BY **Mike Hoffmeister**

O.S.® 65AX TWO-STROKE

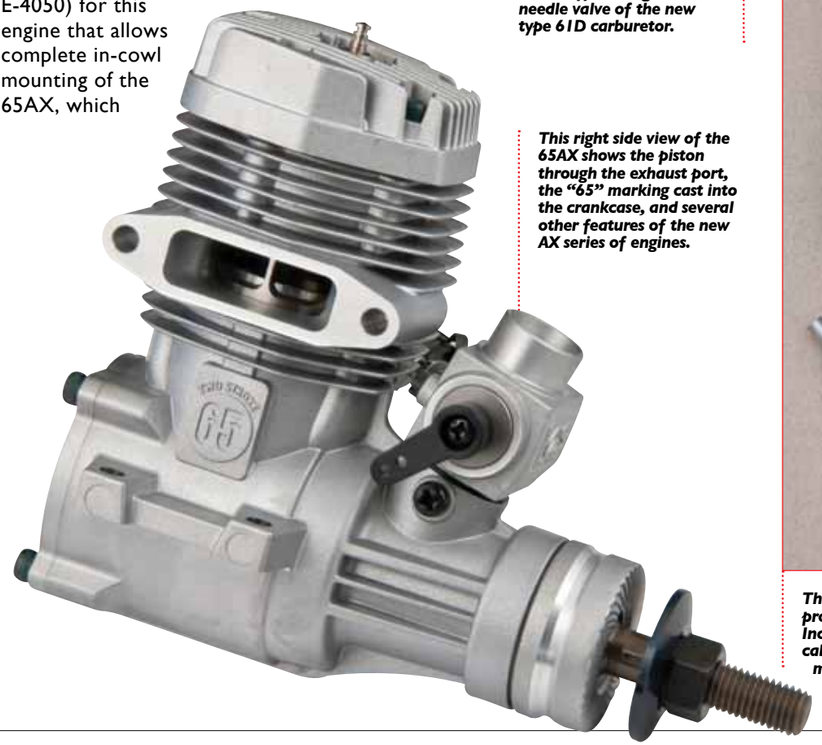
O.S. is releasing a new engine in their AX lineup, with the 65AX being one of the most recent examples. The 65AX shares the same mounting dimensions as the O.S. 61FX ABL engine; however, it features five percent more power and is nearly two ounces lighter than the 61FX ABL. Also, it is ounces lighter and twenty dollars cheaper than the O.S. 75AX engine—in case you are trying to decide between the two.

As with the other engines in the AX lineup, the 65AX features a new cooling fin arrangement for better cooling and appearance, an angled needle valve, and an O-ring-sealed, power box muffler for quiet, leak-free performance. Finally, O.S. has released a new optional muffler (P/N E-4050) for this engine that allows complete in-cowl mounting of the 65AX, which we test and compare to the stock muffler as part of this review.

WHY TO BUY

The O.S. 65AX has a high power-to-weight ratio, and a reasonable price point, with outstanding reliability and ease of tuning, which O.S. engines are known for having. It is compatible with a very broad range of propeller sizes, making it suitable for larger scale, aerobatic 3D and warbird aircraft. Also, the power box muffler does a great job keeping the exhaust note pleasant and the noise level quite low for an engine of this size. The new optional E-4050 in-cowl-style muffler offers you more options than ever for building a model with a clean installation that keeps the muffler completely inside the cowl!

