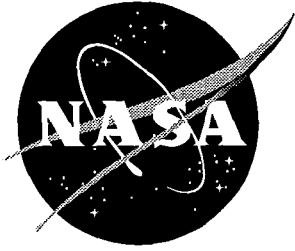


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1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program

Compiled By:

William P. Marable
Hampton University, Hampton, Virginia

Deborah B. Murray
Old Dominion University, Norfolk, Virginia

December 1998

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NASA/CR-1998-208728



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National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia 23681-2199

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December 1998

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SECTION 1
ORGANIZATION AND MANAGEMENT

The 1998 Hampton University (HU)-NASA Langley Research Center (LaRC) Summer Faculty Fellowship Research Program, the thirty-fourth 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.

Fellows accepting the appointment were 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 1998 ASEE Policies, Practices, and Procedures Manual that clarified many commonly asked questions up front regarding the roles, responsibilities, policies, and procedures of both parties. This manual was very beneficial and will be updated annually to be used in the years to come (Appendix XII).

At the Orientation meeting, Dr. Samuel E. Massenberg, Director, Langley Office of Education, welcomed the summer program participants to LaRC. Mr. Edwin J. Prior, Deputy Director, Langley Office of Education, presented an overview of Langley Research Center. Introductions of the Administrative Staff and a program overview was presented by Mr. Roger A. Hathaway, University Affairs Officer. Mr. James R. Hall provided a security briefing followed by a presentation on Information Protection Guidelines by Dr. Thomas E. Pinelli, Technology and Distance Learning Officer, Langley Office of Education. A program breakout session was next on the agenda, enabling the ASEE

administrative staff (Dr. William P. Marable-ASEE Co-Director, and Ms. Debbie Young-ASEE Administrative Assistant) to meet with the 1998 Fellows to discuss administrative procedures and answer questions. Following the breakout session, the Fellows were greeted by their LaRC Associates who then escorted them to their respective work sites. An evaluation of the orientation meeting was completed; refer to Section VI for results.

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

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

SECTION II

RECRUITMENT AND SELECTION OF FELLOWS

Returning Fellows

An invitation to apply and possibly participate in the Hampton University (HU)-NASA Langley Research Center (LaRC) Program was extended to the individuals who held 1997 fellowship appointments and were eligible to participate for a second year. Out of the individuals responding to the invitation, eight accepted offers of appointment (Table 1). Seven Fellows from previous years accepted offers of appointment.

First Year Fellows

For the 1998 program, ASEE Headquarters provided a web site for the summer program application materials in lieu of brochures being mailed out. Many personal contacts to deans and department heads of various engineering schools in the East, South, and Midwest, were made by Dr. William P. Marable 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 minority institutions) and universities in the state of Virginia, as well as, neighboring states were contacted regarding this program (Table 2). Additional recruiting efforts included either attendance at or providing information for several of the minority conferences. These efforts resulted in a total of seventy-three formal applications indicating the HU-ODU-NASA LaRC program as their first choice, and a total of ten applications indicating the aforementioned as their second choice. The total number of applications received came to eighty-three (Table 3).

Forty-two applicants formally accepted the invitation to participate in the program. Six 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-one positions were initially budgeted by NASA Headquarters (*Per AGATE project requirements, two professors split one slot for a total of twenty-two HQ funded Fellows). Twenty- positions were funded by the LaRC Divisions (Table 4).

The average age of the participants was 49.

