCK & AWE

**EXTREME
OUTBACK
AMAZES**

**WOMEN &
WARBIRDS**

Why it's a
Natural Fit

**ADS-B
MADE EASY**

A Step-by-Step
Installation Guide

PILOT'S ARIA?

World-Class
Operatic Tenor Sings
Flying's Praises



2017 Zlin Outback Shock >>

Plane & Pilot[®]

Published August 18, 2017

Shock & Awe

Taking LSA performance to a crazy new level

By Dan Johnson, Photography by Joey Maggio

When CubCrafters of Yakima, Washington, built a Light-Sport Aircraft version of the classic Cub design and installed the industry's most powerful engine, it resulted in the company selling a lot of planes. It's still selling a lot of planes.

It's not the only LSA maker selling what are often referred to as Cub clones. There are many LSAs that can be described as being in the style of a Cub, and it's no surprise. Many pilots look fondly on these modern recreations of the original for nostalgia and simple flying fun. That said, today's aviation consumer demands more than the low-powered bare bones of the old-time tube-and-rag classics, asking for and getting such new-millennia features as modern digital instruments and deluxe, refined interiors. CubCrafters' Carbon Cub had all of that plus a big engine—a 180 hp Titan powerplant that gives the model some eye-popping performance.



Yet when a product succeeds in the American marketplace, it is nearly a sure thing that competitors will follow.

They did. Predictably, they looked to one-up both in terms of performance and features but also by lowering the price.

First came the noteworthy Just Aircraft SuperSTOL. This airplane from South Carolina thoroughly impressed observers with its breathtakingly short takeoff rolls and seriously steep climb angles. It did all that with a 100-horsepower Rotax 912 engine. Over time, the company added increasingly powerful engines, which further improved the already stunning performance. Don't believe it? Check out the YouTube videos.



The Outback Shock needs little more than a small field to get airborne or to set back down again. With its big tires and beefy, shock-absorbing gear, it's rough and ready, and its super-slow landing speeds sweeten the deal.

Then Came Zlin

Although they've gone through the process of meeting ASTM standards and gaining FAA acceptance for earlier models, Just Aircraft has been so busy building a kit version of their warmly received SuperSTOL that they haven't taken the time-consuming step of preparing a ready-to-fly Special LSA variant of this model. If customers wanted a SuperSTOL, they had to build it themselves.

That left an opening. Given that nature and free markets loathe a vacuum, SuperSTOL was soon to have company, though the resultant airplane took kind of a roundabout path to market.



As long-time aviation types know, Czech-based Zlin is no newcomer to the LSA world. Dating back to the late 1990s, you may already know its Savage models, reported frequently as the Classic, former iCub and later the Outback and Nomad, plus the one-of-a-kind Bobber.

Zlin's SuperSTOL competitor, the Outback Shock, isn't exactly a new model, but there's nothing else quite like it. To get to the level of shock it wanted, Zlin upgraded their existing Savage, selling the resulting model in Europe as Shock Cub. Because some of the features of this new model can be added to some older models, SportairUSA importer Bill Canino refers to the new components as "the Shock options." He notes that many of these hardware items can be retrofitted to earlier Outback models—"Outback" being a new name Canino created to avoid use of the name "Cub," which is now owned by CubCrafters. Bill further noted that Outback owners can choose attributes over others in *à la carte* fashion, for example, picking just the landing gear but not the wing slats.



The usual geometry of Cub-like planes hides the fact that the Outback Shock features enhancements at just about every spot on the airframe.

In creating its Shock model, Zlin pulled out all the stops. The Czech company added automatic wing slats, distinctive landing gear, double-slotted flaps, and, of course, the big engine, which combine to create an aircraft that seems custom made to land in a field of large boulders. Okay, we exaggerate, but not by much.

Zlin's clever marketing and the mighty engine combine with the convincing aerodynamic results to create an airplane that's a head turner. When I first saw it at Aero Friedrichshafen in Germany in spring of 2016, the plane attracted admiring glances from pilots everywhere, including me.



