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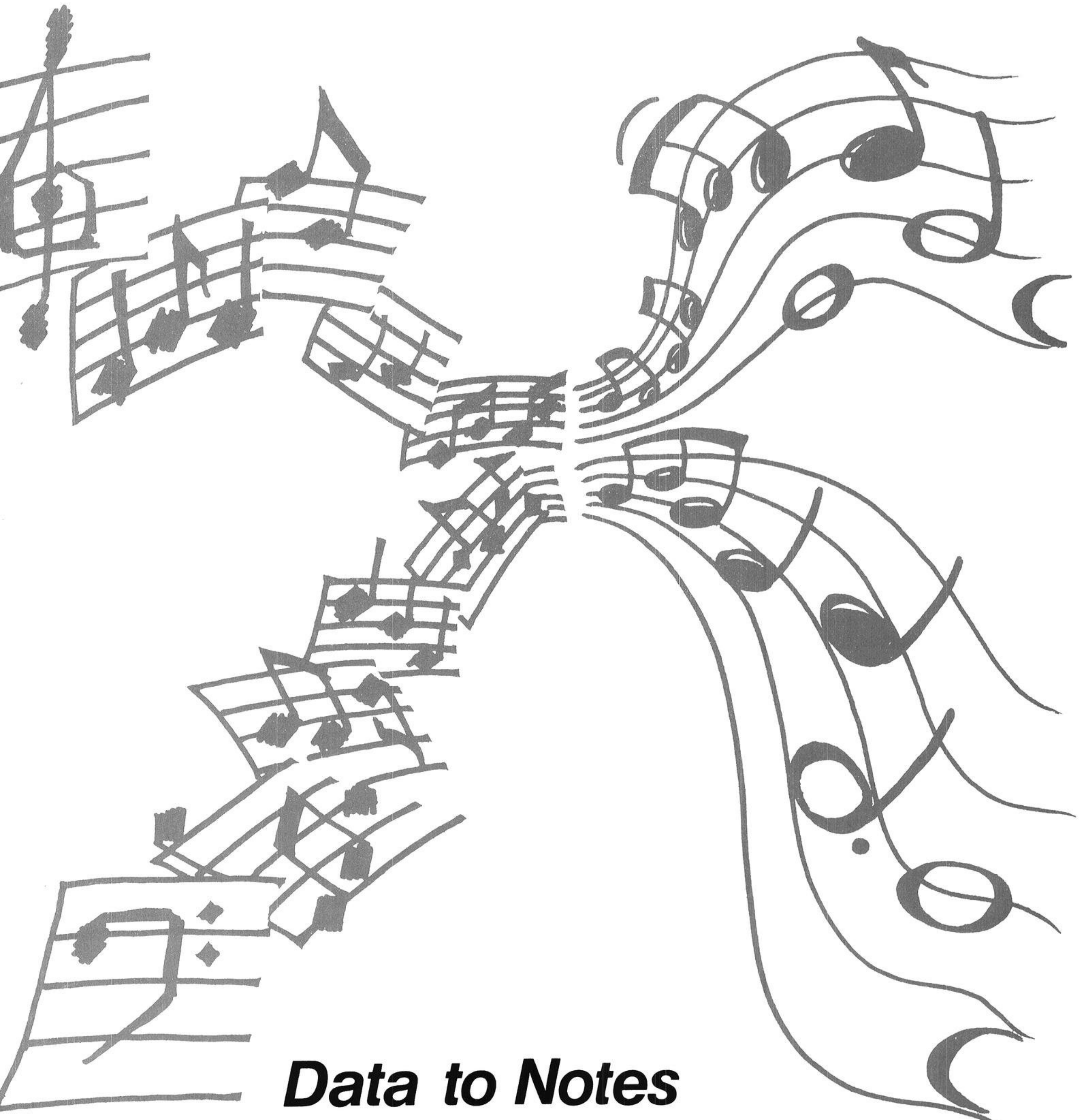
Volume 87, No. 3 February, 1983

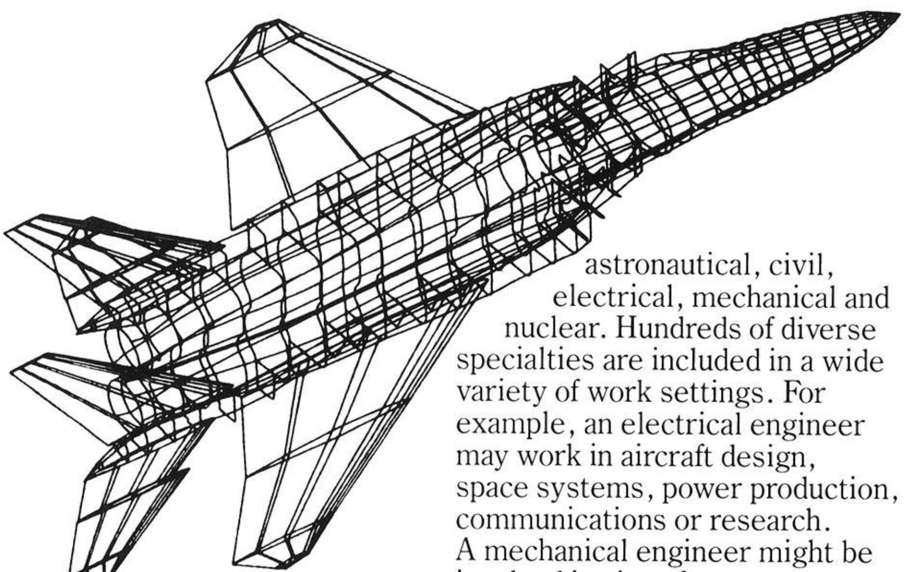
wisconsin engineer



Data to Notes

Making music automatically

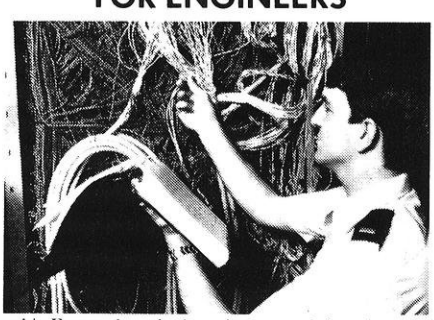
ENGINEERING TAKES ON EXCITING NEW DIMENSIONS IN THE AIR FORCE.



Computer-generated design for investigating structural strengths and weaknesses.

Developing and managing Air Force engineering projects could be the most important, exciting challenge of your life. The projects extend to virtually every engineering frontier.

8 CAREER FIELDS FOR ENGINEERS



Air Force electrical engineer studying aircraft electrical power supply system.

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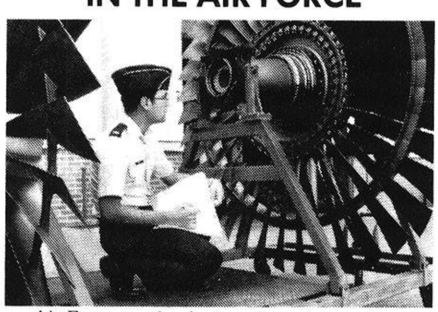
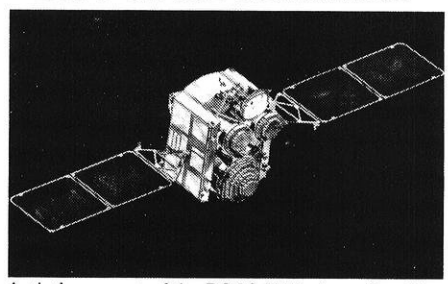
PROJECT RESPONSIBILITY COMES EARLY IN THE AIR FORCE



Air Force mechanical engineer inspecting aircraft jet engine turbine.

Most Air Force engineers have complete project responsibility early in their careers. For example, a first lieutenant directed work on a new airborne electronic system to pinpoint radiating targets. Another engineer tested the jet engines for advanced tanker and cargo aircraft.

OPPORTUNITIES IN THE NEW USAF SPACE COMMAND



Artist's concept of the DSCS III Defense Satellite Communications System satellite. (USAF photo.)

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AIM HIGH AIR FORCE

wisconsin engineer

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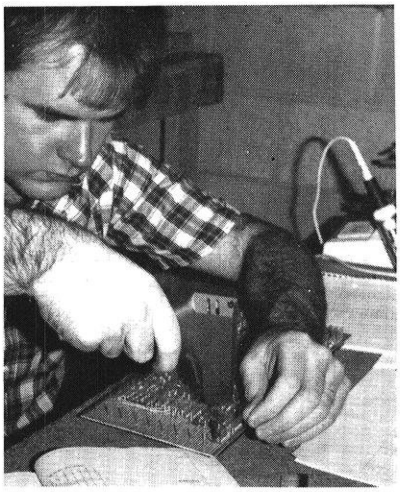

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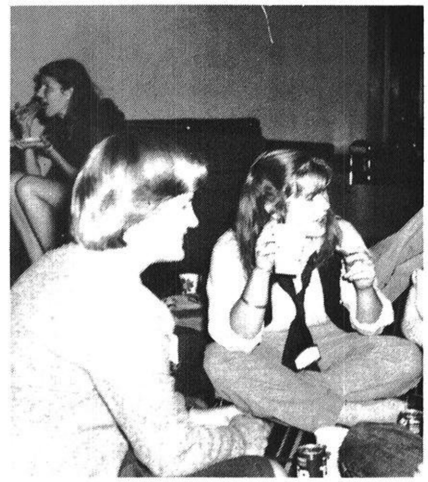
COLUMNS



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FEATURES

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Editorial Ceteris Paribus

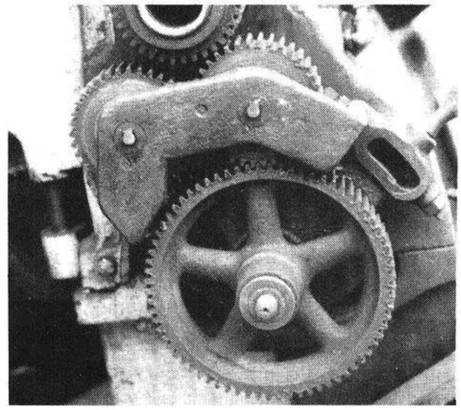


Photo by Ron Hillman

A latin quote is employed either to add richer meaning to, or to disguise the true nature of, the topic at hand. It carries with it an air of authority. The same can be said of certain administrative policies — one being the College of Engineering's liberal arts credit strategies. Each department requires students to fulfill an average of 16 humanities credits, roughly ten percent of the student's career course load. The purpose for these requirements remains dubious. Do these credits add richer meaning to our education, or just disguise the engineering profession's tradition of ignoring the humanities?

The phrase "Ceteris Paribus" means all other things held constant." Borrowed from economics, this quote can also be applied to the college's methods of cultivating student interest in the humanities. Engineering course material avoids any reference to social or cultural values, which the college expects other department to supply. The student is expected to leave the engineering campus for a humanities class and be able to turn on some sort of "social value input program" with the ringing of a class bell. But learning is not an itemized thing. Engineering educators must not differentiate the learning process by separating technology and humanities as the curriculum suggests. The student's need for humanistic input cannot be held "constant" while attending to the other 90% of his/her engineering education. There must be some requirement to assist the student to connect those values taught on Bascom Hill with those taught in the Engineering Building.

Special course in statistics, computer science, and economics have all been developed to suit the needs of the engineering student. The same should be developed for the humanities, for which the college will collaborate with the humanities departments (as an engineer would with an architect) to design a course tying the student's technical experience with the surrounding world. To ensure the engineer's taking the course seriously, it should be required and the final grade included in the student's cumulative engineering grade point average.

Another solution would be to have professors assign one essay question per semester probing the social side of the course or the profession in general. The students themselves could then read each other's papers, then grade and comment on the essays. This practice would save grading costs and generate a greater class awareness of themselves and what they are studying.

Ultimately, the success of the liberal arts credits rests upon the student. But since the college sees the need to guide the student through a specific course of engineering credits, it should also take responsibility that the student also gains the necessary experience in the non-technical domain. □

Lake Water by John Wengler

Tale of the Real World

Craig was pretty pleased last December. He was among the lucky ones who had a job waiting after graduation. His future employer was a large utility, sure to offer the kind of opportunities described by their glossy pamplets. But Craig's optimism was about to falter under the realities of being an employee in our business world.*

Companies like to know who their employees really are. Firms often use screening tests to make sure employees posses no negative traits. Lie detectors, psychological exams, and blood tests are in common use. The results of these tests give companies an idea of who may be a security risk, have a nervous breakdown, or use substances, such as liquor or drugs, that cause these and other problems. They want to know who's playing on the company team.

