ROTARY ENGINEERING:
Your Performance Source

While the stock RX-7 has quite adequate power for most drivers, most of the time, there are those occasions when a bit (or a lot) more power would be beneficial. Examples include those instances when you are at a stop light and a Corvette, complete with a smirking owner waiting to blow you away, pulls up alongside. Or the time you pulled onto the freeway and suddenly realized that you had misjudged just how fast that semi in the outside lane was traveling.

Where can an RX-7 owner turn for a variety of parts that not only make his car go faster but stop faster as well? One of the largest selections anywhere can be found at a firm located in scenic Santa Barbara, California. They either stock or develop almost anything you can imagine and their giant catalog is packed with every item from spark plugs to full-blown rotary racing engines. The name of this company is Rotary Engineering and we visited them recently to discuss the best approach for an owner to take when seeking to upgrade the performance of his RX-7. Rotary Engineering is owned by Wayne Graham, a local dentist who would just as soon smell exhaust fumes as the alternative. Two days a week is devoted to his dental practice and the remainder is spent supervising the development of a wide range of performance components. Mike Pariseau handles sales and purchasing when not enjoying his own new RX-7.

Wayne has long been a racing enthusiast and has owned a long string of Mazda rotary cars. His current steed is an RX-7 fully decked out with Rotary Engineering body panels and a Turbo Alternative engine is under the hood. While Wayne also owns a Porsche 928, he prefers to drive the RX-7 when he wants to really go fast. "Attracts more attention too," he says. Hopefully, not by the CHiPs.

Wayne originally set two goals for Rotary Engineering. First, he provided the operation with complete testing facilities, including a dyno and flow bench, to enable research and development on rotary engines. Currently, a prototype supercharged rotary engine is undergoing evaluation. The second goal was to develop and supply parts for the average rotary engine car owner who wants extra performance from his car. Both goals have been successfully met and their sales volume has grown ten-fold over the past few years. In addition, Rotary Engineering has been very active in SCCA racing.

The range of accessories on their shelves is overwhelming. It isn't possible to cover everything, but several are quite unique and should be of considerable interest to all owners. One item is an anti-theft baffle which fits inside the door. A locked RX-7 can be broken into very easily without this device in place. The baffle is well worth the low price in terms of the protection offered. Two heavy gauge aluminum dash panels for the center console are offered to owners of '79 and '80 cars. One is designed to mount three gauges in addition to all the stock panel components. The other will accept a Compucruise trip computer. A similar panel will soon be available for '81, '82 cars. A number of body panels are also available, including fender flares, a front air dam, and a rear spoiler, to give an RX-7 the look of a race car.

If you have ever had to drill holes under the front bumper to install and mount fog lights, you'll wish you had known about their light bracket kit. No holes need be drilled, the fog lights mount in the optimal location, and the cost is only $11.00. A new electric door mirror kit also utilizes the stock mirror holes to eliminate drilling. In addition, these black mirrors look custom made for the RX-7.

Owners of 1981 and 1982 RX-7s who have been searching for premium-grade front shock absorbers have undoubtedly found that, despite promises of imminent availability, they can't get them. Wayne simply got tired of waiting. Together with Torco, they developed a fluid which converts the stock RX-7 shocks into the equivalent of Konis set on regular. They supply a bottle with just the right amount for both front struts and complete instructions for only $14.50.

Another new item is a super flow air cleaner which fits all rotary engines. It is recommended for any engine performance upgrade since it passes about 20% more air than even a Filtron element. It also remains cleaner much longer.

While spark plugs aren't all that exciting, Wayne recommends the use of Nippondenso replacement plugs. Nippondenso plugs are not only less expensive than the stock units but testing has indicated a slight performance improvement. Wayne cautions that only resistive plugs should be used on 1981 and 1982 cars. A non-resistive plug will damage the electronic ignition used on these models.

