
EXPERIMENTAL
sonex
N141SJ

SUBSONEX SPORT JET JSX-2

HAVING A BLAST

A glider transition to a jet

THE WHITE STRIPES on the runway centerline seem impossibly close as the SubSonex JSX–2 microjet begins its takeoff roll, its bagel-sized tires and stiff, stubby legs transferring every bump in the asphalt to the pilot's seat.

BY DAVE HIRSCHMAN | PHOTOGRAPHY BY MIKE FIZER

VIDEO EXTRA
View the video.

AIRSHOW PERFORMER and test pilot Bob Carlton (top right) flies the JSX-2 at airshows around the country, and he transports the airplane in a custom trailer. FAA DPE Robert O'Haver scrutinizes cockpit video from the single-seat jet before granting a "letter of authorization" to a new pilot (right). The Bonus Jet and JSX-2 are an odd couple, but the glider is meant to prepare pilots for the faster airplane (below).

A high-pitched whistle from the pylon-mounted TJ-100 engine grows to an otherworldly shriek as the tiny airplane accelerates down Runway 18 at New Mexico's windswept Moriarty Airport. The engine's high thrust line pushes the nosewheel down as the jet spits out its full 247 pounds of thrust. A nudge on the airplane's sidestick controller lifts the SubSonex off the pavement at 90 miles an hour—a number that feels even faster given the ground's intimately close proximity.

A smoothness settles over the airframe the instant the wheels break ground, and the rate of acceleration increases. In a 10-degree climb, the pilot must raise the landing gear without delay to avoid blowing through the 130-mph gear speed. It takes six seconds for the landing gear to fully retract, and when it does the SubSonex is climbing at 150 mph IAS and about 1,800 fpm—despite the desert airport's 6,200-foot elevation and 7,500-foot density altitude.

I pull the Lilliputian power lever between my thumb and index finger back to the engine's maximum continuous setting of 92 percent rpm and let the SubSonex accelerate to 200 mph IAS in level flight. Rising columns of warm desert air create light chop, but the airplane's relatively high wing loading (15 pounds per square foot on this flight) allows it to ride out the bumps with minimal disruption, and the Y-tail shows no Dutch-roll tendency.

The SubSonex is quite light in pitch, roll, and yaw, and I've got to remind myself to lighten up on the sidestick and rudder pedals to avoid overcontrolling. This is my first flight as pilot in command of any jet—and it's exhilarating.

Airshow pilot Bob Carlton has developed an innovative week-long transition course for the SubSonex, and actually flying the single-seat jet is the culmination. There's a list of maneuvers that I'll be required to demonstrate to an FAA examiner in two days, but on this first flight, I'm not concerned about a checkride. I want to explore this novel airplane's full, three-dimensional range. And despite my newness to both jet engines and this airframe, the SubSonex and its training program instill confidence. If I'm out of my depth, it doesn't feel that way.

THREE PERSONALITIES

The SubSonex Personal Jet model JSX–2 was designed by John Monnett, a kit manufacturer whose previous creations include Sonerai racers, Monerai motorgliders, and Sonex sport airplanes. The JSX-2 is the first production kit built at the Sonex factory in Oshkosh. And as unconventional as the aerobatic sport jet looks, the training program that prepares pilots to fly it is equally imaginative.

FAA regulations require pilots to obtain type ratings to fly turbojet aircraft. But how can you do that in a single-seat aircraft? Carlton—also an inventor and founder of Desert Aerospace—has created an FAA-approved transition course that allows pilots to operate the TJ-100 jet engine and get familiar with the SubSonex belly-on-the-runway sight picture by first flying a two-seat, jet-powered glider with an instructor.

The Czech-built TST-14 Bonus motor glider was originally equipped with a Rotax 503 engine and propeller that could be stowed in flight. Carlton replaced them with a 45-pound TJ-100

engine and renamed it the Bonus Jet (or TST-14J). It's a sleek, composite glider with forward-swept wings and a 56-foot span, and it's got several distinct personalities.

In takeoff mode, the Bonus Jet mimics a U–2 spy plane. It accelerates and climbs energetically on high-aspect-ratio wings; it's stable in pitch, slow in roll, and can easily reach the flight levels. In sailplane mode with the engine stowed, the Bonus Jet is light and responsive and can turn tightly, able to rise in even slight thermals.

Finally, and most important to aspiring jet pilots, with drag-inducing spoilers out and the engine running, the Bonus Jet requires precise pitch and power management to fly a steady and shallow final approach—just like the JSX–2 with landing gear and flaps down. It also forces pilots to avoid flaring too high, and rewards them for touching down in a semi-flat attitude—like the JSX–2.

"When you look at the two together on the ramp, the Bonus Jet and the JSX–2 don't seem to have anything in common other than the engine," said Carlton. "But when you think about final approach and landing, their drag profiles are extremely similar. The Bonus Jet does a very credible job of preparing pilots to fly the JSX–2."

