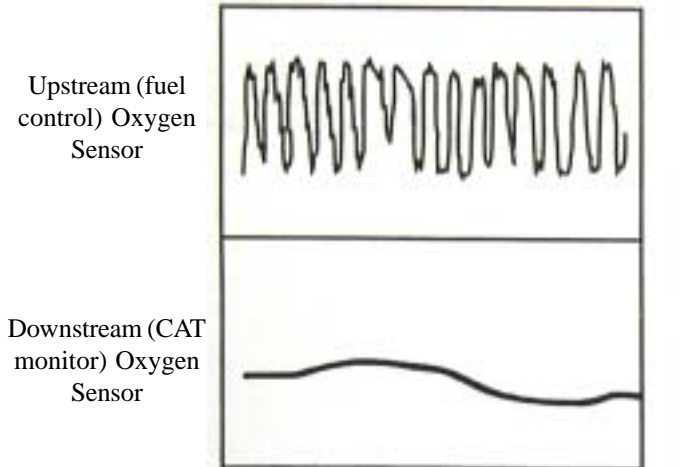


# AutoTeacher News

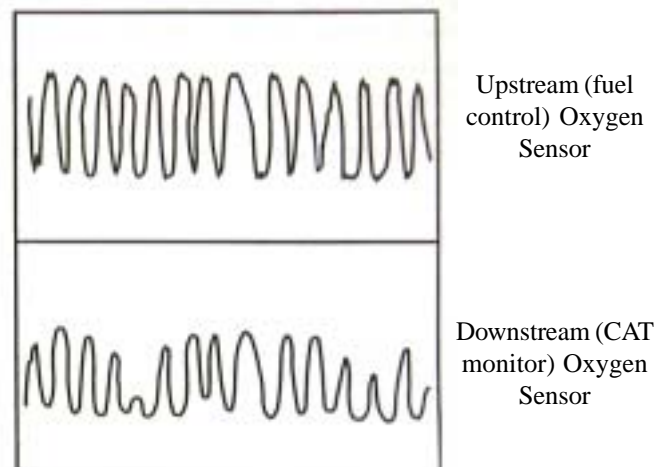
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## OBD II Catalyst Monitor?

### Good Catalyst



### Bad Catalyst



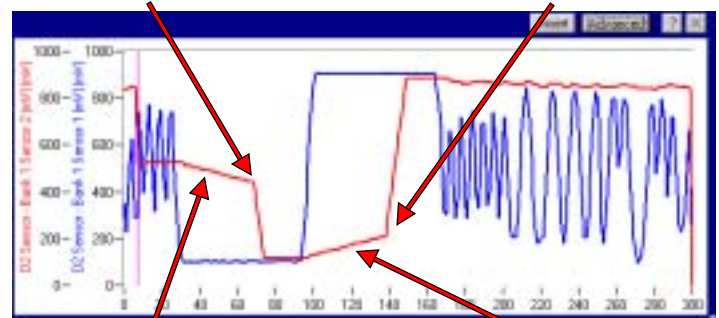
We have all seen the above diagrams depicting good and bad Catalytic Converter (CAT) waveforms in many presentations. Add to that the typical statement “If the frequency of the post-catalyst sensor approaches the frequency of the pre-catalyst sensor, the oxygen storage capacity of the convertor has decreased. Divide the number of switches of the downstream oxygen sensor (post-catalyst) by the number of switches of the upstream oxygen sensor (pre-catalyst) to determine the oxygen storage capacity of the catalytic convertor”. What does it all mean?

Let's take a quick review of the CAT's basic operation. The pre-catalyst oxygen sensor is also called the upstream oxygen sensor or the fuel control oxygen sensor. Other names for the post-catalyst oxygen sensor are the downstream oxygen sensor or the CAT monitor oxygen sensor. During the lean swing of the exhaust stream, the CAT stores oxygen reducing nitrous oxides to nitrogen. On the positive swing, the CAT releases the oxygen producing water vapor and carbon dioxide from hydrocarbons and carbon monoxide.

