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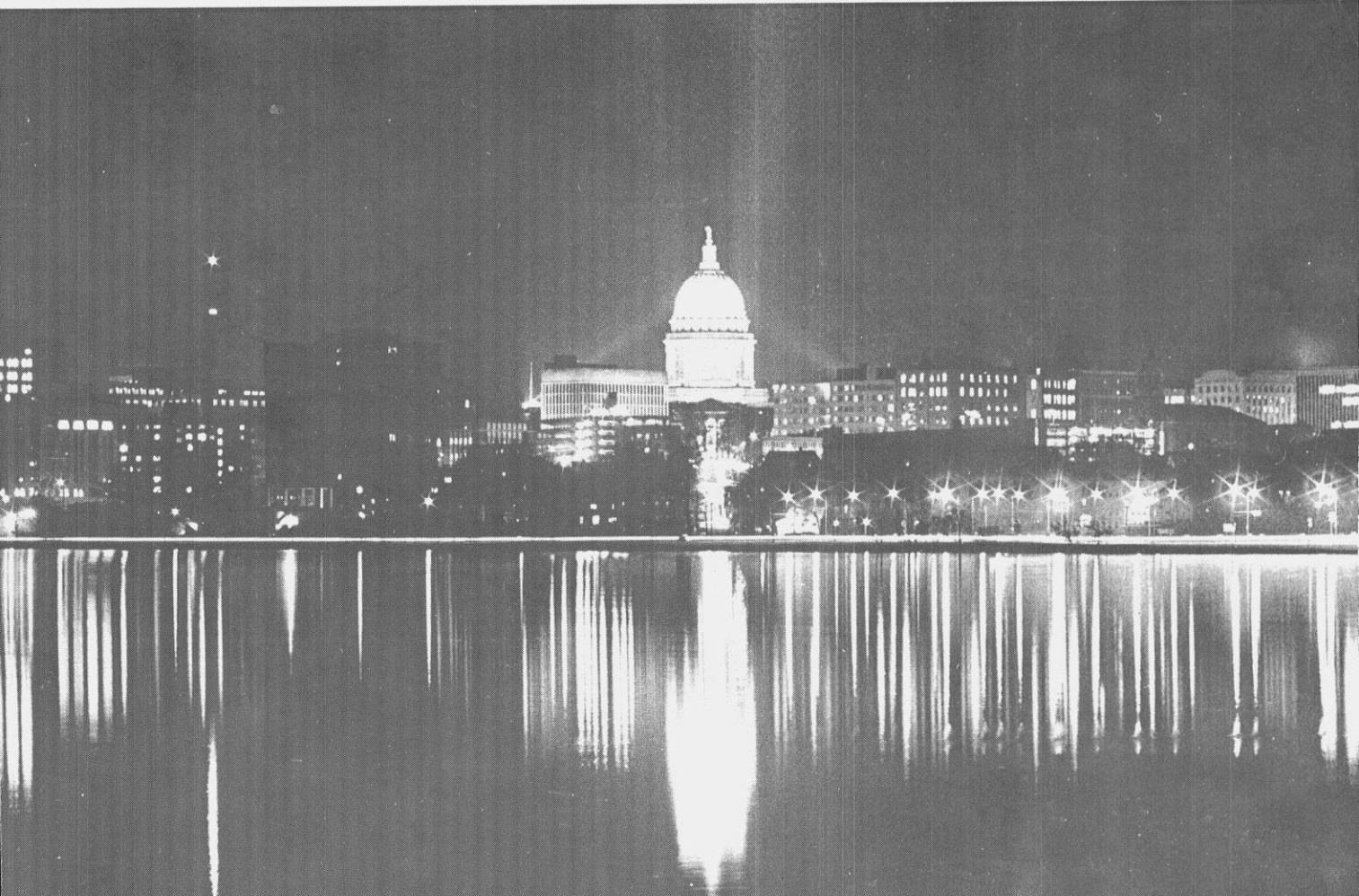
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Wis. Eng.
SB



Madison's Changing Image

Also In This Issue:

Skylab II Astronauts Visit UW

"New Math" Failure



**Let's get
together!**

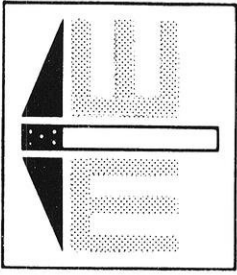
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“Science is not a sacred cow. Science is a horse. Don’t worship it. Feed it.”

