# ATech Educator News

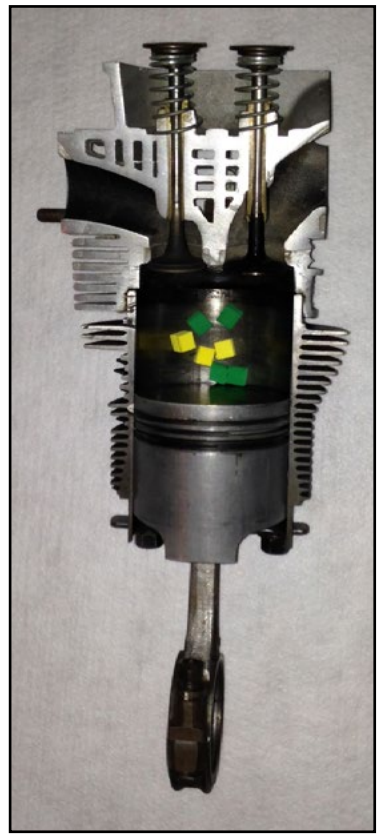


From time to time the ATech newsletter includes articles submitted by individuals who have demonstrated expertise in certain areas of automotive diagnostics, repair, and/or instruction. This month we are privileged to welcome Phil Jelinek retired Automotive Instructor from California as our guest author.

## S.T.E.M.
## The Basics!! Part 1

This is the first of many articles about S.T.E.M. to help students/learners understand the basic concepts of what everyone in talking about, in easy to understand terms. I have attended many S.T.E.M. symposiums, only to discover that after the students explain their projects, they are unable to separate which part of their project is either the Science part, Technology Part, Engineering part, or the Math part. You see, S.T.E.M. is an acronym that stands for Science Technology Engineering and Mathematics.

*Figure 1 Cubic Centimeter*



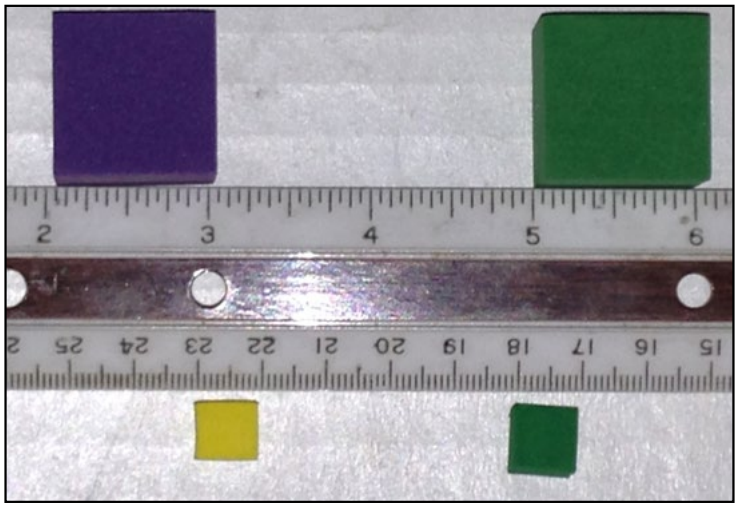
Acronyms/Initialisms!

Many of my students did not know what an acronyms/initialisms were.

Acronyms, of course, are abbreviations where the abbreviation is formed from letters of other words (usually the first letter of each word, though not always). The part of the definition of acronym that many people miss is that the resulting abbreviation needs to be pronounceable as a word. Examples of this would be things like RAM (Random Access Memory); LASER (Light Amplification by Stimulated Emission of Radiation); NASA (National Aeronautics and Space Administration), and OPEC (Organization of Petroleum Exporting Countries).

Initialisms are very similar to acronyms in that they are made up of letters of some name or phrase, usually the first letter of each word as is common with acronyms. The difference between an acronym and initialism is that the abbreviation formed with initialisms is not pronounced as a word; rather you say the individual letters, such as FBI (Federal Bureau of Investigation), CIA (Central Intelligence Agency), and DVD (Digital Video Disk*).

*Figure 2 Below - Cubic Inch and Cubic Centimeter*



The Initialism cc stands for Cubic Centimeter and is a Metric Math term we use to explain the volume of our engines. I use a model of a cc and a cut-away cylinder from a 1600 cc Volkswagen motor (See the accompanied picture #1 & 2). I find it easier to explain the single cylinders combustion chamber's volume as 400 cc's (1600 cc's/ 4 cylinders = 400 cc's per cylinder) and easier to understand when I put the cc's in the combustion cham-

ber as a visual.

