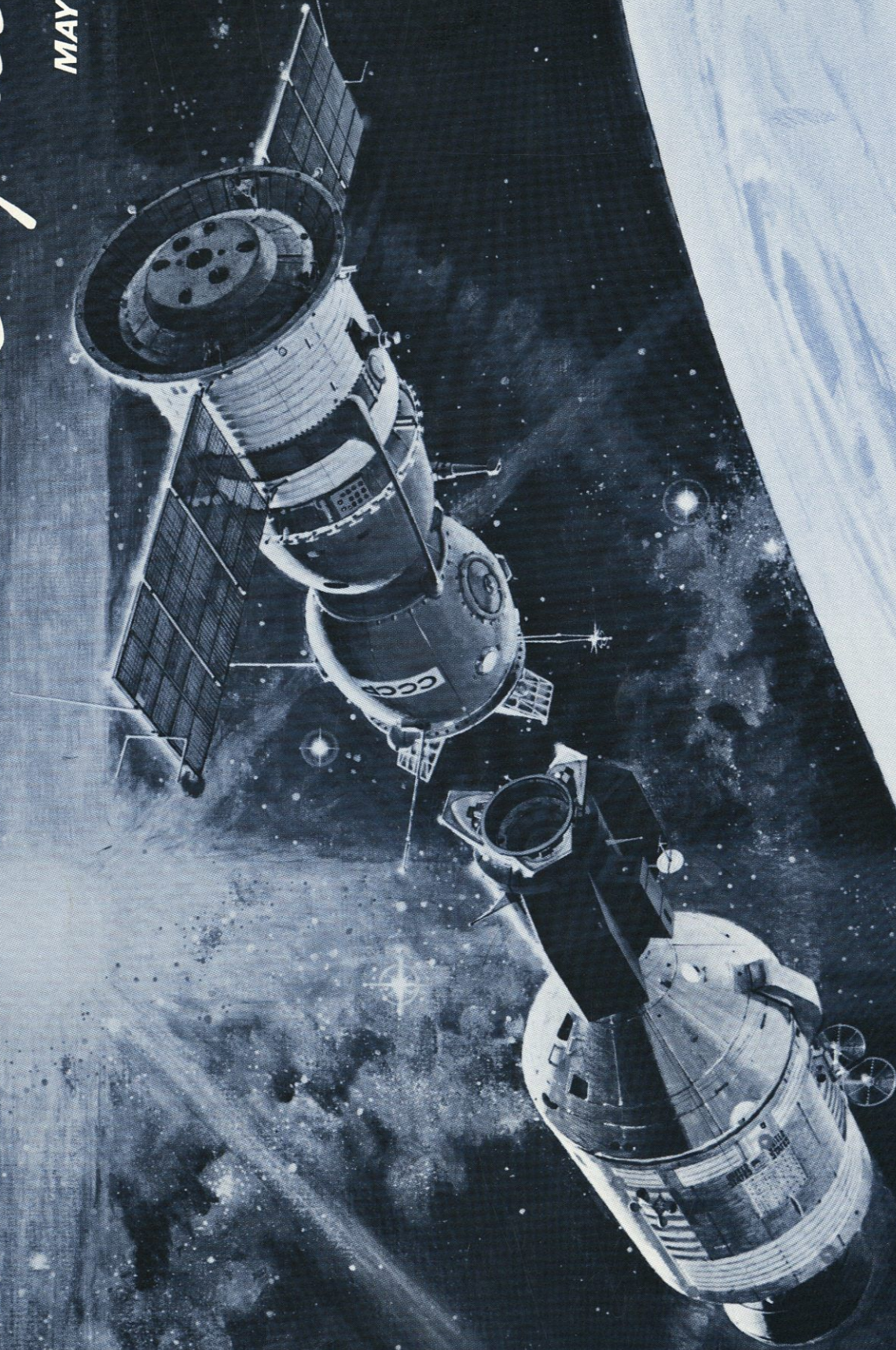


The COLORADO *Engineer*

MAY 1975



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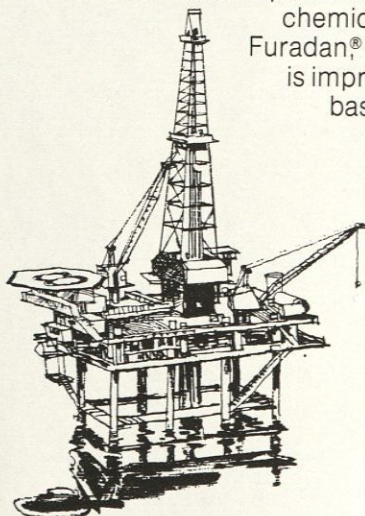
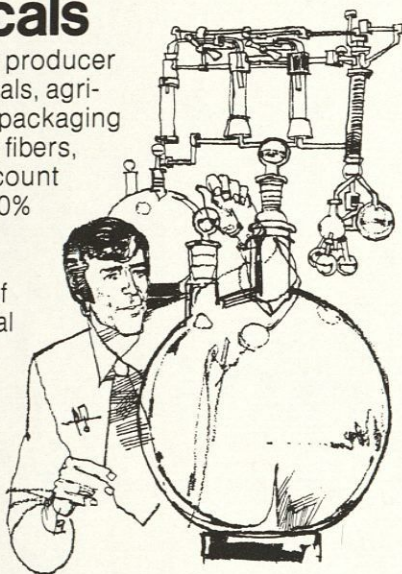
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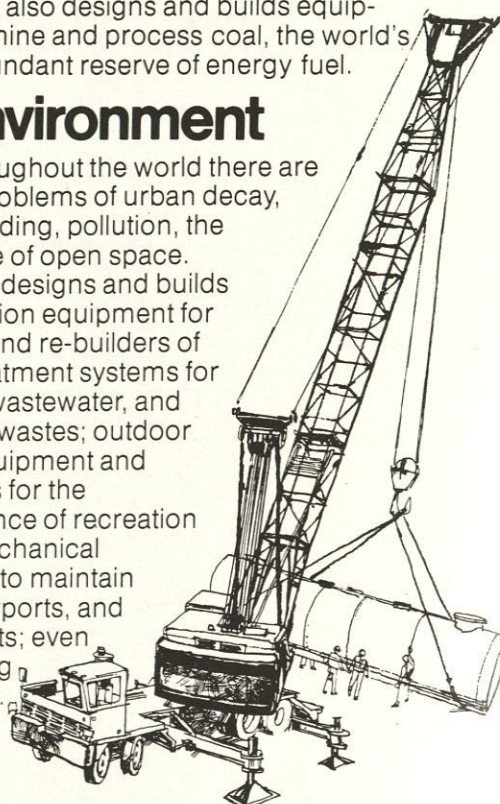
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The Colorado Engineer

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COVER

An artist's concept of an Apollo spacecraft about to dock with a Soyuz spacecraft during the joint U.S.-U.S.S.R. Apollo-Soyuz Test Project mission scheduled for this July. Vance Brand, a C.U. Engineering College alumnus, is going to be one of the American astronauts on the mission. For more on C.U. astronaut alumni, see the article on page, 16.

Drawing by artist Robert McCall; courtesy of N.A.S.A.

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LETTERS



In the March 1975 issue of Colorado Engineer we requested response on the subject of current teaching methods in the College of Engineering. The following was the only written response from students or faculty. -Ed.

This letter is in response to your request for "general observations and criticisms of teaching styles" (*Colorado Engineer*, March 1975).

Your goal of making professors more aware of student needs in order to improve education is a good one, and it is one that should take top priority. However, you assume that the engineering faculty "has aspirations of being educational or instructive in nature." This is not true.

Our faculty's goals are research oriented, not educationally oriented. And can you blame them? Tenure is decided on the number of technical articles published, quality and quantity of research, and petty departmental politics. Quality of teaching does not matter. As a top C.U. administrator recently told me, "Professors try to portray an evenly divided, 50-50 split between research and teaching. Don't believe it. Anyone telling you that research is less than 90% of their job is a liar."

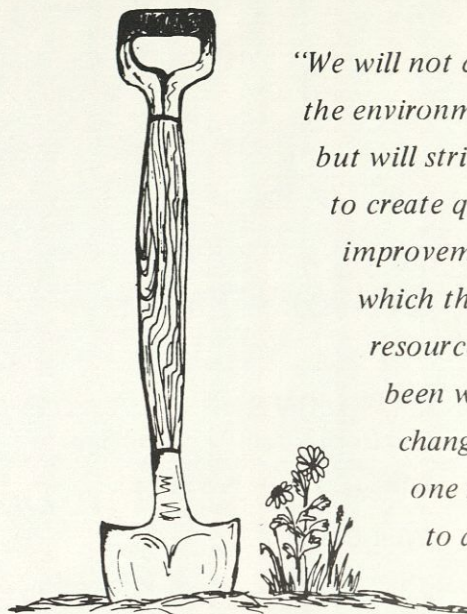
This is not to say that the university shouldn't be a center for research; it should. The state of Colorado gives the university funds partly because it will see returns in the form of technical advancement benefitting **all** of its people. Also, laboratories, equipment, and machinery are expensive. It makes economic sense to share them between those who are learning and those who are discovering. Besides, those who are learning may discover something, while those who are discovering may learn something.

So, any suggestions presented to professors about improving their teaching would fall on deaf ears, whether they came from students, other professors, or administrators. What we need is a shifting of priorities. These ideas may help:

1) Tenure should be decided mostly on quality of teaching, not research. For example engineering professors might be required to take courses in Curri-

culum Development, Educational Psychology, and Instructional Design. Also, objective measurements might be required as proof of high quality instruction, e.g. classroom exams which show how well students have mastered the given material, periodic evaluations by other professors, etc.

- 2) The bulk of the research load which professors now carry should be transmitted to trained personnel whose only job is research.
- 3) Students should have some say in deciding who gets tenure. After all, we pay a high price for our education.



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but will strive
to create quality
improvements in
which the
resources have
been wisely
changed from
one resource
to another."*

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Implementing these or similar suggestions may be difficult. For one thing **students** may have goals other than the upgrading of engineering education, e.g. getting a degree as quickly and cheaply as possible, getting good grades in order to stay on scholarship or to get a good job, or not acting because of concern that "bucking the system" may eliminate them from R.O.T.C. or jeopardize their grades. So until we students can get organized on radically shifting priorities, we'll have to accept the fact that engineering education will not improve, as past years have shown. **Howard Zinn**

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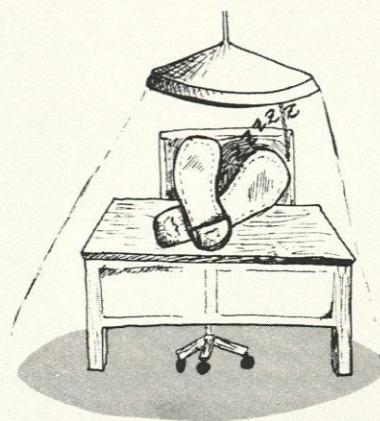
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Editor's Desk



The exploration of space in the past eighteen years, since Sputnik, has been dramatic and exciting. In this issue we present two articles which show how both men and machines from Colorado have been—and are presently—involved in space exploration. Donna Edens, an avid aerospace enthusiast, presents the four men who have graduated from C.U. and have gone on to become astronauts. Tim Doll, another aerospace engineering major, takes a look at the largest aerospace firm in this area: Martin Marietta Aerospace. Tim's article is the first in a series on the Colorado aerospace industry.

In reaction to articles on space exploration there are those who might ask: Who cares? Is pouring money and talent into space operations a valid exercise anymore? There are, of course, many rational arguments in support of space exploration. What I would like to submit is a somewhat irrational, emotional, argument for space exploration. (Yes, I know, this is a engineering magazine.) It is the nature of humans to explore. There is something in the human character which is touched and excited by exploration of any kind. Do you deny this? *Can* you deny an emotional response as you watch a rocket lift off for the moon with three men on board?

The sort of excitement that space flight generates could be put to good use by Americans. For at present we are a people caught in a frustrating economic recession after having just lost the first war in our history, after having just watched a president resign in disgrace. Our minds are numb, our spirits dull. Perhaps the drama of exploration will inspire our imagination and relight our spirit in this age as it has done in other centuries. There are those who would suggest that there are better ways of inspiring the American people. Perhaps. But I am struck by the large enthusiastic crowd which attended astronaut Jim Irwin's lecture in the U.M.C. ballroom last April 16. I remember the sellout crowds for the film, 2001: A Space Odyssey. I am unable to find anyone on the *Colorado Engineer* staff between the hours of 4:00 and 5:00 p.m. because they are all watching reruns of *Star Trek*.

Space flight obviously stimulates persons on a wide variety of levels. I cannot think of a better way to start our third century as a nation than by a new commitment to our goals in space.

