# FORD 6.0–LITER DIESEL SHOOTOUT

## INTRODUCTION

This report documents the results obtained and conclusions derived from the Ford 6.0-Liter Shootout held on September 3rd, 2005 in Nashville. The objective was to measure HP and torque as a function of RPM on a single dynamometer to answer the initial question posed on TDS, which was "what tuner or module generates the most HP/torque at low RPM?" Admittedly, there was great interest in the peak levels attained, but this report focuses on the initial objective (low-RPM power) 1st, then addresses other information captured.

We had planned to do this on both a manual and automatic, however, we really only had time to do the 6-speed. The specific dynamometer used was a DynoJet at *The Performance Garage owned by Chris Berkey, 531 Huntley Industrial Drive, Smyrna, TN 37167*.

Special thanks should go to our numerous sponsors. A detailed breakdown of their support can be found at the end of this report.

## METHODS

The data was collected by installing and optimizing each product and then doing 3 runs back to back with just a few minutes of idle time between runs. The truck used was a 2004 CrewCab Short Bed Dually with a 4" Magnaflow single muffler exhaust and an AFE Stage I intake. The PCM code was ADM1, and the reflash code was 3U7A-12A650FPAA.

Each run was done by running the vehicle through the gears until 5th gear was reached (1:1); the driver then tried to hold the engine speed at 1200-1300 RPM, and when given the ok by the dynamometer operator, the driver went WOT until the engine speed ceased to rise. We ran controls before, during and after the tuner/module runs (4 before any testing, then one after running the Quadzilla Performance Technologies, Inc. modules to make sure leaving the cables connected (but not plugged into anything) had no effect, and then one at the very end). We ran modules 1st, then tuners.

The following is the order of testing performed: Xzillaraider Standard, Xzillaraider XZT, TS 165 Instigator, TS 135 Instigator, Edge/Attitude, Van Aaken, Bully Dog Power Pup, SuperChips 1704A, Predator, and SCT Excalibrator 2. Note that in all cases, the most extreme tune was chosen when there was a choice (e.g., Edge/Attitude was run at 5-5).

Table 1 shows the various products tested and information about the estimated costs and claimed performance.

**Table 1**
**Products Tested – Basic Information**

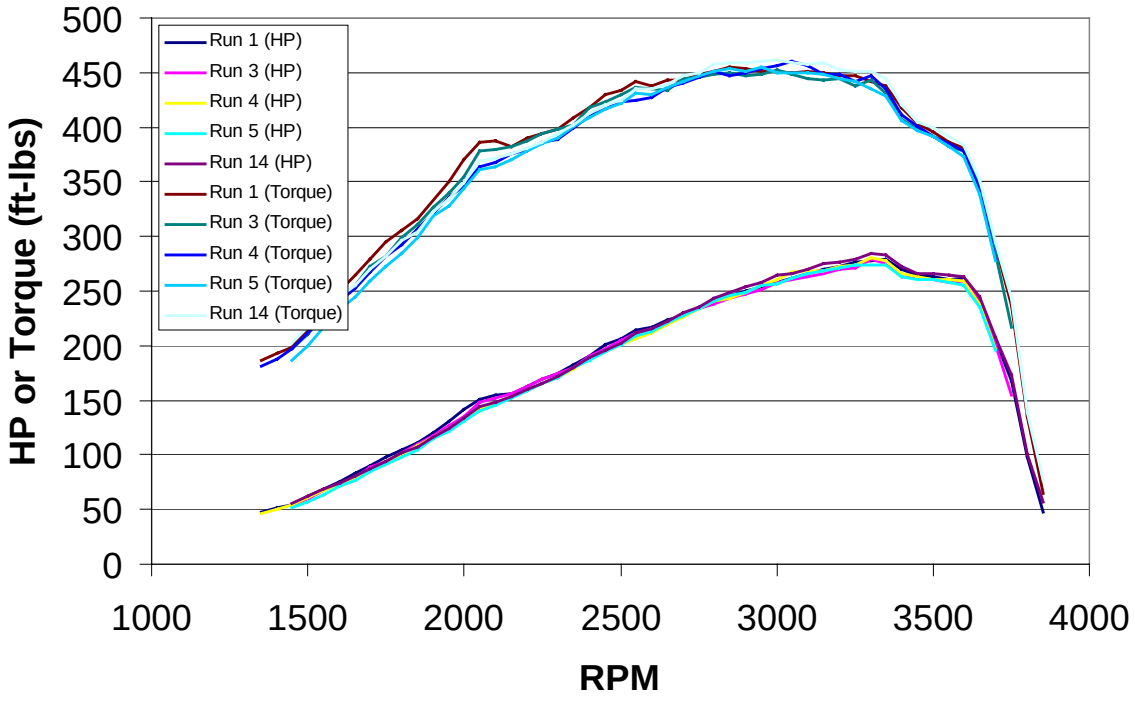
| Product | Manufacturer | Claimed HP/Torque (ft-lbs) | Cost (MSRP) |
|---|---|---|---|
| | | | |
| Xzillaraider XZT | Quadzilla Performance Technologies, Inc. | 65/165 | $299 |
| Xzillaraider Standard | Quadzilla Performance Technologies, Inc. | 120/225 | $449 |
| TS 165 Instigator | TS Performance, Inc. | 165/210 | $549 |
| TS 135 Instigator | TS Performance, Inc. | 135/185 | $549 |
| Edge/Attitude | Edge Products, Inc. | 115/290 | $899 |
| Van Aaken | Van Aaken | 105/N/A | $549 |
| Power Pup | Bully Dog | 155/341 | $549 |
| SuperChips 1704A | SuperChips | 99/172 | $429 |
| Predator | Diablo Sport, Inc. | 100/198 | $544 |
| SCT Excalibrator 2 | SCT, Inc. | 150/250 | $500 |

## RESULTS

Two products could not be tested: the Edge Evolution (tuner version from Edge Products, Inc.) failed to recognize the system; and the ATS Diesel Excalibrator 2 SCT tune (which was run last and immediately after the Innovative Excalibrator 2 SCT) which caused the truck to (a) spew coolant from its coolant reservoir, and it appeared not to build boost, as a tremendous amount of black smoke filled the testing area. It was not possible to determine why this happened, however, the truck owner did not want to pursue further testing other than a stock baseline run to confirm the truck was ok. ATS was contacted regarding the above and they indicated that occasionally, trucks with a 2003 calibration (the truck used has a code of "ADM1," which is a 2003 calibration) have the exact symptoms we experienced, and explained that it is usually very easy to correct, but in this case, regretfully, a correction was not possible. ATS thought that the coolant loss was due to high EGT's (heat flash in the EGR cooler) rather than high cylinder pressures.

