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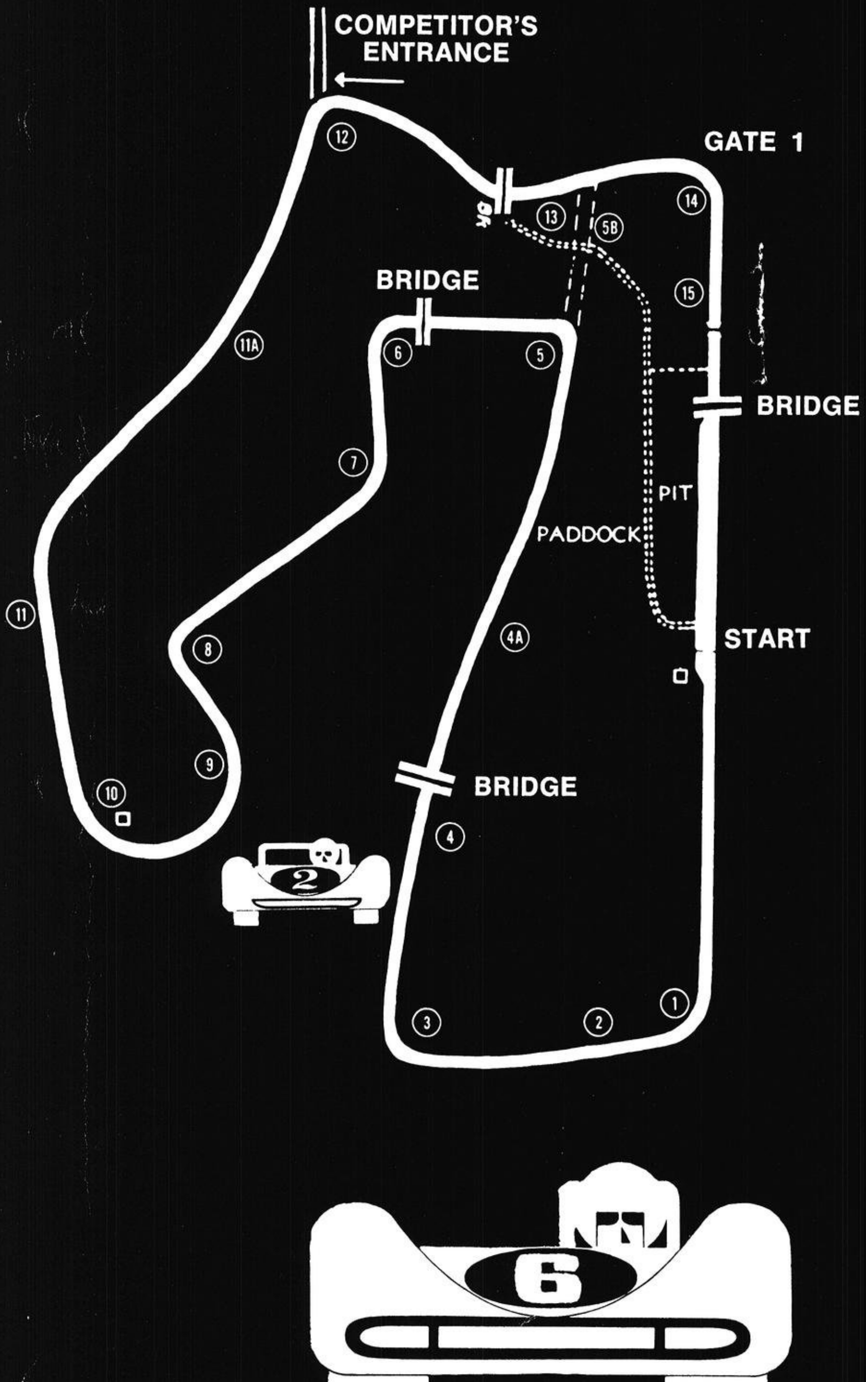
wisconsin engineer



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wisconsin engineer

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An Expresswa

Divides the Campus

by Paul Grossman

Paul Grossman, Administrative Vice President of the Wisconsin Student Association, has been asked to comment on the traffic and pedestrain problems involved in the proposed University expressway. Paul, representing the WSA on the Madison Campus Planning Committee, which recently endorsed expressway plans favored by the city, cast one of two dissenting votes for reasons discussed in his editorial. As Administrative Vice President, he has been involved in negotiating with the University administration, faculty, and state and city governments. Paul has worked actively to improve City-University relations and sits on the University-City Safety Council as well as the special City-State-University Campus Planning Committee seeking solutions to the pedestrain and traffic problems on campus.

As a political scientist I wish to thank the editor of the *Wisconsin Engineer* for giving me the opportunity to address myself to a problem which concerns both engineers and politicians.

On September 12, the city planners presented the campus planning committee with a set of alternatives for widening University Avenue from the front of the Mechanical Engineering Building to beyond Princeton Avenue. The planners, having their favorite alternative already chosen, carefully delivered a 30 minute speech on behalf of their first choice.

The presentation included what the planner considered to be his strongest points on behalf of the plan. He presented the plan as a smooth-flowing traffic pattern speeding the cars from outlying residential areas to downtown business areas. What was disturbing about the presentation was the cursory attention to pedestrians. In the 30 minute presentation the "pedestrian problem" received 2 minutes. Pedestrians were portrayed as villians making unfortunate interruptions in the traffic pattern. Wherever possible lights would be set so as to hold pedestrian interruptions to a minimum. The planner even went so far as to admit that his plan wasn't even designed to carry pedestrian traffic beyond 1972.

In short, this was a case of one-purpose planning which reflected the political realities of Madison, rather than the needs of the people. The objectives of the traffic scheme were designed only to suit the downtown businessmen who want traffic to get to and from their stores. These people are, of course, precisely the people who hold the most sway with the city fathers.

The student who pays no property taxes and has no political power is ignored. His needs are not, and probably never have been, considered in the city plans. Only around student housing projects would the city dare to place eight lanes of highway through the city's densist residential district. Where else would the city place a death trap such as the bus lane?

Some three years after Johnson Street and University Avenue were widened, the city is now just beginning to address itself to the pedestrian problems created by the monstrocities. As a "major concession" the city may now give the students 3 or 4 more traffic lights.

What is most unfortunate about the entire situation is that the planners fail to realize that these highways are having sociological implications on the campus. This campus is being sectionalized by highways to such an extent that the students in dorms on one side of University Avenue aren't even meeting students living on the other side. In the Sellery-Ogg-Witte dorm complex vast areas that were appropriated for recreation are now cement; thus turning what was once a beautifully planned housing project into a concrete cell block.

Engineers, beyond recognizing the political and sociological realities of the situation, must take upon themselves the responsibilities which politicians have not: they must design highways to fit needs instead of political power.

EDITORIAL

Law and Order

Recent months have seen the increasing use of a new political battle cry — the need for more law and order. The way the call for law n' order is rolling off the politicians' tongues, one might think they were asking for ham n' eggs or bread n' butter instead. What I find peculiar about this appeal to law and order is its complete lack of novelty or sensationalism.

Law and order is hardly an objectionable doctrine to most people, yet it is being spoken of as a principle to which a growing number of Americans are opposed. The support for such a claim is the rising role played by violent and disruptive dissent in this nation. The assertion that there is a disregard for the principles of legal responsibility and order are, in large part, directed at the black man of the ghetto and the college student, for clearly it has been on our college campuses and in our urban ghettoes that the greatest sources of social and political unrest have been felt. Major eruptions of violence in the core cities and college campuses have produced a feeling in many people that there is a growing trend toward lawlessness and disorder in the nation. The relatively few instances of violent civil disobedience which have occurred seem to lead many to the assumption that such events will continue to occur at a rapid rate of increase until the nation is in chaos.

The issue of law and order is certainly not the most profound that these sources of civil disorder have pointed to — the demands of the blacks and the college students for a better way of life for all Americans with equal opportunity for all to share in the political process, the cry to end hunger in this wealthiest of nations, the outrage felt at our involvement in a controversial and questionably legal war, the need to reform our draft laws, and to feel confident that the political candidates are indeed their candidates and not those of the political machines — these are the causes for unrest both in the ghetto and on the campus. These are the important issues that confront this nation. And these should be the focus of the politicians' attention, instead of the stale demand that "law and order might prevail again."

I have no doubt that order can be created and tightly maintained through the enactment of more and more stringent laws and the employment of more police with far-reaching powers to enforce those laws. We have watched the growth of that kind of state before — Hitler's Germany and Stalin's Russia were noteworthy cases of a distorted emphasis on law and order. Dissent was absent because it was not allowed to exist; where poverty and injustice abounded they were ignored.

The politicians need to end their empty cry for law and order, and they must turn instead to the crucial social and political issues facing us. The enactment of new laws in this country must not be for the sole purpose of creating order. They must be for the purpose of eliminating problems that produce violent dissent. They must be enacted to the end of creating justice where it is now only promised. When those who have been left out of the political system are given the opportunity to participate in it, they will realize that they have something at stake in this country. There will no longer be the need to take their case into the streets. Justice should be the mechanism to produce order, but justice and equality for all — principles upon which this nation was founded — are long overdue. Now we need turn to the politicians and hope that they will move quickly to speed justice in America, for the wait has been a long one.

Abby Trueblood

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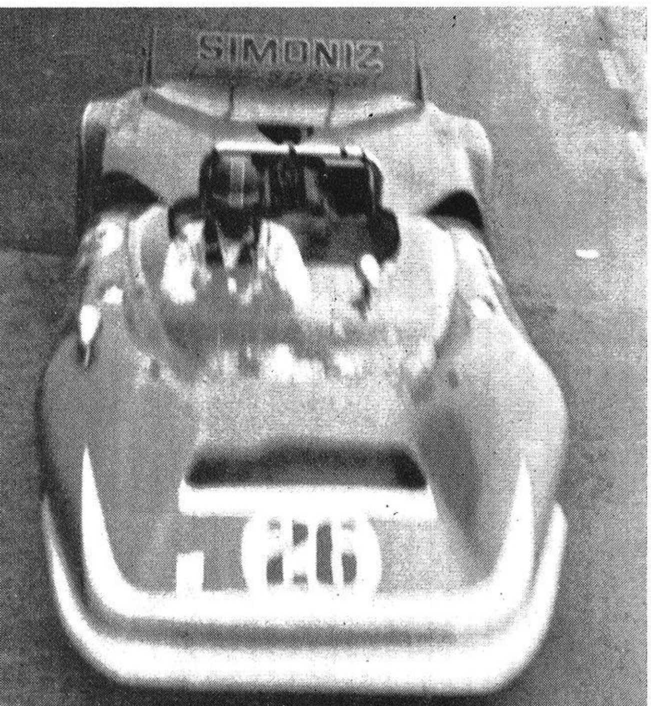
* If you need more excitement, you might find it on the 42 golf courses in the Rochester area.

Below: Local Wisconsin favorite, Skip Scott, who has an unprecedented three successive victories at the Road America 500, streaks by in his modified Chevy Lola.

Above: Charlie Hayes pulls away from the pit area in a revolutionary wedge-shaped car designed by Bob McKee and Ralph Salyer. The design is now used widely in Group 7 cars and is apparent in the smaller grand prix classes.



Race No.
1
No. of Laps
50 (200 miles)
Date
September 1, 1968
Event
Group 7 Can-Am Challenge Cup
Location
Elkhart Lake, Wisconsin

Pos.	No.	Driver	
28	19	Gary Wilson	2:28.5
26	26	Skip Scott	2:26.5
24	15	Brian O'Neil	2:24.4
22	18	Ronald Courtney	2:22.6
20	2	Brett Lunger	2:21.7
18	61	Fred Pipin	2:21.1
16	9	Joakim Bonnier	2:19.6
14	98	George Eaton	2:18.6
12	44	Jerry Hansen	2:17.7
10	22	P. Rodriguez, Jr.	2:15.8
8	21	Mario Andretti	2:13.9
6	10	Chuck Parsons	2:13.4
4	6	Mark Donohue	2:11.0
2	5	Denis Hulme	2:09.9

Pos.	No.	Driver	
29	42	Candido Damota	2:29.2
27	77	Leonard Janke	2.27.4
25	56	Ralph Trieschmann	2:26.0
23	28	Richard Brown	2:24.0
21	31	Geo. L. Ralph, Jr.	2:21.8
19	57	John Cordts	2:21.2
17	63	Roy Kumnick	2:21.0
15	1	Sam Posey	2:18.8
13	39	Ludwig Heimrath	2:18.0
11	32	Ronnie Bucknum	2:16.7
9	25	Charles Hayes	2:15.2
7	52	Peter Revson	2:13.7
5	11	L. Motschenbacher	2:13.4
3	66	Jim Hall	2:10.8
1	4	Bruce McLaren	2:09.8

Elkhart Lake, Wisconsin

Road America Can-Am 1968

by Dan Connley

Elkhart Lake's Road America has hosted the initial race of the Canadian-American Challenge Cup. Before I pursue the action of the up and coming six-race Can-Am series, I think it would be of interest to alleviate some confusion that may exist between racing groups.

There are three major areas in circuit racing: stock cars, controlled mostly by NASCAR; single seaters, which have as their major league the USAC series; and sports cars which are run by the SCCA. NASCAR permits American production engines of up to 7046cc (430 cubic inches) displacement; USAC has an involved formula that includes overhead cam engines of 4.2 liters (256 cubic inches), super charged overhead cam engines of 2,8. liters (171 cubic inches), stock block "rocker arm" engines of 5 liters (305 cubic inches), and turbines of 15.999 square inches; and SCCA's Can-Am series allows unlimited displacement engines of any type.

This is the third year for the Can-Am. The six-race series has accumulated more purse and prize money than any other series in world racing history. In 1968 the awards will total $600,000 or $100,000 per race. The first prize is $40,000 with a total prize point fund amounting to $126,000.

In last year's series first place winner Bruce McLaren collected nearly $100,000 and co-driver Dennis Hulme won an additional $65,000. Team McLaren won five of the six races in 1967 with two M6A type chassis designed and built by Bruce McLaren. There are many good reasons for their victories. Aside from the obvious quality of the drivers, *testing* was the single most important factor. "Testing, testing, forever testing the bloody machine until it doesn't go anything but fast — faster than your opponent's car—faster at every race—faster than even *you* thought it could in those bleary early mornings. It's your job. You're chief development engineer for Bruce McLaren Racing by way of Jim Hall and Midland, Tex." (Said of Gary Knutson.)

Bruce McLaren subcontracted the building of a dozen replicas of the McLaren M6A and called them M6B's. These cars were sold to McLaren's top competitors to race in 1968. For the past year Team McLaren has been testing a new machine, the M8A. It goes without saying in which car Team McLaren places his ultimate confidence. Bruce, who races and builds, has his counterpart in Eric Broadly who designs and builds Lola but doesn't race. He says he sells the same basic car to everyone. Well, almost. Broadly has John Surtees, the 1966 series winner, do all the test and development driving for him. Surtees generally has two Lolas for himself, and while 14 new Lolas are being prepared for August, Mr. Surtees began sorting out the Lolas in June. Surtees is not entered in Elkhart Lake because of coinciding European commitments.

The only Group 7 car with a complete U.S. package is designed by the combined efforts of Ralph Salyer, Bob McKee, and Gene Crowe with Charlie Hayes driving. The body and chassis are designed by McKee Engineering of Palatine, Ill. Like most of the other contenders, Cro-Sal will sport an aluminum 455 cubic inch Tornado engine with 600 horsepower. Gene Crowe has worked

Left: Rear view of Cro-Sal McKee Oldsmobile engine.

Below: Bruce McLaren, favored for the series, goes through individual brake bleedings. To reduce weight McLaren designed the engine as part of the rear chassis. A wet track here at R.A. helped the one-two finish of Team McLaren. At Bridgehampton both Hulme and McLaren retired with blown engines. At the third race, the Klondike 200, the team again finished one-two.

closely with Oldmobile in modifying this engine. For the third race in the series on Sept. 9 at the Klondike Trail 200 in Edmonton, Alberta, a super charger will be employed to boost horsepower to 650. This is the same car that Paul Neuman drove in the movie "Winning."

Cars which few people know much about have seemed to draw quite a bit of speculation. North American Racing Team will back Ferrari in 4.2 liter V-12's. Porsche is expected to run several ultralight, 800 pounds as compared to 1,350 pounds for McLaren's car, 3 liter cars after the first race. Andretti will drive a small 306 cubic inch, high r.p.m., dual overhead cam, Bignotti Enterprises, Indianapolis type engine. Ford president, Bunkie Knudsen, stated that the Aluminum 427 engine would not be competitive in 1968. However, on August 30 Shelby Racing Co. arrived with two Group 7 cars, powered by . . . the *unavailable* and with Peter Revson as driver.