Table 1 - Distribution of 1998 ASEE
Fellows by Year in Program

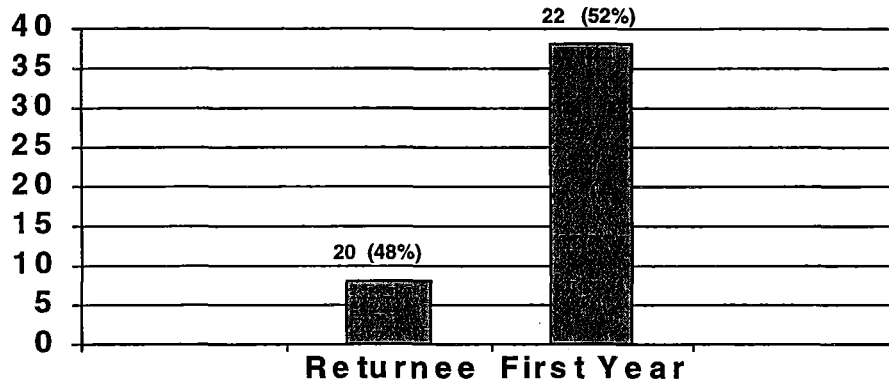


Table 2 - Distribution of 1998 ASEE
Fellows by University

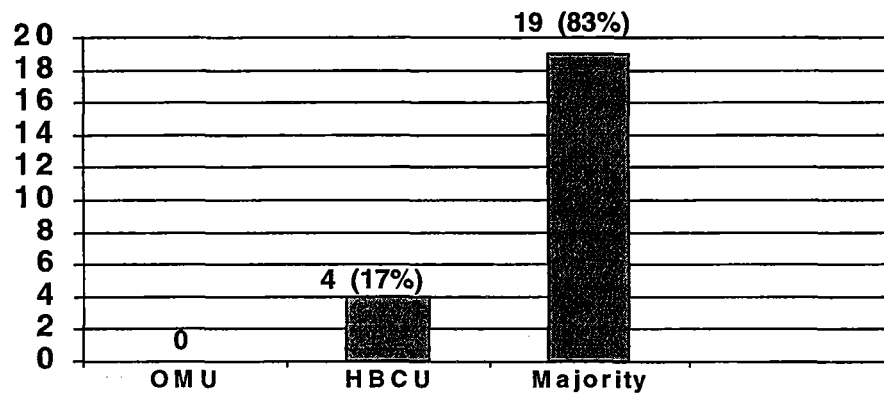


Table 3 - Distribution of 1998 ASEE
Fellows by Selection

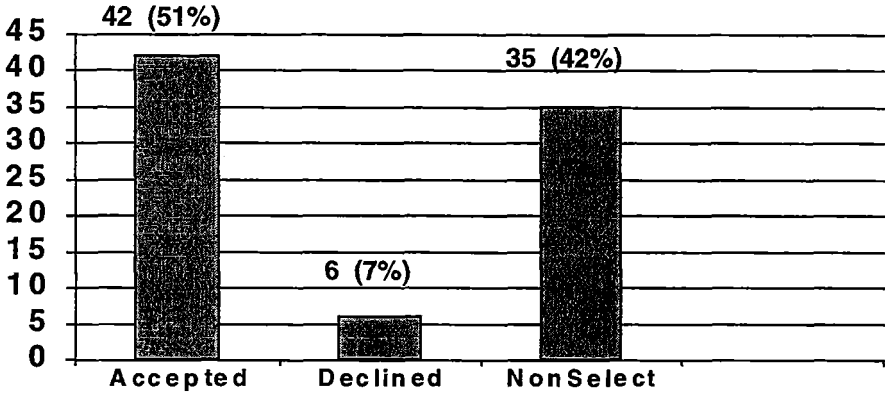
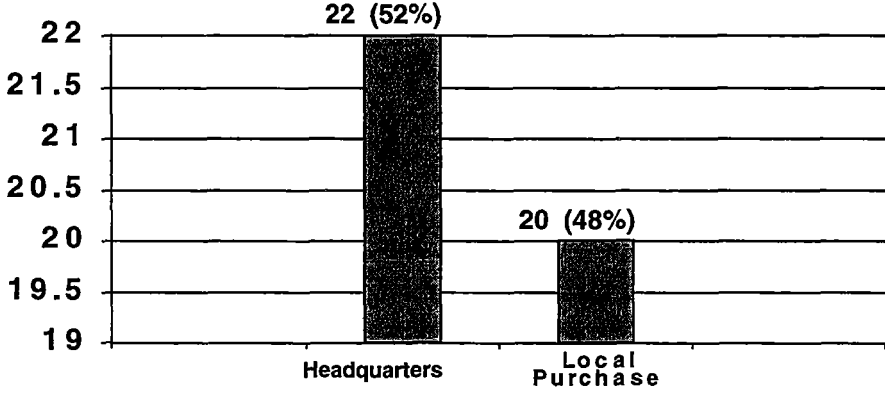


Table 4 - Distribution of 1998 ASEE
Fellows by Funding



SECTION III

STIPEND AND TRAVEL

A ten-week stipend of \$10,000.00 was awarded to each Fellow. Thirty-six percent of the Fellows indicated that the stipend was not the primary motivator in their participating in the ASEE program. This statistic was back up from last year's twenty-two percent which was the lowest percentage in the past 10 years that averaged 53% with a high of 68% in 1987. This continues to suggest that the importance of the stipend amount is quite significant. Twenty-four percent deemed the current stipend as adequate (Survey-Section VI). This stipend continues to fall 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 continues to reflect 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 at a distance of 50 miles or more who were required to relocate.