The ability of the CAT to store and release oxygen is limited. Typically, at a vehicle's engine idle speed, the CAT can store three to five seconds of the lean swing oxygen. In other words, if the fuel mixture is driven lean (fuel control oxygen sensor output is a low voltage) for three seconds, the CAT output will change a small amount and the downstream oxygen sensor's output will stay fairly constant. On the rich

### Lean Punch-Thru

### Rich Punch-Thru

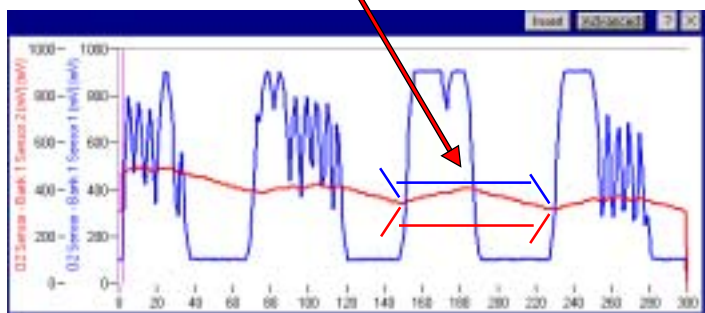


swing, the stored oxygen will be released and, again, the CAT output will change a small amount and the downstream oxygen sensor's output will stay fairly constant.

After the CAT reaches its storage limit, the oxygen will be passed through to the exhaust. The downstream sensor will then indicate either high oxygen content (low voltage) or low oxygen content (high voltage) depending on the swing. The term given to this effect is “CAT Punch-Thru”. On the lean swing, the effect is called “Lean Punch-Thru”. “Rich Punch-Thru” occurs if the effect takes place on the rich swing. Both effects are illustrated above. Also observe the CAT monitor's voltage “drift” that occurs before “Punch-Thru”. The voltage “drift” and “Punch-Thru” effects are the basis of the frequency comparison statement. As the CAT loses its ability to store and release oxygen, the five second time will decrease and the voltage “drift” will increase in amplitude. The normal rich and lean swings of the fuel mixture will produce

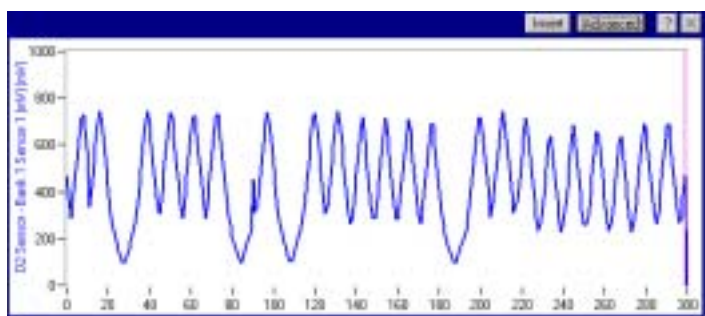
discernable swings in the CAT monitor output as the CAT performance continues to degrade. Once the amplitude

**Periods are the same**



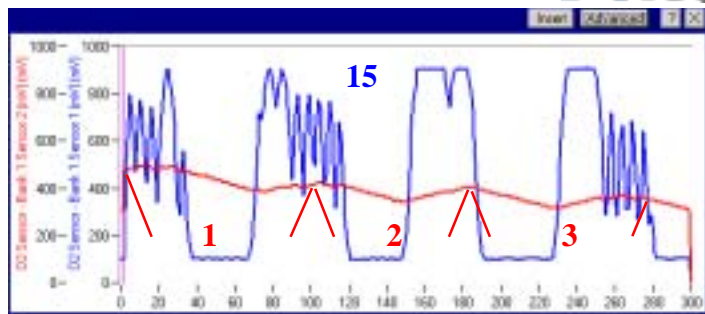
reaches a predetermined reference value, the output will be recognized by the PCM.

