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Proceedings of a Workshop for Program Directors In Engineering Education of Minorities

Conducted by the
Committee on Minorities in Engineering
Assembly of Engineering
National Research Council

June 12-14, 1975
Washington, D. C.

NATIONAL ACADEMY OF SCIENCES
Washington, D. C. 1976

NOTICE

The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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Committee on Minorities in Engineering
Assembly of Engineering
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PREFACE

This is a report on the Minority Engineering Program Directors' Workshop held June 12-14, 1975 and attended by some 200 people concerned with increasing the participation of four minority groups--Blacks, Mexican Americans (Chicanos), Puerto Ricans, and American Indians--in the engineering profession. The workshop was organized and conducted by the Committee on Minorities in Engineering of the National Research Council (NRC). The NRC is the principal structure for conducting studies of important issues on behalf of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

In April 1974 the Committee on Minorities in Engineering was formed to serve as a catalyst for a community of educational, industrial. and governmental interests seeking to foster a tenfold increase in the number of engineering graduates from the four particularly underprivileged and underrepresented minorities by the end of a decade. Since its establishment the committee has worked most often on the decision-making level with interested organizations, institutions, and groups as a focal point of coordination and information. Its 1975 report, Building Effective Minority Programs in Engineering Education, provided an overview of the programs in place at many engineering schools and the problems still remaining to be solved for minority engineering students.

The purpose for the workshop that is the subject of this report was to update that overview. In addition, the workshop was intended to further a continuing exchange of ideas and experiences among educators, counselors, researchers, engineers, and businessmen. It was organized around four major themes:

- The need for guidance, motivation, and preparation of minority students.
- The personal and academic development of minority engineering students.
- The problems of minority student retention in engineering schools.
- The skills and resources required by minority program directors.

These formed the topics of special keynote addresses to the body of participants. Following each keynote speech, a panel of workshop chairpersons presented the highlights of the major themes under consideration during the working groups. Each panel was chaired by a moderator who also provided a summary of the session at the conclusion of the workshop.

This report contains the transcripts of the keynote addresses and edited summaries of the panel presentations and discussions. It also includes summaries of the activities of the working groups.

The committee acknowledges a special debt of gratitude to the many people who contributed to the success of the workshop. In particular it appreciates the thoughtful insights of Dr. Ewaugh Fields, Dr. Arthur Bond, Dr. Elbert Cox, Dean Clinton Dozier, Mr. George Egner, Mr. Rodrigo Garcia, Dr. Raymond Landis, Dr. Richard Mullins, Mr. Willie Nunnery, Mr. Clifton Powell, and Mr. Manuel Salinas--all members of the workshop task force. The committee and the task force are grateful to the many resource people and workshop participants who contributed so much to a stimulating and informative exchange.

Finally, the committee and its staff thank Dorothy Bomberger for her efforts in compiling this report.

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INTRODUCTION

In his incisive analysis of the post-industrial society, Harvard sociologist Daniel Bell identifies engineering, economics, and management as the newer professional occupations that have become central in the nation's technical decisions.[1] Engineering, as it happens, is doubly important because it is often a pathway to the commanding heights of corporate management and research leadership. To bring a great variety of concerns, experiences, and perceptions to such positions, there is a compelling need to broaden the engineering profession by bringing into it those racial and ethnic minorities who have been historically underrepresented.

Studies of occupational patterns and social mobility during the 1950's showed that almost all minority groups have been able to attain status, power, and economic rewards commensurate with their numbers in the community--except Blacks, American Indians, and Hispanic Americans.[2] In 1970 only 2.8 percent of the engineers in the United States were Black, Mexican American, Puerto Rican, or Native American.[3] Taken together, these four minorities made up 14.4 percent of the total population that year. By 1975 3.8 percent of the 38,210 engineering degrees awarded went to those four minorities.[4]

In the wider context, beyond the statistics, it is clear that some progress has been made, but these minorities are not yet adequately represented in engineering. A career traditionally in the mainstream of American life, engineering provides opportunities for producing goods and services for the well-being of society and for participating in the technical decisions that affect the policies of the nation. According to a special commission sponsored by the Sloan Foundation in 1974, a deliberate program is needed to increase the representation of these minorities in engineering.[5]

Identifying, motivating, guiding, and preparing able but disadvantaged young men and women from minorities to attain advanced degrees and pursue engineering careers now engages an increasing number of teachers, counselors, and researchers. Their efforts are complicated by a legacy of prejudice, neglect, and cultural, educational, and financial deprivation. The underprivileged minorities, as some observers have put it, "must make greater sacrifices to remain in school, but they have less incentives than [others] to make these sacrifices, which may well be a major reason why [minority students] often exhibit little motivation to continue in school and advance their education."[6]

An examination of many of the disincentives and barriers to minority men and women who seek careers in engineering was made at a symposium of concerned educators, industrialists, and minority representatives gathered by the National Academy of Engineering in May 1973. The participants discussed various approaches to the recruitment, training, and financial support of minority students in engineering. A tenfold expansion in the nation's minority engineers--to be achieved by raising the number of graduates each year from 500 in 1974 to 5,000 by 1984--was held to be a reasonable goal, provided the necessary resources could be marshalled at national and local levels.

The 1975 workshop, which is the subject of this report, was intended to bring new knowledge and experience to the 1973 study. In addition, it was expected to stimulate new activities, encourage old programs, and establish vital linkages between the various workers in the field.

Some of the statements made at the workshop left no doubt as to the job still to be done. Thus, speaking about guidance, motivation, and preparation, Dr. Armando M. Rodriguez, President of East Los Angeles College, pointed out that "Many minority students have made their way through a school system seemingly designed to impede their learning about possible career opportunities (and to restrict) their academic preparation (for going into) higher education. For these students, guidance and counseling, if these exist, have been notoriously ineffective. We must improve the guidance of potential minority engineers by advising counselors of the benefits and unlimited opportunities in engineering (so that this can be passed on to students). Proper counseling (should include an understanding that scholastic) preparation is needed to enroll in engineering."

On the critical problem of retaining minority students in engineering schools, Dr. Randolph W. Bromery, Chancellor of the University of Massachusetts, called for identifying those with science and engineering abilities "as early as primary school....Minority students, particularly those in an average urban school setting are never made aware of their potential for science and engineering careers. This is due in part to a lack of role models and career counseling and guidance tailored specifically (to the problems of minorities)." A study of Black and Puerto Rican students at the university since 1967, supported by the Ford Foundation, said Bromery, turned up a few startling results. Examples:

- Although counselors at one high school in Springfield, Mass., had reported that 32 Black women were unfit for college work, 28 were graduated from the university in the normal four years;
- Letters of application written by minority students were better indicators of academic success than high school records because the letters revealed the intensity of motivation and the ability of expression better than grades.

At Massachusetts, Bromery pointed out, minority students are brought to the campus for special three-day summer counseling programs to (1) enable them to confront university life before the frustrating period of adjustment begins in the first terms, with emphasis on dormitory residence, personal conduct in such matters as drug use, sexual behavior, and hygiene and hairstyling; (2) provide insight to freshmen courses taught by specific faculty members, and (3) introduce them to the range of remedial programs in, say, mathematics or

English composition, which need not carry the stigma of being labled slow or backward.

Dr. Charles Kishibay, Associate Professor of Mechanical Engineering at the University of Bridgeport, noted that one substantive issue hinged on the "potential trend toward ethnic separation. Taken to the extreme, this could result in a multitude of separate efforts focusing on the identity rather than on the graduation of qualified engineers." What consequences this trend will have is a topic that Kishibay believes should be addressed in a future workshop.

Marion Bowden, Assistant to the General Manager of the Energy Research and Development Administration, observed that "there is a need to raise the level of awareness of employers in both government and industry to the problem of tapping potential human resources among minorities who have so far been overlooked."

With such deficiencies and possible solutions before the participants, it fell to Dr. Ewaugh Fields, chairperson of the Task Force that organized the Minority Program Workshop, to set forth the charges. She said:

> While it is expected that the impetus for this workshop would come from the NRC Committee on Minorities in Engineering, the real commitment and grass roots effort must come from the engineering schools, their deans, and program managers.
>
> To university and college deans, I hope that you will not use fiscal exigencies or the lack of a minority person as excuses to delay the implementation of a minority engineering program. I hope that you will consider this a priority, because such programs have a positive "spinoff."
>
> To those of us who are presently minority program directors, it is hoped that you will share your expertise and experience with others participating in this workshop.
>
> Each participant is charged with the responsibility of helping to make certain that this will be a stimulating and informative workshop by being an active, positive contributor. Feedback evaluation is extremely important.
>
> And to foundation and industrial representatives, we are appreciative of your enthusiasm, concern, dedication, and support.

In his remarks, Melvin Thompson, Executive Director of the Committee on Minorities in Engineering, stated: "The committee views this workshop as an important milestone in its efforts to achieve a tenfold increase in minority engineering graduates. Previously, major meetings have presented the need for minority participation in engineering to decision-makers in industry and education. This workshop and subsequent committee activities focus on action agendas at the critical points and the day-to-day responsibilities of working with students to achieve the goal."

In the end, the Committee and the Task Force urged that:

- Adequate attention should be given to the program areas of identification, guidance, and retention identified in the workshop. Supportive services and interaction with secondary schools should become a part of program efforts or a part of the expansion of those efforts.
- Accurate statistics and detailed reviews of minority engineering programs should be published annually so that others may learn from successful on-going programs.
- Local networks should be created to obtain support from high school personnel, community groups, industry, clergy, and others.

1. Daniel Bell, The Coming of Post-Industrial Society (New York: Basic Books, 1973).
2. For additional information see Seymour Martin Lyiset and Reinhard Bendix, Social Mobility in Industrial Society (Berkeley: University of California Press, 1959); Peter Blau and Otis Dudley Duncan, The American Occupational Structure (New York: John Wiley, 1967); Albert Wohlstetter and Sinclair Coleman, Racial Differences in Income (Santa Monica: The Rand Corporation, 1970).
3. Planning Commission for Expanding Minority Opportunities in Engineering, Minorities in Engineering: A Blueprint for Action (New York: The Alfred P. Sloan Foundation, 1974).
4. Engineers' Joint Council, a memorandum by John D. Alden for the Engineering Manpower Commission, January 1976.
5. Planning Commission for Expanding Minority Opportunities in Engineering, 1974.
6. Blau and Duncan, 1967.

WORKSHOP PROCEEDINGS: THE HIGHLIGHTS

To accomplish the objectives of the workshop, the Task Force on the Minority Engineering Program Directors' Workshop organized the meeting around four major themes: Administrative Skills and Resources for Minority Engineering Program Managers (Session I), Increasing the Pool of Minority Students Through Guidance, Motivation, and Preparation (Session II), The Personal and Professional Development of Minority Engineering Students (Session III), and Retention (Session IV). The following are highlights of the discussions on each of those themes, the major unresolved problems and issues, and recommendations for affirmative action.

*** SESSION I ***

ADMINISTRATIVE SKILLS AND RESOURCES FOR
MINORITY ENGINEERING PROGRAM DIRECTORS

Keynote Address	Panel Moderator	Workshop Chairpersons	Workshop Reporters
Herman B. Smith Chancellor University of Arkansas Pine Bluff, Arkansas	Arthur J. Bond Coordinator, Programs for Disadvantaged Students Purdue University Lafayette, Indiana	Arthur J. Bond Coordinator, Programs for Disadvantaged Students Purdue University Lafayette, Indiana George F. Egner Contributions Advisor Exxon Corporation New York, New York Rene Cardenas Fund for the Improvement of Post-Secondary Education Washington, D. C. Manuel Salinas Assistant to the Chancellor Texas A&I University System Kingsville, Texas	W. Edward Lear Dean of Engineering University of Alabama University, Alabama Joseph Nedrow Assistant Director Placement and College Relations General Motors Corporation Detroit, Michigan M. R. Ray Personnel Relations Dow Chemical, USA Midland, Michigan Winston E. Allen Manager, Education Research and Development Xerox Corporation Leesburg, Virginia

SESSION I: ADMINISTRATIVE SKILLS AND RESOURCES FOR MINORITY ENGINEERING PROGRAM DIRECTORS

> It has long been my conviction that the proper job of the institutional administrator is to be the chief catalyst, facilitator, and interpreter of the institution's educational and service efforts. If any institutional program is to succeed, it must have the informed and enthusiastic backing of the administration. Without such support, the engineering program manager, regardless of how enthusiastic, competent, or committed he may be, can expect less than optimum results from his efforts....
> ...the energetic commitment to and expert execution of a defensible minority engineering program can serve as a useful mechanism for improving and making more effective the institution's engineering program for all students....
>
> Dr. Herman Smith
> Chancellor
> University of Arkansas[1]

Panel moderator Dr. Arthur Bond stated that improving an institution's engineering program, and particularly increasing the number of minorities in that program, requires the institution's commitment to provide the support and resources needed for an effective program to minority engineering program directors. This was a general theme in each of the four concurrent working groups in Session I.

The major theme of Session I was sub-divided into the following:

- Development of Institutional Commitment
  (Chairperson: Dr. Arthur J. Bond).
- Utilizing Industrial Support
  (Chairperson: Mr. George F. Egner).
- Obtaining Resources to Implement a Comprehensive Program
  (Chairperson: Dr. Rene Cardenas).
- Overview of Packaging of Student Financial Aid
  (Chairperson: Mr. Manuel Salinas, Jr.).

Development of Institutional Commitment

The major issues discussed in the working group on institutional commitment were:

- The nature of commitment
- How to achieve institutional commitment.
- The competing pressures on minority engineering program directors who may also be members of the enginering faculty.

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[1] See page 62 for the complete text of Dr. Smith's speech.

- The criteria used by colleges and universities to select minority program directors.

An issue discussed at length was whether the university should be a place for social action as well as education. Although the question remained unanswered, the members of this group generally agreed that the university, by the nature of its interaction with and impact on society as a whole, was an agent of social change and should play a leading role in advancing societal goals. The group felt that a minority engineering program should be an integral part of an institution's engineering program if it is to have the status and support necessary to operate effectively.

The discussion focused on the level of commitment (top administration, faculty, or student), the amount of resources committed to the minority program efforts, and the university's philosophy about its obligation to society. The participants felt that the institution should demonstrate commitment by allocating sufficient resources through the college of engineering to support a strong minority engineering effort.

Even in those institutions committed to a strong program, faculty members who are also program directors often find themselves penalized when it comes to promotion. Most colleges and universities recognize teaching, research, and publication as the major criteria for advancement. Because promotion and tenure are determined by faculty and administrative committees, these committees should consider creating tenured positions for directors of minority engineering programs or reevaluating the criteria for promotion and tenure to recognize the contributions of those faculty who are active in minority programs.

Dr. Paul Gray, Chancellor of the Massachusetts Institute of Technology, described the minority engineering program directors' job as a lonely one, "not part of the traditional context of college and university responsibilities." Dr. Gray added that, "one of the principal benefits of this workshop and similar conferences is that they enable people serving in these positions to realize that the problems they face are not unique to their own campuses, but shared by others in the forefront of social change."

Although there was no general agreement that a program director should be an engineer or a minority person, it was agreed that a qualified person should be in charge of the program. While the lack of a qualified minority is no excuse for failing to implement a minority engineering program, some felt that the selection of a minority director was a demonstration by the institution of its commitment to the minority program goals. A minority director can enhance the image of the institution through contacts outside the institution and provide a role model for minority students.

Recommendations

The primary recommendations made by the working group on administrative skills and resources were that:

- The minority engineering program must be an integral part of the college of engineering if it is to have the status and support necessary to operate effectively.
- Personnel involved in minority engineering programs should have the skills and be given the resources necessary to set up dynamic programs.

- Colleges and universities should consider contributions of faculty who work with minority engineering students as criteria for promotion and tenure.
- Agencies and foundations contributing funds to colleges should encourage those colleges to increase the number of minority engineering graduates as part of their affirmative action plans.
- The Committee on Minorities in Engineering should develop activities that will enhance the awareness, cooperation, and support of members of the engineering and academic communities for minority engineering initiatives.

Utilizing Industrial Support

The major topics discussed in the working group on utilizing industrial support included.

- The specific needs of business and industry which leads them to support minority engineering programs.
- The general and specific patterns of support by industry for minority engineering programs.
- Suggestions for preparing and submitting project proposals to industry and getting those proposals funded.

The resource people encouraged the program directors to learn the general patterns of industrial giving. Each company has its own particular philosophy, structure, administrative procedures, priorities, geographic considerations, and modus operandi that govern minority program efforts.

There is a gap in understanding between some educational institutions and the industries from whom they request assistance, especially of the kind of programs industries want to support. However, it is in the interest of business and industry to contribute to minority program efforts because these programs develop the skilled manpower industry needs. Representatives of both industry and academia should talk openly with each other about their needs and goals.

Industry is presently being called upon to fill--but cannot meet--a financial void created by reduction in government support for science education. Thus, colleges must realize that the lack of sufficient funds makes the situation a sellers' market. They must become accustomed to the eccentricities of the corporate philanthropic structure, which varies greatly from that of foundations and government. For example, while industry often responds to a request more quickly than foundations or government, such rapid response should not be construed as a demonstration of long-range commitment to the project. Long-term commitment is more characteristic of foundations or government, while industrial support is more likely to demand constant reevaluation and fine-tuning. Also, because of the supporters' demands, the final program is usually quite different from the original plan.

Industrial support can be much broader than financial support for specific projects. It can provide supporting services, materials, full or part-time staff, facilities, and access to the media through advertising. Minority program directors should know more about the resources available to them and explore with industry how these resources may fill specific program needs.

Often those colleges and universities that have proven records and have mastered the intricacies of obtaining funds from particular industries continue to get additional support. Other institutions, often the new ones, find it difficult or impossible to obtain support. Representatives of companies that provide support suggested to the workshop delegates some methods of preparing proposals and emphasized the importance of timing in submitting these proposals to the appropriate industrial representative

As George Egner, Contributions Advisor for the Exxon Corporation, stated, "The only way to get a share of the funds is to learn the ropes and develop sound, effective programs. Like it or not, 'have not' institutions must work a little bit harder if they are to receive the desired funding.

