ELECTRONIC ENGINE

IONIZER

Interim Performance Testing Report

This Professional Engineer's report covers the above testing program, as designed, carried out and documented by Ken M. Gibbs, (Professional Bachelor of Mechanical Engineering), in Santa Clarita, California, U.S.A., during September and October 2006.

The product tested is referred to as "the Ionizer" in this report.

A summary of the conclusion for this interim report is as follows;

Each of the vehicles tested as a part of this program improved in various ways, to varying degrees, after the installation of the Ionizer.

From this observation, it can be concluded that the Ionizer is capable of effecting performance improvements in spark ignited, internal combustion engines, in the desirable areas tested, these being fuel economy, power output, exhaust emissions, smoothness and drivability. A payback analysis reveals that the Ionizer is a viable addition to any vehicle or fleet (see section 4.3 – Ionizer Viability).

Further test and development work is required to fully quantify these benefits across the world vehicle fleet, including past and present vehicle designs.

While testing for Ionizer performance, the practicalities of Ionizer installation and operation were encountered. These important factors are also discussed herein.

Interim Performance Testing Report
ELECTRONIC ENGINE IONIZER

Report Contents Page

Interim Performance Testing Report
ELECTRONIC ENGINE IONIZER

0) Introduction

This interim report concerns the performance testing for the Electronic Engine Ionizer ("Ionizer"). This product is an after-market improvement device for spark ignition internal combustion engines.

In this interim report the test program, its major results and conclusions are broadly outlined.

The Ionizer is manufactured in the U.S.A., by Arkansas Blue Skies Inc., of Siloam Springs, Arkansas, U.S.A. ("the manufacturer"). The website for the product is located at the Internet web address :

http://www.engineionizer.com

A good description and background concerning the Ionizer can be found there.

In summary, it is claimed that the Ionizer utilizes ignition system energies, in a simple way, to enhance the preparation of the fuel mixture within the combustion chamber of the engine, prior to combustion. It is further claimed that this action increases the efficiency and effectiveness of combustion.

B. & G. Electronics LLC, also of Siloam Springs, Arkansas, U.S.A. are the Internet distributors for the Ionizer product. This group also maintains the Ionizer website.

1) About this Report, its Purpose, History and Author

1.1 – Using this Report

This report is distributed as an "Adobe PDF" file, as prepared in the OpenOffice software package. See the very end of report for more details. In this report :

A) A Glossary of terms is provided in Appendix Three to assist the reader. When a term appears in quotes, its meaning as it is used in this report is defined in the Glossary. All other words in this report are used as they are normally used. Do refer to any medium to large dictionary or to automotive/engineering references. A very useful dictionary can be found at the website http://www.dictionary.com.

B) Some phrases are defined by showing these within brackets and in quotes. For example, take a look at the sentence "The Engine Ionizer ("Ionizer") was found to be effective". The term "Ionizer" will be used from this point on within the report, to describe the Engine Ionizer in a shortened manner.

1.2 – Report Author

The author of this report is a Professional Mechanical Engineer registered for accepting responsibility in engineering projects, since 1988. At that time, the author was involved in engine controls research for the alternative fuels and autosport markets. Since then the author has pursued contract engineering work in environmental, autosport and technical projects generally, on an international basis.

As a Professional Engineer, one of the roles the author chooses to take is to test new products, technologies or concepts ("products") that promise to improve the environment. A written report is usually always produced from any test program carried out. Such a written report can provide an official reference regarding the validity, importance or viability of the items tested. This provides a greater weight of evidence regarding the potential of the product, to assist officials, legislators, companies, customers, insurance brokers and investors in their decisions regarding it.

The author was approached by the manufacturer to carry out a test program for the Ionizer product. Dr. Lynn Buhr, who is the manufacturer's Technical Director, required professional, independent validation for the Ionizer. This requirement matched the author's line of work and, from this standpoint, the "Professional Test" program outlined in this report was created.

Reports such as this one are intended to encourage other groups or individuals to further test and/or to use the Ionizer, to verify its benefits and/or to gain from them. The environment is improved when products are given greater support, following the release of positive reports about its effectiveness and viability.

A complete, unabridged "professional test" report is yet to be produced for this testing program, where detailed test processes, results, their analyses, conclusions and recommendations are displayed. See the conclusion point 4.8 below, which discusses the possibilities for producing the complete professional test report.

1.3 – References used in this Report

The Internet web addresses for the references used in this report are located in Appendix One, near to the end of this document.

1.4 – Prior Testing : Reports and Testimonials

When asked about prior Ionizer successes, Dr. Buhr explained that positive feedback for the product was historically based on evidence recorded from tests typically of an unofficial nature. Examples of reports from satisfied clients are recorded in Appendix Two. Some of these are from certified testing companies, some from large, professional fleet operators.

1.5 – Report Feedback

Any feedback, queries or suggestions arising from this report can be addressed to the author at the following email address: ev_research_2004@yahoo.co.uk

2) Test Program Summary

2.1 – Test Type and Method

This test program consists of road based testing only. Both the objective and subjective sections of this test program are of a "Back–to–Back" nature with 2 stages, as follows :

A) Evaluation of vehicle performance before the installation of the Ionizer and

B) Evaluation of vehicle performance after the installation of the Ionizer.

For such tests to be valid, various environmental factors must be :

A) Controlled within known tolerances or,

B) Known (so that correction factors can be applied),

so that the test conditions can be recreated later, where required. All of these factors are recorded for both the before and after runs. This also allows a judgement as to whether the before and after tests are comparable. To put a number on this vital comparability, the "repeatability tolerance" value is calculated (see Glossary in Appendix 3). This stable operating basis also allows the before and the after tests to be successfully compared, thereby yielding the test outcome.

The measurement variables of interest are as follows:

1) Ambient Temperature, Humidity, Barometric Pressure and Altitude (for the record).

2) Average and Peak wind speed, across the test course.

3) Tire pressures.

4) Vehicle weight, including the test equipment and the test staff.

5) Fuel temperature.

6) Fuel batch (the same fuel is stockpiled and used through out the entire vehicle test program).

7) Wheel alignment is checked, where necessary.

8) Times for a given test course are taken at several locations to ensure the driver is maintaining a known power and acceleration level, across the test runs.

It is assumed that the engine management system adjusts for the environmental factors as far as engine operation is concerned. The reasons for recording and managing these factors is to ensure that :

A) Wind speed, humidity and barometric pressures factors as measured at the chosen test course are known (or can be corrected for if deemed necessary),

B) Vehicle design, rolling resistance and weight are held as constant as possible,

C) Fuel density is controlled or corrected for ("viz." fuel temperature variations),

D) The vehicle is driven consistently and to known power levels,

and that these factors can be applied, or interpreted, across the various test runs .

As mentioned above, estimates for the test "repeatability tolerance" or "accuracy tolerance" are made for the various tests made. In this way, the test arrangement and method can be rated, this gives a level of confidence to the test outcome. Also with this information, any party can reproduce and possibly improve the tests.

The test process is generally displayed in the Photo Gallery, Appendix Four, (page 23).

2.2 – Selection of Test Vehicles and Blueprinting Status

Initially, three test vehicles were selected to enable the measurement and recording of the anticipated performance benefits and the important operational data for the installation and use of the Ionizer. A fourth vehicle was also chosen (Ford Mustang V–Six) for subjective testing only.

The test vehicle test drivers, engineers and owners also recorded subjective conclusions during the tests, or when the vehicles were returned to normal usage.