This is my last issue of the *Colorado Engineer* as Editor. It has been a gratifying experience this year to see both the magazine and the staff grow and develop. Among our more significant achievements this year was the receipt of three awards for our November 1974 issue at the Engineering College Magazine Association convention in Urbana, Illinois. Four members of the staff attended the convention and workshop which was held on April 4 and 5. The awards were a first place for Best Single Issue, a second place for Best Layout and a first place for Best Editorial. The staff of the magazine is already excited about the award prospects next year because our 1975 issues will not be entered until then.

Next year's *Colorado Engineer* should be better than ever and should be well worth your investment in time and energy if you want to work on the staff. Next year's editor will be Wes Jordan.

Have a good summer.

Gary Mills

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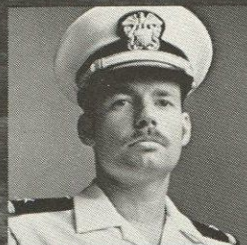
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Book Review by Bill Bernardelli



HARNESSING THE SUN TO HEAT YOUR HOUSE

John Keyes, *International Solarthermics Corp. (ISC)*.
1975 (2nd Edition) \$2.95

Many books and periodicals are available today offering scattered bits of information to the uninformed public and to the backyard experimenter on the subject of home solar heating. These publications, in general, describe a single type of solar home heating unit or simply expound upon the merits of home solar heating. Few, if any, of these publications either include extensive information on the general principles of home heating by solar radiation, or provide sufficient data relating to the variables involved.

Harnessing the Sun, a book written by John Keyes, however, covers various practical approaches to home solar heating. This book gathers into eight chapters the most com-

prehensive summary of the state of the art that I have seen to date. The book is largely non-technical and can be understood by the non-scientific public. To quote the Foreword of the first edition: "This book was prepared to give the reader a general knowledge of the field of solar energy applications and was written as objectively as possible. It has been the intent of the author to present practical information in easily readable form, as opposed to lengthy scientific dissertations."

Topics covered include: Solar Heating Applications, Practical Utilization of Solar Energy, Practical Measurements of Collector Efficiency, Calculating BTU Output from Storage, Heat Loss Calculations and Average Case Engineering. The book also contains 120 pages of data in appendix form providing information on climatological data, physical property data, design outside temperatures and performance calculations.

Although the written text is a short 65 pages, the author manages to supply the reader with a firm overview of the home solar heating field. However, the author does use the text as a platform for explaining his corporation's invention—a solar backyard furnace—and compares the unit to other solar heating systems. The discussions of solar heating systems seem to be slanted towards exposing the virtues of the ISC furnace. He also devotes an entire chapter to the ISC backyard furnace, providing details about its constructions, theory of operation, and control. The text also does not consider total solar energy systems for a home (water heating, home cooling, etc.), nor does the book discuss solar heating systems for buildings larger than residences; but is concerned strictly with the use of solar energy for home heating (as the book title implies).

In all, though, this book offers the reader a broad base of information about home heating by solar methods. It is well written and, despite its faults, it is currently the most comprehensive and understandable book on solar energy.

Program Review : Laserium

by Tim Doll

"Laserium is a trip." This phrase has been used in almost every Laserium press release to date, and for good reason. It is. When you first walk in and hear the music of Aaron Copland's "Fanfare for the Common Man," you know this isn't going to be just another lightshow. This is a live performance by that man behind the bank of controls and he's not going to let you down. After a short speech of do's and don'ts, (note—take his advice, the floor IS the best place to view the show) the lights fade out to reveal a sky full of moving stars which is the background for the entire show. The music starts, glowing through the massive quadraphonic sound system, and clouds of remarkably pure laser light begin to flow and swirl across the sky, keeping perfect time to the music. Soon the music moves to "The Blue Danube" and the laser images change to four different colored rings that waltz to Johann Strauss' masterpiece. From the very classical, the music changes to Emerson, Lake and Palmer's "Tank." A laser projected drumstick flies through the sky beating out rhythms on imaginary drums and cymbals, then shifts to a set of hyper-active laser dots dancing to the already spacey music. The music continues to alter—"Space Race" by Billy Preston, "Abaddon's Bolero" again by Emerson, Lake and Palmer, "Timesteps" from "A Clockwork Orange" by Walter Carlos, and finally ends with "Pines of the Appian Way" by Ottorino Respighi. The laser images also vary: dancing, bounding, rolling, spinning, and exploding into ever-changing shapes and images. Solar winds, northern lights, electron clouds, cosmic

rays, and spinning galaxies all stimulate imagination and mind. As you finally leave the planetarium, you know that you really have gone on a trip.

Laserium truly is a concert in the real sense of the word. This is art for art's sake. There is no hidden meaning behind the show, you are not going to come out with a new outlook on life. Laserium is simply a very enjoyable, relaxing way to spend an evening. Laserium has been appearing at the Gates Planetarium for almost ten months, and all indications are that it will play for another ten months.

Although the laser images are not holographic (three-dimensional) at this time, the illusion that they are three-dimensional is very real. In addition, Laser Images Inc., the group that puts on Laserium, has plans to make the Denver show holographic in the near future, possibly by the time you read this. This would make the already great show nothing short of fantastic. The show is performed live, so if you see it more than once you will probably notice small differences. Bernie Schwayder, the projectionist, reacts very favorably to an appreciative audience, so if you like what you are seeing, let him know; he'll give you an even better show for it.

Laserium, now showing at the Gates Planetarium in the Denver Museum of Natural History, located at the corner of Colorado and Montview in Denver. Tickets are \$2.50 each and should be purchased at least an hour before the show, since most of the shows sell out rapidly. You can call 388-2031 for showtimes and information.

The 1.6 Million Dollar Fiske Planetarium

Isn't that a lot to pay for one classroom?

by Walt Cranor

NO. And there are several good reasons why. The Fiske Planetarium is not being built with University money, for one. The money for the project came from a donation by Wallace Fiske, an alumni. In essence then, the University was given a classroom, and one of the few on campus which will generate a revenue to help defray its expenses.

This "one classroom" has already been scheduled for a variety of diverse subjects as well. The theatre chamber, when not in use as a planetarium, can be used by ensemble groups from the College of Music, and for theatre productions of the drama department. Even the lobby is available as a display area suitable for art exhibits or exhibits relating to the show.

The operation of the planetarium is flexible enough to allow for 30 classroom lecture-shows and two evening performances the same day. Classes using the facility range from A.G. 111-112 which are astronomy classes, to geography and geology. Some biology professors have expressed an interest in using the planetarium, also, as have some from the Communications Department. Dr. Malville of Astro-Geophysics plans on teaching a special course in Religious Studies utilizing the planetarium facilities. Astronomy students from the Denver Center will be brought up for lecture-presentations relating to their studies.

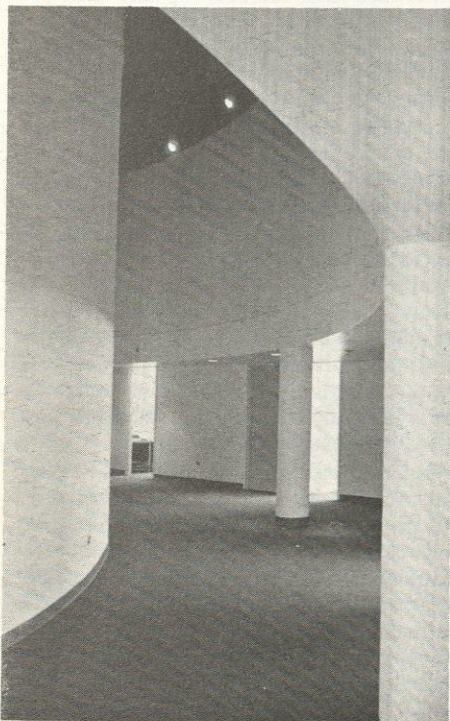
Most people think of a planetarium as just a dome-topped room with a star projector in the middle surrounded by seats. This is part of the picture, but there is much more. In addition to the Zeiss Model VI star projector, there will be between three

and four hundred other projectors for special effects such as comets, panoramas, etc. There is also a control system which is completely recordable, and was no small task to design. It employs a system of tones to signal the dimmers and switches. These tones make recording possible with a studio-type audio recorder. By utilizing the four channels on the recorder and a system of matrices, the system is capable of controlling 400 switches and 16 dimmers.

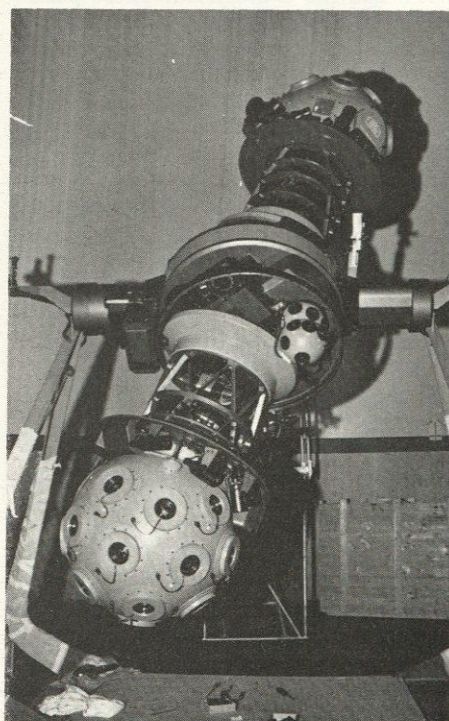
However, the only way something like the planetarium can run successfully is with good personnel. The University has also seen to this detail. The director is to be Dr. Garitt Verschuur, who comes to C.U. from the National Radio Astronomy Observatory in Charlottesville, Virginia. Dr. Verschuur was born in Capetown, South Africa, and received his Ph.D. from the University of Manchester, England. He has been teaching in Astro-Geophysics for the last year and a half.

The programs at the planetarium are to be largely the responsibility of Mr. James Sharp. Prior to coming here, Mr. Sharp was Assistant Director at Fels Planetarium in Philadelphia, and then Director of the Vanderbilt Planetarium on Long Island, where his wife also served as Assistant Director.

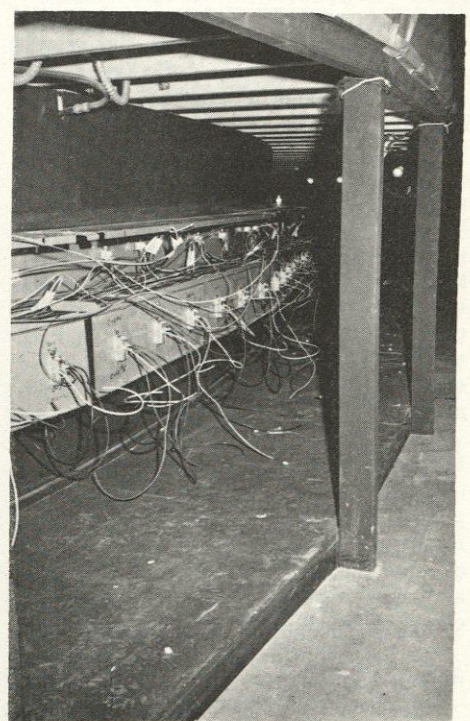
With the planetarium facilities being as good as they are, and the personnel as well qualified, there is no reason to expect that this "one classroom" should not be among the finest of its type in this country.



Lobby and exhibit area.



The Zeiss Model VI star projector.



The back of the slide projector area showing the extensive wiring needed for their control.

C.U. Radio: The Impossible Dream?

After half a century it looks like we're going to make it work.

by Wes Jordan

Do you remember Calvin Coolidge? Or Prohibition, for that matter? Well, perhaps not. How could you be expected to, after all. That was fifty years ago. Consider this, though: the last time a radio broadcast was heard from within this university Coolidge was our president and students were clamoring not for the legalization of marijuana or the abolition of war, but for the legalization of alcohol!

But in 1926, due to a failure to maintain a regular schedule of programming, the Federal Communications Commission (FCC) felt it necessary to revoke the University of Colorado's license for operation of that station. It has now been nearly half of a century since a CU-originated broadcast has been heard over the airwaves.

This simple lack of having a campus radio station is irksome enough in itself, especially when you consider the resurgence of popularity that radio broadcasting (and especially FM stereo broadcasting) has enjoyed over the last decade. When you also consider the high quality of programming being heard from rival schools in Colorado (with not nearly this University's capacity for funding and production), coupled with the humiliating knowledge that CU is perhaps the largest university in the nation not to have its own radio station, then you can begin to understand why there is so much enthusiasm aroused every time there emerges an attempt to establish a station.

There have been many such attempts in the preceding years—all of which have obviously ended in failure. Even at present there are two efforts underway. However, it may be interesting to examine some of the preliminary failures and their relevancy to those present projects for which success seems a possibility.

A recent history

In May of 1969 the Regents of the University of Colorado requested that an attempt be made to plan for the installa-

tion of some sort of a radio station on the CU campus. The reason for the Regents' request is not well known now—but one may imagine that a quite possible reason was the University's embarrassment over not delivering to the community any broadcasting services at all. The response to this request was the establishment of a Joint Board on Radio, comprised of four students elected by the Associated Students of the University of Colorado (ASUC—the predecessor of UCSU) and three members of the faculty elected by the Faculty Senate.

