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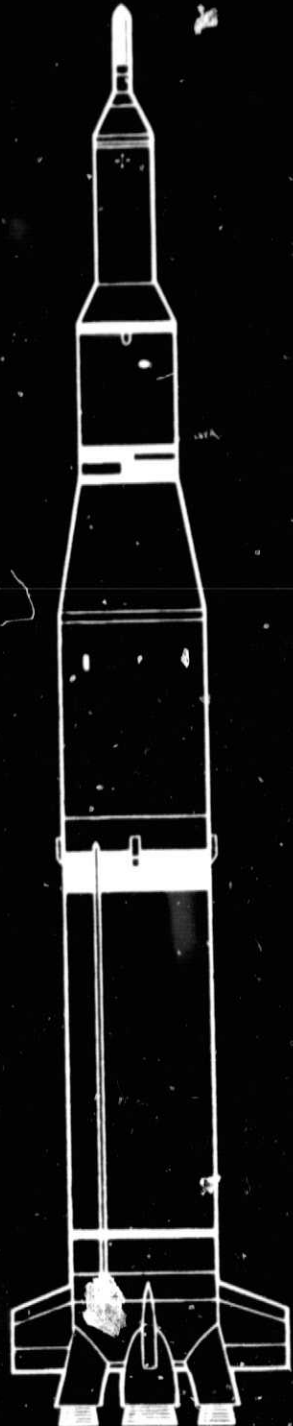
SYRACUSE/NASA PROGRAM

NASA

National Aeronautics and
Space Administration



Syracuse University



FINAL REPORT
of the
SYRACUSE/NASA PROGRAM
AN HISTORICAL CRITIQUE
by
Prof. Martin E. Barzelay
Principal Investigator

Grant No. NGL 33-022-090

MULTIDISCIPLINARY STUDIES IN MANAGEMENT AND
DEVELOPMENT PROGRAMS IN THE PUBLIC SECTOR

SYRACUSE UNIVERSITY
Syracuse, N. Y.

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INTRODUCTION

We are pleased to submit this final report of activities conducted under Grant No. NGR-33-022-09(1) entitled "Multidisciplinary Studies in Management and Development Programs in the Public Sector," between the National Aeronautics and Space Administration and Syracuse University.

In accordance with our discussions with NASA, this final report will be in the nature of an historical critique of the entire Syracuse/NASA Program. Also included are brief summaries of each of the major projects undertaken, including identification of the Principal Investigators and the University departments and disciplines involved. Hopefully, this final report will result in an understanding of the history of the Program and contain some guidelines relating to the performance of such undertakings which will be of assistance to NASA in making decisions about future funding on related types of research.

HISTORICAL MOTIVATION

An association between Syracuse University and NASA, to permit the University to use NASA as a source of learning about successful management experiences, was first mentioned in August 1966 by James E. Webb, NASA Administrator. In subsequent communications between Mr. Webb and others at NASA, and members of the faculty of the Maxwell Graduate School of Citizenship and Public Affairs and Dean Stephen K. Bailey, a long-term association between NASA and Syracuse University was discussed. The proposed objectives of such an association were to permit faculty and

students at Syracuse University to learn at first hand about NASA's organization, communications and management accomplishments and to examine some of the problems that had been and were being encountered by a major government agency in pursuing its complex mission. It was hoped that the unique kind of relationship envisioned would further: 1) improved communications between the university and government, 2) an increased capability in the university to provide highly educated men and women to the public service, and 3) growth in the capacity of scholars to better understand the interdisciplinary dimensions of many of the problems with which they are concerned in their research and teaching and with which government must be concerned. It was felt that this new approach would differ from the usual circumscribed government-university relationship bound by contracts and grants serving to provide services to government or to encourage research and training in specific, limited areas. Further, the university would benefit from the opportunity to do research and practical work in a major government agency. It was also hoped that the engagement of the university with practices and problems in the real world might lead to reevaluation of curricula and to the development of educational endeavors more relevant to contemporary society's needs.

PLANNING AND DEVELOPMENT

In subsequent discussions, and in a formal period of exploration between January 1 and June 30, 1967, University faculty considered with

NASA officials their own interests and ideas and the opportunities which existed to pursue some of these within the NASA context. The result of the exploration was a proposal to NASA for a Syracuse/NASA Program, submitted June 30, 1967. Faculty of the Maxwell School, the School of Education and the School of Management, and the Colleges of Engineering and Law participated under the leadership of Professor John C. Honey of the Maxwell School.

