Foreword

MANAGING STUDENT VEHICLE PROJECTS
The Non-Technical Side

(Revised 25 February 2008)

Dick Golembiewski

In my 20+ years of involvement in SAE student activities, I've seen the rise and fall of many student groups. At one time, the number of truly competitive teams could be counted on one hand. With the rapid growth in participation throughout the past twenty years, the number of competitive teams has increased. Many others however, struggle. By passing on some of my thoughts, observations, and experiences, I hope to provide some guidance to those groups, as well as to those just starting out.

Attitude:

First and foremost, the proper attitude is what makes a successful student (or for that matter any) project. Living in Wisconsin, USA for most of my life, I used to start my vehicle design class with a famous quote from the late Green Bay Packer football coach, Vince Lombardi. In that quote, he talks about how winning is not a sometime thing, and how it is a habit. Unfortunately, so is losing. That does not mean that one has to win all of the time, but rather that one should strive to do so. The great learning experience will come from developing the proper attitude, and doing the things necessary to be successful. In my first incarnation as a faculty advisor (1983-89), I was fortunate enough to infuse a winning attitude in a group of

students. Many years later, I had a project group make a formal presentation in which they said that their goal was to finish in the top ten. One alumnus immediately asked what the top 10 nonsense was all about. "Why not go for the win?" he said. If you plan to finish first you may not get there, but if you plan on finishing second, you'll likely finish third or worse!

The cruel reality is that despite many claims to the contrary, winning pays. Every educational institution likes to say that they don't care if their students win. That's rubbish! The positive publicity that results helps to attract students, as well as many other resources. It is no guarantee of support from a university's administration, but it may help. While there can only be one winner, you'll get the most out of the project by approaching it with a winning attitude.

(This attitude is not just confined to motorsports. Think of it this way: You are involved in trying to bring a commercial product to the market, and are trying to sell your management on its virtues. However, you have to admit that it will not perform as well as your competitor's product, and will cost more to produce. What chance do you think you'll have?)

At the Milwaukee School of Engineering, we won the SAE Midwest Mini-Baja® competition in only our second attempt (1979). We won again the following year. Those first two wins, plus a third in 1983, helped cement our support within the university.

Having said all of that, one must also keep student vehicle design projects in perspective. Your goal at university is to obtain an education. These projects serve to compliment and

enhance that education. For many of my students, the competition they entered was more important than a commencement exercise. Still, while one can accept a certain reduction in grade point average as a price to be paid for one's participation, failing is not acceptable. In my years as a faculty advisor, I monitored my students' GPAs. Some weren't happy when I had to tell them that they couldn't participate until they raised them. Most have to realize that a student, who tries to work on one of these projects while in academic difficulty, hurts both themselves and their team. Since failing grades are unacceptable, the only compromise is to drop the project work. If the team has come to depend on that student, they are also hurt. It is better for all if no exceptions are allowed. Those who want to participate have to meet the minimum standards. It is the same for everyone. Exceptions raise all kinds of questions as to preferential treatment.

Goals:

Every team needs common goals. Without them, all you will have is a group of individuals, each doing their own thing. It is important that all team members understand just what the goals are. Setting goals requires some thought. If the goals are unobtainable, then morale suffers. If they are set too low, the team never knows what it is really capable of doing. It will never improve.

Those goals have to be clear. For instance, if the goal is to win the competition, then the team needs to look at what it takes to win. So many teams each year have what I call "hidden" goals. For instance, in Formula SAE®, each year we see designs more applicable toward

formulae which feature ground effects aerodynamics, and radial tires. We also see cars built as an exercise in building composite structures, or high horsepower engines, rather than orienting their design to what is necessary to achieve overall victory. Be clear about what you are really trying to do!

Planning:

Once the goals are set, the team must develop a plan for how to attain them. Good plans are simple enough to be accepted and understood by all of the team members. Good plans consist of mini-goals, the successful completion of which builds confidence. I am absolutely convinced that "success breeds success", and all my planning has always been done with that in mind. In my teaching, as well as project management, I combine that with an approach that says one learns to crawl before one learns to walk, before one learns to run. The most difficult project can be completed if one simply breaks it down into simple bits which are easily accomplished.