Recommendations

Responding to such statements, participants in the working group recommended that:

- Directors of minority engineering programs should learn the general patterns of industrial giving in order to increase the chances of success when seeking support.
- Directors should increase their knowledge of the full range of possible resources available and explore with potential donors the best ways of increasing the impact of the programs.
- Directors should send project proposals to more than one source to widen the opportunities for success.
- Whenever possible, industry and academia should join together in alerting minority students to career opportunities in engineering.
- Members of industry and academia need to exchange information regarding available resources, manpower requirements, and each other's program goals.
- The Committee on Minorities in Engineering should encourage increased awareness among minority communities of the opportunities offered through engineering education.

Obtaining Resources to Implement a Comprehensive Program

The working group in obtaining resources to implement a comprehensive program heard presentations by representatives of organizations which provide funding for minority engineering programs. They also discussed examples of the types of funding that are available and suggestions for preparing effective project proposals. The resource people provided insights into the criteria used by their organizations to evaluate proposals and select fundable projects.

While model proposals were discussed, several participants emphasized that there is no standard format to meet the requirements of all funding organizations. However, proposals should always include a section detailing how the project will be evaluated and what will be the anticipated cost/benefits.

In the discussion that followed, some participants said they needed to know more about how and where to obtain funds for existing programs and how to develop new programs. Another major concern was the lack of coordinated information on how, when, and where to apply for support for minority programs.

Recommendations

Based on the presentations and discussions, the delegates recommended that:

- Concerned organizations should develop a directory or handbook similar to the Foundation Directory, but with a focus on business, industry, and government agencies, as well as foundations, that provide support to minority engineering efforts. Such a directory should include a calendar indicating when requests should be submitted to major funding agencies and names of the appropriate people to contact.
- Institutions applying for aid should include in their proposals a plan for program evaluation and an explanation of what the cost/benefit ratio is expected to be and how it will be measured.

Overview of Packaging of Student Financial Aid

The working group on the packaging of student financial aid was devoted to:

- Familiarizing participants with technical information, definitions, funds, and mechanics involved in development of student assistance programs.
- Exploring and familiarizing participants with special problems in obtaining financial aid from funding institutions.
- Recommending ways to improve the techniques used in applying for financial aid.

The main problems identified by delegates to this working group included determining student need, inadequate resources to meet the needs of minority students, and the difficulties that work-study students face in handling an engineering curriculum as well as a 15-20 hour work week. A suggested list of criteria for minority engineering program directors to use was developed as an aid in evaluating student need. One of these criteria is the financial need of a student as defined by the differences between reasonable expenses of an academic year and the amount the student's family can contribute toward these expenses.

A weakness in many of the minority program efforts is the inefficient method of forwarding information on financial aid to potential students at the

time they are making post-high school plans. A selected list of federal programs available to students who qualify for financial aid was distributed to workshop delegates.

In his presentation at this working group, Garvey E. Clarke, President of the National Fund for Minority Engineering Students, said the fund will provide scholarships to supplement existing sources of aid for Black, Chicano, Puerto Rican, and Native American students. The awarding of scholarships began in the fall of 1975.

Recommendations

The chairperson and other working group panelists summarized the discussion by encouraging minority program directors to:

- Maintain close contact with financial aid officers in their own institutions and potential funding agencies to facilitate the completion of arrangements for students in need of financial aid.
- Increase their knowledge about federal, state, local and private programs which might provide financial support for their own programs.
- Insure that prospective students receive financial aid information prior to their arrival on campus.

The participants encouraged the Committee on Minorities in Engineering to:

- Explore new methods of enhancing the impact of federal resources on minority program initiatives.

*** SESSION II ***

INCREASING THE POOL OF MINORITY STUDENTS
THROUGH GUIDANCE, MOTIVATION, AND PREPARATION

Keynote Address	Panel Moderator	Workshop Chairpersons	Workshop Reporters
Armando M. Rodriguez President East Los Angeles College Los Angeles, Calif.	Richard T. Mullins Office of the Dean Stevens Institute of Technology Hoboken, New Jersey	Art Velarde President Montebello Unified School District Montebello, California	Frank Negron Director, Affirmative Action Program City University of New York New York, New York
		Carson Carr Syracuse University Ithaca, New York	Clifton Powell Assistant to the Dean for Minority Group Students University of Illinois Chicago, Illinois
		Nate Thomas Illinois Institute of Technology Chicago, Ill.	Francis Wells MITE Program Vanderbilt University Nashville, Tenn.
		Ewaugh Fields Assistant Vice President for Academic Affairs Drexel Univ. Philadelphia, Pennsylvania	Oswald Rendon-Herrero Assistant Professor of Civil Engineering State University of New York Buffalo, New York

SESSION II: INCREASING THE POOL OF MINORITY STUDENTS THROUGH GUIDANCE, MOTIVATION, AND PREPARATION

I call your attention to the means by which we can achieve our goal: Identification, Motivation, Guidance, Preparation, Retention, and Placement of the minority engineering student. Success in each of these areas is dependent upon an organized effort in concert with concerned parties from the fields of education, engineering, and government. These agencies must respond from all levels. Furthermore, our efforts must be geared not only to increasing the pool of minority students but to making certain that these students become engineers.

For too long the nation has wasted a vast and valuable national resource. Engineers are described as people who find practical applications for abstract scientific discoveries. Certainly there is enough creative genius present in our professions to develop the means by which minorities can be equally represented.

Dr. Armando Rodriguez
President
East Los Angeles College[1]

The moderator for this panel, Dr. Richard Mullins, said that the Session II working groups provided an opportunity for minority engineering program directors to interact with engineering deans, secondary school counselors, and university administrators, as well as corporate personnel and representatives of national organizations, such as the American Personnel and Guidance Association (APGA), the National Academy of Engineering, and various government officials, to address the need for parity representation of minorities in engineering. Although racial discrimination continues to be a barrier, delegates to the Session II workshops felt that the programs discussed could provide effective tools for achieving this representation.

The major theme of Session II was sub-divided into the following:

- Guidance and Motivation
  (Chairperson: Dr. Art Velarde).
- Recruitment and Identification
  (Chairperson: Mr. Carson Carr).
- Academic and Personal Preparation - Pre-College
  (Chairperson: Mr. Nate Thomas).
- Academic and Personal Preparation - Pre-Enrollment (Bridge)
  (Chairperson: Dr. Ewaugh F. Fields).

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[1] See page 66 for the complete text of Dr. Rodriguez's speech.

Guidance and Motivation

The major problems considered by the working group on guidance and motivation were:

- High minority drop-out rates.
- Stereotyping of minorities as uninterested in education.
- The poor self-image of minorities which affects their motivation and accomplishments.

Participants in this working group discussed the major barriers faced by minorities seeking access to satisfying educational and employment opportunities. One manifestation of this problem is the high drop-out rate of minority students for such reasons as:

- Boredom and social problems
- Financial responsibilities
- Early marriage
- Expulsion
- Military service

Colleges and universities cannot correct all these problems without cooperation and support from secondary schools, community organizations, professional societies, and others concerned with the problems. In addition to providing counseling, scholarship assistance, and work-study experiences, colleges and universities should work closely with community and high school programs that inform minorities of the attractiveness of the engineering profession and the criteria for acceptance into college and university engineering programs.

Secondary schools can provide students with a better understanding of the demands of an engineering program through improved counseling. Junior and senior high schools should attempt to reduce the pupil/counselor ratio, which is sometimes as high as 400 to 1. Schools with limited resources should seek closer involvement with 4-H Clubs, Future Farmers of America, the Boy Scouts, and other community groups that could contribute program support and motivational role models.

Recommendations

Suggestions and recommendations to secondary school counselors and administrators for ways of improving guidance programs and increasing minority student motivation included:

- Encouragement of state legislatures to appropriate resources to support joint high school-college career education programs.
- Development of programs to increase minority awareness of the careers available to them through engineering.

- Establishment of teacher-industry exchange programs that would increase mutual understanding of the problems and responsibilities faced by each.
- Implementation of programs enabling high school counselors to visit colleges and universities so they may become more familiar with the environment, challenges, and background requirements of engineering programs.
- Expansion of the role of the Committee on Minorities in Engineering in the collection, packaging, and dissemination of information about minority engineering programs.
- Encouragement of the Committee on Minorities in Engineering to establish or support the establishment of an Engineers' Speakers Bureau which could recommend speakers from the engineering profession for junior and senior high school programs.

Recruitment and Identification

The major topics discussed by the working group on recruitment and identification were the importance of ethnic, geographic, and economic factors in identifying and recruiting qualified students and descriptions of several programs which are responding to these needs. The following programs were noted by the resource people in this working group as representative of the kinds of pre-college programs available to minority students.

- CIMPEAT (Committee to Increase Minority Professionals in Engineering, Architecture, and Technology).
  A private, non-profit organization which maintains information on most engineering programs in the country and assists minority engineering students to find employment and financial assistance from business and industry.
- LULAC (League of United Latin American Citizens).
  A private, non-profit organization which is devoted to increasing the enrollment of minorities, especially Latin American minorities, in engineering and other programs. The emphasis of the program is on placement through one-to-one counseling and active follow-up.
- ME^3 (Minority Engineering Education Effort).
  A private, non-profit organization which concentrates primarily on pre-college guidance. It distributes literature to high school seniors who have selected engineering as a career objective through SAT and ACT exams and distributes lists of these students to all engineering schools. ME^3 also sponsors a film, "A Piece of the Action," which is designed as a motivational aid.
- SHPE (Society of Hispanic Professional Engineers).
  A professional organization which concentrates on motivating Hispanic high school students through personal recruiting and follow-up services to those who are accepted into engineering programs.

- MITE (Minority Introduction to Engineering Efforts). Coordinated by the Engineers' Council for Professional Development (ECPD), MITE programs are two-week summer courses designed to motivate minorities to consider an engineering career. The academic sessions feature mathematics, demonstrations, laboratory experiments, case studies, engineering problems, and field trips to industrial plants. Students live in college dorms with all expenses paid.

In the dialogue that followed, the major issues were:

- The use of students in recruitment. Although students can serve as role models, it is important to train those who represent the institution as recruiters. Well-trained students can be effective recruiters, but colleges and universities have a tendency to overuse them for this purpose. The demands of recruiting reduce the time students have to devote to their studies.
- The importance of having minority engineering faculty visit junior and senior high schools. Minority engineering faculty can serve as role models and at the same time present a realistic picture of the demands of an engineering program.
- The need for interviews with parents as well as students. An assessment of the home environment may provide clues to the kinds of problems potential students may encounter if they enroll in engineering programs and can therefore be a useful guidance tool for the minority program director or other counselors.
- The need for supportive services in addition to effective recruitment programs. Once minority students are recruited, a keen sensitivity to their unique problems may be required to help them complete the program successfully. There is a tendency for institutions to overlook the student's needs in their drive to increase the number of minorities on their campuses. This may result in an aggressive recruitment program which presents an unrealistic picture of the demands of the engineering program.

Participants disagreed about the availability of minority students qualified for admission to colleges and universities. Dr. Bond presented statistics on Indiana, showing that there were barely 50 Black high school graduates who were admissible to the top engineering schools. Others argued that, depending on the definition of "admissible," there were more than enough minority students available who could, with the appropriate support, be successful in engineering programs.

Nate Thomas of the Illinois Institute of Technology said "We have to get into more untraditional recruiting methods. This means you are not going to find many of the people who have the potential as you walk in and walk back out of schools.... It may take you to pool rooms, basketball games, the street

corners. You may find them anywhere, but they're out there.... The idea is to turn them on to the objectives we want to reach."

Thomas believes that there are enough qualified minority students right now, "...if we merely open our eyes and go out and take a look and find them through our recruitment programs." He reminded the participants that, "No where, at any time, while espousing this objective, did I hear anyone at the Academy mention the fact that the engineers or minorities that we recruit have to be poor or that they would have to be remedially trained.... We have always had minorities in colleges. We have had them in abundance, especially within the last 10 years. The fact that they did not go into engineering had nothing to do with their finances. It has to do with knowing what the field is all about...."

Recommendations

Delegates to this working group recommended that:

- The Committee on Minorities in Engineering should hold regional meetings to help program managers take advantage of the expertise and experience already available. The meetings might take the form of workshops similar to the Minority Program Directors' Workshop, but should be limited to specific problem areas.
- High schools and community colleges should focus on increasing the kinds of programmatic activities that will result in higher minority engineering enrollments.
- Colleges and universities should increase their use of community agencies such as CIMPEAT, ME^3, LULAC, and MITE, as well as the support of professional societies that can help identify students interested in engineering, provide supportive services to guide them into engineering, and successfully complete their education.
- Colleges and universities should consider using students to recruit qualified minorities for their schools.
- Organizations collecting data on the socio-economic characteristics of minorities should expand the scope of the data to include more information on minority enrollments, retention, and graduates.

Academic and Personal Preparation - Pre-College

The major problems considered by the working group on academic and personal preparation (pre-college) were:

- Minority students are not introduced to the engineering profession early enough to appreciate the rewards of becoming an engineer or to become motivated to strive for admission into an engineering program.
- Students are often evaluated solely on the basis of test scores, without the additional information that personal interviews can provide.

- Not enough emphasis is placed on the positive impact that summer jobs and cooperative education experiences can have on motivating minority students to enter and complete engineering programs successfully.
- Parents and counselors are often unaware of the opportunities available in engineering and engineering education and therefore cannot provide encouragement to students to prepare for and enter these programs.

A major problem that minority students face when they enter college and university engineering programs is that they are inadequately prepared for the discipline and hard work required to complete the programs successfully. To attempt to keep such students in the engineering curriculum, colleges and universities often spend a high percentage of their program funds on remediation to compensate for the inadequate personal and academic preparation of the students.

The discussion focused on ways that secondary school programs could improve preparation. Delegates agreed that there is a critical need at the pre-college level for programs which present a realistic view of the kinds of pressures and demands that students will encounter in colleges of engineering. Such preparation could not only save scarce resources that could be used to strengthen other aspects of minority engineering programs, but could also eliminate considerable frustration and bitterness on the part of individual students.

In addition, Dr. Charles Kishibay emphasized that student dropouts or transfers from the engineering program should not necessarily be interpreted as a failure on the part of the minority engineering program or the student. Engineering is a broad area of education that prepares students for many fields including medicine, law, and dentistry. For this reason, students who are attractive to colleges of engineering are attractive to other departments as well. Likewise, students who do well in engineering may do equally well in other programs and may prefer to apply their knowledge to another field. In the process of trying to acquaint the student with the potential rewards and benefits of engineering, secondary school counselors, college and university recruiters, and others providing guidance to secondary school students should emphasize that engineering training can lead to opportunities in fields other than engineering.

Recommendations

The exchange of ideas in this working group led delegates to recommend that:

- Secondary schools, colleges, and universities should work together to introduce students to the engineering profession and positive engineering-related experiences through visits to engineering companies and universities with engineering programs and personal meetings with successful minority engineers.

- In the case of minority students, colleges and universities should use the results of test scores more as guidance tools than as primary criteria in their acceptance or rejection of the student for college engineering.
- Colleges and universities should strive to follow a student's progress from pre-college motivation programs until after graduation, when the student is well established in an engineering position or has become committed to another field.
- Colleges and universities should direct more of their efforts and funds toward recruitment of well-qualified minorities without regard to the economic status of the potential student.
- The Committee on Minorities in Engineering should conduct a study of the ways in which technical and vocational programs in secondary schools can be strengthened to provide alternate paths of entry into college and university schools of engineering.

Academic and Personal Preparation - Pre-Enrollment (Bridge)

The focus of the discussion in the working group on academic and personal preparation (pre-enrollment bridge programs) was on the essential elements for structuring a bridge program between high school and college. Among those considered essential were:

- Pre-freshman preparation in mathematics and physical science.
- Communication skills--reading, writing, and oral.
- Survival skills--adjustment and pacing.
- Motivation--orientation to potential careers in engineering.
- Orientation--financial aid, admissions, social implications, and parents.
- Exposure to engineering through practical exposure to industry and to the laboratory.
- Supportive services such as tutoring, counseling, and advising as follow-up to bridge programs.

There are three broad categories of bridge program elements:

- Survival skills

Problem areas for which student survival skills would have to be developed are:

.. Adjustment to a new life style. For example, from a rural life to a more demanding urban environment.
.. Competing at a higher academic level than previously experienced.
.. Developing and adjusting to new ways of studying.
.. Surviving as a minority in a traditionally white-dominated setting.

.. Coping with increased freedom and mobility without parental supervision.
.. Using available facilities and resources (library, students, faculty, other campus services).
.. Learning to work and deal with the administrative offices of the college or university.
.. Learning to work with counselors on personal or academic problems.
.. Budgeting time.

- Orientation

.. Pre-Testing of mathematics and reading skills.
.. Familiarization with all of the engineering disciplines.

- Evaluation and Recommendations

Bridge programs should not last longer than eight weeks so that students have a break between high school and college. Among the courses recommended for a bridge program were: trigonometry, algebra, chemistry, communication skills, and an introductory physics course duplicating a non-major first year college course. There is a debate over whether mathematics should be taught by engineers or by mathematicians. Communication skills would include reading and writing. Physics and computer programming are not recommended for bridge programs.

During the bridge program students should be exposed to college-type courses, exams, and quizzes. A highlight of the program should be individual counseling. At the end of the six-to-eight week bridge program, the college or university official should conduct interviews with the student, the teacher, and his counselors. The decision on whether the student is ready for an engineering program should depend on the interviews and the student's performance on exams and quizzes.

