RIVA REVOLUTION

Bringing Ferruccio Lamborghini's Riva Aquarama Back to Life

Story and Photos by Zachary Mayne

Riva boats and Lamborghini cars are both iconic Italian designs. Though historically the two have been for the most part unrelated, there was one Riva boat that was powered by a pair of Lamborghini V12s. This particular boat was owned by Ferrucio Lamborghini, who had ordered it from Riva in 1968, when the Italian supercar company was at the top of its game. The mid-engine Miura supercar had begun production in 1966 and had taken the automotive world by storm and Ferrari was now on notice that it had a serious competitor just down the road.

Normally the sleek, wooden Aquarama boat (hull number 278) that Ferruccio Lamborghini ordered from Carlo Riva would have been powered by a pair of simple but powerful Crusader V8 marine engines made by GM. However, as the owner of a car company known for its fast, high performance road cars, Ferruccio requested that Riva install a pair of Lamborghini-engineered V12 engines in place of the somewhat pedestrian V8s. The pair of motors were sourced from the Espada, a luxury, 2+2 GT car that Lamborghini had begun producing in 1968.

In order allow them to work in the boat, the V12s had to be modified for marine use. Riva also designed and built an exhaust system with open pipes at the request of Lamborghini that would make the boat sound like no other. While a pair of high-revving V12 engines may have been a great idea in theory and one that should have had stellar results, the performance of Ferruccio's one of a kind Aquarama was somewhat disappointing. The primary problem was the fact that the 4.0-liter V12s didn't produce peak torque until 5,000-rpm. Those familiar with boats know that low-end torque is what is needed to get the boat quickly up to planning speed, which is why Rivas were traditionally powered by low-revving, but torque American V8s.

Above: Ferruccio Lamborghini (on left) and Carlo Riva around the time that the Ferruccio ordered the boat.

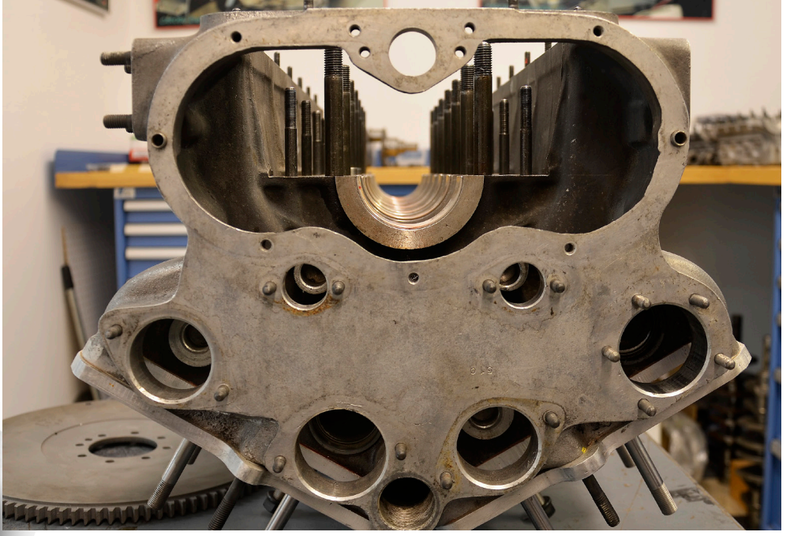
Despite the disappointing performance of his new boat, Ferruccio enjoyed it and kept it until his death in 1993. At that point, the V12s were removed and replaced with the original pair of Crusader V8s. The Lamborghini marine engines were sent to the company's museum, while the boat itself was put into storage, since none of Ferruccio's children had any interest in it.

A few years ago, the boat was rescued from storage by a Dutch enthusiast who decided to restore it back to its original form, complete with a pair of fantastic Lamborghini V12s. While the boat was being restored in Holland by Riva World, a world renowned Riva restoration company, the restorer of Ferruccio's old boat contacted Carobu Engineering about the possibility of building a pair of custom V12s for the boat. Carobu's worldwide reputation as a builder of high performance vintage Ferrari V12s made us the logical choice for the project.

