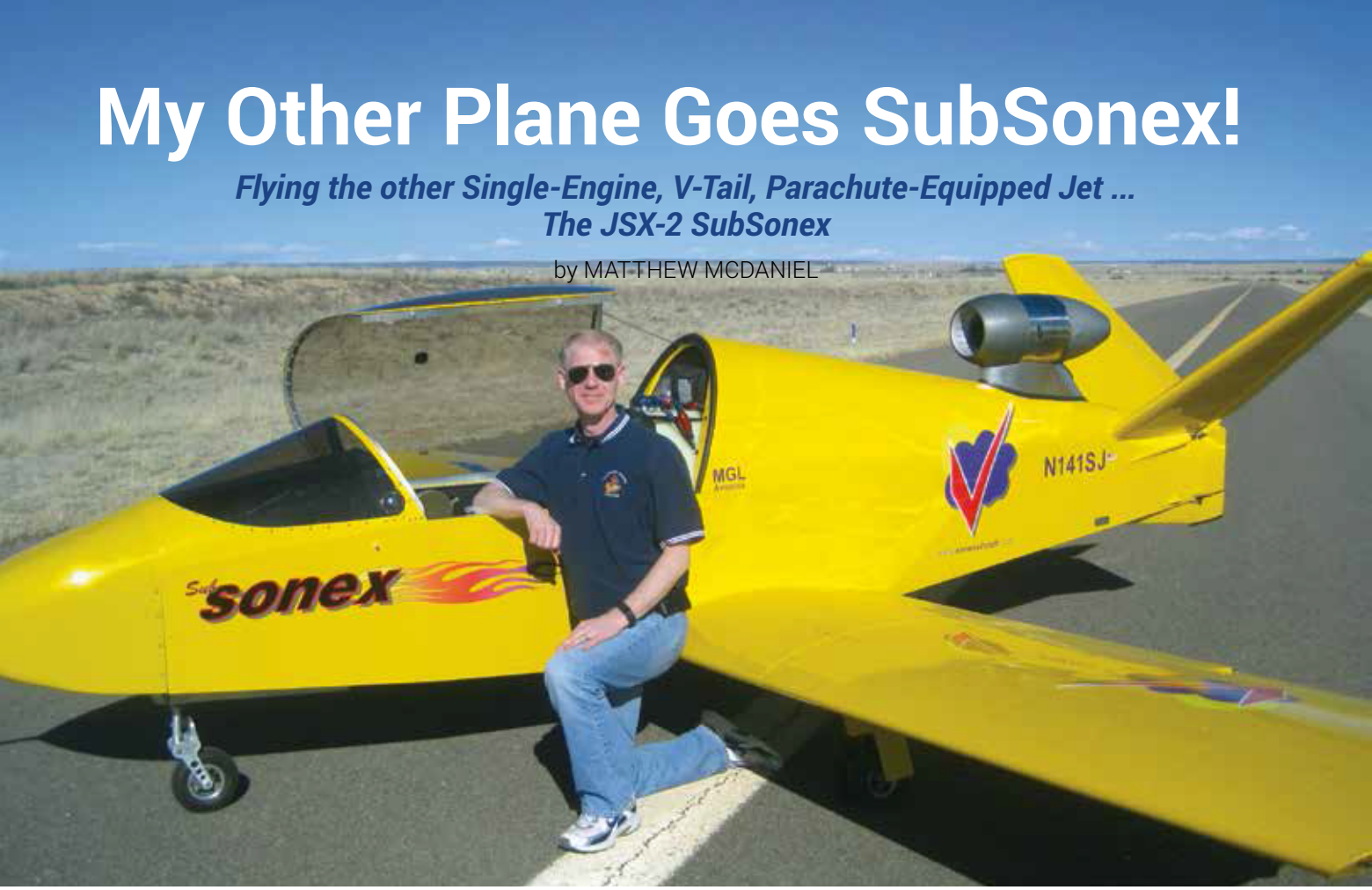
My Other Plane Goes SubSonex!

Flying the other Single-Engine, V-Tail, Parachute-Equipped Jet ... The JSX-2 SubSonex

by MATTHEW MCDANIEL



The author poses with the SubSonex after completing his permanent LOA checkride at the Moriarty, New Mexico airport (0E0).

Author's Note: This is a slight departure from the previous installments of the "My Other Plane" series often featured here. This installment does not involve the ownership of multiple aircraft by a specific COPA member. Nonetheless, it's in the spirit of that series in which I discuss this fascinating aircraft, my experience flying it, and why/how a typical COPA-member/Cirrus-pilot might find it a great choice for their future "other plane."