*** SESSION III ***

THE PERSONAL AND PROFESSIONAL DEVELOPMENT
OF MINORITY ENGINEERING STUDENTS

Keynote Address	Panel Moderator	Workshop Chairpersons	Workshop Reporters
Alvin I. Thomas President Prairie View A & M University Prairie View, Texas	Elbert L. Cox Assistant to the Dean of Engineering Howard University Washington, D.C.	Larry Marshall Assoc. Superintendent for Alternative Educational Programs Houston Independent School District Houston, Texas Fred D. Brown Director, Co-op Program University of Tennessee Knoxville, Tenn. Charles W. Merideth Coordinator of Dual Degree Program Atlanta University Center Atlanta, Georgia Willie J. Nunnery Assistant to the Dean of Engineering University of Wisconsin Madison, Wisconsin	Gil Lopez Project Director Identification of Minorities for Science and Engineering Program University of Massachusetts Amherst, Massachusetts Ray Guthrie Director of Minority Affairs Northeastern University Boston, Massachusetts Joseph Bordogna Professor of Electrical Engineering University of Pennsylvania Philadelphia, Pennsylvania

SESSION III: THE PERSONAL AND PROFESSIONAL DEVELOPMENT OF MINORITY ENGINEERING STUDENTS

> In terms of education and the quality of education, Black youth still receive less education and the quality of this education is lower than for the majority group. The current crisis of the public schools in the nation is nothing compared to the crisis of these minority youth as they fight their way through the integrated schools of this nation.
>
> Currently there are approximately one million engineers in this nation. Approximately 12,479 are Black. This represents less than 1.3 percent of the nation's total...
>
> It is in this context that we seek to increase the number of minority engineers. It is in this setting that we seek the personal and professional development of minority engineering students.
>
> Dr. Alvin I. Thomas
> President
> Prairie View A & M University[1]

Panel moderator Dr. Elbert Cox reviewed the components and designed successful secondary school programs that were discussed during Session III. Each of the four working groups stressed the importance of strong and effective secondary school programs to enhance the personal and professional growth of minorities as these programs are necessary for successful experiences in cooperative education.

This theme was divided into the following:

- Secondary School Programs
  (Chairperson: Dr. Larry Marshall).
- Cooperative Education Experience (Educationally Work Related)
  (Chairperson: Mr. Fred D. Brown).
- Types of Cooperative Efforts
  (Chairperson: Dr. Charles W. Merideth).
- Samples of College/University Minority Engineering Programs
  (Chairperson: Mr. Willie J. Nunnery).

Secondary School Programs

The working group on secondary school programs considered alternate approaches to providing career guidance for those entering the field of engineering and to giving minority students the necessary prerequisites in high

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1 See page 69 for the complete text of Dr. Thomas' speech.

school so they can be regularly admitted into college engineering programs without remedial assistance. The curriculum in secondary schools does not always serve the children of minority and poor backgrounds whose learning style is often different from that of other students. Thus, there is a need for alternate educational choices that are flexible enough to accommodate a variety of unique learning styles while giving the students the sound math and science backgrounds that are critical for success. Two alternatives were considered:

The Houston High School for the Engineering Profession

The Independent High School for the Engineering Professions, located in the Independent School District of Houston, Texas, provides a learning environment for highly talented, college-bound youth who may wish to major in engineering. The students will not, however, be locked into only one possible career. The curriculum will include strong components in communication skills and the humanities and will serve as an excellent preparation for law, medicine, business, and any of the sciences.

The school opened in the fall of 1975 with approximately 125 students (400 applications were received by June 1975) in grades 9 and 10 only. Grades 7 and 11 will be added in the fall of 1976 and grades 12 and 8 in the fall of 1977.

Where appropriate, the school uses individualized instructional techniques that have been demonstrated to be particularly effective with high ability students. The mathematics and English programs in particular incorporate continuous progress systems. These permit high ability students to progress as fast as they are able to demonstrate mastery of the material.

The school is located at the Booker T. Washington High School in Houston Texas, but is an independent school within it, having its own assistant principal and its own faculty or approximately 12 teachers.

College of Engineering, University of Massachusetts

The University of Massachusetts' College of Engineering has just completed the first phase of a long term activity in which an alternative math and science program has demonstrated the feasibility of identifying, counseling, and preparing high ability students in eight high schools for college engineering programs. This program employs the university as a coordinating institution for surrounding high schools and as a resource to assist these schools in developing alternative math and science programs for students who have high math ability and an interest in technical careers. The alternative program is based on a project oriented curriculum directed by a math or science teacher. This teacher works with the program staff from the College of Engineering, which serves as coordinator for the eight schools.

The second phase of the project will continue the development of the project curriculum and establish a consortium of participating high schools, local universities, and community colleges. Representatives from industry, community action groups, and federal and state agencies will also be included in the consortium. The long term goal of the program is to provide students with high math aptitudes an opportunity to have better preparation for a

college engineering program.

In spite of the obvious benefits of such alternate secondary schools, the working group participants identified some potential problems with such programs. For example:

- The Independent High School for the Engineering Professions and similar schools may be taking a small supply of highly talented minority students from other schools, which will leave those schools without the academic leadership necessary for a good overall student environment.

  The argument for this alternative is that, in a specialized high school program dedicated to engineering and science, students who do not now have an opportunity to consider technical careers can realize their full potential through academic challenge and a self-paced learning environment.

- The instructional techniques of these specialized secondary school programs often use individualized and self-paced instructional techniques. Instruction in college, however, is often highly structured. High school students who obtain their secondary school education in such a flexible learning environment may experience difficulties in adjusting to the more highly structured environment in college.

  The argument for this alternative is that the highly individualized and self-paced instructional techniques enable students to progress at their own pace. Those students who are able to complete the course in less than the prescribed period of time should have a strong incentive to go on to progressively more difficult courses. This self-pacing and positive reinforcement can provide the necessary incentive for them to achieve as they work toward academic goals.

Recommendations

Delegates in this working group recommended that:

- Colleges and universities should collaborate and establish formal relationships with local high schools that have a good learning environment for math and science. These high schools, which may be organized within minority high schools, would provide the needed academic preparation for highly talented minority students who do not currently have the proper academic environment with a career track to engineering and science.

- High schools interested in establishing an engineering or science track for their students should establish consortia which include representatives from high schools, colleges, universities, community action groups, industry, and federal and state agencies to broaden

the base of support for minority engineering program efforts. This should increase the awareness by the consortia members of the unique problems and strengths of the other members so that all can work to improve the quality of current minority engineering efforts.

Cooperative Education Experience (Educationally Work Related)

The major objective of the working group on cooperative education experiences (educationally work-related) was to identify cooperative education experiences that could help prepare minority engineering students to be successful in their chosen careers. Two programs were considered:

The Pre-Co-op Program at the University of Tennessee

The Pre-Co-op Program has established a comprehensive scholarship program aimed at a fifteen-fold increase in the number of minority engineering graduates during this decade. A group of minority students is selected each year from high school seniors who are interested in the academically qualified for engineering careers. The number of students selected is determined by the support for this program by government, business, and industry. Students are recruited primarily from Tennessee and other southeastern states but, if necessary or desirable, students may be taken from other areas.

The minority engineering program is built around the co-op program in which students alternate quarters of academic work with industrial experiences. There are two additional components: a pre-co-op summer work period immediately following high school graduation and a grant-in-aid program.

The SCOPE (Scholarship Cooperative Program in Engineering for Minority Students) at Northeastern University

The SCOPE program provides full scholarships to qualified minority students based on merit and need. In addition to the scholarships, cooperative work assignments are given at the end of the freshman year, and alternate quarters in the upperclass years. Each interested student who applies for admission to SCOPE is considered on individual merits.

In considering the advantages of co-op programs for potential engineering students, working group participants identified several primary benefits:

- Early exposure to the field of engineering which could give students the motivation to enter and succeed in an engineering program.
- Engineering-related experience.
- Financial help.

From the point of view of the college or industry providing the co-op work experience, co-ops can serve as a useful public relations tool. Although there are many obvious benefits of co-op programs, some problems were identified:

- There is a lack of meaningful co-op work provided to students by some companies.
- Some co-ops are tied too closely with company scholarships so that it appears the company is buying the services of the minority student.
- Tension often develops between students getting new jobs and local workers being laid off, especially during periods of economic slump.

Recommendations

In view of the overall benefit of co-op experiences, participants in this working group recommended that:

- Colleges and universities should maximize the use of co-op programs as motivation tools and as entry support for potential minority students in terms of recruitment, financial aid, and potentially valuable work experiences.
- Colleges and universities should maintain close working relationships with industries that provide co-op experiences to assure that minority students are gaining the most meaningful engineering-related experiences possible.

Types of Cooperative Efforts

The major topics considered by the working groups on types of joint efforts were:

- The dual degree effort.
- The consortium.
- The community college.
- Special efforts of the National Indian Education Association (NIEA).

The underlying philosophy of these programs is that the traditional channels for moving through the educational system of this country are not sufficient for meeting the challenge of increasing the number of minority graduates. This is primarily because minority students' needs are more than academic. The following examples were discussed in this workshop and represent the types of joint efforts available to minority students:

The Dual Degree Program

Dual degree programs are joint efforts among universities. There are various models and each usually takes four or five years to complete. Students spend one period of the program at one institution and the other in a second institution. Each period is completely separate. They are identified as the 2/2, 2/3, 3/3, and 3/2 programs, depending on the number of years spent at each university. Students can complete these programs in four years, but it is common to spend five years completing one program. Some students earn a Master of Science in Engineering degree in five years. Most programs have a faculty exchange system.

In the dual degree program at Atlanta University Center, for example, the student spends all his time at the first college during the first year and all of his last year at the second college. He has joint registration at both schools (which are in close proximity--about 1.5 miles apart). There are 293 students enrolled over five classes. The program is unique in that it combines four colleges into one center associated with the Georgia Institute of Technology. In addition, the program offers a greater experience in the liberal arts than in the standard engineering program.

Consortium Programs

Consortium programs are joint efforts among a variety of institutions representing the academic, business, and professional communities as well as citizen groups. The Philadelphia Regional Introduction to Minority Engineering (PRIME) program, for instance, effectively combines universities, colleges, community colleges, school districts, major industries, professional societies, governmental agencies, students, and community representatives (parents' associations, Urban League, Explorer Scouts). Membership is by sector of society, not by individuals. PRIME is currently working to gather funds to pair industries on a one-to-one basis with 14 junior high schools.

Community College Programs

Community college programs work closely with both high schools and colleges to provide a bridge between the two so that students who are not ready for entry to college-level curriculum may have additional preparation. The College Discovery Program at the Staten Island Community College provides academic and supportive services. It is geared to providing educational opportunities to disadvantaged students. Introductory college courses have been revised and included in the curriculum. Both student and faculty development is emphasized. The faculty are expected to chart their progress as well as the student's progress. Evaluation of the faculty for promotion and salary increases is based on these progress reports.

Six elected students and six elected faculty members form a governing board for the purpose of budgeting and promotion. The Staten Island development model is compared to other programs by an outside body of evaluators who are asked to provide unbiased feedback to enhance program development.

The National Indian Education Association Program

In addition to the joint efforts that were discussed during this working group, the NIEA efforts were presented by Conrad Downing, NIEA's Associate Executive Director. The main thrust of NIEA is advocacy, communication, and coordination of Indian education efforts.

The School of Engineering at the University of New Mexico was the first to develop an engineering program for Native Americans. At present, the program is oriented toward Navajo and Pueblo, but is open to Native Americans throughout the country. As of June 1975, 65 Native Americans have applied to the program and 120 have contacted the university for further information.

In spite of the benefits of such programs in preparing minority students for entry into colleges of engineering, some weaknesses were identified:

- Inadequate contact of professional societies with community college students.
- The lack of student awareness in community colleges of the curriculum which will best enable them to enter a university or engineering college at the junior level.
- The lack of awareness on the part of college and university faculty of the minority student's problems in community colleges.
- The need for community college administrators to interface with professional organizations and businesses to prepare and motivate community college students for entry into four-year engineering programs.

Recommendations

After having discussed the joint efforts noted above, participants in this working group recommended that:

- The administration and staff of community colleges take steps to have their students take appropriate math and science courses.
- The Committee on Minorities in Engineering study ways of facilitating the transfer of community college students and secondary school students in vocational education to engineering programs in four year colleges and universities.

Samples of College/University Minority Engineering Programs

A number of successful programs were reviewed by the working group on samples of college/university minority engineering programs. The discussion focused on the common features in each of these programs. They included:

- Major support from the dean of the school of engineering and from the university administration.
- Support from the tenured faculty.
- Well-defined organizational structures, whether composed of faculty, volunteers, or non-faculty staff.

A major problem identified was the financial commitment incurred by some minority engineering students and the particular burden this places on students who do not complete the program. The group felt that the only way to avoid this problem was to assure minority students who enter the engineering program that they will not be burdened with major loan commitments. This should be done by providing adequate financial support to those in financial need.

A summary of the programs discussed in this working group as well as a summary of the other major minority engineering programs is included in the report Building Effective Minority Programs in Engineering Education, published by the National Academy of Sciences in September 1975. Copies of the report are available from the Committee on Minorities in Engineering.

*** SESSION IV ***

RETENTION

Keynote Address	Panel Moderator	Workshop Chairpersons	Workshop Reporters
Randolph W. Bromery Chancellor University of Massachusetts Amherst, Massachusetts	Julia Davidson Mission MOTON Education Opportunity Center Washington, D.C.	Leland Blank Mechanical and Industrial Engineering University of Texas El Paso, Texas	Raymond Landis School of Engineering California State University Northridge, Ca.
		Abbas Aberi Engineering Recruitment Coordinator North Carolina A & T State University Greensboro, North Carolina	Phillip Schmidt Assistant Professor of Mechanical Engineering University of Texas Austin, Texas
		Charles Kishibay Associate Professor of Mechanical Engineering University of Bridgeport Bridgeport, Connecticut	Wilbur Somerton Professor of Petroleum Engineering University of California Fullerton, Ca.
		Clinton Dozier Associate Dean of Students New Jersey Institute of Technology Newark, New Jersey	Samuel Mendoza Coordinator of Minority Relations California State University Fullerton, Ca.

SESSION IV: RETENTION

Minority students, even more than non-minority students, need an early visual sighting of a job possibility upon graduation. This will help students to seriously consider alternate professional objectives and to increase their motivation in overcoming academic difficulties. Early identification and counseling should be accomplished for those who demonstrate a strong graduate school potential.

A program of this design was developed and established for minority students (Blacks, Puerto Ricans, and Native Americans) at the University of Massachusetts and the results after seven years indicate a far better than average retention and graduation level at the university.

Dr. Randolph W. Bromery
Chancellor
University of Massachusetts[1]

Panel moderator Dr. Julia Davidson summarized the feelings of the delegates to Session IV by saying that the issues, problems, and recommendations considered and discussed were too complex to treat adequately in half-day sessions. "The diversity of interests and backgrounds represented at the workshop," stated Davidson, "helped to sensitize the participants to the unique problems of the various ethnic groups. The face-to-face interaction gave participants an opportunity to sharpen their focus on the problems and issues confronting those working toward increasing the representation of minorities in engineering." Dr. Davidson emphasized, however, that a certain lack of sensitivity to the problems of minorities persists among some who are involved with the minority engineering effort. She said, "We need to continue to work on sensitizing academic and industry personnel, perhaps through additional conferences such as this one."

It was recommended by the delegates that one follow-up workshop or seminar be devoted exclusively to the topic of retention. The delegates of this seminar should prepare a comprehensive action agenda that could be implemented by educational institutions, business and industry, and government agencies, as well as the Committee on Minorities in Engineering.

The working groups concerned with retention considered three topics: orientation, academic and social support programs, and career development. These working groups were chaired by Dr. Leland T. Blank, Dr. Abbas Aberi, Dr. Charles O. Kishibay, and Mr. Clinton Dozier.

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[1] See page 74 for the complete text of Dr. Bromery's speech.

The following is a summary of selected issues considered by the working groups:

- While all agreed on the benefits of tutorials, there was no general agreement about whether they should be mandatory. Some felt there is a need to distinguish between students who would benefit from tutorials and those who could work better on their own. Others felt that optional tutorials are not effective because only better students use them. It was agreed that all could benefit from a combination of group and individual work and that students who are supported financially should be required to attend tutorials.
- Faculty and staff retention is an issue which has not been addressed adequately. There are several aspects to the problem. First, those faculty who provide part-time support services to a minority engineering program have limited time to devote to research and publication. Since the university reward system recognizes teaching, research and publication as criteria for advancement and tenure, these faculty are in effect penalized for the time they devote to social support services. Secondly, non-faculty minority program directors are often placed in non-tenured positions which raises questions about the security of their jobs. Finally, minority engineering program directors who teach as well may decide to devote their full time to teaching responsibilities, leaving the minority program without adequate leadership.
- Both in pre-college contacts and interactions after the student has enrolled in college, language barriers inhibit communication between minority students and college and university officials. Participants discussed the advantages and disadvantages of using "slang" and "lingo" to break down such barriers. It was generally agreed that the most important concern of the university should be to give the student a realistic picture of what is expected of him as an engineering student and impress upon him the importance of expressing himself or herself effectively. Using sensitive minority graduate students to orient and interact with new students may help to break down communication barriers.

Pre-College Programs

Because academic problems cause the greatest number of minority drop-outs at the college level (though it was agreed that other factors had a significant impact on the drop-out rate but were sometimes harder to single out), pre-college programs were considered critical to the success of the minority engineering goals at the college and university level. Suggestions were made that the pre-college programs be provided as early as junior high school, or at least by the summer between the tenth and eleventh grades.

The success of such pre-college programs and their contribution to the student's achievements in college depends largely in close working relationships between the universities and colleges and the high schools. The inability to make the transition from an inferior secondary school to a rigorous college engineering program is one major cause of student failure.

In addition to sound pre-college programs, factors other than test scores should be used as indicators of potential success or failure. Home environment, parents' employment situation, and the student's own motivation are among the critical factors that should be taken into consideration. Personal interviews with the student and his family can also provide useful information for the evaluation of potential students.

Counseling and Social Support Activities

There was no general agreement about how to implement the most effective support activities for minority engineering programs. Some delegates felt that the support activities should be built on existing counseling programs. Others felt that such activities should be integrated with the total program of the school of engineering. Many participants felt, however, that non-engineers could be more helpful in assisting minority students make the initial social adjustment, because of the tendency of specialized groups to become isolated from the total campus environment.

