Ever-New: The TCM O-200

Its history and some helpful buying hints BY TIM KERN, EAA 852075

TELEDYNE CONTINENTAL MOTORS (TCM) started building small flat four engines just before World War II, with continuous horsepower ratings of 40, 50, 65, 75, 85, 90, and finally 100. When light-sport aircraft breathed new life into the market for a small-ish Continental, TCM got inspired to upgrade the O-200. Technology had progressed, and TCM saw an opportunity to enhance longevity and efficiency while reducing weight, since a fully accessorized O-200-A or -B could weigh as much as 225 pounds.

When Continental "re-introduced" the O-200-A at Oshkosh 2005 (and Mattituck introduced its TMX O-200, an essentially new engine built under the customer's old dataplate), both the light sport and experimental crowds were heartened this would guarantee parts and support for years. Rumor held that TCM hadn't been making or supporting the O-200, though, in fact, the O-200 had never been out of production. In its highest production year (1966) some 3,200 were produced, while more recently fewer than 20 left the factory in Mobile, Alabama, annually.

Today's newest model O-200-D is called the O-200 Light Weight, and it is Cessna's engine of choice for its new Model 162 SkyCatcher. The O-200-D's weight reduction plan has resulted in a savings of at least 25 pounds. Obvious changes include lightweight accessories—starter, alternator, mags—and smaller components, like a smaller, lighter,



A company photo in 2007 showed a front-mounted alternator drive, no-fin cylinders, and no visible sump. This version was never released.

lower-capacity oil sump. Additional metal was removed by trimming the cylinders' cooling fins. One test model eliminated the cylinder fins altogether. They weren't necessary for cooling, but TCM learned that fins helped maintain the shape of the cylinders and beefing up the no-fin design to provide sufficient stiffness added more weight than the small fins!

Additional weight-reduction came from drilling the crankshaft and cam, trimming the propeller hub, and even stamping the valve covers from thinner steel. In the earliest models of the O-200, the "structural" valve covers retained the floating rocker shafts. New shafts are retained by

> a screw anchored in the center support. In any event, ECi furnishes Teflon buttons to use on the oldest-design rocker shafts.

The basics have not changed. The O-200D retains the vintage configuration for 100 continuous horses: a 4.06-inch bore and 3.88inch stroke. It's now running on 100LL and featuring the popular Stellite exhaust valve seats; that hard steel alloy (with cobalt, chromium, molybdenum, and tungsten) generally behaves well at high heat and with unleaded fuel. But don't run this Continental on unleaded mogas. The rest of the metallurgy won't give you long TBOs on unleaded or ethanol mixes.

It's difficult to make things stronger while making them lighter, but the new -D incorporates substantial engineering and metallurgical improvements: the crankcase's main bearing bosses



are beefed up, and there is longer through-stud engagement, eliminating an earlier weak point. Main bearings are upgraded, and the rod bearings are now grooved to provide more piston cooling oil. Oh—in case you're about to go order a bunch of hot-rod parts for your old -A model, Continental warns, "The higher compression ratio pistons of the -D should only be used with the beefed up -D crankcase."

The lightened propeller flange has the same bolt circle as TCM 550-series engines, but it's smaller than that of the O-200-A. This flange has been tested only with metal hub propellers; wooden propellers have not yet been qualified.

Though O-200-family engines have traditionally run 80/87 avgas at compression ratios from the mid-6s to 7.0-to-1, the D-model is pegged at 8.5 and burns 100LL, and rated horsepower (100 at 2750 rpm) remains unchanged. The earlier engines were rated at ± 2.5 percent, while the O-200-D is rated -0 +5 percent. Continental's chief engineer, Bill Brogdon, explained simply, "The O-200-D is a more powerful engine than the -A. The -A version was probably near the bottom of that minus 2.5 percent, and we're right up against the plus 5 percent with the new engine."

It's difficult to make things stronger while making them lighter, but the new -D incorporates substantial engineering and metallurgical improvements...

BUYING THE NEW 0-200-D

TCM is offering the O-200-D series to original equipment manufacturers (including certificated, light-sport aircraft, and 51 percent kit manufacturers), and it will also accommodate individual experimental builders. Eventually the -D will get into the retrofit market. Retail pricing for the engine is \$20,999. In addition, the Teledyne Factory Service Center can supply a new O-200-A through the TMX program: You furnish a certified core, and you'll get your dataplate back on an allnew (-A model) engine for \$20,455. If you don't have a core, you'll pay the same price and still get an all-new engine, but it won't be certified. There are all kinds of running changes on the -A, so the sage advice to look for the newest cylinders, spring-loaded pushrod tubes, one-piece venturi, etc. holds.