The frequency of the output from the CAT monitor sensor must be the **same** as the fuel control sensor because the swings of the fuel control sensor are what produce the output from the CAT Monitor sensor. This can be illustrated by slowing the upstream sensor down as shown in the figure above. Note that the periods of the two signals are the same and the downstream output has a measurable amplitude. If the frequencies are the same, what is the basis for the frequency



comparison statement? All fuel mixture swings will produce output variation at the CAT monitor sensor. But, if the CAT is functioning properly, most of the output signals will be very small in amplitude and ignored by the PCM. In a given time period the variations of the fuel mixture caused by the upstream oxygen sensor will vary from rapid to slow as shown above. The slower variations may produce a measurable output change at the downstream sensor based on the storage ability of the CAT.

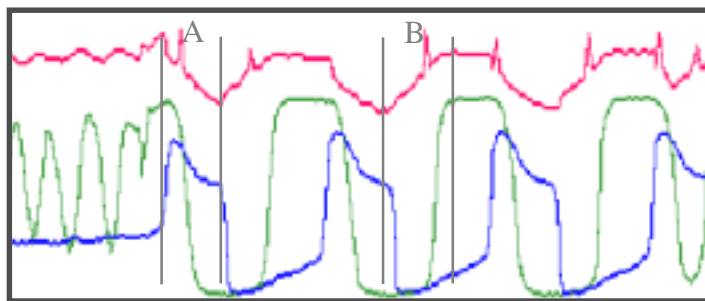
The number of switches (crosscounts) of the upstream sensor might total 150 for a thirty second time period. Some swings would have a period of .1 second while other swings may have a period as long as five seconds. These five second swings will produce a measurable output at the downstream sensor. Comparing the counted upstream and downstream cycles gives an average which is an indicator of the CAT's storage ability. Statistical filtering will take into consideration not only the



relative frequencies but also the swings on which the output occurred.

Using the figure above for an example, the upstream swings total approximately 15 while the downstream has only 3. Dividing the downstream by the upstream as described in the formula gives:  $3/15 = .20$ . A smaller number indicates better storage capacity with 0 being the best possible.

Ford used the "Punch-Thru" method to comply with the required OBD II Cat monitor on the 1995 4.6 liter engine. This was an intrusive test but did not affect



Red - Injector Pulse Width  
Green - Upstream Oxygen Sensor  
Blue - Downstream Oxygen Sensor

drivability because the opposite process was caused to happen on the other bank of cylinders at the same time. The waveforms from a Ford test sequence are shown above. The upstream oxygen sensor's output was controlled by the PCM changing the injector pulse width which alters the air fuel ratio in the exhaust stream. Area "A" is decreasing injector pulse width while area "B" is increasing injector pulse width.

General Motors uses the "Punch - Thru" effect to check the CAT in the Idle Catalyst Monitoring (ICM) test. OBD II systems that use the ICM have the capability of running the diagnostic while the vehicle is being serviced.

## "Factory Training Programs"

ATech was involved with the design and manufacturing of the electricity and electronic trainers currently used by General Motors, DaimlerChrysler, Ford, Nissan, and Bosch.



### GM "Specialized Electronic Training"(SET) Program - Model 18002TR

- Used by GM Training Centers, ASEP Schools, Saturn, John Deere, and Caterpillar
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## **"VIRTUAL" TRAINER - SOFTWARE ONLY**

(Can be purchased with a Site License for 5, 10, 15, or 20 stations)

This ATech software is a new low cost Complement/Alternative to the GM S.E.T. project board. This program provides a virtual simulation of the GM S.E.T. Trainer and the instructional resources to perform the experiments from the GM "Electrical/Electronics" Stage 1, Stage 2, and Stage 3 courses. Version for AYES™ A6 curriculum is also available.

