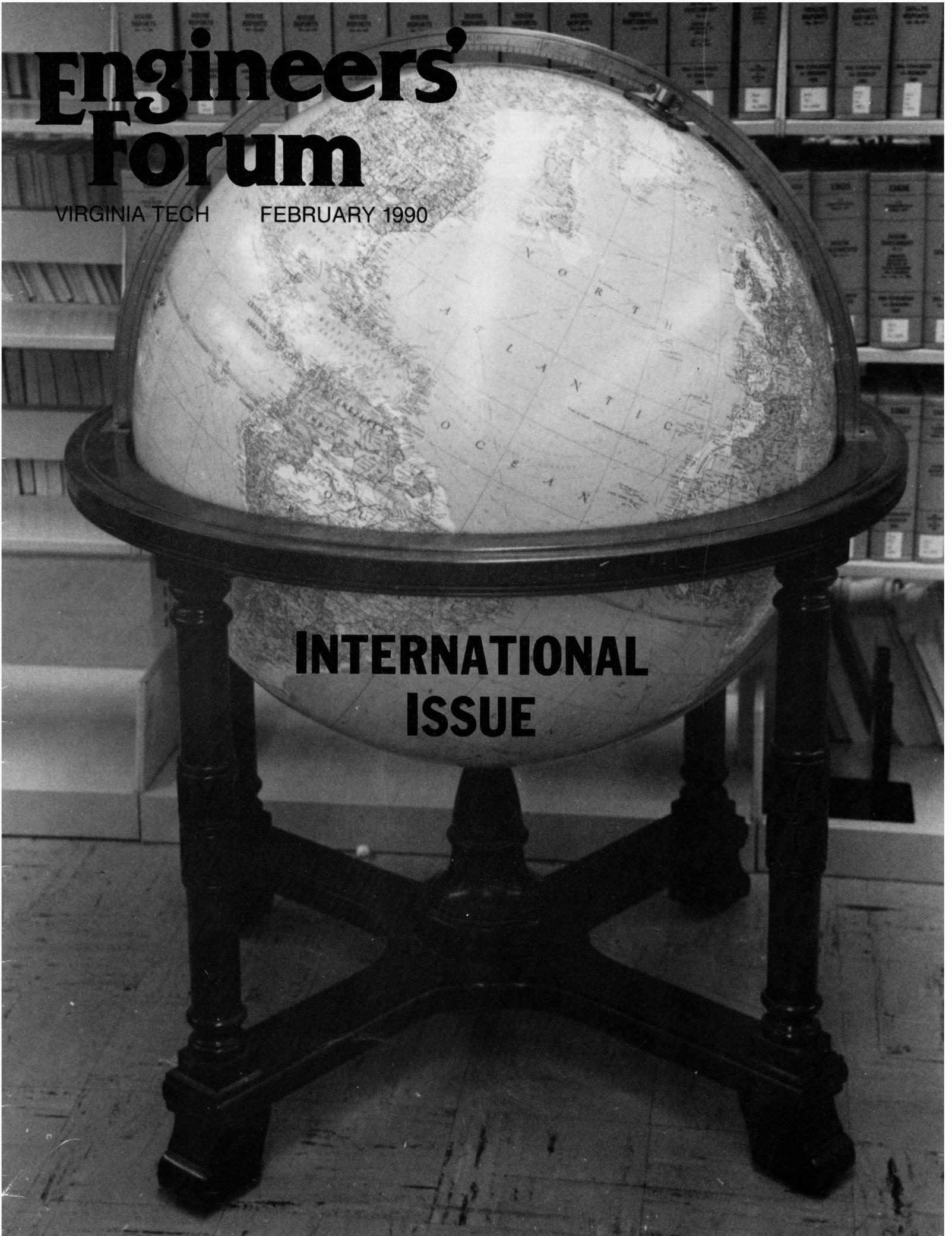


Engineers' Forum

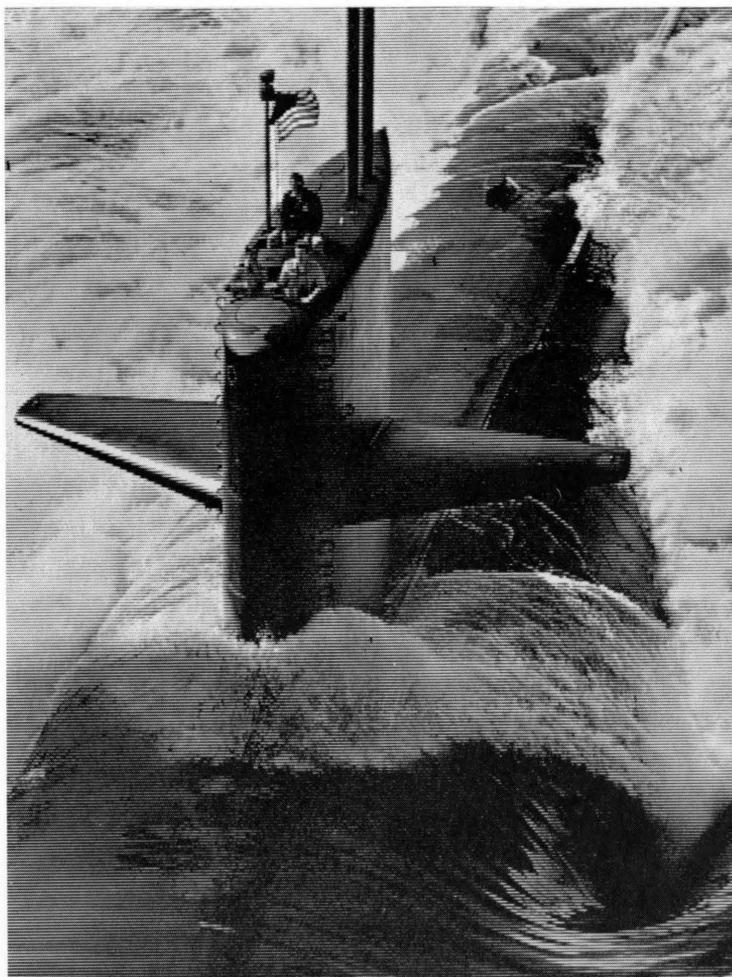
VIRGINIA TECH

FEBRUARY 1990

**INTERNATIONAL
ISSUE**



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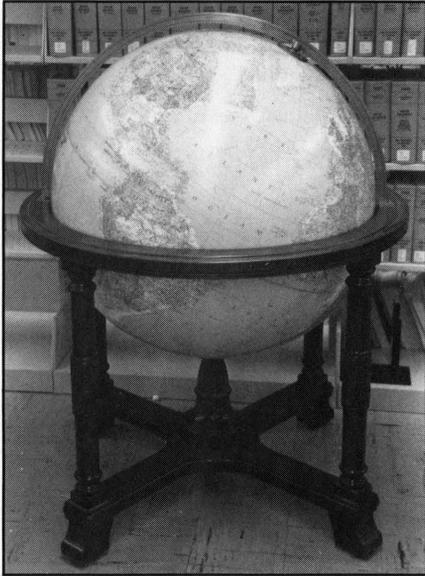
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ON THE COVER

This issue of Engineers' Forum takes a look at global issues that will be of concern to engineers in the years to come. Cover photo by Howard Kash.