These items are only a small sample of their stock. A copy of their new 1982 catalog is required to fully appreciate the scope of products offered. Even more exciting offerings will be forthcoming in the future. One is a lower cost Dual Weber system for stock engines. Unlike the DCD Weber which is 100% tunable for almost any engine modifications, the new DGV is suitable only for the stock 12A. The DGV has more torque at the bottom end but less at the top. It will cost about $150 less than the DCD.

A major current project is development of a supercharger for the RX-7. Like Mazda, Wayne sees many advantages for this approach over conventional turbocharging. Supercharging produces a vast increase in horsepower and torque, particularly at the low end where the normally aspirated rotary engine needs some assistance. Wayne also feels that the supercharger will be easier to install than turbochargers. Their system will be designed to bolt up to the stock exhaust system. As currently planned, the supercharger can be added to any Mazda rotary, from pure stock to the 13B Rally engine. No date has been set for its release because much time must be spent in both lab and road testing to insure that the supercharger/engine combination is both optimized and durable. As soon as it is ready, *Rotary Rocket* will cover and test it.

The attached story gives the recommended stages for enhancing and upgrading the performance of your rotary engine. Send for a copy of their catalog to find out the entire range of performance and appearance products available. Don't forget to mention that you're a member of the RX-7 Club of America because Rotary Engineering offers many discounts to club members. Sorry, but we forgot to ask Wayne if members can also save on dental work.

Upgrading Your RX-7's Performance Can Be Done in Stages.

With all the options available, where does one begin when seeking to upgrade the performance of his rotary engine? Just as important is the question as to where one stops. The answer to the first question involves two considerations. One is where the best performance/price ratio occurs. The other involves the optimal sequence of components so that each new part works best with the previous pieces added. As to where one stops, that is mainly a function of the money available and the level of performance wanted.

The following stages are recommended by the Rotary Engineering staff based on their knowledge and experience. The following information should be quite valuable to the novice ready to coax more horses from his engine.

STAGE 1: Headers represent the first level of upgrade. They connect between the engine and exhaust system. Headers replace the stock exhaust manifold/thermal reactor and improve performance by reducing the back pressure. They use the exhaust flow from one rotor to help suck exhaust from the other rotor.

Rotary Engineering is proud of the header they manufacture which is constructed from 120 wall cold-rolled steel tubing. It is designed to mount up and in-board to follow the path of the stock exhaust. Some competing headers extend a couple of inches lower, inviting contact with the ground on lowered RX-7s when going over bumps or when encountering an object lying on the road. Their header produces at least 116 horsepower between 6000 and 7000 rpm. Headers for 1979-1980 models cost $144. The corresponding price is $179.95 for 1981-1982 model RX-7 headers.

STAGE 2: After adding headers, the stock exhaust should be replaced with a free flowing high performance exhaust system.

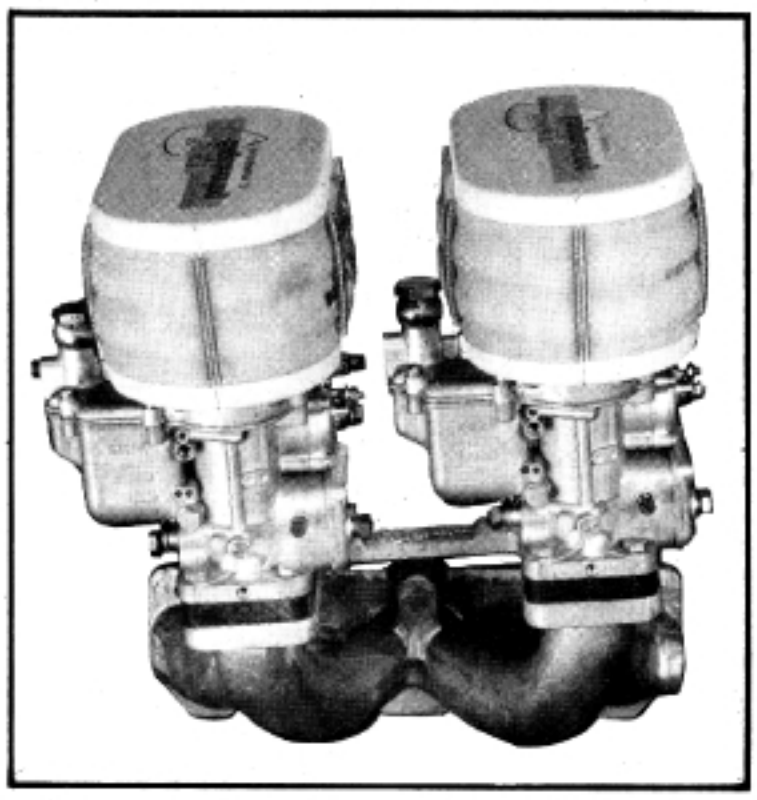
Their new system will cost from $200-$245 and is the culmination of a two year development to get an exhaust system which not only produces a much higher flow than the stock unit but sounds mellow, not raucous. They caution that some so-called performance exhausts actually flow no better than the stock RX-7 system.