*"This is the best automotive electronics training program anywhere!"*

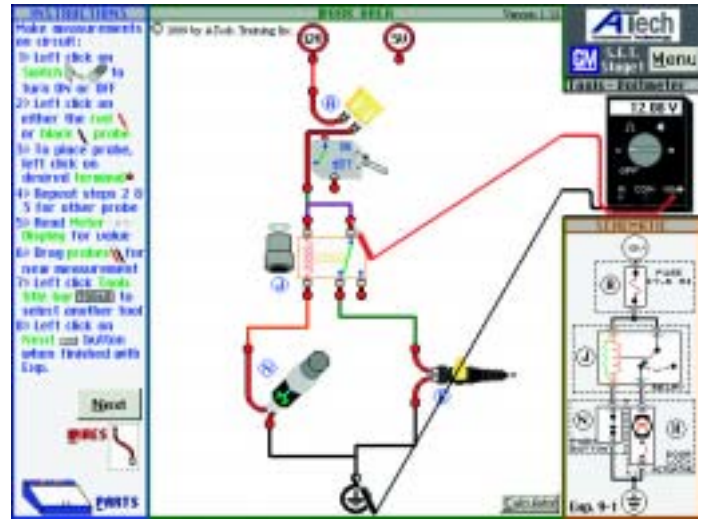
*Automotive Technology  
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- Features:**
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  - Voltage Measurements
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# “VIRTUALS.E.T.” TRAINER - SOFTWARE ONLY

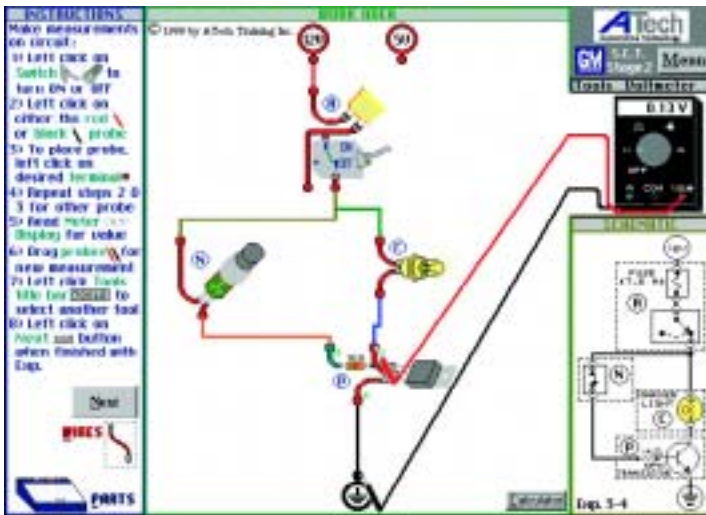
## GM S.E.T. “Virtual” Trainer - Stage 1 Model 18002VT1N

- Properties of Electricity
- Ohm’s Law
- Series Circuits
- Parallel Circuits
- Series-Parallel Circuits
- Circuit Faults
- Electromagnetic Induction



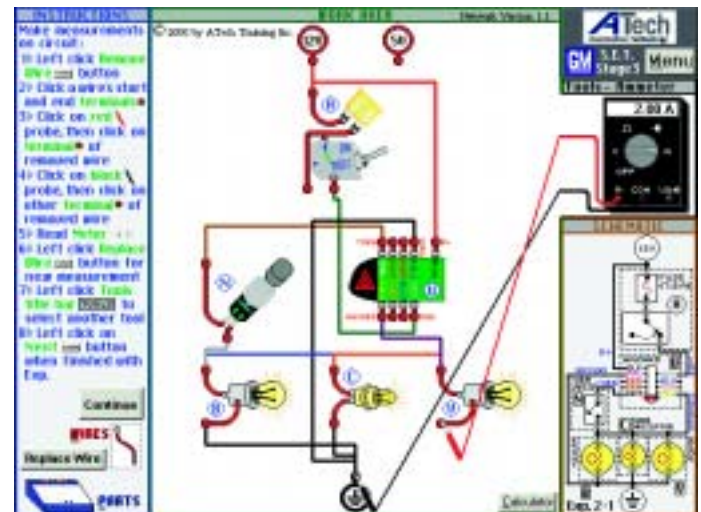
## GM S.E.T. “Virtual” Trainer - Stage 2 Model 18002VT2N