The altimeter reads 9,500 feet MSL, but I'm only at 3,000 or so feet above New Mexico's high desert terrain. If I crank my head over my shoulders, I can see all the way around to the tips of the ruddervators. Yet, I'm still required to do clearing turns before beginning my maneuver series, so I do. I'm about halfway through my Permanent Letter of Authorization (LOA) checkride in the SubSonex microjet and while I am utterly alone in the roomy, but solitary cockpit, I know I'm being monitored. One video camera records my view inside and outside the cockpit, including the instrument panel and controls, while another uses a wide-angle lens to capture the entire right profile of the diminutive JSX-2, as seen from the right wingtip. On the ground, the DPE monitors my radio calls and waits abeam the runway's touchdown zone to assess my ability to land the aircraft precisely.

Micro steps to Microjets

Tiny jets have been around for decades. However, until recently, flying examples have been essentially limited to novelty airshow acts and one-off aircraft originally designed with piston-power in mind. The jet engines they utilized were mostly converted Auxiliary Power Units (APUs) or up-scaled RC/model aircraft engines. While the former suffered from poor power-to-weight ratios and high fuel consumption, the latter lacked reliability and operational convenience.

Then, in 2008, a Czech company with decades of experience building military-grade APUs, introduced something different, something game-changing. The PBS TJ-100 turbojet engine was a modern, clean-sheet design with exceptional thrust-to-weight ratio and fuel economy. Unlike earlier microjet engines, it incorporated computerized digital control, an integrated starter/generator, recirculating lubrication, and spark ignition. People noticed, and soon, the TJ-100 became very desirable for both small manned aircraft and drone applications. Previously built microjets that struggled with engine reliability for years quietly began to convert to PBS engines. While other applications that had been waiting for just such an engine began to move beyond imaginations and into reality.

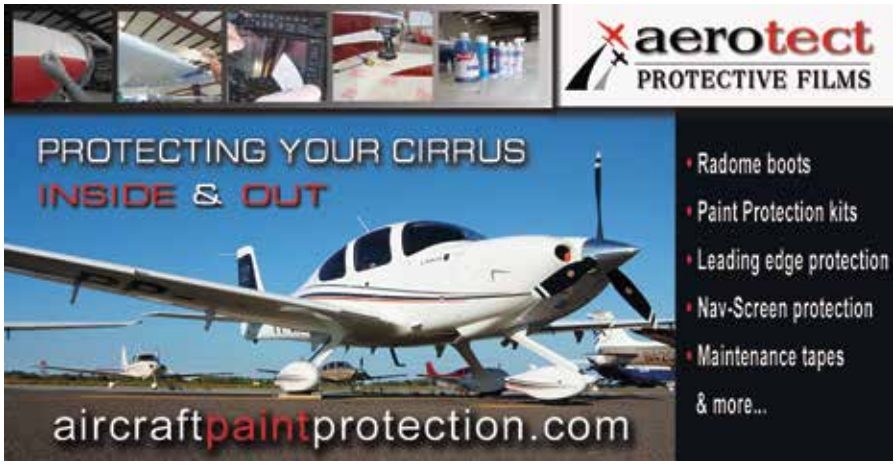
An early adopter, Bob Carlton of Desert Aerospace, engineered the installation of a TJ-100 onto the top of his Salto aerobatic glider. He'd been performing airshows in sailplanes for many years and had previously installed retractable RC-jet engines in an attempt to eliminate his need for tow-planes. That proved only marginally