Engineers' Forum is Virginia Tech's student engineering magazine. *Engineers' Forum* magazine is published four times during the academic year. The editorial and business office is located at 112 Femoyer Hall, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. Phone (703) 231-7738. Member of Engineering College Magazines Associated, Lee Edson, Chairperson.

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TABLE OF CONTENTS

| | |
|--|----|
| Editor's Page | 2 |
| IIE News <i>by Tim Baker</i> | 3 |
| SEC Notes <i>by Kendall E. Giles</i> | 4 |
| Engineers Week: Turning Ideas into Reality <i>by Heidi Johnson</i> | 5 |
| Engineering Abroad: A Different Perspective <i>by Tony Giunta</i> | 6 |
| The Big Picture: Engineering and the Globalization of Markets <i>by Kendall E. Giles</i> | 8 |
| Landslides! <i>by Collin Bruce</i> | 10 |
| Management Systems Engineering <i>by Eileen Van Aken</i> | 12 |
| Co-Op: More than a Money Maker <i>by Jonathan Hess</i> | 14 |
| University Placement Services <i>by Andy Stalder</i> | 15 |
| Photo Essay | 16 |

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EDITOR'S PAGE

Lack of Engineering Leadership Responsible for U.S. Auto Industry Demise

The international focus of this *Forum* issue brings to mind an issue of personal interest, the U.S.'s ever-dwindling market share in the automotive industry.

Everyone points to the Japanese economic invasion as the catalyst for this downward spiral. This observation is accurate, but does not explain why America, the great industrial giant, has not succeeded in turning the tide.

I propose that the lack of engineering leadership is in many ways directly to blame for the industry's demise. This deficiency is evident in both the products and the decisions of modern-day Detroit. And if this deficiency is not corrected soon, the world's largest car company will be known for little more than its trendy advertising.

Consider for a moment the more significant engineering advances of late. Four-wheel steering, active suspensions, anti-lock brakes, variable valve timing. All of these technologies have their origins in Europe or Japan. Meanwhile, American cars are equipped with such marvels as digital gauges, decorative but functionless aerodynamic bodywork, and antiquated overhead-valve engines. A recent General Motors family car advertisement actually stated that Scotchguard-coated seats were one of the car's more important features. And this is the largest carmaker in the world?

While the American public has historically been fascinated by gadgets (like talking cars and digital gauges), they will not accept substandard product for such frivolity. GM's market share plunge to 31 percent supports this. What is required, then, is product integrity and quality. Both are direct results of engineering leadership, and both are notably lacking in Detroit (and especially GM) machines of late.

General Motors was not hesitant to boast about its "revolutionary" Quad 4 engine. You know, the one with overhead cams and four valves per cylinder, like nearly every engine from Japan. Regardless of the powerplant's virtues, it was not an engineering breakthrough; the Quad 4 was not the first of its kind nor the best. This role as a technical follower rather than leader is typical of American automakers in the past decade. To date, GM remains a step behind in engine technology: the Quad 4 remains the only overhead cam multivalve engine in GM's arsenal.

Outdated engine technology is only one example of American technical inferiority. And it is not reserved for General Motors products. When Ford wanted an engine to power its sporty Taurus SHO, it did not send its engineers back to the CAD terminal. Instead, Ford struck a deal with Yamaha for its specially-designed 24-valve V6. The spirited powerplant made the new car a joy to drive, even despite the car's major shortcoming — its American-designed manual transmission.

Perhaps sending the serious engineering work overseas is the way to go, at least in the eyes of Detroit. The Corvette ZR-1 may be America's only world-class sports car, but it's hardly "made in America." Its 380-hp V8 was engi-

Continued on next page

IIE News

by TIM BAKER

The industrial engineering students at Virginia Tech will be hosting the 1990 Districts III and IV Institute of Industrial Engineers University Student Conference from February 15-17, 1990. The theme for the conference will be "Paths to the Future: Diversity in Industrial Engineering." Students and faculty from 16 universities and leaders from industry will be attending to share and learn about industrial engineering growth throughout the world.

The following six distinguished guests will be speaking at the conference:

— Dr. Harold Kurstedt, Management Systems Laboratories

— Dr. Paul Torgersen, Dean, College of Engineering, Virginia Tech.

— Mr. David Law, Woodrow Wilson Rehabilitation Center

— Mr. Gregory Balestrero, IIE Executive Director

— Mr. Dan Dunn, Corporate Industrial Engineer, United Parcel Service

— Dr. Sidney Gilbreath, Tennessee Tech University

Several students will also be speaking on related issues in the technical writing

contest.

In addition, plant trips will be made to Volvo GM in Dublin, VA and to General Electric in Salem, VA. There will be a "Monte Carlo" night to complete the educational and social activities of the conference.

Registration fee is \$40.00 per individual. This fee includes all meals. To register, pick up forms from 271-A Whittemore Hall, or write to: Institute of Industrial Engineers, Virginia Tech Chapter, 271-A Whittemore Hall, Blacksburg, VA 24061, or call (703) 231-6656.

Editorial

Continued from previous page

neered by Lotus, and its new 6-speed gearbox comes from ZF in Germany. So much for Yankee ingenuity.

Chrysler, the smallest of the Big Three, is not immune to using foreign engineering either; its dealings with Mitsubishi have been both frequent and significant.

The U.S. did not always contract out its engineering to foreign nations. Not too long ago it was America, not Japan, that led the world in automotive technology. The automatic transmission and the world's first starter came courtesy of American automakers. Cadillac, a few decades ago, was a symbol of award-winning engineering.

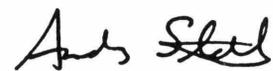
American car companies have led the world in the past, and can do so again. There is no doubt about the engineering talent available; recent products of the defense industry assure this. The engineering talent available simply must be applied in the right areas. Instead of designing fancy instrument displays, engineers should work on 4-valve cylinder heads that will produce more power while meeting the latest clean air standards.

Yet very few engineers have a say as to the projects they work on. In that way, Detroit's managers are ultimately to blame for the misapplication of engineering talent. The typical Harvard MBA may be immensely qualified to market widgets, but he obviously knows little about building or selling cars. If he did, he would spend more money on engineering and less on adver-

tising and market surveys. The recent Chevrolet Lumina was designed after a survey of umpteen thousand households on what they liked in a car. So what's the result, the world's least offensive car? One car hardly imagine the Cadillac of old resorting to such a weak ploy.

Unfortunately, the powers that be in Detroit have about as much confidence in the companies' engineering ability as they do in their car designs. This is reflected in the farming-out of complex engineering tasks like those mentioned before, and in the recent purchases of Jaguar and Saab. Instead of relying on their own engineers to come up with new ideas, auto company managers seem to prefer to buy technology.