After a few weeks on the job, Craig was called in and told a blood test was scheduled for him the following week. Unfortunatly, Craig did not modify his recreational habits and failed the test; the company didn't approve of certain chemicals present in his blood. Craig than received an ultimatum: if he refused to retake the test, he was fired; if he agreed to retake it, the company could give a spot-check test at any time, which Craig had to pass to keep his job. Craig never imagined that fitting into a company meant more than getting a haircut and a new suit. Now his job was on the line because of what he chose to do with his free time.

The point of this story is not whether or not a person should use liquor or drugs, but that companies have controls over workers that surprise many graduates. Both employer and employee can take issue with this control. The company believes it must protect its interests by maintaining certain employee standards. The prospect of an intoxicated worker is understandably undesirable, but the test only proves the person had once consumed the substance, and not that he will show up to work intoxicated.

From Craig's point of view, the employee's right to privacy is clearly violated by screening tests. Research has found that many tests are unreliable in detecting problem workers. This is especially true for polygraphs and psychological tests (the latter was recently given and passed by Craig.) The pressure created by testing affects the workers responses to sensitive questions, altering their intended responses. Ultimately, the issue boils down to how much a company wants to know and what the employee is willing to tell.

Company control of the young engineer can extend past his/her recreational habits to how that person thinks. Alternative thinking can be discouraged or modified when detected in an exam. Disagreements with management could also be solved with ultimatums similiar to that given to Craig. Could Craig even have imagined this? Do the glossy pamphlets ever discuss this problem? Not that Craig ever saw, and none that the rest of us will see until we are caught, like Craig, between a rock and a hard place. □

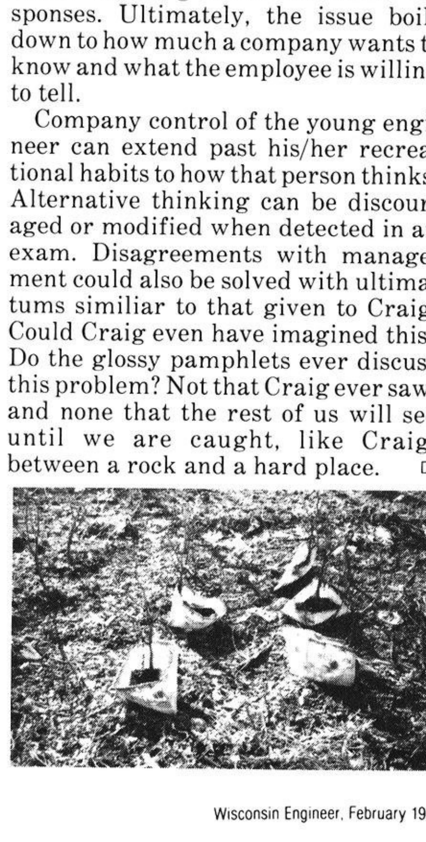
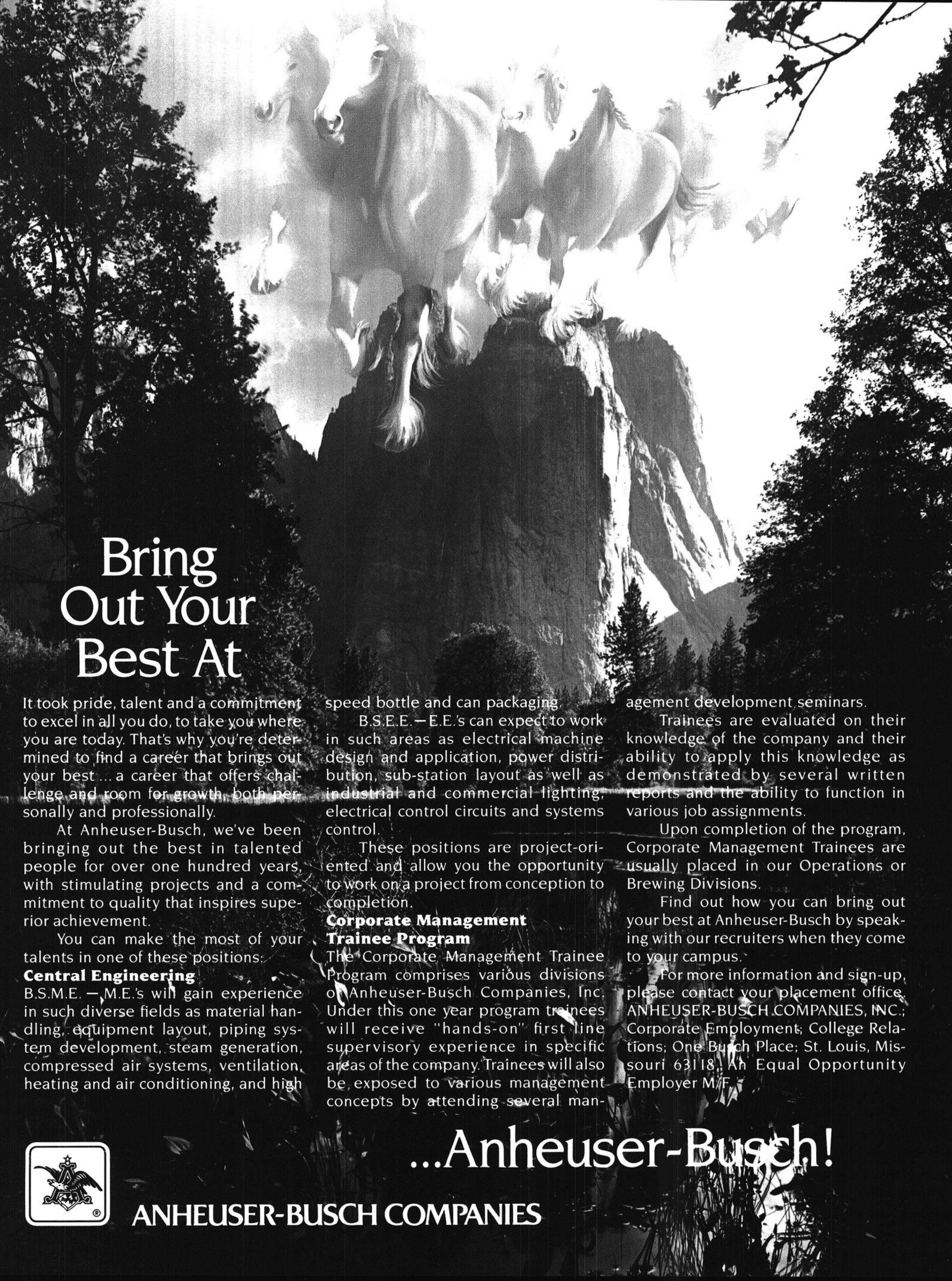


Photo by John Wengler

*This is a true story, but Craig's name has been changed.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The French Connection

by David Eiche

David Eiche, a sophomore in mechanical engineering, visited AMC's Kenosha Lakefront Plant earlier this year. He feels that the following article stresses some of the seldom expressed positive aspects of the automobile industry.

Photo by Steve Salvo

American Motors Corporation (AMC) has led a sort of James Bond existence in the automobile industry. Just as the company seemed doomed in the face of recession or some other difficulty, it would spring back to health by means of clever maneuvering or a fortuitous change of events. By 1978, though, AMC's fancy footwork was slowed by its lack of resources, specifically, it was unable to design an efficient front-wheel-drive car to compete with the Big Three and foreign companies. But once again, the company found a solution to its problem. This time through a "French Connection" with the Regie Nationale des Usines Renault, the largest automaker in France.

Renault allowed AMC to distribute its Jeeps in Europe, and more importantly, invested in the company. Renault's equity in the company was initially 26 percent, a figure which has since grown to 46.4 percent. The accompanying investment started at $200 million and is now $350 million. AMC used some of the money to improve its Kenosha plants to produce an Americanized version of the Renault R9, a newly designed subcompact which had been awarded Car of the Year honors in Europe. This car, named the Alliance, was the perfect addition to AMC's aging product line.

The AMC-Renault partnership has proved beneficial to the larger partner also. As former AMC chairman Gerald Myers told Motor Trend magazine, "The instant, immediate, unavailable-except-at-some-high-cost-over-a-long-period-of-time thing that we had to offer was the sales organization." AMC agreed to sell Renaults through its 1700 dealers, a sales network which would have been very expensive for Renault to develop by itself. These new dealers were crucial to Renault's goal of expanding its sales in the U.S. AMC also possessed an underused manufacturing capability which could be used for jointly-developed products like the Alliance.

The main responsibility for producing the Alliance went to AMC's Lakefront Plant. The plant had originally been a mattress factory and was converted to automobile production in the early sixties. It definitely did not represent the zenith of automotive production technology, and substantial renovation was necessary to bring it up to the exacting production standards of the new car. In July, after an expenditure of nearly $200 million, the first Alliance rolled off the line. It was the first totally new product produced by the plant in nearly ten years. The car is chiefly a Renault product, although it has been improved and modified by American Motors engineers.

AMC and the Kenosha community were so excited about the new car that they held an open house at the plant last August. The building, located on the shores of Lake Michigan, was draped with a large banner declaring it the site of the RENAM manufacturing facility. Long lines for plant tours attested to the immense employee interest in the Alliance, proving that worker apathy, at least at this plant, is a myth. The production start-up resulted in the recall of 1700 workers, a much needed shot in the arm for Kenosha's ailing economy.

Grinning company officials mingled with the crowd as groups were led into the first exhibit, a large hall containing the Alliance and its foreign competitors. The fit and finish of the subcompact was excellent. Body panels fit together with a minimum of clearance. The paint shone with an unusual luster due to a special clear coat. The interior featured ergonomically-designed bucket seats which pivoted like rocking chairs along a single central track. Under the hood was the compact 1.4 liter engine and transaxle unit, both of which are computer controlled on some models. In general, the car exuded a sense of no-nonsense quality.

The next exhibit included a new AMC-designed four-cylinder engine, probably a variant of AMC's reliable 258 CID six. There was another Alliance being "inspected" by a gaggle of slobbering children. This seemed especially fitting, as the Alliance looks like an ideal car for small families.

The more serious part of the tour began in the factory itself, where a

Photo by Steve Salvo

large, complicated machine stood, designed to stamp out the front cradle assembly automatically. This unit locates the engine, transaxle (transmissions are called transaxles on front-wheel-drive cars), steering rack, and suspension to close tolerances, thus

"The production start-up resulted in the recall of 1700 workers, a much needed shot in the arm for Kenosha's ailing economy."

obviating the need to adjust wheel caster and camber. The machine was one of only two in the world; the other is in France.

In another section of the plant was a new and very expensive painting line. The painting equipment was enclosed in a long booth. Through the windows the unpainted bodies were visible, suspended from the ceiling by mechanical arms which move along a rack during production. Various rust-inhibiting materials are applied to the bodies before painting, one of which is applied through a high-voltage cathodic electrocoat process. This ensures a thorough application because the material is electrically attracted to the body.

The production area was very clean due to the recent renovation. However, the plant's age was apparent due to its multi-level design which forces the bodies to travel through the floor to the next assembly level. Critics say this is disadvantageous compared to the modern single-level design, but no unreasonable problems were apparent.

Perhaps the most interesting machines in the factory were the amazing welding robots. The long line of the computerized machines would weld all major body components with tolerances Motor Trend reports, "are reduced to fractions of a "millimeter"." The robots' computer-controlled arms moved with amazing dexterity, deftly performing their tasks with surgical precision. Had the machines been actually welding (no production took place during the tour), there would have been a display of sparks to go along with the "clunk" heard at each welding point.

Photo by Steve Salvo

The tour also included a trip through the final assembly area, located in AMC's gargantuan Main Plant, where the firm's older models and engines are produced. (Alliance engines are produced in France and shipped to Kenosha.) Here the cars were given finishing touches, given emissions and performance tests, and repaired if necessary. The tour ended with a public relations presentation where a company official praised the workers' loyalty and urged them to continue producing quality products.

The Alliance, now in production for several months, has indeed proven to be a quality product. As an experienced worker explained to the Milwaukee Sentinal:

> *The Alliance is the best car we've ever built. Management and employees are really working together on this one. If you have a problem, say something that isn't fitting right . . . they listen.*

This attention to detail, by both workers and the engineers who designed the manufacturing equipment and processes, is readily apparent. Motor Trend magazine wrote that the car might be, "the finest quality car built in this hemisphere, maybe even the world."

The Alliance's quality, high fuel economy, and reasonable price have made it a winner on the sales charts. AMC reports that 87 percent of Alliance buyers had not recently purchased another AMC product, indicating that new customers are coming into the showrooms. Like its European cousin, the Renault 9, the Alliance has been named "Car of the Year", this time by Motor Trend Magazine in the United States.