By October of that year the Joint Board announced its plans. It had decided upon the construction of a small, ten watt, non-commercial facility to be run jointly by the Bureau of Audio Visual Instruction (BAVI) and the board itself. These plans eventually provided for the broadcast power to be boosted into the multi-kilowatt range. They further called for the use of \$18 thousand worth of equipment already owned by BAVI and housed in Folsom Stadium. During the evening, responsibility for programming would rest with the board, but during the daytime hours the facilities would be used by BAVI in a program of broadcast education to be administered by BAVI and the University departments of Journalism and Communications.

Harold Hill, a long-time CU professor in the Communications Department, and then the associate director of BAVI, announced that the operating costs alone would be an estimated \$8300 annually, besides the cost of a transmitter and antenna tower. According to Prof. Hill, while donations and university support would cover some of the total cost, the rest would have to come from student fees. If the Board of Regents approved this plan, added Hill, then an FCC application would be filed. (But one presumes that such an application had long since been filed, as will become evident later.)

At this point optimism among students

ran high over the possibility of having a campus station because thus far no real problems had become apparent that might conceivably impede the broadcast effort. In early December of that same year, however, then CU President Frederick Thieme announced that he would not only like to see the construction of a radio station but an educational television studio as well. He further stated that he would prefer to see the University begin broadcasting with more than the proposed ten watts.

These modest alterations proposed by the president apparently mushroomed in his mind because a few days after his initial comments the president's assistant, Roland Rautenstrauss, announced to the Joint Board that the president would rather see the removal of any student control in favor of a large-scale campus broadcasting network. Rautenstrauss added that the president's plan called for the network to be run with administrative funds rather than student fees, but it further called for sole management of the station to lie with BAVI. According to Thieme the radio station would then be comparable to a chemistry lab in its university function, that is, the main idea would be to restrict broadcasting to purely educational programming. The president was willing to spend as much as three-quarters of a million dollars on the construction of a multi-kilowatt radio and TV complex that would serve the entire Denver-Boulder community.

Rautenstrauss further reported President Thieme as believing "student control over the radio station might not be responsive to the needs of the outside community—academic functions might suffer in favor of student needs because students seem to be more oriented toward power over organizations than toward defining the organizations' functions." Student input was not to be denied entirely, however, as the president's plan allowed for the possibility

that students might become employees of the station, and student curriculum projects might be broadcast as well as important student organization meetings.

On the day following Rautenstrauss' report, ASUC passed a resolution endorsing a radio station run by the students and which further outlined the station's functions and goals. The resolution stated that "the function of the radio station would be toward fulfilling the needs of student culture rather than primarily serving as a public relations medium for information of the general community." Responsibilities within the station were to be held collectively by the students, faculty, and the administration. The resolution specifically advised against sole direction by BAVI.

The collapse of this entire effort was the result of an eventual lack of funding. But it is really apparent that the genuine cause was an argument over politics, not money. The University had applied for a U.S. Department of Health, Education, and Welfare (HEW) matching grant in order to build and operate the station under the Joint Board's original plan of a student operated station. Under the grant the government would provide 60 percent of requested funds while the University was to come up with the remaining 40 percent. This meant that the University would be called upon to provide no more than \$20 thousand. The same President Thieme who had just previously been willing to commit three-quarters of a million dollars to a broadcast network was now unable to find \$20 thousand for student radio. Thus the HEW grant was rescinded and the radio effort died. Incidentally, CU's rejection of this grant is one of a very few instances of such in the history of these grants.

It must be remembered that during this time period, student rebellion was at an all-time high both here at CU and around the rest of the country as well. It may be imagined then that the president saw in the addition of a broadcast voice for the students the possibility that this facility would become simply a grand platform for student demands and ideologies from whence would arise only more revolt and campus disruption. Whether or not this would have been the case, though, one shall really never know. In any case, as noted in a Colorado Daily editorial of December, 1969: "even under the original compromise proposal, student control was not the question—students were to have shared responsibility."

As postscript to this story, two years later, during the '71-'72 academic year, another rekindling of interest in a radio station arose. According to Gary Svoboda, who was at that time President of ASUC,

and who is now assistant director of the University's Human Relations Office, it appeared that somehow, through all the turmoil of the effort of two years previous, the University had been granted an FCC permit to construct a radio facility but obviously no action had yet been taken on it. Naturally, when this became known, there was some excitement generated, but before any concrete proposals could be worked out the license expired and CU was once again left to begin anew.

Professor Miller's proposal

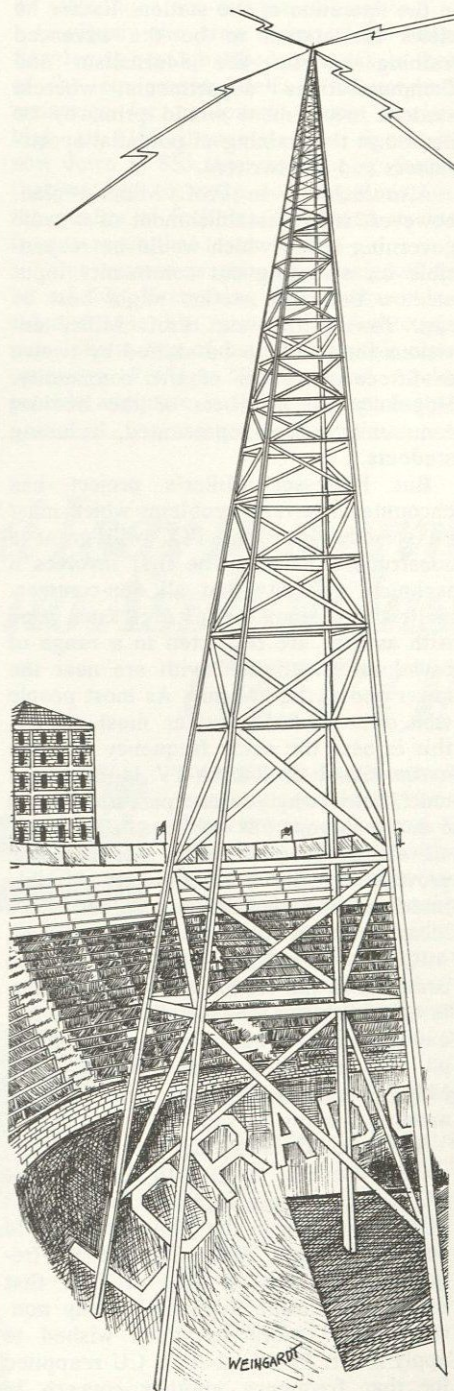
Just prior to President Thieme resigning his office in May of 1974 he contacted Professor Elwood "Woody" Miller, the new acting Director of the Educational Media Center (the new name for BAVI), and requested that Prof. Miller, who had succeeded Prof. Hill to this position, and his staff once again look into the possibility of establishing a radio station on campus. Obviously enthusiastic and ready to comply with the president's wishes, Prof. Miller shortly thereafter filed an application with the FCC on behalf of the University.

Basically, Prof. Miller's proposal differs little from the aforementioned plan for BAVI control of a non-commercial facility, but some interesting ideas (and problems) have arisen to augment the former plan.

Miller plans no implementation of a television facility into his system, explaining that "the cost of operating a television station versus the benefits it will afford are just too great." Rather his facility will center solely about the same equipment which was to be used five years ago, except that an initial thousand watt transmitter is being contemplated for use over the previous ten watt proposal. Because a studio exists in the stadium now, all that is required is a transmitter and a broadcast tower. Prof. Miller plans to broadcast in monophonic initially, and hopes to be on the air at least eighteen hours per day. "It would probably take a year before we could anticipate twenty-four hour broadcasting," he said.

The reason for the initial eighteen-hour format is that this figure is a requirement to qualify for membership into the National Public Radio (NPR) network of broadcasters of which Prof. Miller hopes to become an affiliate. "In the past five years NPR has become quite an extensive operation," commented Miller. "For a mere one hundred dollar per year subscription fee, NPR will supply an affiliate with up to fifty hours per week of programming. KUNC in Greeley and KCFR in Denver, which are the only NPR stations now operating in Colorado, utilize some of this programming during their broadcast day, but each station is free to use what it likes. In addition, being an NPR affiliate makes the station eligible for as much as \$50 thousand in programming grants."

Other sources of income for the station are envisioned by Prof. Miller in addition to possible NPR support. At present there is a bill in the Colorado state legislature which, if passed, would provide non-commercial broadcast stations with financial support. Public support drives, such were





just used by KCFR to raise \$40 thousand for them, are being considered. The University general fund is another source that can probably be depended upon and equipment maintenance support from HEW can be applied for once the station is up and on the air.

The last source of possible revenue mentioned by Prof. Miller involves the management of a subscription radio service which is being considered. It is possible for an FM station to broadcast as many as five simultaneous distinct channels of information within the same frequency bandwidth, only one of which will be captured by an ordinary FM receiver. Through the use of what is known as a sub-carrier circuit (SCA) at the transmission end, and a special receiver leased to those who wish to receive any one of the SCA channels, various community services can be offered by the proposed station. Muzak might be offered on one channel, whereas more directly beneficial programs are contemplated on the others. As many as five states now endorse the broadcast of information over SCA channels to "print-handicapped" persons—that is, persons who for some reason are unable to read newspapers or magazines. For them, an SCA channel might be devoted to the reading of these publications, thus giving these people access to current events, sports news, classified ads, and other information which is otherwise unavailable to them. The National Council for the Blind subsidizes the purchase of the special receiver which would be needed by those not able to afford it.

In addition, the University of Colorado is the National Repository for Audio Tape Programming for Educational Use and as a result now has the world's largest collection of audio tapes of educational programming. There are over 17 thousand tapes of non-copyrighted material on file in the stadium. Prof. Miller anticipates that many may be suitable for distribution on an SCA program subscription basis to any institution which wished to be a recipient of this service.

Unfortunately, Prof. Miller's plans do not include extensive student involvement in the operation of the station. Rather he views the station to be the advanced training lab for the Journalism and Communications departments wherein student involvement would primarily be limited to the training of potential sports-casters and newswriters.

Also included in Prof. Miller's plan, however, is the establishment of a radio governing board which would be responsible for sounding out community input on how the radio station might best be run. Toward this end Prof. Miller envisions the board to be staffed by twelve to fifteen members of the community. Hopefully, all members of the Boulder community will be represented, including students.

But Professor Miller's project has encountered several problems which must be solved before the FCC will grant a construction permit. The first involves a technical difficulty that all non-commercial radio stations in this area must cope with as they are restricted to a range of broadcast frequencies which are near the lower end of the FM dial. As most people who own an FM receiver must realize, this is near the same frequency that the audio signal of KRMA-TV is broadcast on. (That is why you can pick up channel 6 audio on your FM receiver.) Therefore, all non-commercial radio stations must provide for the correction of possible interference with KRMA's signal. CU's idea, which has met with FCC approval, will be to provide all persons who complain to the station about audio interference with the free installation of a frequency selective trap which will filter out all the unwanted audio signal. Prof. Miller does not anticipate that this will amount to many persons.

The second problem, yet to be resolved, concerns itself with the fact that CU is not the only applicant for the 89.3 MHz. spot which the University would wish to occupy. After CU lost its frequency allocation in May of 1972 that frequency became available to any non-commercial enterprise which wished to apply for it. Months before CU reapplied for that frequency another concern in

Denver, known as Granfalloon, had applied, thus adding a major complication to an otherwise routine process. Granfalloon not only has the fact that it filed first going for it, but also it will, of course, be serving a larger population base than a Boulder station. Prof. Miller believes that CU ultimately has the edge in this argument because he believes that CU can present to the FCC a more community oriented service—the University intends its programming to be broad enough in scope to serve the needs of all kinds of people. Besides this fact, as a non-commercial venture Granfalloon will conceivably be serving the same audience that KCFR now serves and the FCC is not likely to allow for a duplication of services. The FCC prefers not to referee a court fight, however, and, at present, CU attorneys are attempting an out of court settlement with Granfalloon.

According to Prof. Miller, President Rautenstrauss has been very supportive throughout these efforts and he is doing what he can to see that this project becomes a reality. Prof. Miller's "objective now is to get this station on the air as a CU centennial station." Interestingly enough the year 1976 will also mark the fiftieth anniversary of radio silence on this campus.

The S*O*A*R proposal

There is another effort, however, which has been entirely researched and organized by the students of the University, and it is known as the Student Organization for the Advancement of Radio (S*O*A*R). While this organization has been in existence for only a short period of time, much talent and effort has been expended these past few months toward attaining its goal of a student-run facility. A petition of students now indicates that nearly five thousand persons on this campus are aware and supportive of this group's goals. Because S*O*A*R is working under the obvious limitations of a lack of time, money, and expertise their plan is perhaps not as airtight as Prof. Miller's. However, this group is serious, enthusiastic, and has the backing of a great percentage of the student body.

