



EXPERIMENTER
FEATURE





CLICK THIS VIDEO
TO SEE MORE ABOUT JOHN CORNEAL'S SUBSONEX

JOHN CORNEAL'S SUBSONEX

A PINT-SIZED JET SATISFIES A BIG AMBITION

BY BUDD DAVISSON

WHEN YOU THINK ABOUT the contrasts within the homebuilding movement, it's hard to keep from grinning. Just glance at the homebuilder items between the covers of this issue of *EAA Sport Aviation*. At one end, you have Bruce Paylor's award-winning homebuilt Bücker Jungmann. At the other, you have John Corneal's Bronze Lindy SubSonex. How much farther apart can you get than a featherweight 1935 biplane and a teeny little jet that looks like it belongs in a remake of a Bond film?

**FIRST THERE WAS THE IDEA
AND THEN THE ENGINE**

John Monnett's company, Sonex, is very much of the Walt Disney mold where the worker bees are "imagineers" and encouraged to think outside the box. Looking back down the 40-year-long chain of Monnett designs that began with the Sonerai in 1971, it's easy to see offshoots into areas that would seem to be far afield from the company's normal business course. A midget jet would be one of those. But, maybe it's not.

"The concept of a small jet airplane had been in the back of our minds ever since the BD-5 arrived on the scene back in the 1970s," John, EAA Lifetime 15941, said. "Then, as model airplane jet engines kept getting bigger, I began to look at the concept closer. I wasn't actually thinking of it as being a new product line but something I just wanted to do. I wanted to be a jet pilot. I'm being totally honest about that. I'm often quoted as saying I waited 68 years to be a jet pilot, and making my own jet airplane seemed like a good way to do that."

John said he knew the idea of a Sonex jet was possible when he saw Bob Carlton doing his air show in a jet glider.

"He had the motor for us," he said. "We had actually already bought a different engine and were designing an airplane around it. But it only had 150 pounds of thrust and came with no fuel control unit. The Czech-built PBS engine Bob was using had 250 pounds of thrust and came completely ready to run with an internal digital control unit. It was literally plug and play. Through him we made connections with the manufacturer and set up sales arrangements. Further, as we got the airplane flying, we worked with him as he developed a pilot training program that would satisfy the FAA's LOA (letter of authorization) pilot licensing requirements. Regardless of the size of a jet, if it's going to be flown in the United States, the pilot needs to go through specialized, government-approved training and testing."



John Corneal had dreamed of flying his own jet since a teenager and Monnett's SubSonex helped him make that dream come true.

ENTER JOHN CORNEAL

John Corneal, EAA 374566, came into aviation the same way the majority of sport pilots do, building models and reading World War II autobiographies and histories.

"I absolutely ate up all of the pilot histories that were available at the time, and were it not for a genetic problem with one of my eyes, I'm positive I would have flown jets in the military," he said.

Corneal graduated from college with a degree in business but, then, went back to get a chiropractic degree.

"There was zero aviation in my family," he said. "In fact, we were a little plain vanilla, but I still had this dream of flying jets. The flying part of it actually took root after attending college at Penn State on an airport called Ridge Soaring. The Appalachian Mountain chain



Inasmuch as the SubSonex evolved from Sonex's well known Waix design series, the cockpits should be expected to be similar.

is ideal for flying gliders. In fact, a lot of distance records have been set there. So, I'd be out there in one of the old Schweizer 2-33s cruising up and down the ridge. However, when I left for chiropractic school, aviation took a back seat for a while. I did, however, actively race sports cars. Specifically, a Trans Am Datsun 510 and later, a Formula Ford."

When things started to settle down in Corneal's career and life, he decided it was time to learn to fly, and jumped in with both feet. "I have a good friend, Dave Dix, who is a CFI-I, and he and I worked our way through a number of rental and club aircraft while he taught me to fly," he said. "In fact, he and I made my first pilgrimage to Oshkosh, when I was a student pilot with 15 hours."

"I GOTTA HAVE A JET!"

Even though Corneal owned a number of different airplanes, the jet urge was still flitting around the edges of his mind. Yes, he was flying, but he wasn't flying what he wanted to be flying.

"I actually went so far as to research and price the older series of corporate jets, but it was obvious I couldn't come close to affording one," he said. "I was about to give up when a friend, who flew a Citation, invited me along on a trip to reposition the jet to its home airport less than 15 minutes away. I taxied out myself, made the takeoff, and flew the whole short leg. That did it! I was totally hooked! Even though I knew it was an impossible dream, I had to have a jet. But, I could see only one way I could afford one: I had to build one. I'm pretty [good] mechanically and at first was thinking BD-5J, but then Monnett announced the JSX-2 SubSonex, and the dream suddenly didn't seem so impossible after all."

