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NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

UNIVERSITY OF HOUSTON-TEXAS A&M UNIV.

1984 FINAL REPORT

UNIVERSITY OF HOUSTON • Founded 1927 •

Department of Electrical Engineering

Cullen College of Engineering

University of Houston

NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

UNIVERSITY OF HOUSTON - TEXAS A&M UNIVERSITY

1984 FINAL REPORT

by

Bayliss C. McInnis

University of Houston - University Park

Michael B. Duke and Bob Crow

NASA Johnson Space Center.

August 1984

GENERAL REVIEW

This report summarizes the twentieth NASA/ASEE Summer Faculty Fellowship Program held at the Johnson Space Center, June 4 through August 10, 1984. The program was administered by the University of Houston and the University Programs Office of the Johnson Space Center with the support of Texas A&M University through a subcontract. A total of thirty-one fellows from throughout the country participated in the program: twenty-eight fellows at the Johnson Space Center at Houston, Texas; one fellow at the White Sands Test Facility at Las Cruces, New Mexico; and two fellows at the California Space Institute in La Jolla, California.

1. Faculty Fellows

A total of 109 applications from a broad geographical distribution and a wide variety of disciplines were received for the 1984 program. A summary of applicant preference regarding the Johnson Space Center is provided in Table 1. This group of applicants was generated through the ASEE direct mailing and advertisements in journals and in technical publications as well as by direct solicitation by the program co-directors. In addition, Bob Crow, JSC University Programs Coordinator, contacted, by mail and phone, minority colleges and universities throughout the U.S.

The program at JSC was originally allocated twenty-eight fellowships, but later four more fellowships were additionally funded by JSC. The selection of fellows was made jointly by the co-directors, representatives of the NASA-JSC engineering and science directorates, and the NASA-JSC research advisors. Table 2 contains a listing of the fellows chosen for the 1984 program along with their academic department and home institution. This year's program had eleven fellows returning for a second year fellowship and twenty fellows participating for the first time. After the program had begun one fellow sent notification that he would not be able to participate, and this position remained unfilled. The backgrounds of the thirty-one summer faculty fellows are given in Tables 3A and 3B, which show that all but one of the fellows have their doctoral degree. The following general disciplines are represented by the summer faculty fellows:

Engineering	13
Biology/Life Science	5
Earth Science	2
Chemistry	2
Math/Statistics/Computer Science	5
Physics/Astronomy	4

This appears to be a suitable combination of disciplines for the distribution of research at the Johnson Space Center.

The thirty-one fellows represent universities in fifteen states. The following is a geographical breakdown of this year's fellows:

Alabama	1
Arkansas	1
Colorado	1
Illinois	1
Iowa	1
Louisiana	1
Maryland	1
Massachusetts	1
Missouri	2
New Mexico	1

New York	1
Ohio	1
Oregon	1
Texas	15
Virginia	2

The large number of fellows from universities in the State of Texas can be justified on the basis of the size of the state and its large number of colleges and universities.

2. Program Administration

The 1984 NASA/ASEE Summer Faculty Fellowship Program at NASA-JSC was conducted by the following:

Bayliss McInnis, Co-Director, University of Houston

Michael Duke, Co-Director, NASA-JSC

Bob Crow, University Programs Coordinator, NASA-JSC

Walter Horn, Texas A&M University

In addition, Dr. H. William Prengle, Jr. of the University of Houston served as an advisor for the program. A full time office, staffed by a senior secretary, was maintained at JSC from May 21 until August 17. The office space and equipment were furnished by NASA-JSC and the secretarial support was funded by the program. In addition to housing the secretary and the university co-director, this office provided a definite focal point for the program as a center of communication between the fellows and the university and all NASA personnel associated with the program as well as a source for the normal administrative and secretarial support needed for the administration of the program.

The ASEE prepared and distributed the program announcements used to generate the applicants for the program. In addition, the society prepared the program certificates of recognition which were presented to each fellow.

3. Seminars

A series of seven seminars was developed to supplement the research activities of the fellows. The purpose of the seminars was to provide the fellows with a view of the spectrum of research and development programs currently in progress at NASA-JSC as well as to provide an opportunity for the fellows to get together with each other and the co-directors of the program for discussions and an exchange of ideas about the seminar topic and the summer program.

A schedule of the seminar program was included on a calendar which was distributed to all faculty fellows during the first few days of the program. Five of the guest speakers were representatives of the Johnson Space Center community while the sixth and seventh speakers were the fellows Dr. E. Julius Dasch and Dr. James L. Carter. Table 4 contains the seminar schedule for this summer's program.

All of the fellows were expected to attend the seminars and were reminded and encouraged to attend each week by a memo from the program office. Each seminar consisted of a formal presentation of approximately one hour. An informal luncheon was planned following each seminar at a convenient local restaurant to promote fellowship among the fellows. The results of the questionnaire distributed to all faculty fellows indicate that this year's seminar program was well received and appreciated by the fellows.

4. Short Courses

In order to provide the fellows with an opportunity to extend their technical knowledge, three short courses were held during the summer. Topics, speakers, and dates are given in Table 5. These short courses were open to NASA and contractor personnel at JSC and were considered to be an important contribution of the summer program to activities at JSC.

5. Oral Reports

Each fellow was asked to present an oral report to his work group. These oral presentations were frequently attended by branch and division chiefs along with other technical personnel. These meetings provided an opportunity for the Co-Director from University of Houston to become acquainted with JSC personnel and problems of current interest. In several cases the fellows were encouraged to publish the results of their research activities.

6. Other Events

The following administrative, technical, and social events were arranged to complement the research activities of this year's participating fellows:

a. Welcoming Ceremony

The fellows were welcomed to the Johnson Space Center on June 4, 1984, by the program co-directors and an assortment of NASA personnel. As shown in Table 6, briefings were provided for the use of JSC library and the Gilruth Recreational Center, on JSC security, on badging, on automobile registration, and on the administrative details of the program.

b. Tour of the Johnson Space Center

A special tour of the Johnson Space Center was arranged on June 5 for the summer faculty fellows. This was a full day tour of the usual tourist attractions supplemented by special visits to many of the laboratory facilities. The principal purpose of the tour was to give the fellows an extensive overview of the facilities and of the programs in progress at the Johnson Space Center. Table 7 contains a summary of the main points of the tour.

c. Social Events

Several social events were scheduled during the summer to encourage communication and fellowship between this year's participants, the program administrators, and the technical advisors. In addition, the social events were designed to help make the summer more enjoyable for the fellow's families. During the summer the following activities were scheduled: dinner at a Texas-style barbeque restaurant, an evening concert of the Houston Symphony in Hermann Park, a boat tour of the Houston Ship Channel, Houston Astro baseball games, Houston Gamblers football games, a trip to see "Hello Dolly," and a boat tour of Armand Bayou Natural Area. A recognition banquet at which Astronaut Ronald Grabe was the speaker was held during the ninth week of the program. Space photographs, a group photograph of the 1984 fellows, and the Certificates of Recognition were given to the fellows at the banquet.

7. Research Activities

The fellows were informed of the NASA-JSC research advisors and their research topics at the time of their selection. The JSC advisors were encouraged to contact the fellows prior to their arrival at JSC to supply the fellows with details concerning the research activity so that the fellow could arrive with a background on the topic. In most cases this communication was successful in that the faculty fellows arrived with a thorough understanding of the research project. All of the fellows felt that their research requirements were interesting and challenging, and that the environment was excellent for a ten-week concentrated effort.

