ENGINE TEST

GT55 2-STROKE 55CC

BY: ***Mike Hoffmeister***

O.S.® First Large-Scale Gas Engine

The O.S. GT55 engine comes well packed in an attractive, high-quality box, and includes instructions, decals, ignition system, propeller washer/bolts, spark plug, and exhaust gasket.

At first, this rear view appears to show that the spark plug is offset, but closer inspection reveals that O.S. has biased the cooling fins to the exhaust side of the cylinder and head. Since the exhaust side of the engine tends to run hotter, this should help assure more even operating temperatures from side-to-side.

O.S. Engines has been a leading model engine company for many years. It is well-known for quality, reliability, ease of tuning, and innovation. With all of the new products O.S. introduces each year, it's not often that we see a "first," but in this case, the news is big. O.S. has introduced its first ever, large-scale gasoline engine, the single-cylinder, 55-cc "GT55."

The GT55 has a few unique features to point out vs. most other single-cylinder engines in the 50-60-cc class. First is the front-mounted carburetor and through-the-crankshaft rotary-valve induction system. Next is the square bore and stroke (meaning the bore diameter is equal to the stroke, vs. most engines that have a larger bore and shorter stroke). Finally, the use of large, thin, closely-spaced cooling fins to maximize cooling fin area. So, how well do these new features work? To find out, please read what we share of our test results and experiences with this new engine.

Why to Buy

The 50-cc class of airplanes is hugely popular, including sport, scale, aerobatic, 3D, and warbird types of aircraft. A key decision when setting up such an airplane is which engine to select. While a newcomer to the gasoline engine market, O.S. is as experienced an engine company as you can find anywhere in the world—and they stand behind their products. The GT55 is powerful, fairly lightweight, easy to tune, and, depending on your application, the front-mounted carburetor may also be a benefit. Finally, O.S. backs up the GT55 with a two-year warranty.

Break-In and Performance Testing

The first step was to adapt the GT55 to my computer-controlled thrust test stand. This turned out to be a simple task as the mounting pattern is nearly identical to some previous engines tested, so I didn't even need to make a new adapter. Also, the throttle linkage proved to be quite easy to rig as the front-mounted carburetor and pre-installed control horn on the carburetor butterfly shaft were all right out in the open. The GT55 is compatible with exhaust systems that fit some

This view gives a good overall perspective of O.S.'s first gas engine offering. It follows their successful front-intake, rotary-valve configuration that has been used for years on most of their two-stroke glow engine lineup.

The rather large exhaust port is on the right side of the engine, as is the ignition sensor. The right side of the carburetor has the fuel inlet fitting and the choke lever. The spark plug slants to the rear as well.

The GT55 uses a front-intake, rotary-valve system to control intake timing and flow, similar to how most O.S. two-stroke glow engines are configured. A blue-anodized aluminum intake stack helps assure smooth airflow into the carburetor.

This right rear view shows how heavily finned the cylinder and head are, which makes for excellent cooling, and also the lightweight but rigid backplate, which serves as the engine mount.

other popular engines in this size class, so a Slimline® in-cowl type muffler was used for all testing. It fit the engine perfectly and was known to be a good performer on other engines (plus one was readily available), so for many reasons it was a good choice.

With the engine mounted on the stand, and wires/fuel lines secured, it was time to fill the

This top view gives a good perspective on the cylinder head arrangement and attachment, using six M4 bolts for retention. The spark plug is angled rearward, and the exhaust side of the head has one more fin than the intake side.

The low-speed and high-speed needle valves, the idle-stop screw, and the throttle arm are all located on the left side of the carburetor. Note that they are recessed into the aluminum carburetor body.

test stand fuel tank and start the engine. The first propeller used was a Menz 22x8, which is the recommended size for break-in. A fresh gallon of regular unleaded gasoline was mixed at 30:1 with Royal Purple synthetic two-cycle oil. The O.S. manual has detailed instructions on oil mix ratios for break-in plus general use after break-in, so it's important

Just to put things into perspective, this is how the new O.S. GT55 compares to the O.S. 25AX two-stroke glow engine!