Overall, the runs went quite smooth. We conducted a total of 45 dynamometer runs over the course of the day. In general, reproducibility was extremely high. As an example, the graph in Figure 1 shows the 4 stock runs done prior to any testing and the 14$^{th}$ run testing the Quadzilla Performance Technologies, Inc. cable mentioned above (note that Run 2 was discarded because it was not completed properly). From Figure 1, it is clear that reproducibility is very good, with all features of the power vs. RPM curve

reproducing almost identically from run to run. These 4 curves were averaged to get a stock baseline for comparison to the modules and tuners being tested. The peak HP




produced by the stock truck (equipped as mentioned above) was 278.9 HP. The peak torque level reached was 454.4 ft-lbs.

**Figure 1.** Stock truck as defined in the methods section – HP and torque replicates. Virtually all features reproduced well from run to run..

After completing all of the runs, a final run in stock trim was conducted to see if there was any drift. If drift was found to have occurred, adjustments would be needed for the later runs to correct them. In fact, there was some/little impact seen in the final run. Figure 2 shows a composite of the 5 runs ["Stock (HP)" or "Stock (Torque)"] above compared to the 45$^{th}$ run. It should be noted that due to the coolant spewing (basically a hard run on the engine), it was surprising that virtually all of the curves character remained intact. Therefore, no corrections were made to any of the data. Last, there is no data smoothing in the data presented herein. It is raw from the dyno other than an SAE correction. The data were viewed with and without the SAE correction, and there is almost no difference (~1HP at peak, for example).

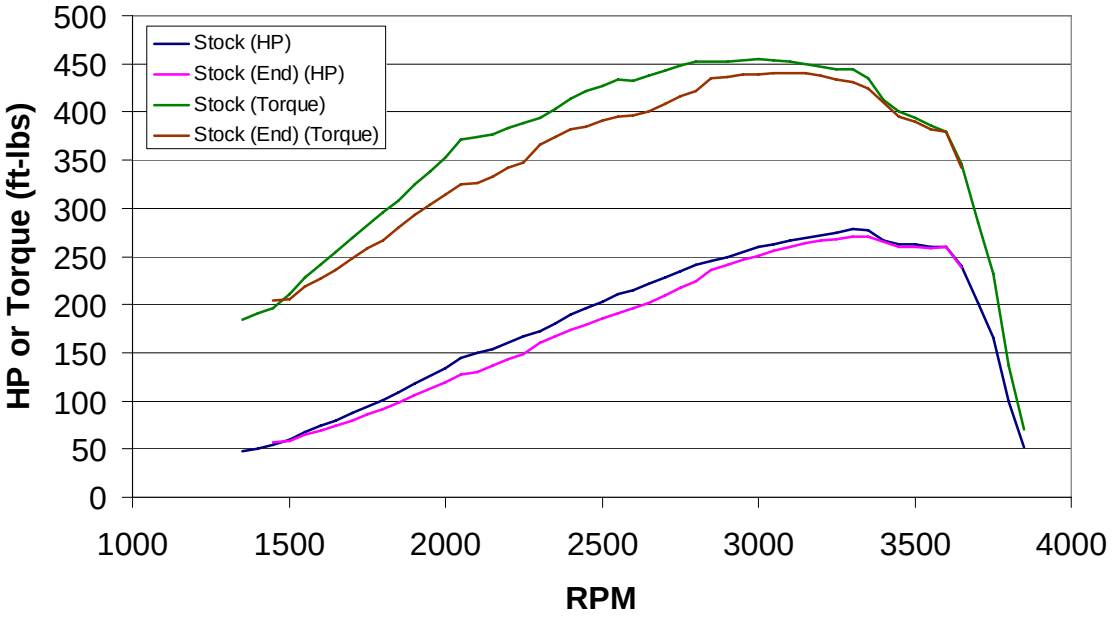



**Figure 2.** Stock truck as defined in the methods section – HP and torque composite of runs 1,3,4,5 and 14 vs. run 45.

The data were extracted using a demo version of DynoJet Research's proprietary software. This allowed graphing and exporting of data for manipulation in MS Excel. For each product tested, the 3 runs performed were averaged in the analysis that follows. Figure 3 shows the composite HP graph for all products tested.