STAGE 3: For $140, Rotary Engineering will re-manufacture your stock carburetor to performance specs. The performance-rebuild, in conjunction with the R/S air cleaner assembly ($41.50), increases horsepower to 130hp at 6000-7000rpm. This combination gives performance very close to that of a Holly 450 CFM carburetor but costs about half as much.

Headers and better carburetion open up the engine, allowing it to breath better by improving the flow of fuel and air. Throttle response becomes much better and the engine will pull strongly all the way to redline.

STAGE 4: For approximately $230, you can add the performance intake manifold and the new superflow air cleaner. Horsepower is increased another notch to at least 140hp. If one proceeds directly to stage four, the cost of the R/S air cleaner (stage 3) can be eliminated.

STAGE 5: To get to over 150 horsepower, use a single 48 IDA single Weber kit. It costs $595 and includes the manifold, air cleaner, linkage, and all hardware. By going directly to this stage initially, many of the costs of stages 3 and 4 are eliminated. This setup gives acceptable low-



end torque and driveability with excellent mid and high end power.

STAGE 6: Instead of stage 5, substitute a twin Weber conversion kit for the single Weber. The dual kit includes everything required and costs $775.00. While peak horsepower is about the same as for stage 5, you get excellent low end torque at the same time and the carburetor is fully tuneable for any degree of additional engine modification you may perform later.

After stage 6, options for a stock 12A engine include turbocharging or, in the future, supercharging. Of course, if one wants to go further than stage 6, Rotary Engineering recommends their Turbo Alternative 13B engine.