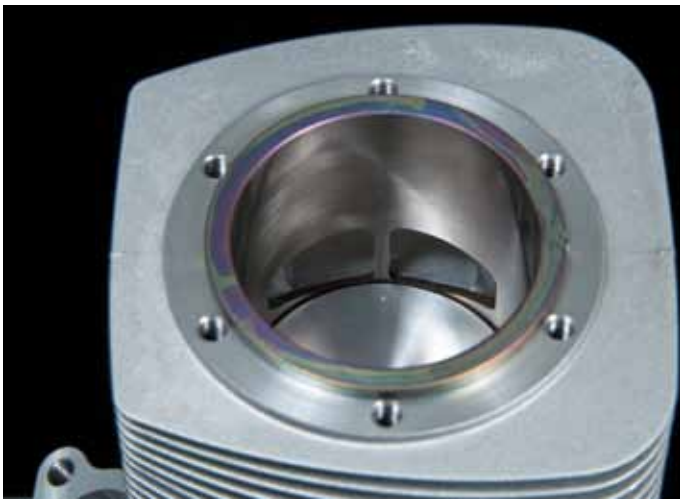
This hardware layout shot shows all of the parts that make up the GT55. Casting and machine finish quality is all typical O.S.—superb!

to follow the manual. I have had good results with Royal Purple oil recently with other gas engines, so it was used for this test, but at a higher concentration (30:1) per the instruction manual.

The manual has detailed instructions for starting the engine either with an electric starter or with a stick (flipping by hand). Most of the instructions assume the engine will be mounted inverted. Due to the configuration of the test stand, it was necessary to mount the engine upright. The engine drew fuel to the carburetor readily, while flipping by hand with the throttle open, choke closed and ignition off. The engine was flipped about 10 more times after fuel reached the carb, to allow filling of the carburetor passages and cavities with fuel, plus initial priming of the engine. Then, with the choke open, throttle at about 10%, and ignition on, the engine

This front view with muffler attached shows how narrow and compact the engine is.

The ignition module includes a shielded spark plug wire and end-cap, ground wire, battery input wire, and sensor wire, which connects to the engine-mounted sensor. It is compatible with 4- and 5-cell NiMH battery packs, or 2-cell A123 packs. Our testing confirmed its efficiency as it drew only 0.59 amp at 6.0 volts at 6000 rpm.



Here is a view down inside of the cylinder sleeve, with the head removed and the piston at bottom-dead-center (BDC). Note the wide, bridged exhaust port, which matches the port in the crankcase perfectly.

With the carburetor and plastic spacer removed, you can see the rotary-valve intake passage in the crankshaft (positioned to show the port half-way open in this photo). The small hole above the intake port goes through to inside of the crankcase, and the curved slot in the casting allows the crankcase pressure pulse signal to reach the carburetor to drive the fuel pump diaphragm.

fired up in about a half-dozen flips—not bad for a first start!

I ran the engine, varying the rpm and load, and quickly confirmed that the initial factory needle valve settings on the carburetor were somewhat rich, which was perfect for initial break-in. After the first half tank of fuel, I was running the engine up to longer periods of full-throttle, and then started to tune the carburetor to obtain cleaner running, while still being cautious to keep the high-speed needle slightly on the rich side. Later in the day, after all testing was complete, I checked the needle valve settings and confirmed the following: high-speed 1-3/4 turns, low-speed 1-5/8 turns. With these settings, the engine idled smoothly, had great throttle response, and ran cleanly at full-throttle, but was just a bit rich on the high-speed needle for running at 100 to 200 rpm down from peak.