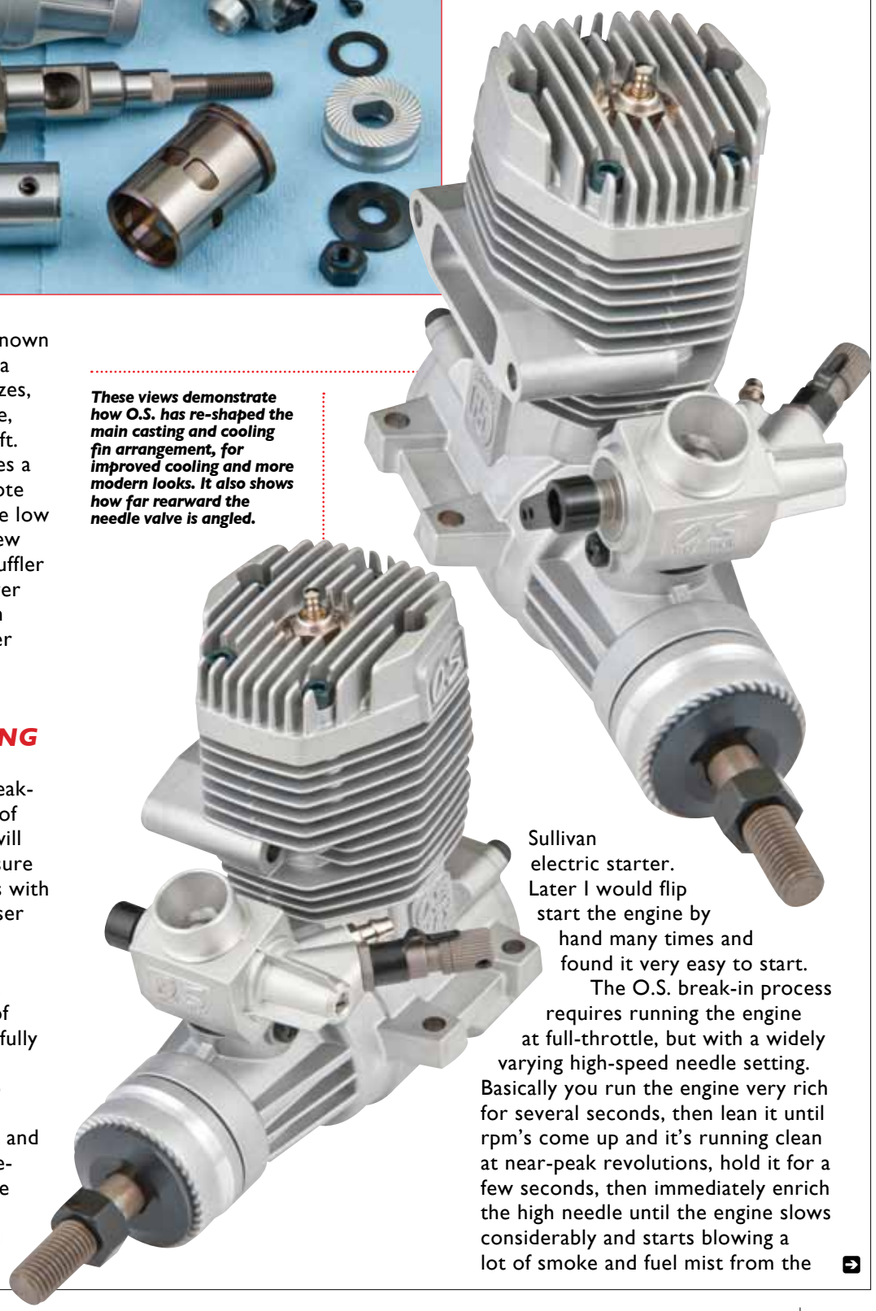
The left side of the engine shows off the angled needle valve of the new type 61D carburetor.



This right side view of the 65AX shows the piston through the exhaust port, the "65" marking cast into the crankcase, and several other features of the new AX series of engines.

The O.S. 65AX comes packed well in a protective bubble pack inside the box. Included: engine, muffler, remote needle cable and knob, #8 glow plug, instruction manual, and decal sheet.

This is a layout of the 65AX parts. Use of o-rings, rubber seals, and a metal head shim make teardown and re-assembly a snap. Note the sturdy connecting rod with bronze bushing, and long-skirt piston design.



These views demonstrate how O.S. has re-shaped the main casting and cooling fin arrangement, for improved cooling and more modern looks. It also shows how far rearward the needle valve is angled.

BREAK-IN AND PERFORMANCE TESTING

I used Wildcat 10 percent premium two-stroke fuel for break-in and testing. There are plenty of other fuels on the market that will perform just as well; just make sure that the fuel you select complies with the requirements listed in the user manual.

O.S. specifies 12×6, 13×6–7 or 14×6 propeller sizes. As part of this review, we tested most of these sizes, plus a few more, to fully explore the 65AX's capabilities.