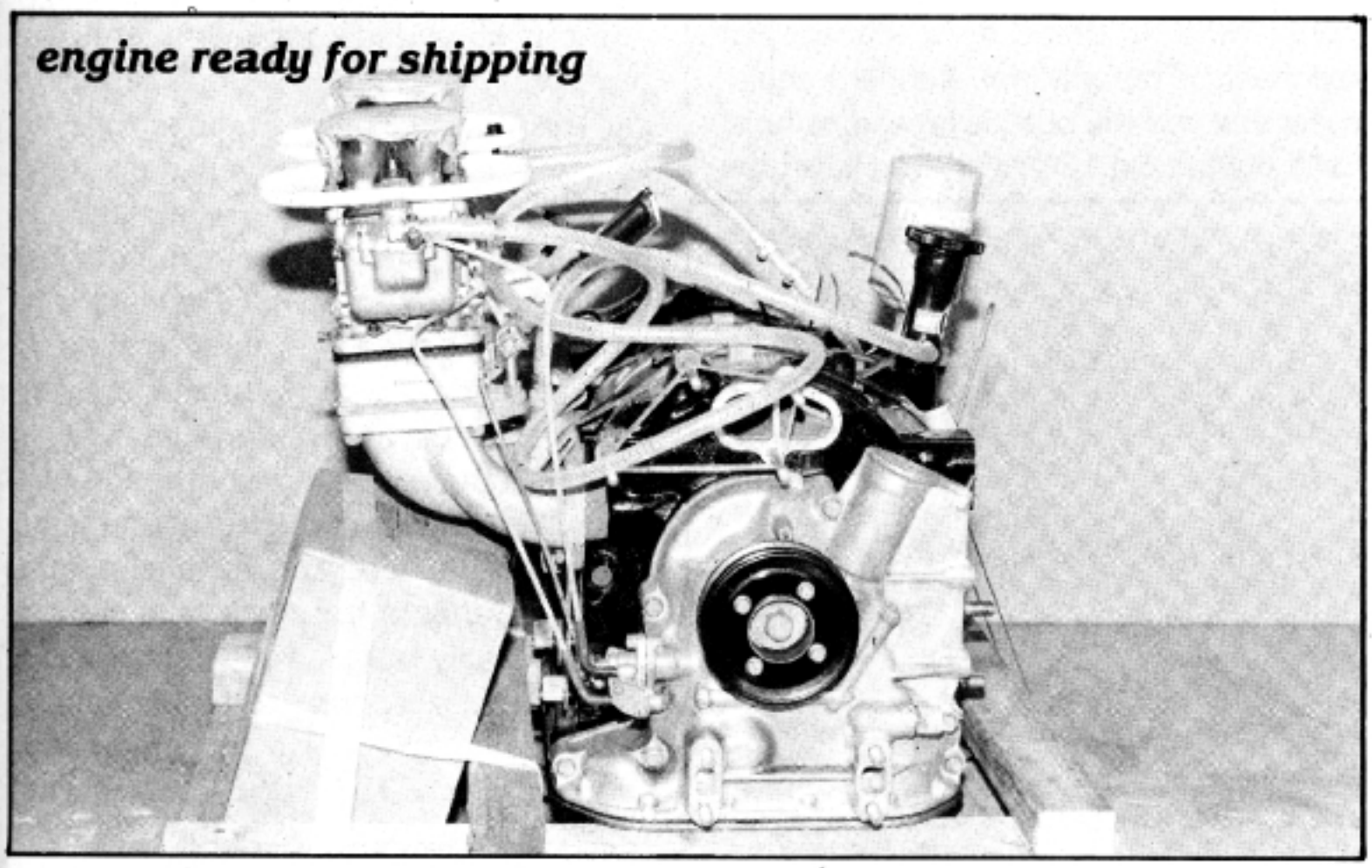
We've covered the range. Whether you want to spend $150 or $3500, there something available to enhance the performance of your RX-7. However, be forewarned that there may be consequences involved in tampering with your engine, no matter how minor you may consider them.

First, any alterations to your stock engine are verboten in many states. In some, you'll have to restore your engine to stock condition before you can sell it. Annual emission inspections can also present a problem. If you still want to add hardware to your engine, we suggest that you retain all the old components so that your motor can be inexpensively restored to stock condition in the future.

In addition, Mazda rightfully frowns on any tampering with their carefully designed engine. You will be throwing your 3 year/50,000 mile warranty away as soon as you add or change anything connected with the engine.

Finally, the more horsepower you add to your RX-7, the greater the stress on the stock clutch, brakes, and suspension. You should seriously investigate upgrading these components to match your increased power. You may also find that you now require super unleaded gas, more frequent engine care, and will have to replace spark plugs more often.

Only you can answer whether these possible negatives outweigh the exhilaration you'll get from driving a faster RX-7. At least we have outlined the steps and hardware required to get from where you are to where you want to go. The rest is up to you.