Later in the testing program it became apparent that more data was required to further investigate the importance of "Blueprinting" (servicing the vehicle to return it to a standard operating condition), prior to Ionizer installation. To investigate more into this area a fifth, older vehicle was added to the program, a 1986 Volvo 240 DL. In the References section, this located in Appendix One (page 26), the authors of

Reference 2.A, refer to the term “Inspection and Maintenance” as being necessary for continued vehicle efficiency. Several references mention the need for keeping the vehicle in tune to reduce pollution in the environment. In this case, in tune means “kept to manufacturers specifications”.

2.3 – Validity of These Tests Due to Small Sample Size

The testing of 5 different vehicles is a very small sample size when attempting to analyze the interaction of the Ionizer with the complexities of vehicle design and operation, across a national vehicle fleet. This report therefore, is intended to be a dependable guideline only with regard the Ionizer. It cannot be an absolute reference document for Ionizer acceptability, status or operational performance.

At all times the Ionizer manufacturer's installation instructions were followed. These are to be found in the product packaging, on the Ionizer website and through a customer's helpline operated by the manufacturer. I am informed that these records are regularly upgraded to ensure that optimum product usage is achievable. Failure to follow these guidelines could result in product malfunction and/or damage.

It is known to the manufacturer that the Ionizer usually yields immediate results but may take many miles of operation to reach full effect. Its benefits could continue increasing, as miles are covered, up to a suggested limit of 2,000 miles, at which time the increase in benefits are reported to level out. These tests have all occurred at lower mileages than this. It has been assumed that the majority of the improvements occur in the first 150 miles or so.

Due to the errors in the portable 5-gas analysis system used for the tests, the exhaust emissions results presented in this interim report are of a tentative nature only (that is, a subjective summary of the potentially faulty objective data is presented). All other data in this report can be accepted at this time.

Incidentally, the emissions data was recorded by the emissions equipment used, onto a hand-held PC.

3) Vehicle test programs, with Results

3.1 – Test Vehicle No 1 – Ford Mustang Sport Coupe.

3.1.1 – General Specs. for Test Vehicle

Year of manufacture = 2003. Miles travelled = 68,300. Fuel = gasoline.
Engine = 3.8 liter V-Six, fuel injected with electronic ignition and SMOG control system, including catalytic converter.

3.1.2 – Vehicle and Test Summary

This car was selected for a subjective test program only. This particular test program was arranged simply to discover any effects that the Ionizer would have on a modern and near–to–new vehicle, without a blueprinting procedure being carried out. A vehicle weight figure was not recorded.

The vehicle appeared to have been maintained during its life. It was not blueprinted by ourselves, prior to this test program. 720 testing miles were covered with this vehicle.

3.1.3 – Issues the Ionizer May Solve

This vehicle arrived into the test program with drivability issues, these reducing the vehicle driving experience, as follows;

A) Performance was perceived to be mediocre. The vehicle was unable to break loose its rear wheels in a U turn on dry asphalt, whichis unimpressive for a rear wheel drive car of this type.

B) Vehicle throttle response was poor, with an associated lag in power delivery. As a result the car was a little annoying to drive.

3.1.4 – Test Outcome

Installation of the the Ionizer improved and perfected the vehicle in the following ways :

A) Performance. In a U turn, the vehicle is now able to break loose its rear wheels, on the same corners as before.

B) Throttle response. Power delivery became smooth, immediately available and graduated.

C) Drivabilty. The car is now a delight to drive (see "B" above).

D) Fuel consumption. When driven in everyday use, in both urban and freeway conditions, the vehicle returned a measured fuel economy of 27 (+ or – 3) miles per US gallon, using regular grade fuel. This is approximately 4 miles per gallon above publicly reported economy figures for this vehicle.

The owner uses the vehicle for everyday business travel daily and is “impressed” with the actual Ionizer results.

3.2 – Test Vehicle No 2 = Jeep “Grand Cherokee Laredo” Sports Utility Vehicle.

3.2.1 – General Specs. for the Test Vehicle

Year of manufacture = 1996. Miles travelled = 178,800 miles. Fuel = gasoline. Engine = 4.0 liter straight six, fuel injected with electronic ignition and SMOG control system, including catalytic converter.

3.2.2 – Vehicle and Test Summary

Objective testing was carried out on this vehicle, regarding emissions, fuel consumption and peak power. The vehicle weighed in at 3,940 lbs. during testing, with the driver and test engineer aboard. This vehicle appeared well maintained, according to its documentation, upon arrival with us.

Initial blueprinting included a new air cleaner as the engine seemed stifled. This made an improvement, subjectively. The owner's documentation revealed that many maintenance items were claimed to have been replaced and should have been in a serviceable condition. 1,320 testing miles were covered with this vehicle in total.

3.2.3 – Test Outcomes

Subjectively, this vehicle generally drove more smoothly and responsively after installing the Ionizer. Economy testing revealed that an approximate 10% fuel saving could be achieved in certain conditions only, namely under lighter, around–town driving. This improvement may have been partly attributable to factors other than the Ionizer, as several ignition system parts (distributor cap, rotor and spark plug wires) had to be replaced during the test process, to achieve these savings. This mid–test part change has unfortunately nullified testing validity, for this vehicle.

Emissions from this vehicle always measured at the lower end of the spectrum, partly perhaps because of the recent installation of a new catalytic converter. A detailed analysis of these emission figures would normally be displayed in the unabridged professional report, should this be produced in due course (see section 4.8, page 23).

Peak power appeared to reduce by approximately 3% but this figure is less than the “repeatability tolerance” in the test procedures, so this cannot be taken for granted. (And note that this vehicle has been discounted from these tests). Regarding "roll on, around–town" power delivery, this felt subjectively better. This is a known, effective area for the Ionizer, as found from :

A) This testing program and,

B) As referred to in various, written Ionizer user success stories that were reviewed , see Appendix Two, page 33.

3.2.4 – Vehicle Disqualification

Further reasons arose that further disqualified this vehicle from this test program (these additional to the above reasons). These further reasons were that some intermittent imperfections in the control of the engine became gradually more evident, as follows :

1) Sudden power surges occurred three times. These were short lasting and barely noticeable.

2) Towards the end of the tests, a slight "stumble" occurred twice.

3) On one occasion, a noticeable harshness occurred, with a related loss of power.

4) Upon return of the vehicle, the owner experienced several engine stoppages, particularly with the throttle shut (while cornering, maneuvering, idling in traffic and so on). Cleaning the engine wiring connections appeared to have improved responsiveness, but there is always difficulty in solving and gauging intermittent faults.

5) Four days after 4) above, these same problems restarted and the vehicle was sent to the mechanics shop for engine control checks and a search for intermittent faults. A blocked idle control servo valve was discovered. Subsequently to this repair, the owners report further improvement in the performance of the vehicle and that all the known faults were remedied.

Intermittent faults are never intended by the vehicle manufacturer. It is therefore evident that blueprinting had not been completed for this vehicle prior to testing for the various reasons outlined above, see also section 4.5 (pg. 21). Therefore this vehicle was not a good candidate for testing the Ionizer, as these problems were discovered during the tests and confirmed later. This is also apparent when comparing thelesser outcomes of these tests to those test results recorded from the other vehicles.

3.2.5 – Further Results Incoming

Subsequent to the above idle valve repairs, the author has retested the vehicle and discovered that a 15% power increase is now available with the Jeep, whereas this was not available after initially installing the Ionizer (due, probably, to the intermittent faults). From this new gain, it is further proposed that the prior tests for this vehicle were definitely invalid.

When driving the vehicle this last time, the throttle openings to achieve acceleration, hill–climbing and cruise all appeared to be significantly less than before (subjective only). The vehicle then had the “sense of urgency” sensation that the other vehicles in this test program have demonstrated after installing the Ionizer.