Though the boat would still use a pair of Lamborghini sourced V12s, the owner wanted the boat to perform properly in a marine application. That meant more torque at lower RPMs. The primary method used to achieve this is to increase the displacement of the engine, which in this case would have a two-pronged effect on the torque curve of the engine. First, a larger motor would produce more torque because of the larger displacement. And second, enlarging the engine while keeping the cylinder heads basically the same would lower the engine speed where peak torque occured. The latter change was particularly important in this case, since the desired result was additional torque at a lower RPM than the original high-revving engines. Peak torque would also be adjusted by altering the camshaft duration.

The first step in the engine building process was inputting the basic en-

RIGHT: Period photo of the Lamborghini-powered Riva was featured in back of Road & Track magazine.



TOP: Bare block came from a Lamborghini Miura.

MIDDLE: Specially made Razzo Rosso pistons were produced for use in the boat application.

BOTTOM: An 80mm Razzo Rosso billet crankshaft was designed and fabricated.

gine parameters into Carobu's engine simulation program. The performance specifications of the original 4.0-liter Espada V12 was used as a baseline from which the final engine would be configured. With the baseline engine simulated properly, changes were then made to achieve the desired result. The bore and stroke was changed, camshaft timing adjusted and the marine specific exhaust system modeled. In the case of the latter, the exhaust is a simple log manifold that cannot be tuned. The intake flow of the engine was also changed for optimum performance.

The results of the computer simulation were then used to design new parts for the engine configuration. Specially made components included a new Razzo Rosso 80mm billet crankshaft, custom connecting rods and Razzo Rosso forged pistons. Because of the longer stroke of the new crankshaft, 9mm deck plates were installed and sealed onto the top of each side of the block. Longer pistons sleeves were installed and bored out to 85mm.

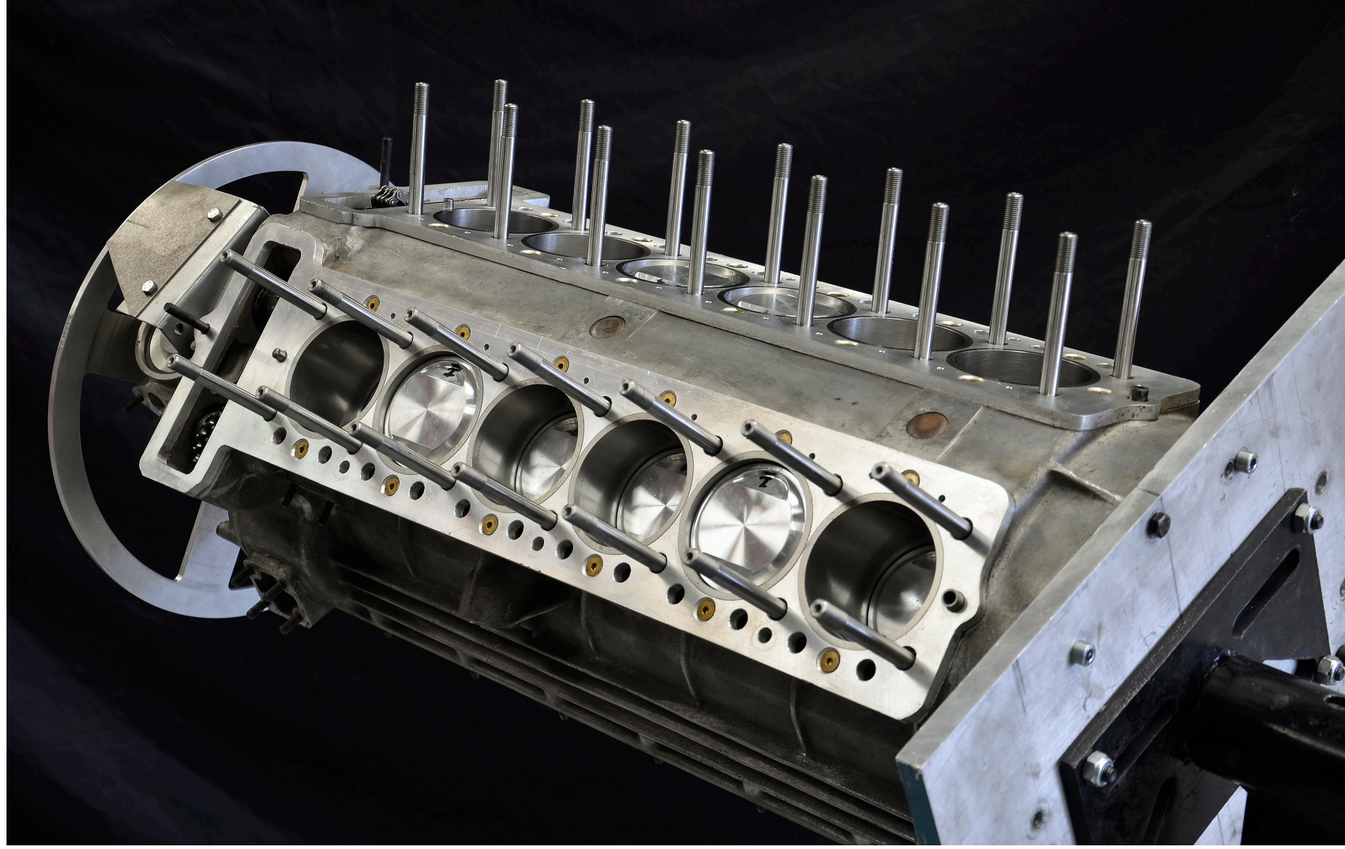
With so many changes and alterations to the original motor, this project was more like an engine development project than a straightforward engine rebuild. Longer head studs were installed to accommodate the deck plates and a longer timing chain and custom machined timing chain tensioner sprocket were installed. During the engine building phase, many of the components had to be hand fitted due to the close tolerances, and there was also special machining on some parts so they would fit properly.