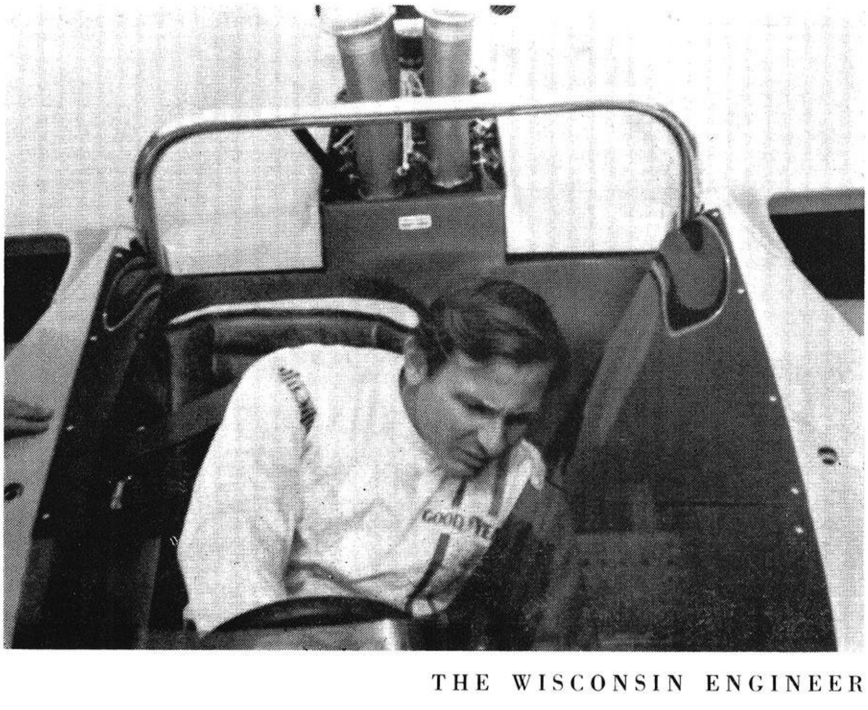
There are among the contenders two others who are not counting themselves out; Jim Hall (Chaparral 2G) and current USAC point leader Mark Donohue (Sunoco Special).

Last year was a bad year for Jim Hall. The Texan has been ominously quiet in 1968, entering only two U.S. Road Racing Championship events and then returning to his desert testing a Midland, Texas. Jim works closely with General Motors. He uses a G.M. computer for analysis of suspension and stress-strain characteristics and will again run a modified automatic transmission powered by a limited experimental all-magnesium block, 427 cubic inch Chevy engine bored to 480 cubic inches.

Roger Penske's Sunoco backed organization purchased two M6A McLaren chassis and has covered them with a new plastic shell which will save considerable weight. They are powered by fuel-injected 427 engines prepared by Traco Chevrolet of California. The hope of the team is Mark Donohue, who at age 31 has become one of the foremost racing drivers in this country. He was won several SCAA National Championships as well as the 1967 and 1968 United States Road Racing Championship. This season he has also won the Trans-American Manufacturers Championship for Chevrolet in his Sunoco Camaro by winning nine of the first eleven races.

Can the motivation to race be economic as throughout most of America? This is doubtful. Virtually no car owners make any money directly from race purses. Operational money is chiefly from sponsorship contingencies: from Goodyear, Firestone, Bosch, STP, Pure, J-WAX, and more. Other factors drive these professionals. There is a fervor for perfection in and over the mechanical machinery and there is the overwhelming joy of knowing that by overcoming the odds against perfection and by vigorous testing in the field, victory can be won.

Since Road America's conception in 1956 when Caroll Shelby won the June Sprints at an average speed of 80.04 m.p.h., the circuit has been witness to many great drivers and car owners in fiery competition. Racing has progressed magnanimously since 1956 with most of the experience and knowledge going di-



rectly to the automotive consumer. 1968's list of entries in the Canadian-American series includes top international drivers Pedro Rodrigas (Mexico City), Jo Bonnier (Le Muids, Switzerland), Dan Gurney (California), George Eaton (Scarborough, Ontario), Hulme and McLaren (New Zealand); sophisticated enginry by Ferrari, Bartz, Traco, Bignotti, Tero, Ford Westlake; chassis and body work by McKee, McLaren, Broadly (Lola), and Chaparral (Road Runner, Jim Hall). They and many others made it to Road America, Can-Am 1968.

There is a lot of milling around now that qualifications have been completed. Spectators are allowed into the competition pit area after the last laps are taken and they flock to see their favorite cars and gawk at the fabled drivers. Hulme and McLaren have repeated their showing of last year's opener by qualifying first and second on the starting grid and by pushing the course speed record of 106.746 m.p.h. set by Hulme last fall to unprecedented speeds of 110.990 m.p.h. and 110.769 m.p.h., respectively. The drivers who operated with the smaller engines, Andretti (306 Ford OHC) and Rodrigas (256 Ferarri), will have to rely on their international experience, their jockeying and cornering ability.

Sunday morning the course is drenched. The previous night's rains continue throughout the morning and into the final hour of prerace practice. The smaller engine cars are elated because the extra horses developed by the 427's can not be transferred to the slick corners. There is an hour of practice with everyone taking at least one circuit on dry tires to check handling. Without fail there is a pit stop to change into wet rubber. It is the first time I have seen the Goodyear and Firestone tire engineers earn their money.

For three hours before the two o'clock race the intermittent clouds and rain gave no certainty to tire selection. Anxiety mounts. At last the 15-minute bomb goes off. With five cars having withdrawn earlier, 32 drivers are ordered to marshal their cars in order of qualifying lap times on the starting grid. Hulme, McLaren, Hall . . . but Donohue's Sunoco Spl. is still in the pit lane on jacks; Mark hasn't made up his mind about tires. At the 60-second bomb Donohue's eyes perceive sunlight, the crew's alerted, and on go the dry tires.

The starting lap is a mixture of confusion, excitement and danger. Confusion because the enormous rooster tails cause some of the fans to wonder whether they are watching the unlimited hydroplanes on Lake Monona instead. Excitement because after one long year of testing and two days of tough competitive practice the initial rase is beginning with the knowledge that any problem requiring a pit stop could cost up to $12,000. Danger because nature has made up her mind and the rain comes down in torrents.

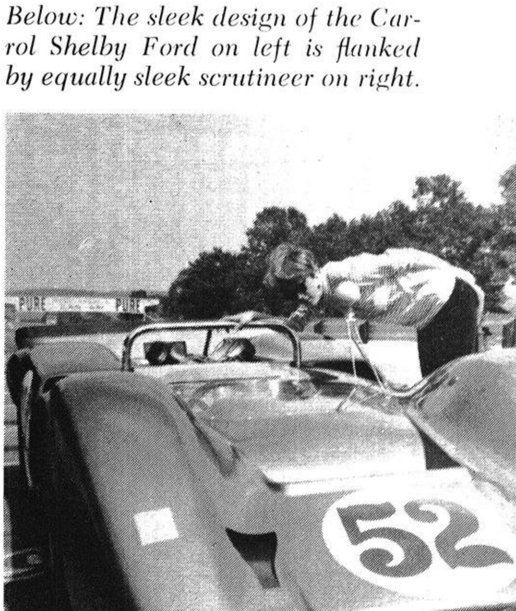
The green flag is waved. With Sterling Moss at the wheel of the Camaro pace car the pace lap begins. Leonard Janke (77) and others stall. The corners are taken at 90° speed. At the last corner the pace car turns onto the pit lane and the field turns it on up the straight.

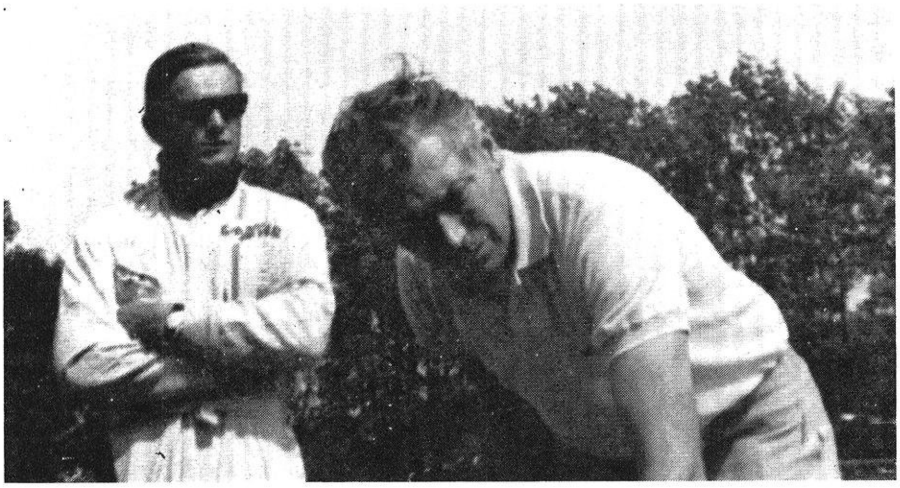
Dennis Hulme opens up a 20-yard

Above: Mario Andretti sits confident in rainy prerace weather Sunday. Caps are placed over the air intake stacks to protect the highly tuned engines from excess moisture.

Above: Veteran car owner-designer Jim Hall ponders the prospect of his winged machine getting the best of him. The wing is movable and functions like an airplane flap.

Below: The sleek design of the Carrol Shelby Ford on left is flanked by equally sleek scrutineer on right.





Right: Carrol Shelby, right, the master tuner himself, has pulled out all stops to attain a Can-Am win, but as yet has had only second division finishes. Pete Revson, left and first picture below, is a veteran driver and shows it in his consistent above fifth place finishes.

Below: Mark Donohue harnesses himself with a form way seat belt. Donohue at 31 has become a consistent winner. He took third at R.A., first at Bridgehampton, and third at the Klondike 200.

lead at the first corner and for the next 30 miles nobody saw anything but a distant spray from his #5. At station #2 Donohue makes a bold move to pass McLaren (4), hydroplanes into corner #3, and spins out. This mistake costs Mark valuable time as he has to wait for nearly the entire grid of 32 cars to pass him.

For the next 20 laps individual battles develop. Hulme's battle is with himself; he has lapped all but eight of the starters and is a minute ahead of second place McLaren. McLaren maintains a 2.8 second lead over Mario Andretti. Mario keeps himself in McLaren's mirror by hard charging and clean, fast shifting. He is able to attain superior RPM's because of his dual overhead cam, Indy type engine.

In a five-way duel for fourth are George Eaton (McLaren M3, Ford Westlake 351 cu. in.), Peter Revson (Shelby's 427, A1 Ford), Lothar Motschenbacker (McLaren M6B, 427 Chevy), Jim Hall (Chaparral, 480 Chevy), and Mark Donohue (Penske-Sunoco Spl., 427 Chevy). Jim has trouble with his injection system and can't get the needed acceleration out of the corners. He is able to stay in competition for a couple of reasons. First, he keeps his airplane-like airfoil consistently in the down position to help force the 15-inch rain tires to grab the slick surface. Secondly, despite fuel problems, the horsepower developed by the bored-out 427 keeps him in competition.

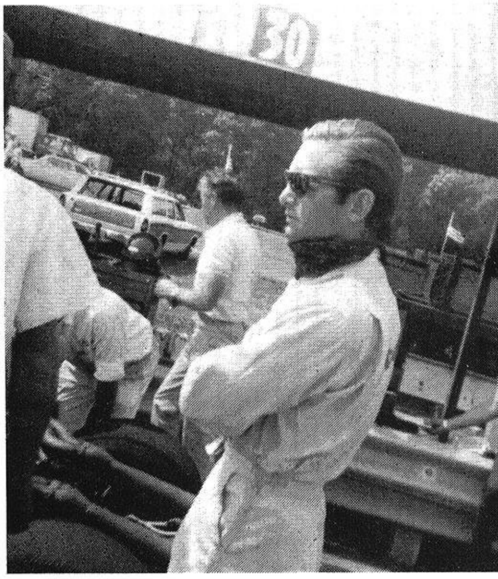
Donohue, who was in last place on corner #3 of lap #1, moves through the pack. He challenges each of the aforementioned cars and on lap #16 pushes by George Eaton and sets his sights on Mario Andretti who is 60 seconds ahead.

There is another battle being won by the spectators. It finally stops raining with 30 of the 50 laps to go. Those with dry tires begin taking up the slack. Hulme laps Jim Hall in his most impressive act of the day. McLaren increases his lead over Andretti until it is a mile at the finish.

By far the most exciting duel of the race is Donohue's challenge of Andretti. On the dry pavement Mark picks up two seconds per lap beginning at the 20th lap when he was 60 seconds behind. Some quick arithmetic shows that at 50 laps this could be quite a race. Not to let any fans go home early, Donohue did just that. At the start of the last lap of the race Mark was only four seconds behind. At corner #7 he was only 80 yards behind (two seconds). Andretti charged all the harder and at station #12 Mario lost his oil cap, blew oil all over the track, with Donohue right behind him, and, I imagine, Andretti cried a little. Donohue placed third. He's probably still wondering if he could have passed Andretti on that last Road America straight. I am!

FINAL RESULTS

1—Dennis Hulme (#5)	$12,000
2—Bruce McLaren (#4)	7,000
3—Mark Donohue (#6)	5,000
4—Peter Revson (#52)	4,000
5—Jim Hall (#66)	3,100
6—Lothar Motschenbacker (#11)	2,100
7—Charlie Hayes (#25)	1,550
8—George Eaton (#98)	1,350
9—John Cordts (#57)	1,150



E. C. C. P.

by Robert Foss, University of Wisconsin News and Publication Service

The Engineering Concepts Curriculum Project is a new program aimed at acquainting high school students with the field of engineering.

Twenty-nine teachers from high schools in Wisconsin and six other states were students at the University of Wisconsin at Madison this summer learning how to teach high school students engineering concepts useful in solving the problems of a "man-made world."

The teachers were in the Engineering Concepts Curriculum Project (ECCP), which is a new high school course developed by the Commission on Engineering Education in Washington, D.C.

The project is an attempt to provide high school students of all backgrounds and interests an understanding of the impact of technology on today's world.

That is why the UW at Madison taught high school teachers this summer how to teach the course in their high schools during the coming school year. The program was also conducted at four other leading universities.

At the University in Madison, Dr. John L. Asmuth, professor of electrical engineering and assistant dean of the College of Engineering, served as academic director of the program. Teaching with him were Profs. Arthur T. Tiedemann, John B. Miller, and Lois Greenfield of the College of Engineering, and James Busch of the School of Education, and Wisconsin high school teachers Robert E. Showers, Green Bay, James J. McNearly, Racine, and Edmund R. Anderson, Monroe.

Dr. W. Robert Marshall, associate dean of the UW College of Engineering and executive director of the Wisconsin Engineering Experiment Station at Madison, is a member of the Board of Directors of the Commission on Engineering Education which sponsored the ECCP project. He also served as chairman of the advisory committee for the project.

How did the ECCP begin?

In the fall of 1963, the National Science Foundation held a meeting in Washington to explore the question, "Are there desirable approaches to the study of physical science in high schools other than those presently available?"

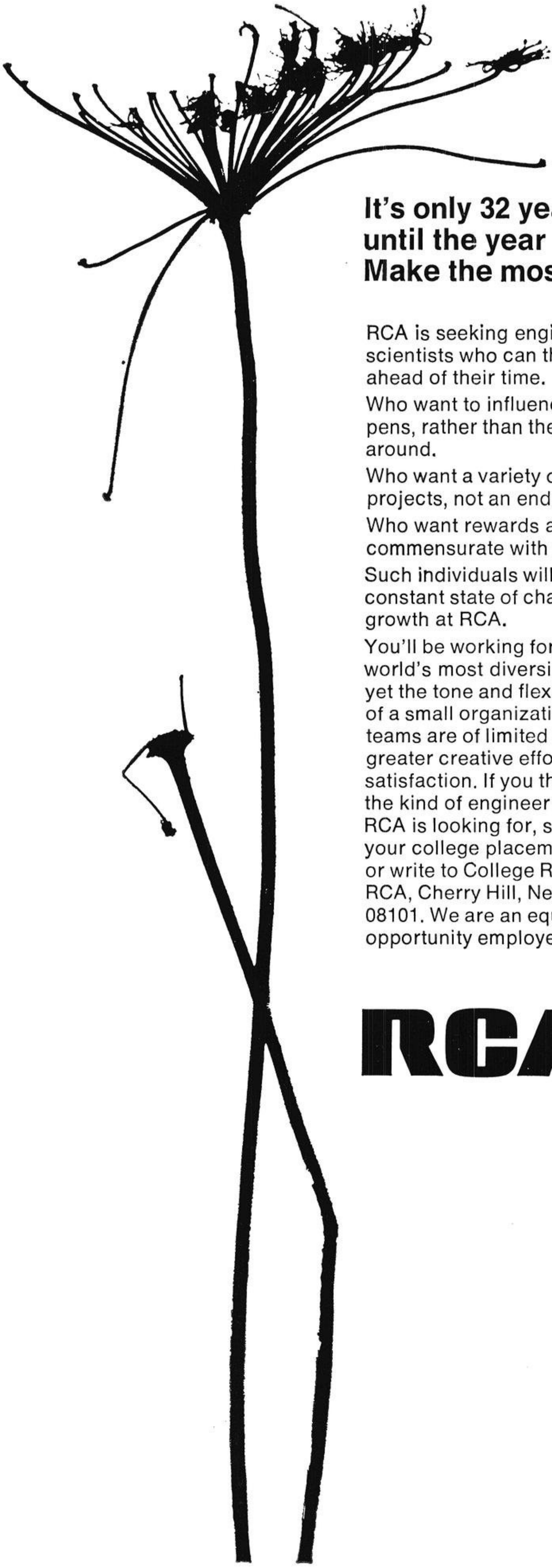
It was recognized that a great deal had already been done or was under way to up-date the teaching of physical science. Physical Sciences Study Committee (PSSC) was in extensive use in schools across the country. Also under development was the Harvard Project Physics Course which takes an historical approach to physics.