- Automotive Electrical Components
- Solid State Components
- Vehicle Systems



## GM S.E.T. “Virtual” Trainer - Stage 3 Model 18002VT3N

- Computers
- Sensor Inputs
- Actuator Outputs
- Series-Parallel Circuits





## Year 2002 Review

For the Automotive Industry Planning Council, 2002 was a difficult year. The unexpected loss of Education Co-Chairman Jim Hannemann resulted in much confusion and a mad scramble to locate the organization's documents. Industrial Co-Chairman Bill Boyd from DaimlerChrysler retired at approximately the same time leaving the Council with no ongoing leadership.

Additional problems came from the withdrawal of funding from ASE and the Automotive Manufacturers Association for AIPC. These two organizations had funded AIPC's annual operations for many years but decided to stop in 2002.

Considering all the problems, it is easy to understand why there was serious consideration given to closing down AIPC. But, some people refused to give up on an organization that has been in operation for over 55 years. John Ball from Honda and Gene Pierce from Tuscola School District stepped forward to become the Industrial Co-Chair and Education Co-Chair. ATech Training Inc., which has been involved with AIPC for over 15 years, provided \$20,000.00 to fund the organization's 2002 operation.

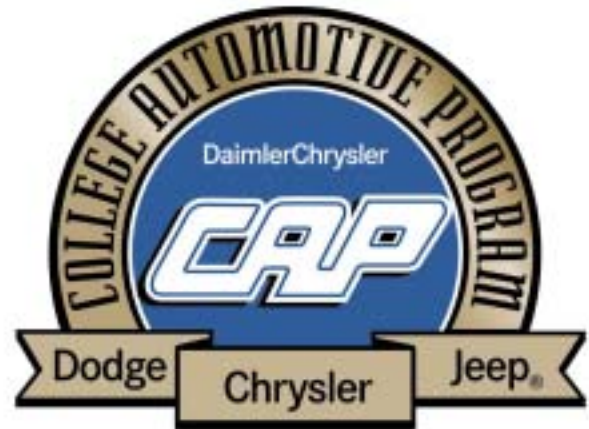
The year's start was difficult but many good things have been accomplished. The organization's Bylaws were updated, a Business Plan was developed, a new website was established, a registration process for applications was put in place, the first AIPC Newsletter was mailed, new State Coordinators were added, and much more.

The Awards Dinner/Program was the best ever thanks to the efforts of Gene Pierce and Mary Hutchinson. Mary is the Executive Director of NATEF and serves as the Executive Secretary of AIPC. Gene is the Assistant Superintendent of Tuscola Intermediate School District.

ASE, ATech Training, DaimlerChrysler, Honda, and NACAT provided over \$400,000.00 in tools, training equipment, and new vehicles for the National Winners, National Runners - Up, and State Winners.

In this and upcoming issues of the AIPC Newsletter, articles from the National Winners will be presented and OEM postsecondary training programs will be featured.