Aubrey Eben

wisconsin engineer

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Four Year Push Unrealistic

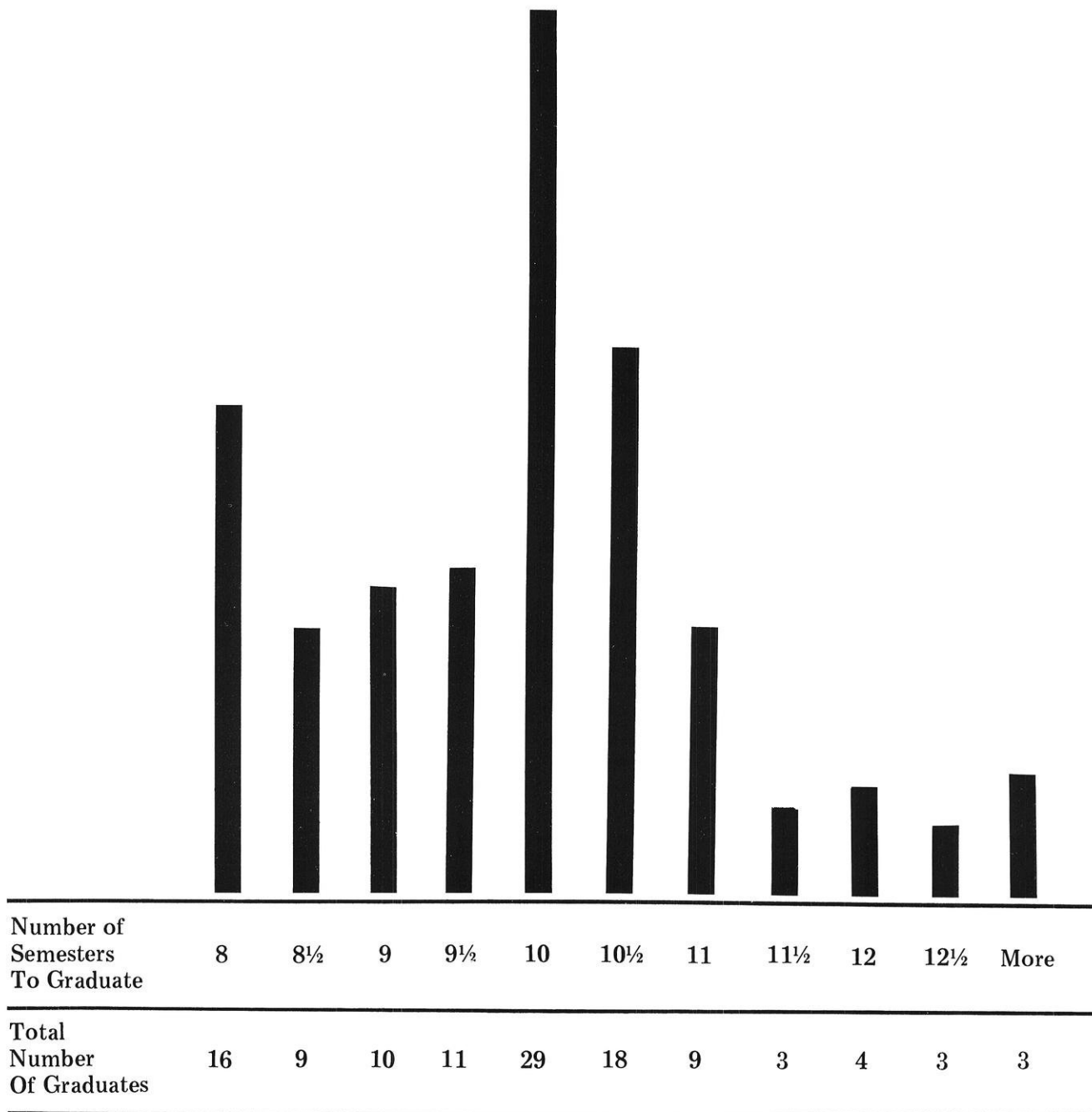
Wondering how many years it will take to graduate? Chances are, it will take more than the expected four years. In fact, most engineering students take five or more years to finish, even though the suggested programs listed in the College of Engineering Bulletin call for only eight semesters of study.

According to statistics prepared by Dean Assmuth concerning the May 1973 graduates from the College of Engineering, over 80 per cent of the graduates spent more than the prescribed number of semesters to complete their studies. In addition, over half, 61 per cent, took a whole five years or more to satisfy the B.S. requirements of their departments. The average, it was shown, was ten semesters of study. Similar statistics are available in relation to other graduating classes.

What is the purpose of presenting a four-year program of study to incoming freshmen, when only very few of them will find it possible to follow? The curriculum is too rigid and stringent. If a student is unable to take one required course in a particular semester, his date of graduation may be delayed by an entire semester. In addition, the program prescribes as many as 18 credits per semester, a load much too heavy for the average student. In today's atmosphere of social awareness, the College should recognize the student's need for varied extra-curricular activities. Finally, it is assumed by the College that the student has fulfilled certain requirements before admission (i.e. has completed a particular math course in high school), which in fact, many students have not. Perhaps even an unfortunate lack of advising in some departments is a partial cause for a student's failure to follow the proposed curriculum.

What is it then, that makes the Bulletin and the various departmental curriculum committees so out of touch with reality? Tradition is part of the blame here, for the situation is not new. The administration and faculty are completely aware that this situation exists, but seem content to leave the four-year program the way it is. The department of Civil and Environmental Engineering has recently made major changes in their curriculum requirements, but has continued with a four-year program. This attitude of clinging to old traditions is contrary to being responsive to the needs of the students.