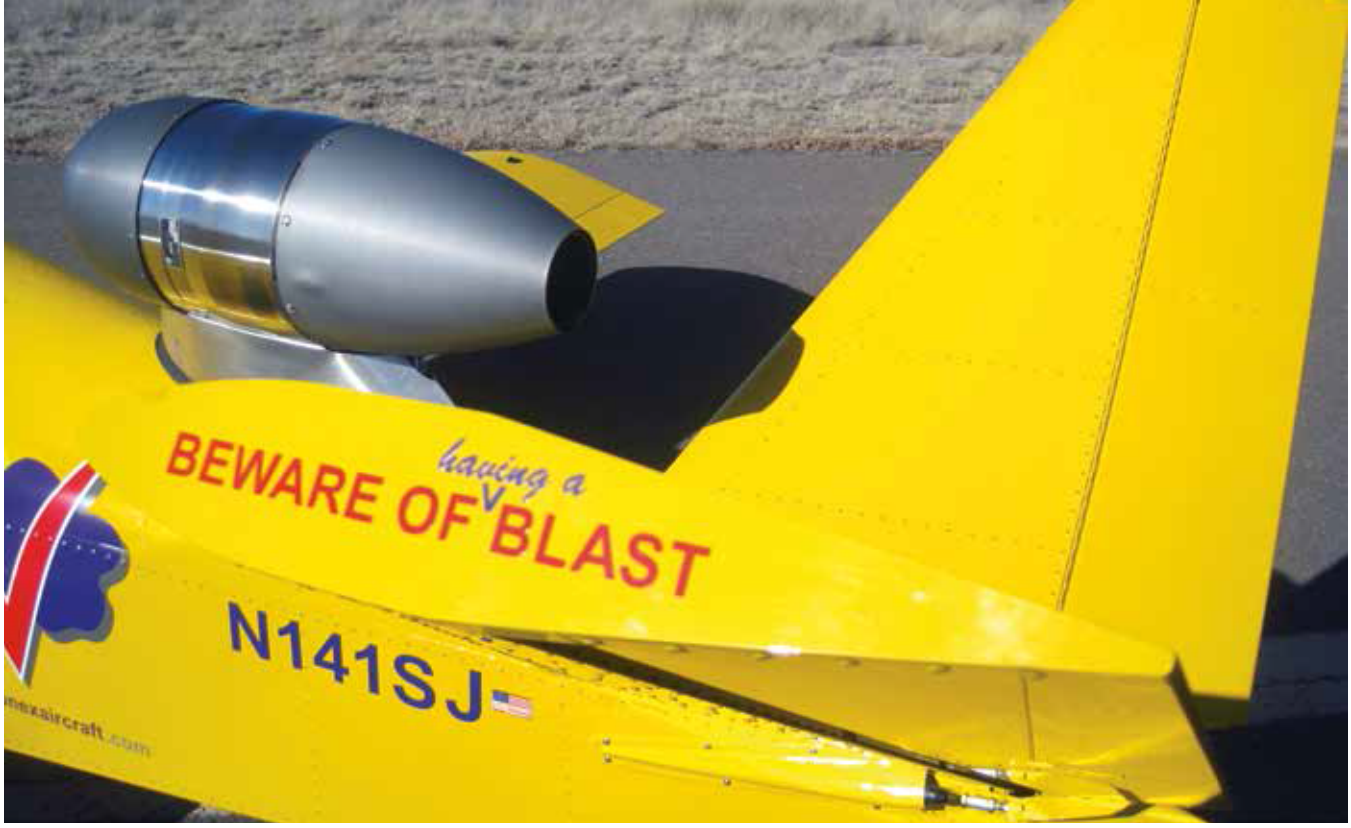
successful, but when he burst onto the airshow scene in May 2008, with his self-launching Super Salto Jet-Sailplane act, he knew he'd finally found the right engine. What he didn't know is that it would be so successful that he'd soon go on to convert a conventional two-seat motor-glider (a Comp-Test TST-14 Bonus) from piston power to a retractable TJ-100 engine, or that he'd be called upon to be test pilot, and eventually airshow pilot, for Sonex's ambitious microjet project.

With the PBS TJ-100's 247 pounds of thrust propelling the project, and Carlton handling the flight testing, Sonex moved their single-seat microjet design from the drawing board, through the prototype stages (as the JSX-1), into a production configuration (the JSX-2), onto the airshow circuit, and finally into the hands of their customers. As of this writing, Sonex has two factory demonstrator JSX-2s flying; Bob's airshow steed (Serial #001) based in Moriarty, New Mexico, and Serial #002, based at the Sonex factory in Oshkosh, Wisconsin. The first customer assembled JSX-2 (#003) has been completed, and begun its flight test program, while at least a half-dozen more are in various stages of construction.

Dispelling Kit-Built Myths

Aviators with limited exposure to the experimental/amateur-built category often confuse kit-built and plans-built aircraft. Plans-building leaves the fabrication and assembly of most everything to the builder. While most components of kit aircraft (including all Sonex models) are manufactured in a factory setting before shipment to the builder for assembly. Nor are all kits created equally. The SubSonex is sold in only quick-build or ultra-quick-build options, which ship with fully completed fuselage and wings, pre-installed canopy, pre-molded fuel cell, interior, and trim pieces, complete landing gear system, and even completed wiring harnesses. In reality, small quick-build kits such as the SubSonex leave relatively little work for the builder compared to





Fun is the primary mission of Sonex Aircraft, LLC and it's apparent in every aspect of their machines and their corporate culture.

traditional kits and can include almost everything for a flyable aircraft (minus paint and avionics). As with any aircraft though, the buyer does have a choice of optional equipment to personalize their jet, not the least of which is a BRS ballistic parachute recovery system.

