

COLORADO ENGINEER **WINTER '85**



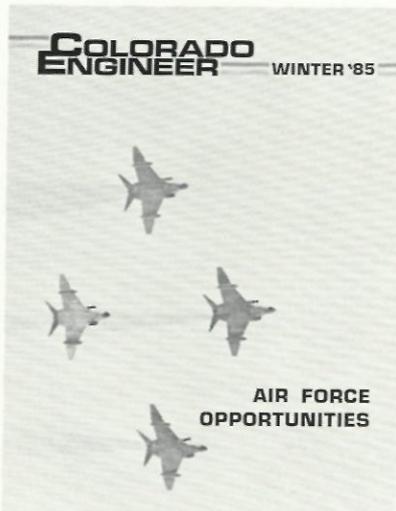
**AIR FORCE
OPPORTUNITIES**



COLORADO ENGINEER

WINTER 1985

VOLUME 82 NUMBER 2



COVER: This issue's cover shows the flight of F-4s in diamond formation in a fly-by during the 1984 ROTC Tri-Military parade.

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Air Force Opportunities

A cadet goes beyond the "Aim High" slogan to uncover engineering opportunities in the United States Air Force.

by Chris Schiller

What opportunities exist for engineers in the United States Air Force? Well, recruiting literature is available, and it gives a fair view of Air Force and Air Force ROTC opportunities. These pamphlets describe full-tuition scholarships and significant military benefits, but there are numerous other opportunities available in the Air Force. This article will take you behind the "Aim High" slogan and let you take a look at the Air Force as seen by an Air Force ROTC engineering cadet.

As a cadet, you will experience many things not available to your contemporaries. The aerospace studies curricula of ROTC put emphasis on leadership, management, public speaking, and writing. The Corps of Cadets is run exclusively by cadets; active duty officers serve as instructors and directors, which means that upon graduation, cadets have extensive experience in the administration and leadership of a 250-person organization. There are opportuni-

positions is provided in the junior year AFROTC class. The curriculum emphasizes management theory and practice. The text is also used for a 300-level management course offered at the College of Business. This ROTC course also allows cadets to

exposure to leadership, management, and public speaking.

One final aspect afforded by Air Force ROTC is the sense of integration, or esprit de corps. AFROTC is not just a class taken for credit hours, it is an organization where

23-year-old second lieutenants are put in charge of vital defense systems, million-dollar contracts, and research projects on the leading edge of technology.

develop and improve public speaking skills in a small setting. Many cadets feel that had they not been involved in Air Force ROTC, their education would have seriously lacked

cadets become part of a team that is mutually supportive. Social activities are a valuable part of the ROTC experience, and life-long friends are made. Becoming a

Becoming a whole person is at least as important as the other aspects of ROTC.

ties for cadets to lead and organize groups in drill, athletics, and other leadership activities. The administrative side of the Corps of Cadets also gives valuable training. Positions include the administration of personnel, athletics, publications, and social activities.

The background for these leadership



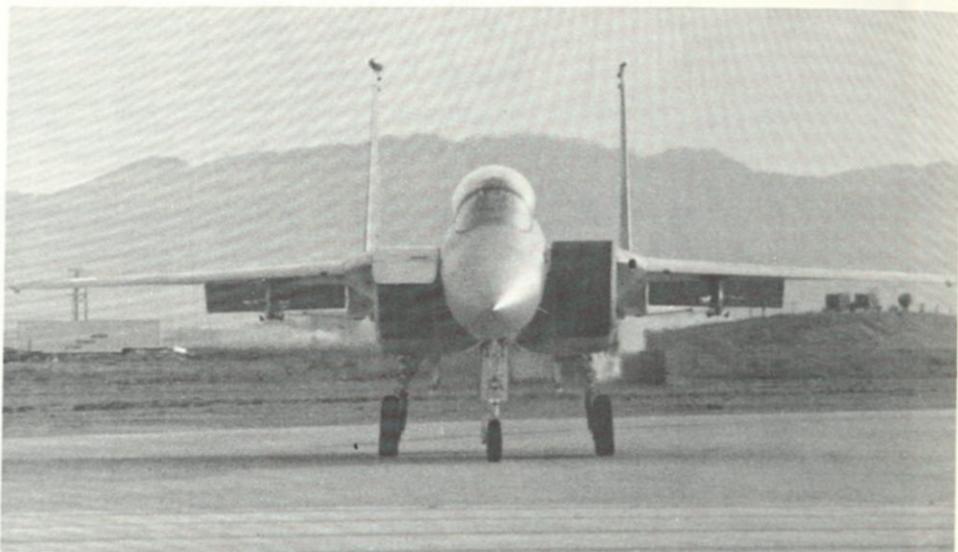
Air Force ROTC prepares students for leadership roles.

