# Creating A "Happy Camper"

## *A Fuel Injected Turbosystem For The 454 GM V-8 That Makes Mole Hills Out Of Mountains*

**If the hills seem to be getting a little steeper in your late-model GM 454 truck or motorhome, then this new fuel injected turbosystem could be the answer for added power, and under some conditions, increased fuel economy.**

**By Everett Steele**

A few issues ago we commented in our editorial that Turbonetics had developed a CARB (California Air Resources Board) exempted turbosystem for the heavy duty GM 454 engines. For those of you not aware, getting this exemption is not an easy task in itself, but one that more of the turbo kit manufacturers are going to have to address to get the sales volume up (and be able to keep prices in line). In quoting the exact wording that comes with the exemption, "This system has been tested for emissions compliance by the state of California and has been issued an exemption under section 27156 of the California Motor Vehicle Code rendering it legal for sale, installation and use in the state of California under executive order D-99-1. By satisfying the requirements of the state of California, this system also satisfies the requirements of memorandum 1A of the United States Environmental Protection Agency and is thereby


*The additional power from this turbosystem did a lot in flattening out hills, and made a dramatic difference in passing performance. With an approximate weight of 15,000 pounds, this 30-foot Rockwood performed as good as some of the "mini-motorhomes" weighing many thousands of pounds less.*

Photo by Frank Balogh

legal for sale, installation and use in all states."

With the legal aspect out of the way, the big question is, how good does it work and will it last? We bring this up as some of the earlier attempts at turbocharging this engine in heavy trucks and motorhomes met with dismal failure. In looking back, these were carbureted draw through systems, which had a difficult time keeping proper air fuel ratios, which in turn caused detonation under heavy loading. To add fuel to the fire so to speak, some of these systems employed the earlier designed Rayjay turbochargers, which were not nearly as efficient as more modern designs. This then created more back pressure which led to higher combustion temperatures, which also led to detonation.

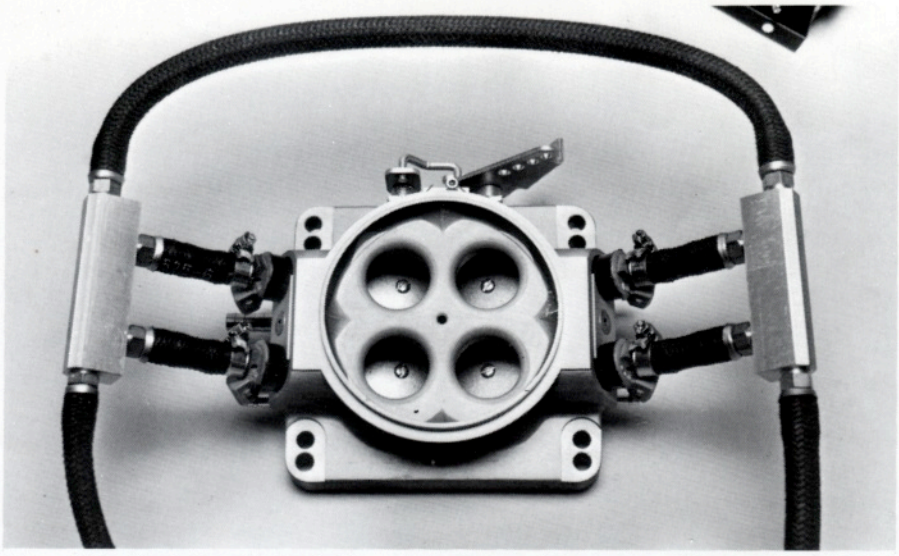
We were recently notified by Turbonetics that they had licensed a local distributor, Pacific Coast Performance, to assemble, sell and install these new systems.

The improvements on this new system used can actually be broken down into two parts: the electronic fuel injection and the turbosystem itself.