Carlton spent most of his professional life designing and building advanced-technology projects at Sandia National Laboratories—a place he describes as a documentary version of the *Big Bang Theory* TV sitcom—in nearby Albuquerque. He began researching small jet engines a decade ago, while looking for ways to launch his aerobatic Salto glider at airshows, where towplanes can be scarce. He finally settled on the PBS TJ-100 engine, a product that evolved from Safire auxiliary power units made for Russian military jets.

But as steeped as Carlton is in technology, he says he appreciates elegant simplicity even more. To that end, he's attached simple yaw strings to the canopies of both airplanes. In cautioning pilots to avoid heavy rudder application, instructor Billy Hill reminds them that the small piece of yarn that moves laterally with shifts in airflow during flight "shouldn't resemble a windshield wiper."

INSTRUCTOR Billy Hill, Bob Carlton, and the author review cockpit video from a training flight (below). The fuselage fuel tank (far right, top) is molded to the pilot seat. The JSX–2 cockpit is surprisingly roomy for such a small airplane and is 24 inches wide at the shoulders.

PAUSE BUTTON

Even at idle power (52-percent rpm) the TJ-100 engine produces about 15 pounds of thrust, and while that doesn't sound like much, it's enough to push the clean SubSonex airframe along for quite a while in level flight.

I get impatient and pull the nose up to bleed off airspeed. Light airframe buffeting begins at about 66 mph IAS and there's a crisp stall break at 64 mph IAS. The nose drops about 20 degrees below the horizon and releasing back pressure allows the airflow to quickly reattach. From the moment the pilot applies full power for the engine rpm to reach 100 percent takes about four seconds.

In the landing configuration with full flaps and the wheels down, the idle stall speed drops to 58 mph IAS. Without a propeller and the accompanying P-factor, stall breaks are feet-on-the-floor events with no tendency for one wing to drop.

But stall recoveries and, to a lesser degree, slow flight are areas in which the engine's high thrust line makes things interesting. At low airspeeds and high power settings, there's a pronounced nose-down pitching moment—a factor pilots must anticipate, and for which they must compensate, during go-arounds. For this reason, go-arounds in the JSX–2 are a three-step process: first, add cruise power to stop the descent; then raise the gear and flaps; and finally, pitch up and climb at full power. This multi-step process will sound familiar to pilots who fly Cessna's big singles—except that instead of pitching up with power, the JSX–2 pitches down.

I've read and heard much about the dangers of jet engine compressor stalls when smooth airflow into the engine gets interrupted

SPEC SHEET
SubSonex JSX-2

SPECIFICATIONS

Powerplant | **PBS TJ-100**
Length | **16 ft 6 in**
Wingspan | **18 ft**
Wing area | **60 sq ft**
Wing loading | **16.6 lb/sq ft**
Seats | **1**
Cabin width | **24 in**
Empty weight | **500 lb**
Aerobatic weight | **900 lb**
Max gross weight | **1,000 lb**
Useful load | **500 lb**
Payload w/full fuel | **232 lb**
Fuel capacity, std | **40 gal usable, 268 lbs usable**

PERFORMANCE

Takeoff distance, ground roll | **1,200 ft**
Rate of climb, sea level | **2,000 fpm**
Max level speed, sea level | **265 mph**
Landing distance, ground roll | **2,500 ft**

LIMITED AND RECOMMENDED AIRSPEEDS

V_A (design maneuvering) | **157 mph**
V_{FE} (max flap extended) | **125 mph**
V_{NE} (never exceed) | **298 mph**
V_{S1} (stall, clean) | **64 mph**
V_{SO} (stall, in landing configuration) | **58 mph**

FOR MORE INFORMATION

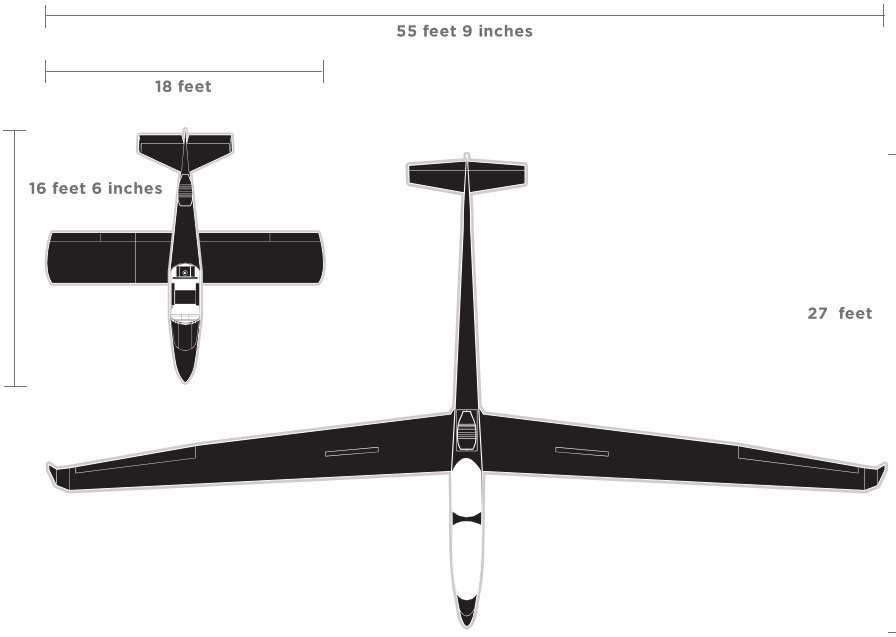
Contact Sonex Aircraft: www.sonexaircraft.com

