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141

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1995 NASA-ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program

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TABLE OF CONTENTS

		Page
Section I	Organization and Management	1
Section II	Recruitment and Selection of Fellows	3
	Returning Fellows	3
	First Year Fellows	3
Section III	Stipend and Travel	8
Section IV	1995 ASEE SFFP Activities	8
	Lecture Series	8
	Interaction Opportunity/Picnic	8
	Proposal Seminar	8
	Seminar/Banquet	9
	ASEE Activities Committee	9
Section V	Research Participation	10
	Fellows by Division	10
	Fellows by Degree Area	11
	Extensions	11
	Attendance at Short Courses, Seminars, and Conferences	12
	Papers Presented	13
	Anticipated Papers	13
	Anticipated Research Proposals	15
	Funded Research Proposals	18
Section VI	Summary of Program Evaluation	19
	Fellows' Survey	20
	Fellows' Comments	26
	Fellows' Recommendations	26
	Summary of Associates' Evaluation	28
	Research Associates' Comments	28
	Research Associates' Recommendations	28
Section VII	Co-Director's Recommendations	29
Appendix I	1995 Participants	30
Appendix II	Technical Lecture Series - Presentations by Research Fellows - Calendar of Activities	35
	Technical Lecture Series	36
	Technical Lecture Series Program Sample	37
	Presentations by Research Fellows	39
	Calendar of Activities	42

		Page
Appendix III	Group Picture of Research Fellows	43
	Group Picture	44
	List of Attendees	45
Appendix IV	Distribution of Fellows by Group	46
Appendix V	Distribution of Fellows Ethnicity/Female	48
Appendix VI	Distribution of Fellows by Ethnicity/Male	50
Appendix VII	Distribution of Fellows by University Rank	52
Appendix VIII	Distribution of Fellows by University	54
Appendix IX	Abstracts - Research Fellows	56
Appendix X	Program Orientation Evaluation Report	112
Appendix XI	Proposal Seminar Evaluation Report	114
Appendix XII	Policies, Practices, and Procedures Manual	117

LIST OF TABLES

Table No.		Page
1	Distribution by Year in Program	4
2	Distribution by University	5
3	Distribution by Selection	6
4	Distribution by Funding	7

LIST OF ABSTRACTS - RESEARCH FELLOWS
(Appendix IX)

Page

EFFECTS OF YARN CRIMPING ON BRAIDED COMPOSITE DESIGN ALLOWABLES by Daniel O. Adams, Iowa State University 57

DETERMINATION OF ATTITUDE JITTER IN SMALL SATELLITES by Marcelo C. Algrain, University of Nebraska-Lincoln 58

LINEAR OPERATING REGION IN THE OZONE DIAL PHOTON COUNTING SYSTEM by Madeleine Y. Andrawis, South Dakota State University . 59

AN OBJECT-ORIENTED, TECHNOLOGY-ADAPTIVE INFORMATION MODEL by Joshua C. Anyiwo, Christopher Newport University 60

EXCURSIONS IN TECHNOLOGY POLICY by Robert B. Archibald, College of William and Mary 61

EVALUATION OF TEACHER ENHANCEMENT INSTITUTE 1995 by Donald W. Ball, University of Virginia 62

RISKS AND RELIABILITY OF MANUFACTURING PROCESSES AS RELATED TO COMPOSITE MATERIALS FOR SPACECRAFT STRUCTURES by Han P. Bao, Old Dominion University 63

1995 SUMMER TEACHER ENHANCEMENT INSTITUTE: CURRICULUM DESIGN, IMPLEMENTATION, AND EVALUATION by Bobbye H. Bartels, Christopher Newport University 64

EVALUATION AND MODIFICATION OF HSCT LANDING GEAR by Sebastian Y. Bawab, Old Dominion University 65

USE OF THE QUARTZ CRYSTAL MICROBALANCE TO DETERMINE THE MONOMERIC FRICTION COEFFICIENT OF POLYIMIDES by Mary M. Bechtold, Hampton University 66

ANALYSIS OF UNCERTAINTY IN FORCE BALANCE CALIBRATION by Faruk H. Bursal, Virginia Polytechnic Institute and State University . 67

ELECTROMAGNETIC COMPATIBILITY AND THE ALL-ELECTRIC AIRPLANE by Alan M. Christman, Grove City College 68

MODELING AND SIMULATION OF A TURBULENT FAR WAKE by John M. Cimbala, Pennsylvania State University 69

Page

UNIVERSAL HUMAN SYSTEMS: ORGANIZATIONAL DEVELOPMENT TECHNOLOGY by Linda W. Deans, George Washington University . . 70

VISCOUS AERODYNAMIC DESIGN USING THE ADJOINT VARIABLE APPROACH by George DeRise, Thomas Nelson Community College . . 71

MICRO-MECHANICS OF MICRO-COMPOSITES by Richard P. Donovan, University of Evansville 72

EXCURSIONS IN TECHNOLOGY POLICY by David H. Finifter, College of William and Mary 73

COMPUTATIONAL STUDY OF INLET INJECTION FOR A PRE-MIXED, SHOCK-INDUCED COMBUSTION (PM/SIC) ENGINE by Dora E. Gonzalez 74

DISSIPATIVE RENDERING AND NEURAL NETWORK CONTROL SYSTEM DESIGN by Oscar R. Gonzalez, Old Dominion University . . 75

THE RESTRUCTURING: HOW NASA AS A GOVERNMENT AGENCY IS OPERATED, BOTH FROM A FINANCIAL AND MANAGEMENT PERSPECTIVE by David J. Gosselin, Christopher Newport University . . . 76

AN EVALUATION OF HPCC-IITA K-12 TECHNOLOGY PROJECTS AT 7 FIELD CENTERS by Barbara L. Grabowski, Pennsylvania State University 77

THREE TWO-WEEK ENHANCEMENT INSTITUTES: DESIGN AND IMPLEMENTATION OF THE TECHNOLOGY AND TELECOMPUTING COMPONENT by L. Vincent Hale, Christopher Newport University . . 78

"WHERE AM I?" - DETERMINING THE ATTITUDE OF SPACECRAFT PARTS by Mark L. Hanson, George Washington University 79

A POLYIMIDE MOLECULAR COMPOSITE by Aprill J. Hart, Norfolk State University 80

ANALYTICAL STUDIES OF HYPERSONIC VISCOUS DISSOCIATED FLOWS by George R. Inger, Iowa State University 81

WORKING TOWARD A THREE-DIMENSIONAL FATIGUE CLOSURE MODEL FOR SURFACE CRACKS by Paul F. Joseph, Clemson University 82

Page

ON THE DEVELOPMENT OF HSCT TAIL SIZING CRITERIA USING LINEAR MATRIX INEQUALITIES by Isaac I. Kaminer, Naval Postgraduate School 83

ENERGY MEASUREMENT OF ELECTRON BEAMS BY COMPTON SCATTERING by Cynthia E. Keppel, Virginia Union University 84

ACTUATOR PLACEMENT FOR ACTIVE SOUND AND VIBRATION CONTROL OF CYLINDERS by Rex K. Kincaid, College of William and Mary 85

STUDY OF THE ROTATIONAL-LEVEL AND TEMPERATURE DEPENDENCE OF THE QUENCHING RATE OF THE OH FLUORESCENCE DUE TO COLLISIONS WITH WATER MOLECULES by Edmond B. Koker, Elizabeth City State University 86

EXPERIMENTAL TESTING USING A REMOTELY OPERATED FLAP WITH A 2D HIGH LIFT MODEL by Drew Landman, Old Dominion University 88

STRUCTURING MENTORING: A METHOD FOR TRAINING ELECTRONIC PACKAGERS by Ellis E. Lawrence, Elizabeth City State University 89

SENSITIVITY ANALYSIS IN MULTIPOLE-ACCELERATED PANEL METHODS FOR POTENTIAL FLOW by James F. Leathrum, Jr., Old Dominion University 90

RESOLUTION OF THE BUOYANCY IN THE 8-FOOT HIGH TEMPERATURE TUNNEL COMBUSTOR by Norman W. Loney, New Jersey Institute of Technology 91

SYNTHESIS OF LOW COLOR, ATOMIC OXYGEN RESISTANT POLYIMIDES by David MacInnes, Guilford College 92

TROIKA PARTNERSHIP MODEL FOR LICENSING NASA-LaRC TECHNOLOGIES by Arlene P. Maclin, Hampton University 93

A TEST OF A VORTEX METHOD FOR THE COMPUTATION OF FLAP SIDE EDGE NOISE by James E. Martin, Old Dominion University . . 94

FUEL/AIR CYCLE ANALYSIS FOR FUEL-INDUCTED INTERNAL COMBUSTION ENGINE CONFIGURATIONS by Gerald J. Micklow, University of Florida 95

Page

THREE TWO-WEEK TEACHER ENHANCEMENT INSTITUTES: DESIGN AND IMPLEMENTATION by Nilda Ocasio de Rodriguez, University of Puerto Rico-Mayaguez 96

FLEXURE FATIGUE TESTING OF 90° GRAPHITE/EPOXY COMPOSITES by Ann "Nancy" W. Peck, University of Wyoming 97

LARGE EDDY SIMULATIONS OF COMPRESSIBLE TURBULENT FLOWS by Freda Porter-Locklear, University of North Carolina-Chapel Hill 98

PRELIMINARY PROPOSAL FOR THE ESTABLISHMENT OF A REGIONAL CENTER OF EXCELLENCE FOR ADVANCED TECHNOLOGY EDUCATION OF GREATER HAMPTON ROADS VIRGINIA AND NORTHEASTERN NORTH CAROLINA by Sandra B. Proctor, Norfolk State University 99

POSITRON ANNIHILATION SPECTROSCOPIC STUDY OF HIGH PERFORMANCE SEMI-INTERPENETRATING NETWORK POLYIMIDS by Asit K. Ray, Christian Brothers University 100

AUTOMATIC RELEVELING OF CALIBRATION STANDS FOR WIND TUNNEL FORCE AND MOMENT MEASUREMENT INSTRUMENTATION by Manuel F. Rodriguez-Perazza, University of Puerto Rico-Mayaguez 101

ELEMENTARY MATHEMATICS OF POWERED FLIGHT by George Rublein, College of William and Mary 102

ENVIRONMENTAL AWARENESS PROGRAM DEVELOPMENT by David A. Steinhauer, Tidewater Community College-Portsmouth 103

DISPLACEMENT BASED MULTILEVEL STRUCTURAL OPTIMIZATION by Alfred G. Striz, University of Oklahoma 104

MODELING USING OPTIMIZATION ROUTINES by Theodore Thomas, Patrick Henry Community College 105

A STRATEGY FOR PROVIDING ELECTRONIC LIBRARY SERVICES by J. Garth Thompson, Kansas State University 106

THE SHAPE OF SPECTRAL LINES: THE IMPORTANCE OF THE FAR WINGS by Richard H. Tipping, University of Alabama 107

PRESSURE CORRELATIONS AT A FLUID/STRUCTURE INTERFACE by George Trevino, Michigan Technological University 108

Page

THE ROLE OF TQM AND CHANGE MANAGEMENT WITHIN A BPR FRAMEWORK AT NASA by Abhay V. Trivedi, North Carolina A&T State University 109

RETRIEVAL OF WATER VAPOR MIXING RATIOS FROM A LASER-BASED SENSOR by George F. Tucker, Sage Junior College of Albany 110

A FRESH VIEW OF THE FLY-BY-LIGHT/POWER-BY-WIRE PROGRAM by John P. Wander, University of Alabama 111

SECTION 1

ORGANIZATION AND MANAGEMENT

The 1995 Old Dominion University (ODU)-NASA Langley Research Center (LaRC) Summer Faculty Fellowship Research Program, the thirty-second such institute to be held at LaRC, was planned by a committee consisting of the University Co-Director, LaRC Staff Assistants (SAs) from the research Groups, and the Office of Education.

An initial assessment of each applicant's credentials was made by the University Co-Director and the NASA LaRC University Affairs Officer. The purpose of this assessment was to ascertain to which Division the applicant's credentials should be circulated for review. Once this determination was made, an application distribution meeting was scheduled with the SAs where applications were distributed and instructions concerning the selection process were discussed. At a later date, the SAs notified the ASEE office of the selections made within their Group.

The University Co-Director then contacted each selected Fellow by phone extending the individual a verbal appointment, which was followed up with a formal letter of confirmation. Individuals were given ten days to respond in writing to the appointment. Once the letters of acceptance were received, a roster was sent to each SA advising them of their Fellows for the summer program.

Each Fellow accepting the appointment was provided with material relevant to housing, travel, payroll distribution, and the orientation. Each Fellow, in advance of commencing the program, was contacted by his or her Research Associate or representative of the branch.

Each Fellow and Research Associate received a 1995 ASEE Policies, Practices, and Procedures Manual which clarified many commonly asked questions up front regarding the roles, responsibilities, policies, and procedures of both parties. This manual was very beneficial and will be updated annually to be used in the years to come (Appendix XII).

At the Orientation meeting, Mr. Edwin J. Prior, Deputy Director for the Office of Education, officially started the first day of the summer program by welcoming everyone to LaRC, introducing the Administrative Staff, and presenting an LaRC overview. He was followed by Mr. Roger A. Hathaway, University Affairs Officer, who presented the program overview. A program breakout session was next on the agenda, enabling the ASEE administrative staff (Dr. Surendra N. Tiwari-ASEE Co-Director, and Ms. Debbie Young-ASEE Administrative Assistant) to meet with the 1995 Fellows to discuss administrative procedures and answer questions. Next, the Fellows were

invited to take a guided bus tour of NASA Langley Research Center. Following the tour, the Fellows returned to the H.J.E. Reid Conference Center where they were greeted by their LaRC Associates who then escorted them to their respective work sites. An evaluation of the orientation meeting was completed; refer to Section VI for results.

Throughout the program, the University Co-Director served as the principal liaison person and had frequent contacts with the Fellows. The University Co-Director also served as the principal administrative officer. At the conclusion of the program, each Fellow submitted an abstract describing his/her accomplishments (Appendix IX). Each Fellow gave a talk on his/her research within the Division. The Group SAs then forwarded to the Co-Director the names of the Fellows recommended within their Group for the Final Presentations. Eight excellent papers were presented to the Fellows, Research Associates, and invited guests. This year for the first time, the presentations were judged by a panel of LaRC researchers for "The Best Research Presentation" competition (Appendix II). The Final Presentations were concluded with a luncheon at the Langley Air Force Base Officer's Club.

Each Fellow and Research Associate was asked to complete a questionnaire provided for the purpose of evaluating the summer program.

SECTION II

RECRUITMENT AND SELECTION OF FELLOWS

Returning Fellows

An invitation to apply and possibly participate in the Old Dominion University (ODU)-NASA Langley Research Center (LaRC) Program was extended to the individuals who held 1994 fellowship appointments and were eligible to participate for a second year. Twenty-seven individuals responded to the invitation and fourteen were selected with thirteen acceptances (Table 1). Fourteen applications were received from Fellows from previous years. Seven were selected with five acceptances.

First Year Fellows

Although ASEE distributed a combined brochure of the summer programs, many personal letters were mailed to deans and department heads of various engineering schools in the East, South, and Midwest, by Prof. John H. Spencer of Hampton University (HU) and Dr. Surendra N. Tiwari of Old Dominion University (ODU) requesting their assistance in bringing to the attention of their faculties the ODU/HU-NASA LaRC program. In addition to the above, a number of departments of chemistry, physics, computer science, and mathematics at colleges (including community colleges) and universities in the state of Virginia, as well as, neighboring states were contacted regarding this program. Although minority schools in Virginia and neighboring states were included in the mailing, the Co-Director from HU sent over three hundred letters to deans and department heads, and to all of the minority institutions across the United States soliciting participants (Table 2). Additional recruiting efforts included either attendance at or providing information for several of the minority conferences. These efforts resulted in a total of one-hundred and eleven formal applications indicating the ODU/HU-NASA LaRC program as their first choice, and a total of forty-two applications indicating the aforementioned as their second choice. The total number of applications received came to one-hundred fifty-three (Table 3).

Fifty-four applicants formally accepted the invitation to participate in the program. Eight applicants declined the invitation. A few Fellows delayed their response while waiting for other possible offers from other programs. The top researchers tend to apply to more than one program, and will make their selection based on research interest and stipend. Twenty-six positions were initially budgeted by NASA Headquarters. Twenty-eight positions were funded by the LaRC Divisions (Table 4).

The average age of the participants was 43.