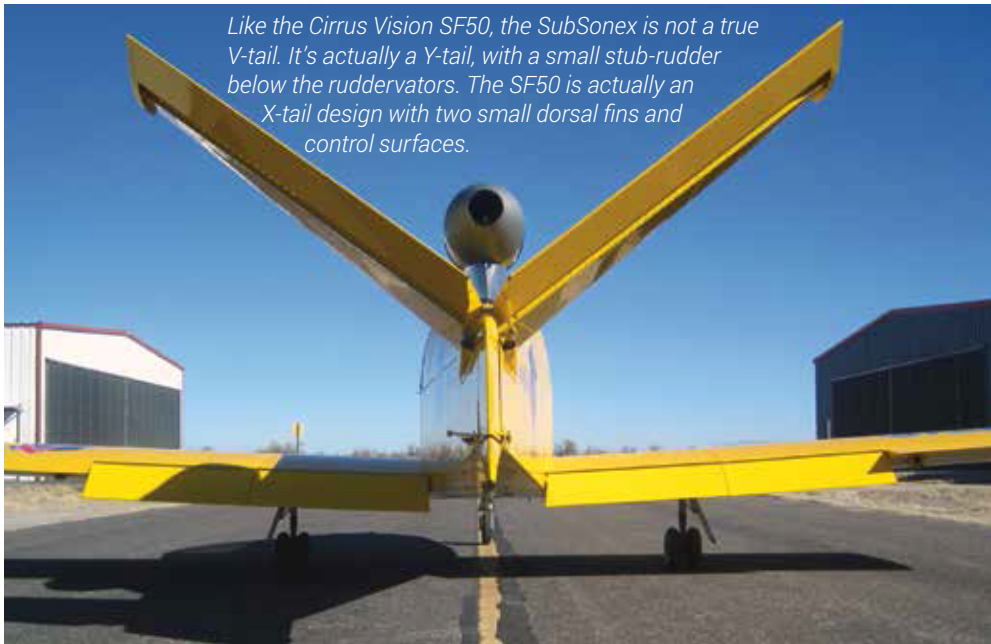
When a Dual Checkout isn't an Option

So, how does one go about learning to pilot a jet that requires FAA authorization to fly, but doesn't have an instructor's seat or a simulator? It's not as tough (or scary) as one might imagine. I'd bet that many builders will elect to hire an appropriately rated pilot to flight test their SubSonex after completion, simply to protect their investment. Yet, transitioning into the SubSonex is enjoyable, educational, and relatively stress-free, especially for pilots accustomed to operating high-performance aircraft and advanced avionics.

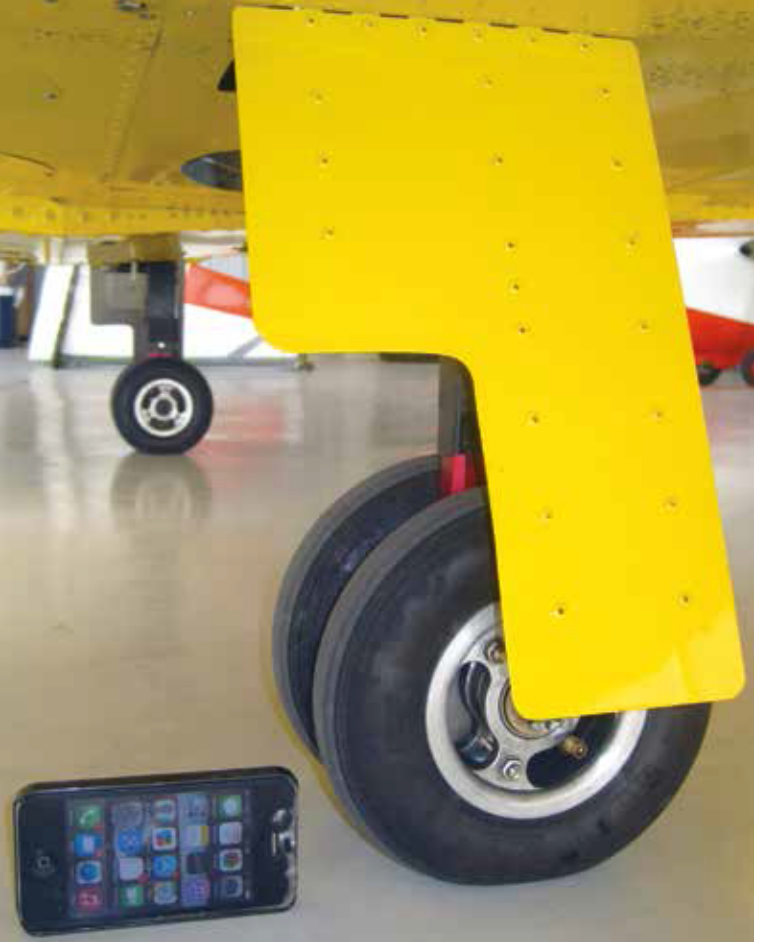
First, complete Sonex's T-Flight Training Program in a nose-wheel version of the two-seat Sonex Sport Trainer to get the feel for the flight controls and sample the airfoil characteristics common to all Sonex aircraft. Second, log some dual instruction in a two-seat TJ-100 powered aircraft to experience the engine operating principals and techniques. Currently, the best option for this is Bob Carlton's TST-14 BonusJet glider course in New Mexico, although other options will inevitably become available over time. After a quick flight with a Designated Pilot Examiner (DPE) in the engine training aircraft (in which