The success of this new car has had a positive effect on more than corporate balance sheets and sales figures. More workers have been rehired due to a second shift at the factory. Morale at the plant is rising, and according to a company spokesman, unexcused absenteeism has dropped from 6 percent to 3 percent. Finally, the Alliance's success has shown that given clever and intelligent engineering, even old factories can produce products of exemplary quality and great popularity. □

Making Music Automatically

by Randall Schnier

Building projects has become an obsession for Randall Schnier. To becalm his soul, Randall decided to build and exhibit a project combining his interests in music and electronics for EXPO '83. An ECE Senior, Randall explains his creation in the following article.

A common feature of music in general, and electronic music in particular, is that it has certain patterns which are repeated throughout a composition. Examples of this might be the bass line of a song, or in the case of classical music, a theme which appears repeatedly in different parts of the composition.

Because electronic music often uses repeating patterns, devices called sequencers were developed to automatically play a group of notes in a pattern programmed by the user. Having constructed two electronic music synthesizers and a stereo audio mixer, I decided the next piece of equipment I would obtain would be a sequencer. There are many different types of sequencers available, each with varying capabilities, limitations, and prices. However, I could not afford to purchase a commercial unit, and I was also in need of a project for the 1983 Engineering Expo.

To solve these two problems, I decided I would try to build a sequencer on my own. I then had to decide what design to use, as well as what features I would try to incorporate in it.

Most synthesizers take their pitch information in the form of a control voltage. If the control voltage is increased, the pitch (frequency) of the oscillator in the synthesizer will also increase. Therefore, the task at hand was to build a device which would generate a sequence of voltages at its output. There are many ways to do this. One of the simplest is shown in figure 1. The voltages v1 through vn are set in advance by the user. As the switch is turned, the oscillator will produce the pitches which correspond to the voltages at the switch terminals. Usually the switching is done electronically with the pattern repeated when the end is reached.

I quickly decided that this method would not be adequate for the uses I had in mind. I wanted to be able to program a number of different patterns and have them played back in a predetermined order, possibly using some patterns more than once. I also wanted to be able to "transpose" a pattern by a preset interval to put it in a different key. This would be useful in bass lines, where often the same pattern is used repeatedly, but in different keys. Finally, since the output of most synthesizer keyboards is a control voltage, I wanted to be able to program the sequencer by connecting this control voltage to it. A sequence of notes could then be stored by playing it on the keyboard.

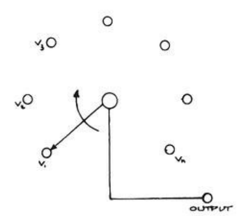


Figure 1: A simple sequencer.

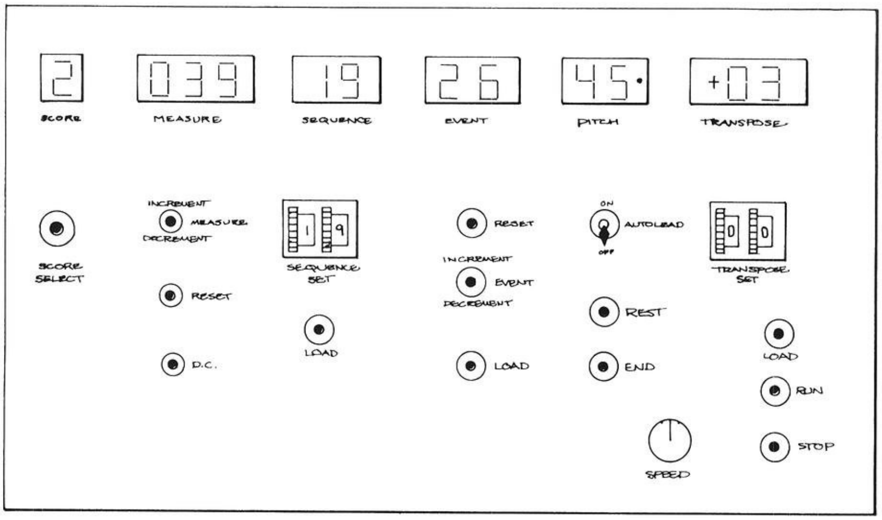
After looking at what was available commercially, it was apparent some type of digital memory circuit would be needed. This meant the control voltage from the synthesizer keyboard would have to be converted into digital form before it is stored. When the sequence is played back, the digital data would be converted back to a control voltage, which is fed to the synthesizer. Fortunately, there are devices called analog to digital (A/D) and digital to analog (D/A) converters which perform the needed conversions. These devices are available in integrated circuit form and need very few external parts.

Thus, the sequencer consists of a large amount of memory, plus the circuitry needed to control which note from the memory is being sent to the synthesizer. I decided to use a memory chip which holds 1024 items of data. This was divided into 32 sequences, each holding 32 events, an event being either a note or a rest.

A second memory was dedicated to storing the playing order of the sequences, as well as what interval to transpose the sequence being played. Again using a 1024 item memory, I decided to organize it into 4 "scores", each score being 256 measures long. This turned out to be very convenient, as most musical material is broken up into multiples of four measures.

After all this preliminary design work, the front panel shown in figure 2 took shape. Numeric output is accomplished via light emitting diode displays. "Score" shows the number of the score the sequencer is playing. "Measure" shows which measure in the score is presently being played, while "sequence" displays which sequence has been assigned to that measure. "Event" displays the event number in the sequence being played, and "pitch" displays the number of the note assigned to that event. The indicator below the pitch display is another light emitting diode which shows whether or not the sequencer is "holding a key down". That is to say, the sequencer doesn't actually press the keys down, but sends the synthesizer the control voltage for the pitch to be played, along with a "gate" voltage. When the gate voltage is at a positive level, the synthesizer thinks a key is being held down. After the gate voltage drops to zero volts, the synthesizer thinks the key has been let up and starts to decay the volume level of the note. If the sequencer "lets a key up" by dropping the gate voltage to zero, the oscillator must keep the pitch it is producing constant. This is because a tone does not usually stop instantly, but decays gradually. If the pitch information changes when a "key is let up", the effect of this pitch change will be very audible. Finally, "transpose" displays the number that is added to the pitch information to change the key a sequence is played in.

Programming the sequencer is done in several steps. First, each sequence that will be used (up to 32) must be programmed with the notes that make up the sequence. To do this, the controls under the "event" and "pitch" displays on the front panel are used. An "autoload" mode was added for convenience. It will allow the programmer to enter a sequence merely by playing it on the keyboard of the synthesizer, adding rests where desired with the "rest" button. As each note or rest is entered, the event counter is automatically incremented. After the sequence has been entered, the "end" button is



Graphics by Alicia Diehl

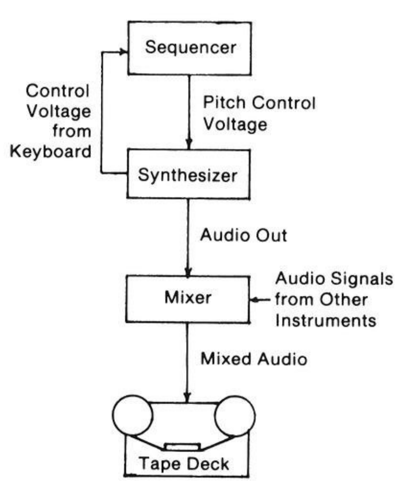
Figure 2: Front Panel.

depressed to mark the last event in it. Using the "increment/decrement event" switches it is possible to edit a seqquence which has already been stored. After stepping to the event number which is to be changed, the replacement note is played on the synthesizer keyboard and the "load" button is depressed. The new note will then replace the note which was previously assigned to that event.

Once the patterns (sequences) to be used have been defined, the next step is to program the order in which they will be used. This is done using the controls under the "measure" and "sequence" displays. Starting at measure "000", the sequence to be assigned to that measure is entered using the thumbwheel switches under the "sequence" display. Pressing the "load" button below the switches causes the number selected with the switches to appear in the "sequence" display. A transpose factor can be added using the thumbwheel switches under the "transpose" display. This number is entered by the same method as a sequence number is entered. These two steps are repeated for each measure in the score. At the end of the song, the sequencer will stop unless it is told to go back to the beginning with the D.C. (da capo) button.

Once a score is entered, the first measure is chosen with the "measure increment/decrement" control. When the run button is depressed, the sequencer will begin playing the programmed score until the stop button is depressed or the end of the score is reached. However, if a "D.C." has been entered at the end of the score, the sequencer will not stop but will reset the measure number to zero and continue playing the score. The speed control determines what speed the score is played at.

When I am composing a piece of electronic music, I will connect the sequencer to my other gear as shown in figure 3. During the time the sequencer is being programmed, the keyboard control voltage will be fed from the synthesizer to the sequencer. As mentioned before, this allows me to program the sequences by playing them on the keyboard. After the score is entered, the output control voltage from the sequencer is fed back to the synthesizer. The audio output from the synthesizer is then routed to the mixer, where it can be combined with other instruments (such as electric guitar), and finally sent to the tape deck where the piece of music is stored. The type of tape deck which is used by most amateur musicians such as myself has four independent channels. Each channel can be recorded on while listening to some or all of the other channels. In this way, the different parts can be synchronized to each other, and the song is recorded in "layers".



Graphics by Alicia Diehl

Figure 3: Connections to other equipment.

For example, if I were to use the sequencer to play a complex bass line, I would program the bass line into the sequencer, and record it on channel 1. After rewinding the tape to the beginning, I would listen to the bass line on channel 1 while recording another part (the melody, for example) on channel 2. Additional parts are added on channels 3 and 4 in a similar manner. This is how almost all electronic music is recorded.

Construction of the sequencer has proceeded according to schedule. After the basic model is assembled and tested, I will attempt to add a "synchronize" feature which will allow me to synchronize the sequencer to a part which has already been recorded on tape, such as another sequence. With this option, I believe some extremely interesting patterns could be produced.

The unit was constructed using a combination of homemade printed circuit boards and wire wrapping. Based on experience with other projects, I have found these methods to be the most reliable and easy to service. I anticipate a total cost for the project in the 600 dollar range. Considering the price of commercial units (about $1500), this figure seems quite reasonable. I will have the final working model on display, along with my other electronic music equipment, at the 1983 Engineering Expo.

In this article I have tried to give the reader some idea of how electronic music is made, as well as a description of one of the more useful and interesting pieces of electronic music equipment, the sequencer. I constructed this sequencer to enhance the quality of my electronic music, and am hopeful it will live up to my expectations. Even if it doesn't, I usually learn a great deal while designing and building a project. Besides, after one project is finished, there's always another one to start on. Already in the works is a computer controlled polyphonic (multiple oscillator) synthesizer, which will at last enable me to play chords. □

Trading Visas for Diplomas

by Hassan Syed

The ensuing trade war threatens to have its effect on the foreign students studying in the U.S. A citizen of Pakistan, Hassan Syed presents the foreign student's view of legislation pending in Congress. Hassan is an electrical engineering student and is interested in international relations.

It seems, now that the United States is going through an economically rough period, that Congress is resorting to quick-fix measures to take care of the country's economic ills. Bills such as the balanced budget amendment and tough immigration laws are being pushed vigorously as economic panaceas. In Congress' almost frenzied approach to cut down unemployment, it is the foreign students at university campuses all over the country who seem certain to be victimized.

A bill currently under consideration in Congress would force foreign students out of the United States after completing their education. The bill, originally proposed by Sen. Allen K. Simpson (R-WY), would prohibit foreign students from applying for permanent residence in the U.S. until two years after graduation. Also, students would not be allowed to extend their visas after graduation, thus forcing them out of the country.

"Bills such as the balanced budget amendment and tough immigration laws are being pushed vigorously as economic panaceas."

If passed, such a bill would have disastrous effects on foreign students. It would create a climate of aggravation and constant worry over future prospects in America for these students. It would undermine the credibility of U.S. educational institutions as world centers for gaining knowledge and technical expertise, since foreign students would not be allowed to stay, work, and gain experience. With the 1960's baby boom gone, it is estimated that college enrollment will decline in the later part of this decade. It would not be prudent to scare a sizable number of foreign students enrolled at small university campuses and would definitely affect the cultural richness of campuses all over the country. In today's world there is more need than ever for people from different countries to get in contact with each other and gain a better understanding of each other's cultures.

Photo by Steve Salvo

The proponents of this bill claim that a large number of foreign students, with no knowledge of this country and its language, are immigrating to the U.S. Such an argument is fallacious. First, statistics prove a large number of foreign students are not immigrating to the U.S. Secondly, it is false to assume that these students have no knowledge about American culture and language. These students are actually well-accustomed to the American lifestyle and in most cases have incorporated it into their daily lives. Most of these intellectuals have an extremely good command of the English language. These students are more suited to blend into the American mainstream than anybody else.