TABLE 1 - DISTRIBUTION OF 1995 ASEE (SFFP) BY YEAR IN PROGRAM

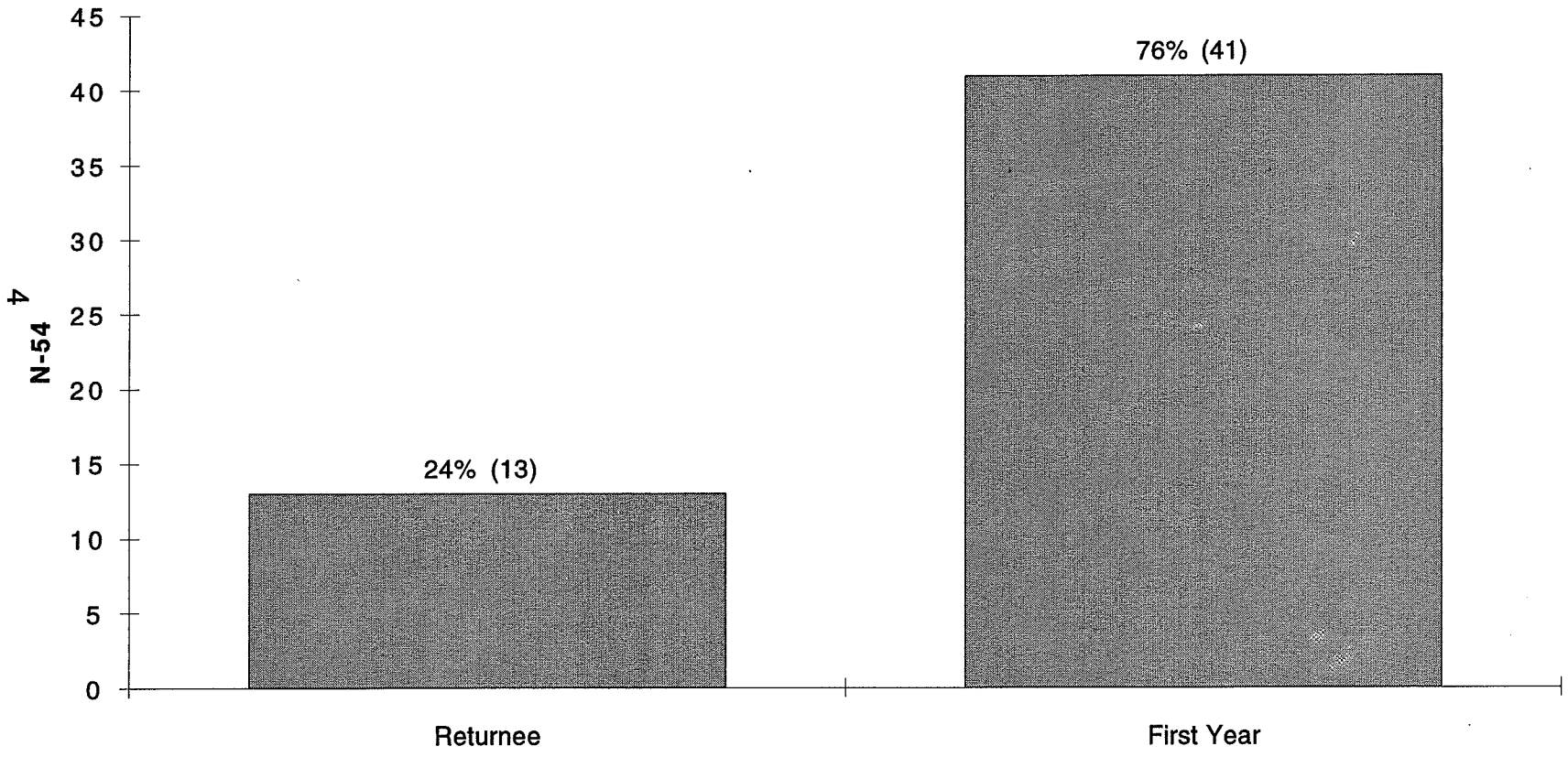


TABLE 2 - DISTRIBUTION OF 1995 ASEE (SFFP) BY UNIVERSITY

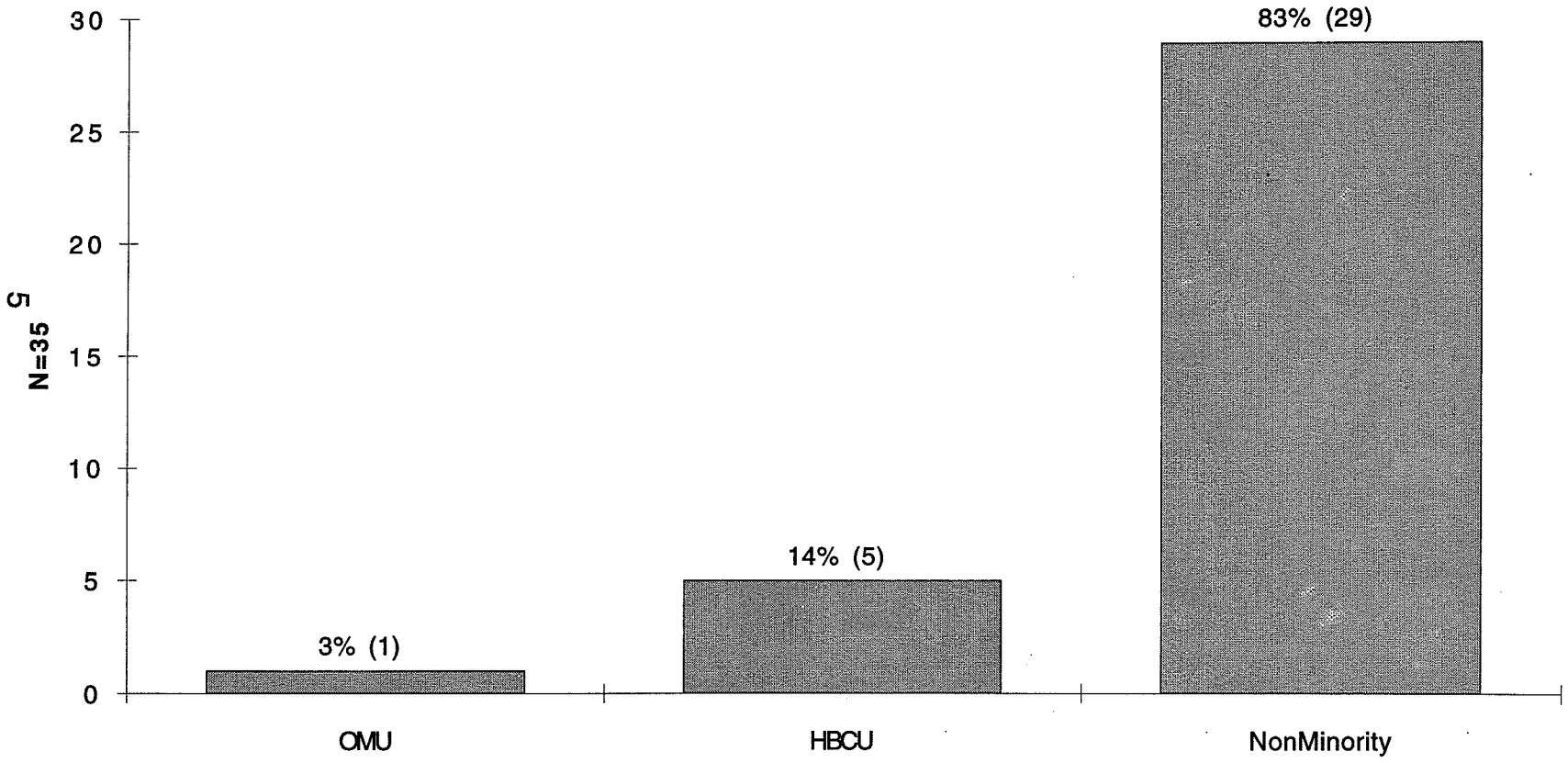


TABLE 3 - DISTRIBUTION OF 1995 ASEE (SFFP) BY SELECTION

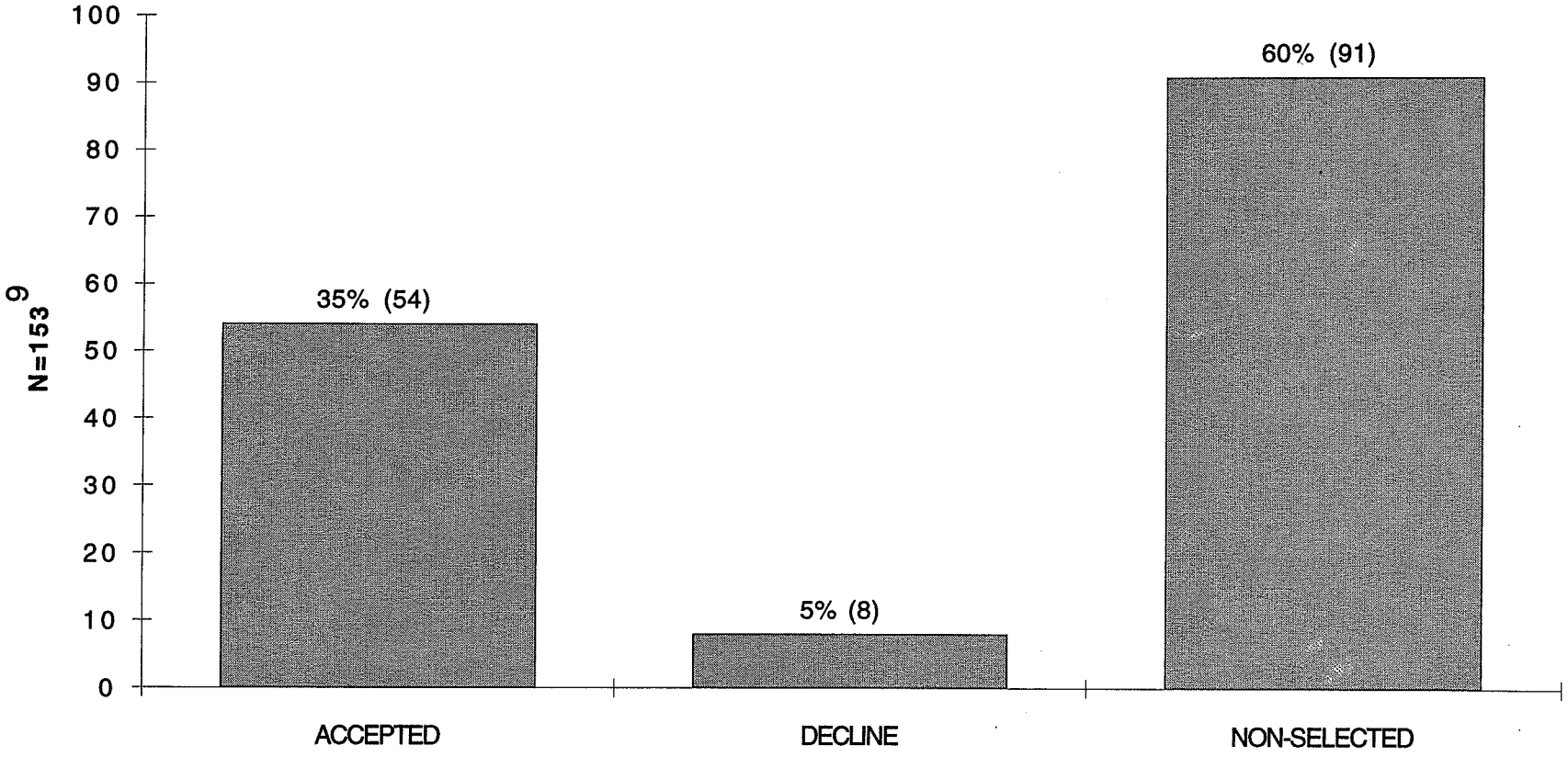
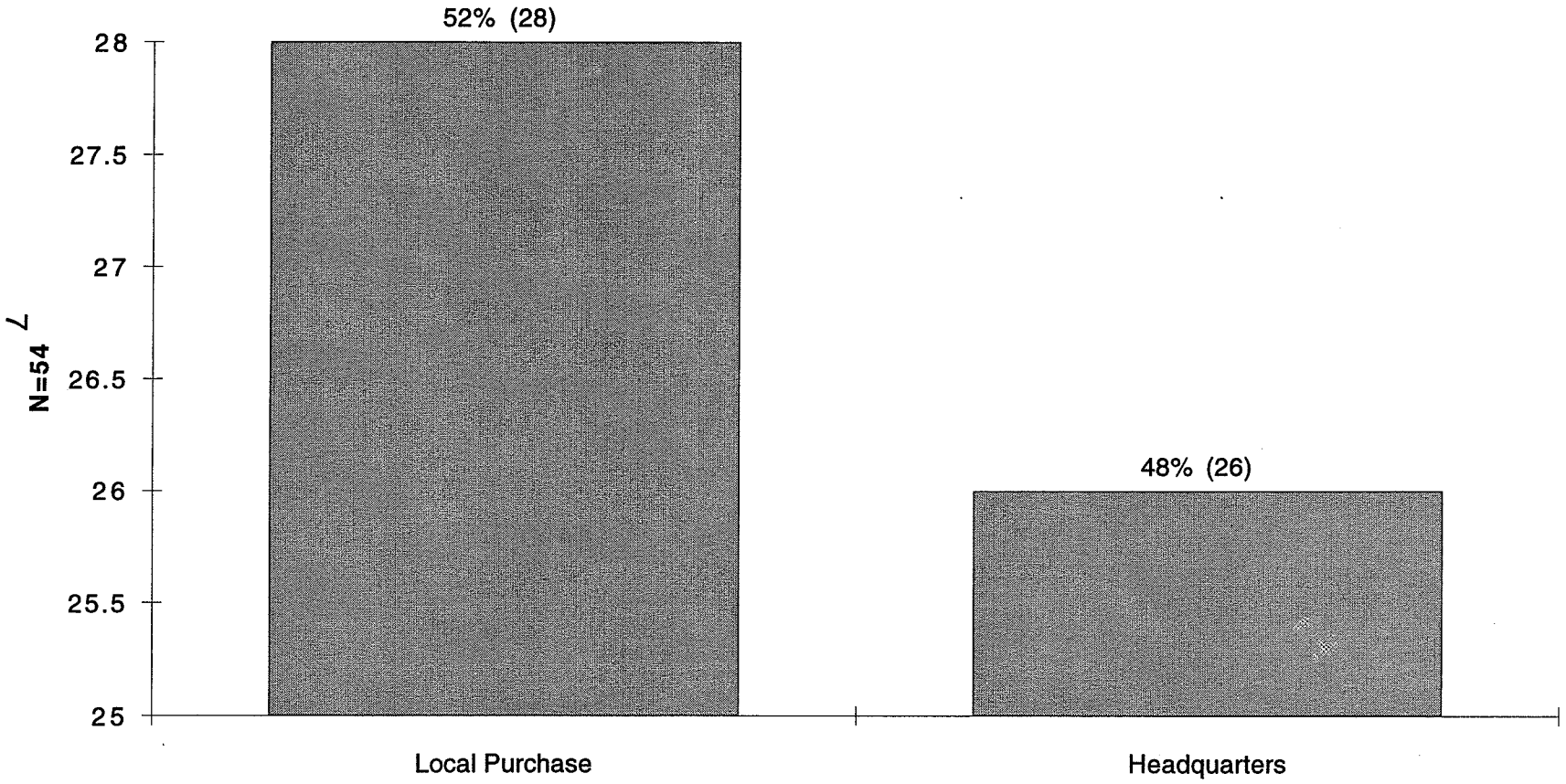


TABLE 4 - DISTRIBUTION OF 1995 ASEE (SFFP) BY FUNDING



SECTION III

STIPEND AND TRAVEL

A ten week stipend of $10,000.00 was awarded to each Fellow. Although 39% of the Fellows (down from 52% for 1994) indicated that the stipend was not the primary motivator in their participating in the ASEE program, 50% (up from 38% for 1994) indicated this amount as being adequate (Survey-Section VI). This stipend still falls short of matching what most professors could have earned based on their university academic salaries. The decision to participate in the summer faculty research program clearly reflects the willingness of the Fellow to make some financial sacrifice in order to have the experience of working with NASA's finest scientists and researchers.

Mileage or air fare expenses incurred by the Fellows from their institution to Hampton, Virginia, as well as their return trip, were reimbursed in accordance with current ODU regulations. A relocation allowance of $1,000 was provided for the Fellows traveling a distance of 50 miles or more.

SECTION IV

1995 ASEE SFFP ACTIVITIES

Lecture Series

The Lecture Series this summer was extremely successful and well received. Again, there was a total of six lectures with four given by invited Langley scientists and researchers and two given by outside guest speakers. Topics included The Hubble Telescope and The Future of Engineering Education (Appendix II).

Interaction Opportunity/Picnic

An annual Office of Education Interaction Opportunity/Picnic was held on Wednesday, June 14, 1995, for the summer program participants, their families, and invited guests. This allowed for informal interaction between the Fellows, as well as, with the administrative staff. The participants were also given the opportunity to purchase T-shirts with an ASEE design by one of the summer students.

Proposal Seminar

A Proposal Seminar was held for the Fellows on Wednesday, July 19, 1995. Dr. Samuel E. Massenberg, Director, Office of Education, presented an overview of the proper procedures to adhere to in submitting an unsolicited proposal to NASA. The program covered both the NASA and university

perspectives. This year, there was also a panel question and answer session. The panel members included Langley researchers who frequently review proposals that are submitted. This aspect of the proposal seminar was very well received. The most current Research Grant Handbook was distributed. (Appendix XI).

Seminar/Banquet

On Thursday, July 27, 1995, a seminar/banquet was held for the Fellows and their spouses. The banquet took place at the beautiful Langley Air Force Base Officer's Club. ASEE end of the program information, certificates, and group pictures were presented to each Fellow at the banquet.

ASEE Activities Committee

As in the past, an ASEE Activities Committee was formed to plan social outings for the program participants and their families (Appendix II). The head of this committee developed a newsletter to share planned events, as well as local events, festivals, entertainment, and so forth. This was very well received by the Fellows, particularly those from outside the Tidewater area. The Office of Education also sponsored a Moonlight Cruise aboard the beautiful Spirit of Norfolk for the Fellows and their spouses.

Spouses Luncheon

Due to an interest expressed in having more activities for the Fellows' families, the ASEE Administrative Assistant sponsored a dutch spouses luncheon at a local restaurant. This provided an opportunity for introductions among the spouses in the hope of having others to socialize with during the ten week tenure of the Fellows.

SECTION V

RESEARCH PARTICIPATION

The ODU-LaRC Summer Research Program, as in past years, placed the greatest emphasis on research aspects of the program. Included in this report are abstracts from the Fellows showing their accomplishments during the summer. These abstracts, together with the comments of the LaRC Research Associates with whom the Fellows worked very closely, provide convincing evidence of the continued success of this part of the program. The Fellows' comments during the evaluation of the program indicated their satisfaction with their research projects, as well as, with the facilities available to them.

The research projects undertaken by the Fellows were greatly diversified as is reflected in their summer research assignments. Their assignments were as follows:

Number of Fellows Assigned	Division
1	Aerodynamics Division
2	Aerospace Electronic Systems Division
1	Aerospace Mechanical Systems Division
2	Atmospheric Sciences Division
3	Experimental Testing Technology Division
1	Fabrication Division
5	Flight Dynamics and Control Division
9	Flight Mechanics and Acoustics Division
3	Gas Dynamics Division
1	Office of Human Resources
2	Information & Electromagnetic Technology Division
6	Materials Division
6	Office of Education
1	Office of Chief Financial Officer
1	Office of Safety, Environment & Mission Assurance
4	Small Business Partnership Team
2	Space Systems and Concepts Division
3	Structures Division
1	Subsonic Transportation Office

Forty-nine (91%) of the participants were holders of the doctorate degree. Four (7%) held masters degrees and one (2%) had a bachelors degree. The group was again highly diversified with respect to background. Following are the areas in which the last degree was earned (twenty-eight different disciplines):

Number	Area of Degree
1	Accounting and Information Systems
1	Aeronautics
2	Aerospace Engineering
1	Applied Mathematics
2	Applied Mechanics
1	Biochemistry
1	Business Administration
2	Chemical Engineering
3	Chemistry (including 1 physical)
1	Computational and Applied Mathematics
1	Computational Fluid Mechanics
2	Economics
2	Education
1	Educational Research
1	Electrical and Computer Engineering
4	Electrical Engineering
1	Electrical Engineering Systems
1	Engineering Mechanics
2	Industrial Engineering
3	Mathematics
9	Mechanical Engineering
1	Mechanical and Aerospace Engineering
1	Nuclear and Metallurgical Engineering
1	Operations Research
1	Organizational Development
5	Physics
1	Social and Philosophical Foundations of Education
2	Vocational Technology Education

Extensions

Per special written request by the LaRC Associate and the approval of the ASEE Co-Director, following individuals were granted a one week extension:

Mr. L. Vincent Hale
Dr. George Rublein
Dr. Asit K. Ray

Attendance at Short Courses, Seminars, and Conferences

During the course of the summer, Fellows have the opportunity to attend regularly scheduled Langley Research Center seminars and meetings, to include

but not limited to ASEE Technical Lectures, Institute for Computer Applications in Science and Engineering (ICASE) seminars, World Wide Web and Internet training courses, computer training, as well as short courses or meetings within their Division. In addition, there were a number of short courses, seminars, and conferences, in which the subject matter had relevance to the Fellows' research projects. A number of Fellows requested approval to attend one or more of these conferences as it was their considered opinion that the knowledge gained by their attendance would be of value to their research projects. Those Fellows who did attend had the approval of both the Research Associate and the University Co-Director.

Short Courses, Seminars, and Conferences Attended

Daniel O. Adams: Society for Experimental Mechanics Conference, Grand Rapids, MI.

Han P. Bao: Two Short Courses on (1) Reliability, Maintainability and Supportability by T. Weber, Rockwell Space Systems, and (2) USAF Reliability, Maintainability and Supportability by R. Dilorenzo and R. Burgan, United States Air Force, at NASA Langley Research Center.

Linda W. Deans: "Organizational Climate for Federal Employees", Jet Propulsion Laboratory, Pasadena, CA. Cultural Diversity Curriculum Development conference at NASA Langley Research Center. Two seminars: (1) Cassini Space Project and (2) Galileo Space Project.

Oscar R. Gonzalez: Workshop on Computational Intelligence and its Impact on the Design, Fabrication, and Operation of Future High Performance Engineering Systems.

George R. Inger: AIAA Applied Aerodynamics Conference, San Diego, CA.

Paul F. Joseph: Joint Applied Mechanics and Materials Division ASME Summer Meeting, University of California at Las Angeles.

Drew Landman: AIAA Applied Aerodynamics Conference, San Diego, CA. AIAA High Lift Short Course, San Diego, CA.

Ellis E. Lawrence: Technology for All Americans Conference.

Norman W. Loney: American Society for Engineering Education (ASEE) Annual Conference, Anaheim, CA. Participated as session moderator.

David MacInnes: Attended two College of William and Mary Chemistry Department Polymer Seminars, Williamsburg, VA.

Arlene P. Maclin: Attended meeting with National Science Foundation and EPA regarding new technologies and universities who might be interested in licensing technologies. Attended a National Science Foundation site visit at City University of New York for an engineering research center.

Sandra B. Proctor: Technology for All Americans Conference. Mission to Planet Earth Conference.

George Rublein: Virginia Math and Science Coalition Mathematics Colloquium, Virginia Commonwealth University, Richmond, VA.

Alfred G. Striz: First World Congress of Structural and Multi-Disciplinary Optimization Conference, Goslar, Germany.

Richard H. Tipping: Fiftieth Symposium on Molecular Spectroscopy, Ohio State University.

John P. Wander: ACC Conference, Seattle, WA.

Papers Presented

John M. Cimbala: "Direct Numerical Simulations and Modeling of a Spatially Evolving Turbulent Wake", Turbulent Shear Flow Conference, August, 1995. "Direct Numerical Simulation of a Turbulent Far Wake", American Physical Society, DFD Meeting, November, 1995.

Linda W. Deans: "Systemic Implications of rightsizing on Organizational Development", for the NASA Langley Employee Development Branch.

David MacInnes: Paper presented at the College of William and Mary's Chemistry Department.

Nilda Ocasio de Rodriguez: Presentation-8th National Conference on Education and Thinking, Puerto Rico, November, 1995, Funded by the University of Puerto Rico, Central Administration and other Universities.

John Wander: Presentation to NASA Langley division resulted in an official contractor's report.

Anticipated Papers

Daniel O. Adams: Plans to submit research results to a composite materials journal and to an undetermined journal at a later date.

Marcelo Algrain: Plans to present research results at the SPIE in Orlando, FL, 1996.

Madeleine Andrawis: "Photon Counting System Characterization for Ozone Measurements" to be presented at a later date.

Joshua C. Anyiwo: "An Intelligent Date-Server Engine", to be submitted to The MIS Quarterly.

Robert Archibald: "A Conceptual Model for Evaluating the Impact of Changes Federal Support for Science and Technology" to be submitted to an academic journal.

Han P. Bao: "Risks and Reliability of Manufacturing Processes as Related to Composite Materials for Spacecraft Structures", to be submitted to a conference of ASME.

Faruk Bursal: "Analysis of Uncertainty in Force Balance Calibration", to be published as a NASA paper; may also be submitted to the AIAA.

George DeRise: "Viscous Aerodynamic Design Using Adjoint Variable Approach", to be presented to ICASE or NASA.

Richard Donovan: Three papers to be presented at a later date to various sources are "Micromechanics Analysis of Microcomposites", "Material Characterization of Microcomposites", and "Mixture Theory Analysis of Piezoelectric Microcomposites".

David H. Finifter: "A Conceptual Model for Evaluating the Impact of Changes in Federal Support for Science and Technology", will be submitted to an academic journal.

David Gosselin: Plans to submit papers to The Government Accountants Journal and to the Journal of Cost Management.

Barbara L. Grabowski: Plans to submit "Generative Learning and internet Activities: An Area Where Theory Meets Practice" to an Educational Technology journal and "Bringing Relevance into the Classroom: NASA's Contribution to Education" possibly to the Computing Teacher.

George Inger: There are several planned papers coauthored with Dr. Peter Gnoffo to be submitted to future AIAA meetings.

Paul F. Joseph: "A Strip-Synthesis Line Spring Model for Part-through Cracks" will be submitted to a refereed journal, and other papers based on this model will follow.

Drew Landman: AIAA paper for the Applied Aero Conference, Summer 1996.

Ellis E. Lawrence: "CAD/CAM In Electronic Packaging", NAIT Conference.

James F. Leathrum, Jr.: "Sensitivity Analysis in Multipole Accelerated Panel Methods for Potential Flow", to be submitted to SIAM Trans. Scientific Computing.

Norman W. Loney: "Resolution of the Buoyancy in the 8"-HTT Combustor", to be submitted to: (1) International Journal of Heat and Mass Transfer or (2) AICHE Journal.

James E. Martin: "On Computing Sound Radiation of a Temporally Evolving Mixing Layer by Vortex Methods and Matched Asymptotic Expansions", to be presented at the January, 1996 AIAA meeting.

Gerald J. Micklow: "A Semi-Empirical Method for Predicting Internal Combustion Engine Performance", Society of Automotive Engineers (SAE).

Asit K. Ray: "Positron Annihilation Spectroscopic Study of High Performance Semi-Interpenetrating Network Polyimids", Society for Advancement of Materials & Processing (Sample).

Alfred G. Striz: "Displacement Based Multilevel Structural Optimization", Submission to 37th SDM Conference, Salt Lake City, Utah, April, 1996.

J. Garth Thompson: "A Strategy for Providing Electronic Library Services to Members of the AGATE Consortium", to be submitted to AGATE Consortium, and "Optimization of Nonlinear Function Interpolation for Simulation", AIAA.

Richard H. Tipping: "Sum Rules and The Symmetry of the Memory Function", to be published in The Journal of Chemical Physics.

Abhay V. Trivedi: "The Role of TQM and Change Management Within a BPR Framework at NASA", ASQC Journal, Fall 1996.

Anticipated Research Proposals

Daniel O. Adams: Plans to submit a proposal to the National Science Foundation, Fall 1995.

Joshua C. Anyiwo: "An object-Oriented, Technology-Adaptive, Information Model", to NASA JOVE Research Project.

Robert Archibald: Plans to submit a proposal to the NASA Langley Technical Applications Group to continue research begun this summer.

Han P. Bao: "Risks and Reliability of Manufacturing Processes as Related to Composite Materials for Spacecraft Structures", to be submitted to the National Science Foundation.

Faruk H. Bursal: "Improved Force Balance Calibration Through the Use of Higher-order Models", to be submitted to NASA Langley Research Center.

John M. Cimbala: Plans to submit a proposal to ONR or AFOSR for computer time to continue work on "Direct Numerical Simulations".

Richard Donovan: Plans to submit two research proposals to Langley Research Center's Structural Dynamics Branch: (1) Analytical Material Characterization of Micro Composites Including Piezoelectric Response", and (2) "Mixture Theory Analysis of Piezoelectric Microcomposite Structures". Plans to submit "Adaptation of Generalized Method of Cells to Include Piezoelectric Response" to the Structures Division at Lewis Research Center.

David H. Finifter: Plans to submit proposal to the NASA Langley Research Center's Technical Applications Group to continue research begun this summer.

Oscar R. Gonzalez: Plans to submit a proposal to NASA Langley Research Center's Dynamics and Control Branch, to the National Science Foundation, and to the Air Force.

Barbara L. Grabowski: "Engaging Learners Through Internet Activities: An Examination of its Effect on Learning", to Ames Research Center. "A Case Study Report of 11TAK-12 Projects in Schools (An In-Depth Study of its Effect on Teaching and Learning)" and "The Development of a Preservice Multimedia Teaching Module on NASA 11TAK-12 Project", to the IITA Program Office.

George R. Inger: "Analytical LCFD Studies of Entry Vehicle Heating", to the Langley Aerothermodynamics Branch.

Paul F. Joseph: "A Three-Dimensional Fatigue Crack Closure Model for Surface Cracks", NASA EPSCoR for South Carolina. It was accepted by the State on Aug. 9, 1995 and sent to NASA in September for final review.

Cynthia Keppel: "CEBAF Compton Backscatter Facility", DOE. "FIR Laser Transport in High Radiation Conditions", NASA.

Rex K. Kincaid: "Placement of Actuators for Noise Cancellation in a Cylinder", MDO Branch, NASA Langley.

Edmond B. Koker: "Rotational-Level and Temperature Dependence of the Quenching Rate of OH Fluorescence Due to Collisions with Water Molecules", NASA.

Drew Landman: "Remotely Actuated Flap Project", to Subsonic Aero Branch and Multidisciplinary Optimization Design Branch, NASA LaRC.

Ellis E. Lawrence: Proposing a grant for an Advance Technology Education Center", NASA.

James F. Leathrum: "The Clustered Multipole Algorithm for Potential Flow", ONR.

Norman W. Loney: "Resolution of the Buoyancy in the 8"-HTT Combustor", to Langley Research Center.

David MacInnes: "Conductive Polymers for Space", NASA.

Gerald J. Micklow: "Internal Combustion Engine Modelling", to NASA Langley Research Center.

Ann "Nancy" Peck: Flexure Fatigue Testing of 90° Graphite/Epoxy Composites", to the DOD EPSCoR Program.

Freda Porter-Locklear: "Numerical Simulations of 2D Subsurface Contaminant Transport for a Superfund Site", National Science Foundation.

George Rublein: Proposal for physical science continuation of mathematical materials to DOE and National Science Foundation.

David A. Steinhauer: "Study of Environmental Education Curriculum at Virginia's Two Year Colleges."

Alfred G. Striz: "Efficient Structural Optimization for Improved MDO", Oklahoma NASA EPSCoR Competition and MDOB, NASA Langley Research Center.

Theodore Thomas: Proposal to bolster his institution's scientific computer software programs to NASA.

J. Garth Thompson: "Simulation of Aircraft Control Systems", to NASA Langley Research Center. "Reliability Assessment of Hybrid Navigation and Control Systems for General Aviation Aircraft", to NASA EPSCoR.

Richard H. Tipping: "Line Mixing in Far Wings of Spectral Lines", NASA Langley Research Center.

Abhay V. Trivedi: Three TQM proposals to NASA Headquarters, the National Science Foundation, and ASQC.

Funded Research Proposals

John M. Cimbala: "Incorporation of Turbulence Modules, Roughness, and Tip-Gap Modifications into a Rapid Turbopump CFD Code", Pratt & Whitney Aircraft Co.
Cynthia Keppel: CEBAF is funding a "Proof of Principle" laser backscattering test in the injector region (installation 12/95).

Ellis E. Lawrence: "Regional Network and Training Site at Elizabeth City State University", Funded by NASA for $1.6 million over the next 5 years.

Gerald J. Micklow: "Three Dimensional Combustor Modelling for Advanced Gas Turbine Combustors", NASA Lewis.

George Rublein: SCHEV/Eisenhower: In-service course for teachers.

SECTION VI

SUMMARY OF PROGRAM EVALUATION

A program evaluation questionnaire was given to each Fellow and to each Research Associate involved with the program. The questions and the results are given beginning on the next page fifty-four of fifty-four evaluations were returned (100%).

A. Program Objectives

1. Are you thoroughly familiar with the research objectives of the research (laboratory) division you worked with this summer?

Yes	45	(83%)
No	9	(17%)

2. Do you feel that you were engaged in research of importance to your Center and to NASA?

Yes	53	(98%)
No	0	(0%)
No Response	1	(2%)

3. Is it probable that you will have a continuing research relationship with the research (laboratory) division that you worked with this summer?

Yes	38	(70%)
No	0	(0%)
Uncertain	16	(30%)

4. My research colleague and I have discussed follow-up work including preparation of a proposal to support future studies at my home institution, or at a NASA laboratory.

Yes	32	(59%)
No	21	(39%)
Uncertain	1	(2%)

5. Are you interested in maintaining a continuing research relationship with the research (laboratory) division that you worked with this summer?

Very much so	53	(98%)
Somewhat	1	(2%)

B. Personal Professional Development

1. To what extent do you think your research interests and capabilities have been affected by this summer's experience? You may check more than one.

Reinvigorated	28	(52%)
Redirected	23	(43%)
Advanced	35	(65%)
Barely maintained	0	
Unaffected	1	(2%)

2. How strongly would you recommend this program to your faculty colleagues as a favorable means of advancing their personal professional development as researchers and teachers?

Positively	54	(100%)
Not at all		

3. How will this experience affect your teaching in ways that will be valuable to your students? You may check more than one.

By integrating new information into courses	44	(82%)
By starting new courses	12	(22%)
By sharing your research experience	44	(82%)
By revealing opportunities for future employment in government agencies	19	(35%)
By deepening your own grasp and enthusiasm	29	(54%)
Will affect my teaching little, if at all	0	
No Response	2	(4%)

4. Do you have reason to believe that those in your institution who make decisions on promotion and tenure will give you credit for selection and participation in this highly competitive national program?

Yes	36	(67%)
No	14	(26%)
Possibly	3	(5%)
Already tenured at highest rank	1	(2%)

C. Administration

1. How did you learn about the Program? Check appropriate response.

Received announcement in the mail	22	(41%)
Read about in a professional publication	2	(4%)
Heard about it from a colleague	23	(43%)
Other (Explain below)	9	(17%)

Previous participation; NASA Center Employee; College Paper; AISES Conference; Earlier association with NASA as a grad student; Bulletin board at another institution

2. Did you also apply to other summer faculty programs?

Yes 15 (28%) No 39 (72%)

1	(2%)	DOE
8	(15%)	Another NASA Center
3	(6%)	Air Force
2	(4%)	Army
8	(15%)	Navy

3. Did you receive an additional offer of appointment from one or more of the above? If so, please indicate from which.

Yes 2 (4%) No 52 (96%)

Navy; Continuous Electron Beam Accelerator Facility

4. Did you develop new areas of research interests as a result of your interaction with your Center and laboratory colleagues?

Many	16	(30%)
A few	34	(63%)
None	4	(7%)

5. Would the amount of the stipend ($1,000 per week) be a factor in your returning as an ASEE Fellow next summer?

Yes 35 (65%) No 18 (33%) Possibly 1 (2%)

If not, why? Experience and knowledge gained more important; Only opportunity to conduct meaningful research; Salary not competitive with level of expertise; Not a factor if travel and relocation allowance increased to offset expenses.

6. Did you receive any informal or formal instructions about submission of research proposals to continue your research at your home institution?

Yes	43	(80%)
No	11	(20%)

7. Was the housing and programmatic information supplied prior to the start of this summer's program adequate for your needs?

Yes	46	(85%)
No	2	(4%)
Not Applicable	6	(11%)

8. Was the contact with your research colleague prior to the start of the program adequate?

Yes	50	(93%)
No	4	(7%)

9. How do you rate the seminar program?

Excellent	28	(52%)
Good	24	(44%)
Fair	0	(0%)
Poor	0	(0%)
No Response	2	(4%)

10. In terms of the activities that were related to your research assignment, how would you describe them on the following scale?