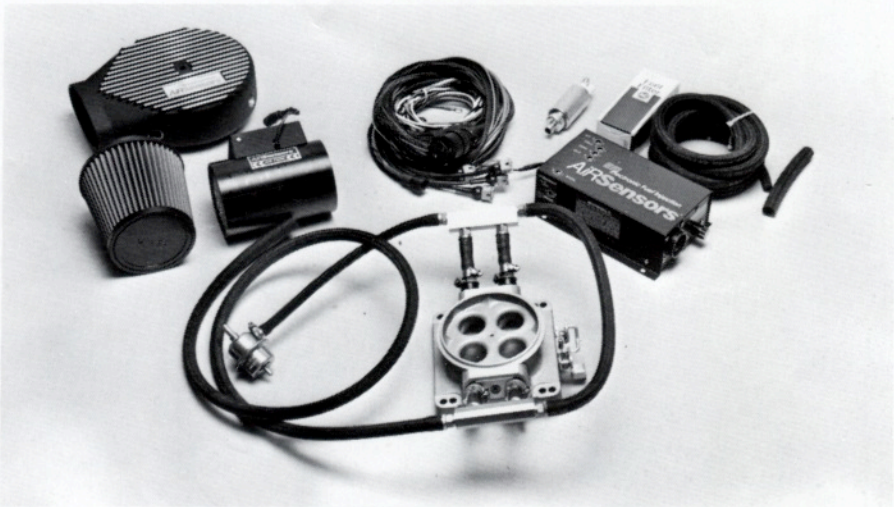
To offer a system that will reliably increase performance, and under some conditions fuel economy, the standard carburetion is removed and replaced with a specially calibrated Air Sensors fuel injection unit. This unit has its own exemption number as a stand-alone normally aspirated fuel injection system for the same engine series.

To install the injection system, the carburetor is removed and replaced with a throttle body unit, which actually bolts on in place of the existing four-barrel carb. With this done the engine sensors (rpm and temperature) and the actual air mass sensor that comes with the system are wired into the new engine management computer. This air mass sensor utilizes the hot wire technology to sense the actual volume of air flowing through the meter, making it an ideal system for blow through turbo applications such as this. In talking to Pacific Coast Performance, who has been installing these FI systems into trucks and motorhomes for some time, "Once they are set-up correctly and 'dialed-in' they have proven very reliable."

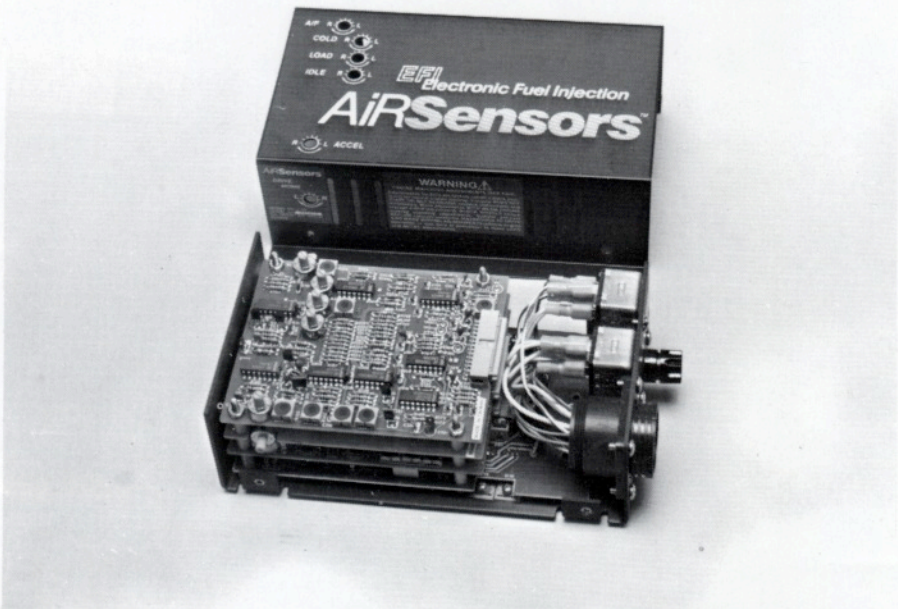
*Continued on page 64*



*One of the first steps in installing this system is to remove the standard 4-bbl carburetor and replace it with this fuel injection throttle body.*




*The fuel injection comes as a complete system which can be used in both turbocharged or normally aspirated applications.*




*The heart of the fuel injection system is the computer control box which even features a "drive home" mode in the case of a malfunction.*

*Continued from page 39*

Since the air flow meter measures the actual volume of air going through it, before any turbo or supercharging and this information is fed into the system's own computer, precise air/fuel mixtures can be obtained up to the system's maximum which would be the equivalent of about 400 horsepower. One other benefit with the fuel injection system is that it is not prone to vapor lock like a standard carburetor, which can prove a frequent annoyance due to the normal heat build up under the hood of a large motorhome.