whole person is at least as important as the other aspects of ROTC.

Upon graduation, cadets are commissioned as officers in the Air Force. Although the primary mission of the Air Force is to fly, engineers find their roles in a myriad of support and subsidiary organizations. Air Force engineers research, develop, test, monitor, and evaluate defense systems both independently and with private corporations.

Civil and structural engineers can find interesting work in the Air Force as there is a constant need for new facilities to support defense systems. Recent emphasis on the hardening of sites and new radar and communications installations are examples of present work.

Aeronautical engineers in the Air Force are involved in the research and develop-



vital defense systems, million-dollar contracts, and research projects on the leading edge of technology. Very few initial jobs in the private sector carry the responsibilities of Air Force jobs.

At the base of anyone's desire to join the

One must believe in this country and be willing to defend the freedom it represents.

Air Force there must be one thing: the desire to serve one's country. To be honest, people do not get rich by becoming an Air Force officer. One must believe in this country and be willing to defend the freedom it represents. The rewards of officership transcend any monetary reimbursement. 200 years of freedom serve as a witness to the commitment of the men and women who defend the United States of America.

Anyone who would like additional information about the Air Force may contact the Department of Aerospace Studies at 492-8351. *



Chris Schiller is Public Affairs Director for Air Force ROTC Detachment 105. He is also a junior in electrical engineering.

ment of modern airframes and engines. Projects include the new forward-swept-wing Advanced Tactical Fighter (ATF), and an improved version of the F-16. The Air Force is constantly developing and upgrading the propulsion and control systems for both new and old aircraft. Engineers are incorporated into every level of aircraft development, starting with basic research and continuing through operational testing.

Initiative, engineers are involved with high-energy lasers and particle beam accelerators.

The Air Force plays a major role in the space program. A great deal of the support for the Space Shuttle is provided by Air Force engineers. From the loading of propellants and the analysis of the mission, to the post-landing refurbishment, engineers play an important role. The Air Force

With the new Strategic Defense Initiative, engineers are involved with high-energy lasers and particle beam accelerators.

Air Force electrical engineers find work in aircraft electronic systems, but they also work on state-of-the-art communications, radar, and electronic warfare systems. Every weapons system in the Air Force inventory has electronics as an integral part. With the new Strategic Defense

is also directing the construction of the new West Coast Shuttle launch facility at Vandenberg Air Force Base, California.

The Air Force demands high standards of its officers, and, consequently, it gives them large responsibilities in their jobs. 23-year-old Second Lieutenants are put in charge of

A Space Station Update

by Deanna Johnson and Monica Nakamura

In the last issue, we ran articles on NASA's proposals for the "power tower" space station. Since the Fall publication, NASA has revamped its plans in response to complaints from scientific and commercial clients. According to the October 14 issue of *Aviation Week and Space Technology*, the new "dual keel" station is a "wide boxlike permanently manned structure . . . to provide a better zero-gravity platform for materials processing and to provide more structure on which to mount experiments, telescopes and upper-stage hardware operating on the \$8-billion facility."

Changes were recommended in safety considerations, operating costs, customer and station crew operations, shuttle support, in-orbit maintenance, and operations management. The new design is expected to slightly increase station costs, but should also increase flexibility in planning for future station growth.

The "power tower" design was defeated after defects in the reference design would

not meet user needs. The proposed crew module designs raised safety concerns, including the need for an emergency return vehicle.

