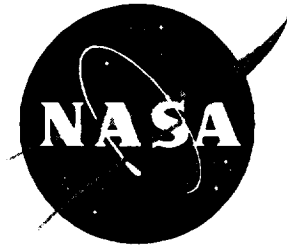


NASA Contractor Report 194972



# 1994 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program

*Compiled By:*

John H. Spencer  
*Hampton University, Hampton, Virginia*

Deborah B. Young  
*Old Dominion University, Norfolk, Virginia*

(NASA-CR-194972) 1994 NASA-HU  
AMERICAN SOCIETY FOR ENGINEERING  
EDUCATION (ASEE) SUMMER FACULTY  
FELLOWSHIP PROGRAM Abstracts Only  
(Hampton Univ.) 155 p

N95-23276  
--THRU--  
N95-23333  
Unclas

G3 199 0040710

Grant NGT 47-020-800

December 1994

National Aeronautics and  
Space Administration  
Langley Research Center  
Hampton, Virginia 23681-0001



**1994**

**FINAL ADMINISTRATIVE REPORT  
NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM**

Langley Research Center  
Hampton, Virginia  
and  
Hampton University  
Hampton, Virginia

SUBMITTED TO:

Ms. Sherri McGee  
NASA Headquarters  
Washington, DC

Dr. Samuel E. Massenberg  
Director, Office of Education  
and  
Mr. Roger A. Hathaway  
University Affairs Officer  
Office of Education  
Langley Research Center  
Hampton, Virginia

ADMINISTRATIVE STAFF:

John H. Spencer, ASEE Co-Director  
FAIA and Distinguished University Professor  
Department of Architecture  
Hampton University

Ms. Deborah B. Young  
ASEE Administrative Assistant  
Old Dominion University

October 1994



## TABLE OF CONTENTS

	<b>Page</b>
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    1994 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 . . . . .	14
Anticipated Papers . . . . .	15
Anticipated Research Proposals . . . . .	17
Funded Research Proposals . . . . .	19
Section VI    Summary of Program Evaluation . . . . .	20
Fellows' Survey . . . . .	21
Fellows' Comments . . . . .	27
Fellows' Recommendations . . . . .	28
Summary of Associates' Evaluation . . . . .	28
Research Associates' Comments . . . . .	28
Research Associates' Recommendations . . . . .	29
Section VII   Co-Director's Recommendations . . . . .	30
Appendix I    1994 Participants . . . . .	31
Appendix II   Technical Lecture Series - Presentations by Research Fellows - Calendar of Activities . . . . .	36
Technical Lecture Series . . . . .	37
Technical Lecture Series Program Sample . . . . .	38
Presentations by Research Fellows . . . . .	40
Calendar of Activities . . . . .	41

	<b><u>Page</u></b>	
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 . . . . .	116
Appendix XI	Proposal Seminar Evaluation Report . . . . .	119
Appendix XII	Banquet Evaluation Report . . . . .	121
Appendix XIII	Associate-Mentor Training Meeting Evaluation Report	123
Appendix XIV	ASEE Headquarters Site Visit Agenda . . . . .	126
Appendix XV	Policies, Practices, and Procedures Manual . . . . .	130

## LIST OF TABLES

<b><u>Table No.</u></b>		<b><u>Page</u></b>
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)**

	<b><u>Page</u></b>
IDEALIZED TEXTILE COMPOSITES FOR EXPERIMENTAL/ANALYTICAL CORRELATION by Daniel O. Adams, Iowa State University . . .	57
STUDY OF ATMOSPHERIC PARAMETERS MEASUREMENTS USING MM-WAVE RADAR IN SYNERGY WITH LITE-II by Madeleine Andrawis, South Dakota State University . . . . .	58
A MANUFACTURING DATABASE OF ADVANCED MATERIALS USED IN SPACECRAFT STRUCTURES by Han P. Bao, Old Dominion University . . . . .	59
INFINITE POSSIBILITIES: COMPUTATIONAL STRUCTURES TECHNOLOGY by Sherilee F. Beam, Hampton University . . . . .	60
SEPARATION OF CRACK EXTENSION MODES IN COMPOSITES DELAMINATION PROBLEMS by Jack L. Beuth, Carnegie Mellon University . . . . .	61
PROJECT: INTERNAL COMMUNICATIONS by Lydia V. Black, Old Dominion University and Virginia Beach Public Schools . . . . .	62
CROSSFLOW INSTABILITY CONTROL ON A SWEEP WING: PRELIMINARY STUDIES by David H. Bridges, Mississippi State University . .	63
AUTOMATION TECHNOLOGY USING GEOGRAPHIC INFORMATION SYSTEM (GIS) by Cynthia L. Brooks, University of Arkansas . . . . .	64
MEASUREMENTS OF STRIAE IN CR+ DOPED YAG LASER CRYSTALS by Fredrick M. Cady, Montana State University . . . . .	65
FORMATIVE AND SUMMATIVE EVALUATION EFFORTS FOR THE TEACHER ENHANCEMENT INSTITUTE CONDUCTED AT NASA LANGLEY RESEARCH CENTER, SUMMER 1994 by Randal D. Carlson, Pennsylvania State University . . . . .	66
HOLOGRAPHIC INTERFEROMETRIC TOMOGRAPHY FOR RECONSTRUCTING FLOW FIELDS by Soyounng S. Cha, University of Illinois at Chicago . . . . .	68
FABRIC GEOMETRY DISTORTION DURING COMPOSITES PROCESSING by Julie Chen, Boston University . . . . .	69



	<b><u>Page</u></b>
DIRECT NUMERICAL SIMULATIONS AND MODELING OF A SPATIALLY-EVOLVING TURBULENT WAKE by John M. Cimbala, Pennsylvania State University . . . . .	70
SCIENTIFIC AND TECHNICAL PHOTOGRAPHY AT NASA LANGLEY RESEARCH CENTER by Andrew Davidhazy, Rochester Institute of Technology . . . . .	71
METHOD DEVELOPMENT FOR COMPENSATING TEMPERATURE EFFECTS IN PRESSURE SENSITIVE PAINT MEASUREMENT by Carlo Greg N. Demandante, United States Air Force Academy . . . . .	72
TEAMS AND TEAMWORK AT NASA LANGLEY RESEARCH CENTER by Terry L. Dickinson, Old Dominion University . . . . .	73
NONDESTRUCTIVE EVALUATION OF FATIGUE DAMAGE IN ALUMINUM 2024 BY X-RAY DIFFRACTION by Milton W. Ferguson, Norfolk State University . . . . .	74
CONTROL OF FLOW SEPARATION IN AIRFOIL/WING DESIGN APPLICATIONS by Thomas A. Gally, Texas A&M University . . . . .	75
ASEE RESEARCH (Patent Protection Being Sought) by J. Anthony Ghorieshi, Wilkes University . . . . .	76
LOCATING BUILDINGS IN AERIAL PHOTOS by James S. Green, Moravian College . . . . .	77
DIRECT NUMERICAL SIMULATION OF SHEARED TURBULENT FLOW by Vascar G. Harris, Tuskegee University . . . . .	78
ANALYSIS OF THE LONGITUDINAL HANDLING QUALITIES AND PILOT-INDUCED-OSCILLATION TENDENCIES OF THE HIGH-ANGLE-OF-ATTACK RESEARCH VEHICLE (HARV) by Ronald A. Hess, University of California . . . . .	79
ELECTRONIC PHOTOGRAPHY AT NASA LANGLEY RESEARCH CENTER by Jack M. Holm, Rochester Institute of Technology . . . . .	80
SYSTEM IDENTIFICATION OF THE LARGE-ANGLE MAGNETIC SUSPENSION TEST FIXTURE (LAMSTF) by Jen-Kuang Huang, Old Dominion University . . . . .	81

	<u>Page</u>
INTERLAMINAR SHEAR TEST METHOD DEVELOPMENT FOR LONG TERM DURABILITY TESTING OF COMPOSITES by Peter G. Ifju, University of Florida . . . . .	82
TASK SCHEDULING IN DATAFLOW COMPUTER ARCHITECTURES by Constantine Katsinis, University of Alabama at Huntsville . . . . .	83
RELIABILITY ANALYSIS IN THE OFFICE OF SAFETY, ENVIRONMENTAL, AND MISSION ASSURANCE (OSEMA) by Paul J. Kauffmann, Thomas Nelson Community College . . . . .	84
RAMAN-SHIFTING AN ArF EXCIMER LASER TO GENERATE NEW LINES FOR OBTAINING OPTICAL DIAGNOSTIC BASED INFORMATION IN FLOW FIELDS by Edmond B. Koker, Elizabeth City State University . . . . .	85
OPTIMIZED DESIGN OF A HYPERSONIC NOZZLE by Ramesh Krishnamurthy, Old Dominion University . . . . .	86
STOCHASTIC DECISION ANALYSIS by Thomas A. Lacksonen, Ohio University . . . . .	87
DESIGN AND IMPLEMENTATION OF TWO TWO-WEEK ENHANCEMENT INSTITUTES by Lynn Lambert, Christopher Newport University . . . . .	88
ACCELERATED PANEL METHODS USING THE FAST MULTIPOLE METHOD by James F. Leathrum, Jr., Old Dominion University . . . . .	89
ON-LINE, ADAPTIVE STATE ESTIMATOR FOR ACTIVE NOISE CONTROL by Tae W. Lim, University of Kansas . . . . .	90
DESIGN OF A VARIABLE AREA DIFFUSER FOR A 15-INCH MACH 6 OPEN-JET TUNNEL by Norman W. Loney, New Jersey Institute of Technology . . . . .	91
DEFLECTIONS OF ANISOTROPIC SANDWICH BEAMS WITH VARIABLE FACE SHEETS AND CORE THICKNESSES by Chu-Ho Lu, University of Memphis . . . . .	92
RESIDUAL STRENGTH OF THIN PANELS WITH CRACKS by Erdogan Madenci, University of Arizona . . . . .	93
TEACHER ENHANCEMENT INSTITUTE by Tina Marshall-Bradley, Norfolk State University . . . . .	94

	<b><u>Page</u></b>
AEROACOUSTIC COMPUTATION OF GUST-BLADE INTERACTION by James E. Martin, Christopher Newport University . . . . .	95
INNER LOOP FLIGHT CONTROL FOR THE HIGH-SPEED CIVIL TRANSPORT by Brett A. Newman, Old Dominion University . . . . .	96
BENCHMARK PROBLEMS IN COMPUTATIONAL AEROACOUSTICS by Freda Porter-Locklear, Pembroke State University . . . . .	97
LANGLEY RESEARCH CENTER STRATEGIC PLAN FOR EDUCATION by Sandra B. Proctor, Norfolk State University . . . . .	98
THIN TAILORED COMPOSITE WING FOR CIVIL TILTROTOR by Masoud Rais-Rohani, Mississippi State University . . . . .	99
DIFFERENTIAL GPS AND SYSTEM INTEGRATION OF THE LOW VISI- BILITY LANDING AND SURFACE OPERATIONS (LVLASO) DEMON- STRATION by James M. Rankin, St. Cloud State University . . . . .	100
PRELIMINARY IDENTIFICATION OF BUFFET PROBLEMS IN HIGH SPEED CIVIL TRANSPORT* by Krishnaswamy Ravindra, Parks College of Saint Louis University . . . . .	101
PREPARATION OF COURSE MATERIALS: ELEMENTARY MATHEMA- TICS OF POWERED FLIGHT by George T. Rublein, College of William and Mary . . . . .	102
ASSOCIATED WITH AEROSPACE VEHICLES DEVELOPMENT OF METHODOLOGIES FOR THE ESTIMATION OF THERMAL PROPERTIES by Elaine P. Scott, Virginia Polytechnic Institute and State University	103
POTENTIAL AEROSPACE APPLICATIONS OF HIGH TEMPERATURE SUPERCONDUCTORS by Raouf Selim, Christopher Newport University	104
UPWARD APPRAISAL AS A MEANS FOR IMPROVING SUPERVISORY PERFORMANCE AND PROMOTING PROCESS IMPROVEMENT, WITH LONG-TERM IMPLICATIONS FOR ORGANIZATIONAL CHANGE by Denise V. Siegfeldt, Hampton University . . . . .	105
TEACHER ENHANCEMENT INSTITUTE by Ron W. Simmons, University of Virginia . . . . .	106
HANDLING QUALITIES OF THE HIGH SPEED CIVIL TRANSPORT by U. Peter Solies, University of Tennessee Space Institute . . . . .	107

	<u>Page</u>
COMPUTATIONAL MODELLING OF Er <sup>3+</sup> :GARNET LASER MATERIALS by Lee H. Spangler, Montana State University . . . . .	108
A NEW LOOK AT THE SIMULTANEOUS ANALYSIS AND DESIGN OF STRUCTURES by Alfred G. Striz, University of Oklahoma . . . . .	109
APPLICATION OF ELECTRON PARAMAGNETIC RESONANCE IMAGING TO THE CHARACTERIZATION OF ULTEM <sup>®</sup> EXPOSED TO 1-MeV ELECTRONS. CORRELATION OF RADICAL DENSITY DATA TO TIGER CODE CALCULATIONS. by Naushadalli K. Suleman, Hampton University . . . . .	110
THEORETICAL STUDIES OF SPECTROSCOPIC PROBLEMS OF IMPORTANCE FOR ATMOSPHERIC RADIATION MEASUREMENTS by Richard H. Tipping, University of Alabama . . . . .	111
COMPUTER MODELING OF THE SENSITIVITY OF A LASER WATER VAPOR SENSOR TO VARIATIONS IN TEMPERATURE AND AIR SPEED by George F. Tucker, Sage Junior College of Albany . . . . .	112
THE SOFTWARE ANALYSIS PROJECT FOR THE OFFICE OF HUMAN RESOURCES by Robert L. Tureman, Jr., Paul D. Camp Community College . . . . .	113
MULTIDISCIPLINARY DESIGN OPTIMIZATION USING GENETIC ALGORITHMS by Resit Unal, Old Dominion University . . . . .	114
HIGH-LIFT FLOW-PHYSICS FLIGHT EXPERIMENTS ON A SUBSONIC CIVIL TRANSPORT AIRCRAFT (B737-100) by Cornelis P. van Dam, University of California . . . . .	115

## **SECTION 1**

### **ORGANIZATION AND MANAGEMENT**

The 1994 Hampton University (HU)-NASA Langley Research Center (LaRC) Summer Faculty Fellowship Research Program, the thirty-first 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 1994 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 XV).

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 and introducing the Administrative Staff. He was followed by Mr. Roger A. Hathaway, University Affairs Officer, who presented the LaRC and program overview. A program breakout session was next on the agenda, enabling the ASEE administrative staff (Mr. John H. Spencer-ASEE Co-Director, and Ms. Debbie Young-ASEE Administrative Assistant) to meet with the 1994 Fellows to discuss administrative procedures and answer any questions that came to mind. 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 Associate 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. Six excellent papers were presented to the Fellows (Appendix II), Research Associates, and invited guests. The 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 Hampton University (HU)-NASA Langley Research Center (LaRC) Program was extended to the individuals who held 1993 fellowship appointments and were eligible to participate for a second year. Twenty individuals responded to the invitation and fourteen were selected (Table 1). Seventeen applications were received from Fellows from previous years. Eight were selected.

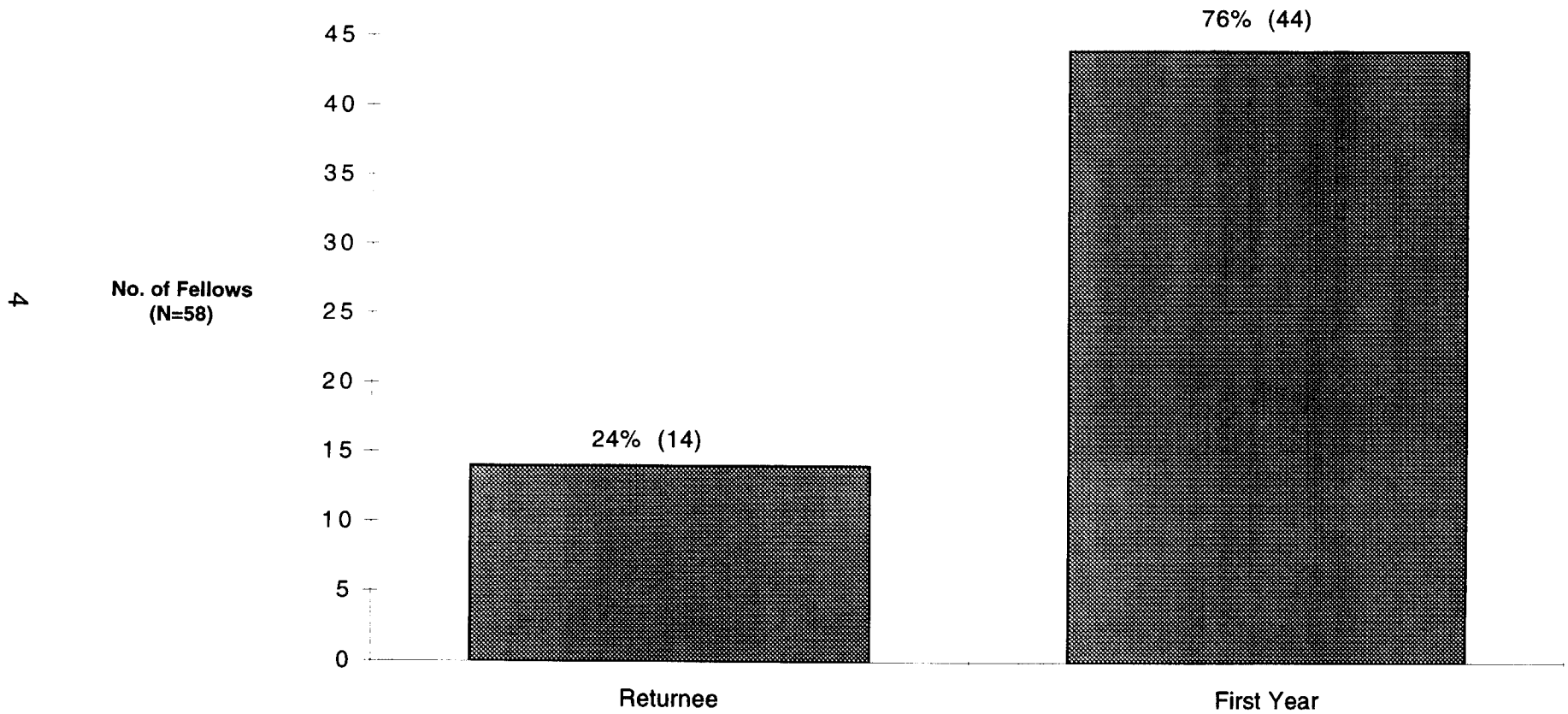
#### **First Year Fellows**

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 Mr. 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 HU/ODU-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). These efforts resulted in a total of one-hundred and fifty formal applications indicating the HU/ODU-NASA LaRC program as their first choice, and a total of twenty-four applications indicating the aforementioned as their second choice. The total number of applications received came to one-hundred seventy-four (Table 3).

Fifty-eight applicants formally accepted the invitation to participate in the program. Five 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. Thirty-two positions were funded by the LaRC Divisions (Table 4).

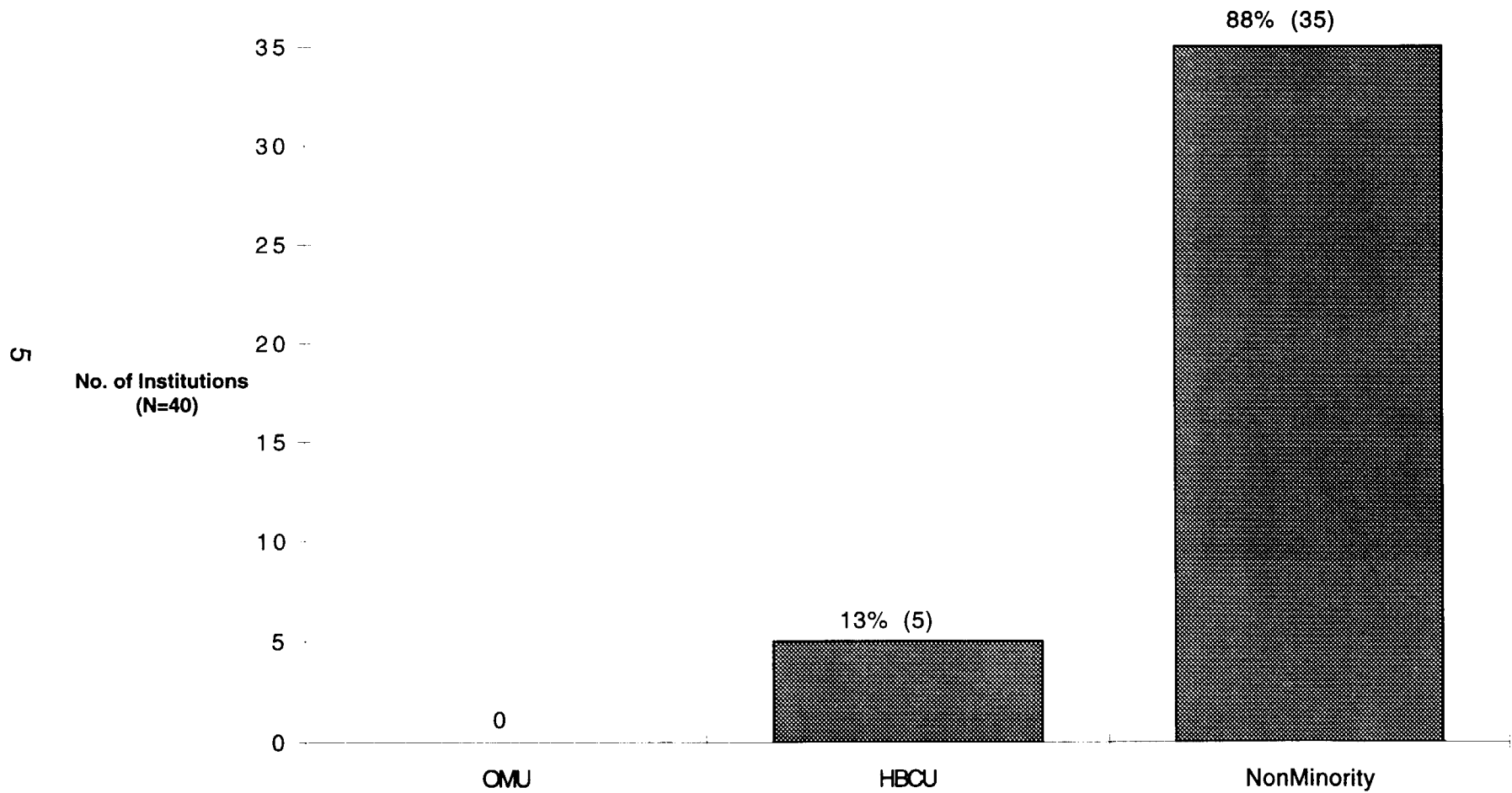
The average age of the participants was 40.

**TABLE 1 - DISTRIBUTION OF 1994 ASEE  
(SFFP) BY YEAR IN PROGRAM**

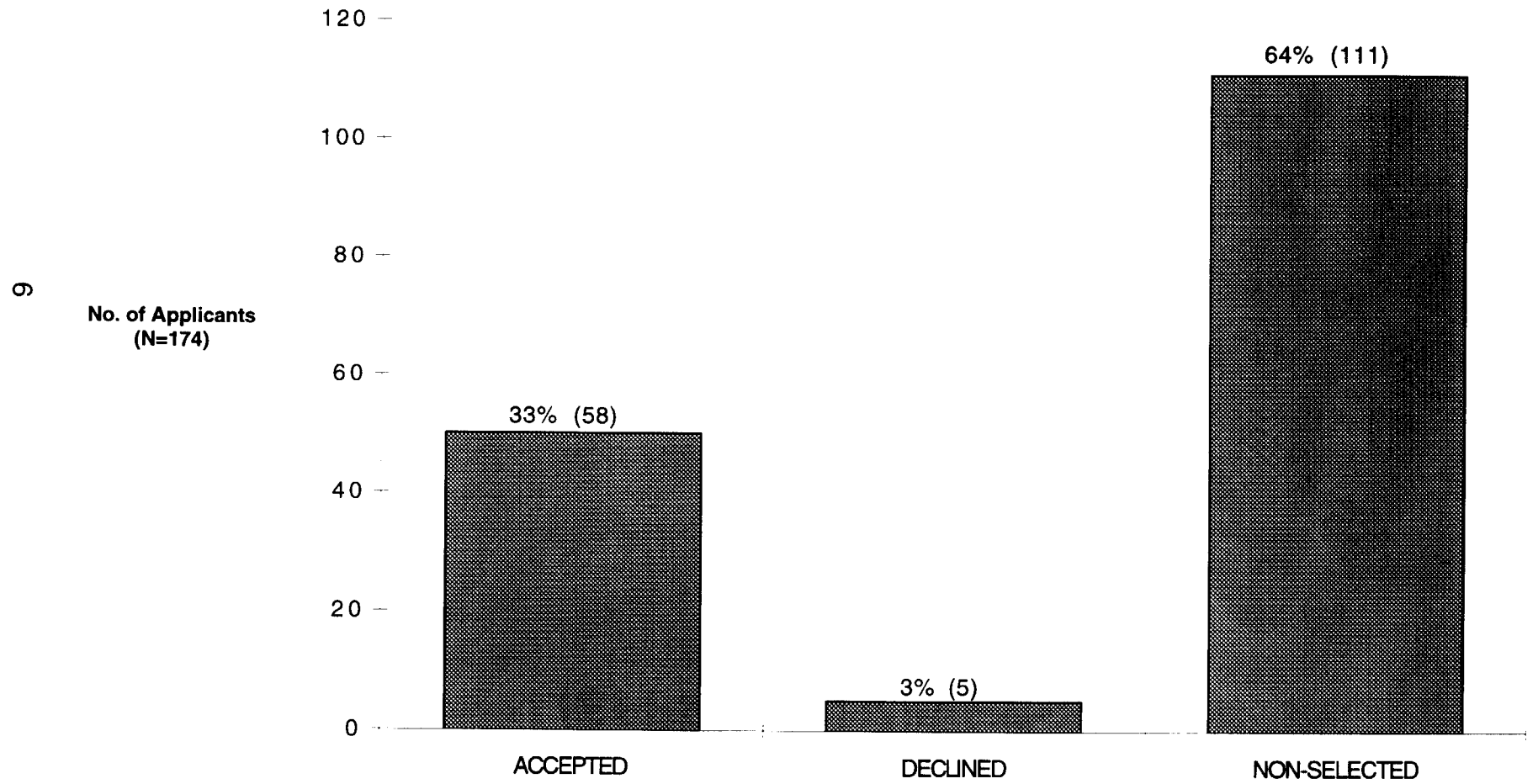




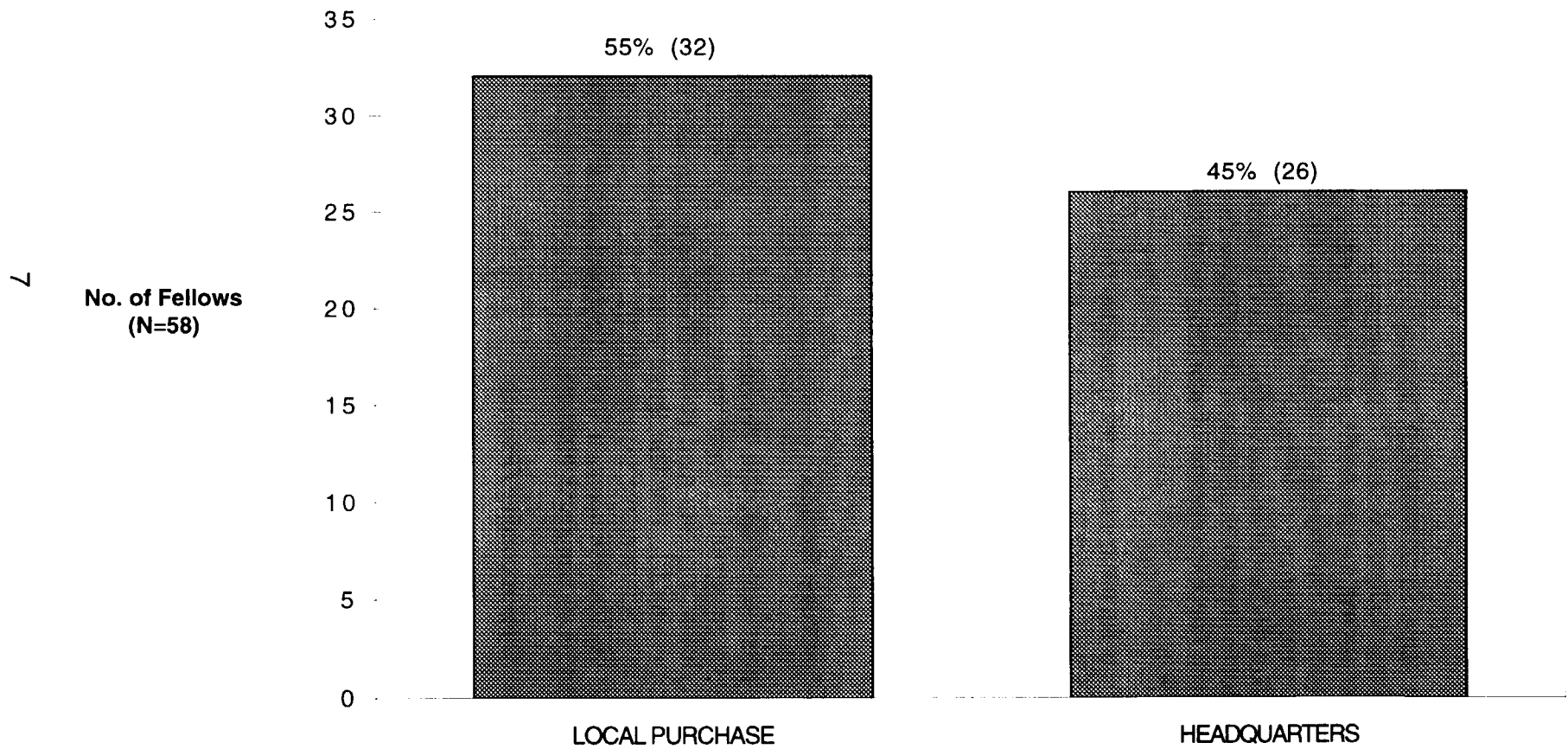
**TABLE 2 - DISTRIBUTION OF 1994 ASEE (SFFP) BY UNIVERSITY**



**TABLE 3 - DISTRIBUTION OF 1994 ASEE  
(SFFP) BY SELECTION**



**TABLE 4 - DISTRIBUTION OF 1994 ASEE (SFFP) BY FUNDING**



## **SECTION III**

### **STIPEND AND TRAVEL**

A ten week stipend of \$10,000.00 was awarded to each Fellow. Although 52% of the Fellows indicated that the stipend was not the primary motivator in their participating in the ASEE program, only 38% 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 HU regulations. A relocation allowance of \$1,000 was provided for the Fellows traveling a distance of 50 miles or more.