With the fuel injection system installed, the next step is the actual turbo system, consisting of a Garrett AiResearch high-flow T04B turbo with watercooled centerbearing. Here it should be mentioned that the current Garrett turbochargers have a considerable increase in compressor efficiency over any of the turbochargers marketed just 10 years ago. This alone can lead to lower backpressure, which can dramatically reduce combustion temperatures. In addition to this, Pacific Coast matches each turbine housing to the intended loading (vehicle weight). This is beneficial as it allows the best response on lighter vehicles without risking higher backpressure on heavier vehicles like a large motorhome.

The turbocharger on motorhome installations is fitted to a heavy steel bracket which mounts it at the lower rear of the engine on the right side. One of the reasons for this positioning is that it places the turbo outside the actual engine compartment and in the path of cooling air from the grille, aiding keeping engine compartment temperature down.

In a normal passenger vehicle, it is difficult even going up hills to keep the turbo boosting for any period of time without exceeding the speed limit. With the heavier coach, however, the turbo will see more actual use, dictating the better cooling. This system is so responsive, in fact, that boost can be obtained almost immediately on acceleration, aiding greatly in stop and go driving with a heavy coach.

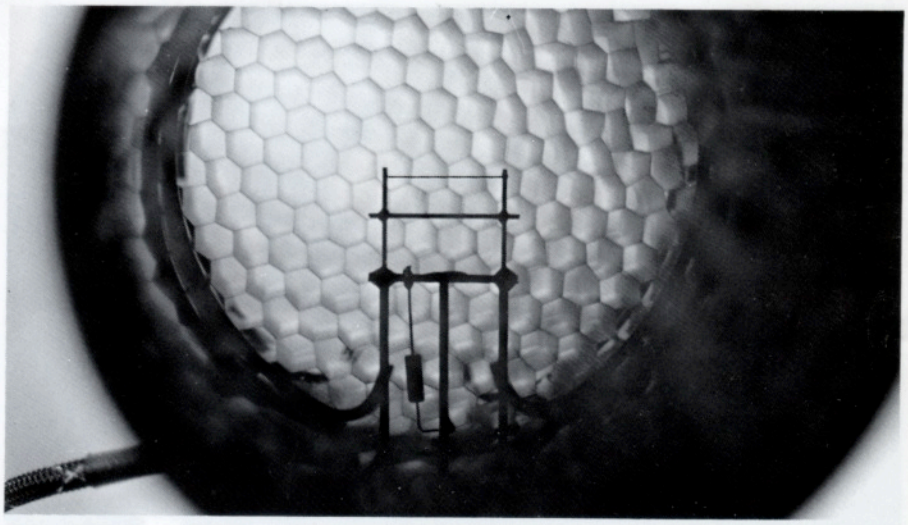
In the exhaust department, large 2½-inch exhaust routes the air to the turbo, with two Turbonetics delta wastegates fitted to control the boost to a constant 5-psi and keeps the backpressure before the turbo to a minimum. Leaving the turbo, 3-inch exhaust tubing is used which connects back into the stock exhaust system just before the muffler.

With the system installed in a fully loaded 30-foot Rockwood motorhome we took a ride with the installers while they did the final tuning of the fuel injection system and checked for any "bugs" in the installation.

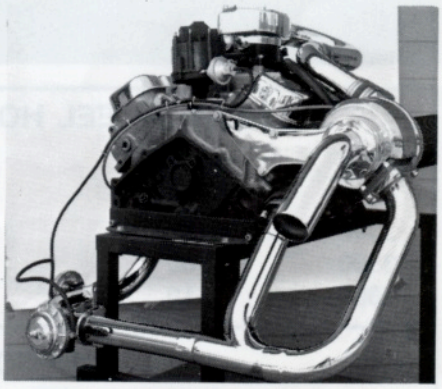
During the initial testing, two minor problems arose, both of which were easy to correct. The first was a large amount of air noise on full acceleration, similar to driving your car without an air cleaner. This was created by the large volume of air going through the air mass sensor. To correct this, a new tube was fabricated placing the air mass sensor and air pick-up in front of the firewall. This actually provided a two-fold gain as it not only eliminated the annoying air noise, but placed the air pick-up in a better air path providing cooler air.