The proposed crew module design raised safety concerns, including the need for an emergency return vehicle.

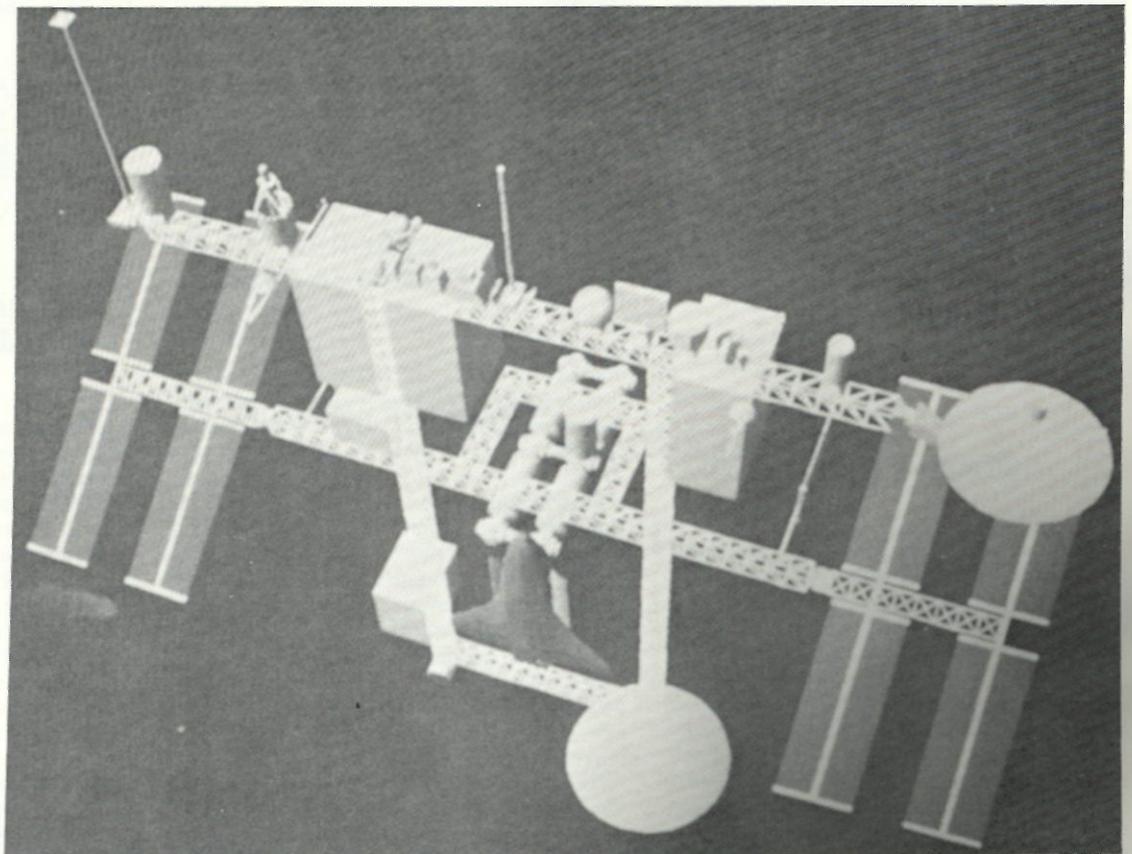
The "dual keel" station consists of two 300 foot masts that extend vertically, bisected by a 300 to 350 foot beam. These form two large areas to be used for scientific and commercial equipment mounts. This is a significant increase in the amount

of space available over the "power tower." Laboratories and housing modules have been moved to the middle of the station, near the station's center of gravity. The new design will be stiffer, and accordingly more stable.

A second, horizontal figure-eight module configuration was also proposed for the "dual keel" station. The previous versions did not allow for individual modules to be sealed off from remaining operational modules in case of emergency.

The configuration is part of the Phase-B work being done primarily by the Lockheed and McDonnell Douglas teams contracted by the Johnson Space Center. All other Space Centers and their contractors contributed input to the design. The "dual keel" plans will be used as a reference design for all remaining studies and revisions until an interim requirement review in January 1986. The final design is expected in March 1986. Hardware contraction will be Phase-C, which is expected to begin in Fiscal 1987.*

This "dual keel" reference configuration has replaced the "power tower" design in order to better meet users' needs.