It is obvious that the students need more than four years to complete their required programs of study. A more realistic approach is needed. A four and a half or five year program should be developed. This would allow the student to work under a more practical load, to become involved in other activities, and to plan on a longer stay in college.



May 1973 Graduates

Madison

Revitalizes

Downtown

by Don Johnson

Today's shopper has made a swift retreat from Madison's capitol isthmus to suburban environs. Pedestrians increasingly avoid the formerly vogue, but congested and fumey, square in favor of shopping malls that offer attractive, clean atmospheres, and places to rest among gushing fountains.

Although plastic by some standards, the malls offer an airy spaciousness that can accommodate crowds of people, without the ever present automobile. A sense of vivacity contrasts markedly with the air of obsolescence that has settled on the central area of Madison. According to John Urich, Asst. Director of City Planning, "Madison was guilty of neglecting the central part of the city, while peripheral areas flourished, leading to the deterioration, obsolescence and congestion of the downtown area." He stresses the need to do something now before "we reach the point of no return."

Cities across the nation have been faced with declining central areas and increasing populations. The U.S. Commission on Population Growth and the American Future reports, "By 2000, urban regions (homes of 70 per cent of Americans) will occupy one sixth of the continental United States land area, and contain five sixths of our nation's people."

Several cities have made attempts at renovating all or parts of their downtown areas. Columbia, Maryland was built as an urban planner's dream. Minneapolis and Ottawa have demonstrated through downtown redevelopment that general deterioration need not and should not be a permanent affliction of the aging city. Urban renewal and redevelopment has spread from an occasional effort to a national trend, and Madison is no exception. Massive efforts are under way to uplift the face of the city through projects coordinated by the City Planning Commission, the Chamber of Commerce, the Madison Redevelopment Authority (MRA), and private enterprise.

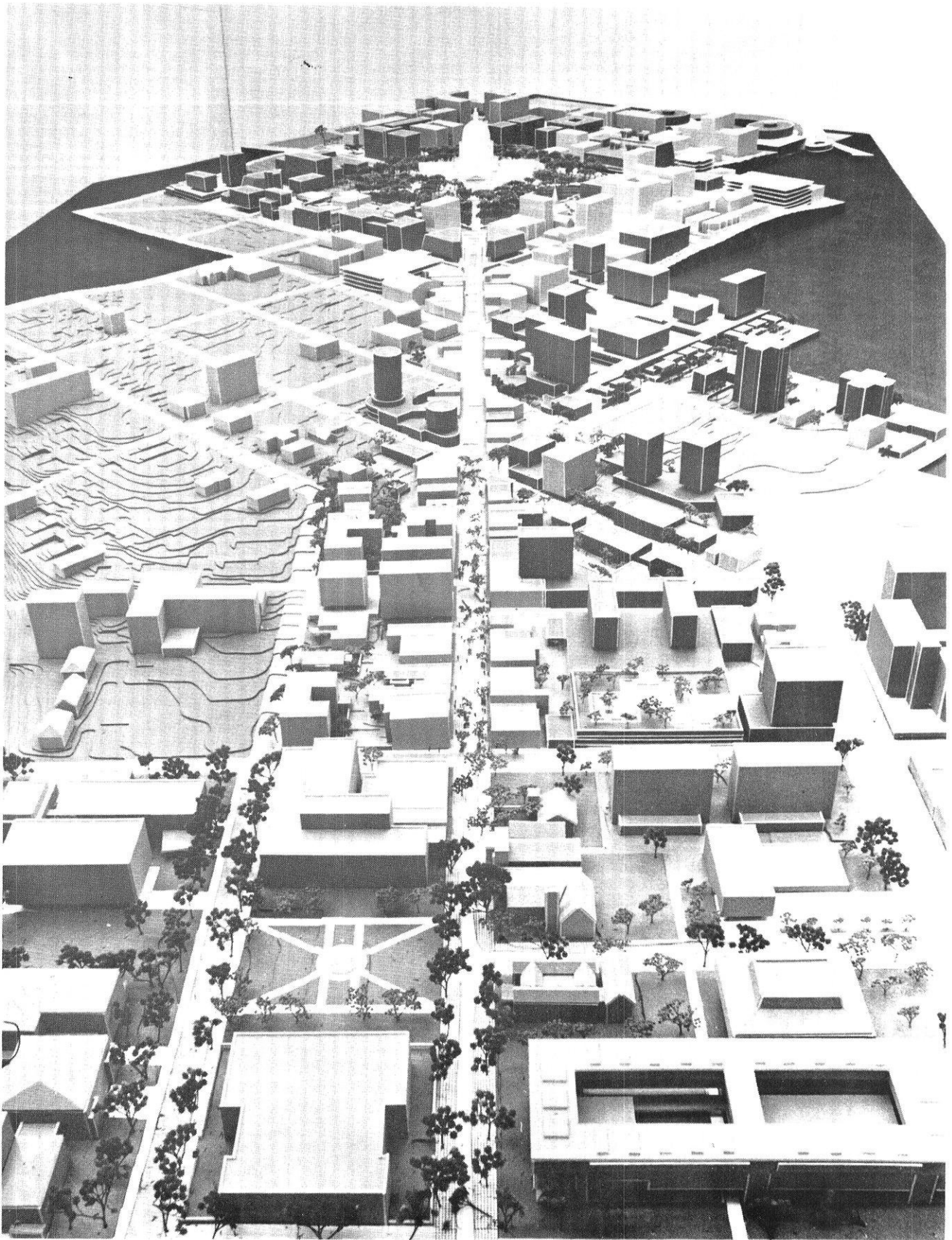
The pride of planners is the Capitol Concourse plan for beautification of the Capitol square itself, long considered the most attractive scene in Madison. The plan proposes the planting of trees and shrubs, and the construction of rest areas, bus stop shelters, sculptured fountains and clocks. In an attempt to attract shoppers, sidewalks will be expanded and motor vehicle traffic will be reduced by one lane. Some planners are hoping to ban the auto completely from the square.