Check one per activity			Time Was:	
Activity	Adequate	Too Brief	Excessive	Ideal
Rearch	21 (39%)	10 (19%)	1 (2%)	21 (39%)
Lectures	35 (65%)	2 (4%)	6 (11%)	11 (20%)
Tours	26 (48%)	15 (28%)	1 (2%)	6 (11%)
Social/Rec.	36 (67%)	3 (6%)	2 (4%)	8 (15%)
Meetings	32 (59%)	5 (9%)	3 (6%)	11 (20%)

11. What is your overall evaluation of the program?

Excellent	46	(85%)
Good	8	(15%)
Fair	0	(0%)
Poor	0	(0%)

12. If you can, please identify one or two significant steps to improve the program.

See Fellows' Comments and Recommendations

13. For second-year Fellows only. Please use this space for suggestions on improving the second year.

See Fellows' Comments and Recommendations

D. Stipend

1. To assist us in planning for appropriate stipends in the future, would you indicate your salary at your home institution?

$ 49,803 per Academic year x or Full year _____.
Median Range

2. Is the amount of the stipend the primary motivator to your participation in the ASEE Summer Faculty Fellowship Program?

Yes 7 (13%) No 21 (39%) In Part 25 (46%)

3. What, in your opinion, is an adequate stipend for the ten-week program during the summer of 1996?

$10K-27 (50%); $11K-5 (9%); $12K-3 (6%); $10-$12K-2 (4%); $12.5K-1 (2%); $12,850K-1 (2%); $14K-1 (2%); $15K-10 (19%); One-(2%) Said: Should be a graduated stipend based on rank and level of experience.

E. American Society for Engineering Education (ASEE) Membership Information

1. Are you currently a member of the American Society for Engineering Education?

   Yes 10 (19%) No 44 (81%)

2. Would you like to receive information pertaining to membership in the ASEE?

   Yes 30 (55%) No 24 (45%)

Fellows' Comments

The program was very educational and enjoyable. I was able to work in my area of expertise, and I believe I made a real contribution to the NASA mission here at LaRC.

It is difficult to improve in perfection. I mean, this program is executed in an excellent manner.

As a learning experience for my own edification, it was absolutely superb!!! The lectures presented in the Division were A#1, with full intellectual discussion and comment during the talk. I witnessed true science being developed and tested.

Most people were kind and helpful. A few too busy, but that is expected.

Langley is a superb site, maybe the only site where I had access to library and personnel who could give me advice on my text project. My faculty Associate could not have been more cooperative.

This program is outstanding. The experience I have had here will allow me to greatly enhance courses I teach. I have worked with many outstanding people who went above and beyond to make my experience a valuable one.

The "Happy Helpfulness" exhibited by ALL the employees of NASA/ODU/HU will be a lasting memory for me. Everyone was professional and helpful.

Overall, an excellent program. Compares favorably with similar programs at Goddard and Ames.

ASEE staff did an outstanding job. Great program. Needs to be continued for the benefit of faculty like us. Thanks a million.

Fellows' Recommendations

- Ninety-six percent of the Fellows indicated they were very pleased with the Lecture Series. Second year Fellows commented on the improved topic selections. Fellows indicated favorites were "Earth's Atmosphere" by Dr. Joel Levine; "The Hubble Space Telescope" by Dr. David Leckrone; and "Wind Shear" by Mike Lewis. Continue with the interesting topics and include more tours. Also, provide a longer Q&A session following the lectures. There should be at least one female lecturer in the series.

- Plan at least one more large family picnic type gathering toward the latter half of the program. Provide opportunities for more interaction between ASEE Fellows.

- Ensure that research Associates are sincerely interested and fully supportive of the program.

- Increase the visibility of women in the program. Include female Fellows in the final presentations.

- Regarding the Orientation tour, provide tour guides who are knowledgeable in the subject areas. The tour should be longer. They should not have to read from a script. Provide a better sound system for the tour guides so everyone can hear what is being said.

- Allow up to $5K funding to allow Fellow to bring a graduate student.

- Do more teaming with LARSS students which will allow for more productivity.

- Provide a guaranteed minigrant or seed money between $7500-$15000, or at least have a given number of those available.

- Be sure Branch staff is aware of and in agreement with Fellow's project before announcing to Fellow. Also, when assigning an off-site project, be sure adequate transportation is available.

- Provide more flexible program dates with an 8-12 week flexible schedule.

- Provide additional travel and relocation allowance. Have relocation allowance available on the first day of the program. Also, provide some sort of travel reimbursement for those traveling just under the 50 mile limit one way. For example, a Fellow who drives 80 miles round trip daily incurs a significant expense over the 10 week summer tenure.

- Regarding the selection of the Best Research Presentation, please inform Division and Branch chiefs beforehand so that they can be motivated to come up with good projects.

- Final Presentations should be longer. Fifteen minutes is not an adequate amount of time to present 10 weeks worth of research.

- There should also be some sort of informal mid program presentations, so everyone will have some idea as to the types of projects being pursued during the summer.

- Share examples of successfully funded proposals. Also share information on cost effective scientific computer software for PCs.

SUMMARY OF ASSOCIATES' EVALUATION

The following comments and recommendations were taken from the questionnaire distributed to the ASEE Associates requesting them to evaluate the overall performance of their ASEE Fellow. Most all of the Associates responding indicated an overwhelming satisfaction with the Fellow's knowledge of their subject, diligence, interest in assignment, and enthusiasm. Ninety-five percent of the Associates indicated they would like to serve as an Associate again. Eighty-eight percent of the Associates indicated that their Fellow was above average when compared overall with other faculty researchers they had worked with before.

Research Associates' Comments

- Excellent program-wish we could extend duration of stay at LaRC of all the Fellows.
- I think the program is doing well. It is capable of accommodating highly experienced researchers as well as novices.
- The program is very good.
- Excellent program.

Research Associates' Recommendations

- Use e-mail for evaluation forms and other announcements to the Associates.
- Allow Fellows to work for a longer period of time.
- More assistance in finding the professor's lodging would relieve them of much anxiety.
- Make it 12 weeks.

SECTION VII

CO-DIRECTOR'S RECOMMENDATIONS

1. It is an 100% recommendation that the program continue.

2. The calendar set explicit dates for the program but flexibility be allowed at the site to accommodate for school calendars and research associate schedules.

3. The lecture series be continued. If using LaRC personnel, be sure topics are more directed towards current research areas. Invite one or two distinguished scholars for special presentations.

4. The stipend be increased to $12K for the ten week period. That amount represents a $60K per year salary (based on a twelve month contract) or a $36K academic year salary (assistant professor level).

5. Recommend $1K relocation allowance be prepared for payment within the first week of the program.

6. The travel and relocation allowances remain at $500 and $1,000.

7. The Fellows be informed early that the travel allowance does not cover meals and lodging for those who decide to drive across the country.

8. Pre-program contact between Fellows and Associates be emphasized. A visit by the first year Fellow to LaRC be strongly recommended.

Co-Director's Proposal Seminar Recommendations:

9.
   - Hand out sample copy of proposal
   - Provide copies of proposals from previous years-Format, budget, etc.
   - Bring in researcher/mentor to explain what is expected.
   - Provide copy of presentation

APPENDIX I

PARTICIPANTS - ASEE/NASA LANGLEY

SUMMER FACULTY RESEARCH PROGRAM

1995 NASA Langley ASEE Summer Faculty Fellowship Program Fellows

Name and Institution	NASA Associate and Division
Dr. Daniel O. Adams (R) Iowa State University	Mr. Clarence C. Poe Materials
Dr. Marcelo C. Algrain University of Nebraska-Lincoln	Mr. David E. Cox Flight Dynamics and Control
Dr. Madeleine Y. Andrawis (R) South Dakota State University	Dr. Edmond J. Conway Atmospheric Sciences
Dr. Joshua C. Anyiwo Christopher Newport University	Mr. Stuart E. Pendleton Small Business Partnership Team
Dr. Robert B. Archibald College of William and Mary	Mr. Robert L. Yang Small Business Partnership Team
Dr. Donald W. Ball University of Virginia	Ms. Marchelle D. Canright Office of Education
Dr. Han P. Bao (R) Old Dominion University	Mr. W. Douglas Morris Space Systems and Concepts
Dr. Bobbye H. Bartels Christopher Newport University	Ms. Marchelle D. Canright Office of Education
Dr. Sebastian Y. Bawab Old Dominion University	Dr. John A. Tanner Structures
Dr. Mary M. Bechtold Hampton University	Dr. Jeffrey A. Hinkley Materials
Dr. Faruk H. Bursal (R) VA Tech Institute and State University	Dr. Ping Tcheng Experimental Testing Technology
Dr. Alan M. Christman Grove City College	Mr. Thomas G. Campbell Information & Electromagnetic Tech
Dr. John M. Cimbala (R) Pennsylvania State University	Dr. Thomas B. Gatski Flight Mechanics and Acoustics
Dr. Linda W. Deans George Washington University	Ms. Janet M. McKenzie Office of Human Resources
Dr. George DeRise Thomas Nelson Community College	Mr. James L. Thomas Fluid Mechanics and Acoustics

Name and Institution	NASA Associate and Division
Dr. Richard P. Donovan University of Evansville	Dr. Howard M. Adelman Structures
Dr. David H. Finifter College of William and Mary	Mr. Robert L. Yang Small Business Partnership Team
Dr. Dora E. Gonzalez University of Texas-Arlington	Dr. Philip J. Drummond Gas Dynamics
Dr. Oscar R. Gonzalez Old Dominion University	Mr. James G. Batterson Flight Dynamics and Control
Dr. David J. Gosselin Christopher Newport University	Mr. Joseph R. Struhar Office of the Comptroller
Dr. Barbara L. Grabowski Pennsylvania State University	Ms. Marchelle D. Canright Office of Education
Mr. L. Vincent Hale Christopher Newport University	Ms. Marchelle D. Canright Office of Education
Dr. Mark L. Hanson George Washington University	Mr. Patrick A. Troutman Space Systems and Concepts
Dr. Aprill J. Hart Norfolk State University	Mr. Robert G. Bryant Materials
Dr. George R. Inger Iowa State University	Dr. Peter A. Gnoffo Gas Dynamics
Dr. Paul F. Joseph Clemson University	Mr. Ivatury S. Raju Materials
Dr. Isaac I. Kaminer Naval Post-Graduate School	Mr. Carey S. Buttrill Flight Dynamics and Control
Dr. Cynthia E. Keppel Virginia Union University	Mr. Leonard R. McMaster Aerospace Electronic Systems
Dr. Rex K. Kincaid College of William and Mary	Dr. Thomas A. Zang Fluid Mechanics and Acoustics
Dr. Edmond B. Koker (R) Elizabeth City State University	Dr. Reginald J. Exton Flight Mechanics and Acoustics
Mr. Drew Landman Old Dominion University	Mr. Edward G. Waggoner Aerodynamics

Name and Institution	NASA Associate and Division
Dr. Ellis E. Lawrence Elizabeth City State University	Mr. James E. Bell Fabrication
Dr. James F. Leathrum (R) Old Dominion University	Dr. Thomas A. Zang Flight Mechanics and Acoustics
Dr. Norman W. Loney (R) New Jersey Institute of Technology	Mr. Richard L. Puster Gas Dynamics
Dr. David MacInnes Guilford College	Dr. John W. Connell Materials
Dr. Arlene P. Maclin Hampton University	Dr. Joseph S. Heyman Small Business Partnership Team
Dr. James E. Martin (R) Christopher Newport University	Dr. Jay C. Hardin Fluid Mechanics and Acoustics
Dr. Gerald J. Micklow University of Florida	Mr. H. Kevin Rivers Structures
Dr. Nilda Ocasio de Rodriguez University of Puerto Rico-Mayaguez	Ms. Marchelle D. Canright Office of Education
Dr. Ann "Nancy" W. Peck University of Wyoming	Dr. T. Kevin O'Brien Materials
Dr. Freda Porter-Locklear (R) University of N. Carolina-Chapel Hill	Dr. Harold L. Atkins Flight Mechanics and Acoustics
Dr. Sandra B. Proctor (R) Norfolk State University	Dr. Samuel E. Massenberg Office of Education
Dr. Asit K. Ray Christian Brothers University	Dr. Jag J. Singh Office of Education
Dr. Manuel F. Rodriguez-Perazza University of Puerto Rico-Mayaguez	Dr. John S. Tripp Experimental Testing Tech
Dr. George T. Rublein (R) College of William and Mary	Mr. James G. Batterson Flight Dynamics and Control
Mr. David A. Steinhauer Tidewater Community College	Mr. John W. Lee Office of Safety, Environment, and Mission Assurance

Name and Institution	NASA Associate and Division
Dr. Alfred G. Striz (R) University of Oklahoma	Dr. Thomas A. Zang Fluid Mechanics and Acoustics
Mr. Theodore Thomas Patrick Henry Community College	Mr. David E. Cox Flight Dynamics and Controls
Dr. Joseph Garth Thompson Kansas State University	Mr. Michael H. Durham Subsonic Transportation Office
Dr. Richard H. Tipping (R) University of Alabama	Dr. Mary Ann H. Smith Atmospheric Sciences
Dr. George Trevino Michigan Technological University	Dr. Lucio Maestrello Fluid Mechanics and Acoustics
Dr. Abhay V. Trivedi North Carolina A&T State University	Mr. J. Milan Waters Aerospace Mechanical Systems
Dr. George F. Tucker (R) Sage Junior College of Albany	Mr. Glen W. Sachse Aerospace Electronic Systems
Dr. John P. Wander University of Alabama	Mr. Mike Goode Information & Electromagnetic Tech

R-Designates returnees

APPENDIX II

LECTURE SERIES

PRESENTATIONS BY RESEARCH FELLOWS

CALENDAR OF ACTIVITIES

1995 OFFICE OF EDUCATION SUMMER LECTURE SERIES

Location: Activities Center Auditorium, Bldg. 1222
Time: 10:00 a.m. - 10:45 a.m. - Lecture
10:45 a.m. - 11:00 a.m. - Questions and Answer

DATE	TOPIC	SPEAKER
June 12	Advanced Aeronautical Concepts	Mr. Dennis M. Bushnell Senior Scientist NASA Langley Research Center
June 19	NASA Langley Research Center A National Lab Resource For U.S. Competitiveness	Dr. Joseph S. Heyman Technical Applications Group
June 26	The Earth's Atmosphere: A Brief History of the First 4.5 Billion Years	Dr. Joel S. Levine Atmospheric Sciences Division Space and Atmospheric Sciences Program Group
July 10	Hubble Space Telescope: The Image Restored	Dr. David S. Leckrone Senior Project Scientist Hubble Space Telescope Project Goddard Space Flight Center
July 24	The Wind Shear Airborne Sensors Program - A Research and Development Success Story	Mr. Michael S. Lewis High Speed Research Project Office
July 31**	Future of Engineering Education	Dr. Joseph DiGregorio Associate Dean College of Engineering Pennsylvania State University

****Please note: July 31, 1995 lecture time will be from 9:00 a.m. to 10:00 a.m.**

Next Lecture
July 24, 1995
10:00 a.m.

The Wind Shear Airborne Sensors Program - A Research and Development Success Story

presented by

Dr. Michael S. Lewis
High Speed Research Project Office

NASA Langley Research Center
ASEE Summer Faculty Fellowship Program
and
Langley Aerospace Research
Summer Scholars (LARSS) Program

Office of Education Summer Lecture Series

July 10, 1995
10:00 a.m.

Hubble Space Telescope: The Image Restored presented by Dr. David S. Leckrone NASA - Goddard Space Flight Center

The Hubble Space Telescope is the culmination of a decades-old dream of astronomers to place a large aperture, diffraction-limited, ultraviolet and optical observatory above the turbulence and selective absorption of the earth's atmosphere. As the backbone of NASA's uv/optical space astronomy program, the HST is intended to function for at least 15 years at approximately three year intervals for in-orbit servicing and orbit reboost. The first servicing mission was successfully completed on December 13, 1993. It demonstrated the feasibility of the in-orbit servicing concept and restored the HST spacecraft to robust good health. Perhaps of greatest interest, however, it allowed new optical components to be installed in the observatory, which correct for the well-known spherical aberration of its primary mirror. The HST's optics now produce images and spectra of spectacular quality with a high degree of quantitative accuracy, allowing the realization of the scientific performance originally expected when the HST was launched in 1990. This talk will illustrate some of the new data acquired with the optically-corrected system and discuss the early scientific results.

Dr. David S. Leckrone Biography

Dr. David S. Leckrone is a career NASA scientist and has worked at the Goddard Space Flight Center since 1969. He has worked on the Hubble Space Telescope Project since 1976 and was appointed to the position of Senior Project Scientist in 1992.

He holds a B.S. degree in Physics from Purdue University, and M.A. and Ph.D. degrees in Astronomy from the University of California at Los Angeles.

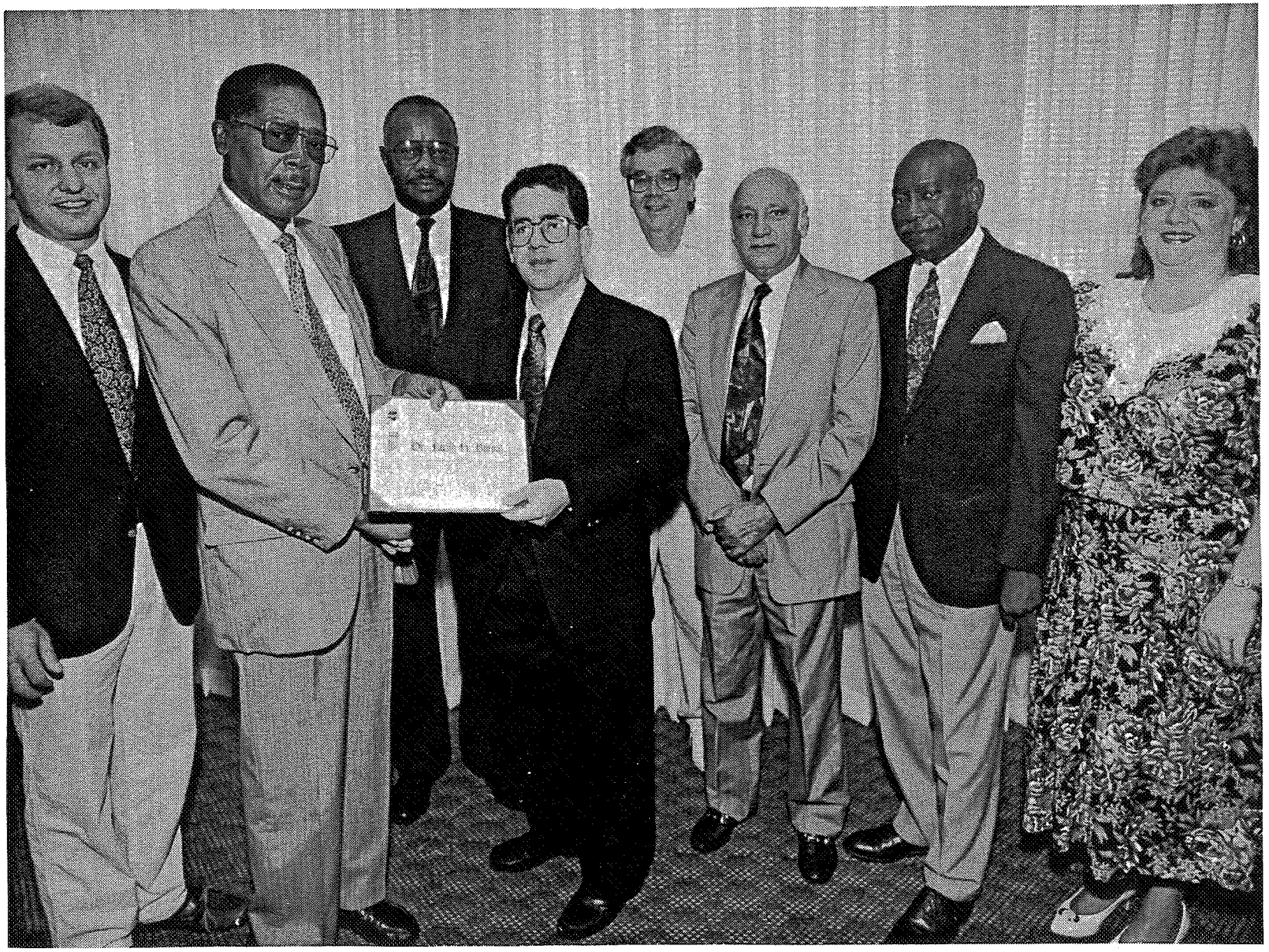
He is a veteran space astronomer, specializing in the ultraviolet spectroscopy of hot stars, and the origin and abundances of the chemical elements.

He was awarded NASA's Exceptional Scientific Achievement Medal in 1992 and the NASA Outstanding Leadership Medal in 1994.

1995 American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program Final Presentations

Monday, August 7, 1995
H.J.E. Reid Conference Center
9:00 a.m. - 12 noon

Welcome		**Dr. Surendra N. Tiwari** ASEE Co-Director
9:00 a.m.	"Resolution of the Buoyancy in the 8-Foot High Temperature Tunnel Combustor"	**Dr. Norman W. Loney** Research and Technology Group (GDD) New Jersey Institute of Technology
9:20 a.m.	"Dissipative Flight Control System Design"	**Dr. Oscar R. Gonzalez** Research and Technology Group FDCD Old Dominion University
9:40 a.m.	"Measuring the Economic Benefits of Technology Transfer from a National Laboratory: A Primer"	**Dr. Robert B. Archibald** and **Dr. David H. Finifter** Technical Applications Group College of William and Mary
10:00 a.m.	"Analysis of Uncertainty In Force Balance Calibration"	**Dr. Faruk H. Bursal** Internal Operations Group ETTD Virginia Polytechnic Institute and State University
10:20 a.m.	"Axial Fiber Crimping Effects in Braided Composites"	**Dr. Daniel O. Adams** Research and Technology Group MD Iowa State University
10:40 a.m.	"The Shape of Spectral Lines: The Importance of the Far Wings"	**Dr. Richard H. Tipping** Space and Atmospheric Sciences Program Group (ASD) University of Alabama
11:00 a.m.	"Electromagnetic Compatibility and the All-Electric Airplane"	**Dr. Alan M. Christman** Research and Technology Group IETD Grove City College
11:20 a.m.	"Micro-Mechanics Modeling of Micro-Composite Materials"	**Dr. Richard P. Donovan** Research and Technology Group (SD) University of Evansville
11:40 a.m.	Closing Comments	**Mr. Roger A. Hathaway** NASA University Affairs Officer
11:45 a.m.	Dutch Lunch for ASEE Fellows - Location to be announced	



Caption Information: Dr. Samuel E. Massenberg, Director, Office of Education, presents certificate for first place recognition in the 1995 NASA LaRC ASEE Summer Faculty Fellowship Program Best Research Presentation Competition to Dr. Faruk H. Bursal, assistant professor, Virginia Polytechnic Institute and State University. Left to right: Dr. Daniel O. Adams, third place; Dr. Samuel E. Massenberg, Director, NASA LaRC Officer of Education; Mr. Roger A. Hathaway, University Affairs Officer; Dr. Faruk H. Bursal, first place; Dr. Richard H. Tipping, second place; Dr. Surendra N. Tiwari and Professor John H. Spencer, ASEE Co-Directors; and Ms. Debbie Young, ASEE Administrative Assistant.

1995 ASEE Calendar of Activities

Date	Function
June 5, 1995	ASEE Orientation Program H.J.E. Reid Conference Center
June 5, 1995	ASEE Social-Get to know your colleagues. Holiday Inn Coliseum Lounge 1813 West Mercury Boulevard
June 12, 1995	Lecture-H.J.E. Reid Conference Center
June 14, 1995	Picnic-H.J.E. Reid Conference Center Picnic Grounds
June 19, 1995	Lecture-H.J.E. Reid Conference Center Stipend Pay Day
June 26, 1995	Lecture-H.J.E. Reid Conference Center
June 30, 1995	Moonlight Cruise-See Enclosed Information
July 4, 1995	Free Day, No work-Happy July 4th Holiday
July 5, 1995	Stipend Pay Day-Hampton Room, Conference Center
July 10, 1995	Lecture-H.J.E. Reid Conference Center
July 17, 1995	Stipend Pay Day-Hampton Room, Conference Center
July 19, 1995	Proposal Seminar
July 24, 1995	Lecture-H.J.E. Reid Conference Center
July 27, 1995	ASEE/LARSS Banquet
July 31, 1995	Lecture-H.J.E. Reid Conference Center Stipend Pay Day
August 7, 1995	ASEE Final Presentations
August 11, 1995	Final Day - Paperwork Due - Final Stipend Pay Date

Following each lecture, reservations will be made for a dutch luncheon for interested Fellows to allow for informal interactions between participants and administrative staff.

Thursday of each week, an informal dinner at restaurants (TBD) will be scheduled for interested ASEE Fellows.

