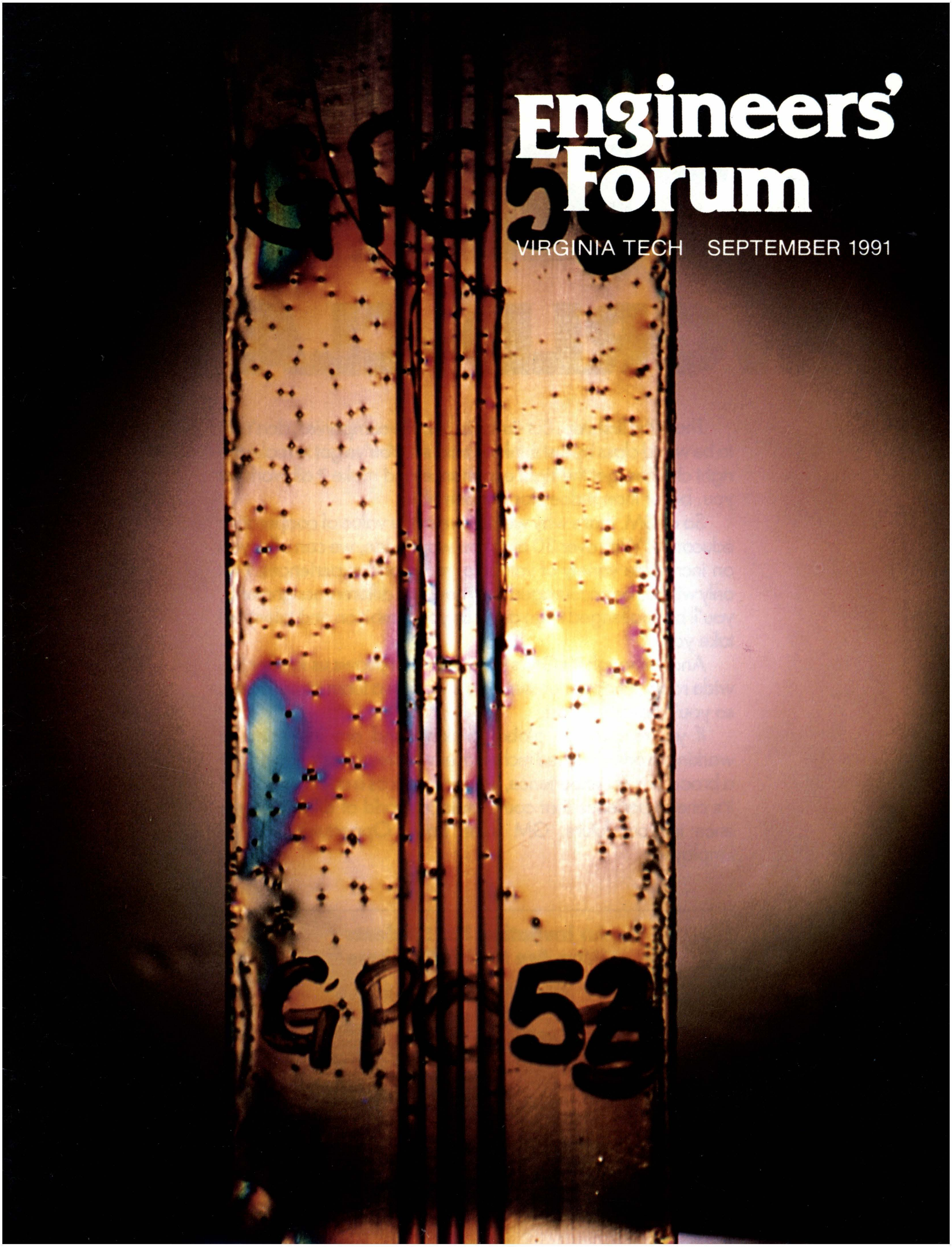
Engineers' Forum

VIRGINIA TECH SEPTEMBER 1991



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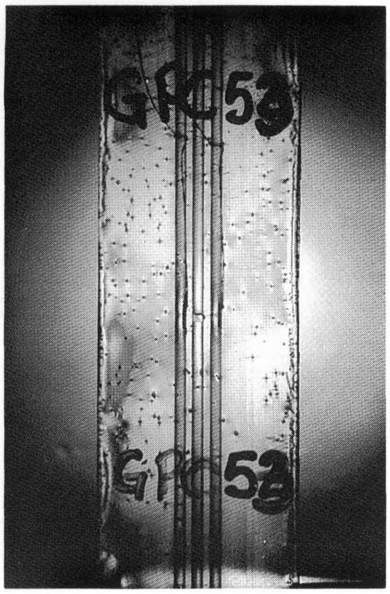

ON THE COVER

Composite materials being strength tested as part of Dr. Wayne Stinchcomb's research at Virginia Tech. Photo by Mark Cherbaka.

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EDITOR'S PAGE

Is the teaching researcher really so bad?

"Recession" — a word we all have heard one too many times in the past year. As economists each give a different view of where our economy is headed, one thing is for certain: It is still extremely difficult to acquire a job.

In these times, emphasis often turns to the quality of education undergraduates who are ready to enter the real world are receiving. After all, when companies are only hiring the best of the best, comparisons tend to be made between different universities as well as between different job candidates.

Quality education filters down through the school system, but in the end it depends on the communication link between the teacher and the student.

Students must be internally motivated to learn a given subject. Hopefully this motivation stems from a desire to comprehend and use the information presented in any given class.

A very important part of the communication process between the student and the teacher is simply how well the teacher can explain information and present it in a somewhat stimulating manner. There are many teachers in this world that are very good at just that. However, at the university level, an aim aside from educating humans is also the enhancement of life through research. This research is largely the responsibility of the teachers or professors of the university. While a large amount of research is conducted by graduated students a great deal of work is the duty of professors.

This raises a commonly debated question: Who is a better teacher — the professor that researches or the professor that is completely devoted to the classroom? One might argue that no professor that spends hours a day researching and studying can be proficient in the classroom. The stress and depression of failed or stagnant research or the excessive adrenaline of successful findings could prove to interrupt the supposedly smooth teaching/learning process.

On the other hand, professors that research are able to stay current with the latest technical developments in their field, thereby allowing he or she to carry this sometimes "state-of-the-art" information into the classroom.

So the question still remains, who is better? Certainly a grumpy, tired professor is not what we would imagine when considering the classroom setting. Occasionally this type of behavior might leak into the classroom, but these professors we are speaking of are professionals and are therefore able to keep research frustrations where they belong — in the lab.

Too often students are quick to blame poor performance in the classroom on a professor, and quite often the complaint is the professor concentrates too much on things outside the classroom — i.e., research. However, a quick look at the teacher evaluation scores filled out by the students themselves indicates that the professors that score highest in the classroom also are extremely productive researchers.

Unquestionably, the main aim of a professor should be to educate students. If this were not the case, who knows where our American universities would be? The teaching researcher is capable of bringing something that the strictly teaching professor may not be able to deliver, hands-on contemporary knowledge.

Until a professor's research starts to take precedent over his or her teaching duties making him or her a researching teacher rather than a teaching researcher, there should not be a concern over the quality of teaching delivered by this individual.

Jonathan Hess, Editor

Kurstedt follows a personal philosophy

by Mary Ann Fallin

Harold Kurstedt received his undergraduate degree in Civil Engineering at Virginia Military Institute in 1961. He then went on to earn graduate degrees in Mechanical and Nuclear Engineering at the University of Illinois. However, for the past 17 years, Dr. Kurstedt has been teaching industrial engineers in Blacksburg the science of management systems engineering.