Downtown Developments

Many new buildings have already changed the appearance of Madison's downtown. Among recent additions are the buildings for United Bank and the Wisconsin Power & Light Co., a new state office building on East Washington Avenue and most recently the First Wisconsin National Bank Building.

Urich feels the Hilton Hotel — arcade system is the most exciting aspect of the redevelopment. E. John Knapp, a Madison architect who designed the Madison Hilton Hotel, has been retained by area businessmen to make a cost estimate of the arcade system. The plan calls for a shopping mall between the Hilton Hotel, now under construction, and the backs of stores which face the square on West Mifflin Street. Urich suggested to a local newspaper recently that \$300,000 was a reasonable figure to expect for the arcade that would be bounded by Wisconsin Avenue and North Carroll Street.

Another plan has been presented by the Central Madison Committee for a Civic Center on the 200 block of State Street. The center may house the Madison Theatre Guild, the Madison Art Center, music, opera, and ballet groups, as well as a museum and commercial offices. The first phase of the plan would involve purchase and remodeling of the Montgomery Ward Store and Burger Chef for use by



A model of the Bascom Hill view of Madison's downtown, constructed by City Planners, shows

existing buildings along with tentative plans. The State Street Mall proposal is in the forefront.

the Madison Art Center. The Civic Music Association and the Madison Opera and Wisconsin Ballet Companies would occupy the Capitol Theatre, Singer Store, and Moon Shop. The plan suffered a setback, though, when it was announced that, after taking some bids, the Capitol Theatre was no longer for sale. Two new theatres with seating for 300 and 700 along with a 300-seat recital hall would replace two parking lots and the Rated-X Book Shop. Estimated cost of this phase is \$6.1 million.

After a trial period last year, studies are also being made on the feasibility of a State Street Mall. Michael Duffy, Chairman of the State Street Mall Committee, announced recently that a \$15,000 study by Maryland consultant Barry Shuttler will be completed by early October. Those interested in contributing to planning may call the Central Madison Committee office at 255-1008.

Triangle Urban Renewal

Construction will begin this fall on the fourth new hotel to be planned near the downtown area, unless the city council rejects the proposal this week. The MRA accepted plans recently for a 154 room Holiday Inn, planned as part of the 3.7 acre Triangle Redevelopment Project at the corner of West Washington Avenue and South Park Street. The hotel will include shops and stores and an enclosed swimming pool.

Construction is already near completion on a new seven story medical office building at Park and Regent Streets in the Triangle urban renewal area. A housing project for the elderly is also included in the plans. Completed phases of the Triangle include the Davis and Duehr Eye Clinic, the Madison Medical Center, the Neighborhood House on Mills Street, and the Gay Braxton Apartments on Regent Street.

University Plans

A shopping arcade and apartment house covering half of University Avenue's 600 block is currently under construction by the MRA. One block down University, a 69,000 square foot mall is planned to occupy most of the block bordered by Johnson and Lake Streets. The mall would include a variety of shops and service stores oriented to the University area, underground parking for 240 cars and possibly a restaurant and theatre. The mall is to be completed by late summer 1974.

Other efforts are underway to give the pedestrian more freedom. Pedestrian skywalks guidelines were approved by the City Council earlier this year, in a resolution which said the city "strongly supports the development of grade-separated pedestrian systems in the University of Wisconsin campus area and in the area around the square." Skywalks have already been completed in recent years across Park Street, University, and Packers Avenues.

The Wisconsin State Journal reported recently that a conservative cost estimation of the projects currently planned or under construction is \$35 million. Most of which will be financed by private enterprise, according to the City Planning Department. Burnell Roble, a civil engineer in the City Engineer's office, refused to release cost estimates on the city's share of the bill and said that the information should be coming from the Mayor's office. He in-

dicated that an announcement about the cost to the public should be coming in October.

Urich explains that it is difficult to tell at this point how much of the redevelopment will be paid for through public financing. Due to recent federal cut-backs Urich said, "We are currently operating under the assumption we will have to go it alone." He suggests, that the city may receive some sort of aid through the bi-centennial project, since Wisconsin's capitol building is the only look alike to the nation's capitol.