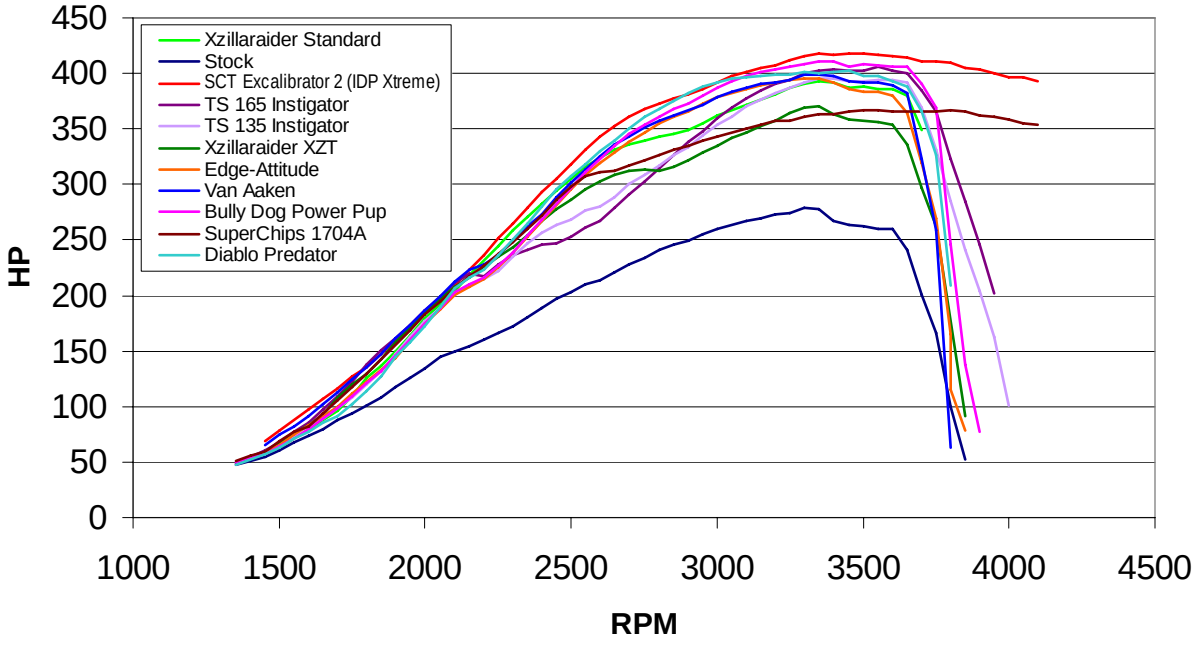



**Figure 3.** Average HP vs. RPM curves for all products tested. Entire RPM range depicted.

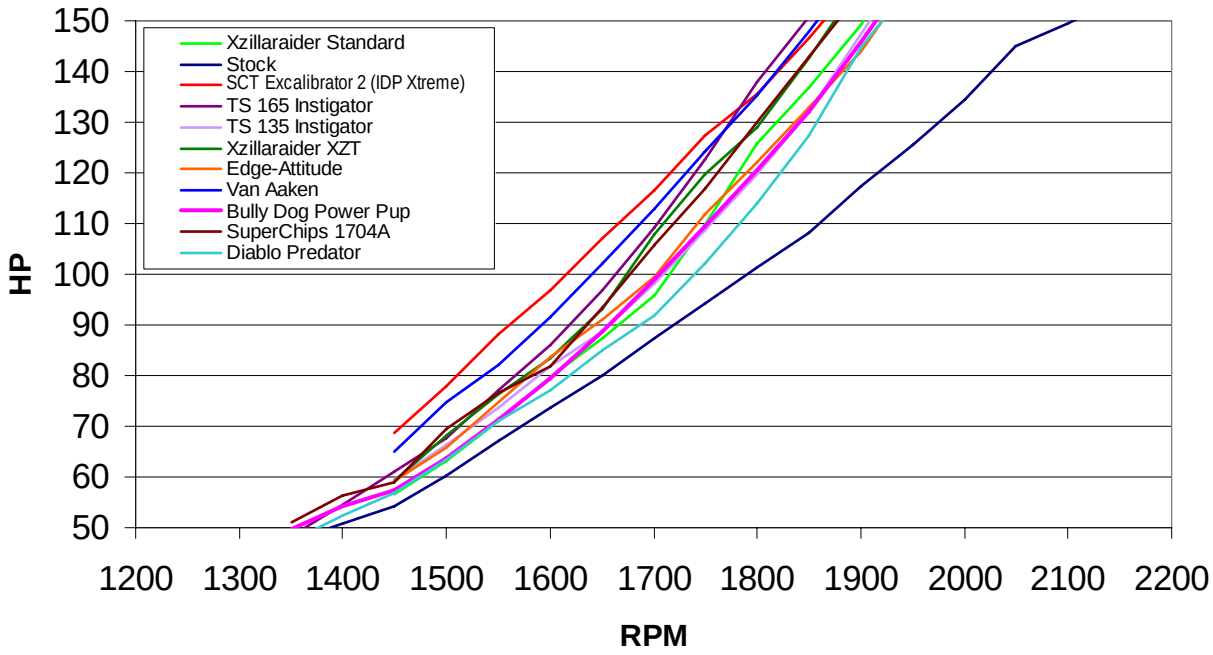



**Figure 4.** Average HP vs. RPM curves for all products tested. Low RPM range depicted.

A closer look at the HP vs. RPM curves at low RPM reveals some differences. One clear conclusion is that all of the products out-performed stock. At up to 1700 RPM, the SCT (Innovative Xtreme Street tune, red curve) demonstrated the highest HP gains, varying from 15HP over stock at 1450 RPM, and climbing quickly to 30HP over stock at 1700RPM. Not far behind is the Van Aaken unit (bright blue curve), and the rest of the products are all very tightly packed just below the 2 leaders. The TS 165 Instigator takes the lead for about 200RPM up to 1900RPM, after which the Van Aaken leads from 1900RPM to 2100RPM, with an impressive 62HP over stock at 2100RPM.