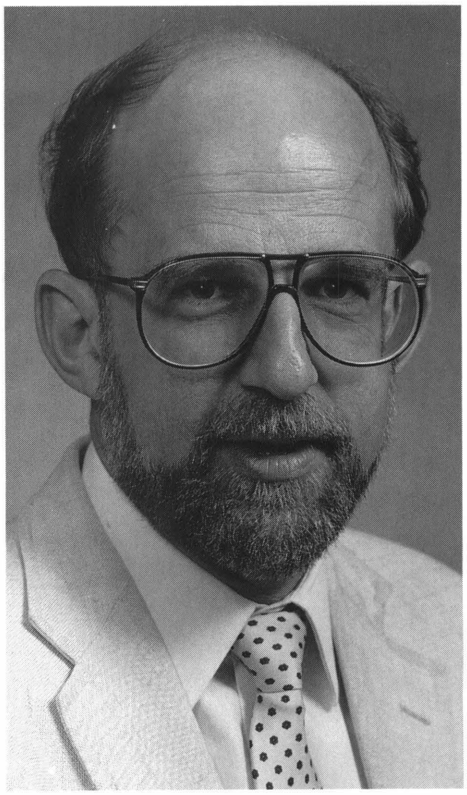
Before graduation from VMI, Dr. Kurstedt received some valuable advice from his department head — advice which subsequently became his philosophy for choosing a career. The advice was to do whatever you want when you graduate, but by the age of 35, you should figure out what you want to do with the rest of your life and do it.

"And that's what I did," said Dr. Kurstedt. "I was in research, I taught at a little school, I taught at a big school, I was in management. I was labeled a mechanical engineer, a nuclear engineer, a civil engineer, and an electrical engineer. Most of the time I was doing industrial engineering. I did all of these things. And when I was 33 I sat down with myself and asked myself what I wanted to do with the rest of my life. I said I want to teach in Virginia. And that's what I'm doing."

Dr. Kurstedt teaches a two semester sequence called "The Application and Design of Management Systems." He was voted "outstanding faculty member" two times by his students in Industrial and Systems Engineering (ISE). In addition to teaching, Dr. Kurstedt is director of Management Systems Laboratory, an industrial engineering consulting firm which is part of Virginia Tech's ISE department.

Dr. Kurstedt describes industrial engineering as the type of engineering where technologically influenced problems are solved using a complete, or holistic viewpoint. "For example," Dr. Kurstedt commented, "the Three-Mile Island problem was not a technical problem. It was only partly a technical problem. It was mainly a management problem." So, what Dr. Kurstedt is really trying to teach with management systems engineering is a generalist approach to the world.

The difference between a generalist and a specialist, he explains, is that the specialist is a person who has a tool and is trying to find a problem to which the tool fits. A generalist, on the other hand, is a person



Dr. Harold Kurstedt

looking for a problem, so that they can find what tool to use to solve that problem. The generalist is more interested in understanding the problem first and then trying to find the right solution. In the real world, people would rather have a mediocre solution to the right problem than a brilliant solution to the wrong problem. Dr. Kurstedt's job is to help students figure out for themselves what the right problems are.

Everyone has a different definition of management. "My definition," says Dr. Kurstedt, "is that management equals decision-making. So, whether you are a two-year-old or the president of a company, every time you make a decision you are managing."

Being engineers, we look at management from a very structured view. A manager can look at responsibilities as a system. The manager converts inputs into output resulting in throughput — everything working to meet a common objective with measures of performance to see how well he/she is doing.

A management system consists of the human decision-maker, a person who manages the physical things you are responsible for (what is managed) and the tools you use to get the information (what is used to manage). If you are going to be successful as a manager, you need these three things to be in balance.

Management systems engineering starts by building everything from human personality traits to organizational culture, to human appraisal of performance. "So, we may take a very structured approach," states Dr. Kurstedt, "but we have a very humanistic viewpoint."

When asked what qualities make a good teacher, Dr. Kurstedt replied, "You have to be thrilled when somebody learns something. When someone understands something that they didn't before has got to be your biggest thrill. If it's not, you have to do something else."

Dr. Kurstedt's desire to teach started before he entered graduate school. "When I graduated from VMI," Dr.Kurstedt said, "What I really wanted to do was teach the eighth grade. I liked that particular age group because I feel that it is the age at which you can make the most difference. It is the age when students are most in transition. And, you can make the greatest change when in transition."

Dr. Kurstedt is not teaching the eighth grade. At the time he received his undergraduate degree, he did not feel that an eighth grade teacher's salary was sufficient to support a family comfortably. (Dr. Kurstedt now has three sons and three daughters).

He is, however, fullfilling his desire to teach, and it is not difficult to see that the industrial engineering students of Virginia Tech are glad he chose them as his pupils.

Childhood hobby grew into career for Bostian

by Andrew Predoehl

For 22 years, Charles Bostian has been lurking around Virginia Tech, teaching and researching. After all this time, what does he have to show for it? Only this: A named professorship, a wall-full of teaching awards, a textbook published in multiple languages, and the directorship of a new research group, the Center for Commercial Space Communication (CCSC). Who would have expected all this from a childhood hobby?

Of course, no childhood hobby alone is responsible, but for Dr. Charles Bostian, Clayton Ayre Professor of Electrical Engineering and IEEE Congressional Fellow, what started as a hobby grew into an enthusiasm for radio, and ultimately a fruitful career.

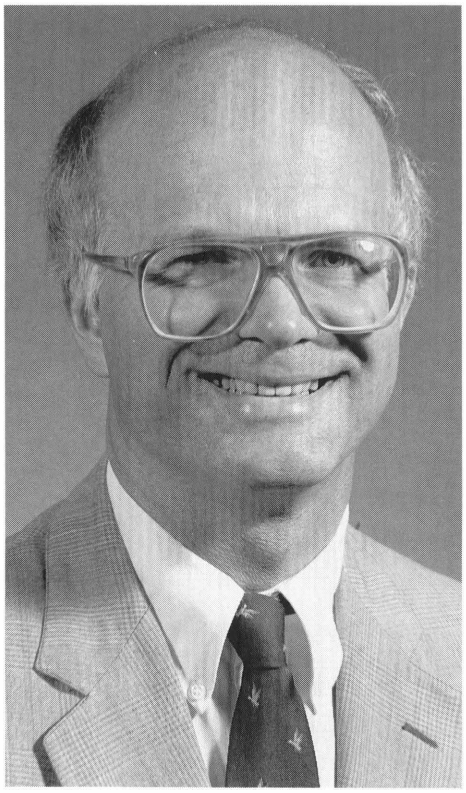
"When I was eight," says Bostian, "my mother got me *A First Radio Book for Boys.*" The crystal receiver he build led him to HAM radio, electrical engineering at North Carolina State for a B.S., M.S., and Ph.D., and then, after two years in the army, to a faculty position at Virginia Tech.

Crystal sets and HAM radios have since given way to antennas and dishes: Dr. Bostian's research these days concerns satellite communication. Specifically, he works with the next generation of satellites, low-earth-orbit satellites, called LEOSATs. LEOSATs are unlike the older and better-known geostationary satellites, since they orbit at 4000 miles, much lower than geostationary satellites, which orbit at 22000 miles. LEOSATs literally represent a new sphere of satellite research.

The New Low: LEOSATs

High orbital space is teeming with geostationary satellites. Like housing in Manhattan, all the good spots were filled early — there are no vacancies. But while geostationary satellites jostle for elbow room at 22000 miles, LEOSATs orbit low, where there is still ample room.

Their low altitude gives them significant advantages. A LEOSAT is cheaper to place into orbit than an older satellite, since the transport rocket doesn't have to push it as high. Further, the signal from a LEOSAT travels a much shorter distance to a ground station; this means that LEOSAT transmitters can afford to be less powerful (for example, if you stand closer to me you don't need to yell as loud).



Dr. Charles Bostian

Unfortunately, LEOSATs are always on the move. A typical LEOSAT will fly over a point on earth some two or three times a day, and one passing overhead can only communicate with a ground station for six to ten minutes while it is visible to a radio antenna. The challenging research problems emerge from this quandary: how do you listen and talk to a satellite rushing by?

Tech's Space Research

That problem is something the Satellite Communications Group investigates. Consider designing an antenna to receive LEOSAT transmissions. Will this antenna track the satellite when it is overhead? Or, will it be an omnidirectional antenna? The first solution is complicated and costly, and the second compromises reception due to less gain.