The cylinder heads were carefully hand ported and polished in order to replicate the proper flow characteristics that were suggested by the engine simulation program. Both the intake and the exhaust camshafts were ground to custom profiles to achieve the proper power band. Another necessary change was clearancing the bottoms of the pistons skirts so that there would be enough clearance when opposing pistons in the 60-degree V12 were at the bottom of their stroke. Additionally, the counter weights on the billet crankshaft were machined down in order to clear the pistons at BDC (Before Dead Center).

Fuel delivery for the bespoke Lamborghini engines is handled by a relatively conventional sextuplet of 40 DCOE side-draught Weber carburetors, which is the same setup that was originally used on the engines in the Espada road cars. In order to work with the more powerful motor however, each of the six carbs was re-jetted to deliver the proper amount of fuel and air to the engine. While the original Lamborghini engines used a primitive points setup in the distributors, the new motors rely on a Pertronix electronic ignition in order to deliver a reliable spark.

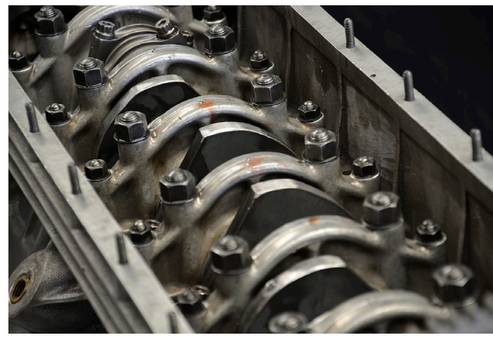
Copies of the simple log manifolds that the original V12 engines utilized for the exhaust system were remade by the very same fabricator in Europe who had built the original manifolds. The manifolds were hand delivered to Carobu's shop in the U.S. by Sandro Zani, the restorer of the boat and the owner of Riva World.

The changes to the original 4.0-liter Espada motor resulted in a healthy displacement of 5.5-liters, while the compression ratio was now a more aggressive 10:1. The most important