In addition to the oral presentations, the fellows were requested to prepare a written final report of their research activities. These reports have been compiled and bound for distribution to NASA Headquarters, NASA-JSC, ASEE Headquarters, and the summer faculty program files. The abstracts of these reports have been included in this report as Exhibit 1. It is evident from these abstracts that the fellows were involved in some interesting and rewarding research projects.

EVALUATIONS AND RECOMMENDATIONS

A questionnaire identical to the one shown in Exhibit 2 was distributed to the faculty fellows, and a similar form, Exhibit 3, was distributed to the JSC research advisors. The purpose of the questionnaires was to evaluate the 1984 program and to solicit ideas for improvement of future programs. The overall evaluation of this year's program was encouraging and the suggested improvements will be taken into consideration for the 1985 program. Exhibit 4 contains a summary of the results of the questionnaires distributed to the fellows. The following is a summary of the results.

1. The overall rating of the program indicated that it was very worthwhile and that it provided an excellent opportunity for interesting and practical research.
2. Most fellows indicated the establishment of a permanent relationship with NASA colleagues and that there was the possibility of acquiring NASA funded research programs at their home institutions.

3. Most fellows thought that the working environment at JSC provided an excellent opportunity to acquire new ideas and to initiate meaningful research.
4. All of the fellows responded that their research assignment was well-defined, challenging, sufficiently narrow in scope, and within their field of competence and interest.
5. Most of the first year fellows indicated that they would like to return for a second summer of research at JSC.
6. The fellows suggested that the stipend should be increased so that the compensation would be in line with average faculty salaries.
7. The housing situation did not seem to be a problem.
8. The seminars and the short courses were appreciated by the fellows.
9. The social activities that had been arranged for the fellows and their families were considered to be an important part of the program.

The JSC technical advisors were interviewed individually during the latter part of the program and were unanimously supportive of the program. It was indicated that the program was indeed worthwhile for both faculty participants and for NASA. The advisors felt that the positive public relations aspect of the program was adequate justification for the program but that, in addition, the fellows contribute directly to the efforts of the JSC staff. They also felt that the presence of the fellows tended to stimulate new ideas and approaches to projects.

TABLE 1

NASA/ASEE SUMMARY OF PREFERENCES SINCE 1977

1977	First Preference:		62
	Second Preference:		25
	Total:	87	
1978	First Preference:		62
	Second Preference:		25
	Total:	87	
1979	First Preference:		58
	Second Preference:		29
	Total:	87	
1980	First Preference:		48
	Second Preference:		30
	Total:	78	
1981	First Preference:		60
	Second Preference:		20
	Total:	80	
1982	First Preference:		90
	Second Preference:		31
	Total:	121	
1983	First Preference:		99
	Second Preference:		35
	Total:	134	
1984	First Preference:		76
	Second Preference:		32
	Total:	108	

TABLE 2

Johnson Space Center

1984 NASA/ASEE Summer Faculty Fellows

1. John E. Akin
Dept. of Mechanical Engineering
Rice University
Houston, Texas 77291

*2. Thomas L. Boullion
Dept. of Math & Statistics
University of Southwestern Louisana
Lafayette, Louisana 70504-1010

*3. Roberta M. Bustin
Chemistry Dept.
Arkansas College
Batesville, Arkansas 72501

4. James L. Carter
Dept. of Geoscience
University of Texas/Dallas
Richardson, Texas 75083

5. Carol G. Crawford
Dept. of Math
U.S. Naval Academy
Annapolis, Maryland 21402

6. Gary Scott Danford
Dept. of Environmental Design
State University of New York/Buffalo
Buffalo, New York 14214

7. E. Julius Dasch
Dept. of Geology
Oregon State University
Corvallis, Oregon 97331

8. Robert E. Donnelly
Dept. of Chemistry
Auburn University
Auburn, Alabama 36849

9. Donald L. Fenton
Dept. of Mechanical Engineering
New Mexico State University
Las Cruces, New Mexico 88003

*10. Karl R. Johansson
Dept. of Biology
North Texas State University
Denton, Texas 76203

11. William B. Jones, Jr.
Dept. of Mechanical Engineering
Texas Tech University
Lubbock, Texas 74909

*12 Kwang Yun Lee
Dept. of Electrical Engineering
University of Houston/UP
Houston, Texas 77004

13. Jerald N. Linsley
Dept. of Chemical Engineering
Prairie View A & M
Prairie View, Texas 77446

14. O. W. Markley
Dept. of Human Science
University of Houston/CL
Houston, Texas 77058

*15. Thomas R. Marrero
Dept. of Chemical Engineering
University of Missouri
Columbia, Missouri 65202

**16. Richard T. Meehan
Dept. of Rheumatology
University of Iowa Hospital
Iowa City, Iowa 52242

*17. Thomas H. Morgan
Dept. of Physics
Southwestern University
Georgetown, Texas 78626

*18. Russell L. Palma
Dept. of Physics
Sam Houston State University
Huntsville, Texas 77341

19. Howard L. Paynter
Dept. of Mechanical Engineering
Metropolitan State College
Denver, Colorado 80204

20. Navaratna S. Rajaram
Dept. of Industrial Engineering
University of Houston/UP
Houston, Texas 77004

21. Ralph Clark Robertson
Dept. of Electrical Engineering
Virginia Tech
Blacksburg, Virginia 24061

*22. Robert C. Runnels
Dept. of Meteorology
Texas A & M University
College Station, Texas 77843

23. Daniel C. St. Clair
Dept. of Computer Science
University of Missouri/Rolla
St. Louis, Missouri 63121

24. Donald D. Seath
Dept. of Aerospace Engineering
University of Texas/Arlington
Arlington, Texas 76019

25. Scot E. Smith
Dept. of Civil Engineering
Ohio State University
Columbus, Ohio 43210

26. Willard A. Stanback
Dept. of Math & Statistics
Norfolk State University
Norfolk, Virginia 23504

*27. Victor G. Szebehely
Dept. of Aerospace Engineering
University of Texas
Austin, Texas 78712

28. Frederic A. Wierum
Dept. of Mechanical Engineering
Rice University
Houston, Texas 77251

29. Ronald J. Willey
Dept. of Chemical Engineering
Northeastern University
Boston, Massachusetts 02115

*30. Joan P. Wyzkoski
Dept. of Mathematics
Bradley University
Peoria, Illinois 61625

*31. Wayne J. Zimmermann
Dept. of Computer Science
East Texas State University
Commerce, Texas 75428

* denotes second year faculty fellows

** as of July 1, 1984, the address is
Richard T. Meehan
Dept. of Internal Medicine
Univ. of Texas Medical Branch
Galveston, Texas 77550

TABLE 3A

BACKGROUND OF FIRST-YEAR FACULTY FELLOWS

NAME	AGE	DEGREE and YEAR	ACADEMIC RANK	MAJOR
Akin	43	Ph.D. 68	Professor	Mech. Eng.
Carter	47	Ph.D. 65	Assoc. Prof.	Geochemistry
Crawford	32	Ph.D. 79	Assist. Prof.	Mathematics
Danford	37	Ph.D. 74	Assoc. Prof.	Env. Psychology
Dasch	52	Ph.D. 69	Assoc. Prof.	Geology
Donnelly	37	Ph.D. 77	Assist. Prof.	Chemistry
Fenton	37	Ph.D. 74	Assoc. Prof.	Mech. Eng.
Jones	47	Ph.D. 70	Assoc. Prof.	Mech. Eng.
Linsley	46	Ph.D. 70	Assist. Prof.	Chem. Eng.
Markley	47	Ph.D. 68	Assoc. Prof.	Social Psychology
Meehan	35	M. D. 72	Assoc. Fellow	Immunology
Paynter	53	Ph.D. 65	Professor	Mech. Eng.
Rajaram	40	Ph.D. 76	Assist. Prof.	Indust. Eng.
Robertson	34	Ph.D. 83	Assist. Prof.	Elect. Eng.
St. Clair	41	Ph.D. 75	Assoc. Prof.	Computer Science
Seath	52	Ph.D. 63	Professor	Aerospace Eng.
Smith	31	Ph.D. 82	Assist. Prof.	Civil Eng.
Stanback	53	M.Ph. 79	Assist. Prof.	Math/Statistics
Wierum	53	Ph.D. 62	Professor	ME/Aerospace Eng.
Willey	31	Ph.D. 84	Assist. Prof.	Chem. Eng.