The five who attended that exploratory conference in Washington shared a strong engineering interest. They felt that the pure physics course, however good in itself, left a considerable gap in the pupil's understanding of the impact of physical science on the real world. As engineers, they felt there was another approach—one that would tie the physical principles to the man-made world, tie them in with the study of systems, processes, and devices man has created to cope with nature. Automatically, this approach would would place emphasis on the influence of technology in creating our modern environment.

To inquire further, they formed, under the sponsorship of the Commission on Engineering Education, a project that came to be known as the Engineering Concepts Curriculum Project (ECCP). Several times that fall they met to define some of the general concepts that could form a basis for a course. None wanted to be in the position of advocating that high school science should go back to the days when specific skills and technology were taught. The question, as they saw it, was, "Are there, behind today's technology, in the world which the student sees, some concepts that could be communicated to him and that could help him to understand his world, and hence help him to live in it as well as with it?"

Tentative material was prepared and in the spring of 1965 a trial was conducted at Polytechnic Institute of Brooklyn with a Saturday morning class consisting of five high school teachers and 15 high school students. On the basis of the encouraging response from both students and teachers, a further grant was applied for and obtained from the National Science Foundation.

The next step was to write a version of the course to cover an academic year and to try it out at five high schools during 1965-66. During July and August, 1965, course material was written at Tarrytown, N. Y., by a team of 25 that included college professors, high school science teachers, and engineers and scientists from industry. The team produced a 28-chapter course as well as 30 experiments incorporating specially devised equipment.



What's in a Name?

Have you ever wondered what to put on an interview form or application blank under the heading "type of work desired?" Professor James A. Marks, placement director, has compiled the following job title dictionary and has distributed it to both students and interviewers in order to improve understanding regarding job interests, but the Wisconsin Engineer feels that it may also be a helpful reference in planning your career.

Design Engineering

The engineer in design prepares plans and specifications for new products or redesigns existing products to make improvements. He selects materials and components and may recommend manufacturing processes. Design may also include the fabrication and testing of design concepts and models. Specifications, product cost and engineering objectives must always be kept in mind.

Development

Development engineers are responsible for developing new products and finding new uses for established products to meet the needs of industry or of the individual consumer. They concentrate on problems such as planning, designing, and testing products to match performance requirements. They also seek to effect product improvement for increased performance efficiency, higher quality, and lower manufacturing costs.

Production Supervision

The production supervisor is responsible for producing a product in desired quantity and quality and for the safe performance of the men and equipment in the operating unit assigned to him. Responsible for:

(1) Instructing others in proper operating procedures, then following up to assure compliance.
(2) Planning production and maintenance schedules.
(3) Assisting in resolving labor problems.
(4) Initiating process-improvement programs to reduce costs.

Research

Obtain new scientific knowledge of physical and human phenomena. Applied research would be doing much the same thing in areas impinging upon technologies of interest to the company. Other aspects of research might include:

(a) Investigate new fields and discover new products
(b) Provide new uses for products
(c) Improve existing products and processes

Sales Engineering

The sales engineer acts as a liaison between sales and engineering and is responsible for customer contact and technical specification analysis. This includes preparing quotations and initiating and recommending engineering design changes. He may also advise on application problems, handle correspondence on product quality, toxicity, and visit customers with salesmen on serious problems, and prepare evaluation reports on experimental products with key accounts.

Field Service Engineering

The field service engineer usually is in close contact with the customer. His duties often include supervising installation and instructing customer personnel in the operation and maintenance of the product.

Technical Services

Providing maintenance and repair of consumer, commercial and industrial products and systems at service centers and at customer sites.

(continued next page)

Facilities Control Engineering

The Facilities Control Engineer has primary responsibility for the planning and incorporation of new equipment and facilities, the replacement of worn or obsolete facilities, and the maintenance of equipment. He prepares cost reduction and quality improvement studies. He also performs economic analysis studies—comparing models of equipment or alternate methods of operation. A Facilities Control Engineer is typically required to plan new equipment or facilities to increase existing production or to produce a new product.

Test Process Engineering

The Test Process Engineer is responsible for providing the test equipment and test procedures that will assure meeting production and manufacturing schedules. He determines the most efficient and economical methods of performing calibrations and test operations for sub-assemblies and/or completed equipment, plans and writes test specifications and processes, and determines test equipment required.

Controls Engineering

The Control Engineer, usually an electrical engineer, designs and develops systems which control a large variety of machines, processing lines and material handling operations. Working with relays, transistors, silicon controlled rectifiers and accessory items; implemented by a knowledge of machine characteristics, digital logic, systems analysis and manufacturing techniques, the engineer solves the many, varied control problems encountered in industry.

Plant Engineering

Planning, developing, installing, and maintaining the plant facilities and services required by the company are the responsibilities of the Plant Engineer. Duties could be layout of machines and equipment, layout of new or existing plants, provide heavier electrical systems, expand or remodel production lines, increase compressed air services, provide air conditioning and humidity control, install larger boilers and all of the other engineered services required in a modern industrial plant.

Quality Control Engineering

The Quality Control Engineer is responsible for the quality and reliability of the product. He controls and evaluates all manufacturing materials and operations which affect product quality and reliability. His specific duties:

(a) Develop and perform incoming, in-process, and final inspection procedures.
(b) Provide facilities for calibrating instruments, equipment, and tooling.
(c) Develop quality assurance procedures that ensure that maintenance of reliability is inherent in the design.
(d) Develop methods of measurement and sampling size from which to provide design engineering with statistical guidance.
(e) Perform quality acceptance evaluations.
(f) Evaluate module and component reliability needs and status.

Process Engineering

Responsible for designing new plants, making changes in existing plants, and engineering new processes. Maybe trouble shooting an existing process and locating its bottlenecks, in order to increase production capacity, to improve product quality, and to lower operating costs. Or, you may be assigned to develop a new process, adapting it to industrial equipment in a pilot plant.

Development Engineering

A development engineer initiates design changes in existing products; modifies existing products; prepares engineering specifications to keep production within cost limits.

It is the function of the production engineer to create maximum value from given inputs. His assignments include increasing production capacity, debottlenecking, and improving overall efficiency. He is involved in reworking existing units or designing new units to produce a new product, installing and starting up new equipment, and making improvements in procedures of materials handling and quality control.

Product Engineering

Product Engineering designs for production and solves problems of manufacturing operations, engineering changes, costs, and servicing. Responsibility continues throughout the manufacturing of a product and includes the handling of engineering changes.

Product Test Engineering

Product Test Engineering initiates the analysis of new product capabilities. Engineers in this area follow a product from early design concepts through the first manufactured units, devising test procedures in advance, and originating methods that will predict product capabilities accurately.

Materials Engineering — Advise design and development engineers on the availability of materials. Evaluate materials and process developments for product line and design groups.

Prepare specifications on non-standard equipment, initiating the purchase of components and the development of special devices to meet customer requirements.Assist and advise design engineers in the development of equipment. Direct technicians and drafting personnel in the development of customized instrumentation and control systems. Coordinate all phases of an assigned project with the customer and with the project team.

Programmer — Functions: Develop and maintain advanced programming systems which enhance and extend the usefulness of computer systems. Analyze software and evaluate customer's programming requirements. Provide liaison between marketing and engineering teams.

Systems Engineer (Data Processing) — Functions: Analyze the requirements of science, industry and the government in all areas of data processing, including communications, information storage and retrieval, random access, command and control, process control and real-time systems. Evaluate alternative systems to meet these requirements in both hardware and software. Design tests and diagnostic procedures to verify performance of prototype equipment according to specifications.

Reliability Engineering — Conduct component and system reliability studies in order to determine product effectiveness. Analyze test results and make recommendations for changes to insure compliance with customer specifications.

Systems Engineering — Position: Systems engineer will be trained to interpret, evaluate, and comply with customer specifications. He coordinates efforts of the various engineering disciplines (electrical, mechanical, maintainability, reliability); also procurement, production, and manufacturing engineering efforts. Customer and sub-contractor engineering liaison is also his responsibility. He schedules engineering manpower and end item design and testing to assure that the product is properly designed, tested and delivered to the customer on time. Specifications for sub-contract items are generated by the systems engineer, and he furnishes other engineering data to procurement to aid in the purchase of these items. In summary, the systems engineer obtains, analyzes and evaluates technical data to fulfill requirements of both the customer and his company's own engineering and production facilities.

Value Engineering — Position: Value engineering has staff responsibility for reinforcing operating divisions, with the objective of improving product quality while reducing cost. The engineer's duties will involve planning, execution and evaluation of cost improvement projects covering all phases from product inception through design, development, testing, equipment design, tooling, and production.

Production Control Engineering — The Production Control Engineer is responsible for designing new control systems, the installation of these systems, and the improvement of scheduling systems which coordinate production efforts.

Project Engineering — The Project Engineer designs equipment, supervises its installation and handles initial operation. Development of new processes and equipment to reduce cost and improve quality, equipment and methods to promote use and sale and to provide technical assistance to plants and customers as requested.

Manufacturing Engineering — Manufacturing engineers develop new standards, study manufacturing processes for methods of improvement, prepare cost estimates for new product proposals and develop new concepts for automating machinery and equipment. Closely related to Production Engineering.

Maunfacturing Methods Engineering — The Manufacturing Methods Engineer determines the necessary equipment, tools and instructions for production of an equipment in accordance with drawings and specifications from Design Engineering. His responsibility extends:

(a) from the time a product has been designed and released for production
(b) through the design, set-up, and initial operation of the production line

(c) until the units are complete and ready for testing, and
(d) the operating production line is turned over to Line Supervision.
General duties: Prepares plans for the application of automated data processing equipment to the solution of company data recording, reporting and operational and administrative problems, and follows development of the plans to satisfactory application.

Systems Design and Development Engineering

Systems Design and Development helps to create new computer systems, with development engineering, product engineering, and programming teams working together to plan and develop an entire system, construct a working model, test it and help put it into production.

Circuit Design (Data Processing)

Functions: Design high-speed linear and switching circuits for use in central processor and input-output equipment. Develop advanced memory techniques including thin films, large-scale partial switching, linear-select core memories and coincident-current core memories. Develop microminiaturization techniques. Develop power systems for power supply design, cable design, start-up switches and interlocks.

Electro-Mechanical Engineer (Data Processing)

Functions: Design mechanical components for input-output equipment, including high-speed mechanisms operating in milliseconds, repeatable in microseconds and with operating life in the hundreds of millions of cycles. This equipment performs the functions of printing, feeding, indexing, selecting, sensing and punching. Analyze performance and reliability requirements while stressing simplicity, serviceability and cost. Develop techniques and equipment to test and evaluate prototype models. Evaluate developments in metallurgy, kinematics, fluid dynamics, physics, magnetics and optics affecting the state-of-the-art of electronic data processing mechanical components. Determine the optimum method for packaging circuitry by evaluating materials, component cooling, and vibration and structural considerations.

The less you've heard about us the better.

Maybe you think that's a funny way to talk to you.

But we don't think it is.

Many people think we're only a big chemical company.

Chemicals being the biggest thing we have.

But what we'd really like you to know is that we're also a forest products company. Olinkraft.

Plus a lightweight paper company. Ecusta.

Plus a packaging film company.

And that we're an aluminum company. And a brass company.

And a sporting arms and ammunition company. (You've heard about Winchester? That's us.)

The reason we're telling you all this is that the competition to get you is awfully tough.

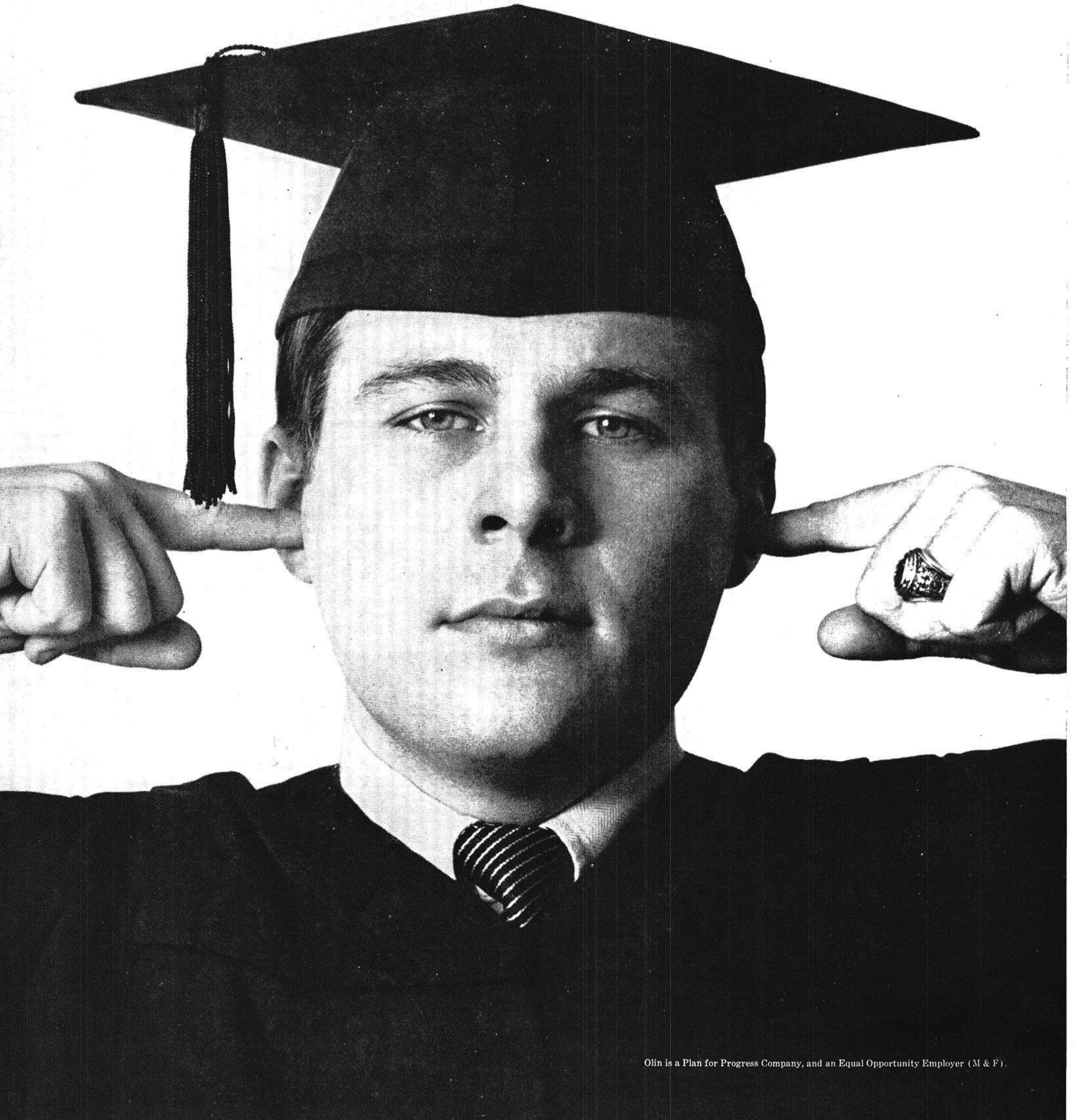
And a big corporation that can offer you the choice of a dozen smaller companies, has an edge.

But don't let this steer you away from chemicals, if that's on your mind. There's everything here from inorganics and organics to specialty and agricultural.