SECTION IV

1998 ASEE SFFP ACTIVITIES

Lecture Series

The Lecture Series this summer was successful and well received. There was a total of six lectures presented. The lectures were given by distinguished NASA scientists and researchers. Some of the topics included "Designing the Mind-Centered Flight Deck", presented by LaRC's Mr. Paul Schutte and Dr. Alan Pope, and "Integrated Vehicle Health Monitoring (IVHM) for Aerospace Vehicles", presented by LaRC's Mr. Leland D. Melvin, who was one of 21 men and women selected to the 1998 astronaut candidate class (Appendix II).

Interaction Opportunity/Picnic

The annual Office of Education Interaction Opportunity/Picnic was held on Thursday, June 11, 1998, for the summer program participants, their families, and invited guests. This allowed for informal interaction between the Fellows, as well as, with the administrative staff. The participants were also given the opportunity to purchase T-shirts with the 1998 ASEE design.

Proposal Seminar

A Proposal Seminar was held for the Fellows on Tuesday, July 15, 1998. 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. Mr. Thayer Sheets gave a presentation on the Small Business Innovative Research program with emphasis on STTR "Small Business Technical Transfer Pilot Program." There was also a panel question and answer session. The panel members included Langley researchers who frequently review proposals that are submitted, and in the audience were representatives from the grants and contracting offices who also responded to questions in their field. This aspect of the proposal seminar was very well received. The most current Research Grant Handbook was distributed. (Appendix XI).

Seminar/Banquet

On Friday, July 24, 1998, 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. Remarks were presented by Dr. Samuel E. Massenberg, Director, Office of Education.

ASEE Activities Committee

As in the past, an ASEE Activities Committee was formed to plan social outings for the program participants and their families (Appendix II). A weekly dinner was planned for those who desired to participate. Tours of Center facilities including a wind tunnel, and Langley Air Force Base were scheduled. This year, Fellows were invited to tour the Canon facility located in Hampton, Virginia. This was very well received by the Fellows. The Office of Education also sponsored a Moonlight Cruise and a Dinner Cruise aboard the beautiful Spirit of Norfolk for the Fellows and their spouses.

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 Fellows' comments during the evaluation of the program indicated their satisfaction with their research projects, as well as, with the facilities available to them.

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

Number of Fellows Assigned	Division
3	Aero- and Gas- Dynamics Division
1	Aerospace Electronic Systems Division
3	Atmospheric Sciences Division
4	Experimental Testing Technology Division
2	Fabrication Division
1	Facilities Program Development Office
1	Flight Dynamics and Control Division
4	Flight Electronics Technology Division
4	Fluid Mechanics and Acoustics Division
1	Hyper-X Program Office
2	Information Systems and Services Division
3	Materials Division
1	Office of Chief Financial Officer
6	Office of Education
1	Office of Human Resources
4	Structures Division
1	Technology Commercialization Team

Thirty-four (81%) of the participants were holders of the doctorate degree. Six (14%) held masters degrees and two (5%) held bachelor's degrees. The group was again highly diversified with respect to background. Following are the areas in which the last degree was earned (twenty-three different disciplines):

Number	Area of Degree
1	Accounting

1	Aeronautics and Astronautics
2	Aerospace Engineering
2	Business Administration
1	Business Administration and Systems Engineering
2	Chemical Engineering
2	Chemistry (including 1 Analytical and 1 Inorganic)
1	Civil Engineering
2	Education (including 1 Higher Education Administration)
7	Electrical Engineering
1	Engineering Mechanics
1	Engineering Technology
1	General Engineering Composite and Aeronautical Engr
1	Geography
3	Mathematics
4	Mechanical Engineering
1	Mechanical Engineering and Mathematics
1	Philosophy
3	Physics
1	Political Economy
1	Structural Engineering
1	Urban Sciences-Management Concentration
1	Vocational Technology Education

Extensions

Per special written request by the LaRC Associate and the approval of the ASEE Co-Director, the following individual was granted an extension of tenure:

Mr. L. Vincent Hale
 Ms. Mary E. Ingham
 Dr. William B. Williams, Jr.

Attendance at Short Courses, Seminars, and Conferences

During the course of the summer, Fellows have the opportunity to attend regularly scheduled Langley Research Center seminars and meetings, to include but not limited to ASEE Technical Lectures, Institute for Computer Applications in Science and Engineering (ICASE) seminars, World Wide Web and Internet training courses, computer training, as well as short courses or meetings within their Division. In addition, there were a number of short courses, seminars, and conferences, in which the subject matter had relevance to the Fellows' research projects. A number of Fellows requested approval to attend one or more of these conferences as it was their considered opinion that

the knowledge gained by their attendance would be of value to their research projects. Those Fellows who did attend had the approval of both the Research Associate and the University Co-Director.