While steeper than a normal climb—if there even is such a thing in this plane—the attitude of the plane shown at right is well within its typical operating envelope. PHOTO: Ole Steen Hansen

Different, And Better

Custom hydraulic side-mounted shock absorbers with 12 inches of travel and a suspension geometry integrated into main and tail landing gear virtually eliminate the problems of touchdown rebound and ground hop common with some traditionally sprung landing gear designs.



Shock absorption is important when you're bouncing off near-boulder-sized rocks, so even the tailwheel gets a strut.



The power sidewall-mounted throttle lever helps clear everything up about what kind of plane you're in. Once you push it forward, your viewpoint on the similarities between old-fashioned Cub and Shock will change immediately.

The gear position is also moved forward to enhance braking capacity with less risk of nosing over. As a result, the Outback Shock lands and taxis with remarkable control and stopping power. The tailwheel is also shock-absorbed.

Looking deeper into the details, the Shock options include what SportairUSA calls the “hyper-STOL” wing profile, boasting short takeoff and a faster rate of climb. This incorporates three-section slatted wings that move independently according to airflows with no pilot involvement, combined with two-element, or double, Fowler flaps plus strategically placed vortex generators in various locations to optimize low-speed control.

Compared to earlier models, the Shock's wing is different in ways beyond the visible slats and Fowler flaps. The newly designed wing has six inches of added chord length, all-new spars, stamped aluminum ribs, plus

strengthened attachments and other structural improvements. Truncated or squared wing tips have wing tip fences (plates on the tip) to control tip vortex and reduce drag.

Joined to a sturdy welded steel inner structure, Zlin successfully subjected the Shock-option Outback to more than 1,600 pounds of load at 6G, holding this weight for over two minutes without deformation.



Big struts and beefy materials are designed to help the Shock continue to take a licking while the pilot still keeps sticking the short-field landings.

Additionally, a 40 percent increase in aileron surface area, together with a refined airflow design aided by vortex generators, allow the pilot to keep full control authority at extremely low speed on approach. Shock's Fowler flaps extend 70% from their retracted position and the flaps can be equipped with mini vortex generators installed inside the vane. Zlin and SportairUSA love VGs; they are available for the wings, rudder, flaps and horizontal tail. The tailplane also saw changes beyond the shock-mounted tailwheel. Rudder and elevator surface areas were extended more than three inches aft to balance the moment from the new wing design.

So what does all this do for you?

The significant increase in wing lift provides added performance in landing and takeoff. With a 180-horsepower Titan engine doing the pulling, Outback Shock can launch in less than 200 feet at gross weight and land in barely over 100 feet. With a single occupant these numbers are halved.

One part of the takeoff and landing prowess of Shock is low stall speeds...really low. Stall in the airplane with a single occupant is an astonishing 18 mph or 15.6 knots; even at gross weight, stall occurs at 23 mph (20 knots).

Shock lets you keep a better eye on your landing site thanks to a pitching moment generated by the deep flaps that results in a lower nose attitude on approach. Shock pilots can operate from smaller fields and land in places you might not otherwise consider (although this comment is not intended to encourage risky piloting behavior).



A popular solution for hot-rod taildraggers, the Titan engine offers conventional design with high-end performance.

Shock In Flight

Descriptive information is useful but pilots want to know, “How does it fly?”

We flew the very first Outback Shock in the country. Because it quickly sold to a customer at Sun ‘n Fun 2017, importer Bill Canino took the front seat as PIC while I maneuvered my way into the rear.



While it sports a familiar Cub-style shape, the control surfaces are big enough to affect the desired control force even at very slow airspeeds, when air flow slows over the surfaces, too, and might otherwise limit control effectiveness.

Entering Shock takes a measure of human flexibility plus the right technique. Your aerial companion should be up for the physical prowess needed to get into the plane. The good news is that once in, the seating is comfortable and egress is considerably easier.

