IEEE Student Newsletter

October 1976

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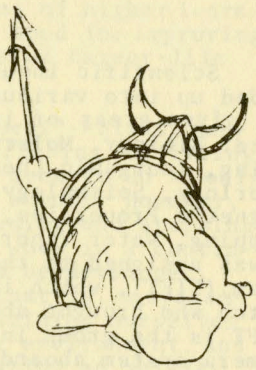


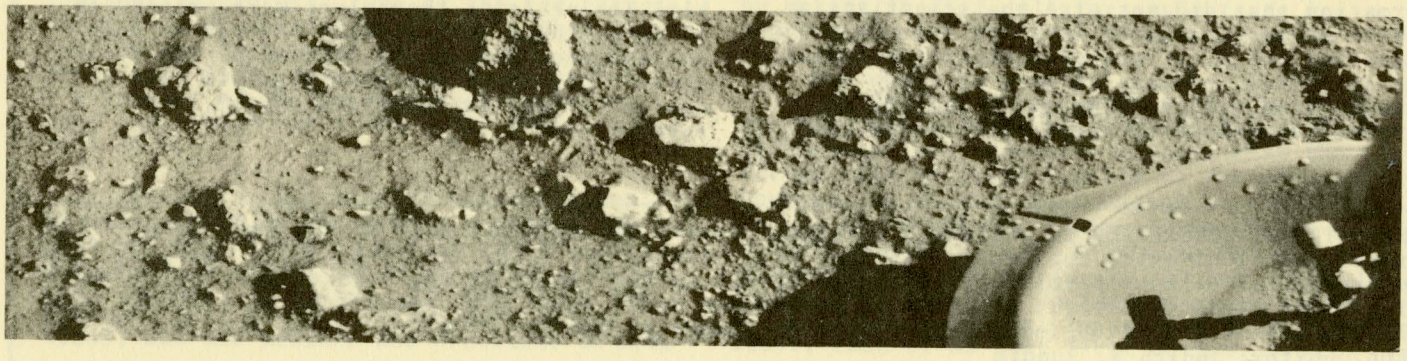
Viking

Nineteen minutes. Suppose you had to wait nineteen minutes before you could hear what your roommate had said to you? Or envision yourself trying to drive a car, but able only to see what was going on nineteen minutes previously. What a massive communications problem! Yet it takes almost nineteen minutes for anything the Viking Spacecraft broadcasts to reach us here on Earth. That means it also takes nineteen minutes for us to find out if we have landed safely. I think that the true complexity of the Viking space shot to Mars didn't hit me until I sat down and thought about that fact. It is a truly historic mission, both in terms of the technological problems conquered and the great strides being taken in the areas under scientific investigation.

But why go to Mars? What is there to gain? The ultimate answer to that question is that study of Mars will give us a better understanding of Earth, and the planetary processes occurring here. This information will now give us an excellent chance to contrast the two planets. Another significant aspect of this mission is that it initiates our search for life in the Universe. This in itself represents a tremendous step outward in the common thinking of the human species.

Viking also represents another historical achievement, perhaps less obvious to the casual observer, but certainly no less important. For the first time in a space project, the scientific investigations have not been cut back due to restricted technology. In the past this has been true due to the massive nature of the technological problems associated with space flight, but experience in this area has brought solutions to many of these problems. Viking is the first space shot ever to fly with more scientific instruments aboard then were called for by the original specifications.

Viking has made many other important advances that have not been mentioned here. While not well known, there is an accomplishment that has been fairly important to me and about 70 other undergraduates who participated in a special program at the Jet Propulsion Laboratory. The name of the program is the Viking Intern Program. It was initiated by Dr. Tim Mutch of Brown University, a member of the original group that brought Viking from its initial conceptualization eight years ago to its fruitful conclusion today. Dr. Mutch felt that an intern program would give undergraduates a real opportunity to become involved with ongoing space science, while at the same time staffing the project with people who could be counted on to be eager and willing to work. Many of Dr. Mutch's colleagues were skeptical of such a program, and when the first interns arrived at the Jet Propulsion Laboratory in Pasadena, California, they occasionally ran afoul of this skepticism. But this quickly diminished as understanding grew. By the time I arrived, the interns had already carved out little areas of responsibility for themselves, and were well on their way to making themselves indispensible members of the flight



This is the first photograph ever taken on the surface of the planet Mars.