DATA CHART – Sonex JSX-2 SubSonex	
Engine	PBS TJ-100 Turbojet, 247 lbs. Takeoff Thrust Engine Weight: 44 lbs. including operating fluids Engine Thrust-to-Weight Ratio: 5.61:1
Wingspan	18 feet
Length	16 feet, 6 inches
Height	5 feet, 1 inch
Wing Area	60 feet²
Max Gross Weight	1,000 lbs. (Utility) 900 lbs. (Aerobatic)
Useful Load	~ 500 lbs.
Wing Loading (1g)	16.67 lbs./ft.² (Utility) 15 lbs./ft.² (Aerobatic)
Aircraft Thrust-to-Weight Ratio (@ Takeoff Thrust & MGW)	1:4.05 (Utility) 1:3.64 (Aerobatic)
Fuel Capacity (usable)	39.5 gal.
Fuel Burn	30-32 gph @ Max Takeoff Thrust 15-16 gph @ Max Cruise Thrust
Brakes	Dual-disc brakes on each main gear
Landing Gear	Retractable Tricycle: Dual-tire mains, single-tire nose
Cockpit Flight Controls	Right hand side-stick, left hand thrust & flap levers
Minimum Controllable Airspeed	~ 60-70 depending on configuration
Stall Speeds	~ 56 (Vso), ~ 65 (Vs)
Maneuvering Speed (Va)	157 @ MGW
Max Gear Speeds (Vlo & Vle)	125
Max Flaps Speed (Vfe)	125
Cruise Climb Speed	150
Cruise Speed	200-250 based on altitude (Typically 225 at 14,000 feet)
Never Exceed Speed (Vne)	287 (250 knots) or Mach 0.386 (@ 10,000 feet)
Final Approach (Vref)-Full Flaps	85-90
Takeoff Distance (@MGW)	~ 1,000 feet @ S.L.
Landing Distance (@MGW)	~ 1,500 feet @ S.L.

All Speeds in MPH, IAS



Like the Cirrus Vision SF50, the SubSonex is not a true V-tail. It's actually a Y-tail, with a small stub-rudder below the ruddervators. The SF50 is actually an X-tail design with two small dorsal fins and control surfaces.