Short Courses, Seminars, and Conferences Attended

H. Marshall Booker: Regional Economic Multipliers Conference, Arlington, VA, July 15, 1998.

William A. Crossley: ICASE/LaRC Workshop on Optimization Under Uncertainty.

Sonja D. Ebron: GEM Summer Institute

Charbel T. Fahed: Small Disadvantaged Business/University Opportunities Forum, Langley Research Center, July, 1998.

Amitabha Ghosh: 2nd Symposium on Theoretical Fluid Mechanics, American Institute of Aeronautics & Astronautics, Albuquerque, NM, June 15-18, 1998.

David J. Gosselin: (1) NASA-Chief Financial Officers Conference, May 4-7, 1998, Ames Research Center. Agency-wide Conference - He did a 2 hour presentation for everyone on "Full Cost." (2) Participated in 2 workshops on IFMP-Full Cost Allocation in Washington, DC. (3) Conducted a weekly course on "Accounting Standards" for LaRC Financial Management Community.

Mou-Liang Kung: National Educational Computing Conference.

Raouf L. Selim: Langley Wind Tunnel Enterprise (WTE) Technical Forum, Pilot Series.

Shantilal N. Shah: Data-Visualization Seminar conducted by LaRC's ICASE.

Mir S. Shirvani: Small Disadvantaged Business/University Opportunities Forum, Langley Research Center, July, 1998.

Kathleen VanScoyoc: Academy of Marketing Science International Conference, May, 1998.

Papers Presented or Anticipated

Jane M. Bailey: "The Developmental Curve of Education Delivery Systems, Past and Future", submitted to American Education Research Association for presentation at AERA Conference, Montreal, CA, April 19-23, 1999.

Mary V. Bicouvaris: A paper will be submitted to the Virginia Mathematics & Science Coalition in October, 1998.

H. Marshall Booker: Presentation to LaRC's Technology Application Group, "Technology, Innovation and Economic Development: The Connections", August 3, 1998.

William A. Crossley: "A Genetic Algorithm with Population-Based Sampling for Optimization Under Uncertainty", submitted to AIAA SDM Conference.

Lawrence R. Daley: Hinkley, J. A. & L. R. Daley, "Extension of a Bond Fluctuator Model for LaRC PET1-5."

Amin N. Dharamsi: "Measurement of Line Narrowing Parameters by Modulation Spectroscopy", to be submitted to the Journal of Applied Physics.

Charbel T. Fahed: Plan to submit a paper to both Old Dominion University's Dr. John Ritz, and to Northern Virginia Community College's Dr. Susan Wagner entitled, "Probing in the ETR New Facility."

Mark Farris: "Mean Curvature of the Influence Surface in Supersonic Propeller Noise Theory and the Kirchhoff Formula", to be submitted to the Journal of Sound and Vibration.

Dawit Getachew: "Assessment of Turbulent Models for Single Element Airfoil at High Lift", anticipated.

Peyman Givi: A paper is to be published in the Journal of Fluid Mechanics.

David J. Gosselin: Working on Full Cost paper for Journal of Government Accounting.

Sophia Hassiotis: "Updating the Finite Element Model for the Starship Fuselage Using Model Measurements", IMAC, submitted, June, 1998.

James M. Hereford: "Impact of Thermal Gradients on Wind Tunnel Force Measurements", 37th AIAA Aerospace Sciences Meeting, January, 1999.

Jen-Kuang Huang: Huang et. al., "Closed-Loop System Identification by Residual Whitening", will be presented at AIAA, Guidance, Navigation and Control Conference, August 10-12, 1998, Boston, MA.

Mary E. Ingham: HQACC/ACC bases- briefings to implement GIS.

David P. Johnson: "Modeling the Dynamic Crush Behavior of Composite/Foam Sandwich Structures", International Journal of Crashworthiness.

David W. Johnson: "Characterization of Digital Library User Behavior in the NASA Technical Report Server."

Mou-Liang Kung: “Assessment of Final Report of Acquisition Team”, and “EFT for NASA STI.”

Donald L. Kunz: “Ground Resonance Suppression Using Internal Resonance”, American Helicopter Society Annual Forum, May, 1999.

Norman W. Loney: “Influence of Simple Jets on Heat Transfer to Container Wall.”

Taj O. Mohieldin: (1) “Hyper-X Research Vehicle Stage Separation: Mach 7 Time Accurate Viscous Computations.” (2) AIAA, date unknown.