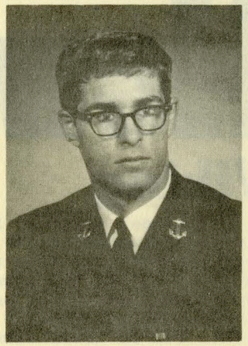
team. When I left, interns were in such demand that there were not enough to go around.

Scientific inquiry on the project was divided up into various teams, which concentrated on given areas of investigation. The teams were: Biology, Molecular Analysis, Lander Imaging, Inorganic Chemical, Entry Science, Meteorlogy, Seismology, Physical Properties, Magnetic Properties, Orbiter Imaging, Thermal Mapping, Water Vapor Mapping, and Radio Science. I was assigned to the Lander Imaging Flight Team (LIFT), which is headed by the same Dr. Mutch who brought about the Intern program. LIFT is the group in primary control of the camera system aboard the lander, which consists of two facsimile scan cameras.

These were the instruments with which I was involved. My primary job was to help in the generation of commands to be sent up for future pictures. The process turns out to be much more complex than might first be imagined. Due to limited communications in terms of bits to be sent, limited tape storage capabilities on the lander, and interaction with the other teams both in competition for limited variables and in support for their activities (for example, pictures of a sample acquisition site before and after sampling), the problem of error detection and coordination becomes nightmarish in size. I also did a fair amount of what is normally referred to as office work, including the proper cutting and filing of photographs as they came in. Other jobs included the building of high resolution mosaics of the various fields of view and developing a computer routine to find stereographically-paired photographs from the pictures we had taken (Stereo pairs are pairs of photographs, one from camera 1 and one from camera 2, of the same area, that can be used under a stereoscopic viewer to see the area in three dimensions.)

The technical experience and professional exposure I gained from the intern program was immense. To me the most important part of the program, however, was the better understanding I developed of the methods and means by which scientists carry on present day research. In my stay at the Jet Propulsion Laboratory, I cannot recall one scrap of information that did not give the scientists a better understanding of Mars and the processes occurring there. It was enlightening to watch the scientific process at work on a new and unknown area; it confirms one's beliefs in scientific methods of investigation. It was also a refreshing approach to principles of a scientific investigation normally presented to undergraduates in canned laboratory exercises. Over all, Viking was an experience I shall never forget.

--John J. Polcari



Midshipman John Polcari

John is in his last year of study at the U.S. Naval Academy. An electrical engineering major, John hopes to tie in his experiences at the Jet Propulsion Laboratory with previous work on minicomputer software by studying basic signal processing with minicomputers.

Career and Life Planning

The IEEE Student Activities Committee has begun work on a project entitled "Career and Life Planning for Students". Through this project, the SAC hopes to make resources available to assist individual students in assessing their own needs and abilities and articulating their career/life goals and objectives. The initial step in this direction begins with this, the first in a series of four articles in the Newsletter that stress getting to know yourself, goal-setting, developing a plan of action, and "working" your plan. This series is designed to open channels of communication for engineering students to share their experiences and for others to learn from them. Our author, Dr. John Picarelli, is soliciting questions and/or comments specifically for this purpose--so don't hesitate to write to him. The articles themselves were printed on an insert page specifically for you to pull out and keep for future reference. The first article begins on the next page. To take charge of your own life and career, start reading now!