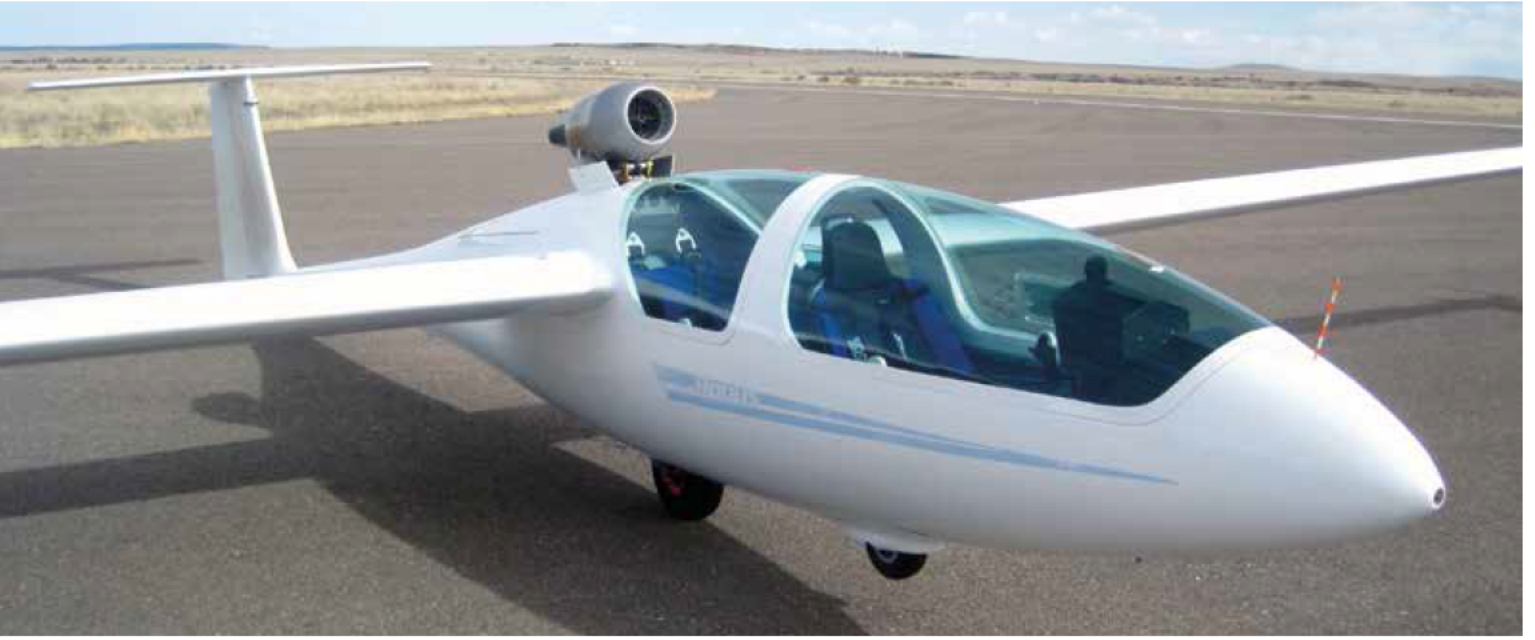
For size perspective, the author placed his iPhone4® next to the SubSonex's main gear. Each tire is inflated to 75 psi and is about the size of a breakfast waffle. Though short-stroked, the struts provide sufficient shock adsorption for landing.

a full blown LOA checkride may be an option, but is not required), you can receive a temporary (30-day) LOA to fly your SubSonex and practice for your permanent LOA checkride. Thereafter, you'll be off flying your own jet and that will have you grinning from ear to ear.

Pilot-in-Command: Logging Jet Time

As sole occupant and, by default, sole manipulator of the controls, you'll be logging jet PIC time even before becoming officially rated in the SubSonex. While I had thousands of turbine hours going in, the BonusJet and JSX-2 were the first single-engine jets I'd ever flown. Even so, with focused studies prior to arrival in New Mexico and the training received there, no real surprises were encountered in either aircraft.