engine ready for shipping

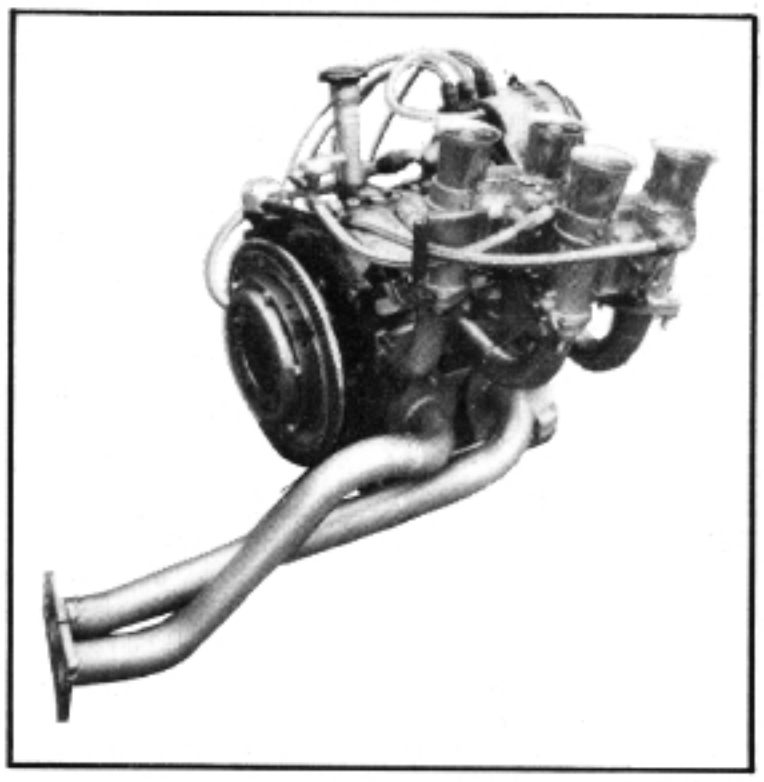
TURBO ALTERNATIVE

If you're looking for "big block" excitement in your RX-7, a turbo isn't the only game in town. Rotary Engineering can put 225 horses under the hood of your Mazda for a level of performance that can flat embarrass Corvettes and Porsches. That engine is the 13B Rally engine, affectionately called the Turbo Alternative. The 13B is a larger displacement rotary engine than the stock 12A which comes with the RX-7. By the time that Rotary Engineering finishes with it, the results are reminiscent of the big block V8 engines of the past

but with the free revving characteristics of the rotary.

The Rally package starts with a 13B engine. Everything is new except for five pieces which are reconditioned and strengthened. Those pieces are both rotors, the oil pan, the aluminum front cover that houses the distributor, and the hardware and fasteners that hold everything together. The rotors are cast iron and the whole assembly is made quite bulletproof to withstand the stresses that can occur in an engine that redlines at 9,000 rpm. The cast iron housing is nitrided, the rotor and stationary gears are located and locked, hardened stationary gears are installed, competition thrust bearings are used, and the engine is street-ported. The same criteria and tolerances are used everywhere as for true race engines.

The stock distributor, water pump, and alternator are retained and need not be relocated. Even the pickup points and the mounting struts for the air conditioning are in the same location as stock. Indeed, everything that mounts onto the old engine, relying on holes or struts, will bolt up to the new engine without modification. Included is a new free flowing air cleaner to pass the copious amounts of air this big engine needs. The package includes a massive 36 DCD Dual Weber carburetor system which is 100% tunable for virtually any performance conditions desired. Finally, a specially engineered header assembly is attached to the 13B exhaust. The header is different for the 1979-1980 and the 1981-1982 models. In each case the appropriate header is supplied to bolt directly to the stock exhaust system with no cutting or welding necessary.



Other than the outstanding performance you get, one of the most attractive features of the Turbo Alternative is the fact that it is a complete package designed to directly replace the stock engine. Before being shipped, each engine is balanced and completely characterized. With his engine, the owner receives a complete set of curves obtained with his engine on the dyno. A metallized sticker goes on the engine noting the measured engine horsepower and torque, the recommended spark plugs and optimum gap, the oil and fuel to use, and the optimum advance setting. The carbs are fully synchronized and the engine is even broken-in before shipping.

The basic installation is not involved and could be done by most owners with a fair degree of automotive experience. If you have any doubts about your qualifications, have it done by a competent mechanic. The only non-standard equipment that you will need is an engine hoist to lift out the old 12A rotary and insert the new engine.

First, all accessories and attachments to the old engine are removed. This involves the distributor, water pump, and alternator. Then the old engine is pulled out. To accomodate the extra length of the 13B engine, the stock engine mounts in the frame cross member must be elongated by ¾ inch using an appropriate grinding tool or drill. This allows the new mounting studs to drop through.