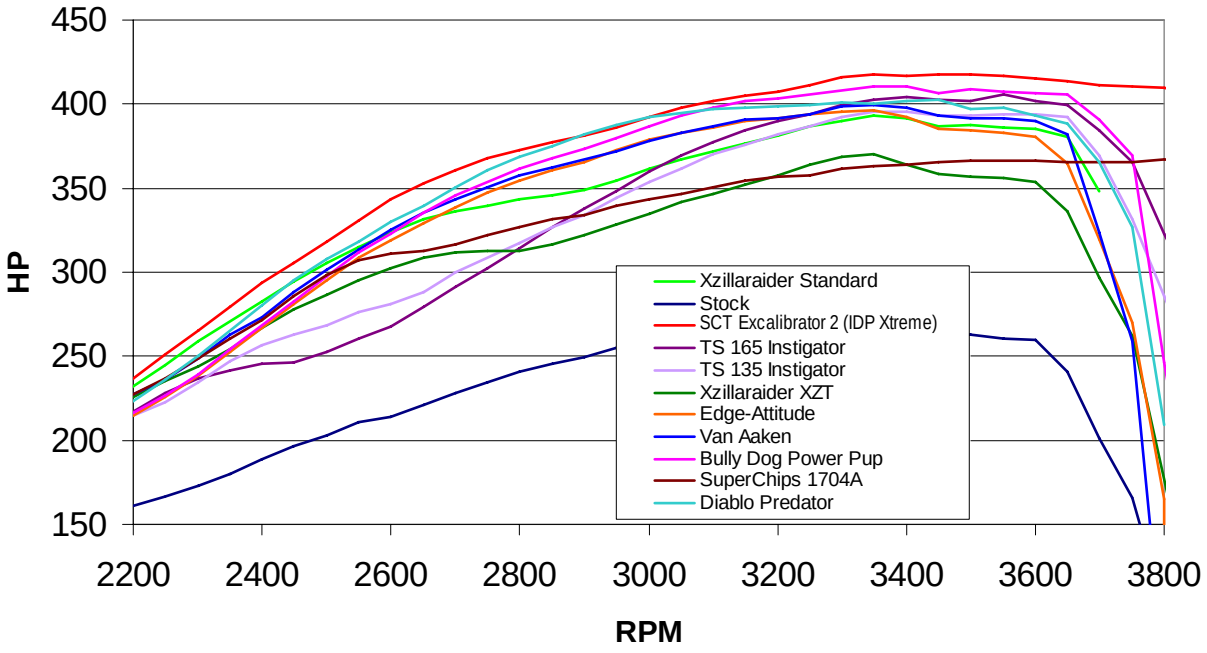



**Figure 5.** Average HP vs. RPM curves for all products tested. High RPM range depicted.

The SCT then regains the lead all the way up to 2900RPM, with a strong 132HP over stock at the same RPM (the Xzillaraider XZT module was very close behind (lime green curve) at this time). For a brief moment, the Predator takes the lead at 3000RPM, but then Innovative's SCT takes the lead the rest of the way, posting an all out best HP of 417.5HP comparing to the stock best of 278.9HP, or a gain of 138.6HP over stock (best SCT vs. best stock; at different RPM).

The takeaway message here is that at low RPM, several of the products give similar low-end grunt. In Figure 3, it is difficult to tell them apart. Figure 4 spreads them out a bit, but keep in mind that the increments on that graph are 10HP each, while on Figure 3, they are 50HP each.

Figure 6 below shows the HP gains relative to the stock truck performance. Each curve was generated by subtracting the stock HP from the measured HP at that same RPM for a particular product. What can be seen clearly is that all of the products provide a minimum of a 50HP gain beginning at 2100RPM, maintaining that gain till at least 3850RPM. Some of the products achieve as much as 150HP over stock (remember that this is the difference between HP generated at a specific RPM, and *not* the difference between the maximum HP produced). Also, at about 3600RPM, the stock setup precipitously decays in power, while many of the products tested maintained their power. That is what explains the large HP gains out in the 3800RPM and above range for some products.

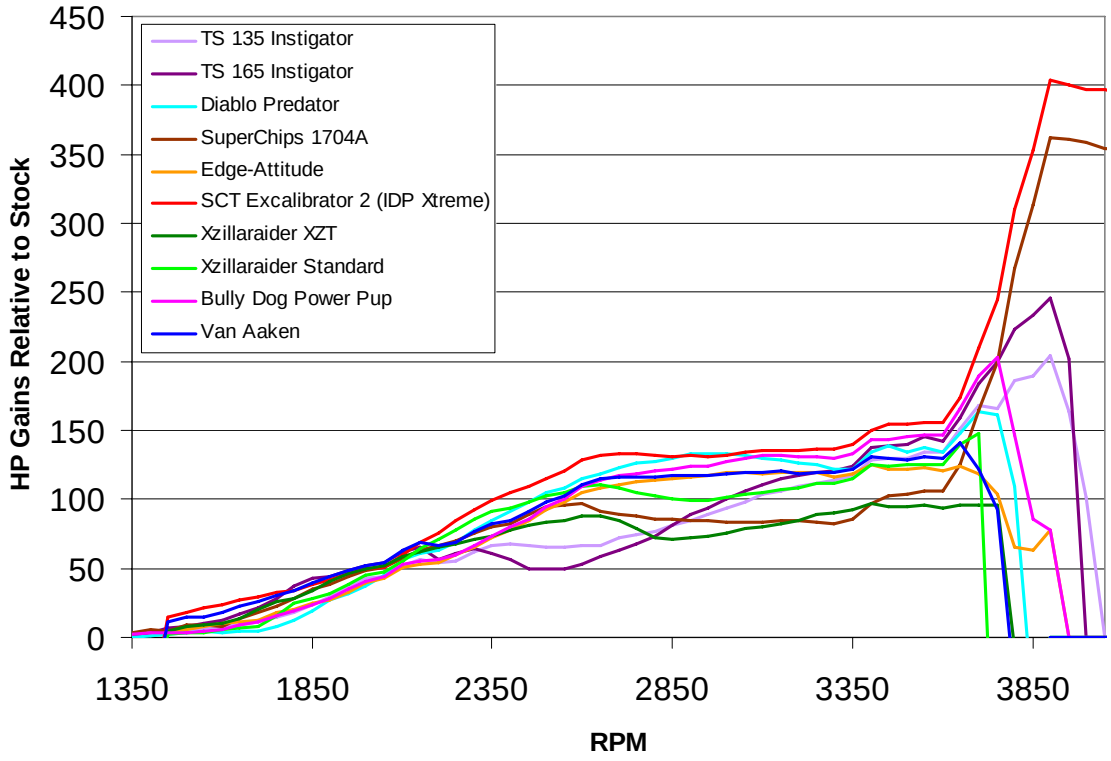



**Figure 6.** HP gains relative to stock performance.

The analysis shown in Figures 3-6 has also been completed for the torque data collected. Figures 7-9 show the torque data (entire range, low end, high end).