What's in store for AIPC in 2003? Nobody knows, but I have a very strong feeling that it is going to be good! Fred Hines, Industrial Chairman



## DaimlerChrysler College Automotive Program

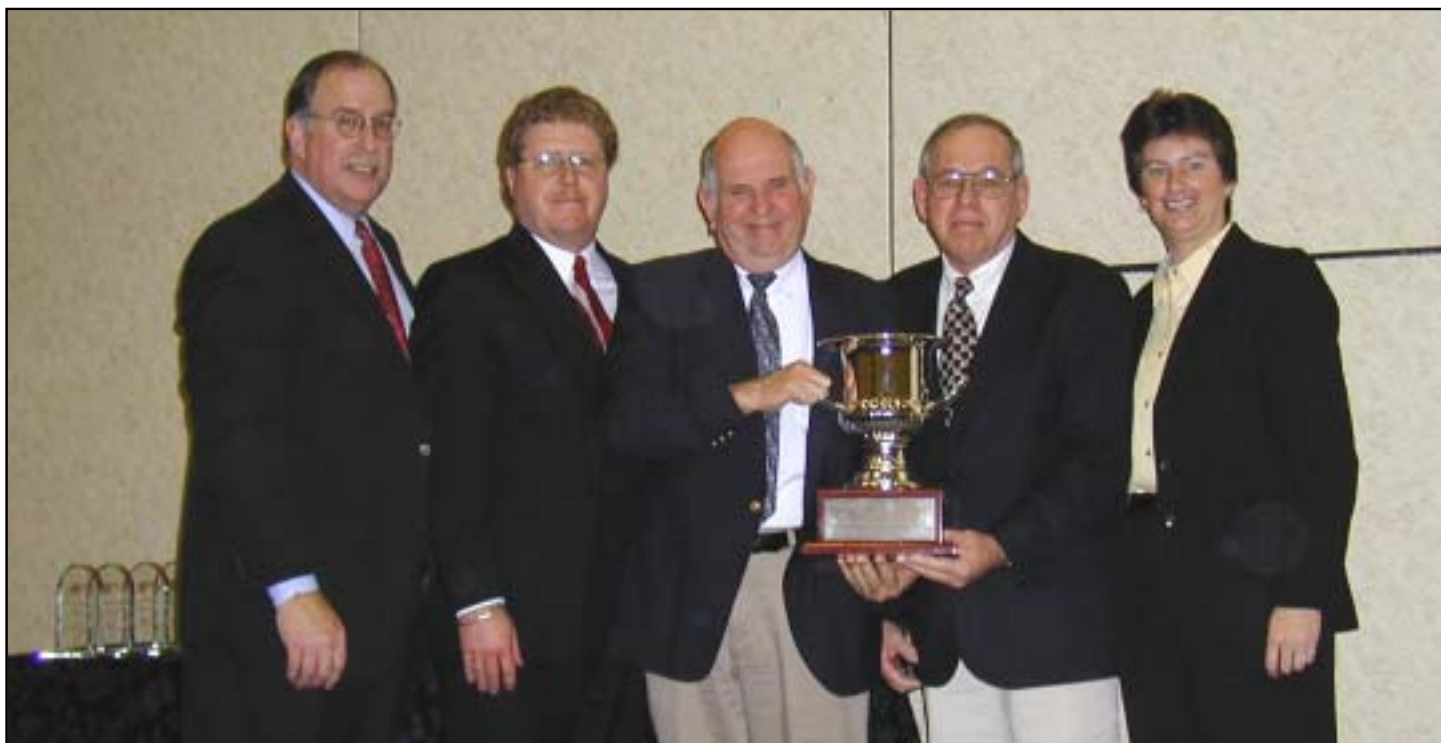
The DaimlerChrysler College Automotive Program (CAP) is a nationwide effort to train and employ the industry's best automotive technicians. CAP seeks to attract top talent by offering the following benefits: 1) High Quality Automotive Education – CAP colleges are certified by NATEF (National Automotive Technician Education Foundation). Every CAP instructor is a DaimlerChrysler trained experienced professional. 2) DaimlerChrysler provides the latest vehicles, components and instructional materials. It also provides high tech tools, including diagnostic equipment for hands-on training. 3) Real World Training – CAP provides valuable internship experience. Along with classroom instruction, CAP offers on-site training at sponsoring dealerships under direction of a master (Mentor) technician. Students rotate class time and internship until they fulfill the requirements of an Associate Degree in Automotive Service Technology.