Even though supporters of the bill claim that the foreign students are needed more in their native countries, the bill has built-in loop-holes. These lope-holes would allow the U.S. officials to retain foreign students with degrees and expertise in highly technical fields. However, a majority of foreign students will not fall under the ambiguous language of these provisions. Such measures in the bill cast doubt on the sincerity of its proponents.

The bill is increasingly gaining momentum because of Washington's paranoia over large-scale illegal immigration into the country. But, the foreign student should not be made a scape-goat in a case over Immigration's inability to curb illegal entries into the U.S. from across the border. □

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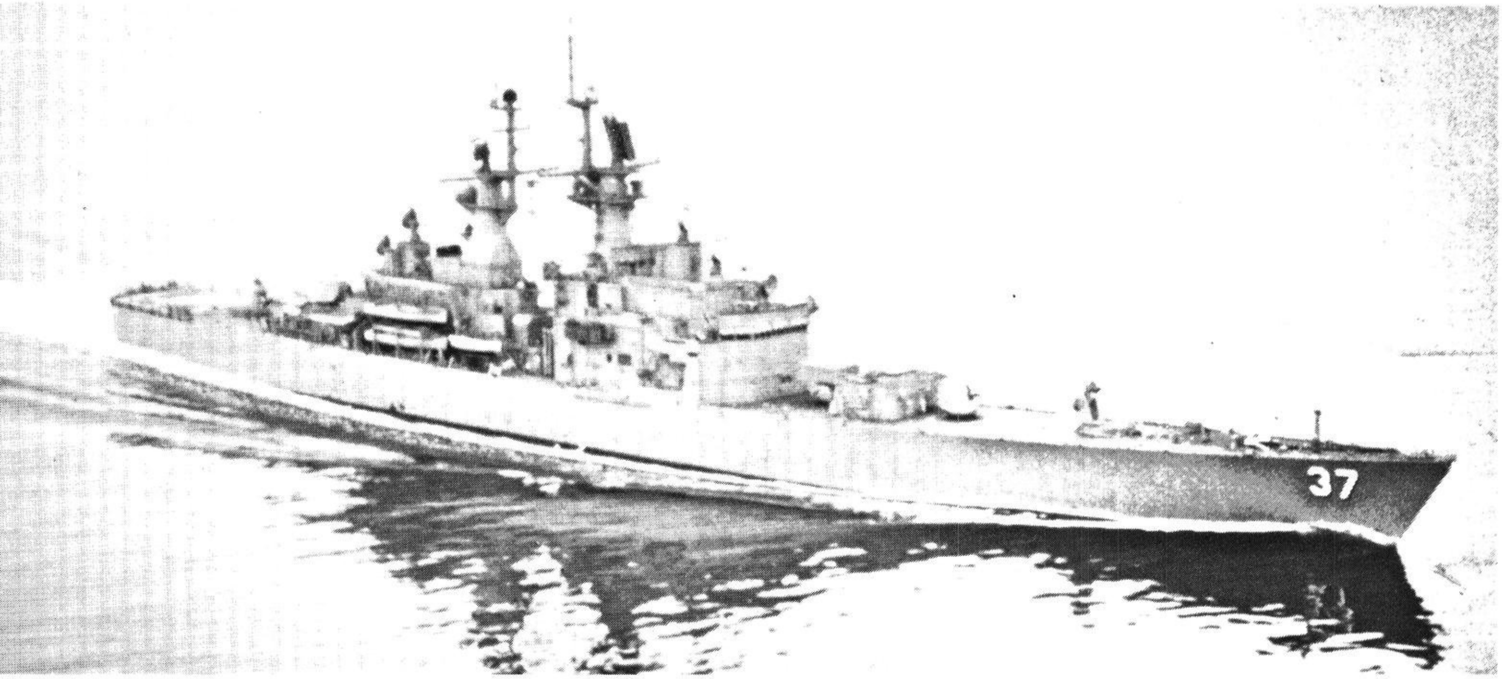

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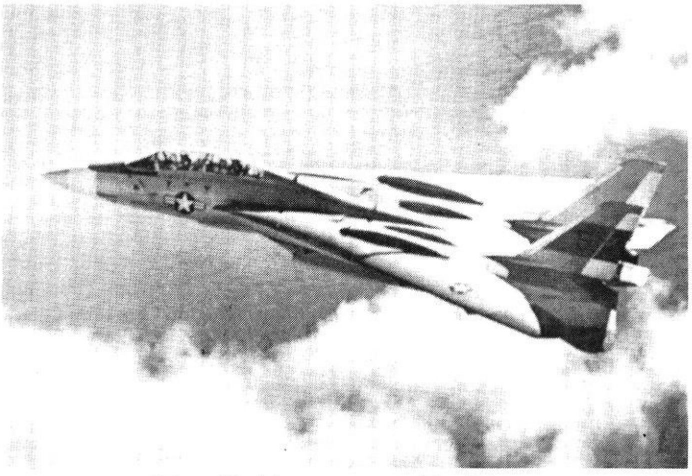

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A New Idea In Scholarships

A Walk on the Dean's Side

by Penny J. Christopherson

The UW College of Engineering has a proud heritage of outstanding deans. Dean Kurt F. Wendt, the namesake of our library, and Dean W. Robert Marshall have passed their legacy to our present dean, John G. Bollinger. Penny Christopherson offers this review of Dean Bollinger's first year in office.

When Dean John G. Bollinger assumed the responsibility for the administration of the College of Engineering in July, 1981, he knew he had a few obstacles to overcome to guarantee engineering students a quality education. Bollinger always enjoys a challenge, and as he saw it then, he had four:

- The need to divide the engineering program into two levels with separate entrance requirements.
- The need for additional building space for classrooms, instructional laboratories, and research facilities.
- The need to hire more top-notch engineering faculty and staff.
- The need to continue building a broader communication network with industry.

At a time when the operating budget was tightened and costs and inflation rates were spiraling, Bollinger faced these problems head-on. He rolled up his shirt sleeves and got down to business.

In the process of addressing these challenges, Bollinger's administration saw three other innovations occur in the College of Engineering:

- The availability of graduate credit for off-campus study.
- The opening of the Computer-Aided Engineering Center.
- Ready accessibility of computers for engineering faculty.

Admission and Entrance Requirements

The engineering program was divided into pre-engineering and engineering levels the fall semester of 1981. At the pre-engineering level, any freshman student eligible for admission to the UW-Madison campus is also eligible for admission to the College of Engineering as a pre-engineering student with an EGR classification. At the engineering level, prior to admission to any degree-granting classification, the student must have a minimum cumulative 2.50 or 3.00 GPA depending on the field of interest. Although the College imposed stiffer entrance requirements for admission to the engineering level, the changes do not appear to effect the current trend of swelling enrollments.

The following chart indicates the pattern of soring enrollments in the undergraduate engineering program over the past two years:

Semester/Academic Yr.	# of Students
Semester I, 1980-81	4,571
Semester II, 1980-81	4,247
Semester I, 1981-82	4,850
Semester II, 1981-82	4,513
Semester I, 1982-83	5,101

Graduate student Weishaung Qu, working with Professor Arne Thesen of the Department of Industrial Engineering, formulated a mathematical model to study alternative programs aimed at curbing the growing enrollment numbers in the College. Based on this study performed by computer analyses, Thesen and Qu presented two principal options to engineering faculty at their October meeting for consideration:

- Raise the present grade point requirements (in some departments the entrace requirement would be a 2.25, 2.50 or a 3.00 GPA) for students being accepted into any degree-granting classification.
- Raise the maintenance grade point for students already accepted in a degree-granting classification from the 2.00 GPA standard.

Bollinger thinks the first option is the best way to curtail the influx of undergraduate engineering students and so do several departments in the College. For the second semester of 1982-83, the Departments of Mechanical Engineering, Chemical Engineering, and Electrical and Computer Engineering have raised their entrance requirements from the established 2.50 GPA to a 3.00 GPA. No action was taken by faculty on the second option presented by the Thesen/Qu duo.

Space Needs for Growing Demands

A major success was met this fall when the final go-ahead was given by the UW Board of Regents on the Center for Applied Microelectronics renovation at 1410 Johnson Drive, the former state highway laboratory. The State Building Commission must still approve the $2.3 million project, but UW officials do not foresee any difficulties in obtaining it. Work is scheduled to begin this spring.

Bollinger says another plan is in the works for takeover and renovation of an additional building that would provide a significant space increase. The building lies in close proximity to the engineering campus.

RMJ Photo

Dean John G. Bollinger

Faculty and Staffing Needs

"The College is hiring as many qualified faculty as there are appropriate people to find," Bollinger says. "Competition for qualified candidates is very severe among institutions."

The College needs to increase its faculty rolls to compensate for attrition and earlier fiscal cuts. Several full-time positions were lost in the last budget although the College did gain in teaching assistant positions. Bollinger says the College is being forced "to become more fluid" in dealing with decreasing state revenues.

A new program was introduced to the engineering campus this fall. IBM loaned two staff members to serve as adjunct assistant professors for the 1982-83 academic year. Thomas E. Dillinger is working on research that has potential for creating high technology jobs for Wisconsin businesses at the Center for Applied Microelectronics. James D. Kelly divides his time between teaching in the Department of Electrical and Computer Engineering and working with the Engineering Minorities Program.

UW-Industrial Relations

The College continues to build strong ties with industry, both statewide and nationally. Faculty says now it is the time for industry and university to pool their resources and pull for one another.

Bollinger notes the expansion in the number of industrial consortia in 1982. An industrial consortia is formed by a group of businesses sharing like interests, who invest their time, money, and concern in developing engineering research projects. Through the contributions of these consortia, both business and engineering research flourish.

Bollinger acknowledges the key role the Industrial Liaison Council plays in its advisory function to the College. The Council, consisting of major state and national business leaders, combines its managerial know-how and experience to advise the College in matters of administration, research, instructional policies, and the like.

This past October the College hosted a series of seminars dealing with electronics and microelectronics, materials science, and manufacturing processing and systems on the day set aside to honor the achievement of eight outstanding engineers -- Engineers Day. The Technology Transfer Seminars drew approximately 80 industrial participants, according to organizers.

In 1981-82, business and industry contributions and private foundation grants accounted for 14 percent of the total funding support to the College of Engineering. Engineering research expenditures for that same period totaled $16.7 million compared to $8.6 million in 1976-77. In 1981-82, $5 million of the research expenditures were financed by nonfederal monies. $4 million came from business and industry donations; $1 million from private foundations. Most business and industrial research grants are faculty-initiated.

In a much broader perspective, according to university officials, private gifts to the UW-Madison campus increased $7.7 million in 1981-82, more than a 30 percent increase. This compares to a national average increase of 11.3 percent. The 30 percent increase occurred at a time when federal grants decreased $4.28 million.

Among public universities, the UW-Madison campus ranked 5th in voluntary gift support in 1981 and 19th nationwide among public and private universities, according to the Council for Financial Aid to Education.

The College of Engineering communicates with its alumni, friends and faculty, and corporations through the efforts of Ann Bitter, director of development for the College at the UW Foundation. Since Bitter's appointment by Dean Marshall in 1981, her office created an annual College of Engineering Fund to provide the College with scholarships, professorships, laboratory equipment and a host of other special projects. Bitter's intent in the creation of this fund was to also increase the number of alumni and corporate gifts to the College.

"The College is hiring as many qualified faculty as there are appropriate people to find," Bollinger says.

University records indicate that since 1981, when this fund was started, the number of private donors jumped from 155 in 1980 to 685 in 1981. The dollar donations doubled in 1981 from $31,000 in 1980. Bitter says the College is well ahead of the 1981 mark in 1982 with 627 donors contributing $71,000 through the end of September.

Many of these contributions are matched by the corporations employing these alumni. Based on statistics provided by Bitter's office, corporate matches total $25,000 already for 1982. In 1980 and 1981 corporate matches were seldom initiated. These contributions, a result of a direct-mail appeal, do not reflect major gifts or bequests. Bitter says that corporate gifts to the College of Engineering increased 138 percent in 1981 compared to 1980 figures.

Other Changes On The Engineering Campus

Graduate Credit via Videotape

This fall the College received approval from the Continuing Education Council, Extended-Timetable Graduate Program, for two graduate-level courses to be offered via videotape for spring, 1983. Associate Dean Donald L. Dietmeyer of Student Affairs says these two courses are ME 601 (432) Robotics and ECE 431 Digital Signal Processing, and they will be offered without fixed lectures.

Students must register in Madison to meet with the professor, learn course requirements and exam dates, and buy textbooks. Lectures will be videotaped and shipped to off-campus locations.

The last time students were offered off-campus credits was in the late 1960's. The venture was experimental, and the courses focused principally in mechanical engineering. Bollinger, who taught two of them, feels they met with great success.