As this vehicle was tested previously to this section, using the instrumentation, the peak power outputs appeared to fall by 3%. (This figure is interpreted as “remained unchanged”, due to the repeatability tolerances of the test procedure which are + or – 5%). The Ionizer is reputed to increase power by at least 10% and so there remains a discrepancy here. A further investigation revealed why, and that this has been found to be **an effect separate to the Ionizer (see next).**

3.2.6 – Unexplained Power Output Variations Affect Testing Results

The newly found peak power figures are summarised as follows :

A) The 0 to 60 times improved when compared to the a pre–ionizer test runs. Before the ionizer, the measured 0 to 60 times matched the advertised 9.5 seconds (for this vehicle). In these latest test runs, with the Ionizer installed and blueprinting done, the 0 to 60 times reduced to 8 seconds, over two runs only. Then these times began to deteriorate when making three runs or more. At the end of 7 runs, the 0 to 60 times were back to the standard 9.5 seconds advertised for this vehicle and still deteriorating.

Previously, without the Ionizer installed, this deterioration effect degraded the 0 to 60 times to approximately 11.5 seconds, from 9.5 seconds. At that time the author was looking for a best time and had ignored the downward trend. If peak power runs are repeatedly done (28 runs in total) then the return to the former state of operation appears to take longer than the time to install the Ionizer and do some miles on it (on this vehicle). In other words, this effect may take time to remedy.

Along with the intermittent faults arising on this vehicle, full ionized power did not return until:

a) The intermittent faults were investigated and remedied at the mechanics shop,
b) Engine controls wiring connections were serviced,
c) 150 miles more were covered, this somehow allowing the above effect to vanish.

Note that the “0 to 60” and the “0 to 70” times are recorded within the same test run, in this test program. (At just over 75 mph, the auto transmission selects 3rd gear, at full power).

B) The 0 to 70 standard test runs that we established improved from 13.5 down to 11.0 seconds within the + or – 5% repeatability tolerance of the test procedure. And as with the 0 to 60 times these began to deteriorate after only 2 runs, but to a less of a deterioration than without the Ionizer installed.

In conclusion, this is an effect which clouds engine performance analysis, as engine power is not necessarily a fixed factor. When peak power is repeatedly used, one conclusion is that the Engine Control System (“ECS”) reduces performance for some reason, perhaps to preserve component life to or to keep one or more system parameters within limits.

The lesson here is that in peak power testing, the test engineer must be aware of this power reduction factor. When testing, it is possible to get the idea that power is reducing due to the product under test, rather than because of this effect.

3.2.7 – Test Instruments Used

During the test a calculating accelerometer device was used to determine power output performance for this Jeep vehicle (see the pictures in Appendix Four). This device measures, records and calculates from measured g–forces and engine speeds.

An error occurred in our use of this device, as follows :

1) The device needs to be fixed horizontal to the vehicle, which we only did accurately on the after–runs, using a spirit level. This increases the repeatability tolerances of this test procedure to + or – 10 %.

We therefore reverted to stopwatch times to determine the above improvement figures. (The repeatability tolerances are better and a stopwatch has had so much development that its accuracy tolerance is usually superb, as supplied from the factory). The lesson here is to take both stopwatch figures and instrumented figures and to compare them. The accelerometer instrument does offer additional insight into performance as it processes, graphs and stores the data to allow easier comparison between runs. This device proved to be very useful for analyzing vehicle performance.

3.2.8 – Further Testing Needed

In order to gain a full insight into the use of the Ionizer on this or similar vehicles, a retest program is necessary based on the factors learned above. Once these figures are available, a more definite overall picture would be made about using the Ionizer on this vehicle.

3.3) Test Vehicle No 3 – Toyota Camry LE Sedan.

3.3.1 – General Specs.

Year of manufacture = 1994. Miles travelled = 223,600 miles. Fuel = gasoline. Engine = 2.3 liter straight four, fuel injected with electronic ignition and SMOG control system, including catalytic converter.

3.3.2 – Vehicle and Test Summary

Objective testing was carried out on this vehicle, for emissions, fuel consumption and power levels at cruise. Additionally, the vehicle owner provided subjective evaluations upon return of the vehicle.

The vehicle weighed in at 3,450 lbs. during testing, with the driver and test engineer aboard. The only blueprinting required on this vehicle was a change of air filter. The vehicle was installed with platinum tipped spark plugs (a long life plug). The alternator belt and the battery posts failed after the tests, through old age and/or incorrect maintenance procedure. The belt had been very tight and the battery overfilled with acid to a point where the battery posts had been corroded through from acid spillage. These items occurred just after the tests and so had no effect on the tests. 720 testing miles were covered with this vehicle.

<u>3.3.3 – Test Outcomes</u>

Objective fuel economy testing revealed that up to an approximate 16% fuel saving was achieved under various load conditions by installing the Ionizer. The + or – 10 % repeatability tolerance figures for these particular tests mean that these results may actually differ from the above claim. (The accurate fuel usage measuring system could not be used on this vehicle, see JPEG 3 in Appendix Four).

Emissions reduced in the area of hydrocarbons by about 25% under one set of operating conditions, according to our potentially faulty 5-Gas analyzer.

Performance wise, the comfortable cruising speed for the engine at freeway speeds increased by 10 miles per hour. (This is an objective test which involves comparing cruising speed, on one test road, at a pre-recorded throttle opening chosen during the pre-ionizer runs). The test driver's subjective analysis of the vehicle also recorded that this vehicle drove noticeably more smoothly and powerfully after installing the Engine Ionizer.

The owner of the vehicle substantiated these gains with his own subjective evaluation about the improvements that the Ionizer caused. He immediately described the vehicle as "peppier and smoother", upon driving it. Later he performed his standard fuel consumption test for the vehicle which involved a return road trip of about 320 miles that he makes regularly. He recorded a 10% improvement in fuel economy. Because he used a full tank of fuel during this test, the tank filling repeatability tolerances were less than with our economy tests, although the other tolerance factors would have been less controlled. It is estimated that the repeatability tolerance on the owner's fuel economy figure would be + or – 5%, overall.

Without question, the vehicle uses less fuel with the Ionizer installed, as found during the test program, and as supported by owner feedback.

The owner uses the vehicle a lot for business purposes and is “very pleased” with the Ionizer installation, particularly after covering miles with it.

3.4) Test Vehicle No 4 – Champion Recreational Vehicle

3.4.1 – General Specs.

Specific model dimensions = 12,000 lb GVW, 30 feet in length, twin axle, dual rear wheels.
Year of manufacture = 1980. Miles travelled = 39,700. Fuel = gasoline.
Engine = 7.2 liter (440 c.i.), V–Eight, carbureted with electronic ignition and a 1979 year SMOG control system. (See "JPEG" 6 in the Photo Gallery in Appendix Four).

3.4.2 – Vehicle and Test Summary

Objective testing was carried out on this vehicle, for emissions and fuel consumption only. The only blueprinting done was the replacement of the ignition leads, distributor cap and spark plugs with new parts.

The vehicle weighed in at 10,280 lbs. during testing, with the driver and test engineer aboard. 110 testing miles were estimated to have been covered with this vehicle. It is accepted that the Ionizer may take more miles than were covered to reach its full effect.

3.4.3 – Test Outcomes

Economy testing revealed that an approximate 16% fuel saving was achieved, as found in typical, but repeatable, around town and highway driving. This improved from approximately 8.2 mpg, up to 9.5 mpg (16 %).

Emissions from this vehicle appeared to improve with regards HC's, (8 %, in certain circumstances), however full and reliable emissions analysis from this test program is doubtful, due to the use of a faulty 5–gas analyzer.