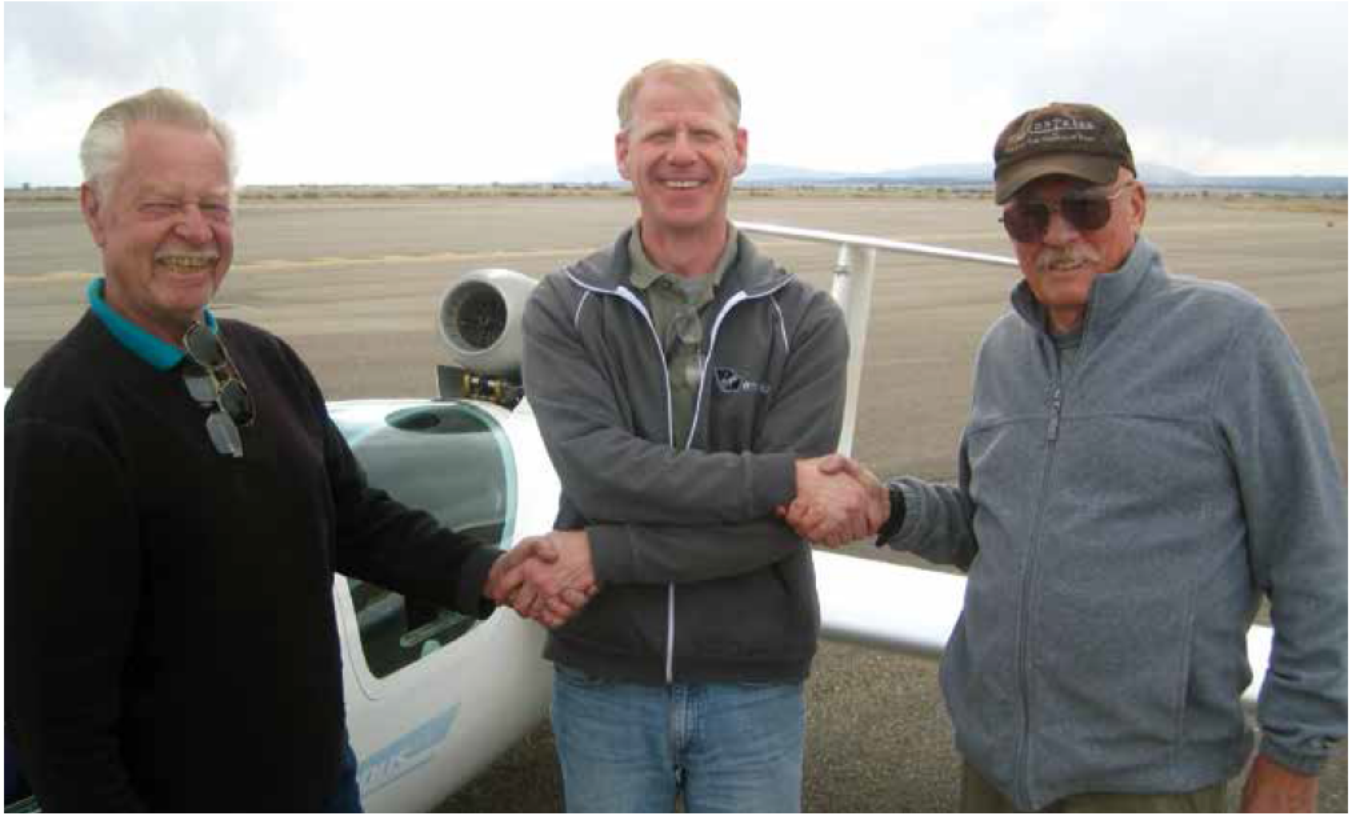
The JSX-2 cockpit is laid out in a logical, ergonomic fashion that meshes well with its relatively simple operation. All controls fall readily to hand and the large combination Primary Flight Display (PFD) and Multifunction Display (MFD) will please Cirrus pilots accustomed to advanced avionics and instrumentation; as will the familiar side-stick and responsive control feel. In fact, the sensitivity and harmony of the flight controls are very similar to those of a Cirrus (minus the routine need for right rudder, of course). The exception is the ailerons become heavier than a Cirrus' at high speeds. Yet, in all fairness, that only really becomes noticeable as speeds climb beyond the redline speeds of the SR-series (in the 200-250 KIAS range).



The TST-14 BonusJet glider is currently the go-to aircraft for transition training into the SubSonex. Along with their engine commonality, the landing picture on both aircraft is nearly identical.

Standard maneuvers such as steep turns, slow flight, and various types of stalls offer no significant surprises. Steep turns are your opportunity to wrack the airplane around a little and it does not disappoint. One tidbit of technology I noted was that as G-loads were induced in level steep turns, a G-meter appears front and center on the PFD. Once G-load is no longer a factor, the G-meter disappears! Even though the JSX-2 is well mannered in slow flight, the pilot must be proactive when so far behind the power curve. A jet engine's available thrust doesn't change in proportion to its operating speed. For example, reducing the TJ-100's RPM just six percent, from max climb (98%) to max cruise (92%), results in a 25% drop in available thrust. Stalls offer plenty of aerodynamic warning, no pronounced tendency to drop a wing (even in turning stalls), and yaw control remains excellent. One must account for the delayed response time a turbojet has in its lower power range, while the pitch induced by the engine's high thrust line must be compensated for during large power changes. However, both characteristics are common to the BonusJet trainer as well, and are easily managed with normal anticipation. Otherwise, the SubSonex flies like most any other aircraft in its weight category, with a similar wing loading (see Data Chart).

The landing phase is where the SubSonex differs most for the Cirrus pilot. First of all, the TJ-100 produces about 36 pounds of residual thrust at idle power (50-54% RPM). With an aerodynamically clean airframe and no windmilling propeller drag, slowing the JSX-2 to near final approach speed before leaving pattern altitude is necessary (lowering the gear early in the downwind leg helps in this endeavor). Otherwise, the slick little bird accelerates during descent to landing with little the pilot can do to mitigate that. The plain flaps effectively lower stall speed, but without significant drag increase (especially at their intermediate settings). While slipping is permitted and effective, it's not an ideal technique due to the indicated airspeed error it can induce (and, I suspect, prolonged slips could induce engine airflow problems due to the small intake size). It's better to slow early and maintain speed while descending via flap and power management. Some pilots will inevitably flare high as they aren't used to sitting a foot above the runway at touchdown. Fortunately, this is another area where the BonusJet training correlates directly to the SubSonex, as both aircraft offer nearly identical landing pictures. With proper flare height and speed stable at 85-90 mph on final approach, landings quickly become predictable and consistent in the SubSonex.