Urich said, however, that getting money is a secondary problem compared to "obtaining political decisions necessary to proceed. Since it's more difficult to obtain decisions, we have to do a better job of obtaining public support."



—photo by Edwin Stein
Wisconsin State Journal

John Urich, Asst. Director of City Planning, reviews a model of suggested plans for one area of Madison's downtown.



Dean's Page

Dean Marshall Projects "New Thrusts"

The Dean's Page for the first 1973-74 issue of the *Wisconsin Engineer* gives me the opportunity and pleasure to welcome all the new students to the College of Engineering at Madison and to greet our returning students and faculty, who have been busy during the summer months in various pursuits. As we begin a new school year, it appears appropriate to review briefly some of the accomplishments of our College during 1972-73, and then look forward to what promises to be an exciting year for 1973-74.

The year 1972-73 had many exciting developments. (Although our undergraduate enrollment slipped for a second year, graduate enrollment stayed steady.) The college continued to inaugurate new engineering programs of substantial importance to the growing problems of society. Substantive studies were carried forth on many aspects of energy, its supply, transmission, and consumption. The College has achieved national recognition for its pioneering effort in the new technology of the storage of energy in superconducting magnets to increase our energy supply. Another team of faculty and students is engaged in a study of the feasibility of nuclear fusion as an energy source. This goal has a much longer time span for potential success, but if success is achieved, the promise to the country is great. Studies continue on the utilization of solar energy, on the improved performance and operation of the internal combustion engine, and on new methods of storing energy by mechanical means.

In the field of environmental control, the College again has achieved national prominence in pioneering efforts with respect to recycling of solid wastes — the current most exciting achievement being the recycling of discarded rubber tires through cryogenic processing. A modern mobile cryogenic processor should be unveiled shortly at LaCrosse, and undoubtedly more will be written about this achievement in future issues of the *Wisconsin Engineer*. Through remote sensing techniques developed by our Civil and Environmental Engineering Department, the College has contributed uniquely to the detection, monitoring, and measurement of the pollution of lakes and streams through rapid remote aerial measurements. Space does not permit the mention of many of the other projects which occurred during 1972-73 which have brought the College prestige, prominence, and a reason for being proud of its goals and objectives. I am confident many will be reported in future editions of the *Engineer*. I must mention,

however, that the Urban Vehicle designed and built by your engineering students was a most successful project and received wide national acclaim.

During 1973-74, even through merger will require much time and attention, I am confident that we will see not only continued development and progress in the areas mentioned above, but significant new thrusts which will bring engineering and technology closer to the social and behavioral sciences. Through a substantial grant from the Sloan Foundation, the College has been funded to develop and provide innovative programs and courses for engineering through the joint efforts of engineering and social science faculties. For example, we have a team of two engineering professors, a law professor, and a sociology professor working jointly on Codes and Standards. There is a team of an engineering professor, a professor of economics, and a professor of business studying the policies and economics of energy consumption. And we have an electrical engineering professor and a sociology professor working jointly on the socioeconomic problems in biomedical engineering. We expect to see these programs and others develop strongly during the year, from which new courses will become available to engineering students during the spring semester. The Sloan Program recognizes the fact that the engineer of the future must understand the social and legal world in which he must function. He must understand the values of the society he is serving as an engineer, and he must learn to take account of these values in the solution of technical problems.

I am further confident that 1973-74 will see the College of Engineering's program for minorities in engineering come to full bloom, and, again, show that the College can provide solid national leadership in the social problem of bringing many members from the important minority segment of our society into the engineering profession, whereby they can develop professional careers and make contributions not only to their own ethnic groups but also to the nation.

During the year I hope to report in more detail other exciting new programs in which the College is engaged, such as, educational technology, technology assessment, technology transfer, and programs not now contemplated. I also hope to be able to report an optimistic picture of enrollments in engineering, which at this writing appear to be increasing at the freshman and sophomore levels, but which cannot be reported quantitatively until we have our final figures available about September 10th.

Skylab II Astronauts Defend Space Research



Astronaut Charles "Pete" Conrad presents Gov. Patrick Lucey with a small piece of moon rock.

In their first public relations visit to a college campus, Skylab II astronauts Charles "Pete" Conrad and Paul J. Weitz, both Navy captains, told more than 400 University of Wisconsin students in Union South last week that we are seeing the beginning of a new era in space exploration. "We have proven that man can live up there," Conrad said. "Now is the time to build a practical orbiting experimental station."

The astronauts spent the first part of their presentation explaining the key objectives in the Skylab missions.

- Finding out if man can live for long periods of time in weightlessness is essential to long term scientific space research. The second manned mission currently underway, has been extended three days.
- Taking a closer look at the sun can provide insights into energy supplies and sources.
- Turning sensors toward earth may offer helpful geological information about weather and ocean currents.

Responding to critics of the National Aeronautics and Space Administration (NASA) program, Conrad said, "We all know how many dollars are invested, but the distinction must be made clear between the cost of something versus the value of it."

One student did question the value of space exploration: "I'm not sure of the exact figures, but Skylab II cost about \$100 million. A lot of information was found, but the amount of money spent could have supported 10,000 graduate students at about \$10,000 per year. Don't you think they could have found something too?"