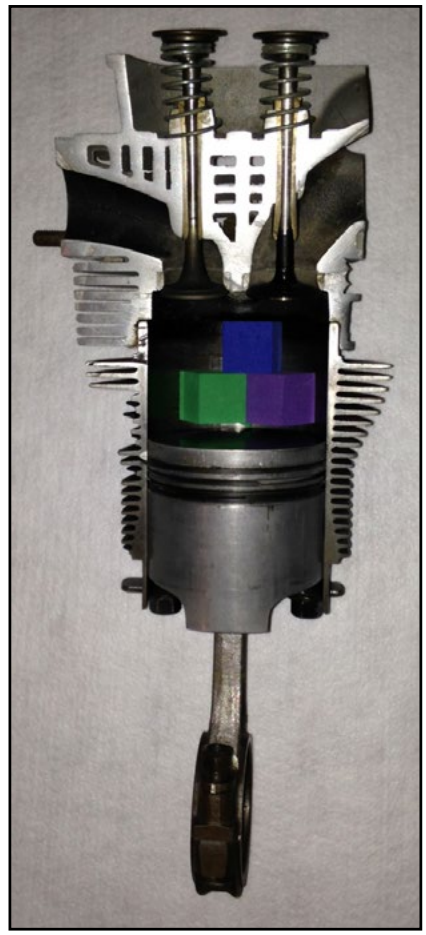
The initialism cid stands for Cubic Inch Displacement and is another Standard Math term we use to explain the volume of our engines. A 350 cid engine has 8 cylinders, i.e. 350/8 = 43.75 cubic inches per cylinder. Using the pictured Cubic Inch blocks in the same manner as the Cubic Centimeters will produce similar results.

The initialism cfm stands for Cubic Feet per Minute and it describes the rate at which a certain volume of air moves in a certain period of time. In the Automotive Field, we use this term to measure the airflow into an Internal Combustion Engine. To give students an awareness of how much a Cubic Foot is, see the accompanied picture #3.

What I would suggest, for those of you who use ACRONYMS and/or INITIALISMS in any teaching situation, that you frequently tell the class what the acronyms/initialisms mean – often and don't ASSUME the class will get it the first, second or fifth time one is used.

*Figure 3 - (Pictured on the Right) Cubic Inch Displacement*

*Figure 4 - (Pictured on the Left) Cubic Foot*



This concludes this first lesson about S.T.E.M.

*by Phillip Jelinek*

# S.T.E.M.
# The Basics!! Part 2

This is the second of many articles about S.T.E.M. to help students/learners understand the basic concepts of what everyone is talking about, in easy to understand terms. I have attended many S.T.E.M. symposiums, only to discover that after the students explain their projects, they are unable to separate which part of their project is either the Science part, Technology Part, Engineering part, or the Math part. You see, S.T.E.M. is an acronym that stands for ***S***cience ***T***echnology ***E***ngineering and ***M***athmatics.

Science!


Many people believe they know what science is but few can put it into words. They believe that science has variables and is subject to opinions and/or preferences. Nothing could be farther from the truth. Science has to do with the Laws of the Universe that have ***NO*** exceptions!!! If there are any exceptions, it just is not a Science Law (rule).

There are a few examples I will use to highlight the point.

Let's take the English Language, considered by many to be a difficult language to learn because there are so many exceptions to the rules. I was taught "The Exception makes the rule" in learning the English Language.

**I before E, except after C, or when sounding like A, as in neighbor or weigh** is a mnemonic rule of thumb for English spelling that gives both the rule and all the exceptions to that rule.