APPENDIX III

GROUP PICTURE OF RESEARCH FELLOWS

Those pictured in group photograph from left to right are:

Front Row Sitting: Ann "Nancy" W. Peck, Isaac I. Kaminer, Linda W. Deans, Bobbye H. Bartels, Nilda Ocasio de Rodriguez, David A. Steinhauer, Arlene P. Maclin, Manuel F. Rodriguez-Perazza, George R. Inger, John M. Cimbala, Faruk H. Bursal, Marcelo C. Algrain, Surendra N. Tiwari (ASEE Co-Director), John H. Spencer (ASEE Co-Director)

Second Row: Aprill J. Hart, Nadim Andary (VASC), David J. Gosselin, Theodore Thomas, Joshua C. Anyiwo, Mary M. Bechtold, L. Vincent Hale, Alan M. Christman, Alfred G. Striz, James E. Martin, George Rublein, David H. Finifter, Robert B. Archibald, Richard P. Donovan, Debbie Young (ASEE Administrative Assistant), Madeleine Y. Andrawis

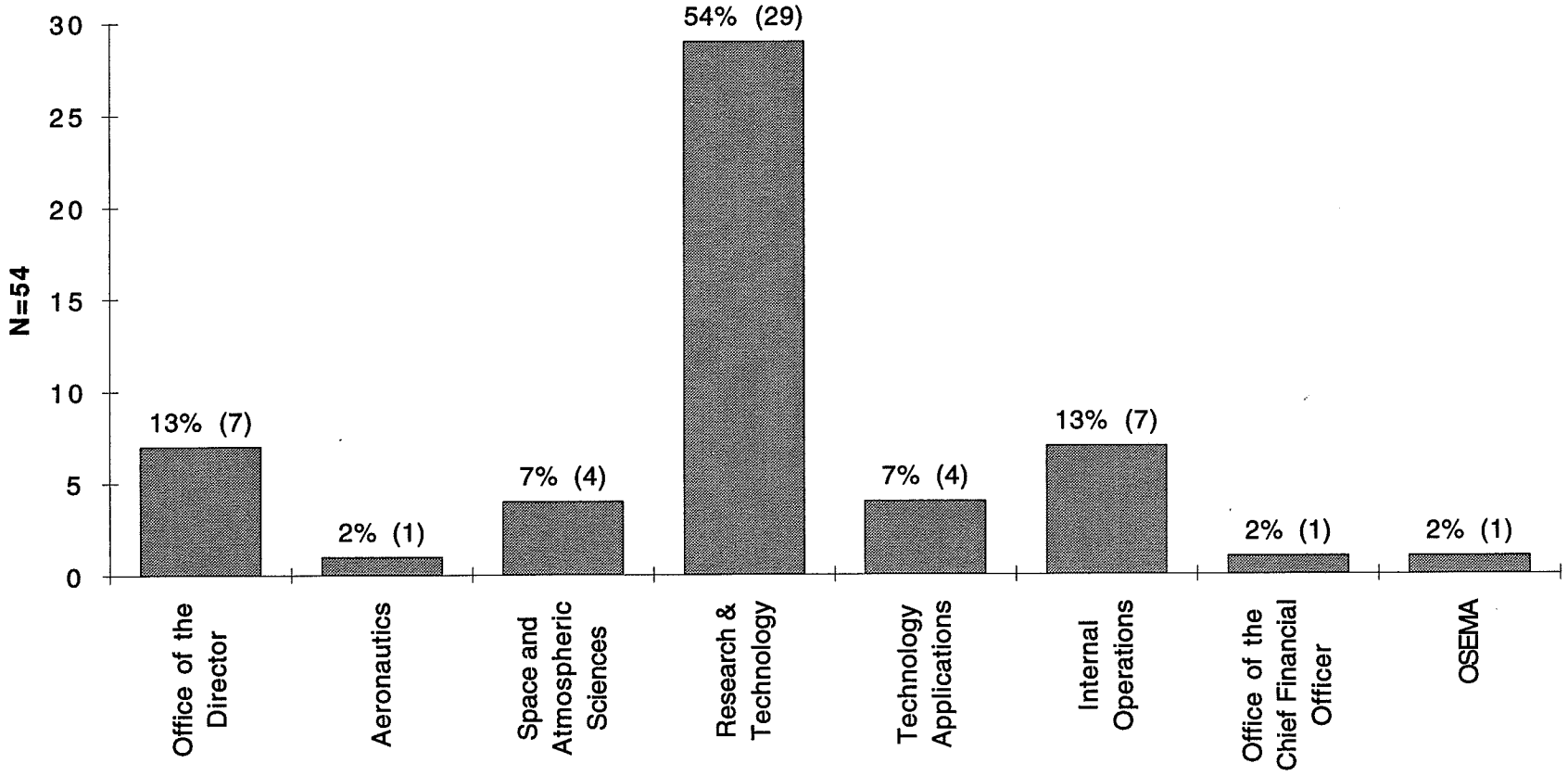
Third Row: Han P. Bao, Cynthia E. Keppel, George DeRise, Sebastian Y. Bawab, George F. Tucker, John P. Wander, Daniel O. Adams, Paul F. Joseph, Gerald J. Micklow, Norman W. Loney, James F. Leathrum, Oscar R. Gonzalez, George Trevino, Mark L. Hanson, Asit K. Ray

Not Pictured: Donald W. Ball, Dora E. Gonzalez, Barbara L. Grabowski, Rex K. Kincaid, Edmond B. Koker, Drew Landman, Ellis E. Lawrence, David MacInnes, Freda Porter-Locklear, Sandra B. Proctor, J. Garth Thompson, Richard H. Tipping, Abhay V. Trivedi

APPENDIX IV

DISTRIBUTION OF FELLOWS BY GROUP

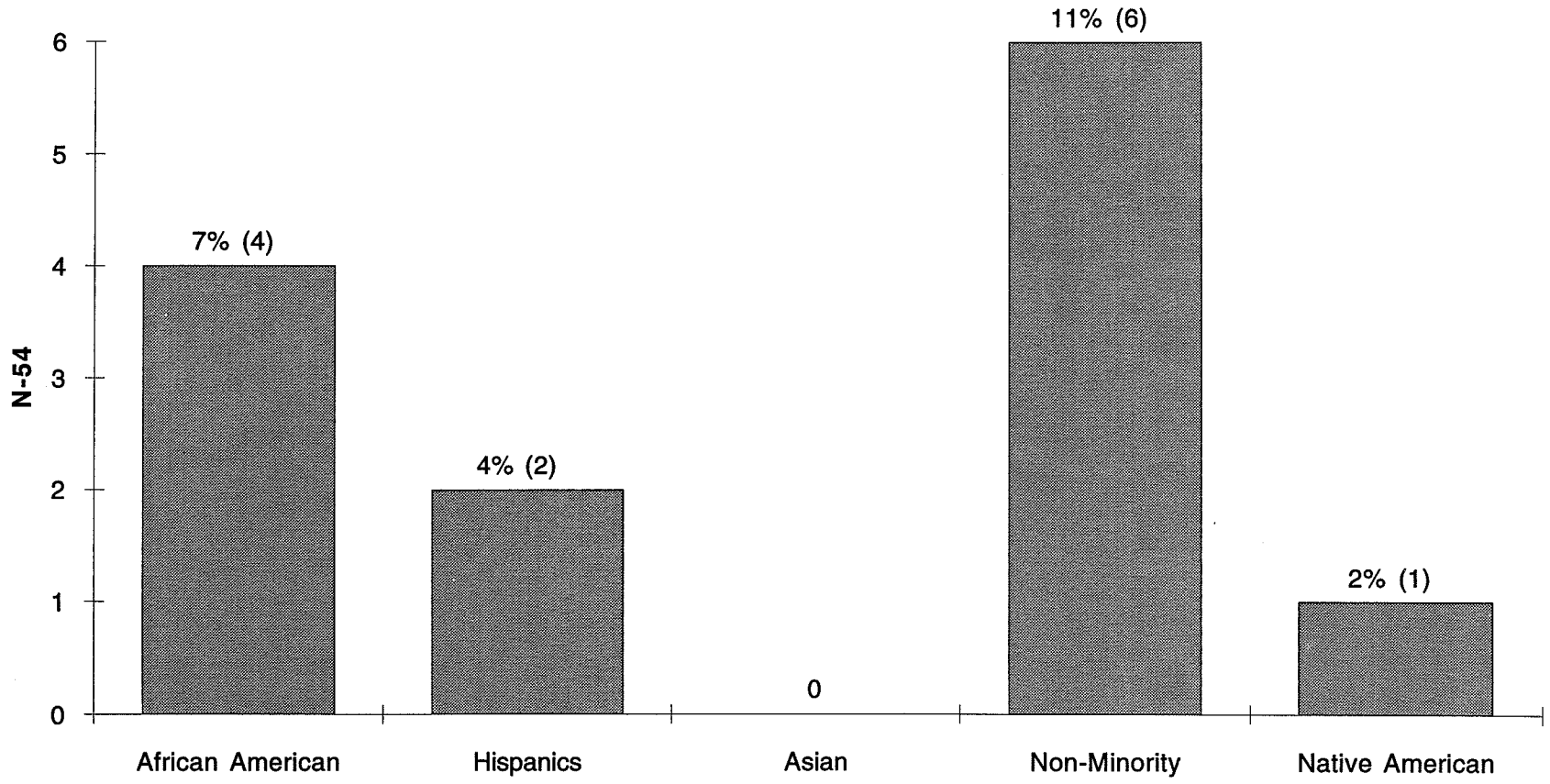
1995 ASEE (SFFP) FELLOWS BY GROUP



APPENDIX V

DISTRIBUTION OF FELLOWS BY ETHNICITY/FEMALE

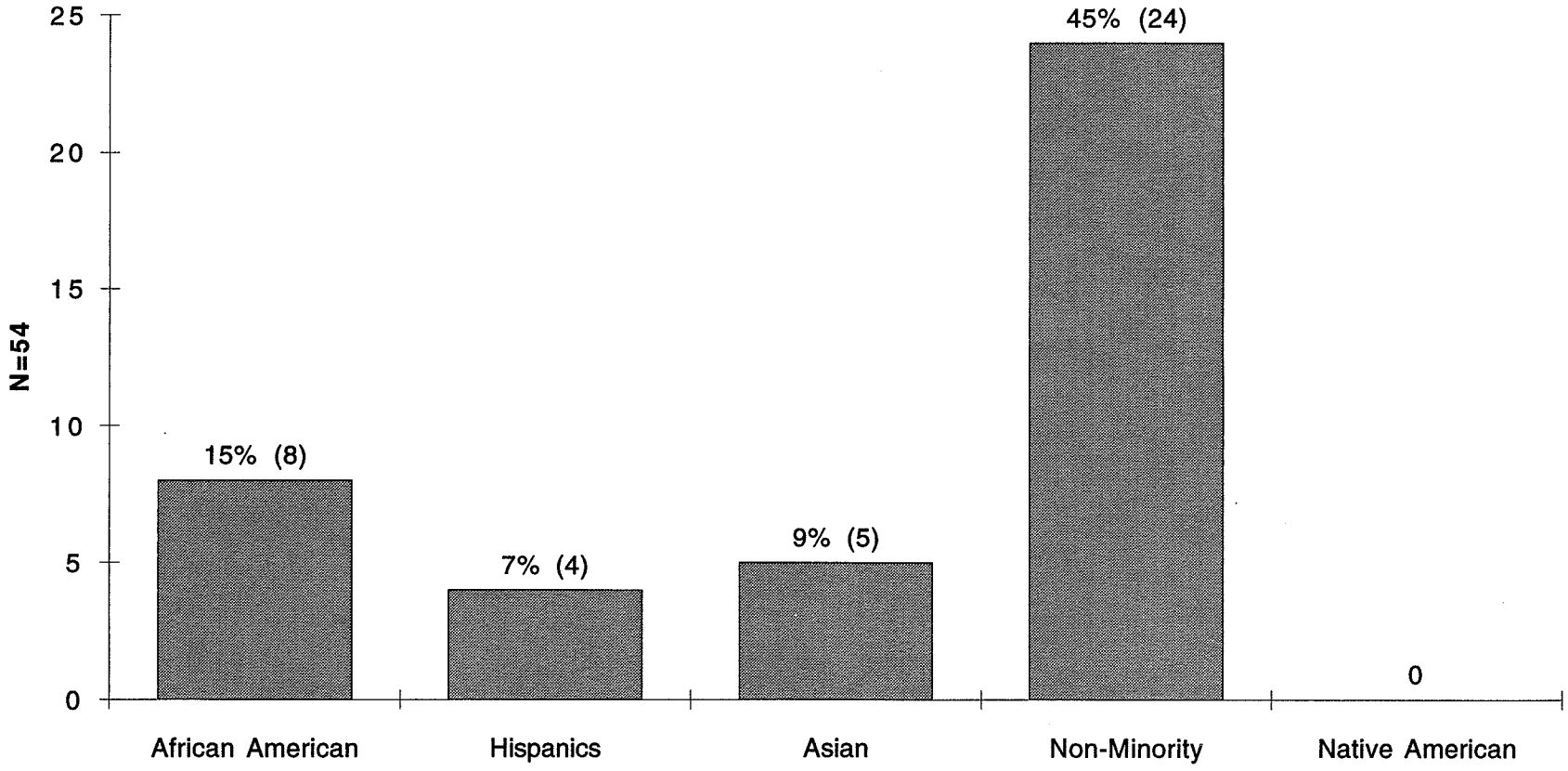
1995 ASEE (SFFP) FEMALE FELLOWS BY ETHNICITY



APPENDIX VI

DISTRIBUTION OF FELLOWS BY ETHNICITY/MALE

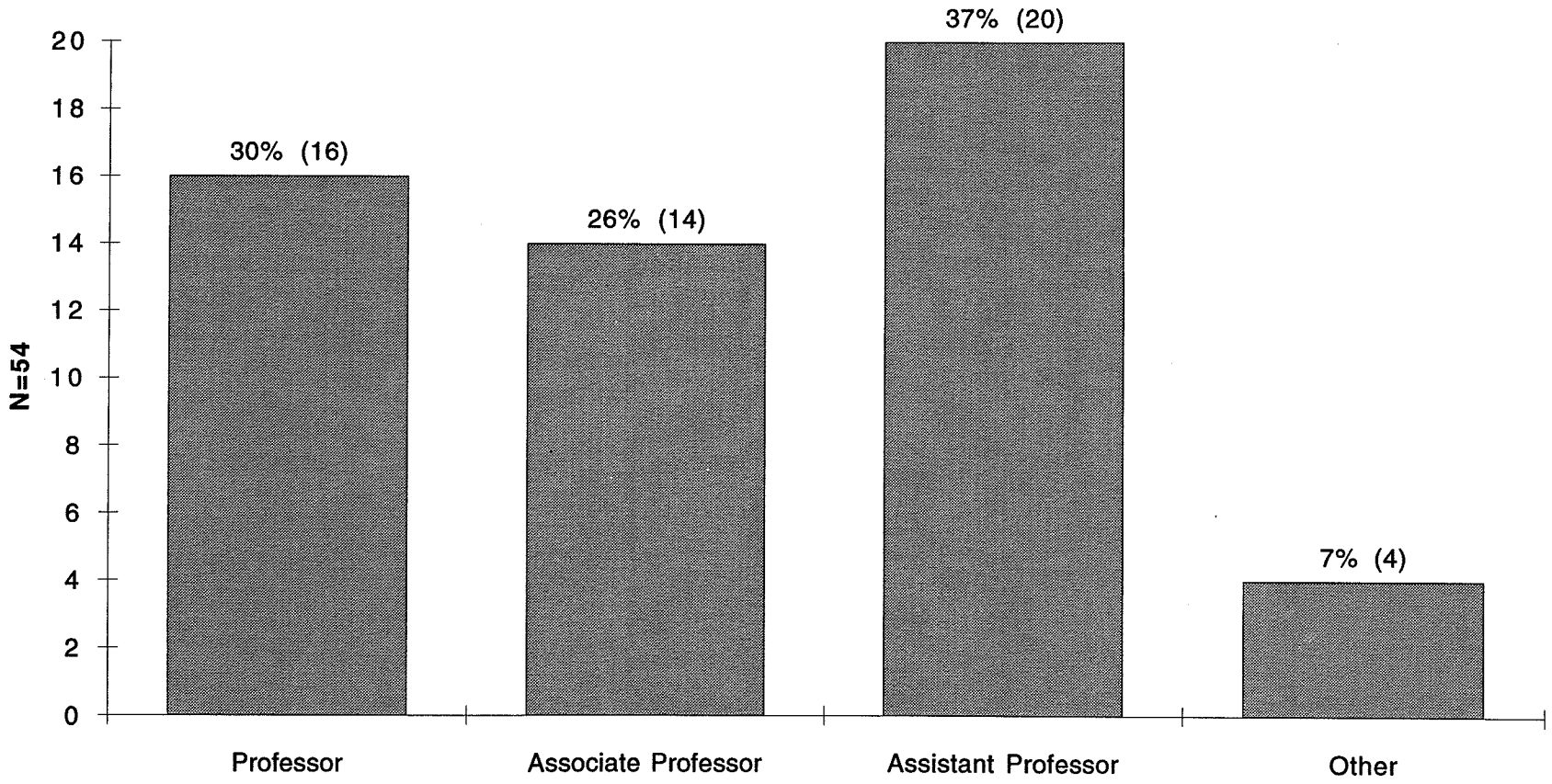
1995 ASEE (SFFP) MALE FELLOWS BY ETHNICITY



APPENDIX VII

DISTRIBUTION OF FELLOWS BY UNIVERSITY RANK

1995 ASEE (SFFP) FELLOWS BY UNIVERSITY RANK



APPENDIX VIII

DISTRIBUTION OF FELLOWS BY UNIVERSITY

1995 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM
INSTITUTION PARTICIPATION

UNIVERSITY/COLLEGE	NO. OF FELLOWS
Christian Brothers	1
Christopher Newport University	5
Clemson University	1
College of William and Mary	4
*Elizabeth City State University	2
George Washington University	2
Grove City College	1
Guilford College	1
*Hampton University	2
Iowa State University	2
Kansas State University	1
Michigan Technological University	1
Naval Post Graduate School	1
New Jersey Institute of Technology	1
*Norfolk State University	2
*North Carolina A&T State University	1
Old Dominion University	5
Patrick Henry Community College	1
Pennsylvania State University	2
Sage Junior College of Albany	1
South Dakota State University	1
Thomas Nelson Community College	1
Tidewater Community College	1
University of Alabama	2
University of Evansville	1
University of Florida	1
University of Nebraska-Lincoln	1
University of North Carolina-Chapel Hill	1
University of Oklahoma	1
^University of Puerto-Rico-Mayaguez	2
University of Texas-Arlington	1
University of Virginia	1
University of Wyoming	1
Virginia Polytechnic Institute and State University	1
*Virginia Union	1
Total Number of Fellows	**54**
Total Number of Institutions Represented	**35**

*Indicates a **H**istorically **B**lack **C**ollege or **U**niversity (HBCU).
^Indicates an **O**ther **M**inority **U**niversity (OMU)

APPENDIX IX

ABSTRACTS - RESEARCH FELLOWS

S1-24
ABS. ONLY
8741
P. 1

EFFECTS OF YARN CRIMPING ON BRAIDED COMPOSITE DESIGN ALLOWABLES

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Braided composite materials are currently being evaluated for wing skin stiffeners on commercial aircraft. These carbon-fiber/epoxy materials allow for low-cost manufacturing while maintaining high strength-to-weight and stiffness-to-weight ratios. The proposed braid architecture consists of axial carbon fiber yarns and braider carbon fiber yarns making 60° to 70° angles with respect to the axial yarns. These 2-D triaxial braids are produced as long, continuous tubes, which are flattened, cut, and stacked to produce the desired part thickness and shape. When infiltrated with epoxy resin and cured under a compaction pressure, the fiber yarns become crimped, allowing for higher fiber packing. Although high fiber packing is desirable, yarn crimping (especially in the axial fiber yarns) is undesirable. Significant axial yarn crimp angles (greater than 10°) have been measured in braided composites. Comparable levels of crimping have been found to produce significant compressive strength reductions in laminated composites consisting of planar fiber sheets. Thus, axial yarn crimping is suspected of producing significant reductions in compressive strength allowables for braided composites.

The objective of this research is to *quantify* the reduction in compressive strength as a function of axial yarn crimp severity. Since crimp severity can be reduced by lowering the compaction pressure during curing, the resulting compressive strengths may be used to determine optimum processing conditions. A "cure-on-the-loom" manufacturing process was developed to produce braided composites with controlled levels of crimping. This method allowed for controlled levels of tension to be placed on the axial yarns and maintained during the curing process. With increasing tension, the crimp severity in the axial yarns was reduced. Thus, varying crimp severities were produced ranging from conventional levels (greater than 10°) to virtually straight axial yarns. Test results indicate that a 30% increase in compressive strength is obtainable by eliminating axial yarn crimping. Further compression testing is underway to quantify the relationship between crimp severity and compressive strength. Additional testing is planned to investigate the effect of crimping on the open-hole compressive strength, often considered a more significant design allowable.

52-18
ABS. ONLY
8742

P-1

Determination of Attitude Jitter in Small Satellites

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For various reasons, including cost, small satellites are becoming more appealing. Because of their smaller inertias, these spacecrafts are more sensitive to disturbances and likely to have more attitude jitter than the bigger units. These jitter levels may be unacceptable for some scientific instruments and need to be compensated. In the case of line-of-sight type instruments, the attitude jitter could be mitigated by incorporating a fast steering mirror into the system. To take full advantage of these devices, the spacecraft attitude needs to be measured at sufficiently high bandwidth, well beyond what is commonly provided by inertial reference units. This research examines various ways to obtain higher bandwidth attitude measurements for the purpose of jitter control.

LINEAR OPERATING REGION IN THE OZONE DIAL PHOTON COUNTING SYSTEM

S3 - 45
ABS. ONLY
8743

P_1

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Ozone is a relatively unstable molecule found in Earth's atmosphere. An ozone molecule is made up of three atoms of oxygen. Depending on where ozone resides, it can protect or harm life on Earth. High in the atmosphere, about 15 miles up, ozone acts as a shield to protect Earth's surface from the sun's harmful ultraviolet radiation. Without this shield, we would be more susceptible to skin cancer, cataracts, and impaired immune systems. Closer to Earth, in the air we breathe, ozone is a harmful pollutant that causes damage to lung tissue and plants.

Since the early 1980's, airborne lidar systems have been used for making measurements of ozone. The differential absorption lidar (DIAL) technique is used in the remote measurement of O_3. This system allows the O_3 to be measured as function of the range in the atmosphere. Two frequency-doubled Nd:YAG lasers are used to pump tunable dye lasers. The lasers are operating at 289 nm for the DIAL on-line wavelength of O_3, and the other one is operated at 300 nm for the off-line wavelength. The DIAL wavelengths are produced in sequential laser pulses with a time separation of 300 μs. The backscattered laser energy is collected by telescopes and measured using photon counting systems.

The photon counting system measures the light signal by making use of the photon nature of light. The output pulse from the Photo-Multiplier Tube (PMT), caused by a photon striking the PMT photo-cathode, is amplified and passed to a pulse height discriminator. The peak value of the pulse is compared to a reference voltage (discrimination level). If the pulse amplitude exceeds the discrimination level, the discriminator generates a standard pulse which is counted by the digital counter.

Non-linearity in the system is caused by the overlapping of pulses and the finite response time of the electronics. At low count rates one expects the system to register one event for each output pulse from the PMT corresponding to a photon incident upon the photocathode, however, at higher rates the limitations of the discrimination/counting system will cause the observed count rate to be non-linear with respect to the true count rate. Depending on the pulse height distribution and the discriminator level, the overlapping of pulses (pulse pile-up) can cause count loss or even an additional apparent count gain as the signal levels increase.

Characterization of the system, including the pulse height distribution, the signal to noise ratio, and the effect of the discriminator threshold level, is critical in maximizing the linear operating region of the system, thus greatly increasing the useful dynamic range of the system.

AN OBJECT-ORIENTED, TECHNOLOGY-ADAPTIVE INFORMATION MODEL

S4-82
ABS ONLY
8744

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P-1

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The primary objective was to develop a computer information system for effectively presenting NASA's technologies to American industries, for appropriate commercialization. To this end a comprehensive information management model, applicable to a wide variety of situations, and immune to computer software/hardware technological gyrations, was developed.

The model consists of four main elements: a DATA_STORE, a data PRODUCER/UPDATER_CLIENT and a data PRESENTATION_CLIENT, anchored to a central object-oriented SERVER engine. This server engine facilitates exchanges among the other model elements and safeguards the integrity of the DATA_STORE element. It is designed to support new technologies, as they become available, such as Object Linking and Embedding (OLE), on-demand audio-video data streaming with compression (such as is required for video conferencing), Worldwide Web (WWW) and other information services and browsing, fax-back data requests, presentation of information on CD-ROM, and regular in-house database management, regardless of the data model in place. The four components of this information model interact through a system of intelligent message agents which are customized to specific information exchange needs. This model is at the leading edge of modern information management models. It is independent of technological changes and can be implemented in a variety of ways to meet the specific needs of any communications situation.

This summer a partial implementation of the model has been achieved. The structure of the DATA_STORE has been fully specified and successfully tested using Microsoft's FoxPro 2.6 database management system. Data PRODUCER/UPDATER and PRESENTATION architectures have been developed and also successfully implemented in FoxPro; and work has started on a full implementation of the SERVER engine. The model has also been successfully applied to a CD-ROM presentation of NASA's technologies in support of Langley Research Center's TAG efforts.

EXCURSIONS IN TECHNOLOGY POLICY

55-81
ABS. ONLY
8745
P-1

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All of my projects were executed jointly with my colleague Dr. David Finifter. There were three distinct projects:

1. **Measuring Economic Benefits** The mission of the Technology Applications Group (TAG) at NASA Langley Research Center is to assist firms interested in commercializing technologies. TAG is a relatively new group as is the emphasis on technology commercialization for NASA. One problem faced by TAG and similar groups at other centers is measuring their effectiveness. The first project this summer, a paper entitled, "Measuring the Economic Benefits of Technology Transfer from a National Laboratory: A Primer," focused on this measurement problem. We found that the existing studies of the impact of technology transfer on the economy were conceptually flawed. The "primer" outlines the appropriate theoretical framework for measuring the economic benefits of technology transfer.

2. **Evaluating the SBIR Program** One of the programs of TAG is the Small Business Innovation Research (SBIR) program. This program has led to over 400 contracts with Small Business since its inception in 1985. The program has never been evaluated. Crucial questions such as those about the extent of commercial successes from the contracts need to be answered. This summer we designed and implemented a performance evaluation survey instrument. The analysis of the data will take place in the fall.

3. **A Model for Evaluating Changes in Support for Science and Technology** At present several powerful forces are combining to change the environment for science and technology policy. The end of the cold war eliminated the rationale for federal support for many projects. The new- found Congressional conviction to balance the budget without tax increases combined with demographic changes which automatically increase spending for some politically popular programs will make it difficult to find funding for science and technology. Also, the two political parties have very different conceptions of the appropriate future for research and development spending. All these changes create the potential for serious, perhaps unintended, consequences for the economic future of the country. In a paper entitled, "A Conceptual Framework for Evaluating the Impact of Changes in Federal Support for Science and Technology," we introduce a model to evaluate the effects of changes in federal spending for science and technology. This paper both provides a way of organizing informed discussions and points out important research topics for science and technology policy.

Evaluation of Teacher Enhancement Institute 1995

omit

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During the summer of 1995, I was the evaluator for the NASA Teacher Enhancement Institute. This program involved three cohorts of teachers. Each group of teachers attended a two week session at NASA Langley. As part of the evaluation, each group of teachers was asked to respond to several questions prior to their participation in TEI activities. These same questions were asked again at the conclusion of the two weeks of activities. Also, the participants were asked to give their opinion on the value of several aspects of the Institute.

My responsibilities included the design and administration of the evaluation instruments, the coding and statistical analyses of the data generated for the evaluation, and the preparation of a final report summarizing the results. Additionally, feedback was supplied to the TEI faculty at the conclusion of each two week session.

S6-18
ABS. ONLY

NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

8746
P-1

HAN P. BAO
OLD DOMINION UNIVERSITY

RISKS AND RELIABILIBITY OF MANUFACTURING PROCESSES AS RELATED TO COMPOSITE MATERIALS FOR SPACECRAFT STRUCTURES

ABSTRACT

Fabricating primary aircraft and spacecraft structures using advanced composite materials entail both benefits and risks. The benefits come from much improved strength-to-weight ratios and stiffness-to-weigth ratios, potential for less part count, ability to tailor properties, chemical and solvent resistance, and superior thermal properties. On the other hand, the risks involved include high material costs, lack of processing experience, expensive labor, poor reproducibility, high toxicity for some composites, and a variety of space induced risks.

The purpose of this project is to generate a manufacturing database for a selected number of materials with potential for space applications, and to rely on this database to develop quantitative approaches to screen candidate materials and processes for space applications on the basis of their manufacturing risks including costs.