Duc Thai Nguyen: “A New Look Into the Old Revised Simplex Method”, SDM Conference.

Thomas P. O’Connor: My research led to a 27-minute video documentary in honor of NASA’s 40th Anniversary entitled, “The Idea Nobody Wanted.” The documentary will also be submitted to the Discovery Channel.

Denise V. Siegfeldt: “Transforming the Wind Tunnel Enterprise at NASA Langley Research Center through Core Competencies”, will be submitted to the Academy of Strategic and Organizational Leadership for presentation at the 1998 international meeting in Las Vegas, NV, October 25-28, 1998, as part of the Allied Academies. Paper will be submitted by September 15, 1998.

Kathleen VanScoyoc: Langley IFMP Training Needs Assessment Document - July, 1998, submitted to IFMP Transition Team - Co Leads; and Tony Maturo - IFMP Training Representative; and NASA Agency Training Program Office.

Shantilal N. Shah: Anticipated paper mentor will present: “Design & Implementation of a High Performance Storage Area Network for the CERES Science Computing Facility”, at the next IEEE Mass Storage Conference.

Keith M. Williamson: “Detection and Measurement of Hidden Corner Cracks Using a Portable NDI Probe”, Journal of Fatigue and Fracture.

Anticipated Research Proposals

Lee A. Belfore, II: “Development of Data Compression Methodologies for FTS Imagery”, NASA Langley Research Center (LaRC).

William A. Crossley: (1) “Genetic Algorithm Approaches for Smart Actuator Placement to Provide Aircraft Maneuverability”, to NASA LaRC. (2) “Optimization Under Uncertainty Via Genetic Algorithm”, anticipated to National Science Foundation.

Lawrence R. Daley: “Further Extension of a Bond Fluctuation Model for LaRC TE11-5”, NASA, Composites and Polymers Branch.

Amin N. Dharamsi: “Higher Harmonic Detection Technique for Accurate Measurements of Line Narrowing Parameters,” NASA LaRC, Aerosol Research Branch.

Sonja D. Ebron: “Carbon Composite Material Selection for Thermal Dissipation of Space Payloads,” NASA FAR Program.

Charbel T. Fahed: “RCS Measurements at LF in ETR,” GMU, Dr. Murray Black.

Peyman Givi: Anticipated proposal to AFOSR.

Amitabha Ghosh: “Implementation of TWNTN4A at the 0.3 Meter Transonic Cryogenic Tunnel,” NASA LaRC.

James M. Hereford: “Tiger PAU 2,” NASA LaRC.

Mary E. Ingham: “Base-wide GIS Implementation,” presenting to HQ ACC for use at ACC bases.

David P. Johnson: “An Investigation of Rate Sensitivity in Material Response in Composite Sandwich Structures,” NASA LaRC, Structures Division.

Mou-Liang Kung: “Then Next Generation Technical Report Servers,” NASA STI Program Office. Point of Contact: Simon Chung, LaRC, Information Systems and Services Division.

Donald L. Kunz: Already submitted proposal to Army Research Office.

Ellis E. Lawrence: Research for Electronic Fiber Optic Technologist.

Norman W. Loney: “Investigate the Influence of Reacting Sets in coflowing fluid on container wall,” NASA.

James A. Lookadoo: Official submission of “Distributed Health Monitoring Network,” to System’s Integration Branch, LaRC.

Taj O. Mohieldin: Research proposals on Hyper-X stage separation will be submitted to Hyper-X Office at NASA LaRC.

Duc T. Nguyen: “An Out-of-Core Revised Simplex Solver for Analysis and Design of Thermal-Structural Applications,” NASA LaRC.

Raouf L. Selim: Investigate the Interface properties of MEMS sensor on Airfoil.

Shantilal N. Shah: “Utilization of Earth-Science Data in Elementary & Secondary Education,” Atmospheric Science Division (Dr. Robert Lee).

Keith M. Williamson: “Detection and Measurement of Hidden Cracks in Marine Pressure Vessels,” Department of the Navy.

Funded Research Proposals

Lee A. Belfore, II: “Virtual Reality Visualization for Marketing the Fairwood Homes Property,” City of Portsmouth (Not related to NASA).

Amin N. Dharamsi: “Measurement of Oxygen A-Band Line Parameters by Modulation Spectroscopy with Higher Harmonic Detection,” NASA LaRC Grant.

Sonja D. Ebron: “Image Compression Methods for X-Ray Inspection Data,” Federal Aviation Administration.

Charbel T. Fahed: “RCS Measurements at LF in ETR,” GMU - Dr. Murray Black.