TABLE 3B

BACKGROUND OF SECOND-YEAR FACULTY FELLOWS

NAME	AGE	DEGREE and YEAR	ACADEMIC RANK	MAJOR
Boullion	43	Ph.D. 66	Professor	Math/Statistics
Bustin	44	Ph.D. 73	Professor	Chemistry
Johansson	64	Ph.D. 48	Professor	Microbiology
Lee	42	Ph.D. 71	Assoc. Prof.	Elect. Eng.
Marrero	48	Ph.D. 70	Assoc. Prof.	Chem. Eng.
Morgan	39	Ph.D. 72	Assist. Prof.	Physics
Palma	32	Ph.D. 80	Assist. Prof.	Space Physics
Runnels	48	Ph.D. 68	Assist. Prof.	Meteorology
Szebehely	63	Ph.D. 45	Professor	Aerospace Eng.
Wyzkoski	35	Ph.D. 79	Assist. Prof.	Mathematics
Zimmermann	45	Ph.D. 75	Assoc. Prof.	Computer Science

TABLE 4

1984 NASA/ASEE SUMMER FACULTY SEMINAR SERIES

DAY	SPEAKER	TOPIC
Friday, June 15	James Oberg	The Russian Space Program
Friday, June 22	Bass Redd	The Space Station
Friday, June 29	Major Larry Cole	Air Force Involvement in the Shuttle Program
Friday, July 6	Dick Underwood	Space Photography
Friday, July 13	Julius Dasch	Teaching Space Appreciation
Friday, July 20	John Annexstad	Antarctic Meteorites
Friday, July 27	James Carter	Springboard to the 21st Century

TABLE 5

1984 NASA/ASEE SHORT COURSES PRESENTED

MODERN CONTROL THEORY AND ITS APPLICATION TO LARGE SPACE STRUCTURES

Dr. D. L. Mingori (UCLA)
Dr. Graham Goodwin (University of Newcastle, Australia)

July 9, 1984   8:30AM-5:00PM
number of attendees: 70

INTRODUCTION TO LISP PROGRAMMING

Dr. Robert Anderson (University of Houston)

July 16, 19, & 23, 1984   9:00AM-12:00NOON
number of attendees: 150

ROBOTICS: MODELING, CONTROL, AND SENSING

Dr. Antal K. Bejczy (Jet Propulsion Laboratory/Cal. Tech.)

August 7, 1984   9:00AM-3:00PM
number of attendees: 150

TABLE 6

1984 NASA/ASEE OPENING CEREMONY

June 6, 1984
Building 1 Room 966 Johnson Space Center

(8:30-9:00 coffee & do-nuts served)

AGENDA

Michael Duke, University Programs Office	Welcome to Johnson Space Center Brief History of Program & JSC Role Introduction of Program Staff
Bayliss McInnis, Co-Director University of Houston	Objectives of 1984 Summer Faculty Program Operating Details of Program Highlights of 1984 Program Introduction of Fellows
Bob Crow, University Programs Programs Office	Explaination of Role in Program Briefing on Security, Badges, Traffic, the Recreation Center, Housing, & the Dress Code Announcement of JSC Tour Social Activities for 1984 Introduction of Summer Secretary & Remarks About the Summer Faculty Office Concluding Remarks & Handing Out of Materials

TABLE 7

JSC TOUR

June 6, 1984

9:00	JSC Walking Tour Begins	Bldg. 2
9:15	Skylab Exhibit Angelo Cassaburri and Jim Poindexter	Bldg. 5
10:45	Mission Simulation & Training Facility Angelo Cassaburri	Bldg. 5
10:15	Weightless Environment Training Facility Lou Fain	Bldg. 29
11:00	Educational Programs/MOCR Jim Poindexter & OMNIPLAN	Bldg. 30
11:45	Vacuum Chamber/Space Station Mock-Up Angelo Cassaburri	Bldg. 32
12:15	Space Shuttle Mock-Up Angelo Cassaburri	Bldg. 9A
1:00	Lunch at Cafeteria/Giftshop	Bldg. 3
2:15	Crew Systems/ Space Suit Display Angelo Cassaburri	Bldg. 7A
3:00	Lunar Receiving Laboratory Angelo Cassaburri	Bldg. 31A
3:45	JSC Walking Tour Ends	Bldg. 2

EXHIBIT 1

THERMAL ANALYSIS UTILIZING FINITE ELEMENT METHODS

Ed Akin
Professor
Department of Mechanical Engineering and Materials Science
Rice University
Houston, Texas

ABSTRACT

The practical utilization of the finite element method for thermal analysis and its interaction with finite element structural models was studied. A series of lectures on the theoretical foundations and assumptions was presented to the potential users of the techniques within the Thermal Branch. Existing in-house software and its supporting documentation was evaluated. The evaluation considered both linear and non-linear applications. The major shortcomings of these computer programs were the lack of data generation for problems involving thermal radiation, and a general lack of user friendliness.

Center Research Advisor: E. T. Chimenti

INVERSE REGRESSION VERSUS CLASSICAL IN CALIBRATION

Thomas L. Boullion
Professor of Statistics
University of Louisiana
Lafayette, Louisiana

ABSTRACT

In incorporating ground truth data to improve biophysical characteristic estimates using remotely sensed data we obtain n data pairs (x_i, y_i) and assume $y_i = \alpha + \beta x_i + e_i$, where α, β are the parameters in the linear relationship and the e_i are independently, identically distributed errors with zero mean and constant variance σ^2. Here x denotes the ground observed and y the Landsat estimated value of the biophysical characteristic of an area segment. Given another data point y, one wants to estimate the corresponding value of x. This can be accomplished using $x^+ = \frac{y - \hat{\alpha}}{\hat{\beta}} = \bar{x} + \frac{S_x^2}{S_{xy}}(y - \bar{y})$, the calibration estimator, or $x^* = \bar{x} + \frac{S_{xy}}{S_y^2}(y - \bar{y})$, the inverse regression estimator. These two competing estimators have different statistical properties and can both be justified on sound statistical methodologies.

Analytical expressions of $O(1/n)$ for their bias and mean squared errors are obtained as well as their asymptotic counterparts under very general distributional assumptions. It is concluded that within a range containing the data $x_1, \ldots, x_n$, and for various values of (β, σ^2), the inverse regression estimator is superior to the calibration estimator in terms of mean squared error.

Center Research Advisor: Richard P. Heydorn

DETERMINATION OF HYDROGEN IN LUNAR SOIL

Roberta Bustin
Professor of Chemistry
Arkansas College
Batesville, Arkansas

ABSTRACT

With a commitment to the space station and with increasing interest in a future lunar base, there is a growing interest in finding an extra-terrestial source of hydrogen for propellants and consumables. Earlier studies have shown that solar wind species are present in lunar soil.