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Career Planning for Students

I. Keys To Finding Fulfilling Work and Building Your Career

In the words of Charles F. Kettering, a great American industrialist and humanitarian, "My interest is in the future because I will spend the rest of my life there." We too should be interested in the future, not only because we will be there, but because we are, at present, helping to shape it through the decisions and choices we make everyday. Those of us in the scientific/technological fields should have a special realization of this for, "No one has a greater stake in the future of technology than the Engineer; the rapidity of technological change in the areas where he makes his career requires that he consider today the shape of his career tomorrow." (William Morch, IEEE Consultant on Technology Forecast and Assessment)

We address in this article, and the ones to follow, the role that career-life planning can play in preparing for and influencing your future. We will examine job-hunting problems, problems engineers face at various stages of their careers, and problems created by growth and change of both individuals and organizations. Focusing on certain problems, our series of articles will present ideas and practical suggestions for dealing with such issues. This tutorial should help you make better judgments and formulate more personally meaningful and realistic plans to identify and work toward your career and life goals.

Four Fallacies to Avoid

A 1976 college graduate once said, "I have no skills or experience. I've been in school most of my life. I hope they're hiring people with my kind of degree." Despite excellent grades, this student is at an extreme disadvantage upon entering the working-world. He has not recognized his own assets or personal qualities. When contacting prospective employers, he knows no more than to point to his degree titles. He has lost control of the job-hunting process. One of the sad things about this student's situation is that it is not unique. It happens to thousands of students each year. And, it is, quite probably, a harbinger of future, mid-career problems that such individuals and their families will face.

How could this student prepare himself so dilligently in the academic sphere yet come out of college so poorly prepared to deal with the realities of the working-world? Four factors, I believe, contribute to the problem. They involve traditional assumptions, and the beliefs and practices of both students and our institutions of higher learning. Each one points to the need for improving the processes and techniques of career-life planning.

"It's Only a One-Shot Deal"--First, many students seem to think that finding fulfilling work is something that they need to do at only one time -- when they leave school. However, they must recognize that needing and striving for satisfying, challenging work is a continuous process. What needs to be developed, therefore, is a "process", that is, a systematic way of periodically examining ourselves in relation to our work, our environment, and our future, and then cultivating an ability to create and implement plans which lead to more fulfillment from our work.

"It Will All Work Out When I Have My Degree"-- Secondly, students very often mistake means for ends. They often blindly assume that a neat, well-ordered system is operating which will enable them to move easily into the work-world after receiving their college degrees. Unfortunately, the system doesn't work that way, as is well described in Caroline Bird's book entitled, The Case Against College (McKay, 1975). The point is not whether to choose college or not; it is to make those crucial decisions concerning one's life in the light of goals and objectives to be achieved. When college is viewed properly as a means to an end, students can better analyze alternatives and make sound judgments.

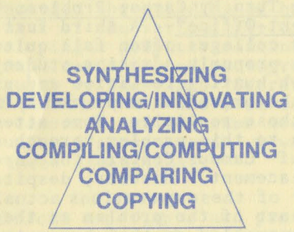
"I Can Turn My Career Problems Over To The Placement Office"-- A third fact to face is that our colleges often fall quite short of the mark in properly advising students of career and job-hunting realities and providing them with the organizational skills needed to deal with those realities. Some attention is being given to this problem through recent development of "Campus Centers for Career Planning and Placement." However, despite their names, many of these operations actually turn out to be part of the problem as they may be employer-controlled or they may not orient themselves to aiding students in the development of that "process" mentioned above--the self-examination in relation to work, environment, and future. In addition, virtually all of them operate outside of the academic programs of the college or university, thereby making it difficult for students to integrate all the critical components of effective career-life planning.

"My College Training Will Keep Me Up To Date"-- Much, if not all, of our formal institutionalized education assumes that the future will be quite similar to the present. However, we do know that change is occurring in all facets of our lives. If we are to achieve any measure of psychological and economic satisfaction in the future, we will be required to learn continuously new ideas to solve our problems. To achieve this, I believe, each of us must first become more con-

cerned with self-management. Better self-management begins with improved self-knowledge, which includes for each person a better understanding of his or her own skills and personal qualities.