Michael Rowden is the chief engineer of the S*O*A*R project. He received his bachelor's degree in electrical engineering from MIT and his professional accomplishments thus far are many and varied. He has served as a systems engineer at Caribou Ranch and other recording studios. In an interview with Mike he indicated his optimism over the student radio project.

"Hopefully, by the end of this semester, we should have student support for the financing of this project,"

Rowden stated. Whether this financing will take the form of a bond issue or a referendum on student fees is not well known now. This is a question that will probably be answered by the time this magazine goes to print. In any case, S*O*A*R is hoping to raise \$100 thousand for the construction of a brand new 1000 watt facility which is designed to broadcast in stereo and for twenty-four hours a day. "We may have to shut down for six hours out of every month at most for transmitter adjustments," said Mike. "Otherwise there is not that much maintenance that this equipment should require, though there will be a person with a first class FCC license available at all times in case of emergencies. If the station were to operate at greater than a thousand watts, then a first class engineer would be required on the premises at all times—this way he is simply required to be on call."

At this point S*O*A*R intends to establish a non-commercial service but also hopes to be a revenue making venture through the support of area advertisers who would be encouraged to pledge grants which would then be acknowledged by the station.

"The search for a commercial frequency, though it was our original intention to have one and thus channel all profits back into the University, would have been a very costly endeavor and would most likely take over two years to complete," according to Rowden. "The students of the University just don't have that kind of money or patience. But even if we establish a non-commercial facility, once the initial cost has been absorbed it will require less than sixty dollars per day to cover all operating expenses, including paid employees. That kind of money can be raised by a non-commercial station."

Obviously the area about which Mike Rowden is best qualified to speak is that of the equipment itself. "Our original estimates for equipment alone ran as high as \$150 thousand—that figure is now down to \$53 thousand but we found that we had to make no compromise in the quality of facilities we intend to deliver to reach that lower figure."

"Our system is primarily designed to be reliable. Everything that we have decided to use has proven itself through many thousands of hours of trouble free operation. Perhaps \$25 thousand would provide adequate facilities for any ordin-

ary station but this facility is intended to be anything but ordinary. We intend a more sophisticated setup than is basically necessary in order to optimize the educational benefits to be provided by this facility. We expect that this equipment will be used heavily and mercilessly by many people and it has been chosen with just this fact in mind."

S*O*A*R's plan calls for the construction of two production facilities as well as a broadcast booth and transmitting facilities. One production facility would be used as a news room and interview studio while the other, which is to be more expensively outfitted, would serve as professional recording facility for use by University choral and concert groups as well as local talent. At present S*O*A*R plans to broadcast a predominantly student oriented programming schedule, but also plans to air important city council and UCSU meetings. Campus speakers would be broadcast as well, but the system is by no means limited to broadcasts originating from this area. Because the system can be linked with conventional phone lines, quite conceivably a broadcast could originate from virtually anywhere.

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The problems which S*O*A*R faces are serious. Funding for this effort continues to be the major question. A bond issue, while less expensive to each student per semester, is nonetheless enormously expensive over the course of twenty or thirty years. The only other alternative, while conceivably unpopular with those who wish to lower student fees, would be to levy an additional \$1.75 per semester against the student fees. That way the initial expense would be paid in just two years and the saving realized to the student body in general would be on the order of \$100 thousand over what a bond issue would cost.

The other major problem concerns the acquisition of an FCC construction permit. S*O*A*R does not wish to apply for a commercial frequency but realizes that if it applies for a non-commercial license under the University's name that it will eventually come into direct conflict with the two litigants who are already battling it out.

The best of both proposals

All of the preceding, however, was the state of affairs of three weeks ago. Since that time much has taken place which leaves one with an even more optimistic

feeling about CU's chances for eventually having a radio station.

On April 21, Mike Rowden and Pete Rybacki (the chairman of the S*O*A*R committee) had a conversation with Professor Miller in his stadium office. Their intent was to seek an understanding over a proposal which would best serve the interests of the University community in general. Out of this meeting came the realization that, while the two efforts differed somewhat in their respective approaches to the problem, both were in agreement over basic goals. Thus a combining of the two efforts ensued with the understanding that each would be able to realize the best aspects of their respective plans. That is, Prof. Miller would be free to initiate extensive sub-carrier service while the S*O*A*R people would be left to construct their main broadcast facility as originally proposed.

They have each agreed to a supervisory Radio Communications Board to be comprised of nine persons, seven of which will be students. As proposed, this board will be charged with the responsibility of maintaining the financial and programming viability of the station. Any accumulated revenue which is over and above normal operating expenses will be

channeled back into the University central reserve thus helping to lower student fees.

The construction site for the facility has not been decided upon, but several alternatives are being considered. Among them are a building at the intersection of 33rd Street and Walnut Avenue, and the much less expensive but much less roomy studio already in the stadium.

This leaves but one problem to be dealt with; that, of course, is money. Because the equipment and construction expenditures are based upon the S*O*A*R proposal, over \$100 thousand must be raised before construction can begin.

In an effort to raise this money, on April 24, Professor Miller and several S*O*A*R representatives appeared before the UCSU Executive Council. At this meeting they requested, and were granted a referendum proposal for funding of the radio project (the results of which should be known by the time you are reading this article.) Briefly, the referendum is to solicit student support for the station in the way of two years of increased student fees. If the referendum is passed then construction can begin as soon as the license question is resolved.

Fundamentally then, the question of whether or not CU will soon enjoy the benefits of having its own radio station has now been left to the students to decide. The sum total of monies requested of the students is considerable, to be sure, but one feels the expenditure to be well worth the undertaking.

Assuming that the students decide to support this proposal, they must also be reminded that their support only begins with the passage of this referendum. Because you will have paid for this facility it then becomes your responsibility to maintain it in whatever way you, as a collective body, best see fit.

Whatever final form the station takes will ultimately be up to you. Its proper functioning will require your constructive criticism, and your constructive recommendations. After all, you have waited long enough for a campus radio station and you certainly don't want to lose it again. □

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RICHARD TALLON
PROP.

E-days 1975

Recognize any of this? If you don't, just flip the page and rest your apathy elsewhere—you missed E-Days, and nothing in these words or scenes will make up the loss.

If you were there, remember the diehards in the Dean's Challenge; the narrow escape of the civils from the clutches of SWE (EDEE wasn't nearly so difficult); Bruce Rowan, Tim Doll, John Norris and their paper wonders; the *Poseidon* and crew (and others less skilled); the purple screw-er; Steve's sidewalk omelet; Darrow's rubber arrows; the dancing and suds and sunlight and the locomotive that nearly demolished the Engineering Center . . .



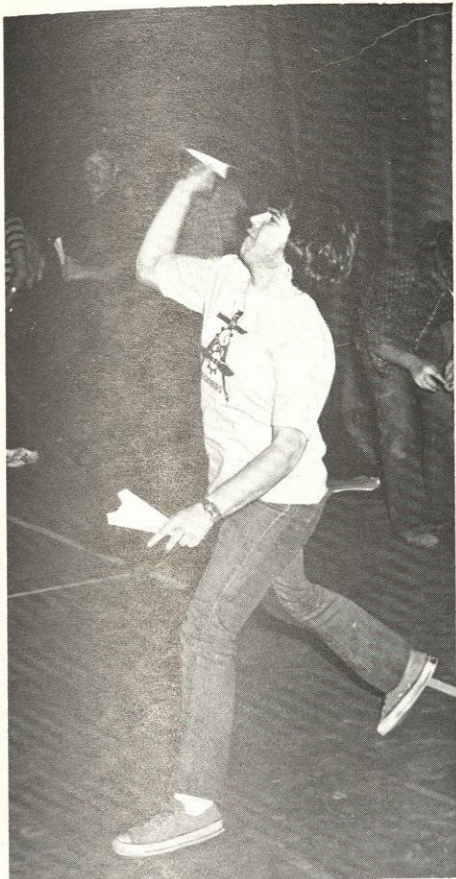
Chaos in the lunch line.



The Beer Elf?

Later at the dance.



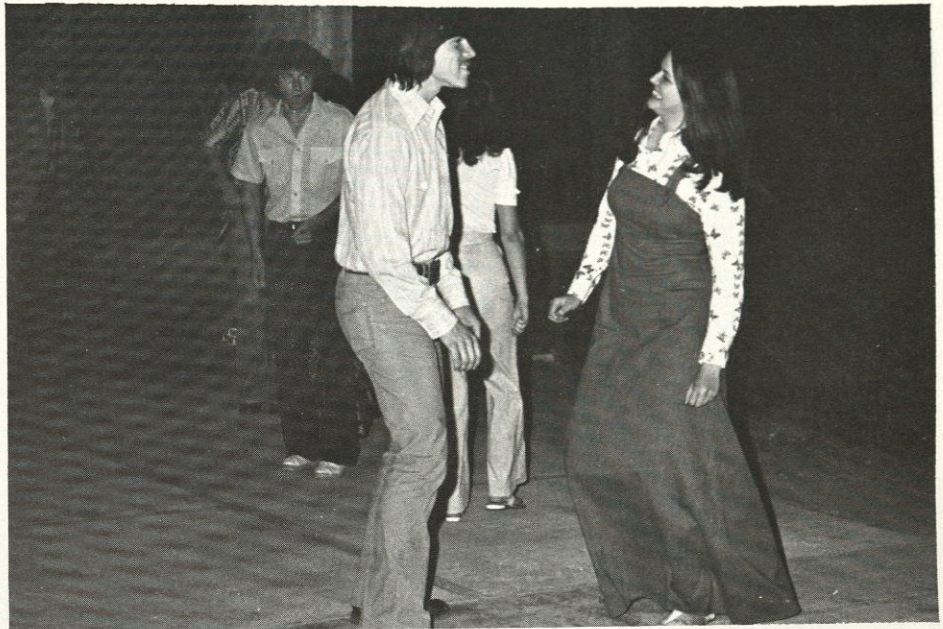


Tim Doll displaying his winning form.



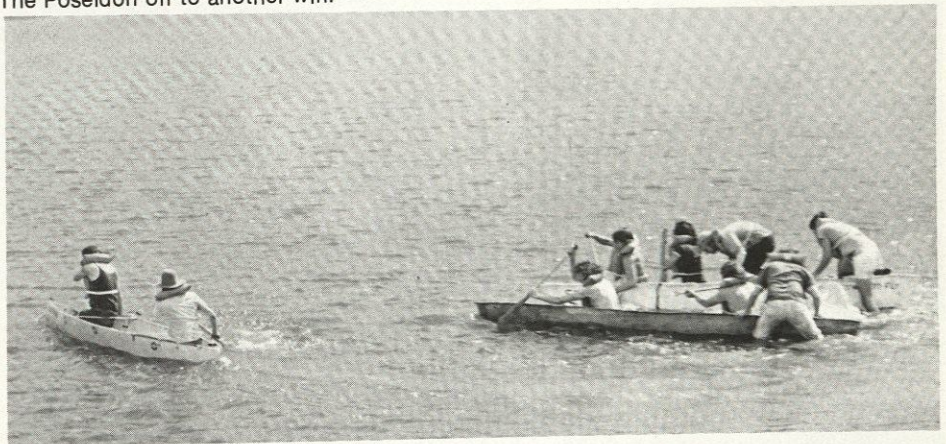
Engineer at work. . .

Strike three! You're out.

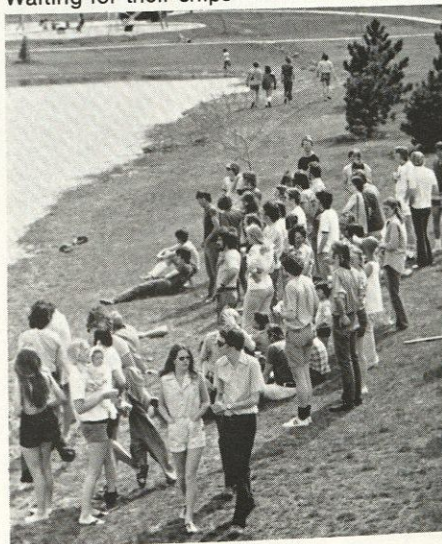


Getting it on at the dance.

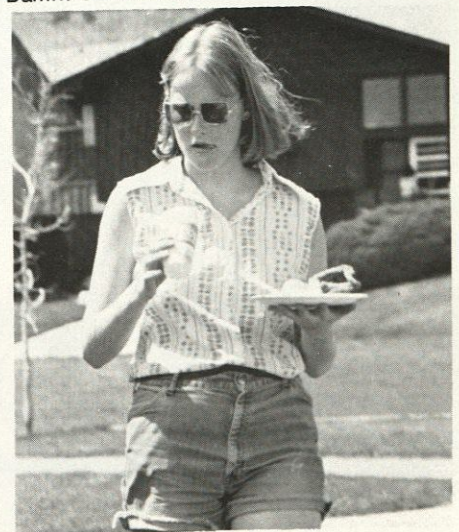
The Poseidon off to another win.