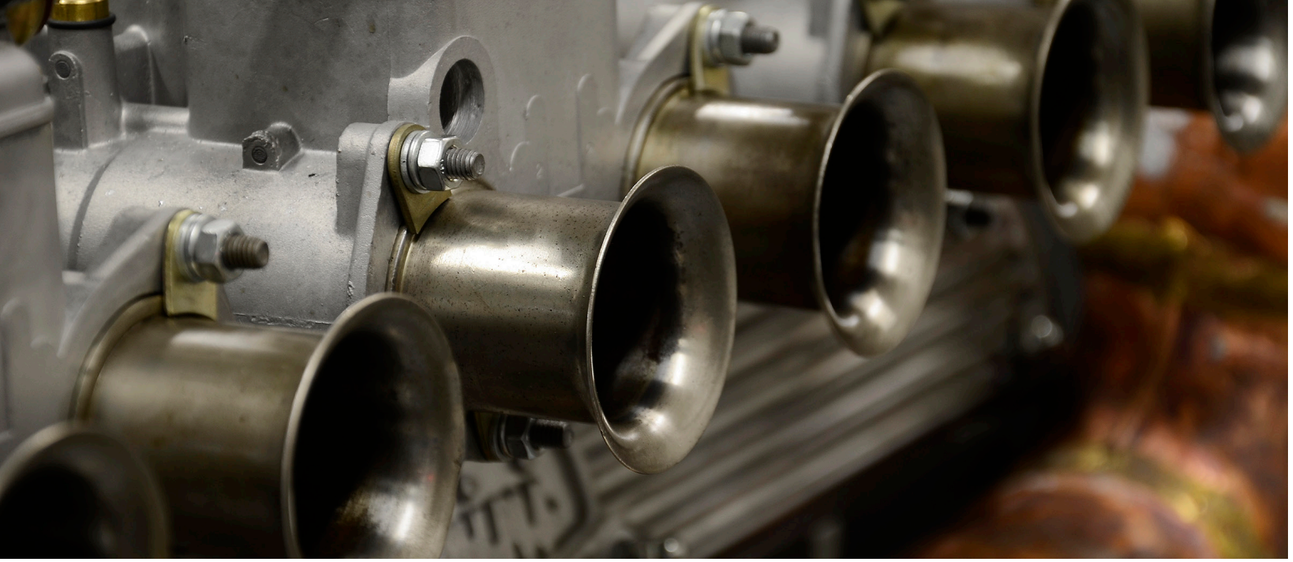


TOP: Block with the custom crank and pistons installed.

BOTTOM: Detail of the crank. The bottoms of the pistons and the counterweights on the crankshaft were machined to provide adequate clearance.



Seen from above, one of the two rebuilt Lamborghini Espada engines shows off its six Weber DCOE carburetors and brass log headers. Before installation in the boat, the headers and other components of the motor are painted the signature blue that all Riva engines were originally painted.



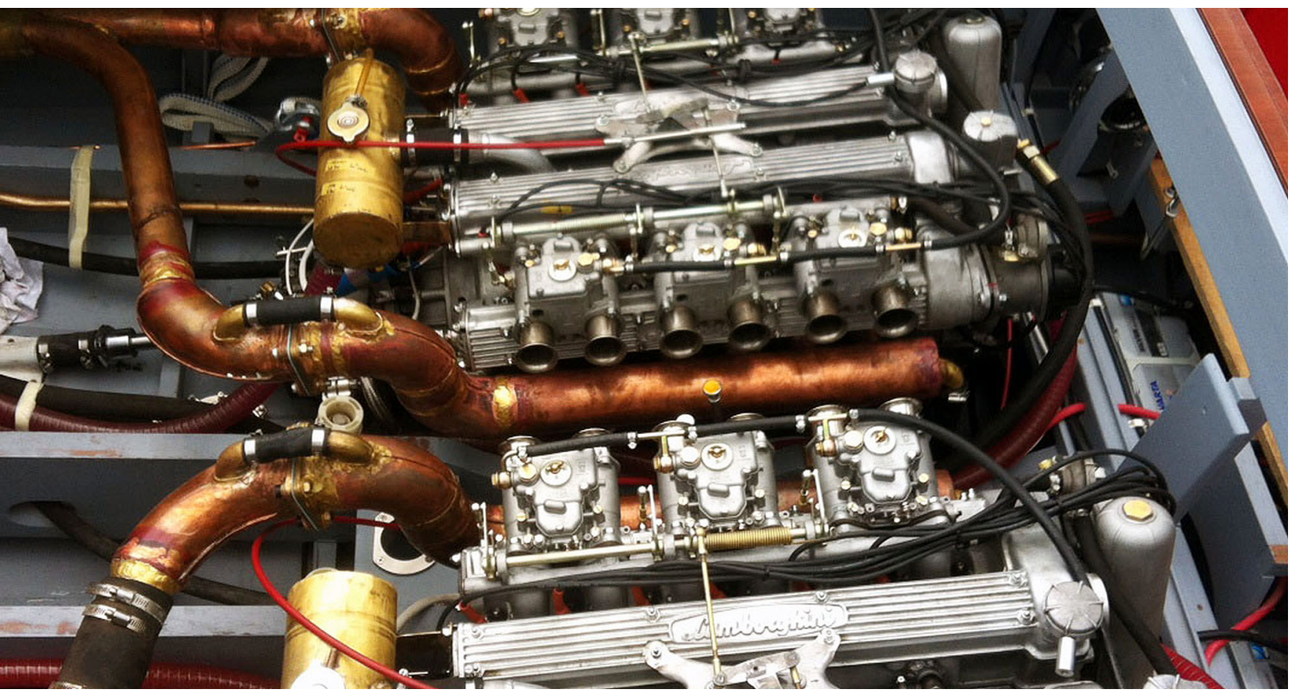
accomplishment however was the dramatic increase in torque that the new motor produced. Horsepower is up to 322 at 5,100-rpm, while peak torque of 379 lb-ft arrives at 3,600-rpm. That is a full 150 more ft-lbs of torque than the original Espada motors produced at the same RPM. The horsepower is equivalent to that produced by the Crusader-Riva 320 V8, though torque is slightly less than the amount produced by the massive 454 cubic inch (7.7L) engines. The combined torque of 758 ft-lbs produced by the two engines will now allow the stunning wooden Riva up to planning speed much more quickly.