ENGINEERING STUDENTS

ASSOCIATED ENGINEERING STUDENTS

Associated Engineering Students is the student government for the College of Engineering. The object of AES is to act as a liaison between the student body and the administration, and to organize student activities. AES meetings are held twice a month to coordinate these activities. Meetings are attended by AES members, representatives of each engineering society, and any interested students. AES membership consists of all students registered in the College of Engineering. There are three elected offices, and the officers for 1986 are Mike Moran, president; Bob Mickus, vice president; and Julie Schroeder, UCSU representative. Many other positions are available to students who would like to become more involved in engineering student government.

Recently, AES has secured a new lounge in an area that was formerly used for T.A. offices. With the help of Dean Maler, and some determination and hard work, AES has transformed the area into student society offices and a great study and hang-out area for the engineering student body. The lounge was dedicated to Associate Dean George Maler for his efforts in making the lounge a reality.

AES has proved to be an effective student government. Currently, it provides an excellent opportunity for students to get more involved with other students, the faculty and administration, while gaining valuable experience and knowledge. AES gives the student a means to realize his own potential as well as that of the College of Engineering.

ETA KAPPA NU

HKN is an Electrical and Computer Engineering Honor Society for junior and senior academic achieving students. However, excelling in school is only the tip of the iceberg. HKN members engage in a preponderance of activities which enhance the College and community. It is our belief that a superior engineer exhibits earnest ethics, community awareness, and vivacious character, as well as academic achievement. Our objective is to broaden the college experience and improve the engineering ambience.



TAU BETA PI

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Excellence in Engineering*

Tau Beta Pi is the national engineering honor society. Members are chosen on the basis of high scholarship, personal integrity, breadth of interest both in and out of the College of Engineering, adaptability, and unselfish activity.

1985 marks the 100th Anniversary of Tau Beta Pi. At the recent national convention, our chapter (Colorado Beta) was presented the Chapter Projects Award for conducting a superior program of chapter projects and activities.

This semester, Tau Beta Pi active and pledges are participating in the following activities:

- YMCA Ski Swap
- alumni phon-a-thon
- engineering center tours
- publishing and selling a resume book for members
- selling EIT manuals.

OMEGA CHI EPSILON

Omega Chi Epsilon is the national chemical engineering honor society. Members are chosen on the basis of scholastic achievement and professional character. We sponsor a wide variety of academic and social events, including graduate school seminars, tutoring, and ski weekends.

Our activities for the year conclude with an annual banquet where pledges are initiated, and awards are given to outstanding students and professors.

The current officers are: president, Christie Swanger; vice president, Sue Parrett; secretary, Traci Simms; treasurer, Cindy Starbuck.

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS

The student branch of the Institute of Electrical and Electronic Engineers at the University of Colorado in Boulder has over 100 members. The society sponsors both academic and social activities. As an academic society, we provide tutors and study references, sponsor guest speakers from companies in the industry, and organize plant trips. We also conduct seminars on research in specific fields of electronics. IEEE also participates in programs and fundraisers such as high school tours and phon-a-thons to benefit the College of Engineering.

Socially, the society is a good way to meet fellow classmates and other people in our field. General meetings are held to inform our members of activities. We also hold entertainment events such as picnics and parties. If there are any questions about IEEE or how to become a member, please contact one of the officers: president, Ann Marie Hopf; vice president, Kurt Johnson; secretary, Mary Feng; treasurer, Larry Erdosh; membership chairwoman, Laura Arnold; publicity chairman, Ted Jones.



AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The American Institute of Chemical Engineers is a national, professional society. The local chapter here at CU is one of over 100 student chapters in the United States. We endeavor to provide a good mixture of academic and social interaction for our members. In order to accomplish this, we invite guest speakers from industry to provide us with an inside look at their jobs and companies. We also plan tours of neighboring industrial plants so that members can formulate their own opinions on their chosen field of study.

