





Jet in a box

Some assembly required

WHAT AVIATION ENTHUSIAST can forget the first time they saw the BD-5J? Whether it was James Bond flying through a barn in *Octopussy*, the diminutive Coors Light Silver Bullet flying at an airshow, or simply the “Bullet-Nosed Beauty” on the cover of *Popular Mechanics*, the little jet invoked a unanimous response: cool! What pilot wouldn’t want a personal jet in which to zip around the sky? Alas, the personal jet concept appeared to have gone the way of the dial telephone—or has it?

Sonex Aircraft hopes to revive the coolness of the personal jet with the SubSonex. Because of some right-place, right-time luck, and a fair amount of experience flying the TJ-100 jet engine in my airshow sailplane, I had the good fortune of being invited to put the SubSonex through its paces as its primary test pilot. I’ve also enjoyed the privilege of working with its designer, John Monnett; his wife Betty; son Jeremy (now CEO of Sonex Aircraft); and the rest of the Sonex Aircraft family.

The SubSonex, which recently completed its test flight program, was built by Sonex Aircraft in Oshkosh, a small company noted for its popular line of airplane kits. The SubSonex is a proof-of-concept aircraft, similar to the rest of the Sonex Aircraft fleet with simple, all-metal monocoque construction and straight, nontapered wing. Its distinct canopy shape bears an unmistakable family resemblance. At just more than 400 pounds and with a wingspan of only 18 feet, the SubSonex is definitely the baby brother of the Sonex fleet.

THE TJ-100 JET ENGINE

Powering the SubSonex is the TJ-100 jet engine, produced by PBS in the Czech Republic. The engine, which weighs only 40 pounds,

produces 247 pounds of thrust and traces its roots to the auxiliary power units used on Soviet helicopters and light fighters. With a dwindling market for Soviet fighters and an ever-increasing market for UAVs, target drones, and light aircraft, PBS used its turbine experience to develop the TJ-100 to fill the gap between large R/C model jet engines (less than 100 pounds of thrust) and small bizjet engines (more than 500 pounds thrust). While closer in size to the R/C model engines, the TJ-100 has many features typically found only in much larger, more expensive engines. Its starter/generator is integral to the compressor, eliminating accessory gearing. It’s controlled by a digital processor (FADEC) located inside the front cowling. Fuel and oil pumps, oil separator, oil cooler, and a one-pint oil sump are also located inside the front cowling, making it a very compact unit.

FIRST IMPRESSIONS

The first word that comes to mind as you approach the SubSonex is tiny. The second word is fighter. Its sloped windscreen and flat-bottomed fuselage give it a bit of an A-10 look (minus the 30-mm Gatling gun on the business end, of course). It has a retractable nose gear and fixed mains, sporting spats instead of conventional wheelpants because of the very short gear-leg length. After all, with no prop to clear, there is no reason to make it any taller. The fuselage tapers to a “Y” tail (a “V” tail with a small sub-rudder for added yaw control). This configuration, while a bit unconventional, has been well proven in the company’s Waix aircraft. The jet engine is mounted on top of the tail cone, just ahead of the tail, leaving ample room for the jet exhaust to exit between the ruddervators. A small nonstructural tail-wheel allows the SubSonex to rest nose-up when the cockpit is empty.



THE NEXT VERSION of the SubSonex will have fully retractable landing gear.

COCKPIT

Opening the side-hinged canopy reveals a relatively sparse cockpit with a canopy rail low enough to easily step over. Primary control is by means of a sidestick and conventional rudder pedals. The large flaps have stops at 15 degrees and 30 degrees, and may be pulled to 45 degrees for additional glidepath control. Disc brakes are operated by a single hand lever. The no-frills instrument panel is reminiscent of the aircraft's proof-of-concept role, and it contains only four switches: master, engine, instruments, and auxiliary fuel pump. Below the panel, a digital Hobbs and voltmeter surround the pitch trim knob. A single lever on the engine control unit, mounted along the left canopy rail, controls engine start, stop, and thrust. The seat-back tank holds 32 gallons of jet fuel, giving the SubSonex about 90 minutes of endurance with reserve.

Operating the TJ-100 engine is simple. After switching on the master, instrument, engine, and aux pump switches, simply push the thrust lever forward. Reaching the first of three nonstart detents, the oil separator spins up. The second detent spins the engine slowly (cooling mode), and the third spins the engine somewhat faster (combustor clearing mode).

For normal starting, these may be quickly bypassed. A small, spring-loaded stop pin prevents unintended further motion of the handle. Pushing in this pin slightly with the thumb allows the thrust lever to continue forward to the start/idle position, commanding the auto start sequence to begin.

As the engine spools up, the controller begins firing the igniter and metering fuel automatically. The pilot monitors the start sequence on the digital display unit. The oil pressure light goes out almost immediately, followed a few seconds later by the unmistakable throaty ignition roar. The temperature indicator comes alive and the EGT climbs to around 600 degrees C before dropping and stabilizing at around 450 degrees C. Just before reaching idle rpm, the generator light goes out, indicating the starter/generator is now providing power to the battery and aircraft systems. Simultaneously, the 50-percent rpm and Engine-OK lights illuminate, indicating the engine has successfully started. All this takes about 20 seconds.

FLYING THE SUBSONEX

In essence, flying a small jet is like driving a car that only has fifth gear. Don't expect jackrabbit starts. However, unlike a propeller—which loses thrust with increasing

airspeed—the jet just continues to push. Its thrust even increases slightly with speed. The takeoff roll begins at a stately pace, but increases steadily to a rotation speed of 80 mph, at which time you become fully aware of the diminutive four-inch main wheels and lack of spring suspension. A slight pull on the side stick and you're airborne.