## **SECTION IV**

### **1994 ASEE SFFP ACTIVITIES**

#### **Technical Lecture Series**

Due to the past success, the Technical Lecture Series was again scheduled for this summer's program. There were a total of six lectures with five given by invited Langley scientists and researchers and one given by an outside guest speaker (Appendix II). For the third year, a Program was prepared and distributed at each lecture (Appendix II). The Program included biographical information on the speaker, a brief abstract of the technical lecture, and the announcement of the next lecture.

#### **Interaction Opportunity/Picnic**

An annual Office of Education Interaction Opportunity/Picnic was held on Wednesday, June 15, 1994, 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.

#### **Proposal Seminar**

A Proposal Seminar was held for the Fellows on Thursday, July 21, 1994. 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. The

most current Research Grant Handbook was distributed. (Appendix XI).

### **Seminar/Banquet**

On Wednesday, July 27, 1994, 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 (Evaluation-Appendix XII).

### **ASEE Activities Committee**

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.

## SECTION V

### RESEARCH PARTICIPATION

The HU-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 Fellow's 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:

<b>Number of Fellows Assigned</b>	<b>Division</b>
1	Aerodynamics Division
3	Aerospace Electronic Systems Division
1	Aerospace Mechanical Systems Division
2	Atmospheric Sciences Division
2	Experimental Testing Technology Division
6	Flight Dynamics and Control Division
8	Flight Mechanics and Acoustics Division
3	Facility Systems Engineering Division
1	Gas Dynamics Division
2	Office of Human Resources
3	Information & Electromagnetic Technology Division
2	Information Systems Division
1	Logistics Management Division
6	Materials Division
1	Office of the Director
5	Office of Education
1	Office of Safety, Environment & Mission Assurance
6	Structures Division
2	Space Systems and Concepts Division
2	Scientific and Technical Information Division

Fifty (86%) of the participants were holders of the doctorate degree. Eight (14%) held masters degrees. The group was again highly diversified with respect to background. Following are the areas in which the last degree was earned:

<b>Number</b>	<b>Area of Degree</b>
2	Aeronautics
1	Aeronautics and Astronautics
7	Aerospace Engineering
1	Agricultural and Mechanical Engineering
1	Applied Mathematics
1	Applied Mechanics
1	Chemical Engineering
4	Chemistry (includes 1 organic and 2 physical)
1	Communications
2	Computer Science
1	Education
5	Electrical Engineering
1	Engineering
1	Engineering Management
3	Engineering Mechanics
1	Engineering Sciences
1	Graphic Design
1	Higher Education Administration
1	Imaging Science
2	Industrial Engineering
1	Information Processing
1	Instructional Media-TV and Film
1	Instructional Systems
1	Mathematics
1	Mathematics and Computer Science
6	Mechanical Engineering
1	Mechanical and Aerospace Engineering
1	Philosophy
4	Physics
1	Psychology
1	Social and Philosophical Foundations of Education
1	Urban Services and Management

### **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:

Dr. Thomas Gally  
Dr. Jen-Kuang Huang

## **Attendance at Short Courses, Seminars, and Conferences**

During the course of the summer 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, Baltimore, MD.

**Madeleine Y. Andrawis:** Seminars on Laser Transmitter and Math Works, NASA Langley Research Center. Short Course, "Lidar", the Peninsula Graduate Center, Hampton, VA.

**Han P. Bao:** Video Conference on "Composites Spacecraft Design Guidelines", NASA Langley Research Center.

**Sherilee F. Beam:** Conference on "The Role of Computers in LaRC Research", NASA Langley Research Center. NASA Langley Internet Fair.

**Lydia V. Black:** Seminar on "Neural Networks", NASA Langley Research Center. Langley Research Center Technology Fair and Open House.

**David H. Bridges:** Seminar on "High Reynolds Number Turbulent Boundary Layer Measurement Challenges", NASA Langley Research Center.

**Cynthia L. Brooks:** ACM SIGPLAN '94 Conference on Programming Language Design & Implementations. Short Course "Leadership: Management With A Vision". Panelist-"SHARP Career Awareness Program", NASA Langley Research Center. Seminars on "Role of Computers in LaRC R&D Workshops" and "The Information Super Highway".

**Randal D. Carlson:** World Wide Web Technology Conference. Seminar on Technology Transfer.

**Soyoung S. Cha:** Committee Meeting of Aerodynamic Measurement Technology, American Institute of Aeronautics and Astronautics (AIAA), Colorado Springs, CO.

**John M. Cimbala:** ICASE Seminars on Computational Fluid Dynamics.

**Andrew Davidhazy:** NASA Langley Internet Fair.



**Thomas A. Gally:** 12th AIAA Computational Fluid Dynamics Conference.

**James S. Green:** NASA Langley Colloquia and Seminars within the Information Systems Division.

**Vascar G. Harris:** Short Course on UNIX Shell Programming, Langley Research Center. ICASE Research Seminars, Turbulence Seminars, and Apollo Lunar Landing Mission Seminar, NASA Langley Research Center.

**Jen-Kuang Huang:** 1994 American Control Conference, Baltimore, MD. Short Course "New Developments in Manufacturing Processes Technology, Michigan Institute of Technology.

**Peter G. Ifju:** Society for Experimental Mechanics Spring Conference, Baltimore, MD.

**Constantine Katsinis:** Internet Fair, NASA Langley Research Center.

**Paul J. Kauffmann:** Short Course on System Reliability by Sverdrup.

**Thomas A. Lacksonen:** Seminar on "Integration with Industry Sonic Boom Program", NASA Langley Research Center.

**Lynn Lambert:** Internet Fair, NASA Langley Research Center.

**James F. Leathrum:** Internet Fair, NASA Langley Research Center. Intel Paragon Lecture and Seminar on Triangularization.

**Tae W. Lim:** Short Course on Fundamentals of Orbital Mechanics, Washington, DC.

**Norman W. Loney:** American Society for Engineering Education (ASEE) Annual Conference, Edmonton, Canada.

**Chu-Ho Lu:** Short Course on MSC/NASTRAN Thermal Analysis.

**James E. Martin:** ICASE Colloquia, "The Modulation of a Subsonic Flame", NASA Langley Research Center.

**Brett A. Newman:** Apollo Lunar Landing Mission Seminar, NASA Langley Research Center. Short Course on "An Introduction to Quantitative Feedback Theory (QFT)", NASA Langley Research Center.

**Sandra B. Proctor:** Teacher Supply-Teacher Demand Conference, Richmond, VA.

**Masoud Rais-Rohani:** World Wide Web Seminar and Short Course on "MSC/NASTRAN Heat Transfer", NASA Langley Research Center.

**James M. Rankin:** Mosaic/Internet Open House, NASA Langley Research Center.

**Krishnaswamy Ravindra:** American Society for Engineering Education (ASEE) Annual Conference, Edmonton, Canada.

**Elaine P. Scott:** Inverse Heat Conduction Conference, Cincinnati, OH.

**Raouf Selim:** World Congress on Superconductivity Conference, Orlando, FL.

**Denise V. Siegfeldt:** Association of Management Twelfth Annual Conference, Dallas, TX. Violence in the Workplace Seminar and Roadmap to Problem Solving Short Course, NASA Langley Research Center.

**Ron W. Simmons:** J. P. Morgan Career Development Conference. Information Superhighway-WHRO Seminar. Bethel High School Internet Demonstration.

**Richard H. Tipping:** 12th International Conference on Spectral Line Shapes, Toronto, Canada.

**George F. Tucker:** NASA AESA 4th Annual Meeting (Poster Session). Internet Fair, NASA Langley Research Center.

**Robert L. Tureman:** NASA R&D Computing Conference. Internet Fair, NASA Langley Research Center.

### **Papers Presented**

**Madeleine Y. Andrawis:** "Study of Atmospheric Parameters Measurements Using MM-Wave Radar in Synergy with LITE-II".

**Sherilee F. Beam:** Videotape "Computational Structures Technology-Unlimited Possibilities", to be widely used by UVA Center for Computational Structures Technology and other institutions, NASA Langley Research Center.

**Cynthia L. Brooks:** "Automation Technology Using Geographical Information systems", Arkansas Computer Science Conference.

**Randal D. Carlson:** "Final Report for the Teacher Enhancement Institute, Session I & II, Summer 1994", NASA Langley Research Center.

**J. Anthony Ghorieshi:** "Microsphere Seeding Particles for Laser Velocimeter in High Temperature Wind Tunnels", NASA Langley Research Center.

**Paul J. Kauffmann:** "Reliability in Engineering Education", American Society for Engineering Education. "Zero Acceptance Sampling", IEEE Reliability.

**Edmond B. Koker:** "Raman-Shifting an ArF Excimer Laser to Generate New Lines for Obtaining Optical Diagnostic Based Information in Flow Fields."

**James F. Leathrum:** "Accelerated Panel Methods with the Fast Multipole Algorithm", AIAA CFD Workshop. "Parallel Panel Methods with the Fast Multipole Algorithm", *SIAM Journal of Scientific Computing*.

**Brett A. Newman:** "Inner Loop Flight Control for the High-Speed Civil Transport", AIAA.

**Krishnaswamy Ravindra:** "Preliminary Identification of Buffet Problems in High Speed Civil Transport."

**George Rublein:** Book entitled, "Mathematics of Powered Flight".

**Denise V. Siegfeldt:** "Organizational Development: A Planned Change Effort at NASA Langley Research Center", Twelfth Annual Association of Management International Conference, Dallas, TX.

**U. Peter Solies:** "On Low Speed Handling Qualities of High Speed Civil Transports", AIAA, Journal of Aircraft.

**Lee H. Spangler:** "A Computational Study of  $Er^{3+}$  Upconversion in Garnets" co-authored with Elizabeth Filer and Norman Barnes, *Journal of Applied Physics*.

**Cornelis P. van Dam:** "Overview of the NASA B737-100 High-Lift Research Programs", 19th ICAS Conference, Anaheim, CA.

### **Anticipated Papers**

**Daniel O. Adams:** Plans to submit research results at a December '94 Textile Composites Working Group Conference at NASA Langley Research Center and to an undetermined journal at a later date.

**Han P. Bao:** "Development of a Manufacturing Complexity Index for Advanced Composite Materials", Annual Conference of Engineering Management of IEEE.

**Jack L. Beuth:** "Separation of Crack Extension Modes in Composite Delamination Problems", ASTM Sixth Symposium on Composites: Fracture and Fatigue.

**Lydia V. Black:** "Viability of TQM in R&D Environment" and "Re-Connecting Organizational Networks After Reorganization".

**Fredrick M. Cady:** "Measurements of Striae in CR+ Doped YAG Laser Crystals".

**Randal D. Carlson:** "Teaching Teachers About Technology: The Development of an Instructional System", Educational Technology Research & Development.

**Soyoung S. Cha:** "Advanced Holographic Interferometry for Aerodynamic Flow Testing", *Applied Optics*.

**Julie Chen:** Paper to be submitted to Composites Manufacturing BU Department Technical Report (Aero/Mech Engineering).

**John M. Cimbala:** Paper submitted to the Turbulent Shear Flows Conference #10 and *Journal of Fluid Mechanics*.

**Andrew Davidhazy:** "Time Sequential Focusing Schlieren", *Industrial Photography Magazine*.

**James S. Green:** Probable paper on "Reduction of Microblobs in Images".

**Vascar G. Harris:** "Compressible Shear Flow Simulations Using a Multi-Domain Pseudospectral Method" co-authored with Dr. P. E. Hanley, American Physical Society Fall '94 Conference.

**Ronald A. Hess:** "High- $\alpha$  Aircraft Handling Qualities", AIAA.

**Jen-Kuang Huang:** "Closed-Loop Frequency Domain System Identification", AIAA Guidance Navigation and Control Conference, Baltimore, MD.

**Ramesh Krishnamurthy:** "An Optimized Design of Hypersonic Nozzle", AIAA.

**Thomas A. Lacksonen:** Paper - Institute of Industrial Engineers.

**Tae W. Lim:** "On-Line Adaptive State Estimator for Active Noise Control."

**Chu-Ho Lu:** "Bending of Composite Sandwich Beams with Variable Faces and Core Thickness."

**Tina Marshall-Bradley:** "Maximizing Teacher Development Programs Through Cooperation with National Laboratories", variety of educational journals.

**James E. Martin:** "Aeroacoustic Computation of a Gust-Blade Interaction", ICASE/LaRC Workshop on Benchmark Problems in Computational Aeroacoustics.

**Elaine P. Scott:** "Optimal Experimental Designs for Estimating Thermal Properties", Presentation and Publication in the proceedings of the Joint

ASME/JSME Thermal Engineering Conference.

**Denise V. Siegfeldt:** “Upward Performance Appraisal as a Means for Improving Supervisory Performance and Promoting Process Improvement, With Long-Term Implications for Organizational Change.”

**Ron W. Simmons:** Submission to NSTA Faculty Development in Engineering.

**Alfred G. Striz:** Submission to 36th SDM Conference and a journal article.

**Richard H. Tipping:** “Theoretical Calculation of the Water Vapor Continuum”, 5th Workshop on Atmospheric Science From Space, Tokyo, Japan.

**Robert L. Tureman:** Submission to Southeastern Small College Computing Conference, Greenville, SC.

**Resit Unal:** “Multidisciplinary Design Optimization Using Genetic Algorithms”, *Engineering Management Journal*.

### **Anticipated Research Proposals**

**Madeleine Y. Andrawis:** “Study of Atmospheric parameters Measurements Using MM-Wave Radar in Synergy With LITE-II”, NASA Langley Research Center.

**Han P. Bao:** “Manufacturing Complexity Index for Material Selection”, NASA Langley Research Center and Wright Patterson Air Force Research Laboratory.

**David H. Bridges:** “Excitation of Crossflow Instability Modes”, FMACB. “Low Reynolds Number Boundary Layer Tripping on Airfoils”, Subsonic Aerodynamics Division. “Forebody Vortex Control at High Alpha”, HSCT Program.

**Randal D. Carlson:** “Instructional Design for the Teacher Technology Workshop”, NASA Langley Research Center’s Office of Education.

**Julie Chen:** “Sensitivity of Composite Fabric Geometry Vanabons”, NASA.

**John M. Cimbala:** “DNS and Turbulence Modeling of a Turbulent Wake”, NASA Langley Research Center.

**Milton W. Ferguson:** “Nondestructive Microstructural Evaluation of Fatigued Alloys by X-Ray Diffraction”, NASA Langley Research Center.

**J. Anthony Ghorieshi:** “Preparation of Microsphere Seeding Particles for Laser Velocimeter in High Temperature Wind Tunnels”, NASA Langley Research Center.

**Vascar G. Harris:** “Establishment of a Fluid Dynamics Institute for Education and Research” in conjunction with Hampton University, to NASA Langley Research Center and NASA Headquarters.

**Ronald A. Hess:** “Multi-Input, Multi-Output Flight Control System Design via Quantitative Feedback Theory” and “Flight Control System Design with Actuator Saturation”, NASA.

**Jen-Kuang Huang:** “On Identification of the Large-Angle Magnetic Suspension System”, NASA Langley Research Center.

**Paul J. Kauffmann:** “Decision Model for Technology Transfer”, NASA Langley Research Center.

**Edmond B. Koker:** “Generation of New Lines By Stimulated Raman Scattering”, NASA.

**James F. Leathrum:** “Sensitivity Derivatives in Accelerated Panel Methods”, NASA. “Grids for Parallel Panel Methods with the Fast Multipole Method”, NAVY.

**Tae W. Lim:** “Feedback Control Approach to Noise Reduction”, NASA Langley Research Center.

**James E. Martin:** “Three-Dimensional Aeroacoustics of Axisymmetric Jets via Vortex Filament Methods.”

**Brett A. Newman:** “Flight Control Support for the High-Speed Civil Transport Down Select Decision.” “Analytical Expressions for Transmission Zeros.” “Root Locus for Multivariable Control Systems.”

**James M. Rankin:** “Differential GPS and Datalink for Low Visibility Airport Operations”, NASA Langley Research Center.

**Krishnaswamy Ravindra:** “Buffet Studies in HSCT”, to Boeing, MDA-W, and NASA.

**George Rublein:** “Math & Engineering for Non-Science Students”, National Science Foundation.

**Elaine P. Scott:** “Development of Methodologies for the Estimation of Thermal Properties Associated with Aerospace Vehicles”, NASA Langley Research Center.

**Raouf Selim:** “Developing a High-Temperature rf-SQUID for Non-Destructive Evaluation”, NASA-STTR Program.

**U. Peter Solies:** Paper to be submitted to the Dynamics and Control Branch.

**Alfred G. Striz:** To submit a proposal for continuation of summer work, Computational Structural Mechanics, NASA Langley Research Center.

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

**Lee H. Spangler:** "A Science Resource for Montana Elementary Teachers" with Arnold Criag, National Science Foundation. "Investigation of Erbium Lasers for Eyesafe and 0.8 Micron Operation", NASA.

**Resit Unal:** "Multidisciplinary Design Optimization for Launch Vehicle Design", NASA Langley Research Center.

**Cornelis P. van Dam:** "Analysis and Prediction of Viscous Flows About Multi-Element High-Lift Systems on Subsonic Civil Transport Aircraft", NASA Langley Research Center.

### **Funded Research Proposals**

**Thomas A. Gally:** "Investigation into Design Methodologies for Airfoil/Wings at Separated or Near Separated Flight Conditions", NASA Langley Research Center.

**Vascar G. Harris:** Funded proposals: HSRII as subcontractor with NASA and Boeing Commercial (with Drs. Ali, Bofah, Hanley, Sheppard, and Sree).

**Ronald A. Hess:** "Development & Maintenance of Perceptual, Procedural, and Manual Skills in Automated Flight Decks", NASA Ames Research Center.

**Krishnaswamy Ravindra:** "Active Control of Buffet", MDA-E.

**Daniel O. Adams:** Plans to submit research results at a December '94 Textile Composites Working Group Conference at NASA Langley Research Center and to an undetermined journal at a later date.

**Elaine P. Scott:** "Development of Methodologies for the Estimation of Thermal Properties Associated with Aerospace Vehicles", Thermal Structures Branch, NASA Langley Research Center.

**Lee H. Spangler:** "The Methyl Rotor as a Probe of Electron Densities", National Science Foundation. "Development of Multi-Dimensional Spectroscopic Techniques for the Characterization of Laser Materials", National Science Foundation-EPSCoR. "Computational and Multidimensional Spectroscopic Studies of Solid State Laser Materials", NASA-EPSCoR.

## **SECTION VI**

### **SUMMARY OF PROGRAM EVALUATION**

A program evaluation questionnaire was given to each Fellow and to each Research Associate involved with the program. A sample of each questionnaire is in Appendix IX of this report. The questions and the results are given beginning on the next page fifty-six of fifty-eight evaluations were returned (97%).



A. Program Objectives

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

Yes	<u>48</u>	(87%)
No	<u>7</u>	(13%)

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

Yes	<u>53</u>	(96%)
No	<u>2</u>	(4%)

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

Yes	<u>44</u>	(80%)
No	<u>2</u>	(4%)
Uncertain	<u>9</u>	(16%)

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	<u>39</u>	(72%)	No	<u>15</u>	(28%)
-----	-----------	-------	----	-----------	-------

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

Very much so	<u>54</u>	(98%)
Somewhat	<u>1</u>	(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	<u>25</u>	(45%)
Redirected	<u>20</u>	(36%)
Advanced	<u>43</u>	(77%)
Barely maintained	<u>0</u>	
Unaffected	<u>          </u>	

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 55 (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	<u>44</u>	(79%)
By starting new courses	<u>9</u>	(16%)
By sharing your research experience	<u>46</u>	(82%)
By revealing opportunities for future employment in government agencies	<u>25</u>	(45%)
By deepening your own grasp and enthusiasm	<u>33</u>	(60%)
Will affect my teaching little, if at all	<u>0</u>	

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 46 (85%)    No 8 (15%)

**C. Administration**

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

Received announcement in the mail	<u>18</u>	(32%)
Read about in a professional publication	<u>4</u>	( 7%)
Heard about it from a colleague	<u>25</u>	(45%)
Other (Explain below)	<u>9</u>	(16%)

Previous participation; NASA Center Employee;  
Sponsored Programs Office at University;  
Bulletin board at another institution

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

Yes 19 (34%)      No 37 (66%)

<u>1</u> ( 2%)	DOE
<u>16</u> (29%)	Another NASA Center
<u>8</u> (14%)	Air Force
<u>4</u> ( 7%)	Army
<u>10</u> (18%)	Navy
<u>1</u> ( 2%)	Other: National Institute of Environmental Health Services (NIEHS)

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

Yes 5 (11%)      No 42 (89%)

NASA Goddard; Air Force; NIEHS

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

Many	<u>13</u>	(23%)
A few	<u>36</u>	(64%)
None	<u>7</u>	(13%)

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

Yes 26 (48%)      No 28 (52%)

If not, why? Adequate and work experience means more; Adequate, but extra amount may allow family to come which may be a deciding factor; Experience worthwhile, plus department supplemented but may not next

summer; Work more important; Enjoy interaction and stimulation from the NASA organization; Stipend amount below "market rate", but purpose is not to make money, but to learn and contribute.

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

Yes 46 (82%) No 10 (18%)

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

Yes 47 (92%) No 4 (8%)

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

Yes 51 (91%) No 5 (9%)

9. How do you rate the seminar program?

Excellent	<u>14</u>	(25%)
Good	<u>26</u>	(46%)
Fair	<u>13</u>	(23%)
Poor	<u>3</u>	( 5%)

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
Research	23 (41%)	10 (18%)	0	21 (38%)
Lectures	39 (70%)	2 (4%)	4 (7%)	7 (13%)
Tours	30 (54%)	12 (21%)	1 (2%)	8 (14%)
Social/Rec.	39 (70%)	3 (5%)	0	10 (18%)
Meetings	38 (68%)	5 (9%)	0	6 (11%)

11. What is your overall evaluation of the program?

Excellent	<u>49</u>	(89%)
Good	<u>3</u>	(5%)
Fair	<u>2</u>	(4%)
Poor	<u>1</u>	(2%)

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?

\$ 47,870 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 5 (9%) No 25 (46%) In Part 24 (44%)

3. What, in your opinion, is an adequate stipend for the ten-week program during the summer of 1995?

\$10K-20 (38%); \$11-7 (13%); \$12K-9 (17%); \$12.5-2 (4%);

\$13K-4 (8%); \$14K-3 (6%); \$15K-4 (8%); \$16-1 (2%)

Two-(4%) Said: Should be proportional to one's academic year salary;  
Consider another pay schedule for senior researchers.

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

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

Yes 12 (21%)                      No 44 (79%)

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

Yes 37 (71%)                      No 15 (29%)

## **Fellows' Comments**

Great program, very well run and administered. I got a good dose of stimulation for teaching and research at home. Hope to continue my association with the lab in the future, funded or unfunded.

Wonderful experience, thanks to all the ASEE personnel. It is difficult to improve a program that is so well organized and administered. Great as is. Don't change a thing.

Well administered and provides a unique opportunity for university faculty to interact with NASA scientists. Keep it running and expand it if possible.

My experience as an ASEE Fellow in the Office of Education has been extremely positive and personally/professionally rewarding. Staff personnel have always been very professional, organized, and devoted to the program. They should be commended for organizing and implementing such a program.

Coordination of the program by Mr. John Spencer and Ms. Debbie Young was perfect. Relocation allowance should be increased for those coming from far away places. Only mileage was paid, no lodging on the way.

I am very interested in NASA's work with educators. I feel that there is a lot of information and research at NASA that would be very important to educators. Students are naturally curious about space and flight. Faculty can provide the skills that will bridge the gap between information at NASA and school needs. I feel that this is important for ensuring that students are educated appropriately in order to provide a pool of scientists and engineers.

This has been an excellent program, one of the high spots of my career

Would be interesting to pair faculty with LARSS students to improve productivity.

Stipends should reflect the fact that many Fellows are forced to operate/pay for two households during the summer.

Debbie did a great job and worked hard, but you guys worry too much about "the program". The real advantages/disadvantages come within each branch and the research there. Organizing social events and general seminars is not that necessary. The key role of program organizers should be in helping us before we get here (they did that well). Once we're here we are much more concerned with goings-on in our individual branch/division.

## **Fellows' Recommendations**

- Many commented on the Technical Lecture Series. Choose more interesting seminar topics with more lively speakers. Some speakers were excellent but others were very poor. Possibly replace one or two lectures with a tour of the facility
- It would be nice to meet other faculty members and their families earlier in the program. Provide better opportunities to meet by introductions at the picnic and organizing other family oriented social functions.
- Provide more outreach to community college faculty in technical areas.
- Provide more flexible program dates and hours. Possibly allow Fellows to work 10 weeks out of a 13 or 14 week calendar which would make it easier for semester vs. quarter people.
- Provide a higher relocation allowance, particularly for those from far away. Have relocation allowance available on the first day of the program.
- Provide more housing options with a map indicating the location of each.
- Ensure adequate facilities are prepared **prior to** arrival of Fellow, including office space, desk, computer, phone, e-mail, computer accounts, and any special supplies needed for the research.
- Provide exposure to other branches and points of contact.
- Prepare an annual document for review that briefly lists the research projects done by ASEE Fellows in the other ASEE Programs across the nation.
- Emphasize to NASA researchers that follow-up work (preparation of research proposals) is important.
- Develop an ASEE video and brochure to reach a wider faculty audience.

## **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.

### **Research Associates' Comments**

I would be an Associate again only if I had a role in selecting the individual.



Since the administrative support was transparent to me as an Associate, it probably was exceptional.

My dilemma is how do I get more individuals (like my ASEE Fellow) with ideas grounded in reality and less "ivory tower" types.

While research progress was good, the amount of time was simply too short. Plan for a longer summer term, like maybe 12 weeks.

The strength of the program for my Fellow and me was his autonomy to use his own initiative and vision to access the unique talents and skills to be found here at Langley. Bring in the best and leave them alone!

My Fellow was adequately prepared because he was in contact several times prior to the start of the program to do background work.

Little interaction was required with the ASEE staff, but very good response when it was needed.

Fellow was equal to the best and the ASEE administrative staff support was exceptional. Everything was great!

Many Associates commented on the excellent quality of work/research put forth by their ASEE Fellow.

Yes, I am interested in being an Associate again. It is very important for the Fellow to take an appreciation of Computational Fluid Dynamics back to his institution. If I can help in this, I will.

### **Research Associates' Recommendations**

- Based on my limited experience, the program operates smoothly. Maybe some mechanism should be investigated to allow Fellows to work after hours as required.
- The Associate/Mentor training Seminar was useful for first time Associates like myself.
- Start Associate Mentor training Seminar at 9:00, safety portion too long, and need to clarify policy on Fellows taking leave and making up time. Instead of having so many briefings, have more experienced Associates and ASEE staff on a panel and allow most of the time for Q & A.
- Make it 12 weeks.
- Program excellent as is, no recommended improvements.

- Perhaps funds could be made available so that the Associate could visit the Fellow at his/her home institution.
- Provide more advanced information on the ASEE Fellow.