The Syracuse proposal underwent thorough review in NASA, culminating in NASA step-funding of the proposed program for a three-year period starting January 1, 1968. Subsequently, NASA also provided funds for five three-year traineeships in public administration, beginning in September 1968, which were to be administered in close association with the ongoing Syracuse/NASA Program.

PROGRAM MODIFICATION

In transmitting the initial grant funds of \$500,000 for the first three years, the covering letter from NASA to Syracuse University stated the following:

"This grant is to support a broad integrated program of space-related scientific and engineering basic research activities. The character of this program, the scope and aims of the research activity and the methodology to be employed have been defined in the Syracuse University's proposal and mutually agreed upon by NASA and Syracuse University. It is recognized that the Grantee will select specific research tasks to be performed within this program as described above. Because of the necessity that NASA-sponsored research be closely related to NASA's mission and objectives, we request that you inform this office, in advance of any expenditure of funds, of the

title or description, of identification of principal participants in, and approximate budget for each proposed project."

This paragraph effectively modified the apparent open-endedness of the initial Webb-Syracuse University discussions. It is noted that while the Grantee is free to select specific research tasks to be performed, that in light of the necessity for the research to be closely related to NASA's mission and objectives that NASA would be informed "in advance of any expenditure of funds, of the title or description, of identification of principal participants in, and approximate budget for each proposed project." This key concept set the tone for the way in which the project was carried out thenceforth.

While there was some reduction in funding from the original proposal, there was a judgment in NASA, with which the University concurred, that the essence of the proposed program could still be pursued. Thus, while most of the initially proposed research and related educational activities remained in the University's program, it was necessary to modify the distribution of funds within the grant. During the "start-up" period from January to March 1968, the University participants received suggestions and advice regarding work in progress in NASA which were helpful to the Program, and guidance as to certain projects which might preferably be deferred or which did not appear feasible to pursue. Also, field visits to NASA installations were made by some faculty participants which permitted further refinements in the research plans.

One of the early but major changes in direction in evolving the final components of the research program involved the studies concerning project management. Mr. Charles Bingman of NASA made very strong recommendations that the project management group should include an adequate group of engineers from the College of Engineering. As originally formulated, this subproject contemplated only one engineer in the interdisciplinary group which was being formed for the studies, but Mr. Bingman felt that since the project managers who were being studied were, for the most part, engineers, it was imperative that engineers be included in the University group. This caused a major reformulation at a very early stage in the project management study, and the engineers continued to play a major role throughout this research. This step indicated the significant input that NASA made as a major contribution in guiding the direction of the program.

INITIAL PROGRAM

Upon final refinement, four major research projects were undertaken involving approximately twenty faculty members and about fifteen graduate students from the Maxwell School, and the Colleges of Engineering, Law, and Management. The major projects were entitled: "Role of the Project Manager," "Regulations in Space," "Case Studies," and "NASA-Business Relations." The Regulations in Space and the Case Studies started initially with two faculty members each, and NASA-Business Relations with three, while the Project Manager study group initially had nine faculty members participating, and was the only one of the four that was interdisciplinary in both

scope and personnel. The initial directors of the four major projects were: Professors Richard Hopeman (Management) and Martin Barzelay (Engineering) for the studies on the Role of the Project Manager; Professor Peter Franck (Management) for studies of NASA-Business Relations; Professor George Alexander (Law) for studies of Regulations in Space; and Professor Edwin Bock (Maxwell School) for Case Studies.

A brief summary of each of these four programs is included here, plus summaries of two projects instituted later in the grant period entitled "Social and Physical Processes in Systems Science," and "Management of Safety at NASA." In each of these we have identified the Principal Investigators. It is particularly interesting to note that in the case of the "Role of the Project Manager" study there was an evolution in the method of handling this project which differed from the other research areas. When Professor John C. Honey was named Vice President for Sponsored Programs, and Professor Barzelay moved up to Principal Investigator for the entire Syracuse/NASA Program, the key investigative members developed a rotating leadership in which Professors Drucker, Pooler, Wilemon and Wood assumed the leadership for various time periods. As mentioned elsewhere in this report, this project was the most interdisciplinary in nature and the rotation of leadership helped in fostering a truly interdisciplinary spirit.

PROJECT MANAGEMENT

As part of the Syracuse/NASA Program, an interdisciplinary team of faculty members and graduate students undertook a study of the character-

istics of project management in the Apollo Program. While the research was conceived in response to the concept of NASA making itself available as a learning laboratory in the area of a large-scale governmental technological enterprise, it was also anticipated that an unbiased, objective investigation of project management practices by an outside group could result in new insights, if the University-based research team could penetrate the NASA Manned Space Flight organization. Almost all NASA personnel contacted displayed an openness, a degree of cooperation, understanding, and confidence, exceeding the most optimistic hopes. Thus, the learning laboratory concept was realized, and new insights were indeed realized and embodied in research reports, resulting in benefits to both the University and NASA.