The new engine is inserted in place and bolted down. Then the old distributor, water pump, and alternator are reattached. If the car has air conditioning, the unit can be re-installed using the same pick-up points as before. Since the carb and linkage adjustments have already been preset at the factory, the only remaining adjustment is setting the timing to the specs sent with the engine. The hose and throttle/choke cables are connected to the Weber and the header assembly is bolted to the existing stock exhaust system.

With the correct tools, this can easily be done over a weekend. Just be sure to save your old engine, especially if you live in a state with regulations which might force you to return your car to stock condition at some point in the future. You may also want to restore your car to stock before you sell it, putting the 13B engine in your next RX-7. The self-contained, bolt-on concept of the Turbo Alternative package makes replacing the stock engine a simple matter.

If this all sounds appealing, and you have the money it takes, don't expect to call the folks at Rotary Engineering with your order and have delivery next week. There is a three to four week delivery time because the engines are not built until an order is received. That is due to several factors. The major reason is that each engine is fabricated to the owner's specs and options as well as based on the model year of the RX-7 he owns. As an example, one option is an aluminum flywheel. This flywheel weighs about 1/3 that of the stock one, producing noticeably better acceleration and a more direct response to driver inputs. Rotary Engineering also recommends a stronger clutch. The stock Mazda clutch, which barely copes with the standard

engine power, would soon be decimated by the 225 horsepower of the new motor. All such modifications and options are built into the engine package before balancing takes place. The balancing job alone takes four days.

Although the engine is designed to bolt directly onto the stock exhaust system, full horsepower will not be realized. Performance is more than adequate with the stock exhaust, but about a ten percent gain will occur with use of a free-flowing performance exhaust, particularly at the high end of the rev range. In truth, all high performance engines require a better exhaust system. The price you pay for a system that can flow more exhaust is a louder sound. In some cases, a lot more. If you want the quietest, stick with the one that came with your car. Rotary Engineering has just completed a multi-year development of an exhaust system which they feel is a really good compromise between flow and the resulting sound. It has a far more mellow subdued tone than the forced blare that often comes from other performance exhaust/muffler combinations. Don't forget that, if you opt for a performance exhaust system other than their version, you will undoubtedly lose the advantage of being able to bolt the system right up to the new engine. An adaptor may have to be fabricated.

Rotary Engineering also recommends that the stock fuel pump be replaced in order to supply adequate gas under all conditions. The stock pump would certainly start out all right, but would eventually run out of the fuel capacity required to supply the Webers. They sell a kit that includes two high flow pumps with everything needed to install it. The dual pumps are mounted in the stock location underneath the car, just in front of the axle.

While any high performance pump will work, they chose two for several reasons. Paramount is the problem encountered when all the fuel required must be forced through a single line. Their approach splits the line so that each carburetor has its own feed line giving each Weber its own dedicated fuel pump. Since most high performance fuel pumps are quite noisy, the use of two smaller capacity pumps reduces the overall decibel level. There is another plus to the pumps which Rotary Engineering selected. When one of their pumps run dry, it emits a clicking sound to give the driver an advance warning that he is headed for trouble. They estimate that, when the clicking begins, there should still be enough fuel left to travel another ten miles at cruise speeds.