Peyman Givi: Grants funded through the American Chemical Society and NASA LaRC.

Sophia Hassiotis: “Design of Long-Span Bridge,” Florida Department of Transportation.

James M. Hereford: “Tiger PAU,” NASA LaRC.

Mary E. Ingham: NASA GIS grant to Valdosta State University

Mou-Liang Kung: “Updated Investigation of Web Security for Wired and Wireless Data Networks,” Federal Aviation Administration.

Ellis E. Lawrence: NASA Network Resource training grant, Co-PI, NASA LaRC.

James A. Lookadoo: (1) NASA/Kansas Space Grant through NASA’s National Space Grant Office. (2) Kansas EPSCoR through NASA EPSCoR program.

Lawrence A. Newquist: Contract to continue research as an Associate Employee of Science & Technology Corporation (STC) in connection with ARB in ASD.

SECTION VI

SUMMARY OF PROGRAM EVALUATION

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

A. Program Objectives

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

Yes	<u>41</u>	(98%)
No	<u>1</u>	(2%)

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

Yes	<u>41</u>	(98%)
No	<u>1</u>	(2%)
No Response	<u>0</u>	(0%)

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>37</u>	(88%)
No	<u>1</u>	(2%)
Uncertain	<u>4</u>	(10%)

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>36</u>	(86%)
No	<u>2</u>	(5%)
Uncertain	<u>4</u>	(9%)

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>41</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>20</u>	(48%)
Redirected	<u>15</u>	(36%)
Advanced	<u>26</u>	(62%)
Barely maintained	<u>0</u>	(0%)
Unaffected	<u>0</u>	(0%)

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	<u>40</u>	(95%)
Not at all	<u>0</u>	(0%)
No Reply	<u>2</u>	(5%)

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>33</u>	(79%)
By starting new courses	<u>6</u>	(14%)
By sharing your research experience	<u>38</u>	(90%)
By revealing opportunities for future employment in government agencies	<u>24</u>	(57%)
By deepening your own grasp and enthusiasm	<u>29</u>	(69%)
Will affect my teaching little, if at all	<u>0</u>	(0%)
No Response	<u>0</u>	(0%)

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	<u>32</u>	(76%)
No	<u>9</u>	(21%)
No Answer	<u>1</u>	(2%)
Already tenured at highest rank	<u>0</u>	

C. Administration

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

Received announcement in the mail	<u>17</u>	(40%)
Read about in a professional publication	<u>2</u>	(5%)
Heard about it from a colleague	<u>13</u>	(31%)
No reply	<u>3</u>	(10%)
Other (Explain below)	<u>6</u>	(14%)

Prior Participant; Called directly by Office of Education; Contacted by NASA Researcher

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

Yes 7 (17%) No 34 (81%)

<u>0</u>	DOE
<u>3</u>	Another NASA Center
<u>4</u>	Air Force
<u>1</u>	Army
<u>4</u>	Navy

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

Yes 1 (2%) No 33 (79%) No Answer 8 (19%)

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

Many	<u>10</u>	(24%)
A few	<u>28</u>	(66%)
None	<u>2</u>	(5%)
No reply	<u>2</u>	(5%)

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

Yes 36 (78%) No 8 (17%) Not Sure 1 (2%) No Answer 1 (2%)

If not, why? Money is secondary after technical opportunities; stipend covers relocation, no net gain in salary; assume it remains same and doesn't decrease; doesn't come close to defraying living expenses-short term leases are expensive.

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

Yes	<u>25</u>	(60%)
No	<u>16</u>	(38%)
No reply	<u>1</u>	(2%)

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

Yes	<u>35</u>	(83%)
No	<u>0</u>	(0%)
Somewhat	<u>1</u>	(2%)
Not Applicable	<u>6</u>	(15%)

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

Yes	<u>38</u>	(91%)
No	<u>2</u>	(5%)
Somewhat	<u>1</u>	(2%)
No Answer	<u>1</u>	(2%)

9. How do you rate the seminar program?

Excellent	<u>23</u>	(55%)
Good	<u>11</u>	(26%)
Fair	<u>4</u>	(10%)
Poor	<u>1</u>	(2%)
No reply	<u>3</u>	(7%)

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				
Activity	Adequate	Too Brief	Excessive	Ideal
Research	25 (60%)	10 (24%)	0 (0%)	7 (17%)
Lectures	23 (55%)	0 (0%)	6 (14%)	8 (19%)
Tours	21 (50%)	4 (10%)	0 (0%)	8 (19%)
Social/Rec.	22 (52%)	0 (0%)	1 (2%)	10 (24%)
Meetings	21 (50%)	2 (5%)	2 (5%)	9 (21%)

11. What is your overall evaluation of the program?

Excellent	<u>34</u>	(81%)	No reply	<u>2</u>	(5%)
Good	<u>5</u>	(12%)			
Fair	<u>1</u>	(2%)			
Poor	<u>0</u>	(0%)			

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

See Fellows' Comments and Recommendations

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

See Fellows' Comments and Recommendations

D. Stipend

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

\$ 65,962* per Academic year x or Full year ____.
 Median Range *Based on 37 professors' salaries provided.