Conrad: "I'm not in the business of forecasting the pros and cons of where the money goes, but I'll tell you that we brought back 30,000 photos of the sun, 15,000 photos of the earth and 14,000 feet of magnetic tape, and I will guarantee that will keep your graduate students busy for the next fif-

teen years, producing the data." Conrad received sustained applause.

He told reporters later at the state Capitol that some critics of funding for the space program are being one sided. "NASA spends less than one per cent of the total federal budget, while other social welfare agencies receive nearly 46 per cent of the national budget. I think it would be unfair to take away our one per cent." He said that NASA expenditures may be reduced by one tenth during the next year.

Pointing to the practical aspect of space exploration, Weitz said that all endeavors in space are ultimately geared to the study of earth, and have applications for everything from crop management to resource discovery. He attributed the Skylab's malfunctions to a combination of poor engineering and a lack of communication.

Future NASA plans include the operationalization of a space shuttle by the 1980's. Both Weitz and Conrad expressed hope that women astronauts will be selected in a few years. The space shuttle is designed to facilitate both men and women, and has also opened the door to non-technical laymen as passengers in space, according to Conrad.

A joint Russian-American mission under the Apollo Service Test Project (ASTP) is scheduled for July 1975. The project is primarily an exercise in testing a common docking apparatus. An operational rendezvous would provide a rescue capability should the need ever arise. Weitz said, however, that a group of twelve experiments are being developed that would still make the mission "meaningful" should the Russians withdraw from the flight.

The astronauts explained that the psychological problems and pressures on an astronaut are not any greater than if they were in another occupation. Both agreed that longer flights seem very promising.

Charles Conrad, Jr. (Captain, USN) was born on June 2, 1930 in Philadelphia, Pennsylvania. He received a Bachelor of Science degree in Aeronautical Engineering from Princeton University in 1953, an Honorary Master of Arts degree from Princeton in 1966, an Honorary Doctorate of Laws degree from Lincoln-Wesleyan University in 1970, and an Honorary Doctorate of Science from Kings College, Wilkes-Barre, Pennsylvania in 1971. Conrad is a Fellow of the American Astronautical Society, and the New York Academy of Science; and Associate Fellow of the American Institute of Aeronautics and Astronautics, and the Society of Experimental Test Pilots.

He has been awarded the NASA Distinguished Service Medal, two NASA Exceptional Service Medals, the Navy Astronaut Wings, the Navy Distinguished Service Medal, and two Distinguished Flying Crosses.

Conrad entered the Navy upon graduation from college and became a project test pilot. He has logged more than 6,000 hours flight time, with more than 4,800 hours in jet aircraft. He was selected as an astronaut by NASA in September 1962. In August 1965, he served as pilot on the eight day Gemini 5 flight. In September 1966, he was command pilot for the three day Gemini II mission, and was subsequently assigned as backup spacecraft commander for the Apollo 9 flight. Conrad was also commander of Apollo 12 in November 1969. He has completed three space flights, logging a total of 506 hours and 48 minutes in space.



Paul Joseph Weitz (Captain, USN) was born in Erie, Pennsylvania, on July 25, 1932. He received his Bachelor of Science degree in Aeronautical Engineering from Pennsylvania State University in 1954 and a Master's degree in Aeronautical Engineering from the U.S. Naval Postgraduate School in 1964. Weitz received his commission as an Ensign through the NROTC program at Penn-

sylvania State University and after flight training, was awarded his wings in September 1956.

He has logged more than 3,900 hours flying time — 3,400 hours in jet aircraft. Weitz is one of the 19 astronauts selected by NASA in April 1966, and served as a member of the astronaut support crew for Apollo 12.

“New Math” Starves Enrollment



Prof. J. A. Marks

*“It is no wonder
thousands of high school
graduates lacked the
confidence in math to even
consider engineering.”*

The drop in engineering enrollment during the past few years is not news. The tight job market no doubt has had much to do with this but distorted publicity in the news media also described the situation as being much worse than it really was.

What few people realize — even professionals in engineering manpower recruiting — is that freshman enrollment in engineering started to drop in 1966, **four years** before the market tightened. In fact, the late sixties were the most hectic of the almost twenty years of a shortage of graduates and it was during this time that enrollments were already dropping.

Why? No one has had an answer except for the feeling that technology had become the whipping boy for all kinds of problems and maybe this discouraged many high school students from entering engineering.

Now another factor has surfaced that may have had an even greater effect. Could it be that the drop in engineering enrollment came about because of the introduction of the “New Math”? According to a recently published book, *Why Johnny Can't Add: The Failure of the New Math*, by Morris Kline, the New Math fad was at its height in the early sixties. It was in the fall of 1966 that enrollment in engineering began to drop.

Kline claims rather persuasively that the New Math was a dismal failure. If it was and if, as he points out, the New Math “bored and bewildered numerous youngsters” it is no wonder that thousands of high school graduates lacked the confidence in math, much less basic knowledge in it, to even consider engineering. Kline says that “lots of today’s Johnnies and Janes do not know even basic arithmetic very well despite . . . the new math”.