Computer-Aided Engineering Center

January, 1982 marked the opening of the Computer-Aided Engineering (CAE) Center, under the direction of Professor John J. Uicker, Jr. At present 58 terminals are available for student access, according to CAE Program Supervisor Michael J. Redmond. Twenty-six terminals are located at both the CAE-West (360 Mechanical Engineering) and the CAE-East (B555 Engineering) sites, and six terminals are housed in CAE-Central (1011 Engineering).

According to CAE statistics, 25,000 hours of connect time were logged from March through July on the Harris 800 system alone. Other available systems for student access at the CAE sites include the Wircs Vax-11/780, and the Wits PDP-11/70. The Sperry Univac 1100 computer can be accessed by funded students and faculty only. The Harris 100 system is for the exclusive use of faculty and staff.

Any engineering student, faculty, or staff member may access these computer terminals.

Computer Availability for Faculty

Well underway is Bollinger's request for a broadband communications network to be installed in the office of each faculty. This network has the capability of linkage with computing resources. CAE Supervisor Michael Redmond reports that by mid-December, 1982, 120 offices will be wired, with 40 offices having full terminal communications ability.

Bollinger's reasons for making computers more easily accessible to faculty are two-fold:

- -- He feels the computers will better enable faculty to interact with students in problem solving, program instruction, and problem-solution review.
- -- He doesn't want faculty competing with students for quality computer time.

continued on page 23.

The Chromium Mechanism

The first comprehensive explanation of electrochemical activity during the plating of chromium has recently been formulated at the General Motors Research Laboratories. This understanding has aided in transforming chromium plating into a highly efficient, high-speed operation.

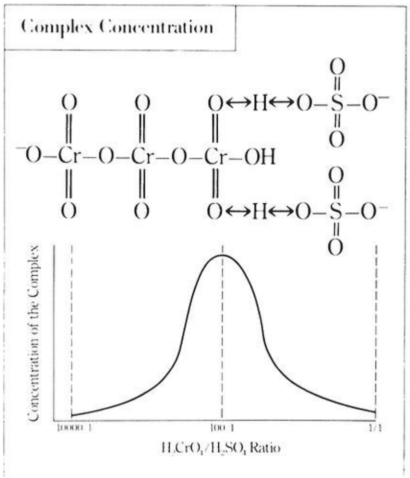


Figure 1: The electroactive complex and a theoretical plot of its concentration as a function of chromic acid to sulfuric acid ratio.

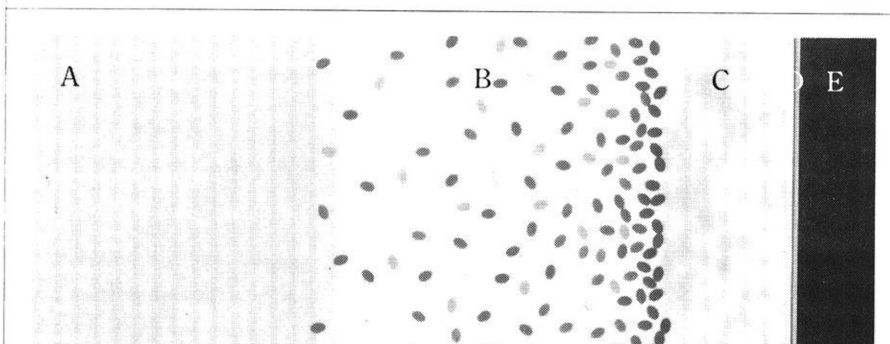
Figure 2: The electroactive complex diffuses from the bulk electrolyte solution (A) through the diffusion layer (B) to the Helmholtz double layer (C) to be discharged as metallic chromium (D) on the cathode (E) surface.

FOR MANY industrial applications, chromium coatings of more than 0.2 mil thickness are required for wear and corrosion resistance. But the conventional method of plating chromium is neither fast nor efficient. Nor, until the recent work of a GM researcher, had the steps involved in the century-old plating process been explained in detail. Through a combination of theory and experiment, Dr. James Hoare has devised the first comprehensive mechanism for chromium plating. This increased understanding has helped electrochemists at the General Motors Research Laboratories develop a system that plates chromium sixty times faster than the conventional method, while improving energy-efficiency by a factor of three.

The electrolyte for plating is a chromic acid solution which contains various chromate ions: chromate, dichromate and trichromate. From a series of steady-state polarization experiments, Dr. Hoare concluded that trichromate is the ion important in chromium deposition.

Sulfuric acid has been recognized as essential to chromium plating and has been assumed by some to be a catalyst for the process. In this strongly acidic solution, sulfate should be mostly present as the bisulfate ion $(HSO_4)^-$. Dr. Hoare found, contrary to expectations, that the addition of sulfuric acid to the plating bath decreased the conductivity of the solution.

Combining these findings with the results of previous investigations, Dr. Hoare concluded that the electroactive species was a trichromate-bisulfate complex (see Figure 1). From equilibrium considerations, he theorized that the maximum concentration of this species occurred at a 100-to-1 chromic acid/sulfuric acid ratio. The observation that the maximum rate of chromium deposition also occurred at this ratio supports the conclusion that this trichromate-bisulfate complex is the electroactive species.



During the plating process, the complex diffuses from the bulk solution toward the cathode (see Figure 2). Electron transport takes place by quantum mechanical tunneling through the potential energy barrier of the Helmholtz double layer and the unprotected chromium in the complex (Cr atom on the left in Figure 1) loses electons by successive steps, going from Cr^{+6} to Cr^{+2}. Decomposition of the resulting chromous dichromate complex takes place by acid hydrolysis to form a chromous-oxybisulfate complex:

$$^{+}Cr{-}O \leftrightarrow H \leftrightarrow O{-}\overset{\displaystyle O}{\overset{\|}{\underset{\underset{\displaystyle O}{\|}}{S}}}{-}O^{-}$$

The positive end of this complex is adsorbed onto the cathode surface. Electrons are transferred from the cathode to the adsorbed chromium ion, forming metallic chromium and regenerating the $(HSO_4)^-$ ion. Thus, Dr. Hoare's mechanism explains how sulfuric acid, in the form of the bisulfate ion, participates in the plating process.

IT HAS long been known that chromium cannot be plated from a solution when initially present as Cr^{+3} because of the formation of the stable aquo complex, $[Cr(H_2O)_6]^{+3}$. Yet chromium can be plated when initially present as Cr^{+6} even though it must pass through the Cr^{+3} state before being deposited. Dr. Hoare's mechanism handles this paradox by explaining that the chromium ion being deposited (on the left in Figure 1) is protected by the rest of the complex as it passes through the Cr^{+3} state, so that the stable aquo complex cannot form.

The diffusion of the electroactive complex apparently controls the rate of the process, so that shortening the diffusion path increases the speed of chromium deposition. A high rate of relative motion between the electrolyte and the cathode will shorten the path. This can be accomplished by rapid flow or by agitation of the electrolyte.

Dr. Hoare found that the rate of chromium deposition increased with electrolyte flow until the process was no longer diffusion-controlled. He also found that the use of dilute electrolyte significantly increased plating efficiency.

"This project is an excellent example," says Dr. Hoare, "of how basic research and engineering principles can be combined to develop a new, successful process. Now, we'd like to take on the challenge of plating successfully from Cr^{+3}, which would be an even more efficient way to provide corrosion and wear resistance."

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THE MAN BEHIND THE WORK

Dr. James Hoare is a Research Fellow at the General Motors Research Laboratories. He is a member of the Electrochemistry Department.

Dr. Hoare served as an electronics technician in the U.S. Navy during the Second World War. In 1949, he received his Ph.D. in physical chemistry from the Catholic University of America. After an assistant professorship at Trinity College in Washington, D.C., he joined the US Naval Research Laboratory as a physical chemist. He became a staff member at General Motors in 1960.

Dr. Hoare's sustaining interest has been in electrochemical kinetics and the mechanisms of electrode processes. He is best known to the scientific community for his basic studies of hydrogen and oxygen electrode mechanisms. His book, *The Electrochemistry of Oxygen,* published in 1968, is considered a work of primary importance to the field. In addition to his work on chromium plating, he is responsible for the fundamental research that helped make electrochemical machining a precision process.

Engineers in the Band

by Mike Reiels

At about 1:10 on football Saturdays, 200 uniform clad band members come strutting out of the tunnel doing the famed run-on step. Few people realize that almost half of the people out there are engineering students. The Wisconsin Band is comprised of about 40 percent engineering students, 30 percent Letters and Science students, 20 percent agricultural students and about 10 percent music majors. Why are so many band members engineering students?

Director Michael Leckrone explains, "The band attracts the same kind of student that engineering does." The band demands that a person be intellegent (at least smart enough to learn the routines), energetic, well rounded, and somewhat athletic. The band also offers an excellent release from the daily grind and most importantly it's fun."

Senior mechanical engineering student John Morley comments, "Sure, band is a lot of work, but it's fun. If it weren't fun, I certainly wouldn't spend all the time required for the one credit." "The exhilaration of marching through the tunnel into the sight of 80,000 fans is a feeling that can only be experienced-words would never do!" exclaims drum major and agricultural engineer, Steve Winestorfer. Certainly, this feeling is quite different than anything experienced in engineering. John Tank, a senior in electrical engineering, speaks for many when he calls band "a very much needed relief period from engineering."

Once the marching season is over, the marching band becomes the varsity band which plays for hockey and basketball games. The demands of varsity band are much less; rehersals are only once a week instead of four times and the games are more laid back. "The band's job at these games is to entertain," says Leckrone. "People come for the total package: the game, the fans, the band, and fun." The cheers and comments at the games are not rehearsed; the band members come up with them on the spur of the moment. Fortunately I don't have to prompt people, in fact, I'd much rather have to harness people than drive them (to come up with cheers)," quipps Leckrone.

This emphasis on entertainment is certainly a refreshing change from engineering and is no doubt attractive to engineering students in band. So, next time you're at a game, take a second look at the band, you may recognize quite a few classmates. □

Drum major and agricultural engineer Steve Winestorfer claims that performing before "80,000 fans is a feeling that can only be experienced !"

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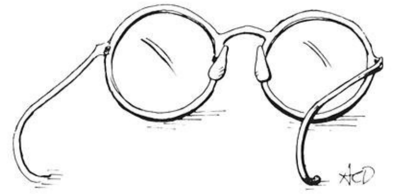


The Right Stuff

Written by Tom Wolfe

> **"Each . . . had the 'right stuff', . . . the ability to go up in a hurtling piece of machinery, and put his hide on the line, . . . and then to go up again the next day . . . even if the series should prove infinite."**

I have always enjoyed Tom Wolfe's cultural journalism *(The Electric Kool-Aid Acid Test, The Pump House Gang)*, but when I heard about his book on the first American astronauts, I thought, "Big deal". It was a great engineering feat, sending the boys up and getting them back down again over **20** years ago. But the astronauts themselves -- they seemed about as thrilling as seven identical slices of Ma's apple pie.

Well, *The Right Stuff* is a real eye-opener -- about the astronauts' lives and personalities, about Project Mercury, and about the mental climate of America as it entered the space age. The book has thrills. It has intrigue. And it's very, very funny.

The book begins at the real beginning of the country's space program with a description of the training of Navy test pilots, who, in the 1950's, were ready to reach the boundaries of the atmosphere in the X-15. Each of these flyers had the "right stuff"; not merely courage, but "the ability to go up in a hurtling piece of machinery and put his hide on the line and then have the moxie, the reflexes, the experience, the coolness, to pull it back in and last yawning moment -- and then to go up again the **next day** and the next day, and every next day, even if the series should prove infinite".

However, most of these men were to be denied the ultimate test of their "stuff". A **piloted** orbit of the earth was still years away, but a manned space flight of some type was needed much sooner. The Cold War was raging and in order to beat the Russians in the race to the skies, Project Mercury was conceived. Using rockets already available, a man would be **propelled**, not fly, into space.

The Navy test pilot fraternity ridiculed the whole space capsule idea -- the so-called astronauts would be nothing more than passive passengers, medical guinea pigs. However, to the President, the press, the public, to everybody but their fellow test pilots, the seven men chosen for Project Mercury were the ultimate embodiment of the right stuff.

Even before the first manned rocket took off, the astronauts were idolized in print, given parades, listened to by Congress -- they were seen as "Single Combat Warriors", risking their lives on each flight to symbolically preserve the American way of life.

Planners decided that the astronauts had to have the "right stuff" to go into orbit without losing their minds.