## **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.
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.

**APPENDIX I**  
**PARTICIPANTS - ASEE/NASA LANGLEY**  
**SUMMER FACULTY RESEARCH PROGRAM**

## **1994 NASA Langley ASEE Summer Faculty Fellowship Program Fellows**

### **Name and Institution**

Dr. Daniel O. Adams  
Iowa State University

Dr. Madeleine Y. Andrawis  
South Dakota State University

Dr. Han P. Bao  
Old Dominion University

Ms. Sherilee F. Beam (R)  
Hampton University

Dr. Jack L. Beuth  
Carnegie Mellon University

Ms. Lydia V. Black  
Virginia Beach Public School Systems/  
Old Dominion University

Dr. David H. Bridges  
Mississippi State University

Ms. Cynthia L. Brooks  
University of Arkansas-Pine Bluff

Dr. Fredrick M. Cady  
Montana State University

Dr. Randal D. Carlson  
Pennsylvania State University

Dr. Soyoung S. Cha  
University of Illinois

Dr. Julie Chen  
Boston University

Dr. John M. Cimbala (R)  
Pennsylvania State University

Dr. Andrew Davidhazy  
Rochester Institute of Technology

Capt. Carlo Greg N. Demandante  
United States Air Force Academy

### **NASA Associate and Division**

Mr. Clarence C. Poe  
Materials

Mr. Jose M. Alvarez  
Atmospheric Sciences

Mr. W. Douglas Morris  
Space Systems and Concepts

Mr. William H. C. von Ofenheim  
Information Systems

Dr. Thomas K. O'Brien  
Materials

Dr. Belinda H. Adams  
Office of the Director

Dr. Jerome T. Kegelman  
Flight Mechanics and Acoustics

Mr. Floyd S. Shipman  
Information & Electromagnetic Tech.

Dr. Norman Barnes  
Aerospace Electronic Systems

Dr. Samuel E. Massenberg  
Office of Education

Mr. Alpheus W. Burner  
Experimental Testing Technology

Mr. H. Benson Dexter  
Materials

Dr. Thomas B. Gatski  
Flight Mechanics and Acoustics

Dr. Thomas E. Pinelli  
Scientific and Technical Information

Dr. Billy T. Upchurch  
Experimental Testing Technology

**Name and Institution**

Dr. Terry L. Dickinson  
Old Dominion University

Mr. Milton W. Ferguson (R)  
Norfolk State University

Dr. Thomas A. Gally (R)  
Texas A&M University

Dr. Jamal Anthony Ghorieshi (R)  
Wilkes University

Dr. James S. Green (R)  
Moravian College

Dr. Vascar G. Harris  
Tuskegee University

Dr. Ronald A. Hess  
University of California-Davis

Mr. Jack M. Holm  
Rochester Institute of Technology

Dr. Jen-Kuang Huang (R)  
Old Dominion University

Dr. Peter G. Ifju  
University of Florida

Dr. Constantine Katsinis  
University of Alabama-Huntsville

Mr. Paul J. Kauffmann  
Thomas Nelson Community College

Dr. Edmond B. Koker (R)  
Elizabeth City State University

Dr. Ramesh Krishnamurthy (R)  
Old Dominion University

Dr. Thomas A. Lacksonen  
Ohio University

**NASA Associate and Division**

Dr. Michael Glenn  
Office of Human Resources

Dr. Min Namkung  
Materials

Mr. Richard L. Campbell  
Aerodynamics

Mr. Warren C. Kelliher  
Facility Systems Engineering

Ms. Kathy Stacy  
Information Systems

Dr. John V. Shebalin  
Flight Mechanics and Acoustics

Dr. Barton J. Bacon  
Flight Dynamics and Control

Dr. Thomas E. Pinelli  
Scientific and Technical Information

Mr. Nelson J. Groom  
Flight Dynamics and Control

Dr. Thomas B. Gates  
Materials

Mr. Paul J. Hayes  
Information & Electromagnetic Tech.

Mr. Charles E. Cockrell  
Office of Safety, Environment and  
Mission Assurance

Dr. Reginald J. Exton  
Flight Mechanics and Acoustics

Mr. Griffin Y. Anderson  
Gas Dynamics

Mr. Richard A. Foss  
Aerospace Electronic Systems

**Name and Institution**

Dr. Lynn Lambert  
Christopher Newport University

Dr. James F. Leathrum  
Old Dominion University

Dr. Tae W. Lim  
University of Kansas

Dr. Norman W. Loney  
New Jersey Institute of Technology

Dr. Chu-Ho Lu  
Memphis State University

Dr. Erdogan Madenci (R)  
University of Arizona

Dr. Tina Marshall-Bradley  
Norfolk State University

Dr. James E. Martin  
Christopher Newport University

Dr. Brett A. Newman  
Old Dominion University

Dr. Freda Porter-Locklear  
Pembroke State University

Dr. Sandra B. Proctor (R)  
Norfolk State University

Dr. Masoud Rais-Rohani (R)  
Mississippi State University

Dr. James M. Rankin (R)  
St. Cloud State University

Dr. Krishnaswamy Ravindra  
Parks College

Dr. George T. Rublein  
College of William and Mary

Dr. Elaine P. Scott  
VA Tech Institute and State University

**NASA Associate and Division**

Dr. Samuel E. Massenberg  
Office of Education

Dr. Thomas A. Zang  
Flight Mechanics and Acoustics

Mr. Richard J. Silcox  
Flight Mechanics and Acoustics

Mr. Jon E. Thompson  
Facility Systems Engineering

Dr. James H. Starnes  
Structures

Dr. James H. Starnes  
Structures

Dr. Samuel E. Massenberg  
Office of Education

Dr. Jay C. Hardin  
Flight Mechanics and Acoustics

Mr. Carey S. Buttril  
Flight Dynamics and Control

Dr. Harold L. Atkins  
Flight Mechanics and Acoustics

Mr. Edwin J. Prior  
Office of Education

Mr. Donald J. Baker  
Structures

Mr. Steven D. Young  
Information & Electromagnetic Tech.

Mr. Stanley R. Cole  
Structures

Mr. James G. Batterson  
Flight Dynamics and Control

Dr. Charles J. Camarda  
Structures

**Name and Institution**

Dr. Raouf L. Selim  
Christopher Newport University

Dr. Denise V. Siegfeldt (R)  
Hampton University

Dr. Ron W. Simmons  
University of Virginia

Dr. Uwe Peter Solies  
University of Tennessee Space Institute

Dr. Lee H. Spangler  
Montana State University

Dr. Alfred G. Striz  
University of Oklahoma

Dr. Naushadalli K. Suleman  
Hampton University

Dr. Richard H. Tipping  
University of Alabama

Dr. George F. Tucker  
Sage Junior College of Albany

Mr. Robert L. Tureman  
Paul D. Camp Community College

Dr. Resit Unal  
Old Dominion University

Dr. Cornelis P. van Dam  
University of California

R-Designates returnees

**NASA Associate and Division**

Mr. Warren C. Kelliher  
Facility Systems Engineering

Mr. Howard Puckett  
Logistics Management

Dr. Samuel E. Massenberg  
Office of Education

Mr. E. Bruce Jackson  
Flight Dynamics and Control

Dr. Norman Barnes  
Aerospace Electronic Systems

Dr. Jaroslaw Sobieski  
Structures

Dr. Sheila Thibeault  
Materials

Dr. Mary Ann H. Smith  
Atmospheric Sciences

Mr. Glen W. Sachse  
Aerospace Electronic Systems

Mr. John J. Cox  
Office of Human Resources

Mr. Douglas O. Stanley  
Space Systems and Concepts

Mr. Long P. Yip  
Flight Dynamics and Control

**APPENDIX II**  
**LECTURE SERIES**  
**PRESENTATIONS BY RESEARCH FELLOWS**  
**CALENDAR OF ACTIVITIES**



1994 NASA/ASEE Summer Faculty Fellowship Program  
and Langley Aerospace Research Summer Scholars (LARSS) Program

TECHNICAL 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

<b><u>DATE</u></b>	<b><u>TOPIC</u></b>	<b><u>SPEAKER</u></b>
June 13	Earth On Fire: The Atmospheric, Climatic, and Biospheric Implications of Global Burning	Dr. Joel S. Levine Space and Atmospheric Sciences Program Group
June 20	Integrating Computing Architectures: The MetaCenter	Dr. Frank C. Thames Internal Operations Group
June 27	The High Performance Computing Program: The Need for Teraflops	Mr. Manuel D. Salas Research & Technology Group
July 12	NASA LaRC A National Resource for Economic Growth	Dr. Joseph S. Heyman Technical Applications Group
July 18	High Speed Research Sonic Boom Program	Dr. Christine M. Darden Aeronautics Program Group
July 25	The Nauticus Museum	Ms. Kelly Nolte Nauticus Museum Norfolk, Virginia

**NEXT LECTURE**

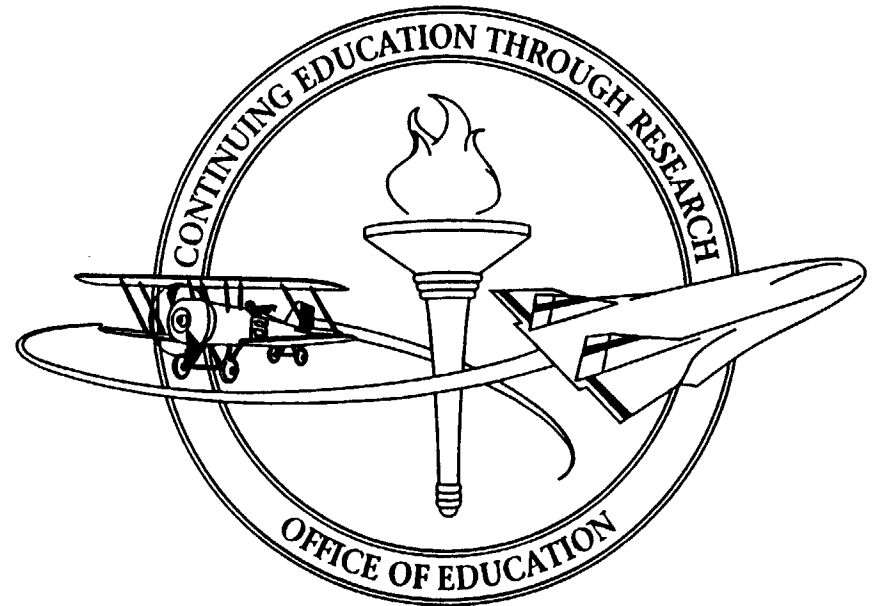
July 12, 1994

**NASA LaRC A NATIONAL RESOURCE  
FOR ECONOMIC GROWTH**

presented by

Dr. Joseph S. Heyman

Technology Applications Group

**NASA Langley Research Center  
ASEE Summer Faculty Fellowship Program****and****Langley Aerospace Research Summer****Scholars (LARSS) Program****TECHNICAL LECTURE SERIES****June 27, 1994**

## **The High Performance Computing and Communications Program: The Need for Teraflops**

This presentation will begin with an overview of the organization and mission of the newly formed Research & Technology Group. This will be followed by the main subject of the talk, the High Performance Computing and Communications Program.

The Research & Technology Group (RTG) consists of approximately 800 engineers and scientists divided into seven critical disciplines and constitutes the core of research activities at Langley. The RTG is organized as a matrix from which multidisciplinary teams can be quickly created to support aeronautics core discipline programs and some selected focused programs. In addition, the RTG supports the Atmospheric Science and Space Planning Program Group.

3  
6

The High Performance Computing and Communications (HPCC) Program is a Federal Program created by the Office of Science and Technology back in 1989 to accelerate the availability and utilization of high performance computers and networks throughout the United States. It is driven by the recognition that unprecedented computational power and its creative use are needed to investigate and understand a wide range of scientific and engineering problems. Among the many problems that will benefit from this effort are: weather prediction; studies involving climate and global change; determination of molecular, atomic, and nuclear structure; understanding turbulence, pollution dispersion, and combustion systems; improving research and education communication; and understanding the nature of new materials.

In this talk, we begin by reviewing the Federal Program, then move on to review NASA's role, and finish by discussing the on going effort at Langley Research Center.

## **Manuel D. Salas**

- \* Manager, Computational AeroSciences Office, Research & Technology Group, NASA Langley Research Center.
- \* Graduated from the Polytechnic Institute of Brooklyn (today known as the Polytechnic University) and holds degrees in Aerospace Engineering and Astronautics. His graduate work was focused in computational fluid dynamics. He is the author or co-author of over 75 technical papers and editor of three books. He has lectured extensively at national and international meetings and taught graduate courses at Virginia Tech, the University of Rome, Italy, the Polytechnic University, and Brown University.
- \* Mr. Salas has 25 years experience in conducting and managing basic and applied research in fluid mechanics. His work on computational fluid dynamics is extensively used today by the aerospace industry and the academic community. In 1991, he was awarded NASA's medal for exceptional scientific achievement for his many contributions to this field.
- \* Prior to his current position, he served as Chief Scientist for the Fluid Mechanics Division. In this position, he advised the Division Chief on theoretical and computational research and conducted personal research with an emphasis on aerodynamic optimization. Prior to that, as Head of the Theoretical Aerodynamics Branch, he led a group of about 30 researchers in the development of many of the computational tools used today.
- \* In his current position as manager of the Computational AeroSciences Office, he directs NASA Langley's efforts in the High Performance Computing and Communications Program.

# 1994 American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program Final Presentations

Wednesday, August 10, 1994  
H.J.E. Reid Conference Center  
9:00 a.m. to 11:30 a.m.

Welcome		Dr. Samuel E. Massenberg Director Office of Education
9:00 a.m.-9:20 a.m.	"Holographic Flow Measurements"	Dr. Soyoung S. Cha Internal Operations Group (ETTD) University of Illinois
9:20 a.m.-9:40 a.m.	"Stochastic Decision Analysis"	Dr. Thomas A. Lacksonen Internal Operations Group (AMSD) Ohio University
9:40 a.m.-10:00 a.m.	"Langley's Teacher Enhancement Institute"	Dr. Tina Marshall-Bradley Office of Education Norfolk State University
10:00 a.m.-10:20 a.m.	"Flow Separation Control in Design Applications"	Dr. Thomas A. Gally Research and Technology Group (AD) Texas A&M University
10:20 a.m.-10:40 a.m.	Break	
10:40 a.m.-11:00 a.m.	"Automation Technology Using Graphical Information Systems"	Professor Cynthia Brooks Research and Technology Group (IETD) University of Arkansas- Pine Bluff
11:00 a.m.-11:20 a.m.	"Thin Tailored Composite Wing for Civil Tiltrotor"	Dr. Masoud Rais-Rohani Research and Technology Group (SD) Mississippi State University
11:20 a.m.-11:30 a.m.	Closing Comments	
11:45 a.m.	Lunch for ASEE Fellows at LAFB Officer's Club (Tables reserved)	

**American Society for Engineering Education (ASEE) Program  
1994 Schedule of Activities**

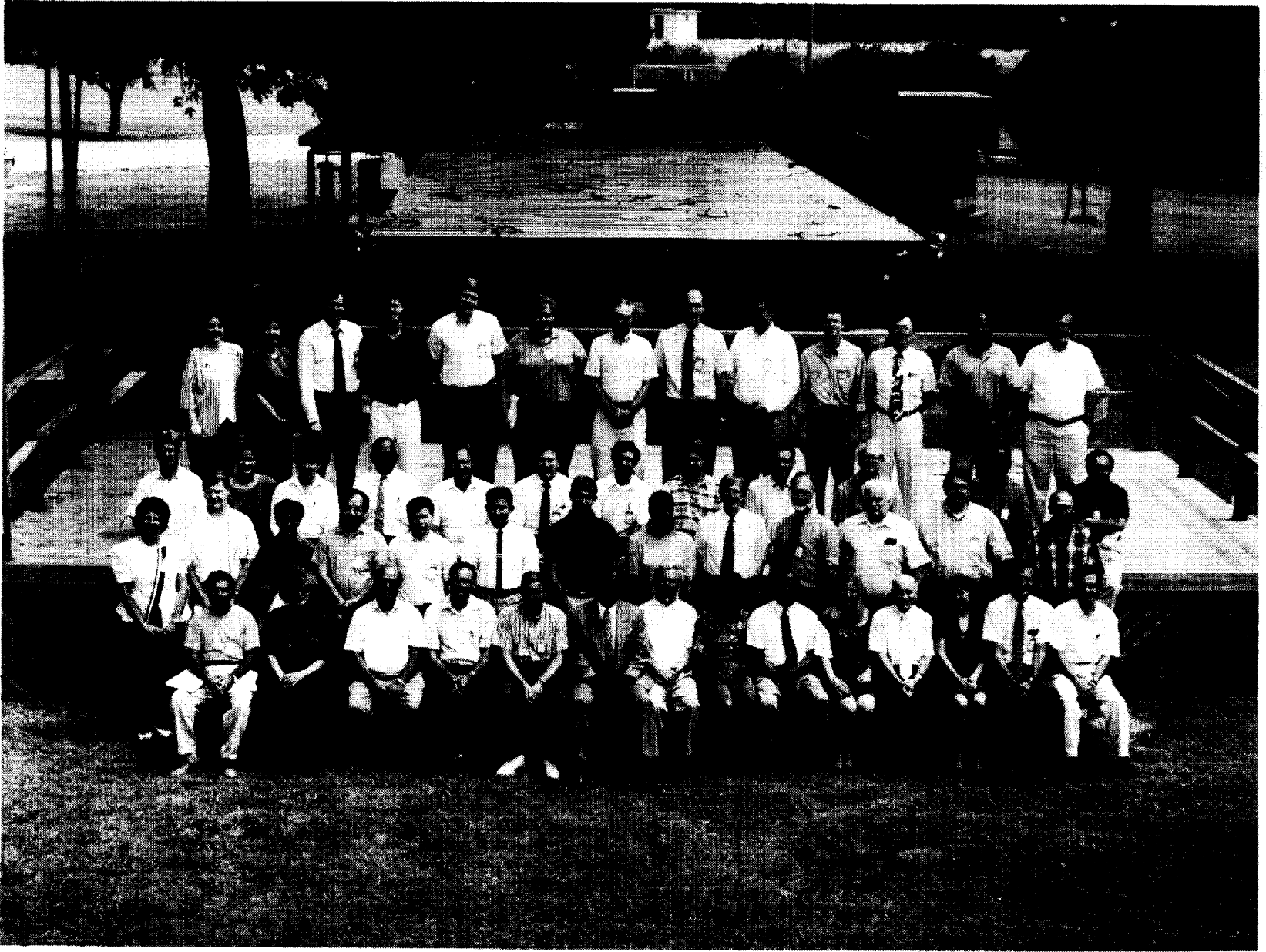
<b>Date</b>	<b>Function</b>	<b>Location</b>
June 6, 1994	Orientation Program	H.J.E. Reid Conference Center 14 Langley Boulevard, Bldg. 1222 Time: 8 a.m. - Registration 9 a.m. - Program Begins
June 6, 1994	ASEE Mixer	Holiday Inn Coliseum Lounge 1813 West Mercury Boulevard 5 p.m. - 7 p.m.
June 13, 1994	Technical Lecture	H.J.E. Reid Conference Center
June 15, 1994	Picnic	H.J.E. Reid Conference Center (Picnic Grounds)
June 20, 1994	Technical Lecture	H.J.E. Reid Conference Center
June 27, 1994	Technical Lecture	H.J.E. Reid Conference Center
July 12, 1994	Technical Lecture	H.J.E. Reid Conference Center
July 18, 1994	Technical Lecture	H.J.E. Reid Conference Center
July 21, 1994	Unsolicited Proposal Seminar	H.J.E. Reid Conference Center
July 25, 1994	Technical Lecture	H.J.E. Reid Conference Center
July 25-26, 1994	ASEE HQ Site Visit	Building 1218, Rms. 205 and 209
July 27, 1994	Banquet	Officer's Club Langley Air Force Base, Virginia
July 27, 1994	CEBAF Tour	Continuous Electron Beam Accelerator Facility-Newport News
July 29, 1994	Spirit of Norfolk Moonlight Cruise	Norfolk Waterside
August 10, 1994	ASEE Final Presentations	H.J.E. Reid Conference Center
August 12, 1994	Official Last Day of Program	

Following each Technical 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: Naushadalli K. Suleman, Sherilee F. Beam, Ramesh Krishnamurthy, Krishnaswamy Ravindra, John M. Cimbala, Norman W. Loney, Ronald A. Hess, Cynthia L. Brooks, John H. Spencer-ASEE Co-Director, Denise V. Siegfeldt, Terry L. Dickinson, Lynn Lambert, Paul J. Kauffmann, Masoud Rais-Rohani

Second Row: Madeleine Y. Andrawis, Daniel O. Adams, Julie Chen, Chu-Ho Lu, Fenglien Frank Lee (JOVE), Carlo Greg N. Demandante, Randal D. Carlson, Tina Marshall-Bradley, Jack M. Holm, Andrew Davidhazy, James S. Green, Robert L. Tureman, Erdogan Madenci

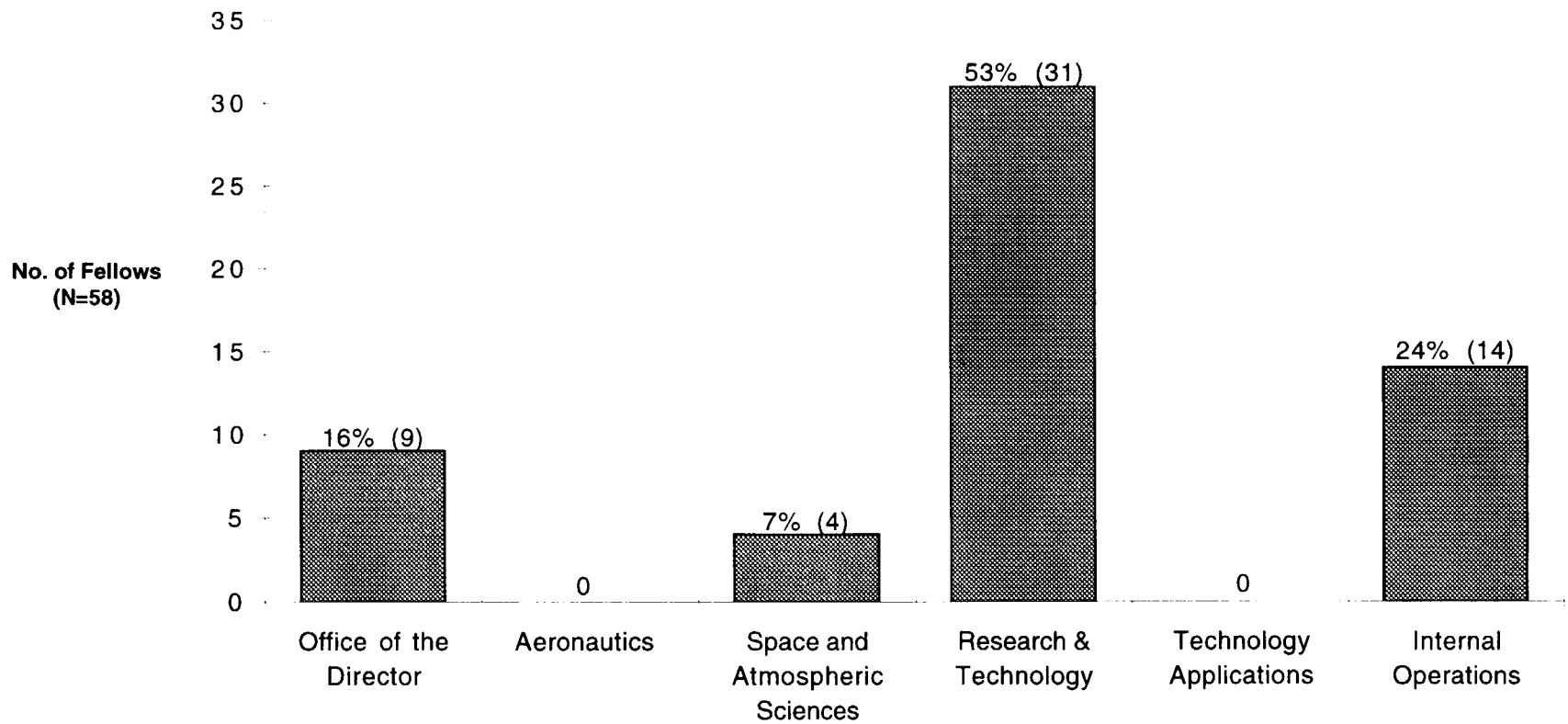
Third Row: Constantine Katsinis, Freda Porter-Locklear, Jamal "Tony" Ghorieshi, Milton W. Ferguson, Raouf L. Selim, Alfred G. Striz, Thomas A. Lacksonen, James M. Rankin, Vascar G. Harris, George Rublein, Edmond B. Koker, Han P. Bao

Back Row Standing: Debbie Young-ASEE Administrative Assistant, Lydia V. Black, James F. Leathrum, Peter G. Ifju, Jack L. Beuth, George F. Tucker, Fredrick M. Cady, Brett A. Newman, U. Peter Solies, James E. Martin, Jen-Kuang Huang, Ron W. Simmons, Richard H. Tipping

Not Pictured: David H. Bridges, Soyoungh S. Cha, Thomas A. Gally, Tae W. Lim, Sandra B. Proctor,

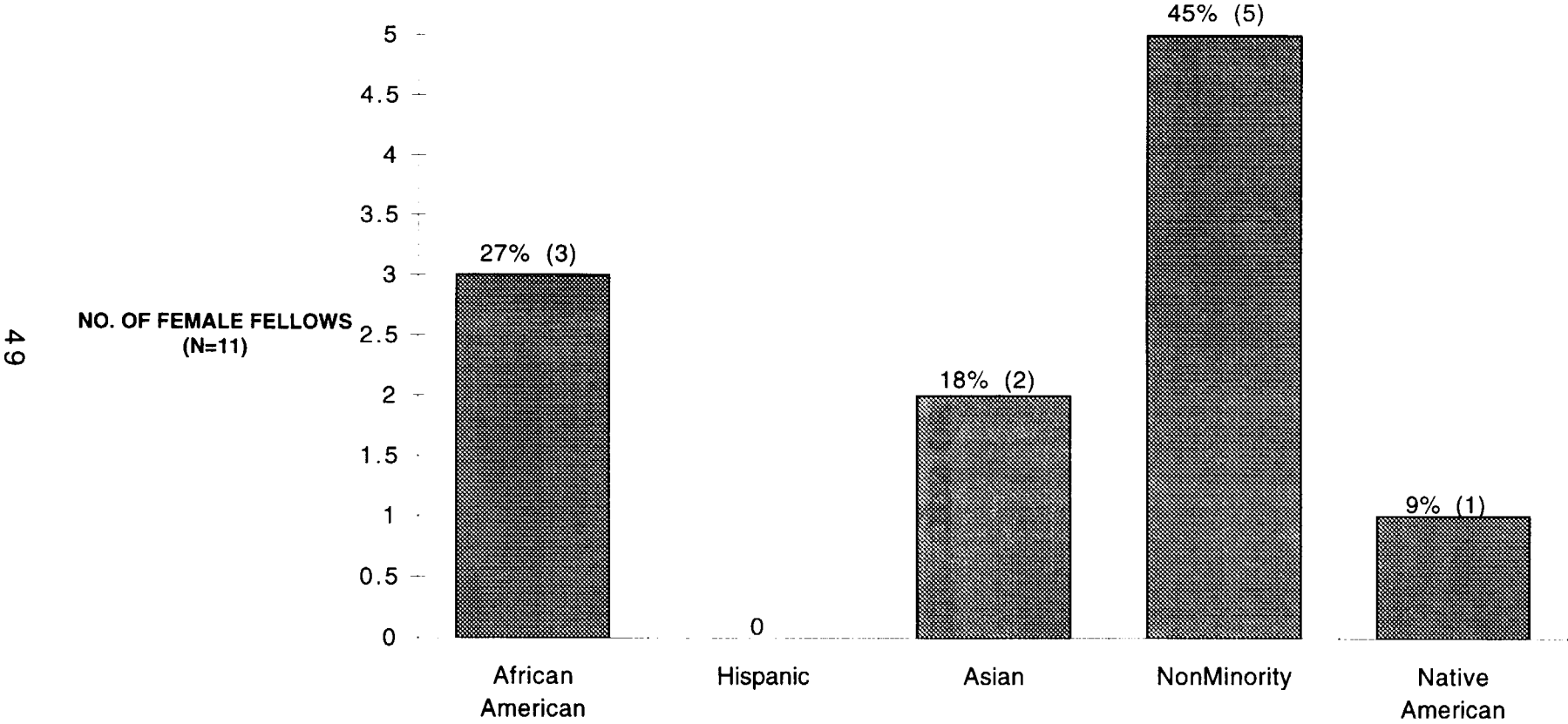
**APPENDIX IV**  
**DISTRIBUTION OF FELLOWS BY GROUP**