There are other challenges. LEOSATs typically transmit their radio waves at UHF and VHF frequencies, or 130 to 1500 MHz, and the noise environment in that frequency range is still being explored.

Propagation, or how the waves travel through different obstacles, is another major concern: how well can you receive a signal from inside a building? How well can you communicate when the satellite is near the horizon and obstacles block the way? How does the atmosphere itself affect communication? Furthermore, just how does the satellite motion (the Doppler shift) affect the radio signal? These are the topics that satellite researchers, including Bostian, study.

While the Satellite Communication Group investigates these questions, the CCSC exists to help put the results into use. CCSC works with industry to help develop commercial products that utilize LEOSAT technology, and Bostian, as executive director, handles CCSC's relationships with industry and government.

For too long, he says, hardly anyone in this country (except the military) spent money developing consumer satellite-technology products. Bostian says, "I think it's important that we redirect our efforts toward end products also" to help American business rebuild a stake in consumer electronics, at least in products using satellites. Thus, CCSC not only helps apply new research to practical uses, it encourages American industry to start expanding into this new market. "I'm excited about what I'm doing now," he says.

Global access is the running theme through these new devices. Some of the products you will be seeing include a cigarette-pack-sized device, made by Orbcomm, that satellites can track. Someone far from a phone, say a mountain climber or camper, who carries it can call for help and can be

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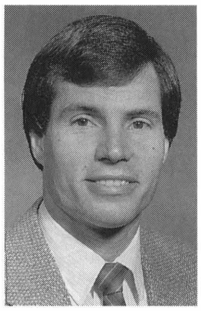
Reinholtz strikes a balance between teaching and research

by Stephen Payne

For any professor, excelling in both teaching and research is no easy task. Some would rather not have their on-going research habits interrupted by mandatory teaching schedules, while others would rather spend time in the classroom and possibly let some graduate students carry a bit more of the workload.



Dr. Reinholtz

The duty of continuous research is always important. Just as important as the mix between teaching and research duties is the involvement of undergraduate students in the research realm of the university. Dr. Charles Reinholtz, an associate professor of mechanical engineering at Virginia Tech, is just one of many professors who has done his best to do his part in this area.

There is proof of this: awarded the Presidential Young Investigator Award in 1987, Reinholtz continues to do research. This prestigious award is given by nomination to persons excelling both in teaching and research at the university level, and gives a five-year grant of $25,000 per year to the university, as well as up to $37,500 for matching industry money. Thus, it serves to foster university and industry interaction, something very important to both parties.

Besides this award, Reinholtz is consistently a highly-rated instructor by his students. Since the completion of his thesis in 1983, on the optimization of 3-D mechanisms, Reinholtz has enjoyed working with students. He enjoys teaching, especially at the undergraduate level — his favorite classes being Kinematics and Robotics — probably not coincidentally the primary areas of his research.

Also, he likes to think of the university as an "open learning environment." More than anything, though, beyond any other accomplishments he hopes to achieve, he wants to do a good job and earn respect from his peers.

Currently, as most professors are, Dr. Reinholtz is involved with several different projects at the same time. For one, he, along with several graduate and undergraduate students, is working in tandem with Babcock & Wilcox in Lynchburg, VA to develop a new type of robotic manipulator arm. This arm would operate inside the steam generator of a nuclear power plant and perform maintenance and inspection on the tubes within the heat exchanger that provide the feedwater for the cooling of the reactor core.

Also, he works with Nautilus, again with several graduate and undergraduate-level students, doing work on cam design and kinematics. This work serves to improve the design and efficiency of some of their exercise equipment.

He has also been involved with Windward International, improving the design of their extruder screws — experimenting with different types of helical threads.

In addition, Reinholtz has received a National Science Foundation grant to do work on a variable geometry truss based crawling machine. This is a mechanism where different geometries are utilized to form a machine with the highest degrees of freedom possible.

As mentioned earlier, almost all of Reinholtz's research is done with the help of several graduate students and undergraduate students. Often these projects are in conjunction with a few other professors as well.

Another sponsor of a lot of the work is the Virginia Center for Innovative Technology (CIT). The Center has co-supported most of the work with industry, especially the work with Babcock & Wilcox and Windward International.

Another recent project is the involvement of companies with the Senior Design course for Mechanical Engineers during the undergraduate's final year. This past year, for instance, Tennessee Eastman worked with students and some other faculty members to complete their senior design requirements. This provided the undergraduate

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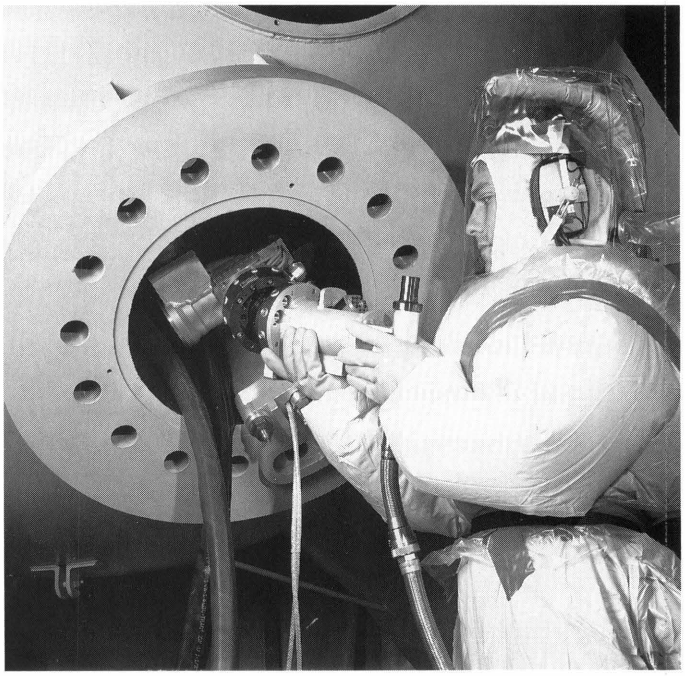


A worker for Babcock and Wilcox, wearing a radiation suit because he is inside a steam generator, installs a robotic manipulator arm. The manipulator performs maintenance and inspection on flow tubes in a heat exchanger, located in an irradiated environment. Photo courtesy of B&W.

Johnson regards life as 'a sort of continuing education'

by Robin Elder

"You might be aware that Virginia Tech is very strong in materials, and composite materials in particular amongst many departments here: spanning from Chemistry in Arts and Sciences to the departments of Chemical Engineering, Engineering Mechanics and Aerospace — there (are) a lot of people that are involved with composite materials," said Dr. Eric R. Johnson, associate professor in the Department of Aerospace and Ocean Engineering (AOE).

Dr. Johnson is not just any professor, but is also a teacher who always scores "very high" on both student and peer evaluations of his work, said Joseph A. Schetz, head of the AOE Department.

Johnson has been lauded as one of the "finest composite structuralists," by coworker Rakesh K. Kapania, associate professor in AOE. Another of Johnson's peers, Raphael Haftka, chaired Professor and scholar in AE, feels Johnson is "very thorough" and "a good person to work with."

Johnson's realm of expertise can be dubbed "the buckling of structures, including plates and shells fabricated from composite materials." However, said Kapania, Johnson stands out by his focus on the "use of (these) materials in real life structures. He's one of the first to study the problems of changing from many to less plys in composites."

In airplane wings, for example, more plys are needed at the root of the wing than at the tip. In this area, Dr. Johnson's research revolves around what happens to the stress concentrations in the area where the ply is dropped.

One of his graduate students has recently finished a study in another area: delamination. Said Johnson, "He worked on extracting more information out of a finite element code than just the raw displacement data and, say, the raw in-plane stress data. It turns out that (with) composites, one of their favorite failure modes is to become unglued, or delaminated. That's a nasty problem because all vehicle structures are primarily thin-walled and you'd like to carry the stresses in the plane of the structure. Near stress concentrations, and even near a free edge, you can develop what used to be called 'secondary stresses,' stresses through the thickness that don't matter much for isotropic, metallic materials."