The CAP program offers the industry best retention rate for graduates - approximately 70%. 70% of all CAP graduates are still with DaimlerChrysler dealers 10 years after graduation. 40% are still with the dealer that sponsored them. CAP is the only manufacturer program that offers a written agreement/contract between student and dealer (50/50 tuition split option available). Upon graduation, there is 100% job placement.

If you are looking for a high paying, in-demand job that translates into job security, opportunities for mobility and excellent benefits, give the CAP program a serious look.

DaimlerChrysler administers the CAP program through 33 schools across the United States. The National Manager for the CAP program is Mike Collins. Peter Riccardo – Vocational Educational Coordinator, supports Mike Collins. For further information on the CAP Program, please visit the website at [www.cap.daimlerchrysler.com](http://www.cap.daimlerchrysler.com)

## National Winner Santa Fe Community College



From Left to Right:

Rick Ciesla - Global Technical Training, DaimlerChrysler, MI, (AIPC Treasurer)

Gene Pierce - Assistant Superintendent, Tuscola Intermediate School District, MI, (AIPC Education Co-Chairman)

Ron Chappell - Automotive Program Coordinator, Santa Fe CC, Gainesville, FL

Mario Schwarz - Automotive Instructor, Santa Fe CC, Gainesville, FL

Mary Hutchinson - Executive Director of NATEF, (AIPC Executive Secretary)

### The AIPC Award Can Make a Quality Automotive Training Program a Real Winner

While there is an ever-increasing shortage of skilled automotive technicians, the average young person of today is unaware of the many opportunities available in the automotive field. It is imperative that educational facilities and the automotive industry work together to attract young people into the industry and properly train them for a successful career and a secure future.

The Automotive Industry Planning Council has developed standards and worked hard to help make this possible. The AIPC presents the Automotive Award of Excellence in Automotive Technician Training to selected automotive programs throughout the country. At the national level, one first place and two runner-up awards are given each year in three program categories: secondary, post secondary generic, and post secondary manufacturer affiliated. Awards are also given at the state level.

The automotive programs at Santa Fe Community College in Gainesville, Florida have received several of these coveted awards. Since 1994, we have been awarded three national first place and three national runner-up awards. As part of these awards we

have received a value of over \$160,000 in funds, equipment and training vehicles. In addition, the national and local recognition and publicity we received was absolutely priceless. We felt that we already had an excellent program but as a result of working to achieve these awards, our program was greatly improved. Many perks came along with the awards we received. We were able to update our equipment and our training vehicle fleet and to add substantial funding to our endowed student scholarship program. It has been a win/win situation in all respects. Our program quality has been greatly enhanced, our student numbers have increased and our program has a very successful placement rate.

As a NATEF evaluation team leader, I visit many quality automotive training programs and often see AIPC plaques and trophies on display. I am always asking the instructors at other schools if they are aware of the AIPC Awards and if they have ever applied. Many times the answer is they don't think their program is large enough or they don't feel they have a chance.

It is my belief that quality is where you find it and is not necessarily measured in the size of the

program or the amount of funding available. I have seen excellent facilities with healthy budgets that were lacking in quality training. I have seen small facilities in sparsely populated areas with less than desirable funding that have very dedicated instructors and staff who provide excellent quality training. These schools produce very successful students who enter the work force and become professional, skilled automotive technicians. I believe it is the dedication and hard work of quality staff members that makes for success. Any automotive training program that is not applying for the AIPC Award each year is truly missing out.

The first step to success is to obtain ASE Certification through NATEF, if your program doesn't already have it. This gives the program a mark of distinction and provides current industry standards to ensure quality up to date training.