So far, the following materials have been included in the database : epoxies, polycyanates, bismalemides, PMR-15, polyphenylene sulfides, polyetherimides, polyetheretherketone, and aluminum lithium. The first four materials are thermoset composites; the next three are thermoplastic composites, and the last one is is a metal.

The emphasis of this database is on factors affecting manufacturing such as cost of raw material, handling aspects which include working life and shelf life of resins, process temperature, chemical/solvent resistance, moisture resistance, damage tolerance, toxicity, outgassing, thermal cycling, and void content, nature or type of process, associate tooling, and in-process quality assurance. Based on industry experience and published literature, a relative ranking was established for each of the factors affecting manufacturing as listed above.

Potential applications of this database include the determination of a delta cost factor for specific structures with a given process plan and a general methodology to screen materials and processes for incorporation into the current conceptual design optimization of future spacecrafts as being coordinated by the Vehicle Analysis Branch where this research is being conducted.

August 11, 1995
NASA Langley Research Center

1995 SUMMER TEACHER ENHANCEMENT INSTITUTE: CURRICULUM DESIGN, IMPLEMENTATION, AND EVALUATION

omit

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The 1995 Summer Teacher Enhancement Institute (TEI), in its second year, was designed to provide aeronautics experiences and instruction for elementary and middle school teachers so the teachers could use aeronautics to teach science and mathematics. Through an application process, 59 teachers were selected to participate in the Institute, representing seven states and the District of Columbia. Four faculty members worked as a team to design the curriculum, determine the schedule, and manage and evaluate the Institute.

The objectives of the Institute were (a) increase participant's content knowledge about aeronautics, science, mathematics and technology, (b) model and promote the use of scientific inquiry through problem based learning, (c) investigate the use of instructional technologies and their applications to curricula, and (d) encourage the dissemination of TEI experiences to colleagues, students and parents.

The Institute included presentations, tours and hands-on experiences. NASA scientists made presentations relating their area of research to elementary and middle school curricula, and tours of NASA facilities were taken to observe the scientific environment of aeronautics. Participants performed hands-on experiments dealing with aeronautics, experiments they could use in their classrooms; and one day was spent at a local airport learning about pilot training. Participants were given Spacelink accounts, so they could communicate through e-mail and explore the resources on the Internet.

Authentic assessment instruments were used to assess participant understanding and implementation of their experiences. Assessment included the design and presentation of lesson plans that incorporated aeronautics and problem based learning, portfolios for aeronautics, and the development and classroom implementation of a unit on aeronautics. Follow-up of the participants' implementation of aeronautics and problem based learning will continue through the 1995-1996 school year through three means: e-mail communication between participants and each other and TEI faculty members, classroom observations, and presentations of unit plans at three follow-up sessions scheduled during the year.

Instruments to evaluate the Institute were designed by the TEI faculty and consisted of pre- and posttests of confidence and knowledge of aeronautics. Preliminary results indicate increases in participants' confidence in their ability to teach science and mathematics using aeronautics, problem based learning, and technology.

Evaluation and Modification of HSCT Landing Gear

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Norfolk, VA 23529

S7-05
ABS. ONLY
8747
P-1

The primary objective of the research project conducted this summer is to analyze and assess the strut of the High Speed Civil Transport (HSCT) Ref-H Cycle 1 landing gear. In addition, the tire model is to be added to the strut to simulate the performance of the landing gear more accurately.

The HSCT Ref-H Cycle 1 simulation data base model is a part (subroutine) of a general code that simulates the flight of the HSCT. The HSCT Ref-H Cycle 1 landing gear analyzes the dynamic behavior of the landing gear as a single strut. It excludes the tire and the fuselage. The model calculates the displacement and rate of change of the strut as well as the velocity longitudinal and lateral directions. The rolling, side plane, and braking friction are included in the code. The forces and moments produced by the strut onto the fuselage are computed and then returned to the main code.

The HSCT Ref-H Cycle 1 landing gear is derived from a generic landing gear model developed by Boeing Commercial Aircraft Group (BCAG). Braking characteristics, squat switch logic, wheel spin-up friction, and nose wheel steering are the user selectable values.

The software included in the report was scanned and then converted into an ASCII file. The compilation errors were removed and the evaluation was conducted with a careful examination of the equations. The results were compared to the HSR Cycle 1 Standalone Gear Model Package written by Michael Madden. Most of the errors and discrepancies that were obtained agreed with those documented by Michael Madden except for the rate of compression of the strut.

The second phase of the report dealt with the addition of the tire model to the landing gear. The strut is modeled as a nonlinear spring with respect to the displacement, a nonlinear damper with respect to the displacement and velocity, and linear coulomb damper with respect to the velocity. The tire is modeled as a nonlinear spring with respect to displacement and a linear damper with respect to the velocity. When these two models are coupled, two ordinary non-linear differential equations are formed where the values of the components characteristics are documented in look up tables. These equations can be solved using a numerical method scheme such as Runge-Kutta's method. Subroutine DDRIV2 shown in appendix B is used to integrate the equations.

S8-35
MOS. ONLY
8748
p.1

USE OF THE QUARTZ CRYSTAL MICROBALANCE TO DETERMINE THE MONOMERIC FRICTION COEFFICIENT OF POLYIMIDES

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When a thin film of polymer is coated on to a quartz crystal microbalance (QCM), the QCM can be used to detect the rate of increase in weight of the polymer film as the volatile penetrant diffuses into the polymer. From this rate information the diffusion coefficient of the penetrant into the polymer can be computed. Calculations requiring this diffusion coefficient lead to values which approximate the monomeric friction coefficient of the polymer.

This project has been concerned with the trial of crystal oscillating circuits suitable for driving polymer coated crystals in an atmosphere of penetrant. For these studies done at room temperature, natural rubber was used as an easily applied polymer that is readily penetrated by toluene vapors, qualities anticipated with polyimides when they are tested at T_g in the presence of toluene. Three quartz crystal oscillator circuits were tested. The simplest circuit used $\pm$ 5 volt dc. current and had a transistor to transistor logic (TTL) inverter chip that provides a 180° phase shift via a feed back loop. This oscillator circuit was stable but would not drive the crystal when the crystal was coated with polymer and subjected to toluene vapors. Removal of a variable resistor from this circuit increased stability but did not otherwise increase performance. Another driver circuit tested contained a two stage differential input, differential output, wide band video amplifier and also contain a feed back loop. The circuit voltage could not be varied and operated at $\pm$ 5 volts dc.; this circuit was also stable but failed to oscillate the polymer coated crystal in an atmosphere saturated with toluene vapors. The third oscillator circuit was of similar construction and relied on the same video amplifier but allowed operation with variable voltage. This circuit would drive the crystal when the crystal was submerged in liquid toluene and when the crystal was coated with polymer and immersed in toluene vapors. The frequency readings obtained when using this oscillating circuit are highly variable. This circuit requires further modification to stabilize frequency readings before its use in studies to determine the diffusion coefficient of penetrant molecules into a polymer film coated on a QCM.

S9-64
ABS ONLY
8749
p. 1

Analysis of Uncertainty in Force Balance Calibration

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In order to reduce errors encountered in the measurement and identification of loads using force balances, a third-order forward polynomial relation between loads and output voltages is proposed. This full third-order model represents an alternative to the second-order model currently in use at NASA Langley Research Center (LaRC) and many other installations worldwide. The new model requires the identification of 84 coefficients (including the 28 used presently) for each of the six outputs. The existing LaRC calibration loading sequence is insufficient for identification of many of these 504 coefficients because critical three-load combinations are absent. Accordingly, a new loading sequence that permits the identification of all 504 coefficients has been developed and is described fully. It is apparent from numerical tests that the new third-order model is clearly superior to second-order models in the presence of small amounts of random measurement noise, assuming that there are indeed higher-order interactions between loads. As the amount of noise increases, however, a third-order model becomes less attractive due to its ability to match the noise itself more faithfully than a second-order model. Numerical results suggest that the transition occurs when the magnitude of random noise becomes of the same order as that of the physical higher-order interactions.

510-08
ABS. ONLY
8750

Electromagnetic Compatibility and the All-Electric Airplane

P-1

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NASA is studying the feasibility of installing "all-electric" controls in future commercial aircraft, replacing the current hydraulic and pneumatic systems. Planes utilizing such equipment should weigh less and be cheaper to maintain, but might also be susceptible to interference from undesired external electromagnetic fields. Possible sources of these extraneous signals include radio and television broadcasters, two-way communications stations, and radar installations of all kinds.

One way to reduce the hazard would be to use fiber-optic cables to carry signals from the cockpit to the various points of use, a concept known as "fly-by-light" or FBL. However, electrical circuits (PBW, or "power-by-wire") would still be required at both ends of the cables to perform control functions, so the possibility of harmful interference would remain.

Computer models for two different antennas were created in order to find the magnitude of the electric fields which would be generated in the airspace around them while in the transmit mode. The first antenna was a horizontal "rhombic" used by the Voice of America (VOA) for long-distance short-wave broadcasting. The second antenna was a multi-element "log-periodic dipole array" (LPDA) of a type often used for two-way radio communications. For each case, a specified amount of power was applied in the computer model, and the resulting electric field intensity was predicted at a variety of locations surrounding the antenna. This information will then be used to calculate the levels of interference which could occur inside an airplane flying in the vicinity of these radiation emitters.

S11-34
ABS. ONLY
8751
P-1

Modeling and Simulation of a Turbulent Far Wake

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Work continued on two projects which had been started during previous years. Both projects involve calculations of the subsonic, turbulent far wake of a two-dimensional object at a Reynolds number of 1000 (based on wake momentum thickness). 1. This flow was used as a test case for direct comparison of various turbulence models. 2. Direct numerical simulations (DNS) of this flow were undertaken. These efforts are discussed in more detail below:

In the turbulence model comparison studies, for any particular model tested, a unique self-similar solution was obtained far enough downstream, regardless of inlet conditions. Furthermore, different turbulence models led to different far-wake equilibrium solutions. No turbulence model could correctly predict *all* features of the turbulent far wake. For example, the spreading rate and turbulent shear stresses were underpredicted by all the standard models (both two-equation and full Reynolds stress models). In cases where a more correct spreading rate was achieved, it was at the expense of the turbulent kinetic energy, which was overpredicted. In general, the Algebraic Dissipation Rate Model of Gatski and Speziale, 1992, when added to any of the standard models, improved the results dramatically. Also, full Reynolds stress closure models did a much better job at predicting the shapes of both the mean and turbulence profiles, but the spreading rate was not significantly improved over that predicted by the simpler two-equation models. There are two main conclusions from these studies: First, in a comparison such as this, it is not enough to compare just one parameter, like the spreading rate. A good prediction for one parameter does not necessarily imply good predictions for *all* parameters in a flow! Second, since no turbulence model could correctly predict the turbulent far wake, much of the important physics of turbulent free shear flows is apparently lost by the assumptions inherent in today's methods of turbulence modeling; turbulence models must be improved.

Direct simulations of this flow were begun last year in order to provide a data base through which some of the deficiencies of the existing turbulence models could be identified. Quantities such as the pressure-strain correlation, turbulent diffusion, and the dissipation rate tensor can be easily calculated from the DNS results, whereas these quantities are nearly impossible to measure experimentally. Improvements to existing turbulence models (and development of new models) require knowledge about flow quantities such as these. During this summer, diagnostics codes were written which will calculate the parameters mentioned above, along with other single-point and multi-point statistics. The DNS calculations are still in progress at the time of this writing. When these calculations are complete, the diagnostics codes will be applied so that the results can aid turbulence modelers. In addition, the results will show whether or not there exists a *universal* equilibrium turbulent far wake, independent of initial conditions.

omT

Universal Human Systems: Organizational Development Technology

Linda W. Deans, Ph.D.
George Washington University

As a multi-disciplined team, the Employee Development Branch commits its energy and ideas to realizing a shared purpose by drawing upon individual strengths and team synergy. The Branch is seeking strategies by which to foster a climate that supports and enhances pen and full communication among members and their customers. Processes are designed and continuously evaluated to exceed customer expectations. Additionally, world-class facilities and state-of-the-art equipment are used to produce high quality products. However, Branch "technology" remains an area where considerable effort is required in order to meet the objectives and needs of both members and customers.

Typically, an organization's technology is represented by written "documentation" concerning the nature of work, how it is performed, and its value to the organization. In some instances, the technology may be as simple as an office aid or"standard operating procedure." In other cases, the documentation may be very complex in its description, incorporation of statutory requirements, or reference to other programmatic initiatives. In its purest form, technology is created by the organization as its contribution to a well defined body of knowledge or the work of the larger organization. During this work assignment, the primary task was to assist in the identification of priorities for developing Branch technology, designing the format for technology production, and implementing a comprehensive strategy intended to gather the data appropriate for inclusion in the final product.

S12-63
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8752
p-1

Viscous Aerodynamic Design using the Adjoint Variable Approach

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The use of classical optimal control methods, in particular variational methods, to solve the airfoil optimization problem, by deriving a set of adjoint (costate) equations and boundary conditions has already been done for inviscid (potential and Euler flows) and two dimensional, steady state, incompressible flow governed by the Navier-Stokes equations.

The interior and boundary terms of the volume integral have been derived (in this work) for the steady Navier-Stokes equations in three dimensions for a viscous, compressible heat conducting fluid. This can be used to derive the adjoint equations and numerical boundary conditions for general classes of problems and hence paves the way for a solution to the aerodynamic optimization problem for compressible viscous flows.

The next steps to the realization of that goal are projected as below. The usual square integral pressure functional as an objective function is being replaced by a more realistic drag functional subject to a lift constraint.The feasibility of attempting the more difficult time dependent problem is being investigated. It remains to get the full system of adjoint equations and boundary conditions with the new functional. The state and adjoint equations must be discretized and coded. An appropriate optimization program must be used (steepest descents seems inadequate) and various known airfoil shapes should be recovered in test cases of the computer program.

S13-24
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8753
P-1

Micro-mechanics of Micro-composites

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The Structural Dynamics branch at NASA LaRC is working on developing an active passive mount system for vibration control. Toward this end a system utilizing piezoelectric actuators is currently being utilized. There are limitations to the current system related to space applications under which it is desired to eliminate deformations in the actuators associated with thermal effects. In addition, a material that is readily formable into complex shapes and whose mechanical properties can be optimized with regards to vibration control would be highly desirable. Microcomposite material are currently under study to service these needs. Micro-composite materials are essentially materials in which particles on the scale of microns are bound together with a polyimide (LaRC Si) that has been developed at LaRC. In particular a micro-composite consisting of LaRC Si binder and piezoelectric ceramic particles shows promise in satisfying the needs of the active passive mount project. The LaRC/ Si microcomposite has a unique combination of piezoelectric properties combined with a near zero coefficient of thermal expansion and easy machinability.

The goal of this ASEE project is to develop techniques to analytically determine important material properties necessary to characterize the dynamic properties of actuators and mounts made from the LaRC Si / ceramic microcomposite. In particular, a generalized method of cells micromechanics originally developed at NASA Lewis is employed to analyze the microstructural geometry of the microcomposites and predict the overall mechanical properties of the material. A testing program has been established to evaluate and refine the GMC approach to these materials. In addition, a theory of mixtures analysis is being developed that utilizes the GMC micromechanics information to analyze complex behavior of the microcomposite material which has a near zero CTE.

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EXCURSIONS IN TECHNOLOGY POLICY

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All of my projects were executed jointly with my colleague Dr. Robert Archibald. There were three distinct projects:

1. **Measuring Economic Benefits** The mission of the Technology Applications Group (TAG) at NASA Langley Research Center is to assist firms interested in commercializing technologies. TAG is a relatively new group as is the emphasis on technology commercialization for NASA. One problem faced by TAG and similar groups at other centers is measuring their effectiveness. The first project this summer, a paper entitled, "Measuring the Economic Benefits of Technology Transfer from a National Laboratory: A Primer," focused on this measurement problem. We found that the existing studies of the impact of technology transfer on the economy were conceptually flawed. The "primer" outlines the appropriate theoretical framework for measuring the economic benefits of technology transfer.

2. **Evaluating the SBIR Program** One of the programs of TAG is the Small Business Innovation Research (SBIR) program. This program has led to over 400 contracts with Small Business since its inception in 1985. The program has never been evaluated. Crucial questions such as those about the extent of commercial successes from the contracts need to be answered. This summer we designed and implemented a performance evaluation survey instrument. The analysis of the data will take place in the fall.

3. **A Model for Evaluating Changes in Support for Science and Technology** At present several powerful forces are combining to change the environment for science and technology policy. The end of the cold war eliminated the rationale for federal support for many projects. The new-found Congressional conviction to balance the budget without tax increases combined with demographic changes which automatically increase spending for some politically popular programs will make it difficult to find funding for science and technology. Also, the two political parties have very different conceptions of the appropriate future for research and development spending. All these changes create the potential for serious, perhaps unintended, consequences for the economic future of the country. In a paper entitled, "A Conceptual Framework for Evaluating the Impact of Changes in Federal Support for Science and Technology," we introduce a model to evaluate the effects of changes in federal spending for science and technology. This paper both provides a way of organizing informed discussions and points out important research topics for science and technology policy.

S14-37
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8754
P-1

Computational Study of Inlet Injection for a Pre-Mixed, Shock-Induced Combustion (PM/SIC) Engine

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A computational simulation of reacting 2-D and 3-D flowfields in a model inlet section of a Pre-Mixed, Shock-Induced Combustion (PM/SIC) engine concept was performed. LARCK, a multi-dimensional Navier-Stokes code with finite-rate kinetics chemistry developed at NASA LaRC by J.A. White, was adapted for this simulation. The flow conditions in the simulation match those envisioned for the PM/SIC engine experiments currently planned at LaRC. The reacting flowfields were Mach 6.3 freestream air and Mach 2 hydrogen at various pressure and temperature conditions injected through a slot injector at the base of the inlet section.

In the PM/SIC engine, fuel is injected at the inlet section upstream of the combustor, and reaction is initiated by the shock wave at the inlet which increases the gas temperature and pressure beyond the kinetic limits for reaction. Many challenges exist prior to establishing shock-controlled combustion as a practical engine concept. These challenges include fuel injection schemes that can provide proper fuel-air mixing without creating large losses in the inlet section, and control of the combustion process so that early ignition or combustion propagation through the inlet boundary layer does not occur.

For this project, a parametrics study was carried out to model the fuel injection of hydrogen at different flow conditions. It was found that, as the fuel temperature and pressure were increased, the potential for pre-ignition was high at a short distance downstream of the slot injector.

The next stage of this work will investigate injection techniques for enhancing mixing of fuel and air in a manner that prevents or reduces the potential for premature ignition observed numerically.

DISSIPATIVE RENDERING AND NEURAL NETWORK CONTROL SYSTEM DESIGN

515-63
ABS. ONLY
8755
P-1

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Model-based control system designs are limited by the accuracy of the models of the plant, plant uncertainty, and exogenous signals. Although better models can be obtained with system identification, the models and control designs still have limitations. One approach to reduce the dependency on particular models is to design a set of compensators that will guarantee robust stability to a set of plants. Optimization over the compensator parameters can then be used to get the desired performance. Conservativeness of this approach can be reduced by integrating fundamental properties of the plant models. This is the approach of dissipative control design.

Dissipative control designs are based on several variations of the Passivity Theorem, which have been proven for nonlinear/linear and continuous-time/discrete-time systems. These theorems depend not on a specific model of a plant, but on its general dissipative properties. Dissipative control design has found wide applicability in flexible space structures and robotic systems that can be configured to be dissipative. Currently, there is ongoing research to improve the performance of dissipative control designs.

For aircraft systems that are not dissipative active control may be used to make them dissipative and then a dissipative control design technique can be used. It is also possible that rendering a system dissipative and dissipative control design may be combined into one step. Furthermore, the transformation of a non-dissipative system to dissipative can be done robustly. One sequential design procedure for finite dimensional linear time-invariant systems has been developed.

For nonlinear plants that cannot be controlled adequately with a single linear controller, model-based techniques have additional problems. Nonlinear system identification is still a research topic. Lacking analytical models for model-based design, artificial neural network algorithms have recently received considerable attention. Using their universal approximation property, neural networks have been introduced into nonlinear control designs in several ways. Unfortunately, little work has appeared that analyzes neural network control systems and establishes margins for stability and performance. One approach for this analysis is to set up neural network control systems in the framework presented above. For example, one neural network could be used to render a system to be dissipative, a second strictly dissipative neural network controller could be used to guarantee robust stability.

OMIT

David J. Gosselin

Abstract

Was assigned to a NASA Headquarters project through Joseph Struhar, the Comptroller at NASA Langley, Virginia. The project is part of the restructuring of how NASA as a government agency is operated, both from a financial and management perspective.

The project involves devising and implementing a full-costing system within NASA. Our piece involved describing the concept, defining the terms and their meanings and how the full-costing methodology will affect NASA as an organization. My part involved writing the concept paper, doing research in the area of full costing, describing current industry practice and keeping the focus in tune with current accounting and management theory.

This project will continue into the future, as it will not be an easy task to implement. My involvement will continue as an academic advisor.

An Evaluation of HPCC-IITA K-12 Technology Projects at 7 Field Centers

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Seven NASA field centers underwent a significant evaluation of their IITA K-12 Technology Projects to meet a three-year milestone. Assistance was provided to each center to develop an indicator plan that is being synthesized into an overall report assessing the national and local impact of the entire program. The indicator system includes an analysis of the project from inputs, process and outcome measures.

The report is organized around NASA's five categories of educational activity: Educational Technology, Teacher Enhancement, Curriculum Support, Student Support, and Systemic Change/Collaboration. Data on twenty-seven projects across the seven centers were gathered to be included in the final report. Baseline data regarding the number of schools, teachers, and students in the United States will be used as one overall benchmark for comparison. Currently there are 83,425 schools, 2.5 million teachers, and 43.5 million students in the United States.

Also being established is a summary of the existence and access to technology in the schools. From the Office of Technology Assessment Report (1995), nine percent of the schools have access, but only three percent use on-line database Internet.

While the final analysis has not yet been completed, it is evident that NASA has made a dramatic contribution, both in terms of depth as well as breadth of impact. These projects not only provide computer technology and administrative support, but also training on effective use of this technology by teachers and students.

Some of the most significant projects include enabling students to remotely "look through" and operate telescopes; enabling students to relate theory to real world missions through simulations; connecting teachers and students to NASA scientists and engineers to answer pressing questions they may encounter in their classroom; providing a quick search tool for references on the World Wide Web, without having to spend hours 'surfing the net'; teaching teachers about the real educational value of internet as well as providing them with efficient strategies for accessing relevant information; and, providing year long support for those teachers to be ambassadors back at their school. These are just a few highlights of the projects that are underway that will be analyzed as part of the final evaluation report.

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P-1

Three Two-Week Enhancement Institutes: Design and Implementation of the Technology and Telecomputing Component

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The Teacher Enhancement Institute (TEI), under the direction of the Center Education Programs Officer offered three two-week workshops to 58 elementary and middle school teachers in science, math, and technology using the Problem Based Learning Model. The 1995 program was designed with input from evaluations and recommendations from previous TEI participants and faculty. The TEI focused on Aviation and Aeronautics as the unifying theme. Four ASEE Fellows worked together to develop each two-week session.

Participants in the 1995 Teacher Enhancement Institute represented school systems where income levels are low, where the use of technology is limited, and student served tend to lack exposure to innovative instruction in mathematics and science. Seven states were represented which include Virginia, Kentucky, North Carolina, South Carolina, West Virginia, Maryland, and Utah. Washington, DC was also represented.

Four specific objectives were developed. After completing the requirements for the TEI, the participants should be able to: (1) Increase their content knowledge, particularly in aeronautics, science, math, and technology. (2) Design and implement lessons that use scientific inquiry through Problem Based Learning. (3) Demonstrate knowledge of instructional technologies, their uses, and applications to curricula. (4) Disseminate to their school communities the information acquired through the TEI.

Thirty percent of the program was devoted to the effective use of computer technology. Prior to the start of the program, participants were surveyed as to their experience and skill level with personal computers, software, and telecommunications. The survey results revealed that approximately 25% of the participants had **no** experience with computers, less than 20% indicated they were proficient, while the remaining 55% had some limited experience. Only 20% had used E-mail and fewer than 5% had used the World Wide Web.

The computing component, interwoven throughout the program activities, was designed to assist participants in developing technology rich skills. Survey results guided the methodology used which emphasized the use of the computer as a tool for collegial interaction and scholarly research. This practical, applications approach enabled participants, with varying skill levels, to learn at their own pace and provided individual attention when needed.

SpaceLink, the NASA telecomputing service for educators, was the primary tool used in the technology component of the institute. The training focused on the use of SpaceLink and its many educational services, and Internet tools because of its universal, nongraphical link to any computer platform the participant may use at his or her school or home. All participants were given Educator Accounts to facilitate the use of E-mail, and access to the Internet and the World Wide Web using their SpaceLink accounts.

Classroom demonstrations used videotaped guides and handouts to support concepts presented followed by intensive hands-on activities. Each participant was assigned to an individual Power Mac networked workstation and introduced to the state of the art, graphical, Word Wide Web with the Netscape browser.

The methodology proved very effective in reaching the program's goals for technology integration by having the participants learn to use the computer as a tool for communication and research rather than teaching the use of any particular software application alone. However, because of the skill level of the majority of the participants, more hands-on computer time is recommended for future Teacher Enhancement Institutes.

"Where Am I" - Determining the Attitude of Spacecraft Parts

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S7-18
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8757
P-1

In the preliminary design of spacecraft, spreadsheets are often used to scale and size components. While offering some benefits, using spreadsheets does have some drawbacks. In particular, since time is typically not one of the input values, overly conservative designs can results because scheduling issues are not considered. To overcome this problem, the Space Systems Concepts Division is developing a time dependent, virtual spacecraft simulation system.

Since the performance of many components on the spacecraft are sensitive to the attitude of the spacecraft, a method or function is needed to determine the attitude of a part. Thus, the primary goal of this research was to develop a software module that calculates the attitude of an arbitrary part on the spacecraft. This module is then used by subsystem engineers, e.g. the power subsystem, to compute the attitude relative to the spacecraft, the sun, the Earth, or a user specified target.

S18-27
ABS. ONLY
8758
P-1

A POLYIMIDE MOLECULAR COMPOSITE

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A polyimide is a hard and sturdy thermoplastic made from the combination of tetracarboxylic dianhydrides and diamines in a polar aprotic solvent.

A series of polyimide blends comprising of a tough moldable, wholly aromatic polyimide and a highly crystalline rigid polyimide were prepared. The flexible polyimide was based on LaRC-SI with a 2% offset, and the rigid polyimide as based on para-phenylenediamine and biphenyltetracarboxylic dianhydride encapped with pthalic anhydride. The polyimide blends were cast as films and cured at 100, 200, and 300° C in air. These films were characterized by finding their glass-transition temperature, melting temperature, coefficient of thermal expansion, tensile modulus, tensile strength, and percent elongation. These characterizations found out which polyimide blend had exceptional mechanical and thermal properties.