Now you've heard more about us. That's better.

You can do two things now. Meet with your Placement Officer. Or write Monte H. Jacoby, our College Relations Officer, here at Olin, 460 Park Ave., N. Y. 10022.

Olin



1968 FALL INTERVIEW DATES . . .

Wednesday, October 9

Argonne National Labs A.M.
Argonne National Labs (Ph.D.'s) A.M.
Bailey Meter Co. A.M.
Calif. State Government
Collins Radio (2 of 2)
DuPont (2 of 4)
Claud S. Gordon—now Pneumo Dynamics P.M.
Green Bay Pkg. P.M.
Johnson and Johnson P.M.
Keebler Co. A.M.
Parker Pen A.M.
Marathon Oil A.M.
Penn Controls P.M.
Petro-tex Chemicals P.M.
Wayne Co. Road Com. A.M.
West Va. Pulp and Paper Res.
Youngstown Sheet & Tube Res. P.M.

Thursday, October 10

All Steel Equipment P.M.
American Potash P.M.
DuPont (3 of 4)
Freeman Chemicals A.M.
General Electric (1 of 2)
Interstate Power A.M.
Mitre Corp. P.M.
Stauffer Chemicals
UCC—Carbon Products (1 of 2)
UCC—Food Products A.M.
U. of Ill. Grad. School A.M.
U.S. Army Engr. Distr.
Naval Ships Systems Command

Friday, October 11

Amoco Chemicals
Barrett Cravens Electronics A.M.
DuPont (4 of 4) A.M.
Fansteel Met. (1 of 2) P.M.
General Electric (2 of 2) A.M.
LTV Aerospace (Tx)
LTV Missiles (Mich.)
Marbon Chemicals
Modine Mfg.
North Electric P.M.
Richards Wilcox P.M.
UCC—Carbon Prods. (2 of 2) P.M.
Whirlpool (2 of 2) P.M.
Zimpro P.M.

Monday, October 14

Bendix
Elgin, Joliet & Eastern Railway P.M.
International Harvester (1 of 5)
Mobil Res. & Dev. Ph.D.'s (1 of 2)
Motorola (1 of 2)
Phillips Petroleum (1 of 2)
Kurt Salmon Associates P.M.
O. M. Scott & Sons A.M.
Sunbeam
Sun Oil

Tuesday, October 15

Amana Refrig. A.M.
Celotex P.M.
Illinois Tool Works P.M.
Interlake Steel (1 of 2) P.M.
I.B.M. (1 of 2)
International Harvester (2 of 5)
Johnson Service
Ladish P.M.
Mobil Oil (1 of 2)
Motorola (2 of 2) A.M.
Perfect Circle A.M.
Shell Development Ph.D.
Snap-On Tools P.M.
U.S. Industrial Chemicals A.M.

Wednesday, October 16

American Oil—All divisions including Amoco Chemicals (2 of 2)
Arthur Andersen
Applied Physics (1 of 2) P.M.
Burlington Lines P.M.
Dayton Power and Light A.M.
General Dynamics
Goss Co.
Hewlett Packard (1 of 2)
I.B.M. (2 of 2)
Procter & Gamble (1 of 3)

Thursday, October 17

Applied Physics (2 of 2) A.M.
Bemis Co. A.M.
Boeing Co. (1 of 2)
Combustion Engr.
Corn Products P.M.
Hewlett Packard (2 of 2)
Indiana State Natural Resources A.M.
Link Belt P.M.
Martin (1 of 2)
McGraw Edison Power Systems P.M.
Northern States Power (1 of 2)
Chas. Pfizer A.M.
Procter & Gamble (2 of 3)
Stanley Consultants
Quality Evaluation Labs (Hawaii) P.M.

Friday, October 18

American Appraisal P.M.
Aqua Chem P.M.
Belden Mfg. P.M.
Belle City Malleable P.M.
Boeing (2 of 2)
Clark Dietz & Associates
Commercial Solvents (2 of 2) A.M.
General Mills (2 of 2)
Globe Union
Kohler (2 of 2) A.M.
Martin (2 of 2)
PPG Ind. (2 of 2)
Procter & Gamble (3 of 3)
Zenith Radio
C.I.A. (4 of 4)

Monday, October 21

Allen Bradley
American Express A.M.
Dow Corning (1 of 3)
Eastman Kodak (1 of 2)
General Electric—Ph.D. (1 of 2)
Eli Lilly (1 of 2) A.M.
Merck & Co. (1 of 2) P.M.
Wm. S. Merrell (1 of 2) P.M.
Monsanto (1 of 2)
National Lead A.M.
Nordberg Mfg. P.M.
Owens Corning Fiberglas P.M.
Pratt & Whitney
Raytheon (1 of 2)
A. O. Smith
Swift & Co. P.M.
UCC—Ph.D.'s (1 of 2)

Tuesday, October 22

Allegheny Ludlum Steel A.M.
Amphenol Corp. (1 of 2) P.M. (now Bunker Ramo)
Consumers Power
Detroit Edison A.M.
Eastman (2 of 2) if needed
Inst. Paper Chemistry (Miller) P.M.
Kelly Springfield Tire A.M.
Monsanto (2 of 2)
Raytheon (2 of 2)
Jos. Schlitz A.M.
Timken Roller Bearing P.M.
UCC—Ph.D.'s (2 of 2) A.M.
UCC—Mining and Metals P.M.
Union Electric (2 of 2) A.M.
Western Union P.M.
Wisconsin Public Service
Worthington

Wednesday, October 23

Alcoa
Anheuser Busch
City of Los Angeles—Dept. Water
Corning Glass Works (1 of 2)
FMC (Hoopeston) P. M.
FMC (American Viscose) A.M.
FMC (Northern Ordnance) A.M.
FMC (Chemicals)
FMC (Hydrodynamics) A.M.
FMC (Hudson Sharp) P.M.
Factory Mutual A.M.
Fischer Governor
Hoffman LaRoche (2 of 2) P.M.
Mead Corp. (2 of 2) P.M.
U.S. Gen. Acctg.—117 Bascom or Commerce

Thursday, October 24

American Hospital Supply (1 of 2) 117 Bascom
Anderson Clayton (1 of 2) A.M.
Corning Glass (2 of 2)
Corning Glass—Ph.D.'s A.M.
Goodyear Aerospace (1 of 2)
Goodyear Tire & Rubber (1 of 2)
Hamilton Std. (1 of 2)
Honeywell (1 of 2)
Mack Trucks A.M.
Sylvania (2 of 2)
Torrington
Std. Oil of Ohio (1 of 2)
U.S. Steel
Vilter Mfg. P.M.
West Bend

Friday, October 25

American Hospital Supply (2 of 2) 102 Commerce
American Cyanamid (2 of 2)
Beloit Corp.

Columbian Carbon Co. P.M.
Commonwealth Edison P.M.
Dames & Moore
Falk Corp.
Goodyear Aerospace (2 of 2) A.M.
Goodyear Tire & Rubber (2 of 2) A.M.
Great Northern Railway P.M.
Hamilton Std. (2 of 2) A.M.
Honeywell (2 of 2)
S. C. Johnson
Nalco Chemicals P.M.
Perfex P.M.
PPG—Chemicals Div.
Std. Oil of Ohio (2 of 2) A.M.
Stanford University P.M.
U.S. Gypsum

Monday, October 28

Abbott Labs (1 of 2) P.M.
Ayerst Labs P.M.
Bell System (1 of 5)
City of Detroit (1 of 2) P.M.
Cleveland Cliffs
General Tel. of Wis. (1 of 3) P.M.
I.I.T. Res. Inst. A.M.
Industrial Nucleonics A.M.
National Steel A.M.
Nekoosa Edwards
Std. Oil of Calif. (1 of 5)
UCC (1 of 2) Group I
Upjohn
U.S. Naval Weapons Center—China Lake

Tuesday, October 29

Babcock & Wilcox
Bell Systems (2 of 5)
Brunswick (1 of 2) P.M.
R. R. Donnelley (2 of 3) A.M.
Eaton Towne & Yale A.M.
Control Data
E. F. Johnson A.M.
Kimberly Clark (1 of 4)
Std. Oil of Calif. (2 of 5)
UCC (2 of 2)
Uniroyal (1 of 2)
USDA—Soil Conservation P.M.

Wednesday, October 30

Bell Systems (3 of 5)
Bergstrom Paper
Harza Engr. Co.
Ingersoll Milling Machine
Raychem
G. T. Schjeldahl A.M.
Std. Oil of Calif. (3 of 5)
Uniroyal (2 of 2)
General Services Adm. P.M.
U.S. Geological Survey P.M.
U.S. Geological Survey (Minn.) P.M.
Dept. Housing and Urban Dev. A.M.

Thursday, October 31

Allied Chemical
Cont. Corp. of America (2 of 2) A.M.
Cont. Oil (1 of 2)
Diamond Alkali-T. R. Evans Res. P.M.
Ford Motor (1 of 2)
Schlumberger Well Service
Shell Companies (1 of 2)
Square D (1 of 2)
Std. Oil of Calif. (4 of 5)
Sundstrand Corp. (1 of 2)
UCC—Nuclear (1 of 2)
Uniroyal Res. (1 of 2) P.M.

Friday, November 1

Chicago, Milw. & St. Paul RR A.M.
Cont. Oil (2 of 2)
Crown Zellerbach
Ford Motor (2 of 2) A.M.
Hughes Aircraft—From Oct. 22
Mallinckrodt (2 of 2)
Northern Natural Gas P.M.
Oak Electro/netics P.M.
Pan American Petroleum P.M.
Parker Hannifin
Shell Companies (2 of 2)
Square D (2 of 2)
Std. Oil of Calif. (5 of 5)
Sundstrand (2 of 2)
West Va. Road Commission
U.S. Atomic
U.S. Forest Service—Chequamegan Nat'l Forest A.M.

Monday, November 4

Blaw Knox A.M.
Caterpillar Tractor (1 of 2)
Ceco Corp. P.M.
City of Milwaukee P.M.
Clark Equipment A.M.
Emerson Electric
Esso Res. & Engr. (1 of 4)
George Hormel (1 of 3) P.M.
Inst. Paper Chemistry A.M.
Jet Propulsion Labs (1 of 2)
Kellogg (1 of 2) P.M.
Scott Paper (1 of 2)
Naval Weapons Center—Corona A.M.

Tuesday, November 5

American Can (1 of 3)
Caterpillar Tractor (2 of 2)
Deere & Co. (1 of 2)
Esso (2 of 4)
Ethyl Corp. (1 of 2)
Jet Propulsion Labs (2 of 2) A.M.
Koehring P.M.
Pickands Mather
Pullman Std. A.M.
Pure Oil—Union Oil Calif. (1 of 3)
Scott Paper (2 of 2)
Wright Patterson AFB Aeronautical P.M.

Wednesday, November 6

American Can (2 of 3)
American Electric Power A.M.
Armco Steel A.M.
Charmin Paper (1 of 2)
Cutler Hammer
Esso (3 of 4)
Ethyl (2 of 2) A.M.
General Foods (1 of 2)
Racine Hydraulics
Swift Research P.M.
H. Walker
Xerox Corp.

Thursday, November 7

Louis Allis (1 of 2)
American Can (3 of 3) A.M.
Burroughs P.M.
J. I. Case P.M.
Celanese Corp.
Charmin Paper (2 of 2)
Chicago Bridge & Iron
City of Minneapolis
Cornell Areon. Labs P.M.
DeSoto Chemicals A.M.
General Foods (2 of 2) A.M.
IT&T A.M.
Northern Illinois Gas P.M.
Ralston Purina (2 of 2)
Sparton Electronics A.M.
UCC—Linde Div. (1 of 2)
Waukesha Motor P.M.

Friday, November 8

Louis Allis (2 of 2)
Ashland Chemicals A.M.
County of Los Angeles
Cargill
Elliott Co. A.M.
General Radio
Iowa Electric Light A.M.
Kennecott Kopper
Morton Chemical Co. P.M.
Leeds and Northrup
Olin Mathieson
Parke-Davis (2 of 2) P.M.
Sola Basic Industries P.M.
Underwriters Labs P.M.
UCC—Linde Div. (2 of 2)
Wisconsin State Highway P.M.
Woodward Governor

Monday, November 11

Atlantic Richfield (Tx)
Chrysler
Cummins Engine P.M.
Los Alamos Scientific (1 of 2)
Milwaukee Co. Civil Service P.M.
3M (1 of 5)
Penn Central R.R. (1 of 2) P.M.
RCA Labs A.M.
Texaco (1 of 2)
Universal Oil P.M.
Weyerhaeuser (1 of 2) P.M.
Wisconsin Power & Light (1 of 2)
Wyandotte Chemicals (1 of 2)
U.S. Patent (1 of 2)
Pacific Missile Range—Pt. Magu P.M.
Unilver Ltd. (117 Bascom)

Tuesday, November 12

Avco Lycoming
Ansul Corp. (1 of 2) P.M.
Heil Co. (1 of 2) A.M.
Illinois Div. Highways P.M.
3M (2 of 5)
Outboard Marine
Panduit
Rex Chainbelt
Sinclair Oil (1 of 2)

(continued on page 33)

"...What do I live for?

Knowing that every time a jet takes off, some part that makes it go is made of an alloy I worked on..."

Clarence Bieber is a metallurgist for International Nickel.
In forty years, he's contributed to dozens of alloys that have helped make the twentieth century what it is.

"...These alloys are my children...does that sound strange? You've got to be a little unconventional to create. Every problem that can be solved by ordinary people has already been solved..."

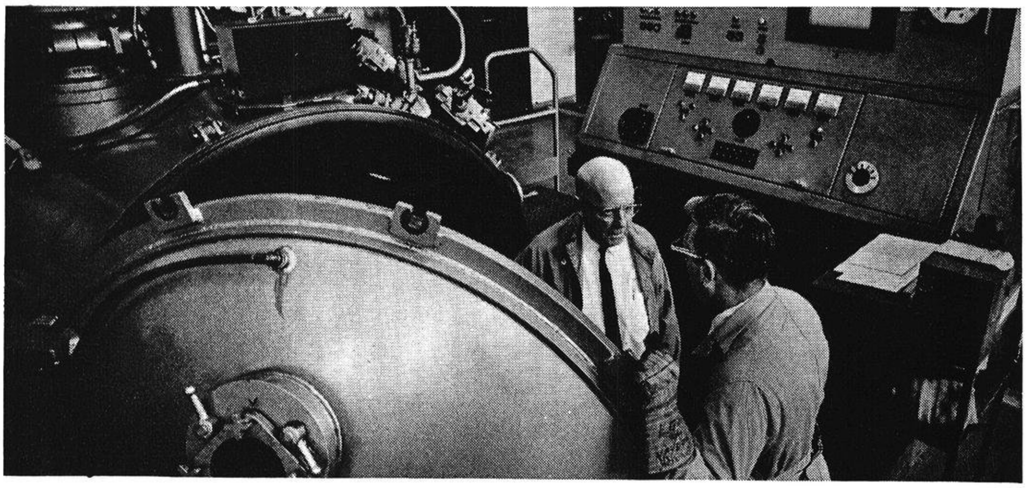
Solving problems is the work of 32,000 Inco people. Those who search the globe for nickel. Those who bring it back. Those who make each rock yield more of it. Those who find new and better ways to use it.

"...when MacArthur left Corregidor he used a PT boat. They bent the propeller shaft dragging it over rocks...but it was made of an alloy we developed for toughness and corrosion resistance, so they could bang it back in shape and escape...I guess I've contributed something..."