University Social and Professional Organizations

Student organizations can be an extremely valuable aid in academic and social counseling. Some, however, are more political than service-oriented, and thus alienate some engineering students. A problem encountered at several institutions was the identification of some minority students' organizations with political movements or causes in developing countries. At some schools the Black students from engineering societies identify with these "third world" movements and lose sight of their primary goal--graduating as engineers.

In addition to keeping minority student organizations integrated with overall program efforts, staff and faculty working with social and professional organizations should work to integrate industry, professional societies, and practicing engineers into the educational process as motivational tools.

Separate minority engineering organizations have been successful in several places. Representatives from such schools as the University of Texas at Austin, Stevens Institute of Technology, and Purdue University discussed the organizations on their campuses. A common factor in all the successful programs discussed was the effort by faculty advisors or staff directors to assure that such organizations remain an integral part of overall minority engineering efforts.

Recommendations

The working group delegates recommended that:

- Institutions with co-op programs, industry, and government should work more closely with minority engineering program directors to

enhance retention rates and to consider the cultural and geographical problems characteristic of different minority groups which hinder communication.

- Pre-college efforts are essential to the increased retention of minorities at the college level. Therefore, bridge programs and other pre-college efforts should receive increased attention and support by both colleges and secondary schools.
- Colleges and universities should assist high school counselors and teachers to identify potential engineering students early and to work closely with these students to guide them into college engineering programs.
- Colleges and universities, with the support of professional societies, should work to provide potential minority students with adequate information and materials to motivate and prepare them for entry into the engineering curriculum.

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LIST OF PARTICIPANTS

MINORITY ENGINEERING PROGRAM DIRECTORS' WORKSHOP

Abbas Aberi
Engineering Recruitment Coordinator
North Carolina A & T State University
312 North Dudley Street
Greensboro, North Carolina 27411

Sam Ajiri
Detroit Institute of Technology
2727 Second Avenue
Detroit, Michigan 48201

Winston E. Allen
Manager, Education Research and Development
Xerox Corporation
Post Office Box 2000
Leesburg, Virginia 22075

Douglas Ames
Assistant to the Dean
College of Engineering
Oklahoma State University
Room 111 Engineering North
Stillwater, Oklahoma 74074

Robert Armstrong
Manager, College Relations
Employee Relations Department
E. I. duPont de Nemours and Company
Wilmington, Delaware 19898

Louis Baldwin
Union Carbide Corporation
270 Park Avenue
New York, New York 10017

Maria A. Barden
Assistant Director
Engineering Opportunity Program
New Jersey Institute of Technology
323 High Street
Newark, New Jersey 07102

David Bates
Department of College Relations
U.S. Steel Corporation
600 Grant Street
Pittsburgh, Pennsylvania 15230

Michael Besel
Associate Dean
College of Engineering
University of Wisconsin
Milwaukee, Wisconsin 53211

Robert Blake
Associate Professor
College of Engineering
Ohio State University
2015 Neil Avenue
Columbus, Ohio 43210

Leland T. Blank
Mechanical and Industrial Engineering Department
University of Texas at El Paso
El Paso, Texas 79968

Dorothy Bomberger
Conference Coordinator
Committee on Minorities in Engineering - JH 611
National Research Council
2101 Constitution Avenue
Washington, D. C. 20418

Arthur J. Bond
Coordinator, Programs for Disadvantaged students
Freshman Engineering Department
Purdue University
Lafayette, Indiana 47907

Joseph Bordogna
Professor of Electrical Engineering
University of Pennsylvania
109 Towne Building/D3
Philadelphia, Pennsylvania 19174

Robert Borrmann
Assistant Dean
School of Engineering
Manhattan College
4513 Manhattan College Parkway
Bronx, New York 10471

Marion Bowden
Assistant to General Manager
Energy Research and Development
Administration
Washington, D. C. 20545

Karl Brenkert
Dean of Engineering
University of Mississippi
University, Mississippi 38677

Carmen Brock-Smith
Counsellor
School of Engineering
Howard University
2300 6th Street, N.W.
Room 1110
Washington, D. C. 20059

Randolph Bromery
Chancellor
University of Massachusetts
Amherst, Massachusetts 01002

Julius Brown
Professor of Engineering
Southern Illinois University
Edwardsville, Illinois 62025

George Butler
Acting Director of Voluntary
Programs
Equal Employment Opportunity
Commission
1800 G Street, N.W.
Washington, D. C. 20550

Rene Cardenas
Fund for the Improvement of
Post-Secondary Education
400 Maryland Avenue, S.W.-Room 3141
Washington, D. C. 20202

Carson Carr
(Syracuse University)
103 Birchwood Drive
Ithaca, New York 14850

Rudy Castro
LULAC National Education Centers
400 1st Street, N.W. - Room 716
Washington, D. C. 20001

Salvador Ceja
Energy Research and Development
Administration
Washington, D. C. 20545

Warren Cerrone
Assistant Dean
College of Engineering
University of Detroit
4001 West McNichols Road
Detroit, Michigan 48221

Gil Chavez
Office of Spanish Speaking Concerns
Office of Education
400 Maryland Avenue, S.W.
Washington, D. C. 20202

J. T. Childs, Jr.
IBM Corporation
Armonk, New York 10504

Garvey Clarke
President
National Fund for Minority
Engineering Students
220 East 42nd Street - Room 420
New York, New York 10017

Paul Collins
American Personnel and Guidance
Association
1607 New Hampshire Avenue, N.W.
Washington, D. C. 20036

Elbert L. Cox
Assistant to the Dean
School of Engineering
Howard University
2401 6th Street, N.W.
Washington, D. C. 20001

W. Lionel Craver, Jr.
Department of Mechanical and
Industrial Engineering
University of Texas at El Paso
El Paso, Texas 79968

Richard Daugherty
Assistant Dean of Engineering
University of Delaware
Newark, Delaware 19711

Julia Davidson
Mission of Community Concern
Mission MOTON Education
Opportunity Center
3920 South Capitol Street, S.E.
Washington, D. C. 20032

Wilbert Davis
Assistant Director - ACT 101
Drexel University
Philadelphia, Pennsylvania 19104

George Dawson
Department of Economic Development
National Urban League
501 East 62nd Street
New York, New York 10021

Eugene DeAcosta
Board of Education
100 Newkirk Street
Jersey City, New Jersey 07306

Conrad Downing
National Indian Education
Association
3036 University Avenue, S.E.
Minneapolis, Minnesota 55414

Clinton N. Dozier
Associate Dean of Students
New Jersey Institute of Technology
323 High Street
Newark, New Jersey 07102

George Egner
Contributions Advisor
Exxon Corporation
1251 Avenue of the Americas
New York, New York 10019

William Elliott
Manager, Educational Relations
American Cyanamid Corporation
Public Affairs Division
Wayne, New Jersey 07470

Ewaugh F. Fields
Assistant Vice President for
Academic Affairs
Drexel University
Philadelphia, Pennsylvania 19104

Dennis Ford
School of Business
Texas A & I University
Kingsville, Texas 78363

Dale Foreman
Associate Professor and Affirmative
Action Officer
Colorado School of Mines
Basic Engineering Department
Golden, Colorado 80401

G. P. Francis
Chairman, Department of Mechanical
Engineering
State University of New York
Main Street
Buffalo, New York 14214

Ernest Franke
Dean of Engineering
Texas A & I University
Kingsville, Texas 78363

Elmer Gaden
Dean of Engineering
University of Vermont
Burlington, Vermont 05401

Rodrigo Garcia
Society of Hispanic Professional Engineers
Post Office Box 48 Main Office
Los Angeles, California 90053

John Gilmore
Professor of Math and Physics
University of Arkansas
Pine Bluff, Arkansas 71601

Ricardo Girakos
National Spanish Speaking Program Coordinator
Department of the Navy
110 West C Street
San Diego, California 92101

Bruin Glover
Director of PROMES
Cullen College of Engineering
University of Houston
Houston, Texas 77004

Edmund Gonzales
(Eight Northern Indian Pueblo Council)
1500 5th Street, No. 13
Santa Fe, New Mexico 87501

Paul Gray
Chancellor
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Irwin Goodwin
Assembly of Engineering
National Research Council
2101 Constitution Avenue
Washington, D. C. 20418

Raymond Guthrie
Director of Minority Affairs
Northeastern University
College of Engineering
360 Huntington Avenue
Boston, Massachusetts 02115

Ted Habarth
Applied Physics Laboratory
Johns Hopkins University
8621 Georgia Avenue
Silver Spring, Maryland 20910

Mildred Haney
Administrator, Dual Degree Program
Fisk University
Department of Development
Nashville, Tennessee 37203

Arthur G. Hansen
President
Purdue University
Lafayette, Indiana 47907

Jack Harkey
Assistant Dean of Engineering
Southern Methodist University
Institute of Technology
Dallas, Texas 75275

Joseph Harris
Staten Island Community College
715 Ocean Terrace
Staten Island, New York 10301

W. Lincoln Hawkins
Assistant Director of Chemical Research Laboratory
Bell Laboratories
600 Mountain Avenue
Murray Hill, New Jersey 07974

Thomas Henderson
School of Engineering
Southern University
Post Office Box 9969 Southern Branch Post Office
Baton Rouge, Louisiana 70813

Rudolf Henning
Assistant Dean of Engineering
University of South Florida
4204 Fowler Avenue
Tampa, Florida 33620

John Hernandez
College of Engineering
New Mexico State University
Box 3449
Las Cruces, New Mexico 88003

Lucille Higgins
Financial Aid Director
Pratt Institute
Brooklyn, New York 11205

William Hogan
Associate Dean of Engineering
University of Kansas
Lawrence, Kansas 66045

Clyde Holland
Coordinator, Civil Engineering Technology
Northern Arizona University
NAU Box 15600
Flagstaff, Arizona 86001

Clarke Howatt
Assistant Dean of Engineering
University of Southern California
University Park
Los Angeles, California 90007

Earl Iselin
Assistant Professor of Industrial Technology
University of Dayton
300 College Park Avenue
Dayton, Ohio 45469

David R. Jenkins
Chairman, Department of Civil Engineering
Florida Technological University
Box 25000
Orlando, Florida 32816

David Johnson
Director of Engineering Admissions
Cornell University
Carpenter Hall
Ithaca, New York 14850

Helen Johnson
Special Assistant
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706

Robert B. Jones, Jr.
Voluntary Council on Equal Opportunity, Inc.
1901 Gas & Electric Building
Baltimore, Maryland 21203

David Kent
President
National Scholarship Service and Fund for Negro Students
1776 Broadway
New York, New York 10019

Charles Killgore
Associate Dean of Engineering
Louisiana Tech University
Box 4875 Tech Station
Ruston, Louisiana 71270

Kenneth Kimball
School of Engineering
California Polytechnic State University
San Luis Obispo, California 93407

Charles Kishibay
Associate Professor of Mechanical Engineering
University of Bridgeport
Bridgeport, Connecticut 06602

William Kucker
ALCOA
Pittsburgh, Pennsylvania 15219

Raymond Landis
School of Engineering
California State University
Northridge, California 91324

Harold Lanier
Corporation for Advanced
Experimental Learning Program
North Carolina A & T State
University
202 Dudley
Greensboro, North Carolina 27411

W. Edward Lear
Dean of Engineering
University of Alabama
Post Office Box 1968
University, Alabama 35486

Karl Lewis
Director, Pitt Engineering Impact
Program
School of Engineering
University of Pittsburgh
740 Benedum Engineering Hall
Pittsburgh, Pennsylvania 15261

Thomas Liao
Associate Director
Engineering Concepts Curriculum
Project
College of Engineering
State University of New York
Stony Brook, New York 11790

Peter Likins
Assistant Dean of Engineering
UCLA
7400 Boelter Hall
Los Angeles, California 90024

Erna Aparicio Lindley
Director
LULAC Education Center
440 Education Center
Phoenix, Arizona 85066

Catherine Little
Assembly of Engineering
National Research Council
2101 Constitution Avenue
Washington, D. C. 20418

Jose Longoria
Director
LULAC Education Center
702 Morgan Avenue
Box 3455
Corpus Christi, Texas 78404

Gil Lopez
Project Director
Identification of Minorities for
Science and Engineering Program
School of Engineering
University of Massachusetts, Amherst
Amherst, Massachusetts 01002

Jesse Lopez
General Atomic Corporation
10955 John Hopkins Drive
San Diego, California

Alfonso Ludi
Director, Spanish Speaking Program
National Aeronautics and Space
Administration
600 Independence Avenue, S.W.
Washington, D. C.

Robert MacCallum
Associate Professor
College of Engineering
University of Arkansas
Fayetteville, Arkansas 72701

Louis Madonna
Associate Dean of Engineering
Widener College
17th and Walnut Streets
Chester, Pennsylvania 19013

Lawrence Marshall
Associate Superintendent for
Alternative Educational Programs
Houston Independent School District
3830 Richmond Avenue
Houston, Texas 77027

James Matheny
Dean, School of Engineering
California State University, Fresno
Fresno, California 93740

James Mayo
Deputy Director, Science Education
Resource Improvement Division
National Science Foundation
1800 G Street, N.W.
Washington, D. C. 20550

Henry McCloud
Director of Financial Aid
New Jersey Institute of Technology
323 High Street
Newark, New Jersey 07102

Claude McGee
Kennedy King Junior College
69th and Wentworth Avenue
Chicago, Illinois 60621

Fred McKenzie
Coordinator of Co-op Education
West Virginia Institute of
Technology
Montgomery, West Virginia 25136

Jackie Means
Committee to Increase Minority
Professionals in Engineering,
Architecture and Technology
Post Office Box 1097
Atlanta, Georgia 30301

Forrest Lee Melton
Associate to the Dean
College of Engineering
University of Florida
Gainesville, Florida 32611

Samuel Mendoza
Coordinator of Minority Relations
Career Planning and Placement
Center
(and Mexican American Engineering
Society)
California State University, Fullerton
Fullerton, California 92634

Charles W. Merideth
Coordinator of Dual Degree Program
Atlanta University Center
Box 262
Atlanta, Georgia 30314

Roger Messenger
College of Engineering
Florida Atlantic University
Baca Raton, Florida 33432

Caroline N. Metcalf
Acting Director
Native American Program
College of Engineering
University of New Mexico
Albuquerque, New Mexico 87131

Edward Misiaszek
Associate Dean of Engineering
Clarkson College of Technology
Potsdam, New York 13676

L. K. Monteith
Professor of Electrical Engineering
North Carolina State University
232 Daniels Hall
Raleigh, North Carolina 27607

Anne Monterio
Director, Minority Projects Office
University of Michigan
Room 268 West Engineering Building
Ann Arbor, Michigan 48104

George Moore
College of Engineering
University of Missouri, Columbia
Columbia, Missouri 65201

Richard T. Mullins
Office of the Dean
Stevens Institute of Technology
Castle Point Station
Hoboken, New Jersey 07030

Kenneth Murray
Assistant Dean of Engineering
Old Dominion University
Hampton Boulevard
Norfolk, Virginia 23508

Micah H. Naftalin
Executive Director
Assembly of Engineering
National Research Council
2101 Constitution Avenue
Washington, D. C. 20418

Joseph Nedrow
Assistant Director, Placement and College Relations
General Motors Corporation
8-162 General Motors Building
Detroit, Michigan 48202

George Neely
Director, Dual Degree Program
Department of Development
Fisk University
Nashville, Tennessee 37203

Frank Negron
Director of Affirmative Action Program
City University of New York
430 East 80th Street
New York, New York 10021

Willie J. Nunnery
Assistant to the Dean
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706

Marion Oliver
Director, C-MAP
Carnegie Institute of Technology
Carnegie-Mellon University
5000 Forbes Avenue
Pittsburgh, Pennsylvania 15213

Philip Ordung
Professor of Electrical Engineering
University of California
Santa Barbara, California 93106

William Orme
General Electric Foundation
1285 Boston Avenue
Bridgeport, Connecticut 06602

Louis Padulo
Director, Minority Programs
Stanford University
Stanford, California 94305

J. W. Parker
Manager, Urban and Community Affairs
Energy Research and Development Administration
9800 South Cass Avenue
Argonne, Illinois 60439

Paul Parker
Assistant Dean of Engineering
University of Illinois
207 Engineering Hall
Urbana, Illinois 61801

George Pearsall
Professor of Mechanical Engineering
Duke University
Durham, North Carolina 27706

Ed Peña
Office of Contract Compliance
Equal Employment Opportunity Commission (and Vice President of LULAC)
2401 E Street, N.W.
Washington, D. C.