Waiting for their ships to come in.



Damn! Out of beer.



CU's Alumni Astronauts

Three graduates have already flown in space and a fourth is scheduled to be a member of the Soyuz-Apollo mission this summer.

by Donna Edens

A personal thank you from the author to Mr. Carpenter and Mr. Swigert for their telephone interviews, and to the National Aeronautic and Space Administration for their courteous help.



Scott Carpenter

During the 1960s, the "race to space" initiated a direct and somewhat unfriendly confrontation between two super powers struggling to develop their space technology. The race began October 4, 1957 with the launch of the Russian spacecraft Sputnik I, the first man-made earth satellite. The finish line was Tranquility Base, reached on July 20, 1969, by the slow-starting, but evenly paced Americans. Since the first lunar landing, Americans have launched six more Apollo missions and three Skylab crews into space.

The next space mission, however, is designed to serve as a culmination of both Soviet and American technologies. Friendship will be demonstrated between the two this July 15 with the docking of Soyuz and Apollo capsules. However, the "race" to space is not yet over, although the term has taken on a different meaning. There is an informal, undeclared competition between many universities across the country for the honor of having graduated the largest number of astronauts that have actually flown in space.

C.U. ranks third in the competition, trailing behind M.I.T. and the University of Michigan. M.I.T. has had eight graduates launched into space; the University of Michigan, six; and C.U., four. Three C.U. alumni have flown into space thus far, but a fourth is scheduled to do so in the July mission.

The four alumni that C.U. can claim as her "own" are Scott Carpenter, John Swigert, Stuart Roosa, and Vance Brand.

Scott Carpenter may perhaps be identi-

fied more closely with Boulder than the other three because he was born and raised here. He graduated from Boulder High School and then attended C.U. Mr. Carpenter inspires optimism in every student by revealing, "I was in the class of '49, but I flunked thermodynamics and didn't get my degree until '62." The University awarded him his degree then for "his contributions to space technology."

Carpenter entered the U.S. Navy in 1949, where he received flight training and became a flight test pilot. He was selected as one of the original seven astronauts in 1959 because of his flight background. He piloted the second American manned orbital flight in the Aurora 7 capsule (named after his former Boulder address).

After his flight, Carpenter monitored the design and development of the lunar module. "I left (NASA) in '67," states Mr. Carpenter, "to go back to manage the Navy's underwater program, Sealab III." For his participation in Sealab, he was awarded the Navy's Legion of Merit. Carpenter left the Navy in 1969 and entered private business.

Mr. Carpenter, now living in Los Angeles, heads a group called EDICT (Ecology Development and Implementation Commitment Team) which is under contract with the state of California. EDICT is studying the production of fuels from solid and agricultural waste.

Although Scott Carpenter is now involved in environmental projects, he nevertheless remains interested in space development.

John (Jack) Swigert, born and educated in Denver, attended C.U. and graduated in 1953 with a degree in mechanical engineering. Swigert then joined the Air Force, where he received pilot training. After serving as a jet fighter pilot, he held a position as engineering test pilot before joining NASA.

Jack Swigert was one of the nineteen astronauts selected by NASA in 1966. Assigned as the backup command module pilot of Apollo 13, Swigert was substituted for Thomas Mattingly only 72 hours before the launch. The prime crew had been exposed to German measles, and Mattingly, having no immunity to the disease, was therefore dropped.

Apollo 13, enroute to the moon, experienced a sizable explosion. "Hey, we've got a problem here," Swigert told Mission Control. "Actually, we didn't really know what had happened," Swigert stated in a telephone interview. "The warning signals in the spacecraft had indicated that it was an electrical problem. It wasn't until later that we were able to assess that it was a problem with the



John Swigert

oxygen tank." The oxygen pressure readings rapidly fell to zero, and all thoughts of a lunar landing were abandoned.

The lunar module was adopted as a lifeboat. The astronauts, with the aid of NASA technicians, were able to bring Apollo 13 safely home.

Mr. Swigert, now in Washington D.C., is the Executive Director of the Committee on Science and Technology. "It's a committee of the House of Representatives which specializes in research and development. It has under its jurisdiction the space program and NASA, and the National Science Foundation," explains Swigert. "I think there's a chance to

really do something for the country in this job."

Stuart Roosa, born in Durango, attended C.U. under the Air Force Institute of Technology Program. Roosa graduated with honors and a degree in Aeronautical Engineering. Prior to joining NASA, he was both a maintenance flight-test pilot and an experimental test pilot for the Air Force.

Mr. Roosa, like John Swigert, was selected for astronauts training in 1966 because of his flight background. Roosa was command module pilot of Apollo 14, man's third moon landing.

The flight was accompanied by a serious technical problem which occurred



Stuart Roosa

three hours after lift-off. At the end of the docking maneuver, Roosa had to make six attempts before he succeeded in docking with the lunar module. It is theorized that ice formed on the capture latches since no mechanical failure was indicated.

While Roosa's companions explored the lunar surface, Roosa was busy piloting the command module in lunar orbit, conducting experiments, and taking photographs.

Mr. Roosa is currently continuing as an astronaut with NASA.

Vance Brand, born in Longmont, graduated from C.U. in 1953 with a degree in business. Mr. Brand then served with the

U.S. Marine Corps as a jet fighter pilot, and returned to C.U. to obtain a degree in Aeronautical Engineering in 1960. Brand was then employed as a flight test engineer and later was transferred to the experimental test pilot ranks.

Vance Brand also was chosen by NASA in 1966 because of his jet pilot background. Brand has been a back-up crewman for five missions, and this summer he is scheduled for his first flight: the Apollo-Soyuz mission.

The Apollo-Soyuz Test Project (ASTP) calls for the docking of a U.S. Apollo and a Soviet Soyuz spacecraft in earth orbit to test compatible equipment and procedures for rendezvous and docking. The major

objective of the program is the in-flight testing of a jointly-designed docking mechanism, making emergency rescues possible.

The ASTP was inspired by the movie "Marooned," which depicted American astronauts stranded in orbit and a rescue attempt by Russian astronauts. Both governments, impressed with the idea behind the film, began expanding scientific contacts and started discussing the design of a common docking mechanism. ASTP was born.

The Soyuz will be launched July 15, followed seven and one-half hours later by the Apollo. The two spacecrafts will dock and both crews will perform various experiments for two days. Then they will undock; the Soyuz remaining in orbit two more days, the Apollo a little over three. The total duration of the Apollo mission will be nine days.

The American crew, Thomas Stafford (commander), Donald Slayton (docking module pilot), and Vance Brand (command module pilot) have been training with their two Soviet counterparts for years. Not only has scientific knowledge been shared, but also culture and friendship. This friendship between the space explorers not only fosters better political relationships, but creates a "family" feeling of trust among the men. "We feel we have a very good relationship with the Soviet crew," Brand said. "We think knowing each other well will pay off in space."

This feeling of trust must be transmitted to the machinery itself. The Russians recently experienced a third-stage rocket failure which sent two cosmonauts to an emergency landing in Siberia. There is some concern over the safety of the astronauts because of this recent mishap. Mr. Swigert comments, "From what little I know, the problem was in their booster, so if the Russians experience the same problem they'll never get into orbit. This means that we'll never have a rendezvous. In that respect, there is no compromise in safety for the American flight crew. I think the Russian space program has demonstrated that whatever problem they've experienced, they'll work very hard to solve it. I really don't feel that there's any reason to worry for safety purposes." However, Swigert candidly stated that he did not think the U.S. would learn anything new from the Russians in terms of spaceflight technology.

After the completion of the Apollo-Soyuz mission, the U.S. has no manned flights scheduled until the 1979 space shuttle. During this program, the shuttle will be launched into space, experiments will be performed by "passengers," and

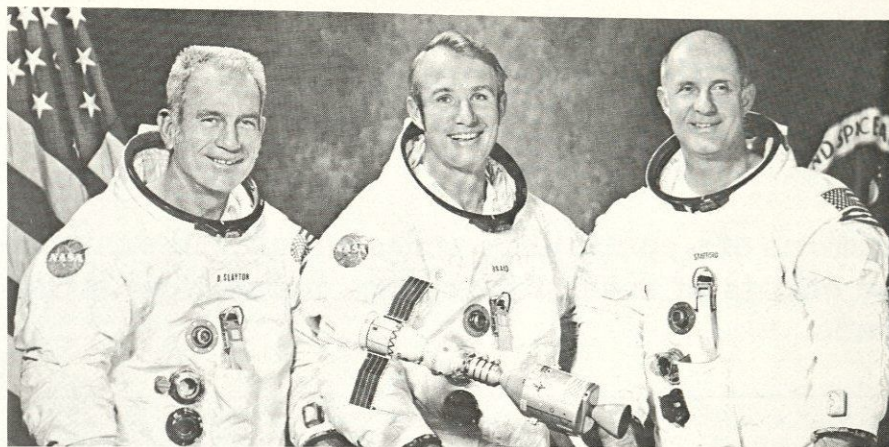
the shuttle will then be piloted back to earth. The shuttle spacecraft is being designed for as many as 100 flights.

All four alumni astronauts have one obvious element in common: they were able to become involved in the space program because of their flight background. With the initiation of the piloted space shuttle, will astronauts be required to have extensive flight training?

Jack Swigert replies, "I think you're going to find pilot types whose job it is to be able to get the vehicle into space. You're going to find the mission specialists who know the spacecraft and the systems and have a scientific background of their own. You're going to find scientists who work in a laboratory at a university who are going in space to perform a certain experiment. They'll be reasonably healthy people that you see every day on the street. You're going to look at crew members flying in the shuttle program who are specialists in a particular field."

Carpenter, Swigert, Roosa, and Brand are NASA astronauts with flight backgrounds. They are also C.U. alumni with degrees from the College of Engineering and specialists in their particular field.

In the future, we are likely to see more scientists and engineers in space. To date, C.U. had educated over ten percent of NASA astronauts, and the "race to space" is far from finished. These men are more than proud statistics; they are former students whose engineering education at C.U. gave them a scientific background to build on, and perhaps influenced them to reach out into space. □



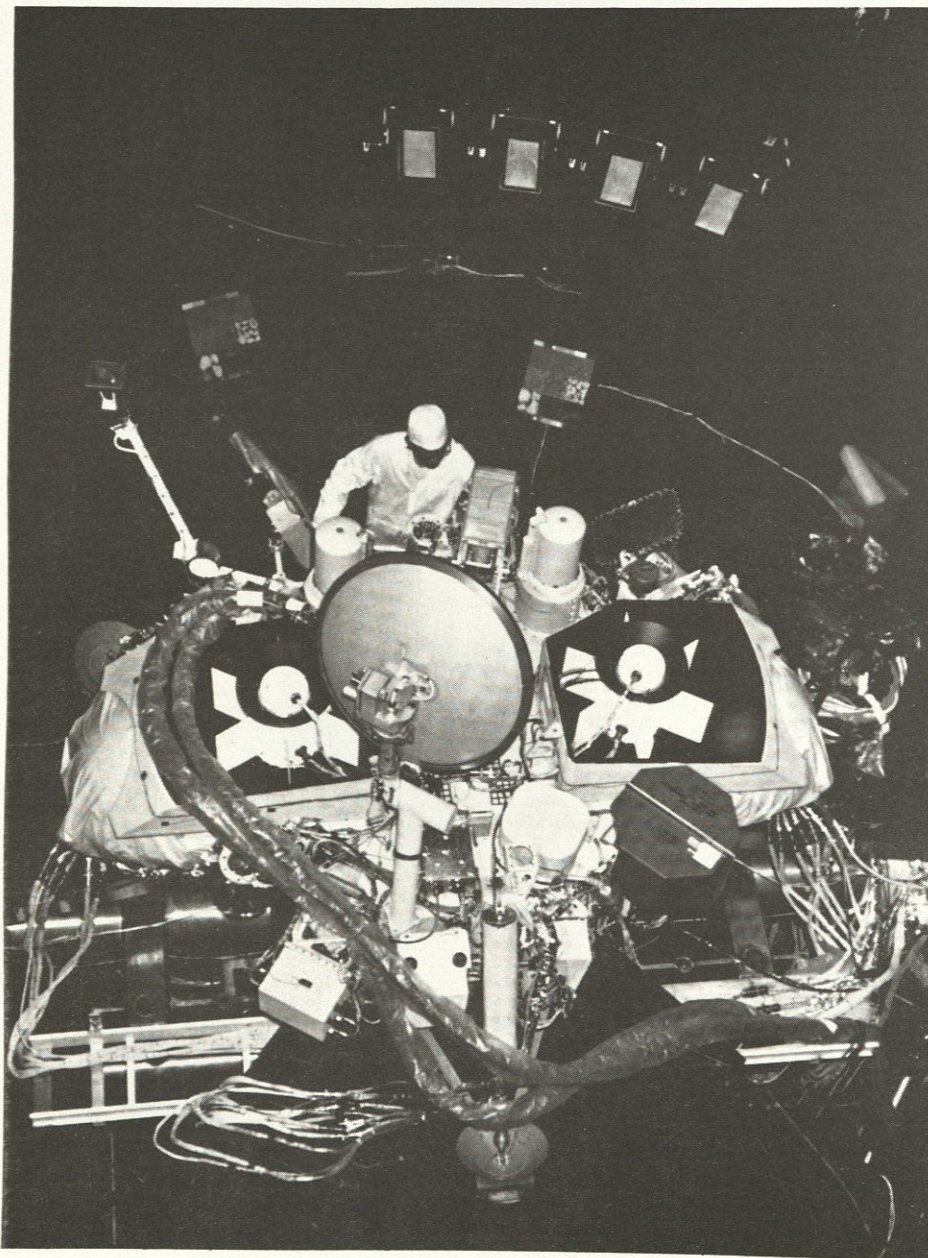
Vance Brand



Martin Marietta

Part one of a continuing series which will examine the efforts of several aerospace industries in Colorado.

by Tim Doll



Martin Marietta employees put the finishing touches on one of the Viking Mars landers at the MMA Denver plant.