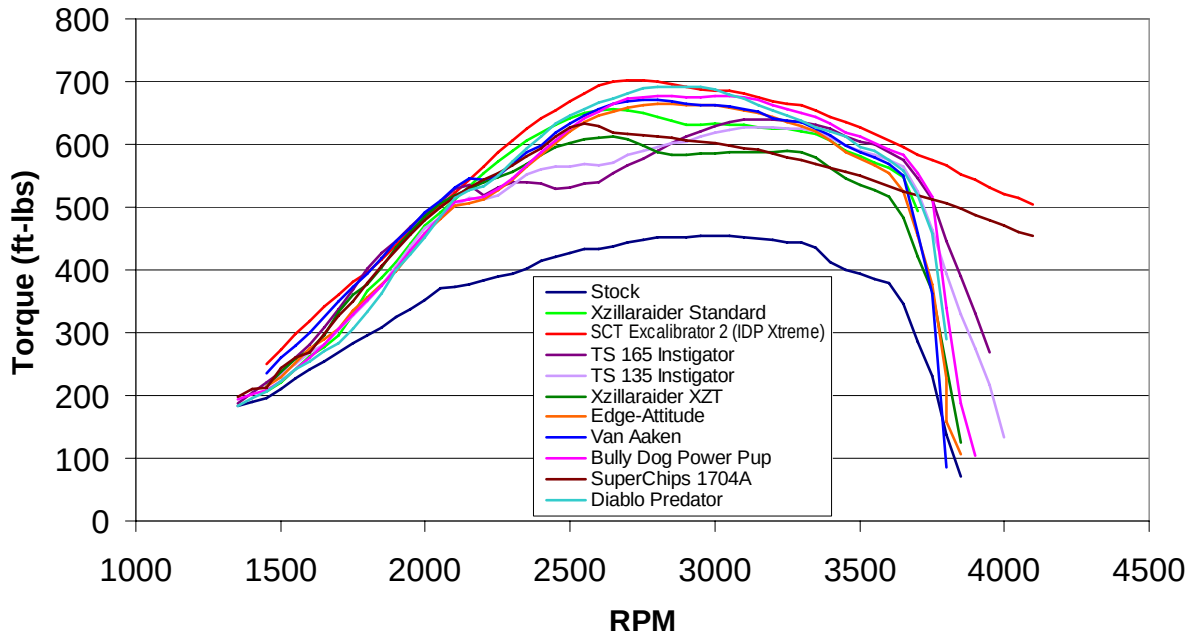



**Figure 7.** Average torque (ft-lbs) vs. RPM curves for all products tested. Entire RPM range depicted.

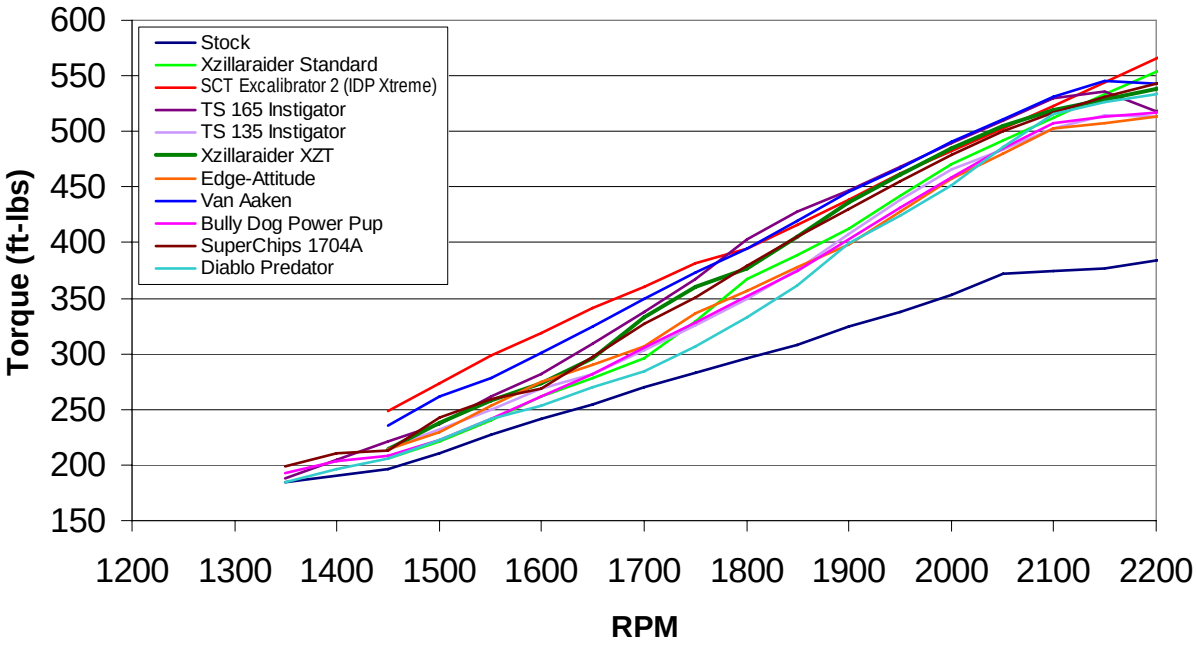



**Figure 8.** Average torque (ft-lbs) vs. RPM curves for all products tested. Low RPM range depicted.

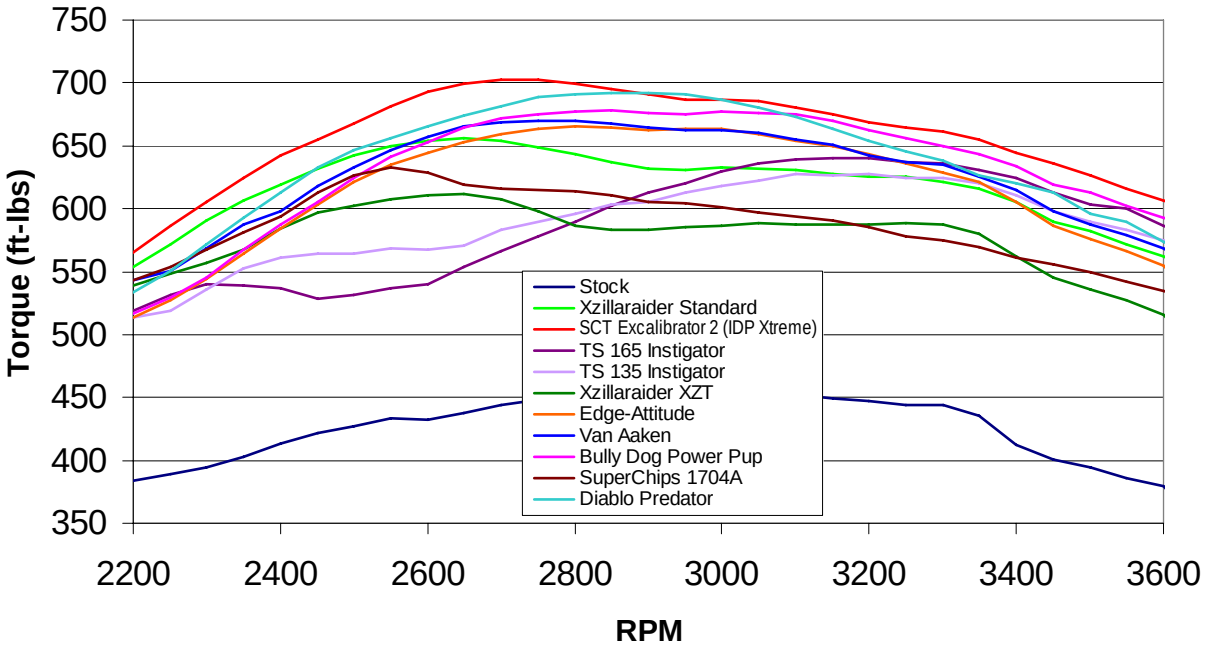



**Figure 9.** Average torque (ft-lbs) vs. RPM curves for all products tested. High RPM range depicted.

Figure 10 depicts the torque (ft-lbs) gains generated relative to stock as a function