Ettore Peretti
Assistant Dean of Engineering
University of Notre Dame
Notre Dame, Indiana 46556

Percy Pierre
Dean of Engineering
Howard University
2300 6th Street, N.W.
Washington, D. C. 20001

Ralph Pike
College of Engineering
Louisiana State University
Atkinson Hall
Baton Rouge, Louisiana 70803

Jurgen Pohly
Chief of Minority Research
Code P
Office of University Affairs
National Aeronautics and Space Administration
Washington, D. C. 20546

Clifton Powell
Assistant to the Dean of Engineering for Minority Group Students
University of Illinois
Box 4348
Chicago, Illinois 60680

Melvin Ramey
Associate Professor
College of Engineering
University of California, Davis
Davis, California 95616

Julius Randall
Minority Engineering and Science Co-op Program
Pratt Institute
Chemistry Building 16B-C
Brooklyn, New York 11205

Alfonso Ratcliffe
Director, Minority Engineering Program
College of Engineering
California State University
Northridge, California 91324

M. R. Ray
Personnel Relations
Dow Chemical, USA
Barstow Building
2020 Dow Center
Midland, Michigan 48640

Fred Reeves
Coordinator of Co-op Education
Illinois Institute of Technology
10 West 33rd Street
Chicago, Illinois 60616

Oswald Rendon-Herrero
Assistant Professor of Civil Engineering
State University of New York
Buffalo, New York 14214

Stephen Rice
Assistant Professor of Mechanical Engineering
University of Connecticut
U-139
Storrs, Connecticut 06268

Elliot Rich
Associate Dean of Engineering
Utah State University
University Hall
Logan, Utah 84322

Alfred Richardson
Los Angeles Council of Black Professional Engineers
5768 West Pico Boulevard
Suite 4
Los Angeles, California 90019

Cordell Richardson
C-MAP Program
Carnegie-Mellon University
Pittsburgh, Pennsylvania 15213

Ernest Robles
Executive Director
LULAC National Education Center
400 1st Street, N.W.
Washington, D. C. 20003

Martin Roden
Associate Professor of Engineering
California State University
5151 State University Drive
Los Angeles, California 90032

Armando Rodriguez
President
East Los Angeles College
5357 East Brooklyn Avenue
Los Angeles, California 90022

James Rogers
Associate Professor of Electrical Engineering
University of Alaska
3211 Providence Avenue
Anchorage, Alaska 99501

Barrie S. H. Royce
Associate Professor of Engineering
Princeton University
Princeton, New Jersey 08540

Manuel Salinas, Jr.
Assistant to the Chancellor
Texas A & I University System
Kingsville, Texas 78363

Richard Salvatierra
LULAC Education Service Center
400 1st Street, N.W.
Washington, D. C. 20003

Medardo Sanchez
Director of Spanish Speaking Programs
Department of Agriculture
Washington, D. C. 20250

Phillip Schmidt
Assistant Professor of Mechanical Engineering
University of Texas, at Austin
Taylor Hall
Austin, Texas 78712

F. W. Schutz
Assistant to the Dean of Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Lionel Senhouse
Executive Director
Minority Engineering Education Effort (ME^3)
345 East 47th Street
New York, New York 10017

William Shanahan
Manager, Cooperative Engineering Education and Admissions
George Washington University
725 23rd Street, N.W.
Washington, D. C. 20052

Benito Sinclair
Los Angeles Council of Black Professional Engineers
5768 West Pico Boulevard
Suite 4
Los Angeles, California 90019

Kenneth Smikle
Associate Director, IEMSE
School of Engineering
University of Massachusetts, Amherst
Amherst, Massachusetts 01002

Herman Smith
Chancellor
University of Arkansas, Pine Bluff
Pine Bluff, Arkansas 71601

William Smith
Assistant Director of Dual Degree Program
School of Engineering
Vanderbilt University
Box 6138 Station B
Nashville, Tennessee 37235

Robert Snelsire
Associate Professor
College of Engineering
Clemson University
Clemson, South Carolina 29631

Robert Snyder
Director of MITE Program
Rochester Institute of Technology
One Lomb Memorial Drive
Rochester, New York 14623

Wilbur Somerton
Professor of Petroleum Engineering
University of California, Berkeley
5134 Etcheverry Hall
Berkeley, California 94720

Carl W. Staples
Student Employment Coordinator
Chemicals and Plastics Division
Union Carbide Corporation
South Charleston, West Virginia

Steven Sylvester
Assistant to the Vice President
for Academic Operations
Stevens Institute of Technology
Castle Point Station
Hoboken, New Jersey 07030

Janie Taylor
Naval Material Command Headquarters
MAT OOE C.P. Number 5
Washington, D. C. 20360

Alvin I. Thomas
President
Prairie View A & M University
Prairie View, Texas 77445

Floyd Thomas
Associate Dean of Engineering
California State University
800 North State College Boulevard
Fullerton, California 92634

George Thomas
Director of Indian Affairs
College of Engineering
University of Oklahoma
202 West Boyd
Norman, Oklahoma 73069

Nate Thomas
Illinois Institute of Technology
3300 Federal Street
Chicago, Illinois 60616

Raymond F. Tickner
Coordinator of Minority Engineering
Education
Exxon Company, USA
Post Office Box 2180
Houston, Texas 77001

J. C. Twombly
Director, Engineering Minority
Program
University of Colorado
EC OT 1-4
Boulder, Colorado 80302

Arturo Velarde
President
Montebello Unified School District
123 South Montebello Boulevard
Montebello, California 90640

Julia Weertman
Assistant to the Associate
Dean of Engineering
Northwestern University
2145 Sheridan Road
Evanston, Illinois 60201

Francis Wells
MITE Program
Department of Electrical Engineering
Vanderbilt University
Nashville, Tennessee 37203

Rita Welte
Coordinator of MEIOP
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106

George L. White
Director of Corporate Support
Programs
Bethlehem Steel Corporation
Bethlehem, Pennsylvania 18016

Minerva White
Director, Native American Special
Services Programs
(and Coalition of Eastern Native
Americans)
St. Lawrence University
13-B Hepburn Hall
Canton, New York 13617

James Williams
Dallas ME^2 Coordinator
c/o Education Opportunity Center
Room 307
Main Bank Building
Dallas, Texas 75201

Ethel Williamson
Acting Director, Engineering
Opportunity Program
New Jersey Institute of Technology
323 High Street
Newark, New Jersey 07102

Eugene Wilson
Director of Engineering Equal
Opportunity Porgram
Michigan State University
112 Engineering Building
East Lansing, Michigan 48824

William Wockenfuss
Associate Dean of Engineering
University of Maryland
College Park, Maryland 20742

Robert Young
Director of Engineering Technician
Training Program
University of Southwestern Louisiana
USL Box 3690
Lafayette, Louisiana 70501

Jacques Zakin
Director, Minority Engineering
Program
University of Missouri, Rolla
Rolla, Missouri 65401

TASK FORCE ON MINORITY ENGINEERING PROGRAM DIRECTORS' WORKSHOP

Chairperson: Ewaugh F. Fields
Assistant Vice President
for Academic Affairs
Drexel University
32nd and Chestnut Street
Philadelphia, Pennsylvania 19104

Arthur J. Bond
Coordinator, Programs for
Disadvantaged Students
Purdue University
Lafayette, Indiana 47907

Elbert L. Cox
Assistant to the Dean
of Engineering
Howard University
2401 Sixth Street, N.W.
Washington, D.C. 20001

Clinton N. Dozier
Associate Dean of Students
New Jersey Institute of Technology
323 High Street
Newark, New Jersey 07102

George Egner
Contributions Advisor
Exxon Corporation
1251 Avenue of the Americas
New York, New York 10019

Rodrigo T. Garcia
The Society of Hispanic Professional
Engineers
Post Office Box 48 Main Office
Los Angeles, California 90053

Raymond Landis
School of Engineering
California State University
Northridge, California 91324

Richard Mullins
Office of the Dean
Stevens Institute of Technology
Castle Point Station
Hoboken, New Jersey 07030

Willie J. Nunnery
Assistant to the Dean
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706

Clifton Powell
Assistant to the Dean for Minority
Group Students
University of Illinois
College of Engineering
Box 4348
Chicago, Illinois 60680

Manuel Salinas, Jr.
Assistant to the Chancellor
Texas A & I University System
Kingsville, Texas 78363

INTRODUCTORY REMARKS AND KEYNOTE SPEECHES

- Dr. Arthur G. Hansen
- Dr. Percy A. Pierre
- Mr. Melvin W. Thompson
- Dr. Herman B. Smith
- Dr. Armando M. Rodriguez
- Dr. Alvin I. Thomas
- Dr. Randolph W. Bromery

The Role of the Assembly of Engineering in the Minority Engineering Effort

Arthur G. Hansen
Chairman, Committee on Minorities in Engineering
President, Purdue University

OPENING

Two years ago the National Academy of Engineering (NAE) sponsored a symposium that set in motion the events that led to the sponsorship of this workshop by the Committee on Minorities in Engineering. Some of you were present at that meeting and appeared on its program. Indeed your involvement preceded that meeting and has been crucial to the continued growth of minority engineering programs. For some of you, this is your first opportunity to meet with others working toward the common goal of increased minority participation in engineering. I welcome each of you and trust the workshop will meet your expectations and provide you with valuable tools for continuing your work.

Tonight, I would like to take a few minutes to review the events of the past two years as they relate to the NAE's role in the minority engineering effort. I would like to focus on the background of the Committee, its goals and strategy, its structure, and its current activities.

COMMITTEE HISTORY

The National Academy of Engineering hosted a "Symposium on Increasing Minority Participation in Engineering" in Washington on May 6-8, 1973. Approximately 250 engineers, engineering educators, university representatives, and minorities met to discuss approaches to minority engineering student recruitment, supportive programs, and financial needs.

Members of the Symposium, meeting in a final plenary session, agreed unanimously to establish a national goal of achieving a ten-fold increase in minority engineers within a decade by raising the annual number of minority engineering graduates from 500 to 5,000. There was consensus that this was a reasonable goal, provided the necessary resources could be marshalled on the national and regional level.

Two implementing recommendations were adopted:

1. That the National Academy of Engineering establish a Standing Committee on Minorities in Engineering composed of a cross section of Symposium delegates to include engineering educators, members of minority groups, representatives of industry, and professional/technical organizations.

2. That the National Academy of Engineering take the initiative in exploring with industry, government, and educators, the feasibility of creating a National Council on Minorities in Engineering.

Following the Symposium, potential participants in both mechanisms were contacted to determine their interest and role should the decision be made to create a "Committee on Minorities in Engineering" and a "National Advisory Council on Minorities in Engineering." In early 1974, a steering committee meeting was held to determine initial goals and objectives of a Committee program.

The first meeting of the National Advisory Council on Minorities in Engineering (NACME), formed by invitation of former NAE President Robert C. Seamans, Jr., met on February 6, 1974. Reginald H. Jones, Chairman of the Board and Chief Executive Officer of the General Electric Company, convened the first meeting of the Council which provides advice to the NAE. Dr. Richard J. Grosh, President, Rensselaer Polytechnic Institute, was named Chairman of the Committee on Minorities in Engineering.

Under the leadership of Dr. Grosh, the Committee held its first meeting April 29, 1974. Goals, objectives, and initial activities were approved by the Committee. In the following months, the Committee began its multi-faceted program of action oriented toward achieving these goals and objectives.

The efforts of the Committee were recognized late in 1974 in a report of the Planning Commission for Expanding Minority Opportunities in Engineering entitled Minorities in Engineering: A Blueprint for Action, where the following recommendation was made:

> The Task Force recommends that the National Academy of Engineering (NAE) assume a leadership role in coordinating the efforts of the many organizations working to increase minorities in engineering and in stimulating development of new programs that may be needed nationally. Without surrendering their independent prerogatives, these organizations should participate in the coordination effort and cooperate fully with each other, discussing their current activities and future plans so that other participants can factor these actions into their own plans and carry out a cohesive national effort.

Thus, the Committee and NACME have responded to the challenges of the Symposium and the Planning Commission.

COMMITTEE GOALS AND STRATEGY

The Committee on Minorities in Engineering serves in response to the need for national leadership and coordination of activities which are best calculated to achieve parity representation for minorities: Black, Chicano/Mexican-American, Puerto Rican, and American Indian among each class of B.S. engineering graduates. To achieve this mission, the Committee has the following five general goals:

- To encourage and develop opportunities to increase minority participation in engineering by defining needs, resources, and recommending programmatic activities.
- To develop generic models of successful approaches to minority engineering activities.
- To coordinate and stimulate minority engineering activities by providing advice and encouraging interaction between appropriate groups.
- To serve as a resource center on minority engineering activities and programs related to minority engineering activities.
- To communicate and disseminate data, information, and studies related to minority participation in engineering.

To achieve these goals the Committee on Minorities in Engineering interacts on the decision-making level with the organizations and institutions that influence the career choice, preparation, education, employment, and financing of minority engineering students and programs. It encourages effective and efficient use of the institutional structures, organizational mechanisms, and delivery systems available to increase minority participation in engineering. Priority is given to activities which can become an integral part of established processes so as to produce measurable progress toward achievable enrollment, retention, and graduation targets.

Where necessary, we facilitate the creation of mechanisms or organizations that are viewed as essential to achieving our final goal. For example, the Committee reviewed the recommendations that a scholarship program for minority engineering students could help overcome the financial obstacles facing students. In addition, it was noted that such a program could provide a means for industry, foundations, and others to demonstrate to minority students their commitment to bring minorities into the mainstream of the economy.

After careful deliberations, the Committee created the National Fund for Minority Engineering Students. J. Stanford Smith, President of International Paper, is Chairman of the Board of Trustees. Garvey Clarke, President of the Fund, is with us for this workshop; you will have an opportunity to hear and meet with him over the next two days. As a free-standing corporation, the Fund will develop its own program and priorities. As a member of the Board of Trustees, I can assure you that we will be formulating plans that will reinforce your efforts.

COMMITTEE STRUCTURE

Let's now look at the structure as it currently exists. The planning, implementation, and evaluation of the Committee program to increase minority participation in engineering involves several mechanisms.

National Advisory Council on Minorities in Engineering

The National Advisory Council on Minorities in Engineering composed of Chief Executive Officers of some of the nation's leading corporations, universities, engineering societies, and minority organizations, together with cabinet and sub-cabinet level government advisors, meets semi-annually to provide

advice and counsel to the President of the National Academy of Engineering and also to the Committee. The Council, through the industrial members, also provides financial support for the Committee.

Committee on Minorities in Engineering

The Committee on Minorities in Engineering is composed of a cross-section of individuals from the fields of engineering, engineering education, industry, minority organizations, and government. Its twenty-two members meet several times annually to establish policy, receive reports from subcommittees and task forces, and evaluate the progress toward minority enrollment and graduation targets.

Subcommittees

Four subcommittees guide the major areas of the Committee program. These subcommittees have the following responsibilities:

- Pre-Engineering Education, Guidance and Motivation is seeking to increase the pool of motivated and prepared candidates for admission to engineering schools. It reviews the need for improved guidance and motivation techniques and educational programming, especially at the secondary school and community college level.
- Engineering Education reviews academic and supportive service programs for minority students in engineering schools and other post-secondary institutions that may be preparing minority students for transfer to an engineering curriculum.
- Manpower Utilization focuses on increasing employment opportunities, the career mobility of minority engineers and the co-op programs and summer jobs available for minority engineering students.
- Finance serves as a national focal point for the coordination and collection of data on funding programs which will aid both engineering students and engineering schools in meeting the goals of the national program.

Task Forces

Two types of task forces provide the mechanisms for responding to the opportunities for increasing minority participation in engineering. One type of task force is composed of persons working on specific opportunities identified by the Committee, such as retention, career mobility, or secondary school curriculum. The second type of task force focuses on opportunities that cut across subcommittee lines or focus on broad issues related to minority engineering activities. Examples include task forces that focus on American Indian, Mexican-American, or Puerto Rican participation in engineering or on Black Engineering Schools. Task Force reports or products provide input to the appropriate subcommittees or the Committee.

Staff

The Committee staff prepares documents, reports, proposals, and other papers, as directed by the Committee, subcommittees, or task forces; interacts with participant organizations and institutions; and carries out such other tasks as it is assigned. The Executive Director is responsible to the Chairman of the Committee for the general management of the program and supervision of a staff which includes a Deputy Director, an Educational Specialist, a Manpower Specialist, and a Program Analyst.

COMMITTEE ACTIVITIES

In the first phase of its operation the Committee completed its organizational structure, staffed itself, and adopted a plan of action. As a consequence, the following activities were initiated or are in various stages of development:

- Facilitated the creation of the National Fund for Minority Engineering Students.
- Planned the Minority Program Directors' Workshop.
- Interacted with engineering schools, consortia, minority organizations, government agencies, industry, educational organizations, professional societies, and others on various phases of the minority engineering effort.
- Convened donor representatives to exchange information, discuss priorities, and identify needs in the minority engineering effort.
- Created a Task Force to stimulate local/regional coordinating activities aimed at increasing minority engineering activities.
- Completed a study to be published shortly on minority engineering programs at engineering schools.
- Created a Task Force on Governmental Involvement in Minority Engineering Activities.
- Created a Task Force on Puerto Rican Participation in Engineering.
- Created a Task Force on American Indian Participation in Engineering.
- Created a Task Force on Public Relations.
- Collected data, information, program descriptions, studies, and other materials on minority engineering activities.
- Developed a communications network for disseminating information to those interested and/or involved in minority engineering activities.

The first phase of the Committee activities achieved the following:

- Attracted a commitment to minority engineering goals from the highest levels of education, industry, government, and minority organizations.
- Provided a focal point for exchanging information, providing

advice, and offering assistance to those participating in the minority engineering effort.

FUTURE DIRECTIONS

The second phase of the Committee's effort will continue to focus on the four subcommittee program areas by stimulating and assisting in the development of initiatives which increase the pool of motivated and prepared minority freshman and transfer students. New initiatives will occur through:

- Creation of a Task Force on the role of math and science teachers in the minority engineering effort.
- Creation of a Task Force on curriculum innovations which effectively motivate and prepare junior and senior high school minority students for an engineering education.
- Creation of a Task Force on Retention.
- Creation of a Task Force on the career development of minority engineering graduates.
- Creation of a Task Force on summer programs or institutes.
- Creation of a Task Force to evaluate motivational techniques and instruments useful to the minority engineering effort.
- Creation of a Task Force on Chicano/Mexican-American Participation in Engineering.

I would like to thank the staff of CME for their efforts in making this workshop possible. With the help of such dedicated people along with help of people that are in attendance at the workshop our goals should be reached. Thank you for your interest and cooperation.

Keynote Address: Minority Program Directors' Workshop

Percy A. Pierre
Dean, School of Engineering
Howard University

A little over two years ago, I had the privilege of welcoming the participants in the Symposium on Minorities in Engineering. Many of you were there. At that time, we talked about a tenfold increase in minority engineering graduates. Although we are still a long way from that goal, I think the progress we have made so far is outstanding. I'm confident that this workshop will be a major stimulant in moving us closer to our goal.

As many of you know, I have had the major responsibility for administering the Alfred P. Sloan Foundation's program to increase opportunities for minorities in engineering. In the brief time allotted to me, I would like to tell you a little about that program and how it relates to other efforts in this area.

In September of 1973, the governing board of the Alfred P. Sloan Foundation agreed to invest from 12 to 15 million dollars over a 5 to 7 year period in efforts to increase opportunities for minorities in engineering. This commitment amounts to roughly 20 percent of the annual giving of the Foundation.