Graphics by Rock

Although Wolfe satirizes the whole hyped-up "right stuff" concept, which produced flying aces who, rather than declare an emergency in the air, would crash and burn to prove their manhood, the astronauts come across as interesting and likable individuals. Wolfe's astronauts are competent and brave, but hardly the sanitized heroes portrayed in the 60's press. Some of them were hard drinkers in those early days, and they didn't always exactly ignore the Cape Canaveral groupies. And the camaraderie of this chosen few was often strained by backbiting over who was to be the first man in space, and by irritation over the holier than thou behavior of "Deacon" John Glenn.

Though Wolfe's astronauts are imperfect but admirable characters, other figures in the book aren't so lucky. For example, Wolfe calls the collective numbers of the American media a "Victorian gentlemen". The press airbrushed the astronauts' photographs and their life stories as well -- any hint of marital strife or less than model behavior never appeared in print. However, these same reporters saw nothing scandalous in laying siege to the astronauts' homes while space flights were in progress, pressuring already harried wives and children for comments.

And in the funniest scene of the book, Wolfe skewers Texans and their famous hospitality. He describes a "little" cocktail party honoring the astronauts and their families -- held in the Houston Coliseum: "There were thousands of people milling around and some sort of incredible smell and a storm of voices and the occasional insane cackle. There were five thousand extremely loud people on the floor eager to tear into roast cow with both hands and wash it down with bourbon whiskey."

The Right Stuff puts human flesh on the bare technical bones of one of this century's greatest engineering accomplishments. If you're interested in space travel, technology, history, journalism, celebrity gossip, or just a good laugh - you'll thoroughly enjoy this book. --***Reviewed by Bonnie Buhrow.*** □

Norway Captivates Chem. E.

by Solveig Christenson

Having traded Lake Mendota for a lonely fiord, Eric Christenson has been studying chemical engineering in Norway. Solveig Christenson, Eric's sister, here presents the saga of his academic and cultural experiences. Solveig is a CEE sophomore, with a strong interest in hydrology.

Eric Christenson has given his Chemical Engineering studies a strong Norwegian accent. Since May of 1981, Eric has lived, worked, studied, and traveled in Norway; a long step from his sophormore year when he first walked into the UW's International Engineering Program's office in 1980.

"I went to find out about working in Norway," Eric recalled. "But UW was trying to arrange a student exchange program with the Norges Tekniske Høgskole (NTH, translated the Norwegian Institute of Technology)," he continued. "So Ms. Bonnie Kienitz (the coordinator at the time) asked if I'd be interested in studying in Norway. I was, so she referred me to a visiting NTH professor named Olav Erga." Erga and Kienitz helped arrange an auditor status for Eric. Though formally enrolled as a UW student, Eric would attend classes at NTH, which is located in Trondheim, Norway.

Before departing, Eric was introduced to Aksel Lyderson, another visiting NTH professor. The two discussed Eric's plans for the next semester. Lyderson suggested that Eric work in Norway before studying there, and was instrumental in landing him a job. "Aksel called the head of the engineering division of the Exxon oil refinery in Tønsberg, Norway, and asked if he wouldn't mind employing a U.S. student. So I had a job right away, which was a good chance to practice speaking Norwegian before classes began.

Eric left the U.S. in May 1981 and briefly toured Luxemburg, Germany, and Scandinavia before starting work in Tønsberg. At Tønsberg, Eric worked within the "powerformer" section of the refinery which calculated the yields in the conversion of lower octane feed into high octane products.

While working in Tønsberg, Eric immersed himself into Norwegian culture and language. Two years of studying Norwegian in Madison acted as the foundation for his growing vocabulary. Norwegian, like German, has many different dialects. Eric had learned the most commonly taught dialect, Bokmal, but found it wasn't spoken in the countryside where Tønsberg is located. Fortunately, Eric was able to teach himself Nynorsk, the village's dialect. During his summer; Eric went on biking, hiking, and photographing excursions in the surrounding country.

> **"Although classes were taught in Norwegian, Eric experienced few difficulties."**

That fall, he moved to Trondheim, the third largest city in Norway and home of NTH. Although his classes were taught in Norwegian, Eric experienced few difficulties. "Still," he admitted, "it wasn't the easiest way to get an education."

The Norges Tekniske Høgskole, is the only Norwegian school granting higher degrees, similiar to the U.S.'s masters and Ph.D. degrees. Considering that Norway is about the size of Wisconsin, admission standards are understandably rigid. Only applicants with outstanding grades or exceptional work experiences are accepted to the student body of 5000 men and women. "Often people go to one of the lower degree engineering schools, which take three years, and then are accepted to NTH", Eric explained.

Eric obtained permission to remain as a bona fide student when his auditor status expired in 1982. During the past school year, he has studied courses in Process Control, Thermodynamics, Chemical Engineering Lab, Reactor Design, Plant Design, Advanced Statistics, Process Dynamics, and Simulation. All that remains between Eric and a master's degree is one semester of thesis work.

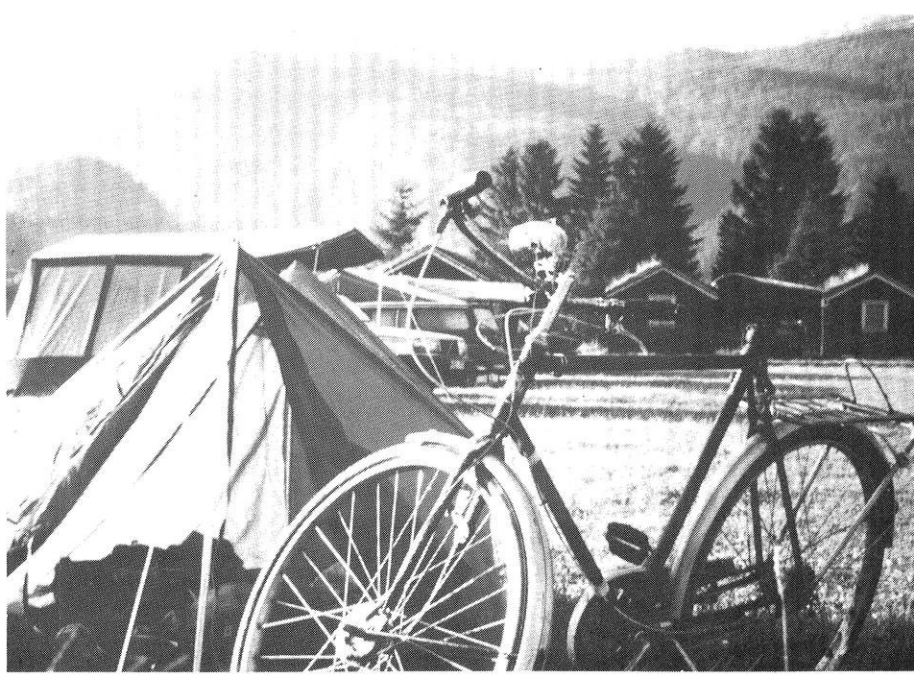


Photo by Eric Christenson

Dawn warms the Norwegian mountains and this cozy campsite located near Stavanger.

Preparation for an engineering career in Norway is similiar to that experienced in the U.S.. Most NTH students begin in the "gymnas", an academically orientated high school. These students concentrate on calculus and scientific courses. Upon admission to college, chemistry and chemical engineering majors are both placed in the Chemistry department. These students attend the same classes during the first two years, usually in lecture halls of 100 to 200 students. Two-thirds of weekly homework must be approved before students may take the end of semester exams, which count as the entire grade. In the third year of NTH study, the Chemistry department subdivides and students follow curricula in one of eight areas, one of them being Chemical Engineering. For his '81-'82 year at NTH, Eric was placed within a group of approximately thirty Chemical Engineering students. By the fourth year, these subgroups divide again into each student's special area of interest.

Photo by Eric Christenson

Beautiful mountain scenery can be found in many places among the fiords of Norway's coast.

The NTH education encourages students to gain "hands on" work experience during their summer vacations. The goal is to get the students as far away as possible from classrooms and

"Norwegians seem more interested in world politics than the average American."

calculators. "Hands on" took its literal meaning, for Eric was employed as a sampling technician by GECO, the Geophysical Company of Norway. This Norwegian-based company ranks among the top three international firms dealing with marine seismic exploration. At GECO, Eric did "just about anything you can think of to do to a 50 to 60 foot core sample, except analyze it." He wrote home in June 1982 that he was "taking samples, sawing them up, putting them in and taking them out of the deep freeze--there's something funny about putting rocks in a freezer." The samples themselves contained some surprises. "One time I saw a fossil of a nautilus type creature in some shale from four kilometers down," Eric said.

During his summer with GECO, Eric continued traveling during the weekends and had several memorable experiences. One vivid memory was an excursion to "Preikestolen" (pulpit rock) in Lysefjord. "I was riding on my extremely heavy bike on a mountain road when I slid on some gravel in a hair-pin turn. Luckily I was caught by a guard rail or I would have been even more uncomfortable on the rocky riverbed down the cliff. Still, I lost a reasonable amount of blood before a farmer's wife bandaged me up and I rode ten miles to the ferry," Eric said.

Right after his episode, Eric limped to the wedding of relatives in Vinje, and was able to witness the famous Telemark valley traditional ceremony. While there, he had learned the dialect of the Vinje valley, which he used now as his everyday speech. "Because of my Vinje dialect, no one knows I'm American until I tell them. That can be quite fun," Eric said.

Still attending NTH in Trondheim, Eric continues to enjoy Norway's spectacular scenery. "NTH students are very outdoor oriented. Just west of the city about half an hour uphill by bike is a fantastic recreation area with lakes and small mountains," Eric said. Students use the area for X-Country and downhill skiing, jumping, and hiking. "There is something very exciting about X-Country skiing in Norway. X-Country means across, down, and up mountains," Eric explained.

A Trondheim organization called the Studentsamskipnaden owns cabins in the mountains south of Tronheim and loans the keys for students to use in hiking and skiing trips. Eric goes on outdoor trips with Trondheim's Kristelige Studentlag, a Christian student group of which he is a member. One hiking trip with this group took him up the steep cliffs of Blahoa. "The climb up was made more exciting by loose rocks and gusty wind. It was impossible to go down after we'd reached a certain point--after only five minutes of climbing, we had to go up," Eric recalled.

Eric joined a 100 member folk-dancing group which meets once a week. On Friday and Saturday nights, dancing is held at the NTH "union", with folk dancing on the top floor, jazz on another, and rock and disco in the basement. Debates are also held on weekends, where political issues are discussed. "Norwegians seem more interested in world politics and international relations than the average American," Eric remarked.

Living in Norway has created no problems for Eric. "I try to live on as few kroner as possible, so I can save my money for trips to the mountains," he said. School, though, is his major priority until he graduates to work "hopefully in a pollution-control or energy research position."

Eric encourages others to sample international life, either for a year or a summer. Those UW-Madison engineering students interested should contact Merton Barry of the International Engineering Programs office. □

More To SWE Than What Meets The Eye

by Cindy Christofferson

Cynthia Christofferson is a senior in electrical engineering with a special interest in biomedical engineering. She is presently a director of SWE and chairman of the 1983 SWE Region IV Conference to be held here at the UW.

Some people imagine that the Society of Women Engineers is a group of girls who get together to gossip and plan bake sales. Others imagine it to be a branch of the feminist movement. Actually, SWE is an organization of professionals and students whose objective is to inform the general public of the qualifications and achievements of women engineers and the opportunities open to them.

The student section of SWE was founded on the UW campus only seven years ago but has grown quickly. In the past year, the section has grown in both membership and enthusiasm and as a result, its activities have been expanded and improved. These activities include social gatherings as well as professional awareness projects. The monthly meeting usually features a speaker followed by some type of social activity such as the pizza party sponsored by McDonnell-Douglas at the October meeting. The December meeting was a Christmas party to which the engineering professors of all departments were invited.

One of the SWE's most successful projects has been its resume book. The resume book is a collection of resumes submitted by SWE members that is sold to companies which employ engineers. In the end, the project helps students find summer or post-graduate employment and raises money for other activities as well. In addition to the resume book, SWE sponsors a summer job search workshop to help its members find employment.

SWE offers its members many opportunities to expand their personal skills by sponsoring "handy workshops" in areas such as woodworking, bicycle maintenance and repair, and electronics. During an electronics workshop held last year, participants learned wire wrapping, soldering, and the simple electronic assembly needed to construct a digital timer. These type of workshops encourage the hands-on participation and teamwork that are essential in engineering.

Another major activity of SWE is its outreach program. In order to introduce potential engineering students to the ups and downs of an engineering education and career, many SWE members arrange to speak at high schools and career awareness conferences. The speaker usually offers information and advice on the problems and pleasures of college life as well as the opportunities in engineering. For both audience and speaker, the most rewarding part of the experience is answering the questions that follow the prepared speech. When answering, the speaker exposes her enthusiasm for the subject which may inspire a listener to follow in her footsteps.