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

Yes 6 (14%) No 15 (36%) In Part 17 (40%)

Not Indicated 4 (10%)

3. What, in your opinion, is an adequate stipend for the ten-week program during the summer of 1999?

\$10K-6 (14%); \$10-\$12K-3 (7%); \$11K-4 (10%);
\$12K-13 (31%); \$12.5K-1 (2%); \$13K-2 (5%); \$14K-1 (2%);
\$15K- 8 (19%); \$20K- 1 (2%); Not Indicated-3 (7%)

Several suggested that the relocation allowance was inadequate for those having to maintain two households during the summer. It was recommended that either the stipend be significantly increased, the relocation allowance be significantly increased, or a combination of the two.

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

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

Yes 14 (33%) No 27 (64%) Not Indicated 1 (2%)

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

Yes 13 (31%) No 23 (55%) Not Indicated 6 (14%)

Fellows' Comments and Recommendations

- No recommended improvements. I thought the program went very well.
- The lectures should be more on actual research and less on PR related activities and speculation. As a second year Fellow, no suggestions. We knew what we were getting into.
- Not near enough *funding* to cover expenses at home and living near Center.
- Everything was pleasant and enjoyable. Suggest more tours, formal visits to other peers, more access to internet (some Fellows never got messages the committee announced).
- Research experience in invaluable.
- Carry on funding.....another \$10K or so to go back to my institution and continue the research *begun* here would be great. Provide follow up commitment of support.
- The program was excellent in the social/recreation area. Make the program bigger to give opportunities to more people. Have a pre-evaluation of the project 2-4 weeks before it is due, and a final evaluation one week before the due date. I have appreciated the opportunity to work in a scientific community and to be involved in a project which opened new vistas for me as a teacher educator and one who has intimate knowledge of education reform both nationally and in Virginia. I had never stopped to think that NASA informs mankind about space and accepts its responsibilities so seriously at the same time. I, as a social science person, always appreciated the clear and concise language of scientists and my admiration for that was reinforced this summer as I listened to the lectures of notable scientists. I was impressed at the number of programs that NASA has on the burner regarding education and I wish that every teacher in the US had some on-site professional development at NASA.
- Set up a web site with complete information and schedules of activities throughout the summer.
- Would welcome a better/greater instruction about submission of research proposals to NASA.
- Excellent program. Excellent management (Debbie, Sara). Excellent mentor (Dr. Drummond). Excellent social activities. Excellent research environment. Make the program shorter and increase the stipend. The ideal program duration would be 6 weeks with an ideal stipend of \$2000 per week. Keep up the excellent work.
- First, the efforts of Debbie Young and Sara Williams must be recognized. They were well organized and a joy to work with. Similar comments for Dr. Marable from Hampton University for coordinating and processing stipends in a timely fashion - not easy in a university environment. Just a quick note on the unusual nature of the fellowship (5 weeks shared). I believe the arrangement worked to LaRC's advantage. The short time downsides were more than compensated by effort leveraging. My co-fellow, Randy Buchanan, and I through parallel efforts and similar work habits were able to create the branch's study in short order - so the NASA colleague's interests were not short changed. On the downsides, the cost of

maintaining two residences (permanent and VA short term) were rather high. At least the relocation allowance would be a good area for study. Costs to relocate seem inadequately addressed. You may be short changing your talent base by making distant faculty members pass up appointment attempts.