Subjectively, this vehicle drove far more smoothly and responsively after installing the Ionizer. This vehicle had been maintained and drove well on arrival, considering the age of the vehicle. The driving experience became exceptional after Ionizer installation, especially considering the large nature of the vehicle. So much so that during the "post–Ionizer" runs, the test driver had difficulty keeping down to the original speeds and power levels of the "pre–Ionizer" runs. This brings out the idea that an Ionized vehicle may easily, or unwittingly, be driven more sportingly, or briskly, and so fuel economy may appear unchanged whereas, in fact, the vehicle is travelling and accelerating faster. Acceleration rates are a major factor in altering fuel usage figures.

3.4.4 – Further Investigations

Additional data regarding the "blueprinting" aspect of Ionizer installation became available through further work with this vehicle. The on–board, 5–gas exhaust emission analyser device that we used for all of these tests was unusable in certain areas of operation. We decided to compare this unit against official SMOG testing emission equipment. While our confidence in the repeatability of our on-board, 5-Gas analyzer unit was restored somewhat, the exact accuracy against the calibrated SMOG station equipment appeared to no better than +/- 15% only (subjective estimate).

3.4.5 – Blueprinting Data

Also carried out was a "post-Ionizer" SMOG check to compare against the SMOG figures recorded before the Ionizer was installed. While the vehicle passed both of these non-dyno (due to vehicle size and age) SMOG checks (i.e. the before and the after), it was found during an ignition timing review that the timing was too far advanced (by 4 degrees) and that the vacuum advance/retard mechanism was inoperable.

This situation shows that :

A) SMOG checks may not be overly stringent on older vehicles,

B) Positive results can be realized with the Ionizer, despite faulty engine control systems, in some instances.

It also means that there can be greater benefits in more elaborate blueprinting programs, particularly for older vehicles. (For example, repair the distributor, make it operable, verify its calibration).

3.4.6 – Further Tuning Potential, Where Possible

This also indicates that post-Ionizerinstallation "tuning" (altering vehicle design and/or settings to achieve greater performance, in some area) could be beneficial in vehicles where engine control system adjustments are actually possible, as found in:

A) Older or specialist vehicles (including motorcycles) or in,

B) New vehicles, from the drawing board stages onwards, by the manufacturer, or in,

C) Non-road going engines, for example, those in marine, agricultural, aeronautical or stationary usage.

Obviously, such a pursuit for excellence must result in an actual improvement to a vehicle's overall performance, particularly from an exhaust emissions viewpoint.

3.4.7 – Further Investigations Required

From these factors, including the negative issue discovered AFTER the Jeep tests, it was decided to investigate blueprinting further, by also including an older and more out-of-tune vehicle into the testing program. See the next test vehicle.

3.5 – Test Vehicle No 5 – Volvo 240 DL Sedan.

3.5.1 – General Specs. for the Test Vehicle

Year of manufacture = 1986. Miles travelled = 300,000 + (odometer faulty).
Fuel = gasoline. Engine = 2.3 liter straight four, fuel injected with electronic ignition and SMOG control system, including catalytic converter.

3.5.2 – Vehicle and Test Summary

This car was chosen for a subjective test only. No vehicle weight was recorded because of this. 220 testing miles were covered with this vehicle, to date. It is known that the Ionizer takes more miles than this to reach full effect.

This vehicle was added to the test program after it became apparent to the test engineer that Blueprinting, as a concept, needed more research. Further data was needed regarding various Ionizer installation questions, for example, "Can an Ionizer counteract a non-blueprinted issue, in some or all cases ? ?" Examples of this would be :

1) To get a vehicle through a SMOG test when the catalytic converter is near to requiring replacement,

2) To solve drivability issues, as found in the Mustang above,

3) To reduce engine smoke, overheating and poor starting, etc.

As it came to us, the Volvo demonstrated performance and engine smoothness, considering the age and condition of the vehicle, that would :

A) In freeway driving be considered adequate.

B) In around-town driving be considered mediocre.

The vehicle was chosen for the test mainly because it was out of tune at idle, this being the main issue (one cylinder not firing every time, at idle).

3.5.3 – Initial Test Outcomes

Fortunately an explanation for what happened after installing the Ionizer was easily discovered. Following the initial Ionizer installation, the owner (also the test driver) had the impression that something had worsened the running of the vehicle. This was explained later, see below. To the test engineer, it was perceived to be running harshly with a stifled feeling to it, in around–town driving. Because of a lack of blueprinting, the true source of this lack of improvement was unknown.

3.5.4 – Investigation into non–Outcome

To help discover the true situation, the Ionizer was removed to discover if the Ionizer itself was adversely affecting anything. The vehicle **continued** to run badly in around–town and in freeway driving with the **Ionizer removed**, according to the test driver's and the test engineers subjective observation. The conclusionfor the test engineer was that:

A) The Ionizer was not able to correctly function on this vehicle for an unknown reason (and remembering the non–blueprinted state of the vehicle).

B) Some faults could be getting rapidly worse as testing proceeded, thus offsetting any benefits generated from the Ionizer.

To begin to discover why this could be, the blueprinting process was carried out. This activity uncovered the following issues :

A) The bad idle and lack of smoothness was caused by one severed and badly eroded spark plug wire (this break was at the cylinder end of this wire). Repairing this remedied the poor idle condition immediately and the car also ran better during subjective road tests. This was most probably disturbed and made worse during the initial Ionizer install.

B) The car was not shifting into 4th gear at all. This would possibly explain the impression by the owner that the car was "slower and noisy" at freeway speeds, compared to how it had been earlier in its life.

C) The engine control systems settings needed review (for example idle speed, throttle pot setting, air–flow meter setting and so on), as idle remained uneven, even though the one cylinder “miss” was remedied.

D) The air filter, spark plugs, rotor and distributor cap were found to be serviceable.

3.5.5 – Ionizer Installation Recommendations Found

Upon reinstalling the Ionizer it was also discovered that the original installation may have been incorrect. It was possible that two Ionizer blocks had been installed on the one wire, leaving one wire "un–Ionized". So there is importance in checking the Ionizer installation for issues such as :

A) The one just mentioned, where more than one Ionizer block is installed on each ignition wire,

B) Ionizer blocks are reversed in their direction,

C) Ionizer connector wires are grounding (passing metal) or crossing and so on.

3.5.6 – Positive Test Outcomes now Found

After Ionizer installation for the second time, the Volvo immediately began to run smoothly with a "sense of urgency" at around–town speeds. Within 20 miles the "sense of urgency" sensation had spread to freeway driving and the vehicle soon exceeded its previous highest speed (according to the owner), while still lacking a fourth gear. The engine now performs strongly, consistently and the car is satisfying to drive, considering the age and condition of the vehicle.

Performance had clearly been made even better when some small tuning actions were taken, particularly regarding the smoothness of idling. The Ionizer is probably also continuing to improving performance, as 2000 miles are not yet covered since its installation. Idling performance is now superb, compared to the pre–ionizer situation.

This test is ongoing, at this writing, as the transmission problem is being rectified. Once this is done then realistic fuel economy data can be gathered that can be compared to the national database figures for this vehicle.

3.5.7 – Important Conclusion

The lesson here is that effective blueprinting is necessary so that the Ionizer cannot be blamed for poor performance in the circumstances where the Ionizer cannot correct technical issues in the vehicle.