In the first year and a half, we have spent about $3 million in a variety of grants. Some of these grants were made with the understanding that they could be renewed. Therefore, our actual commitments at this point are closer to $5 million than to $3 million. It is important to note that the Foundation will continue to make new commitments over the next 3 to 5 years as our understanding of the problem increases and as the various programs evolve.

The history of the Alfred P. Sloan Foundation's commitment may be of interest to you. The concept of a focused program to increase opportunities for minorities was first used by the Sloan Foundation in its program in medicine and management. The total investment in these programs was approximately $10 million. During 1974 those programs were phased out in order to provide some of the resources for the minorities in engineering program.

When we started the management and medicine programs, consideration was given to an engineering program since engineering education is a major interest of the Foundation. However, it was concluded that the medical profession was more ready for an effort of this kind than the engineering profession. It was decided to review the possibility of an engineering program near the end of the medicine and management program. The key determinant was to be whether the engineering profession showed any signs of being ready for such an effort. Those signs began to appear in 1972.

It was in the summer of 1972 that the General Electric Company invited a group of deans of engineering to a meeting at Crotonville, New York to discuss

the problem of getting more minorities into engineering. Prior to that time, many of the major corporations had been active in supporting individual schools in developing minority engineering programs. Many of those companies had been quite generous and had been in part responsible for the noticeable progress that had occurred in the previous five years. However, G.E. brought a new concept to the effort, i.e., a coordinated and concerted effort to make significant nationwide progress in increasing the numbers of minority graduates. Following the General Electric meeting, an approach was made to the Commission on Education of the National Academy of Engineering under the chairmanship of W. Robert Marshall. The commission decided to sponsor a symposium on minorities in engineering to which I have previously referred.

About the same time, the six historically Black schools of engineering approached the Alfred P. Sloan Foundation as a group to seek support for their programs. As a result, the Foundation decided not only to encourage the Black schools but also to support the symposium, and finally, to consider launching a major effort in this direction. Eventually, the staff of the Foundation decided to make such a recommendation to the Board of Directors.

After approval by the Board in September 1973, we began with the following principles, or more accurately, biases:

1. Immediate funding should go to efforts that promised quick payoffs in freshman enrollments
2. Financial aid was essential
3. An overview of the dimensions of the problem was needed
4. Pre-college preparation was essential

In all of this, it was understood that the Foundation would have to run a highly "levered" program, i.e., invest in activities which would require and invite other sources of support. The first action was to follow through on our commitment to the Black schools. In doing so, we encouraged them to get involved in pre-college activities and recruitment.

Through our support of ME^3 (Minority Engineering Education Effort), we encouraged recruitment by all schools of engineering. For some schools, the ME^3 identification effort has proved quite useful.

Based on our experiences in the medicine and management program, we realized that financial aid was a vital ingredient of the solution. Indeed, we felt that it would be irresponsible to recruit students to opportunities that were not real and we knew that without financial aid, they would not be real. It has taken us longer than we had hoped to put in place a response to that problem, but we feel that we have made a promising start with the National Fund for Minority Engineering Students. You will be hearing more about the Fund during the next few months.

Since the creation of this organization was one of the principal recommendations of the Sloan Task Force, perhaps I should say a few words about it. This group was put together to provide a systematic picture of the problem, some of the barriers we face, some approaches to overcoming these obstacles, and some cost figures. It was not designed as an advisory group for the Sloan Foundation. In addition, we realized from the beginning that many of its projections would prove wrong. For example, who could have guessed that freshman engineering enrollments would jump from 52,000 in 1973 to 63,000 in 1974? In

my judgment, the principal value of such projections included in the report is to help us make qualitative judgments rather than to provide us with numerical facts. We feel that it has given us the approximate dimensions of the problem. Certainly, our concepts will continue to evolve.

Having satisfied ourselves that we were on the right track with the Fund, we renewed our interest in pre-college programs. We have supported a variety of summer programs, including two-week career orientations, eight-week instructional programs, and summer correspondence. All of these programs share the characteristic that they are aimed at giving the student what he didn't get in high school.

We have supported a few efforts that deal with students while they are in school. We need much more of this. One example is the Houston Alternative School. The beauty of this is that instead of teaching in the summer what should have been given in school during the year, it happens right in the schools.

In summary, our approach has been to: (1) support immediate recruitment efforts; (2) assure financial support for students; and (3) help increase the pool of prepared and interested minority high school students.

For the future we see continued support of the Fund, continued support of recruitment activities, and serious consideration of ways of getting more and better instruction out of the high schools.

Opening Statement

Melvin W. Thompson
Executive Director
Committee on Minorities in Engineering

In the late 60's, individual engineering schools, government agencies and corporations plunged into the minority engineering effort, though sometimes the programs they initiated were by trial and error. Most were not sure what they were getting into or even the commitments required for a sincere effort. They soon found out! Except in the Black engineering schools and a few other places, little experience was available. No handbooks outlined effective approaches; no flow-charts or plans described the critical path for increasing enrollments and graduation rates. Initially, attrition rates were high in most programs. Tutorial and other supportive activities were either minimal or non-existent. Some questioned whether minority efforts were the responsibility of engineering colleges.

By 1973, however, results began to show. Schools that previously had 0.5 percent Blacks, Mexican Americans, Puerto Ricans and Native Americans had 5 percent and more; more importantly schools began to graduate measurable and significant numbers of these minority students. These graduations indicated that what had not occurred, had not occurred because little had been done to provide genuine access to minorities desiring an engineering education. Thus, what began in isolated programs in different parts of the country, was recognized as an achievable objective by engineering educators and others. More importantly, participation in engineering by minorities was viewed as critical for the achievement of national goals and as a way of providing minorities the means of participating in the economic and educational mainstream of American life. As a result, minority participation in engineering received increased attention from industry, foundations, government, and minority organizations.

You are well aware of what followed. First, commitments developed from the highest levels of industry, education, government, and minority organizations to support a national effort to increase participation of the underrepresented minorities in engineering. Second, mechanisms critical for the effort were enacted such as: ME^3 to identify students; the Sloan Task Force to study program levels and make comprehensive recommendations; the Committee on Minorities to provide coordination; and the National Fund for Minority Engineering Students to provide scholarship assistance. Third, various activities enabled participants in the minority engineering effort to exchange ideas and information. For example, the Symposium held here in May of 1973, the regional meetings of the American Society for Engineering Education (ASEE) on minority programs; the Philadelphia Regional Introduction to Minority Engineering (PRIME) efforts in Philadelphia; and the other meetings held by industry and coalitions

of engineering schools provided useful forums.

Each of these activities, which were part of a start-up phase in the minority engineering effort, demonstrated that the various sectors of American life (industry, education, government and minorities) were committed to minority program goals. What remains however, is the most difficult period. That is, wide-spread implementation of activities that will increase in a meaningful way, the number of minority students prepared, motivated, and graduating with engineering degrees.

To ensure that program administrators, faculty, and others would increase their effectiveness and in some instances not lose time by reinventing the wheel or ignoring the delivery systems already in place, the Committee on Minorities in Engineering responded to numerous requests for a forum and decided to hold a workshop which would review the current state of the art. The Committee views this workshop as a turning point in the effort. Previously, major meetings have presented the need for minority participation in engineering to decision-makers in industry and education. This workshop and subsequent Committee activities will focus on action agendas at the critical points, and the day to day responsibilities of working with students.

This workshop thus is aimed at providing each of you with a series of experiences and activities that can strengthen and refine your programs. We also hope to stimulate broader commitments and encourage additional cooperation with the engineering profession, industry, government, minority organizations, and others.

If we are successful in identifying major program components, the vehicles for implementation and other variables, this workshop will be a milestone to those whom we serve.

In addition, we hope this workshop will identify other areas that need more attention in local or regional meetings. Retention; increasing the pool of motivated and prepared high school students; motivating local educators, engineers, and others to cooperate with your minority engineering program, are areas which must be analyzed and discussed in great detail and should result in specific recommendations and actions.

No one individual can alone accomplish what needs to be done. This workshop will provide you with an opportunity to meet new faces and identify individuals with whom you can work. While the Committee is striving to provide a national communications network, the creation of local networks is crucial for the success of our effort. In the next year, the Committee plans to facilitate the organization of local coordination efforts where the leadership and the interest is identified. The workshop, then, is for you. It is to assist you in strengthening your programs or to provide you with information as you initiate or expand your current efforts.

So far I have concentrated on what you can expect from the workshop and our Committee follow-up. Before I discuss the response we would like from you following this conference, I would like to comment briefly on the opportunities to increase minorities in engineering by making observations about (1) the nature of the Committee's national, multi-ethnic effort; (2) increasing organizational and institutional commitments to the minority engineering activities; and (3) the major challenges to increase minority enrollments and graduations.

While the Committee does not have a Constitution to guide it in deciding what is to be done nationally and what is to be done locally, we do have a mandate to provide a national focal point for discussing and catalyzing policies

and identifying resources that will lead to parity representation in the engineering profession for Blacks, Mexican-Americans, Puerto Ricans and Native Americans.

While the nature of the environments that produced inequality of educational opportunity for these underrepresented minorities are quite different, certain basic problems are common to all groups that have come from disadvantaged backgrounds. The approach to supportive services might be different because of the nature of the institution and background of the minority students, but there are common educational elements and supportive services which impact on retention.

A second factor that we are responsive to is related to the characteristics of the diverse institutions you represent. The Committee's program encompasses all types of educational institutions, covering all geographical areas of the nation, the historically Black engineering schools, four year engineering colleges, junior/community colleges, public and private institutions, etc. All have a key role in helping us realize our objectives.

To say it another way, we want to look carefully at both the students who come from different minority backgrounds and the institutions serving them. Our purpose is to encourage and support activities that result in significant increases in minority engineering graduates.

This takes me to my third point: increasing commitments to the minority effort. Minority engineering enrollments were just under 10,000 during 1974-75, or approximately 4.5 percent of the total engineering enrollments. Both the total number and percentage of minority engineering students have increased over the last few years. We are reaching a critical stage, however. Total minority enrollments in colleges are not increasing. As identification and motivation efforts increase and result in greater numbers of students seeking admissions, we will reach a point where we are not going to move ahead unless increased numbers of institutions and individuals become involved in funding and implementing programs. At a time of economic crisis when budgets are being cut, there is a growing tendency to cut or restrict minority programs. But let us place these events in perspective. The unemployment rates, business failures, and other economic statistics that describe America today have been the norm for minority communities. Minorities are aware of the motives of affirmative action and compensatory or vocational education programs. Let us not forget, however, the rationale for increased participation of minorities in engineering: it is a profession that provides a long term solution to the economic development of a neglected segment of our society. It provides career mobility and flexibility. It provides opportunities to enter the circle of decision makers whether at the local level in a city government or in a major industry. In other words, it is a profession that is critical for a nation whose future depends on productivity and effective use of both human and natural resources.

The White-Anglo Saxon American has traditionally used engineering as a path for upward mobility. Blacks, Chicanos, Puerto Ricans and Native Americans must have the same path. In that regard, the Committee has chosen to focus on the following:

1. Increasing the pool of qualified and qualifiable minority candidates for engineering schools.
2. Influencing, with others, teachers and guidance counselors in the secondary school system so they will have a positive view

of engineering as a career for minorities.

3. Instituting, with others, curriculum innovations that will make learning experiences more meaningful for minority students.
4. Improving the retention rates of minority engineering students.
5. Initiating and supporting activities which provide adequate financial aid to minority engineering students.

But to realize our goals, our Committee needs your cooperation and involvement.

In conclusion, I would like to comment on what we expect from you after this conference. In the next two days you will have the opportunity to exchange ideas about your problems and responses with other workshop participants. You can compare notes on effective ways to meet current challenges. You can begin to identify possible resources and talents. But after the workshop, the real impact of this workshop will occur at your respective institution or organization. In a sense it will be an evaluation that will not be complete for several years.

Following this workshop, we hope that the following will occur:

First - Adequate attention would be given to the program areas identified in the workshops. Supportive services and interaction with secondary schools should become a part of your effort or part of the expansion of your efforts.

Second - Accurate statistics and a detailed view of your program would be published annually so that others can learn from your program experiences.

Third - Local networks would be created to provide support from high school personnel, community groups, industry, clergy and others.

Developing Administrative Skills and Resources for Minority Engineering Programs: A Challenge to Minority Program Directors

Herman B. Smith
Chancellor
University of Arkansas

I appreciate the opportunity to participate in this workshop for it is my judgment that concerns which are to be addressed during the next two days are critical for the industrial and economic health of our nation. It is also my judgement that the pattern of operation for this workshop is an effective approach to the ultimate achievement of our announced objective: the conspicuous and expeditious increase of minorities participating in the profession of engineering.

At the outset I wish to make clear for all that I am not an engineer, that I know almost nothing about engineering, and that I am not even particularly competent in elementary mathematics. I lay no claim to extensive knowledge in any area of the natural sciences or any technical subjects.

Rather, I am a professional administrator who takes pride in being a catalytic agent, a facilitator, and a professional promoter. I suppose it is correct to say that I stumbled into this national program of increasing minorities in engineering. While serving as the first director of the Office for Advancement of Public Black Colleges in Atlanta, an operating office of the National Association of State Universities and Land Grant Colleges, I was invited to join an ad hoc group which was attempting to develop locally an effective means of increasing the pool of prepared minorities available and qualified to be employed by the engineering firm responsible for design and construction of the Metropolitan Atlanta Rapid Transit System. My firsthand knowledge of the educational program of the historically Black colleges and universities resulted in my election as the first chairman of what is known today as the Committee to Increase Minority Professionals in Engineering, Architecture and Technology (CIMPEAT). This Committee after receiving a grant from the General Electric Foundation to assist in carrying out its program, accepted responsibility as the Southeastern operating arm of the Minority Engineering Education Effort ME^3 Program.

During my six years of service in the Atlanta Office it was my privilege to communicate extensively with administrators of the historically Black institutions, including those which offer educational programs in engineering or engineering technology. I have assisted these programs in developing and expanding, even to the extent of gaining professional accreditation from the Engineers' Council for Professional Development (ECPD).

One year ago I accepted the chancellorship of the University of Arkansas at Pine Bluff and was pleased to discover that the institution has a growing cooperative program in engineering with the University of Arkansas at Fayetteville.

My actual experience in these three positions (two in Atlanta and the current one in Pine Bluff, Arkansas) provides the background for my remarks on developing administrative awareness for minority programs within post-secondary institutions.

It has long been my firmly held conviction that the proper job of the institutional administrator is to be the chief catalyst, facilitator, and interpreter of the institution's educational and service efforts. If any institutional program is to succeed, it must have the complete and informed backing of the administrator. Without such support, the minority engineering program manager, regardless of how enthusiastic, competent, or committed he may be, can expect less than optimum results from his efforts.

Here is indicated, then, the importance of developing appropriate administrative awareness of the minority engineering program: its origin, its rationale, its objectives, its potential, its implications. Each of these considerations should be an element of the total effort to enhance administrative awareness of the program.

Deliberately, I have chosen to focus my subsequent remarks on suggesting a point of view appropriate for consideration and implementation by administrators, as distinguished from an outline of skills which will assist the program managers in imparting and selling the point of view, or a catalog of resources available to accomplish the crucial job of enhancing awareness. These will become clear, I think, from our ensuing discussions. The internalization of the following point of view has facilitated my own support of our institution's cooperative engineering program.

At the outset, I would suggest that the gross and conspicuous underrepresentation of minorities in the engineering profession is not an indictment or negative commentary upon minorities. Rather it is the factual communication of an unfortunate situation in our society and throughout the engineering profession. It is the demonstration of a societal flaw which must be corrected as effectively and as expeditiously as possible.

For those institutions, public and private, which have adopted a commitment to serving the needs of society, it is entirely consistent for them to embrace meaningfully the announced objective of increasing the preparation, graduation, and employment of minorities in engineering. It should be understood, also, that to do so is not an act primarily of doing something special for minorities, but is an act of responding specifically to a critical societal need.

A second suggestion which I would make is that administrators should recognize clearly, in participating in evaluations of minority engineering programs and the apparent progress or lack of progress of minorities in engineering, those points where there is divergence in pattern from the total pattern of so-called "mainstream" students. One finds too often where special minority programs are established that so much attention is focused upon the experience that there is a failure to compare adequately the experiences with those of the majority group. Thus, there might be the tendency to make much of the fact that minority enrollees require longer than four years to complete their program or that they report much dissatisfaction with the nature and quality of their experience in certain courses or sequences. A possibly damaging outcome of such evaluations, in these days of dwindling financial resources, is the tendency to conclude that minority enrollees are slower and less able, and therefore more costly to support than students of the majority group.

A further suggestion is not original with me but is worthy of inclusion in our point of view. The energetic commitment to and expert execution of a defensible minority engineering program can serve as a useful mechanism for improving and making more effective the institution's engineering program for all students. Summer programs, developmental and tutoring programs, increased personal interest by faculty members, better student orientation and counseling, and flexible freshman curricula - all these, as we know, are elements of successful minority programs designed to reduce attrition and enhance the effectiveness of efforts to prepare minority enrollees. These same mechanisms are equally useful for making the engineering curriculum more effective for all students. They should be so perceived and provided routinely for all.

I am unable to erase from my consciousness the experience of an in-depth interview last spring with a successful minority enrollee at Georgia Institute of Technology. It might be pointed out, incidently, that the speaker is an individual in the final phase of his study in mechanical engineering, having enrolled at Tech after the first year of study in the dual degree program operated with Morehouse College and other institutions of the Atlanta University Center.

His case, in my own experience, is not atypical of the origin and circumstances of an important segment of the minority population and it is instructive further in distilling suggestions useful in enhancing administrative awareness. I shall refer to the enrollee as Tom.