After mounting the engine to the test stand, installing an APC 12×7 propeller, fueling the tank, and connecting the hoses and double-checking everything, I primed the engine by choking it and flipping by hand, then the engine started promptly when I used my Sullivan electric starter. Later I would flip start the engine by hand many times and found it very easy to start.

The O.S. break-in process requires running the engine at full-throttle, but with a widely varying high-speed needle setting. Basically you run the engine very rich for several seconds, then lean it until rpm's come up and it's running clean at near-peak revolutions, hold it for a few seconds, then immediately enrich the high needle until the engine slows considerably and starts blowing a lot of smoke and fuel mist from the

The included E-4010 power box muffler fits perfectly and is very effective in keeping noise levels in check, and the sound quality is quite pleasing.

The steel crankshaft is finely finished, and the counter-weight is shaped and offset to compensate for the imbalance caused by the intake passage cutout, which you can see in this view behind the counterweight.

Note how compact the new optional E-4050 in-cowl muffler is compared to the stock power box muffler. Both do a great job keeping dB levels down, so the selection is really dependent on your application.

exhaust, then repeat this process for a couple tanks of fuel. Over the course of the first two tanks of fuel, this process is repeated over and over, with steadily increasing duration of near-peak revolution periods of operation. I found that it tuned well and idled/transitioned really well even before completing the initial break-in running.

Once the break-in was complete, I tuned the low and high needles in a back-and-forth manner until it gave a slow and steady idle, with clean acceleration even when the throttle was opened rapidly. I set the engine's high needle setting about 100 rpm on the rich side of peak (a few clicks more open on the high needle than the setting that produces highest rpm). The instructions include a clear, step-by-step approach at tuning the carburetor. After break-in and tuning, the engine could easily hold 1800 to 1900 rpm idle without stumbling upon quick throttle opening, and it also held steady rpm at full throttle. At a proper high-speed mixture, I was a bit surprised to see the high speed needle only out about one full turn, however, this was not an issue as tuning response was good and not overly sensitive.

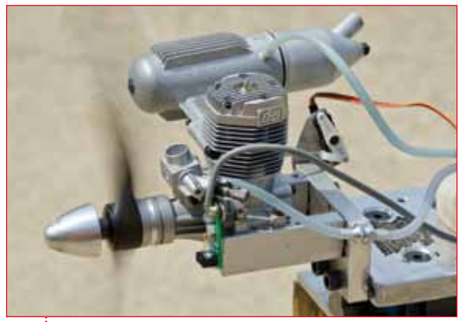
I set up a digital, sound-pressure-level meter on a tripod, at the same height as the crankshaft centerline, with the meter at a 45-degree, rearward angle from the propeller hub, at a distance of 10 feet. I put it on peak-hold setting, so after each test run I could record the peak dB value during my test. The meter was set on the A-weighting scale, which simulates the frequency sensitivity of the human ear. Although compact in size, the power box muffler proved to be very effective, and much of the noise heard is from the propeller. I measured 86.8 to 97.1 dBA. After testing the seven propellers included in this review, we then changed from the included power box muffler to the optional in-cowl E-4050 muffler. I had to mount it inverted vs. design intent, to clear the test stand. With the E-4050 installed, we repeated performance tests with two propellers, the Master Airscrew 13×5 and the Master Airscrew 14×6. This was done to allow comparison of the mufflers with a low-load, high rpm propeller, and a higher load/lower rpm propeller. The E-4050 emitted a pleasant exhaust note, with very similar performance to the stock power box muffler. The readings showed very slightly lower noise levels, and also very slightly lower peak rpm figures. Practically speaking, the mufflers can be considered interchangeable from a noise and performance point of view, so you can choose the new in-cowl E-4050 without worrying about sacrificing performance! Also, the E-4050 is lighter than the stock muffler. See the data table for a summary of rpm, thrust, pitch speed, and dBA levels for each of the 10 propellers tested.