Four Key Ideas About Skills

Webster's Seventh New Collegiate Dictionary defines 'skill' as "(a) the ability to use one's knowledge effectively and readily in execution or performance; and (b) a learned power of doing a thing competently." Unfortunately, whenever you ask a group of students to define the word 'skill', their answers almost exclusively focus on examples of manual or physical skills such as typing, drawing, driving, and electrical wiring. Too infrequently their answers include examples of cognitive skills such as planning a project, forecasting resources requirements, and analyzing a problem for causative factors. The reason for this is that they are never taught through traditional academic programs to analyze experiences in these terms. Students are left to learn such matters on their own after they enter the work world, without too many clues as to how vitally important they are to the future. There are four key ideas concerning skills that need to be understood by students, and everyone else, so that a more effective job can be done in personal and career development activities.



Hierarchy of Skills Related To Interaction with Data or Information

"There Are Many Levels of Skills"-- A skill in general can be considered to belong to a hierarchy wherein the lower-levels of ability coincide with someone else's (say an employer's) dictating how the skill will be used or performed and wherein the higher-levels of ability coincide with the individual being able to exercise more of his own discretion in performance. For example, if a student were examining his ability to interact with data, it is profoundly significant whether that student could merely copy the data or whether he could analyze it and make judgments from it. These distinctions enable the individual to seek applications of skills consistent with ability-level and thereby increase the potential for satisfaction from such activities. This idea for the hierarchy of skills has significance in the job-hunting process itself as is well described by Richard Bolles in What Color is Your Parachute? (Ten-Speed Press, 1976.)

"Skills Can Be Developed"--It is also important to understand that a person can actively develop a particular skill in any area in which there is a weakness perceived in relation to personal goals. A person can consciously seek those opportunities which would enable improvement in any area desirable. For example, a young engineer with whom I was working in a career-development program concluded after careful analysis that his weakness was being out of tune with his customer's needs. He was technically knowledgeable-but dissatisfied with his projects and unsure of his committment to his company. All of that changed when he decided to do something about his weakness. He actively sought and began securing opportunities to meet with the customer. As he developed his customer relations skills, his self-confidence steadily improved and so did his method of relating to his work. The idea that a person can and should develop skills in which he may be weak may seem surprising but it can be very important. A student can systematically seek learning opportunities which can help him expand his skill base and levels. Extra-curricular school projects, internships, work/study cooperative programs, and participation in professional societies can provide "test-tracts" and "proving-grounds" where skills and personal qualities can be developed and observed.

"Skills Can Be Transferred"-- A third important point to remember is that skills are highly transferable from one area of application to another. Unfortunately students (and others!) seriously overlook or misunderstand this point. A striking example is provided by a mother who wishes to find work believing she has no marketable skills. Her experiences often include raising children, counseling family through crises, managing a household, and creative community projects, yet she misses the fact that the valuable skills she used are applicable in other settings. Students similarly dismiss their experiences as not being useful in their career and life planning or job-hunting activities.

"A Most Important Skill Is The Language of Communication"-- Fourth, each of us must learn how to communicate his or her skills to everyone. The mistake that most people commonly make is trying to use jargon to impress someone with their technical or sophisticated knowledge. For example, if I wanted to describe the work I did in the Air Force I could say either (a) that I managed the development of a new quasi-one-dimensional computer code for solving the front surface physics problems of x-rays incident on three-dimensional composite heatshield materials; or, (b) that I planned, organized and supervised the development of effective computer solutions to engineering research problems on specialized materials. In the former case, I would be likely to communicate with only those people who were familiar with front surface physics phenomenology of radiation heatshields. In the latter case, I could communicate with a layman or with a professional in the field. I would not have precluded communication by using language understandable to only specially-trained individuals but could still introduce technical detail if necessary.