Let us use an analogy to explain what I mean. Consider the simple question: ***Can we change Time???*** Most people's first response would be to say no!! Then I ask them what we do each November and March???? We change time. In fact, in 1592 we lost 10 days. See the article below:

> Imagine waking up tomorrow and finding out that the calendar date is now 10 days later then when you went to bed! Sound likes a movie right? Truth is stranger than fiction. Europeans went to bed on Thursday, October 4, 1582 and awoke the next morning to learn that the date is now Friday, October 15, 1582. Where did 10 days go?!
> We know that a year measures how long it takes the Earth to make one complete revolution around the Sun. In the 16th century, whether the Earth was at the center of the Solar System or it was the Sun, was still a controversial question. But what was known to even earlier cultures was that the pattern of stars you would see repeats every 365 days or so. We know that a year is roughly 365.25 days meaning that unless we add a leap day every 4th year (or so), our civilian calendar will slowly drift with respect to the stars. The Julian calendar, introduced by Julius Caesar in 46 BC has a regular year of 365 days divided into 12 months. Although Greek astronomers had known that the solar year was a few minutes shorter than 365.25 days, the Julian calendar did not compensate for this difference. So the calendar year gained about three days every four centuries compared to observed equinox times and the seasons. But so what? The calculated date of Easter gradually moved out of alignment with the March equinox. By 1582, Easter was ten days out of alignment from where it supposedly had been in 325 during the Council of Nicaea. Because the celebration of Easter was tied to the spring equinox, the Roman Catholic Church considered the steady drift in the date of Easter too long to be undesirable. So the Gregorian calendar was introduced in 1582 and 10 days were removed from the calendar! Our civilian calendar is now again in synch with the stars.

Some people say yes!!! To them I ask, Can we change the physical time the Earth rotates one revolution and we call that a Day. We could change the 24 divisions of that day we call Hours into 10, 20 or 50 if we all could agree but we can't change the time of the actual 24 hour day.

The correct answer would be another question, What do you mean by changing Time???


These are the laws I am talking about. Laws that have no exceptions, opinions or preferences!!! Some of these Laws include but are not limited to: The Laws of Fluid Dynamics, The Three Laws of Motion, The Four laws of Thermodynamics and the Laws of Gravity just to name a few.

So what is Science? ***Science is a systematic and logical approach to discovering how things in the universe work.*** It is derived from the Latin word "scientia," which translates to knowledge. Unlike

the arts, science aims for measurable results through testing and analysis. **Science is based on fact, not opinion or preferences.** According to Webster's New Collegiate Dictionary, the definition of science is "knowledge attained through study or practice," or "knowledge covering general truths of the operation of ***General Laws***, esp. as obtained and tested through scientific method [and] concerned with the physical world."

So here is a simple sentence to help you understand what Science is: ***Science deals with the Physical Laws of the Universe where there are no Exceptions, Opinions or Preferences.***

*by Phillip Jelinek*

# S.T.E.M.
# The Basics!! Part 3

This is the third of many articles about S.T.E.M. to help students/learners understand the basic concepts of what everyone in talking about, in easy to understand terms. I have attended many S.T.E.M. symposiums, only to discover that after the students explain their projects, they are unable to separate which part of their project is either the Science part, Technology Part, Engineering part, or the Math part. You see, S.T.E.M. is an acronym that stands for ***S***cience ***T***echnology ***E***ngineering and ***M***athematics.

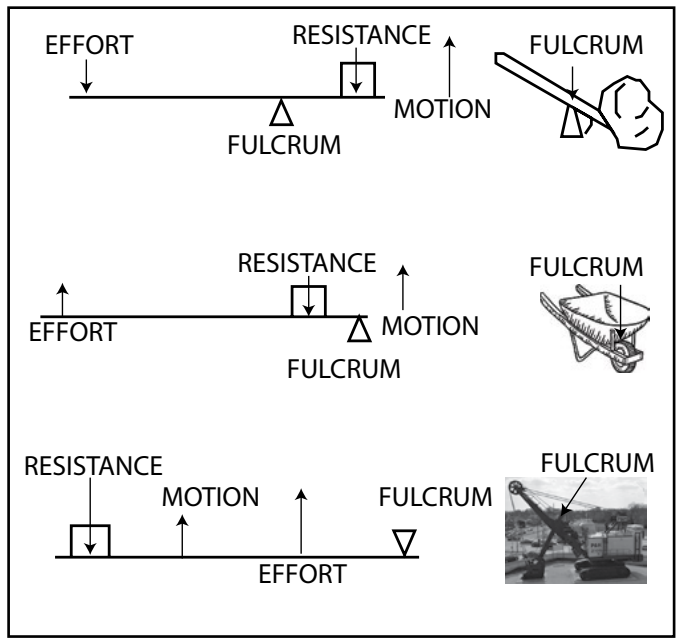
Technology!