The final report of the project management group, submitted in January 1972, was entitled, "Project Management in the Apollo Program: An Interdisciplinary Study." This report may be identified as NASA-CR-126941 (STAR citation N72-32954). The published abstract follows:

Findings concerning project management in the NASA Apollo program are presented. The Apollo program in the context of the total NASA organization is examined along with the nature of project management and the manner in which project managers functioned in the Apollo program. The utilization of the in-house technical competence in the support of the Apollo program, and the formal and informal relationships between Apollo managers and the contractors are discussed.

The complexity of the task originally defined required the team to constrain itself to the study of something less than the entire NASA operation or even of the entire Apollo program. By virtue of the mutual

interest of NASA and Syracuse University, the research team concentrated on the role of the project manager in the Apollo program. Since the term "project manager" has many different interpretations in NASA and contractor usage, it should be noted that the type of project used as a model in the study is that exemplified by the LM, CSM, S-IC, S-II, and S-IVB efforts.

The information on which the research was based was gathered by well over 200 intensive field interviews, almost always attended by more than one person from the team and usually from different disciplines. The interviews were usually tape recorded, transcribed, and submitted to interviewers for corrections. NASA personnel at several levels at the three major field centers and headquarters were interviewed, as well as engineers and managers at the plants of five prime contractors, NASA resident people, Congressmen and Congressional committee staff members.

During the course of the research, a three-day conference was held with team members and various NASA interviewees in attendance. The purpose was to informally discuss and offer criticism of some of the preliminary hypotheses and conclusions. The remarks of the NASA representatives were extremely helpful in this regard.

It should also be mentioned that the four key members of the project management group (Drucker, Pooler, Wilemon, and Wood) undertook a separately funded study following completion of the above described work. The final report on this closely related project, entitled "Manned Space Flight in Transition," was published in March 1973 and was abstracted in NASA SP-7500 (08), "Management, a Continuing Literature Survey," of March 1974.

The abstract, STAR citation N73-21879, is as follows:

A study was conducted to analyze the reorientation of NASA programs in the post-Apollo period. The study is an external view of NASA by unbiased observers as an input to and aid in the decision making process concerning near and long term planning. The subjects discussed are: 1) the near-term NASA scenario; 2) organization of field centers; 3) planning activities; and 4) operational activities. A summary of the recommendations arising as a result of the study is presented.

CASE STUDIES

The major work carried out was divided into two major efforts. One of these was embodied in the weather modification studies carried out by W. Henry Lambright; the other was the major study of government decisions regarding manned space programs following the NASA moon landing, carried out by Emmette S. Redford and Orion F. White. Both of these resulted in major publications: "Weather Modification: The Politics of an Emergent Technology," by Prof. Lambright and "What Manned Space Program After Reaching the Moon? Government Attempts to Decide: 1962-1968," by Professors Redford and White. Both publications were originally submitted to NASA under this grant, and later were published under the Inter-University Case Program. These efforts were conducted under the cognizance of Professor Edwin Bock, who headed the Case Studies portion of the Syracuse/NASA Program, and who is also the President of the Inter-University Case Program, Inc.

The weather modification report of Professor Lambright reviewed the state of the art and of technology, then went on to discuss the state of public policy with respect to the field and to delineate ways and

means to bring about a better match between what could be done through R & D and what ought to be done through policy.

The Redford/White study presented an analysis of the attempt in the Federal Government between 1962-1968 to formulate and decide upon a manned space program to follow the Apollo manned moon missions. The format used was somewhat different from the conventional case study methodology characteristic of previous Inter-University Case Program studies in that in addition to the traditional narrative history, a philosophical and analytical framework were set out which provided a conceptual context for viewing the events that took place. This framework attempted to conceptualize the myriad factors involved in a large-scale governmental decision. At the end of the case study, among the various questions, the large philosophical question was raised as to how democracy operates in the face of an important matter in science and technology.

In addition to this research activity, Professor Lambright, while on leave from Syracuse University with NASA in 1970 as a Practitioner in Residence, participated in meetings of the Interdepartmental Committee for Atmospheric Sciences (a subcommittee of the Federal Council on Science and Technology) on weather modification.

In 1974-75 Professor Lambright will co-author a paper to be delivered at the American Meteorological Society meeting, November 1974, entitled "Policy Determinants of Weather Modification." Finally, in early 1975 he will chair a Panel at the International Studies Association entitled, "The International Consequences of Changes in Weather and Climate."