The second problem, the transmission might not occur on lighter vehicles, but the added horsepower combined with the 15,000 pound weight of this fully loaded coach was starting to cause some extra heat in the transmission and some minor slippage under hard acceleration. Since the final turbosystems would be going on a variety of trucks and motorhomes, some of these costing well over $100,000, it was decided to offer a transmission upgrade as a recommended option with the package. This upgrade consists of a new torque converter, modification of the valve body and an additional large capacity transmission cooler. While this might not be required for some of the truck or smaller motorhome applications, for the larger coaches or tow vehicles it is recommended with the higher power output.

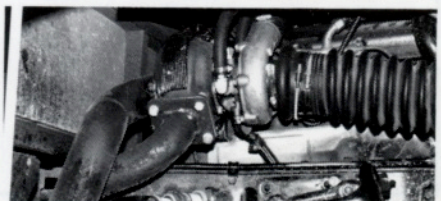
To get an idea of the actual horse-



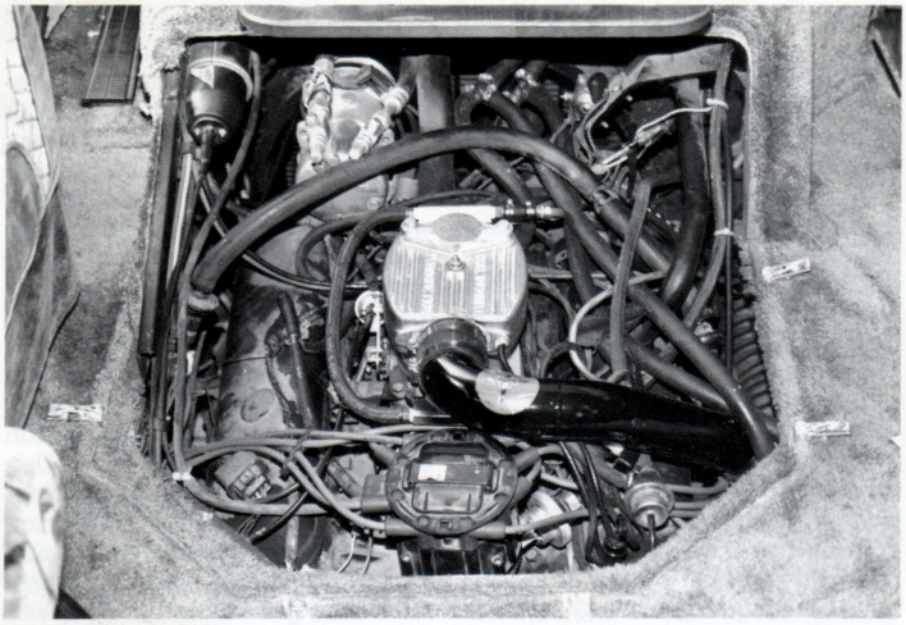
***Looking through the air mass sensor of the FI system, you can see the "hot wire" used to measure the volume of air. By using this measurement of air mass and feeding the information into the system computer, it is possible to maintain correct air fuel ratios under a variety of conditions.***



***On motorhome applications the turbo is mounted to a thick steel bracket which mounts at the rear of the head. This positions the turbocharger outside of the actual engine compartment and into the path of cooling air.***