- He originated from Cross, South Carolina, a tiny town in the Charleston area of the state.
- He has five brothers and four sisters. He is the fourth child.
- He was number three in his graduating class from an all Black high school of about 1,400 students with an enrollment ranging from grades 8 through 12.
- He was the second in his immediate family to complete high school.
- On completion of high school there was no assurance of his chances to even enroll in college. His mother was unemployed. His father was a laborer in Charleston.
- As a high school senior he took several of the standardized aptitude and achievement tests administered to high school seniors.
- He thought in terms of enrollment at South Carolina State College or Clemson University. Upon receiving results of his efforts on the test, he was advised of his potential for enrollment at each of these institutions. He was also advised of the importance of his applying to Morehouse College in Atlanta
- Prior to this communication from the test company he had never heard of Morehouse College. The offer of an adequate financial aid package by Morehouse College caused him to enroll at that institution, not necessarily the excellence and traditions of the College.
- On enrolling at Morehouse College he decided to be a math major because of his apparent aptitude for math. He had

identified no particular professional or vocational objectives at that time.

- After his sophomore year he began to think about what he could do as a math major after college. At that time he heard of the dual degree program involving Morehouse College and Georgia Tech and he conferred with Dr. Charles Merideth, Coordinator of the program for Morehouse.
- I interviewed him when he was a senior in mechanical engineering and was looking forward to graduation and an initial annual salary of $12,000 or more.
- He was an honor roll student at Morehouse College. He, at that point, had a 2.4 average at Georgia Tech on a 4.0 scale.
- There yet exists a lack of understanding about what engineering is in his home community of Cross.

As we reflect upon the profile of this Black Georgia Tech alumnus, several striking characteristics emerge:

- There was no relationship between his ability to perform satisfactorily as a college student at Morehouse and Georgia Tech and his obviously disadvantaged background.
- The advantages, rewards, and opportunities of engineering as a profession meant nothing to him in 1968 for no one at his high school in Cross, South Carolina, had discussed engineering with him.
- His enrollment in an engineering curriculum was the result of a random and indeliberate process.
- The availability of adequate financial aid was the major determinant in his selection of Morehouse College, a decision which facilitated his subsequent enrollment at Tech.
- Although he had to work hard to make the grade in mechanical engineering at Tech, he reported no major difficulties once he was motivated to pursue a degree in engineering. He became very optimistic and self-assured in total outlook about his future as a professional in engineering.

The elements of randomness and indeliberateness must be removed from the paths of minorities enrolling in engineering programs. To the extent that our efforts can result in increased contacts with prospective engineering enrollees, preferably at junior high school levels, students can be aided to pattern their courses and alter other educational experiences in such fashions that they will arrive at college better equipped educationally and psychologically to pursue engineering curricula. The university personnel do have a meaningful role to play in this effort and administrators should be so apprised.

When I survey the national undertaking in engineering which we are now conducting, my own conclusions as an administrator are definite: the time is late; the challenge is great; the potential is substantial; the cause is impelling.

Increasing the Pool of Minority Students Through Guidance, Motivation, and Preparation

Armando M. Rodriguez
President
East Los Angeles College

It's always a pleasure to renew friendships, and as I look around I see many familiar faces. But what has been most gratifying since my arrival, is the general concern shown with the important task which lies ahead. You should be complimented for your courage and dedication to this most important national problem.

While preparing for this address, I was astounded at the fact that 98% of American engineers are white males, with minorities (including women) making up the other 2 percent. Looking at it from another perspective, in the Greater Los Angeles Area, where the population is 11 percent Black and 18 percent Chicano, enrollment in local engineering schools has been raised, with intensive efforts by individual universities, to only about 4 percent Black and 5 percent Chicano. The ratio is even more striking in engineering graduating classes -- 1 percent Black and 3.5 percent Chicano last year.

Similar figures nationwide accentuate the need for a concerted effort to achieve the goal established by the National Academy of Engineering. In concert with the Academy, we must strive for at least a tenfold increase in the number of minority graduates from 500 to 5,000 per year as a beginning. This may appear to be a most difficult task but not an impossible one. All it takes is an honest commitment.

What makes this goal so important?

And why must the system be taken to task for not having a great many more minority engineers than exist today?

Aside from the fact that minorities are demanding full parity representation in engineering consistent with the populations they represent, about 60 percent of top management positions in American industry and business are held by people with technical degrees. As J. Stanford Smith so dramatically put it while speaking at the Engineering Education Conference in Crotonville, New York, in July 1972, "It usually takes 15 to 20 years for someone who is Anglo to rise to the top. If, as at present, only 2 percent of new engineers come from minority groups, it means that all things being equal, about the same proportion will reach the top by 1990 to 1995. If we are to continue the current trend this will be nothing less than a formula for tragedy. We cannot -- and let me emphasize -- we will not wait that long."

By bringing women and members of ethnic minorities into the managerial leadership of the United States, the national goal will be advanced politically and culturally. By participating to a greater degree in the management of business and industry we will be making significant contributions to the economic

growth of the nation. Since so much of the nation's management is drawn from the ranks of engineering graduates, more minority representation is needed in engineering and that need is now, not mañana.

Having discussed the problem and the reasons why it must be resolved, I call your attention to the means by which we can achieve our goal: Identification, Motivation, Guidance, Preparation, Retention, and Placement of the minority engineering student. Success in each of these areas is dependent upon an organized effort in concert with concerned parties from the fields of education, engineering, and government. These agencies must respond from all levels. Furthermore, our efforts must be geared not only to increasing the pool of minority students but to making certain that these students become engineers. The high schools and community colleges must develop the minority students' academic skills, study habits, and self confidence in preparation for the advance work in the schools of engineering. In this manner, the minority student will be equipped with the skills necessary to compete successfully in and complete the engineering program.

Identification of potential minority engineers should take place in the early years of secondary school. As part of a long range plan I see minority students at the seventh grade level as our chief target. After identifying students with the potential to become engineers, we can take measures to motivate them. Motivation may take different forms from supplying students with scientific materials to involving their parents by introducing the families to successful minority engineers. For the time being, part of the focus must be on advanced high school students, so that some can enter engineering schools beginning this fall, or at least in 1976.

Motivation is essential, since many minority students do not consider engineering as a possible career. It is a profession about which they have only the vaguest understanding or vague aspirations. Juniors and seniors in high school, teachers, and counselors, must be informed of the opportunities available in the field of engineering. The Society of Hispanic Professional Engineers, under the leadership of Mr. Rodrigo Garcia, has employed a series of motivational techniques in grades 1 through 12 including: engineering awareness sessions, science fairs, and engineering career days. This effort must be expanded to the school staff if we are to bring about the change needed.

Many minority students have made their way through a school system seemingly designed to impede their learning about possible career opportunities or their academic preparation necessary to enroll in higher education. For these students guidance and counseling activities, if they exist, have been notoriously ineffective. We must improve the guidance of potential minority engineers by advising counselors of the benefits and unlimited opportunities in engineering. Proper counseling is necessary to be sure these students understand the preparation that is needed to enroll in an engineering curriculum.

Articulation between the high school, community college, and the university is of paramount importance if our efforts are to be fruitful. We must develop and employ creative means by which the minority student can "bridge the gap" between these different levels of education. A technique employed with a considerable amount of success at East Los Angeles College has been to involve capable high school seniors with advanced pre-professional courses on our campus. After experiencing a college environment the students are more self-confident and capable of handling college on a full-time basis. Exchange programs of this nature could also be initiated between the community college

and the university. Cooperative education programs exist at many universities and serve to bridge the gap between the university and industry. At California State University, Los Angeles, a program began in the Spring of 1974. Through its School of Engineering, this innovative program offers minority engineering students the opportunity of working three months in industry followed by three months in class.

Retention of the student is largely dependent on financial aid, counseling, and tutorial assistance. Financial aids are important in minimizing the economic restraints experienced by most minority students. Tutoring in areas such as engineering mechanics are essential to continued academic progress.

When the minority engineer has completed his formal education it is incumbent upon all of us to make certain that a pool of minority engineers is established for referral to employers, particularly in areas with increased employment opportunities and subsequent upward mobility for the minority engineer.

Our formula for success revolves around the areas of:

- Identification
- Motivation
- Guidance
- Preparation
- Retention
- Placement for the minority engineering student

For too long the nation has wasted a vast and valuable national resource. Engineers are described as people who find practical applications for abstract scientific discoveries. Certainly there is enough creative genius present in our professions to develop the means by which minorities can be equally represented.

If our efforts here are earnest and sincere, we should leave this conference feeling that we have embarked upon a new era in opportunities for minorities in engineering. And this is what we should all be about.

A System Approach to the Personal and Professional Development of Minority Engineering Students

A. I. Thomas
President
Prairie View A&M University

I wish to bring you greetings from Prairie View A&M University of Texas and especially the School of Engineering. Dean A. E. Greaux asked me to extend his special greetings to you. He is busy at the Prairie View A&M University campus with a host of programs leading to the production of an increasing number of minority engineers.

Let me commend you on this important conference. A special commendation must go to:

> Melvin W. Thompson, Executive Director, Committee on Minorities in Engineering;
>
> Ewaugh F. Fields, Chairperson, Task Force for Workshop Planning and Assistant Vice President for Academic Affairs, Drexel University;
>
> Percy A. Pierre, Program Officer, Sloan Foundation, and Dean, School of Engineering, Howard University; and
>
> Arthur G. Hansen, Chairman, Committee on Minorities in Engineering and President, Purdue University.

Commendations are certainly in order for you the participants in the Minority Engineering Program Directors' Workshop.

During the past several years, we have seen an increase in minority engineering efforts in many quarters. The speeches of J. Stanford Smith, then of General Electric, have been well read. The support of the Sloan Foundation is well known and highly appreciated. Throughout the past several years numerous conferences, professional meetings, and professional journals have all addressed the subject of the minority engineer.

Most of the thoughts and certainly a definite direction have been established in the report of the Planning Commission for Expanding Minority Opportunities in Engineering entitled: Minorities in Engineering: A Blueprint for Action." This Minority Engineering Program Directors' Workshop represents another effort to address a complex and difficult problem.

We look forward in 1976 to the celebration of the 200th birthday of our nation. A nation characterized as democratic; a nation which signs its name as the land of the free and the home of the brave; a nation which has in its constitution one of the most advanced political documents ever written in the history of mankind; a nation which has since its birth spoken of equality, of justice, and of opportunity.

The problem we face today has its roots in the fact that from 1776 to 1954, despite the constitution, this nation systematically, philosophically, and actually denied equality of opportunity in virtually every area to its Black people. The problem we face today has its roots in the fact that from 1954 to 1975 this nation has still not mustered its resources to correct the condition it has created for minority people.

Today, as we prepare to celebrate our 200th birthday, the following conditions exist in the sixth largest city of this nation, a city which boasts of prosperity in a period of recession:

> Sixty-nine percent of Houston's 316,000 Blacks live in low-income areas, defined by the Census Bureau as those in which at least 20 percent of the population is below the poverty line. (The poverty level for a family of four was $3,743 in 1969, when the measurements were made.)
>
> Of the dozen cities with at least 250,000 Blacks, Houston ranks third in the proportion of Blacks living in poor areas, behind New Orleans (86 percent) and St. Louis (79 percent). Seventy-seven percent of Dallas' 207,000 Blacks reside in low-income areas.
>
> The report also shows that most low-income areas in Houston are predominantly Black. Although Blacks make up 26 percent of Houston's population, they comprise 61 percent of low-income areas, and only 11 percent of the higher income areas.
>
> In Dallas, the concentration is even greater, with Blacks comprising 75 percent of poor areas, and only 8 percent of the higher income areas.
>
> The report suggests that education is one vehicle of upward mobility for Blacks.

While the national average shows almost 10% unemployment, unemployment among Blacks and among teenagers is normally 17 to 20 percent. It has reached 65 percent in some areas and is generally around 39 percent. When Blacks are employed they are more likely to work in blue collar and service occupations, rather than in professional jobs such as engineering. Black families are more often headed by a woman. Since families headed by a man are less likely to receive public support, this may well be a contributing factor in the tendency toward female-headed households among Blacks.

In Boston, where 35% of Black families in poor areas get welfare 42% are headed by females. In Philadelphia, 40 percent of the Black families in poor areas are female headed. In the poor areas of New York, Chicago, Philadelphia,

Atlanta, and Boston as well as many other cities less than half of Black children live with both parents.

In terms of education and the quality of education, Black, Chicano, Puerto Rican, and Native American youth still receive less education and the quality of this education is lower than for the majority group. The current crisis of the public schools in the nation is nothing compared to the crisis of minority youth as they fight their way through the integrated schools of this nation.

It is in this context that we seek to increase the number of minority engineers. It is in this setting that we seek the personal and professional development of minority engineering students.

Currently, there are approximately 1 million engineers in this nation. Approximately 12,479 are Black. This represents less than 1.3 percent of the nation's total. There are even fewer of the other minorities represented in this program. Currently, slightly over 1 percent of the annual production of all engineering graduates are Black. Statistics are even more tragic when consideration is given to the enrollment of Blacks in chemical engineering, nuclear engineering, petroleum engineering, aerospace engineering, and other distinct branches of this important mainstream occupational area.

When we think of increasing the number of minority students tenfold we should remember that minority students often come from (1) a poverty background, (2) a family without a heritage of professional occupations, (3) a home or family headed by a female, (4) limited and low income, (5) poor schools, (6) poor education, and, (7) a distinct culture.

On the positive side, the minority student brings (1) potential, (2) interest and desire to get out of his situation, (3) ability to learn, (4) an opportunity for America to realize its dreams, and (5) the potential of utilizing the positive aspects of his culture to strengthen the entire democratic system.

Because of the uniqueness of the problem, it is our position at Prairie View A&M University that a systems approach must be used in confronting the personal and professional development of the minority engineering student.

The development of a systems model is difficult. To correct the problem, one should logically start at the birth of the minority child. Probably we should begin before birth, with the parents. This approach if followed would never give a stable beginning, however.

At Prairie View, we start with the student where we find him. In some instances it is in elementary level, junior high, senior high or freshman class. In some instances it may be as late as a junior college transfer. The important fact is that we start. Wherever we find the student, we start at this point.

The Prairie View program is not primarily an engineering program. It is first a people's program. We do not seek to make any Black with a brain an engineer. We seek to assist people who want to be engineers realize their goal.

The individual student is important. His very cultural limitations make him prey. His academic ability makes him prey. A caution must be expressed at this point in terms of the student's personal and professional needs.

During recent years, Prairie View A&M University, under the leadership of Dean Greaux and his faculty, has developed many excellent programs to enhance the personal and professional development of the students. It is the philosophy of the college engineering at Prairie View A&M University that every minority student has the potential to succeed.

In a dynamic book entitled Born to Win, James and Jongeword make the following statement:

> "Each human being is born as something that never existed before. He is born with what he needs to win in life. Each person in his own way can see, hear, touch, taste, and think for himself. Each has his own unique potentials--his capabilities and limitations. Each can be a significant, thinking, awarding, and creatively productive person in his own right--a winner.
>
> The words 'winner' and 'loser' have many meanings. When we refer to a person as a winner, we do not mean that he should win by beating the other guy and making him lose. To us, a winner is one who responds authentically by being credible, trustworthy, responsive, and genuine, both as an individual and as a member of a society. A loser is one who fails to respond authentically."

The Prairie View systems approach begins with an effort to encourage each parent, teacher, counselor, principal, community, politician, benefactor, everyone, to embrace its philosophy for minority students.

The complete education and experiences of the students before and after they enroll in the college of engineering is designed and implemented to help them keep the status to which they were born, namely: they were born to win. They were born to succeed. Historically and currently, society has denied this philosophy and right to minority students. Any program seeking to enhance the personal and professional development of minority engineering students must, in our opinion, include this philosophy and the mechanics which implement it.

The College of Engineering at Prairie View recognizes that many students admitted to its program have personal, social, academic, economic, and professional handicaps. No students are admitted, however, with handicaps which cannot be corrected so that the student can achieve success in engineering. The students do have the potential to succeed. The programs growing out of the systems approach are based on the philosophy that it is the responsibility of the College of Engineering to organize its human and material resources into a sub-system that will maximize the personal, social, academic, and professional attainment of each student enrolled. The program is based on the philosophy that it is important for the student to enroll in engineering, but is even more important that the student graduates from the engineering program with a wide variety of personal and social experiences. We fear that many current programs have no concern for the graduation of the minority student.

Since its early beginning the college has served the minorities of this state and nation. It has developed programs with strong and purposeful orientation and with strong and purposeful orientation and with special sensitivity, for the professional adequacy of the minority and a positive effort to improve the imbalance which has developed in these important professions. The results have been that Prairie View A&M University has had a strong record of producing competent, capable, productive professionals. It has demonstrated this fact by graduating over 900 engineers.

I want to close by encouraging you in your efforts. You have made big plans for a big task. Stick to your plans. Do not let your dream of a ten-fold increase in minority engineering graduates become a dream deferred.

You recall the poem by Langston Hughes:

What happens to a dream deferred?

Does it dry up
like a raisin in the sun?
Or fester like a sore--
And then run?
Does it stink like rotten meat?
Or crust and sugar over
like a syrupy sweet?

Maybe it just sags
like a heavy load

Or does it explode?

Your dream must not be deferred. It must be attained. I want to close with one of my favorite poems by Robert Frost entitled "The Road Not Taken".

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;

Then took the other, as just as far,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as far that the passing there
Had worn them really about the same.

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way lends on to way,
I doubted if I should ever come back.

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I--
I took the one less traveled by,
And that has made all the difference.

You have decided through this conference to travel an important road into the future of engineering, the future of minorities, the future of American.

I am sure that it will make all the difference.

An Example of Student Retention for Minority Engineering Programs

Randolph W. Bromery
Chancellor
University of Massachusetts

A truly viable program aimed at the selection, retention, and graduation of minority students in schools of engineering should be carefully constructed to include the following components:

1. Early identification of minority students who are potential candidates for science and engineering programs. It is my contention that such identification of minorities must begin as early as primary school. If we aren't successful in changing science education in our primary and middle schools, we can never hope to develop literacy in the areas of natural resources and environmental matters among minority students.