3.5.8 – Other Ionizer Benefits

As an aside, an interesting statement from the testimonials in Appendix Two is that the Ionizer has been found to reduce carbon deposits over time. After 200 miles the Volvo spark plugs were removed and it could be seen that the minimal deposits that were present were thinning out very slightly. It is also evident that the plugs are now more even in their appearance, between the four cylinders. Of particular interest is the back cylinder which was noted to be more sooty than the other cylinders, prior to the final Ionizer installation. This plug now resembles the others in colour.

Because spark plug photographs were not taken before installing the Ionizer, this evidence cannot be fully substantiated. In future testing, the spark plugs should be photographed (and rated in some way) before and after the replacing of the Ionizer, particularly for Professional level tests. If in some tests it is decided to evaluate carbon reduction, then the plugs should not be mechanically cleaned or replaced before, or during, the test program.

Should the Ionizer be proven to be capable of reducing carbon deposits in the engine and exhaust system then catalytic converter life or effectiveness may be improved by this – see section 4.4 below (next page), for further discussion.

This improvement in spark plug evenness and slightly cleaner appearance should not be due to the recent blueprinting actions. This because only one spark plug wire from a different cylinder was changed and because the mixture changes that were made apply to all cylinders.

4) CONCLUSIONS

4.1 – Performance Improvements due to Ionizer installation

Each of the vehicles tested as a part of this test program improved in various ways, to varying degrees, after the installation of the Ionizer.

From this observation, it can be concluded that the Ionizer is capable of effecting performance improvements in spark ignited, internal combustion engines, in the desirable areas of fuel economy, power output, exhaust emissions, smoothness and driveability. The best figures obtained were, in certain cases :

A) A 16% fuel economy improvement (+ or – 10%),

B) Available peak power outputs temporarily increasing by up to 15% (+ or– 5%),

C) Emissions that could be reduced by as much as 25%, again in certain cases, on vehicles that are blueprinted.

According to the manufacturer's website, such benefits are also demonstrated on vehicles operating on any liquid or gaseous fuel.

4.2 – Throttle Response Improvements

The Ionizer was found to improve throttle response and low to medium load operation in all engines tested. Consequently, operating smoothness, drivability and responsiveness are always reported as being improved, following Ionizer installation, particularly where the vehicle was blueprinted before installation.

4.3 – Ionizer Viability Calculation

In all product engineering work, the viability of the product is important. The following calculation for viability was carried out, assuming a situation as follows:

1) 25,000 miles per year, $2.30 per gallon, 18 mpg, 10 to 16% savings in fuel.

Fuel costs per year, in stock form = (25,000/18) x 2.3 = $3,194 for fuel annually.

At a 10% saving = 0.1 x 3194 = approximately $319 are saved per year.
At a 16% saving = 0.16 x 3194 = approximately $511 are saved per year.

If $90 are spent to purchase and fit the Ionizer to a 6 cylinder vehicle then payback =

@ 10% saving = (90/319) x 12 = 3.4 months.

@ 16% saving = (90/511) x 12 = 2.1 months.

This represents an impressive investment, in either case.

It is assumed that blueprintingcosts are separate to this analysis as these costs should be in the normal budget for an economy concious vehicle operator.

4.4 – Catalytic Converters – future work and benefits from the Ionizer

The test results and conclusions for exhaust emissions are of a subjective nature in this interim report, due to faulty exhaust emissions recording equipment.

It is possible that catalytic converters tend to mask what the Ionizer is doing. This is because catalytic converters attempt to process all passing gases down to a minimum emission level, providing the catalytic converter is in good working order and is up to its temperature of operation (see references in Appendix One, section 1).

Future testing programs should therefore measure and record emissions before and after the catalytic converter, to understand how much work the Ionizer is actually doing to reduce pollutants (and how much work the catalytic converter is doing to try to finish the job).

The Ionizer may also be proven to increase catalytic converter (and oxygen sensor) life by reducing the amount of pollutants arriving at the catalytic converter, due to more efficient operation itself and because of smoother throttle response. Such capabilities were not directly investigated in this test program, but the possibility of this was made possible by :

A) The HC reduction available on the Champion RV and in the Toyota Camry (which had a suspect catalytic converter), under certain operating conditions.

B) The smoother operation as found in all vehicles during acceleration. (Any short term peaks may excessively increase pollutant loadings on the catalytic converter).

C) Any fuel consumption reduction, as found in all vehicles where fuel economy was tested for in this test program.

The possibility of improving catalytic converter life is further referenced in Appendix One. There it is mentioned that deposit build-up on the catalytic converter internals can mask the precious metals deposited within the catalytic converter, thereby reducing the effectiveness of the converter.

In this report some work was done in this area in Section 3.5 (Volvo test car). Should the possibility of exhaust deposit removal be substantiated in future test programs for the Ionizer, then it is highly possible that the ionizer could increase the useful life of expensive exhaust (and engine) components. See the product website under "Removing Carbon Buildup" at the website address :

http://www.engineionizer.com/recabu.html

4.5 – Blueprinting Importance

The success of the installation of the Ionizer appears dependent on the engine type, its control system type, overall vehicle condition, SMOG control arrangement and state of tune of the whole package.

Blueprinting has been proven to be necessary so that the Ionizer has a chance to demonstrate improvements, particularly where the ignition system is in good condition.

The lesson from the Volvo test is that effective blueprinting is necessary so that the Ionizer cannot be blamed for a lack of performance in the circumstances where the vehicle has technical issues that the Ionizer cannot correct.

It appears that the Ionizer may be able to correct fueling issues but maybe not issues to do with the high–voltage ignition circuit, these usually arising from :

A) Old, worn–out or damaged spark plug wires (viz. broken wires, faulty or degraded wire insulation, corroded or missing wire tips, incorrect wire resistance etc.) or,

B) Faulty distributor parts (viz. encrusted distributor cap tips, insulation breakdowns, incorrect parts) or

C) Faulty spark plugs (viz. insulation breakdown, worn/burnt/encrusted electrodes, incorrect parts or incorrect gap settings).

This makes sense as the Ionizer technology depends on energy gathered from the ignition high voltage circuitry for its successful operation. See the manufacturer's website below for an explanation of how the Ionizer functions :

http://www.engineionizer.com/technicalpaper.html

4.6 – Wide range of Applications for the Ionizer

In addition to improving modern, street legal vehicles, the Ionizer appears also to be suited to engines that have adjustable control systems, such as found with carbureted engines. This category would typically include racing engines, motorcycle, stationary, agricultural, marine, aeronautical engines and older, street legal vehicles. Here there are gains that can be generated by tuning. Obviously, all relevant laws governing any engine must be adhered too.

This category is not referring to modern, street legal vehicles where the control system attempts to impose a set of dynamically variable control criteria with the primary objective of achieving a low exhaust emissions output by maintaining exhaust gas conditions that support successful catalytic converter operation. (See references in Appendix 1.1). Important performance gains still do occur with such engines, as found in this report, viz the 2003 Mustang.

With so called adjustable engines, even better performance from the Ionizer may occur through expert, post-Ionizer tuning practices.

This conclusion arose from experience gained with the Volvo, which is old enough to have a minimal adjustability, and from some tuning work on the Champion RV, which is carbureted with a traditional distributor based ignition and is therefore adjustable.

4.7 – Further Ionizer Research

It is apparent that the full benefit from the use of the Ionizer product is yet to be completely realized. Greater Ionizer performance should be possible as research, development and experience bring about a greater understanding of how to fully utilize this unique concept and product. The continuing manufacturer's research and development program is therefore very positive.

For example, the area of Ionizer installation research could yield further improvements. The installation details for the Ionizer are important as the Ionizer was found to be compromised by incorrect installation (viz. Volvo tests). For example, the defining of the length and routing of the Ionizer wiring, the temperature stability of specified components and component clearances etc, are areas that may become better specified. (There is useful but minimal instruction concerning these issues in the as-supplied instruction sheet and on the product website).