The instructions include a clear, step-by-step approach at tuning the carburetor. With the larger propellers, the engine could easily hold 1700 to 1800 rpm idle without stumbling upon quick throttle opening, and it also held steady rpm at full-throttle. With the smaller propellers (having less rotational inertia, or "flywheel" effect) it seemed more comfortable and smooth with an idle rpm of 1800 to 1900. The engine produces little to no perceptible mechanical noise, however the in-cowl muffler was fairly loud, making it difficult to

These two photos show the crankshaft and connecting rod at top-dead-center (TDC) and bottom-dead-center (BDC) to demonstrate how far things move inside the engine, at more than 100 times per second! The connecting rod is fully-machined aluminum with drawn-cup needle bearings pressed into each end.

The crankcase has notches machined for clearance to the connecting rod—shown here in the position of minimum clearance. O.S. does a great job getting the fit and clearances of the parts set to avoid any contact, while keeping the size of parts to a minimum.

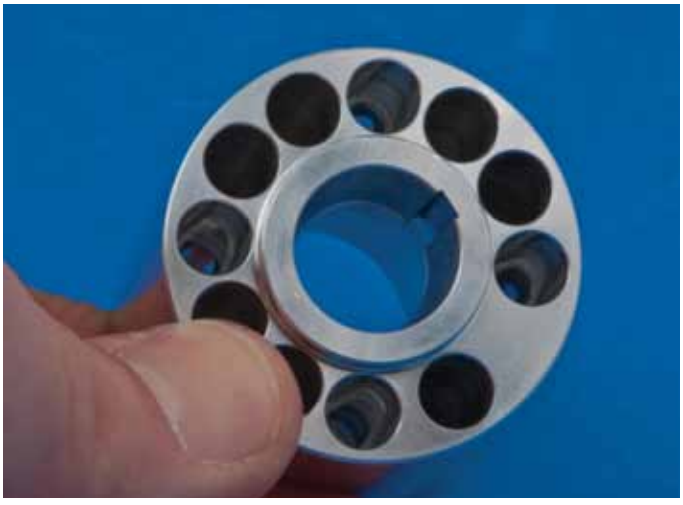
hear much aside from the exhaust. Depending on your application, a canister-type exhaust system or even a tuned pipe may be a better option; however, if noise is not a problem at your airfield, and you want to keep things light and simple, the in-cowl muffler works great.

The standard test run has the engine running for five seconds at stable idle, then five seconds at 20% throttle, then five seconds at 40% throttle, and so on, with the final five seconds at wide-open throttle. All the while, the Medusa Research Power Analyzer Pro data system is capturing rpm, thrust, throttle position, ignition current draw, and temperature. In a test taking less than one minute, a large amount of data is captured, which then allows graphing of the results so that they can be easily interpreted, and various propellers can be compared to each other. After this first test with the Menz 22x8, I then changed propellers several times until I had a good clean test run for each of the five propellers included in this review. I found that the high needle needed only a slight adjustment with each propeller change. Three of the five propellers tested delivered 30 lb thrust or more, which is very good for an engine in this size. The Mejzlik 21x12 delivered almost 80 mph static pitch speed, while still delivering an impressive 27.5 lb thrust. This is quite impressive for a smaller diameter, higher-pitch propeller. While not one of the recommended propellers in the O.S. instructions, the rpm was consistent with propellers in the specified range. It would be a great choice for a warbird, where ground clearance and high pitch speed are important.