Sonex began taking deposits for its jet at EAA AirVenture Oshkosh 2014, and Corneal said he was one of the first people in line.

"I'd be lying if I didn't admit to being excited," he said. "So, when the boxes all arrived on February 20, 2015, I really tore into it. I had a two-car garage with a tall tractor garage next to it and a 20-by-20 woodworking shop that became a small parts factory. So, by the time the kit arrived, I had my workspaces all outfitted and ready to go."

TIME TO GET STARTED BUILDING

The original Sonex kits included everything Corneal needed to build his new airplane, but today they can be split into components, and some previously standard features are now optional.

"The BRS is optional, and you can split the kit into engine and airframe packages when you purchase it, putting the engine expense off. Also, I bought the E-AB quick-build version," Corneal said.

With considerably more than 40 years of kit production experience, Sonex had kept up with the very latest in kit tooling, which is another way of saying almost all of the holes are pre-punched, major pieces are bent and formed, and the pieces fit. The majority of the component fabrication for the Sonex builder is in building the control surfaces. And, of course, in fitting the numerous systems. It is, after all, a retractable-gear jet airplane.

"One of the smartest things I did in prepping for the project was attending one of EAA's metal workshops," Corneal said. "They are well worth the time because you'll see and do almost every process involved in making anything out of sheet metal. Every possible kind of rivet type (flush, universal head, etc.) are used, every type of joint, and most of the applicable tools are used. It really increased my confidence in working with aluminum."



The Czech-built PBS engine only weighs 44 pounds yet puts out 250 pounds of thrust.



The landing gear system is pneumatically operated by an electric pump behind the pilot's seat.

Corneal said he started with the tail, and although he knew the pieces in the kit were designed to fit perfectly, he had difficulty believing the pre-punched holes would match up.

"Just to convince myself that the concept worked, before drilling and deburring the holes, I Clecoed the entire assembly together. And it was amazing how well everything went together," he said. "Everything is assembled with stainless steel pop-type rivets, so once I took it apart, drilled, and deburred all the holes, I started pulling rivets and in a few weeks had a completed tail. That much finished in what was a fairly short period of time made the entire project seem more doable."

It should be noted that the tail of a SubSonex isn't your average homebuilt tail. A standard on the Waix designs, it looks like a V-tail at first glance but it's actually not. Monnett calls it a Y-tail (hence their Waix — pronounced Y-X — series of designs) because the V-tail surfaces are joined by a small vertical rudder beneath making them into a Y.

"Not everything was perfect," Corneal said, "but considering I was the fourth purchaser and the first seven kits went out the door at the same time in 2014, you'd have to expect some teething problems. Fortunately, they were mostly minor things in the plans, like calling out a dimension wrong or calling for the wrong sized bolt. However, a call to Sonex would resolve my question. The support for what is a very new product was quite good. They were on top of every problem or question I had, and being a first-time builder, I probably had more than my share."

TIME FOR THE ENGINE

"Even though it's a jet engine and you'd expect it to be complicated, it isn't. In fact, it's one of the simpler parts of the kit," Corneal said. "I had to laugh, when I went down to the FedEx terminal to pick it up. There was this 3-foot cube that was light enough that one employee and I easily loaded it."

Corneal said the shipping weight of the engine was just 98 pounds.

"It's a beautiful engine! But more important, when you open the box, it's ready to go," he said.

The engine kit comes with the throttle quadrant and engine shut-off controls ready to be mounted, and Sonex supplies the wiring harness and engine instrument gauge.

"The component layout is specified in the prints, so it's pretty foolproof," Corneal said. "I wish I had a video of me installing the engine because it was so simple. The engine itself only weighs 44 pounds, so I just cradled it in my arm, laid it into the fuselage mounts, and slid the two bolts in. It's almost comical. It's important, however, to notice that you have to install the engine before finishing the fuselage metal work. There's a panel on the bottom of the fuselage that's temporarily riveted in place from the factory. You remove the rivets, reach in to finish the engine installation and, when you've run the engine to check for leaks, you permanently rivet the panel back in place."

LIGHT THE FIRES AND KICK THE TIRES

The engine has a full authority digital engine control (FADEC) system, which Corneal said makes starting and operating it easy.

"It's all done electronically," he said. "That having been said, the first time you light it off, it doesn't work the way you think it would. I forgot the fuel lines between the header tank and the engine shut-off were empty, so I started the sequence including all the pumps like you're supposed to. The engine spooled up but no ignition. I was sitting there thinking I had done something wrong when suddenly 'Whoom' and a large fireball shot out the tailpipe as it ejected the pickling fluids. *Really* impressive!"