Strategic planning for a student vehicle competition starts by carefully reading the rules. **Every** team member should be intimately familiar with all of the rules. Start by looking at the point totals for the individual scored events. In most SAE student vehicle competitions, the endurance event is the most heavily weighted. Therefore, one has to do well in that event in order to score well in the competition. Plan accordingly.

Of course, it helps for a team to have attended the previous year's competition. Potential

team members can familiarize themselves with the various events and the courses they are run on. Time some of the better cars in the events, or write down the official times as they are announced. They will act as some design targets. Download a full set of results after the event is over. Pick up a program if one is available. Some of them contain data on the vehicles entered. (How accurate those team-reported figures are is, of course a different matter!) Read any and all articles on the competition, and on previous competitions.

While you are there, have a look at the various vehicles. Keep in mind that no vehicle is going to be perfect. Some have some really neat features, while others make you wonder what the students were thinking. Take a look at how well (or how poorly) the teams have integrated the various features into their overall design. Take a look at how well the various teams are organized. Are they still building the car at the competition, or does it arrive ready to go? You can learn a lot just by making some intelligent observations.

At this point it might be wise to interject a bit of wisdom. Racers have a tendency to copy something which is successful. This is certainly flattering to the team whose design is being copied, but therein are some traps. A basic law of motor racing is that the team that wins is the one with the best package during the competition. One need not have the best design, the best driver, or the best organization. To be victorious, one must put all of the pieces together better than one's competition on a given day. When evaluating a winner, be sure to carefully analyze what went into the victory. Was it a superior design, or a clean, simple, basic, but more importantly tested and developed design? Were the drivers trained? Had they gotten seat time in

the car? Was the team well organized? Did they present themselves well? At the same time, don't reject a design feature just because it is on a car which didn't win. It may have a great deal of merit, but in a package which was not necessarily the best on that day. Some features may be great conceptually, but poorly executed. Don't let that stop you from considering them.

At the opposite extreme, many technical /scientific people suffer from what is known as "N.I.H." (Not Invented Here). Having been trained to look for "new" knowledge, they are apt to reject some feature just because it was thought of by another. If you see something which is innovative, or particularly well done, don't be afraid to use it, provided you understand its strengths and weaknesses. Rejecting a feature due to N.I.H. is shortsighted. Acknowledging a great feature, but improving it even further is just good sense! (In the real world, innovations may be protected, and companies acknowledge someone's creativity by licensing the idea from them.)

Those with a research bent are apt to want to see some great new innovation. In motorsports, most successful innovation is introduced incrementally, with new ideas being proven on the test bench or test "mule" (a car which will not be raced, but which is used to test some new idea) before it is ever raced. Student design competitions are no different. If you take a look at those schools which are perennially amongst the top finishers, you may not see great changes from year-to-year. However, if one looks at a car built five years earlier, and one this year, one might see significant innovation. Contrast that with a school which tries to make one giant innovative leap, and then spends the next 1-5 years developing and executing the concept.

While at the competition, be sure to watch the cars on the track. In most student design competitions, performance covers a wide range. In Formula SAE® for instance, look at the car's balance. Is it under/over steering? Why? Watch the sprung mass in roll and pitch. What about the tire's attitude as the car goes around the track? In Mini-Baja®, have a look at how the car handles the various types of terrain: hills, whoops, drops, higher speed, washboard surfaces. (One advantage to participating in **both** Formula SAE® and Mini-Baja® is that it forces you to **think** about the different compromises necessary for each competition. It really makes one go back to fundamentals.) Is the problem with the car or the driver? Videotape a number of cars, and use them as examples of both good and bad characteristics. What areas of the track can you gain time in? How did the various cars do in those sections, and what characteristics are necessary to do well there? (I might add that this is a great training ground, as you won't always see problems in as gross a manner in other forms of motorsports. Then again, those reading this may learn enough to make it hard to see in these competitions as well!)