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.

by slipping or skidding turns, so I'm reluctant to slip in the JSX–2. But I've watched Carlton perform hammerhead turns during his airshow routine while the engine runs without interruption, and he says that the TJ-100's centrifugal (not axial) compressor isn't prone to compressor stall. I try a few slips, both clean and dirty, with no ill effects. Then I move on to lazy 8s, aileron rolls, and barrel rolls, and the controls seem well balanced and harmonized throughout the normal speed range, but when maneuvering above 200 mph IAS the JSX–2 is lighter in pitch than roll. (V_{NE} is 298 mph IAS.)

Also, during over-the-top aerobatic maneuvers such as loops and half Cubans, the high thrust line pushes the nose away from the pilot near the top of each maneuver. Carlton said he's become so accustomed to that characteristic in his aerobatic glider that he hardly notices it in the JSX-2—but it requires firm back stick and/or a significant power reduction at the top of a loop to get the nose pointed back at the Earth.

The JSX–2 has a single 40-gallon fuselage fuel tank, right on the airplane's center of gravity. To remain within the airplane's 900-pound aerobatic weight limit, I took off with just under 30 gallons. But jet engines are thirsty, and the TJ-100 gulps 34 gph at full power and about 20 gph at cruise. After 20 minutes in the air, it was time for my first jet landing.



THE BONUS JET glider has a 40:1 glide ratio with the TJ-100 engine retracted. The sleek glider is the stepping stone to pilots preparing for the JSX–2.

Overhead the airport, I activate the engine-protection override system, which prevents an internal computer from automatically shutting down the engine if temperature or pressure limits are exceeded. The SubSonex has a BRS-6 full airframe parachute system, but Carlton would rather sacrifice the engine close to the ground than risk an unintended shutdown during takeoff or landing.

I adhere to the patterns Bonus Jet instructor Hill had demonstrated and stack the deck in my favor with a long, stabilized two-mile final approach at 95 mph IAS, slowing to 90 over the threshold. The idle thrust and close proximity of the wing to the runway (the flap trailing edge is just 12 inches off the surface) create a pronounced float in ground effect. The SubSonex touches down about 1,100 feet down the 6,201-foot runway and rolls another 3,000 feet with light braking.

I fly the jet a second time the next morning in cool, still air, and reduce the final approach to 85 mph on short final. That dramatically reduces the amount of float, as well as total landing distance.

A third and final flight is an FAA-observed checkride that includes an aborted takeoff, no-flap approach and touchdown, low-altitude go-around, and a stall series. FAA Designated Pilot Examiner Robert O'Haver administers the test and records the flight with a pair of GoPro cameras, one in the cockpit and the other on the right wing. During the debrief, there's no concealing even minute speed and altitude excursions as he reads the airspeed and altitude on the MGL Primary Flight Display as well as the power settings. "The entire flight is recorded from start-up to shutdown, and my computer has a pause button," says O'Haver, who is rated in both the Bonus Jet and JSX–2. "That's something I'd sure like to have when I'm in the airplane during checkrides."

WE'RE ALL JET PILOTS

John Monnett knows that, whether we admit it or not, those of us born in the second half of the twentieth century are all jet pilots at heart. More than seven decades after they were invented, jets are still synonymous with modernity and speed.

The astronomical cost of owning and operating jet aircraft has mostly limited them to corporate and government use. But a new generation of small, affordable, and relatively efficient jet engines could put them within reach of recreational pilots—and that's a game changer. At about $50,000, the cost of a TJ-100 is close to that of a new piston aircraft engine. And new materials and higher production volume could make small jets less costly in the future.

The JSX–2 is designed for personal challenge, fulfillment, and fun. It's a niche airplane meant to go fast, maneuver aggressively, and land pretty close to the place it took off. Designer Monnett, 72, makes no apologies for his airplane's impracticality.

"It's a great toy," said Monnett. "I made it for the selfish reason that I always wanted to fly a jet—and I finally got to do that at age 69. It's a fun and exciting airplane to fly. It makes about as much sense for business trips as driving a Lamborghini to the grocery store." JSX–2 kits sell for $135,000, including the engine, and more than a half-dozen customer aircraft are currently under construction.

The JSX–2 and the training program that supports it are unique, and Sonex, Desert Aerospace, and the FAA's Albuquerque Flight Standards District Office should be commended for their close collaboration in getting this singular enterprise off the ground.

While the JSX–2 is one of the first kit aircraft based on a new breed of tiny, modern jet engines, it won't be the last. **AOPA**

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