of RPM. The conclusions are the same as those mentioned above for the HP analysis shown in Figure 6.

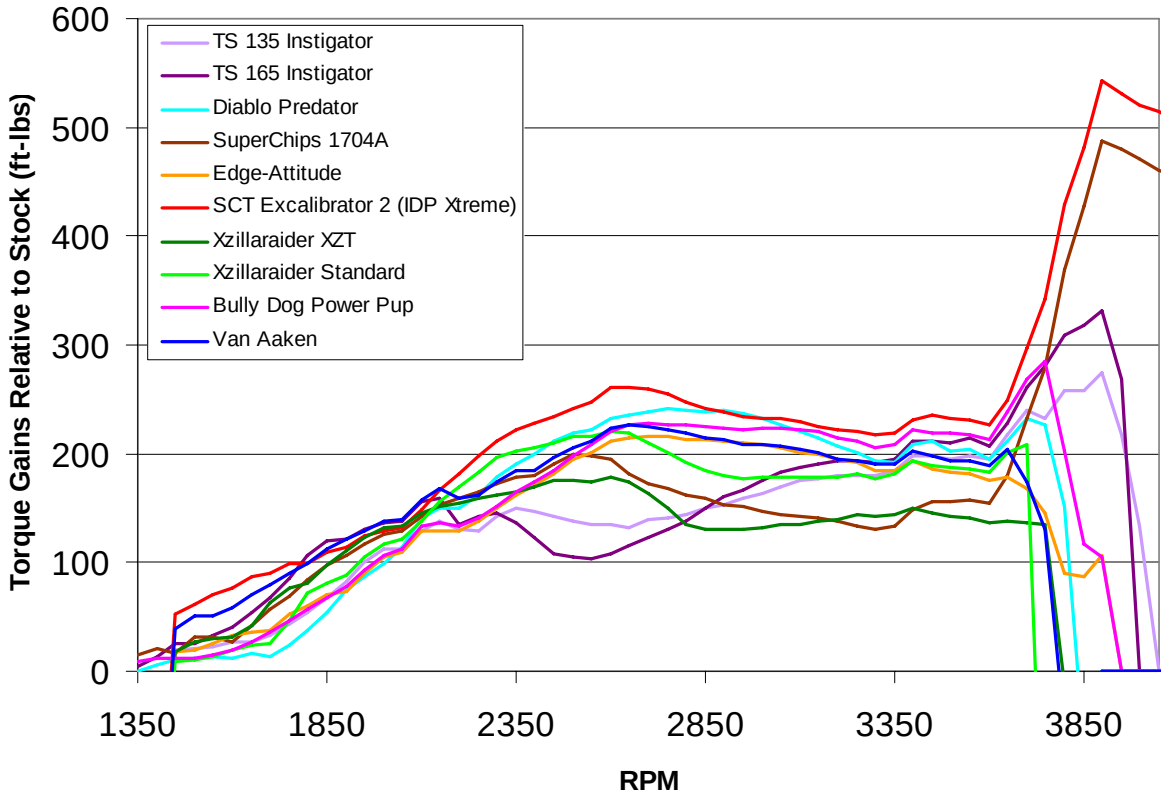



**Figure 10.** Torque (ft-lbs) gains relative to stock performance.

Another way to assess low engine speed power improvement would be to look at what point the product being tested produced a target separation. For example, Figures 11, 12 and 13 show the RPM at which each product developed 50, 75, and 100 RWHP above and beyond what the stock vehicle achieved (respectively).