This project included developing a method for the determination of hydrogen in lunar soil and finding the hydrogen concentrations in a number of bulk soils, particle size fractions, and mineral separates. The largest hydrogen concentrations were found in small grain size fractions. Contrary to previous expectations, hydrogen was not found to be highly concentrated in fractions consisting of the mineral ilmenite or in agglutinate fractions.

Center Research Advisor: Dr. Everett Gibson

COMPUTER AIDED ENGINEERING

FOR THE MECHANICAL SYSTEMS BRANCH OF THE SYSTEMS ENGINEERING DIVISION

JOHNSON SPACE CENTER

Dr. Carol G. Crawford

Assistant Professor of Mathematics

United States Naval Academy

Annapolis, Maryland

The Mechanical Systems Branch is responsible for the design and development of mechanical systems for the Orbiter. This engineering process is greatly enhanced by the use of computer aided design and engineering. A review of the branch's current and anticipated computer aided engineering requirements was conducted. This review included the determination of specific analyses utilized within the branch; the establishment of criteria for selection of appropriate computer aided analysis packages; the coordination of branch requirements with those of other branches in the division; an inventory of existing hardware and software capabilities; the evaluation of commercial packages to meet branch requirements; a listing of implementation options, schedules and costs; and a final recommendation presenting different scenarios for possible selection.

SELECTED PSYCHO-SOCIAL AND ORGANIZATIONAL CONFIGURATION DRIVERS AND SPACE STATION DESIGN

Scott Danford, Ph.D.
Associate Professor of
Environmental and Organizational Psychology
School of Architecture and Environmental Design
State University of New York at Buffalo

Abstract

It is the major contention of this study that implementation of an architectural configuration for space station which fails to accommodate salient psychological, social and organizational concerns will inevitably undermine the mission performance capacity of space station. To evidence this contention, this research project (a) delineates selected (and apparently undervalued) psychological, social and organizational concerns relevant to the productive, long-term human habitation of the isolated and confined environment of space station, (b) manifests those selected concerns through development of behavioral episode scenarios which demonstrate the potential of those concerns to diminish mission performance capacity if currently popular design configurations for space station are implemented, and (c) provides limited examples of ways in which currently popular design configurations might be altered to enable space station better to accommodate those selected psychological, social and organizational concerns.

Center Research Advisor: Mr. John A. Mason

Isotopic Chronology of Two Clasts of Aluminous Mare Basalt Separated From Apollo Breccia 14321

and

Strontium Isotopic Analysis of Xenoliths and "Clot Bands" From the Skaergaard Intrusion, Eastern Greenland

E. Julius Dasch
Department of Geology
Oregon State University
Corvallis, OR 97331

ABSTRACT

1. Based on petrographic and chemical criteria, Dickinson et al. (1984) have identified two broad groups and a total of five subdivisions of types of aluminous mare basalt from clasts separated from Apollo breccia 14321. The principle distinguishing chemical characteristic of the five groups is a systematic, eight-fold variation in rare-earth element concentrations; equally importantly, the groups show significant and systematic rare-earth element abundance pattern variations. These characteristics may be interpreted in terms of several possible histories. None, however, are unequivocal. The determination of time-of-formation isotopic composition of strontium and neodymium in two clasts chosen from chemical extremes of the five groups, as well as their radiometric ages, now in progress, should help to constrain hypotheses of their history -- especially, whether the groups are related genetically.

2. Beginning with the classic work of Wager (1934) on the Skaergaard layered intrusion of eastern Greenland, scientists have been intrigued by the degree to which assimilation of the three billion-year old host gneiss may have affected the character and crystallization of Skaergaard magma (see, for example: Leeman, et al., 1976; Leeman and Dasch, 1978). Preliminary strontium-isotopic analyses of a feature obviously an example of the assimilation process -- a partially digested gneissic xenolith collected from within the host gabbro -- shows an expected, monotonic variation of isotopic composition, from the center of the radiogenic xenolith well into contiguous, comparitatively nonradiogenic gabbro. A presently unexplained finding is that more central samples of xenolith are considerably more radiogenic than any of a small but supposedly representative set of about 15 samples of gneiss collected well away from the Skaergaard intrusion and presumably unaffected by it. Undoubtedly, the most likely explanation for this rather striking discrepancy is simply that the more radiogenic extremes of the gneiss were not analyzed; a much less likely, but more interesting possibility is that radiogenic strontium, during partial assimilation, migrated into the center of the more silicic xenoliths. Work in progress may help to resolve this question.

Almost everyone who has worked on the Skaergaard intrusion has been fascinated by the so called "clot bands" (pegmatitic gabbro) that occur within the Marginal Border Group of rocks. Many have believed that the crystallization of these quite coarse-grained gabbroic clot bands has been influenced by volatile constituents, perhaps assimilated from the host gneiss. Preliminary strontium-isotopic analyses of plagioclase separated from clot-band rocks indicates that the rocks are isotopically identical, within analytical uncertainties, to Skaergaard gabbro.

NASA/JSC Research Advisor: Laurnece E. Nyquist

IIMPLEMENTATION OF A MULTIFUNCTION DISPLAY AND CONTROL SYSTEM ON THE ORBITER

Robert A. Donnelly
Department of CHemistry
Auburn University
Auburn, Alabama

This project is concerned with development of an interactive graphic display/control system for the orbital maneuvering system (OMS). Current control of the OMS requires that the crew address individual valves in the system and interpret of large amounts of tabular data. The goal of this project is the facilitation of crew control of the OMS through automation of OMS procedures and display of system status during execution of such procedures. A preliminary design concept for such a system was developed by the Boeing corporation.

Implementation of the Boeing design concept requires construction of an executive computer program capable of simultaneously monitoring an array of push-buttons (used for command input), a low resolution screen (used for menus and checklists), and a high resolution graphics display (used to display the status of valves and system parameters of the OMS). The push-button array is currently simulated by a touch panel, and a single prototype pushbutton. The executive program interacts with the user, displaying the system status which results upon execution of commands entered from the touch panel.

Computer routines for interrupt-driven RS-232 communications have been written, and are used to monitor the status of the touch panel. A display processor for the high resolution graphics screen has been completed, and a database (display list) of pertinent structures in the OMS has been generated. Menus and checklists, and a command parser are being developed, and a simple executive has been written. A preliminary version of the completed package is now being tested.

Center research advisor: Michael M. Thomas

Karl R. Johansson August 31, 1984

Biological Processing of Lunar Ore; Closed Ecological Life Support Systems on the Moon or other Planetary Bodies

ABSTRACT

The interactions between microorganisms and various ores or metal ions were reviewed. Acid leaching, bioconcentration and biotransport processes received particular attention. It was concluded that once the chemical reductive processing of iron ores, e.g., illmunite, as well as life support systems, were well established, on the Moon, for example, it might be feasible to beneficiate the ores, or their tailings, through vat leaching. A protected enclosure within which the chemical environment could be modified so as to support aerobic microbial growth would be needed. Cultures of bacteria known to enhance the leaching process of ores, particularly those of copper (not especially abundant on the Moon), could be introduced together with some sulfuric acid to initiate the vat acid leaching process. For this biological system to function, however, protection from radiation and from wide temperature fluctuations would be required. Also, water, oxygen, carbon dioxide and inorganic nitrogen (N_2 or nitrate) would need to added to the enclosed environment, as in any ecological life support system on the Moon.

The problem of establishing a closed ecological life support system (CELSS) on the Moon, or elsewhere in space, was addressed, with particular emphasis on chemical augmentation and species selection. It was concluded that there is great need for further investigations of closed and semi-closed ecological systems here on Earth before long-term, successful living communities can be established upon any non-terrestrial planetary site.