To zero in on an example of this, it was found that a perceivable difference may have occurred when changing the Ionizer connecting wire arrangement from that shown in JPEG 1 to that in JPEG 2, in Appendix 4 Further R. + D. may explain and allow the specification of improved installation details. The final solution may end up to be something completely different.

4.8 – Status of the Unabridged Professional Test Report for This Test Program

The proposed full report for this test program would cover the full test procedure, results write-ups, results analysis and conclusions. The unabridged professional report is currently superfluous because the errors found in the 5-gas analyzer have made data analysis difficult. This does negate the emissions results, although some minimal conclusions can be gleaned from them. Getting this interim, abridged report published is seen to be more important at present.

This also allows test resources to be better directed, these toward an improved test program that should be carried out in the medium-term future. In this proposed test program, report accuracy, repeatability, accuracy and effectiveness is to be increased greatly, because of the experiences gained from this test program. See section 5.2.2 below for a discussion about this.

5) SUGGESTIONS SUPPORTING FUTURE IONIZER EXPANSION

5.1 – Major Conclusion

Now that the Ionizer has proven itself to be of value in the road test program presented here, from the technical viewpoint, further research, development and official commercial progress with the product is recommended.

5.2 – Future Development

Suggested areas of technical activity that will help drive such forward progress are as follows:

5.2.1) The incorporation of the Ionizer into new engine designs may well yield greater results and improvements across the board, by enabling a more complete utilization of the unique concept behind this product.

5.2.2) Many vehicles of different types, in different states of condition, should be more fully tested in the future. This activity will allow a wider understanding of the Ionizer operation, from a suitably large test sample size. Greater benefits, in all respects, should be realized from this activity.

The proposed, improved test programs would add the following program steps, as examples of testing improvements that can be made:

1) Dyno testing to national emissions standards (viz. EPA), using calibrated instrumentation.

2) Emission samples being captured and analyzed before and after the catalytic converter.
3) Fully professional blueprinting being carried out throughout the test program, this including the use of manufacturer's vehicle monitoring equipment.
4) The monitoring and recording of performance figures on the dyno for the first 150 miles, and recorded at least every mile. This should show the improvements as the Ionizer effect takes over.
5) A full run-in program for the Ionizer. That is, at least 1000 miles is to be put onto the vehicle between the before and after tests. (Part of this to be recorded).
6) Also including a third stage in the back-to-back tests where the Ionizer is removed, the vehicle is data-logged for 150 miles, then 1000 miles is run before the final test runs are made.
7) More information to be recorded, such as spark plug and cylinder carbon deposit levels, before and after the tests.

By using EPA national testing standards and processes, it is far easier to maintain a consistency with existing performance databases (http:\\www.epa.gov).

5.2.3) Blueprinting is one factor in successful Ionizer usage. Liaison with professional car tuning companies, groups and/or experts would be important for any large Ionizer installation program or commercial activity. While most individuals can install an Ionizer, blueprinting can require professional input, knowledge, equipment and practices.

6) DISCLAIMER

The Author takes no responsibility for any occurrence arising from the use or mis-use of data recorded herein, or the contents of, this report. It is assumed that the further application of any information from this report is carried out or administered by professionals in the area in question. The validity of the data in this report is limited by the quality of the test apparutus utilised in the test program.

Abidance with all relevant laws is also expected in any type of internal combustion ("I.C.") engine related work, including rework, research, testing or development of such. Of particular relevance are the vehicle emission laws, as administered by the EPA in the U.S.A, see www.epa.gov. Each country will also have a similarly responsible body who's laws and guidelines should be adhered to.

The author requires that any and all uses of the information in this report are intended to provide improved performances from I.C. engines in all respects, while maintaining abidance with all relevant laws concerning the operation of I.C. engines and their loads.

The author reserves the right to correct or upgrade this report at any time without notice, by up-issuing it, as further data, corrections or input become available.

7) RESPONSIBLE TESTING ENGINEER SIGN-OFF (for this report, Version 1.5.1)

____ **Release Date** = 31 October, 2006.

By signing, the following statements are factual.

This interim professional engineer's report outlines the test work carried out on an automotive after market product called the Electronic Engine Ionizer, or Ionizer.

It is a factual summary of the test work and the outcome of that work. The professionalism of this report is intended to assist other groups to carry out similar work, thereby continuing to improve and expand this particular industry.

At all times it is assumed that thereader shall follow all relevant laws and ensure that they are also followed by those in his/her sphere of influence. The author takes no responsibility arising from the use or misuse of information contained herein.

For further information, any enquiries or to send feedback, do email me at the address given below.

Ken M. Gibbs (Professional Bachelor of Mechanical Engineering)
Design and Transport Engineer
email ; ev_research_2004@yahoo.co.uk

Report Appendices follow.

Appendix One

References Used in This Report

Most of these references are referred to in this test Report.

1) Regarding Catalytic Converter Operation:

A) http://www.mcnamaras.ie/main/convertors.php3
B) http://www.dcl-inc.com/catthrway.cfm?lg=EN
C) http://www.andertechs.com/english/products/products-03-04-01.htm
D) http://www.epa.gov/otaq/cert/factshts/catcvrts.pdf

2) Regarding Blueprinting:

A) http://www.epa.gov/otaq/cfa-air.htm
B) http://www.epa.gov/otaq/consumer/17-tips.htm

3) Regarding Vehicle Emissions, in general:

A) http://www.epa.gov/otaq/consumer/05-autos.pdf
B) http://www.epa.gov/otaq/consumer/17-tips.pdf
C) http://www.epa.gov/otaq/transport.htm
D) http://www.epa.gov/otaq/ld-hwy.htm#regs
E) http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=7042424
F) http://www.arb.ca.gov/html/brochure/50things.htm

Appendix Two
Typical Ionizer Reports from the Past

See also the website pages:

"http://www.engineionizer/testimonial.html" and
"http://www.engineionizer/articles.html"

Below is a selection of written reports about Ionizer tests which were done before catalytic converters became popular. Tests 3 and 4 have a professional aspect, as a dynomometer and emissions instrumentation is used and the results appear certified in some cases.

The reports below are very valuable and present a similar, positive picture to that found in this report. The positive emission results (for non–catalytic converter vehicles) are rewarding results when the emission results in this report are doubtful, due to the faulty 5–gas emission analyzer. The importance of reviewing non–catalytic converter reports is that the direct effect of the Ionizer on the engine can be seen. Future Ionizer testing should refine this whole area of exhaust emissions testing, to EPA standards – see section 5.2.2 for discussion.

These testimonials are as supplied by the manufacturer.