What language is most useful in communicating skills and abilities? I have found that the answer probably includes those terms which are generally associated with the four functions of management. If we consider the functions as planning, organizing, leading, and controlling, together with their respective activities, we can see how broadly applicable they are to our work/life experiences. Presented here is a list of functions and activities of management based on the excellent book, The Management Profession by Louis A. Allen (McGraw Hill, 1964): I. "Planning" includes researching, forecasting, establishing objectives, programming, scheduling, budgeting, establishing procedures and developing policies; II. "Organizing" includes developing organization structure, delegating, and establishing relationships; III. "Leading" includes decision-making, communicating, motivating, selecting people, and developing people; IV. "Controlling" includes establishing performance standards, measuring performance, evaluating performance, and correcting performance.

A Sample Analysis

Let's consider an example of how work/life experiences can and should be reported and analyzed. Summarized below is a single experience out of the life of a young graduate engineer named Stephen. It is followed by an analysis of the skills and personal qualities he was demonstrating and using in that experience.

The experience Steve reported concerned his work in helping establish a non-profit IEEE Electronic Components Store for students and faculty at a leading state university. The problems the store faced included a lack of local suppliers, an unacceptably long waiting time for supplies, and above-normal prices for such supplies. In his own words:

"...The responsibility for organizing the necessary manpower, funding and materials for the store was placed in my hands. The Student Branch officers and I decided the inventory would consist of components commonly used by students...I decided to request a loan from the Electrical Engineering Department. The Department Head greeted my proposal with enthusiasm and promptly allocated the needed funds to establish the non-profit enterprise and acquire initial inventory...

"...I staffed the store with a junior and senior to help ensure continuation. We sent out a request for bids to suppliers for the inventory we desired. I directed renovation of a seldomly used store-room for use as our place of business...

"...We evaluated all bids, picked our supplier and placed our order. I sought help in establishing a bookkeeping system to handle cash receipts, expenditures and inventory. I opened a checking account, prepared and distributed a price catalog, established store policies, scheduled store hours, and assembled performance and specification data on components for sale..."

Here is an analysis of skills and personal qualities Steve demonstrated based on the above experience: ...Analyzing Supply Problems and Identifying Their Key Characteristics...Leadership...Innovate Problem-Solving...Entrepreneurial Spirit...Business and Profit Planning...Organizing the Necessary Manpower for Business Operations...Inventory Planning...Preparing and Justifying Operating Budgets...Developing and Implementing Creative Approaches to Raising Needed Capital...Resourcefulness...Attentive to Details ...Negotiating...Selling and Salesmanship... Foresight in Planning...Developing Staffing Plans...Evaluation and Decision-making to Meet Goals and Objectives..Service-and Economy-minded...Writing Request for Proposal...

...Effectively Converting Store-room Space into Productive Business Space..Evaluating Technical and Cost Proposals... Choosing Suppliers after Careful Analysis ...Motivating Peers and Associates to Voluntarily Contribute Time and Effort to Ensure Enterprise's Success...Designing Effective Bookkeeping and Accounting Systems ...Inventory Record-keeping...Financial Resources Management...Pricing Inventory Items for Sale...Writing Pricing Catalog... Creating Policies for Business Operations.. Leadership in Developing and Implementing Cost-Effective Supply Systems for Engineering Students...Managing Limited Resources for Better Meeting Customer's Needs..."