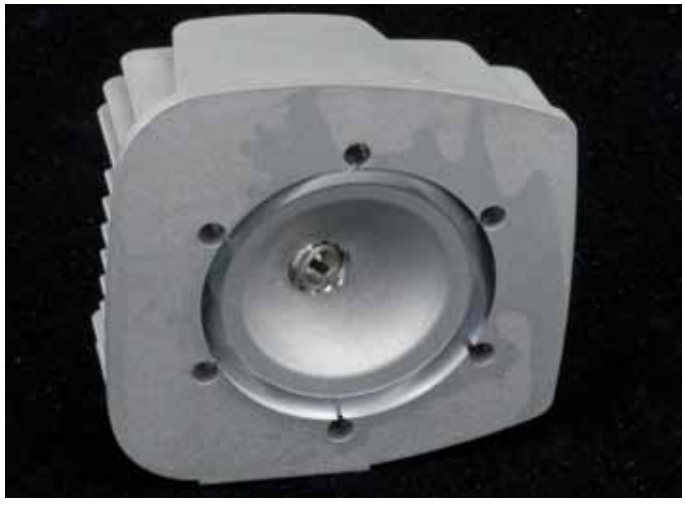
A digital sound pressure level meter was set up to capture decibel levels, set to the A-weighting scale, which simulates the response of the human ear. With the meter at a distance of 10 feet from the propeller, at a 45-degree angle to the side and rear of the engine, the sound pressure levels ranged from 99 to almost 104 dBA, which is fairly loud. Much lower values could be obtained by using a

The crankshaft uses a long key to lock the propeller drive hub to the crankshaft rotationally (to maintain ignition timing), and a tapered collet to assure the propeller drive hub runs true and is positively clamped onto the crankshaft.

O.S. applied a nice combination of tapered collet and a drive key to assure robust retention and rotational timing between the crankshaft and the propeller drive hub. Note how the large end-gap in the tapered collet fits around the key perfectly.



The propeller drive hub is rather long, to place the propeller forward of the front-mounted carburetor. To keep weight to a minimum, O.S. has drilled lightening holes in the back side of the hub as shown.



The GT55 cylinder head features a rearward-angled spark plug, to keep overall engine height to a minimum, while maintaining a central location in the combustion chamber, which you can see clearly in this photo.

header with canister muffler, or muffled tuned pipe.

The O.S. instructions contain a lot of good advice, which is for the most part not unique to the GT55 engine. Here is a quick list of some of these helpful tips:

- Replace fuel tubing at least once per season, including the clunk line inside the tank, and use cable ties to secure lines.
- Use an inline fuel filter between the tank and carburetor, and clean it occasionally.
- Assure adequate cooling air flow to the engine, and away from the engine.
- Make sure the firewall or mounting surface is flat, particularly if using shims to get thrust angle set.
- Tighten propeller bolts before each flying session.
- Pg 24 in the manual has a nice graph to show how the high-speed and low-speed needle valves interact and affect fuel mixture across the throttle range.
- Make sure to mount the ignition box so it is isolated from vibration.

Finally, a few comments about the features of the ignition system. The unit is compatible with a wide variety of power sources—from 4- to 6-cell NiCd or NiMH packs, to 2-cell A123 packs, to 2-cell LiPo packs. Should the voltage drop below a threshold, the engine will misfire above 5000 rpm as an indication to land immediately and change or charge your ignition battery. O.S. specifications claim that the ignition system draws only 0.6 amp at 6000 rpm. Measured data, while running on a regulated 6-volt power source, confirms the high efficiency of the system, drawing a measured 0.59 amp. At idle, the current consumption

The piston is CNC-machine made from bar stock. It features a single, thin ring, large cutouts in the skirt to avoid blocking the entrance to the transfer ports, and the piston pin is placed high to allow the longest possible connecting rod length. The piston pin has internal threads to allow extraction through the access port in the rear transfer port casting.

Here you see the results of some fine CNC machine work at the O.S. factory. The piston and connecting rod are CNC-machine made from bar stock, and the connecting rod is fitted with needle roller bearings at both ends. The piston pin is retained by a pair of C-clips. These are quality made parts, which result in an engine that performs well.

O.S. uses a one-piece casting for the crankcase and cylinder. Note how large the rear ball bearing is, allowing almost a full view of the front bearing, which uses rubber seals. Also note the hole through the casting wall in the rear transfer port—this allows access to remove and install the piston pin.

The steel cylinder sleeve features very neatly machined ports, and a super-fine honed finish in the cylinder bore. To the left is the large, bridged exhaust port, and to the right is the front transfer port.