# DISTRIBUTION OF 1994 ASEE (SFFP) FELLOWS BY GROUP



**APPENDIX V**  
**DISTRIBUTION OF FELLOWS BY ETHNICITY/FEMALE**

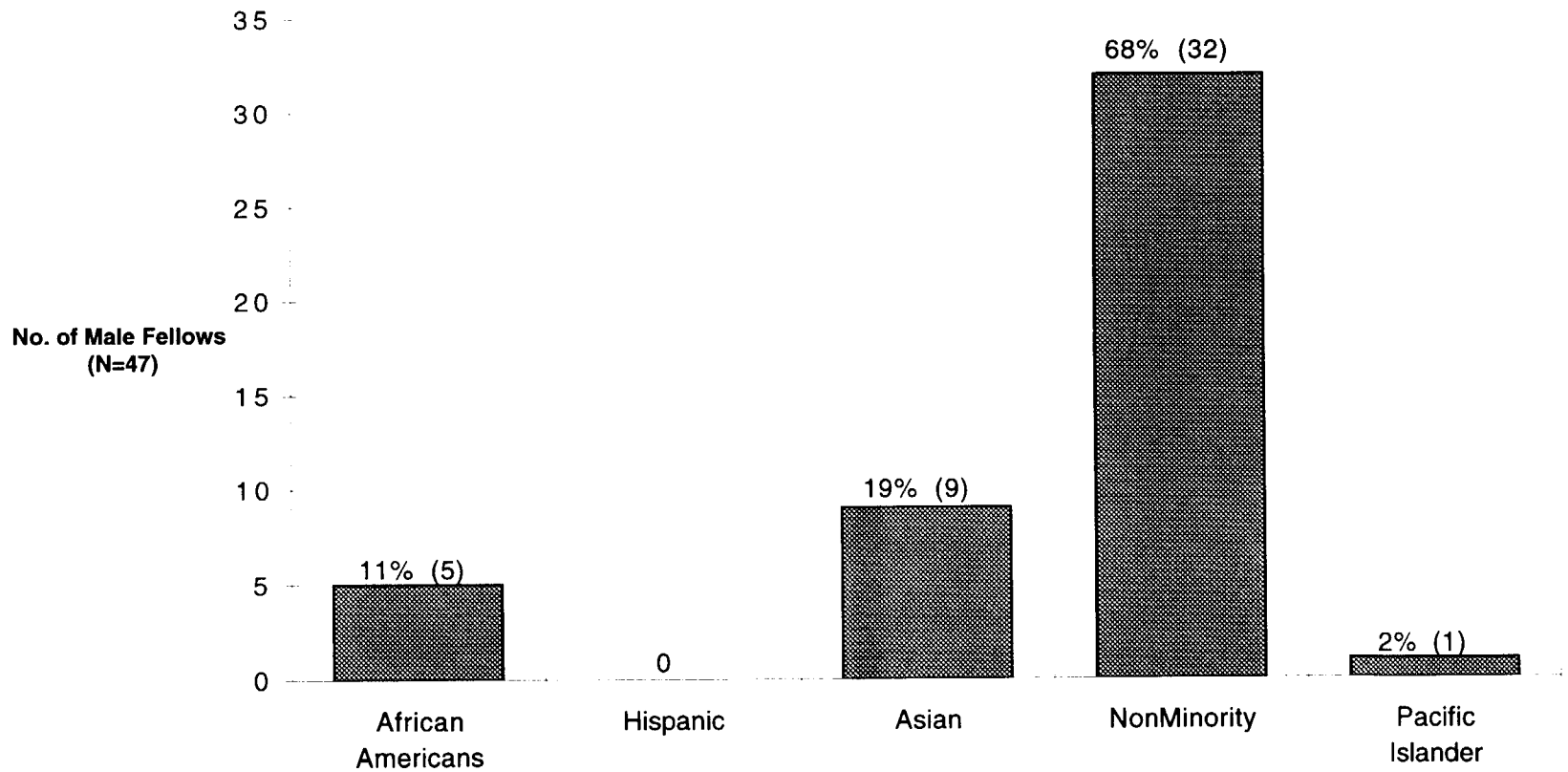
# DISTRIBUTION OF 1994 ASEE (SFFP) FEMALE FELLOWS BY ETHNICITY



**APPENDIX VI**  
**DISTRIBUTION OF FELLOWS BY ETHNICITY/MALE**

# DISTRIBUTION OF 1994 ASEE (SFFP) MALE FELLOWS BY ETHNICITY

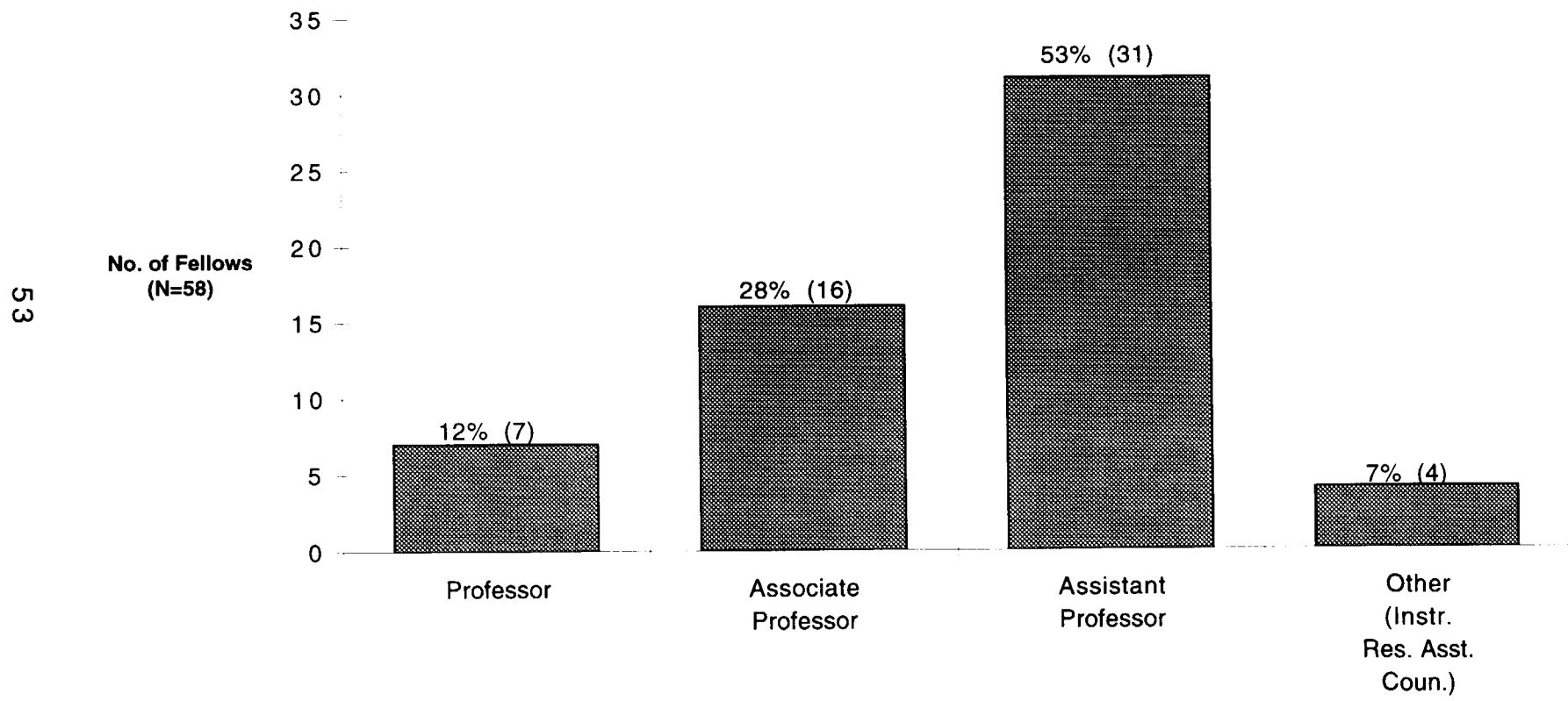
51



**APPENDIX VII**  
**DISTRIBUTION OF FELLOWS BY UNIVERSITY RANK**



# DISTRIBUTION OF 1994 ASEE (SFFP) FELLOWS BY UNIVERSITY RANK



**APPENDIX VIII**  
**DISTRIBUTION OF FELLOWS BY UNIVERSITY**

**1994 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM  
INSTITUTION PARTICIPATION**

<u>UNIVERSITY/COLLEGE</u>	<u>NO. OF FELLOWS</u>
Boston University	1
Carnegie Mellon University	1
Christopher Newport University	3
College of William and Mary	1
*Elizabeth City State University	1
*Hampton University	3
Iowa State University	1
Memphis State University	1
Mississippi State University	2
Montana State University	2
Moravian College	1
New Jersey Institute of Technology	1
*Norfolk State University	3
Ohio University	1
Old Dominion University	7
Parks College	1
Paul D. Camp Community College	1
^Pembroke State University	1
Pennsylvania State University	2
Rochester Institute of Technology	2
Sage Junior College of Albany	1
South Dakota State University	1
St. Cloud State University	1
Texas A&M University	1
Thomas Nelson Community College	1
*Tuskegee University	1
United States Air Force Academy	1
University of Alabama	1
University of Alabama-Huntsville	1
University of Arizona	1
*University of Arkansas-Pine Bluff	1
University of California	2
University of Florida	1
University of Illinois	1
University of Kansas	1
University of Oklahoma	1
University of Tennessee Space Institute	1
University of Virginia	1
Virginia Beach Public School System/Old Dominion University	1
Virginia Polytechnic Institute and State University	1
Wilkes University	<u>1</u>
<b>Total Number of Fellows</b>	<b>58</b>
<b>Total Number of Institutions Represented</b>	<b>41</b>

\*Indicates a **H**istorically **B**lack College or University (HBCU).

^Indicates an **O**ther **M**inority **U**niversity (OMU)

**APPENDIX IX**  
**ABSTRACTS - RESEARCH FELLOWS**

1995/11/6 857

N95-23277

**IDEALIZED TEXTILE COMPOSITES FOR  
EXPERIMENTAL/ANALYTICAL CORRELATION**

**Dan Adams  
Aerospace Engineering. and Engineering Mechanics Dept.  
Iowa State University  
Ames, IA 50011**

Textile composites are fiber reinforced materials produced by weaving, braiding, knitting, or stitching. These materials offer possible reductions in manufacturing costs compared to conventional laminated composites. Thus, they are attractive candidate materials for aircraft structures. To date, numerous experimental studies have been performed to characterize the mechanical performance of specific textile architectures. Since many materials and architectures are of interest, there is a need for analytical models to predict the mechanical properties of a specific textile composite material. Models of varying sophistication have been proposed based on mechanics of materials, classical laminated plate theory, and the finite element method. These modeling approaches assume an idealized textile architecture and generally consider a single unit cell. Due to randomness of the textile architectures produced using conventional processing techniques, experimental data obtained has been of limited use for verifying the accuracy of these analytical approaches.

This research is focused on fabricating woven textile composites with highly aligned and accurately placed fiber tows that closely represent the idealized architectures assumed in analytical models. These idealized textile composites have been fabricated with three types of layer nesting configurations: stacked, diagonal, and split-span. Compression testing results have identified strength variations as a function of nesting. Moire interferometry experiments are being used to determine localized deformations for detailed correlation with model predictions.

## STUDY OF ATMOSPHERIC PARAMETERS MEASUREMENTS USING MM-WAVE RADAR IN SYNERGY WITH LITE-II

Dr. Madeleine Andrawis  
Electrical Engineering Department  
South Dakota State University  
Brookings, S.D. 57007-0194

The *Lidar In-Space Technology Experiment*, (LITE), has been developed, designed, and built by NASA Langley Research Center, to be flown on the space shuttle "Discovery" on September 9, 1994. Lidar, which stands for *light detecting and ranging*, is a radar system that uses short pulses of laser light instead of radio waves in the case of the common radar. This space-based lidar offers atmospheric measurements of stratospheric and tropospheric aerosols, the planetary boundary layer, cloud top heights, and atmospheric temperature and density in the 10-40 km altitude range.

A study is being done on the use, advantages, and limitations of a millimeter-wave radar to be utilized in synergy with the Lidar system, for the LITE-II experiment to be flown on a future space shuttle mission.

The lower atmospheric attenuation, compared to infrared and optical frequencies, permits the millimeter-wave signals to penetrate through the clouds and measure multi-layered clouds, cloud thickness, and cloud-base height. These measurements would provide a useful input to radiation computations used in the operational numerical weather prediction models, and for forecasting.

High power levels, optimum modulation, data processing, and high antenna gain are used to increase the operating range, while space environment, radar tradeoffs, and power availability are considered.

Preliminary, numerical calculations are made, using the specifications of an experimental system constructed at Georgia Tech. The noncoherent 94 GHz millimeter-wave radar system has a pulsed output with peak value of 1 kW. The backscatter cross section of the particles to be measured, and are present in the volume covered by the beam footprint, is also studied.

## A MANUFACTURING DATABASE OF ADVANCED MATERIALS USED IN SPACECRAFT STRUCTURES

by

Han P. Bao, Ph.D., P.E.  
Professor of Manufacturing Engineering  
Department of Engineering Management  
Old Dominion University  
Norfolk, Virginia 23592

Cost savings opportunities over the life cycle of a product are highest in the early exploratory phase when different design alternatives are evaluated not only for their performance characteristics but also their methods of fabrication which really control the ultimate manufacturing costs of the product. In the past, Design-To-Cost methodologies for spacecraft design concentrated on the sizing and weight issues more than anything else at the early so-called "Vehicle Level" ( Ref: DOD/NASA Advanced Composites Design Guide ). Given the impact of manufacturing cost, the objective of this study is to identify the principal cost drivers for each materials technology and propose a quantitative approach to incorporating these cost drivers into the family of optimization tools used by the Vehicle Analysis Branch of NASA LaRC to assess various conceptual vehicle designs.

The advanced materials being considered include aluminum-lithium alloys, thermoplastic graphite-polyether etherketone composites, graphite-bismaleimide composites, graphite- polyimide composites, and carbon-carbon composites. Two conventional materials are added to the study to serve as baseline materials against which the other materials are compared. These two conventional materials are aircraft aluminum alloys series 2000 and series 7000, and graphite-epoxy composites T-300/934.

The following information is available in the database. For each material type, the mechanical, physical, thermal, and environmental properties are first listed. Next the principal manufacturing processes are described. Whenever possible, guidelines for optimum processing conditions for specific applications are provided. Finally, six categories of cost drivers are discussed. They include, design features affecting processing, tooling , materials, fabrication, joining/assembly, and quality assurance issues. It should be emphasized that this database is not an exhaustive database. Its primary use is to make the vehicle designer aware of some of the most important aspects of manufacturing associated with his/her choice of the structural materials .

The other objective of this study is to propose a quantitative method to determine a Manufacturing Complexity Factor ( MCF ) for each material being contemplated. This MCF is derived on the basis of the six cost drivers mentioned above plus a Technology Readiness Factor which is very closely related to the Technology Readiness Level ( TRL ) as defined in the *Access To Space* final report. Short of any manufacturing information, our MCF is equivalent to the inverse of TRL. As more manufacturing information is available, our MCF is a better representation ( than TRL ) of the fabrication processes involved. The most likely application for MCF is in cost modeling for trade studies. On-going work is being pursued to expand the potential applications of MCF.

1995/11/28/60

**N95- 23280**

**Infinite Possibilities:  
Computational Structures Technology**

by

Sherilee F. Beam  
Hampton University  
Hampton, VA 23668

Computational Fluid Dynamics (or CFD) methods are very familiar to the research community. Even the general public has had some exposure to CFD images, primarily through the news media. However, very little attention has been paid to CST--Computational Structures Technology. Yet, no important design can be completed without it.

During the first half of this century, researchers only dreamed of designing and building structures on a computer. Today their dreams have become practical realities as computational methods are used in all phases of design, fabrication and testing of engineering systems. Increasingly complex structures can now be built in even shorter periods of time. Over the past four decades, computer technology has been developing, and early finite element methods have grown from small in-house programs to numerous commercial software programs. When coupled with advanced computing systems, they help engineers make dramatic leaps in designing and testing concepts.

The goals of CST include: predicting how a structure will behave under actual operating conditions; designing and complementing other experiments conducted on a structure; investigating microstructural damage or chaotic, unpredictable behavior; helping material developers in improving material systems; and, being a useful tool in design systems optimization and sensitivity techniques. Applying CST to a structure problem requires five steps: 1) observe the specific problem; 2) develop a computational model for numerical simulation; 3) develop and assemble software and hardware for running the codes; 4) post-process and interpret the results; and 5) use the model to analyze and design the actual structure.

Researchers in both industry and academia continue to make significant contributions to advance this technology with improvements in software, collaborative computing environments and supercomputing systems. As these environments and systems evolve, computational structures technology will evolve. By using CST in the design and operation of future structures systems, engineers will have a better understanding of how a system responds and lasts, more cost-effective methods of designing and testing models, and improved productivity.

For informational and educational purposes, a videotape is being produced using both static and dynamic images from research institutions, software and hardware companies, private individuals, and historical photographs and drawings. The extensive number of CST resources indicates its widespread use. Purdue University, Lawrence Livermore National Laboratory, Sandia Laboratories, Boeing, Langley, Johnson, and Lewis Research Centers, ANSYS, MSC NASTRAN, Cray, Inc. and several other locations have submitted images, either on videotape or in a digital file format. Applications run the gamut from simpler university-simulated problems to those requiring solutions on supercomputers. In some cases, an image or an animation will be mapped onto the actual structure to show the relevance of the computer model to the structure.

Transferring the digital files to videotape presents a number of problems related to maintaining the quality of the original image, while still producing a broadcast quality videotape. Since researchers normally do not create a computer image using traditional composition theories or video production requirements, often the image loses some of its original digital quality and impact when transferred to videotape. Typical problems include: image size perspective (not created in video format of three by four); color (the full color saturation of the image cannot be reproduced on video); an overabundance of red in an image, as well as other problems. Although many CST images are currently available, those that are edited into the final project must meet two important criteria: they must complement the narration, and they must be broadcast quality when recorded on videotape.



## Separation of Crack Extension Modes in Composite Delamination Problems

by

Jack Beuth  
Assistant Professor  
Department of Mechanical Engineering  
Carnegie Mellon University  
Pittsburgh, PA 15213

This work concerns fracture mechanics modeling of composite delamination problems. In order to predict delamination resistance, an applied stress intensity factor,  $K$ , or energy release rate,  $G$ , must be compared to a mode-dependent critical value of  $K$  or  $G$  from experiment. In the interfacial fracture analysis of most applications and some tests, the mode of crack extension is not uniquely defined. It is instead a function of distance from the crack tip due to the oscillating singularity existing at the tip. In this work, a consistent method is presented of extracting crack extension modes in such cases. In particular, use of the virtual crack closure technique (VCCT) to extract modes of crack extension is studied for cases of a crack along the interface between two in-plane orthotropic materials.

Modes of crack extension extracted from oscillatory analyses using VCCT are a function of the virtual crack extension length,  $\Delta$ . Most existing efforts to obtain  $\Delta$ -independent modes of crack extension involve changing the analysis in order to eliminate its oscillatory nature. One such method involves changing one or more properties of the layers to make the oscillatory exponent parameter,  $\epsilon$ , equal zero. Standardized application of this method would require consistent criteria for identifying which properties can be altered without changing the physical aspects of the problem. Another method involves inserting a thin homogeneous layer (typically referred to as a resin interlayer) along the interface and placing the crack within it. The drawbacks of this method are that it requires increased modeling effort and introduces the thickness of the interlayer as an additional length parameter.

The approach presented here does not attempt to alter the interfacial fracture analysis to eliminate its oscillatory behavior. Instead, the argument is made that the oscillatory behavior is non-physical and that if its effects were separated from VCCT quantities, then consistent,  $\Delta$ -independent modes of crack extension could be defined. Knowledge of the near-tip fields in a planar orthotropic material interfacial fracture analysis is used to determine the explicit  $\Delta$  dependence of VCCT parameters. Once this  $\Delta$  dependence is determined, energy release rates are defined with this  $\Delta$  dependence factored out. This modified VCCT method is applied to results from two finite element test cases. It is shown that, as predicted,  $\Delta$ -independent modes of crack extension result.

The modified VCCT approach shows potential as a consistent method of extracting crack extension modes. It uses the same information from a finite element analysis (i.e. nodal forces and displacements) as the traditional VCCT method does. The  $\Delta$ -independent modes extracted using the modified VCCT approach can also be used as guides to test the convergence of finite element solutions.

**PROJECT: INTERNAL COMMUNICATIONS**

for

Dr. Belinda H. Adams  
Assistant Director for Planning  
NASA Langley Research Center  
Hampton, Virginia

by

Lydia Black  
1994 ASEE Fellow

**PROJECT ABSTRACT**

The purpose of this study was to ascertain the perceived information needs of NASA Langley employees. One hundred and twelve fact-to-face interviews were conducted with a representative sample of aero-space technologists, administrative professionals, technicians, and secretarial/clerical personnel. Results of employee perceptions are analyzed and summarized using affinity diagramming. Particular strategies to maximize use of existing internal communication networks are discussed.

**Crossflow Instability Control on a Swept Wing: Preliminary Studies**

David H. Bridges, Assistant Professor  
Department of Aerospace Engineering  
P.O. Drawer A  
Mississippi State University, MS 39762

The pressure distribution on a swept wing causes the streamlines at the edge of the boundary layer to be curved. This pressure gradient normal to the external streamline creates a velocity component normal to the external streamline within the boundary layer which is referred to as the crossflow velocity. Because the crossflow velocity profile perpendicular to the wing surface has an inflection point, the profile is unstable. The stationary instability mode takes the form of crossflow vortices. Under these conditions, the boundary layer on the wing is extremely unstable and transition to turbulent flow takes place much closer to the leading edge of the wing than it would on an unswept wing. Higher skin friction drag is associated with turbulent flow, and so better aircraft performance could be obtained if the crossflow could be eliminated.

One method of controlling crossflow that is being investigated is boundary-layer suction. An extensive airfoil suction experiment in the 8' Transonic Pressure Tunnel (TPT) at NASA Langley Research Center will begin late in 1994. Because of the size, complexity, and expense associated with this test, a number of "risk-reduction" tests are currently being conducted. The 20"x28" Shear Flow Control Tunnel at NASA Langley is being used for some of these tests. Prior to the summer of 1994, a flat plate with a swept leading edge was installed in the 20"x28" tunnel, with a displacement body mounted on the tunnel ceiling that created a pressure distribution on the plate similar to the pressure distribution on a swept wing. The flow over the plate was investigated during the summer of 1994 using a laser Doppler velocimeter (LDV) system. The LDV measurements indicated the possible presence of multiple disturbance modes, a rarely-seen phenomena, since in most tests, one disturbance mode dominates. A number of difficulties were encountered in using the LDV system, however. The material used to seed the flow accumulated on the leading edge of the plate, causing the boundary layer to transition to turbulent flow at the leading edge. This in itself was a positive result with regards to the large 8' TPT experiment, in that the time and effort that would have been required to clean the model after each run (or worse, during a run) validated the choice made previously to use hot-wire anemometry as the velocity diagnostic tool in the 8' TPT test. The possible existence of multiple disturbance modes in the flat plate boundary layer, however, means that the flow in the 20"x28" tunnel is of interest itself, and will be investigated more thoroughly in the future. With a view to these investigations, the boundary layer traverse mechanism in the 20"x28" tunnel was modified to improve its performance, and strain gauges were mounted on the traverse in order to monitor its deflection during a test. Other preliminary work conducted in the 20"x28" tunnel included the use of an infrared camera system. Previous work with this system showed that transition indeed could be detected, but the signal produced by the crossflow vortices was too weak to be detected. It was hoped that spraying the flat plate with naphthalene would augment the heat transfer associated with the crossflow vortices so that they would show up in a IR image; however, experiments showed that this would not work.

Another set of tests were conducted in the 20"x28" tunnel to determine the tripping requirements for a set of airfoil-shaped struts that will be used in the 8' TPT experiment. Since the Reynolds number associated with these struts is small, a laminar boundary layer would separate early, causing large fluctuations in the flow field. A turbulent boundary layer would remain attached further back, but tripping from laminar to turbulent flow at low Reynolds number is very difficult. However, trip strip configurations were found that should effectively trip the boundary layer at the required conditions.

Currently underway is an investigation of the data acquisition requirements for the 8' TPT experiment, with the purpose of the finding the minimum amount of data needed to characterize sufficiently the swept-wing boundary layer. This study is being conducted using a numerically-generated data set.

**Automation Technology Using  
Geographic Information System (GIS)**

by

Cynthia L. Brooks  
Assistant Professor  
Department of Mathematics and Computer Science  
University of Arkansas  
Pine Bluff, Arkansas 71601

Airport Surface Movement Area is but one of the actions taken to increase the capacity and safety of existing airport facilities. The System Integration Branch (SIB) has designed an integrated system consisting of an electronic moving display in the cockpit, and includes display of taxi routes which will warn controllers and pilots of the position of other traffic and warning information automatically.

Although, this system has in test simulation proven to be accurate and helpful; the initial process of obtaining an airport layout of the taxi-routes and designing each of them is a very tedious and time-consuming process. Other methods of preparing the display maps are being researched. One such method is the use of the Geographical Information System (GIS).

GIS is an integrated system of computer hardware and software linking topographical, demographic and other resource data that is being referenced. The software can support many areas of work with virtually unlimited information compatibility due to the system's open architecture. GIS will allow us to work faster with increased efficiency and accuracy while providing decision making capabilities. GIS is currently being used at the Langley Research Center with other applications and have been validated as an accurate system for that task. GIS usage for our task will involve digitizing aerial photographs of the topology for each taxi-runway and identifying each position according to its specific spatial coordinates. The information currently being used can be integrated with the GIS system, due to its ability to provide a wide variety of user interfaces.

Much more research and data analysis will be needed before this technique will be used, however we are hopeful this will lead to better usage of man-power and technological capabilities for the future.

**Measurements of Striae in CR+ Doped YAG Laser Crystals**

by

Fredrick M. Cady  
Department of Electrical Engineering  
Montana State University  
Bozeman, Mt 59717

Striations in Czochralski (CZ) grown crystals have been observed in materials such as GaAs, silicon, photorefractive crystals used for data storage, potassium titanyl phosphate crystals and  $\text{LiNbO}_3$ . Several techniques have been used for investigating these defects including electron microscopy, laser scanning tomography, selective photoetching, X-ray diffuse scattering, interference orthoscopy, laser interferometry and micro-Fourier transform infrared spectroscopy mapping.

A 2mm thick sample of the material to be investigated is illuminated with light that is absorbed and non-absorbed by the ion concentration to be observed. The back surface of the sample is focused onto an solid-state image detector and images of the input beam and absorbed (and diffracted) beams are captured at two wavelengths. The variation of the coefficient of absorption as a function of distance on the sample can be derived from these measurements.

A Big Sky Software Beamcode system is used to capture and display images. Software has been written to convert the Beamcode data files to a format that can be imported into a spreadsheet program such as Quatro Pro. The spreadsheet is then used to manipulate and display data.

A model of the intensity map of the striae collected by the imaging system has been proposed and a data analysis procedure derived. From this, the variability of the attenuation coefficient  $\alpha$  can be generated. Preliminary results show that  $\alpha$  may vary by a factor of four or five over distances of 100  $\mu\text{m}$ .

Potential errors and problems have been discovered and additional experiments and improvements to the experimental setup are in progress and we must now show that the measurement techniques and data analysis procedures provide "real" information. Striae are clearly visible at all wavelengths including white light. Their basic spatial frequency does not change radically, at least when changing from blue to green to white light. Further experimental and theoretical work can be done to improve the data collection techniques and to verify the data analysis procedures.

**Formative and Summative Evaluation Efforts for the  
Teacher Enhancement Institute conducted at  
NASA Langley Research Center, Summer 1994**

by

**Professor Randal D. Carlson**  
Instructional Systems Program  
College of Education  
The Pennsylvania State University  
University Park, PA 16802

### **Introduction**

During the 1980s, a period of intense concern over educational quality in the United States, few indicators of U.S. student achievement garnered the interest of policy makers and pundits as successfully as the results of international testing in mathematics and science. This concern was so great that a task force was established to generate goals for the nation. This move became known as Goals 2000. As a part of the Goals 2000 initiative, President George Bush indicated that "By the year 2000, U.S. students should be first in the world in mathematics and science."

### **Background**

The Teacher Enhancement Institute (TEI) at NASA Langley Research Center was developed in response to Executive Order 12821 which mandates national laboratories to "assist in the mathematics and science education of our Nation's students, teachers, parents, and the public by establishing programs at their agency to provide for training elementary and secondary school teachers to improve their knowledge of mathematics and science. Such programs, to the maximum extent possible, shall involve partnerships with universities, state and local elementary and secondary school authorities, corporations and community based organizations."

To those ends, the TEI faculty planned a program using the general guidance given in Executive Order 12821, implementing NASA directives, and local guidance. The unifying theme of aeronautics was arrived at, allowing the institute to capitalize on Langley's unique strengths in that area. Six specific program objectives were developed. After completing TEI, the program participants should be able to:

- develop an aviation and space instructional module in mathematics, science and technology appropriate for the teacher's class. This module should be based on experiences in research accomplished at the Teacher Enhancement Institute and utilize the Problem Based Learning model.
- demonstrate knowledge of resources available through NASA and the education technology that will support current mathematics, science and technology instruction.
- disseminate to students, peer teachers, administrators and parents information acquired through Teacher Enhancement Institute on integrating this material in mathematics, science and technology.
- create learning communities and an electronic network of human resources that will enable teachers to discuss curricular, scientific, and technological issues discussed in the Teacher Enhancement Institute.
- use computers as a tool to enhance classroom learning.
- recognize America's role in aeronautics.

From the TEI objectives, the lesson blocks were formed. Four general categories of activities utilized to implement the objectives and the approximate amount of time spent on each one were:

pedagogical issues	15%
educational technology	30%
application of NASA research and aeronautics to the classroom	40%
co-operative learning - sharing applications	15%

### **Formative Evaluation**

The faculty worked closely with one another and the invited speakers to insure that the sessions supported the objectives. Speakers were informed of the objectives and given guidance concerning form and function for the session. Faculty members monitored sessions to assist speakers and to provide a quality control function. Faculty provided feedback to speakers concerning general objective accomplishment. Participant comments were also provided when applicable. Post TEI surveys asked for specific comments about each TEI session. During the second of the two, two week institutes, daily critiques were provided to the participants for their reflection. This seemed to provide much improved feedback to speakers and faculty because the sessions were fresh in each participant's mind.