Martin Marietta Aerospace (MMA), Denver division, is located about fifteen miles southwest of Denver on Highway 75. This complex is one of the largest and most important suppliers of aerospace and related products in the United States. With over 4,000 people employed by Martin Marietta Denver and an annual payroll of over \$21.8 million, MMA is a vital part of the Denver area economy.

Martin Marietta Denver also has subdivisions in Cocoa Beach, Florida; New Orleans, Louisiana; Huntsville, Alabama; and Vandenberg AFB, California.

Current work at the Denver division is mainly concerned with three areas: construction and assembly of the Titan III launch vehicles; construction and testing of the Viking Mars lander; and research and development, evaluation, testing and assembly of spacecraft and transportation subsystems.

At the present time the vast majority of the facilities, time, and money at MMA is being spent on the construction and assembly of Titan III launch vehicles. The Titan III is used by both NASA and the Dept. of Defense and is the third in a family of highly successful launch vehicles.

The Titan I was the first in the family. Also manufactured in Denver, it was used by the Air Force as the first intercontinental Ballistic Missile (ICBM) to be stationed in underground launch silos and was the first liquid propellant rocket to start its engine in flight.

Following in the footsteps of the Titan I was the Titan II, an improved ICBM. The Titan II is still our country's most powerful deterrent against surprise nuclear attack. The Titan II was adapted, manufactured, and used as the launch vehicle for the Gemini manned space program which launched ten two-man teams of astronauts into earth orbits.

The Titan III is a product of the knowledge gained from the first two Titans series. It is designed as an all-purpose

launch vehicle. By starting out with an advanced version of the two-stage Titan II, and by adding a third stage (transtage) which can start and stop its engines in flight, you have the basic Titan IIIA. If you replace the transtage with an Agena upper stage, you have a Titan IIIB. Take the Agena off, put the transtage back on, and add two ten-foot diameter solid propellant strap-on motors and you have a Titan IIIC. Take the transtage off the Titan IIIC and replace it with a high energy Centaur upperstage and you have the Titan IIIE/Centaur. Take off the solid propellant strap-ons and leave off the third stage entirely and you have a Titan IIID. With all these options to choose from, MMA can supply a Titan III launch vehicle for just about any conceivable need.

The Titan III has several other things going for it besides its modular construction, including some unequalled by any other "large" rocket produced anywhere in the world. Since its first launch in April, 1967, the Titan III has achieved an unbroken record of 67 consecutive successful launches. It has also achieved the most perfect circular orbit for a satellite—less than a .04% deviation from the circular. The Titan III has also placed more satellites in an equatorial orbit (a synchronous orbit over the equator) than all other U.S. launch vehicles put together.

The Titan IIIE/Centaur is the newest addition to NASA's stable of launch vehicles, and will probably remain so until the Space Shuttle becomes operational sometime in 1979 or 1980. A Titan IIIE/Centaur will be used later this year for the launch of two Viking Mars landers which are scheduled for a July 4, 1976 landing on Mars.

... the Titan III has achieved an unbroken record of 67 consecutive successful launches.

Martin Marietta Denver division is the prime contractor for NASA's one billion dollar Viking Mars lander project. NASA and MMA claim that the Viking Mars lander is the most advanced, most complex scientific instrument ever built by Man. There will be two Vikings sent to Mars to insure that at least one of the spacecraft is successful, and to obtain a maximum amount of data. The Vikings will be launched on separate rockets during August of this year to start their eleven-month, 440 million mile trip to Mars. When they arrive at their destination the two Viking spacecraft will enter

highly elliptical (930 by 20,500 mile) orbits. They will then circle the planet for a period of from 10 to 50 days doing mapping and landing site reconnaissance. After its landing site is confirmed, the Viking orbiter will release the 2,400 pound lander for its descent to the Martian surface. After the lander has entered the Martian atmosphere, it will discard its protective heat shield and release a 50 ft. parachute to slow its descent. When the lander is one mile above the Martian surface it will jettison the

graphs for chemical identification, 40 thermostats, 22,000 transistors, 18,000 other electrical parts, and 43 miniature valves. An extendable scoop will then reach out as far as ten feet from the lander and pick up soil samples. These are then dropped into the biology unit which tests the samples for chemical composition in addition to testing for signs of life.

In addition, the lander will take pictures of the surrounding area and transmit them back to earth along with the

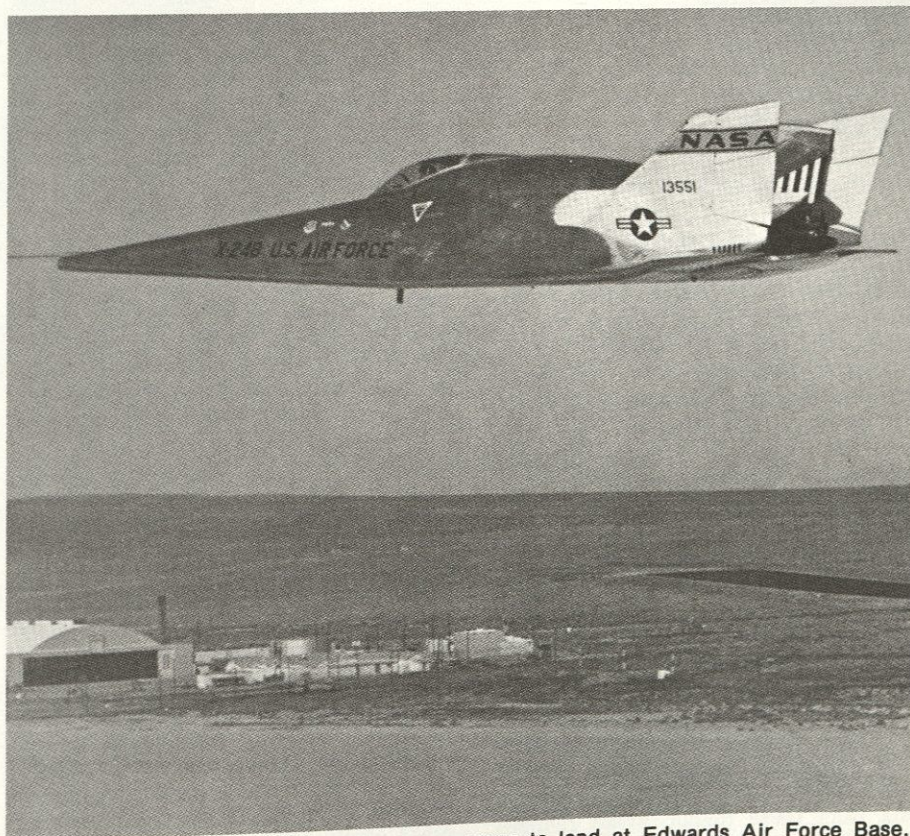
... improved aerodynamics of the X-24B has resulted in radically improved performance, including a three fold increase in gliding range.

parachute and begin firing its retro rockets to achieve a soft landing.

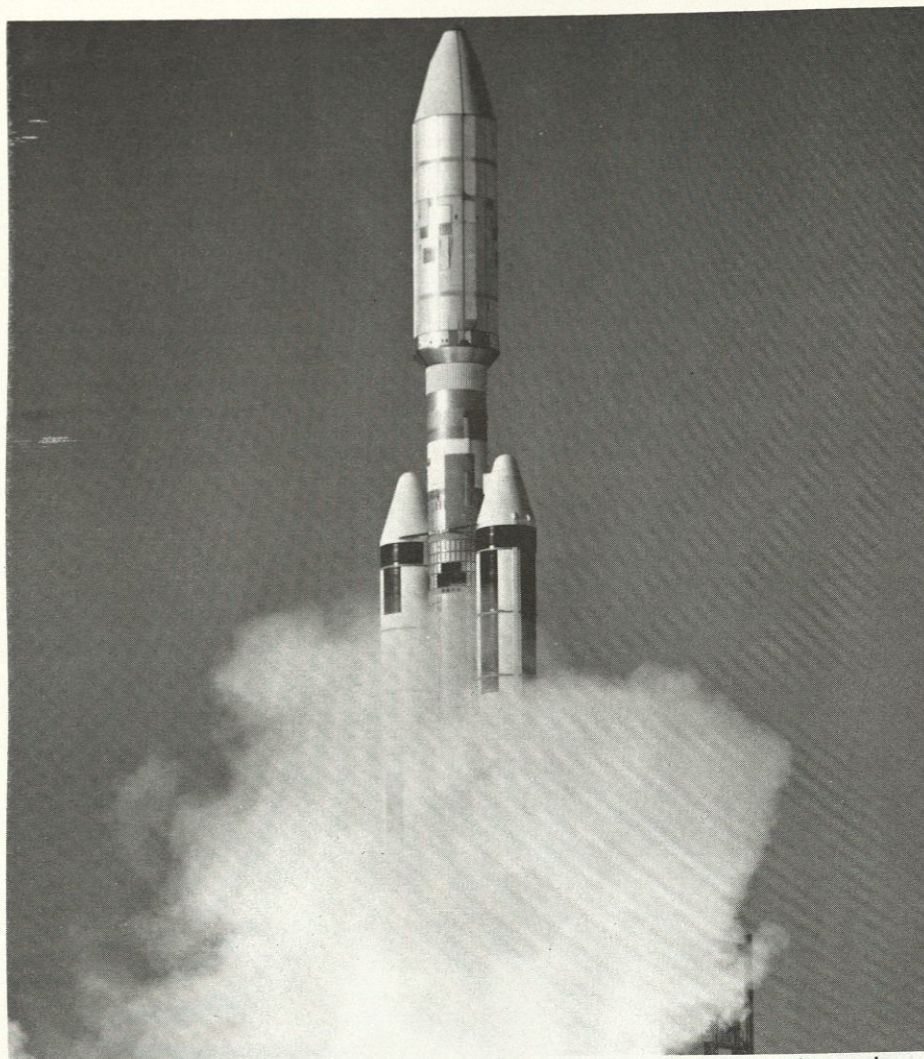
Now the complex mission starts. MMA engineers have put the equivalent of several full-sized laboratory rooms into a one cubic foot biology unit. This unit contains three completely automated chemical labs to test for three signs of life: photosynthesis, metabolic activity, and respiration. In this biology unit is a computer, several tiny ovens, counters for radioactive tracers, filters, a lamp to simulate Martian sunlight, gas chromato-

data from the soil samples. The lander also contains instruments to study the Martian atmosphere, as well as a seismometer to detect volcanic activity, meteor impacts, and internal planet structural shifts (earthquakes).

The lander is designed to continue all tests and operations for 90 days after landing. To insure that all 90 days can be used to an optimum degree, the lander has its own built-in nuclear power source to furnish itself with uninterrupted power. It was realized that solar cells



MMA's X-24B, advanced lifting body, prepares to land at Edwards Air Force Base, California.



A Martin Marietta Titan III/Centaur lifts-off from Cape Canaveral carrying a simulated Viking payload into earth orbit.

may not receive sufficient light during the frequent Martian duststorms to power the lander. After 90 days much of the biology lab, as well as other instruments, will be unable to function, however, other systems on the lander may continue to operate and send data back to earth for over a year. Furthermore, while the lander is testing the Martian soil and atmosphere, the orbiter will remain overhead mapping the planet for several months.

In the area of spacecraft subsystems, MMA has also been quite busy. MMA built the multiple docking adapter and was prime contractor for the highly successful solar telescope used on Skylab. MMA also designed and built the X-24A and X-24B advanced lifting bodys. The Air Force and NASA conducted twenty-eight successful manned flights on the X-24A between 1969 and 1971. Using the data from these flights, MMA retained the same basic design of the X-24A but

extended the nose, increasing the overall length from 24.5 ft. to 37.5 ft. The resulting X-24B is currently being tested at Edwards Air Force Base in California. The improved aerodynamics of the X-24B has resulted in radically improved performance, including a three-fold increase in gliding range.