> **"I think when you're a teacher, the (important) thing is that you can keep on learning."**

In composite materials, however, "you're confronted with one of the major limiting stress states of these structures."

"I think the big thing in aerospace structures is to provide the minimum weight structure with new materials, which will be some composite of course. It used to be that a lot of design work was based on experience. You would calculate stresses approximately and say, 'we'll multiply them by 1.5 and we'll do this' — which was fine. But now you can actually get in and do some of the science behind that. You can minimize weight and yet keep the strength up. You can talk about complicated effects like stress concentration, fatigue, and actually handle some of these things mathematically with, of course, the computer. The analytical capabilities now are actually getting to the point where (we) can actually design these very complicated structures using just basic good old science, and I think that makes it interesting."

Johnson regards his life as a sort of continuing education, enhanced by the university atmosphere. "I think when you're a teacher, the (important) thing is that you can keep on learning," he said. Research enables him to do just that. "When you do research, you like to come up with new ways of doing things, maybe an innovative approach or something new and novel, something comparably useful. But I think along the way you learn a lot — through interacting with other people, other faculty members, (and) students."

Dr. Johnson graduated with a B.S. in Mechanical Engineering from the University of Michigan during the Vietnam War. "If you didn't get a job they had one for you," he remembered. "I didn't want to go to school anymore. Matter of fact, I was kind of disillusioned with mechanical engineering," he said. "It was too 'hands on' in some sense — not enough science for me."

Johnson accepted a position with Vickers, a division of Sperry-Rand Company. "It was an interesting job because I could go around to different divisions and do a lot of analytical-type work. If I went to a large company, I think I would've been buried in some really applied group," he said. "When I got this job with a smaller company, I really got a chance to do a little bit more analysis."

Immediately after earning his Ph.D. in Applied Mechanics from Michigan in 1976, Dr. Eric Johnson arrived at Virginia Tech's Engineering Science and Mechanics Department.

Five years later he transferred to Aerospace and Ocean Engineering where he now conveys his knowledge in Aerospace Structures and Stability of Structures. To graduates, he lectures on Elastic Stability and Vehicle Structures. "Whatever he knows, he makes sure you know," commented Kapania. "Maybe that's why he gets such good teacher evaluations."

Schetz said that Johnson's performance is not a recent development. He has received "very consistent, very good ratings" from the beginning. Eric Johnson "always does really

Dr. Johnson holds a piece of composite material.

well." Said Haftka, Johnson has a "great physical understanding of mechanics, in particular in the mechanics of solids. He's very good at manipulating the basic equations of mechanics without having to run to the computer to do finite element analysis."

A lot of people in the area Johnson works in, continued Haftka, have sort of abdicated the responsibility of concentrating on the specifics of the equations with which they're working. Dr. Johnson has a "combination of an understanding of mechanics and of the lost art of manipulating equations."

"I had a strong desire to teach when I was a graduate student," Johnson said. "One thing that always irritated me as a student was the poor quality in the way some of the descriptions would come off." While a teacher's assistant for a "big team-taught course" in computers, he handled the recitations for one of the professors. "I came to the conclusion that I could explain the things better than the professor could," he said. "I could decipher and make them simple."

Johnson expressed irritation towards a high school teacher who "gives awful difficult problems, almost to the extent that it bewilders (the students), makes them scared of the subject."

"I read an article the other day that said that all engineering courses are dull and boring, and that bothers me too. I don't think they need to be that way," said Johnson. One of the weapons he uses to combat this is his 'dry wit' — often a subtle twist placed expertly in the midst of important material. When asked to comment on this humor, Johnson chuckled, glancing down at his desk. Hints of the once-shy child, afraid of getting beaten up on the playgrounds of Detroit flashed into view.

On student evaluations, he began, "Oftentimes I get a comment (saying) that, 'he interjects humor occasionally.' That's just my personality. I think it's important, particularly in structures. People in this area tend to get very serious about what they're doing because they're liable. You're the person who's got to sign off on a drawing that certifies the airplane. It's very serious work. We want to calculate things correctly and do things correctly, but, by the same token, I don't think we have to be stodgy about it."

Johnson's goal is to "create an atmosphere that's not intimidating, one in which any question "that would come to mind" can be asked. When someone asks a question, he explained, the teacher can see where the problem is.

Johnson likes to talk to students, hopefully, he said, to try and get some feedback. "I usually feel satisfied with teaching if I can find out where the students are, meet their needs, and yet cover all the material that's required. Then I think I did a good job."

He said the teacher who stops trying is a bad teacher. "I don't think I could just teach and not do research," said Johnson. "I think you have to do both. I don't think people should be at a university like this if they just wanted to teach."

He believes people instruct differently with the knowledge of what's happening on the outside, what the current problems are and how others attack them. "If you don't have that kind of input, I don't see how you can effectively update your curriculum. You have to stay current in engineering. You can't just sit in Blacksburg. The rest of the world goes on — you gotta go with it."

Earthquakes pose challenges for Tech researchers

by Mike Reese

Following the earthquake which struck San Francisco in October of 1989, the country was reminded of the damage which a natural disaster of this caliber or greater could cause. Americans saw the destruction which transpired on this heavily populated and industrialized city and knew that precautions had to be taken to prepare for the next event of this magnitude.

Some of the researchers given this challenge are affiliated with Virginia Tech. They are: Dr. Wayne Clough, dean of engineering, assisted by Dr. James Martin, assistant professor of civil engineering. They are part of a team recruited by the National Science Foundation to commence research in the prediction and effects of earthquakes in the future.

The earthquake which hit California may have been a disaster to the citizens and industry, but for the engineers it was a new place to gather data. Dr James Martin said, "Every earthquake is a database. It explains what happened by current theory."

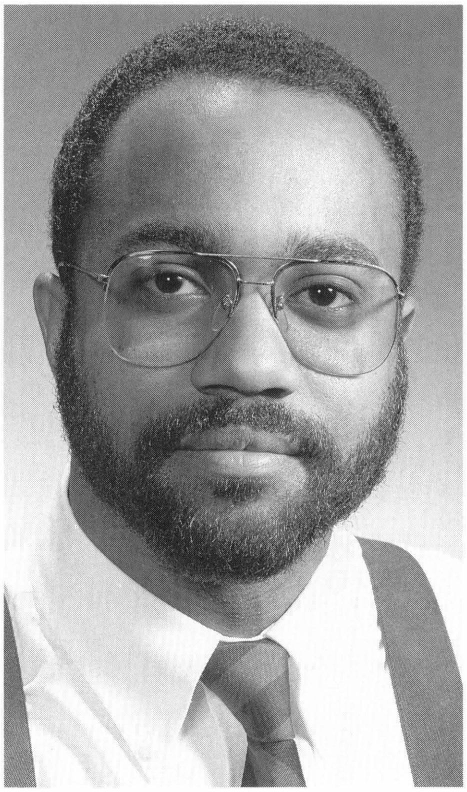
After the earthquake, engineers were rushed to the site to examine this new natural laboratory, allowing them to check old theories and then formulate new ones.

During the earthquake at San Francisco, major damage was done by soil liquefaction, which is when saturated ground temporarily loses its strength. These periods range from a few seconds to a few hours. It becomes much like quicksand. This effect is only seen in soft soils like sand; hardrock in the East does not have this liquefaction as a characteristic. Much research is therefore concentrated here to discover why this phenomena occurs.

Another problem similar to liquefaction is amplification. This is simply when the ground shakes like jello. Both of these can cause large scale damage, thus it is evident why research is needed in these areas.

The recent earthquake was one which could be studied immediately, but what information was used before? Dr. Martin says that previous earthquakes, before records were taken, are the only source.

When soil undergoes liquefaction, holes are created where water has sprouted from backed up pressure. These holes fill up in the following weeks after the quake with organic materials such as leaves. Many years later these materials can be dated using systems like Carbon 14 dating, giving a system for discovering cycles, thereby aiding in the prediction of future quakes.