REGULATIONS IN SPACE

The three major objectives of this project were: 1) to describe the interaction of law and space management in terms of solution of specific problems; 2) to critically analyze and identify legal problems pertaining to space; and 3) to produce a case book on space management law problems appropriate for use in law schools and possibly schools of public and business administration. All of these objectives were effectively carried out; for example, the materials on space law were used at the University of San Francisco in a course taught by J. Henry Glazer, formerly Chief Counsel of the Ames Research Center.

Dr. George J. Alexander, who headed this project while at Syracuse University (now Dean of the College of Law at Sanata Clara University) was active during the period of the project in many other aspects of space law. Among these was participation in a Practicing Law Institute conference, the first such meeting in Space Law presented to the practicing bar rather than to an exclusive, small group of practitioners in this area. Another important offshoot of this project was the dissertation of Professor Malcolm D. Schlusberg entitled, "NASA Contract Dispute Adjudication: A Study in Legal Systems Perspective." At the time this dissertation was written Dr. Schlusberg was an Associate Professor of Business Administration and also held a joint appointment in the College of Law.

Several publications in law journals by Dr. Alexander and others resulted from the work of this project.

NASA-BUSINESS RELATIONS

Throughout the period of activity in this area the faculty members and graduate students who participated were engaged in a continuing study of the decision-making criteria and organizational structure which affected the absorption of new technology by manufacturing firms, both large and small; and the evaluation of institutions which were specifically funded to assist in the process of making technology more widely available to business enterprises. In particular, Professor Eric Lawson dealt with R & D budgeting practices, Professor E. Bruce Fredrikson with new economic criteria as related to decision processes, and Professor Peter Franck with technology transfer. Perhaps a broader view of the scope of these interests can be gleaned from the titles of the reports submitted to NASA and the publications which ensued, both of which categories are listed in Appendixes B and C of this report.

Another project which should be mentioned at this point is the study carried out by Professor George Fisk entitled "Non-Economic Criteria for Project Evaluation." This study was not included as part of the NASA-Business Relations subproject and was, in fact, separately funded. It did, however, grow out of the original interests in the School of Management in NASA-Business Relations. While the chief focus for this study was in the School of Management, one of the principal participants was Mr. David Curzon of the Maxwell Graduate School of Citizenship and Public Affairs.

SOCIAL AND PHYSICAL PROCESSES IN SYSTEMS SCIENCE

This project was organized on the principal that an interdisciplinary group could be assembled which would be interested in a common, thematic approach to problems, but where the problems were different in nature. The theme was quantitative modeling of systems; systems that included coupled social, financial and physical parameters. It was felt that through regular meetings of such an interdisciplinary group, including faculty and graduate students, that research results as they evolved could be presented and criticized and assessed for possible applications to broader problems. The quantitative models used in different ways by the various investigators was indeed found to be helpful as the interactions took place over the course of the project. The specific problems, involving a variety of modeling techniques, were the following:

- A. Partitioning Models for Incentive Contracts
P. Bruce Berra - Industrial Engineering
- B. Dynamic Models for Simulating Political Environments
W. D. Coplin - Political Science
- C. Cost Estimating Models for Hospital Services in Metropolitan Areas
B. N. Horwitz - Accounting
- D. Models for Assessing Cost Information Accuracy for Decision Makers
M. Onsi - Accounting

E. General Dynamic Models for Coupled Socio-physical
Systems

N. Schwartz - Electrical Engineering

While Professor Schwartz was himself involved in one of the sub-project areas, he was also the Principal Investigator of the group.

MANAGEMENT OF SAFETY AT NASA

In the last year of the grant a new study was undertaken in the management area. After several meetings between Syracuse University and NASA personnel to decide upon objectives, a group was formed from several experienced members of the management study group, augmented by an additional faculty member and graduate student. In the study, NASA's organizational arrangement for the management of safety was found to vary from Center to Center and from program to program, but despite the diversity, unification had been achieved to a large extent through the SR&QA office at Headquarters. An extensive final report was submitted upon completion of this investigation.

Personnel involved were Professor Martin E. Barzelay, Principal Investigator; Professors John E. LaGraff, David L. Wilemon and Bernard D. Wood; and Mr. Rajan Chandran, a doctoral candidate in the School of Management.

PARTICIPANT STATISTICS

Over the period of the grant a total of twenty-nine faculty members from thirteen disciplines participated in the research program. Their names and disciplines together with schools or colleges are given in Appendix A. Approximately sixty graduate students participated in the research work. A number of these students based their Masters Theses or Doctoral Dissertations on their research participation. Many of these graduate students have since left the University to work in industry, government agencies, or in teaching careers. Many have indicated to us their work was enhanced by their relationship with NASA.