At this point, one can begin to develop a list of design requirements. These will probably be set based on the points available for various events. Inevitably, in engineering design, there are compromises, as some of the design requirements will conflict. Again, have a look at where the maximum number of points will be gained. Normally, I would require a set of performance targets, which later become the design specifications. At this point in time, the more detailed planning can begin. These include schedules for the various subsystems.

The planning doesn't stop with the design stages. Development requires planning as well. Many student groups are happy simply to have their vehicle up and running, and don't take the time to formulate a proper test plan. (We are assuming here that the car is properly prepared prior to going testing. Nothing is as frustrating as having to spend all day at the test track working on problems which should have been fixed in the shop.) What are you trying to accomplish in the test? Priorities must be set. Note that there is a difference between testing and "playing". The time for the latter is after the car is properly developed.

Leadership:

It would seem appropriate to interject a bit of personal observation. When I was an engineering student in the 1970s, most racing cars were completely designed by a single individual, with perhaps one or two assistants. If one looks at those designers, one sees remnants of that approach even today. Despite the advances in various CAD systems, they still prefer to conceptualize at a drawing board, where they can see an overall layout.

Today, racing cars are designed by teams, using computers. Many of the engineers are really specialists, who have responsibility for a small portion of the overall design. The technical director's job has become much more of a coach/manager than an actual designer. Still, one person **MUST** retain overall design responsibility. That individual has to view the design as a whole, making sure that all of the individual bits are integrated into the overall design. In some ways it is a much more difficult job.

(As an aside, I highly recommend that prospective engineers read the biographies of successful racing car designers. I started reading them while in grade school, and now collect them. These can be books or magazine articles. You can gain a lot of insight by reading about those folks!)

While you're at it, consider this: Leadership positions carry with them great responsibility. Every cadet at Sandhurst (the UK's equivalent of West Point) is taught, "Your men first always; yourself last always". Your mission as a leader is to help your people accomplish their job. Officers don't eat until all of their people have eaten. You personally, only do as well as they help you to do. Bows you take as a team; responsibility for mistakes you take as their leader.

A real balance has to be achieved to be a successful leader of a student design project. Your motivation for seeking such a role may come from the fact that you have a vision as to what type of vehicle you would like to see built, and the drive and intestinal fortitude to actually complete the project. Without that vision and drive, you would never undertake the task. Still, you must accept the fact that these projects are not just about your personal goals, but rather are also about your entire team's. As a leader, your responsibility is to help your team accomplish its goals, even if it means putting those goals above a few of your own. If the entire project is about "you" then one tends to become overbearing and turn your teammates off - and without those folks, you may not be able to accomplish your own goals. This is especially true in an all-

volunteer organization! (I wrote those thoughts some months ago. This evening, 29 August 2000, before putting the finishing touches on this piece in anticipation of posting it, I was in the public library doing research for another project. As I am occasionally apt to do, I picked up a copy of *The Marine Corps Gazette*, and had a look at some of the articles - particularly those on leadership. For a humbling experience, take a look at page 40 of the August, 2000 issue, and ask yourself if you would do the same.) Esprit de corps suffers under selfish, ambitious and/or fraudulent leadership.

Teamwork:

Like it or not, a group of people working together as a team can accomplish a great deal more than any individual. Getting folks to work well together is a real challenge. This is where proper leadership is essential. Regular communication helps. Oddly enough, the most successful student teams I have had the privilege to advise, have had certain common characteristics:

They hung out together. They knew each others' schedules. If one or more members were going to have some examinations which would keep them from working on the car, they would make sure that they had things organized so that someone else could pick up the work. They often helped each other out with their studies. They plain flat helped each other out, period! They all made mistakes, but when one was made, they might have a good laugh about it, console each other, and go about the job of fixing it.

Years later, those groups still keep in contact with each other. I've been to competitions where former teammates get together. Good teams use those folks as an example.

Most engineering students are individualists. Unless they have played some sort of organized team sport, they have been evaluated as individuals, rather than as team members their entire lives. (In academia, working together on a test is usually considered cheating!) The idea of: "if one fails, we all fail" is foreign to most students. These projects are far too complex for one individual to take on themselves, while carrying a full load of classes, working part-time, etc. All of us have experienced a situation where we've seen one student try to do it his/herself. Team members are interdependent, and each job is important. A culture has to be developed within the student group which rewards teamwork. Most successful military organizations strive to impart a sense of teamwork in their recruits. So should you. (Racing drivers and fighter pilots have a strong individualistic bent, but we're not talking about things at that level.)