Of course, this analysis is related to only one experience out of a person's life. Other experiences, in school, at work, and in community groups, can be so analyzed by the individual. The result would be literally hundreds of skills and personal qualities. For each person to reduce these data to a more manageable number, he would

find that they can be logically grouped under from ten to thirty separate genetric headings. Typical ones could include: 'Financial Resource Management', 'Solving Sophisticated Engineering Design Problems', 'Leading Experimental Research on Improved Energy Systems', and 'Decision-making". An important reference on this "skill-clustering" process is Where Do I Go From Here With My Life? by John Crystal and Richard Bolles (Seabury Press, 1974). The key to finding fulfilling, satisfying and challenging work and being able to continue to grow and develop throughout one's career and life is self-knowledge. A person who knows thoroughly what he can do and likes to do, and who knows where his weaknesses lie is the one prepared to recognize an opportunity and seize it in an on-going process of growth and personal management.

Suggested Exercises

Here are a few suggested exercies to help a motivated person begin:

1. Write out a complete chronological outline of your work/life experiences. Take it one year at a time and be sure to jot down notes as to where you were and what you did. Make sure your outline refers to not only school and work activities but also clubs, groups with which you were associated, and hobbies and projects you pursued. A suggested starting point is the ninth grade and the end point of your outline, would be the present.

2. Carefully go over your outline and write out the details of those experiences and events you noted (refer to Steve's example above). Write them out in the first person; that is, saying "I did...", "I felt ...", "I saw...", etc. Be sure to record how you felt at the time and what your attitudes and values were.

3. Analyze your detailed account of your work/life experiences for the skills and personal qualities you were demonstrating and using. Refer to the Sample Analysis above. Try to use as many of the functions and activities of management (as defined above) as you can. Refer also to the books, What Color Is Your Parachute? and Where Do I Go From Here With My Life?, as noted earlier.

4. Review your identified skills and begin organizing them under suitable group headings.

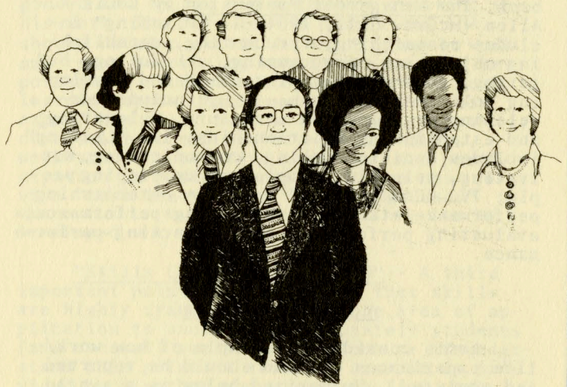
-- John G. Picarelli

Send Us Your Comments

Author's Note: It is hoped that we will use the IEEE Student Newsletter as a vehicle for exchanging views and ideas, raising and answering questions, and sharing experiences that can be discussed in future issues. For this purpose, please address any questions or correspondence concerning Career-Life Planning to: Dr. John G. Picarelli,IEEE/SAC Career-Life Planning Project, Washington International College, 1239 G Street, N.W., Washington, D.C. 20005.

About the Author

Dr. John G. Picarelli is the Dean of Washington International College and a consultant to industry, education and government specializing in management and human resources development. He is a member of IEEE's Student Activities Committee and Chairman of its Sub-Committee on Career-Life Planning.



Region 1 Student Conference

The major spring event in student activities for Region 1 was the Student Conference held at Northeastern University in April. The three-day conference was "kicked-off" by a wine and cheese open house, hosted by Boston area IEEE Student Branches. Highlighting the Conference were activities such as the Branch Counselor-Chairman Workshop, the Regional Paper Contest, an all day Microprocess Course, and tours to Boston Edison's Mystic 7 Generating Station and the FAA Air Traffic Control Center in Nashua, New Hampshire. A Professional Concerns Seminar featured speakers on Patent Rights, Pensions, Career and Life Planning and Engineering Registration.

A special treat for the Region's electronickers was the golf ball launch contest, cleverly entitled "The Great Catapult Contest." The contest's objective was to electrodynamically propel a plastic golf ball the greatest distance, with given energy and time constraints. David Syracuse, IEEE Student Branch Chairman at the University of New York at Buffalo, charged a bank of capacitors and fired them through a solenoid to walk away with first prize--$50 and a case of beer.