Results showed the following:

- A blend with increasing amounts of flexible polyimide produced a better film.
- A blend with increasing amounts of rigid polyimide produced a brittle film.
- LaRC-SI (2% offset) tended to phase separate during film casting.
- Most of the films produced were brittle.
- There was an inability to obtain mechanical and thermal properties due to having brittle film.

These conclusions demonstrate the difficulty in producing a polyimide blend comprising two physically distinct polyimides. Combining a polyimide with a poly(amic acid) thermosett could be the next phase of research in polyimide synthesis.

Analytical Studies of Hypersonic Viscous Dissociated Flows

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S19-34
NGS ONLY
8759
P-1

This project primarily dealt with integral boundary-layer solution techniques that are directly applicable to the problem of determining aerodynamic heating rates of hypersonic vehicles like X-33 in the vicinity of stagnation points, windward centerlines, and swept-wing leading edges. The analyses include effects of finite-rate gas chemistry across the boundary layer and finite-rate catalysis of atom recombination at the surface. A new approach for combining the insight afforded by integral boundary-layer analysis with comprehensive (and expensive) computational fluid dynamic (CFD) flowfield solutions of the thin-layer Navier-Stokes equations was developed. The approach extracts CFD derived quantities at the wall and at the boundary layer edge for inclusion in a post-processing boundary-layer analysis. The post-processed data base allows a designer at a workstation to ask and answer the following questions: (1) How much does the heating change if one uses a thermal protection system ("TPS") with different catalytic properties than was used in the original CFD solution? (2) How does the heating change when one moves the interface of two different TPS materials with different catalytic efficiencies for the purpose of reducing vehicle weight and expense? The answer to the second question is particularly critical, because abrupt changes from low catalytic efficiency to high catalytic efficiency can lead to localized increase in heating which exceeds the usually conservative estimate provided by a fully catalytic wall assumption. Some examples of results obtained this summer were presented at the July 25 ASEE lecture to the Gas Dynamics Division.

A secondary issue that was addressed involves the prediction of heating levels in the vicinity of sharp corners that are transverse to or aligned with the flow. An example of the first case is heating at the edge of the COMET reentry module. An example of the second case is heating along the side edge of a deflected body flap on an SSV. The difficulty of putting grids in the vicinity of such corners with continuously varying metric coefficients causes problems in CFD predictions. A preliminary theory for prediction that says the heating at the corner is X percent of the heating N boundary-layer thicknesses inboard was developed. This will prove useful to analytically evaluate the possible benefits of rounding the edges of these configurations and defining how much rounding is sufficient.

S26-39
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P. 1

Working Toward a Three-Dimensional Fatigue Closure Model for Surface Cracks

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The first reliable elastic fracture mechanics solutions for a surface crack in a plate were obtained by Newman and Raju (1979). The authors, both from the Mechanics of Materials Branch at NASA-Langley, used a highly detailed finite element solution requiring substantial computational resources. Computers have since become more powerful and available; however, many important related problems remain "computationally expensive". The problem of three-dimensional fatigue crack growth taking into account plasticity-induced crack closure (Elber, 1970), is one such problem. It is the goal of this research to provide an efficient method to account for three-dimensional crack closure in fatigue.

Newman (1981) developed a two-dimensional plasticity-induced crack closure model for center cracked specimens. This model requires iterations to determine both the contact solution at each growth step and the extent of the plastic zone at the crack tip. A three-dimensional version of this model would require obtaining these nonlinear variables all along the crack front. This model must be efficient so that repeated calculations can be performed during crack growth simulations.

The highly versatile Line Spring Model (LSM) (Rice, 1972) with contact (Joseph and Erdogan, 1989, Cordes and Joseph, 1994), fatigue (Joseph and Erdogan, 1989) and plasticity (Lee and Parks, 1994) will form the basis of the closure model. There are several required additions to past work to address the three-dimensional crack closure problem. Initially, these additions will include (1) an improved LSM to more accurately obtain the crack opening displacement, stress intensity factors and elastic T-stress near the ends of the surface crack, (2) a method to determine the extent of the plastic zone all along the crack front, (3) a method to determine the contact zone given a perfectly plastic layer of material on the crack surfaces, (4) a method to determine the magnitude of the compressive contact stress, and (5) a way to implement the degree of constraint along the curved crack front.

During the summer ASEE program an enhanced LSM was developed. A method similar to that of "strip synthesis" first introduced by Fujimoto (1976) was used. Briefly, the crack opening displacements of "slices" of the surface crack in a direction parallel to the plate surface are considered in addition to the standard LSM approach that makes use of springs obtained from slices perpendicular to the plate surface. This enhancement is necessary so that an accurate three-dimensional representation of quantities such as contact zone size, plastic zone size, stress intensity factors, T-stress and crack opening displacement can be determined. By combining results of previous investigations with the LSM, the problem of three-dimensional crack closure will be addressed. In addition to a closure model, the enhanced LSM can be used for many other problems including interacting surface cracks and fatigue crack growth of a through crack with a curved crack front.

521-05
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On the Development of HSCT Tail Sizing Criteria Using Linear Matrix Inequalities

8761

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P-1

Abstract

This report presents the results of a study to extend existing HSCT tail sizing criteria using Linear Matrix Inequalities (LMI). In particular, the effect of feedback specifications, such as MIL STD 1797 Level I and II flying qualities requirements and of actuator amplitude and rate constraints on the maximum allowable cg travel for a given set of tail sizes is considered. Results comparing previously developed industry criteria and the LMI methodology on an HSCT concept airplane are presented.

S22-73
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P-1

Energy Measurement of Electron Beams by Compton Scattering

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A method has been proposed to utilize the well-known Compton scattering process as a tool to measure the centroid energy of a high energy electron beam at the 0.01% level. It is suggested to use the Compton scattering of an infrared laser off the electron beam, and then and to measure the energy of the scattered γ-rays very precisely using solid-state detectors. The technique proposed is applicable for electron beams with energies from 200 MeV to 16 GeV using presently available lasers. This technique was judged to be the most viable of all those proposed for beam energy measurements at the nearby Continuous Electron Beam Accelerator Facility (CEBAF).

Plans for a prototype test of the technique are underway, where the main issues are the possible photon backgrounds associated with an electron accelerator and the electron and laser beam stabilities and diagnostics. The bulk of my ASEE summer research has been spent utilizing the expertise of the staff at the Aerospace Electronics Systems Division at LaRC to assist in the design of the test. Investigations were made regarding window and mirror transmission and radiation damage issues, remote movement of elements in ultra-high vacuum conditions, etc. The prototype test of the proposed laser backscattering method is planned for this December.

Actuator Placement for Active Sound and Vibration Control of Cylinders

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S23-71
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P-1

Abstract. Active structural acoustic control is a method in which the control inputs (used to reduce interior noise) are applied directly to a vibrating structural acoustic system. The control concept modelled in this work is the application of in-plane force inputs to piezoceramic patches bonded to the wall of a vibrating cylinder. The cylinder is excited by an exterior noise source–an acoustic monopole–located near the outside of the cylinder wall. The goal is to determine the force inputs and sites for the piezoelectric actuators so that (1) the interior noise is effectively damped; (2) the level of vibration of the cylinder shell is not increased; and (3) the power requirements needed to drive the actuators are not excessive. We studied external monopole excitations at two frequencies. A cylinder resonance of 100 Hz, where the interior acoustic field is driven in multiple, off-resonance cylinder cavity modes, and a cylinder resonance of 200 Hz characterized by both near and off-resonance cylinder vibration modes which couple effectively with a single, dominant, low-order acoustic cavity mode at resonance. Previous work has focused almost exclusively on meeting objective (1) and solving a complex least-squares problem to arrive at an optimal force vector for a given set of actuator sites. In addition, it has been noted that when the cavity mode couples with cylinder vibration modes (our 200 Hz case) control spillover may occur in higher order cylinder shell vibrational modes.

To model objective (1) a p by k complex transfer matrix H is calculated, either experimentally or with a mathematical model, in which each entry of H gives the contribution of each of the k actuators sites to interior noise reduction at each of the p error microphone locations, whenever a unit amplitude input is applied to actuator site k. Objective (2) requires more information. A pair of complex three dimensional matrices of shell displacement modal coefficients, W^s_{jmn} and W^c_{jmn}, (one to account for the coupling with the sine functions and the other for the cosine functions) can be calculated, either experimentally or with a mathematical model. Each entry of the matrices gives the displacement coefficient produced by a unit amplitude input at actuator site j for mode m, n. These two matrices are then used to compute the vibration levels of the cylinder shell at all modes for any combination of the j actuator sites for a given force input. Lastly, since power is directly related to the magnitude of the force inputs required, objective (3) can be measured by considering either the the Euclidean or max norm of the actuator force input vector.

How to determine the best set of actuator sites to meet objectives (1)–(3) is the main contribution of our research effort. The selection of the best set of actuator sites from a set of potential sites is done via two metaheuristics—simulated annealing and tabu search. Each of these metaheuristics partitions the set of potential actuator sites into two disjoint sets: those that are selected to control the noise (on) and those that are not (off). Next, each metaheurstic attempts to improve this initial solution by calculating the change in the objective value when one selected actuator site is turned off and one actuator site that previously was not selected is turned on. All such pairwise exchanges are performed and the exchange that improves the objective the most is made. Eventually the search is unable to improve the objective value and a local optimum (with respect to pairwise exchanges) is reached. Both simulated annealing and tabu search provide mechanisms to escape local optima and allow the search to continue until (hopefully) a global optimum is found.

Our experiments with the 100 Hz and 200 Hz cases confirm that both metaheuristics are able to uncover better solutions than those selected based upon engineering judgement alone. In addition, the high quality solutions generated by these metaheuristics, when minimizing interior noise, do not further excite the cylinder shell. Thus, we are able to meet objective (2) without imposing an additional constraint or forming a multi-objective performance measure. An additional observation is that in many cases the amplitude and phase values for several chosen actuator sites were nearly identical. This natural grouping means that fewer control channels are needed and the resulting control system is simpler. Currently no power requirements have been set, so objective (3) cannot be addressed. A set of experiments is planned with a laboratory test article (a cylinder). For these experiments the transfer matrices will be generated experimentally. It is hoped that the predicted performance of the best actuator sites found by our metaheuristics will correlate well with the measured performance.

S24-46
87-4
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p-2

STUDY OF THE ROTATIONAL - LEVEL AND TEMPERATURE DEPENDENCE OF THE QUENCHING RATE OF OH FLUORESCENCE DUE TO COLLISIONS WITH WATER MOLECULES

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The importance of the OH radical as an intermediate in many combustion reactions and in atmospheric photochemistry has led many researchers to use it as a diagnostic tool in these processes. The amount of data that has been acquired over the years for this radical is quite considerable. However, the quenching rate of OH with water molecules as a function of temperature and the rotational level of the excited state is not very well understood. The motivation of the studies undertaken is really to bridge the gap between the low temperature measurements and the high temperature ones reported in the literature. The technique generally employed in these diagnostics is laser-induced fluorescence (LIF), through which rotational state selective excitation of the radical is possible. Furthermore, in a combustion medium, water is produced in abundance so that knowledge of the quenching rate of OH due to water molecules plays a crucial role in interpreting the data.

In general, the precursor to an understanding of the collisional quenching rates of OH involves a characterization of the mode in which the radical is produced; the resulting rotational and translational distribution, followed by a measurement of the OH temperature; and ultimately obtaining the rate constants from the pressure dependence of the fluorescence signal. The experimental implementation of these measurements, therefore involved, as a first step, the production of the OH radicals in a microwave discharge cell using water vapor as the source, wherein a hydrogen atom is abstracted from H_2O as follows:

1. $H_2O\ (g) + h\upsilon_{microwave} \longrightarrow H + OH\ (X\ ^2\Pi_i,\ v^{11} = 0)$

The second step involved the absorption of photons from the frequency - doubled output of a pulsed - amplified, single - frequency cw ring dye laser. The output of this laser system near 308 nm was then tuned across the rotational (Q_1 (3)) electronic transition of the $X\ ^2\Pi_i\ (v^{11} = 0) \longrightarrow A\ ^2\Sigma^+\ (v^1=0)$ system of OH:

2. $OH\ (X\ ^2\Pi_i,\ v^{11} = 0) + h\upsilon_{LASER} \longrightarrow OH(A\ ^2\Sigma^+,\ v^1 = 0)$

The excited OH then re-emits the absorbed photons after a finite lifetime in this state. Thus the fluorescence from this level was observed as per equation 3:

3. $OH\ (A^2\Sigma^+, v^1 = 0) \xrightarrow{k_f = 1/\tau} OH\ (X\ ^2\Pi_i, v^{11} = 0) + h\upsilon_{Flourescence.}$

The possibility of the collisional quenching of this fluorescence by water molecules is the main concern of this study:

4. $OH\ (A^2\Sigma^+, v^1 = 0) + M\ (H_2O) \xrightarrow{k_q}$ Quenching

Rotational state selective fluorescence excitation of the X $\longrightarrow$ A system of OH is possible in this experiment for the following reasons: The linewidth of the cw ring dye laser is <1 MHz; the linewidth after the pulsed dye amplification process has occurred is 100 MHz; the doubling process increases this linewidth to about 200 MHz. Now since the Doppler linewidth of the OH transitions at 300 K is about 0.1 cm^{-1} (3 GHz), it stands to reason that the laser linewidth is negligible compared to the absorption linewidth of the OH transitions. Therefore, by scanning the laser across the transition and observing the total fluorescence, the translational temperature in the region of interest in the discharge cell was obtained. Typically, a translational temperature of 800 K was obtained by tuning the laser system to the Q_1 (3) transition of OH. This temperature might be considered to be indicative of the bulk vapor temperature. Varying the microwave power from 30 to 70 Watts yielded information pertinent to the temperature dependence.

By tuning the laser to the peak of the transition and observing the fluorescence decay after the laser pulse, the lifetime of the OH in a particular rotational electronic state was determined (τ = 1.4 usecs for Q_1 (3)). Knowledge of this parameter led to a determination of the quenching rate.

By varying the water vapor pressure in the cell and measuring the lifetime as a function of pressure a linear plot of the quenching rate as a function of pressure was obtained. Using this plot, the quenching cross section was deduced. It has therefore, been possible to measure the local translational temperature and the quenching cross section with one laser system.

525-05
ABS ONLY
8765
p.1

EXPERIMENTAL TESTING USING A REMOTELY OPERATED FLAP WITH A 2D HIGH LIFT MODEL

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The problem of efficient wind tunnel testing for multi-element airfoils was first addressed by the author during a previous ASEE fellowship. A modern 3 element model with internal actuators to position a flap in two degrees of freedom was designed and later built. Some preliminary testing proved that the approach was viable. The purpose of this summer's work was to fully develop experimental methods including efficient data acquisition. The final goal is to develop dense data sets for both lift and drag measurements as a function of flap position for both take-off and landing configurations.

The model has a span of 36" and chord of 18" and is currently being fitted for a 3' x 4' low speed wind tunnel. The model and wind tunnel have previously been described in AIAA paper number 95-1784. The flap was reworked to allow all pressure taps to function after initial tests showed two blocked ports. The serial method of obtaining pressures from the surface taps was found to be exceedingly slow so a new method using 12 pressure transducers and a 12 port parallel scanning valve were developed. A new automated data acquisition and control algorithm was developed using LabView software and a PC platform. Flow 2-dimensionality is currently under investigation with boundary layer control by blowing; this was previously omitted for initial testing. By the end of the summer a detailed data set (uncorrected) consisting of lift coefficient versus flap position for the landing configuration should be available.

In the future I hope to continue with this project by first developing an automated method to measure drag. I would also like to fabricate brackets for the slat and flap in the take-off configuration and repeat the measurements for lift and drag. Ultimately the model is to used for flow on optimization methods. The ability to change geometry while the tunnel is running has obvious benefits. Restricting consideration to a single flap element with a fixed geometry main element (and fixed slat) there are four degrees of freedom involved. These are the angle of attack of the main element, the relative angle of attack of the flap, and the relative vertical and horizontal position of the flap. If a test matrix of 10 values for each parameter is considered , then 10,000 points are required ! In the case of high Reynolds number cryogenic or pressurized testing facilities, the time between test points can be on the order of hours due to required access and manual adjustments. Test engineers thus face the problem of choosing an extremely sparse test matrix , with the hope of finding the optimum geometry.

cmiT

ABSTRACT

Structured Mentoring: A Method for Training Electronic Packagers

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Industrial and governmental agencies are attempting to downsize by reducing the number of workers in their labor force. The lost of competent workers is detrimental to mentoring programs. Mentoring is one effective means of training new electronic packagers; however, the lack of documentation or structure among mentors makes it difficult to determine the effectiveness and efficiency of this training process. The objective of this research was to develop a modified structured mentoring program which will train more productive packaging personnel in less time. An additional purpose was to determine the maximum number of mentorees who could be effectively trained by one mentor during a given period of time. The relevant information for this research came from current literature and interviews with mentors. The findings of this study have enormous potential for co-op coordinators, personnel managers, engineers, research and development, education and industry. This structured mentoring approach will provide inexperienced electronic packagers a real world awareness of what is expected of them in the positions they are seeking. Since budget restraints at institutions or corporations demand accountability, training programs must be structured and measurable. If a new employee demonstrates that he or she can use a schematic to design a quality electronic package, then the agency can justify the price of training. A poorly designed package could lead to the malfunctioning of a piece of medical equipment or the failure of a multimillion dollar aircraft.

S26-02
ABS. ONLY
8766
P.1

Sensitivity Analysis in Multipole-Accelerated Panel Methods for Potential Flow

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In the design of an airframe, the effect of changing the geometry on resulting computations is necessary for design optimization. The geometry is defined in terms of a series of design variables, including design variables to define the wing planform, tail, canard, pylon, and nacelle. Design optimization in this research is based on how these design variable affect the potential flow. The potential flow is computed as a function of the geometry and location of a series of panels describing the airframe, which are in turn a function of the design variables. Multipole accelerated panel methods improve the computational complexity of the problem and thus are an attractive approach. To utilize the methods in design optimization, it was necessary to define the appropriate sensitivity derivatives. The overhead incurred from finding the sensitivity derivatives in conjunction with the original computation should be small. This research developed the background for multipole-accelerated panel methods and the framework for finding sensitivity derivatives in the methods.

Potential flow panel codes are commonly used for powered-lift aerodynamic predictions for three dimensional geometries. Given an airframe which has been discretized into a series of panels to define the airframe geometry, potential is computed as a function of the influence of all panels on all other panels. This is a computationally intensive problem for which efficient solutions are desired to improve the computational time and to allow greater resolution by use of more panels. One such solution is the use of hierarchical multipole methods which entail approximations of the effects of far-field terms.

Hierarchical multipole methods have become prevalent in molecular dynamics and gravitational physics, and have been introduced into the fields of capacitance calculations, computational fluid dynamics, and electromagnetics. The methods utilize multipole expansions to describe the effect of bodies (i.e. particles, astrophysical bodies, panels, etc.) within a sphere on points distant from the sphere, where the influence diminishes as a function of distance. The expansions are exact with infinite series, however, for practical computations, the series are truncated and accuracy is selected based on the number of terms retained in the expansions. A hierarchical tree structure groups bodies together based on proximity to allow definition of multipole expansions for each group. The multipole expansions are then used to compute the effect of the bodies in a group on distant bodies.

Resolution of the Buoyancy in the 8-Foot High Temperature Tunnel Combustor

S27-09
MBS ONLY
8767
P-1

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ABSTRACT

Currently, the 8-Foot High Temperature Tunnel (8-Ft. HTT) combustor produces a good profile at only one point (2000 psia and 3650 °R with oxygen enrichment). Air is enriched with oxygen (liquid) so that the combustor product gas will contain the volumetric amount of oxygen normally found in air. The oxygen enriched air has a large fraction that is not reacted and flows through the outer periphery of the fuel injector. This ring of cold air in addition to the relatively cold walls of the combustor set up buoyancy forces that produce a segregation of relatively cool gases at the bottom of the combustor exit. The basic problem is to produce a test gas that has uniform properties at all combustor conditions. The combustor temperature may be as high as 3700 °R or as low as 2000 °R. Combustor pressures can be as high as 3500 psia (no oxygen enrichment) and as low as 600 psia. The segregation is most severe with oxygen enriched air, since its temperature is lower and its density is high. The combustor is lined with nickel 201 and can be operated at about 1600 °R maximum. A global mixing process is desired that produces an acceptable profile of temperature, species, and velocity at the exit of the combustor. The ultimate goal is a temperature profile with about 100 °R variance and about 2 percent variance in oxygen. The exit total temperature must not be lowered significantly by the mixing apparatus or mechanisms employed. If immersed bodies are used, they must also be kept very hot. All combustor wall modifications must be able to survive the heat and structural conditions of the varied operating conditions.

Our approach to resolving this issue is being conducted in three stages:

1) Consider mixing exclusively
2) Resolve the heat transfer concerns resulting from the chosen mixing strategy
3) Solve the material and structural problems resulting from stages (1) and (2).

Since the 8-Ft. HTT is unavailable for experimentation, the study is conducted exclusively with computational fluid dynamic (CFD) codes (Fluent/Uns and Rampant 3.1) using unstructured grid through body fitted coordinates. Both CFD codes are general purpose Navier-Stokes solution packages that can solve integral conservation equations for conservation of mass, momentum and energy. The governing equations are discretized using a control-volume finite-element method on unstructured triangular 2-D grids. In the interest of time, a 3-D tetrahedral grid was used to check the 2-D results on one mixing strategy and the 2-D results were confirmed.

Preliminary results indicate that excellent mixing can be achieved with a body placed in the center of the flowing hot fluid with a minor modification to the combustor wall similar to a model positioned in the test section of a wind tunnel. The concept here, is to create longitudinal vortices strong enough to bring both fluids into intimate contact with each other near the wall where the cold fluid resides. However, there may be a trade-off in the choice of mixing strategy, heat transfer and structural requirements.

Currently, we are examining the more promising geometries for heat transfer concerns and developing strategies for the material of construction of the center body.

S28-27
ABS. ONLY
8768
p.1

SYNTHESIS OF LOW COLOR, ATOMIC OXYGEN RESISTANT POLYIMIDES

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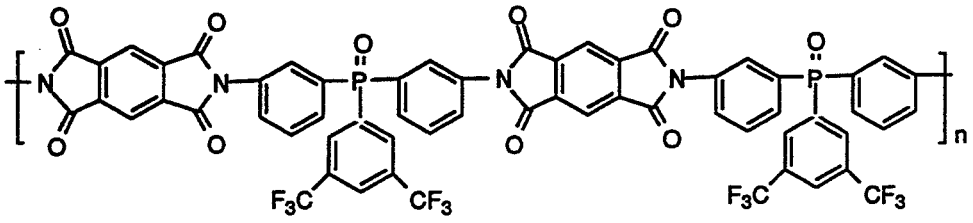
The purpose of this project was to develop low color, atomic oxygen resistant polyimides for potential applications on spacecraft in low earth orbit. The material is needed in order to protect satellites and spacecraft from the gases and radiation found at those altitudes.

Phosphorous containing polyimides have been shown to be especially resistant to corrosion and weight loss under oxygen plasma. Unfortunately the color of these phosphorous containing polyimides is still too high for them to be good heat insulators. While they are not as effective as Teflon, the current material of choice. polyimides are much less dense than Teflon and would be especially valuable if they could be made with low color.

The approach taken was to synthesize a monomer which would contain the elements needed for giving the final polyimide its desired properties. In particular the monomer should incorporate phosphine or phosphine oxides and have bulky side groups to block any color forming charge transfer structures. The target molecule, 3,5-di-(trifluoromethyl-phenyl)-bis(3-aminophenyl) phosphine oxide, (containing both a phosphine oxide group and a bulky ditrifluoromethylphenyl group) was synthesized via three reactions in overall yield of 21 %. In addition, a model compound, bis(3-phenylamine) phenyl phosphine oxide, was synthesized two different ways in order to establish the conditions for the nitration of phosphine oxides and their reduction to the amine. Finally, a trisubstituted phosphine oxide was synthesized. In all, seven phosphorus containing organic compounds were synthesized, purified and characterized.

The model compound was reacted with oxydiphthalic anhydride to form a polyamic acid with inherent viscosity of 0.34. This material was cast into a film and heated, forming a normally colored fairly strong polyimide with a T_g of 240°C. The target compound was reacted with 6-fluorodiphthalic anhydride to give a polyamic acid with inherent viscosity of 0.19 and cast to give a heavily cracked colored film with a T_g of 230°C.



Synthesized polyimide

S29-85
MAS. ONLY
8769

TROIKA PARTNERSHIP MODEL FOR LICENSING NASA-LARC TECHNOLOGIES

p. 1

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ABSTRACT

The Technology Applications (TAG) Group at NASA Langley Research Center has currently more than 100 technologies that are ripe for commercialization. These technologies are categorized by various sectors including : Energy and the Environment; Materials and Structures; Manufacturing; Information and Communications; Transportation, and Medical/Sensor/ Instrumentation. A requirement that TAG has placed on all technologies ready for licensing is that there will be some university involvement in the technology transfer or knowledge transfer process. This model involves the troika of government (LaRC), Industry and University. A number of variations on the Troika Partnership Model (TPM) were developed as a part of this ASEE Fellowship. Furthermore, five technologies were identified--three of which industrial interests have been matched: LaRC-SI, a thermoplastic that can be used as a coating; Variable Geometry Truss Manipulator Arm that can be used for nuclear waste clean -up and as scaffolding; and ADAPT (Approach to Data Management, Archive Protection, and Transmission) is a technology that could be used for a variety of multi-tasking operations over the Internet.

The aim of this work was to initiate a Space Act Agreement (SAA) for at least one of these technologies using one of the options of the TPM. A preliminary partnership agreement using the SAA is currently being negotiated with NASA-LaRC, VPI and Virginia Power for the LaRC-SI thermoplastic that will be used as a coating.

S30-71
ABS ONLY
8770
p.1

A Test of a Vortex Method for the Computation of Flap Side Edge Noise

by

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Upon approach to landing, a major source location of airframe noise occurs at the side edges of the part span, trailing edge flaps. In the vicinity of these flaps, a complex arrangement of spanwise flow with primary and secondary tip vortices may form. Each of these vortices is observed to become fully three-dimensional. In the present study, a numerical model is developed to investigate the noise radiated from the side edge of a flap. The inherent three-dimensionality of this flow forces us to carefully consider a numerical scheme which will be both accurate in its prediction of the flow acoustics and also computationally efficient.