The author (center) poses with retired ATC Specialist, Regional Airline Captain, and current BonusJet instructor, Billy Hill (right), and retired FAA Inspector and current BonusJet/SubSonex DPE, Bob O'Haver (left), after his TST-14 BonusJet permanent LOA checkride.

The checkride to earn your permanent SubSonex LOA is about as straight forward as any checkride you'll ever take. The LOA functions essentially as a type rating that is required for any turbine powered aircraft, regardless of weight. It appears permanently on your pilot certificate by aircraft type. Because the JSX-2 is intended to be a VFR fun machine, no instrument maneuvers are required. An aborted takeoff must be initiated around 50% of takeoff speed (about 50 mph). A balked landing (go-around) is required below 100 feet AGL after crossing the threshold to ensure you understand the delay associated with jet engine spool up times and the pitching moments involved with large power changes. Climbing at 150 mph, you'll reach maneuvering altitude in a couple minutes and be ready for clearing turns, steep turns, slow flight, and a stall series. All too soon, it's back to the airport for the balked landing, a no-flap landing (probably a touch-and-go), and a full-stop landing within a previously briefed portion of the touchdown zone. The most difficult approach is the no-flap. Without flaps to help prevent acceleration on descent, it's critical to plan accordingly to remain on-speed. If you do, the longer landing float is manageable and you'll be rewarded with a roll-it-on landing.

As of this writing, eight airmen have added a permanent LOA of "SubSonx" to their pilot certificate (the maximum of seven-characters for an aircraft identifier required the elimination of the 'e' as the official FAA designation). Earning the "SubSonx" LOA will allow pilots to act as PIC in any subsequent models deemed by the FAA to be "common type" (should evolutionary changes ever lead to a JSX-3 or JSX-4 being introduced, for example). While those eight pilots represent only the FAA, Sonex and Desert Aerospace staff, and three aviation journalists, the first builder to complete a JSX-2 has recently flown his SubSonex on a temporary LOA and is practicing/training towards his permanent LOA checkride.

Sport Jet versus Personal Jet

"Personal Jet" is a term that the PR folks at both Cirrus Aircraft and Sonex Aircraft have used to describe their respective single-engine jets, but let's be clear, the SubSonex is no Cirrus Vision SF50 jet. The two designs might be similar in basic airframe configuration, but similarities end there. The Vision is a cabin-class personal jet that will create an entirely new niche in the jet aircraft marketplace. While its mission is similar to that of the FIKI SR22T, it will complete its missions with all the advantages that turbine speed/power and pressurization bring to the table. Additionally, I have no doubt that it will excel at those missions and more. Nonetheless, such capabilities come with a price tag that many Cirrus pilots reading this simply do not have the means to fund. Enter the sport jet.

While still "personal," the SubSonex is probably better described as a sport jet and will, in all likelihood, create its own niche in the sport aircraft market. Desiring the thrill of flying your own jet, the unadulterated fun of streaking to altitude in a nearly vibration-less airframe, the achievement of earning a jet rating for your pilot certificate, and the pseudo fighter pilot experience, all while staying far away from seven-figure price tags and wallet emptying fuel bills? The SubSonex is a sport jet that can provide all that, for less than you'd spend on the oldest, highest-time, G1 SR20 on the used market! All that with a fuel consumption comparable to a normally-aspirated SR22. Plus, with its +6/-3 G airframe strength and crisp control response, the SubSonex offers one other piloting option that you won't have in the SF50 or most other civilian jets (micro or otherwise): Aerobatics! Regardless of your flight profile, you'll be hard pressed to wipe the smile off your face at the end of each SubSonex flight. ⊕

Matthew McDaniel is a Master & Gold Seal CFII, ATP, MEI, AGI, & IGI and Platinum CSIP. In 25 years of flying, he has logged nearly 16,000 hours total, over 5,500 hours of instruction-given, and over 5,000 hours in all models of the Cirrus. As owner of Progressive Aviation Services, LLC (www.progaviation.com), *he has specialized in Technically Advanced Aircraft and Glass Cockpit instruction since 2001. Currently, he also flies the Airbus A-320 series for an international airline, holds eight turbine aircraft type ratings, and has flown over 80 aircraft types. Matt is one of only 25 instructors in the world to have earned the Master CFI designation for seven consecutive two-year terms. He can be reached at:* matt@progaviation.com *or (414) 339-4990.*