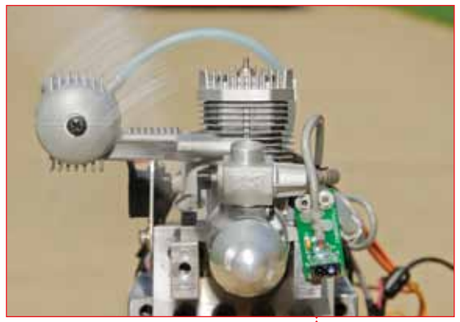
This view of the main cylinder casting, the cylinder sleeve, and the cylinder head show how the small roll pin is used to assure perfect alignment of the cylinder, and therefore the transfer and exhaust ports.

The 61D carburetor works great, plus offers a new 45-degree orientation of the high-speed needle valve. This keeps your fingers well clear of the propeller, while eliminating the need for a remote needle valve.

Here you see the overall test stand and equipment arrangement. A sound level meter is mounted to a camera tripod (in the background), and the PC that controls and monitors the thrust test stand is to the right, on a small folding table.

The O.S. 65AX is running on the thrust test stand, with a Master Airscrew 13×5 composite propeller attached. The throttle servo is commanded via PC control for a test run, with all data being displayed and recorded by the computer via the Medusa Power Analyzer Pro data system.





This gives you a close-up view of the O.S. 65AX in action! The small green circuit board is the optical tachometer pickup that provides a signal to the Medusa Power Analyzer Pro box.

O.S. 65AX Two-Stroke Glow

	RPM	Static Thrust (lb)	Pitch Speed (MPH)	Sound Pressure Level (dBA)
APC 12X7	11,525	8.2	76.4	92.2
APC 12X8	10,550	7.2	79.9	90.8
MA 13X5	12,075	9.6	57.2	97.1
MA 13X5 w/E-4050	12,025	9.3	56.9	96.2
MA 13X6	10,200	7.9	58.0	88.5
APC 13X6	11,350	8.7	64.5	91.7
MA 14X6	9,250	8.1	52.6	87.8
MA 14X6 w/E-4050	9,250	8.2	52.6	87.4
Zinger 14X6 Wood	8,603	7.1	52.6	86.8

This table shows the top rpm, static thrust, pitch speed, and decibel level (dBA) achieved with each of the seven propellers tested, including two repeat tests after changing to the E-4050 in-cowl muffler.

After break-in, I moved on to my standard step-throttle test, with each of the seven propellers. The test that I run has the engine running for five seconds at stable idle, then five seconds at 20 percent throttle, then five seconds at 40 percent throttle, and so on, with the final five seconds at wide-open throttle. All the while, the data system is capturing rpm, thrust, ambient temperature, and cylinder head temperature. The engine ran well with each propeller, and required adjustment to the high-speed needle only when switching among the various size/pitch propellers, which was due to the large variation in load.

There are several graphs included in this review, demonstrating how the engine performs with each propeller. Of particular interest to note is the Thrust vs. Throttle Position graph, as this one clearly depicts what static thrust the engine/propeller combination produces over the entire throttle range. For example, if you are planning to use the engine in a sport airplane or warbird where you need more pitch speed, but still don't want to sacrifice too much static thrust, you can look at the Thrust vs. Pitch Speed graph and get an idea of the tradeoffs.

ENGINE HARDWARE LAYOUT

The O.S. 65AX is very easy to work on. Being a two-stroke, its parts count is low, plus O.S. uses O-rings or metal gaskets at each sealing interface. The fit and finish of both the castings and machined parts is superb, and the angular arrangement of the cooling fins looks cool, plus it is functional.

The cylinder sleeve has a very close but smooth slip fit into the crankcase. Also, O.S. uses a small roll pin in the top of the crankcase, which engages a small slot in the cylinder sleeve upper flange, assuring correct alignment of the sleeve in the crankcase. The crankshaft has a milled flat that engages a matching feature inside the propeller drive hub, making removal and installation of the drive hub very simple, with no puller tool required. The backplate has webbing cast into it for added structural support of the crankcase as well.