Between sessions one and two, some changes were made to the program as a result of the formative evaluation process. Those changes, though, were minor in nature and comprised what may be called "fine tuning" a well conceived and implemented program.

### **Summative Evaluation**

After the objectives were written, an assessment instrument was developed to test the accomplishment of the objectives. This instrument was actually two surveys, one given before the TEI and one given after the TEI. In using such a series, it was expected that changes in the participants induced by attendance at TEI may be discovered. Because the institute was limited in time and depth of exposure, attitudinal changes (self-assessment of ability and confidence) were chosen to be surveyed. On the pre-survey, seven general categories of questions were asked. The post-survey repeated three of these categories, providing a pre and post evaluation of the same questions and added a fourth category which asked the participant to self-assess objective accomplishment.

### **Results and Conclusions**

The assessment process for TEI was valuable when one looks at the final accomplishments of the TEI. A number of aspects stand out:

- Formative evaluation during project development allowed the goals and objectives to guide the development of the institute.
- Formative evaluation provided positive guidance to presenters in developing and implementing their session.
- Formative evaluation helped presenters to improve or focus their sessions.
- Summative evaluation provided managers a way to gauge the success of the institute.
- Summative evaluation provided a benchmark for future programs to be measured against.

---

Copies of the surveys and critiques are included in the Final Report of the Teacher Enhancement Institute, available from the Office of Education, 17 Langley Boulevard, Mail Stop 400, Langley Research Center, Hampton, VA 23681-0001

1995/11

## **Holographic Interferometric Tomography for Reconstructing Flow Fields**

by

Professor Soyoung S. Cha  
University of Illinois at Chicago

Holographic interferometric tomography is a technique for instantaneously capturing and quantitatively reconstructing three-dimensional flow fields. It has a very useful application potential for high-speed aerodynamics. However, three major challenging tasks need to be accomplished before its practical applications.

First, fluid flows are mostly unsteady or at least non repeatable. Consequently, a means for instantaneously recording three-dimensional flow fields, that is, a simple holographic technique for simultaneously recording multi-directional projections, needs to be developed. Second, while holographic interferometry provides enormous data storage capabilities, expeditious data extraction from complicated interferograms is very important for timely near real-time applications. Third, unlike medical applications, flow tomography does not provide complete data sets but instead involves ill-posed reconstruction problems of incomplete projection and limited angular scanning.

During this summer research period, new experimental techniques and corresponding hardware were developed and tested to address the above-mentioned tasks. The first task was achieved by diffuser illumination. This concept allows instantaneous capture of many projections with a conventional setup for single-projection recording. For the second task, a phase-shifting technique was incorporated. This technique allows one to acquire multiple phase-stepped interferograms for a single projection and thus to extract phase information from intensity data almost at real-time. For the third task, the research that has been extensively conducted previously was utilized. In this research period, a complete experimental setup that provides the above three major capabilities was designed, built, and tested by integrating all the techniques. A simple laboratory experiment for simulating wind-tunnel testing was then conducted. A test flow was produced by employing a relatively simple device that generate a gravity-driven flow. The flow was then experimentally investigated to check the viability of the holographic interferometric tomographic technique before wind-tunnel application.



## Fabric Geometry Distortion During Composites Processing

Professor Julie Chen  
Dept. of Aerospace & Mechanical Engineering  
Boston University

Waviness and tow misalignment are often cited as possible causes of data scatter and lower compression stiffness and strength in textile composites. Strength differences of as much as 40% have been seen in composites that appear to have the same basic material and structural properties -- i.e., yarn orientation, yarn size, interlacing geometry. Fabric geometry distortion has been suggested as a possible reason for this discrepancy, but little quantitative data or substantial evidence exists. The focus of this research is to contribute to the present understanding of the causes and effects of geometric distortion in textile composites.

The initial part of the study was an attempt to gather qualitative information on a **variety of textile structures**. Existing and new samples confirmed that *structures with a significant z-direction presence would be more susceptible to distortion* due to the compaction process. Thus, uniweaves (fiber vol frac: 54%-72%) and biaxial braids (vf: 34%-58%) demonstrated very little fabric geometry distortion. In stitched panels, only slight buckling of z-direction stitches was observed, primarily near the surface. In contrast, for structures with high compaction ratios -- e.g., large cylindrical yarns(2.5:1) or powder towpreg(4:1) -- *there were visible distortions where previously smooth and periodic undulations were transformed to abrupt changes in direction*.

A controlled study of the **effect of forming pressure** on distortion was conducted on type 162 glass plain weave fabrics. Panels (6x6in) were produced via a resin infusion type setup, but with an EPON 815 epoxy resin. Pressures ranging from hand layup to 200psi were used (vf : 34%-54%). Photomicrographs indicated that at pressures up to 50psi, large changes in thickness were due primarily to resin squeeze out. At higher pressures, when intimate contact was made between the layers, there was some tow flattening and in-plane shifting to optimize nesting. However, *even at 200psi the period and amplitude of the tow undulation remained constant*, suggesting that for this relatively fine fabric, distortions from compaction were not a problem.

Because of the interest in using larger tows (to reduce cost) and more complex structures, tests were also run on 2D triaxial glass braid (113 yd/lb @ 0, 225 yd/lb @  $\pm 45$ ). Forming pressures of 20, 50, 200, and 500 psi were used, and **short block compression tests** were run. The 500psi specimen had a 10% decrease in modulus and an almost 50% decrease in strength (vs.20psi). Because the total fiber wgt/panel was kept constant, the thickness varied from 0.32 to 0.22in (49%-70% vf). Yet, the strength value is clearly below what would be expected, even with the decrease in thickness. Photomicrographs of these samples will be taken to determine if more fabric distortion exists in the 500psi specimens.

Finally, because the ultimate goal is to be able to predict and control distortion in a variety of textile structures, a **model compaction test** was developed to directly measure the deformation of the tows during compaction. Layers of dry glass fabric were placed in a mold with a clear plexiglass window. The yarn amplitude and period was then calculated using image analysis of the videotaped deformation. Preliminary tests demonstrated the feasibility of this technique for simple fabrics with large tows.

Further research is needed to isolate the transition from periodic (though not necessarily in-phase) nesting to the nonuniform crimp which may be the cause of localized differences in strain and net reductions in composite strength.

## Direct Numerical Simulations and Modeling of a Spatially-Evolving Turbulent Wake

by

*John M. Cimbala*

Associate Professor, Mechanical Engineering  
The Pennsylvania State University  
University Park, PA 16802

Understanding of turbulent free shear flows (wakes, jets, and mixing layers) is important, not only for scientific interest, but also because of their appearance in numerous practical applications. Turbulent wakes, in particular, have recently received increased attention by researchers at NASA Langley. The turbulent wake generated by a two-dimensional airfoil has been selected as the test-case for detailed high-resolution particle image velocimetry (PIV) experiments. This same wake has also been chosen to enhance NASA's turbulence modeling efforts. Over the past year, the author has completed several wake computations, while visiting NASA through the 1993 and 1994 ASEE summer programs, and also while on sabbatical leave during the 1993-94 academic year. These calculations have included two-equation ( $K-\omega$  and  $K-\epsilon$ ) models, algebraic stress models (ASM), full Reynolds stress closure models, and direct numerical simulations (DNS). Recently, there has been mutually beneficial collaboration of the experimental and computational efforts. In fact, these projects have been chosen for joint presentation at the NASA Turbulence Peer Review, scheduled for September 1994.

DNS calculations are presently underway for a turbulent wake at  $Re_\theta = 1000$  and at a Mach number of 0.20. ( $\theta$  is the momentum thickness, which remains constant in the wake of a two-dimensional body.) These calculations utilize a compressible DNS code written by M. M. Rai of NASA Ames, and modified for the wake by J. Cimbala. The code employs fifth-order accurate upwind-biased finite differencing for the convective terms, fourth-order accurate central differencing for the viscous terms, and an iterative-implicit time-integration scheme. The computational domain for these calculations starts at  $x/\theta = 10$ , and extends to  $x/\theta = 610$ . Fully developed turbulent wake profiles, obtained from experimental data from several wake generators, are supplied at the computational inlet, along with appropriate noise. After some adjustment period, the flow downstream of the inlet develops into a fully three-dimensional turbulent wake. Of particular interest in the present study is the far wake spreading rate and the self-similar mean and turbulence profiles.

At the time of this writing, grid resolution studies are underway, and a code is being written to calculate turbulence statistics from these wake calculations; the statistics will be compared to those from the ongoing PIV wake measurements, those of previous experiments, and those predicted by the various turbulence models. These calculations will lead to significant long-term benefits for the turbulence modeling effort. In particular, quantities such as the pressure-strain correlation 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. Present turbulence models do a very good job at prediction of the shape of the mean velocity and Reynolds stress profiles in a turbulent wake, but significantly underpredict the magnitude of the stresses and the spreading rate of the wake. Thus, the turbulent wake is an ideal flow for turbulence modeling research. By careful comparison and analysis of each term in the modeled Reynolds stress equations, the DNS data can show where deficiencies in the models exist; improvements to the models can then be attempted.

## Scientific and Technical Photography at NASA Langley Research Center

by

Professor Andrew Davidhazy  
 Department of Imaging and Photographic Technology  
 Rochester Institute of Technology  
 Rochester, NY 14623

As part of my assignment connected with the Scientific and Technical Photography & Lab (STPL) at the NASA Langley Research Center I conducted a series of interviews and observed the day to day operations of the STPL with the ultimate objective of becoming exposed first hand to a scientific and technical photo/imaging department for which my school prepares its graduates. I was also asked to share my observations with the staff in order that these comments and observations might assist the STPL to better serve its customers.

Meetings with several individuals responsible for various wind tunnels and with a group that provides photo-optical instrumentation services at the Center gave me an overview of the services provided by the Lab and possible areas for development. In summary form these are some of the observations that resulted from the interviews and daily contact with the STPL facility.

1. The STPL is perceived as a valuable and almost indispensable service group within the organization. This comment was invariably made by everyone. Everyone also seemed to support the idea that the STPL continue to provide its current level of service and quality.
2. The STPL generally is not perceived to be a highly technically oriented group but rather as a provider of high quality photographic illustration and documentation services.

In spite of the importance and high marks assigned to the STPL there are several observations that merit consideration and evaluation for possible inclusion into the STPL's scope of expertise and future operating practices.

1. While the care and concern for artistic rendition of subjects is seen as laudable and sometimes valuable, the time that this often requires is seen as interfering with keeping the tunnels operating at maximum productivity. Tunnel managers would like to shorten down-time due to photography, have services available during evening hours and on short notice. It may be of interest to the STPL that tunnel managers are incorporating ever greater imaging capabilities in their facilities. To some extent this could mean a reduced demand for traditional photographic services.
2. The photographic archive is seen as a Center resource. Archiving of images, as well as data, is a matter of concern to the investigators. The early holdings of the Photographic Archives are quickly deteriorating. The relative inaccessibility of the material held in the archives is problematic.
3. In certain cases delivery or preparation of digital image files instead of, or along with, hardcopy is already being perceived by the STPL's customers as desirable. The STPL should make this option available, and the fact that it has, or will have, this capability widely known.
4. The STPL needs to continue to provide expert advice and technical imaging support in terms of application information to users of traditional photographic and new electronic imaging systems. Cooperative demo projects might be undertaken to maintain or improve the capabilities of the Lab.
5. STPL personnel do not yet have significant electronic imaging or electronic communication skills and improvements in this is an area could potentially have a positive impact on the Center.
6. High speed photographic or imaging services are often mentioned by the STPL as being of primary importance to their mission but the lab supports very few projects calling for high speed imaging services. Much high speed equipment is in poor state of repair. It is interesting to note that when the operation of lasers, digital imaging or quantitative techniques are requested these to are directed another NASA department. Could joint activities be initiated to solve problems?
7. The STPL could acquire more technical assignments if examples of the areas where they possess expertise would be circulated around the center. The fact that the STPL owns high speed video capability could be "advertised" among its customer base if there truly was an interest in building up a customer base in this area. The STPL could participate in events like TOPS as an exhibitor, as well as a documenter, of the event.

## **Method Development for Compensating Temperature Effects in Pressure Sensitive Paint Measurements**

by

Carlo Greg N. Demandante, Captain, USAF  
Department of Chemistry  
United States Air Force Academy  
USAF Academy, Colorado 80840

Pressure sensitive luminescent paints (PSP) have recently emerged as a viable technique for aerodynamic pressure measurements. The technique uses a surface coating which contains probe molecules that luminesce when excited by light of an appropriate wavelength. The photoluminescence of these materials is known to be quenched by the presence of molecular oxygen. Since oxygen is a fixed mole fraction of the air, the coating's luminescence intensity varies inversely with air pressure. Digital imaging of the luminescence varying across a coated surface produces a pressure distribution map over that surface.

One difficulty encountered with this technique is the temperature effect on the luminescence intensity. Present PSP formulations have significant sensitivity to temperature. At the moment, the most practical way of correcting for temperature effects is to calibrate the paint in place at the operating temperatures by using a few well-placed pressure taps. This study is looking at development of temperature indicating coatings that can be applied and measured concurrently with PSP, and use the temperature measurement to compute the correct pressure.

Two methods for this dual paint formulation are proposed. One method will use a coating that consists of temperature sensitive phosphors in a polymer matrix. This is similar in construction to PSP, except that the probe molecules used are selected primarily for their temperature sensitivity. Both organic phosphors (e.g., europium thenoyltrifluoroacetate, bioprobes) and inorganic phosphors (e.g.,  $Mg_4(F)GeO_6:Mn$ ,  $La_2O_2S:Eu$ , Radelin<sup>®</sup> Type phosphors, Sylvania<sup>®</sup> Type phosphors) will be evaluated for their temperature sensing potential. The next method will involve a novel coating composing of five membered heterocyclic conducting polymers which are known to show temperature dependent luminescence (e.g., poly(3-alkylthiopene), poly(3-alkylselenophene), poly(3-alkylfuran)).

Both methods will involve applying a bottom layer of temperature sensitive coating followed by a top coating of PSP. An oxygen-impermeable polymer can be used as the temperature sensitive coating matrix, or it can be layered in between the coatings to prevent oxygen quenching of the bottom coating's luminescence. The probe molecules of the coatings will be excited by a broad band of light, with the different emissions detected and measured at their distinct wavelengths. Developmental research of these coatings is still in progress; however, preliminary results look very promising.

**Teams and Teamwork at NASA Langley Research Center**

by

Professor Terry L. Dickinson  
Department of Psychology  
Old Dominion University  
Norfolk, Virginia 23529

The recent reorganization and shift to managing total quality at the NASA Langley Research Center (LaRC) has placed an increasing emphasis on teams and teamwork in accomplishing day-to-day work activities and long-term projects. The purpose of this research was to review the nature of teams and teamwork at LaRC. Models of team performance and teamwork guided the gathering of information. Current and former team members served as participants; their collective experience reflected membership in over 200 teams at LaRC. The participants responded to a survey of open-ended questions which assessed various aspects of teams and teamwork. The participants also met in a workshop to clarify and elaborate on their responses.

The work accomplished by the teams ranged from high-level managerial decision making (e.g., developing plans for LaRC reorganization) to creating scientific proposals (e.g., describing spaceflight projects to be designed, sold and built). Teams typically had nine members who remained together for six months. Member turnover was around 20 percent; this turnover was attributed to heavy loads of other work assignments and little formal recognition and reward for team membership.

Team members usually shared a common and valued goal, but there was not a clear standard (except delivery of a document) for knowing when the goal was achieved. However, members viewed their teams as successful. A major factor in team success was the setting of explicit a priori rules for communication.

Task interdependencies between members were not complex (e.g., sharing of meeting notes and ideas about issues), except between members of scientific teams (i.e., reliance on the expertise of others). Thus, coordination of activities usually involved scheduling and attendance of team meetings.

The team leader was designated by the team's sponsor. This leader usually shared power and responsibilities with other members, such that team members established their own operating procedures for decision making. Sponsors followed a hands-off policy during team operations, but they approved and reviewed team products. Most teams, particularly high-level decision-making teams, had little or no authority to carry out their decisions.

Team members had few interpersonal conflicts. They monitored each other respectfully about meeting deadlines. Feedback and backup behaviors were seen as desirable aspects of teamwork, wanted by the members, and done appropriately.

# NONDESTRUCTIVE EVALUATION OF FATIGUE DAMAGE IN ALUMINUM 2024 BY X-RAY DIFFRACTION

by

Professor Milton W. Ferguson  
Department of Physics  
Norfolk State University  
Norfolk, Virginia 23504

Aluminum alloys are widely used in the automobile and aerospace industries. This is due to their attractive low density-high modulus and low density-high strength characteristics. Unfortunately, cyclic stress-strain deformations alter the microstructure of aluminum alloys when they are placed into service. These structural changes can lead to fatigue damage and ultimately service failure. Since X-ray diffraction analysis is known to be a sensitive nondestructive indicator of structural changes due to deformations, this technique is being used to evaluate changes in the microstructure of cycled aluminum 2024 commercial alloys.

Line shapes, widths, and positions in an X-ray diffraction pattern depend on microstructural properties such as grain size, grain orientation, residual stress, microstrain, etc. Changes in the microstructure due to fatigue will appear as changes in the diffraction pattern. One parameter used to characterize a reflection in a diffraction pattern is the full width at half maximum (FWHM).

Preliminary X-ray diffraction results on cycled Al 2024 indicate that the (111) and (222) reflections of the matrix phase do not show any variations in the FWHM due to an increase in the fatigue cycles. However, the FWHM of the (200) and (400) reflections of the same phase unexpectedly showed a dramatic decrease. These results can be interpreted as due to the relaxation of some initial nonuniform residual stresses in the matrix phase lattice. Further work is in progress to evaluate the FWHM of the second phase of the cycled alloys.

## Control of Flow Separation in Airfoil/Wing Design Applications

by

Dr. Tom Gally  
Aerospace Engineering Department  
Texas A&M University  
College Station, TX 77843

### Abstract

Existing aerodynamic design methods have generally concentrated on the optimization of airfoil or wing shapes to produce a minimum drag while satisfying some basic constraints such as lift, pitching moment or thickness. Since the minimization of drag almost always precludes the existence of separated flow, the evaluation and validation of these design methods for their robustness and accuracy when separated flow is present has not been aggressively pursued. However, two new applications for these design tools may be expected to include separated flow and the issues of aerodynamic design with this feature must be addressed.

The first application of the aerodynamic design tools is the design of airfoils or wings to provide an optimal performance over a wide range of flight conditions (multi-point design). While the definition of "optimal performance" in the multi-point setting is currently being hashed out, it is recognized that given a wide enough range of flight conditions, it will not be possible to ensure a minimum drag constraint at all conditions, and in fact some amount of separated flow (presumably small) may have to be allowed at the more demanding flight conditions. Thus a multi-point design method must be tolerant of the existence of separated flow and may include some controls upon its extent.

The second application is in the design of wings with extended high speed buffet boundaries of their flight envelopes. Buffet occurs on a wing when regions of flow separation have grown to the extent that their time varying pressures induce possible destructive effects upon the wing structure or adversely effect either the aircraft controlability or the passenger comfort. A conservative approach to the expansion of the buffet flight boundary is to simply expand the flight envelope of non-separated flow under the assumption that buffet will also thus be alleviated. However, having the ability to design a wing with separated flow and thus to control the location, extent and severity of the separated flow regions may allow aircraft manufacturers to gain an advantage in the early design stages of an aircraft, when configuration changes are relatively inexpensive to make.

Continuing the work begun last year, an airfoil design package has been modified to provide some control over the existence and extent of flow separation. This package consists of a 2-D Navies-Stolkes flow solver which is coupled to the CDISC (constrained direct/iterative surface curvature) design method. The first modification is a prediction method for determining whether separation is likely based solely upon a given pressure distribution. If separation is predicted but is undesirable, the new routines will modify the pressure distribution to alleviate the problem. This new pressure distribution is then used in the design method to generate a new aerodynamic shape. Since separation may be acceptable in some cases, particular if the separation does not extend to the trailing edge, another added logic estimates the extent of separation based upon a correlation with calculated separated flow cases. If a the flow behind a shock induced separation is not predicted to reattach before the trailing edge, the logic weakens the shock strength and otherwise alters the pressure distribution in order to promote reattachment. This later addition is as yet unreliable due to secondary separation effects, but additional work is being pursued to improve the method.

**ASEE Research**

by

Professor J. Anthony Ghorieshi  
Mechanical and Material Engineering Department  
Wilkes University  
Wilkes-Barre, PA 18766

Patent Protection Being Sought



1995/116875

**Locating Buildings in Aerial Photos**

**N95- 23295**

Jim Green  
Department of Computer Science  
Moravian College  
Bethlehem, PA 18018

Algorithms and techniques for use in the identification and location of large buildings in digitized copies of aerial photographs are developed and tested. The building data would be used in the simulation of objects located in the vicinity of an airport that may be detected by aircraft radar. Two distinct approaches are considered.

Most building footprints are rectangular in form. The first approach studied is to search for right-angled corners that characterize rectangular objects and then to connect these corners to complete the building.

This problem is difficult because many non-building objects, such as street corners, parking lots, and ballparks often have well defined corners which are often difficult to distinguish from rooftops. Furthermore, rooftops come in a number of shapes, sizes, shadings and textures which also limit the discrimination task.

The strategy used linear sequences of difference samples to detect straight edge segments at multiple angles and to determine when these segments meet at approximately right-angles with respect to each other.

This technique is effective in locating corners. The test image used has a fairly rectangular block pattern oriented about thirty degrees clockwise from a vertical and alignment, and the overall measurement data reflect this. However, this technique does not discriminate between buildings and other objects at an operationally suitable rate. In addition, since multiple paths are tested for each image pixel, this is a time consuming task. The process can be speeded up by preprocessing the image to locate the more optimal sampling paths.

The second approach is to rely on an human operator to identify and select the building objects and then to have the computer determine the outline and location of the selected structures.

When presented with a copy of a digitized aerial photograph, the operator uses a mouse and cursor to select a target building.

After a button on the mouse is pressed, with the cursor fully within the perimeter of the building, the program scans from the position of the cursor to a perimeter position where a shift in grayscale is detected. Once at the perimeter, the process traces along it until it, around the building, until it eventually returns to the perimeter starting point.

Spatial resolution limits cause the perimeter trace to be somewhat course so that a line straightening algorithm is employed. One result is that the building corner positions become more distinctly defined.

## Direct Numerical Simulation of Sheared Turbulent Flow

Vascar G. Harris  
Department of Aerospace  
Science Engineering  
Tuskegee University  
Tuskegee, Alabama 36088

August 3, 1994

The summer assignment to study sheared turbulent flow was divided into three phases which were: 1. Literature survey, 2. Computational familiarization and 3. Pilot computational studies.

The governing equations of fluid dynamics or Navier-Stokes Equations describe the velocity, pressure, density as functions of position and time. In principle, when combined with conservation equations for mass, energy and thermodynamic state of the fluid a determinate system could be obtained. In practice the Navier-Stokes equations have not been solved due to the non-linear nature and complexity of these equations.

Consequently, the importance of experiments in gaining insight for understanding the physics of the problem has been an on going process. The homogeneous shear flow problem has been studied experimentally by Champagne, Harris and Corrsin(1969), Harris, Graham and Corrsin (1977) and Tavoularis and Corrsin (1981). In each of the above cases measurements were reported in the simplest conceivable sheared flows, namely free shear layers, which were statistically homogeneous with a linear or quadratic dependence of mean velocity on position.

Reasonable computer simulations of the problem have occurred as the computational speed and storage of computers has evolved. The importance of the microstructure of the turbulence dictates the need for high resolution grids in extracting solutions which contain the physical mechanisms which are essential to a successful simulation. The recognized breakthrough occurred as a result of the pioneering work of Orzag and Patterson (1972) in which the Navier-Stokes equations were solved numerically utilizing a time saving toggling technique between physical and wave space, known as a Spectral Method. A wealth of literature has been generated addressing the turbulence problem utilizing these methods. This includes investigations by Shebalin on isotropic turbulence (1992,93) and many others.

An equally analytically insoluble problem, containing the same quasi-chaotic nature as turbulence, is known as the three body problem which was studied computationally as a first step this summer. This study was followed by computations of a two dimensional (2D) free shear layer. These results will be available on departure from N.A.S.A. in August.

**Analysis of the Longitudinal Handling Qualities and  
Pilot-Induced-Oscillation Tendencies of the  
High-Angle-of-Attack Research Vehicle (HARV)**

by

Ronald A. Hess  
Department of Mechanical and Aeronautical Engineering  
University of California  
Davis, CA 95616

The NASA High-Angle-of Attack Research Vehicle (HARV), a modified F-18 aircraft, experienced handling qualities problems in recent flight tests at NASA Dryden Research Center. Foremost in these problems was the tendency of the pilot-aircraft system to exhibit a potentially dangerous phenomenon known as a pilot-induced oscillation (PIO). When they occur, PIO's can severely restrict performance, sharply diminish mission capabilities and can even result in aircraft loss. A pilot/vehicle analysis was undertaken with the goal of reducing these PIO tendencies and improving the overall vehicle handling qualities with as few changes as possible to the the existing feedback/feedforward flight control laws.

Utilizing a pair of analytical pilot models developed by the author, a pilot/vehicle analysis of the existing longitudinal flight control system was undertaken. The analysis included prediction of overall handling qualities levels and PIO susceptibility. The analysis indicated that improvement in the flight control system was warranted and led to the formulation of a simple control stick command shaping filter. Analysis of the pilot/vehicle system with the shaping filter indicated significant improvements in handling qualities and PIO tendencies could be achieved. A non-real time simulation of the modified control system was undertaken with a realistic, nonlinear model of the current HARV. Special emphasis was placed upon those details of the command filter implementation which could effect safety of flight. The modified system is currently awaiting evaluation in the real-time, pilot-in-the-loop, Dual-Maneuvering-Simulator (DMS) facility at Langley.

**Electronic Photography at NASA Langley Research Center**

by

Jack Holm  
Imaging Consultant  
Rush, New York 14543-9769

The field of photography began a metamorphosis several years ago which promises to fundamentally change how images are captured, transmitted, and output. At this time the metamorphosis is still in the early stages, but already new processes, hardware, and software are allowing many individuals and organizations to explore the entry of imaging into the information revolution. Exploration at this time is prerequisite to leading expertise in the future, and a number of branches at LaRC have ventured into electronic and digital imaging. Their progress until recently has been limited by two factors: the lack of an integrated approach and the lack of an electronic photographic capability. The purpose of the research conducted was to address these two items.

In some respects, the lack of electronic photographs has prevented application of an integrated imaging approach. Since everything could not be electronic, the tendency was to work with hard copy. Over the summer, the Photographics Section has set up an Electronic Photography Laboratory. This laboratory now has the capability to scan film images, process the images, and output the images in a variety of forms. Future plans also include electronic capture capability. The current forms of image processing available include sharpening, noise reduction, dust removal, tone correction, color balancing, image editing, cropping, electronic separations, and halftoning. Output choices include customer specified electronic file formats which can be output on magnetic or optical disks or over the network, 4400 line photographic quality prints and transparencies to 8.5 by 11 inches, and 8000 line film negatives and transparencies to 4 by 5 inches.

The problem of integrated imaging involves a number of branches at LaRC including Visual Imaging, Research Printing and Publishing, Data Visualization and Animation, Advanced Computing, and various research groups. These units must work together to develop common approaches to image processing and archiving. The ultimate goal is to be able to search for images using an on-line database and image catalog. These images could then be retrieved over the network as needed, along with information on the acquisition and processing prior to storage. For this goal to be realized, a number of standard processing protocols must be developed to allow the classification of images into categories. Standard series of processing algorithms can then be applied to each category (although many of these may be adaptive between images). Since the archived image files would be standardized, it should also be possible to develop standard output processing protocols for a number of output devices.

If LaRC continues the research effort begun this summer, it may be one of the first organizations to develop an integrated approach to imaging. As such, it could serve as a model for other organizations in government and the private sector.

## SYSTEM IDENTIFICATION OF THE LARGE-ANGLE MAGNETIC SUSPENSION TEST FIXTURE (LAMSTF)

by

Dr. Jen-Kuang Huang  
Department of Mechanical Engineering  
Old Dominion University  
Norfolk, Virginia 23529-0247

The Large-Angle Magnetic Suspension Test Fixture (LAMSTF), a laboratory-scale research project to demonstrate the magnetic suspension of objects over wide ranges of attitudes, has been developed. This system represents a scaled model of a planned Large-Gap Magnetic Suspension System (LGMSS). The LAMSTF consists of a small cylindrical permanent magnet suspended element which is levitated above a planar array of five electromagnets mounted in a circular configuration. The cylinder is a rigid body and can be controlled to move in five independent degrees of freedom. Six position variables are sensed indirectly by using infra-red light-emitting diodes and light-receiving phototransistors. The motion of the suspended cylinder is in general nonlinear and hence only the linear, time-invariant perturbed motion about an equilibrium state is considered.

One of the main challenges in this project is the control of the suspended element over a wide range of orientations. An accurate dynamic model plays an essential role in controller design. The analytical model is first derived and open-loop characteristics discussed. The system is shown to be highly unstable and requires feedback control for system identification. Projection filters are first proposed to identify the state space model from closed-loop input/output test data in the *time* domain. This method is then extended to identify linear systems from the *frequency* test data. A canonical transformation matrix is also derived to transform the identified state space model into the physical coordinate.