Vortex methods have offered a fast and efficient means of simulating many two and three-dimensional, vortex dominated flows. In vortex methods, the time development of the flow is tracked by following exclusively the vorticity containing regions. Through the Biot-Savart law, knowledge of the vorticity field enables one to obtain flow quantities at any desired location during the flow evolution. In the present study, a numerical procedure has been developed which incorporates the Lagrangian approach of vortex methods into a calculation for the noise radiated by a flow-surface interaction. In particular, the noise generated by a vortex in the presence of a flat half plane is considered. This problem serves as a basic model of flap edge flow. It also permits the direct comparison between our computed results and previous acoustic analyses performed for this problem.

In our numerical simulations, the mean flow is represented by the complex potential $W(z) = Aiz^{1/2}$, which is obtained through conformal mapping techniques. The magnitude of the mean flow is controlled by the parameter A. This mean flow has been used in the acoustic analysis by Hardin (1980) and is considered a reasonable model of the flow field in the vicinity of the edge and away from the leading and trailing edges of the flap. To represent the primary vortex which occurs near the flap, a point vortex is introduced just below the flat half plane. Using a technique from panel methods, boundary conditions on the flap surface are satisfied by the introduction of a row of stationary point vortices along the extent of the flap. At each time step in the calculation, the strength of these vortices is chosen to eliminate the normal velocity at intermediary collocation points. The time development of the overall flow field is then tracked using standard techniques from vortex methods. Vortex trajectories obtained through this computation are in good agreement with those predicted by the analytical solution given by Hardin, thus verifying the viability of this procedure for more complex flow arrangements.

For the flow acoustics, the Ffowcs Williams-Hawkings equation is numerically integrated. This equation supplies the far field acoustic pressure based upon pressures occurring along the flap surface. With our vortex method solution, surface pressures may be obtained with exceptional resolution. The Ffowcs Williams-Hawkings equation is integrated using a spatially fourth order accurate Simpson's rule. Rational function interpolation is used to obtain the surface pressures at the appropriate retarded times. Comparisons between our numerical results for the acoustic pressure and those predicted by the Hardin analysis have been made. Preliminary results indicate the need for an improved integration technique. In the future, the numerical procedure developed in this study will be applied to the case of a rectangular flap of finite thickness and ultimately modified for application to the fully three-dimensional problem.

S31-37
NBS. ONLY
8771
P-1

Fuel/Air Cycle Analysis for Fuel-Inducted Internal Combustion Engine Configurations

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Abstract

A quasi-one-dimensional computer code based on a fuel/air cycle analysis was developed to predict the performance of two and four stroke fuel inducted engines. The code utilizes a variable specific heat calculation throughout the cycle. The compression of an air/fuel/residual gas mixture is calculated followed by a finite rate burn where the burn duration is calculated based on the turbulent flame speed and cylinder geometry. During combustion and expansion, ten equilibrium combustion product constituents are tracked. Instantaneous heat transfer and blowby past the rings is calculated based on empirical correlations. The tendency for engine knock or autoignition of the fuel is also calculated. The analysis is to be used to provide boundary conditions for a finite element analysis to predict thermal and mechanical loading of carbon-carbon pistons for use in advanced internal combustion engine concepts. The computer code will predict the required boundary conditions, which are gas pressure and temperature and heat transfer coefficients as a function of crank angle, along with engine indicated power output, indicated thermal efficiency, and indicated mean effective pressure(imep). Good agreement is obtained when compared with actual engine operation.

omit

Three Two-Week Teacher Enhancement Institutes: Design and Implementation

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The Teacher Enhancement Institute (TEI), under the direction of the Center Education Programs Officer offered three two-week workshops to 58 elementary and middle school teachers in science, math, and technology using the Problem Based Learning Model. The 1995 program was designed with input from evaluations and recommendations from previous TEI participants and faculty. The TEI focused on Aeronautics as the unifying theme. Four ASEE fellows worked together to develop each two-week session.

Participants in the 1995 Teacher Enhancement Institute represented school systems where income levels are low, where the use of technology is limited, and students served tend to lack exposure to innovative instruction in mathematics and science. Seven states were represented which include Virginia, Kentucky, North Carolina, South Carolina, West Virginia, Maryland, Utah. Washington, DC was also represented.

Four specific objectives were developed. After completing the requirements for the TEI the participants should be able to: (1) Increase their content knowledge, particularly in aeronautics, science, math, and technology. (2) Design and implement lessons that use scientific inquiry through Problem Based Learning. (3) Demonstrate knowledge of instructional technologies, their uses, and applications to curricula. (4) Disseminate to their school communities the information acquired through the TEI.

Participants were exposed to instruction by educators and NASA staff in theoretical and experimental foundations in problem solving. They also received hands-on telecommunication experiences, research experiences, special presentations, and tours. Most of the hands-on activities were done in small groups called flight teams. Cooperative learning strategies were encouraged in discussions of various topics, resources research, and in the planning and presentation of lesson plans.

Authentic assessment techniques included portfolios, reflective journals, self evaluation, and oral and written presentations.Teachers were evaluated on the quality and level of their work in cooperative groups and individual participation.

Teachers' levels of confidence towards the use of technology, the teaching of science, math, and aeronautics were assessed using instruments developed by the TEI summer faculty members. An on-site evaluation regarding the impact of TEI on the participants was also developed. Data from these instruments will be analyzed and reported in a final report submitted to the director of the Office of Education.

Post-institute follow-up activities were programmed to ensure implementation of Institute strategies. It is expected participants will develop a unit plan that will be field tested in their classrooms during the1995-96 school year. The effort should be a collaborative one between participants and the school community.

Flexure Fatigue Testing of 90° Graphite/Epoxy Composites

S32-24
ABS. ONLY
8772
P-1

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A great deal of research has been performed characterizing the in-plane fiber-dominated properties, under both static and fatigue loading, of advanced composite materials. To the author's knowledge, no study has been performed to date investigating fatigue characteristics in the transverse direction. This information is important in the design of bonded composite airframe structure where repeated, cyclic out-of-plane bending may occur. Two such scenarios where this takes place are in a compressively loaded post-buckled panel or a full-scale pressurized fuselage such as the one being investigated by the NASA Advanced Composite Technology (ACT) program. In the latter case, as a result of the internal pressurization within each panel bay, the skin will bulge or "pillow." These out-of-plane deformations create local bending moments along the skin-stiffener and skin-frame interfaces, which in turn create shear and peel stresses along the various bondlines. Recent tests characterizing skin/stringer debond failures in reinforced composite panels where the dominant loading in the skin is flexure along the edge of the frame indicate failure initiated either in the skin or else the flange, near the flange tip. When failure initiated in the skin, transverse matrix cracks formed in the surface skin ply closest to the flange and either initiated delaminations or created matrix cracks in the next lower ply, which in turn initiated delaminations. When failure initiated in the flanges, transverse cracks formed in the flange angle ply closest to the skin and initiated delamination. In no configuration did failure propagate through the adhesive bond layer. For the examined skin/flange configurations, the maximum transverse tension stress at failure correlates very well with the transverse tension strength of the composites.

Transverse tension strength (static) data of graphite epoxy composites have been shown to vary with the volume of material stressed. As the volume of material stressed increased, the strength decreased. A volumetric scaling law based on Weibull statistics can be used to predict the transverse strength measurements. The volume dependence reflects the presence of inherent flaws in the microstructure of the lamina. A similar approach may be taken to determine a volume scale effect on the transverse tension fatigue behavior of graphite/epoxy composites.

The objective of this work is to generate transverse tension strength and fatigue S-N characteristics for composite materials using 3-point flexure tests of 90° graphite/epoxy specimens. Investigations will include the volume scale effect as well as frequency and span-to-thickness ratio effects. Prior to the start of the experimental study, an analytical study using finite element modeling will be performed to investigate the span-to-thickness effect. The ratio of transverse flexure stress to shear stress will be monitored and its valueas predicted by the FEM analysis compared with the value obtained using a "Strength of Materials" based approach.

J33-34
ABS ONLY

Large Eddy Simulations of Compressible Turbulent Flows

8773

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An evaluation of existing models for Large Eddy Simulations (LES) of incompressible turbulent flows has been completed. LES is a computation in which the large, energy-carrying structures to momentum and energy transfer is computed exactly, and only the effect of the smallest scales of turbulence is modeled. That is, the large eddies are computed and the smaller eddies are modeled. The dynamics of the largest eddies are believed to account for most of sound generation and transport properties in a turbulent flow. LES analysis is based on an observation that pressure, velocity, temperature, and other variables are the sum of their large-scale and small-scale parts. For instance, u_i (velocity) can be written as the sum of $\overline{u}_i$ and u_i', where $\overline{u}_i$ is the large-scale and u_i' is the subgrid-scale (SGS). The governing equations for large eddies in compressible flows are obtained after filtering the continuity, momentum, and energy equations, and recasting in terms of Favre averages. The filtering operation maintains only large scales. The effects of the small-scales are present in the governing equations through the SGS stress tensor τ_{ij} and SGS heat flux q_i. The mathematical formulation of the Favre-averaged equations of motion for LES is complete. The equations are:

$$\frac{\partial \overline{\rho}}{\partial t} + \frac{\partial(\overline{\rho}\tilde{u}_i)}{\partial x_i} = 0$$

$$\frac{\partial(\overline{\rho}\tilde{u}_i)}{\partial t} + \frac{\partial(\overline{\rho}\tilde{u}_i\tilde{u}_j)}{\partial x_j} = \frac{\partial(\tilde{\sigma}_{ij} - \tau_{ij})}{\partial x_j}$$

$$\frac{\partial(\overline{\rho}\tilde{E})}{\partial t} + \frac{\partial[\overline{\rho}\tilde{u}_i\tilde{E} - \tilde{u}_j\tilde{\sigma}_{ij}]}{\partial x_i} + \frac{\partial[(-\overline{k} + c_\nu k_T)\frac{\partial \tilde{T}}{\partial x_i}]}{\partial x_i} - \tilde{u}_i[\frac{\partial(\tilde{\sigma}_{ij} - \tau_{ij})}{\partial x_j}] = 0$$

Note that the energy equation is in conservative form in contrast to other formulations. The coefficients in the SGS stress terms will be computed using a dynamic SGS model. Next the model will be integrated into an existing high order essentially non-oscillatory (ENO) code for separated flows. Little work has been done for LES in compressible turbulent flows where shocks are present.

omit

Preliminary Proposal for the Establishment of a Regional Center of Excellence for Advanced Technology Education of Greater Hampton Roads Virginia and Northeastern North Carolina

by

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Introduction

Workforce 2000 reported that the new jobs in the 21st century will demand much higher skill levels, and that policymakers must find ways to improve the educational preparation of all workers, and raise the standard of the American educational system. Effective development and use of new technologies and other high technology activities requires well-educated science and engineering technicians. Improvement in the quality of our workforce depends on strong and innovative science, technology, engineering, and mathematics education at associate degree granting institutions. To best serve the nation, technological education programs require partnerships among two and four year colleges, universities, secondary schools, business, government, and industry.

Summary

Working with a team of educators, an extensive research undertaking was executed to develop a preliminary proposal for the development of a Regional Center of Excellence for Advanced Technology Education of Greater Hampton Roads and Northeastern North Carolina.

The goal of the Center is to serve as a unifying force to insure business, industry, government and secondary and college education communities work collaboratively to address the disparity between the ever-changing industrial demands for a highly skilled workforce and existing skills and competencies of students, teachers, and faculty in mathematics, science and engineering and science technology. It is proposed that the center will address these concerns through curriculum development, faculty enhancement and preparation, teaching methods, and the development of educational materials in the mathematics and science disciplines, and expanding opportunities for apprenticeships, internships, cooperative education experiences, and exchanges for students, teachers, and faculty.

This proposal was submitted for external funding and, if funded, will serve as a prototype for other regional centers across the nation.

534-72
ABS. ONLY

POSITRON ANNIHILATION SPECTROSCOPIC STUDY OF HIGH PERFORMANCE SEMI-INTERPENETRATING NETWORK POLYIMIDS

8774

Asit K. Ray

Christian Brothers University

Semi-interpenetrating(S-IPN) network polyimids were made from different proportions of LaRC RP46(a thermosetpolyimid) and LaRC BDTA-ODA (a thermoplastic polyimid). The ultimade goal of this networking is to improve the mechanical properties of the thermoset polyimid. Positron lifetime study was made to calculate lifetime based on second component of the life time spectra and the free volume & microvoid size. All these properties tend to decrease steadily with increasing thermoset content except at the 50% thermoset level where these properties show sudden drop. This result contradicts with the initial expectation that the blend properties should change gradually if it were a solid solution of thermoset (TSP) and thermoplastic(TPP) components. Thermal analyses(TMA,DSC,DMA & TGA) were run to complement the positron life time studies. The TMA and DSC studies confirm the contradiction mentioned above. Further experimentation with S-IPN polymers made at TSP/TTP content around 50/50 level are being conducted to explain this anomaly. Scanning electron microscope study of the S-IPN polyimid samples is under way in order to detect morphological differences which might help explain the phenomenon mentioned above.

S35-09
ABS. ONLY
8775
p-1

Automatic Releveling of Calibration Stands for Wind Tunnel Force and Moment Measurement Instrumentation

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Wind tunnel force and moment measuring instrumentation at NASA LaRC are calibrated by applying NIST certified dead loads, to generate forces and moments in three orthogonal axes, in twenty five percent increments, up to full-load and down to no-load in a nine point continuous procedure, using specially built calibration stands. The measuring instruments deflect upon the application of loads. These deflections must be cancelled to minimize loading interactions. The older calibration stands, integrated with AC induction motors, or DC motors, have provisions for manually releveling the loading point after each load. A newer stand, with integrated DC stepper motors, relevels automatically under software control. It was proposed to extend automation to the old stands. An algorithm to control the unwieldy induction motors to relevel a calibration stand, to within two arcseconds of horizontality automatically, was developed. The system developed uses coasting prediction and load adaptation in a general type robust stability control configuration with noncoincidental feedback. Automatic releveling cuts the releveling time to approximately half of the time required to do it manually. The principal constraint for shorter times is the time constant of the angular position feedback transducer.

omit

Elementary Mathematics of Powered Flight

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The author continued work on the preparation of course materials in mathematics for non-science students. Two new chapters were completed; one on cabin pressure and the reaction of the middle ear to altitude changes and a second on the aircraft in level cruise. In addition, three appendices were written dealing with the simplest cockpit instruments: navigational aids, altimeters and airspeed devices.

In each case, problem sets were constructed, these providing a variety of arithmetic and very elementary trigonometric exercises that will encourage familiarity with the physical mechanisms at work in the aircraft and its instrumentation. A final chapter on takeoff and landing remains to be written.

Environmental Awareness Program Development

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S36-45
ABS. ONLY
8776
p-1

Work this summer in the Office of Safety, Environment, and Mission Assurance began with a review of current initiatives and environmental projects at the Langley Research Center (LaRC). This involved researching many of the documents on file which detail problems which have occurred as well as various approaches which have been used to address these problems. A large portion of the time was spent interviewing and working with each of the engineers , industrial hygienists and other professionals connected with the Office of Environmental Engineering.

A few of the projects I worked on include:

-Researching environmental compliance, and pollution prevention efforts.
-Touring many of the facilities at LaRC to observe the environmental efforts in the work place.
-Researching equipment needs for the Recycling/Reclamation Center.
-Writing scripts for in-house training videos.
-Working with the Video Production Department to produce a training video.
-Developing e-mail distribution list.
-Developing environmental coordinator's database.
-Working with others to research logistics of recycling and waste minimization efforts.

The time spent at LaRC has proven to be extremely informative. The experiences here will continue to be very beneficial to myself and in my work with the Virginia Community College System.

I would like to express my sincere gratitude to Mr. John Lee, Head of the Office of Environmental Engineering and to Mrs. Leslie Holland, Industrial Hygienist. They provided me with opportunities, direction and resources which made my fellowship an outstanding experience.

537-61
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P-1

Displacement Based Multilevel Structural Optimization

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Multidisciplinary design optimization (MDO) is expected to play a major role in the competitive transportation industries of tomorrow, i.e., in the design of aircraft and spacecraft, of high speed trains, boats, and automobiles. All of these vehicles require maximum performance at minimum weight to keep fuel consumption low and conserve resources. Here, MDO can deliver mathematically based design tools to create systems with optimum performance subject to the constraints of disciplines such as structures, aerodynamics, controls, etc. Although some applications of MDO are beginning to surface, the key to a widespread use of this technology lies in the improvement of its efficiency.

This aspect is investigated here for the MDO subset of structural optimization, i.e., for the weight minimization of a given structure under size, strength, and displacement constraints. Specifically, finite element based multilevel optimization of structures (here, statically indeterminate trusses and beams for proof of concept) is performed. In the system level optimization, the design variables are the coefficients of assumed displacement functions, and the load unbalance resulting from the solution of the stiffness equations is minimized. Constraints are placed on the deflection amplitudes and the weight of the structure. In the subsystems level optimizations, the weight of each element is minimized under the action of stress constraints, with the cross sectional dimensions as design variables. This approach is expected to prove very efficient, especially for complex structures, since the design task is broken down into a large number of small and efficiently handled subtasks, each with only a small number of variables. This partitioning will also allow for the use of parallel computing, first, by sending the system and subsystems level computations to two different processors, ultimately, by performing all subsystems level optimizations in a massively parallel manner on separate processors. It is expected that the subsystems level optimizations can be further improved through the use of controlled growth[1], a method which reduces an optimization to a more efficient analysis with only a slight degradation in accuracy.

The efficiency of all proposed techniques is being evaluated relative to the performance of the standard single level optimization approach where the complete structure is weight minimized under the action of all given constraints by one processor and to the performance of Simultaneous Analysis and Design[2] which combines analysis and optimization into a single step. It is expected that the present approach can be expanded to include additional structural constraints (buckling, free and forced vibration, etc.) or other disciplines (passive and active controls, aerodynamics, etc.) for true MDO.

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1 P. Hajela and J. Sobieszczanski-Sobieski, "The Controlled Growth Method — A Tool for Structural Optimization", AIAA Journal, Vol. 20, No. 10, Oct. 1982, pp. 1440–1441.

2 R.T. Haftka and Z. Gurdal, *Elements of Structural Optimization*, Kluwer Acad. Publ., Boston, 1992, pp. 404–406.

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MODELING USING OPTIMIZATION ROUTINES

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Modeling using MATHEMATICAL OPTIMIZATION dynamics is a design tool used in magnetic suspension system development. MATLAB (software) is used to calculate minimum cost and other desired constraints. The parameters to be measured are programmed into mathematical equations. MATLAB will calculate answers for each set of inputs; inputs cover the boundary limits of the design. A Magnetic Suspension System using Electromagnets Mounted in a Plannar Array is a design system that makes use of OPTIMIZATION modeling.

539-82
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p.1

A Strategy for Providing Electronic Library Services to Members of the AGATE Consortium

by

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August 1995

Abstract:

In November, 1992, NASA Administrator Daniel Goldin established a Task Force to evaluate conditions which have lead to the precipitous decline of the US General Aviation System and to recommend actions needed to re-establish US leadership in General Aviation. The Task Force Report[i] and a report[ii] by Dr. Bruce J. Holmes, Manager of the General Aviation/Commuter Office at NASA Langley Research Center provided the directions for the formation of the Advanced General Aviation Transport Experiments (AGATE), a consortium of government, industry and university committed to the revitalization of the US General Aviation Industry. One of the recommendations of the Task Force Report was that "a central repository of information should be created to disseminate NASA research as well as other domestic and foreign aeronautical research that has been accomplished, is ongoing or is planned...A user friendly environment should be created." This paper describes technical and logistic issues and recommends a plan for providing technical information to members of the AGATE Consortium.

It is recommended that the General Aviation office establish and maintain an electronic literature page on the AGATE Server. This page should provide a user friendly interface to existing technical report and index servers identified in the report and listed in the Recommendations section. A page should also be provided which gives links to Web resources. A list of specific resources is provided in the Recommendations section. Links should also be provided to a page with tips on searching, a form to provide for feedback and suggestions from users for other resources. Finally, a page should be maintained which provides pointers to other resources like the LaRCsim workstation simulation software which is avail from LaRC at no cost. The developments of the Web is very dynamic. These developments should be monitored regularly by the GA staff and links to additional resources should be provided on the Server as they become available. An recommendation to NASA Headquarters should be made to establish a logically central access to all of the NASA Technical Libraries, to make these resources available both to all NASA employees and to the AGATE Consortium.

THE SHAPE OF SPECTRAL LINES: THE IMPORTANCE OF THE FAR WINGS

S40-45
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P-1

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Spectroscopy, the study of the interaction of radiation and matter, provides most of the information we have gleaned about the composition, structure, and evolution of the Universe. As is well known, by measuring the frequencies of spectral lines in absorption or emission, one can uniquely infer the presence of atoms or molecules as well as their physical state and environment (e.g., solid or gaseous, neutral or ionized, moving or stationary, etc.). Furthermore, by studying the intensities of these lines, one can determine the abundance (i.e., number of a particular species per unit volume). Although less well known, the shape of the spectral lines, in particular, the structure of the far wings, plays a very important role in many important atmospheric phenomena such as the Greenhouse effect or the absorption of harmful ultraviolet radiation.

Although first measured more than 50 years ago, the anomalous absorption of radiation by water vapor in the Earth's atmosphere was postulated to be due to far wings of allowed lines. However, only within the past few years has a quantitative verification of this hypothesis been possible through the development of an accurate theoretical description of the shape of self-broadened water lines. During the summer, work has been done on improving this theory and in comparing the results to other theories valid near the center of the lines. The relevance of this work to measurements of Greenhouse gases, of Earth-based measurements of the 3 K cosmic background radiation, of satellite-based measurements of the atmospheres of the Earth and other planets, and other similar problems will be discussed briefly.

541-34
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P.1

PRESSURE CORRELATIONS AT A FLUID/STRUCTURE INTERFACE

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The structure of pressure-pressure correlations at the interface of an incompressible steady-state turbulent flow with a rigid boundary was investigated. For the sake of completeness, the absolute value of the correlation between two random varying functions is herein defined as a number greater than or equal to zero and less than or equal to unity which is a measure of that fraction of one of the functions that "follows" the second function (or vice versa). It was found that the soughtafter correlations can be determined by consideration of the high *Re* Navier-Stokes equation, but that the complexity of boundary layer turbulence, in particular the inhomogeneity perpendicular to the boundary and the anisotropy due to convective flow gradients, makes the structure of said correlations extremely difficult to assess. One of the earlier researchers in this field described the quantity under present consideration as "a quantity which is beyond assessment." Nonetheless, it was found that under some rather simplifying assumptions the determination of the required structure necessitates the formulation of the related structure of second order two-point correlations of turbulent velocity gradients, as well as third order two-point correlations of velocity gradients. The presence of these latter gradients is due to the nonlinearity in the turbulence ("turbulence self-interaction"). Both of these correlations are scaled, although not similarly, by factors dependent upon the magnitude of the convective flow, which can be modeled using a *log law* approximation. Fourth order correlations, although present, can be ignored, since they constitute "higher order terms." In a slightly more complex situation, it was found that convective flow gradients also have to be incorporated. At the moment, no definitive algebraic information peculiar to pressure-pressure correlations is available save in the most highly idealized cases.

THE ROLE OF TQM AND CHANGE MANAGEMENT WITHIN A BPR FRAMEWORK AT NASA

omit

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Abstract:

Quality improvement comes from hardwork, dedication and application of common sense. A management system that recognizes and encourages ongoing quality improvement efforts must be developed and implemented. In rewarding quality success, emphasis should be placed on accomplishments of teams as well as the individual. Recognition and reward should be provided in a timely manner. At NASA TQM and BPR play a key role in maintaining integrity of future projects and productivity increase measures. This abstract follows the NASA strategy through the questioning of the following tasks:

1. What is the impact of "Customer Focus" on the organization ?
2. What constitutes "excellence" in the long-term ? in the short term ?
3. What is the "Cost of Change" to the organization ?
4. What are the "Core Competencies" defined for the organization ?
5. What is the "Vision" as expressed by the organization ?
6. What are the "Key success factors" attributable to the success in the past ?
7. What are the "Key success factors" attributable to success in the future ?
8. How will change affect:
   1) Resources / Business Philosophy
   2) Business Strategy
   3) Profit / Benefits
9. How are "Centers of Excellence" defined ?
10. How is the "Co-Relation" between "Centers of Excellence" defined ?
11. What impact will "Re-engineering" have on "Technology Output" ?
12. To what extent will "TQM", "ISO 9000" be implemented:
    1) System wide 2) Individual "departments" 3) Selective "organizations"
13. How will the "Core Competencies" be affected by "Change Management" ?
14. How does "Centralization" or "De-centralization" efforts affect the "status-quo" ?
15. How is "Value-Added" defined with respect to "Change Management" ?
16. What is the relevance of "Technology" to "Productivity" throughout the organization ?
17. What impact would "Technology Commercialization" have on "Core Research" ?
18. How would "Benchmarking" parameters be set-up with respect to non-quantitative or "derivative" research ?
19. How would "excellence" be balanced with "short-term success goals ?"
20. How would you rate the "urgency" of change with respect to "factors beyond control" for the organization ?

542-36
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8782

Retrieval of Water Vapor Mixing Ratios from a Laser-based Sensor

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Langley Research Center has developed a novel external path sensor which monitors water vapor along an optical path between an airplane window and reflective material on the plane's engine. An infrared tunable diode laser is wavelength modulated across a water vapor absorption line at a frequency f. The 2f and DC signals are measured by a detector mounted adjacent to the laser. The 2f/DC ratio depends on the amount of wavelength modulation, the water vapor absorption line being observed, and the temperature, pressure, and water vapor content of the atmosphere. The present work concerns efforts to quantify the contributions of these factors and to derive a method for extracting the water vapor mixing ratio from the measurements.

A 3 m cell was fabricated in order to perform laboratory tests of the sensor. Measurements of 2f/DC were made for a series of pressures and modulation amplitudes. During my 1994 Faculty Fellowship, a computer program was created which allowed 2f/DC to be calculated for any combination of the variables which effect it. This code was used to generate 2f/DC values for the conditions measured in the laboratory. The experimental and theoretical values agreed to within a few percent. As a result, the laser modulation amplitude can now be set in the field by comparing the response of the instrument to the calculated response as a function of modulation amplitude.

Once the validity of the computer code was established, it was used to investigate possible candidate absorption lines. 2f/DC values were calculated for pressures, temperatures, and water vapor mixing ratios expected to be encountered in future missions. The results have been incorporated into a database which will be used to select the best line for a particular mission. The database will also be used to select a retrieval technique. For example, under some circumstances there is little temperature dependence in 2f/DC so temperature can be neglected. In other cases, there is a dependence with temperature for a particular pressure, requiring a more complicated retrieval algorithm.

Future experimental work is necessary to test agreement with the theoretical values over a range of temperatures and mixing ratios. Additionally, retrieval algorithms for forthcoming missions must be incorporated into the software package which controls the instrument.