In addition, we should also mention at this point that the initial five NASA Trainees were increased to ten under a separate grant. A number of these individuals worked closely or in relationship with the Syracuse/NASA Program or directly with NASA itself. In a few cases they worked with other government agencies while in the traineeship program.

UNIVERSITY ORGANIZATION

In the early years, since the program was a University-wide endeavor, a committee of the deans of the four participating schools and colleges was set up to maintain cognizance of the program under the jurisdiction of the University's Vice President for Research and Administration. Initially, Professor John C. Honey, the Director of the Program, reported to this committee. However, this structure was found to be

somewhat cumbersome. When Professor Koney was named Vice President for Sponsored Programs, Professor Martin E. Barzelay, who took his place as Director of the Program, reported only to him. The transition was greatly aided by the fact that Mrs. Jean T. Golemo, who had been Program Manager under the directorship of Professor Honey, continued in her role throughout the remainder of the grant.

To promote the overall understanding of the Program in the University community, periodic reviews were conducted for the Chancellor of the University and selected key University personnel. At several of these presentations key NASA personnel also were present. In addition, seminars were held regularly which included all members of the Syracuse/ NASA Program, at which progress reports were presented concerning the various subprojects. This enabled the participants to achieve a better perspective of the entire program and was helpful in that questions and criticisms could be aired. The seminars were also helpful in giving members who might be working in a rather narrow area a wider view of the entire NASA Program as seen through the eyes of their colleagues. It should be added, however, that while these seminars provided a very useful tool in the first several years of the program it became more difficult to maintain their continuity with the passage of time as the program diminished in scope and as the remaining members became, in their opinions, adequately cognizant of the entire program.

SYRACUSE UNIVERSITY - NASA RELATIONS

During the grant period meetings were held periodically between University and NASA personnel at which agreement was reached before new or extended undertakings were begun under the general guidelines of the grant, both in the above projects and other minor subprojects. When in later years funding became more restricted and some existing projects had to be of necessity cut back as new projects appeared to be of more value, this process became more difficult and time-consuming. Despite the difficulties, however, the process was of real value and thus needs some explication.

While funding administrators and project personnel changed over the years, NASA personnel from the Office of University Affairs, and in particular, Mr. Charles Bingman, on loan to them, met regularly with the group leaders of the various projects which were continuing, and with prospective leaders of new projects to discuss what had been done and what was proposed to be done. While these meetings were largely substantive in content, they also included thorough budget review and the establishment of budgets for the following year for each individual project in the overall program. This constant review process was beneficial in keeping the projects close to NASA's interests while at the same time permitting the faculty to clearly define their ongoing and future interests. It is our feeling that this was one of the major aspects of the Syracuse/NASA Program worthy of notice by NASA.

BENEFITS

The Syracuse/NASA Program was an experiment in government-university relations which was unique in that it had not been previously attempted elsewhere in the form adopted. The idea of opening up a major government agency as a laboratory to a university, for the purpose of bringing teaching and research into closer contact with the realities of practice, was in our opinion, an approach which might well be followed by many agencies and many universities. Given government's dependence on the universities for its trained manpower, it was highly useful to encourage closer communication between educators and practitioners, and the Syracuse/NASA Program was one means of accomplishing this.

Our experience suggests the importance of ample opportunity for a university to explore, in an Agency such as NASA, the possibilities of matching Agency interests with ongoing activities. If this is provided, there can be little danger of diverting the academician from his own central intellectual endeavors. Equally important is the cooperation of the Agency and a clearly designated locus in the Agency for liaison and advice to the university. The Syracuse group was impressed with the consistent responsiveness of NASA officials in furthering the objectives of the grant. We were particularly impressed with the sensitive, cooperative and judicious approach taken by the Office of University Affairs in monitoring the Syracuse/NASA Program.

Several observations with regard to the research may be in order. The opportunities to engage in externally supported research had been

particularly limited for our School of Management and College of Law prior to the Syracuse/NASA Program. The availability of resources, and appropriate subject matter of a social science character, to engage the interest of Engineering faculty had been virtually non-existent. The NASA grant thus offered research opportunities to a number of faculty who otherwise would not have participated in research of the kind undertaken.