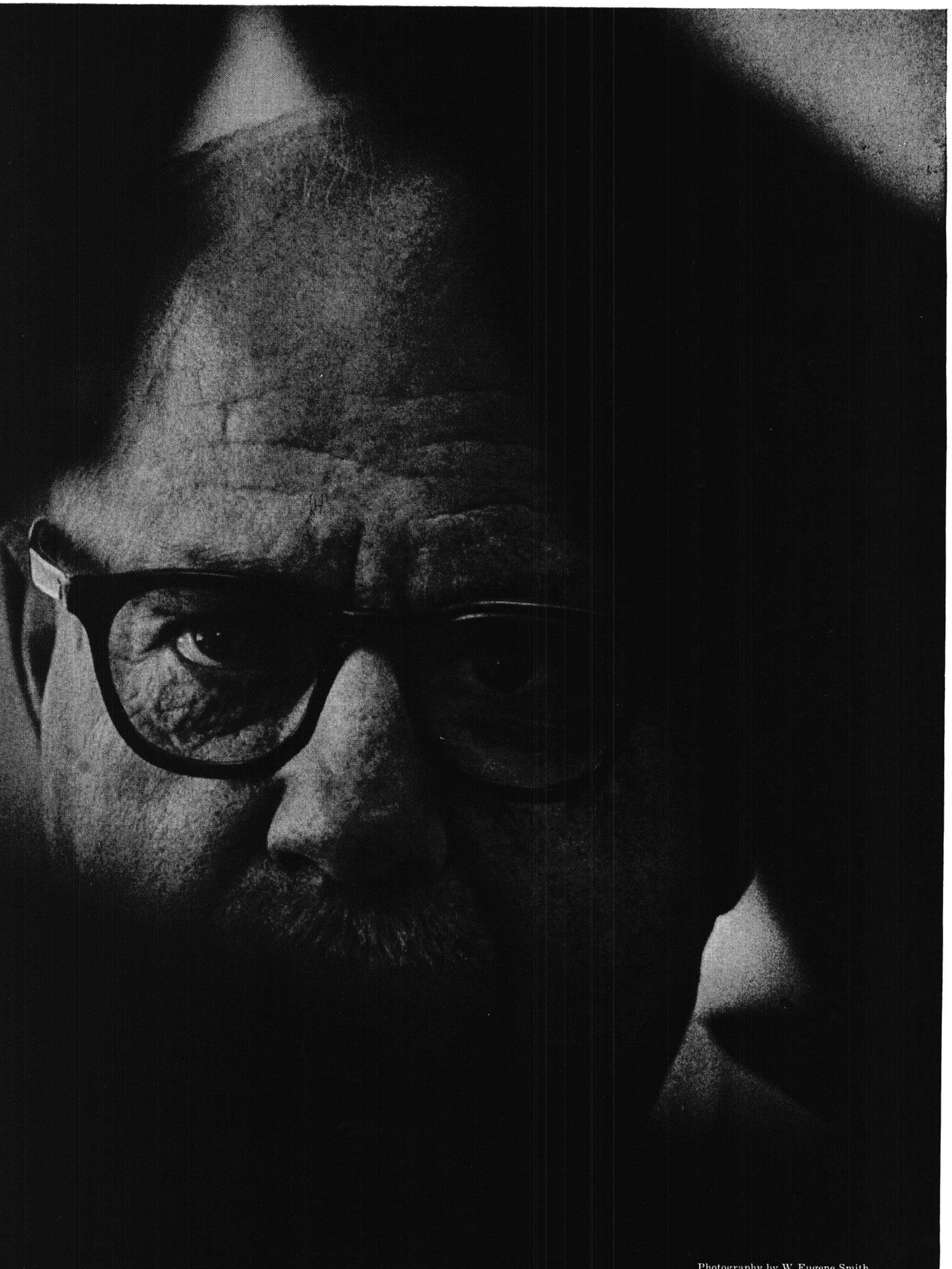
Each Inco man contributes something. He's the man who accepts the challenge of bringing the world the nickel it needs. More and more nickel to make other metals stronger, tougher, more corrosion-resistant. To make over 3,000 alloys perform better, longer.
Nickel, its contribution is quality.

INTERNATIONAL NICKEL

The International Nickel Company, Inc., New York, N.Y.
The International Nickel Company of Canada, Limited, Toronto, Ontario
International Nickel Limited, London, England



"We don't draw lines between fundamental and applied research. In our research laboratory at Sterling Forest, New York, we duplicate in pilot equipment the techniques used to melt and form metals. This lets us take alloy development to a stage where our results have real meaning for industry."



Photography by W. Eugene Smith.

INTERVIEW DATES continued

Skelly Oil A.M.
Texaco (2 of 2)
Trane (1 of 4)
USAMC—Techn. Placement (1 of 2) P.M.

Wednesday, November 13

Allis-Chalmers (3 of 5)
Dairyland Power Coop. A.M.
General Motors (2 of 4)
Hercules Research
Kearney & Trecker (1 of 2) P.M.
3M (3 of 5)
Peoples Gas Light & Coke P.M.
Public Service Electric and Gas A.M.
RCA (1 of 2)
Trane (2 of 4)
Twin Disc P.M.
Naval Facilities Engr. Command

Thursday, November 14

Allis-Chalmers (4 of 5)
Atlas Chemicals A.M.
General Motors (3 of 4)
General Tire & Rubber P.M.
Gulf General Atomic
Metropolitan Dis. Sanitary of Greater Chicago A.M.
National Cash Register P.M.
Northwest Paper A.M.
RCA (2 of 2)
St. Regis Paper P.M.
TRW Systems
Trane (3 of 4) A.M.
N.A.S.A. Lewis Res. Ctr. (1 of 2)

Friday, November 15

General Motors (4 of 4)

Monday, November 18

Crane Co.
Ebasco Services A.M.
General Dynamics Electric Boat
B. F. Goodrich (1 of 2)
Gulf Oil—Texas
Gulf Res. & Dev.
Harnischfeger (1 of 2)
Magnavox A.M.
Sperry Flight Systems
Vanity Fair P.M.
Wisconsin Electric Power (1 of 2)
U.S. Naval Ships Missiles Systems A.M.

Tuesday, November 19

Automatic Electric P.M.
City of Los Angeles—Bureau of Engr.
City of Philadelphia A.M.
Diamond Alkali A.M.
B. F. Goodrich (2 of 2)
Hercules Powder (Kirk)
Joslyn Mfg.
P. R. Mallory A.M.
McDonnell Douglas (1 of 2)
Oscar Mayer
Maytag A.M.
National Castings P.M.
Owens Illinois A.M.
Univac (1 of 2)
Washington State Highway

Camp Randall Stadium Rolls Out the GREEN carpet

by Eric Fonstad

Camp Randall has reached the second stage in the remodeling program that started with the addition of a second tier of seats over part of the stadium. The newest improvement is one that is primarily for the comfort and safety of the athletes. It is a half-inch-thick, grass-like, nylon "carpet" which now covers the football field.

Developed by the 3M Company, the new material is called Tartanturf and not only will it be easier to take care of than the real grass it replaced, but it also affords the football players a great advantage: it is safer. The new turf is slip-proof, even when wet, and because cleats cannot dig deeply into it (for there are no holes or soft spots), there is less chance of knee or ankle injuries.

Funds for the new turf were provided for by the Wisconsin Parking and Transport Board in exchange for the conversion of the practice fields to the north of the stadium into parking lots. The installation of Tartanturf, here shown in pictures with a more detailed explanation of what it actually is and what is expected of it, was completed midway through September. It has much to offer in terms of low maintenance, but the most important point is the hope that there will be fewer injuries to our players.

This new 3M product provides a grass-like surface which is intended for use in all "grass" sports, including football, baseball, soccer, la crosse, golf, etc. It is a unified material combining a unique cushiony base and a nylon pile fiber top surface to provide the necessary resilience, texture, traction, and color for all grass sports. 3M Company has had over ten years' research on this product. The base material has been used for horse racing for over five years. Wear and weathering have been very slight. The nylon surface has been used indoors and out for a like period of time with very little effect.

CHARACTERISTICS

1) Resiliency remains the same in all kinds of weather — hot or cold, dry or rainy.

2) Remains color-fast under all weather conditions.

3) Remains completely stable — does not stretch or shrink.

4) Traction is virtually identical, wet or dry.

5) Most conventional football shoes can be used on the surface. Also, soccer shoes and flats work very well.

ADVANTAGES OVER NATURAL TURF

1) Reduces injuries to knees, ankles and elbows to a substantial degree. Cleats don't catch in 3M's turf as they do in natural turf. Also, the surface is uniform in its resilience—no soft and hard spots, holes and other injury-contributing problems of natural turf: fast stops, cuts, reversed fields.

2) Saves space—the main stadium field will not have to be reserved for six or eight intercollegiate games a year. The competition field becomes also the practice field, leaving previous practice fields free for new construction or other purposes.

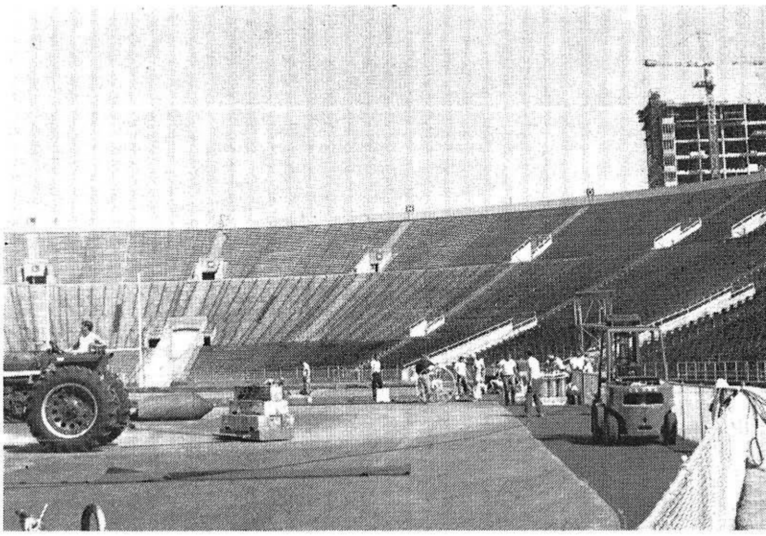
3) Appearance remains beautiful at all times—no bare spots, no tear spots, stays green—looks great from the stands and on television.

4) 3M turf stays clean. No more

(continued next page)

Right: A tractor pulls a sled loaded with lead to crush and soften the base material before the turf is laid.

Below: Some workmen spread out the adhesive as others lay the turf.



dirt and mud covered players and uniforms. Substantially reduced uniform and uniform maintenance costs.

5) Easier on bare skin. Abrasions, tears and cuts will be greatly reduced.

6) 3M turf field would not be a football field alone, but could become one field for all to use: other intercollegiate sports, intramurals, physical education, student and faculty recreation and community use.

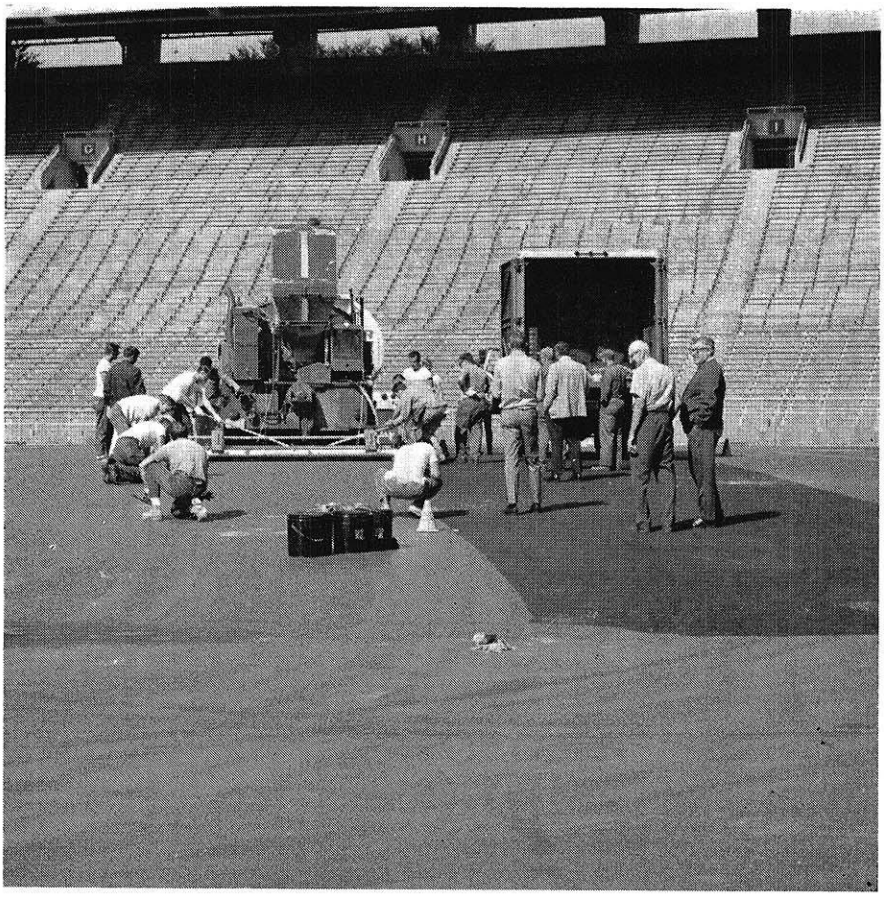
7) Any kind of spikes may be used.

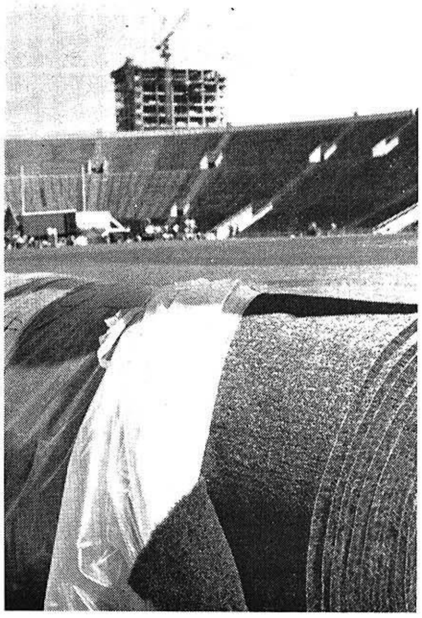
8) Costs of maintaining natural turf are almost completely eliminated. These include costs for labor and material to cover the following: resodding, striping, mowing, watering, fertilizing, weed killing, aerating, etc., since one 3M turf field will handle all games.

9) Games will always be played under ideal conditions. When fans realize this, you're more apt to have better attendance.

Titanturf is designed to be used where resiliency, uniformity, high traction, all weather qualities, turf-like performance and appearance, as well as low maintenance, are required for such events as football, soccer, baseball and related sports. The material is resistant to bacteria, mildew and other forms of biological attack. It is designed to present a constant, rugged, non-slip surface, wet or dry. The shock-absorbing qualities are virtually unaffected by extremes in environmental temperature.

Titanturf consists of two sections: An elastomeric base and a fiber pile top. The elastomeric base consists of a two-part pour-in-place resin con-





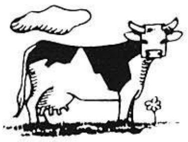
Top: The new engineering building can be seen behind this roll of Tartan turf and beyond the stadium.

Left: Special equipment is used to lay the elastomeric base material. Former head football coach, Milt Bruhn, far right of the picture, looks on.

taining crushable, light-weight inorganic particulate matter. The resin cures within two hours to a polymer, which has a mean molecular weight and crosslink density such that retardation to impulse is not purely elastic (i.e., proportional to deformation) but partially viscous (i.e., proportional also to rate of deformation) so that deceleration is more nearly uniform. The crushable, light-weight inorganic particulate matter embedded in the polymeric matrix, following an initial crushing load which leaves voids of appropriate size and volume fraction, will further contribute to uniform shock-absorbing qualities. The elastomeric base is one-half inch thick and is adhered completely to the asphalt foundation. The top consists of a cut nylon pile placed into a knitted polyester backing. The nylon fibers are circular in cross section, crimped, weather resistant and of approximately equal thickness. The top is totally adhered to the base with a solvent-free two-part adhesive which cures to form a permanent resilient polymeric bond that is virtually unaffected by changes in environmental temperature.

How to keep a cow's mind on milk. Instead of flies.

An informal report on a few current projects at Shell. Some of them might seem like offbeat work for an oil company. But this is a company that contributes broadly and significantly to society. A company of experts that brings out the best in its engineering, scientific and business people.



Shell scientists have come up with a vast improvement over even the most talented cow tail. It's called VAPONA® insecticide. A plastic strip impregnated with it will kill flies in a cow stall for up to three months. And VAPONA® insecticide combined with CIODRIN® insecticide keeps cows fly-free 24 hours a day—even out in pasture. Give you ideas for further applications?

Energy from under the sea

Shell is heading into ever-deeper water in the search for oil and natural gas. Recently we designed and installed permanent drilling/production platforms as tall as a 34-story building, with still bigger structures in the works. And we are operating in considerably deeper water from floating platforms. We are also searching on land in 16 states to help meet burgeoning energy needs.

Digestible detergents

The main trouble with detergents is they don't go away. They pollute streams, make fresh water foamy. The solution: detergent compounds that organisms can consume. These "biodegradables" clean clothes just as effectively, but keep streams free of detergent foam. Elsewhere in the chemical part of our business, Shell research has resulted in a wealth of plastics for home and industry, and fertilizers to alleviate food shortages.

The name of the game

More gasoline per barrel of crude oil delights engineers, scientists and conservationists alike. Our new hydrocrackers actually produce *more* than a gallon of refined product from a gallon of feed stock. And we are using sophisticated techniques to tailor-make products by reassembling hydrocarbon molecules.

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Does Artificial Turf Reduce Injuries?