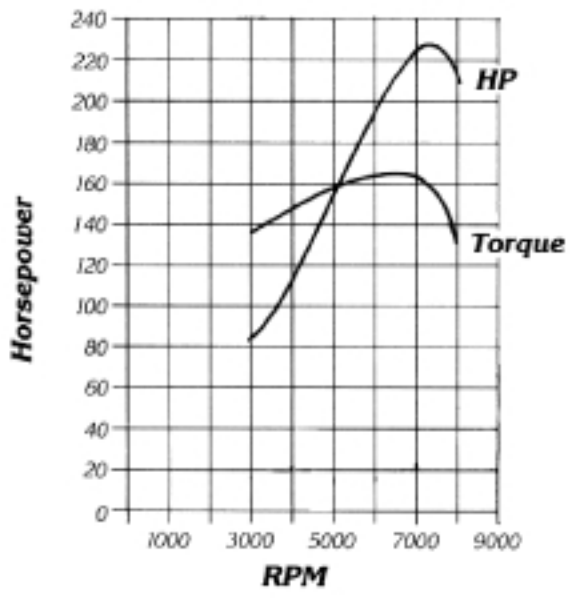
While the stock ignition should be adequate, owners of 1979 models should consider purchasing an electronic ignition. This will eliminate timing variations, give a much longer lasting tune, and probably help operation at high revs. With one of their racing engines, they found that switching to a MSD multiple spark discharge system produced an additional twenty horsepower. This system costs about $1,000, which works out to around $50 per horse. It is not only expensive, but a smaller increase would occur with a stock engine or even the 13B Rally version.

While all rotaries should use only unleaded gas, the Rally engine should be run only with the newer super unleaded fuels having an octane rating of 91 or more. A high quality oil should be used. Either Castrol GTX or a Valvoline oil is the choice of the Rotary Engineering staff.

13-B Rotary Engine
EVALUATION

Driving an RX-7 equipped with the Turbo Alternative is a revelation. From the first push of the throttle, you know you've got a tiger under the hood. Floor the gas pedal and you're at redline almost immediately. The same for all gears. Even in fifth, there is a satisfying pull from the faster acceleration. 0-60 takes less than 6 seconds. A stock RX-7 would require roughly 50% more time to get there. To put this into perspective, this car will pull ahead of a Porsche 928 and stay in the lead until about 70mph. After that, the big Porsche V8 would begin to have an advantage. Not bad for a car and engine whose total cost is about one-third that of the Porsche. This is by far the fastest RX-7 I have ever driven, with the exception of the Avatar ESP convertible and an IMSA racing RX-7. For even more speed, a turbo can be added for another 100hp.

Speed is great, but it is important that a car be driveable and mannered in traffic as well. While the 13B definitely prefers to run in the range of 3000-8000 rpm, it runs well through all gears. Below 2500 rpm there was some minor roughness, but this is not a problem in normal driving. Our 13B engine package included a light weight aluminum flywheel. This option gives the engine extraordinary responsiveness and acceleration seems instantaneous. Press down on the pedal and it feels like you've got an electric motor under the hood. Lift up and it decelerates much faster than a normal engine.



It is inevitable that the Turbo Alternative be compared to its alternative, the turbo. The RX-7 turbo cars I have driven are always impressive compared to a stock engine. However, their claim to fame is chiefly in the mid and upper rpm ranges. Strong boost typically begins somewhere around 3000-4000rpm and acceleration builds rapidly until the normal RX-7 redline. With the 13B engine, both horsepower and torque are vastly higher than the corresponding figures for the conventional 12A engine all the way from 2000 rpm to the redline at 9000 rpm. Indeed, you can get to legal speed limits in second gear.

Admittedly, the 13B is more expensive than adding a turbo onto your stock engine. If you have the extra money, the 13B has a definite edge in terms of both driveability and performance. In addition, there is always the question of the durability of the stock engine when used with a turbo. Our current turbo owner survey, in fact, is seeking to determine the answers, but final results aren't in. Rotary Engineering feels that, if 8000rpm is used as redline, the engine should easily be good for 50,000 miles due to all the care taken to strengthen the 13B engine and its auxillary components.

Performance rotary engines tend to be loud, as you know if you've ever heard them racing. To tame the sound, extensive pre-silencing and muffling must be used. Unfortunately, since high performance engines require a non-restrictive exhaust system, there is a limit to how much silencing can be used before the peak performance begins to significantly deteriorate. We were very pleased to find out that our performance exhaust worked well with the engine and sounded mellow, with just the right note to remind one of all that horsepower at his command.

The sound is louder than you get with a stock RX-7, but not enough to be bothersome to occupants of the car or to anyone outside. We took a sound level meter to measure the exhaust noise. First, we placed the meter 30 feet behind the tailpipe and aimed the microphone right at it. At idle, the level was only 80db. Quick revs to 5000rpm produced peaks of 105db. The sound level drops rapidly off-axis. At the side of the road, 5 feet off axis, the levels were already down by 10db.