With no pounding pistons, pulsing prop, or propeller slipstream, the instant transformation from an overspeeding wagon to intense smooth is nothing short of inspirational. The acceleration continues, quickly pushing the little craft to its best climb speed of 140 mph. A little nose up and she's rocketing skyward at nearly 2,000 feet per minute. Raising the nose gear further enhances the silky smooth ride.

Once airborne, there are no surprises. With the SubSonex's light weight, ample control surfaces, and short wings, handling is understandably sporty, but not twitchy. With the pilot's full-forward position and no engine or propeller up front, visibility through the bubble canopy is superb. With a good pair of noise-cancelling headsets, the experience is a bit glider-like, except for the speed and climb rate.

The TJ-100 engine is limited to five minutes at full power, so upon reaching

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a comfortable turn-back altitude of about 3,000 feet, reducing thrust to the engine's continuous power setting of 90 percent rpm (about 70 percent thrust) provides a climb rate of about 1,000 fpm while maintaining the respectable 140 mph cruise climb speed. The 22-plus gallon/hour fuel burn tapers off to 18 at 10,000 feet and 14 at 17,500 feet. Nosing over slightly settles the SubSonex into a cruise speed of 190 mph true. When it's time to come down, reducing power to 70 percent rpm while maintaining 140 mph provides an average descent of about 800 fpm.

During the descent, a faint voice is heard. It's not ATC or the headset's Bluetooth link. The subliminal voice, emanating from the soul of the aircraft and transmitted directly into your cerebral cortex, is whispering, "roll me." A quick check of airspeed and airspace, and it's time for some aerobatics. Showing none of the undeserved reputation of V-tail aircraft, the nimble little jet rolls easily with almost effortless coordination. Loops and cloverleaves are just as simple. At the slower end of the speed range, stalls are accompanied by ample buffeting and a very honest nose-drop.

Landing is straightforward as long as you remember that energy corrections don't happen instantly. Setting up a slightly higher than normal pattern—and remembering the fifth-gear-only sensation at the beginning of the takeoff roll—a long, stable final approach is in order. With flaps at 30 degrees, 90 mph provides a comfortable margin above stall, and crisp control feedback. Some glide-angle adjustment is available by manually increasing flaps, which increase drag a bit, and there's no settling when returned to the 30-degree detent.

Because of the time required to add energy, and a slight nose-down tendency when adding full power at low airspeed, a decision to go around should be made early. Because of the flat approach angle and the wing's proximity to the ground, only a slight flare is required—just be careful not to flare too high if you're used to a taller airplane.

Once the mains touch down, the nosewheel lowers quickly and she's firmly planted. Steering requires only a light touch of the rudder pedals. The disc brakes bring her to a stop in less than 1,000 feet.

The SubSonex in its current form is technically not even a prototype, but more of a preprototype, proof-of-concept aircraft. Its primary purpose is to establish the feasibility of the very, very light jet (VVLJ) concept. To that end, it has been a resounding success. The performance numbers have been adequate, the engine and systems have proven reliable, and it is easy to fly. At this writing, work is progressing on the first production-ready prototype. Laser-cut and drilled skins, spars, ribs, and structural components will be complemented by an array of billet-machined components, all reducing the complexity of building the kit.

The cockpit has been extensively modified to provide ample room for reasonably large pilots, a larger instrument panel, and more aesthetically pleasing contours. A ballistic parachute will eliminate the need for a personal chute, adding even more room to the cockpit. Fuel capacity will be around 42 gallons, and the landing gear will be electrically retractable. Price is projected to be comparable to that of a new LSA, with a substantial portion of the kit's cost going to the new PBS engine. While Sonex has not officially committed to producing the SubSonex kit, it's hard to hide the excitement the little jet has created at the factory.

This is not an aircraft for the suit-and-tie crowd to whisk away to important meetings. It's more the aviation equivalent of a high-performance crotch rocket motorcycle. Range with VFR reserve will be around 350 miles. There is no room for golf clubs, suitcases, or even a large sack lunch—the SubSonex is all about taking you back to that adrenaline rush you felt when you first saw the BD-5J. It's for those times when you just feel the need for speed. **AOPA**

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FAA and jets

The reason behind most jet regulations is simple: Jets fly fast, high, and far; therefore, the pilots who fly them need special training. For decades, using propulsion type as the dividing line has worked well. After all, you don't see many piston singles with Mach meters in the upper flight levels, nor do you see many jets doing touch and goes for fun on a Saturday morning.

The advent of small, reliable jet engines such as the TJ-100 will certainly smudge that line. There are no light jet regs, so they're lumped in with the Lears, Citations, and Gulfstreams. Not bad company, but not necessarily appropriate for a jet-launched glider with a stall speed of 38 knots—or an aircraft like the SubSonex, with about the same performance as many high-end piston homebuilts.

Maybe the FAA will come around, but for now, flying any turbojet-powered airplane will require a type rating (or Letter of Authorization in lieu of a type rating for Experimentals). The details of what will be required for an LOA in the SubSonex are still being debated, but additional training will be required to ensure the pilot understands the engine, systems, and differences in energy management. Despite the somewhat anachronistic regulatory situation, the folks at the FAA have been helpful and supportive of the SubSonex. Let's face it, even the FAA recognizes cool. —Bob Carlton