Advisor: Dr. David McKay

(Note: I spent my fellowship at the California Space Institute, La Jolla with the special program on Space Based Resourses and Operations)

CONTROL OF SPACE STATION

By

Kwang Y. Lee
Associate Professor
Department of Electrical Engineering
University of Houston-University Park
Houston, Texas 77004

ABSTRACT

The control of Space Station is limited by the flexible structural modes. Therefore, it is attempted to develop an attitude control system which will limit the controller band in the frequency spectrum below the flexible modes so that the controller will not excite the vibrational modes of structures.

The attitude control system is formulated as an optimal control problem with a linear quadratic performance index. The response of a closed-loop controlled system is depending upon the weighting matrices of the quadratic performance index which are usually decided on by trial and error to get good response.

Therefore, an inverse optimal control problem is forulated to determine the quadratic weights which will locate all poles of the closed-loop system in a specified region where there is no vibrational modes of flexible stuctures.

Center Research Advisor: R. Berka

SOLAR DYNAMIC

POWER SYSTEM STUDIES

SUMMER - 1984

Jerald N. Linsley, Ph.D., P.E.
Associate Professor of Chemical Engineering
Florida Institute of Technology
Melbourne, FL 32901

formerly

Assistant Professor of Chemical Engineering
Prairie View A&M University
Prairie View, TX 77446

ABSTRACT

Studies of a number of somewhat disparate topics were pursued. These include: (1) A list of candidate thermal energy storage phase change materials (molten salts) was formulated; (2) Containment materials and their corrosion/compatibility with molten salts was investigated; (3) A search for heat transfer design methods for phase change material - thermal energy storage devices was conducted; (4) The chemistry of lithium hydride was investigated; (5) The scope of previous studies on optimal organic Rankine cycle working fluids selection was performed; (6) Some calculations relevant to the Prairie View A&M University lithium battery research project were performed; (7) A process analysis of solar dynamic power systems was performed, and the design variable selection algorithm was applied to the resulting system of equations. The result is a mathematical model of the solar dynamic power system suitable for optimization studies. Recommendations for further work are discussed, and some general comments on the Summer Faculty Fellowship program are offered.

A PILOT SITUATION AUDIT OF STRATEGIC PLANNING AT THE JOHNSON SPACE CENTER

O. W. Markley
Associate Professor
Department of Human Science and Studies of the Future
University of Houston - Clear Lake
Houston, Texas

ABSTRACT

The views of selected JSC personnel were surveyed regarding trends, issues, and transitions needing to be considered if affairs affecting the center are to be managed in an informal way.

The results indicate that most managers at JSC have thus far given little thought to how such factors may impact on the center during the coming decade. Although views were quite varied regarding the nature of strategic planning or its feasibility at an institution such as JSC for dealing with future uncertainties, there was general agreement that the development of automated information systems is an important priority, especially for administrative planning and management.

Center Research Advisor: Joseph P. Loftus

REVIEW OF CARBON DIOXIDE REDUCTION AND CARBON FORMATION CONCEPTS

Thomas R. Marrero, Ph.D.
Associate Professor
Department of Chemical Engineering
University of Missouri
Columbia, Missouri 65211

ABSTRACT

The state-of-the-art of carbon dioxide reduction systems and concepts for the proposed Space Station life support systems was reviewed. Detailed evaluations were made of current methane pyrolysis experimental data and a previous study of CO_2 decomposition by silent electric discharge. New information was also obtained about solid oxide electrolyte cells. The results of this review were recommendations to extend the existing experimental studies of CH_4 pyrolysis, to conduct new experiments using solid oxide electrolytic cells, and to continue broad based reviews of the carbon dioxide/carbon monoxide reduction processes. The application of the silent electric discharge process for CO_2 decomposition does not appear promising.

Center Research Advisor: Dr. Chin H. Lin

THE EFFECT OF PSYCHOLOGIC STRESS ON HUMAN LYMPHOCYTE ACTIVATION

Richard T. Meehan, M.D.
Assistant Professor
Department of Internal Medicine
University of Texas Medical Branch
Galveston, Texas

ABSTRACT

Since recent post-space flight *in vitro* lymphocyte studies revealed reduced blastogenesis, this study was designed to develop and evaluate new methods for detecting psychologic stress-induced altered immune function in man. Three different functional *in vitro* mitogen-stimulated parameters of lymphocyte activation were developed allowing simultaneous evaluation of PWM and PHA induced: protein synthesis at 24 hours (^{35}S methionine incorporation), blastogenesis at 72 hours (^{3}H thymidine uptake), and day 7 immunoglobulin production (secreted Ig G, A and M by ELISA assay). These tests will be compared to results obtained using the NASA JSC protocol of ^{3}H thymidine uptake using 10, 25, and 50 ug/ml of PHA at 72 and 96 hours of culture. The percentage of B cells, T cells, monocyte, T helper, and T suppressor/cytotoxic cells before culture are determined by fluoresceinated monoclonal antibodies detecting cell surface antigens. Cell cycle kinetics and viability at 72 hours will also be determined using propidium iodide with flow cytometry analysis.

The above protocol will evaluate peripheral blood mononuclear cell responses from nine University of Texas Medical Branch medical students the day of a major academic examination, 7 days preceeding and 10 days after the test. We should evaluate the effect of stress *per se* upon an early, intermediate, and late parameter of lymphocyte activation induced by two different mitogens and identify factors which contribute to individual subject variations on these functional assays.

Center Research Advisor: Gerald R. Taylor, Ph.D.

LUNAR LUMINESCENCE AND THE FILLING-IN OF FRAUNHOFER LINES IN MOONLIGHT

Thomas H. Morgan
Assistant Professor of Physics
Department of Physics
Southwestern University
Georgetown, Texas 78712

ABSTRACT

The filling in of Fraunhofer lines in moonlight has been attributed to lunar luminescence. In order to test mechanisms proposed for this effect, measurements were made of the filling-in of the H α line, the K I line, the Na D doublet, and a number of lines near the doublet. The degree of filling-in was not correlated with wavelength in a way expected from a broad-band luminescence, such as thermoluminescence. However, it was correlated with equivalent width of the Fraunhofer line, such that it increased as equivalent width decreased. This suggests that the Fraunhofer line filling at the Moon's surface is caused by inelastic scattering of sunlight with a small wavelength shift, as for example, photon-phonon scattering. The photon-phonon scattering process on broken surfaces cannot be treated analytically, but it has been possible to make a preliminary paarameterization of the process.

Center Research Advisor: Andrew E. Potter

THE ADSORPTION OF ATMOSPHFRIC XENON AND INERT GAS MEASUREMENTS IN SIZE SEPARATES OF THE ALLENDE METEORITE

Russell L. Palma
Assistant Professor
Physics Department
Sam Houston State University
Huntsville, Texas

ABSTRACT

Powdered and solid piece samples of the Allende meteorite were heated in various temperature steps to analyze their xenon compositions mass spectrometrically. The samples were then exposed to the atmosphere for three days. The samples were reheated to test for possible adsorption of atmospheric xenon and its release temperature.

Similar samples were exposed to a xenon gas which was strongly enriched in the light isotopes. With this unusual isotopic composition, adsorption and mass fractionation effects may easily be seen.

All of the inert gases, helium, neon, argon, krypton, and xenon, were measured mass spectrometrically from totally fused Allende samples which had been prepared by crushing and sieving into size fractions. The objective was to examine possible correlations of gas concentration and compositions with grain size.