Dr. James Martin

These holes left from prerecorded earthquakes are a link to the past. Since earthquake have been scientifically studied, there has not been a catastrophic event to research from the East. This also means that there has not been an earthquake to alarm people. Although there has not been a large quake in the recent past, this does not imply there will not be future occurrences. The liquefaction holes found in the East prove that large earthquakes exist and only occur on a larger cycle, about every several hundred years.

The reality is that the East and West have an equal seismic risk. Seismic risk is generally the amount of damage left after an earthquake strikes. The West has earthquakes which are generally larger, but the affected areas are not as densely populated as in the East. The East's smaller earthquakes not only hit larger and more dense areas of population, but the geologically older rock carries the shaking more efficiently, almost ten to 30 times greater.

This means that an earthquake's effect is felt further away from the epicenter, the actual site of the quake. This dying out effect is called atinuation. Atinuation and population density are not the only compositions of seismic risk.

Architectural structures are large factors in this risk. Since the industrial revolution and the building of large structures, the East has not had a quake to test the structures which have been standing for many decades. The West, being under the constant scare of a disaster, has strict building codes to help prevent large scale damage and death. Thus even if an earthquake was small, the weaker structures of the East would not be able to handle the large stresses put on them.

This can be very dangerous when these structures enclose toxic materials or nuclear reactors. Dr. Martin was called upon by a nuclear reactor plant in Charleston, SC, to give a prediction on the size of an earthquake to be expected, so a building can be built strong enough to handle the strains put on it, and still keep toxic material encased.

Once again there has not been a large scale earthquake measured in the area, so the only information is that which foregoing earthquakes have left behind. This gives into quantitative engineering parameters, when instruments were not here to give informa-

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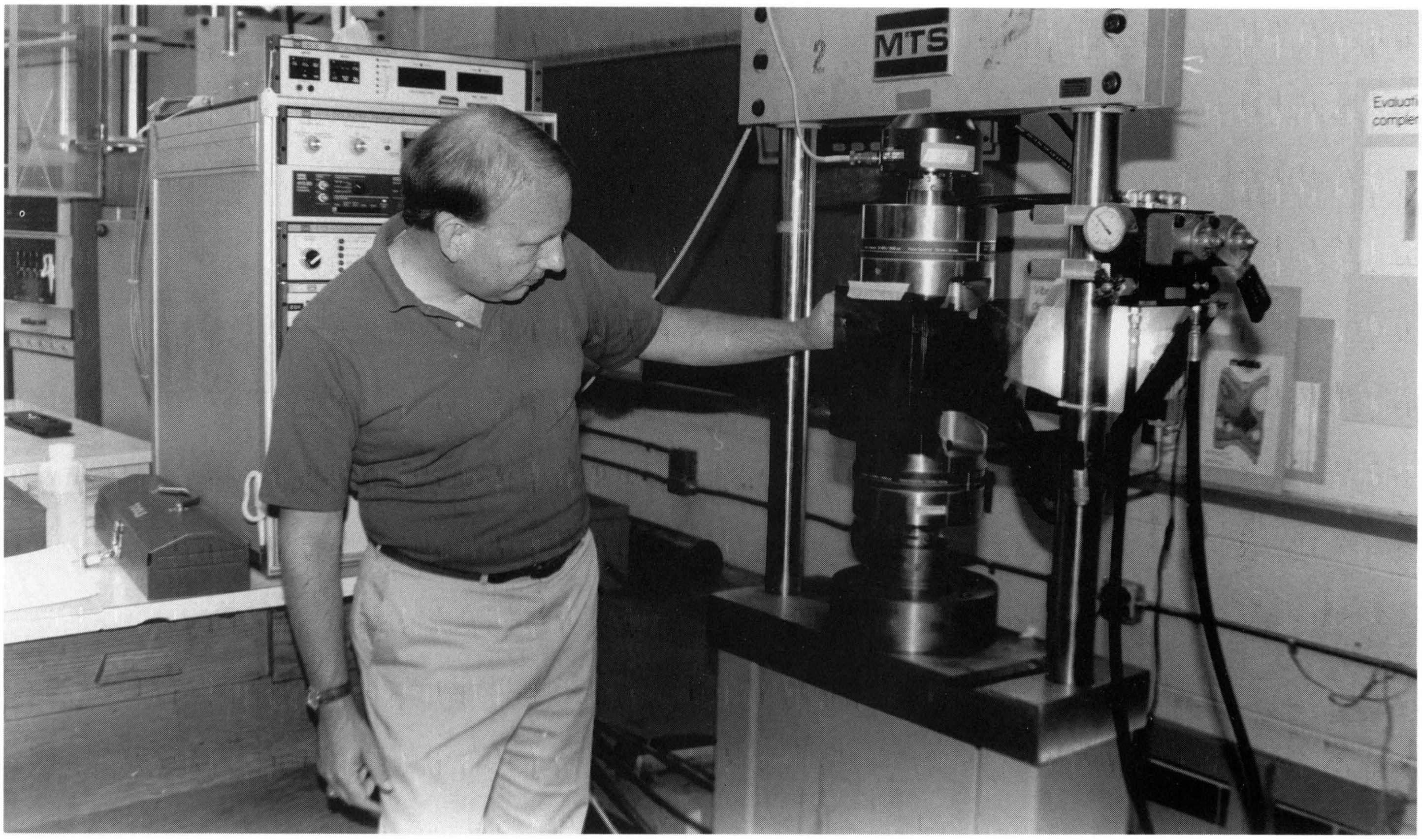


Dr. Stinchcomb checks compression/tension test equipment.

Stinchcomb stresses the personal element

by John Cole

According to Professor Wayne Stinchcomb, "Teaching should be viewed as an investment in our future." Stinchcomb is a professor in the Engineering Science and Mechanics Department, teaching core classes such as statics, dynamics, and deformables and upper-level classes such as mechanics of materials and mechanical behavior of materials.

One element he stresses in his classes is the ability to get to know his students as people and to set good relations with them. He believes this greatly contributes to the students ability to willingly and effectively learn.

Stinchcomb graduated from Virginia Tech in 1965 with a B.S. degree in engineering mechanics. Then he went on to co-op at NASA during his years at Virginia Tech. Next he went to Penn State, where he received his M.S. degree in 1967 and his Ph.D. in 1971, in the field of engineering mechanics. While at Penn State, Stinchcomb gained experience teaching engineering mechanics.

He joined the faculty of the Engineering Science and Mechanics Department at Virginia Tech directly following his work at Penn State. Presently, Stinchcomb is Chairman of the Center for Composite Materials and Structures here, which is an organization for research and education on composite materials, containing 55 faculty members.

Stinchcomb has dedicated many hours into research and studying composite materials, trying to achieve high strength to weight and stiffness to weight ratios in materials. In studying materials he usually deals with fiber-reinforced materials such as fiberglass.

Some of his work has been with the Aerospace Engineering Department, working on a high-speed commuter plane which would have to be fabricated from new materials, able to withstand higher temperatures and be lighter and more economical. His present research efforts are in the field of long term composite materials behavior, concerning the properties of composites that control long term behavior.

He has won many awards for his teaching and research excelence and had publications in the field of composite materials, including the Sporn award in 1974-1975, and two teaching excellence awards.

Additionally, in the Engineering Science and Mechanics Department, Stinchcomb has been honored with the Frank Maher award and the Outstanding Educator Award.

His various publications discuss the mechanics of composite materials and the research done on them.

Outside his involvement with the college, family is Stinchcomb's first priority. He and his wife Grace, and two sons, Adam and Matt, are active in family and church activities, being members of the Blacksburg Christian Fellowship.

Bostian *Continued from page 4*

located anywhere on the planet.

A much bigger project is Motorola's proposed global portable-telephone network. Interconnected by 77 LEOSATs, the network would allow an individual to have a global telephone number. The portable phone he or she carries would work anywhere on earth, and would allow instant communication with anyone else near, or carrying, a phone.