1) June 3, 1971

I am writing you this letter to evaluate the Ionizer you left me.
We put it on a 1970 Plymouth Station Wagon, License No. 03052, driven by Bill Kelt. Before the Ionizer was installed, Bill was getting from 9.7 to 10.3 miles per gallon. For the four weeks it was on, he averaged anywhere from 11.2 to 12.5 miles per gallon. This was running empty and loaded – approximately 2,000 lbs. Per trip. The average weekly mileage was 800 miles. The driver, Bill Kelt, was quite impressed as he saw a great difference in the car's performance. The other Ionizer I put on my 1965 T-Bird which was getting 15.6 miles per gallon. On a trip to Roswell last week, I averaged 17.9 miles per gallon.
I still don't know how it works, but work it does – I've been shown.
By the way, the plugs on that 1970 Plymouth had about 5,000 miles before the Ionizer was put on and they were black and dirty. After the four weeks of driving, we pulled the plugs and they were clean and looked like new.
Yours truly,
W. J. Mayer, Shop Foreman
New Mexico State Highway Department

2) June 5, 1971

After a 30-day trial of the Electronic Ionizer, I am happy to say that the Ionizer does everything they claimed it would do.
My gasoline mileage has been improved from 10.5 MPG to 13 MPG. My spark plugs burn cleaner; tailpipe appearance was sooty at the start, now it is clear. I also find that I have better and faster starting, smoother running, and faster acceleration. Also, I am averaging 17.5 MPG on open road driving.
The Electronic Ionizer has indeed improved the performance of my 1968 Belair Chevrolet. It is truly a "Money Saver" for the ordinary working man, and being a member of this class, I do recommend it.
Sincerely,
Omer T Despres, Auto Diagnostic Technician
Auto Diagnostic Center
Albuquerque, New Mexico

3) December 10, 1970.

Sample: Automobile Exhaust Studies
Date Submitted: Dec. 10, 1970
Submitted by James Turner & Associates, Inc. on behalf of the Electronic Engine IONIZER.
Analytical Report No. 1,321
Mileage on Vehicle: 42,453.8 at time of installation of IONIZER
The exhaust gases of a 1968 Chevrolet 6 cylinder running at idle speed were collected by inserting a glass probe into the tail pipe and drawing the exhaust through 250 milliliter gas collecting bottles with a Gelman Air Sampling vacuum pump.
The exhaust samples were passed through the gas collecting bottles long enough to sweep out normal air and the stop cocks were closed simultaneously as the pump was turned off.
The samples were analyzed by Gas Chromatography Procedures using a Beckman G. C. 2-A Instrument

SUMMARY ANALYSIS
On comparing the concentrations of the exhaust gases before installation of the Ionizer and after installation 3,00 miles later, the following values were obtained:
Hydrogen = 0.41% Increase
Methane = 100.00% Decrease
Hydrocarbons heaver than Methane = 100.00% Decrease
Carbon Monoxide = 4.22% Decrease

Nitrogen and oxygen being normal components in the air, are not calculated as to increase or decrease.
At the time of installation of IONIZER, condition of tail pipe and spark plugs

were observed. Both were substantially cleaner and carbon-free 3,000 miles later, indication improved combustion efficiency.

4) March 16, 1971.

This is to certify that we made a dynomometer test on your Pontiac 285 H.P., 350 cu. in., Standard Stock Engine – car mileage at end of test = 8216. This test was performed in our shop on March 16, 1971, with the following results :

COMBUSTION EFFICIENCY

M.P.H.	Standard Ignition System	Ionizer Installed
35	79.9%	83.3%
55	83.0%	85.5%
75	68.8%	75.0%

TORQUE CHECK (assumed to be in "lbs ft")

MPH	Standard Ignition	Ionizer Installed
40	210	230

BRAKE HORSEPOWER (assumed to be at 40 MPH)

MPH	Standard Ignition	Ionizer Installed
40	67.2	73.6

EXHAUST EMISSION TESTS, before and after the Ionizer Install

Engine Speed	HC Before	HC After	CO Before	CO After
@ Idle	410	310	4.5%	3.5%
@2500 RPM	210	110	n/a	n/a

Reg Beezley, Dynamic Balancing Service, Memphis, Tenessee.

Appendix Three
Glossary of terms as used in this test program

Note : *This Glossary defines any specialized or specific wording used for reporting on this test program. All words used in this report are defined either in this Glossary or they are used in the normal way, as defined in commonly available dictionaries or industry publications. Any medium or large sized dictionary should be used to locate the correct definition for common words. For example, The Oxford Concise dictionary and others like it are very usable dictionaries. Another useful dictionary is maintained at the website http://www.dictionary.com. Please utilize these valuable tools to assist you.*

Viz = A word already in the dictionary that can be read as "namely". It can also be used in a slang form, for project work. Then it can be read as "visualize". That is, "please visualize the following".

Subjective Test = A test that is perceived, judged and recorded by the test driver, directly.

Objective Test = A test that is perceived through readings from instruments, these interpreted, recorded, judged and certified by the test engineer. When the instrumentation becomes flawed, faulty or second rate, the engineer can begin to make subjective judgements in order to make conclusions.

Back–to–Back Test = A test where there are several identical stages containing a similar test procedure. The stages must be operated in a particular sequence and the results from each stage compared later to arrive at a conclusion.

Each stage contains a similar test procedure acting on the system, product or assembly that is under test and in a known state.

Before–and–After Test = A back–to–back test with at least two of its stages that concern one product tested before some change is made and the same product tested after that change is made. In the first of these stages a product is tested in its standard form before a proposed, yet contested, improvement occurs. The second of these stages occurs after the proposed improvement has been applied to the target system, product or assembly.

The results of these two test stages can be compared with each other and to industry standards because the test procedure is known to be similar in both cases, within a known and documented test repeatability and a test accuracy tolerance (see definitions below).

Professional Test = A repeatable test activity where two experienced and qualified individuals (the test driver and the test engineer) work together to obtain, record and process objective data from the vehicle under test. During a professional test, subjective data is usually also gathered. A professional test requires the test engineer to sign off the test, so as to vouch for its validity and repeatability. A professional test includes the following elements :

A) The test process is designed and arranged to carry out the test program so as to produce the desired testing outcomes. The test design and arrangement data is recorded (see E below).

B) All important environmental test conditions are also recorded (see E below). This may include the application of correction factors (for example, fuel density correction) to the report.

C) The test is monitored and recorded to ensure the test is carried out as designed (see E below).

D) An analysis of all the test measurement tolerances is carried out and recorded (see E below). This allows an evaluation of exactly how similar one test is to another. From this, each engineer in future test programs can judge if the test that they are running is comparable to the original. Once this is known, it can be judged whether the results of the later test programs are comparable to the original results. Should the results become nullified for some reason, the test could be marked as "Interim" and subjective evaluations presented instead of objective ones, in the areas in question.

E) Accurate and complete test documentation so that it can be repeated, by other groups or individuals.

It is expected that professional level tests are improved through time by the work of various testing groups and individuals writing similar reports and agreeing to improve the industry standard. The EPA (www.epa.gov) vehicle testing programs are superb examples of professional level vehicle test procedures.

Test Driver = The driver/operator of the vehicle during testing. A test driver is often required to sense, mentally record/judge performance and to record a conclusion regarding the vehicle as tested.

Test Engineer = The test engineer designs the testing apparatus and method, from the testing specification provided by the client. The test engineer may also assist the client to piece together the test specification itself.

The test engineer is responsible for ensuring the test is carried out according to its design. In this test program, the test engineer is also responsible for collecting and analyzing the test data during the test run, using suitable instrumentation. This includes the setup maintenance and operation of that test instrumentation.

The test engineer is also responsible for ensuring the test is fully documented, that conclusions are drawn and that a report is written to enable test reproduction.

Authors Note

The above roles are simply post descriptions. Any suitably trained and competent person could hold any of the two posts, but not at the same time of course. In this test program the author fulfilled the role of Test Engineer.

Blueprinting = Maintaining and servicing the vehicle so as to place it in a standard operating condition, as established by the manufacturer and to take steps to ensure the blueprinted condition is maintained. In the blueprinted state, the performance figures for the vehicle should match (within accuracy tolerances) the published performance figures for the vehicle, in all respects.

For testing, a quality of blueprinting that meets or exceeds the manufacturer's expectation for the vehicle has to also be made stable enough to continue unchanged throughout the duration of the test program, within the estimation of repeatability and/or accuracy tolerances.