It may be seem easier to buy technology now rather than develop it, but this tactic is bound to become too expensive. Nor is it necessary. The U.S. auto industry has a wealth of engineering talent from which to draw, and it will require this talent to regain its former strength. But it is imperative that this talent be effectively managed to work on worthwhile and significant projects. Only then can the successes of the past be repeated.



Andrew E. Stalder
Editor



NOTES



by KENDALL E. GILES

It is time for George Washington's birthday again folks, and we all know what that means — **National Engineers' Week**. National Engineers' Week was established by the National Society of Professional Engineers in 1951 and is always celebrated around George Washington's birthday.

To refresh your memory, our nation's first president was a military and agricultural engineers as well as a surveyor. He founded the first U.S. engineering school at Valley Forge, Pennsylvania, which later became the U.S. Military Academy at West Point, New York. Not bad

for a guy with wooden teeth.

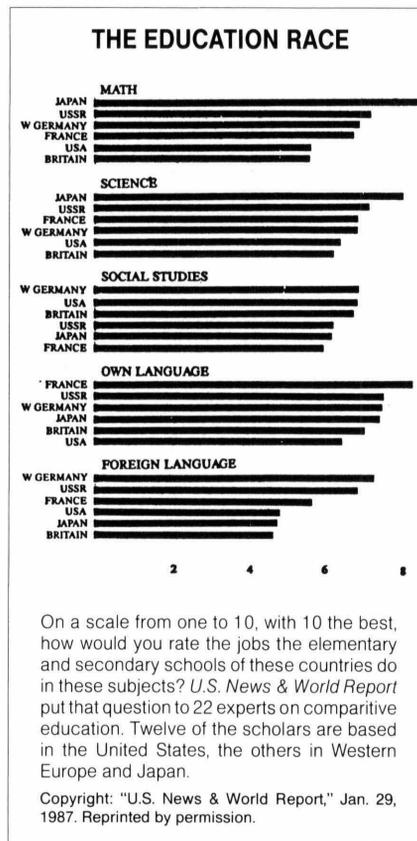
For our celebration of Engineers' Week here at Tech, we have a lot of activities, competitions, and speakers planned — so show some spirit, put away those books, turn off your calculators, and come out to some of the events and have some fun. Whether you are in the mood for dancing, tugging on a rope, hopping on a ball, broadening your horizons by considering global engineering, touring a lab, or drinking a drink, we will have it all available for you during Engineers' Week.

The Bigger Picture

When our noses are constantly in the books and when thinking about the future means deciding whether to throw darts or watch a movie this weekend, a lot of the world passes us by. It is sometimes helpful to come up for air once in a while, see where we are, then re-submerge again with a clearer direction in mind. I'm talking about the bigger picture in life. As engineers we should be aware of several relevant facts that might influence our future, our careers, and our roles in society:

- The number of science and engineering baccalaureates in 1996 will fall short of demand by 45,000. By the year 2010, the shortfall will be 700,000. (National Science Foundation)
- By 1995, engineering baccalaureates earned by foreign citizens may increase to 9,000, accounting for 13% of degrees awarded. (NSF)
- Women and minorities are severely underrepresented in all disciplines of engineering. Women represent less than 3% of the engineering work force. Women tend to concentrate in chemical and industrial engineering, and are less well represented in high-growth

- Blacks and Hispanics earn only a small



fraction of the degrees awarded in engineering. In 1986, Blacks received less than 3% of the engineering baccalaureates. Hispanics, while comprising about 7% of the U.S. population, received about 2% of the engineering baccalaureates. (NSF)

- Engineers and scientists make up only 4% of America's workers, but their skills are central to the nation's competitiveness and the world's quality of life. (Office of Technology Assessment)
 - Between 1984 and 1987, the number of bachelor's degrees awarded in engineering fields declined approximately 10%. Half the number of Ph.D.s awarded in the physical sciences during the 1970s were not awarded in the 1980s. (OTA)
 - The United States continues to be the only country in which a student can earn a doctorate without ever having to take a language course. (National Governors' Association)
 - The mean pre-tax income of all non-student U.S. IEEE members in 1988 was \$54,700. (IEEE)
 - U.S. corporations spend \$210 billion
- See SEC, page 7*

Engineers Week: *Turning Ideas into Reality*

by HEIDI JOHNSON

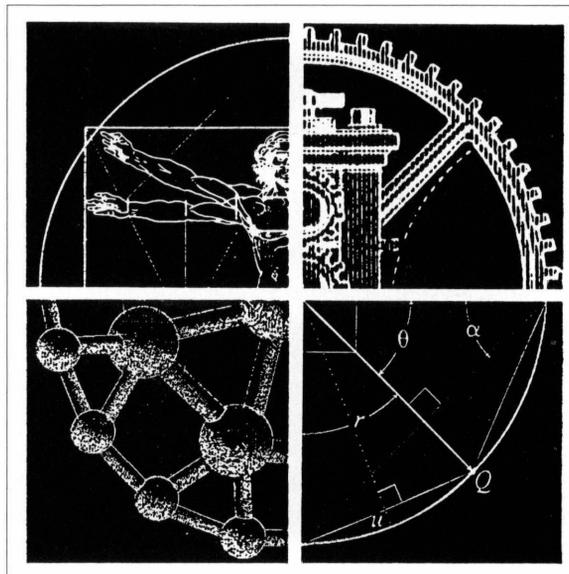
National Engineers Week, February 18-24, 1990, is a week dedicated to honoring all engineers nationally. This week helps to promote recognition and appreciation of the creative engineers who are building America by "turning ideas into reality." Engineers Week was first founded by the National Society of Professional Engineers in 1951 to honor George Washington, who was a military and agricultural engineer. In conjunction with the national event, the Student Engineers' Council (SEC) at Virginia Tech is sponsoring many engineering-related events and activities.

To kick off Engineers Week, the SEC and the American Society of Civil Engineers will host the First Annual College of Engineering Semi-Formal Dance at Owens Banquet Hall. The dance will be held on February 16, 1990 from 9:30 p.m. to 1:00 a.m. Invitations are extended to all undergraduate engineering students and their guests. Tickets will be sold up until February 15 between 10 a.m. and 2 p.m. in the lobbies of Patton, Whittemore, and Randolph Halls. The price is \$3.00 per person, or \$5.00 per couple. Let's help make the First Annual College of Engineering Semi-Formal Dance a great success!

A new event this year is the SEC Olympics. This sports event promotes friendly competition and interaction among the engineering societies. Included in the Olympics this year will be beach blanket bingo, tug-o-war, crab crawl, wheelbarrow race, pogo ball jump, three-legged race, and much more. Trophies will be awarded to the top three teams. If you are interested in participating, get in touch

with your respective engineering society and join the fun!

On a more formal level, the students and faculty are given another chance to become acquainted outside the academic environment at the annual Engineers Week Luncheon. Selected faculty members and society members are invited. The guest speaker for this year's luncheon is



Hugh W. Munson, a professor in Engineering Fundamentals, who is the winner of last year's Sporn Award.