Center Research Advisor: Donald D. Bogard

LOW-GRAVITY LIQUID PROPELLANT TRANSFER

Howard L. Paynter

Professor of Mechanical Engineering Technology

Metropolitan State College, Denver

ABSTRACT

Low-gravity, or simply low-g, is the condition of near-weightlessness during drifting maneuvers in space. It tends to eliminate the weight difference between liquid and gas presenting challenging design problems to the efficient resupply of liquids. Cryogenic propellants were emphasized because of their thermal complications and the limited experience for cryogenic liquids in low-g. Preferred design approaches are identified considering that up to one-million pounds of liquid hydrogen and oxygen will be needed annually to operate an Orbital Transfer Vehicle (OTV) based at the Space Station in the mid-1990's. Controlled low-g testing in the Orbiter's cargo bay and mid-deck compartment is recommended to develop both quantitative design data and instrumentation needed to demonstrate efficient resupply as a Technology Development Mission (TDM) using the early Space Station in 1991.

Center Research Advisor: Mr. Warren L. Brasher

Preliminary Research Plan

Use of Symbolic Manipulation Methods for Problem Specification and Automatic Code Generation

Prepared by

N.S Rajaram

Industrial Engineering Department
University of Houston- University Park

Abstract

As NASA enters the Space Station era, it faces major challenges in software and application development productivity. Unlike the shuttle, the Space Station is likely to be highly software intensive, with the potential for major problems in cost overruns and schedule slippages. It is highly desirable to enhance the productivity of software development by minimizing the amount of hand coding done in languages such as Fortran, Cobol, or Ada. Little improvement in productivity can be expected as long as humans are required to code and debug programs in such languages. Advances in a branch of Artificial Intelligence called Symbolic Manipulation, offers the potential for problem specification and code generation at a much higher level of description. SMP and MACSYMA are such high level languages which permit manipulation of mathematical expressions *symbolically*, while code is generated *automatically*. The usefulness for such an approach for high level problem specification and automatic code generation will be explored.

INFRARED TRANSMISSION AND RECEPTION TECHNIQUES

R. Clark Robertson
Assistant Professor
Department of Electrical Engineering
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia

ABSTRACT

Infrared transmission and reception techniques have application to Space Shuttle related goals such as an infrared communications system for the crew and an infrared laser docking system. There are also potential medical applications for an infrared communications system.

An infrared transmitter and an infrared pre-amplifier have been designed and tested. The transmitter consists of a cascode pair acting as a modulated current source for an infrared diode. Risetimes on the order of 115 ns have been obtained. Comparable falltimes are obtained when the low level of the signal is biased above zero. The high frequency receiver pre-amplifier is designed in a transresistance configuration; frequency response is insensitive to variations in gain from 1000 V/A to 100,000 V/A when the cascode pair transmitter is used as the infrared source. This implies that the maximum system bandwidth of 2 MHz is limited by the transmitter.

There are several fruitful directions for extension of this work. In the area of the transmitter, it is highly desirable to obtain enhanced falltimes without having to resort to a non-zero low level. In the area of the receiver pre-amplifier, there are several desirable extensions. First, the current pre-amplifier is not designed to be low noise due to the necessity of using off-the-shelf components. Second, the present design is highly sensitive to large input signals when a large gain is employed. A different topology that allows high

gain as well as large input signals needs to be examined. Third, succeeding stages of amplification need to be implemented so that TTL output levels may be obtained for all expected input signal levels. Finally, the pre-amplifier high frequency response needs to be extended in order to use it with the laser docking system.

Use of the LOWTRAN 6 Atmospheric
Radiative Transfer Model

Robert C. Runnels
Department of Meteorology
Texas A&M University
College Station, Texas

ABSTRACT

Preliminary testing has been performed of a computer code that accomplishes a numerical integration of the equation of radiative transfer in several model atmospheres. Called LOWTRAN 6, this code was tested by comparing its output to several large-scale atmospheric radiation problems. Agreement was very good between the observations of the large-scale radiation and the predicted values from the numerical integrations. Values of radiance within small wavelength intervals and at atmospheric microscales did not compare as favorably. Use of the LOWTRAN 6 code appears to offer much promise in the solution of problems of radiative transfer at large and medium atmospheric scales.

Center Research Advisor: Dr. David E. Pitts

FUNCTIONAL REQUIREMENTS

FOR THE

SPACE STATION DISPLAYS AND CONTROLS PROCESSOR

Daniel C. St. Clair
Professor of Computer Science
University of MO--Rolla
Graduate Engineering Center
St. Louis, MO 63121

ABSTRACT

Johnson Space Center (JSC) is considering the use of computer graphics devices for both monitoring and controlling all subsystems on the space station. It is expected that the space station command center will consist of several graphics devices all tied to a displays and controls (D&C) processor. The D&C processor will not only manage these I/O devices, it will send information to and receive information from various space station subsystems through a high speed fiber optics bus system. To study the various concepts involved in this type of monitoring and control environment, the Simulation and Avionics Integration Division (SAID) at JSC is developing a Space Station Command Center Mockup (SSCCM).

Research was conducted to determine the functional requirements for two different but related D&C processors: the D&C processor for the SSCCM and the D&C processor for the space station itself. Processor sizing was performed to determine necessary memory sizes, the number and types of interfaces, and the speed required for processing and I/O for both D&C processors. A survey of currently available commercial processors was made to see which fulfilled the functional requirements.

Center Research Advisor: Mr. Jon H. Brown

THE QUARTER-HERTZ MOTION OF THE SPACE SHUTTLE ORBITER

Donald D. Seath, Ph.D.
Professor of Aerospace Engineering
University of Texas at Arlington
Arlington, Texas

ABSTRACT

An unexpected lateral (roll-yaw) oscillation of the Space Shuttle Orbiter occurred during re-entry on the first flight. The oscillation is approximately ¼-Hz in frequency, and, although small in magnitude and controllable with ailerons, rudder, and yaw jets, was not predicted by wind tunnel tests, analysis, or by digital simulation of the vehicle. Since the first flight, theories have been proposed as to the cause of the oscillation, but no conclusive evidence has been found to substantiate any of the theories. This report describes the so-called quarter-hertz motion, collects and discusses several of the theories proposed to explain the cause, and offers suggestions for further investigation to identify the cause.

Preliminary analysis of wind tunnel data shows evidence of the possibility of asymmetric flow around the vehicle that could be responsible for the quarter-hertz oscillation. Vortices forming from the flow separation around the vehicle's nose, glove, and wing regions have a substantial influence on the aerodynamic forces and moments. Vortex asymmetries can be caused by moderate-to-high angles of attack, small angles of sideslip, surface irregularities, shock wave interactions, etc. Flow hysteresis may also be caused by convective effects on vortices. Further investigation is recommended to confirm asymmetric flow patterns around the vehicle. Comparison of wind tunnel and flight data to flow visualization studies may reveal evidence of asymmetric vortices. Additional extensive pressure distribution data during flight is desirable to verify asymmetric flow.

Center Research Advisor: Jimmy M. Underwood

APPLICATION OF ADVANCED VERY HIGH RESOLUTION RADIOMETER AND THEMATIC MAPPER DATA TO LAND COVER/ ATMOSPHERIC INTERACTION ANALYSES

Scot E. Smith, Ph.D.
Assistant Professor of Civil Engineering
The Ohio State University
Columbus, Ohio

ABSTRACT

A protocol has been devised for testing the applicability of data from the National Oceanographic and Atmospheric Administration's Advanced Very High Resolution Radiometer and the Thematic Mapper on board Landsat for quantification of land cover and atmospheric interactions. Information derived from the study will be used in gaining an understanding of the relative importance of environmental mechanisms that drive the soil/water and radiation balance with the atmosphere. This will lead eventually to local, regional and global predictive climate capability.