Study by
Dr. Emmet Kelly

These are the results of a survey taken by R. Emmet Kelly, M.D., director of Monsanto Company's Medical Department, comparing the incidence of knee and ankle injuries during the 1967 football season in games planed on Monsanto's artificial turf, AstroTurf, to those played on grass. AstroTurf differs from the Tartanturf made by 3M that will be used in Camp Randall Stadium in that it is a bladed nylon pile over a polyvinle chloride cushioning foam and a nylon mat, while Tartanturf has circular fibers in its nylon pile surface with an elastomeric base. The injury-reducing characteristics of a uniform surface without holes or soft spots is the same for both surfaces. Consequently, the results of this survey can be taken as an indication of what can be expected from Camp Randall's new turf.

A questionnaire was sent by Monsanto to the 542 colleges and universities listed in the "NCAA Official Collegiate Football Guide, 1967." The response to the questionnaire was regarded by the company as excellent, with 185 schools reporting (34.1 per cent).

The questionnaire requested information pertinent to the number of knee and ankle injuries occurring during practice and in regularly scheduled games and the extent of the injury; that is, whether the injury required surgery and/or the amount of time a player was sidelined as a result of the injury. Within the questions, the schools were asked to classify the injuries as to whether turf was a factor.

Although traction and maneuverability are generally equivalent on natural turf and artificial turf, the penetration of the football cleat necessary to achieve traction and maneuverability on natural turf is a major contributing cause of injury. A foot locked into the surface cannot always yield to a blow coming from the side. Artificial turfs, however, permit cleat penetration only in the face fibers and depend on this limited penetration plus surface friction to achieve its remarkable performance, and, as a result, a foot is not locked into the surface.

A summary of the results from the 185 schools (see table I) is the basis for the following conclusions:

- Over 50 per cent of the serious knee and ankle injuries are either turf related or possibly turf related.
- The number of injuries occurring in practice is greater than in games. However, assuming averages of 90 practice sessions and 10 games for each school, the serious leg injury rate for games on natural turf is .362 per game while practice rates are only .066 per session.
- If the total number of serious leg injuries (1,771) reported by the 185 schools is extrapolated to the 542 colleges and universities in the NCAA guide, the total of such injuries occurring in these schools in 1967 was approximately 5,190.
- The serious knee injury is more prevalent than the serious ankle injury and requires surgery far more often. However, in spite of the almost universal practice of ankle

(continued next page)

TABLE I
SUMMARY BY TYPE INJURY
(185 Reporting Colleges)

	Practice				Games				Total				
	TR	NTR	PTR	Total	TR	NTR	PTR	Total	TR	NTR	PTR	Total	Averages
Knee — Surgery	30	116	58	204	44	80	38	162	74	196	96	366	1.98
Knee — No Surgery*	74	204	136	414	39	124	64	227	113	328	200	641	3.56
Total Knees	104	320	194	618	83	204	102	389	187	524	296	1007	5.44
Ankle — Surgery	11	9	9	29	1	8	2	11	12	17	11	40	.22
Ankle — No Surgery*	134	179	141	455	61	122	87	270	195	301	228	724	3.91
Total Ankles	145	188	150	483	62	130	89	281	207	318	239	764	4.13
TOTAL INJURY	249	508	344	1101	145	334	191	670	394	842	535	1771	9.57
%	14.1	28.7	19.4	62.2	8.2	18.9	10.8	37.8	22.2	47.5	30.2	100.0	

*Missing one full week or more
TR — Turf Related
NTR — Non-Turf Related
PTR — Possible Turf Related

taping, the serious ankle injury is still a major factor.

1967 ANKLE AND KNEE INJURIES ON ASTROTURF

There were three AstroTurf football fields in use throughout the 1967 football season; one indoor field at the Astrodome in Houston, Texas, and two outdoor fields located at Seattle (Wash.) Memorial Stadium and Indiana State University in Terre Haute. There were 69 football games and 79 football practice sessions on these three fields during the year. In addition, there were several soccer games played on the field as well as a full major league baseball schedule on the Astrodome surface. There was no discernible wear on the artificial turf on any of the surfaces during this period, and the surface relationship to performance remained consistent through wet or dry conditions and varying temperature conditions. This, in itself, is a remarkable performance. However, the most startling result was in the great reduction of serious injuries on this surface.

A detailed summary (see table II) shows the results of the 1967 experience on AstroTurf and is the basis for the following conclusions:

1. AstroTurf reduces the total number of serious knee and ankle injuries appreciably.

2. There were no surface related knee and ankle injuries on AstroTurf in practice or games in 1967.

ASTROTURF VS. NATURAL TURF

The rates of injury occurrence for AstroTurf and natural turf were compared (see table III). However, the following comments on these comparisons should serve to make the data more meaningful:

1. If the games and practices that were held on AstroTurf had been held on natural turf, the expected total number of serious knee and ankle injuries would have been:

Practices	79 x .066 =	5.2
Games	69 x .362 =	25.0
TOTAL Expected		30.2
Actual Experience		5.0
Difference		25.2

2. If the estimated 1,850 games played by the reporting schools had been played on AstroTurf, the total number of serious knee and ankle injuries would have been only (.058 x 1,850) = 107, as compared to the 670 they reported, based on these data.

3. Again, based on these data, one

TABLE II
ASTROTURF® SUMMARIES — 1967

Practice Sessions

	College	Pro	H.S.	Total
Astrodome	—	—	—	—
Indiana State U.	50	—	—	50
Seattle	5	6	18	29
TOTAL	55	6	18	79

Football Games

	College	Pro	H.S.	Total
Astrodome	6	—	—	6
Indiana State U.	5	—	14	19
Seattle	—	6	38	44
TOTAL	11	6	52	69

Total Serious Knee & Ankle Injuries — Games

Knee Injuries — Surgical — Non-Turf Related	2
Knee Injuries — Non-Surgical — Non-Turf Related	1
Ankle Injuries — Surgical — Non-Turf Related	1
Ankle Injuries — Non-Surgical — Non-Turf Related	0
Turf Related — Knee or Ankle — Surgical or Non-Surgical	0
TOTAL	4

Total Serious Knee & Ankle Injuries — Practice

Knee Injuries — Surgical — Non-Turf Related	1
Turf Related Injuries — Knee or Ankle — Surgical or Non-Surgical	0
Non-Turf Related — Non-Surgical — Knee or Ankle	0
Non-Turf Related — Ankles — Surgical	0
TOTAL	1

TABLE III
ASTROTURF® VS. NATURAL TURF — SERIOUS* KNEE & ANKLE INJURY RATES — 1967

	Injuries Per Session**					
	Practice			Games		
	AstroTurf	Nat. Turf	Ratio $\frac{NT}{A}$	AstroTurf	Nat. Turf	Ratio $\frac{NT}{A}$
Knees						
Turf-Related	.000	.018	—	.000	.100	—
Non-Turf Related	.012	.019	1.58	.043	.110	2.56
Total Knees	.012	.037	3.08	.043	.210	4.88
Ankles						
Turf-Related	.000	.018	—	.000	.082	—
Non-Turf Related	.000	.011	—	.014	.070	5.00
	.000	.029	—	.014	.152	10.86
Total						
Turf-Related	.000	.036	—	.000	.182	—
Non-Turf Related	.012	.030	2.50	.058	.180	3.10
Total Knees & Ankles	.012	.066	5.50	.058	.362	6.24

* Total of injuries requiring surgery and those resulting in loss of player for more than one week.

** Practice sessions estimated at 90 per school
Games estimated at 10 per school

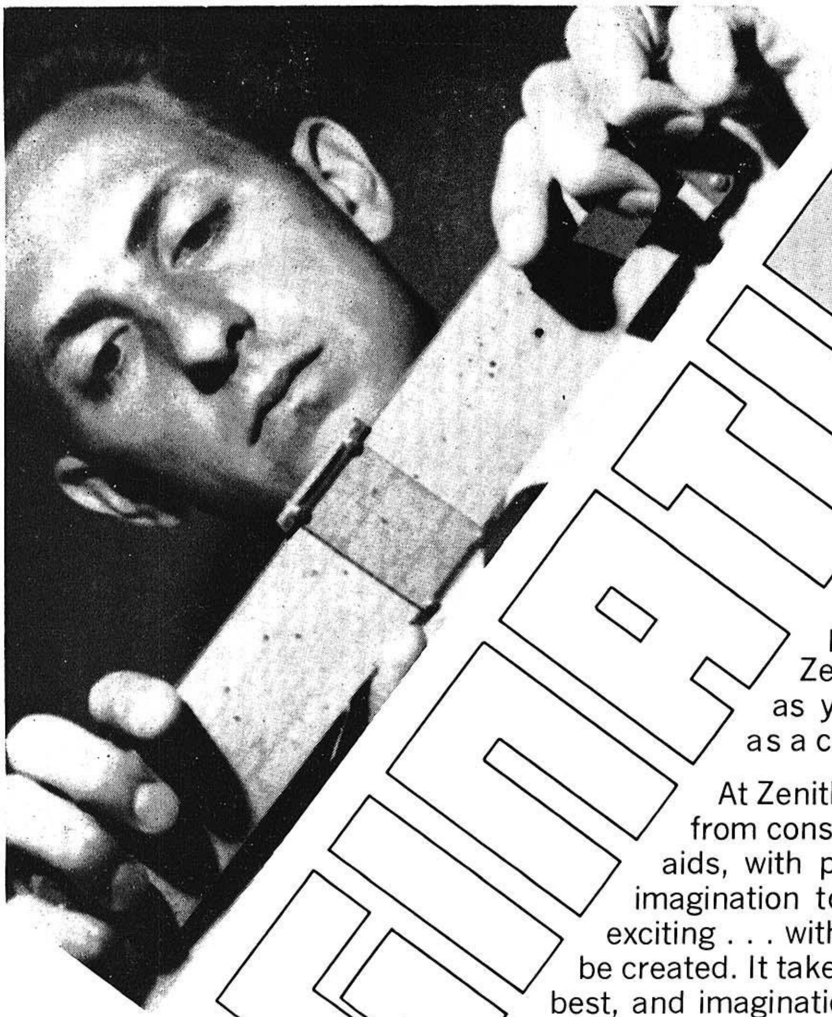
185 Reporting Schools
Astroturf® sessions are actual count: Games — 69, Practices — 79

concludes that the total number of injuries, practice and game, would have been only 307 (107 games and 200 practice) as compared to the 1,771 reported by the schools.

4. If these data are extrapolated to the entire 542 NCAA schools, then the comparison of total serious knee and ankle injuries would be: AstroTurf, 900; natural turf, 5,190.

5. The probability of a serious knee or ankle injury for a boy playing on AstroTurf is reduced to 1 in 67 in any given year as compared to the 1 in 8 (assumes an average of 75 players per school) calculated for the reporting schools. Further, the odds are less than 1 in 17 for the four years in schools as compared to 1 in 2.4 calculated for the reporting schools.

6. The total number of serious knee and ankle injuries per school on AstroTurf is less than 1.6 per year as compared to the experience of 9.6 by the reporting schools.



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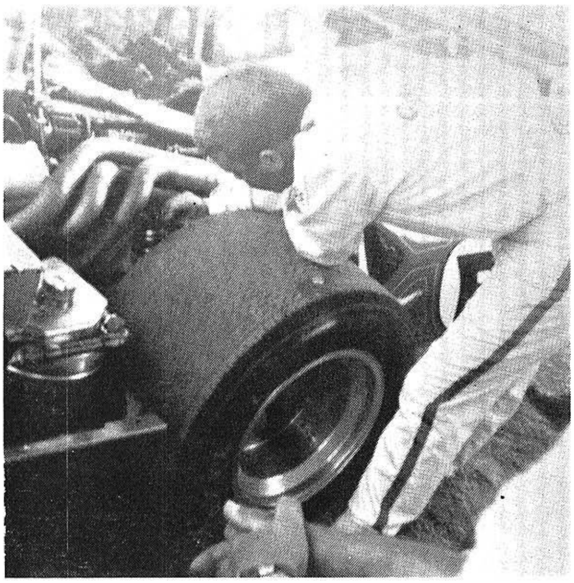


Mark Donohue checks for wear on his giant 15½-inch Goodyear tires. Temperature checks of the tire give the pit crew a guide to adjust tire camber.

Sports Car Cornering Techniques

by Rolf Stoylen

Reprinted from *Minnesota Technolog*

Since the end of the Second World War, the development of racing automobiles has been spectacular to say the least. For example, at the famous twenty-four hour road-race in Le Mans, France, the 1949 race winning average was about 83 miles per hour Last year the winning Ford Mk IV prototype averaged 135 mph. (a total distance of 3500 miles). This is an improvement of 61% in eighteen years. A large portion of this improvement is due to a development of a better understanding of "road holding" or cornering characteristics. The purpose of this article is to describe simply the dynamics of automobile cornering and to discuss some of the current methods of high speed cornering.

Without some understanding of the pneumatic tire, an intelligent discussion of cornering characteristics is impossible. When any car travels in a curved path its tires distort themselves (Fig. 1-a) while producing a cornering force that counteracts centrifugal force. Fig. 1-b shows the plane of the wheel *aa'* makes an angle *s* with *ob*, the instantaneous direction of travel. The angle and the resulting distortion of the tire tread is called the slip angle. The cornering force *f* is actually applied a distance *d* behind *o*, the effective swivel point of the wheel, causing a self aligning torque $f \times d$. The self aligning torque supplies the so-called "feel" at the steering wheel up to slip angles of about ten degrees. For some reason at this point, this force either becomes zero or actually reverses itself instead of acting as a restoring force that realigns the front wheels. If the slip angles of the tires are increased beyond this point the tire will lose adhesion and skid across the road surface. To increase tire cornering force, distortion and hence slip angles must be reduced. There are several ways this can be done: high inflation pressures may be used, wheel rim width and tire section can be increased, and tire cord angles can be reduced. It should be understood that it is impossible to build a tire that incorporates all favorable

features, so design work is a compromise to achieve the most desirable combination. Modern racing tires are very wide (up to 18") and have the so called low profile section (almost rectangular and wide compared to height). Cord material is usually nylon and construction is a two ply radial type. This combination effectively minimizes slip angles and provides stable high speed characteristics.

As an automobile travels around a corner in a curved path, it is clear that the inside wheel will have to follow a tighter circle than the outside wheel. In order to do this without forcing the inside wheel to scrub, or drag, the inside wheel must turn through a greater angle than the outside one. This is accomplished by the use of the Ackerman steering geometry. Within very small error limits the Ackerman system turns the front wheels so as to provide minimum tire scrub. In Fig. 2 an automobile is traveling in a curved path around its Ackerman center A, found by extending the tire cornering force lines until they intersect. The diagram assumes that the slip angles are zero, i.e., that the car is traveling at low speed. If the car then takes the same bend at a higher rate, the tire slip angles will increase to some set angle, depending on speed, and the turning center will move forward to B. The position of B depends on whether or not the car inherently oversteers or understeers. When the slip angles of the front tires are normally greater in a turn, the front tires will lose adhesion first and the car will understeer. This will cause B to move farther towards the outside of the turn, and the car will tend to slide off the road on the outside when going too fast. Exactly the opposite thing happens when an automobile oversteers, and the car will tend to lose control by spinning to the inside. Almost all modern racing cars are purposely set up to understeer. This is because it has been found that at high speed an understeering automobile is much more stable than an oversteering car. The reason for this will be clarified in the following discussion of the "four wheel drift."