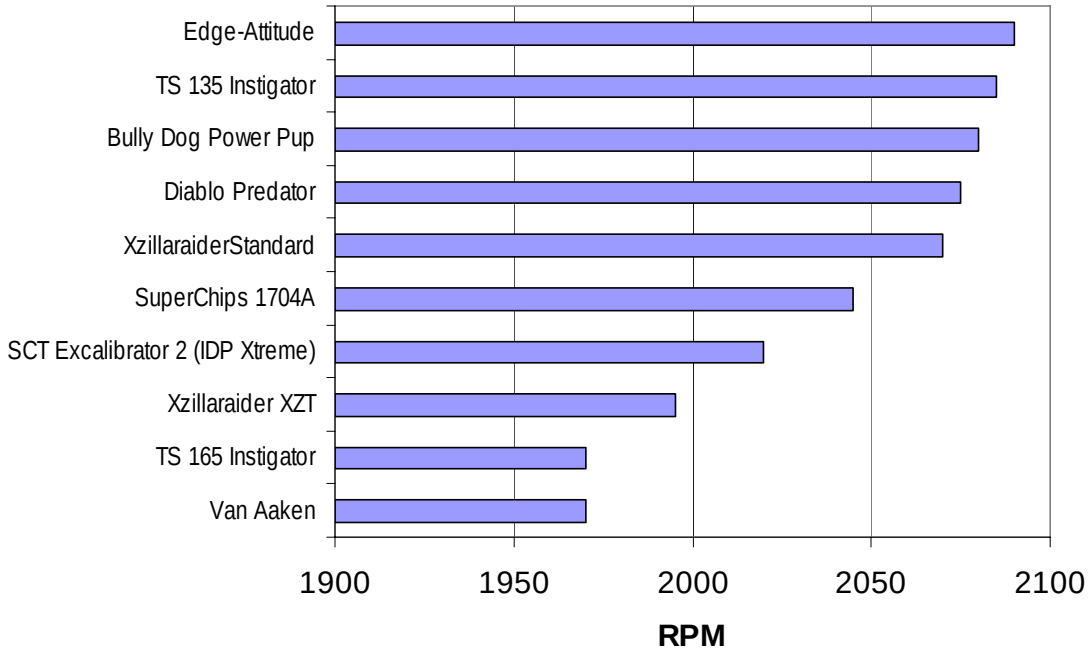



**Figure 11.** For each product tested, the RPM at which it generated 50 RWHP greater than stock is shown.

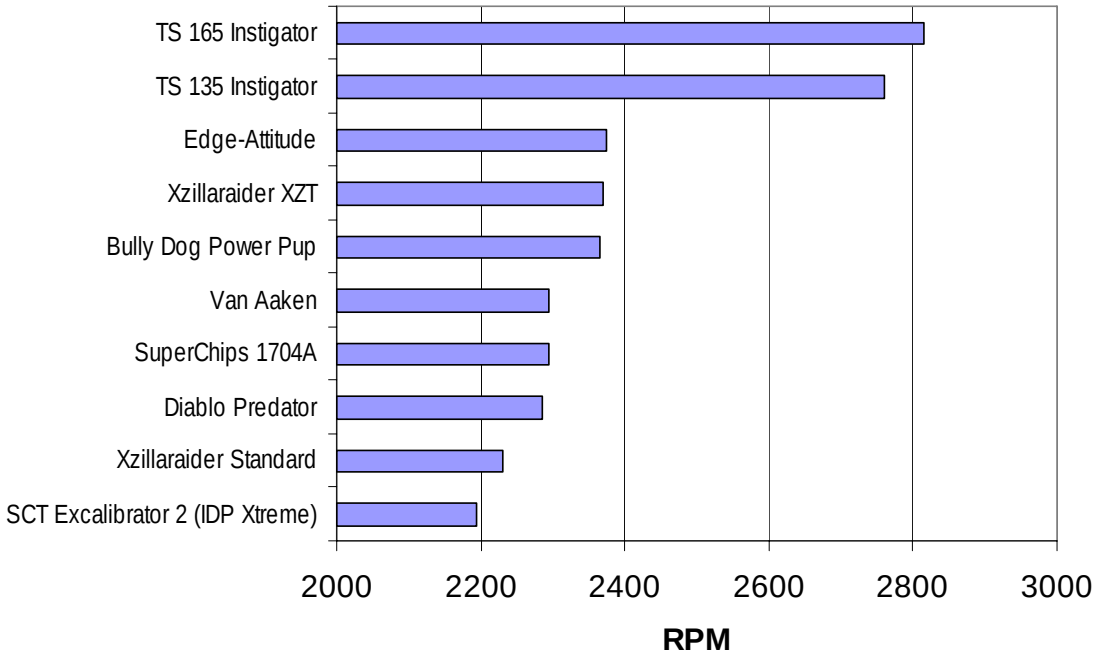



**Figure 12.** For each product tested, the RPM at which it generated 75 RWHP greater than stock is shown.

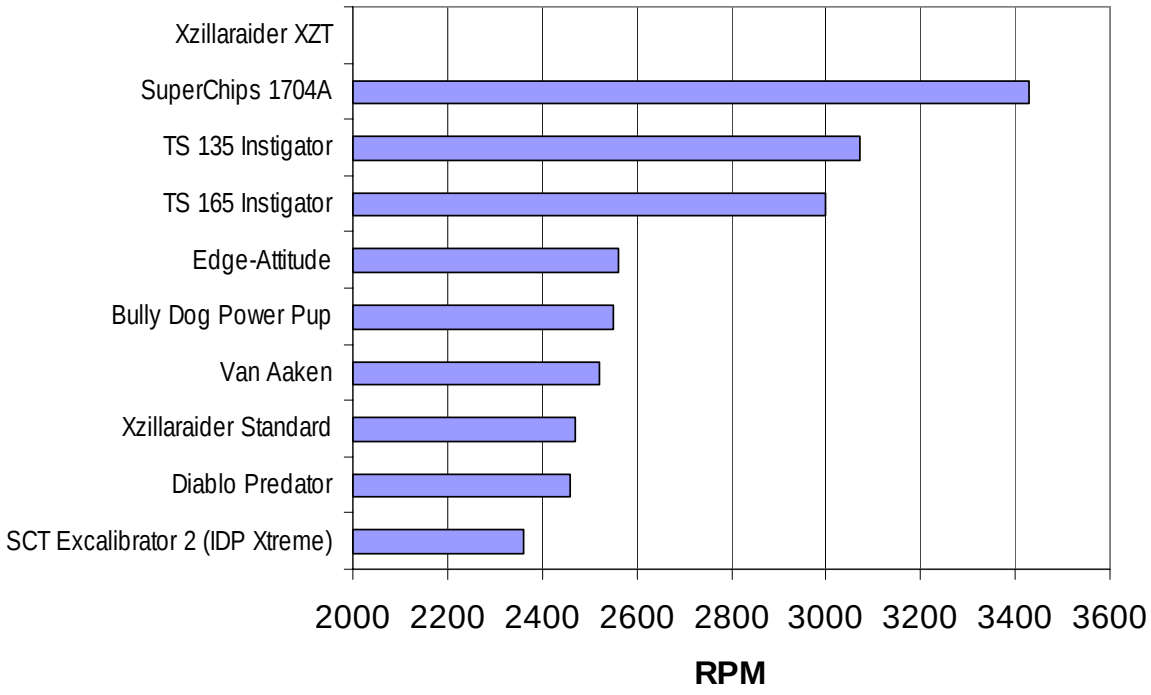



**Figure 13.** For each product tested, the RPM at which it generated 100 RWHP greater than stock is shown (Xzillaraider XZT did not reach a 100 RWHP gain during the study).

Table 2 lists the maximum HP and maximum torque (ft-lbs) measured for each configuration. The gain is calculated via difference relative to the stock configuration. The percentage shown is determined by dividing the actual gain by the claimed gain.