We also sponsor many social activities throughout the year. In the past, these have included picnics, intramural volleyball teams, ski trips, FACs, pizza parties, and more.

STUDENT SOCIETIES

NATIONAL SOCIETY OF ARCHITECTURAL ENGINEERS

The National Society of Architectural Engineers is an organization which encompasses the building energy, construction, and structural aspects of engineering. The University of Colorado student chapter of NSAE is currently working on goals to improve the link between the students' education and their desired professional career. NSAE has consistently organized field trips to professional companies and has invited various speakers on architectural engineering-related subjects.

This fall, NSAE, along with other department societies, is initiating a summer internship program. We have organized a committee to find prospective employers to provide summer internships. We are excited about the encouraging response received from the professional societies. Interested students are welcome to come to our next meeting. NSAE is looking forward to an exciting and profitable year.



SOCIETY OF WOMEN ENGINEERS

The Society of Women Engineers is a student chapter of a national organization founded to advance the role of women in engineering. At the local level, we support these goals by sponsoring speakers, seminars, and tours which give our members experience in the professional aspects of each engineering field.

One of our goals is to better prepare our members to enter the job market or continue their education. We also hope to encourage more young women to consider an education in engineering. To do this, we are developing a presentation to make at local high schools which will inform the younger students of opportunities available at the College of Engineering at the University of Colorado.



ASSOCIATED GENERAL CONTRACTORS

The Associated General Contractors is a relatively new group at the University of Colorado. AGC is for any student interested in the building construction industry.

AGC activities include site tours, speakers, and visits to the Denver professional chapter. In the recent past, AGC has toured an advanced computer-aided design facility, visited the construction site of a multi-million dollar hotel, and has met with the AGC chapter at Colorado State University. In January, the student chapter will have a booth at the Construction Exposition in Denver.

The national and regional professional chapters of AGC greatly support the student chapter by offering numerous scholarships and summer internships. If you would like to join AGC, or if you would like information on the scholarship and internship programs, visit our desk in ECST 3-3 and talk to one of the officers.

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

The primary activities of the American Institute of Aeronautics and Astronautics include the following: national competitions and scholarships; area industry tours; works in conjunction with Associated Engineering Students (AES) to conduct high school tours and phon-a-thons; monthly dinner meetings with the local AIAA professional society; AIAA annual student paper conference (at Iowa State University in the spring of 1986); sponsoring lectures with CU alumni astronauts such as Vance Brand and Marcia Ivens; Engineering Days' Road Rally and Beach Party.

The faculty advisor is Professor Don Kennedy. The current officers are: president, Johan Morris; vice president, Jean Gardner; treasurer, Christi Liebe; secretary, John McGlinchy. The officers can be found in ECST3-3 or ECOT6-16.

COLORADO ENGINEER

The *Colorado Engineer* is the official, award-winning magazine of the College of Engineering. It is also the oldest and one of the most distinguished publications on campus.

The magazine is a member of the Engineering College Magazines Associated (ECMA), a national organization comprised of nearly 50 national engineering student magazines. Awards are given at the annual ECMA convention. Over the past ten years, the *Colorado Engineer* has received over 50 awards for journalistic and artistic excellence.

The magazine is produced solely by students—everything from writing to advertising sales and art work. Working on the *Colorado Engineer* can benefit students from every major. The unique experience gained by volunteering for a professional magazine greatly supports academic work, and it shows (future employers) how varied a student's interests really are.

Members of the magazine have the chance to meet and work with a diverse group of students and professionals in the working world. They also gain unlimited and exciting experience in areas such as communication, public relations, and money and time management—all of which are extremely important in today's society.

If you welcome the challenge of becoming a 'well-rounded' student and contributing your ideas to a unique student organization, stop by our office (ECST3-5—above the Real McCoy Lounge) or call us at 492-8635.

SIGMA GAMMA TAU

Sigma Gamma Tau is the honor society for aerospace engineering. It seeks to identify and recognize achievement and excellence in the aerospace field.