Assume that the automobile in Fig. 3 is a rear wheel drive, understeering racing car with a high power to weight ratio. As the car enters a turn it is steered into a cir-

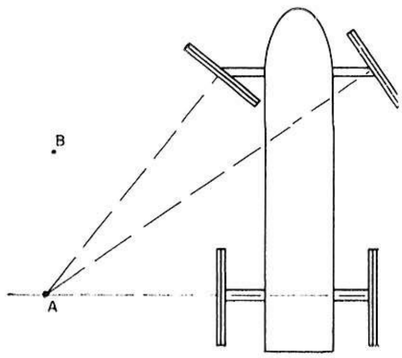


Fig. 2

cular path (center B) with tire cornering forces f_1 and f_2 counteracting centrifugal force F. If the driver applies just enough power to overcome normal rolling resistance and aerodynamic drag, the machine will gradually lose speed as it travels through the corner because the increased slip angles cause higher than normal rolling resistance. This inherent deceleration is unwanted as the driver clearly wishes to, at least maintain his speed, if not accelerate. If the driver accelerates through the turn, the forces affecting his automobile are rather different. The triangle of forces on the right side of the diagram indicates the accelerative force as A. Its composition with f_2, the rear wheel cornering force, results in the new net rear wheel cornering force f_3. It can be seen that this change will immediately shift the effective turning center from B to B'. Of course the increase in speed will increase the slip angles at both the front and rear wheels. As the slip angles increase, the car will assume an observable yaw angle. This angle is measured between a perpendicular drawn to $B'O$ and the center line of the automobile. The perpendicular is the instantaneous direction of the car, and slip along this line can be detected as a sideways drift. As the car rounds the turn, it appears that it is about to hit the inside verge but it slips sideways enough to make the turn. Cornering in this fashion is actually rather easy as the car's tendency to understeer will correct many minor driver errors. If the driver continues to accelerate, the yaw angle of the car will increase

(continued on page 53)

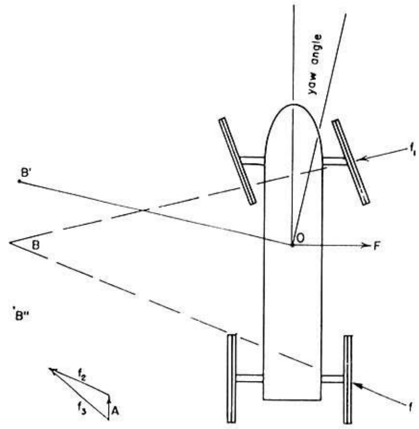
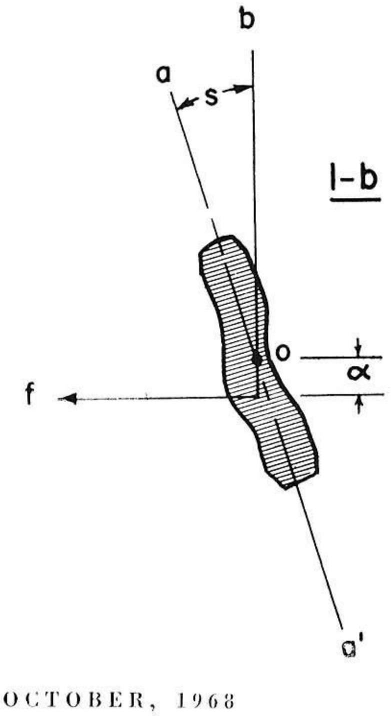
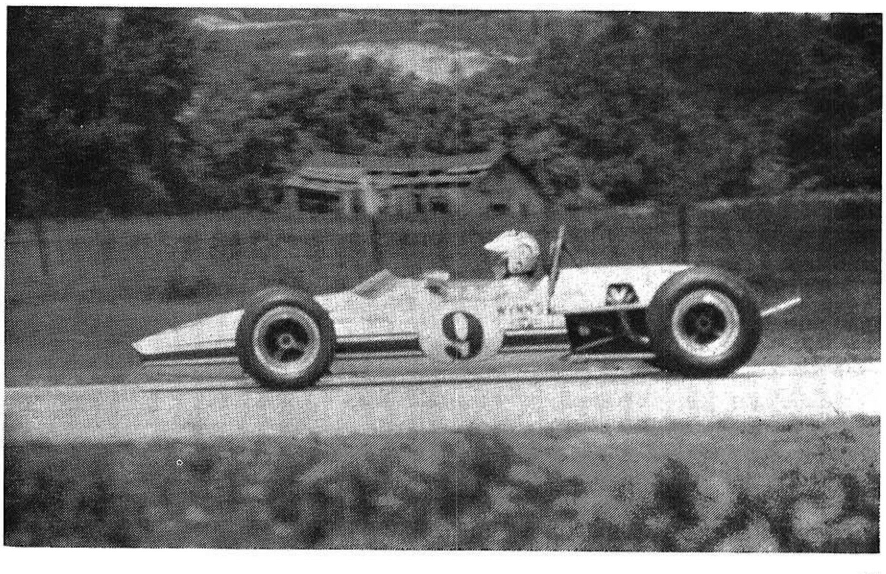
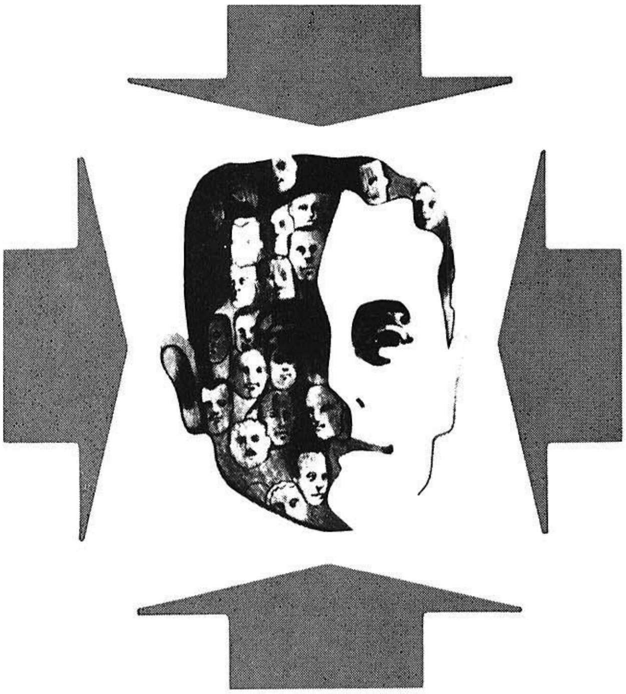


Fig. 3



None other than Dick Smothers in an open wheeled formula A. Usually nine inches on the front and eleven inches on the back are standard tire widths for these cars.





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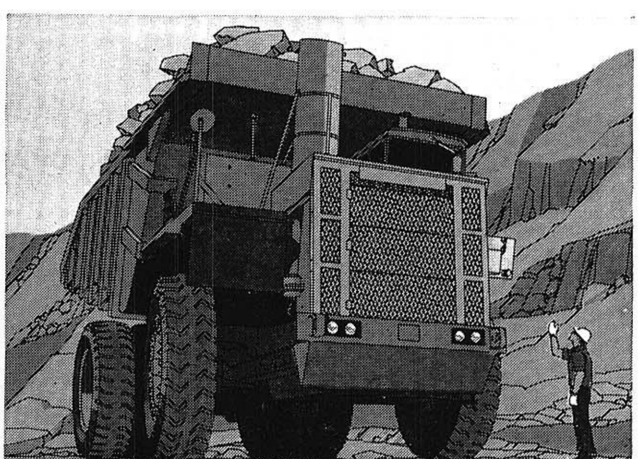

This 100-ton mining truck is powered by an 1100 horsepower IH gas turbine.

• 1969 COLLEGE OF ENGINEERING EXPOSITION

by Mary Ingeman

There are many factions on this campus who feel that the words "engineer, white socks, and illiterate" form some sort of equality. "A University is not a place to learn a trade, it is a place for great ideas, for freedom, for . . ." — does this sound familiar?

Our engineering exposition is the best chance we have to demonstrate what engineering is all about—what progress, technology, and achievement mean in the world of the engineer; to show how many of the comforts, the everyday luxuries, depend on engineering design and development. This year Expo will host nearly 25,000 people from all over the state. We hope that this series of articles will keep you informed and encourage you to become a part of it so that you, in turn, can make it a really great Exposition.

To many of you reading this, an article about the Engineering Exposition that's to be held next April may seem a little premature. If so, you will be surprised to know that the Expo's executive committee has been hard at work since last April, and is already wishing there was more time.

Planning an Exposition for a campus of this size is no small job. Perhaps the biggest single problem, once the chairman has been interviewed and chosen, is for him to choose his executive committee. Together with the executive committee, the chairman must decide the scope, the theme and the ideas behind this year's Expo. It is not enough to merely review what was done before and improve upon past mistakes. The chairman must shape and define the Exposition so that it takes on a character of its own — an identity that makes it Expo '69 and not just the Engineering Exposition.

This year's chairman, Gary Mitchell, is well suited to this job; he has a long list of accomplishments including high grade point, membership in many honorary fraternities, president of ASME, and more.

Gary's executive committee is also high on the lists around the campus. Bill Lehrman is business manager, Lloyd Wykhuis and Al Voss are building organization co-chairmen, Eric Fonstad will head publicity, Mary Ingeman is in chareg of exhibits, Ray Eisemann and John Holman are special effects chairmen, Paul Van Akkeren is high school chairman, and Dan Connley will handle the program.

Last year the meeting of the executive committee developed a plan of action for the entire Exposition. With the help of Joyce Frasure in the computer lab, a critical path schedule of the entire operation — beginning last April—was punched and run. This way each chairman would know when each job should be started and when it must be finished.

The route of the Exposition, traveling through the Mechanical Engineering building, across the parking lot, and through the Engineering building, was planned and a map of the entire exhibit area drawn up showing each exhibit space laid off in 10′ x 10′ squares. The building organization committee contacted each building's manager to determine what changes would be made inside (before next April) and incorporated these changes into their final plans.

Meanwhile, a file was developed and a contact letter written to each of the 600 companies that interview here at Wisconsin. This letter outlined the goals of the Exposition, the background of it, and suggested that the company write for further information if it is interested in participating. Each company interested was sent the maps of the exhibit areas, additional information, a questionnaire, and contract. So far, response has been excellent.

The special effects committee is making arrangements for a sky-div-

(continued on page 53)

EXPO continued

ing show — held several times each day during Expo, an antique car exhibit, and several other spectacular displays. It will also be concerned with overall security for these exhibits, which is no small task.

Of course, there is much more to tell, and this could go on and on. Hopefully, you have gotten the idea that Expo isn't just going to happen. It will take a lot of hard work, and a lot of time, to create the best Exposition we've ever had, but that's exactly what Gary and his committee aim to do. Of course, they will need help. Before this is over, there will be over 500 engineers working on the different committees. Are you interested? Why don't you contact Gary Mitchell (262-7343; 257-2975), or one of the executive committee members, or just stop by the Exposition office (Rm. 1142 in the Engineering building)? They are more than anxious to hear your suggestions, or have you work, and you'll know you're a part of the "really big show." Go Expo!

SPORTS CAR CORNERING continued from page 46

until the slip angles of the front tires exceed the limit at which they can maintain adhesion. When this happens the front tires will skid across the road, reducing f_1 to almost nil. The automobile must then assume a curved path of greater radius, and with a minor correction of the accelerator opening the driver can regain his normal drifting position. A secondary result of this controlled skid is to bring the car nearer the outside verge of the road. In a racing situation the driver may find he does not have the room necessary to regain control in this manner and must react in a different way. If he backs off on the accelerator engine compression will impart a braking force through the driving wheels. This decelerating action will cause the instantaneous turning center to shift backwards to B''. The car will turn away from the edge of the road. but the sudden change of direction and the weight transfer to the front caused by the reduction in speed may cause a violent oversteer. The only way to prevent a spin is to steer into the slide and hope. Needless to say, this maneuver is a last resort for it can be as dangerous as leaving the road. The use of the four wheel drift is usually confined to medium and high speed bends (80-150) miles per hour. At lower speeds a different technique is used for several reasons.

When any car enters a turn, its own linear momentum tends to make it understeer. For several reasons this effect is more pronounced on sharp bends. The result is that the typical racing car that is set up to understeer lightly on high speed bends becomes almost impossible to turn in a sharp corner. Unfortunately, most drivers prefer an understeering car on sharper corners for the simple reason that by bringing the rear wheels around quicker than the front ones the car can be aligned with the following straight earlier and hence accelerated earlier. To overcome this problem a rather unorthodox style is used to make an inherently understeering machine behave like an oversteering automobile. As the car enters the turn, the driver applies the brakes and turns before releasing the brake pedal. The weight transfer to the front will make the rear wheels more prone to slide and the machine will assume an oversteering attitude. In order to maintain this position the driver accelerates enough to spin the rear wheels. The combination of the rear wheel cornering force and the accelerative force will cause the rear tires to skid faster than the front tires and the car will oversteer in the desired fashion. This method of cornering has the disadvantage of being very unstable and, hence, is more difficult to control than the four wheel drift. However, because it is used on "slow" corners there is some margin for error and most drivers prefer this technique.

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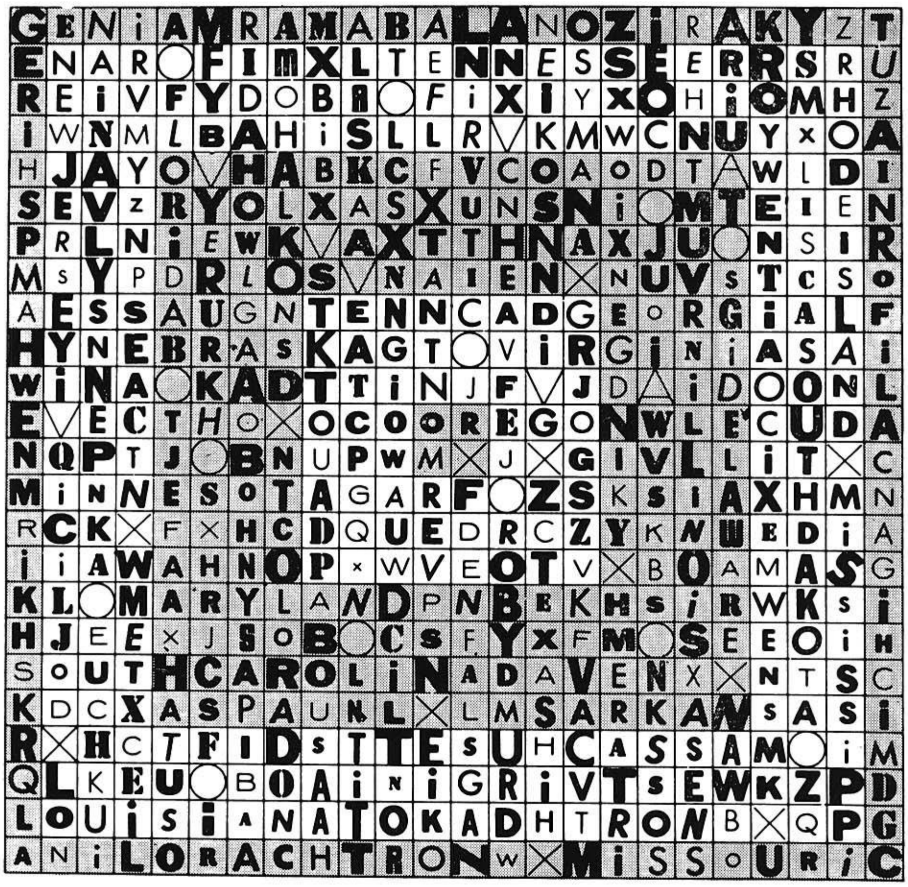

can you find the names of all 50 states?

(THE NAMES MAY READ UP, DOWN, FORWARD, BACKWARD OR DIAGONALLY.)

Think Maine to Hawaii.

We're located in 36 of them. In fact, every day just about every person in all 50 of them uses, or comes in contact with at least one of the 1700 different things we make.

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All of which makes our sales more than the gross national product of some countries. Almost a billion and a half in '67. We want to do twice that by 1980.

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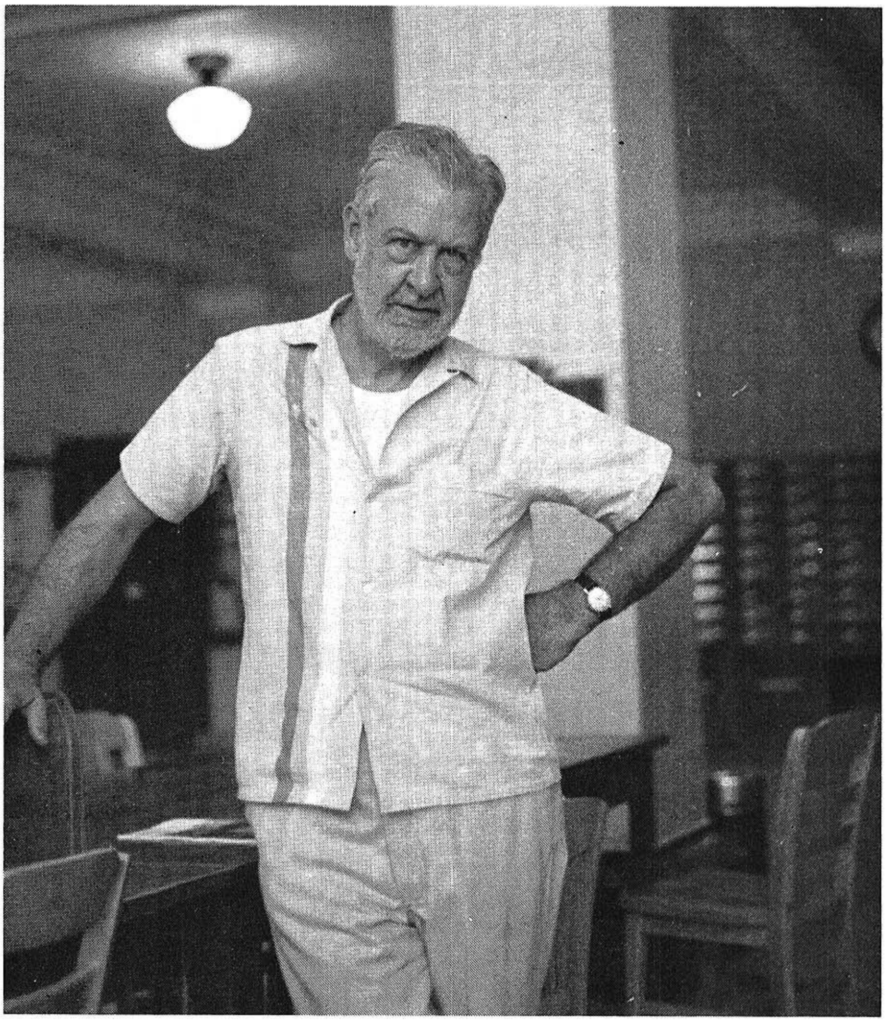
Prof. Obert is well known in the College of Engineering for the vigor and enthusiasm with which he attacks almost any subject. He has taught for more than 30 years, is considered an authority on thermodynamics, and was recently elected to the grade of Fellow in the American Society of Mechanical Engineers. This picture of Prof. Obert was taken this fall while he was growing a beard in order to demonstrate to other longhaired people how haggard they may look. "I'm doing this as a scientific experiment." The following article is the text of a talk Prof. Obert gave last spring in answer to questions raised by the Ogg Hall Discussion Sessions.