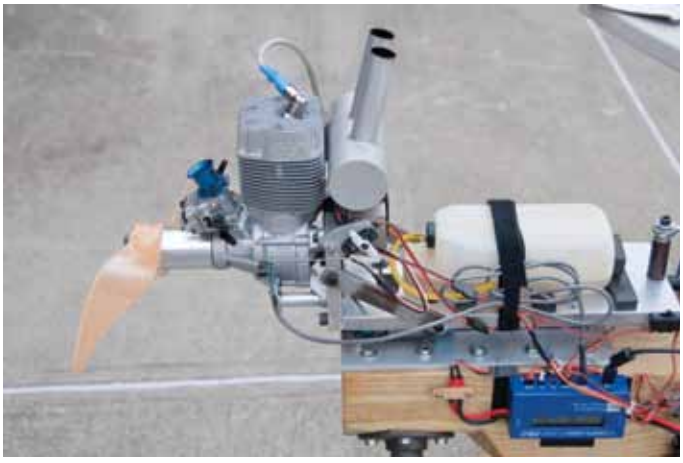
is only 0.2 amp. See the included graph for the profile of current draw vs. rpm across the operating speed range.

Engine Hardware Layout

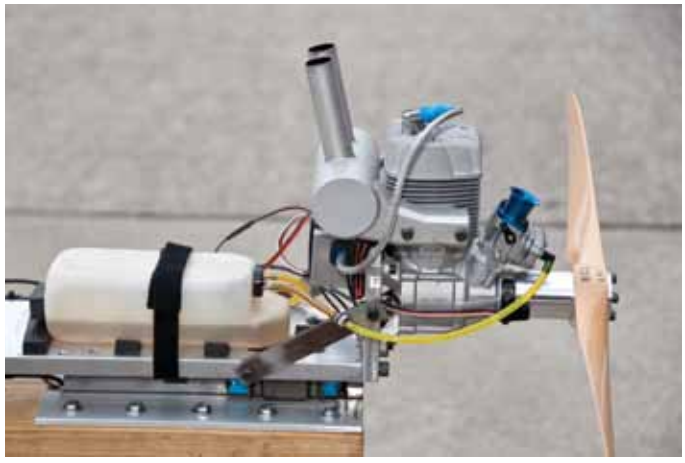
First, it's necessary to point out that disassembling the engine should not be necessary, and if for some reason it would be required, the best approach is to have a qualified service center do the work. Having said this, I tore the engine down completely in order to show more of the engine's components for this review. The teardown was straightforward for the most part, but there are a couple of steps that are unique and require great care.

First, removal of the propeller drive hub requires a special extra-deep socket to remove the pilot shaft's nut, due to its length. The other step to highlight as requiring special attention is the

Installing the piston pin is a bit tricky. The piston has to be placed inside the cylinder with the sleeve removed, lined up so the piston pin can be installed through the access window in the crankcase, and pushed through the piston and upper connecting rod bearing at the same time. Then the C-clip must be installed using long, needle-nose snap-ring pliers.



It proved very easy to mount to the PC-controlled test stand, including connecting the throttle linkage to the front-mounted carburetor. The base plate of the test stand rides on a re-circulating roller bearing linear slide, for near friction-free movement, allowing for accurate measurement of thrust with the engine running.



This right side view shows how well the Slimline muffler fits the GT55, and how compact the ignition sensor is. The fuel line looks like it is rubbing on the propeller drive hub…but it actually has plenty of clearance as the fitting on the carburetor angles away from the drive hub.

For this test, a Vess 23B propeller is installed. The camera flash freezes the propeller, making it appear as if you can see through the blade! Note the exhaust's position at the back of the motor, which means in most applications it will run inverted.