Although most of these activities are centered around the upperclassmen and society members, freshmen are definitely not excluded from the celebration. In order to integrate the freshmen into the engineering departments, the SEC has planned Engineering Choice, an information night in which freshmen will be able to talk to upperclassmen about their respective engineering disciplines. This event is being held before the freshmen must declare a major, in hopes of reinforcing their selected choice or helping

point them in a new direction. Each engineering department will be represented by its society and a faculty member.

As everyone knows, in 1992 the European Trade Barrier is scheduled to come down. Accordingly, the SEC has planned a panel discussion on this topic involving distinguished guests from the government, educational, and industrial communities. This event is tentatively scheduled for February 21, 1990 at the Donaldson Brown Center. (For more information please see the separate article in this issue.)

SEC is not the only organization sponsoring events throughout the week. Tau Beta Pi, the engineering honor society, is sponsoring its Third Annual College of Engineering Open House on February 23, 1990. Again, all engineering departments will be represented and various tours through the departments will be offered. Tau Beta Pi has invited university faculty, university students, high school students, and the local community to attend. Open House has high potential to become an important public relations medium for the College of Engineering and its various departments. Virginia Tech is now known as one of the few universities to host both an EXPO and an Open House.

The American Institute of Aeronautics and Astronautics will be sponsoring a speaker, Dr. John W. Fozard, on February 20, 1990. Dr. Fozard was chief designer on the Harrier from 1963-1978 and will be talking about the evolution of the Harrier, the cooperation between the United Kingdom and the United States in development, to just give a few topics. The

See Week, page 7

SEC

Continued from page 4

on all forms of training each year. That's more than the budget for the entire elementary, secondary, and higher education system. (American Consulting Engineers' Council)

- It costs \$200 to train a U.S. worker in statistical process control, a basic manufacturing technique. It costs only 47 cents to teach the same process to a Japanese worker. (ACEC)
- According to the National Engineers' Week committee's survey of life in the 22nd Century, artificial body parts will become "off-the-shelf" items to be purchased as needed; we will inhabit the moon and man-made planets but not Mars or any other planets; we will not control Earth's weather and the most critical environmental problems will be hazardous waste disposal, lack of natural resources, clean air and water shortages; nearly one-third of all respondents believe that new communications techniques will make newspapers obsolete.

As the National Commission on Excellence in Education in 1983 announced in their report, *A Nation at Risk*, "Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being challenged by competition throughout the world." The world in which we live is increasingly becoming more and more technical and, as engineers, we are going to be assuming much more responsibility than we are now. Unless the other professions are able to keep up with new technology, engineers will be assuming many roles — not just that of designer. We will also have to become competent in applying, lobbying for, and defending our designs and equipment in the service industries such as medicine, law, politics, education, and other businesses. Engineers will have to perform as well in America as in Europe and along the Pacific rim. We will have to become "global engineers," knowledgeable about the foreign countries and the ways of the people with whom we will

have to do business.

Commenting on our current ignorance of other cultures and customs, former CIA Deputy Director Admiral Bobby R. Inman said to a Congressional Committee:

"I have watched us become subject to surprise time and again...surprise because we did not understand the events that we had some inkling were underway. We have become very good at counting things, and very poor at projecting challenges we are likely to face."

As engineers, we excel at developing new technology. In America, we have some of the greatest minds hard at work on projects dealing in biotechnology, alternative energy sources, space travel, and information gathering. But U.S. mono-lingual engineers are failing to take advantage of the work produced by the brightest minds in other countries. For example, when only 5% of Japanese technical literature is translated into English, our standard of living definitely suffers. The Japanese, who have over 10,000 English-speaking business representatives in the U.S., have free pickings over our technical advances to develop new consumer products. There are less than 900 American business representatives in Japan — and only a few speak Japanese. Says John F. Welsh, Jr., Gen-

eral Electric Company Chairman and CEO:

"The American engineering profession needs to reassert its leadership; to raise its eyes and voices, roll up its sleeves, and do again for the nation what it did a century ago; make it a winner in the world marketplace. If competing and winning — rather than puttering and theorizing — become the real stuff of an engineering career, our best men and women — our winners — will once again gravitate toward the profession, and the impending decline of American engineering will become a thing of the past."

These are some sobering and inspiration words that should not be taken lightly. We as students need to keep this picture and these facts in mind as we re-submerge and once again return to mid-terms, finals, and interviews. But hopefully now you will be chugging along in a direction towards a rewarding, responsible, and worthwhile career that performs some service for our fellow neighbors. If you have any questions or concerns, contact me through the SEC office (110 Femoyer, 231-6036) or give me a call, 951-8343. See you at the next meeting.

— Kendall Giles, President, SEC

Week

Continued from page 5

time and place will be later provided by AIAA. Look for flyers soon!!

Finally, to thank all the societies and engineers who participated in Engineers' Week, the Student Engineers' Council is throwing a happy hour party at the end of the week on February 23, 1990. The celebration is a great conclusion to a fun and busy week!

For all of these great events there will be flyers, banners, and posters out soon, so look for all the details in the following weeks. If you want more information about the activities, please call the Student Engineers' Council at 231-6036.

A tentative schedule for activities planned for Engineers Week can be found on page 16.

THE BIG PICTURE:

Engineering and the Globalization of Markets

by KENDALL E. GILES

The European nations have grown tired of watching America and Japan keep them on a leash economically, manipulate them geographically, and ignore them politically. Twelve countries have decided to work together towards creating a unified European Community streamlined for becoming a market and political force in its own right. This unified market will be composed of 323 million consumers, roughly 1.5 times that of the American market. This single bloc will produce some \$4.5 trillion in products and services, placing it ahead of Japan and just behind the U.S. in economic strength. The deadline for this inter-country merger is scheduled for December, 1992. As this date is drawing closer, American companies and the American government are becoming ambivalent

with both fear and hope.

The idea of a unified market started with the Treaty of Rome, signed in 1958 by France, West Germany, Italy, Luxembourg, the Netherlands, and Belgium. This treaty was to abolish all tariffs and quotas among these six original members. At the time, American support for such a unified Europe was high. This new political federation would be strong enough to decrease the need for dependence on the U.S. and NATO for military support and would return Europe to international respectability. During the Eisenhower administration Secretary of State John Foster Dulles claimed that "It would actually be a healthy thing for these nations to try to mold themselves into a Third Force." Later, Secretary of State George Ball, under the Kennedy

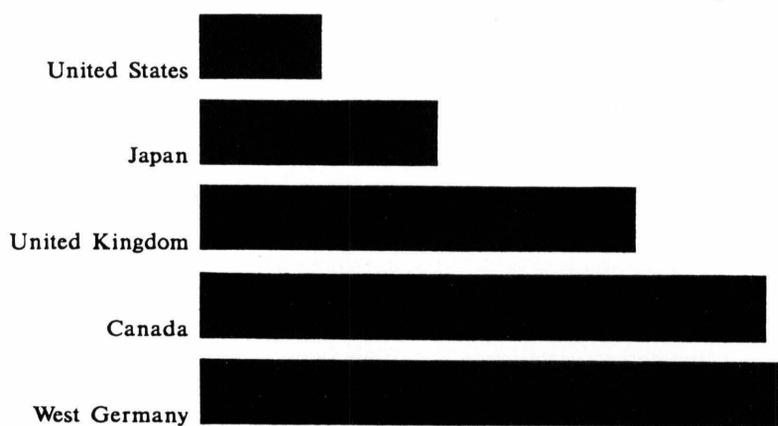
administration, said:

"As long as Europe remained fragmented, as long as it consisted merely of nations small by modern standards, the potentials for true partnership were always limited....We have wanted a Europe united and strong that could serve as an equal partner in the achievement of our common endeavors."