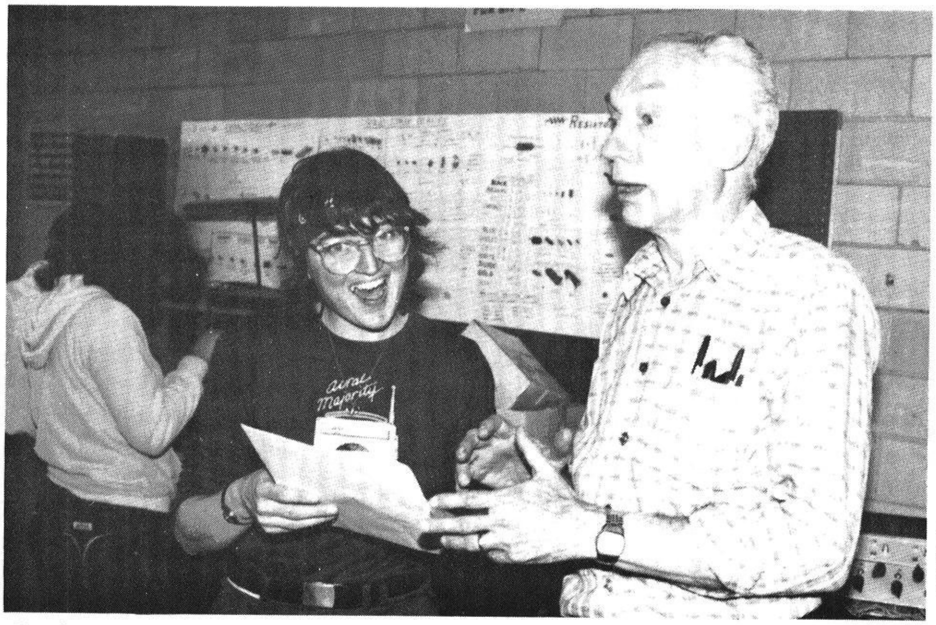
This year, SWE created the Big Sister/Little Sister program to supplement the outreach program. Over the summer, the names of women interested in an engineering major were collected at the SOAR sessions; then, SWE members were matched up with these new students to provide the newcomers with a "big sister" to consult with. Over 100 new and transfer students participated, making the project quite successful and establishing it as an annual activity.

The UW student section has a special project on its hands this year: planning and coordinating the Society of Women Engineers Region IV Conference for October 1983. The conference typically involves 150 to 200 students from midwestern colleges and universities. Included in the plans for this year's conference are several professional awareness workshops and a career fair featuring corporate representatives from many leading companies.

"Contrary to popular belief, men are encouraged to join."

Generally, technical projects do not make up a major activity, but this year SWE is busy developing a project for **EXPO '83**. Since the organization encompasses all disciplines of engineering the SWE expo committee has tried to come up with a project that involves many aspects of engineering.

SWE keeps itself busy with many smaller projects too. These projects include arranging group plant trips, writing a "Women in Engineering" pamphlet, and selling College of Engi-



SWE Photo

Professor Asmuth and Betty Iwanski review a difficult piece of electronic theory at the electronics workshop.

neering shirts. The group also sponsors an intramural volleyball team call the SWEets.

All these different projects and activities leave room for many people to get involved. The leadership is headed by faculty advisor Lois Greenfield, four officers, twelve directors, and two Polygen representatives. This year, SWE takes special pride in having two of its members elected to WSA. The organization is open to all students of engineering and related fields, and contrary to popular belief, men are encouraged to join.

Although the Society of Women Engineers has not been around long on the UW campus, it has established itself as a valuable organization to all students. □

EXPO '81 Dedicates Park to Dean Marshall

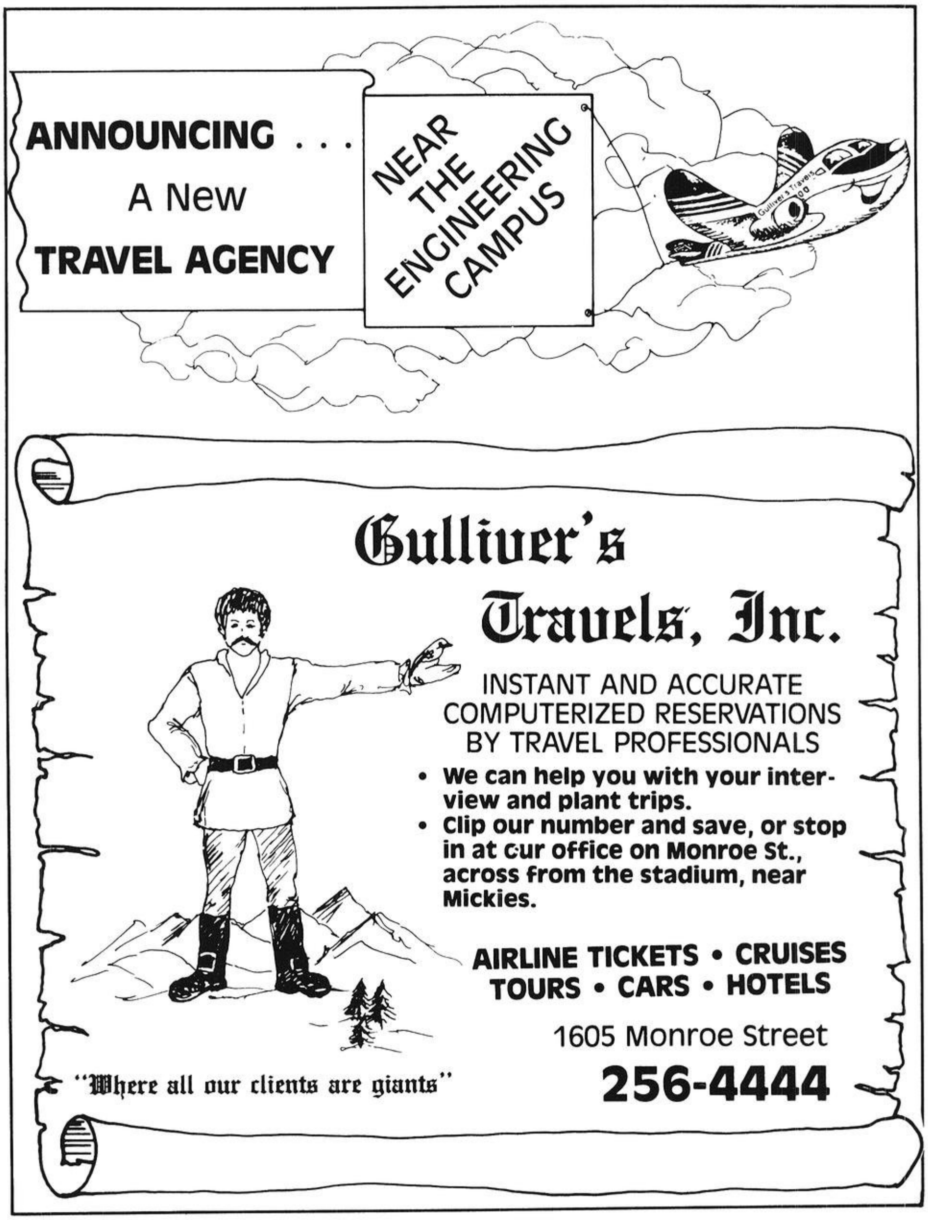
by Scott Paul

This mall is dedicated to W. Robert Marshall whose career as Dean of the College of Engineering and whose service (1948-1981) as an educator at the University of Wisconsin-Madison exemplified the best in engineering and higher education.

So reads the plaque that is to be the finishing touch on the construction project funded by EXPO 81. The mall was conceived in March of 81 as a way to dispose of funds that were left over from the EXPO. They decided to construct a park-like mall in front of the Engineering Building because they wanted to leave a gift to the student body that all the students could use. "After all," said EXPO 81 co-chairman Joe Velk, "the EXPO is run by students, and it only seems appropriate that we use the money on a project that would benefit students."

The mall consists of some fancy concrete work, 4-6 wooden benches which have not yet been installed, and a large rock upon which the plaque dedicating the mall to W. Robert Marshall will be fastened. Velk said that he found it hard to believe all the red tape they had to go through in order to get the project built. He said, "The government treated this as if we were building a major building." The $5500 project is slated for completion in the spring of this year. □

Designers of the new W. Robert Marshall park point out that the park offers a visual conclusion to the Henry Mall and extended flower beds (in front of the Engineering Building across Johnson Ct.) when viewed from the steps of Ag Hall.



Frightening Prospects of Ozone Depletion

by Man Ken Cheung

As research strives to cure cancer, the rest of society is stripping the earth of some natural preventive medicine, our ozone layer. Man Ken Cheung analyses the cause and effects of ozone depletion. Originally from Hong Kong, Man Ken is a first year chemical engineering major and has previously studied in Malaysia.

Atmospheric ozone is a protective shield which shields the sun's lethal ultra-violet (UV) radiation from the earth's surface. Its stable concentration ". . . in the stratosphere is determined by a complex balanced set . . ." of ozone destroying and creating natural chemical reactions, and this complex balanced set of reactions can be upset by human activity (1:244). If the equilibrium is unbalanced, more UV radiation is able to reach the earth's surface. Currently, the National Research of the National Academy of Sciences predicts a five to nine percent depletion over the next decade (2:396). The implication of ozone depletion is grave; for example, it may lead to an increased incidence of skin cancer.

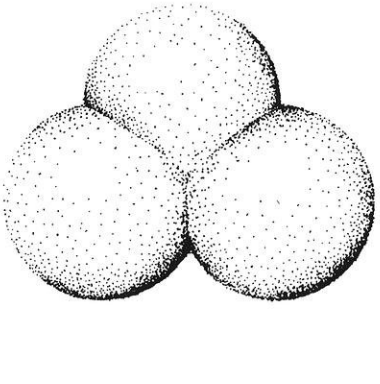
Recent studies show ". . . that each one percent depletion in the concentration of stratospheric ozone will increase the amount of UV radiation that reaches the earth's surface by two percent" (2:396). This increase in radiation causes serious health hazards. The National Academy of Sciences stipulates that "more than 90 percent of skin cancer, other than melanoma in the United States, is associated with sunlight exposure and that the damaging wavelengths are in the UV-B region (290 to 320 nm)." (2:396). For every one percent depletion in the concentration of ozone, the incidence of basal cell skin cancer (currently between 300,000 and 400,000 cases in the US each year) increases by two to five percent, and that of the more serious squamous cell skin cancer (currently about 100,000 cases each year) by four to ten percent (2:396). These estimates depend on "location, sex, skin type, life-style, and other variables," and the increase in cancer would be more severe in lower latitudes than in higher latitudes. It is still unclear whether ozone depletion would increase the cases of the rare but more dangerous form of skin cancer, malanoma skin cancer.

"The NAS stipulates that more than 90% of skin cancer . . . is associated with sunlight exposure. For every one percent depletion in ozone concentration, the incident of basal cell skin cancer increases by two to five percent."

UV radiation can affect the immune system of both animals and humans. T.H. Maugh II in *Science* reports:

> A mild sunburn, for example, decreases the viability and function of circulating lymphocytes in humans for as long as 24 hours. In animals, otherwise tolerable doses of UV radiation can produce changes in allergic reactions, skin graft rejection, and other immune responses (2:396).

Don Wuebbles, Fred Luther and Joyce Penner of Lawrence Livermore, California, have used 43 different chemicals to carry out 133 chemical reactions, and have used the Laboratory's Gray computer (2:397) to study the effect of other gases on ozone chemistry. Their calculations yield a lower



A graphical representation of ozone.

Graphics by Alicia Diehl

percentage of ozone depletion: two percent of depletion by the year 2000 (1:244). Their calculations also indicate:

> CFC's [chlorofluorocarbons] and nitrogen oxides may have destroyed four percent of ozone in the upper stratosphere during the last decade, but that other pollutants have added a nearly equal amount at lower altitudes -- a conclusion in surprising agreement with Health observations (2:397).

Donald Health and colleagues at the Goddard Space Flight Center examined a series of data collected by the satellites, Nibmus-4 and 7, during the last decade, and found out that the ozone depletion at about 40 km has decreased about 0.5 percent a year, while the concentration at the troposphere has increased by a similar amount (3:1088). Health suggests that a change in the distribution of ozone in the upper atmosphere can alter temperature distribution, and hence a change in the world's climate (3:1088).