Social Responsibilities and Irresponsibilities

by Prof. E. F. Obert

"Ideals are like stars... choose them as your guides, and following them, reach your destiny."

CARL SCHURZ

Recall, as a boy, how you needed your mother to comfort you; later, how you needed your father to serve as your idol; and then, still later, from family, church, neighborhood or school emerged the inspiration to reach the stars. You were the gallant knight, or the wealthy land-owner, or the world champion of something. All boys (and, probaby, girls) go through these stages whether or not they have good or bad fathers and mothers, whether or not they live in a slum or in a suburb. Manhood is reached when the boy sees, not only the weaknesses or those he once worshipped, but also, despite his new vision, keeps the faith—his eyes toward the stars. The unrest on the campus, the unrest in the streets, the unrest in the world, all arise primarily from the lack of ideals—the lack of truth and honesty at local, national, and international levels.

"Mine honor is my life, both grow in one; take honor from me, and my life is done."

RICHARD III

A secondary reason for the unrest (and a primary reason for the wars) lies in our educational system that produces legislators, lawyers, social workers and philosophers, as well as high school teachers and college professors, who are woefully ignorant to the technological society that the engineer has created: What it can do—and what it cannot do. As a consequence, the fruits of engineering have been largely wasted in fighting two unbelievably stupid wars (Korea and Vietnam), while setting up psychologically unsound welfare-state programs, and building a spreading bureaucracy that, even in the next month or so, might lead to financial disaster! (The picture is so appalling that one might well ask: Are our leaders really so irresponsible or are we being betrayed from within?)

"Democracy in the United States will last until those in power learn that they can perpetuate themselves through taxation."

DE TOCQUEVILLE

What are the remedies? Your second (what is the first?) responsibility is to remember:

II. The good citizen contributes to the welfare of society—each according to his abilities.

At the university level, the contributions should be substantial and should be creative, therefore,

III. The good citizen must prepare himself by studying, not only the liberal arts, but also science, engineering, and business, if he is to be an intelligent contributor to society.

Thus, the students in liberal arts (our future legislators, high school teachers and college professors) have the social responsibility to take, say, 12 semester hours of selected engineering-science studies so that they can at least understand the structure and some of the details of our industrial "establishment." (If they do not, how can they criticize constructively? How can they vote on billion-dollar projects?) This point is emphasized by the fact that not one of our governmental leaders was educated in science or engineering (the President, all of the presidential candidates, all of the Congressmen, and all of the Supreme Court Justices). And it is these men who control peace and war, home and abroad, not the munitions manufacturers, nor "the military-industrial fanatics."

"And for purposes of discipline—intellectual, moral, religous—the most effective is science."
HERBERT SPENCER

Note that the engineering student is broadly educated. The cirrculum in Mechanical Engineering (for example) requires 22 semester hours of liberal arts, plus a possible 6 hours of electives, plus 31 hours of mathematics, physics, and chemistry. In addition, many of the plays and the shows, and the books that the engineer sees and reads are case studies in sociology, philosophy, or psychology. Too, just living in our society and observing adds to an understanding of these subjects. On the other hand, the LA student can progress through the years only in liberal arts (and business). Unlike the engineer or scientist, he does not have the fundamental education required for independent study in other disciplines.

As a corollary to III, a social responsibility of the scientist and engineer is to become active in politics. I suggest that the hope of the world today lies in electing (or appointing) engineers and scientists to key government positions of responsibility and authority. For example, the escalation of the war might have come about because of misinterpretations of radar-sonar readings. An interesting question is this: Would the Bay of Tonkin Resolution have been passed if there had been several electrical engineers or physicists in Congress?

One other cause for anarchy and looting on the streets is the example of anarchy and looting (and overall boorishness) set by a few (percentagewise) college students. Shop-lifting (theft) at all stores near the campus (and at college stores all over the nation!) is appalling. For example, one of our local book stores showed losses of $50,000 last year, despite 147 arrests and 200 "stops" (books recovered and arrests waived). The students involved were mainly enrolled in liberal studies (few engineers) and some were working for their Ph.D. degrees. Almost all came from good homes, "and rob the establishment because it is making a large profit."

"The poor and the ignorant will continue to lie and to steal as long as the rich and the educated show them how."
ELBERT HUBBARD

We wonder if the students involved are not unsure of themselves in a technological society. Are they rebelling because they realize the career-oriented students (enneering, science, business) take little part in the campus unrest? Why? Are they socially unconscious? Or do they have a goal, which the others do not have? Too, how can a man teach (be a teaching assistant), be a candidate for a degree (research plus study), and still have time for hours of other activities?

If there is time, and a desire for constructive action, why not organize student seminars to study the voting records of our legislators? Sufficient power might be generated to drive from office all of the Congressmen who voted for the Bay of Tonkin Resolution (all, since they were either stupid or naive or weak). (But, after they sense the "way the wind is blowing," don't make them presidential candidates by your cheers and applause, as you are doing.) The students in the colleges have the numbers (including their families) to exert a powerful political force. Why not organize politically to abolish a restricted-age draft law? (I do not say that draft laws should be abolished—the horror of Auschwitz is too recent.)

Therefore, another social responsibility is this:

IV. The good citizen does his best to study and to judge each problem (including the voting records of his representatives) without e m o t i o n, and registers his beliefs at the ballot box.

Thus the words Babbitt, racist, etc., should be used sparingly, if at all. (Bertrand Russell: "But so blinded by its own ferocious prejudices is the military-industrial complex . . . " What an example!)

"If there is order in the nation, there will be peace in the world."
OLD CHINESE PROVERB

IRRESPONSIBILITIES

It has become the fashion to blame the scientist and the engineer for the mess that the United States is in today. We are accused of "spewing change into society with scant thought for the consequences" (R. Sinsheimer), and we are condemned for inventing machines that can be used for mass murder. Our critics (for example, R. Hutchins: "Stamp Out Engineering Schools," *Engineer*, Mar.-Apr., 1968), many of whom have had great influence on government policies in the last 30 years, advocate that engineering schools should be eliminated so that "science . . . (can) be regulated (!) in the public interest . . . if in their place, true universities can arise, nothing that science can give us will be lost except those applications which are destructive of both science and society."

Behind all of the criticism is the naive belief that there are "good" and "bad" things waiting to be invented. In truth, every scientifc or engineering advance represents an evolution of many sparks ("good" and "bad") before the final kindling of an atomic bomb ("bad") or an atomic power plant ("good"). Where would our critics start their regulations? And can one, should one, regulate research in a "true" university?

The thought is also advanced that if the engineer understood moral and political philosophy, he would refuse to work on "bad" things. But almost all of our scientists who work on "bad" things have a liberal arts background and were at least exposed to their friends in sociology and philosophy. Too, some of us remember the "popular" war, and the millions of men, women, and children killed in gas chambers by SS guards with Ph.D. degrees.* Practically everyone in America—men, housewives, students, and clergymen — worked in the war machine. Would you have fought in the war against Hitler? Or worked at that time on the atomic bomb? (Recall, while you deliberate on these two questions, that hundreds of children and babies were being put to death each week!)

If you refuse to work on "bad"things, or refuse to "press the button," and, instead, work in scientific research or, say, teach mathematics to future scientists, this is your right in a free society. (Would it be your right in Russia or China?) But you are kidding yourself if you call your action as one "fulfilling a social responsibility." Rather, you have merely dodged the dirty work (I wash my hands of it) and substituted teaching and research that contribute just as much, if not more, to the technological power. Those of us who abhor war can not excuse our consciences by saying that "we did not push the button, nor were we close to it, nor were we a part of it." We "push the button" whenever our duly-elected representatives perform an act of war; we are "close to it and a part of it" as long as we accept the benefits of our economic system and the protection of our government!

The solution (other than retiring to a cave) is, and must be, the ballot box.

Great harm can be done to persons, to industrial companies, and to economic systems by false tales.** Therefore, anohter social responsibility is this:

V. The good citizen does not bear false witness against his neighbor, his enemy, or his country.

Since many of our students are future high school teachers (and future mothers), they must not be exposed to false rumors:

> "*And shall we just carelessly allow children to hear any casual tales which may be devised by casual persons, and to receive into their minds ideas for the most part the very opposite of those which we should wish them to have when they are grown up? We cannot.*" PLATO

Have you heard, and believed, the following canards?:

1. The Standard Oil Company has suppressed a carburetor patent which would have enabled an automobile to travel 50 miles on a gallon of gasoline. (Or a magic pill plus water?)
   a. Historical note: Told to me by my high school chemistry (!) teacher some 30 years ago, and still floating around. Why?
2. An experimental airplane (rocket-plane or what-have-you) was delivered for an official government test, even though the manufacturer had been informed that the plane would, most probably, fail (and kill the pilot).
   a. Comment: Whenever a plane fails, commercial or military, engineering heads are lopped off. Why? It costs the company literally millions of dollars in lost contracts (and loss of confidence by prospective buyers); even when contracts are not cancelled, the company is still in trouble since inspection (which costs money) is doubled and tripled (and I was a U.S. Navy inspector).
3. A company knowingly shipped defective merchandise.
   a. This story may or may not be true. Here a knowledge of production and the product is necessary. For examples, the story is definitely not true for quality products (steam turbine for power generation), because defective machines cost much more to repair outside of the plant, and because of loss of future sales.
   b. On the other hand, for mass-production products (automobiles, television sets, etc.) it happens every day since the dealer and company have agreed to the procedure. For example, the automobile dealer receives $50/car to repair (and complete) the product.
   c. It also happens with all low-quality, cheap, mass-production items since materials, inspection and testing are minimized. (Why? The price would necessarily be higher!) Certainly when you buy an electric coffee pot for $3.00, even the nontechnical buyer must realize that he is taking a chance (on the statistical average), since other pots (same size, shape, and appearance) cost $20 or more. (Similarly for nuts, bolts, paint brushes, etc.)
   d. It also happens with fly-by-night concerns, but this is a different story.

In closing I make one plea: Where is the esprit de corps on this campus for our country? You bring up Vietnam and I wince (and the remedy is to vote from office your representatives who voted for the Bay of Tonkin Resolution), but this is no excuse for forgetting all of the good things that have been done for all the world. Who is paying your way on this campus? (Foreign and domestic students):

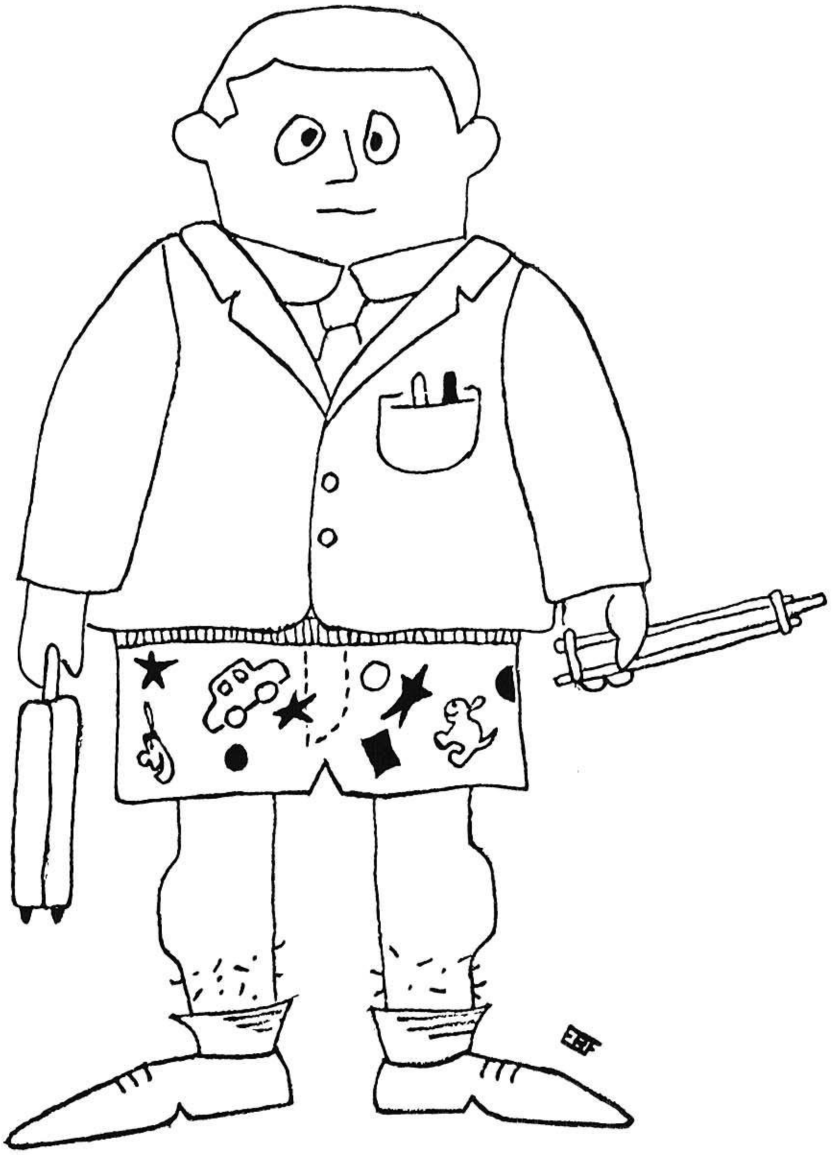
> "*If you pick up a starving dog and feed him, he will not bite you; that is the difference between a dog and a man.*" MARK TWAIN

I wonder, sometimes, what would have happened if Hitler (or Stalin) had achieved the atomic bomb first. Would there be a place in the world where a man would be free to say or to do what he pleased? East Germany, the gas chambers, and the slaughter of the captured Polish armies are vivid reminders of the acts of other nations.

*25 percent of the SS ("Science, Scientists, and Politics;" Center for the Study of Democratic Institution, Santa Barbara, Calif.).

**My name is gossip. I have no respect for justice; I ruin without killing; I team down homes and countries.

Do You Feel Like You're Missing Something?



You are if you're not on the staff of the *Wisconsin Engineer.* For more information call Eric at 262-3494 or 233-6192 or stop in at the office in room 308 Mechanical Engineering building.

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But already you yourself will be carrying a certain measure of responsibility for the flavor of our chemical engineering. Not just the preceding generation. Little by little it is your own idea of the direction that your profession and your company should move that you are selling when you return to the campus.

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Typical work areas on the photographic side of our operation include surface diffusion of chemisorbed species; interaction of antagonistic polyelectrolytes; rheology of non-Newtonian fluids. Subjects of concern on our non-photographic side are, for example, solid-phase polymerization; high-temperature vapor-phase pyrolysis; liquid-phase air oxidations. More general: design of pilot plant and plant equipment from laboratory data and basic chemical engineering unit operations; drying operations for fibers, plastics, and chemicals; viscous flow and heat transfer.

In Rochester, N. Y., we make photographic and non-photographic products. In Kingsport, Tenn., our Tennessee Eastman Company makes fibers, plastics, and industrial chemicals. In Longview, Tex., our Texas Eastman Company does petrochemistry, and in Columbia, S. C., our Carolina Eastman Company has a new fibers plant. Everywhere an equal-opportunity employer offering a broad choice of professional work and local conditions, with geographical mobility only for those who want work that requires it.

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