When near disaster struck the Skylab mission, Martin Marietta employees started working twenty-four hours a day developing and submitting ideas to save the two billion dollar laboratory. After NASA had decided on the method to be used, MMA employees still went without sleep, this time modifying the MMA built experiment package that was used to hold the chosen solar curtain. When the Skylab crew was able to extend the parasol sunshade that turned a possible disaster into an unprecedented success, it was in no small part due to the hard work of MMA employees.

The future appears to be fairly bright

for MMA at this time. Although the Viking project will be drawing to a close with the launching of the spacecraft in a couple of months, talk is already being heard of using the basic Viking design for future Mars missions. Since the research, development, and testing has already been done, further Mars missions using the Viking as the basic spacecraft could be flown at a minimum cost. For example, there is talk of putting wheels and a motor on the Viking and driving around the Martian surface. Another possibility is putting a small rocket on top of the lander, having the lander scoop up some soil and place it in the rocket. The rocket would then fly to a rendezvous with the orbiter. Then the orbiter would return the sample to earth where it could be retrieved by a Space Shuttle mission. The possibilities are endless—and all would mean an abundance of business for MMA.

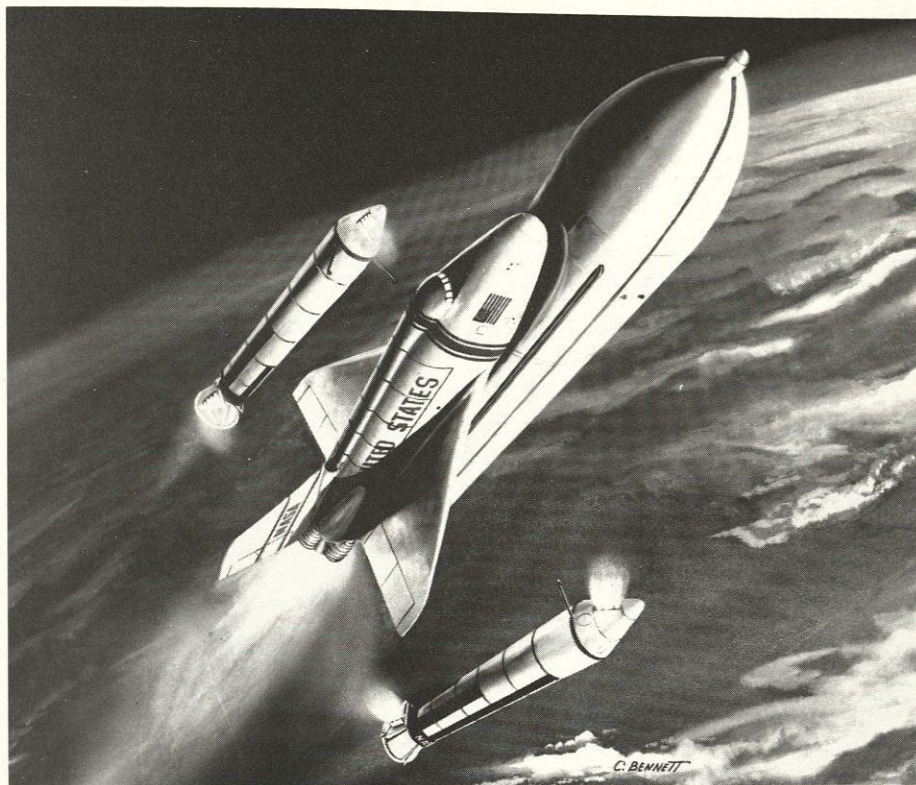
The Titan III launch vehicle is expected to stay busy, at least until the Space Shuttle becomes fully operational, and possibly thereafter. MMA has also been selected as the prime contractor for the external fuel tank for the Space Shuttle. MMA is to produce three test tanks, six flight models, and a possible maximum of 24 tanks per year for as long as the shuttle is operating, since the external fuel tank is the only structural part of the shuttle that is expended on every flight. The NASA plans call for an all aluminum tank 153 ft. long and 27 ft. in diameter, making it the single largest piece of the space shuttle. Internally the tank is sub-divided into two separate tanks, one for the propellant and one for the oxidizer, for a total weight of 1.55 million pounds. MMA also has been contracted to do R&D work on parts of the large space telescope, one of the first payloads scheduled to be orbited by the space shuttle.

MMA is also prime contractor in the now dormant Sprint Anti Ballistic Missile (ABM) system. Since equipping the only allowed U.S. ABM site, the Sprint system has been put on standby; but if disaster should strike and the SALT agreement should fall apart, the Air Force has plans for a new, improved Sprint to be developed and produced by MMA. The Sprint and Sprint II programs have already proved to be highly successful. In tests the Sprint missiles have been launched at simulated ICBM's seconds before they are due to impact, and have intercepted the simulated warheads at a safe altitude.

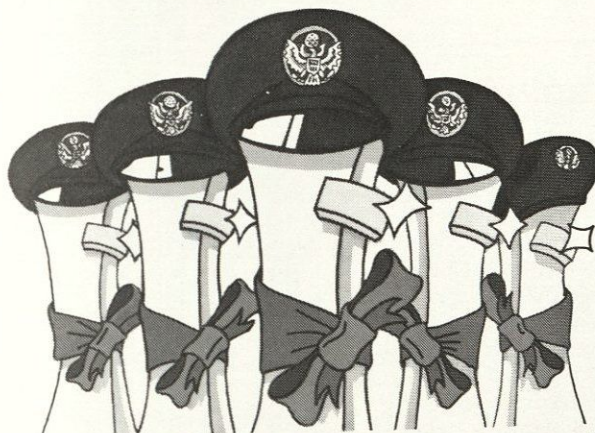
Martin Marietta is a diverse corporation. In addition to Aerospace, there are four other divisions. MM Cement, MM Aggregates, MM Chemicals and MM

Aluminum. The aerospace division is not Martin Marietta's chief profit maker, either. In 1974, although 44% of Martin Marietta's net sales came from the aerospace division, only 13% of their profits came from it. In contrast, only 27% of MM net sales came from aluminum, yet it accounted for over 45% of their profits.

After a very successful 1974, which saw Martin Marietta's net sales boom to over 1.2 billion (an eighty million dollar increase over 1973), and net earnings soar to new highs as well, Martin Marietta is sitting in a very comfortable position and with a bright outlook toward the future.



An artist's conception shows the Space Shuttle separating from the solid propellant boosters. The large external fuel tank is being manufactured by Martin Marietta Aerospace.



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Professor Leo Novak

An appreciation extended in behalf of the many grateful students he has befriended over a distinguished thirty-two year career.

by June Goodman



Leo Novak recently received the Charles Hutchinson Memorial Teaching Award and everyone seems to agree that teaching is indeed what Leo does best. In accepting the award Leo commented that he always tried to follow the example of Hutch, especially in his careful preparation of lectures. "Most people think that a professor can look over his notes two minutes before a class and then put on a good lecture. You can't do it. Hutch was always in his office at seven o'clock to prepare for the eight o'clock lecture."

The letters written in support of his receiving this award are evidence of the high esteem held for him by those who know him. As a former student of Prof. Novak, CU president, Roland Rautenstrauss stated, "He inspired those of us who have gone on to teach to teach better." And in the words of Mr. H. G. Isbel, "He instilled a sense of professionalism and inspired many people with a positive attitude; I've never seen him negative." One theme that was repeated time and again, "He is the type who always comes to mind when alumni think of their undergraduate years and those who influenced them most in preparing for their careers."

Leo Novak is now retiring from CU after teaching here for 32 years. He came to the University in 1938 after receiving both a B.S. from Iowa State College and an M.S. in Civil Engineering from A & M College. He taught here until 1941, and then served active duty in the Army Corps of Engineers until 1946. He has spent the past 29 years teaching at CU.

The fame that this man has to his credit is not a mountain of technical papers, books, or financial fortune, but rather it is the successful careers of those to whom he has so faithfully dedicated his life. His reward has been the admiration and deep devotion that so many of his former students and friends hold for him.



Dr. Tulin, chairman of the Civil Engineering Department and former student, had this to say, "I had him for several structures classes in my undergraduate study, and he was a remarkable professor. He could take the most difficult subjects, break them down into basics and explain them in the simplest of ways."

The kind of rapport he holds with students is self-evident. One of the courses he teaches is Engineering Economics (C.E. 497), a senior class which usually carries 30 students under Leo. Most senior elective classes carry 15 to 20 students. Word got around that this spring would be the last time the course would be taught by Leo and 68 students signed up for his class. This rapport is also evidenced by the many student groups Leo has advised. He has long been faculty advisor to the Associated Engineering Students and has been faculty advisor to the magazine staff.

There is one special accomplishment for which Leo Novak is acknowledged. He helped develop all of the examinations given by the Colorado State Board of Registration for Professional Engineers. Anyone who has taken one of the PE exams would readily admit that Leo's task was no small feat. Leo said he has worked on the state board exams since about 1948. He enjoys doing it. He doesn't actually write them, but compiles and edits them. He calls it a "Dog Robber" job!

Leo Novak is noted for his outlook on life, and he has a knack for instilling that outlook in others. "He encouraged us to play football, drink beer and learn to live; to be people, while expecting us to do our best," stated H.G. Isabel. Leo believes what most people know but never take to heart—there's a time for work and a time for play, and you need a little of both. Leo cared about his students, he cared about their problems, personal as well as academic. He made the study of engi-



neering fun and interesting, which is, unfortunately, a rare ability.

Leo knows how to work. In the late 1940s and early 1950s, when the College of Engineering was extremely crowded, there were more than 2300 students enrolled in engineering. In 1950 there were approximately 125 graduates in Civil Engineering alone compared to 40 graduates per year now. Leo often taught 12 to 15 hours of undergraduate classes, then drove to Denver to teach night classes. In addition, he somehow found time to advise as many as five graduate students.

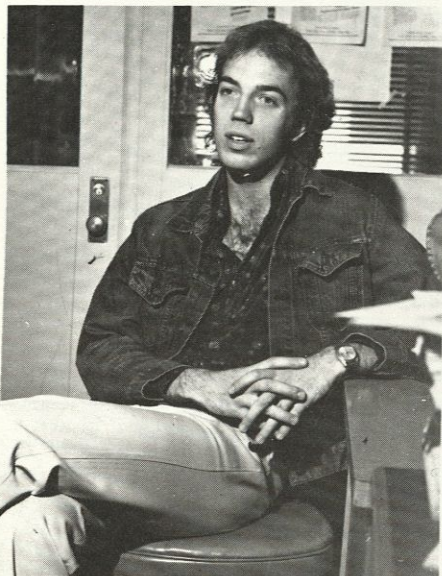
Leo knows how to play, too. This always stands out in a conversation about him. C.E. Professor James Chinn, also a former student, remembers of his undergraduate years, "Leo was the most popular among students, often having them over to his home." But one event which

markedly stood out to Mr. Martin Barber, and he told it with a smile, was E-Days two years ago. It was the Dean's Challenge Race and all contestants were instructed to run completely around the track. When the whistle blew, Leo headed for a nearby truck, ran around it, and crossed the finish line first. Although he was not acclaimed winner of the race, he was awarded the "Best Cheater Award" after profoundly stating he thought the Dean had said truck, not track.

No one who knows him will ever forget him. Leo, we're gonna miss you. □

An Interview with C.o.P.I.R.G.

by Ruby Davis



Philip Rippy

The Public Interest Research Group (PIRG) is a nationwide organization headed by Ralph Nader. They essentially concern themselves with consumer issues, and their range of activities is far greater than one may expect. They fight against government waste and corruption, corporate irresponsibility and environmental rape throughout the nation.

At present, the Colorado affiliate of PIRG (CoPIRG) is attempting to establish itself on the CU campus. In February of this year, in what has since become a highly controversial referendum ballot, the students of this university supported the establishment of a CU chapter through the acceptance of a mandatory student fee assessment.

The problem arose over an alternative proposal on the same ballot which was to be considered in the event that the primary proposal was not voted approval. This alternative, which was to be set up much like the Blue Cross-Blue Shield negative

check-off system, was passed by a much greater margin than the primary proposal. This assessment, however, was to be refundable should any student not wish to support CoPIRG.

If all this sounds confusing, you are not the only one to think so. Based upon just this contention, David Zale and Linda Christopher, the UCSU Co-presidents, have initiated another CoPIRG referendum, which is an attempt to clarify the first. In essence it asks the students whether or not they understood the first one, and if they did, do they still support its decision.

The following was an interview conducted recently with CoPIRG leaders on the CU campus. They are Philip Rippy, Pam Eakins, State organizer Hunter Davidson and former CoPIRG leader (1972) Steve Rapinowitsh. In it they attempt to clarify CoPIRG's role in the University, the state, and as part of the national PIRG effort.

Interviewer: How was the national PIRG formed?

Phil: Ralph Nader and Donald Ross saw the need for a consumer activities group during the early 60's. Nader once made the point that there were 25,000 manicurists in this country and only 400 consumer activists. Therefore the average man has very little representation and voice in special interests and government activities that concern him.