Sigma Gamma Tau's collegiate chapters elect annually to membership those students, alumni, and professionals who exceed in their studies or professional duties. *

Electrical Engineering and Computer Science Research at the University of Colorado

by Brian Walker

Research being conducted in the department of electrical and computer engineering is both diverse and plentiful. The various fields of study include research in bioengineering, computer engineering, control theory, digital signal processing, electromagnetics, power, propagation and remote sensing, semiconductor devices and properties of solid state material, VLSI design automation, and research in optics and lasers. Because of the diversity of the research, this article will only focus on the areas of bioengineering, optics and lasers, and computer engineering.

They are studying the effects of electro-magnetic fields on living tissue.

Professors Frank Barnes and Howard Wachtel are continuing their research in the area of bioengineering. Currently, they are studying the effects of electro-magnetic fields on living tissue, particularly nerve cells. Possible outcomes of this research include external pacemakers and improved methods for laser surgery.

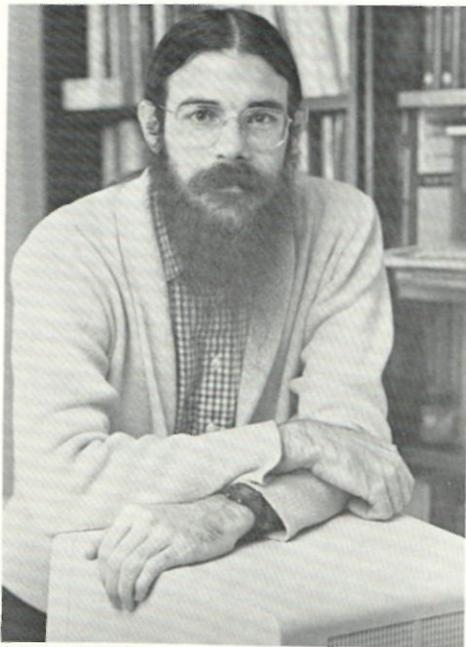
The optics and lasers group includes Frank Barnes, Thomas Cathey, Kristina Johnson, and Alan Mickelson. Professor Barnes is currently conducting research in the production of high power lasers from a semiconductor chip of Gallium Arsenic (GaAs). Thomas Cathey is studying a technique to compensate for atmospheric distortions in radar-imaging devices. Professors Johnson and Mickelson are studying the potential advantages of high speed optical processing systems.

Finally, researchers in the computer engineering group are attempting to design hardware and software systems that would significantly improve the reliability and functions of existing technology. Lecturer Vincent Heuring and Professor Waite are applying the concepts of knowledge engineering to aid in the construction of language compilers. These will embody general 'rules of thumb' into the construction of complex language compilers so that they can be created efficiently while relying less on the programmer.

Concurrently, Professor Fabrizio Lom-

bardi is investigating the properties of fault tolerance which can then be used to design computer systems which will be less prone to failure. Likewise, Professor James Avery is conducting research into the control of instrumentation through the use of microprocessors. This area of research has many applications in real time systems where time is an integral element of the processing of data.

These research projects combined with a multitude of others comprise the research effort of the department of computer science. Each, in it's own way, will contribute to the advancement of current technology.



Michael Lightner

The department of electrical computer engineering has also been honored by the presence of three Presidential Young Investigators who have been selected by the National Science Foundation for their outstanding merits. As part of this award, each professor receives funds for research in the form of \$25,000 as a base grant and up to \$37,500 from NSF as matching funds for grants that they receive from industry. The staff of the *Colorado Engineer* wishes to congratulate Professors Kristina Johnson, Michael Lightner, and Renjeng Su for their accomplishment.

Research in the department of computer science is divided into three general fields of interest: software engineering, artificial intelligence, and computer science theory. Individually, each group of researchers, through diverse methods, is endeavoring to develop methods and tools to help programmers design faster and more reliable programs with less effort. As a whole, the researchers will combine their efforts to develop software for a parallel processing system made possible by a grant from the National Science Foundation.

The focus of the software engineering group is the development of software environment which would assist programmers to write programs. Such an environment would include tools for finding mistakes in programs (debugging) and for modifying existing programs. This environment would also include facilities to add new tools to meet future requirements. In addition, the software engineering group is developing formal design techniques and rules to verify the operation of programs.