With the meter inside the car, we measured a level of 73db at idle. This is not much above the ambient noise level. Under maximum acceleration, the level hit 90db. Cruising at 55mph in fifth gear dropped the level back down to 75db. In fact, rear axle whine could be heard at

about the same level as engine/exhaust.

As a final consideration, our highway fuel mileage averaged 25mpg, about the same as for a 1979 RX-7 with the stock motor. This is unusually high efficiency for a 225hp engine. Around town, gas mileage will vary all over the place depending on how one drives. Having a car this powerful, it is tempting to be a leadfoot from stoplight to stoplight. With this kind of driving, gas consumption is much higher and typically is in the of 15mpg.

The high power of the 13B really demands an improved clutch. The RX-7 we tested had a Rotary Engineering competition clutch which is capable of the demands imposed by this engine and should give a long and useful life. Besides, it will really build up the muscles in your left leg. Perhaps Nautilus should incorporate one of these into their machines. Rotary Engineering will soon offer their new "center-force" pressure plates which will offer both high clamping pressure and normal stock pedal pressure at idle. At 6000rpm, centrifugal force is utilized in this unique design to give the same clamping force as the stiff competition clutch. This clutch appears to be the new hot tip and will be available by the time you read this.

High speeds and rapid acceleration also puts abnormal demands on your suspension and brakes. Going faster often means having to stop faster. Make sure your brakes are in good shape or go to a brake upgrade package such as the one offered by Rotary Engineering. Make sure that your shocks, springs, and tires are in good condition too. Otherwise, the potential performance will be compromised by these components.

Nowhere in our testing did we ever encounter any abnormal levels of oil and water temperature or oil pressure. All stayed at roughly the same levels as a stock engine. Of course, if you race through the Mojave desert in the summer at 140 miles per hour, all bets are off.

If you have the money and are yearning for this level of performance, the Rally 13B engine is definitely a winner and highly recommended. If you act soon, you can save a bundle since Rotary Engineering is selling the engine to club members for a limited introductory period at a savings of $500.

VIEWPOINT

from page 7

tions asks which accessories or performance items you have added to your car. Whenever possible, include the brand and model of the accessory. If you are either very pleased or unhappy with it, let us know. We will find this information useful in future product reviews and comparisons in order to alert readers to the best values as well as which products to avoid.

A recent survey in *Popular Mechanics* indicated that a high percentage of RX-7 owners plan to purchase another RX-7 in the future. If you are in this group, we are giving you the opportunity to tell us what you would like to see in your next RX-7. Perhaps you'd like a 200 horsepower RX-7 with a targa top. Maybe you'd prefer that it retain its present power and styling. While there will undoubtedly be no consensus of opinion among the various responses, we are hoping to determine in which directions (and price range) the majority of you would like to see it evolve in the future.

Finally, a group of questions are designed to let you give us the feedback we need to continue serving you in the best manner. Are there additional club benefits you'd like to see made available? What articles do you like most in *Rotary Rocket?* Which are of the least interest to you? If you would like to see a certain subject covered, or a particular product reviewed, in a future issue, let us know. There is a good chance that it will appear in an upcoming *Rotary Rocket.*

Please complete and return the survey form, mailing it to the club address in Rolling Hills, California. The value of the survey increases in direct proportion to the number of owners who participate. You will be benefitting everyone who reads the results, which will appear in an upcoming issue. We will also forward the results to Mazda who, you can be sure, are extremely interested in what you think of their car and what you would like to see in future versions. More than any other automobile manufacturer, Mazda solicits and listens to their owner's opinions.

If you would rather not cut apart this magazine, make a copy of the questionnaire. That is perfectly acceptable to us. Don't hesitate to continue your comments on a separate sheet of paper. Send it along with the questionnaire form.

Thanks again for your cooperation. We are looking forward to hearing from you and will print the results just as soon as possible.