The LAMSTF system is stabilized by using a linear quadratic regulator (LQR) feedback controller for closed-loop identification. The rate information is obtained by calculating the back difference of the sensed position signals. Only the closed-loop random input/output data are recorded. Preliminary results from numerical simulations demonstrate that the identified system model is fairly accurate from either time-domain or frequency-domain data. Experiments will be performed to validate the proposed closed-loop identification algorithms.

INTERLAMINAR SHEAR TEST METHOD DEVELOPMENT FOR LONG  
TERM DURABILITY TESTING OF COMPOSITES

by

Peter Ifju

Aerospace Engineering, Mechanics & Engineering Science Department  
University of Florida  
Gainesville, FL 32611-6025

The high speed civil transport is a commercial aircraft that is expected to carry 300 passengers at Mach 2.4 over a range of more than 6000 nautical miles. With the existing commercial structural material technology (i.e., aluminum) the performance characteristics of the high speed civil transport would not be realized. Therefore there has been a concerted effort in the development of light weight materials capable of withstanding elevated temperatures for long duration. Thermoplastic composite materials are such candidate materials and the understanding of how these materials perform over the long term under harsh environments is essential to safe and effective design.

The matrix dominated properties of thermoplastic composites are most affected by both time and temperature. There is currently an effort to perform short term testing to predict long term behavior of in-plane mechanical properties  $E_{22}$  (transverse modulus of elasticity) and  $G_{12}$  (shear modulus). Out-of-plane properties such as  $E_{33}$ ,  $G_{13}$  and  $G_{23}$  are inherently more difficult to characterize. This is especially true for the out-of-plane shear modulus  $G_{23}$  and hence there is no existing acceptable standard test method. Since  $G_{23}$  is the most matrix dominated property, it is essential that a test method be developed. This summer I have developed a shear test methodology to do just that. The test method called the double notched specimen along with the shear gage which I had previously developed was tested at room temperature. Mechanical testing confirmed the attributes of the methodology. A finite element parametric study was conducted for specimen optimization. Moire interferometry, a high sensitivity laser optical method, was used for full-field analysis of the specimen. Future work will involve extending the test methodology to elevated temperature testing. From this work, material parameters will be determined and thus enable the prediction of long term material behavior of laminates subjected to general loading states.

**Task Scheduling in Dataflow Computer Architectures**

by  
Dr. Constantine Katsinis  
Associate Professor  
Electrical and Computer Engineering  
University of Alabama in Huntsville  
Huntsville, AL 35899

Dataflow computers provide a platform for the solution of a large class of computational problems, which includes digital signal processing and image processing. Many typical applications are represented by a set of tasks which can be repetitively executed in parallel as specified by an associated dataflow graph. Research in this area aims to model these architectures, develop scheduling procedures and predict the transient and steady state performance.

Researchers at NASA have created a model and developed associated software tools which are capable of analyzing a dataflow graph and predicting its runtime performance under various resource and timing constraints. These models and tools were extended and used in this work.

Experiments using these tools revealed certain properties of such graphs that require further study. Specifically, the transient behavior at the beginning of the execution of a graph can have a significant effect on the steady state performance. Transformation and retiming of the application algorithm and its initial conditions can produce a different transient behavior and consequently different steady state performance. The effect of such transformations on the resource requirements or under resource constraints requires extensive study. Task scheduling to obtain maximum performance (based on user-defined criteria), or to satisfy a set of resource constraints, can also be significantly affected by a transformation of the application algorithm. Since task scheduling is performed by heuristic algorithms, further research is needed to determine if new scheduling heuristics can be developed that can exploit such transformations. This work has provided the initial development for further long-term research efforts.

A simulation tool was completed to provide insight into the transient and steady state execution of a dataflow graph. A set of scheduling algorithms was completed which can operate in conjunction with the modelling and performance tools previously developed. Initial studies on the performance of these algorithms were done to examine the effects of application algorithm transformations as measured by such quantities as number of processors, time between outputs, time between input and output, communication time and memory size.

**Reliability Analysis in the Office of Safety, Environmental, and  
Mission Assurance (OSEMA)**

by

Paul Kauffmann  
Department of Engineering and Technology  
Thomas Nelson Community College  
Hampton, Virginia 23670

The technical personnel in the SEMA office are working to provide the highest degree of value - added activities to their support of the NASA Langley Research Center mission. Management perceives that reliability analysis tools and an understanding of a comprehensive systems approach to reliability will be a foundation of this change process. Since the office is involved in a broad range of activities supporting space mission projects and operating activities (such as wind tunnels and facilities), it was not clear what reliability tools the office should be familiar with and how these tools could serve as a flexible knowledge base for organizational growth.

Interviews and discussions with the office personnel (both technicians and engineers) revealed that job responsibilities ranged from incoming inspection to component or system analysis to safety and risk. It was apparent that a broad base in applied probability and reliability along with tools for practical application was required by the office.

A series of ten class sessions with a duration of two hours each was organized and scheduled. Hand out materials were developed and practical examples based on the type of work performed by the office personnel were included. Topics covered were:

- Reliability Systems: A broad system oriented approach to reliability
- Probability Distributions: Discrete and continuous distributions
- Sampling and Confidence Intervals: Random sampling and sampling plans
- Data Analysis and Estimation: Model selection and parameter estimates
- Reliability Tools: Block diagrams, fault trees, event trees, FMEA

In the future, this information will be used to review and assess existing equipment and processes from a reliability system perspective.

An analysis of incoming materials sampling plans was also completed. This study looked at the issues associated with Mil Std 105 and changes for a zero defect acceptance sampling plan.



# **Raman-Shifting an ArF Excimer Laser to Generate New Lines for Obtaining Optical Diagnostic Based Information in Flow Fields**

by

**N95-23303**

**Professor Edmond B. Koker  
Department of Physical Sciences  
Elizabeth City State University  
Elizabeth City, NC 27909**

The application of tunable excimer lasers in combustion and flow diagnostics is almost routine nowadays. The properties of this laser system that enable density and temperature measurements in supersonic and hypersonic flow fields to be conducted are; its high power, high repetition rate and high spectral brightness. The limitation imposed by this system on these measurements is the paucity of lines in the wavelength region, the vacuum-ultraviolet, where species of interest, such as OH, N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>, H<sub>2</sub>O, CO, NO, etc., are susceptible to electronic excitation to high-lying states. To circumvent this problem one normally resorts to non-linear optical techniques such as frequency conversion via stimulated Raman Scattering (SRS), more commonly known as Raman-Shifting or Raman Mixing, to extend these non-intrusive and non-perturbing techniques to the shorter wavelengths in the VUV region and, for that matter to longer wavelengths in the infrared region, if the need arises.

The theoretical basis of SRS and its application are well documented in the literature. In essence, the Raman shift is a consequence of the inelastic scattering of the incident radiation by the sample. Most of the scattered radiation from the molecules of the sample is unchanged in frequency. However, a small fraction of the incident radiation is changed in frequency. This shift is a result of the fact that some of the incident photons on colliding with the molecules of the sample give up some of their energy and emerge with a lower energy resulting in the lower-frequency Stokes radiation. Other incident photons may increase their energy by colliding with the vibrationally excited molecules of the medium and emerge as higher-frequency anti-stokes radiation. The generation of the latter is the main objective of this project.

The process, however, depends on several factors, including the beam quality of the pump laser; the cross-section of the gaseous medium; the gas pressure, and the ambient temperature of the gas near the focal region. Furthermore, since the Raman-Shifting process is polarization sensitive, it is necessary to have all of the laser energy in a single polarization. These factors were taken into consideration in the execution of the project.

The implementation of the Raman-Shift was accomplished by focusing the 193nm output of an ArF excimer laser (Lamda-Physik LPX 150) into a 1-meter long high pressure recirculating Raman cell filled with H<sub>2</sub> gas. The laser system was modified in order to improve the mode quality of the pump beam to enhance the Raman-Shifting. To accomplish this feat, a prism beam expander and grating on the oscillator discharge provided wavelength tuning over the excimer gain profile. Furthermore, a triple-pass configuration, as opposed to unstable resonator optics, was employed in the operation of the amplifier cavity so that when the oscillator output radiation, focused by a 51-cm focal length fused silica lens through a 50 μm pinhole (serving as a spatial filter) and recollimated with a 25-cm focal length lens, was fed into the amplifier, it was injection locked, thereby providing tunable radiation with relatively low divergence.

The forward scattered radiation emanating from the impingement of the modified pump beam on the Raman cell was detected using an energy meter after the latter had been separated from it using a dispersing prism. Work is in progress to measure the conversion efficiency in this gaseous medium as a function of focusing geometry, gas pressure, and speed of the recirculating fan, as well as extending the technique to other gaseous samples such as deuterium, methane, nitrogen, and carbon monoxide.

## Optimized Design of A Hypersonic Nozzle

by

Ramesh Krishnamurthy  
Department of Mechanical Engineering  
Old Dominion University  
Norfolk, VA 23529

Conventional procedures for designing nozzles involve the design of an inviscid contour (using the method of characteristics) that is corrected with a displacement thickness calculated from boundary-layer theory. However, nozzles designed using this classical procedure have been shown to exhibit poor flow quality at Mach numbers characteristic of hypersonic applications. The nozzle to be designed will be a part of the NASA HYPULSE facility which is being used for hypervelocity flight research. Thus, the flow quality of the nozzle is a critical question that needs to be addressed.

Design of nozzles for hypersonic applications requires a proper assessment of the effects of the thick boundary layer on the inviscid flowfield. Since the flow field is largely supersonic, the parabolized form of the Navier-Stokes (PNS) equations can be used. The requirement of a uniform flow at the exit plane of the nozzle can be used to define an objective function as part of an optimization procedure. The design procedure used in this study involves the coupling of a nonlinear (Least-Squares) optimization algorithm with an efficient, explicit PNS solver.

The thick boundary layers growing on the walls of the nozzle limit the extent of the usable core region ( region with uniform flow) for testing models (especially rectangular). In order to maximize the region of uniform flow, it was decided to have the exit plane of this nozzle to be (nearly) rectangular. Thus, an additional constraint on the nozzle shape resulted, namely the nozzle will have a shape transitioning from a circular one at the inlet to that of a rectangle at the exit. In order to provide for a smooth shape transition, the cross sectional contour of the nozzle is defined by a superellipse. The nozzle is taken to be a meter in length. The axial variations of the major and minor radii of the superellipse are governed by cubic splines. The design parameters are the coefficients of the splines associated with the local nozzle wall slopes.

Extensive calculations have been made (with a three-dimensional Euler Code) to understand the effects of various parameters such as, location of the knot points of the spline function, different ways of characterizing the uniformity of the flow in the exit plane as well as the effect of constraining the area of the nozzle to be invariant. Turbulent flow (measurements indicate that the flow at the nozzle inlet is turbulent) calculations are now being performed (with the inviscidly designed nozzle contours) to assess the flow quality. It is planned to extend these computations by coupling the optimization program with a viscous (turbulent) PNS code. This would be undertaken after modifying the existing PNS code by incorporating a wall-function algorithm to reduce the computational costs.

**STOCHASTIC DECISION ANALYSIS**

by

Thomas A. Lacksonen  
Dept. of Industrial and Systems Engineering  
Ohio University  
Athens, OH 45701

Small space flight project design at NASA Langley Research Center goes through a multi-phase process from preliminary analysis to flight operations. The process insures that each system achieves its technical objectives with demonstrated quality and within planned budgets and schedules. A key technical component of early phases is decision analysis, which is a structure procedure for determining the best of a number of feasible concepts based upon project objectives. Feasible system concepts are generated by the designers and analyzed for schedule, cost, risk, and technical measures. Each performance measure value is normalized between the best and worst values and a weighted average score of all measures is calculated for each concept. The concept(s) with the highest scores are retained, while others are eliminated from further analysis. This project automated and enhanced the decision analysis process.

Automation of the decision analysis process was done by creating a user-friendly, menu-driven, spreadsheet macro based decision analysis software program. The program contains data entry dialog boxes, automated data and output report generation, and automated output chart generation.

The enhancements to the decision analysis process permit stochastic data entry and analysis. Rather than enter single measure values, the designers enter the range and most likely value for each measure and concept. The data can be entered at the system or subsystem level. System level data can be calculated as either sum, maximum, or product functions of the subsystem data. For each concept, the probability distributions are approximated for each measure and the total score for each concept as either constant, triangular, normal, or log-normal distributions. Based on these distributions, formulas are derived for the probability that the concept meets any given constraint, the probability that the concept meets all constraints, and the probability that the concept is within a given amount of the best score. Formulas are also derived for the probability that one concept's total score is within a given amount of a second concept's total score. These probabilistic calculations provide more realistic data entry and output information for designers, enabling designers to better determine which concepts to eliminate and which concepts to retain at the decision points of each design phase.

**Design and Implementation of Two  
Two-Week Teacher Enhancement Institutes**

**Lynn Lambert  
Christopher Newport University**

During this summer, I have been part of a four team effort that planned and executed two two-week Teacher Enhancement Institutes (TEI) for 40 K-8 teachers from this area. The TEI was designed to enhance teachers' background in aeronautics and technology so that they would be better equipped to encourage and to train students in the mathematics, science, and technology fields. The teachers were given a stipend and three graduate credits from Christopher Newport University for their participation in this program.

The four ASEE fellows worked together to develop objectives and a schedule of activities for each two-week session based on the program outline given in the grants that were funding this effort. We divided the responsibilities in coordinating and implementing each part of the TEI based on the specific strengths and background of each ASEE fellow. My specific responsibilities were: 1) to develop the course syllabus and generally handle all matters involved with the graduate course; 2) coordinate the follow-up sessions; and 3) design and manage half of the technology sessions that we had scheduled (approximately 30% of the TEI was devoted to technology). Because the first two responsibilities were primarily administrative in nature, I will address only the last.

The technology sessions were divided into computer-only and other technologies (e.g., television and digital technology including scanning, digital photography and CD-ROM). I had responsibility for the computer-only technology sessions. The emphasis of these sessions was on use of the Internet specifically to locate and use educational resources. To maximize learning, these sessions were hands-on with two teachers at each computer. Each teacher received instruction in, and actually used, the most popular tools available on the Internet: email (they were given temporary accounts at NASA LaRC), anonymous ftp and archie, gopher and veronica, mosaic, and telnet. Teachers participated in hands-on workshops to learn about these programs, but were also given time during the two-week session to explore on their own and to find resources on the Net that specifically met their needs. In order to ensure that Internet access continues after their return to the classroom, all teachers who did not have them also applied for Learning Link accounts (from WHRO, the local public television station) and Virginia Pen accounts (from the Department of Education of Virginia), both of which allow text-based access to Internet. In addition to getting exposure to and practice with Internet tools, teachers were also given a hands-on seminar (and also given practice time) on ClarisWorks, an integrated word processing, spreadsheet, database, and paint package. The technology sessions (and TEI as a whole) were enthusiastically received by both new and more experienced teachers as extremely helpful in improving their ability to use technology in developing lesson plans.

## Accelerated Panel Methods using the Fast Multipole Method

by

**N95-23307**

James F. Leathrum, Jr.  
Dept. of Electrical and Computer Engineering  
Old Dominion University  
Norfolk, Virginia 23529

Panel methods are commonly used in computational fluid dynamics for the solution of potential flow problems. The methods are a numerical technique based on the surface distribution of singularity elements. The solution is the process of finding the strength of the singularity elements distributed over the body's surface. This process involves the solution of the matrix problem  $Pq = p'$  for a set of unknowns  $q$ . The Fast Multipole Method is used to directly compute  $q$  without using matrix solvers. The algorithm works in  $O(N)$  time for  $N$  points, a great improvement over standard matrix solvers.

In panel methods, the surface of a body is divided into a series of quadrilateral panels. The methods involve the computation of the influence of all other panels on each individual panel. The influence is based on the surface distribution, though this can be approximated by the area for distant panels. An alternative approximation, though with arbitrary accuracy, is to develop a multipole expansion about the center of the panel to describe the effect of a given panel on distant points in space. The expansion is based on the moments of the panel, thus allow the use of various surface distributions without changing the basic algorithm, just the computation of the various moments. The expansions are then manipulated in a tree walk to develop Taylor series expansions about a point in space which describe the effect of all distant panels on any point within a volume of convergence. The effect of near panels then needs to be computed directly, but the effect of all distant panels can be computed by simply evaluating the resulting expansion.

The Fast Multipole Method has been applied to panel methods for the solution of source and doublet distributions. A major feature of the algorithm is that the algorithm does not change to derive the potential and velocity for sources and doublets. The same expansions can be used for both sources and doublets. Since the velocity is related to the potential, and the doublet potential is related to the  $z$ -component of the source velocity, all values can be derived from the same expansion by taking a series of partial derivatives. This requires more expansion terms to be kept since terms are lost in the process of taking partial derivatives. Thus to maintain accuracy for the doublet computation, more terms are required than if just evaluating for sources. The resulting Fast Multipole code should then parallelize better than classical panel methods due to the locality of data dependencies found in the Fast Multipole Method. Theoretically the parallelized code should execute in  $O(\log N)$  time with  $O(N)$  processors, though this is not practical. Ongoing work includes implementing the parallel accelerated panel method, including methods to improve the load balancing of the problem by taking advantage of the known geometry of panels, and to incorporate sensitivity analysis into the algorithm.

**On-Line, Adaptive State Estimator for Active Noise Control**

by

Prof. Tae W. Lim  
Department of Aerospace Engineering  
University of Kansas  
Lawrence, KS 66045

Dynamic characteristics of airframe structures are expected to vary as aircraft flight conditions change. Accurate knowledge of the changing dynamic characteristics is crucial to enhancing the performance of the active noise control system using feedback control. This research investigates the development of an adaptive, on-line state estimator using a neural network concept to conduct active noise control.

In this research, an algorithm has been developed that can be used to estimate displacement and velocity responses at any locations on the structure from a limited number of acceleration measurements and input force information. The algorithm employs band-pass filters to extract from the measurement signal the frequency contents corresponding to a desired mode. The filtered signal is then used to train a neural network which consists of a linear neuron with three weights. The structure of the neural network is designed as simple as possible to increase the sampling frequency as much as possible. The weights obtained through neural network training are then used to construct the transfer function of a mode in z-domain and to identify modal properties of each mode. By using the identified transfer function and interpolating the mode shape obtained at sensor locations, the displacement and velocity responses are estimated with reasonable accuracy at any locations on the structure. The accuracy of the response estimates depends on the number of modes incorporated in the estimates and the number of sensors employed to conduct mode shape interpolation. Computer simulation demonstrates that the algorithm is capable of adapting to the varying dynamic characteristics of structural properties.

Experimental implementation of the algorithm on a DSP (digital signal processing) board for a plate structure is underway. The algorithm is expected to reach the sampling frequency range of about 10kHz to 20kHz which needs to be maintained for a typical active noise control application.

# **Design of A Variable Area Diffuser For A 15-inch Mach 6 Open-Jet Tunnel**

**N95- 23309**

Dr. Norman W. Loney

Department of Chemical Engineering, Chemistry & Environmental  
Science

New Jersey Institute of Technology, Newark, New Jersey 07102

The Langley 15-inch Mach 6 High Temperature Tunnel was recently converted from a Mach 10 Hypersonic Flow Apparatus. This conversion was effected to improve the capability of testing in Mach 6 air at relatively high reservoir temperatures not previously possible at Langley. Elevated temperatures allow the matching of the Mach numbers, Reynolds numbers, and ratio of wall-to-adiabatic-wall temperatures ( $T_w/T_{aw}$ ) between this and the Langley 20-inch Mach 6 CF<sub>4</sub> Tunnel. This ratio is also matched for Langley's 31-inch Mach 10 Tunnel and is an important parameter useful in the simulation of slender bodies such as National Aerospace Plane (NASP) configurations currently being studied.

Having established the nozzle's operating characteristics, the decision was made to install another test section to provide model injection capability. This test section is an open-jet type, with an injection system capable of injecting a model from retracted position to nozzle centerline between 0.5 and 2 seconds.

Preliminary calibrations with the new test section resulted in Tunnel blockage. This blockage phenomenon was eliminated when the conical center body in the diffuser was replaced. The issue then, is to provide a new and more efficient variable area diffuser configuration with the capability to withstand testing of larger models without sending the Tunnel into an unstart condition.

Use of the 1-dimensional steady flow equation with due regard to friction and heat transfer was employed to estimate the required area ratios (exit area/ throat area) in a variable area diffuser. Correlations between diffuser exit Mach number and area ratios, relative to the stagnation pressure ratios and diffuser inlet Mach number were derived. From these correlations, one can set upper and lower operating pressures and temperatures for a given diffuser throat area. In addition, they will provide appropriate input conditions for the full 3-dimensional computational fluid dynamics (CFD) code for further simulation studies.

# Deflections of Anisotropic Sandwich Beams With Variable Face Sheets And Core Thicknesses

N95-23310

by

Professor Chu-Ho Lu  
Department of Mechanical Engineering  
The University of Memphis  
Memphis, Tennessee 38152

A sandwich construction consists of a low-density core material with high-strength face sheets bounded to the top and bottom surfaces. The construction has been widely used in the aerospace and marine industries due to its outstanding characteristics such as noise absorption, weight minimization, heat insulation, and better bending stiffness. In sandwich structures used in high-performance aircraft, the face sheets are often made of fiber-reinforced composite materials and the core is made of honeycomb. The structures may also have variable thickness so as to satisfy aerodynamic requirements. In the stress analysis, the constant-thickness face sheets are usually considered as membrane and the core is assumed to be inextensible but deformable in the thickness direction.

The static behavior of variable-thickness, isotropic and homogeneous sandwich beams was successfully studied by employing a constant-thickness theory but allowing stiffnesses to vary in accordance with local thickness variations. It has been recently found in a refined theory that the analyses based on the constant-thickness theory locally can lead to significant errors in structural responses if the sandwich beam is thickness-tapered and the cores are deformable in transverse shear. The errors arise mainly from two factors: (a) the transverse shear components of the membrane forces in the face sheets alter the transverse shears carried by the core, and (b) the face-sheet membrane strains arise from transverse shear deformation of the core.

In practice the variable thickness may not only exist in core but also in face sheets. The thickness-variations may even be a type of step function. In this case the transverse shear stress in the face sheets and bending stress in the core should be taken into account in the refined theory mentioned. In the present study, energy principles are employed in deriving governing equations for general bending of anisotropic sandwich beams with variable thickness in both face sheets and cores. Solutions to these equations are based on a finite difference scheme. As an example in application, a simply supported thickness-tapered sandwich beam subject to a concentrated load at its center is considered. Let  $W'$  be the maximum deflection of the beam in which face sheets are considered as membrane, while  $W''$  is that based on using the modified refined theory. It is found that  $W'$  is always larger than  $W''$ , however the magnitude of  $(W' - W'')$  appears to be insensitive to the change of the taper of the beam.



## **Residual Strength of Thin Panels with Cracks**

by

Professor E. Madenci  
Department of Aerospace and Mechanical Engineering  
The University of Arizona  
Tucson, Arizona 85721

The previous design philosophies involving safe life, fail-safe and damage tolerance concepts become inadequate for assuring the safety of aging aircraft structures. For example, the failure mechanism for the Aloha Airline accident involved the coalescence of undetected small cracks at the rivet holes causing a section of the fuselage to peel open during flight. Therefore, the fuselage structure should be designed to have sufficient residual strength under worst case crack configurations and in-flight load conditions. Residual strength is interpreted as the maximum load carrying capacity prior to unstable crack growth.

Internal pressure and bending moment constitute the two major components of the external loads on the fuselage section during flight. Although the stiffeners in the form of stringers, frames and tear straps sustain part of the external loads, the significant portion of the load is taken up by the skin. In the presence of a large crack in the skin, the crack lips bulge out with considerable yielding; thus, the geometric and material nonlinearities must be included in the analysis for predicting residual strength. Also, these nonlinearities do not permit the decoupling of in-plane and out-of-plane bending deformations.

The failure criterion combining the concepts of absorbed specific energy and strain energy density addresses the aforementioned concerns. The critical absorbed specific energy (local toughness) for the material is determined from the global specimen response and deformation geometry based on the uniaxial tensile test data and detailed finite element modeling of the specimen response. The use of the local toughness and stress-strain response at the continuum level eliminates the size effect. With this critical parameter and stress-strain response, the finite element analysis of the component by using STAGS along with the application of this failure criterion provides the stable crack growth calculations for residual strength predictions.

## TEACHER ENHANCEMENT INSTITUTE

Dr. Tina Marshall-Bradley  
 School of Education  
 Norfolk State University  
 Norfolk, Virginia 23504

During the 1980s, a period of intense concern over educational quality in the United States, few indicators of U.S. student achievement garnered the interest of policy makers and pundits as successfully as the results of international testing in mathematics and science. This concern was so great that as a part of the Goals 2000 initiative, President George Bush indicated that "By the year 2000, U.S. students should be first in the world in mathematics and science." The Clinton Administration is placing a major emphasis, not only on rigorous academic standards and creating a new system for assessing students' progress, but also including professional development as a major focus. The argument being that teachers need more sustained, intensive training to prepare them to teach to higher standards. Executive order 12821 mandates that national laboratories "assist in the mathematics and science education of our Nation's students, teachers, parents and the public by establishing programs at their agency to provide for training elementary and secondary school teachers to improve their knowledge of mathematics and science."

These and other issues led to the development of ideas for a project that addresses the need for excellence in mathematics, science and technology instruction. In response to these initiatives the NASA/LaRC Teacher Enhancement Institute was proposed.

The TEI incorporated systemic reform perspectives, enhanced content knowledge for teachers, and teacher preparation. Emphasis was also placed on recruiting those educators who teach in impoverished urban school districts with at-risk student populations who have been traditionally underrepresented in science, mathematics, technology and engineering. Participants in the Teacher Enhancement Institute were 37 teachers from grades K-8, teaching in Region 2 in the state of Virginia, as well as 2 preservice teachers from Norfolk State University and one teacher from Dublin, Virginia where a Science/Mathematics model school has been established. Teachers selected for this project represented school systems where income levels are extremely low, and students served tend not to receive innovative instruction in mathematics and science and their use of technology is limited.

The Teacher Enhancement Institute contained several features, that when combined, allowed for a unique experience. Some of these features included local teachers, administrators and school board members as presenters, instruction and use of technology every day, tours of select features of the research facility, briefings by NASA/LaRC scientists, engineers and researchers as well as individuals from the Continuous Electron Beam Accelerator Facility (CEBAF). Another unique feature of this program is to have participants convene on three separate occasions throughout the academic year to discuss strategies for information dissemination and implementation results.

Teachers' attitudes towards the use of technology, their ability to develop lessons using technology and their ability to develop lessons using information obtained through TEI were assessed using instruments developed by TEI summer faculty members. Data from these instruments were analyzed and reported in a final report submitted to the director of the Office of Education.

Bradley, A. "Teacher Training A Key Focus for Administration." *Education Week*, 1994, 13(39), 1, 20.

Raizen, S. A. and Michelsohn, A. M. *The Future of Science in Elementary Schools*. San Francisco: Jossey-Bass, 1994.

## Aeroacoustic computation of gust-blade interaction

by

James E. Martin  
 Department of Mathematics  
 Christopher Newport University  
 Newport News, VA 23666

To better understand and address the challenges faced in computing the acoustics of flow fields, test problems must be considered. In the present study, the sound radiated by the interaction of a flat plate with an oncoming gust containing a two component, mean velocity is computed. The gust has a uniform mean flow in  $x$  with Mach number  $M_\infty$  equal to 0.5. The gust's mean velocity in  $y$  is of smaller amplitude and is given by

$$v = 0.1 \sin \left[ \frac{\pi}{8} \left( \frac{x}{M_\infty} - t \right) \right]$$

This problem has been posed for an upcoming ICASE/LaRC workshop on benchmark problems in computational aeroacoustics.

A plate with a length of 30 units in  $x$  is used. The plate is assumed to be infinitesimally thin and is centered at the origin. All variables are made dimensionless using the scales specified. Acoustic quantities are obtained by numerically integrating the linearized Euler equations. Integration is performed on the computational domain  $-100.0 \leq x \leq 100.0$ ,  $-100.0 \leq y \leq 100.0$ , using unit length grid spacing in  $x$  and in  $y$ . An integration scheme is sought which will provide accurate solution to the small quantities of interest at a minimal computational expense. Results indicate that with the given discretization a scheme of minimal fourth order accuracy might be adequate to approximate the waves within the given flow. Thus, a variation of the MacCormack scheme with fourth order accuracy in space and second order accuracy in time was chosen. A scheme with sixth order accuracy in space has also been implemented and results compared with those of the fourth order accurate scheme.

To ensure no mass flux, zero normal velocity is assigned at the plate. This condition will induce a discontinuity in the pressure across the plate location. Values for the perturbation pressure  $p'$  along the surface of the plate are obtained using a one-sided, third order Taylor expansion, such that  $p'_y = 0$ . In accordance with the Kutta condition, perturbation pressure at the trailing edge is assigned to zero. In the far field, radiation boundary conditions have been implemented. The effectiveness of the far field conditions are validated by computing in a larger computational domain and comparing the results.