In the context of my earlier comments, the leader must constantly monitor the project. If someone is falling behind, he needs to find out why. That individual may need some help. If they can't handle the task (or are really slacking off), then reassignments may be necessary. Remember to praise **publicly**, and reprimand **privately**.

Resources:

Your most valuable resource is your people. Everyone has different strengths and

weaknesses. You must learn to take advantage of the strengths, while working to improve weaknesses. Don't forget that these often compliment each other (one person's weakness is another's strength).

Some folks are good at design, others at production or development. Some have the personality traits necessary to raise the necessary funds, while others are born organizers. Part of a teams' challenge early on is to identify those individuals who are best suited to particular missions. (Time permitting; some cross-training can be done.)

I might add that I have always felt that every attempt should be made to involve team members early in their academic careers. If one keeps in mind certain fundamentals (minimum grades, success breeds success, and crawl-walk-run) a steady supply of team members can be produced. These folks have experienced the competitions, worked in the shops machining or fabricating, attended design reviews & test sessions, etc. They know how to successfully work within the academic institution. They gain confidence and responsibility, and are then able to tackle a project themselves. Just as importantly, they've learned about leadership and teamwork. In our heyday at MSOE, we used to try and bring our students along from their freshman year on. It really does work. (This assumes that one has an on-going program. Failure to design and build a car of some sort each year without proper planning can be devastating, as the new team must start from scratch.)

At MSOE, experienced students together with a volunteer member of our mechanical engineering support staff would hold basic machining and welding classes. Students who had

little or no experience could gain enough to become proficient, and the student instructors, got to know the capabilities of their potential team members. Everyone won!

The importance of integrating new members into the team cannot be overstated. In his tome, *The U.S. Marine Corps in Crisis: Recruit Training and Ribbon Creek* (University of South Carolina press, 1990), Keith Fleming takes issue with the long-standing U.S.M.C. belief that stern discipline, as exemplified by immediate obedience to orders, was the overriding factor in combat success.

Fleming points out that the early island-hopping campaigns in the Pacific were characterized by brief periods of intense combat. The units had trained together and had a high degree of cohesiveness. Replacements were generally not available during the campaigns, but were integrated into the individual units after they had been rotated back (as units) to rear areas. This fostered their integration, and allowed the veterans to pass along their experience.

Later in the war, this did not occur. Veterans in the Marianas' campaigns wrongly concluded that the new replacements, which were thrown into combat during the battles, had somehow lost their discipline while aboard ship. Rather, they had not been integrated into the primary units. The replacements had no social identity with their fellow combatants. The veterans felt the same way about the replacements.

Winning organizations point with pride to their history. New members are taught that

history, and are told early-on that they are joining a unique group. The concept is very simple. If you tell an individual that they are going to be a member of a special group with a proud history, they will act according to the standards which have been set. Having been accepted into the organization, they will strive to meet those expectations, and will not let their teammates down. It can be quite contagious! (Not letting your teammates/buddies/'mates down is probably one of the strongest motivating forces in the human spirit, if it is instilled properly.)

If you have an extensive history exploit it. If not, build one. Start by compiling all of the reports, drawings and after race "post mortems" (You do have team members do these, right?) of all the vehicles you have built. These will aid future teams. Gather all of the press clippings on your exploits. These can be used in sponsor hunting, as well as in building esprit de corps. Be proud of your efforts, and show it!

Other resources include funding, machining, fabrication, painting, and test facilities. Here each individual team has to evaluate their needs in lieu of their university culture and location. Some schools have access to more than others. Still while this makes it easier for those who have the access, those who don't, build character by having to overcome the limitations they are given. Winners go out and do it. Losers whine about how everyone else has things they don't. I like to say that when I was a student, we were so successful in the Midwest Mini-Baja® competition because we were too dumb to know that we shouldn't have been competing against some of the larger schools, so we just did it. It took many years for some of those larger schools to take advantage of the resources available to them.