There is evidence to support the theory that the new math might have been a primary cause of the drop in engineering enrollment. If the New Math did indeed short change the high school graduates of the sixties this could be reflected in what happened to them when they started taking math courses in college. And it has. For freshmen entering the College of Engineering at the University of Wisconsin-Madison the per cent who had to take remedial math almost doubled between 1966 and 1972, from 29 to 51 per cent. During the same period the percentage who were able to enroll in advanced math dropped from 3.3 to 1.4 per cent.

There is other evidence, too. According to a recent report, California sixth graders have had declining scores on nationwide standardized math tests. It was felt that this was a result of the use of the new math which California pioneered in the early '60's.

But it is indeed unfortunate if the New Math has been part of the cause of the drop in engineering enrollment. Engineering colleges recognize that new students might have deficiencies in math as well as other subjects and have regular courses to help bring them up to competitive levels. Placement tests will help determine if a student does have the basic mathematical ability to be successful in engineering regardless of how he got his background in math.

by Prof. J. A. Marks

Engineering Placement Director

Curriculum Changes

Cause

Enrollment Shift

by Bruce Haas

This fall semester 1973, marks the beginning of the new curriculum and degree requirements for the Department of Civil and Environmental Engineering. After more than a year of planning and proposals, the changes have been approved and are now in effect.

Several new courses were added to the curriculum, including two required courses. One is an introductory course in Civil and Environmental Engineering Computations, and the other an advanced surveying course colorfully entitled, "Geometronics". Other significant changes in the curriculum include an end to the CEE summer camp session previously required for all CEE students, and the dropping of Route Surveying from the curriculum.

The most dramatic changes, though came in degree requirements. The department now requires 28 natural science electives, 16 liberal arts electives (requiring one Economics course), and various technical electives under the labels of "Designated Electives", "Method Electives", and other technical and free electives. The total number of degree credits required for graduation was reduced from 142 to 134 credits.

The purpose of the curriculum changes is to allow the student to manufacture his own custom-fitted course outline, while satisfying basic departmental requirements. Under the new curriculum, it is possible for a student to follow either a very broad and integrated schedule, or to specialize in any of the many fields of Civil and Environmental Engineering. Another basic aim in developing the new curriculum is to "provide for the early development of enthusiasm for Civil and Environmental Engineering." Thus, the new CEE student will have increased flexibility in his program, as well as an earlier introduction and exposure to the various facets of Civil and Environmental Engineering.

So what have been the effects of these changes on classes this fall? As would be expected, there have been the usual confused students, the administrative paperwork, and the long counseling hours by advisors. More importantly, though, there has been a traumatic increase in enrollment in many of the undergraduate courses. Junior and seniors who chose to follow the new curriculum, have found a couple of new Sophomore level course requirements that have to be satisfied. Likewise, lower classmen, sticking to the suggested program laid out by the department for the first two years under the new curriculum, are taking courses previously taken by juniors and seniors.

The result is a tremendous overcrowding of many CEE and related courses. Many courses, such as Geometronics and Fluid Mechanics, have had such an unexpected influx of students, that new lab and lecture periods have had to be organized during the first week of classes. In other courses, labs and lectures remain twice as crowded as would have been desirable.

The curriculum changes have affected other departments as well, influencing course enrollments and the nature of the courses. Civil and Environmental Engineers are now required to take only one five-credit semester course in Statics and Dynamics in the Engineering Mechanics Department. Likewise, Soil Mechanics, once directed toward senior-level Civil and Environmental Engineers, is now finding itself confronted with the prospect of teaching the course to lower classmen. Enrollment in other departmental courses, such as Introduction to Materials Science in Metallurgical and Mineral Engineering, has found a significant increase in Civil Engineers enrolled.

Time and experience will be needed to sort out all of the problems associated with a major curriculum change. In a few years, the changes that have been made may be reflected in an increased personal flexibility and better education possibilities for students of Civil and Environmental Engineering.

Interviewing Opportunities

FRIDAY, SEPT. 21

Stauffer Chemicals — PhD (2 of 2 days)

MONDAY, SEPT. 24

General Electric — PhD (1 of 2 days)

TUESDAY, SEPT. 25

Argonne National Labs — PhD

Atlantic Richfield — PhD

General Electric — PhD (2 of 2 days)

WEDNESDAY, SEPT. 26

Western Electric Res. — PhD

THURSDAY, SEPT. 27

FRIDAY, SEPT. 28

Amco Prod. Res. — PhD

MONDAY, OCT. 1

Bucyrus Erie

Intel. Corp

McDonnell Douglas (1 of 2)

Ohio Brass Co.

TUESDAY, OCT. 2

American Motors

Applied Physics Labs (1 of 3)

Corning Glass (1 of 2)

Firestone (2 of 3)

General Motors (1 of 3)

McDonnell Douglas (2 of 2)

National Cash Register

Peoples Gas Light & Coke

Sargent and Lundy

U.S. Atomic Energy (1 of 2)

WEDNESDAY, OCT. 3

Applied Physics Labs (2 of 3)

Continental Can

Corning Glass (2 of 2)

Firestone (3 of 3)

General Motors (2 of 3)

Rohm & Haas (1 of 2)

Rohm & Haas (PhD) (2 of 2)

Stanford U.