Tuning = the altering of vehicle design and/or settings to achieve greater performance, in some area. This may mean altering settings away from the blueprinted state. Design changes are of course deviations from manufacturer blueprinting, unless the manufacturer approves the change.

Repeatability Tolerance = A figure that describes the ability of a test arrangement to provide repeatable measurements (which is necessary to provide useful comparisons with other, similar tests).

This figure is used when comparing test results to each other to evaluate the similarity of tests. The figure is presented in the form "+ or – xx %", where xx % describes the percentage range that the actual figure may fall inside, as caused by the uncertainty of the repeatability of the test arrangement and its instrumentation.

Accuracy Tolerance = A figure that describes the ability of a test control arrangement and the resulting measurements to be accurate, against known, world standards. This requires the use of calibrated instrumentation.

This figure is used when evaluating the similarity of a test measurement with the same industry standard measurement for the same variable – see next Author's Note, para 3.

The figure is presented in the form "+ or – xx %", where xx % describes the percentage range that the actual figure may fall inside, as caused by the uncertainty of the test arrangement and its instrumentation with regard matching to world standards.

AUTHORS NOTE:

With back–to–back, before–and–after testing (as used here) accuracy is unimportant compared to repeatability. This type of testing was chosen for this test program for this reason because it removes the need for calibrated instrumentation, which reduces testing costs dramatically.

The test engineer can calculate both of the above tolerance figures from an analysis of the test arrangement used for the test program.

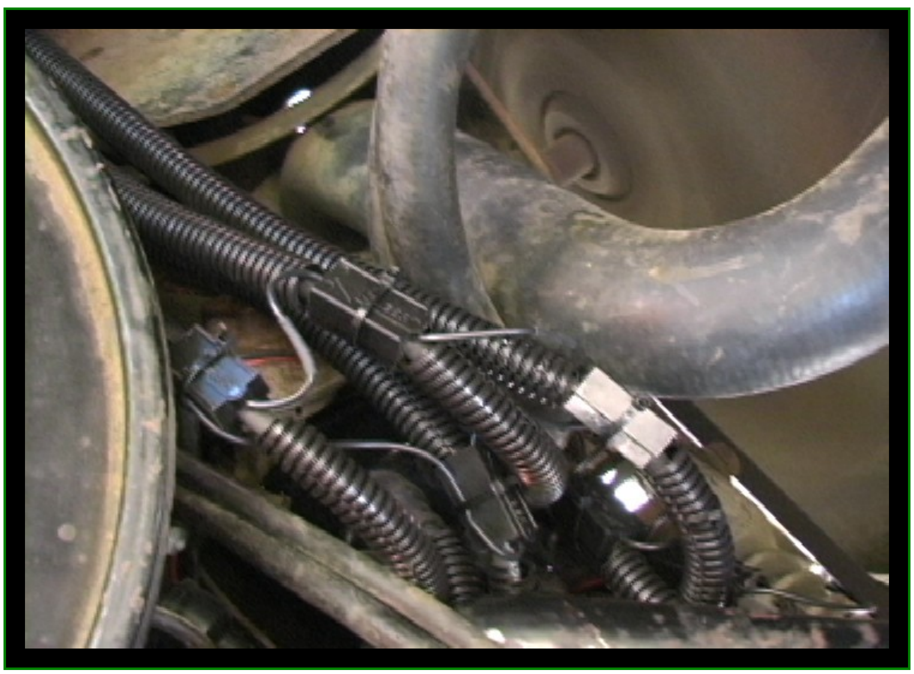
When comparing test figures to the same industry figures, accuracy tolerances become important. For example when comparing miles per gallon or exhaust emission figures to published figures.

The relationship between repeatability and accuracy tolerance figures are that accuracy tolerance figures are measured from calibrated equipment. Repeatability tolerances, on the other hand, can help gauge an overall system that cannot actually be calibrated, such as one that is very complicated.

JPEG = A name chosen for photographs displayed in this report. This comes from the name of the format in which the photograph is stored on computers. The JPEG format is commonly used in computers today.

Appendix 4 : Test Program Photo Gallery

JPEG 1 – Ionizer Blocks installed on the JEEP Cherokee.
Note the "split-loom" and the looped connecting-wire layout.



JPEG 2 – Ionizer Blocks installed on Champion 440 c.i. RV (seen during a road test). Note the "split loom" and the direct connecting wire layout.

JPEG 3 – Fuel usage measuring rig as installed in the Champion 440 RV.
The test engineer is shown setting up the rig.

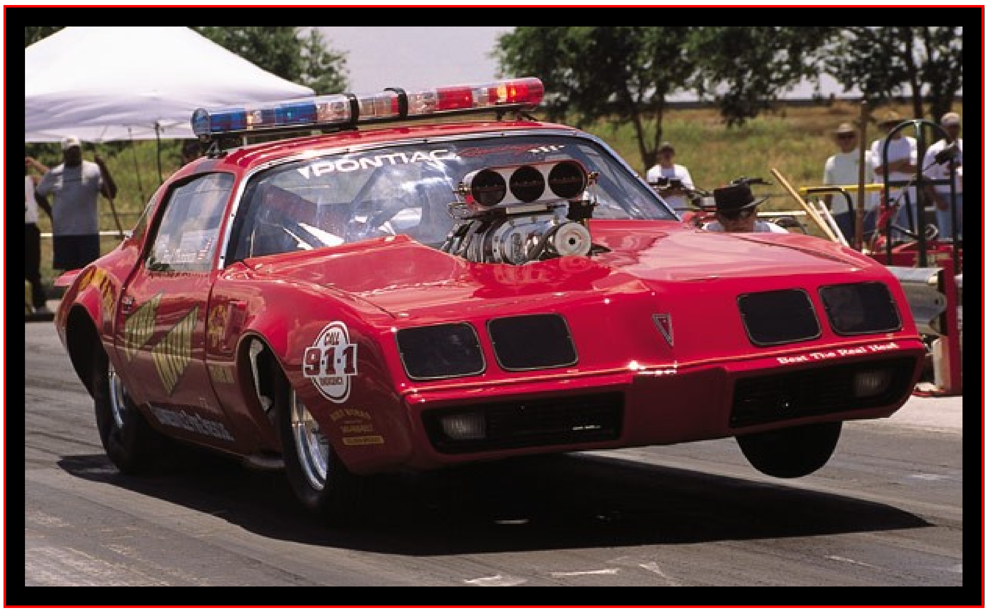
JPEG 4 : The test engineer captures the fuel usage and the elapsed time readings. All tests are fixed-course road runs.

^ *JPEG 5 : Recording measurements. From the JEEP test runs.*

< *JPEG 6 : Frontal Area – Champion.*

JPEG 7 : Windscreen mounted accelerometer – showing the 0 to 60 times. As recorded by the onboard video camera.

JPEG 8 : Early morning emissions testing – Camry



JPEG 9 – 23 years of experience have shown me that only the most effective products ever make it onto a race car. Brad Thompson directly attributes the Ionizer for helping his "Lil' Injun" dragster capture the 2005 "Beat-the-Heat" world championship. The Ionizer shaves approx. 0.15 sec. from a run. With the Ionizer, his fastest ¼ mile time was 8.72 sec.

Interim Report Ends. Document usage notes follow:

1) This document is maintained in Open Office (see : www.openoffice.org).

2) It is distributed in the Adobe (www.adobe.com) "PDF" format. At this time, "Adobe Reader" version 7.0.8 is current. Prior versions of Adobe Reader may work.

3) These software packages are free to use and are suitable for most of the computer systems in use today. Updates to the latest versions of these software packages are freely available at the above websites.