New O-200-D parts should start becoming available from TCM "fairly soon." The -D parts should be every bit as good as the old ones, or better, and many are lighter. It remains to experimenters to determine which will work as direct plugand-play parts with their older mates, and in which combinations, but the originals are plenty good, with a long history of decent power-to-weight ratios, plenty of aftermarket support, custom suppliers, experienced mechanics and rebuild houses, moderate fuel consumption—and the ability to put smiles on the faces of everyone from hard-core racers and builders to the kid who just soloed.



The new ATS Engine Test Kit has all of the test equipment needed to check engine compression, synchronize magnetos, time aircraft engines, and test ignition leads all in one tool box.

The kit contains: the ATS 2EM Differential Pressure Tester with master Orifice, LED52 Electronic Magneto Synchronizer, Eastern E25 Aircraft Timing Indicator, Eastern E5 High Voltage Cable Tester, our new Compression Tester Extension & #19000 Hip Roof Tool Box.

As a new addition to our EK5EM Kit, our new Compression Tester Extension may be just what you need if you sometimes have trouble getting to the spark plug port for compression testing due to distance or obstructions.

It's a replacement 18mm aviation plug adapter with an 8-1/2" reach to work around manifolds, baffiling, harnesses, support structures, and anything else that gets in your way. The T-handle lets you screw and unscrew the extender into the port without a wrench. And finally, the quick connect coupler and the O-ring seal to protect the spark plug port makes it a snap to hookup and disconnect your tester.

ww.circrch1-tool.com

Power to the Sport Pilot...



AeroVee Engine Kit

\$6.495

- 80 Horsepower
- 151 Pounds
- AeroInjector Equipped
- Solid State Dual Ignition
- 20 Amp Alternator & Sky-Tec Starter
 Builder Assembled and Maintained

www.AeroConversions.com

Since 1937, EVERYTHING that keeps you flying



As the complete buyer's resource for aviation, we've kept flying affordable for generations of pilots by helping them find the best deals. With hourly updates, search all our ads free online!



HANDS ON

FIREWALL FORWARD

BUYING A USED 0-200

Good news: Many of the newest components are retrofittable to the older engines. This brings us to the topic, "What do I look for in a used O-200?"

Used (and used-up) O-200s are plentiful at Reno, since the Formula One racers wear things out at a prodigious rate. While 4000-plus rpm is not a normal operating range for most of us, it's encouraging that racing has proven that the O-200 is one strong little engine. Racers and crew members helped sort it out.

Certain stock components (pistons, cylinders, valves, and springs) can last at those speeds provided they're selected, prepared, matched, and balanced exactly and correctly. Continental makes good parts: The rods, for instance, are all shotpeened at the factory and are durable. Amateurs frequently try to lighten the rods...and then they break.

EVALUATING A USED ENGINE

If the used engine you want is runable, pull the spark plugs and see if there are any signs of detonation or bridging, carbon buildup, or oil. Use a borescope (or at least a tiny mirror on a stick and a light) to check for obvious scratches or gouges. Check the compression and do a leak-down test. Before you test-run it, look at the oil. Is it filthy, sticky, or smelly? Autopsy the oil filter (but first offer to pay for a new one and an oil change, in the event that you don't buy the engine). Examine the logbook. Are there a lot of entries in the same ink and handwriting, but perhaps dated over several years? (Hey, it happens.)

Crankshaft run-out is sometimes overlooked. A little end play is not often a problem, but any other crank anomalies are bad news. Prop flange wobble or radial runout generally signify trouble—you're likely buying a core, not an engine.

A hot tip for those who are experiencing objectionable oil blowby: The Cessna Aerobat uses a modified breather elbow (part number 633182) that draws from a "cleaner" spot in the crankcase. You can make a similar one by drilling out the existing threaded end and brazing in a thin-wall tube about 2 inches long. (This author, of course, assumes no responsibility!)