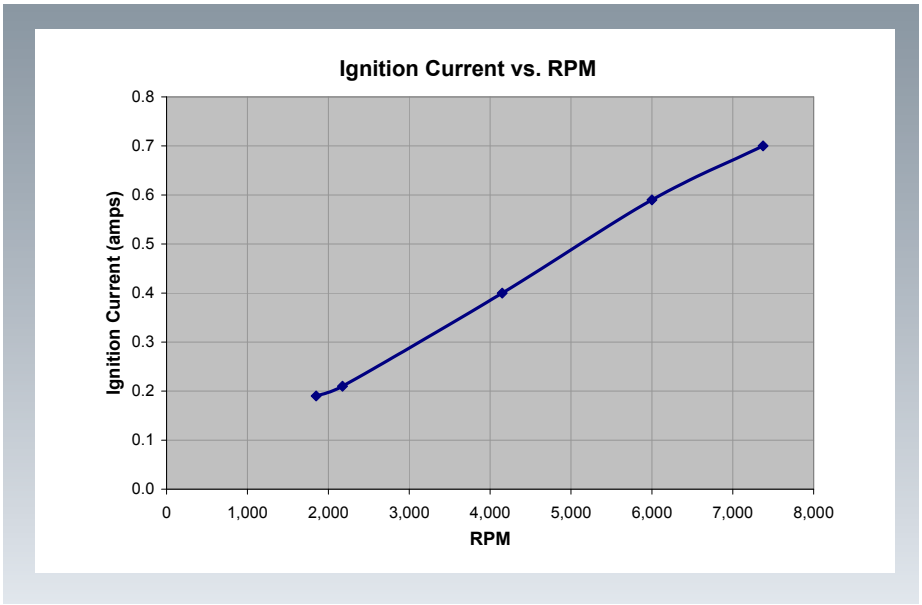
These are the five propellers which were tested on the GT55. The Menz 22x8 produces the lightest load and was used for break-in plus thrust testing. The Mejzlik 24x10TH produced the highest load, but the GT55 turned it at impressive 6000 rpm.

O.S. GT55 Gasoline Two-Stroke				
	RPM	Static Thrust (lb)	Pitch Speed (MPH)	Sound Pressure Level dBA
Menz 22X8 Wood	7,400	30.0	56.1	103.7
Menz 22X10 Wood	6,500	28.3	61.6	101.0
Vess 23B Wood	6,925	30.8	52.5	101.1
Mejzlik 21X12 Carbon	6,925	27.5	78.7	99.5
Mejzlik 24X10TH Carbon	6,000	30.3	56.8	101.5

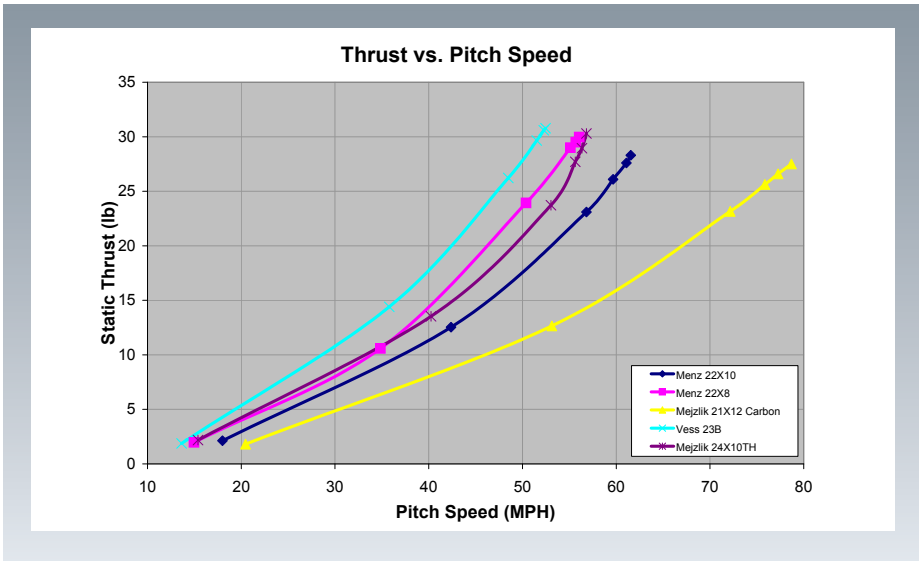
This table shows the top rpm, static thrust, pitch speed, and dB level achieved with each of the five propellers tested.