Specifications

Type	Two-stroke, glow-ignition engine
Displacement	0.65 cu in. (10.6 cc)
Bore	0.95 in. (24 mm)
Stroke	0.93 in. (23.5 mm)
Practical rpm	2,500–16,000
Power output	2.0 hp @ 16,000
Weight	17.5 oz (497g) without muffler
Propeller	12×6, 13×6–7 or 14×6
Crankshaft thread size	5/16-24
Fuel	Glow fuel with minimum 18% oil, and 5–20% nitromethane
Muffler type	E4010A Aluminum, dual-chamber
Optional muffler	E-4050 Aluminum, in-cowl
Cylinder type	Steel sleeve
Carburetor	Type 61D
Crank type	Ball bearing
Mounting dimensions	At: osengines.com

Distributor

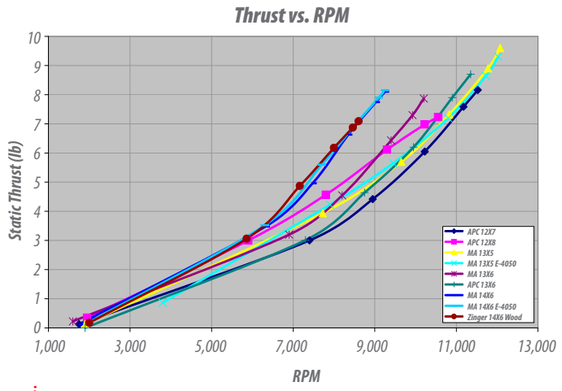
Great Planes
P.O. Box 9021
Champaign, IL 61821
Phone: 800-637-7660
osengines.com

The new, optional E-4050 in-cowl muffler is very compact, offering an OEM muffler option that completely fits inside the cowl of some airplanes. Noise level and performance are very similar to the stock power box muffler.

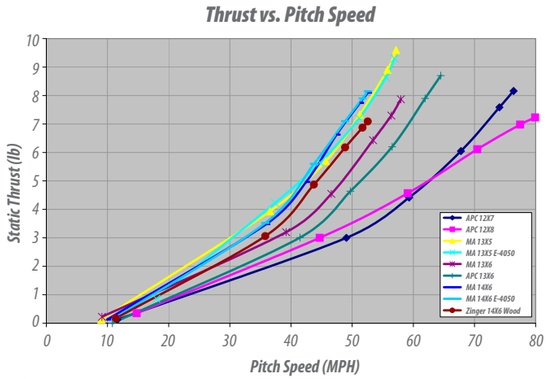
These are the seven propellers used in the test, including three APCs, three Master Airscrews and one Zinger.

CONCLUSIONS

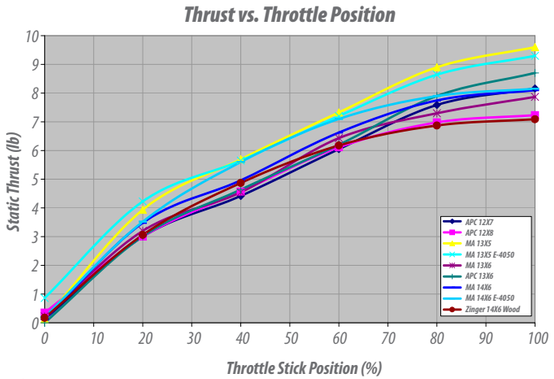
The O.S. 65AX is an excellent choice for a broad range of .60-size aircraft. The engine ran perfectly throughout all testing, and it idled extremely well and spooled up quickly even after extended idle, plus vibration levels are quite low for an engine this size. As demonstrated in this review, the engine is happy to perform with a very broad range of propeller sizes. And finally, its low noise levels and a pleasing exhaust note are a big plus, especially with the added flexibility offered by the optional E-4050 in-cowl muffler! Please visit YouTube to see our video of the 65AX test, by searching on RCSportFlyer.



This graph shows how thrust relates to engine rpm for each of the seven propellers tested, including two repeat tests after changing to the E-4050 in-cowl muffler.



This graph shows how static thrust and static pitch speed relate to each other. For maximum static thrust, the Master Airscrew 13×5 composite propeller does a great job. For higher pitch speed at the expense of some static thrust, the APC 12×7 and 12×8 propellers both perform well. Ultimately, experimenting on your aircraft is the ideal way to choose the "best" propeller for your application.



This graph shows how thrust output varies with throttle position. To compare maximum thrust, just look at the right side of the graph at 100% throttle. Note that the thrust response is rapid from idle up to 20%, and then fairly linear from 20% to 80%, and not much more is gained going from 80% up to 100%.