The racers agree that any and every used case needs to be sent to a reputable shop for a full remanufacture. The studs on earlier cases sometimes get loose; top shops fix this with heli-coils (a repair or upgrade that's okay with the FAA but not recommended by the factory). Newer cylinders have the Stellite exhaust seats and flow better than the earliest ones, due to smaller-diameter valve stems. The newest cylinders are best of all, according to the factory and those racers who are saving up for them.

One thing that seems to be non-functional on a lot of old engines is the oil temperature probe. Its design invites destruction, so use care when removing it. Another item: When you rebuild, use the newer spring-loaded pushrod tubes. These won't leak like the older swaged design does.



Experts say that if you need to rebuild your cylinders (cracks are frequently found between the valve seats or emanating from a spark plug hole)—don't. Buy new instead. The oldest cylinders have only partial part numbers stamped on the sides of their bases, adjacent the case. Newer cylinders (part number 641917 and above) carry the full part number. If you have all four "newer" cylinders, you can use 28-degree before top dead center timing; older cylinders are covered by an airworthiness directive (AD) that restricts timing to 24 degrees.

Some very old carburetors contained defective two-piece venturis (and some were okay). If you get the chance, look. Even if the two-piece venturi has been no trouble for the past 40 years, you can still get a few dollars off when you buy it. There was an AD (93-18-03), but not all engines needed to comply with it, or did.

Accessory houses love the O-200, and that's good news for us. Spin-on oil filter adapters, lightweight starters, alternators, Slick magnetos (all included on the -D version), special exhaust systems, and electronic ignitions are all readily available. Aviation hot rodders have developed their own favorite intake modifications and exhaust systems in both mild steel and stainless.





HANDS ON

FIREWALL FORWARD

	Engine Specifications	0-200-D Lightweight	0-200-A	C75	C85	C 90
8	Displacement (cu.in.):	201	201	188	188	201
a d	Bore:	4 - 1/16"	4 - 1/16"	3 - 7/8"	3 - 7/8"	4 - 1/16"
E	Piston Stroke:	3 - 7/8"	3 - 7/8"	3 - 5/8"	3 - 5/8"	3 - 7/8"
ě	Compression:	8.5:1	7:1	6.3:1	6.3:1	7:1
Bio	Power Rating	100	100	75	85	90
	Normal Related RPM	2750	2750	2275	2575	2475



Resources:

Teledyne Continental Motors www.GenuineContinental.aero

Teledyne Mattituck Services Inc. www.Mattituck.com

Engine Components Inc. (ECi) www.ECI.aero

Lycon Aircraft Engines (case work and race preparation) http://Lycon.com

Light Speed Engineering (aftermarket ignition systems) www.LightspeedEngineering.com

Formula One Air Racing www.IF1AirRacing.com



Above: The basic components of an 0-200 engine.

When you're building your own engine, be realistic. You can get pistons up to 10-to-1 compression, but can you cool them? Experience proves that pro-built O-200s can withstand more than 4000 rpm for several minutes at a time (and produce more than 140 hp). For non-racers, the question is, "So?" Are you willing to have a hard-starting, unpredictable engine with a TBO reduced by maybe 95 percent and one that requires constant attention? Do you measure your flying in dozens of hours a month or in dozens of laps a year? The Reno guys go like crazy (more than 250 mph) with these little engines, but they're always over an airfield (and they get their airplanes to and from that airfield in trailers). So, think about the one thing that always matters in the air—reliability—and build accordingly!

A note about exhausts: There is tuning involved, and it is good to use an established system or to hire a knowledgeable engine consultant. Don't just make up something that fits unless you have no other way to package it. If all else fails and if noise is not a concern, make them short—just long enough to keep the exhaust from setting the airplane on fire.

PARTS AND PIECES

Don't think that buying used rods in a "balanced set" is automatically a good thing. First, the entire reciprocating system (pistons, pins, rods, and crank) needs to be balanced together. Second, you may get some improperly modified rods. The late Gary Hubler, five-time Formula One champ and still the class record-holder, told me years ago, "If you get a race engine that somebody's been hacking on, you might get a good one, or you might get a piece of junk. If somebody balanced the rods the wrong way, you can get a rod that could break."

If you don't know, then don't do it. As the legendary builder Kenny Tunnell says, "People need to do their homework before they just start whittling on the parts." EAA

Tim Kern is a private pilot and certified aviation manager as well as an aviation writer and consultant based near Indianapolis. You can find him online at www.TimKern.com.