Under the grant circumstances a good deal of learning accompanied the research process, much of which was later transferred to teaching. A number of faculty who had had little or no experience with NASA, and in some cases relatively little research experience, learned a great deal about the NASA program, the competence and imaginativeness of personnel in government and the realities of conducting research in the real world. It seems fair to say that the exposure to NASA provided ample corrective to the tendencies in universities to abstraction and generalizations based on limited empirical data. There also was evidence that some NASA officials found that their contacts with University personnel enabled them to translate certain of their specific experiences into more general propositions.

We observed that diverse objectives often were served by the research program. Participating faculty are primarily interested in advancing their own intellectual interests and their own professional stature. They desire to learn, to incorporate the learning into improved teaching and publications, and these latter into career advancement. They are

somewhat less moved by the abstractions of "encouraging interdisciplinary research" or "increasing articulation in government-university relationships." However, NASA officials were helpful in suggesting foci for research which were of value to faculty members, while at the same time the results of the research projects were, we feel, of interest and value to the agency. The University administration and Program leadership desired to see several parts of the University more engaged in research, but wanted the assurance of achieving research results that were competent. The pursuit of an abstract idea called "interdisciplinary research" was not always of major importance to the administrators.

The final results of the Syracuse/NASA Program can be characterized as positive and gratifying to all concerned. There is no question that through the opportunity provided by the NASA grant, a substantial group of faculty and graduate students experienced an unusual opportunity to see at first hand, and to some extent participate in, the work of a major and successful government agency. Teaching and research at the University were enhanced as a result in ways which have been further delineated in this report.

In our view, the interaction between University and Agency personnel was of benefit to the Agency. We felt that the large number of people with whom we came in contact at the Agency not only gained useful insights to the research processes as carried out by University personnel, but what is more important, benefitted by insights from the research

reports themselves. In many instances we received comments that indicated the usefulness of such information to the Agency person concerned. We also feel that much was gained by such people as Mr. James L. Daniels, Jr., formerly in the Office of the Administrator, NASA Headquarters, who, as a Practitioner in Residence, spent an academic year at the University as part of the Program.

We feel that the nation as a whole benefitted through the strengthening of the University and the education of many students, but most of all, by the dissemination of information through speeches, meetings, personal contacts, TV interviews, and research publications which gave a much broader view of what NASA was doing for the nation, especially in the management area, than the strictly technical viewpoints which were being profusely disseminated during the period of the grant.

INTERDISCIPLINARY CONSIDERATIONS

As indicated earlier with regard to interdisciplinary research, the only truly interdisciplinary group in scope and personnel was the one studying the "Role of the Project Manager." While several studies of interdisciplinary research have been written by members of this group, we might briefly summarize by saying that on the whole, the interdisciplinary approach did function satisfactorily over the entire life of the Syracuse/NASA Program despite trials, tribulations and a few defections from the group. After an initial somewhat difficult shakedown period during which the group had some difficulty in adapting the various re-

search styles peculiar to their own disciplines to each other, there came a time when a common research mode of operation became acceptable to all. The research rested primarily on a technique of interviewing project managers and related personnel throughout the NASA organization by interdisciplinary teams from within the study group based on sets of questions which had evolved through meetings of the entire group. Somehow the togetherness of the traveling and interview schedules and subsequent transcribing, editing and abstracting of information from the interviews provided the glue which held the interdisciplinary group together. While this interdisciplinary group, which started initially with nine faculty members, shrank over the years for reasons indicated above, and because of reduced financing, the final group was still interdisciplinary with one member from the School of Management, one from Sociology in the Maxwell School, and two from the College of Engineering, nearly proportional to the original distribution of faculty personnel.

One of the major benefits from the interdisciplinary work was that students from various schools and colleges who worked with this group became acquainted with each other's disciplines in ways which were quite unusual at Syracuse University at that time but have become common since. Another quite significant effect, and we believe an enduring one, is that many Syracuse University faculty members from various disciplines, who in many cases had never previously met, developed a mutual respect as they worked together for each other's disciplines. At the same time, they

also learned how other departments and colleges in the University solve their academic and managerial problems. Not unexpectedly, much of the interdisciplinary work which has evolved since the Syracuse/NASA Program started has come about through the efforts of faculty members who participated in the Program. This we consider a very strong plus for the Syracuse/NASA Program.

REPORTS AND PUBLICATIONS

In the period of the grant a large number of documents were produced, over one hundred in number, reporting on the research output. These were in the form of Working Papers, Occasional Papers, Reports, and Theses and Dissertations. The nature of each of these may be seen in Appendix B, which contains a complete listing.