However, problems were encountered among the nations in consolidating a unified market. Efforts slowed and suffered from "Eurosclerosis."

With the 1980s came high inflation, high unemployment, and a very vivid realization that if something concrete was not done, Europe would fall hopelessly and forever behind Japan and the United States. In 1985 the EC (European Community) Commission, based in Brussels, Belgium, established 300 proposals to eliminate barriers to a unified market by December 31, 1992. This date was chosen as a target and ideal to work towards, a time limit that European companies could keep in mind so that they could get ready for this new marketplace. Membership in the EC jumped to twelve countries, and to date these countries are the original six plus the United Kingdom, Denmark, Greece, Spain, Portugal, and Ireland. Other countries like Sweden, Norway, and Finland are considering joining, but as for now are remaining characteristically neutral. The proposals were trimmed to 279 and came forth in the

MERCHANDISE EXPORTS AS PERCENT OF GNP, 1987



Source: U.S. Department of Commerce

Fast Company: EC, America and Japan

Gross domestic product (GDP) and trade in billions of dollars, population in millions (all figures for 1987)

| | GDP | Population | GDP/capita | Total imports & exports |
|--------------------|---------|------------|------------|-------------------------|
| European Community | \$4,287 | 323 | \$13,275 | \$784.3 |
| United States | 4,497 | 245 | 18,353 | 660.4 |
| Japan | 2,373 | 122 | 19,446 | 352.8 |

SOURCES: Commerce Department; Japanese Embassy; European Community; Population Reference Bureau

Single Europe Act, signed in July, 1987. To date, 107 proposals have been adopted and the remaining 122 are in various stages of the decision-making process. EC 1992 is now at the point of no return and this leaves many U.S. companies in a cloud of doubt and fear.

The EC is at present America's largest commercial partner. U.S. company sales with the twelve European nations total more than \$500 billion, compared to \$200 billion with Canada and \$130 billion with Japan. According to Catherine Vial, in the Office of European Community Affairs, established by the U.S. Department of Commerce to deal with developments in Europe:

“The whole point to the EC 1992 program is removing barriers to increase competitiveness within Europe. European companies will become tougher competitors — not only just in Europe, but also globally. All American firms — including smaller firms — must become tougher competitors themselves lest they lose out worldwide.”

Engineers should be especially concerned about these events. We are going to be the people who will have to design and market the products and services to compete in this tougher marketplace. No longer will we have an automatic customer for our goods. The world is no longer marching to the beat of American drums. Our total trade balance has swung from a \$6.8 billion surplus in 1981 to a \$15 billion deficit in 1987. Though blame can be thrown all over, from the deterioration of

the family, to a floundering sense of national pride and purpose, to a rotten and outdated academic system, the problem is here and now. We have to realize that as we approach the 21st century, we are in a world market. We have to design our products with an eye for foreign outlets.

As engineers, we need to design products that those of different cultures will want to buy, not force our visions of American luxury down their throats. For example, we cry foul when the Japanese will not buy our huge, gas-guzzling, gaudy cars. We do not realize that such cars go completely against the Japanese culture and way of life. Remember, Japan is an island nation almost completely dependent on foreign countries for all their resources. Efficiency and economical sizes are necessary for survival. Which is why the Japanese gangsters tend to favor the large American cars — these cars are a symbol of the gangsters' desire to defy the system and cause disgust wherever they go.

Engineers should not have to be told that high technology and information-based systems are the most rapidly growing segments of the international economy. Eight of the 15 fastest growing U.S. industries are related to high technology. However, America's one time dominance of research and development is slipping. No comments need to be made concerning Japan's hold on the semiconductor and consumer electronic industry. In fields like telecommunications, chemicals, and pharmaceuticals, European companies are going to become first-class.

This not meant to paint the picture that all is hopeless and lost. America has a

rich tradition of responding to adversity with triumph and innovation. With the 21st century at hand, we must learn to see the world from a new perspective. The business people are reacting with “global managers.” We can do our part by becoming “global engineers.” We need to become more international in our views, shorten our reaction time to world events, clean up our act at home, and get ready for the challenges to come from increased competition from Japan and the new European Economic Community. Says Senator Lloyd Bentson, D-Texas, “Europe 1992 provides tremendous opportunities, but it also generates some concerns.”

The opportunities created by EC 1992 include economies of scale, lower distribution costs, harmonized standards, liberalized trade and investment, and faster market growth. America just needs to wake up now and start gearing up for a leaner, lower cholesterol 1992. The stakes are too high to be hesitant, and those American companies who are becoming established now in Europe are rightfully feeling pretty good. Says Charles Goldman, V.P. of ITT Corp., “ITT regards 1992 as the promised land. For us, it's terrific.” Let us hope EC 1992 fares as well for America on the whole.

EC 1992 at Tech

During Engineers' Week the Student Engineers' Council is hosting a panel/conference on “Engineering and the Globalization of Markets.” Panel members include representatives who will present their own perceptions of possible problems for future American competitiveness and how these events will affect engineers. All students, faculty, and members of the public are invited to attend the conference and to ask questions of the panel members. The event is to take place on Wednesday, February 21, at 4:00 p.m. in the Donaldson Brown Auditorium. Admission is free. For more information, contact Ken Giles, 951-8343.

LANDSLIDE!

Research reduces threat to Panama Canal

by COLLIN BRUCE photos by MIKE DUNCAN



On December 31, 1999, at high noon, the Panama Canal Treaty will expire, transferring all control of the canal to the Republic of Panama. The United States will no longer be primarily responsible for protecting, maintaining, and operating this monumental international waterway.

The canal is an extraordinary technological wonder. The Gatun locks, 19 miles inland on the Atlantic side of Panama, raise ships 85 feet to Lake Gatun. Ships travel 26 miles on the man-made lake to the Gaillard Cut. The Cut, only nine miles long, winds through the mountains of Panama and the continental divide, ending at the Pedro Miguel locks. A 31-foot descent here, followed by a 54-foot descent at the Miraflores locks, brings ships to the Pacific Ocean a little over a day later. The 51-mile waterway allows ships to avoid an 8,000-mile journey around Cape Horn at the tip of South America.