U. S. Gypsum Research

U.S. Atomic (2 of 2)

Univac — Data Processing (2 of 2)

THURSDAY, OCT. 4

Airco Incorp.

General Motors (3 of 3)

General Motors Research (2 of 2) — PhD's

Hewlett Packard

Rohm & Haas (2 of 2)

Westinghouse Electric (1 of 2)

FRIDAY, OCT. 5

City of Chicago

Collins Radio

Inland Steel

Kellogg (2 of 2)

Ryerson Steel

U. of Mich. Grad School

Westinghouse Electric (2 of 2)

Wisconsin Public Service

Zimpro Inc.

Capital Area Personnel

MONDAY, OCT. 8

American Cast Iron

Baxter Labs

Comonwealth Associates

Gleason Works

Illinois Central Gulf R.R.

Koehring Co.

McQuay Perfex

Magnavox Co. (1 of 2)

Morse Chain Div.

Oilgear Co.

Pratt & Whitney

Rexnord

Universal Oil Products

TUESDAY, OCT. 9

Alcoa (1 of 2)

Dayton Power & Light Co.

Foster Wheeler

Illinois Dept. Personnel

Institute of Paper Chemistry

Eli Lilly & Co.

Magnavox (2 of 2)

Motorola Inc. (1 of 2)

Stauffer Chemicals (1 of 2)

Torrington Co.

Trane Co. (1 of 4)

U. S. Industrial Chemicals

WEDNESDAY, OCT. 10

Alcoa (2 of 2)

Brunswick

Consolidation Coal (1 of 2)

Dairyland Power

Detroit Edison Co.

Motorola Inc. (2 of 2)

Procter & Gamble (1 of 2)

Sundstrand Corp.

Trane Co. (2 of 4)

Walker Mfg. Co.

Check Placement Office bulletin boards regularly for additions and deletions to interview schedules.

ENGIN- EER- ING IS

**the professional art of applying science
to the optimum conversion of natural resources to the
benefit of man."**

Stanford School of Engineering's wide-ranging graduate programs offer qualified men and women exciting avenues to rewarding, satisfying, professional careers.

The Stanford School of Engineering is searching for graduate students from among qualified majors in engineering, mathematics, and the sciences.

A representative from the school will be on campus to discuss Stanford's ten engineering departments and interdisciplinary programs, research opportunities, the financial assistance available, and other aspects of engineering at Stanford.

■ Wednesday, October 3, 1973

Make arrangements to meet him through

■ Engineering Placement Office.

**SCHOOL OF ENGINEERING
Stanford University**



In today's plastic world, it's nice to know there are still a few dependables.

Every material has its use. But something that's good for one use isn't necessarily good for another.

Some sewer pipe materials shouldn't be used in sewer pipes. They lack the structural characteristics found in a dependable sewer pipe system. They have minimum resistance to rot and roots. Deflection under load which can cause stoppages and eventual collapse. Thin walls susceptible to puncture. And weakness when exposed to high temperatures.

But the dimensional integrity of a *clay* sewer pipe system eliminates these worries.

Clay pipe can permanently resist all the chemicals and acids commonly found in a sewer system. Offer the only absolute resistance to rot, roots, abrasion, infiltration

and exfiltration. And Dickey clay pipe carries a full 100 year guarantee.*

And the patented urethane joint makes Dickey clay coupling pipe the best you can buy. With the most dependable and effective seal you can get in a wastewater system, even if settling occurs.

As a matter of fact, our clay pipe will not only outlast the Bond Issue, but also the people who buy it.

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Clay Manufacturing Company

Kansas City, Missouri; St. Louis, Missouri;
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*Dickey Clay will supply — free of charge — replacements for any clay pipe which has been damaged, destroyed or impaired in service for a period of 100 years from contract date, if damage has been caused by corrosion or other chemical decomposition from acids, alkalis, sewage or industrial wastes (except Hydrofluoric Acid) or damage by rats or other rodents whether pipe is used for industrial, residential or general drainage purposes. Damage from improper handling, placement or trench loading is not covered.

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which is one very good reason for considering Atlantic Richfield for your career.

It's energy that has created and maintains the fabric of today's civilization. That's basic.

But getting and using energy has also created some very large and basic problems: air pollution, ecological disruption, resources depletion—to name a few of the obvious ones.

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We want the best brains we can find to help us arrive at these answers. We want people sensitive to the human and natural environment—and realistic enough to know that preserving both must come from tough, intelligent, dedicated work . . . backed by outstanding resources in capital, research and experience, such as those of Atlantic Richfield.

If tackling such large-scale, significant problems is one of your criteria in selecting a job, join us. We can offer you a career rich in challenge, rich in meaningful work, rich in personal reward.

We typically offer opportunities to engineers, accountants, financial analysts, auditors, geologists, geophysicists, sales representatives and programmers.

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