Back down to Earth

Despite such lofty, still speculative plans, Bostian's other role of professor keeps him well-connected to Tech's students. In his research, he supervises an undergraduate and some half-dozen graduate students, and he often works with several faculty members.

In addition, Bostian always teaches one class per semester. In fact, Bostian has done so well at teaching, he helps explode the myth regarding faculty that strong researchers are not strong teachers. In 1978 he received the recognition of the Virginia Tech Academy of Teaching Excellence, and in 1982 he received the William E. Wine Award for Excellence in Teaching.

Furthermore, like all the professors profiled in this issue, last year his student evaluations rated him above a 3.5 (out of 4); only 81 in the college received such a high evaluation.

"Research forces me to be current in my field, and it's a source of examples and problems," he says. Bostian enjoys teaching, and explains that he would lose contact with the students otherwise; furthermore, his student contact is the source of research assistants. All the students that work as research assistants for him were once in his classes. Thus he finds that the two roles complement each other: "I think for me they couple very well."

Bostian usually teaches undergraduate courses, and, in particular, he enjoys teaching the fundamentals of electrical engineering, such as networks and fields, as well as the more specialized courses, such as radio engineering, microwaves, antennas, and of course, satellite communication.

The Future

For satellite technology, Dr. Bostian says the trend will be portability. Although optical fiber has mostly replaced satellites for traditional communication, products providing portable communication will require satellites.

How much more satellite research will there be? Consider this: After the satellite boom in the 70's, satellites seemed all figured out. And they were, too, at least regarding geostationary satellites. LEOSATs reopened that field, and after researchers answer all their questions about them, who knows what will be the next hot topic?

As for his own future, Bostian has less doubt. "I've been here 22 years," he says, "I plan to be here." If the next two decades are like the first, Dr. Bostian will continue to be a distinguished teacher and researcher, and will continue to be an asset to Virginia Tech engineering.

Reinholtz *Continued from page 5*

students an invaluable opportunity to interact on a more professional level with their professors and other engineers.

Besides all of this, Dr. Reinholtz always looks forward to getting away from it all (as best he can) with his family each year. For the past four summers, he has worked at Milliken in Spartanburg, SC, for a period of four to five weeks.

Besides all of the standard publishing, reviewing, and the other "standard" duties of a university professor, he has found enough time to serve on several committees, and remain active in the senior section of the American Society of Mechanical Engineers.

Dr. Reinholtz admits to probably liking teaching better, but maintains that "research is more or less just like teaching. You take a project, spread around the information, and get to learn from it and make more out of it."

He stresses the importance of working with students on research as well. He says that graduate level students are naturally extremely important and likes to have good relations with them, since they are an important part of the educational process.

When the time comes for undergraduate students to research, things aren't always as easy as he would like them to be. He believes his students always do good work, but sometimes it is hard for them to walk right in: It is often difficult to outline the work in the limited amount of time available. In the right situations, things work out great for him and the students, and that it is a very good experience all around.

With all of the research that is done at Virginia Tech, sometimes the light at the end of the "educational tunnel" is blurred. However, with this combination of research and teaching, involving both graduate and undergraduate students, providing an invaluable opportunity to experience more than just the classes themselves, Reinholtz is one of many who firmly believe in the importance of the "practical and applied," in conjunction with the "theoretical and the learned."

Earthquakes

Continued from page 9

tion, history builds the information instead.

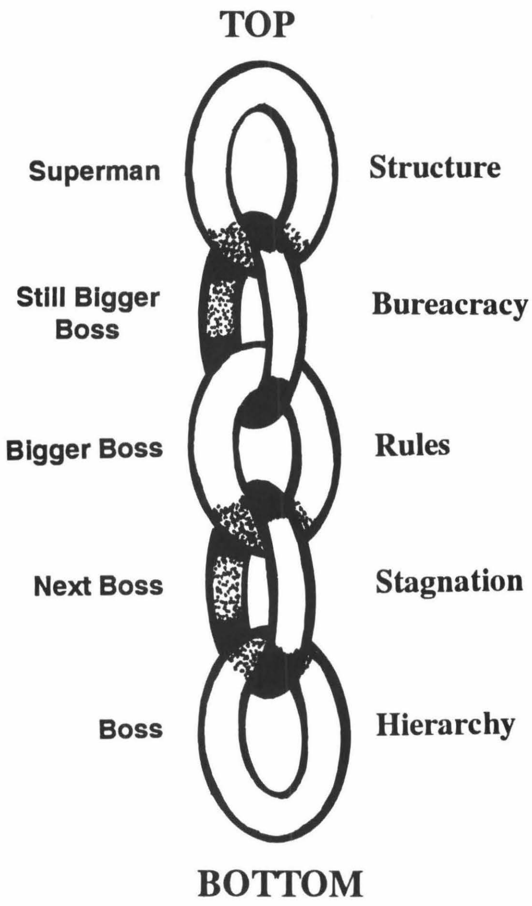
Engineers have a challenging problem facing them with earthquakes. There is limited data, and the data given must be digested quickly yet also thoroughly. With small links to the past, engineers have a difficult future planning new structures which will be capable of handling the great forces of coming quakes. It is not only laborious predicting the size, but time-consuming as well. Finding cycles and warning signs are just as complicated, yet also necessary. They are needed to warn people to seek safer places and to take proper precautions.

There is much still to learn about earthquakes, but there is a small amount of information to study. As Dr. Martin said, "These small things are all we got."

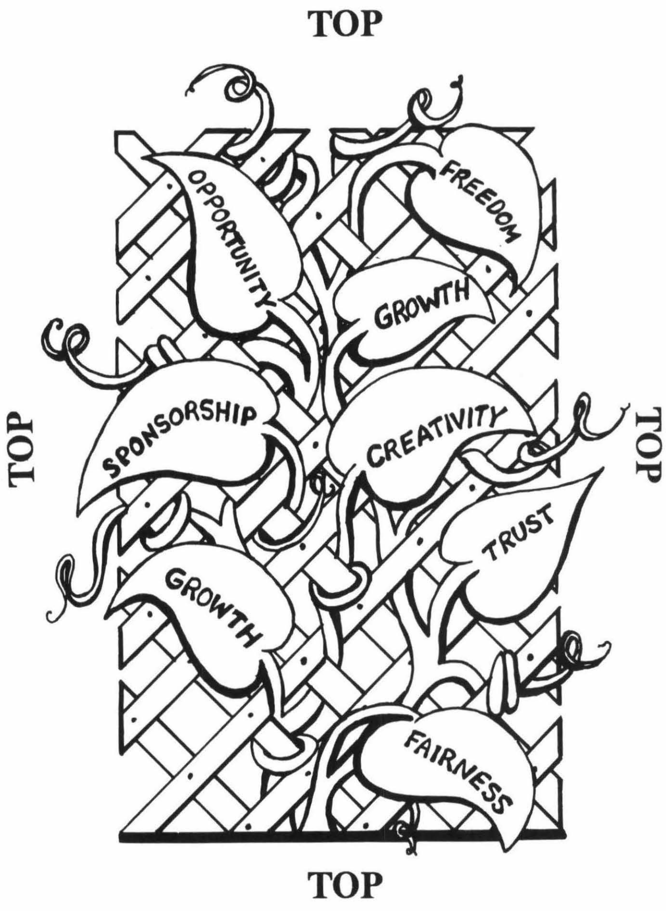
A Short Course on Business Organizations

(or "Why I might consider working for W. L. Gore & Associates, Inc.")