The first Region 1 Student Conference was considered a great success and plans are beginning for an even better Conference to be held in 1977 in conjunction with ELECTRO in New York. Students interested in helping in the organization and planning for this year's extravaganza should contact: Judy Rundle, IEEE, 345 East 47th Street, New York, New York 10017.

--Michael Hachey, Region 1 Student Representative

Get Help With Report Construction!

When your write a technical report, do you have trouble organizing your time, effort, or materials? There is a solution. The IEEE Professional Communication Group is making available (at a special low price!) a handy volume designed to help you with this problem. Report Construction: A Handbook for the Preparation of Effective Reports written by M. F. Buehler, a technical editor at the Jet Propulsion Laboratory. To order Report Construction send a check or money order to: IEEE-PC, 6411 Chillum Place, NW, Washington,D.C.20012. Prices are $2.00 each for orders of 1 to 10; $1.90 each for orders of 10 to 25; and $1.75 each for orders of 25 - 50.

SCORE
STUDENT COMPETITIONS ON RELEVANT ENGINEERING INC

SCORE, or Student Competitions on Relevant Engineering, annually runs interdisciplinary design competitions among nearly 100 colleges and universities in the United States and Canada. Past competitions have included the Urban Vehicle Design Competition, Students Against Fires, and the Clean Air Car Race. SCORE's 1976-1977 Energy Resource Alternative II Competition stresses the construction of projects which produce electrical power from nonconventional sources. The practical experience and professional exposure gained by participating in this year's competition will be a meaningful and rewarding adjunct to your engineering education.

The deadline for submitting entry forms is November 15, 1976. For further information write to: SCORE, ERA II Coordinating Committee, Department of Mechanical Engineering, Washington State University, Pullman, Washington, 99163. The IEEE Student Newsletter encourages you to become involved... and please keep us informed of what you're doing. We'd like to pass the good news and photos along to our readers.

-- Richard Aseltine,
President, SCORE

SPECTRUM Highlights

Have you ever wondered why some highly publicized technical projects suddenly fade into oblivion?Usually the answer is simple--they failed. October's Spectrum investigates some of these failures and what was learned from them in a special issue devoted to:"What went wrong?" For instance, in the last 1950's, The U.S. Navy attempted to build a mammoth radio telescope with a 600-foot diameter antenna that would have been fully steerable. The structure, twice as large as any fully steerable telescope since built, would have towered 66 stories above its seven-acre foundation. Find out what happened to the "Big Dish" in October's Spectrum. Look also for details on the Northeast blackout of 1965, Viking's troublesome soil-sampler arm, the "megaflop" supercomputer Illiac V, and the fate of many other spectacular fiascos.

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Great Lofty Ideas Can Happen!

Do you want to build an amateur radio station, a satellite tracking system, or investigate atmospheric electrical fields, or put together anything else you may think only Jules Verne could have created? Why stop dreaming because you don't have the funds?

Many Student Branches have asked the IEEE Student Services Department how they can get more funding for Branch projects. The answer is simple--participate in the Bendix Competition. Your group can win up to $500 for an innovative project. All that is required is a six-page proposal describing your project and demonstrating that it will strengthen the professional development of its creators while contributing to the development of the Branch program as a whole.

The odds that your Branch can win are increased this year for two reasons. First, the Bendix Corporation has increased its support for the Competition by $1000. Therefore, the IEEE judging committee can make more grants to those Branches preparing innovative proposals. Secondly, the Bendix subcommittee of the IEEE's SAC has prepared a 4-page "tutorial", giving you tips and helpful hints on how to prepare that award-winning proposal.

The best hint, however, is to start planning now. The contest deadline is November 15. Get contest rules and information from your faculty Counselor or write to: Coordinator, Student Services, 345 East 47 Street, New York, New York 10017.

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Send Form 3579 to IEEE, 345 East 47 Street, New York, NY 10017