Remember that having access to resources will not automatically make you a winner. In my tenure at MSOE (student and faculty member), we only received direct financial support twice (1979 & 1989). We did receive support over the years from our Student Government Association. Instead, we received a great deal of support in terms of access to facilities, expendable tooling, etc. As a faculty advisor, my travel was always paid for. (I usually traveled with the students.)

Instead we raised our own funds in cooperation (not competition) with our development and alumni offices. It was hard work, but worth it. Don't underestimate the value of a "thank you" with your sponsors. A letter of thanks after the competition, along with a photograph of the vehicle, plaque, or some other item shows your appreciation, and often results in a renewal the following year.

Keep in mind that you'll probably spend whatever you raise. A large budget is nice, but not always necessary. For instance, for two years in the mid-8s, we had sponsorship from a large brewery. Most of our competitors estimated that we received 5-10 times the cash that we actually did, because of our performance, and the way in which we presented ourselves. It is not the money, but rather how you use it that counts.

The Value of Experience:

A lot of folks think that you have to have some sort of racing experience to do well in student vehicle competitions. That isn't necessarily so. If your particular organization is training its own people, you'll find that you'll build the experience you want.

Experience is only good if coupled with a willingness to learn, and an open mind. If not, it can be a detriment. For instance, welding experience is somewhat useless, if the welder does not properly prepare the two pieces to be welded. M.I.G. welding through paint, oil and grease may have its place in the heat of a Mini-Baja® endurance race, but it is hardly what one is looking for when fabricating in the shop. (Even at this level, we're talking about aircraft construction techniques, folks.)

To race, one simply needs a race car, a license, and enough funding to enter. It does not necessarily require intelligence. There are lots of folks in racing who don't fully understand vehicle design or dynamics, but who do things because it is the way that they have always done them. Racing experience doesn't necessarily make you a winner.

What should you look for in racing experience? I would recommend that you look for someone with a hunger to win, and a willingness to do whatever it takes to do so. That means scrapping preconceived notions, thinking things out from fundamentals, and adapting to the particular competition, rather than blindly following some course of action because it works in another series. Look for someone who has learned that race teams are just that - teams. Such experience should be exploited.

The Value of Course Credit:

All student designers wish that they would receive course credit for their work on vehicle design projects. How one might obtain credit varies from university-to-university, and depends on the academic policies of each. In North America, credit for design (as opposed to construction) work is usually given for some sort of capstone design course(s), as required by the Accreditation Board For Engineering & Technology (ABET). Other countries have similar requirements. Likewise, some sort of prerequisite work in vehicle dynamics is helpful, and this can be had from a separate course. It is up to you and your advisor to determine how to go about making it possible within your university's structure.

The ability to receive course credit has its downside. If all of the team members do not have the necessary motivation and commitment to see the project through, then a number of students may take the course because it appears to be "cool" with little understanding of just how much work is really involved. Such students rarely make good team members.

Of course, if you are bringing your team members up from their freshman year on, those who lack the necessary commitment will have seen how much work is involved and are unlikely to register for the course(s). Likewise, the faculty advisor will have some idea as to just who is

motivated to take on the workload, and can accept them into the courses. The others can be directed elsewhere. Another reason for building such an organization!

The Care and Feeding of the Faculty Advisor:

Faculty advisors come in all types. They will have varying degrees of professional and academic experience. Most will not have any motorsports experience. At a major university, their activities with student vehicle competitions may be tolerated, but not supported very well.

It is up to you to adapt to your university culture, as well as to your faculty advisor's needs. If you find one willing to learn, and to work with you, cultivate him/her. If they are doing a good job, show your gratitude, and let his/her superiors know that you appreciate those efforts. It can go a long way.

A good faculty advisor represents your interests when dealing with the university administration. On the other hand, they must also represent the university to you. Do not be surprised if you are occasionally chastised by yours because of some infraction. Advisors don't like surprises, so keep yours informed. Nothing is as disheartening as to be called on the carpet by one's administration for something one's students did, if it comes as a surprise. If you're in the wrong, don't expect any support, but if you are in the right, you can lose your advisor's support if he/she feels that you did something without their knowledge. Seek advice and consent first.