Chain of Command System



Lattice System



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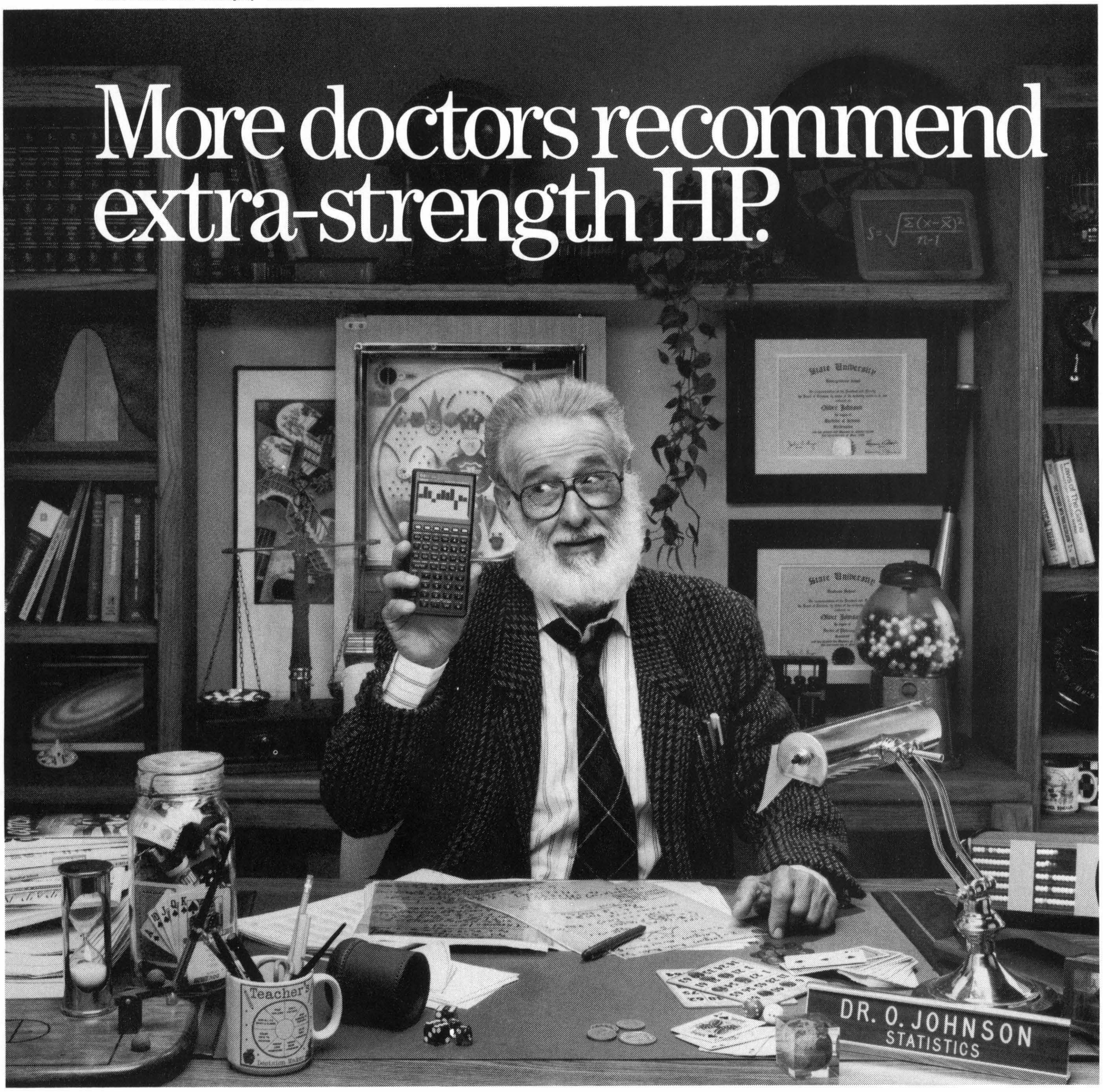

More and more PhDs across the country are recommending Hewlett-Packard financial and scientific calculators to their students. And for some very strong reasons.

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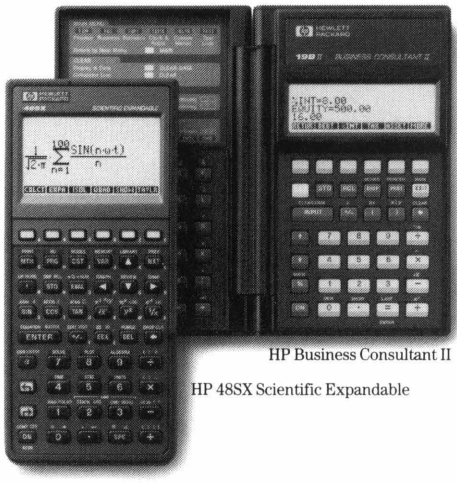
"The HP Business Consultant II has an equation solver and extensive math functions. These free the students from computational tedium so they can think and interact on a higher level," says Dr. Lee V. Stiff, a professor of math education at North Carolina State University.



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Society Name: **ASM International**
Associated Major: Materials Engineering Mining Engineering

ASM International serves the needs of Material and Mining Engineers. The Virginia Tech chapter participates in activities such as technical speakers, banquets and other social activities.

Society Name: **The American Institute of Aeronautics and Astronautics**
Associated Major: Aerospace Engineering

The American Institute of Aeronautics and Astronautics is open to any student with an interest in aerospace. AIAA participates in picnics, conferences, speakers and other technical activities.

Society Name: **American Institute of Chemical Engineers**
Associated Major: Chemical Engineering
President: Brian Flack

The American Institute of Chemical Engineers introduces new students to the professional world of Chemical Engineering. The society also determines the various needs of Chemical Engineers and implements changes and improvements.

Society Name: **American Nuclear Society**
Associated Major: Any
President: Glenn Dentel

The American Nuclear Society is open to any student or faculty member interested in nuclear power. The society participates in various activities.

Society Name: **American Society of Civil Engineers**
Associated Major: Civil Engineering
President: Eric Haukdal

The purpose of the American Society of Civil Engineers is to get students involved with extracurricular civil engineering activities such as concrete canoe and steel bridge design and construction. The society also sponsors guest speakers, plant trips, social activities, and promotes faculty-student interaction.

Society Name: **Biomedical Engineering Society**
Associated Major: Any
President: Alan Williams

The Biomedical Engineering Society assembles undergraduate, graduate students, and faculty who have an interest in the application of engineering in medicine. The society disseminates information about events and publications and organizes lectures, videos, tours of facilities and social events.

Society Name: **Human Factors Society**
Associated Major: Industrial & Systems Engineering
President: Barry S. Grant

The purpose of the Human Factors Society is to promote the study of human factors, which is an interdisciplinary field concerned with designing systems and products that are safer and easier for people to use. Membership is open to any student or faculty member.

Society Name: **International Society of Hybrid Microelectronics**
Associated Major: Electrical Engineering, Computer Engineering

The International Society of Hybrid Microelectronics is active with hands-on projects in the hybrid lab, plant trips, speakers, newsletters, attending regional and international symposia and social events.

Society Name: **Institute of Electrical and Electronics Engineering**
Associated Major: Electrical Engineering
President: Pamela Leadbetter

The Institute of Electrical and Electronics Engineering acts as a liaison between students, the faculty, and the electrical engineering industry. It provides opportunities to attend lectures presented on a variety of EE concerns and opportunities for "hands-on" work with projects like the IEEE robot car.

Society Name: **Institute of Industrial Engineering**
Associated Major: Industrial & Systems Engineering
President: Jennifer Haight

The Institute of Industrial & Systems Engineering is promotes the field of Industrial Engineering and informs students of available opportunities. The society is active with picnics, meetings, speakers, plant trips and social activities.

Society Name: **National Society of Professional Engineers**
Associated Major: Any

OF SOCIETIES

President: Cherie Leffler

The National Society of Professional Engineers promotes professional awareness and responsibility in addition to discussing and demonstrating ethics in engineering. The society encourages all engineering students at Virginia Tech to professionally register by emphasizing its importance in a student's engineering career and through a cost sharing plan for the E.I.T.

Society Name: **Operations Research Society of America**
Associated Major: Industrial & Systems Engineering

The Operations Research Society of America organizes and encourages the exchange of information related to Operations Research, the discipline which deals with the application of scientific methods to decision making and allocation of resources. The society is involved in seminars, symposia and social activities.