Technology today has come to mean some sort of Electronics, which by and large means COMPUTERS. Is that really what Technology is??? We need to change this perception. At one time (16th Century) the Lead Pencil was considered the latest technology of its day. Paper clips, circa 1867, were the technology of their day.

What I presented to my students on the third day of class were the Six Simple Machines. They can be defined as "The simplest mechanisms that use mechanical advantage to multiply force". These Six Simple Machines go back to the 3rd century B.C. They are: The Lever, Wheel and Axle, Pulley, Inclined Plane, Wedge and the Screw and ***knowing them will change the way you look at your world!***

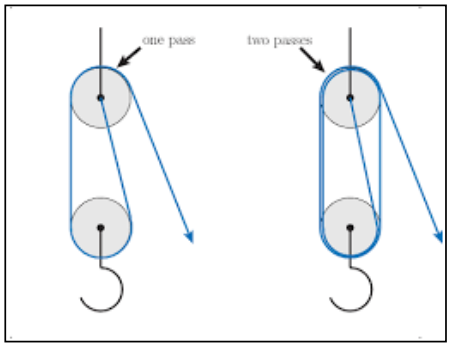
When teaching about the Automobile, these Six Simple Machines are a foundational technology and can be regarded as the elementary building blocks of which all complicated machines are composed.

Let's take the first one, the Lever. We get the term "Leverage" and it is used throughout the automobile and the tools we use to repair it. When you start to study



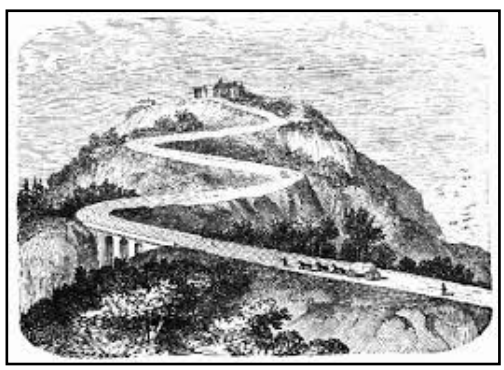

the Lever, you will find there are three classes of levers. There are three types or classes of levers, according to where the load and effort are located with respect to the fulcrum. **Class 1** has the fulcrum placed between the effort and load. **Class 2** has the load between the effort and the fulcrum. **Class 3** has the effort between the load and the fulcrum. Do some research on your own to find out how many "Levers" are around you at home, in your vehicle, and at work. They are everywhere from the scissors we use (Class 1), to the diving board at a pool to the shovel used to dig up dirt (Class 3), to the Wheelbarrow (Class 2) into which we put the dirt. (See Picture)

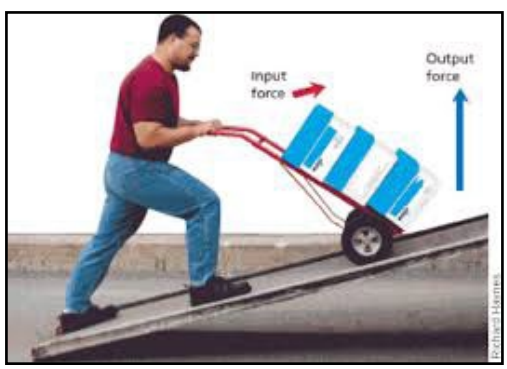
The Wheel and Axle: You don't have to go far for this one, all you have to do is turn a door knob. In the automobile we have a steering wheel, with the axle being the shaft to the steering mechanism. Then we have the Drive axle turning the Wheels of the vehicle. (See Pictures)



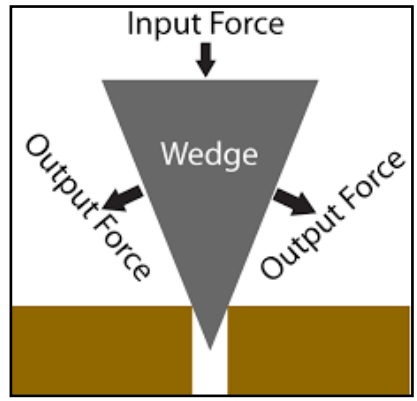

Pulleys: While we are familiar with sailing ships using blocks and tackles to support masts and to raise and lower sails, we use a Belt and Pulley system on our engines to turn our Water Pumps, Power Steering Pumps, Cooling Fans and Alternators that are mounted at the front of our engines. (See Pictures)