Early in time, sound waves begin to radiate from the plate. A Doppler effect is observed. After the initial transients disappear, the strongest waves leave the trailing edge at an approximate 45 degree angle. The intensity pattern of pressure fluctuations shows five lobes (of increasing magnitude with increasing downstream direction) emerging from the plate. Undesirable short wave contaminants are observed in the computed pressure distribution along the plate surface. For a more accurate solution at small scales, a more refined discretization will be required.

## **Inner Loop Flight Control For The High-Speed Civil Transport**

**Brett Newman  
NASA-ASEE Summer Faculty Fellow  
Assistant Professor  
Department of Aerospace Engineering  
Old Dominion University**

High-speed aerospace vehicles which employ high strength, light weight, yet deformable materials may exhibit significant interaction between the rigid-body and vibrational dynamics. Preliminary High-Speed Civil Transport (HSCT) configurations are a prime example. Traditionally, separate control systems have been used to augment the rigid-body and vibrational dynamics. In the HSCT arena, the highly coupled motions may not allow this design freedom. The research activity addresses two specific issues associated with the design and development of an integrated flight control system (FCS) for HSCT configurations, which are discussed next.

The HSCT is expected to have a short period instability at subsonic speeds. Flight vehicles with this characteristic (i.e., F-16, F-22, X-29, Space Shuttle) are stabilized with what is called a superaugmented pitch rate loop. One concern is "Will this stability augmentation logic work for a HSCT?" Studies show that an idealized pitch rate design would be acceptable, but is not realistic. Investigations using a contaminated pitch rate design reveal serious hurdles to overcome in the FCS design. Mounting location for the pitch rate sensor is critical. Results indicate a forward location leads to destabilizing pick-up of aeroelastic modes, while aft locations lead to undesirable coupling of the dominate pitch mode with the 1<sup>st</sup> aeroelastic mode. Intermediate locations for the sensor may not be acceptable. The source of the problem is the presence of low frequency aeroelastic modes in HSCT configurations, which are not present in vehicles currently using the superaugmented logic. To say the least, a conventional superaugmented pitch rate loop strategy may have undesirable characteristics. An unconventional strategy, which attempts to eliminate the above deficiencies by blending several pitch rate signals, indicates an improvement in the FCS architecture feasibility, but still lacking in some respects.

The HSCT configuration does not have aerodynamic surfaces in the vicinity of the nose (i.e., no canard or vane). A second concern is "Can the fuselage bending/torsion aeroelastic modes be effectively augmented without sufficient control input near the vehicle nose?" The superaugmented FCS results above may be suggesting the necessity of a secondary feedback loop to achieve an acceptable integrated FCS. Preliminary analysis of HSCT aeroelastic mode shapes indicate the use of existing wing leading edge devices as a second control input may be lacking in control authority for the rigid-body attitude and aeroelastic modes. An effort is underway to incorporate generic wing leading edge devices and canards into a generic HSCT model for the purpose of assessing additional control authority and it's use in candidate FCS designs.

A generic HSCT mathematical model was necessary for the studies above. A HSCT category model is available in NASA-CR-172201. This model describes the linear, longitudinal dynamics about the following flight condition: ascent,  $W = 730,000$  lbs,  $h = 6,500$  ft,  $M = 0.6$ . The model incorporates the full rigid-body variable set, as well as eighteen aeroelastic modes. Elevator deflection serves as the control input. Modifications to the model include the incorporation of relaxed static stability (i.e., static margin from -7.3% to +10%) and additional control inputs.

**Benchmark Problems in Computational Aeroacoustics**

by

Freda Porter-Locklear  
Pembroke State University  
Pembroke, NC 28372

A recent directive at NASA Langley is aimed at numerically predicting principal noise sources. During my summer stay, I worked with high-order ENO code, developed by Dr. Harold Atkins, for solving the unsteady compressible Navier-Stokes equations, as it applies to computational aeroacoustics (CAA).

A CAA workshop, composed of six categories of benchmark problems, has been organized to test various numerical properties of code. My task was to determine the robustness of Atkins' code for these test problems. In one category, we tested the nonlinear wave propagation of the code for the one-dimensional Euler equations, with initial pressure, density, and velocity conditions. Using freestream boundary conditions, our results were plausible. In another category, we solved the linearized two-dimensional Euler equations to test the effectiveness of radiation boundary conditions. Here we utilized MAPLE to compute eigenvalues and eigenvectors of the Jacobian given variable and flux vectors. We experienced a minor problem with inflow and outflow boundary conditions. Next, we solved the quasi one-dimensional unsteady flow equations with an incoming acoustic wave of amplitude  $10^{-6}$ . The small amplitude sound wave was incident on a convergent-divergent nozzle. After finding a steady-state solution and then marching forward, our solution indicated that after 30 periods the acoustic wave had dissipated (a period is time required for sound wave to traverse one end of nozzle to other end).

**Langley Research Center Strategic Plan for Education**

by

**Professor Sandra B. Proctor  
School of Social Work  
Norfolk State University  
Norfolk, Va.**

Research assignment centered on the preparation of final draft of the NASA Langley Strategic Plan for Education. Primary research activity consisted of data collection, through interviews with LaRC Office of Education and NASA Headquarters staff, university administrators and faculty, and school administrators/ teachers; and documentary analysis.

Pre-college and university programs were critically reviewed to assure effectiveness, support of NASA and Langley's mission and goals; National Education Goals; and educational reform strategies. In addition to these mandates, pre-college programs were reviewed to address present and future LaRC activities for teacher enhancement and preparation. University programs were reviewed with emphasis on student support and recruitment; faculty development and enhancement; and LaRC's role in promoting the utilization of educational technologies and distance learning.

The LaRC Strategic Plan for Education will enable the Office of Education to provide a focused and well planned continuum of education programs for students, teachers and faculty. It will serve to direct and focus present activities and programs while simultaneously offering the flexibility to address new and emerging directions based on changing national, state, and agency trends.

**Thin Tailored Composite Wing For Civil Tiltrotor**

by

Professor Masoud Rais-Rohani  
Department of Aerospace Engineering  
Mississippi State University  
Mississippi State, MS 39762

The tiltrotor aircraft is a flight vehicle which combines the efficient low speed (i.e., take-off, landing, and hover) characteristics of a helicopter with the efficient cruise speed of a turboprop airplane. A well-known example of such vehicle is the Bell-Boeing V-22 Osprey. The high cruise speed and range constraints placed on the civil tiltrotor require a relatively thin wing to increase the drag-divergence Mach number which translates into lower compressibility drag. It is required to reduce the wing maximum thickness-to-chord ratio  $t/c$  from 23% (i.e., V-22 wing) to 18%. While a reduction in wing thickness results in improved aerodynamic efficiency, it has an adverse effect on the wing structure as it tends to reduce structural stiffness. If ignored, the reduction in wing stiffness leads to susceptibility to aeroelastic and dynamic instabilities which may consequently cause a catastrophic failure.

By taking advantage of the directional stiffness characteristics of composite materials the wing structure may be tailored to have the necessary stiffness, at a lower thickness, while keeping the weight low. The goal of this study is to design a wing structure for minimum weight subject to structural, dynamic and aeroelastic constraints. The structural constraints are in terms of strength and buckling allowables. The dynamic constraints are in terms of wing natural frequencies in vertical and horizontal bending and torsion. The aeroelastic constraints are in terms of frequency placement of the wing structure relative to those of the rotor system. The wing-rotor-pylon aeroelastic and dynamic interactions are limited in this design study by holding the cruise speed, rotor-pylon system, and wing geometric attributes fixed. To assure that the wing-rotor stability margins are maintained a more rigorous analysis based on a detailed model of the rotor system will need to ensue following the design study.

The skin-stringer-rib type architecture is used for the wing-box structure. The design variables include upper and lower skin ply thicknesses and orientation angles, spar and rib web thicknesses and cap areas, and stringer cross-sectional areas. These design variables will allow the maximum tailoring of the structure to meet the design requirements most efficiently.

Initial dynamic analysis has been conducted using MSC/NASTRAN to determine the baseline wing's frequencies and mode shapes. For the design study we intend to use the finite-element based code called WIDOWAC (Wing Design Optimization With Aeroelastic Constraints) that was developed at NASA Langley in early 1970's for airplane wing structural analysis and preliminary design. Currently, the focus is on modification and validation of this code which will be used for the civil tiltrotor design efforts.

**Differential GPS and System Integration of the  
Low Visibility Landing and Surface Operations (LVLASO) Demonstration**

by

Dr. James Rankin

Department of Electrical Engineering

St. Cloud State University

St. Cloud, Minnesota 56301

The LVLASO Flight Demonstration of ASTA concepts (FDAC) integrates NASA-Langley's electronic moving map display and Transport Systems Research Vehicle (TSRV) (a modified Boeing 737 aircraft); ARINC's VHF data link, GPS ground station, and automated controller workstation; and Norden's surface radar/airport movement safety system. Aircraft location is shown on the electronic map display in the cockpit. An approved taxi route as well as other aircraft and surface traffic are also displayed.

An Ashtech Z12 Global Positioning System (GPS) receiver on the TSRV estimates the aircraft's position. In Differential mode (DGPS), the Ashtech receiver accepts differential C/A code pseudorange corrections from a GPS ground station. The GPS ground station provides corrections for up to ten satellites. The corrections are transmitted on a VHF data link at a 1 Hz. rate using the RTCM-104 format. DGPS position estimates will be within 5 meters of actual aircraft position.

DGPS position estimates are blended with position, velocity, acceleration, and heading data from the TSRV Air Data/Inertial Reference System (ADIRS). The ADIRS data is accurate in the short-term, but drifts over time. The DGPS data is used to keep the ADIRS position accurate. Ownship position, velocity, heading, and turn rate are sent at a 20 Hz. rate to the electronic map display.

Airport traffic is detected by the airport surface radar system. Aircraft and vehicles such as fuel trucks and baggage carts are detected. The traffic's location, velocity, and heading are sent to the TSRV. To prevent traffic symbology from jumping each second when a location update arrives, velocity and heading are used to predict a new traffic location for each display update. Possible runway incursions and collisions can be shown on the electronic map

Integrating the different systems used in the FDAC requires attention to the underlying coordinate systems. The airport diagram displayed on the electronic map is obtained from published navigational charts. The charts reference the North American Datum of 1927 (NAD27) or a local state-plane coordinate system. GPS uses the World Geodetic Standard of 1984 (WGS84). Both NAD27 and WGS84 model the Earth as an ellipsoid, however, they use a different origin and different size ellipsoids. Latitudes and longitudes given in these systems can be converted to a Cartesian system with the origin at the Earth's center. The surface radar detects traffic in a locally-level, rho-theta coordinate system.

The electronic airport diagram is stored using a flat XY coordinate system. The map origin is at the tower and is referenced as True North up. All ownship and other traffic positions must be converted to the electronic map's frame of reference for display.



**PRELIMINARY IDENTIFICATION OF BUFFET PROBLEMS  
IN HIGH SPEED CIVIL TRANSPORT\***

by

K. Ravindra  
Department of Aerospace Engineering  
Parks College of Saint Louis University  
Cahokia, IL-62206

In the present study, some effort is made to identify whether empennage buffet is a relevant factor in the design and operation of the High Speed Civil Transport (HSCT). Based on some results of the only operational supersonic transport, Concorde and the innumerable studies that exist on the tail buffet of high performance airplanes, CFD analyses on the HSCT as well as low speed wind tunnel tests on models, it appears as though buffet will be a factor that needs attention in the proper design of empennage structure. Utilizing the existing empirical relation between the reduced frequency of the leading edge vortices and the geometric parameters, it is estimated that the characteristic frequencies of the vortices from the wing cranks are in the range of certain fundamental frequencies of the wing-fuselage-empennage structure. Buffet is believed to be critical during take-off, climb, descent and landing. Computational and experimental data available in open literature indicates coherent vortex flow structure in the empennage region at supersonic cruise speeds. This raises further concern on the fatigue life of the empennage structure. Three second generation supersonic transport designs taken from open literature are briefly compared with the "empennage buffet" in mind. Future research efforts relating to buffet studies on the HSCT are summarized. A bibliography pertaining to the present research, including relevant studies on the first generation supersonic transport is presented. The effect of rounded wing leading edges on the present frequency estimates needs further study. The effect of engine exhaust on the flow field in the empennage region also needs further study.

---

\* A report that describes this research is available from the author.

**Preparation of Course Materials: Elementary Mathematics of Powered Flight**

by

George Rublein  
Department of Mathematics  
College of William and Mary  
Williamsburg, VA 23185

Non-science students at William and Mary will soon be required to take a mathematics course in order to earn a bachelor's degree. A standard menu of technique courses is the usual way in which universities provide for this requirement: Trigonometry, probability, geometry for teachers, and the like. In this work, we attempt to break away from these largely unsuccessful choices.

Our intent is to prepare material that sets a variety of simple mathematical procedures in the context of a commonly experienced part of students lives: riding in commercial airplanes. The work, begun last summer at Langley, is now close to completion and trial in upcoming fall term at William and Mary. As of this writing, the narrative is complete for 12 to 14 projected sections.

We have prepared material on wind triangles, wind roses, navigation maps, drag induced loss of velocity for unpowered missiles (tennis balls), luggage and its effect on center of gravity, localized magnetic declination and VOR orientation, geometry of great circles, terminal velocity for falling bodies, pressure vessels: tires and balloons and blimps, global structure of declination lines, map projections (mercator, azimuthal equidistant, Lambert), Ears and their reaction to altitude change. The next section will treat lift, drag and thrust. The last will treat control surfaces.

The entire approach avoids any effort to investigate mathematical topics that arise in the solution of problems. And by the same token, we avoid any organized attempt to explain aeronautical engineering, even on an elementary level. We look only at enough mathematics to do a problem and we select only engineering topics that permit some kind of (elementary) mathematical analysis.

In the end, we will think of the material as successful if two things happen: Students must come away with some confidence that even lay people can quantify parts of their surroundings. Other potential instructors must be willing to gain enough familiarity with the physical content of the material so that it can be used at other universities.

**Associated with Aerospace Vehicles Development of Methodologies for the  
Estimation of Thermal Properties**

**N95- 23321**

by

Professor Elaine P. Scott  
Department of Mechanical Engineering  
Virginia Polytechnic Institute and State University  
Blacksburg, VA 24061-0238

Thermal stress analyses are an important aspect in the development of aerospace vehicles at NASA-LaRC. These analyses require knowledge of the temperature distributions within the vehicle structures which consequently necessitates the need for accurate thermal property data. The overall goal of this ongoing research effort is to develop methodologies for the estimation of the thermal property data needed to describe the temperature responses of these complex structures. The research strategy undertaken utilizes a building block approach. The idea here is to first focus on the development of property estimation methodologies for relatively simple conditions, such as isotropic materials at constant temperatures, and then systematically modify the technique for the analysis of more and more complex systems, such as anisotropic multi-component systems. The estimation methodology utilized is a statistically based method which incorporates experimental data and a mathematical model of the system.

Several aspects of this overall research effort were investigated during the time of the ASEE summer program. One important aspect involved the calibration of the estimation procedure for the estimation of the thermal properties through the thickness of a standard material. Transient experiments were conducted using a Pyrex standard at various temperatures, and then the thermal properties (thermal conductivity and volumetric heat capacity) were estimated at each temperature. Confidence regions for the estimated values were also determined. These results were then compared to documented values. Another set of experimental tests was conducted on carbon composite samples at different temperatures. Again, the thermal properties were estimated for each temperature, and the results were compared with values obtained using another technique. In both sets of experiments, a 10-15% off-set between the estimated values and the previously determined values was found.

Another effort was related to the development of the experimental techniques. Initial experiments required a resistance heater placed between two samples. The design was modified such that the heater was placed on the surface of only one sample, as would be necessary in the analysis of built up structures. Experiments using the modified technique were conducted on the composite sample used previously at different temperatures. The results were within 5% of those found using two samples.

Finally, an initial heat transfer analysis, including conduction, convection and radiation components, was completed on a titanium sandwich structural sample. Experiments utilizing this sample are currently being designed and will be used to first estimate the material's effective thermal conductivity and later to determine the properties associated with each individual heat transfer component.

**Potential Aerospace Applications of High Temperature Superconductors**

by  
**Raouf Selim**  
**Department of Physics & Computer Science**  
**Christopher Newport University**  
**Newport News, Va 23606-2998**

The recent discovery of High Temperature Superconductors (HTS) with superconducting transition temperature,  $T_c$ , above the boiling point of liquid nitrogen has opened the door for using these materials in new and practical applications. These materials have zero resistance to electric current, have the capability of carrying large currents and as such have the potential to be used in high magnetic field applications.

One of the space applications that can use superconductors is electromagnetic launch of payloads to low-earth-orbit. An electromagnetic gun-type launcher can be used in small payload systems that are launched at very high velocity, while sled-type magnetically levitated launcher can be used to launch larger payloads at smaller velocities. Both types of launchers are being studied by NASA and the aerospace industry. The use of superconductors will be essential in any of these types of launchers in order to produce the large magnetic fields required to obtain large thrust forces. Low Temperature Superconductor (LTS) technology is mature enough and can be easily integrated in such systems. As for the HTS, many leading companies are currently producing HTS coils and magnets that potentially can be mass-produced for these launchers. It seems that designing and building a small-scale electromagnetic launcher is the next logical step toward seriously considering this method for launching payloads into low-earth-orbit.

A second potential application is the use of HTS to build sensitive portable devices for the use in Non Destructive Evaluation (NDE). Superconducting QUantum Interference Devices (SQUIDS) are the most sensitive instruments for measuring changes in magnetic flux. By using HTS in SQUIDS, one will be able to design a portable unit that uses liquid nitrogen or a cryocooler pump to explore the use of gradiometers or magnetometers to detect deep cracks or corrosion in structures.

A third use is the replacement of Infra-Red (IR) sensor leads on Earth Orbit Systems (EOS) with HTS leads. IR detectors on these EOS missions are cooled to 4.2K to improve their signal to noise ratio. They are connected to data acquisitions systems using manganin wires (low thermal conductors) to reduce the heat load on the cryogen. Replacing these wires with HTS leads will increase the lifetime of these missions by about 50%. This is a promising application that is ready for actual implementation on such systems. The analysis also show that as the number of IR detectors increase in larger EOS systems, substantial increase in the lifetime of each mission will be realized by using HTS leads instead of the manganin ones.

**Upward Appraisal as a Means for Improving Supervisory Performance  
and Promoting Process Improvement, With Long-Term  
Implications for Organizational Change**

by

Professor Denise V. Siegfeldt  
Department of Management  
Hampton University  
Hampton, Virginia 23668

This study represents the implementation phase of an organizational development project which was initiated last year in the Management Support Division (MSD) at Langley Research Center to diagnose organizational functioning. As a result of MSD survey data from last year's effort, a Quality Action Team was created to address the responses compiled from the MSD Organizational Assessment Questionnaire and Follow-Up Questionnaire. The team was officially named the MSD Employee Relations Improvement Team (MERIT).

MERIT's goal was to analyze major concerns generated by the questionnaires and to present feasible solutions to management which would improve supervisory performance, promote process improvement; and ultimately, lead to a better organization. The team met weekly and was very disciplined in following guidelines needed to ensure a fully functioning team. Several TQM tools were used during the team process, including brainstorming and the cause and effect diagram.

One of the products produced by MERIT was a "report card," more formally known as an upward appraisal system, to evaluate supervisory performance in the division office, its three branches, and in teams. Major areas of emphasis on the 47 item report card were those identified by employees through the previously administered questionnaires as needing to be improved; specifically, training, recognition, teamwork, supervision and leadership, and communication. MERIT created an enlarged and modified version of the report card which enabled scores for each individual supervisor to be recorded on a separate form, along with summary results and employee comments.

Report card results have been compiled and fed back to the Division Chief and Assistant Division Chief. These individuals will in turn, feed the results back to the remaining supervisors and the team leaders. Although results differ among supervisors, some similarities exist. Communication generally appears to be adequate, which represents an improvement over last year. In contrast, recognition and teamwork are the two major areas where improvement in supervisory performance seems to be most needed.

The initial report card results will serve as a baseline against which future performance ratings will be compared. Once supervisors have been presented with their data and given an opportunity to analyze and discuss the results, they will be assisted in developing an action plan for improving their performance and work processes. They will be provided with ongoing support from management in following through with the action plan.

**Teacher Enhancement Institute**

by

Ron W. Simmons  
University of Virginia  
Charlottesville, VA 22903

In a team building, team teaching strategy with four faculty, can learning strategies such as educational technology and problem based learning be provided to forty local teachers of primary, elementary, and secondary students. The impetus for the effort is to provide information about science and engineering at NASA and motivate students to pursue careers in science and technology. Teachers, identified and selected through a rigorous application procedure, participated in a two week workshop for graduate credit. Teachers were exposed to computer applications such as INTERNET, MOSAIC, Power Macintosh word processing, NASA scientists and laboratory experiments. Teachers were evaluated on level and quality of their participation, design of teacher application materials and relevant lesson plans and presentations. The results show that teachers, regardless of preparation and background, can learn science and engineering applications and develop relevant materials to transfer information to their classroom. Follow-up during the academic year will show that teachers are successfully using materials.

## Handling Qualities of the High Speed Civil Transport

by

U. Peter Solies, PhD  
NASA-ASEE Research Fellow Summer 1994  
Associate Professor  
University of Tennessee Space Institute  
Tullahoma, Tennessee 37388

The low speed handling qualities of a High Speed Civil Transport class aircraft have been investigated by using data of the former Advanced Supersonic Transport (AST) 105. The operation of such vehicles in the airport terminal area is characterized by "backside" performance. Main objectives of this research effort were: a) determination of the nature and magnitude of the speed instability associated with the backside of the thrust required curve, b) confirmation of the validity of existing MIL-SPEC handling qualities criteria, c) safety of operation of the vehicle in the event of autothrottle failure, and d) correlation of required engine responsiveness with level of speed instability.

Preliminary findings comprise the following:

The critical velocity for speed instability was determined to be 196 knots, well above the projected approach speed of 155 knots. This puts the vehicle far on the backside of its thrust required curve. While the aircraft can be configured to have static and dynamic stability at this trim point, a significant speed instability emerges, if a pilot or autopilot attempts flight path control with elevator and/or canard control surfaces only. This requires a properly configured autothrottle and/or variable aerodynamic drag devices which can provide speed stability.

An AST 105 type vehicle meets MIL-SPEC criteria only in part. While the damping criteria for phugoid and short period motion are met easily, the AST 105 falls short of the required minimum short period frequency, meaning that the HSCT is too sluggish in pitch to meet the military criteria. Obviously the military specification do not consider a vehicle with such high pitch inertia. With regard to speed stability and flight path stability criteria, the vehicle meets levels 2 and 3 of the military requirements, indicating that it could be landed safely with manual controls in case of an autothrottle failure, even though the pilot workload would be high.

This requires quick thrust response to throttle adjustment, however. If the engine responsiveness is slow, the aircraft handling qualities are further deteriorated. Progress has been made in correlating required engine response dynamics with the given level of speed instability of the vehicle.

ASEE Abstract: Computational Modelling of Er<sup>3+</sup>:Garnet Laser Materials

Lee H. Spangler  
 Department of Chemistry  
 Montana State University  
 Bozeman, MT 59717  
 Phone: (406)994-4399  
 E-Mail: uchls@msu.oscs.montana.edu

Associate: Norm Barnes, Flight Electronics Division

The Er<sup>3+</sup> ion has attracted a lot of interest for four reasons: 1) Its  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition lases in the eyesafe region near 1.5  $\mu\text{m}$  2) the  ${}^4I_{11/2} \rightarrow {}^4I_{13/2}$  transition lases near 2.8  $\mu\text{m}$ , an important wavelength for surgical purposes 3) It displays surprisingly efficient upconversion with lasing observed at 1.7, 1.2, 0.85, 0.56, 0.55, and 0.47  $\mu\text{m}$  following 1.5  $\mu\text{m}$  pumping, and 4) It has absorption bands at 0.96 and 0.81  $\mu\text{m}$  and thus can be diode pumped. However, properties desirable for upconversion reduce the efficiency of 1.5 and 3  $\mu\text{m}$  laser operation and vice versa. Since all of the processes are influenced by the host via the crystal field induced stark splittings in the Er levels, this project undertook modelling of the host influence on the Er lasing behavior. While growth and measurement of all ten Er<sup>3+</sup> doped garnets is the surest way of identifying hosts which maximize upconversion (or conversly, 1.5 and 3  $\mu\text{m}$  performance), it is also expensive - costing ~\$10,000/material or ~ \$100,000 for the materials computationally investigated here.

The calculations were performed using a quantum mechanical point charge model developed by Clyde Morrison at Harry Diamond Laboratories. The programs were used to fit the Er:YAG experimental energy levels so that the crystal field parameters,  $B_{nm}$ , could be extracted. From these radial factors,  $\rho_n$ , were determined for Er<sup>3+</sup> in garnets. These, in combination with crystal field components,  $A_{nm}$ , available from X-ray data, were used to predict energy levels for Er in the other nine garnet hosts. The levels in Er:YAG were fit with an rms error of 12.2  $\text{cm}^{-1}$  over a 22,000  $\text{cm}^{-1}$  range. Predicted levels for two other garnets for which literature values were available had rms errors of less than 17  $\text{cm}^{-1}$ , showing the calculations to be reliable. Based on resonances between pairs of calculated stark levels, the model predicts GSGG as the best host for 1.5  $\mu\text{m}$  laser operation, GSGG or YSAG as the best host for 2.8  $\mu\text{m}$  operation, and LuGG as the best host for an upconversion material.



**A New Look at the Simultaneous Analysis and Design of Structures**

Alfred G. Striz

School of Aerospace and Mechanical Engineering

The University of Oklahoma

Norman, Oklahoma 73019-0601

The minimum weight optimization of structural systems, subject to strength and displacement constraints as well as size side constraints, was investigated by the Simultaneous ANalysis and Design (SAND) approach. As an optimizer, the code NPSOL was used which is based on a sequential quadratic programming (SQP) algorithm. The structures were modeled by the finite element method. The finite element related input to NPSOL was automatically generated from the input decks of such standard FEM/optimization codes as NASTRAN or ASTROS, with the stiffness matrices, at present, extracted from the FEM code ANALYZE.

In order to avoid ill-conditioned matrices that can be encountered when the global stiffness equations are used as additional nonlinear equality constraints in the SAND approach (with the displacements as additional variables), the matrix displacement method was applied. In this approach, the element stiffness equations are used as constraints instead of the global stiffness equations, in conjunction with the nodal force equilibrium equations. This approach adds the element forces as variables to the system.

Since, for complex structures and the associated large and very sparse matrices, the execution times of the optimization code became excessive due to the large number of required constraint gradient evaluations, the Kreisselmeier-Steinhauser function approach was used to decrease the computational effort by reducing the nonlinear equality constraint system to essentially a single combined constraint equation. As the linear equality and inequality constraints require much less computational effort to evaluate, they were kept in their previous form to limit the complexity of the KS function evaluation.

To date, the standard three-bar, ten-bar, and 72-bar trusses have been tested. For the standard SAND approach, correct results were obtained for all three trusses although convergence became slower for the 72-bar truss. When the matrix displacement method was used, correct results were still obtained, but the execution times became excessive due to the large number of constraint gradient evaluations required. Using the KS function, the computational effort dropped, but the optimization seemed to become less robust. The investigation of this phenomenon is continuing.

As an alternate approach, the code MINOS for the optimization of sparse matrices can be applied to the problem in lieu of the Kreisselmeier-Steinhauser function. This investigation is underway.

**APPLICATION OF ELECTRON PARAMAGNETIC RESONANCE IMAGING TO THE  
CHARACTERIZATION OF ULTEM<sup>R</sup> EXPOSED TO 1-MeV ELECTRONS.  
CORRELATION OF RADICAL DENSITY DATA TO TIGER CODE CALCULATIONS.**

N. K. SULEMAN\*

Assistant Professor, Department of Chemistry, Hampton University  
Hampton, Virginia 23668

A major long-term goal of the Materials Division at the NASA Langley Research Center is the characterization of new high-performance materials that have potential applications in the aircraft industry, and in space. The materials used for space applications are often subjected to a harsh and potentially damaging radiation environment. The present study constitutes the application of a novel technique to obtain reliable data for ascertaining the molecular basis for the resilience and durability of materials that have been exposed to simulated space radiations.

The radiations of greatest concern are energetic electrons and protons, as well as galactic cosmic rays. Presently, the effects of such radiation on matter are not understood in their entirety. It is clear however, that electron radiation causes ionization and homolytic bond rupture, resulting in the formation of paramagnetic spin centers in the polymer matrices of the structural materials. Since the detection and structure elucidation of paramagnetic species are most readily accomplished using Electron Paramagnetic Resonance (EPR) Spectroscopy, the NASA LaRC EPR system was brought back on-line during the 1991 ASEE term [1]. The subsequent 1992 ASEE term was devoted to the adaptation of the EPR core system to meet the requirements for EPR *Imaging* (EPRI), which provides detailed information on the *spatial* distribution of paramagnetic species in bulk media [2].