removal (and then re-installation) of the rear piston pin retaining clip. Due to the one-piece crankcase/cylinder design, and the clearances involved, it is necessary to remove the cylinder sleeve, and then the piston, while the connecting rod is still installed on the crankshaft. This is done by pulling out the cylinder sleeve, removing the crankcase plug from the rear transfer port area, and then accessing the piston pin C-clip with a needle-nose snap-ring pliers. Once the clip is extracted, the piston pin can be pulled out so the piston can be removed from the connecting rod and cylinder. Then the connecting rod comes off the crankshaft, and the crankshaft can be removed. This arrangement is a bit tricky at first, but I found the re-assembly to be quite straightforward, and after gaining this experience I realized that this configuration is a fairly elegant solution to fitting all of the parts together. For me, the piston pin slid out easily, but in case it is a bit tight, the inside diameter of the pin is threaded to allow use of an extraction tool. This may be necessary for an engine with a season or two of run-time on it.

Other than these unique steps, the rest of the job was typical of an O.S. glow-ignition two-stroke engine. I also scribed a very small line along the end of the ignition sensor prior to removal, so I could make sure to re-fit it with the same ignition timing—as it features adjustment slots.



This graph shows the ignition current draw across the rpm range, using a regulated 6.0-volt power source. The ignition system is very efficient, drawing 0.59 amps at 6000 rpm, closely matching the specification provided by O.S.



This graph shows how static thrust and static pitch speed relate to each other. If you want maximum static thrust then just pick the one with highest thrust, but if you want to trade off some static thrust for more pitch speed, this graph can help you visualize the tradeoff. The Mejzlik 21x12 Carbon prop produced the most pitch-speed by far, and would be a great choice for a warbird application for example.

GT55 2-Stroke 55cc Specifications

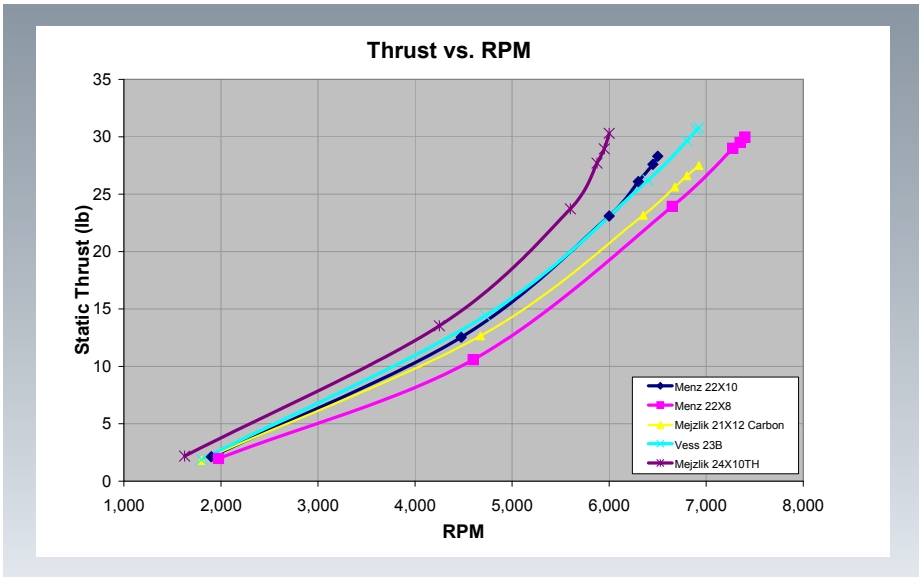
Type	Two-stroke gasoline
Displacement	3.35 cu in. (54.9 cc)
Bore	1.62 in. (41.2 mm)
Stroke	1.62 in. (41.2 mm)
Cylinders	Single
Engine (Only) Weight	55.7 oz (1580 g)
Ignition Weight	4.94 oz (140 g)
Crankshaft Threads	Four M5 bolts with 10-mm pilot shaft
Prop Range	22x8 (break-in), 22x10, 23x8, 23x10, 24x8, 24x10
Rpm Range	1800 - 8000
Fuel	Gasoline (regular unleaded) with high-quality two-cycle oil mixed per instruction manual
Mounting Dimensions	See towerhobbies.com or osengines.com
Muffler Type	Slimline #2123 (used in our testing) or 2123S, Bisson #9250, or JTEC #JTCG7950 or other DA-50R / DLE55 compatible
Cylinder Type	Steel sleeve
Carb Type	Walbro WLA-2 pumper, 2-needle valve
Crank Type	Dual ball bearing