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p. 1

A Fresh View of the Fly-By-Light/Power-By-Wire Program

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NASA has been funding a focused program to promote the development of optical signaling and electrical actuation for civil transports. This program is reviewed in the context of other government and private sector initiatives. It is concluded that significant resources have and continue to be expended to develop these technologies. A second goal of the program is to develop certification methods for aircraft that implement these new technologies. It is concluded that there is a significant need for this effort and that NASA in cooperation with the FAA are well suited to do satisfy the need.

Electrical actuation is not new but has recently been made feasible for a broader array of high power applications than previously because of developments in power switching technologies, motors, and computers. This development has been well explored by the Air Force and the private sector and requires little more government attention. Light signal and sensor technology has been developing under public and private funding and has reached a level of maturity such that some companies are using optical signal carriers for flight control on private jets. Several issues remain unresolved but centrally focused government effort is not an effective way to pursue the variety of issues that persist.

Certification of aircraft for flight is a government activity. The poor preparedness of the FAA to certify fault tolerant digital flight control systems against electromagnetic effects coupled with the increasing number of electromagnetic emitters constitutes an impediment for development of this technology. The complete lack of preparation to certify optical components is currently causing concern for a general aviation supplier who is having difficulty certify their system. NASA with the FAA should work to develop clear, reasonable, and cost effective ways of certifying the reliability of fault tolerant digital and optical flight control components and systems.

CONT TO
END

APPENDIX X

PROGRAM ORIENTATION EVALUATION REPORT

1995 ASEE PROGRAM ORIENTATION EVALUATION REPORT

(Thirty-seven Orientation evaluations were returned.)

A. Overall Organization

1 - Poor - 0%
2 - Fair - 0%
3 - Average - 0%
4 - Good - 18 (49%)
5 - Excellent - 19 (51%)

B. Pre-Conference Notification

1 - Poor - 2 (5%)
2 - Fair - 1 (3%)
3 - Average - 2 (5%)
4 - Good - 9 (25%)
5 - Excellent - 23 (62%)

C. Information and Knowledge Gained

1 - Poor - 0%
2 - Fair - 0%
3 - Average - 2 (5%)
4 - Good - 16 (43%)
5 - Excellent - 19 (52%)

D. Program Breakout Session

1 - Poor - 0%
2 - Fair - 0%
3 - Average - 1 (3%)
4 - Good - 13 (35%)
5 - Excellent - 23 (62%)

E. In General, How Do You Rate This Orientation

1 - Poor - 0%
2 - Fair - 0%
3 - Average - 1 (3%)
4 - Good - 13 (35%)
5 - Excellent - 23 (62%)

Comments and Recommendations:

- It is clear that a great deal of thought and energy has gone into planning the orientation. Outstanding program, dedicated staff, and a first class operation.
- Very thorough, all the information I need.
- The level of presentation during the ASEE bus tour was very poor. Seemed rushed.
- The starting time of the orientation was not made clear.
- Local information would also be helpful.
- Debbie Young mentioned that there is an IRS fellowship brochure. Please provide copies or an IRS phone number to help inform us better.
- Well organized, and not too much information for the first day.
- The tour was lacking. The guide did not seem too well versed and should not be reading as we go by. But, the concept of a tour is still a good one. The audio equipment was not the best. Everything else was OK.
- Use overheads in the breakout session and provide copies to Fellows.
- Well planned.

APPENDIX XI

PROPOSAL SEMINAR EVALUATION REPORT

1995 PROPOSAL SEMINAR EVALUATION REPORT

Twenty Seminar evaluations were returned.

A. Timely Notification
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 0%
4 - Good - 3 (15%)
5 - Excellent - 17 (85%)

B. Presentation Delivered in Clear and Concise Manner
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 1 (5%)
4 - Good - 3 (15%)
5 - Excellent - 16 (80%)

C. Speaker Had Good Command of Material
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 0%
4 - Good - 6 (30%)
5 - Excellent - 14 (70%)

D. Panel Discussion/Question and Answer Session Helpful
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 3 (15%)
4 - Good - 6 (30%)
5 - Excellent - 11 (55%)

E. Information and Knowledge Gained Through Seminar
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 3 (15%)
4 - Good - 8 (40%)
5 - Excellent - 9 (45%)

F. Overall Organization
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 0%
4 - Good - 6 (30%)
5 - Excellent - 14 (70%)

Fellows Comments:
- Excellent effort - about 100% better than last year's; one or two microphones would be better.
- Distribute viewgraphs at beginning of program and shorten presentation.
- I really appreciated the hand outs. The discussion entertained all my questions without me asking. I have a better understanding of how proposals should be written, and as a result, hopefully I will be working my first proposal. More research proposal seminars are needed.
- Regarding timely notification, almost too much.
- Excellent presentation, very clear and concise. Speaker seems to have a real competency in the area. Good format.
- Introductory presentation was too long. The panel discussion and direct questions were more relevant. Total seminar could be cut to 1 or 1 1/4 hrs.

- Could be presented earlier, maybe the first two weeks of the program. This allows Fellows more time to make contact with NASA researchers.
- Keep the question and answer session and Dr. Massenberg's presentation. It was very informative and helpful.
- Include a list of Do's and Don'ts when writing a proposal.
- The panelists were most helpful and open.
- Thanks for an excellent seminar.

APPENDIX XV

POLICIES, PRACTICES, AND PROCEDURES MANUAL

NASA LANGLEY AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) SUMMER FACULTY FELLOWSHIP PROGRAM

1995

POLICIES,

PRACTICES,

and

PROCEDURES

MANUAL

A Handbook for ASEE SFFP Fellows

Table of Contents

Introduction 120
Definitions 121
Accepting a Fellowship and Beginning Tenure 121
Stipend 123
Relocation Allowance and Travel 124
Insurance 124
Taxes 125
Leave 126
Housing 126
Lecture Series 127
Activities Committee 127
Security 127
Safety 128
Mail Room 129
Library 130
Cafeteria 130
H.J.E. Reid Conference Center 131

Introduction

Since 1964, the National Aeronautics and Space Administration (NASA) has supported a program of summer faculty fellowships for engineering and science educators, whereby faculty members spend ten weeks working with professional peers on research.

The ASEE Program is administered by a collaborating university. Either a Co-Director from Old Dominion University or Hampton University, on alternate years, works with the NASA LaRC University Affairs Officer, who is the Technical Monitor.

The faculty member will participate in three primary elements of the ASEE Program which are (1) a research project in cooperation with a NASA Associate, (2) a study program consisting of technical lectures and seminars given by distinguished scientists and engineers from NASA, education, or industry presented to program participants, and (3) a technical presentation and paper. Additional elements of this program include tours of LaRC wind tunnels, computational facilities, and laboratories. Library and computer facilities will be available for all participants.

The objectives of the program are (1) to further the professional knowledge of qualified engineering and science faculty members, (2) to stimulate an exchange of ideas between teaching participants and employees of NASA, (3) to enrich and refresh the research and teaching activities of participants' institutions, and (4) to contribute to the research objectives of the Center.

The Policies, Practices, and Procedures Manual sets forth the conditions of your award, your responsibilities as an ASEE Fellow, and the procedures observed by the Universities and the Office of Education (OEd) in supporting and implementing your summer research program.

1.0 Definitions

1.1 ASEE Summer Fellow

As an ASEE Summer Fellow you are a faculty member, competitively selected by the Langley Groups in a national competition, who has been offered a fellowship to perform scholarly research on a problem of interest to NASA Langley Research Center in the ASEE Summer Faculty Fellowship Program.

You enjoy the status and privileges of a guest summer faculty Fellow at LaRC. You are not an employee of LaRC or the sponsoring Group and do not perform personal services for either organization.

1.2 Langley Research Center

For the purposes of the ASEE Program, the terms "Center" and "LaRC" are used to refer to NASA's Langley Research Center.

1.3 ASEE Associate

An ASEE Associate is the scientist or engineer at the Center with whom you will work most closely. All matters relating to your research program will fall under his or her purview. The Associate also assists, as needed, in securing space, equipment, or technical support.

1.4 ASEE Co-Director

The ASEE Co-Director from Old Dominion University (ODU), working in conjunction with the LaRC University Affairs Officer as Technical Monitor, is responsible for the proper administration of the ASEE Program. The Co-Director is available to discuss all aspects of the program with you, and he is your prime contact person in the OEd.

1.5 ASEE Administrative Assistant

The ASEE Administrative Assistant is a support-staff member working closely with the ASEE Co-Director in the administration of the program, and acting as his representative in his absence. The Administrative Assistant is also available to answer any questions.

1.6 Approval

Throughout this handbook, various procedures are cited that require the exclusive approval of the Co-Director. The use of the word "approval" means written approval. Any document requiring the Co-Director's approval will have the concurrence of the appropriate Associate. Any actions taken on the basis of verbal concurrence are not binding on the Co-Director unless followed by appropriate written authorization.

2.0 Accepting a Fellowship and Beginning Tenure

2.1 Notification of a Fellowship

You will be notified of your ASEE Fellowship by an official selection letter that states the conditions of your fellowship, information concerning your stipend, and the period of your tenure at LaRC which will be a maximum of ten weeks.

2.2 Acceptance Letter

Once you receive your selection letter, please notify us of your decision to accept or decline the fellowship not later than the date specified in your award letter. If your acceptance letter is not received by the specified date, your fellowship may be withdrawn.

If you are requesting an alternate start or end date, please do so in your acceptance letter. The approval of both the Co-Director and the Group with whom you will be working is required before your tenure may officially begin. These approvals are necessary to ensure compliance with the Center's scheduling of research and its availability of support facilities.

You must also return the completed Form 531 in order to facilitate a security background check.

2.3 Information Package

Included with your selection letter is an Information Package. The purpose of this package is to provide you with information which will facilitate your stay at LaRC. Included in this package is the following:

(a) Policies, Practices, and Procedures Manual
(b) Name Check Request, NASA Form 531 and Sample
(c) LaRC Vehicle Code Brochure
(d) NASA Fact Sheet
(e) Map of the Area
(f) Directions to NASA
(g) Housing Information
(h) Travel Expense Voucher
(i) Tentative Timeline
(j) Return Envelope
(k) Activities Interest Form

2.4 Working with the ASEE Associate

You are expected to maintain close contact with your assigned Associate who will offer guidance in all aspects of your technical activities and assistance in acquiring research support facilities.

2.5 Change of ASEE Associate

If for any reason your assigned ASEE Associate changes, you must notify the Co-Director immediately in writing. The change will not be effective until the

Co-Director and OEd have concurred with the request.

2.6 Conforming to Center Policies

ASEE Fellows are expected to conform to all established policies and procedures of the sponsoring Center as they pertain to guest researchers and the safety and health of individuals working at the Center.

2.7 Extensions of Tenure

There will be no paid extensions of tenure. The only exception is at the **sole discretion and written approval of the Co-Director**. In order for him to consider an extension, he must receive a written memorandum submitted by the LaRC Associate. This memorandum must outline the critical need for the extension well in advance of the program end date. At that point, the Co-Director will consider the request and may or may not approve depending on funding availability.

3.0 Stipend

3.1 Stipend Amount

The amount of your stipend is $1,000.00 per week. Stipends are paid on the basis of a 5-day work week and are issued bi-weekly, beginning the third Monday of the ASEE Program. Therefore, all ASEE Fellows should be prepared to provide for themselves financially the first two weeks of the program (Refer to Section 4.0).

3.2 Acceptance Letter

Your acceptance letter must be received by the Co-Director before stipend payments can be authorized.

3.3 Locator Form

In your orientation package you receive on the day of your arrival, you will receive a Locator Form. This form must be completed and returned to the Administrative Assistant as soon as possible following your arrival. On this form, you will be requested to supply your local address and phone number, a person to contact in case of an emergency, and your actual physical location on Center, including Mail Stop, building address, building number, room number, and extension. **This office should be notified immediately if any changes are made once this form has been turned in**.

3.4 Receiving Stipend Payments

Your biweekly stipend payments are not available for deposit by electronic funds transfer (EFT). They must be picked up in person from the ASEE Administrative Assistant. In order to receive your stipend payment, you must bring your badge for proof of identification and sign the form confirming receipt of payment.

Final stipend payment will be made only after you have submitted your Final Report, the Program Questionnaire, the Final Report Forms, the Final Checkout Form with appropriate signatures, your badge and pass, and any additional information required. If you will not be on Center the last day when stipend checks are available, submit to the Co-Director a signed memo indicating the address to which your check is to be mailed.

3.5 Cashing Your Stipend Checks

Langley Federal Credit Union (LFCU): LFCU has agreed to offer you stipend check cashing privileges for a fee. Due to their policy, you will be unable to open an account or cash personal checks.

Nations Bank: Your stipend checks are cut from Nations Bank and you may cash it at any of their branches free of charge. (Locations listed on hand out in Information Package)

4.0 Relocation Allowance and Travel

4.1 Relocation Allowance

A relocation allowance of $1,000 will be provided to any Fellow whose home/school address is more than 50 miles from NASA Langley Research Center. This is provided to assist in the additional expenses incurred in relocating to the Tidewater area. No additional receipts are required.

4.2 Travel Reimbursement

Fellows are reimbursed for their travel under the following terms:

- Round trip coach air fare (receipt required) or,
- Round trip mileage up to the cost of coach air fare, maximum $500.

Meals and overnight accommodations are the Fellow's responsibility. The travel expense form provided in this package should be filled out and returned to the Administrative Assistant at the Orientation in order to ensure prompt processing. Both the relocation allowance and travel reimbursement will be provided at the next pay date following submission of your information if time allows.

5.0 Insurance

5.1 Health and Medical Insurance

It is the responsibility of the ASEE Fellow to have the appropriate health and medical insurance coverage. The ASEE Program does not provide any insurance coverage. Experience has shown that coverage for you and your dependents is extremely beneficial. Unless you already have insurance coverage, you are

advised to weigh carefully the cost/risk factor in reaching a decision to participate in this program.

5.2 Worker's Compensation Type Insurance

ASEE Fellows are not covered by any type of Worker's Compensation Insurance through the ASEE Program. If injured while on duty, however slight, immediately notify your Associate and the Co-Director at (804) 864-5215. Medical help is provided in the Clinic-Occupational Health Services Facility. Hours of operation are from 7 a.m. to 4:30 p.m. In any medical emergency, dial extension (804) 864-2222 or go directly to Building 1149 at 10 West Taylor Street.

5.3 Automobile Insurance and Driver's License

You must have a valid driver's license, automobile insurance, and a current inspection sticker certifying your automobile is safe.

6.0 Taxes

6.1 Federal Tax Liability of United States Citizens

Since you are not an employee of NASA LaRC or ODU, but are an ASEE Fellow and considered self employed, neither the OEd nor ODU withhold taxes from stipend payments to you. You will receive from the university, a form 1099 indicating your total stipend.

You should refer to the pertinent tax publications and plan ahead to meet any tax obligations, both federal and state, if applicable, and file your returns as required by Federal law. The responsibility for the payment of your income taxes rests solely with you. The OEd and ODU cannot provide information or consultation concerning income taxes.

6.2 Social Security Taxes

Since you are not an employee of NASA LaRC or ODU, but are an ASEE Fellow and considered self employed, neither the OEd nor ODU withhold Social Security Taxes from your stipend payments. You should refer to the pertinent publications on Social Security Taxes to determine whether you have incurred any tax obligation. Although Social Security Taxes are not withheld from stipend payments, you are nonetheless required to have an assigned Social Security Number.

6.3 State Tax Liability

You may be liable for state income taxes and should file the appropriate tax return in compliance with the laws of the state in which you reside. You should consult a local government tax authority at the beginning of tenure for further details concerning this liability.

7.0 Leave

7.1 Leave

As a guest researcher in the ten-week ASEE Program, you are not eligible for annual leave, sick leave, or personal leave.

If there are reasons why you need to be absent from work during the summer research experience, there are a few steps you must take **prior** to the absence. First, you must clear this absence with your LaRC Associate. Next, submit a memo to the ASEE Co-Director indicating your Associate's concurrence, requesting approval for your absence. This is to include any conferences or presentations of papers. If this absence is directly related to your summer research and a memo to that affect is submitted by your Associate, then time approved can be considered a part of your ten week tenure. If you are approved to attend a conference not related to your summer research, then the time away **must be made up** before receiving your final stipend check. **If you are aware, prior to the start of the summer program, of a meeting or conference you desire to attend during the ten-week period, we ask that you request approval for this absence as soon as possible to allow for timely processing.**

7.2 Work Hours

The typical work schedule is from 8 a.m. to 4:30 p.m. Once you arrive on Center, you will need to conform to the schedule applicable to your Division, as schedules may vary.

7.3 Working After Hours

After hours work is discouraged; however, in special situations in order for you to work after hours, several steps must be taken. You must first have the approval of your Associate. Your Associate must submit to Security a request for you to work after hours. Also, your Form 531 and the background check must have been completed. This information is subject to change

8.0 Housing

8.1 Housing Package

The ASEE Office provides information on short-term leasing to those Fellows who require housing while in the ASEE Program. Included with your award letter is a Housing Package with pertinent information.

8.2 Disclaimer

It is the Fellow's responsibility to contact the apartment complex, etc., to finalize all housing arrangements. You are strongly encouraged to make these arrangements as early as possible since short term leases are in great demand during the summer due to the influx of people into the area. **Neither ASEE, NASA, ODU, nor any staff representatives shall intercede in the lease agreement made between the tenant and the landlord**. This information is

provided for the sole purpose of assisting you in making your transition to the Tidewater area easier. Once again, the only form of financial assistance provided for your housing is the relocation allowance (See Section 4.1). It is recommended that as soon as you know your departure date, you submit this information **in writing** to the complex management.

9.0 Lecture Series

9.1 Attendance

Weekly attendance at the Lecture Series by all Fellows is **strongly** encouraged. The purpose of the Lecture Series is to expand the knowledge of the professors with hopes of enhancing their classroom teaching and to give a greater knowledge of NASA's special research activities being conducted at the Center.

9.2 Distribution of Information

The weekly Lecture Series will also be used as an avenue to distribute pertinent program information.

10.0 Activities Committee

A voluntary activities committee will be formed at the onset of the program. This committee will plan various after work activities for the Fellows and their families. Participation in any activity is solely on a voluntary basis, and neither NASA nor Old Dominion University assume any responsibility for any events.

11.0 Security

11.1 Security Requirements

All ASEE Fellows are required to complete the NASA Form 531, Name Check Request, which is included in your Information Package, prior to reporting to NASA LaRC. Complete the NASA Form 531, using instructions provided, and return same as soon as possible. **It is imperative that you include all information requested in order to prevent any unnecessary delays upon your arrival to LaRC.** Even though you are not considered employed by NASA, if you had prior affiliation with LaRC or any other NASA Center, please note under "Employment" on the NASA Form 531. If you have access to a fax, the Form 531 may be faxed to the LaRC Security Office at 804-864-8868. A NASA National Agency Check (NASA NAC) shall be conducted on all summer ASEE Fellows requiring access to LaRC and its facilities.

11.2 Langley ASEE Summer Faculty Fellows

Upon arrival at NASA LaRC, all Fellows must report to the Badge and Pass Office at the Main Gate, Building 1228, 1 Langley Blvd., to obtain identification badges for access to LaRC facilities. At this time, your photo will

be taken and a temporary badge will be issued. You will return within three business days to pick up your permanent summer badge. **Please note: Before a badge can be issued, your 531 must have been in with all information being legible and accurate.**

Additionally, when reporting to LaRC, bring your driver's license for the issuance of a vehicle pass. If the vehicle you are driving is registered to another party, a signed letter authorizing you to drive the vehicle will be required. **On the morning of June 5, 1995 only, ASEE Orientation Day, vehicle passes will be issued at the H.J.E. Reid Conference Center**. If you arrive at any other time, the vehicle pass will be issued at the Badge and Pass Office.

If additional information is required, feel free to contact the NASA LaRC Security Office, Anne Young or Susan Linton, at 804-864-3426/37.

12.0 Safety

12.1 Safety Program

The objective of this program is to ensure each Fellow a safe and healthful working environment that is free from unacceptable hazards which could result in property damage, injury, or loss of life. The Langley Safety Manual is a compilation of documents which sets forth procedures pertinent to the safety operations of the Langley Research Center.

Each facility/building has a designated Facility Safety Head and Facility Coordinator (published in the LaRC Telephone Directory) responsible for ensuring adherence to safety rules and regulations.

12.2 Hazardous Communications Training

All Fellows are required to receive Hazardous Communications Training. This training provides awareness of dealing with chemicals which are physical or health hazards.

12.3 Safety Clearance Procedures

These procedures are used to ensure personnel or equipment safety during installation, maintenance, or in any situation where an equipment configuration must be temporarily maintained for the protection of personnel or equipment. The red-tag may be placed upon any device which could, if actuated, cause personnel or property to be endangered. The red-tag may also be used to forbid entrance to dangerous areas.

No person, regardless of position or authority, is to operate any switch, valve, or equipment which has a red-tag attached to it, nor will such tag be removed except as directed by an authorized authority.

12.4 Accident Reporting

Fellows shall immediately report all job-related accidents, injuries, diseases or illnesses to the supervisor and the Office of Safety, Environment and Mission Assurance (OSEMA), (804) 864-SAFE ((804) 864-7233).

Obtain medical treatment from the Occupational Medical Center, Building 1149, or call extension (804) 864-2222 for emergency medical assistance.

12.5 **Personnel Certification**

It is LaRC policy to certify Fellows performing tasks which could be potentially hazardous to either the individual, or coworkers. These requirements vary with the type of activity being performed, and consequently are described in detail in the LaRC Safety Manual dealing with the specific topic/hazard.

Particular research assignments may require training, certification, and medical surveillance requirements. Examples of these types of research assignments are chemical, radiation and/or pyrotechnic operations.

13.0 Mail Room

13.1 **Official Mail**

The LaRC mail system is only to be used for official mail. All offices are assigned a Mail Stop to which mail is routed. ASEE Fellows typically share a Mail Stop with their Associates. One mail delivery is made each day to in/out boxes located near the mail stop custodian. Distribution of packages and boxes which are too large for internal mail distribution are made to a designated table located in each facility.

Messenger envelopes are used to send mail internally. Before placing the envelope in the mail system cross out the previous name and Mail Stop, fill in the addressee's name and Mail Stop. Internal mail can not be delivered without a Mail Stop.

If you change your work site, it is your responsibility to complete NASA Langley Form 41, "Langley Research Center (LaRC) Directory Change Notice," (located in the back of the Langley Telephone Directory). This form is used to place your name on internal mailing lists, and is necessary that this information be kept up-to-date.

13.2 **Personal Mail**

Personal mail may be placed in the U.S. Post Office boxes located in front of the Cafeteria and Langley Federal Credit Union. Additionally, the Langley Exchange Shop, located in the cafeteria, will mail your personal packages.

13.3 **Additional Items to Remember**:

- Do not use official Government envelopes for personal mail.

- For fastest delivery by the post office: address envelopes in all capital letters,

no punctuation, and use state abbreviations.

- Each piece of outgoing mail requiring postage must be stamped with the mail stop of the originating organization for identification.

- Do not use NASA Langley Research Center as a mailing address for personal mail.

- Do not send personal mail (cards, chain letters, job resume, etc.) in the internal mail delivery system.

- When addressing messenger envelopes, use first and last name. Do not use nicknames.

- Do not use room numbers in place of mail stops on messenger envelopes.

- Mail Stops are required for delivery of internal mail.

If you have any questions, please call the Mail Manager, (804) 864-8159.

14.0 Library

The NASA Langley Technical Library holds more than a million titles, including books, documents, journals, and audiovisual materials. Coverage is limited to the areas of aeronautics, space science and technology, engineering, physics and chemistry, electronics and control, structural mechanics and materials, atmospheric sciences, computer science, and administration and management.

To attain access to library services, the employee's name must be listed on the official ASEE and LARSS rosters issued by the University Affairs Office. Basic services include literature searches on NASA RECON and CD-ROM databases, photocopying, and the loan of books and documents. All loan materials are due in the library two weeks prior to the conclusion of the program.

15.0 Cafeteria

15.1 NASA Exchange Cafeteria

Locations:	16 Taylor Drive, Building 1213 and 5 North Dryden, Building 1202
Hours of Service:	Monday thru Friday
Breakfast:	6:15 a.m .- 8:30 a.m.
Lunch:	10:45 a.m. - 1:30 p.m.
Holidays:	Closed

15.2 Additional Items to Remember

Busiest Time: 11:30 a.m. to 12:15 p.m.

Reservations: None Accepted between 11:30 a.m. to 12:30 p.m.

Large groups after 12:30 p.m.

15.2 **Check Writing Policies**

Maximum amount checks are cashed for is $20.00. Participants must have a badge and obtain management approval.

15.3 **Area Tickets Available**

Discount tickets for Busch Gardens, Water Country, Kings Dominion, AMC Theaters, and Colonial Williamsburg can be obtained at the Exchange Shop in the Cafeteria. If you are interested in tickets, call (804) 864-1585.

16.0 H.J.E. Reid Conference Center

16.1 **Conference Center**

The Conference Manager serves as a consultant and advisor for conferences and technical meetings. Reservations can be made for the auditorium, the Langley, Hampton, and Wythe Rooms in Building 1222 at 14 Langley Boulevard through the Conference Manager. Also, there are conference Centers at 3 S. Wright Street and Room 200 in the 7 x 10 Facility at 17 W. Taylor Road. For reservations, call (804) 864-6362.

16.2 **Picnic Shelters**

There are two picnic shelters on the grounds of the Reid Conference Center that can be reserved for office picnics. You are welcome to use a table anytime one is available. For reservations, call (804) 864-6369.

16.3 **LaRC-sponsored clubs**:

Aerobic Club
Astronomy Club
Conservation Club
History and Archeology Club
Radio Model Club
Science Fiction Club
Tennis Club
Amateur Radio Club
Bass Club
Garden Club
Karate Club
Runners Club
Softball League
Volleyball League

16.4 **Additional Information**

If you would like to see exhibits on NASA or view the featured film in an IMAX theater, you can visit the new Virginia Air and Space Center in downtown Hampton.

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13. ABSTRACT *(Maximum 200 words)*
Since 1964, the National Aeronautics and Space Administration (NASA) has supported a program of summer faculty fellowships for engineering and science educators. In a series of collaborations between NASA research and development centers and nearby universities, engineering faculty members spend 10 weeks working with professional peers on research. The Summer Faculty Program Committee of the American Society for Engineering Education supervises the programs. Objectives: (1) To further the professional knowledge of qualified engineering and science faculty members; (2) To stimulate and exchange ideas between participants and NASA; (3) To enrich and refresh the research and teaching activities of participants' institutions; (4) To contribute to the research objectives of the NASA center. Program Description: College or university faculty members will be appointed as Research Fellows to spend 10 weeks in cooperative research and study at the NASA Langley Research Center. The Fellow will devote approximately 90 percent of the time to a research problem and the remaining time to a study program. The study program will consist of lectures and seminars on topics of interest or that are directly relevant to the Fellows' research topics. The lectures and seminar leaders will be distinguished scientists and engineers from NASA, education, or industry.

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