Aiding entry for each of us was a very wide (front-to-rear) door combined with an overhead welded steel structure useful to hoist yourself inside. After strapping down with secure four-point seat belts and donning Lightspeed headsets with active noise reduction, we were ready to fire up the Titan engine.

Once cleared by the air boss for launch, we added full power and the Titan X-340 roared in response.

Two things happen almost immediately. The throttle barely hit the forward stop and the Shock's tailwheel lifted off the ground, propelled by a huge blast of air over the empennage. You are pushed back in your seat. The signal is clear. You are soon to leave *terra firma*.

On the somewhat bumpy grass runway in Paradise City at Sun 'n Fun, it was hard to estimate the takeoff roll, yet it appeared close to the 200 feet stated by the factory. It took but a few seconds and we left the ground in a rush to the sky. Once we left the pattern, Bill handed the controls to me.



There are numerous glass panel options available to the Outback Shock builder, but many choose to go with steam gauges supplemented by a tablet or two.

I often start with Dutch rolls. This coordination exercise tells me what to expect of an airplane's general handling qualities. Initially, I found the controls slightly heavier than I expected; the Outback Shock is larger than the slimmest Light-Sport Aircraft. However, control authority was excellent. What you input returns a predictable result; no one will call the Shock twitchy.

Roll response was smooth and soft. I discovered no edginess to make me uncomfortable. I was able to pivot the Shock from 45 to 45 degrees each direction while keeping the nose pointed mostly straight ahead after only a couple trials. Such fast success proved satisfying and reassuring. It was clear that landing on a short strip would not introduce control worries.



The cockpit configuration is very much like an old Cub or Super Cub, with the horizontally folding barndoor-style entry. You do solo this bird from the front, like the PA-18 but unlike the J-3.

What about landing speeds?

Given dependable, effective controls on approach to a very short runway, you can slow, and slow, and slow to speeds called extreme by most other pilots. How slow? Before making a landing approach, to learn about slow-speed handling, we first did a series of stalls at altitude.

My regular routine includes power-off approach-to-landing stalls, full-power departure stalls, and accelerated stalls, by which I mean banking to 45 degrees and pulling aft until entering stall. With the joystick as far back as I could move it and even when entering more aggressively, the Shock proved exceedingly well behaved.

Every time, the Outback Shock entered mushing flight, becoming somewhat more sluggish in response but not feeling unstable in any axis. Indeed, I experienced no drop of the nose and no drop of the wings regardless of how gently or assertively we entered stall. Throughout multiple stalls, I saw speeds in the 26-27-28 range and this is in miles an hour (22-24 knots). Remember, this is no ultralight; the Shock is a substantial airplane, yet its stall behavior is very unthreatening and its very slow speeds seemed surreal.

Thanks to a tailplane with generous volume located well aft, the stall exercises demonstrated pitch is also highly predictable. No sudden movements occurred.



In its element in the grass at dawn, the Outback Shock is ready to bump a few times and then take to the air.

That big Titan engine is mighty powerful but also much noisier than the Rotax 912 that is still overwhelmingly the most popular LSA engine. Of course, the Titan powerplant also consumes more fuel than the very eco-friendly Rotax series. If those qualities concern you, you can always choose a Rotax 912-powered Shock. From a performance standpoint, you won't miss much as the engine is considerably lighter, offsetting the lower power (100 horsepower versus Titan's 180).

The Outback Shock is not a particularly speedy cross-country cruiser. Max speed is 112 mph or 100 knots. Typical cruise is about 90 mph or around 80 knots. Many Light-Sport Aircraft models will run right past Shock. But then again, they'll have to overfly any number of landing spots that the Shock finds downright spacious.

So, let's go land this machine.



The spirit of the plane is pure adventure done intelligently. A super-beefy welded chromoly occupant cage, serious restraints and ample escape avenues are the result of safety-first design.

With Titan's growl now reduced to a purr, our landing approach was at a leisurely pace. As speed dropped down into the 50s, then 40s on approach (still miles an hour), Bill deployed one, then two notches of flaps. The flap level can only be operated from the front seat.