Center Research Advisors: Drs. Victor S. Whitehead
David L. Amsbury

STATISTICAL ANALYSIS OF FLUX DENSITY AT THE EARTH'S SURFACE DUE TO SPACE STATION COMMUNICATION SYSTEMS

Willard A. Stanback
Assistant Professor of Mathematics
Norfolk State University
Norfolk, Virginia

ABSTRACT

An investigation was made into the development of an acceptable algorithm or system of algorithms to be used to predict the percentage of interference related to the radiation of power flux density (PFD) on the Earth's surface due to Space Station communication systems. The amount of allowable interference has to conform to the specific guidelines assigned to a given agency by the Comite' Consultaf International Radio (CCIR).

One basic concern in this investigation of power flux density was, in a general sense, the development of a "start-up" analysis to be used as part of a further detailed study into the effects of allowable flux density given additional constraints.

August 6, 1984

APPLICATIONS OF ORBIT MECHANICS TO SPACE MISSIONS

Victor, Szebehely, Professor
D. D. Cockrell, Chair
Department of Aerospace Engineering
University of Texas, Austin, Texas
Consultant: McDonnel Douglas Corporation
Houston, Texas 77058

ABSTRACT

This report covers several technical problems investigated during the author's stay at the Johnson Center, NASA as a participant in the Summer Faculty Fellowship Program. The main problem areas studied were: (1) Tethered Satellite Systems; (2) Lunar Assisted Geosynchronous orbits; (3) Autonomous Operation of Space Craft.

Center Research Advisors: Victor R. Bond, Ivan L. Johnson and D. Jezewski.

LASER TECHNIQUES FOR ARC JET PLASMA DIAGNOSTICS: A FEASIBILITY AND DESIGN STUDY

F. A. Wierum
Professor
Mechanical Engineering and
Materials Science Department
Rice University
Houston, Texas

ABSTRACT

Several laser-based diagnostic techniques have been investigated as possible methods for intrusive measurement of density, species concentrations, temperatures, and velocity in the JSC low density, high enthalpy arc-heated wind tunnel facility. Laser-induced Raman scattering spectroscopy techniques appear to be feasible means for density, species concentration, and temperature determinations. However, before preliminary design and specification of a particular diagnostic system is undertaken, the emission experiments currently in progress to determine the spectral radience distribution from the arc jet flow need to be completed for ranges of input power level, folw Mach number, static pressure, and temperature for which the tunnel will be used. A laser Doppler velocimeter technique should be feasible for velocity measurements. However, an appropriate "particle" seeding mechanism needs to be developed first. Consideration should be given to use of a "fluorescing" atomic specie as seed particles.

Center Research Advisor: Carl D. Scott

THE IDENTIFICATION OF EXCITED SPECIES IN ARC JET FLOW

Ronald J. Willey
Assistant Professor
Department of Chemical Engineering
Northeastern University
Boston, Massachusetts

ABSTRACT

Spectrographic work done at the Atmospheric Reentry Material and Structures Facility (Arc Jet) located at the Johnson Space Center has led to the identification of several excited molecular and atomic states. The excited molecular states identified were: First Positive Nitrogen System ($B^3\Pi \rightleftharpoons A^3\Sigma$), Second Positive Nitrogen System ($C^3\Pi \rightleftharpoons B^3\Pi$), First Negative Nitrogen System ($B^3\Sigma_u^+ \rightleftharpoons X^2\Sigma_g^+$), and the γ System for Nitric Oxide ($A^2\Sigma^+ \rightleftharpoons X^2\Pi$). Excited atoms identified were: nitrogen, oxygen, copper, sodium, barium, and potassium. The latter four are considered contaminates. Excited molecular states of oxygen were not seen, suggesting full dissociation of oxygen molecules to oxygen atoms within the arc column and nozzle. Further, evidence exists that O^- may be present since a background continuum is seen, and because of the existence of positive species (First Negative Nitrogen System). Interpretation of spectrographic plates was enhanced by the use of a Perkin Elmer PDS Microdensitometer, and by the application of a second order least squares routine which determined wavelength as a function of plate location. Results of this work will ultimately improve models used in the calculation of heat transfer rates to the space shuttle and the aerobraking orbital transfer vehicles.

Center Research Advisor: Dr. Carl Scott

A COMPUTER GRAPHICS PAYLOAD BERTHING AID
FOR THE REMOTE MANIPULATOR SYSTEM OPERATOR

Joan Wyzkoski
Department of Mathematics
Bradley Univeristy
Peoria, Illinois

ABSTRACT

A computer graphics aid has been developed which provides the Remote Manipulator System (RMS) operator with additional visual cues. This assists the operator to secure payloads in the cargo bay. Wire-frame drawings of the top, front and side views of the payload with respect to the cargo bay are displayed. Also displayed are the Point of Resolution (POR) position and attitude data. It is implemented on a GRiD Compass II Computer, which has been flight qualified. Due to the 16-bit architecture, this is a nearly real-time visual aid for the operator of the robot arm.

Utilizing data from an actual berthing procedure, software was developed to simulate a payload berthing. An initial evaluation was conducted in the Johnson Space Center Manipulator Development Facility (MDF). This consisted in establishing communications between the GRiD and the SEL computer which runs the MDF. Payloads were secured with the use of this computer graphics aid. Since response has been favorable, further development with the goal of an eventual flight experiment is appropriate.

Center Research Advisor: Jeri W. Brown

Computerized Determination of Reach Envelopes

W. J. Zimmermann

East Texas State University

Commerce, Texas

1984

ABSTRACT

The Anthropometric Measurements Laboratory of NASA at JSC has aquired a large body of data in previous experiments. The data is noisy and sometimes sparse. The purpose of the work is to develop an algorithm which will remove the noise and fit an envelope.

An interactive package approach was taken. Since the data is starlike, it is necessary to determine the concave segment of the boundry. This is done by applying a modified tomography technique, namely, to determine a set of functions defined by the MAX of the data after each rotation of a specified number of degrees. This set of functions is then used to determine the boundry by rotating them back to their original position and then ordering them for smoothing. The smoothed data is then retained as the boundry of a single cross-section. The set of boundries are then used to define the three dimensional surface which is the REACH ENVELOPE.

Center Research Advisor: Ms. Barbara Woolford

EXHIBIT 2

NASA/ASEE SUMMER FACULTY RESEARCH FELLOWSHIP PROGRAM

Univ. of Houston   Texas A&M   JSC

PROGRAM EVALUATION QUESTIONNAIRE FOR JSC FACULTY FELLOWS

1. Your Name ______________________________

2. Home Dept./Institution ______________________________

3. Name of Research Advisor/Organization ______________________________

4. Brief description of research topic ______________________________

____

____

Please evaluate this year's program by answering the following questions. When appropriate, circle the number indicating:

5 - excellent; 4 - very good; 3 - good; 2 - fair; 1 - poor.