Landslides have always been a serious problem in the history of the Panama Canal. The French, who began digging the canal in 1880, were forced to stop the project after massive landslides filled areas already cleared. The United States, who began to work on the canal shortly after the French, lost months of work after

landslides covered equipment with mud.

"The landslides only occur within the Gaillard Cut, the part of the canal running through the mountains," says Michael Duncan, a professor in the geotechnical department of civil engineering at Virginia Tech. When the canal was built, engineers from the United States attempted to blast a pathway straight through the mountains without supporting the tops. The weight of the peaks caused the landslides, filling the areas which had been cleared.

The slides usually occur in the rainy season, David McCullough wrote in his book *The Path Between the Seas*: "The slides occurred when the clay layers on the slopes became thoroughly saturated, slick and heavy, with a consistency of soup left overnight in water. But the saturation stopped at the underlying rock and the build-up of water created a slippery zone. Gravity moved the clay layer down into the Cut."

The organization in charge of the Canal, the Panama Canal Commission, created a geotechnical advisory committee to study the landslides after a slide closed the canal temporarily in 1986. Duncan, a member of the committee, along with individuals from Georgia Tech, the University of Alberta, and the U.S. Geological Survey, visited the Canal in an attempt to con-



The Gaillard Cut today.

trol the slides.

"The angle of the slopes was reduced and rainwater was drained from the tops, decreasing the chance of further landslides," Duncan recalls. "We also set up equipment to monitor activity on the slopes and to analyze the stability of the mountain side."

Since the formation of the committee and the work which has been performed on the slopes, the threat of slides has been reduced. There has not been one major slide in the Gaillard Cut since 1986.

With the geotechnical program in place, the problem of landslides in the Panama Canal is under control. However, Duncan points out that there remains a slight chance that a severe, continuous rainstorm could loosen the mountain sides.

Enough work has been done on the sides of the cut to reduce any damage that might result from a landslide in the Panama Canal today. Furthermore, as technology advances further in the upcoming century, landslides will cease to be a problem in the Panama Canal.

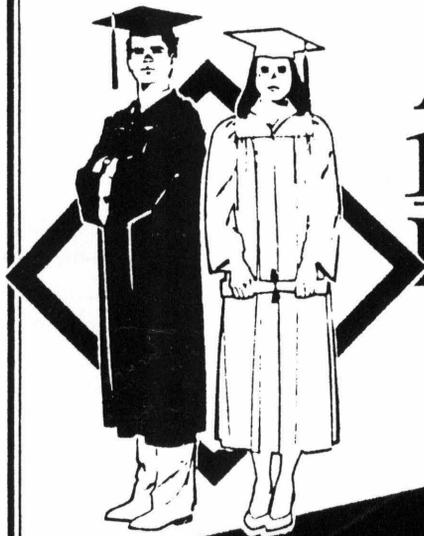


Construction of the canal through the Gaillard Cut, 1912.



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Management Systems Engineering:

The Systems Approach to Global Competitiveness

by EILEEN VAN AKEN

By now, everyone is familiar with the claim that the U.S. is on the decline as an industrial competitor. You've heard countless compelling examples of how "bad" we're doing, against Japan, Korea, and any number of other up and coming nations. Everyone has a different solution to how we can regain our competitive edge, but they all boil down to the same thing: improving the performance of organizations to more successfully compete in a global marketplace.

The Management Systems Engineering (MgtSE) option offered by the Industrial Engineering and Operations Research Department at Virginia Tech offers a solution by providing students with the necessary skills and knowledge to solve the complex, dynamic and multidisciplinary problems they will face as managers in the organization of the future. These skills are critical in helping organizations improve performance and survive in the '90s and beyond. The option allows professionals and students the opportunity to continue their formal education with a focus on the management of complex socio-technical systems.

MgtSE, one of four graduate options in the IEOR Department, was formed in 1984 primarily by Dr. Harold Kurstedt, Professor of IEOR and Director of Man-

agement Systems Laboratories. Dr. Scott Sink, Associate Professor of IEOR and Director of Virginia Productivity Center, serves as the MgtSE Coordinator. In addition to Drs. Kurstedt and Sink, there are four other faculty listed under MgtSE. This article will reveal what's meant by the "engineering of management systems." We also examine the curriculum, the students, MgtSE-affiliated research centers, and job opportunities for MgtSE graduates.

What is MgtSE?

MgtSE uses the engineering approach to the design, development, and implementation of management systems. A management system has three primary components: the manager (anyone who uses information to make decisions), the physical things managed, and the management tools to provide information. Examples of management systems of particular interest in the MgtSE option are: planning; measurement; compensation management; information; problem-solving; resource allocation; and manufacturing systems. The primary aim of the MgtSE option is to transfer knowledge and skills regarding how to engineer improved management systems. The engineering approach is fact or knowledge-

based, systematic, rational, analytical, and planned.

The Curriculum

MgtSE offers a rigorous and challenging curriculum, and is unique in that it balances the development of analytic and intuitive skills necessary to contribute to a management team. Students entering the program are required to hold a degree in engineering, business, industrial psychology or sociology, computer science, or math/statistics from an accredited institution.

The MgtSE M.S. and Ph.D. programs are each approximately 21 to 27 month programs. Forty-eight semester credits are required for a master's degree and 96 total credits for a Ph.D. degree. Beyond the four core required courses, students choose remaining courses from engineering, business, social sciences, communications, math/statistics, and law/ethics.

MgtSE is not the same as getting an M.B.A. In MgtSE, engineers and scientists can further their technical background while learning business principles and practices. An MgtSE student can choose engineering electives and continue or expand upon an engineering background. Business principles are taught in such courses such as Finance, Accounting, and Human Resource Management. Numerous courses are offered in sociology, psychology, ethics, as well as math/statistics. This variety of courses provides for a well-rounded technical education unique in comparison with that provided by a typical MBA or engineering master's program.

"...these (management) skills are critical in helping organizations improve performance and survive in the '90s and beyond."

Although a relatively young option..., MgtSE is rapidly becoming a premiere program for engineers and scientists to further their formal education and excel professionally.

The Students

There are currently about fifteen students enrolled in the option (nine master's candidates and six Ph.D. candidates). The students' undergraduate backgrounds vary from aerospace, civil, industrial, mechanical, electrical, and mining engineering to applied mathematics. About half of the students have acquired several years of full-time work experience prior to enrolling. Since 1984, five master's degrees have been awarded in MgtSE. It is anticipated that four more master's students and two Ph.D. students will graduate in 1990. Research topics of theses and dissertations include strategic planning; consensus in group decision-making; compensation management; performance measurement; quality management; and autonomous work teams.

Efforts are currently underway to organize activities among students and faculty. Students have met to generate ideas on how to improve the option, and MgtSE recently sponsored a seminar on corporate culture. During weekly research meetings, students share problems, concerns, and insights about their own research and assist each other. These meetings are an effective mechanism to share information about conferences and journals to publish papers, curriculum changes, and student social activities.