Inclined Plane: also known as a ramp, is a flat supporting surface tilted at an angle, with one end higher than the other, used as an aid for raising or lowering a load. We have many examples of inclined planes from on/off ramps, roads up mountains/hills, to driveways, loading ramps and skate parks. The concept is that it is easier to push/pull something up a ramp than to pick it straight up. (See Pictures)






Wedge: is a triangular shaped tool, and is a portable inclined plane. It functions by converting a force applied to its blunt end into forces perpendicular to its inclined surfaces. We use Wedges to split logs, raise the corners of machines, and to keep the head on hammers and such. (See Pictures)

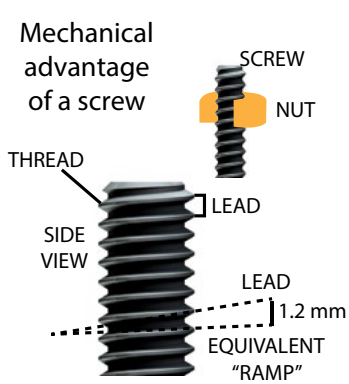



Screw: is a mechanism that converts rotational motion to linear motion. It is an inclined plane wrapped around a rod. The longer the inclined plane, the closer the threads are together. Coarse screws go in faster but don't have the clamping strength. Fine thread takes longer to go in but have greater clamping strength. This knowledge along with a couple of models (See pictures) will go a long way in helping students understand the differences between coarse and fine thread bolts and screws.

So what is a simple one sentence explanation of Technology: ***Technology is the "What" - tools, machines, techniques, etc. that are used to solve problems and/or perform functions.***

*by Phillip Jelinek*

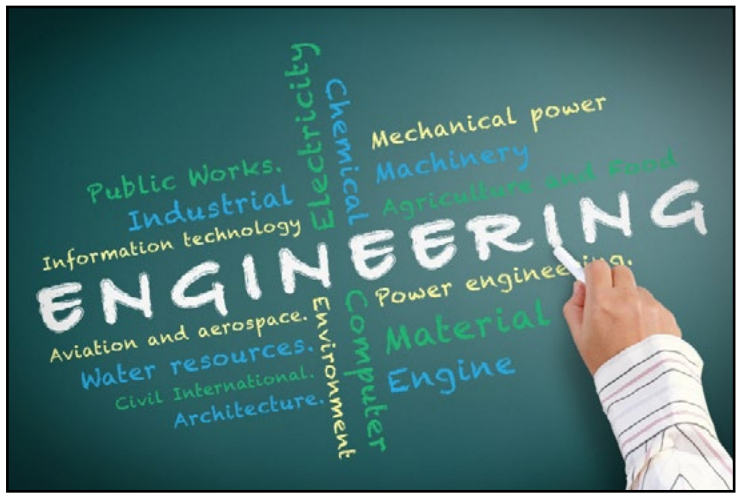
## 6.3 Gears, ramps and screws




- A screw is a simple machine that turns rotating motion into linear motion.
- A screw works just like a ramp that curves as it gets higher.

# S.T.E.M.
# The Basics!! Part 4

This is the final of many articles about S.T.E.M. to help students/learners understand the basic concepts of what everyone is talking about, in easy to understand terms. I have attended many S.T.E.M. symposiums, only to discover that after the students explain their projects, they are unable to separate which part of their project is either the Science part, Technology Part, Engineering part, or the Math part. You see, S.T.E.M. is an acronym that stands for ***S***cience ***T***echnology ***E***ngineering and ***M***athematics.




## Engineering!

What is Engineering? – Engineering combines the fields of Science, Technology and Math to solve real world problems that improve the world around us. Engineers apply the Laws of Science, using the Technology available to them and applying Mathematics to develop economical solutions to technical problems.

According to the Bureau of Labor Statistics, there are 17 Engineering Categories. These are: Aerospace, Agricultural, Architects, Biomedical, Chemical, Civil, Computer Electrical/Electronic, Environmental, Health and Safety, Industrial, Marine, Materials, Mechanical, Mining/Geological, Nuclear, and Petroleum Engineers.