5. Information supplied prior to the start of the program

5	4	3	2	1
excellent	very good	good	fair	poor

6. Contact and correspondence with JSC Program Co-Director prior to the start of the program

   5   4   3   2   1

7. Selection of your research topic

   5   4   3   2   1

8. Definition of your research project by JSC

   5   4   3   2   1

9. Scope of your research project for a 10 week period

   5   4   3   2   1

10. How would you rate your research assignment in terms of its value and challenge and appropriateness to your interest and field of competence

5 4 3 2 1

11. The probability of your embarking on a research effort of a similar nature after returning to your institution(as a result of your research activities at JSC)

5 4 3 2 1

12. The probability of future research activities with JSC or other NASA centers in the form of research contracts

5 4 3 2 1

13. How would you rate the tour of JSC?

5 4 3 2 1

14. How would you rate your housing for the summer?

5 4 3 2 1

15. How would you rate the social activities coordinated by the Summer Faculty Office

5 4 3 2 1

16. Contact with your potential JSC technical advisor prior to the start of the program

5 4 3 2 1

17. The administrative support you received from the JSC Summer Faculty Program Office and co-directors

5 4 3 2 1

18. Your local housing this summer was: (give address)

____
STREET CITY ZIP

It consisted of: (please fill in or circle as appropriate)

a) House/apartment air conditioned? yes/no

b) living rm/dining rm; ____bedrooms; ____baths/other____

c) utilities included in rent? yes/no

19. Housing Finances:

a) rent $______week/month

b) lease required? yes/no terms________

c) deposit required? $______yes/no refunded yes/no

d) approximate monthly utilities cost (above and beyond rent)______________

e) would you recommend this housing to next year's fellows? yes/no

20. The seminar program

5 4 3 2 1

21. Relations with your JSC technical advisor during the program

5 4 3 2 1

22. JSC support for your research activities (office space, facilities, etc.)

5 4 3 2 1

23. Your estimate of potential personal benefits and/or your institution's benefits from your participation

5 4 3 2 1

24. The ratio of time spent on research to time spent on other activities (seminars, tour, etc.)

5 4 3 2 1

25. How would you rate the Johnson Space Center as a place to spend a summer as a Faculty Fellow?

5 4 3 2 1

26. How would you rate Clear Lake/Houston and its environs as a place to spend a summer?

5 4 3 2 1

27. The stipend rate was

5 4 3 2 1

28. Please suggest topics and/or speakers that you feel would be appropriate for the seminar program

29. What would you suggest to improve the seminar series?

30. Please suggest ways to improve the social aspect of the program

31. What do you think would be a reasonable stipend for this program? ______/wk.

32. Was there a financial sacrifice on your part in participating in this program? _______ If so, how much? _________

33. If you are a first-year fellow, would you like to participate in the program during the summer of 1984? _______

34. Do you feel that your participation in this year's program has enhanced your teaching and research potential?

35. Please comment on the overall conduct of this year's program and on any ways that the program might be improved (tours, seminars, facilities, housing, technical advisors, procedures, social activities, communication,etc.)

36. Your overall rating of the JSC Summer Faculty Program

5 4 3 2 1

EXHIBIT 3

NASA/ASEE SUMMER FACULTY RESEARCH FELLOWSHIP PROGRAM

Univ. of Houston Texas A&M JSC

NAME OF JSC TECHNICAL ADVISOR ____________________

DIRECTORATE ____________________

DIVISION ____________________

BRANCH ____________________

NAME OF FACULTY FELLOW/UNIVERSITY ____________________

____

DISCRIPTION OF RESEARCH PROJECT OR WORK ASSIGNMENT (NATURE OF WORK RESULTS TO BA OBTAINED, ETC.)

____

____

____

____

____

PLEASE EVALUATE THE PROGRAM BY ANSWERING THE FOLLOWING QUESTIONS....CIRCLE THE NUMBER INDICATING THE APPROPRIATE ANSWER

5	4	3	2	1
excellent	very good	good	fair	poor

1. Preparation of the fellow for the research project.

   5 4 3 2 1

2. Appropriateness of the fellow's background and principal field of competence for this summer's research program.

   5 4 3 2 1

3. Appropriateness of his/her work for JSC mission and goals.

5 4 3 2 1

4. Stimulation of your JSC group as a result of having a summer faculty fellow.

5 4 3 2 1

5. Overall rating of the fellow.

5 4 3 2 1

6. Effectiveness of program in enhancing fellow's research & teaching potential.

5 4 3 2 1

7. Direct benefit of Summer Faculty Program to NASA from a technical standpoint.

5 4 3 2 1

8. Benefit of the program to NASA in terms of university & public relations.

5 4 3 2 1

9. Effectiveness of the program in stimulating an exchange of ideas between faculty & NASA/JSC.

5 4 3 2 1

10. Overall rating of the program.

5 4 3 2 1

FACULTY FELLOWS ARE PERMITTED TO PARTICIPATE IN THIS PROGRAM FOR TWO SUMMERS, IF THIS FELLOW IS ELIGIBLE AND REAPPLIES FOR A SECOND SUMMER, WOULD YOU LIKE TO HAVE HIM/HER ASSIGNED TO YOU AGAIN? YES ____ NO ____

IF FUNDS WERE AVAILABLE, WOULD THIS FELLOW AND HIS PROJECT BE APPROPRIATE FOR INTERIM FUNDING BETWEEN THE FIRST AND SECOND SUMMERS? YES ____ NO ____

ANY ADDITIONAL COMMENTS AND SUGGESTIONS RELATED TO THIS FELLOW, HIS/HER PERFORMANCE, OR THE SUMMER FACULTY PROGRAM WILL BE GREATLY APPRECIATED.

____

____

____

(continued on next page)

Typed name of advisor ______________________________

Organization code/Advisor signature ______________________________

Please return to:
SN/Bob Crow
University Programs

EXHIBIT 4

1984 NASA/ASEE SUMMER FACULTY EVALUATION RESULTS

Based on a scale of 1 to 5:

5 = excellent   4 = very good   3 = good   2 = fair   1 = poor

Information supplied prior to the program 4.00

Contact & correspondence with JSC co-director prior to start of program 4.17

Selection of research topic 4.50

Definition of research project by JSC 4.39

Scope of research project for a ten week period 4.28

Project in terms of value, challenge, & appropriateness 4.44

Probability of embarking on a similar research effort as a result of JSC activities this summer 3.83

Probability of future research activities with JSC or other NASA centers in the form of research contracts 3.89

Johnson Space Center tour 4.50

How would you rate the housing for the summer? 4.47

Social activities? 4.39

Contact with potential JSC technical advisor prior to the start of the program 4.28

Administrative support received from the JSC Summer Faculty Office 4.83

How would you rate the seminar series? 4.28

Relation with JSC technical advisor? 4.39

JSC support for your research activities 4.33

Estimate of personal benefit &/or institution's benefit from participation 4.39

Ratio of time spent on research to time spent on other activities 4.22

JSC as a place to spend the summer 4.83

Clear Lake area as a place to spend the summer 4.33

The stipend rate 3.61

OVERALL RATING OF THE JSC-NASA/ASEE SUMMER FACULTY PROGRAM 4.67

Suggested improvements for seminars/short courses:

1. Weekly seminars should be more scientific in nature.
2. Course notes should be handed out prior to the short courses.
3. Bring in speakers from other NASA centers.
4. Provide lectures on specific details of space flight & training.

Suggested improvements for research activities:

1. A pre-summer discussion with technical advisor.
2. Circulate the project statements of all of the fellows to each fellow early in the summer.
3. Waiting for equipment could be eliminated so that project proceeds smoothly.

Suggested miscellaneous improvements:

1. JSC library should keep hard copies of all NASA & government reports.
2. Change the name of "advisor" to "associate" in order to better describe the relationship which is mutual in nature.
3. Have a conference of interested fellows in the fall or spring at a central location for an exchange of ideas and formation of future plans.
4. Provide technical tours of specific NASA projects throughout the summer.
5. Make this a three-year program.