Artificial intelligence is a new field of study at the University of Colorado and promises to be highly productive. The primary goal of this research is to make it easier for the average person to communicate with a computer. Professor Paul Smolinski is attempting to provide this

There would be between thirty and fifty separate work stations which could each be as powerful as a VAX computer.

communication by modelling human mental processes with mathematics so that they can be simulated on a computer. Another similar approach to the problem is the development of an 'expert system' which would guide the user through the programs by making the machine appear intelligent.

The field of computer science theory can be further divided into three sub-topics: algorithm analysis, formal language theory, and numerical computation. Primary interest in the study of algorithms (the method by which a program solves a problem) has

been in the development and verification of programs that operate in parallel processors. This interest arose because parallel processors, which can solve a problem quickly by dividing the task between many machines, present situations where conventional programming techniques become obsolete. In formal language theory, researchers are attempting to establish a basic structure for programming languages.

As an off shoot of this research, some of the techniques of formal language theory are being used by the department of molecular, cellular, and developmental biology to unravel the genetic code. Finally, researchers are using numerical computa-

tion to optimize and verify algorithms. As a part of this research, Professor Michael Main is conducting research to provide a mathematically rigorous definition of computer languages.

Collectively, the researchers will use their combined talents to program a loosely-coupled network of computer work stations to solve various problems. There would be between thirty and fifty separate work stations which could each be as powerful as a VAX computer. The funds for this network were provided through a five-year, \$4.2 million—of which \$3.2 million was provided by the National Science Foundation—grant.

The software engineering group will study ways to deal with programs when pieces of it are spread to different machines. The artificial intelligence group will develop user interfaces for the system. Similarly, the numerical computation group will create algorithms that will use the network efficiently by reducing the amount of communication between machines. At the time of printing, the department of computer science was still receiving bids for the individual work stations.

There is much more research being done in the department of computer science but they could not be included in this report. *

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PROFILES

Mike Moran

Major: Civil Engineering

Hometown: Grand Junction, Colorado

Date of Birth: October 9, 1964

Occupation: AES President, 1986

High School: Grand Junction High School

Hobbies: Biking, racquetball, coin collecting

What do you like the most about C.U.?

"The variety of people that are here."

What do you like the least about C.U.?

"Teachers who can't communicate."

What extra-curricular activities are you involved in?

Associated Engineering Students (AES), Tau Beta Pi, Chi Epsilon pledge, C.U. World Citizens, Pre-Law Club, former member of President's Leadership Class.

What are your goals for AES in the coming year?

"Everybody should know what AES is; we need good communications with the students so that the school doesn't look so dead. We need to get the freshmen and sophomores involved. I'd like to make E-Days bigger. At the convention we went to (concerning engineering student governments), other schools told us about theirs, and some are huge. I'd like to involve the whole community. Maybe we can start teacher evaluations to be published in a book."

What changes would you like to make in

the coming year?

"The image of engineers, instead of 'engineers.' I'd like to have the students respect the building more."

What would you do if you suddenly had a million dollars?

"I would like to spend it on trying to help world peace. I don't know how, but on something to help everybody."

What was your first job?

"I worked at Coors Recycling picking up, weighing, and sorting cans."

What do you want to be when you grow up?

A lawyer or a philanthropist.

What's the weirdest thing that has happened to you at C.U.?

"When I was a freshman, my roommate and I were walking back from dinner, and we saw a mattress floating in the Kittridge pond. When we got back to our room, we found out it was one of ours!"

Where have you traveled?

Costa Rica, Mexico, Hawaii, and Alaska.

Where would you like to travel?

Europe, all over the Soviet Union, South America.

What is your favorite book?

"I don't have one yet. It's still up for grabs."

What is your favorite food?

"EVERYTHING!"

What is your pet peeve?

"I hate disorganization."

Who is your favorite professor?

Professor Roland Rautenstrauss

What is your philosophy of life?

"To make the world a better place, to assist in the progress of mankind."