MgtSE Affiliated Centers/Laboratories

Management Systems Laboratories (MSL) and the Virginia Productivity Center (VPC), research arms of the IEOR Department, are the two main sources of Graduate Research Assistantships for MgtSE students. MSL researches the man-

agement process and tools for various types of management systems, such as emergency management, manufacturing, office automation, project management, and government management. Specifically, MSL researches how to characterize different types of management systems to determine the best tools for providing information to their managers.

VPC researches methods and tools which enable managers to plan, implement, measure, evaluate and control their organization's performance improvement efforts. The Center's major activities are in the areas of: strategic planning for performance improvement; measurement and evaluation; management of participation; compensation management; and management systems engineering as it relates to quality and productivity management. The VPC also publishes books, articles, and the quarterly journal QPM; creates instruments and software; and provides continuing management development workshops and seminars.

As Graduate Research Assistants at MSL or VPC, students gain valuable experience by working directly on research contracts, enhancing project management skills, and working with sponsor organizations. Students graduating in MgtSE are well-prepared to take on "real-world" problems because they've had practice doing just that.

Job Opportunities

Many opportunities are available for MgtSE graduates because the knowledge and skills acquired through the option are transferrable to any industry or type of organization. In addition to the tradi-

tional IE or other engineering positions, there is a demand for MgtSE graduates in the areas of quality and productivity management, and management information systems. In fact, companies like Proctor & Gamble and Coopers & Lybrand have called MSL and VPC to look for MgtSE graduates. Management consulting provides opportunities whereby graduates can work in a consulting firm or as an "internal consultant," or change agent, in a quality and productivity improvement department within an organization. People in these positions interact heavily with employees from all areas in a plant or facility and with all levels — from the CEO down to production, or front-line service, workers.

Although a relatively young option (six years) at Virginia Tech, MgtSE is rapidly becoming a premier program for engineers and scientists to further their formal education and excel professionally. The option has two internationally renowned faculty, in addition to students who have outstanding academic and professional backgrounds. During the '90s and beyond, successful organizations will be demanding managers skilled in designing, developing and implementing management systems. Virginia Tech's MgtSE option is preparing students to meet this challenge.

For further information about the MgtSE option, contact Eileen Van Aken at 703/231-4596.

Eileen is a graduate student in the MgtSE program at Tech, and a graduate research assistant at the Virginia Productivity Center.

CO-OP:

More than a money maker

by JONATHAN HESS

Virginia Tech CO-OP. You may think that it is just a chance to take a semester off from school to make a little money, but it is much more than that. Surely you have heard of the CO-OP program, but do you know the real scoop? It is sad, but reality, that all the knowledge you are obtaining from the hours of mind-boggling studies are only part of the ticket to a successful and interesting job.

The other part is something no book can give you, and that is experience. The CO-OP office, located at 252 Henderson Hall, has the information you need on how to obtain this work experience while working toward your degree. By alternating a semester of classes and a semester of work (as determined by the schedule the CO-OP

office and you form) as student can enter the world of seemingly endless interviews with an advantage over many other graduates. A CO-OP student will be able to answer "Yes" to the dreaded interview question, "Do you have any experience?"

If you are interested in CO-OP positions for Summer/Fall 1990, you should contact the CO-OP office now. On March 6, 1990 from 10:00 a.m. to 4:00 p.m., the employers listed below and many more will assemble in the Owens Banquet Room for the 1990 "CO-OP Connection." In order to prepare for this event, you should obtain a Student Personal Resume form from the CO-OP office to complete and submit to employers on March 6.

LIST OF VIRGINIA TECH CO-OP EMPLOYERS

| | | | |
|--------------------------------------|----------------------------------|---|--|
| Allied Signal | Computer, chemical, mechanical | Joyce Engineering | Civil |
| American Electric | Civil, electrical, mechanical | McCrone | Civil |
| Archer-Western Construction | Civil | McDonnell Douglas | Aerospace, electrical, mechanical |
| Ashland Oil | Chemical | Merck & Company | Chemical |
| Ashland Petroleum | Chemical, civil, mechanical | Mitre Corporation | Electrical |
| Babcock & Wilcox | Electrical, mechanical | Mobil Oil | Chemical, mechanical |
| Bechtel Corporation | Civil, mechanical | National Security Agency | Electrical |
| BNR | Civil, electrical | Naval Sea Combat | Civil, electrical |
| Burroughs Wellcome | Chemical | Newport News Shipbuilding | Civil, electrical, mechanical |
| CACI | All engineering | Norfolk Southern | Civil, electrical, mechanical |
| Carilion | Industrial | Philip Morris | Chemical, electrical, industrial, mechanical |
| Chesapeake | Electrical, mechanical | RCG/Hagler, Bailey | All engineering |
| Dow | Chemical | Sentara Health System | Industrial |
| Duke Power | Electrical, mechanical | Schnabel Engineering | Civil |
| Du Pont (Seaford) | Chemical, electrical | Science Applications International Corp. | All engineering |
| ELS, Inc. | All engineering | Scott-Long Construction | Civil |
| Federal Highway Administration | Civil | Tennessee Eastman Co. | Chemical, electrical, industrial, mechanical |
| GE Information Service | Computer | TRW | Computer, electrical, mechanical |
| General Electric (Salem, VA) | Computer, electrical, mechanical | UNISYS | Electrical |
| General Motors (Maryland) | Electrical | U.S. Forest Service | All engineering |
| General Service Administration | All majors | Vatell | Electrical, mechanical |
| Hoechst Celanese | Chemical | Virginia Power | All engineering |
| Hollingsworth & Vose | Chemical | Whitney Bailey Cox | Civil |
| IBM Corporation | Electrical | | |

University Placement Services Not Only for Seniors

by ANDY STALDER

Most seniors by now are aware of the University Placement Services and its on-campus interviewing procedures. But not everyone knows of the many other services offered that can be equally helpful for the underclassman or the alumnus interested in employment.

The Placement Services, located on the third floor of Henderson Hall, routinely offers workshops each semester to aid job-hunters. Such subjects as resume preparation, locating an overseas job, and finding the right summer internship are covered. Placement also offers individual assistance to job-searching, resume writing, and interview preparation by appointment.

A bulletin board listing of relevant job openings is updated daily. Placement has a huge employer information library, consisting of bound literature and videotapes. And, of course, Placement organizes the weekly interviews for both permanent and summer jobs.

Placement caters its services to the underclassman, the graduating senior,

and the alumnus; anyone searching for a job is welcome there. Below is a list of the remaining spring workshops, and a list of companies still to interview on campus for summer internships. A complete list of companies interviewing for permanent positions is available at Placement. Contact the Placement Services office, 232-6241, for more information.