In addition to these documents a substantial number of articles were published by project personnel in professional journals and similar publications peculiar to the given field of endeavor. This has been an ongoing activity which continues even today and is expected to continue beyond the life of the grant from utilization of research source material accumulated. It has been difficult to keep track of all such publications attributable to the NASA grant, and therefore only a sample is given in Appendix C, Publications.

It is worthy of note at this point that whereas earlier in this report we mentioned that several colleges had had little or no opportunity for research prior to the NASA grant, some of these, such as the School of

Management, were among the most prolific in publishing. We particularly wish to mention Professor David L. Wilmon, of the School of Management, who has published widely both in scholarly journals and in business publications, and has lectured extensively both in this country and abroad, thus bringing NASA management techniques to the attention of a wide and varied audience.

APPENDIX A

FACULTY PARTICIPANTS

<u>Name</u>	<u>Discipline</u>	<u>School or College</u>
George J. Alexander	Law	Law
Martin E. Barzelay	Mech. & Aerospace Eng.	Engineering
Bruce Berra	Industrial Eng.	Engineering
Edwin A. Bock	Political Science	Maxwell Grad. School
William D. Coplin	Political Science	Maxwell Grad. School
E. E. Drucker	Mech. & Aerospace Eng.	Engineering
George Fisk	Marketing	Management
Peter G. Franck	Finance	Management
H. G. Frederickson	Political Science	Maxwell Grad. School
E. Bruce Fredrikson	Finance	Management
John C. Honey	Political Science	Maxwell Grad. School
Richard J. Hopeman	Organization & Management	Management
Bertrand N. Horwitz	Accounting	Management
John E. LaGraff	Mech. & Aerospace Eng.	Engineering
W. Henry Lambright	Political Science	Maxwell Grad. School
Eric W. Lawson	Finance	Management
G. Harry McLaughlin	Communications	Journalism
Frank Marini	Political Science	Maxwell Grad. School
Mohamed Onsi	Accounting	Management
William S. Pooler	Sociology	Maxwell Grad. School

<u>Name</u>	<u>Discipline</u>	<u>School or College</u>
Emmette S. Redford	Political Science	University of Texas
Robert G. Sargent	Industrial Eng.	Engineering
Malcolm D. Schlusberg	Law & Public Policy	Management
Nathan Schwartz	Electrical Eng.	Engineering
Kin N. Tong	Mech. & Aerospace Eng.	Engineering
James N. Vedder	Quantitative Methods	Management
Orion White	Political Science	Maxwell Grad. School
David L. Wilemon	Marketing	Management
Bernard D. Wood	Mech. & Aerospace Eng.	Engineering

APPENDIX B

DOCUMENTS

The documents produced by the Syracuse/NASA Program resulted from studies supported by a grant from the National Aeronautics and Space Administration to Syracuse University. They were prepared by professors and graduate students from the following fields: business administration, engineering, journalism, law, political science, and sociology.

The documents include the following classifications:

1. Working Papers (WP) which are developed as interim reports of concepts associated with the specified project. These papers are exploratory in nature and serve as a focus for discussion and are subject to further refinement as the research program progresses.
2. Occasional Papers (OP) which are developed in areas not directly related to the project, but which cover topics of interest to the investigators which are generated through participation in the research project.
3. Reports (R) which are unpublished documents submitted to NASA and other interested parties which represent the final results in particular areas of inquiry in the research project.
4. Theses and Dissertations (TD) which are the unpublished results of the research efforts of graduate students associated with the project and which represent the writing requirements of their degree programs.

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<u>Document Number</u>	<u>Title, Author, Date</u>
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6222-R-1	"Weather Modification: The Politics of an Emergent Technology," W. Henry Lambricht, Sept., 1970. 520 p.
6222-R-2	"What Manned Space Program After Reaching the Moon? Government Attempts to Decide: 1962-1968," Emmette S. Redford and Orion F. White, Dec., 1971. 234 p.

ROLE OF THE PROJECT MANAGER

6223-WP-1	"The Role of the Project Manager and Management Systems in the Management of the Apollo Program," Richard J. Hopeman and David L. Wilemon, Dec., 1968. 10 p.
6223-WP-2	"Systems Analysis and Management," Richard J. Hopeman, Dec., 1968. 49 p.
6223-WP-3	"The Spectrum of Project Management," John P. Cicero, Dec., 1968. 13 p.
6223-WP-4	"The Apollo Project Manager - Contractor Interface," Eugene E. Drucker, Oct., 1969. 17 p.
6223-WP-5	"Project Management Authority: Some Preliminary Insights," David L. Wilemon, Dec., 1968. 29 p.
6223-WP-6	"A Concept of Project Authority," John P. Cicero, March, 1969. 24 p.
6223-WP-7	"A Concept of Project Authority: The NASA/Apollo Programmatic Environment," John P. Cicero and David L. Wilemon, June, 1969. 42 p.
6223-WP-8	"NASA and the Apollo Program," William Pooler and Alphonse Sallett, July, 1969. 24 p.
6223-WP-9	"Project Management: A New Dimension in Complex Task Management," David L. Wilemon, July, 1969. 43 p.