GT55 2-Stroke 55cc Vendors

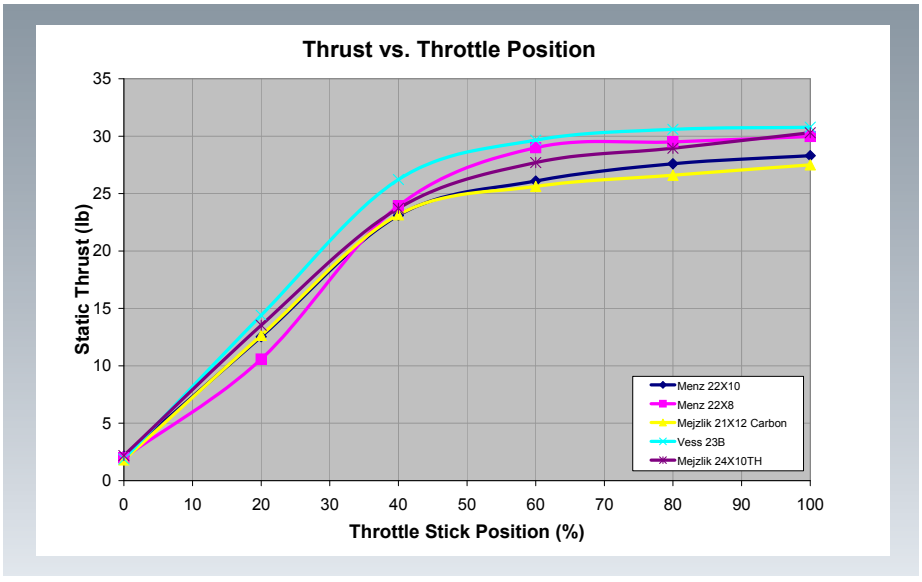
Great Planes Model Distributors
P.O. Box 9021
Champaign, IL 61826
(800) 637-7660
Web site: greatplanes.com

O.S. Engines
Web site: osengines.com

Tower Hobbies
P.O. Box 9078
Champaign, IL 61826
(800) 637-4989 (orders)
Web site: towerhobbies.com



This graph shows how thrust relates to engine rpm for each of the five propellers tested. This also helps visualize the relative load each propeller will impart to the engine across the rpm range.



This graph shows how thrust output varies with throttle position. As throttle is advanced to 40-50%, thrust increases rapidly and fairly linearly. Beyond 50% throttle, little additional thrust is gained. Use of a throttle curve or throttle exponential could help make the thrust response feel more linear.

Conclusions

The new O.S. GT55 engine proved to be a strong performer, with good manners in terms of tuning and throttle response. It ran extremely well with each of the five propellers tested, covering a wide range of rpm and load conditions. The price point is similar to other premium engine brands, especially when taking into account the discount offers that are frequently available at towerhobbies.com, and the value of O.S.'s strong after-sales support and warranty should also be considered. For all of these reasons, the new GT55 should certainly be considered as you make the decision for which power plant to select for your 50- to 60-cc class airplane.

To see and hear the GT55 engine run, please see the videos at youtube.com by searching on RCSportFlyer.