Those double-section Fowler flaps—complete with VGs located in the middle surface or vane—brought Shock to a crawl through the air. The three-section leading edge slats operated in sequence, with the elements rotating up to guarantee airflow sticks firmly to the wings, even with the Fowler flaps extended further and further aft. They can go down to 48 degrees if needed but we used a bit less thanks to South Lakeland's 4,000 feet of turf extending out ahead of us.



While the shape of the nose is very familiar to old-school Cub aficionados, the gear looks wildly overbuilt. It is. That's the point.

Then, a weird, helicopter-like feeling gradually arrived.

As you slow, the Shock's hard-working wing and tail seem content to transition to little more than the speed of a human running on the ground. The earth passed by slower and slower. Adding a bit of power to accentuate the effect, Bill entered a nose-high attitude. Despite a steep deck angle, from the rear seat—though not from the front, he said—I could easily see both giant tundra tires in my peripheral vision.

It felt like the tail must land well before the mains did.

We seemed to slap the ground but the bump was no jolt. The fat tundra tires and long-stroke shock absorbers took the touchdown like we'd done it into a mountain of foam rubber. Even the shock-absorbed tailwheel accepted this punishment as though it was a reward.

Since we touched down in the first couple hundred feet of a 4,000-foot strip we elected a touch-and-go, pushing the throttle back to full blast. Almost immediately the Titan-powered Shock had us jumping off the surface and climbing like the proverbial homesick angel.



Absorption much? Let us count the ways: Big tires, giant struts, welded truss-style gear legs and, in back, a shock-absorbing tailwheel, too.

We did this four more times and I never tired of the sensation. What a thrill ride!

With two aboard and nearly full fuel Outback Shock revealed more than 1,500 fpm of climb rate. Although this performance may vary depending on atmospheric conditions, loading, and skill, no doubt exists as to the Outback Shock's capabilities.

Traveling back to the crowded pattern at Sun 'n Fun, I was glad we had broad visibility—to the front, sides, and overhead—to watch for the swarm of diverse traffic always buzzing about at Paradise City.

We didn't get to the field quickly; that isn't the Shock's purpose. I commonly saw around 80 miles an hour, though, at altitude and trimmed perfectly, that number could be 100, Bill indicated. If you're looking to go fast, quietly, and seeking to minimize fuel use, you have other choices in Light-Sport Aircraft.

As we approached and once back on the ground, the Shock attracted envious eyes.



The Shock carries 12 gallons of fuel in each wing, translating to more than three hours of flying, or a good bit more if you don't run the ponies up front at full tilt. Indeed, you need to allow time most places you go because fellow aviators may question how you could land so slow or take off so quickly. They'll also want to examine this machine's many unique features.

Add to these bragging rights a reasonably modest cost of around \$150,000 (tens of thousands less than some comparable choices) and a solid U.S. distributor, and you can see why the airplane is causing some serious (sorry) Shock waves.

What Is A Hyper-STOL Wing?

One description might be that Hyper-STOL uses every aeronautical trick available to make the wing effective at super-slow speeds without sacrificing higher-speed performance.



Here's a partial list of the wing's features:

- Customized wing profile with six inches of added chord length, new spars, stamped aluminum ribs, strengthened attachments and other structural improvements
- Tested to more than 1,600 pounds at 6G without deformation
- Wing tip fences to limit tip vortices and reduce drag
- A 40% increase in aileron surface area, together with refined airflow design, aiming to keep full control authority at extremely low speed on approach
- Double-slotted Fowler-style flaps that extend to become 70% larger; can be equipped with mini vortex generators installed inside the vane
- Vortex generators are available for the wings, rudder, flaps, and horizontal tail
- Optional extra-light wing slats pivot in response to airflow, slowing the airplane to very low speed. Of this design Canino said, "This simple slat device was developed and extensively tested in Alaska to minimize cruise speed reduction (less than three mph) and yield predictable performance on approach, in turbulence, during turning or sideslip, and near the ground."