As the airplane came together, Corneal began to think about the process he would have to go through to get an LOA to fly it.

"Between Sonex and Bob Carlton in Moriarty, New Mexico, they've worked out a really clever and thorough way of training wannabe jet pilots like me," Corneal said. "There are actually two components that have to be learned. The first is how to fly the airplane, and the second is learning to operate the jet engine. Bob Carlton has been doing air shows for years in a jet-powered sailplane that uses the same engine. So, he uses a two-place sailplane, the TST-14 Bonusjet, where you log dual while

learning to fly the engine. Also, with the spoilers out, the glider pretty much duplicates some of the handling characteristics of the SubSonex as well as having a nearly identical sight picture on landing.”

To assist SubSonex builders with transition training, the Sonex factory gives dual time in its Waix trainer.

“Then, once you’ve become comfortable with both the engine and the airframe characteristics, you are issued a temporary LOA that is valid for 30 days,” Corneal said. “That allows you to fly your own airplane and practice for the permanent LOA checkride. Usually, a jet LOA has the check pilot riding with you while you do what he’s asking, but obviously you can’t do that with a single-place airplane. So, you do a series of maneuvers and procedures that they prescribe with a GoPro camera mounted in a chest harness recording the instrument panel and the view forward for review on your return.”

The list of requirements during the LOA flight are pretty well spelled out. They include an aborted takeoff at about 50 percent of takeoff speed, an aborted landing/go-around, steep turns, stall series, a no-flap landing, and a full-stop landing within a prescribed area.

GET IT FLYING

“On the first flight I was surprisingly calm,” Corneal said. “In fact, I remember sitting on the end of the runway grinning and thinking, ‘This is going to be fun.’ Which it was. The airplane accelerates briskly, as the engine takes about eight seconds to spool up from idle to 100 percent, but all that time it’s accelerating. It’s also noticeable that the high thrust line will keep the nose wheel stuck to the runway until you run out of pavement unless you forcibly pick the nose up. That happens around 75-80 knots and 1,400 feet. You have to be mindful of the fact that it would be easy to over-rotate. Fortunately, the way the side stick is configured, it’s easy to pressure the nose up and not overdo the rotation.”

The SubSonex has pneumatic landing gear activated by a gear switch on the panel. The switch activates a pump behind the pilot that pulls the gear up in mere seconds.

“There are red and green lights telling you the gear position, but there’s also a little backup camera on the bottom of the fuselage facing forward that lets you physically look at the landing gear,” Corneal said.

Once the landing gear is up, it’s held in place by pneumatic pressure instead of mechanical up-locks.

“Considering it only has 250 pounds of thrust, it climbs really well and feels solid in the process,” Corneal said. “At 130-140 knots, I’m getting about 1,600 feet per minute, which isn’t bad. That’s at 98 percent power. The jet is happiest cruising at about 16,000 where, at 92 percent power and 19 gph, it’s truing an honest 177 knots, although John Monnett likes to say it’s doing over 200 mph because that sounds faster. Push the nose down 5 degrees and you’re at 215 knots in a flash.”

Corneal said the SubSonex’s 40-gallon tank gets him about 275-300 nm and added that it’s a good idea to be on final approach within about an hour and a half to an hour and three quarters.

“Like everything else, landing the airplane is really easy except for one thing: At idle the engine is still delivering 30 percent thrust, so the airplane really doesn’t want to land,” Corneal said. “For that reason, it won’t tolerate excess airspeed if you expect to land on normal length runways. At the same time, because of the longish spool up time on the engine, you don’t want to get low and slow. You want to be on glide slope and on speed using some power. Having the power around 80 percent on approach means it only takes 3-4 seconds to get full power. If you bring it over the fence at 77-80 knots, at engine idle, with full 45-degree flaps, it’ll settle on nicely. But, you need to get on the brakes shortly after touchdown because it won’t roll to a stop.”

Corneal said the airplane is light and quick on the controls in the air but doesn’t feel “twitchy.”

“In about two minutes, you realize that’s the way all airplanes should feel,” he said. “The airplane is stressed to aerobatic category limits, +6g and -3g, and does terrific aerobatics. Maneuvers take on an entirely different feeling when all you hear is wind noise and a little hum behind you. And everything is so smooth.”

So, now John Corneal has scratched his jet itch. Just think of all the money he saved by not buying a Learjet! *EAA*

Budd Davison is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of *Flight Journal* magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on www.AirBum.com.