Spring Workshops

- What the University Placement Services Can do for You: An Orientation to Services and Resources
Every Monday at 5:00 p.m. through April 23; University Placement Services
- Skills for Successful Interviewing
February 13 at 6:00 p.m., University Placement Services
- Locating a Dynamic Summer Job or Internship: A Basic Overview of Resources and Strategies
February 14 at 5:00 p.m., February 22 at 5:00 p.m., February 26 at 6:00 p.m.,

March 21 at 5 p.m., March 27 at 6 p.m.; University Placement Services

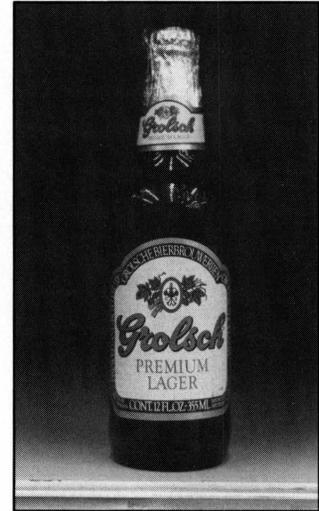
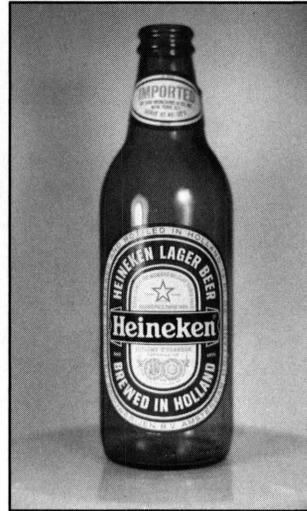
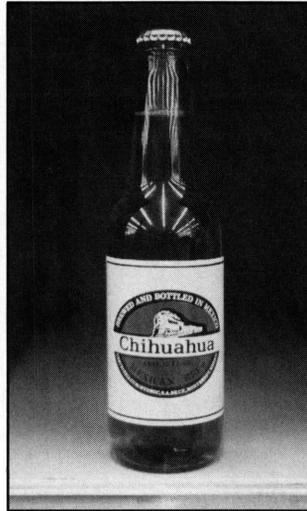
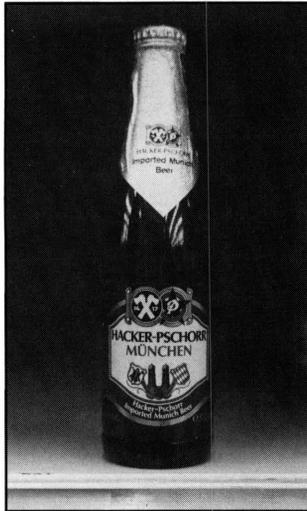
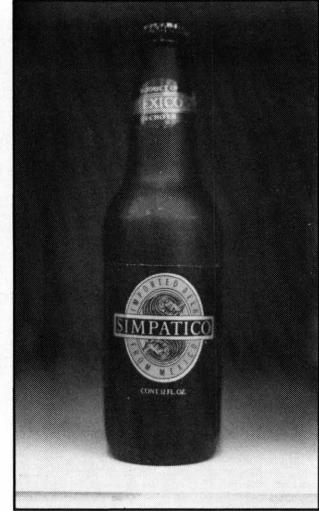
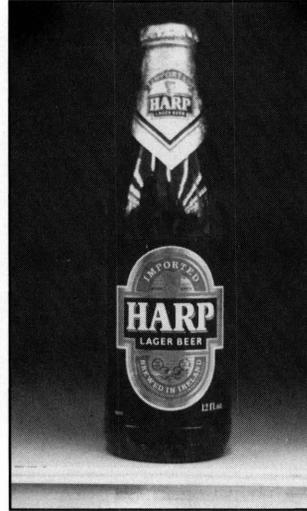
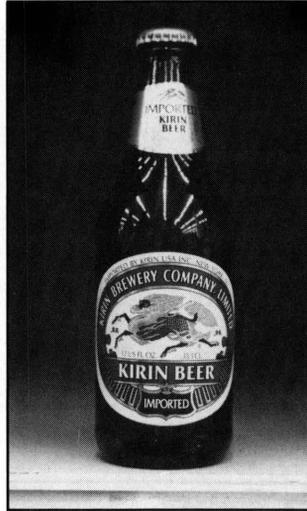
- Finding an Overseas Job: Resources and Strategies
February 15 at 5:00 p.m., University Placement Services
- Getting a Job With the Federal Government
February 21 at 3:00, 1084 Derring
- Putting Yourself on Paper: Effective Resume Writing
February 26 at 3:00 p.m., 1084 Derring
- Job Search Strategies for the International Student
March 1 at 5:00 p.m., 30 Pamplin
- How to Find a Job *Other Than* Through On-Campus Interviewing
March 6 at 7:00 p.m., University Placement Services
- Practical Training for Student Visa Holders
March 8 at 5:00 p.m., 30 Pamplin

Companies Interviewing on Campus for Summer Internships

| Company | Engineering majors desired | Company | Engineering majors desired |
|----------------------------------|--|---------------------------------|---|
| Kiewit Eastern Company | Civil | TRW/Systems Division | Electrical, mechanical, ocean |
| Armstrong World Ind. | Industrial, chemical, electrical, mechanical | Atlanta Testing and Engineering | Civil |
| General Motors Corp. | Mechanical, industrial | Atlantic Research Corp. | Aerospace, mechanical |
| H.C.B. Contractors | Civil | CGC Inc. | Civil |
| National Starch & Chemical Corp. | Chemical | ICS Information Technologies | Computer, electrical |
| Lord Corporation | Chemical, electrical, materials, mechanical | PCC Airfoils | Electrical, industrial, materials, mechanical |
| Eldec Corporation | Electrical | APG Lime Corp. | Mechanical, electrical |

PHOTO ESSAY: International Brews

Engineers' Forum takes a look at some of the many available international beers available in the Blacksburg area. Photos by Howard Kash and Scott Dau.



TENTATIVE SCHEDULE FOR ENGINEERS' WEEK ACTIVITIES

FRIDAY, FEBRUARY 16

ASCE/SEC sponsored 1st Annual College of Engineering Dance: Owens Banquet Hall, 9:30 p.m. - 1:00 a.m.

SUNDAY, FEBRUARY 19

SEC Olympics: Rector Fieldhouse, 9:00 a.m. - 2:00 p.m.
Engineering Choice: Owens Banquet Hall, 7:00 p.m. - 8:30 p.m.

TUESDAY, FEBRUARY 20

AIAA speaker, Dr. John Fozard: Time and place to be announced

WEDNESDAY, FEBRUARY 21

Trade Barrier Discussion: Donaldson Brown Center, 4:00 p.m. - 6:00 p.m.

THURSDAY, FEBRUARY 22

Student/Faculty Luncheon: Donaldson Brown Center, 12:00 p.m. - 1:30 p.m.

FRIDAY, FEBRUARY 23

Tau Beta Pi Open House: Burruss Hall, 9:00 a.m. - 5:00 p.m.
E-Week Happy Hour: Place to be announced, 8:00 p.m. - ???

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Jeff helped GE plant managers and environmentalists join forces with the EPA to ensure a clean operation. It challenged not just his technological skills, but also his ability to communicate and take charge.

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