Health's observations and Wuebbles' research findings indicate the overall concentration of ozone could well remain constant as the change in concentration of ozone at high altitudes is balanced by the similar change in concentration at lower altitudes. The amount of UV radiation passing through the atmosphere might thus remain constant, but the change in temperature distribution could have a significant effect on the world's climate. Until then, it is still premature to state the definite effects of ozone depletion, and thus it would seem that the eventual resolution of ozone depletion requires continued active research. □

List of References

1. Garman, L. and Simon, C. "Ozone Depletion Estimates Halved." *Science News*, 121 (April 10, 1982), 244.
2. Maugh II, T. H. "New Link between Ozone and Cancer." *Science*, 216 (April 23, 1982), 396-97.
3. Norman, Colin. "Satellite Data Indicate Ozone Depletion." *Science*, 213 (Sept. 4, 1981), 1088.

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UW-Madison Engineering Campus
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What, When, and How of Summer Jobs

Searching for a summer job? With the economy in dismal shape, it's not an easy task. Perhaps the best way to get an edge on the competition is to talk to someone who had already tried to land a job. Intrepid WE reporters searched out such individuals, and their findings are summarized below.

Tom Hurrish, ME-4
Student Engineer
Tom Hurrish was employed in Wisconsin by the Fort Howard Paper Co. in Green Bay. He applied for the job after his freshman year and was responsible for the modification and design of machine parts and equipment. Tom felt his experience was especially valuable, since "it allows one to relate topics learned in school with 'real world' problems."

Job experience is a critical part of a graduate's resume. Summer vacation is the time to gain some.

Tom Turner, graduate student
UW Researcher
Tom told his advisor that he wanted to do some research over the summer. The advisor found some money, and Tom was able to work on getting "the Environmental Protection Agency's Storm Water-Management Model up and running on one of the University's computers." Next semester, he plans on finishing requirements for his master's degree.

John Wengler, CEE-3
Assistant Civil Engineer
John, the WE's "big cheese," sent out resume letters to many firms in search of employment. In April, he got an offer from his hometown government, specifically, the Village of Wilmette, Illinois Department of Streets and Sanitation. He earned $5.50 an hour surveying, drafting and checking calculations, along with other office duties. Next year, John intends to go to summer school.

Bernhardt R. LaBastide, Jr., ME-3
Assistant Supervisor
Bernhardt worked in Oconomowoc at Blaney Farms/Stauffer Seed, earning $4.09 an hour. The company grows hybrid seed corn, and he worked on hoeing, rogueing, and supervising his crew. He applied for the job at the end of May and started work in mid-June. Next year, he hopes to intern at an engineering firm.

Send letters of inquiry by the end of February, if possible.

James Denman, ME-4
Piping Designer and Computer Programmer
James earned $360.00 a week at IBM in Endicott, New York. The job included selecting materials for a given design, ordering them, and drawing up blueprints, along with doing some FORTRAN programming. He didn't really use his education on the job, yet did observe many of the processes he had studied. James credits his success in finding employment to writing down "the right things" on his application, being specific, and having good grades. He hopes to find a similar internship at IBM next year.

Look in engineering trade magazines for addresses of companies in your field.

Jeffrey Jezerc, CHE-4
Student
Unable to find a summer job, Jeffrey decided to go to summer school to ease his course load and gain research experience in the process. Although he used the placement office and talked to professors about jobs, he felt that a lack of interviews prevented his finding a job. He says that students seeking employment should be sure to use the placement office and talk to professors and upperclassmen.

Try everybody! Anyone from your neighbor to the government might have a summer job for you!

Andy Platz, CEE-3
Materials Tester
The Wisconsin Department of Engineering employed Andy in La Crosse. He earned $6.50 an hour using a nuclear density machine to measure soil and bituminous density, along with miscellaneous soil testing. The civil engineering junior was offered the job in May after applying through the placement office in February. He feels that the job has helped him in his schoolwork and related well in his major. Next year, he hopes to work for a private contractor or the state. Sometimes having a job creates contacts; Andy was offered the private job while working during the summer. □


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Creative Financing for M.E.'s

by Darci Buelow

Darci Buelow has a strong interest in the topic of her article, for she is a freshman majoring in mechanical engineering. Darci is a native of Madison, WI.

In times like these, financial problems can come crashing down upon the unsuspecting student. The red tape and competition for most student loans and scholarships can seem insurmountable. For the last 17 years there has been a loan program for students with emergency financial needs, and the loan does not accumulate interest until after graduation.

In 1965 the American Welding Society donated monies to the University of Wisconsin - Madison for use in a loan program. The program was designed by Prof. Braton, who saw a need for mechanical engineering students to be able to obtain emergency funding with relatively little trouble and at a low interest rate.

"The major asset is that no interest is accumulated on the loan, as long as the student remains enrolled."

The loan program was so well received that when Prof. Delmar W. Nelson of the U.W.-Madison died, the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) gave funding for another program to be established in his name in 1976. It was patterned directly after the Welding loan program.

An American Welding Society loan is available to undergrad students who have completed a basic welding course and have enrolled in or have completed at least one welding course beyond the basic course. A loan is also available to Masters and Ph.D. students who have demonstrated an interest in the field of welding.

An ASHRAE - Delmar W. Nelson loan can be obtained by undergrads who are enrolled in Mechanical Engineering and to graduate students who are specializing in some area of Mechanical Engineering.

The size of a loan for both programs is at maximum $500.00. The average loan is about $350. The student is able to set the date of payback according to his/her own circumstances within reason.

The key to both of these programs and the major asset is that no interest is accumulated on the loan, as long as the student remains enrolled. As soon as he/she graduates an interest level of 6% will be added until repayment.

Prof. Braton designed the program so that it is a revolving fund. There is always money coming in from past loans and is available for loaning out at all times. Around 200 loans have been made in the 17 years of its existance. The remarkable aspect of this unique program is that these loans are made without the conditions which are usually present. Students need to demonstrate a need and file a brief fact sheet for record keeping and then have their loan approved by Dean Bollinger with Prof. Braton's signature.

Yet this seemingly lax system of screening has not been abused. There are only three people who have been deliquent in repayment. Every year Prof. Braton reports to the donors, and every year the donors give supplemental money to the funds.

The real credit for the implementation and success of this program has to be given to Prof. Braton. "It was just an idea I had one day," he modestly states, and many students who have benefitted are grateful for that idea. □

A Walk on the Dean's Side

(cont. from page 11.)

Bollinger says computers "will do a more effective job teaching more students using fewer people". In the long run, increased computer usage should alleviate some of the burden placed on faculty due to increasing class sizes.

Dean Bollinger continues to monitor the challenges brought about by escalating enrollments and a decreasing budget. He keeps an ever-attentive ear tuned to what students and industry are saying. □

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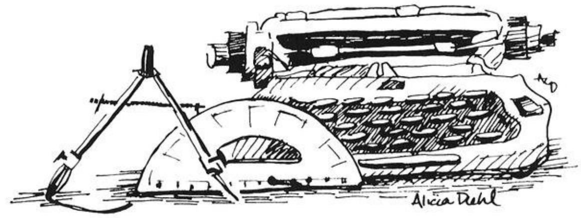
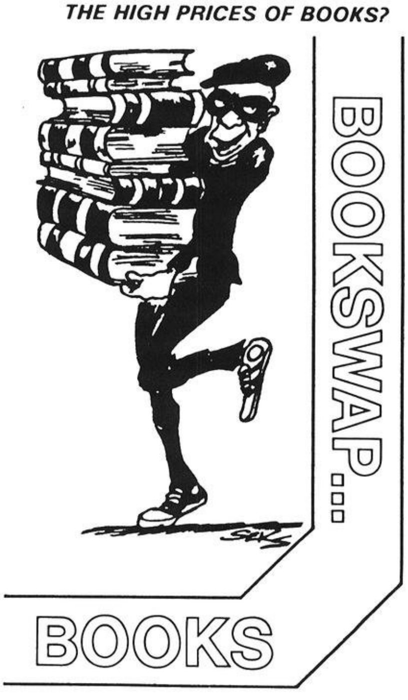


Doing Keynes Proud

Polygon glorified the free enterprise system with its registration week book sale. Held in Union South, students could avoid the middle man (i.e. bookstores) and buy or sell textbooks at better prices. "We're happy with the turnout," exclaimed Jeff Jezerc, Vice-President of Polygon, "the sale worked for a good many people." Formerly held in the Placement Office, Polygon moved the bookswap to Union South to handle the increasing business and improve visibility. Also, Polygon didn't take a cut for the first time.

Though there was positive student feedback, the sale had a few minor setbacks. Information was not available concerning which specific books are being used by different professors. Students had to be referred to one of the campus' major bookstores. "We're going to work on that for next fall's sale," concluded Jezerc. "The swap has great potential to give full service to engineering students."--*Shaw Walker*

ARE YOU CONCERNED ABOUT THE HIGH PRICES OF BOOKS?



The logo for Polygon's book swap, pictured above, is symbolic of the steals that students could score at the sale.

Top Secret

There has been considerable debate over defense contracts at universities and their effect on the openness of research programs. The U.S. government rarely allows defense research to be made public, and this has enraged critics who feel that secrecy discourages academic inquiry. Typical of such sentiments is this from the Panel of Scientific Communication and National Security:

". . . The long-term security of the United States depends in large part on its economic, technical, scientific, and intellectual vitality, which in turn depend on the vigorous research and development effort that openness helps to nuture."--*NAS News Report*

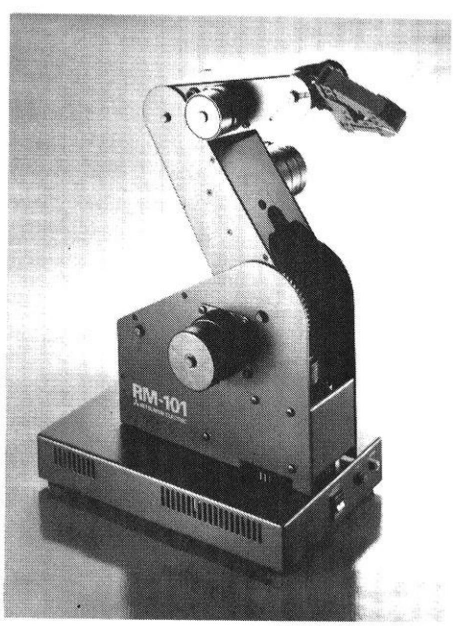
ECE Shortage

The U.S. electronics industry is facing a critical shortage of qualified people. In 1982, there were 1,252 job vacancies in electronics, and electrical and computer engineering, along with computer science. The reason for this is summarized in this quote by Professor W.P. Birkemeier, the chairman of the UW ECE department:

"When you consider what the Japanese are doing to us in the electronics industry, you realize that the only way we can fight that threat is by high-technology education. The Japanese graduate more engineers than we do and they're probably better trained. But our problem isn't people. Students are breaking down the doors to get into our electrical engineering department because that's a field with available jobs. But we can't accommodate any more students. We've had no increase in dollars for ten years in this department. We go to private industry, to the people who use our products, and explain that if industry doesn't help us, we're going to turn out unskilled graduates. So industry gives us some money and a lot of equipment. They've even lent us some of their people to teach on a part-time basis to help with our faculty shortage. For example, we have gotten free computers from several companies, but we have not been able to find the money to maintain them." --*Health Company News Release*

New Kid on Block

A desktop robot with functions equal to those of industrial robots now in use on production lines has been developed by Mitsubishi Electric as a teaching aid for training operators and engineering students on robot language and operating techniques. Called the RM-101 Movemaster, the microcomputerized robot offers completely independent rotation around six axes and the same five degrees of motion as many of the industrial robots. Easily programmed on a personal computer, the miniature robot comes with three hands for handling different manipulative problems under simultaneous computer control.--*Mitsubishi Electronic News Release*



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Expand the mind of the microchip.

Remember when electronic calculators were considered a luxury? Well, consider this sign seen recently outside a gasoline station in Schenectady, New York: "Free calculator with an oil change."

That's just one sign of the enormous impact microchips have had on the way we do everything – from banking to game-playing.

But how will we use microchips that are smarter, faster, more reliable, and less expensive to design? How will these new microchips be used to improve systems, products, and processes? As one GE engineer puts it, "The sky's the limit!"

That sky is replete with a number of integrated circuit concepts that GE is applying right now.

There's the custom IC, a chip that performs highly specialized functions. Traditionally, creating this chip has been an expensive, time-consuming job. So we're working on ways to cut design time and cost.

We're using computer-aided design (CAD) to design and simulate chips right on computer screens. We're also developing gate arrays, a system that allows you to build inexpensive prototype chips that can be "played" in systems before the final design is fixed.

Another area that GE is developing is VLSI (Very Large Scale Integrated) circuits. These ICs will eventually squeeze one million transistors onto a single chip.

Where will all this super electronic power be applied? GE engineering manager Don Paterson sees it this way:

"At GE you can innovate from the system down to the chip to create... whatever ignites your imagination."

In other words, you can dream it... and do it.

WE BRING GOOD THINGS TO LIFE

An equal opportunity employer.