The next step is to obtain an AIPC application packet, make copies and set up a meeting with the program staff to look over the forms and begin to make plans to produce an award-winning package. Someone should be appointed as chair of the project to keep records and assign various tasks to staff members. Remember to carefully read and follow instructions accurately. It is possible to produce an otherwise quality package but be disqualified by omitting required information; exceeding the limit of pages; using the improper size font or an improper loose leaf binder. You will find that you will be accomplishing quite a thorough review of your program as you set up the necessary documentation. Don't be afraid to involve everyone at your facility including administrators, staff, instructors, students and staff from various departments who can help you document information. Also include your advisory committee. Set up a schedule and set a timeline to complete various sections. You are required to request letters of support from various groups of people. Do this early to give them plenty of time and you time to remind them if they procrastinate. You may want to request more letters than you actually need to ensure you will get the required number. You will need photos of your facility. Take good quality pictures and take plenty so you can choose the most appropriate ones.

Finish your award package early, making it as neat and accurate as possible. Have several people proofread the material to catch errors and to look for methods of improvement. Make sure that all requirements are met. You will now need to make the appropriate number of copies (remember to make at least one to keep) and forward them to the appropriate State Director.

After completing this process, you will have learned much about your program and how it appears to

outsiders. You will likely have discovered many improvements you may want to accomplish in the future. You will have accomplished a thorough self-evaluation. If you have reached this point, it is likely that your staff is very dedicated and you have a quality program worthy of winning a first place award. You are competing with many other quality programs and if you are not a winner this year, you still have accomplished a great achievement. You have developed a quality packet that accurately presents your program. You can continue to improve it for next year's award competition. More important, you will now find yourself looking more closely at ways to improve your program.

Remember, the program that wins National First Place will be out of the competition for the next five years. For all you know you many have been only a few points behind them and may get your chance next year. Just hang in there, strive for quality, apply for the award each year and you will likely soon receive the recognition your program deserves. I speak from experience. This award is well worth the effort of pursuing. Just the act of applying for it will likely turn up ways that you can make program improvements.

Good luck, see you at the awards ceremony.

**Ron Chappell**  
**Coordinator of Automotive Technology**  
**Santa Fe Community College**

## **2003 Awards Program**

The 2003 Guidelines and Application should be available on the AutoIPC website, [www.autoipc.org](http://www.autoipc.org). Registration is required at the website to receive the documents in an email. Ensure that the email address you enter is correct. In year 2002, 99% of the problems with receiving the documents was due to an incorrect email address. The first year for registration was 2002 and proved to be very valuable in tracking submissions from schools and obtaining input on improving the process.

As can be seen from the Santa Fe Community College article, the process is not complicated but requires some time and effort. You must perform a thorough self evaluation of your program and involve other members of your school, including the administration. The improvements in your program that will result from going through the process are worth the effort.

The prizes for this year's program have not been determined as they depend on donations and commitments received by AIPC during the year. If you know of any organizations or individuals who might participate in supplying items for the winners, please email [fhines@autoipc.org](mailto:fhines@autoipc.org) with the information. Additional funding for operations is also being solicited.



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**Automotive Industry Planning Council**



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**And actively supports:**



**Free Electrical Troubleshooting Skills Development Program**

AutoIPC (AIPC) and ATech through a collaborative effort have made a free downloadable program available on [www.autoipc.org](http://www.autoipc.org). The program's purpose is to develop electrical troubleshooting skill in both technicians and students. It is free for you to use personally or in your classroom. All other copyright restrictions are maintained.

Two of AIPC's Areas of Concern are: "Reinforcement and support of existing training programs" and "Instructor Professional Development". This skill development program is the initial step in addressing these concerns.

The program is a variation of the ATech Skills For Electrical/Electronic Troubleshooting (SEET) program. The variation allows faulted circuits to be displayed and diagnosed using standard virtual instruments. The program as downloaded contains one faulted circuit. New faults for the circuit and new circuits will be made available periodically on the AutoIPC website for downloading.

As of February 1, additional faults are available for download on the AIPC website and all registered users have been notified of their availability.