James C. Sherman

Title: Director of Undergraduate Counseling and Student Records

Hometown: Boulder, Colorado

Date of Birth: September 21, 1941

Degrees Conferred: B.S. in Secondary Education (History), Northern Arizona University; M.A. in Oriental Studies (Chinese), University of Arizona; M.A. in Student Personal Services, University of Denver; Ph.D. in Higher Education Administration, University of Denver.

Hobbies: "Reading, carpentry, and being with my family."

What do you like the most about C.U.?

"I feel that I'm working with an institution and a college that are excellent. I like to work with other people who are doing a good job. I enjoy working with the students in this college, and they are very good students, very courteous. There is a certain type of student at each college, and the ones here are much like the ones I went to school with. I hope my kids turn out as highly motivated as the students here. I also like the area."

What do you like the least about C.U.?

"The low level of state support, it's frustrating."

What are your goals for the coming year?

"With the retirement of [Associate] Dean Maler, I'd like to make the transition between the out-going and in-coming Deans as smooth as possible."

What would you do if you suddenly had a million dollars?

"I'd spend half of it paying off bills. I'd finish some improvements on my house, maybe do some traveling, and make sure my children have enough money for college."

What was your first job?

"I worked serving ice cream in Mary Coyle's Ice Cream Store in Phoenix, Arizona. It was one of those exclusive, hard-packed ice cream stores, but it was very famous. We had lots of celebrities come in. I was a big fan of the New York Yankees, and one day some of them came in. I served Yogi Berra and Mickey Mantle. Because of that job, until I was out of college I worked in food stores. I was a short order cook; cooked, especially prime rib, in a hotel. I cooked my way through college."

What would you like to be when you grow up?

"I like having the flexibility to change my mind, and then go do it. I don't ever want to [be in a position where I] have no options. I don't ever want to grow up."

What's the weirdest thing that has ever happened to you at C.U.?

"I guess it was about 11 years ago, in the Spring Semester, and streaking was in





vogue. I was the Hall Director at Nichols Hall. C.U. had a big streak bash, with lots of [unofficial] publicity. There was more traffic coming in from Denver for this than for a football game. About a third of the students from Nichols and most of the student staff went. The dorm residents all came out in groups, and the highlight was when the girls from Hallett Hall, it was all girls then, came

out carrying a huge banner. It was out on Farrand Field, and I remember so many bodies going by, but I couldn't remember one person the next day."

Where have you traveled?

The western part of the United States; Washington D.C. and North Carolina in the last several years.

Where would you like to travel to?

"Hopefully soon Japan, I'd like to go to China, and Southeastern Asia."

What's your favorite book?

"I don't have a favorite, I like to read anything about international relations, or mystery novels. I'm reading a book now on the Vietnam Conflict. I like mostly non-fiction. There are many interesting books; I'll walk into a bookstore and come out with several paperback books."

What's your favorite food?

"Mexican food. I'd like to go to the Szechuan area of China, since they specialize in hot spicy foods."

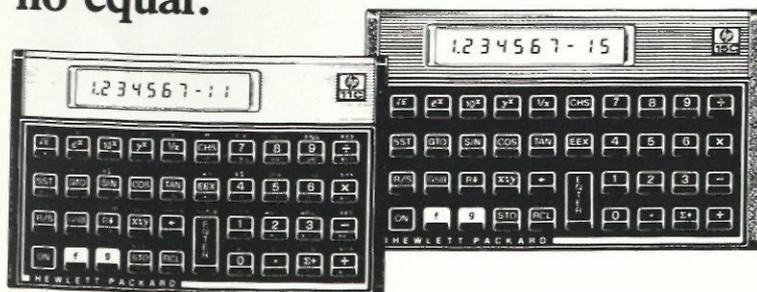
What is your pet peeve?

"I don't really have one, but the thing that does get to me, is new freshmen needing to learn for themselves the difference between high school and college in how to study. You have to watch them correct themselves, and it's frustrating. It's like drowning until you learn to swim."

What is your philosophy of life?

"I don't really have a specific one, but I think that I have gained a perspective of life from growing up on a farm. You learn to see cycles of life, including death, as in the animals. I guess I'd emphasize watching the cycle of things." *

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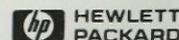
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