Society Name: **Professional Society of Asian Engineers**
Associated Major: Any
President: Jeffrey Tao

The Professional Society of Asian Engineers provides Asian engineers with a forum in which they can help one another in the engineering field. The society also promotes professional growth among Asian engineers.

Society Name: **The Society of Automotive Engineers**
Associated Major: Any
President: Derek Whitehurst

The Society of Automotive Engineers, comprised of over 50,000 members worldwide, joins engineers to work together to further research, design, manufacturing and the utilization of land, sea, air and space vehicles.

Society Name: **Society of Engineering Science**
Associated Major: Engineering Science & Mechanics
President: B.T. Owen

The Society of Engineering Science provides a fellowship for students from multidisciplinary fields of engineering by joining sciences like math and physics with engineering technologies such as mechanics, fluids and materials to achieve a common goal. The society is also involved in activities such as trips, speakers and social events.

Society Name: **Society of Manufacturing Engineering**
Associated Major: Industrial & Systems Engineering
President: Keith Imlay

The Society of Manufacturing Engineering promotes and discusses topics in the manufacturing industry. The society is involved in plant trips, speakers, social events and other activities.

Society Name: **The Society of Women Engineers**
Associated Major: Any

The Society of Women Engineers is dedicated to informing the general public of the achievements and opportunities available to women engineers. The society also encourages women engineers to attain high levels of education and professional achievement and acts as a center of information for women in engineering.

Society Name: **Triangle Fraternity**
Associated Major: Engineering, Architecture & Scientists
President: Jim Maino

Triangle is a national Greek social fraternity. Membership is restricted to engineers, architects and scientists. The organization offers many unique opportunities. Brothers of Triangle participate in regular social events covering a wide range of activities, and maintain a proper balance of academic excellence.

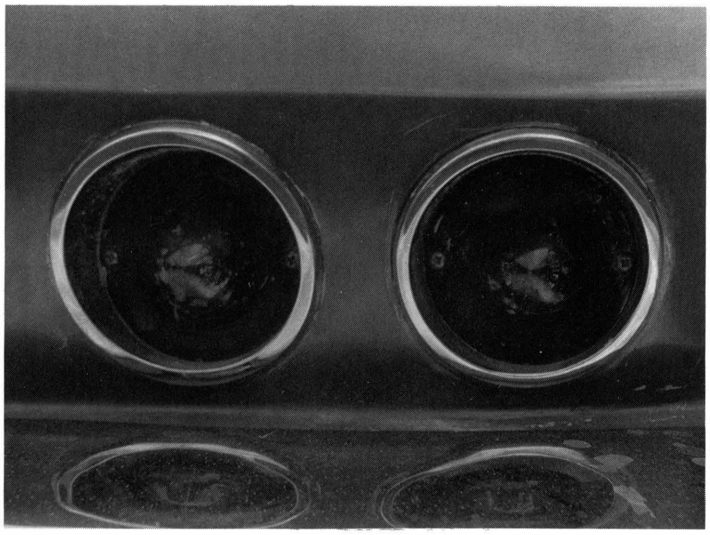
Directory compiled by Collin Bruce

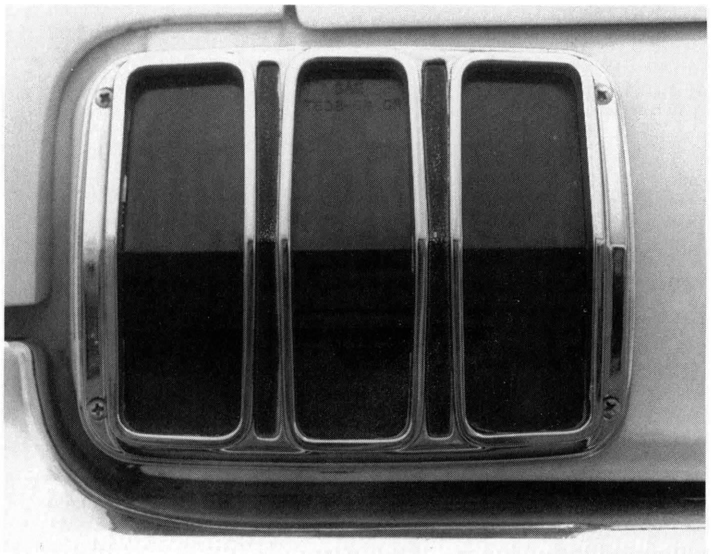
Correction

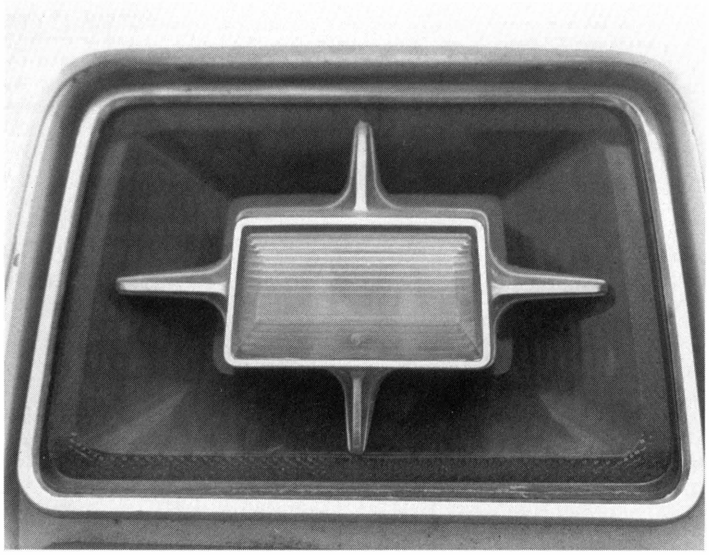
In the April 1991 edition we reported that the Channel Tunnel will use over 11 tons of railway track; in fact it will use more than 11,000 tons of track. *Engineers' Forum* apologizes for the inaccuracy.

PICTURE QUIZ

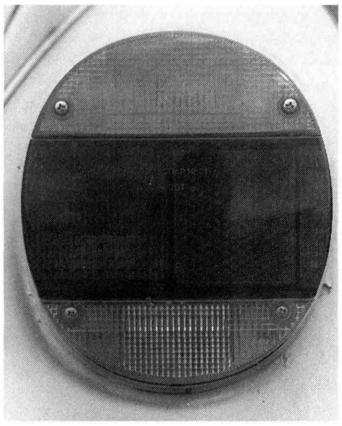
Here are some tail-lights of some common and not-so-common vehicles. Can you name the vehicle by identifying the lights?

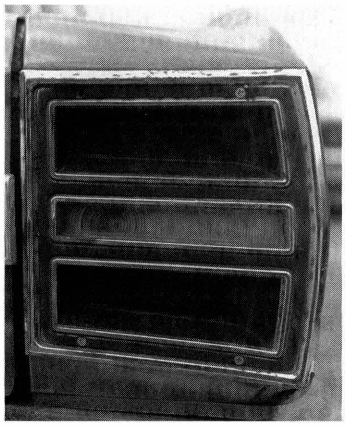






Answers: Top left, Chevrolet Corvette; *top right,* AMC Gremlin; ***center left,*** Ford Mustang; *center right,* Ford Galaxie 500; *bottom left,* VW **Bug**; ***bottom right,*** Dodge Dart





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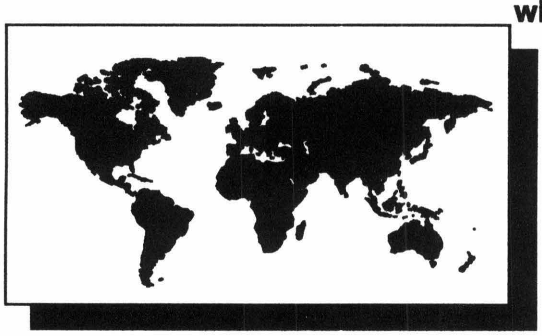

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