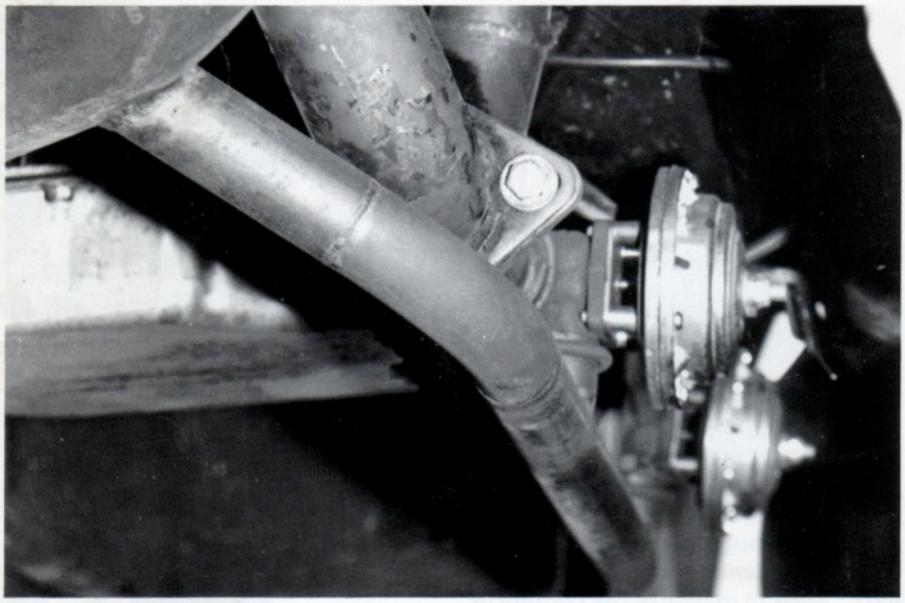


***Looking in from the right front wheel well you can see the high-flow Garrett AiResearch T04 turbo with watercooled centerbearing. Large duct draws air in from the FI air mass sensor.***



*Looking from the rear of the engine compartment, note that the air bonnet used with the turbosystem is different than the one pictured earlier with the standard fuel injection system. This bonnet is designed for pressurized use.*

*In order to hold the boost pressure down to 5 psi without incurring excessive backpressure, twin wastegates are employed. As mentioned earlier, combating backpressure is of prime importance in applications like this.*



power increases with the turbo, we hooked the unit up to Pacific's 500-horsepower Clayton chassis dyno. While doing the actual testing for horsepower, we were also able to monitor the backpressure, which in this case was 8-9 psi at 3-4000 rpm with 5 psi boost. As a comparison, some of the earlier turbosystems we spoke of had backpressures as high as 20-25 psi at 5 pounds boost. The backpressure we are speaking of is the amount of pressure build-up in the exhaust system *before* the turbocharger. With most automotive applications this area of backpressure is important to performance but is not as critical to engine life as when compared wtih a very heavy vehicle with large cubic inch displacement engine, a low boost pressure and relatively small turbocharger.

In measuring the actual horsepower, a maximum gain of 80 horsepower to the rear wheels was found at 3500 rpm, which translated into a healthy increase (see chart).

With the dyno testing completed, we proceeded to drive the coach over a variety of highways, freeways and some hills to check out the overall driveability. Overall response considering the size of the coach was excellent and our zero-to-sixty times of 18.62 seconds for a fully loaded, fueled and watered motorhome were very respectable. Traction did *not* pose a problem even under hard acceleration testing.

To get a better feel for the reliability, we held this article long enough to track this and one other 35-foot Suncrest "pusher" (rear engine) motorhome using this system. The Rockwood recently returned from a 3000 mile trip through the western states and the "pusher" over 4000 miles through the Pacific northwest. Both vehicles were inspected and no ill-effects from the turbosystems were detected. As far as overall performance of the coaches, both vehicle owners were "happy campers." ●

**REAR WHEEL HORSEPOWER CHART**

| RPM | STOCK | WITH TURBO | GAIN |
|---|---|---|---|
| 2500 | 80 | 125 | 45 |
| 3000 | 85 | 148 | 63 |
| 3500 | 100 | 180 | 80 |
| 4000 | 110 | 185 | 75 |

**PERFORMANCE**

| | STOCK | WITH TURBO |
|---|---|---|
| 0-30 | 8.97 | 8.30 SECONDS |
| 0-40 | 14.54 | 9.59 SECONDS |
| 0-50 | 22.64 | 14.42 SECONDS |
| 0-60 | 34.99 | 18.62 SECONDS |

**THE SOURCE**
**Pacific Coast Performance**
3901 W. Segerstrom
Dept. Turbo 11/87
Santa Ana, CA 92704
714/751-2422