Interviewer: How does this relate to students?

Phil: Nader and Ross thought that students would be a good resource to provide this public service. Students are idealistic and energetic and have a lot of time and could apply their particular fields of knowledge to the organization.

Interviewer: How would students benefit from this?

Phil: CoPIRG provides an opportunity for them to apply their knowledge to reality. By participating in CoPIRG, students could investigate corporations such as

Rocky Flats and others.

Interviewer: After two years on campus why has it taken so long to become recognized?

Phil: There are always problems with student governments, since they are shy of new organizations. The Board of Regents is also a problem because they are constantly afraid of students.

Interviewer: Has the organization changed in the past two years?

Steve: Not much has changed. The organization has become broader. Our first year here we dealt with a couple of minor issues and problems.

Interviewer: What were the issues then?

Phil: Mainly the apartment situation and how realtors were ripping off students. We did an extensive campaign and received over 7,000 signatures, we also put a lot of people out of business in the end.

Interviewer: Where is PIRG located?

Phil: The national office is in Washington, D.C.; our statewide office is in Denver.

Interviewer: Then CoPIRG is set up all over Colorado?

Hunter: Presently Colorado State University, Loretto Heights College, University of Northern Colorado have all had a program for at least a year. We are now working on Community College of Denver and to a small extent the University of Denver. We are trying to make CU our major emphasis.

Interviewer: Has it been easier to initiate the organization at other colleges and universities in Colorado?

Hunter: No, it hasn't been easier. You have to have a key group of people who are really interested. But CU has a really good staff.

Interviewer: What are you doing now?

Pam: We just finished a sex discrimination project which involves the employment agencies.

Interviewer: How was that set up?

Pam: We sent two people (male and female) with the same experience and resumes to these agencies not more than an

hour apart from each other. We controlled for everything we thought possible such as family and marital status, background and personal history. The results should come out in a couple of weeks.

Phil: We are also compiling a directory of medical physicians in Boulder. This is so that the consumer will be more knowledgeable in choosing a doctor. It will be especially helpful for the people who are new in Boulder.

Interviewer: How will you do this?

Phil: We compiled a questionnaire to be sent to all the doctors. We were concerned with general things such as if they prescribe by brand names or generically, what their office hours are and if they prescribe methods of birth control.

Phil: For future projects we are considering re-structuring the judicial districts in Colorado. This would be provided by a small claims court. Presently cases that would go to a small claims court are in the county civil court. By doing this we will help the consumer eliminate the costs of lawyers and the judges can be the mediator. We are also thinking of compiling a directory of dentists.

Interviewer: How is the organization set up?

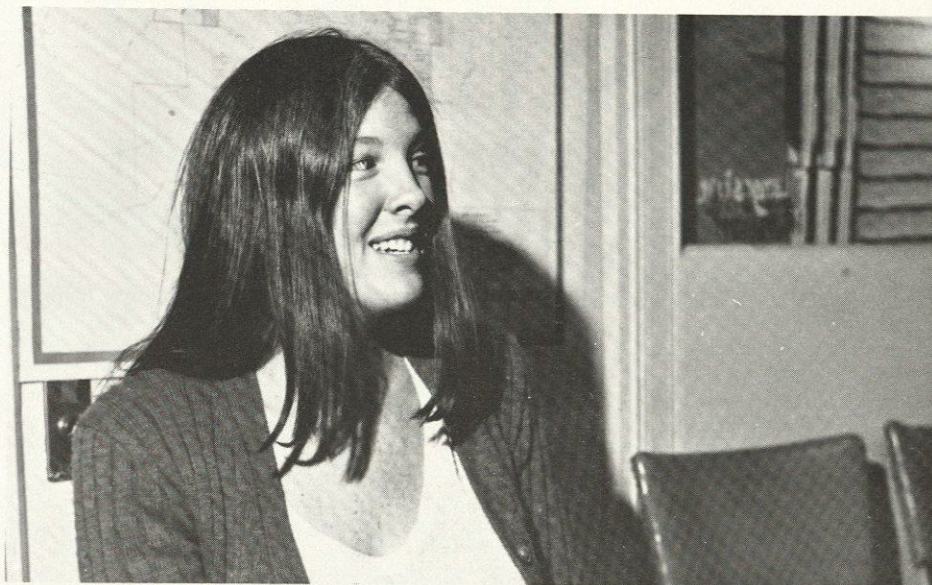
Phil: We have a professional staff of lawyers, lobbyists and directors who represent us. This means we have a combination of expertise—in that we have professionals and continuity in that we continue to work year round.

Interviewer: Is this why you want so much money?

Phil: We are asking \$2.25 per student with an option of a refund. CoPIRG could not be effective on a small amount of money if we are to maintain a professional staff.

Interviewer: What type of issues would you deal with?

Phil: Essentially whatever the students are interested in. Once we do receive money, we will elect a local Board of Directors composed of students who would decide the problems and issues of the time.



Pam Eakins

Hunter: CoPIRG is not just a consumer organization; we are also concerned with the environment and lobbying. An example of our environmental interests is our suit against the Environmental Agency (EPA) for their misuse of radioactive materials. We won the suit on appeal and it is now before the Supreme Court. As lobbyists we deal with Common Cause. We provided research and testimony for the House Committee in favor of the decriminalization of marijuana and the enactment of the Sunshine Law.

Pam: CoPIRG is a constructive organization. We are not taking up projects to knock down businesses. But we want to educate the consumer of his rights and of the laws which are established to protect him.

Interviewer: Why has the Colorado Daily taken such a dim view of CoPIRG?

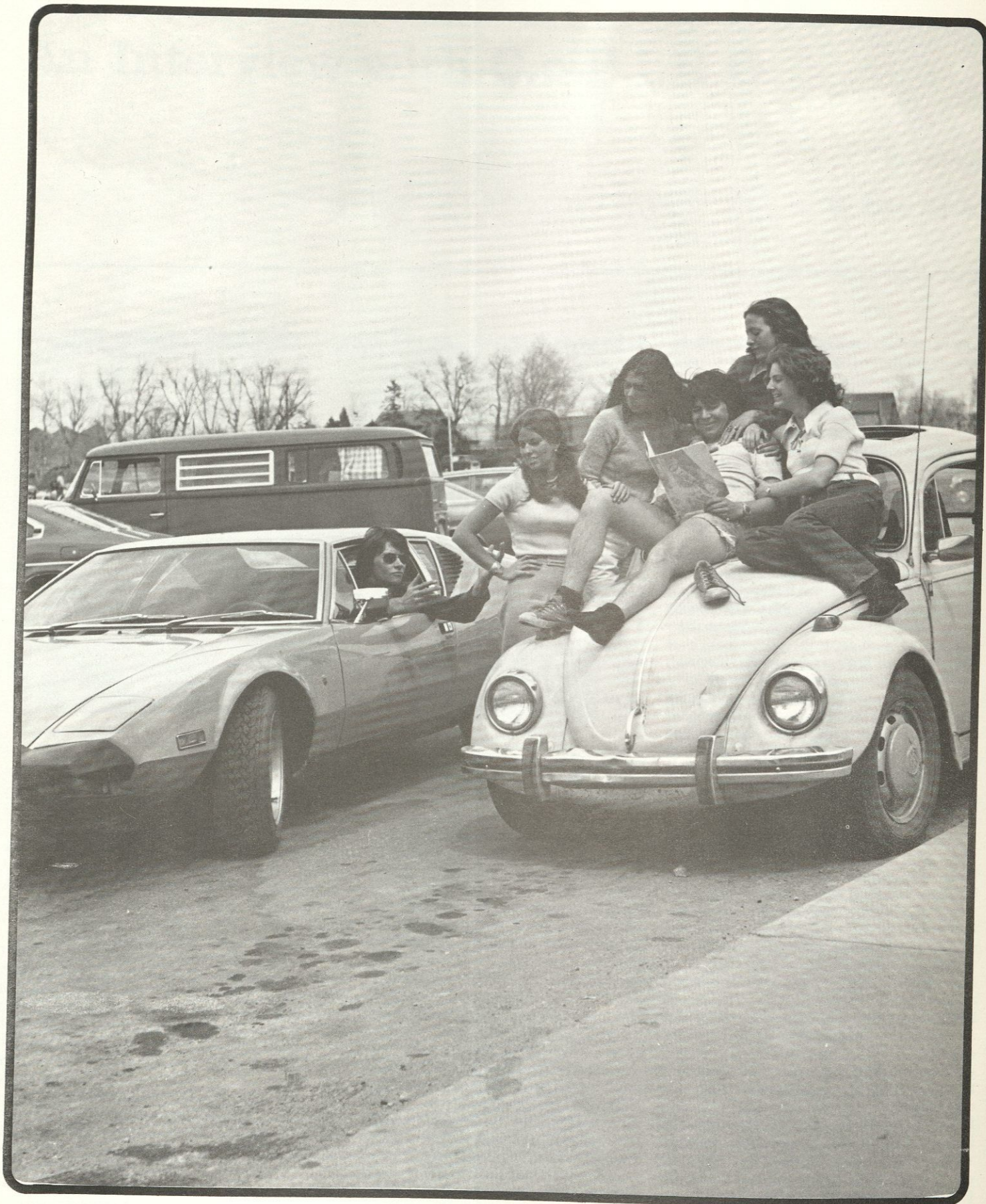
Hunter: It began two years ago when Tim Lange talked to a PIRG representative. Tim's contention then was that the group is

liberal but not radical—he does not think PIRG is for the revolution!

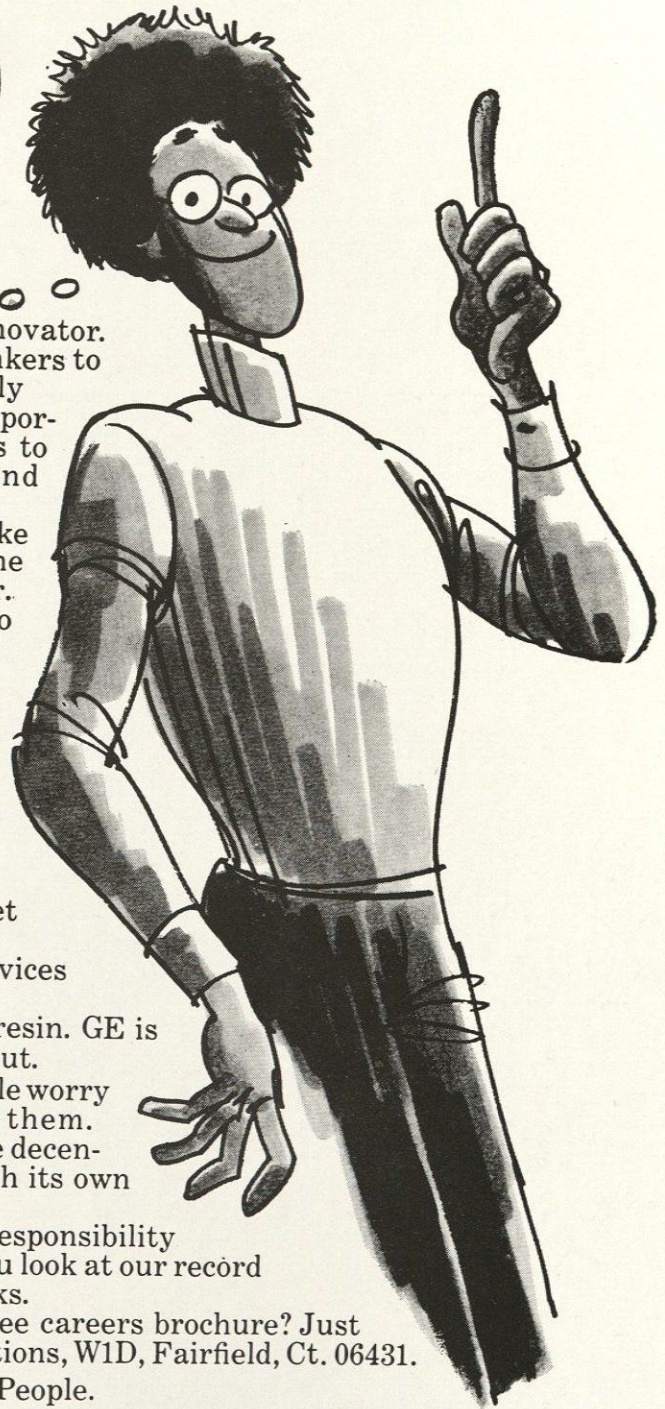
Interviewer: Which means that Tim Lange and the Daily are for revolutionary ideas?

Hunter: If so their intended radicalism is not very considerable; their editorials are extremely conservative—and Tim even supports conservatives such as Lamm. . . . We've had troubles getting a letter to the editor printed in the Daily, and it took one and a half months to print the grocery survey. But it seems they may be coming around to our side. Just recently the Daily gave me the full editorial page and they have printed a few articles concerning our organization.

In The Final Analysis...



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