**Table 2**
**Products Tested –Actual Maximum HP & Torque**

| Product | Measured HP | HP Gain | Claimed HP Gain | % of HP Claim | Measured Torque (ft-lbs) | Torque Gain (ft-lbs) | Claimed Torque Gain | % of Torque Claim |
|---|---|---|---|---|---|---|---|---|
| Stock | 278.9 | - | - | - | 454.4 | - | - | - |
| Xzillaraider XZT | 369.9 | 91 | 65 | 140.0% | 611.5 | 157.1 | 165 | 95.2% |
| Xzillaraider Standard | 393.2 | 114.3 | 120 | 95.3% | 656.4 | 202 | 225 | 89.8% |
| TS 165 Instigator | 405.8 | 126.9 | 165 | 76.9% | 640.6 | 186.2 | 210 | 88.7% |
| TS 135 Instigator | 395.5 | 116.6 | 135 | 86.4% | 627.4 | 173 | 185 | 93.5% |
| Edge/Attitude | 396 | 117.1 | 115 | 101.8% | 665.2 | 210.8 | 290 | 72.7% |
| Van Aaken | 399.1 | 120.2 | 105 | 114.5% | 670.2 | 215.8 | N/A | N/A |
| Power Pup | 410.4 | 131.5 | 155 | 84.8% | 677.7 | 223.3 | 341 | 65.5% |
| SuperChips 1704A | 366.8 | 87.9 | 99 | 88.8% | 632.5 | 178.1 | 172 | 103.5% |
| Predator | 402.4 | 123.5 | 100 | 123.5% | 692.5 | 238.1 | 198 | 120.3% |
| SCT Excalibrator 2 | 417.8 | 138.9 | 150 | 92.6% | 702.6 | 248.2 | 250 | 99.3% |
| | | | | | | | | |

## CONCLUSIONS

The following are the general conclusions that the data would support:

- All of the tuners and modules produced more power and torque than the stock engine as measured on the DynoJet.

- The DynoJet yielded very good reproducibility from run to run.

- The baseline runs in the stock configuration did not indicate any large changes over the course of the day; therefore, no data adjustments were made.

- At low RPM (<2000RPM), all of the products produced similar power and torque levels ranging from 10HP to 60HP and 50-140 ft-lbs over stock.

- At low RPM, the products that displayed the best gains over stock were the Excalibrator 2 SCT (IDP Xtreme), TS 165 Instigator and Van Aaken.

- At higher RPM (2000-3600RPM), the products that displayed the best gains (>100HP) over stock were the Excalibrator 2 SCT (IDP Xtreme), Diablo Predator, Bully Dog Power Pup, Van Aaken, TS 135 Instigator, TS 165 Instigator, Edge/Attitude, and the Xzillaraider Standard.

- The conclusions drawn for torque are the same as those for HP

- The Van Aaken and TS 165 Instigator were the 1st to demonstrate a gain of 50 RWHP over stock (at the same RPM), followed by the Xzillaraider XZT and the SCT Excalibrator 2 (IDP Xtreme).

- The SCT Excalibrator 2 (IDP Xtreme) and the Xzillaraider Standard were the 1st to demonstrate a gain of 75 RWHP over stock (at the same RPM), followed by the Diablo predator Extreme, SuperChips 1704A and the Van Aaken.

- The SCT Excalibrator 2 (IDP Xtreme) and the Diablo Predator Extreme were the 1st to demonstrate a gain of 100 RWHP over stock (at the same RPM), followed by the Xzillaraider Standard and the Van Aaken.

- The data shown in Table 2 indicate that, on average, the HP claimed by the manufacturer is met at about the 100.5% level, +/-19.8%. This means that on average, if a manufacturer claims a certain level, you will generally fall within about 20% of the full claim.

- The data shown in Table 2 indicate that, on average, the torque claimed by the manufacturer is met at about the 92.0% level, +/-16.2%. This means that on average, if a manufacturer claims a certain level, you will generally fall within about 16% of about 92% of the full claim.

Recall that the objective was to measure HP and torque as a function of RPM on a single dynamometer to answer the initial question posed on TDS, which was *"what tuner or module generates the most HP/torque **at low RPM**?"* Therefore, some of the products tested may not have been designed for peak HP at higher RPM.

**ACKNOWLEDGEMENTS**

All of the activity conducted would not have been possible without the support of our sponsors. We received financial support (to pay for the dynamometer usage) from TS Performance ($500), Diesel Performance Parts, Inc. ($100), and Beans Diesel Performance ($150). In addition, we also received the following products for testing, some of which were donated to attendees after testing was completed:

| Product | Sponsor | Comments | Donated? |
|---|---|---|---|
| | | | |
| Quadzilla Xzillaraider Standard | Quadzilla Performance Technologies, Inc. | None | Yes |
| Quadzilla Xzillaraider XZT | Quadzilla Performance Technologies, Inc. | None | Yes |
| Quadzilla Air Intake | Quadzilla Performance Technologies, Inc. | Not Tested Due to Time Constraints | Yes |
| TS 165 | TS Performance, Inc. | None | Yes |
| TS 135 | TS Performance, Inc. | None | Yes |
| Edge/Attitude | Diesel Performance Parts, Inc. | None | No |
| Van Aaken | Diesel Performance Parts, Inc. | None | No |
| Bully Dog Power Pup | Diesel Performance Parts, Inc. | None | Yes |
| SuperChips 1704A | Diesel Performance Parts, Inc. | None | Yes |
| Diablo Predator | Diesel Performance Parts, Inc. | None | No |
| SCT | Innovative Diesel | None | Yes |
| SCT | ATS Diesel | Product Testing not Completed | Yes |

There were 5 other forms of support that should be recognized:

(1) Diesel Performance Parts, Inc., held an open house the day before offering beverages and a barbecue to all who attended.

(2) TS Performance arrived at the dynamometer testing site with a number of TS 135 units to give to attendees (20 or so were given away), and paid for lunch during the testing.

(3) Jeff Wilkins, through his contacts at International, provided various items (PSD portable coffee mugs, PSD mouse pads, PSD mini race trucks, PSD flashlights, International lapel pins, etc.).

(4) Diesel Performance Parts, Inc., has secured approval from Edge Products, Inc. to donate one of their Edge Platinum products when it is released in a couple of months. This award was raffled off at the shootout.

(5) A local PSD enthusiast donated the use of his 6-speed 6.0-Liter truck for the testing. Without the use of his vehicle, none of this would have been possible.