Safety is an area which should never be compromised, and a good advisor is going to look out for yours, even when you don't. That means safe practices in the shop, as well as while testing and competing. I always insisted on safety glasses in the shop, and my students had my permission to remind me if I failed to wear mine. I insisted on going to all tests, as I was the university's representative. No one wants to see a student hurt. If your humanity doesn't convince you of the need for safety, then consider the fact that the easiest way to lose a university's support is to have a serious injury due to unsafe practices.

(By the way, a clean and organized shop is not only likely to be a safe one, but also shows pride and professionalism. You can show it off to your sponsors and potential sponsors. Your university may wish to show it off to prospective students, and donors. Keep that in mind.)

I always told my students that I would seek to pass on my knowledge and experience to them. I would candidly tell them what I thought of their designs, as well as what I thought they should do, if I saw something amiss. Not everyone appreciated that (at least at the time), but most did (if sometimes only later). The only time I ever insisted that my students do something was if it affected safety. Only then did I dictate a result. How they achieved it was up to them (and I was perfectly willing to make suggestions if they wanted them), but they had better make a change. Ditto for academics. I had to tell a few students in my incarnations as a faculty advisor that they couldn't participate in the project until they boosted their GPAs. Most didn't like that decision at the time it was made. Still, if the faculty advisor doesn't look out for his/her students' academic success, who will?

What if you have an honest disagreement with your advisor? I am assuming here that your advisor looks out for you, and has your best interests at heart. (If not, it's time to look for a new one.) Present your case privately to him/her. Make your case, bringing as much supporting material as possible. Many times you can win simply by presenting a strong, well-documented case in a professional manner. Emotional ranting won't get it done. A good advisor will at least take your point under advisement. You may not win, but he/she may thank you for your time, and patiently explain to you why you didn't. Believe it or not, you may have lost the point, but you will have gained much respect in the eyes of your advisor. Avoid pitting another faculty member against your advisor, like some spoiled little child playing his parents against each other. Most of the time it won't work (Faculty members do speak to each other.), but some colleagues might enjoy the ego boost from being used like that, and it isn't going to help your relationship with your advisor. Don't do it.

The Care and Feeding of Competition Officials:

The folks who run SAE competitions are volunteers, who have a particular love for student activities. I have seen a few for whom running a competition was a way to massage their own egos, but fortunately, they are not that common. Good officials recognize that you have put thousands of hours into your project, and have sacrificed grades, sleep, and social lives. They will strive to help you. They will not compromise safety.

Disagreements should be handled in much the same way as those with your faculty advisor. Be professional. Try to get them worked out before you arrive. You may not win, but you will earn respect, which may help you if you have a second disagreement.

Here's a true story. In the late 1970s it was generally illegal in the U.S.A. to wear the original closed-face Bell "Star" helmet while riding a motorcycle. It had received Snell approval, but Bell had not applied for American National Standards Institute (ANSI) Z90.1a, or U.S. Department of Transportation (D.O.T.) approval. The rules for the Midwest Mini-Baja® competition stated that all helmets must carry a Z90.1a sticker. Snell approved helmets were not legal. The rule came about because the safety official worked for Harley-Davidson at the time, and that was the standard for motorcycles. In 1979, I called the late Dr. George Snively, who was the founder of the Snell Memorial Foundation, and explained the situation. Dr. Snively was kind enough to send the official a letter, explaining that he was also a member of the ANSI committee for helmets, and that a helmet which carried Snell approval would easily meet the ANSI standard. He enclosed copies of both standards. Snell helmets were later approved.

A year later, I graduated and went to work for Harley-Davidson. The former safety official was now the competition's organizer, and needed a replacement. He asked me. I like to joke that he had a look on his face which said, "OK wise guy, let's see how well you'll do!" The truth is that he was impressed by how I had handled the situation a year earlier. I served as the safety official for two years, and then as the organizer in 1983.

I might add that a way to ensure a steady supply of good officials is for you to volunteer to serve as such after you graduate. You will see things from another perspective. Get involved!