- Three inches more surface area added to the rudder and elevator surface area, to balance the moment from the new wing design

Shock Options



PHOTO: Ole Steen Hansen

- Hyper-STOL wing profile for short takeoff and faster rate of climb
- Slatted wings for low-speed control
- Fowler flaps further aiding low-speed control
- Oversized outboard shock absorbers to tame landings and limit rebound (54-inch side-mounted shock-absorber suspension system with 12 inches of compression)

- Flattened landing flare lets you keep visibility of the landing site
- Load-tested to more than 1,600 pounds
- Outback Shock is available with three engine options:
 - 180-horsepower Titan
 - 100-horsepower Rotax 912
 - 115-horsepower turbocharged Rotax 914 engine

The airplane flown for this report was the first production model in the United States. It was outfitted with all equipment as seen in the accompanying photos with commonly ordered avionics (a wide variety is available and can be installed in the USA). Exterior paint and interior finish are standard for the Outback Shock, though other choices are available. The review airplane was equipped with a new Titan X-340 engine and has demonstrated compliance with relevant ASTM standards used to gain acceptance by FAA.

Price as flown: \$168,005 (includes all base price items plus 26-inch tires, radio, transponder, ADS-B In)

Base Price: \$154,900 (includes Titan X-340 engine, slats, carbon components package, side shocks, 23-inch tires)

Zlin Outback Shock Specifications

Published August 18, 2017

2017 Zlin Outback Shock Specifications

The airplane flown for this report was the first production model in the United States. It was outfitted with all equipment as seen in the accompanying photos with commonly ordered avionics (a wide variety is available and can be installed in the USA). Exterior paint and interior finish are standard for the Outback Shock, though other choices are available. The review airplane was equipped with a new Titan X-340 engine and has demonstrated compliance with relevant ASTM standards used to gain acceptance by FAA.

Price As Flown: \$168,005 (includes all base price items plus carbon components package, 26-inch tires, radio, transponder, ADS-B In)

Base Price: \$154,900 (includes Titan X-340 engine, slats, side shocks, 23-inch tires)

Engine: 100 hp Rotax / 180 hp Titan

Propeller: Sensenich / Catto, 84-inch diameter

Seats: 2 (tandem)

Wing Span: 29.5 feet

Length: 22.4 feet

Height: 7.4 feet with Alaskan 29-inch tires

Wing Area: 163.7 square feet

Wing Chord: 66.5 inches
Wing Loading: 8.2 pounds/square foot
Load Factor: +4/-2 Gs
Cabin Width: 27.1 inches
Undercarriage Width: 7.8 feet
Gross Weight (MTOW): 1,320 pounds land / 1430 pounds sea
Empty Weight: 790 pounds / 980 pounds
Useful Load: 530-640 pounds / 340-450 pounds
Fuel Capacity: 24 gallons
Never Exceed Speed (with Slats): 120 mph
Maximum Operating Speed: 100 mph / 112 mph
High Cruising Speed: 90 mph / 100 mph
Cruise Speed (75% power): 70 mph / 80 mph
Climb Rate: 1,000 fpm / 1,600+ fpm
Stall Speed, Full Flaps (Gross Weight): 23 mph / 26 mph
Service Ceiling: 10,000 feet / 15,750 feet
Range At 65% power: 302 sm / 256 sm
Takeoff Roll (Solo): 115 feet / 86 feet
Takeoff Roll (Gross Weight): 188 feet / 110 feet
Landing Roll (Solo): 56 feet / 75 feet
Landing Roll (Gross Weight): 75 feet / 85 feet
Landing Roll (50 ft obstacle): 160 feet / 200 feet

Dan Johnson writes extensively about Light-Sport Aircraft, light kit aircraft, and ultralights. For articles, videos and more, please visit ByDanJohnson.com.

For additional information: SportairUSA, info1@sportair.aero, 501-227-7777, www.savage.aero