<u>Document Number</u>	<u>Title, Author, Date</u>
6223-WP-10	"The NASA Scheduling System: Scheduling in the Apollo Program," R. J. Hopeman, July, 1969. 34 p.
6223-WP-11	"The NASA Scheduling System: Scheduling in Project Management," R. J. Hopeman, August, 1969. 28 p.
6223-WP-12	"The NASA Scheduling System: The Techniques of Scheduling in the Apollo Program," R. J. Hopeman, May, 1970. 21 p.
6223-WP-16	"Project Management at Houston," Henry J. Anna, August, 1969. 18 p.
6223-WP-17	"Project Authority: A Multidimensional View," John P. Cicero and David L. Wilemon, December, 1969. 18 p.
6223-WP-18	"The Apollo Project Manager: Anomalies and Ambiguities," David L. Wilemon and John P. Cicero, December, 1969. 21 p.
6223-WP-19	"Relationships Between Research and Development Operations and Industrial Operations at MSFC," Bernard D. Wood, April, 1969. 27 p.
6223-WP-20	"Project Management and the Organization, Part I," Henry J. Anna and H. George Frederickson, August, 1969. 66 p.
6223-WP-21	"Project Management as a Transferable Management System," David L. Wilemon, September, 1969. 24 p.
6223-WP-22	"Project Management and the Organization, Part II," Henry J. Anna and H. George Frederickson, October, 1969. 51 p.
6223-WP-23	"On the Application and Dissemination of Space Age Management Technology," David L. Wilemon, January, 1970. 21 p.
6223-WP-24	"The NASA-Apollo Contractor Interface: The Resident Management Operation," B. Kelmachter, February, 1970. 16 p.
6223-WP-25	"NASA Priorities in Orbit: The Waxing and Waning of Moon Mania," H. George Frederickson and R. Loverd, February, 1970. 11 p.

<u>Document Number</u>	<u>Title, Author, Date</u>
6223-WP-26	"The Power Spectrum in Project Management," G. R. Gemmill and D. L. Wilemon, February, 1970. 17 p.
6223-WP-27	"Transferring Space-Age Management Technology," D. L. Wilemon, July, 1970. 17 p.
6223-WP-28	"Dimensions of Interpersonal Power in Project Management," David L. Wilemon and Gary R. Gemmill, November, 1970. 25 p.
6223-WP-29	"Program Innovation in a Complex Organization (MSFC's Program Development Operation)," David L. Wilemon, July, 1971. 29 p.
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6223-OP-2	"Reflections on Interdisciplinary Research," Richard J. Hopeman and David L. Wilemon, June, 1969. 20 p.
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6223-OP-5	"Bureaucracy and the Urban Poor," H. George Frederickson and Henry J. Anna, August, 1969. 20 p.
6223-OP-6	"Interdisciplinary Effort: Research or Problem Solving?" Eugene E. Drucker, September, 1969. 10 p.
6223-R-1 (Interim Report)	"Project Management in the Apollo Program," Eugene E. Drucker, William S. Pooler, David L. Wilemon, and Bernard D. Wood, April, 1970. 34 p.
6223-R-2	"Project Management in the Apollo Program: An Interdisciplinary Study," Eugene E. Drucker, William S. Pooler, David L. Wilemon, and Bernard D. Wood, January, 1972. 173 p.
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6223-TD-3	"The Professional and Technical Qualifications of Apollo Project Managers," John P. Cicero, August, 1969. 151 p.
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6223-TD-5	"Non-Hierarchical Public Management: A Study in Science and Technology," Henry J. Anna, August, 1971. 279 p.
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6223-TD-7	"Human Relations Training for Complex Project Management," Paul M. Nakai, April, 1972. 105 p.
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6224-WP-8	"Some Domestic Legal Problems in the Earth Resource Satellite Program," George J. Alexander and James P. McDonald, October, 1969. 23 p.
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6225-WP-9	"The Role of the Atomic Energy Commission in Technology Transfer: The Civilian Power Reactor Program," Louis Buttino, October, 1969. 27 p.
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6221-TD-1	"Interdisciplinary Research in Theory and Practice: A View from the University," William E. Davis, April, 1970. 156 p.
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APPENDIX C

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