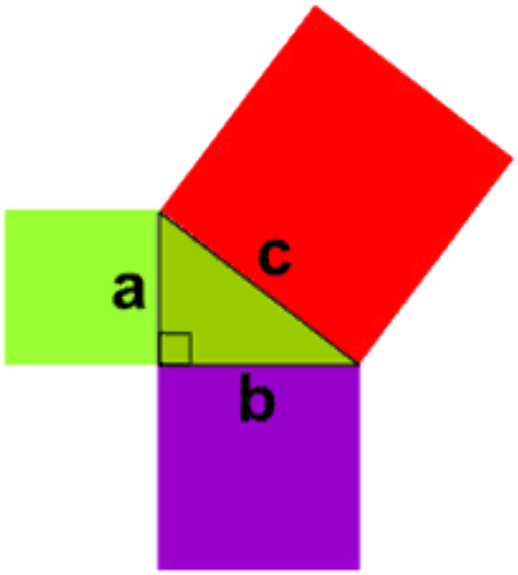
So what is a simple one-sentence explanation of Engineering: ***Engineering is the "Who" and their work (Engineers) is the link between Scientific Discoveries and the commercial applications that meet societal and consumer needs.***

This last sentence needs some explanation. People who invent make prototypes, able to get the principles of theory and design across but not able to handle the rigors of continual usage of the public. So engineers bridge this gap.

## Math!

Math is probably the most misunderstood of the sciences. To many, it is difficult, scary, and/or unfathomable. To others, Math teaches, instructs, and opens doors to wonders beyond our understanding without it. Sir Isaac Newton, Dec 25, 1642 – March 20, 1726, who is widely recognized as one of the most influential scientists of all time, laid the foundation for classical mechanics. He formulated the Laws of Motion and Universal Gravitation (Gravity), which dominated scientists' view of the physical universe for the next three centuries. In order to explain to other scientists the Laws of Motion and Universal Gravitation (Gravity), he needed to create a New Language. That language was ***Calculus***!!! Galileo Galilei (Feb 14, 1564 – Jan 8, 1642) said it best, "The universe cannot be read until we have learned ***the language*** and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word. Without these, one is wandering about in a dark labyrinth."

Like any language you first have to learn the "alphabet". Math's "alphabet" are the "Letters" we use to make all the "Words". These letters are: 1,2,3,4,5,6,7,8,9, & 0. We call it the decimal system since it has 10 "Letters". We put the "Letters" together to make "Words". 12 is a Math "Word", when we put letters from our own alphabet with them, they make it meaningful, like 12 a.m.



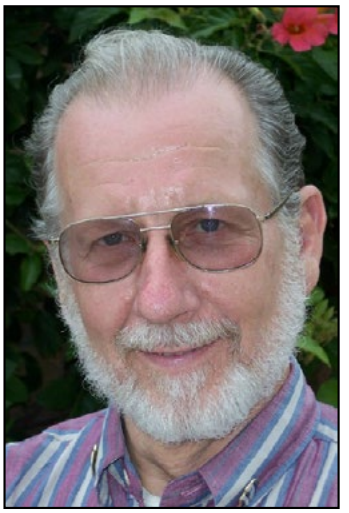

The "Sentences" are the formulas we use with the Letters to make sense of the world around us, such as: the Pythagorean Theorem, $\mathbf{a^2 + b^2 = c^2}$ as stated in Math language, or as stated in our words; In a right angled triangle: the square of the hypotenuse is equal to the sum of the squares of the other two sides. (see the picture for further clarification)

Math is all around us; it is the building block for ***everything*** in our daily lives, including mobile devices, architecture (both ancient and modern), art, money, engineering, and even sports.

What would we do without MATH?? It tells us the size of the Football Field, how to keep score, the size of the ball etc. Math tells us how Fast we are going, especially in a vehicle, 60, 70 MPH and up!!!! We use math to tell time throughout the day, when to do or not do things.

*by Phillip Jelinek*

WATCH NOW...
How to Incorporate STEM Principles In The Classroom



Phil Jelinek, who is now retired, was an award winning automotive instructor for over 25 years. He developed and implemented the first UC approved Automotive Physics (d-Lab Science) class and Automotive Engineering (g-Elective) class in California, there-by helping to save HS auto programs from extinction in that state. Three different years, he had teams attend the National New Car Competition in New York City, has been selected Teacher of the Year by three different organizations, and is currently the Past-President of the California Automotive Teachers Association.

You may contact Phil at pjelinek@calautoteachers.com