Building a good student team isn't easy, but it is amongst the intangibles which set those who have participated in such projects apart from those who have solid academic credentials but little else. Work at it. It's worth the effort!

Dick Golembiewski

Dick Golembiewski has seen SAE student vehicle competitions from just about every possible perspective. As an undergraduate student at The Milwaukee School of Engineering (MSOE), he designed and built "Mini-Indy" (the predecessor to Formula SAE®) and Mini-Baja® vehicles. (MSOE was the 1979 & 1980 Midwest Mini-Baja® champion.) He spent part of his senior year working as a mechanic for a local Formula Atlantic team.

After graduation, he was hired by former Brabham/Ford/Shadow engineer/designer Michael Hillman at Harley-Davidson. During this time, he served as the safety official for the Midwest Mini-Baja® competition. He went on to organize the 1983 event, and completely revised the rules.

He was asked by one of his former professors to come back and teach the Vehicle Design Course with him. The resulting car dominated its competition, finishing first in six of eight events. He returned to MSOE to teach, rising to the rank of a full professor, and serving as director of the mechanical engineering program from 1987-89. He served as faculty advisor to the SAE student branch from 1983-89, 1993-96, and to the Formula SAE® team in 1997-98. He and his students were the recipients of numerous awards.

During this time, he began a ten-year tenure on SAE's student activities committee. He was a founding member of both the SAE faculty advisors' council and the student competitions committee. He chaired the latter from 1991-95. He has served as a design judge at the Formula SAE® competition in 1999-2002, 2004 & 2006, the Midwest Mini-Baja® in 2002 and at Formula Student in 2001.

During his tenure in academia, he consulted to numerous firms, and served as a consultant and/or race engineer to local teams competing in F. Super-Vee, F. Atlantic, and S2000. He engineered sports car driver Bill Auberlen's first IMSA pole and win at Elkhart Lake in 1993. He is the author of a four part series on aerodynamics which appeared in *On Track* magazine in 1992.

He left academia, and was scheduled to become director of R&D for a new racing car design/development/manufacturing firm in the Charlotte, NC area. (The first project was to have been a chassis for the IRL.) Unfortunately, that idea was still-born. Most recently, he was director of engineering for Quarter Master Industries, Inc., a manufacturer of racing driveline components. In 2004, he joined the Bimmerworld team in the Speed World Challenge Touring Car series at Elkhart Lake. As of this writing, his drivers finished 3rd (first podium and best career finish), 4th (career best and fastest race lap) and 5th (tying a career-best finish) at Road Atlanta in only his second race with them.

He credits SAE student activities for giving him his start, and is dedicated to helping them grow and succeed.

Afterword

Some folks, either through desire, training, or culture seek to produce work which is acknowledged as "the definitive" in some field. In the area of leadership, it is my contention that very little has really been learned about the subject, simply because we as human beings have not really changed much. Good leaders have practiced the same techniques (adapted to their own needs and times) throughout history. Such thoughts have been repackaged and distributed as new, but when one reads many ancient works, one sees the same basic concepts.

As such, this is not meant to be anything like a definitive source for student vehicle project leaders. Rather, this is a collection of my thoughts and experiences. Those of you reading this will both agree and disagree with many of those thoughts. That is natural. I hope that they at least get you thinking.

Those of you, who might read Dick Marcinko's books, have heard him talk about a concept passed on to him by one of his "sea daddies", which he calls "Barrett's Law of the Sea". Essentially, it says that as you have been helped, so too must you help those who come after you. This requires that you pass along your knowledge. This is no more than what we call mentoring, and is something I have practiced with both my students, and my colleagues. (I remember being new to industry, and later to teaching.)

Every good **teacher** knows that for every answer they think they have found, three more questions are generated. Likewise, the highest compliment that a student can give a teacher is to take the knowledge and inspiration given to them, and develop it to the point where the former teacher must now acknowledge that he/she is now the student.

If you have learned from these thoughts, please let others know. If you take them, improve and implement them, please do the same. Likewise, if you disagree, but take your own thoughts and successfully apply them to this subject, pass those experiences on to those who come after you.

Good luck!

Dick Golembiewski
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