2. A continuing program of awareness in the elementary and secondary schools describing the various personally and professionally rewarding options in engineering careers.

Minority students in particular in an average urban school setting are never made aware of their potential for science or engineering careers. This is due in part to a lack of role models and individually tailored career counseling and guidance.

3. An identified place in a college or university with both financial assistance and academic support services.

In addition to a continuing program of individual career counseling, many minority students need adequate financial assistance and a strong academic support program which includes both a tutored-remedial component and a peer counseling component.

4. An early introduction to the job possibilities, prior to college or university and throughout the student's academic career.

Minority students even more so than non-minority students need an early visual sighting of a job possibility upon graduation. This will help students to seriously consider alternate professional objectives and to increase their motivation to overcome academic difficulties. Early identification should be undertaken and counseling provided who demonstrate a strong graduate school potential.

A program of this design was developed and established for minority students (Black, Puerto Rican, and Native Americans) at the University of Massachusetts. The results after seven years indicate a far better than average retention and graduation level at the University. This program was distinctive in that it was planned, developed, and operated by the Black faculty members at the University of Massachusetts. In addition, these same faculty members obtained the federal, state, and foundation support for the program. The organization known as The Committee for the Collegiate Education of Black Students, Incorporated, was a private foundation incorporated under Massachusetts General Law.

Massachusetts now has a Puerto Rican population that almost equals the Black population in the state. We also have a third group of minority students that, for one reason or another, has only about 1 or 2 percent of its young people going to college. They are the citizens of Portugese extraction. Along the South Shore there is a large Portugese population and a very few of the young people ever go to college. Our program has been extended to try to induce some of these young people to consider college careers. Therefore, I think that we're experiencing many of the problems that your engineering programs are undergoing or have undergone. I'm hoping that we can compare our experiences and recommend ways to make both of our programs more viable. When some members of our faculty got together, we decided to start an educational program that would begin as a predominantly Black program. We knew, however, that the continued success or viability of such a program would require the inclusion of all minorities as well as non-minority people who needed help and our assistance.

In 1967, eight Black faculty members at the University of Massachusetts at Amherst talked to the Ford Foundation and asked if we could secure funding to admit and support minority students for an experimental education program. We carefully selected 128 students for our first class. All of the students selected were personally interviewed in their homes by one of the Black faculty members. We interviewed their families, friends, and ministers. We went to their schools and interviewed their school counselors and teachers.

One of our findings was that in general the least amount of useful information was obtained from the records of high school counselors. There were, however, notable exceptions. We secured more useful information from the other people interviewed. For example, 32 of our 128 students were Black women from the same school in Springfield, Massachusetts. The same high school counselor had written on the application form of each one of these 32 women, "This student does not indicate a potential for doing college work." The same words appeared on all 32 of these students' forms. We graduated 28 of those same students in the normal four years!

In general, we found that only in a few rare instances did the high school counselors provide us with information that was useful in helping select and counsel these students. The key ingredient we found, however, was that regardless of the quality of a person's school, the student's class standing appeared to correlate better with academic success than anything else we could document. We also found that motivation was an important factor, if students were at the top of the class.

After personally interviewing each student, we then requested letters of recommendation from neighbors and friends. We also asked the student applicants to write letters outlining in their own words why they wanted to attend college.

This latter set of letters served two purposes: one, to determine the student's feelings about going to the university, and second, to determine whether the student was able to express these same feelings in writing. We felt this information would be of use in the planning of our remedial program.

We faced another major problem: the adjustments students had to make to survive in a large residential university. At the beginning of the program in 1968, we had nearly 18,000 students on campus. Of these, about 12,000 students lived in the campus residence halls. We also knew from experience that even when you bring an academically prepared student from a large suburban high school onto a large residential campus, these same students sometimes have difficulty adjusting. They are not able to make the tremendous social adjustment to living on a large residential campus.

We were very well aware that minority students' problems are further complicated by being thrust into a predominantly white environment. To prepare for this we planned a special 3-day summer counseling program where the students would be brought to the campus. In addition to the usual testing and course selection that occurred, we also placed the students in selected dormitories and walked them through their class schedules. I remember that when I was an undergraduate at the University of Michigan more than two decades earlier, it took me 3 days to locate my first class because I couldn't find the building. We didn't want these students to experience the confusion that affects new students when they arrive on campus in the fall. The beginning is a critical time for these students. They can turn off rapidly when they experience relatively small problems such as not being able to find their classrooms or dining commons or not getting along with a new roommate. This 3-day summer orientation session was spent trying to work out these critical logistic problems for the students.

The program had 3 major components - a well engineered tutorial program, a broad based social counseling program, and a carefully designed remedial program. The tutorial program first determined whether the student would do better in a group tutorial or an individual tutorial setting. In some of the courses, we found that a student would do well in a group tutorial and in other courses they needed individual tutoring.

Perhaps at this point I should tell you the secret behind our tutorial program. Our tutorial program was patterned after similar arrangements that most fraternities and sororities at colleges and universities have used for a century or more. We developed a fairly complete file on each professor including a documented history of that professor's examinations and what the professor expected in the student's approach to the answers. We then tutored our students appropriately. I guess one might say we established our own sorority or fraternity. In addition, we placed our program staff in the classrooms in order to teach the students the proper way to take notes and to establish a correlation between the individual professor's lecture materials and the course material covered in the examinations. You see, our tutorial was not simply geared to Botany 101 but specifically geared to Botany 101 taught by Professor Jones. We found this approach to be of considerable help to the students. I must confess, however, that although we were seriously hoping that our students would learn botany, we were primarily interested in the students passing the course. The objective was that program students sitting in with the "regularly admitted students" could survive.

The second component of the program was the social counseling program.

Our counseling groups were divided into two major subunits: One was a more relaxed and informal social counseling by the other students living in the dormitories. The individual adjustment problems with the residence halls were taken care of at the dormitory level. The other component was peer group drug and sex counseling. In addition, we had a financial counseling service to teach the students how to budget their financial stipends and "how not to run out of money two weeks before the end of the month." Included in our social counseling programs were things that might sound strange in an educational program but nevertheless were very important to the student. We counseled the students on their personal habits such as facial make up, hairstyling, and how to dress on a limited budget.

The third component of the program was the remedial program, and here is where we believe our program differs from all other similar programs. The minority student programs at the other local schools, Smith, Mt. Holyoke, and Amherst Colleges all had one thing in common, a very comprehensive summer bridge program. Our remedial program was continuously geared up and ready to go, however, we did not attempt to remediate the students academic efficiencies until the student recognized the problem and requested the assistance. Our remedial program did not simply tell a student, "You can't write so you to into the remedial program." We would help the students themselves find that they needed help even if it took until mid term before they realized they were failing in English Composition or Mathematics. We found that it was a lot more efficient and beneficial to remediate the student when they requested assistance. We had remedial programs in English Composition, Reading, Writing, and Math Skills.

We also developed several auxiliary programs to teach study habits and library use. We have an interesting spin off in our program on the use of the library. There are many students on the campus who graduate at the end of 4 years and never know the proper way to find a book in the library. Our students were reported showing the "regularly admitted students" how to find their books in the library. Finding a book in our campus library can present logistical problems. We have a library which is described in the Guiness Book of Records as the tallest library in the world. Our library is 28 stories high and one almost suffers from shortness of breath looking for a physics book near the top of the building.

We had another aspect of the program which made it similar to a fraternity or sorority. Once you were admitted to the program, you stayed in the program. If you were successful and didn't need further tutorial or remedial assistance, then you helped other students in the program who needed help. It was like a four year hitch in the military - once you signed the dotted line, you were in for the term. By the end of our second year, program students were recruiting the new students for the program. We sent the students to Springfield, Pittsfield, and Boston.

I must admit that in Massachusetts it's somewhat easier to recruit minority students, because nearly 95 percent of the minority persons in the state are concentrated in Boston and Springfield. The Black and Puerto Rican communities are well delineated and are easy to locate geographically for recruiting purposes. Today, all of the recruitment for the program is performed by the program students. The students try to present an honest picture for the high schools of the difficult moments they have had and what the program demands of them. The program will offer financial, academic, tutorial, and social counsel-

ing support. Further, the program will attempt to monitor the student's progress through 4 years of university training and to see that they graduate with their respective degree and some useful knowledge.

The program requires a serious approach and effort from each student. Among the inalienable rights of students at colleges and universities is the right to fail. The program students enjoy this same student right of failure. There are too many programs where students have been enrolled for 4 or more years and are never going to graduate. A university is failing in its obligation if it never drops the student who is failing. The program has a long waiting list, and others can make better use of the space, effort, and finances.

Today, in 1975, nearly 1,300 students enter the program. Compare this to the original 128 students who entered in 1968. To date, we have graduated nearly 65 percent of these students.

Perhaps I could give you a short profile of the program students using SAT scores. For analysis and study, we encouraged the students to take their SAT exams in high school. Our experience in the program indicates that in general SAT scores are meaningful at the low and high ends. In the middle range, we found that there is little correlation between the college level academic achievement or grade point average and the SAT scores of the students. The University SAT norm in 1968, at the time of our first program class, was a 550 average verbal SAT score and a 570 average math SAT score in a freshman class numbering 3,600 students. The program students had Verbal SAT scores averaging 387 and Math SAT scores averaging 409. At the end of four years in June 1972, about half of the first students graduated with an average 2.6 grade point level out of a 4.0 maximum grade point level. At the end of 10 semesters, or June 1973, nearly 65 percent of that first class of students were graduated.

To round out the program we offered career counselings. We begin counseling the students in their high schools. We counseled them in the many varied engineering career options that many minority students have never considered. Among these career options is my own profession in geophysics and geology. If engineers think that recruiting minority students into engineering professions is difficult, then you should try and counsel a minority student into geological or geophysical careers.

If you would permit me, I would like to take my own experiences as an example. When I came out of high school, I had never even heard the words geology or geophysics. I stumbled into my profession by accident. When I was an undergraduate student at the University of Michigan I needed a science elective. I was told by the student grapevine that there was a course in historical geology which was a pushover. It was conducted in a lecture hall similar to this hall. The lights were turned off and 50 minutes of color slides were shown. It was scheduled at 8 o'clock in the morning, so half the class slept. I took this easy course in historical geology and to my surprise, when the lights went out, the professor showed a fantastic slide collection and delivered a superb and informative lecture. I was wide awake and being counseled into a geological profession by accident. We try now not to have the students elect career options by accident. We start at the high school level and are further convinced that in the sciences, mathematics, and engineering careers, one may have to start talking to these young minority students at the 4th or 5th grade level.

Another factor in our program that might have played a role in our abnor-

mally high retention rate is the method of funding for the program. The program at the University of Massachusetts was different from other similar programs in that the original black faculty members went to a private foundation for support. The foundation said they would fund the Black faculty organization, not the University directly. This was the primary reason that we became incorporated as a private foundation. The student and program support funds came directly to our private foundation from the foundation and other sources. We opened a corporation bank account and then in turn paid the university to provide service to the program. In fact, the bank account was the only leverage available to us. In 1968 there were nearly 1100 faculty members and only 8 Black faculty. Over four years we did, however, have a yearly average of one quarter of a million dollars in the bank in the name of our corporation - The Committee for the Collegiate Education of Black Students, Inc.

Actually, the fraternity, club, or special student program at the University of Massachusetts at Amherst brought in over 3 million dollars in federal, state, and foundation funds in five years. The program also underwent the normal academic scrutiny. The faculty Senate at the University debated the structure and academic components of the program, and then voted to support it. Because the program had credibility and independence we had many Black and Puerto Rican students who were not enrolled in the program, the so-called "regularly admitted students", who wanted to enroll in the program. It meant something to these students to belong to a cohesive group.

Today, we have moved beyond those early days in 1968. My Black faculty colleagues decided that in addition to developing and conducting the undergraduate student program described earlier, we would also recruit minority graduate students, faculty members, and professional and non-professional staff members. We would also expand the program to include more Puerto Rican, Native American, and white students who did not normally have access to the University because of financial and academic reasons.

To give you some indication in the "change in complexion" at the University over these past 7 years, in 1968 there were 35 Black students and 1 Puerto Rican among the 15,000 students. We couldn't find a Native American, despite the fact that there are quite a few Native Americans living in New England, particularly in the Commonwealth of Massachusetts. On Cape Cod there is a relatively large Native American population, but very few, if any, were going to the University. Also in 1968, there were eight Black faculty members and about three or four Black graduate students. Today, in 1975 the total minority population at the University is nearly 800 undergraduate students, approximately 400 minority graduate students, and nearly 80 minority faculty members of which more than 60 are Black faculty members. In addition there are more than 200 minority persons in non-teaching professional and non-professional staff positions at the University.

We are still recruiting minority students with average SAT scores ranging between 370 and 400, and we still continue to graduate better than half of the students with a better than 2.5 grade point averages. So perhaps those of you here today can tell me, what was the key ingredient in the program? Why did we have an abnormally high retention rate? Over the past seven years we did everything possible to avoid making the students involved in the program feel part of an experiment. Perhaps after eight years the students themselves who

are graduates of the program will analyze most of the data for the program. Anyway, effort should be made to disseminate this information for use in developing similar programs at other colleges and universities.

In the last two years, we expanded the number of Puerto Rican students. One of their major problems was their lack of facility with the English language. Probably the larger Chicano communities in the west and southwest experience the same difficulty. The admissions materials and some of our recruiters at the University are bilingual. While we are improving the Puerto Rican student's English language capabilities, we also conduct some of our regular courses, primarily freshman and sophomore required courses, in Spanish. We even have a geology course conducted in Spanish. In this way, the students can progress through school while they improve their English language ability. Although we are pleased with such accomplishments, we must continue to increase our efforts to recruit more citizens of Portuguese descent.

This has been a very brief story of the program for minority students, founded and developed at the University of Massachusetts at Amherst. We would be happy to share some of our information with you. We have a large amount of statistical data which we are beginning to analyze in order to determine what we've done that is right and what we've done that is wrong. As in the beginning, we are always ready to change program direction or content when required. When indications were that something was wrong, we immediately made the required change. It would be extremely useful if the National Academy, through this Committee on Minorities, would join with the various college and university representatives to develop similar programs for minorities in engineering. The University of Massachusetts at Amherst and our School of Engineering stand ready to offer assistance.

Thank you.

APPENDIX

- National Advisory Council on Minorities in Engineering
- Committee on Minorities in Engineering
- Committee on Minorities in Engineering: Staff

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Washington, D. C. 20001

Dr. L. Bryce Andersen
Dean of Engineering
New Jersey Institute of Technology
Newark, New Jersey 07928

Mr. Jack A. Baird
Vice President
American Telephone & Telegraph Company
New York, New York 10007

Mr. Pepe Barron
Director, Office of Spanish Speaking Fomento
American Association of Community and Junior Colleges
Washington, D.C. 20036

Dr. Herman R. Branson
President
Lincoln University,
Lincoln University, Pennsylvania 19352

Dr. Randolph W. Bromery
Chancellor
University of Massachusetts
Amherst, Massachusetts 01002

Dr. Robert Bromberg
Vice President and General Manager
Science and Technology Division
TRW Systems Group, TRW Inc.
One Space Park
Redondo Beach, California 90278

Mr. Calvin H. Conliffe
Manager, Manufacturing Engineering Technology
Aircraft Engineering Business Division
General Electric Company
Mail Drop N104
Cincinnati, Ohio 45215

Mr. Cesar DeLeon
Director
Office of Pipeline Safety
Department of Transportation
400 7th Street, S.W.
Washington, D. C. 20590

Dr. Ewaugh F. Fields
Assistant Vice President for Academic Affairs
Drexel University
32nd and Chestnut Street
Philadelphia, Pennsylvania 19104

Mr. David M. Ford
Manager, Industrial Control Product Development
Allen Bradley Company
1201 South Second Street
Milwaukee, Wisconsin 53204

Dr. Elmer L. Gaden, Jr.
Dean of Engineering
University of Vermont
Burlington, Vermont 05401

Dr. John W. Gibson
Consultant
IBM World Trade Center
Armonk, New York 10504

Dr. Paul E. Gray
Chancellor
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dr. Austin E. Greaux
Dean of Engineering
Prairie View A & M University
Prairie View, Texas 77445

Dr. Richard J. Grosh
President
Rensselaer Polytechnic Institute
110 8th Street
Troy, New York 12181

Dr. W. Lincoln Hawkins
Assistant Director, Chemical Research Laboratory
Bell Laboratories
600 Mountain Avenue
Murray Hill, New Jersey 07974

Dr. John W. Hernandez
Dean of Engineering
New Mexico State University
Las Cruces, New Mexico 88001

Mr. Robert N. Mills
Manager, Recruiting and Entry Level Programs Operation
General Electric Company
Post Office Box 368
Croton-on-Hudson, New York 10520

Dr. Richard F. Neblett
Contributions Manager
EXXON Corporation
1251 Avenue of the Americas
New York, New York 10019

Dr. Louis Padulo
Dean of Engineering
Boston University
Boston, Massachusetts 02215

Mr. Harold W. Paxton
Vice President - Research
U.S. Steel Corporation
600 Grant Street
Pittsburgh, Pennsylvania 15230

Dr. David R. Reyes-Guerra
Executive Director
Engineers' Council for Professional Development
345 East 47th Street
New York, New York 10017

Dr. Herman B. Smith, Jr.
Chancellor
The University of Arkansas, Pine Bluff
Pine Bluff, Arkansas 71601

Mr. Morris Thompson
Commissioner
Bureau of Indian Affairs
Department of the Interior
1951 Constitution Avenue, N.W.
Washington, D. C. 20245

COMMITTEE ON MINORITIES IN ENGINEERING

Staff

Melvin W. Thompson
Executive Director
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Robert A. Finnell
Deputy Director
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Patricia A. Hicks
Administrative Secretary
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

LaVoy Spooner
Educational Staff Associate
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Patricia A. Meigs
Secretary
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Glenda Taylor
Program Analyst
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Marlene M. Perry
Secretary
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Marilyn A. Washington
Administrative Assistant
Committee on Minorities in
Engineering - JH 611
National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418