Once the first engine was built and proven on the dyno, work quickly began on the second motor, which had one major difference over the first engine. Since the engines work together in the boat, the second V12 had to be counter-rotating, a change that required many small modifications to various components on the engine. The camshafts were re-profiled and oiling holes relocated to the thrust flank of the cam, a very involved process. An EDM (electronic discharge machining) machine was used to drill the holes.

ABOVE: Weber air horns are things of beauty.

BELOW: Tha engines at home in the Riva

RIGHT: The finished Riva, restored to its formy glory and beyond with more performance than even Ferruccio had imagined.



The ignition on the second engine was also modified. The dual distributors were made to run backwards, which included modifying the counter weights. Like the first V12 that Carobu engineered, Pertronix electronic ignitions were then installed in each of the distributors. The spark plugs wiring was reordered as well in order to accommodate the reverse firing order of the engine. Another special detail is the water pump housing on the front of the engine, which was specially cast to match the non-automotive one used on the original, 1969 Riva-Lamborghini engine. Furthermore, the oil pump was modified to turn the correct way in order to circulate the oil supply. As originally designed, the Espada V12's oil pump is driven by the crankshaft through a series of gears. For the reverse engine, a direct drive setup was designed and expertly fabricated to allow the pump to operate in the correct direction. In order to allow the engine to be started, the starter ring gear was recut to accept the Bendix drive.

From start to finish, the design and engineering of the two engines took nearly 20 months. Once the two engines were shipped back to Holland, Sandro Zani and his crew set to work on installing them in the restored Riva Aquarama speedboat. The first engine was installed to check the fit of the custom made oil pan and the intercooled cooling system. Then the exhaust was installed as well as the various throttle linkages and other bits.

When the second engine arrived the installation went much smoother and both engines were test run in the boat for the first time.

After all the systems were checked and adjusted, the boat had its first tests on the water. From the shore, the sound of the twin Lamborghini V12 engines through the un-muffled exhaust was thrilling. In the boat, the performance was startling. The Riva easily got up on plane and sprinted to a top speed of 53 mph. The throttle response was crisp and the open mouth Weber carburetors made some serious intake roar as the linkages snapped open.

The Riva-Lamborghini restoration project is almost done. The final interior appointments need to be finished before this regal wooden speedboat can be delivered to its new owner. This Riva-Lamborghini is a very unique version of the Aquarama series; only around 700 boats were made over a 30 year period. And only one was powered by Lamborghini V12 engines.

As a side note, Carlo Riva and Bob Wallace both said that the Lamborghini engines would never work right in the Riva. Never say never...

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