The present (1994) ASEE term was devoted to the calibration of this EPR Imaging system, as well as to the application of this technology to study the effects of electron irradiation on Ultem<sup>R</sup>, a high performance polymer which is a candidate for applications in aerospace. The Ultem<sup>R</sup> was exposed to a dose of  $2.4 \times 10^9$  Rads (1-MeV energy/electron) at the LaRC electron accelerator facility. Subsequently, the exposed specimens were stored in liquid nitrogen, until immediately prior to analyses by EPRI. The intensity and dimensions of the EPR Images that were generated for the irradiated specimens showed that the electrons penetrated the material to a depth of approximately 0.125 inch. These data show a very high degree of correlation to the energy deposition profile as predicted by the Tiger Code [3], a Monte Carlo code that provides guidelines for the transport of electrons in matter. Subsequent efforts will focus on delineating the transport properties of energetic protons in Ultem<sup>R</sup>.

### References

1. Suleman, N. K. *NASA Contractor Report* # 187598, 1991, 213.
2. Suleman, N. K. *NASA Contractor Report* # 189691, 1992, 185.
3. Halbleib, J.; Mehlhorn, T.; Kensek, R. *TIGER P, Version 2.1*; 1987, Sandia National Laboratories.

\*Present Address: Dept. of Chemistry, University of Guam, Mangilao, Guam 96923, USA.

**Theoretical Studies of Spectroscopic Problems of Importance for  
Atmospheric Radiation Measurements**

by

Professor Richard H. Tipping  
Department of Physics and Astronomy  
University of Alabama  
Tuscaloosa, Alabama 35487

Many of the instruments used to deduce the physical parameters of the Earth's atmosphere necessary for climate studies or for pollution monitoring (for instance, temperature versus pressure or number densities of trace molecules) rely on the existence of accurate spectroscopic data and an understanding of the physical processes responsible for the absorption or emission of radiation. During the summer, research was either continued or begun on three distinct problems: 1) an improved theoretical framework for the calculation of the far-wing absorption of allowed spectral lines; 2) a refinement of the calculation of the collision-induced fundamental spectrum of  $N_2$ ; and 3) an investigation of possible line-mixing effects in the fundamental spectrum of  $CH_4$ . Progress in these three areas is summarized below.

During the past few years, we have developed a theoretical framework for the calculation of the absorption of radiation by the far wings of spectral lines. Such absorption due to water vapor plays a crucial role in the greenhouse effect as well as limiting the retrieval of temperature profiles from satellite data. Several improvements in the theory have been made and the results are being prepared for publication.

Last year we published results for the theoretical calculation of the absorption of radiation due to the dipoles induced during binary collisions of  $N_2$  molecules using independently measured molecular parameters; the results were in reasonable agreement with experimental data. However, recent measurements have revealed new fine structure that has been attributed to line-mixing effects. We do not think that this is correct, rather that the structure results from short-range anisotropic dipoles. We are in the process of including this refinement in our theoretical calculation in order to compare with the new experimental data.

Subtle changes in the spectra of  $CH_4$  measured by researchers at Langley have also been attributed to line-mixing effects. By analyzing the same spectral lines broadened by air and by  $N_2$ , and by studying different spectral lines, we have attempted to verify or rule out possible line-mixing mechanisms. Due to the complexity and richness of the spectrum of this highly symmetric molecule, as well as the small magnitude of the effects, a detailed first-principle calculation of the mixing is a difficult problem. Before such a program is undertaken it is important to glean as much information as possible concerning the possible mechanisms by a systematic analysis of the existing data.

**Computer Modeling of the Sensitivity of a Laser Water Vapor Sensor to Variations in Temperature and Air Speed**

by

Professor George F. Tucker  
Math/Science Division  
Sage Junior College of Albany  
140 New Scotland Avenue  
Albany, New York 12208

Currently, there is disagreement among existing methods of determining atmospheric water vapor concentration at dew-points below -40 degrees C. A major source of error is wall effects which result from the necessity of bringing samples into the instruments. All of these instruments also have response times on the order of seconds. NASA Langley is developing a water vapor sensor which utilizes the absorption of the infrared radiation produced by a diode laser to estimate water vapor concentration. The laser beam is directed through an aircraft window to a retroreflector located on an engine. The reflected beam is detected by a infrared detector located near the laser. To maximize signal to noise, derivative signals are analyzed. By measuring the  $2f/DC$  signal and correcting for ambient temperature, atmospheric pressure and air speed (which results in a Doppler shifting of the laser beam), the water vapor concentration can be retrieved. Since this is an in situ measurement there are no wall effects and measurements can be made at a rate of more than 20 per second. This allows small spatial variations of water vapor to be studied.

In order to study the sensitivity of the instrument to variations in temperature and air speed, a computer program which generated the  $2f$ ,  $3f$ ,  $4f$ , DC, and  $2f/DC$  signals of the instrument as a function of temperature, pressure and air speed was written. This model was used to determine the effect of errors in measurement of the temperature and air speed on the measured water vapor concentration. Future studies will quantify the effect of pressure measurement errors, which are expected to be very small.

As a result of these studies, a retrieval algorithm has been formulated, and will be applied to data taken during the PEM-West atmospheric science field mission. Spectroscopic studies of the water vapor line used by the instrument will be used to refine this algorithm. To prepare for these studies, several lasers have been studied to determine their output frequency range and power.

**The Software Analysis Project for the Office of Human Resources**

by

Professor Robert L. Tureman, Jr.  
Department of Computer Information Systems  
Paul D. Camp Community College  
Franklin, Virginia 23851

There were two major sections of the project for the Office of Human Resources (OHR). The first section was to conduct a planning study to analyze software use with the goal of recommending software purchases and determining whether the need exists for a file server. The second section was analysis and distribution planning for a retirement planning computer program entitled VISION<sub>TM</sub> provided by NASA Headquarters.

The software planning study was developed to help OHR analyze the current administrative desktop computing environment and make decisions regarding software acquisition and implementation. There were three major areas addressed by the study: current environment, new software requirements, and strategies regarding the implementation of a server in the Office. To gather data on current environment, employees were surveyed and an inventory of computers was produced. The surveys were compiled and analyzed by the ASEE fellow with interpretation help by OHR staff. New software requirements represented a compilation and analysis of the surveyed requests of OHR personnel. Finally, the information on the use of a server represents research done by the ASEE fellow and analysis of survey data to determine software requirements for a server. This included selection of a methodology to estimate the number of copies of each software program required given current use and estimated growth.

The report presents the results of the computing survey, a description of the current computing environment, recommendations for changes in the computing environment, current software needs, management advantages of using a server, and management considerations in the implementation of a server. In addition, detailed specifications were presented for the hardware and software recommendations to offer a complete picture to OHR management.

The retirement planning computer program available to NASA employees will aid in long-range retirement planning. The intended audience is the NASA civil service employee with several years until retirement. The employee enters current salary and savings information as well as goals concerning salary at retirement, assumptions on inflation, and the return on investments. The program produces a picture of the employee's retirement income from all sources based on the assumptions entered. A session showing features of the program was conducted for key personnel at the Center. After analysis, it was decided to offer the program through the Learning Center starting in August 1994.

## Multidisciplinary Design Optimization Using Genetic Algorithms

Resit Unal  
Associate Professor  
Old Dominion University  
Norfolk, VA 23529

Multidisciplinary design optimization (MDO) is an important step in the conceptual design and evaluation of launch vehicles since it can have a significant impact on performance and life cycle cost. The objective is to search the system design space to determine values of design variables that optimize the performance characteristic subject to system constraints. Gradient-based optimization routines have been used extensively for aerospace design optimization. However, one limitation of gradient based optimizers is their need for gradient information. Therefore design problems which include discrete variables can not be studied. Such problems are common in launch vehicle design. For example, the number of engines and material choices must be integer values or assume only a few discrete values.

In this study, genetic algorithms are investigated as an approach to MDO problems involving discrete variables and discontinuous domains. Optimization by genetic algorithms (GA) uses a search procedure which is fundamentally different from those gradient based methods [1,3,4]. Genetic algorithms seek to find good solutions in an efficient and timely manner rather than finding the best solution. GA are designed to mimic evolutionary selection [1,3,4]. A population of candidate designs is evaluated at each iteration, and each individual's probability of reproduction (existence in the next generation) depends on its fitness value (related to the value of the objective function). Progress toward the optimum is achieved by crossover and mutation operations [2,3,4]. GA is attractive since it uses only objective function values in the search process, so gradient calculations are avoided. Hence, GA are able to deal with discrete variables. Studies report success in the use of GA for aircraft design optimization studies, trajectory analysis, space structure design and control systems design [1,2,4]. In these studies reliable convergence was achieved, but the number of function evaluations was large compared with efficient gradient methods.

Application of GA is underway for a cost optimization study for a launch-vehicle fuel-tank and structural design of a wing. The strengths and limitations of GA for launch vehicle design optimization is studied.

### References

1. P.Gage and I Kroo, 1993, "A Role for Genetic Algorithms in a Preliminary Design Environment," AIAA-93-3933, August.
2. P.Gage, R.D. Braun and I Kroo, 1994, "Interplanetary Trajectory Optimization Using a Genetic Algorithm," AIAA-94-3773, August.
3. D.E. Goldberg, 1989, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison Wesley, Reading, Massachusetts.
4. M. Srinivas and L.M. Patniak, 1994, "Genetic Algorithms: A Survey," Computer, (IEEE) Vol. 27, No. 6, June.

**High-Lift Flow-Physics Flight Experiments on a Subsonic Civil Transport Aircraft (B737-100)**

by

Professor C. P. van Dam  
Department of Mechanical and Aeronautical Engineering  
University of California  
Davis, CA 95616

As part of the subsonic transport high-lift program, flight experiments are being conducted using NASA Langley's B737-100 to measure the flow characteristics of the multi-element high-lift system at full-scale high-Reynolds-number conditions. The instrumentation consists of hot-film anemometers to measure boundary-layer states, an infra-red camera to detect transition from laminar to turbulent flow, Preston tubes to measure wall shear stress, boundary-layer rakes to measure off-surface velocity profiles, and pressure orifices to measure surface pressure distributions. The initial phase of this research project was recently concluded with two flights on July 14. This phase consisted of a total of twenty flights over a period of about ten weeks. In the coming months the data obtained in this initial set of flight experiments will be analyzed and the results will be used to finalize the instrumentation layout for the next set of flight experiments scheduled for Winter and Spring of 1995. The main goal of these upcoming flights will be to measure more detailed surface pressure distributions across the wing for a range of flight conditions and flap settings, (2) to visualize the surface flows across the multi-element wing at high-lift conditions using fluorescent mini tufts, and (3) to measure in more detail the changes in boundary-layer state on the various flap elements as a result of changes in flight condition and flap deflection.

These flight measured results are being correlated with experimental data measured in ground-based facilities as well as with computational data calculated with methods based on the Navier-Stokes equations or a reduced set of these equations. Also these results provide insight into the extent of laminar flow that exists on actual multi-element lifting surfaces at full-scale high-lift conditions.

Preliminary results indicate that depending on the deflection angle, the slat and flap elements have significant regions of laminar flow over a wide range of angles of attack. Boundary-layer transition mechanisms that were observed include attachment-line contamination on the slat and inflectional instability on the slat and fore flap. Also, the results agree fairly well with the predictions reported in a paper presented at last year's AIAA Fluid Dynamics Conference.<sup>1</sup> The fact that extended regions of laminar flow are shown to exist on the various elements of the high-lift system raises the question what the effect is of loss of laminar flow as a result of insect contamination, rain or ice accumulation on high-lift performance.

---

<sup>1</sup> van Dam, C. P. Vijgen, P. M. H. W., Yip, L. P., Potter, R. C. "Leading-Edge Transition and Relaminarization Phenomena on a Subsonic High-Lift System," AIAA Paper 93-3140, July 1993.

**APPENDIX X**  
**PROGRAM ORIENTATION EVALUATION REPORT**



## 1994 ASEE PROGRAM ORIENTATION EVALUATION REPORT

Forty-one Orientation evaluations were returned.

### A. Overall Organization

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 39%
- 5 - Excellent - 61%

### B. Pre-Conference Notification

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 10%
- 4 - Good - 41%
- 5 - Excellent - 49%

### C. Information and Knowledge Gained

- 1 - Poor - 0%
- 2 - Fair - 2%
- 3 - Average - 5%
- 4 - Good - 59%
- 5 - Excellent - 34%

### D. Program Breakout Session

- 1 - Poor - 0%
- 2 - Fair - 2%
- 3 - Average - 0%
- 4 - Good - 47%
- 5 - Excellent - 51%

### E. In General, How Do You Rate This Orientation

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 2%
- 4 - Good - 37%
- 5 - Excellent - 61%

### Comments and Recommendations:

- Interesting, Informative, and very well organized.
- Well planned and organized - not too much information to be overwhelming.
- Needed time to introduce each other (ASEE/JOVE/Other) informally.
- Informative and helpful, especially to new attendees.
- A little earlier pre-conference notification would have been helpful.
- Separate badging lines for ASEE and LARSS would help speed process up.
- The line for registration can be made more efficient - two tables.
- Provide relocation allowance and travel reimbursement on the day of the

- orientation would be helpful, especially for those with families/mortgages.
- Very good. Thorough. Nice overview and tour. 8-9 a.m. registration waste of time. For breakout session, have all details written down and allow Fellows to ask questions.

**APPENDIX XI**  
**PROPOSAL SEMINAR EVALUATION REPORT**

## 1994 PROPOSAL SEMINAR EVALUATION REPORT

Twenty Seminar evaluations were returned.

### **A. Timely Notification**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 10%
- 4 - Good - 35%
- 5 - Excellent - 55%

### **B. Presentation Delivered in Clear and Concise Manner**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 50%
- 5 - Excellent - 50%

### **C. Speaker Had Good Command of Material**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 5%
- 4 - Good - 25%
- 5 - Excellent - 70%

### **D. Information and Knowledge Gained**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 25%
- 4 - Good - 30%
- 5 - Excellent - 45%

### **E. Overall Organization**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 50%
- 5 - Excellent - 50%

### **Fellows Comments:**

- Have seminar earlier in the program.
- Invite NASA experts/researcher/mentor who have reviewed proposals to discuss what they look for.
- Copies of sample winning proposals from previous years would be useful.
- Put details of seminar in orientation package.
- Examples and handouts of presentation available at beginning of seminar.

### **Co-Director's Recommendations:**

- 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 XII**  
**BANQUET EVALUATION REPORT**

## 1994 BANQUET EVALUATION REPORT

Thirty-three evaluations were returned.

### **A. Location with Social Area and Dining Area Separated.**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 6%
- 4 - Good - 55%
- 5 - Excellent - 39%

### **B. Cost**

- 1 - Poor - 6%
- 2 - Fair - 9%
- 3 - Average - 9%
- 4 - Good - 61%
- 5 - Excellent - 15%

### **C. Menu-Bufferet Versus Pre-Selected Meal for Everyone**

- 1 - Poor - 0%
- 2 - Fair - 3%
- 3 - Average - 18%
- 4 - Good - 39%
- 5 - Excellent - 39%

### **D. Program with No Key Speaker Versus Having a Key Speaker**

- 1 - Poor - 6%
- 2 - Fair - 6%
- 3 - Average - 12%
- 4 - Good - 42%
- 5 - Excellent - 33%

### **E. Overall Organization**

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 12%
- 4 - Good - 55%
- 5 - Excellent - 33%

### **Comments and Recommendations:**

- Very well organized.
- Excellent Banquet.
- Serve a dessert.
- Must include a main vegetarian entree.
- Short comments are appropriate, instead of a lengthy speech.
- Keynote speaker a must for this type of activity.

**APPENDIX XIII**  
**ASSOCIATE-MENTOR TRAINING MEETING**  
**EVALUATION REPORT**

## 1994 Associate-Mentor Training Meeting Evaluation Results

### A. Overall Organization

Poor 1- 1 (3%)	Fair 2- 1 (3%)	Average 3- 4 (11%)	Good 4- 22 (59%)	Excellent 5- 9 (24%)
-------------------	-------------------	-----------------------	---------------------	-------------------------

### B. Timely Notification of Training

Poor 1- 0	Fair 2- 0	Average 3- 6 (16%)	Good 4- 16 (43%)	Excellent 5- 15 (41%)
--------------	--------------	-----------------------	---------------------	--------------------------

### C. Information Provided by the Training

Poor 1- 2 (5%)	Fair 2- 4 (11%)	Average 3- 6 (16%)	Good 4- 20 (54%)	Excellent 5- 5 (14%)
-------------------	--------------------	-----------------------	---------------------	-------------------------

### D. Do You Feel You Have the Information Needed to be an Effective Mentor?

Yes- 36 (97%)                      No- 1 (3%)

### E. In General, How do You Rate this Training

Poor 1- 3 (8%)	Fair 2- 2 (5%)	Average 3- 5 (14%)	Good 4- 20 (54%)	Excellent 5- 7 (19%)
-------------------	-------------------	-----------------------	---------------------	-------------------------

### F. Comments:

More emphasis on quality mentoring.

I would suggest having a sample mentor and student evaluation in package.

Suggest having a clearly written goal statement for the LARSS and ASEE

Programs on a single sheet of paper.

Good safety briefing, but too long.

Scheduled to start too early, started late, some overheads too hard to read.

A single sheet with all relevant phone numbers and names would be useful.

Some of the material presented seemed non-applicable (at least for mentors and associates). Most of it we've seen before. A Fact sheet should suffice, rather than 1 hour plus of introductions/presentations.

The emphasis on presentations (particularly for LARSS students) at the end of the summer was good. Perhaps a day (or several sessions) could be set aside at the end of the summer so the students could present to themselves the work they've accomplished over the summer.

Is this training meeting new? I was not informed in previous years of such a meeting.

Most info was just reading the handouts. A lot of program patting on back.

Safety seemed to be trying to justify existence. Don't need people telling me administrative programmatics. Qualified mentors should know LaRC pretty well, if not, they are not qualified.

Need info on kinds of work appropriate, scope of project, tips on how to work with LARSS student. Only 1 of 10 talks addressed this.

Policies and Practices Manual is new to me. Good - Looks all inclusive.



F. Comments Continued:

Speakers' time frame was evenly distributed which contributes to a good presentation. Very informative.

Training should be given or made available to "first-time" mentors. It should be optional to all others.

It seemed like there were more speakers than necessary. On the positive side most of the speakers were brief. Info provided was pretty good. The security briefing seemed to include a lot of information that was unnecessary for us. Could boil the safety briefing down to ~5 minutes max! Need to start the meeting on time and try not to keep people too long.

Introduce key P.O.C. in OEd to mentors. Include Pre-College programs personnel. Need to reach pre-college programs as well. Need to start on time; possible added handouts for those who are late. Was attendance taken to verify participation?

Keep the presentations, activities, and materials associative and supportive. The process seems disjointed. Timely notification provided enough time to get on busy schedule. Information provided by the training provided nothing useful for stated purpose other than printed handouts-the materials. I have the information needed to be an effective mentor, but not because of this meeting. Then manuals are useful, but I didn't need to be here to get one.

Information was useful, but I think it could have been compressed to about one hour. The info packet could be given ahead of time to allow us to familiarize ourselves & prepare questions for the training sessions.

Consider adding to mentors' manual this information and then conduct a 1 hour meeting for panel/questions-answers.

Safety overemphasized its functions, rather than do's & don'ts.

One hour should suffice-too much information with little substance (especially safety). Too much of wrong info on safety. One hour should be sufficient (2 hours too long).

Safety briefing too long and detailed.

Information specifically relevant to ASEE/LARSS programs was sparse. St. Clair had some useful comments. Other speakers were mercifully brief except for safety. Start on time. Keep it to an hour - there was less than hour content to this meeting.

Less time on safety.

All necessary information could be presented in one hour, one or two speakers. Shorter more concise training would yield better retention of important material.

**Recommendations:**

- Continue Associate/Mentor Training Program.
- Provide information package prior to meeting to allow time for mentors to familiarize themselves with details and come with questions in mind.
- Do more Q & A with a number of experienced, enthusiastic Associates/Mentors on panel. More emphasis on quality mentoring.
- Provide sheet with POCs and extensions for OEd and other pertinent offices.
- Start no earlier than 9:30 a.m. and limit to one hour.
- Use safety handout with do's and don't's and minimize or eliminate briefing.

**APPENDIX XIV**  
**ASEE HEADQUARTERS SITE VISIT AGENDA**

# 1994 ASEE HEADQUARTERS COMMITTEE LaRC SITE VISIT AGENDA

**Monday and Tuesday, July 25-26, 1994**

<u>Time</u>	<u>Activity</u>	<u>Location</u>
8:00-8:20 a.m.	Entrance Interview with NASA LaRC Office of Education Dr. Samuel E. Massenberg, Director Mr. Edwin J. Prior, Deputy Director Mr. Roger A. Hathaway, University Affairs Officer	Bldg. 1216 Room 101
8:30-8:40 a.m.	Meet Dr. H. Lee Beach, Jr. Deputy Director, Langley Research Center	Bldg. 1219
9:00-9:30 a.m.	Entrance Interview with University Administrative Staff Prof. John H. Spencer, HU ASEE Co-Director Dr. Surendra N. Tiwari, ODU ASEE Co-Director Ms. Debbie Young, ASEE Administrative Assistant	Bldg. 1222 Conf. Center Wythe Room
10:00-11:00 a.m.	ASEE/LARSS Lecture	Bldg. 1222
11:15-12:30	ASEE Group Lunch	Golden Palace

**The afternoon interviews for Monday, July 25, will take place in Bldg. 1218, Room 205**

12:50 p.m.	Ms. Sheri Beam, Fellow, Hampton University
1:10 p.m.	Dr. Norman Loney, Fellow, New Jersey Institute of Technology
1:30 p.m.	Dr. Peter Ifju, Fellow, University of Florida
1:50 p.m.	Dr. James Rankin, Fellow, St. Cloud State University
2:10 p.m.	Mr. Steven Young, LaRC Associate for Dr. James Rankin
2:30 p.m.	Ms. Kathy Stacy, LaRC Associate for Dr. James Green
2:50 p.m.	Dr. James Green, Fellow, Moravian College
3:10 p.m.	Dr. George Rublein, Fellow, College of William & Mary
3:30 p.m.	Dr. Elaine Scott, Fellow, Virginia Polytechnic Institute & State University
3:50 p.m.	Dr. Min Namkung, LaRC Associate for Mr. Milton Ferguson
4:10 p.m.	Mr. Jim Batterson, LaRC Associate for Dr. George Rublein

# 1994 ASEE HEADQUARTERS COMMITTEE LaRC SITE VISIT AGENDA - PAGE 2

**Morning interviews for Tuesday, July 26, will take place in Bldg. 1218, Rms 205 & 206**

Schedule for Room 209 with Dr. Ronald Eck:

- 8:00 a.m. Dr. Randy Carlson, Fellow, Pennsylvania State University
- 8:20 a.m. Dr. Sandra Proctor, Fellow, Norfolk State University
- 8:40 a.m. Dr. Madeleine Andrawis, Fellow, South Dakota State University
- 9:00 a.m. Mr. Jose Alvarez, LaRC Associate for Dr. Madeleine Andrawis
- 9:20 a.m. Dr. Jen-Kuang Huang, Fellow, Old Dominion University
- 9:40 a.m. Mr. Nelson Groom, LaRC Associate for Dr. Jen-Kuang Huang
- 10:00 a.m. Dr. Belinda Adams, LaRC Assistant Director for Planning and Associate for Ms. Lydia Black
- 10:20 a.m. Ms. Lydia Black, Fellow, Adjunct Professor with Old Dominion University and Guidance Counselor with Virginia Beach Public Schools
- 10:40 a.m. Dr. Edmond Koker, Fellow, Elizabeth City State University
- 11:00 a.m. Mr. Jeff Balla, LaRC Associate for Dr. Edmond Koker
- 11:20 a.m. Dr. Jamal Anthony Ghorieshi, Fellow, Wilkes University
- 11:40 a.m. Mr. Warren Kelliher, LaRC Associate for Dr. J. Anthony Ghorieshi

Schedule for Room 205 with Dr. Robert Page:

- 8:00 a.m. Mr. Carlo Demandante, Fellow, United States Air Force Academy
- 8:20 a.m. Dr. Billy T. Upchurch, LaRC Associate for Mr. Carlo Demandante
- 8:40 a.m. Dr. Milton Ferguson, Fellow, Norfolk State University
- 9:00 a.m. Dr. Thomas Gally, Fellow, Texas A&M University
- 9:20 a.m. Dr. Alfred Striz, Fellow, University of Oklahoma
- 9:40 a.m. Dr. Constantine Katsinis, Fellow, University of Alabama-Huntsville
- 10:00 a.m. Ms. Cynthia Brooks, Fellow, University of Arkansas-Pine Bluff
- 10:20 a.m. Dr. Julie Chen, Fellow, Boston University
- 10:40 a.m. Mr. Benson Dexter, LaRC Associate for Dr. Julie Chen

# 1994 ASEE HEADQUARTERS COMMITTEE LaRC SITE VISIT AGENDA - PAGE 3

Schedule for Room 205 with Dr. Robert Page continued:

- 11:00 a.m. Mr. Jon Thompson, LaRC Associate for Dr. Norman Loney
- 11:20 a.m. Mr. Paul Kauffmann, Fellow, Thomas Nelson Community College
- 11:40 a.m. No Interview
- 
- 12 noon-1:00 p.m. Lunch-LaRC Cafeteria- Exit briefing with NASA Office of Education staff and University staff
- 1:30-3:30 p.m. Tour of NASA Langley Research Center  
See attached agenda

**APPENDIX XV**  
**POLICIES, PRACTICES, AND PROCEDURES MANUAL**

**NASA Langley Research Center  
American Society for Engineering Education (ASEE)  
Summer Faculty Fellowship Program**

**1994 POLICIES, PRACTICES,  
AND  
PROCEDURES MANUAL**



**A Handbook for ASEE Participants**

## Table of Contents

Introduction . . . . .	ii
Definitions . . . . .	1
Accepting a Fellowship and Beginning Tenure . . . . .	2
Stipend . . . . .	3
Relocation Allowance and Travel . . . . .	4
Insurance . . . . .	5
Taxes . . . . .	5
Leave . . . . .	6
Housing . . . . .	7
Technical Lecture Series . . . . .	7
Activities Committee . . . . .	7
Security . . . . .	8
Safety . . . . .	8
Mail Room . . . . .	9
Library . . . . .	11
Cafeteria . . . . .	11
H.J.E. Reid Conference Center . . . . .	12



## **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 Hampton University or Old Dominion 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 University Affairs Office (UAO) 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 Directorates 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 Directorate 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 Hampton University (HU), 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 UAO.

### **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.

### **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

### **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 UAO 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.

## 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 **Langley Federal Credit Union (LFCU)**

LFCU has agreed to offer you stipend check cashing privileges. Due to their policy, you will be unable to open an account or cash personal checks.

## **4.0 Relocation Allowance and Travel**

---

### **4.1 Relocation Allowance**

A relocation allowance of \$1,000 will be provided to any Fellow whose home 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.

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 HU, but are an ASEE Fellow and considered self employed, neither the UAO nor HU 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 UAO and HU cannot provide information or consultation concerning income taxes.

### 6.2 Social Security Taxes

Since you are not an employee of NASA LaRC or HU, but are an ASEE Fellow and considered self employed, neither the UAO nor HU 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, HU, 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 **Technical Lecture Series**

---

### 9.1 **Attendance**

Weekly attendance at the Technical 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 Hampton University assume any responsibility for any events.

## **11.0 Security**

---

### **11.1 Security Requirements**

All 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 enclosed NASA Form 531, using instructions provided, and return the form to the NASA LaRC Security Office as soon as possible. If you have access to a fax, the form may be faxed to the Security Office at 804-864-8868. A NASA National Agency Check (NASA NAC) shall be conducted on all summer Fellows requiring access to NASA LaRC and its facilities.

Persons with prior affiliation with a specific NASA installation and have previously completed NASA Form 531 must still complete another, in order to bring your file up to date.

### **11.2 Langley ASEE Summer Faculty Fellows**

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. (Husband or wife not bound by this stipulation.)

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 Risk Management Branch, Systems Safety, Quality and Reliability Division (SSQRD), (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 co-workers. 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. Two mail deliveries are 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) 864-6034.

## **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. - 8:15 a.m.
Lunch:	10:45 a.m. - 1:15 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.

### **15.3 Check Writing Policies**

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

### **15.4 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

Amateur Radio Club  
Bass Club

Conservation Club  
History and Archeology Club  
Radio Model Club  
Science Fiction Club  
Tennis 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.

# REPORT DOCUMENTATION PAGE

*Form Approved*  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> December 1994	<b>3. REPORT TYPE AND DATES COVERED</b> Contractor Report(June 6-Aug. 12, 1994)	
<b>4. TITLE AND SUBTITLE</b> 1994 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program			<b>5. FUNDING NUMBERS</b> NGT 47-020-800	
<b>6. AUTHOR(S)</b> John H. Spencer and Deborah B. Young (Compilers)				
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Hampton University Hampton, VA 23668			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681-0001			<b>10. SPONSORING / MONITORING AGENCY REPORT NUMBER</b> NASA CR-194972	
<b>11. SUPPLEMENTARY NOTES</b> Langley Technical Monitor - Roger A. Hathaway				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Unclassified - unlimited  Subject Category - 80			<b>12b. DISTRIBUTION CODE</b>	
<b>13. ABSTRACT (Maximum 200 words)</b> 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. <u>Objectives:</u> (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. <u>Program Description:</u> 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.				
<b>14. SUBJECT TERMS</b> ASEE-NASA Summer Faculty Fellowship Program ASEE-NASA Administrative Report			<b>15. NUMBER OF PAGES</b> 155	
			<b>16. PRICE CODE</b> A08	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b>	