- Put lectures in the evening. Arrange after hour visits to the laboratories.
- Some business related topics for lectures. Science and engineering need to have this also.
- Larger stipends would attract faculty from a more diverse group of colleges. Most of this year's fellows were from local colleges.
- More interaction between Branches so professors can see other research activities at NASA.
- Facilitate access to Tech Library, e-mail, computer support after the summer session. Facilitate travel between sessions.
- It would be a good idea to "cycle" the various speeches through the summers so that those returning for a second summer would not have the same presentation again. Just a suggestion about the Graduate School Seminar. Would it be possible that once the presentations are over, the follow-on discussion held (Q & A) that the room then be open to all NASA-LaRC employees. Many universities were represented there and some had little activity.....maybe other regular and/or contract employees would have appreciated having all the universities in one location for an hour or so. Thanks.
- Raise the stipend. Keep the lectures optional for faculty. Have internet access and NASA e-mail addresses for all Fellows. There were some miscalculations with two of the social events that I attended this summer. One incident was at the summer picnic. The advertisement stated 4-8 p.m., however, the food was taken away by 6:30 p.m. People attending the picnic at a later time (some with families) were disappointed to find no food available after 6:30 p.m. The advertisement for the picnic should have been more clear about when the food was being served. I expected food to be served from 4-8 p.m. The other embarrassment was at the banquet where the food ran out. It was unfortunate that people had to wait to be served food that wasn't even part of the original menu. Mention of entertainment to follow the banquet would be beneficial.
- Reduce, if possible, the amount of paperwork needed; e.g. Combine this survey with Edcats. This program is a great opportunity for young faculty members, and overall I have found it to be outstanding. I thought the "Grantsmanship 101" seminar was a good idea, but from my point of view it would be more helpful to illustrate example proposals, or have the technical evaluators provide some sort of "Do's and Don'ts" for preparing proposals to NASA. Having more technical evaluators on the proposal panel would be helpful also; too many administrators. On page 3 of this questionnaire, a question asks if participating in this program would be "credited" towards promotion and tenure. My understanding of my university's/department's view of this program is not very important. Far more credit is given to successfully winning research grants; a follow-on research program as part

of this program would be a great way to make this more relevant for promotion and tenure.

- Keep the Tuesday seminars optional, but strongly encourage Fellows to attend the final presentations of their colleagues.
- Allow Fellows access to the research Center during the weekends.
- Talks seemed more targeted toward students than faculty. Faculty may want to attend other seminars in lieu of these general talks. In the final paper competition, three were in material sciences, two in structural mechanics, and one in computer engineering. The proportion seemed to indicate what this Center is interested in, rather than a competition based on technical merits in the ASEE faculty research work.
- No improvement needed.
- I really cannot think of any significant improvements. It is an excellent program as is!
- The ASEE program is an excellent one. It enhances the interaction between university professors and NASA scientists. This cross-fertilization helps both sides. University professors can energize their research and NASA can benefit from some fresh ideas to solve some of their research problems.
- No improvements needed. Program was outstanding.
- Increase the length of the program by one or two weeks. Overall I had a great summer and the Program was excellent.

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. A total of 41 evaluations were returned. See statistics based on the number returned below:

- 95% aware of participation as Associate prior to start of program
- 90% contacted Fellow prior to start of program
- 90% stated Fellows accomplished established research goals
- 95% interested in serving as Associate again (one-no due to retirement)
- 78% indicated there was discussion of possible follow on research via submission of a proposal
- 92% with first year Fellows indicated a desire to continue research with the 1999 program

- 73% indicated their Fellow was above average when compared overall with other faculty researchers they had worked with before

Research Associates' Comments

- Senior staff member stated, "I have no recommendations for improving the program. The program worked very well this summer."
- I would jump at the opportunity to participate as a Research Associate in the future. My Fellows were second year, but I would like to work with them again.
- Fellow exceeded established goals!
- Thanks for a great program, advocacy for getting Jon here under HQ funded slot, and help with getting his grad student on Center for instructional tours. These programs (ASEE, LARSS, GSRP) are something Langley does exceedingly well. I look forward to participating in these programs in the future. 1998 was another great summer for ASEE/LARSS.
- The project came together faster than expected - Associate and Fellow were a better match than we knew. There is an obvious grant follow-on....I hope I can find funding.
- I think you guys are doing a great job.
- In terms of the Fellow being adequately prepared for his research assignment, our area of research advances so rapidly such that most outsiders can only know a fraction of what is going on. The research goals were accomplished in an excellent manner.
- Dr. D. P. Johnson is my second ASEE Fellow, and I have enjoyed the opportunity to work with both individuals.
- The ASEE program is great, but my Fellow was in over his head. The project scope was significantly reduced to match his skills. Again, I eagerly await next year's program. My Fellow simply did not have a good working knowledge of computer science and never seemed to get over the learning curve.
- I think it is an excellent program. I got a late start and did not do a good job of screening my Fellow.
- Mir Shirvani has been an asset to the branch. His knowledge of fiber optics and electronics has added to the value of the branch for NASA.
- Too many "meaningless" meetings

Research Associates' Recommendations

- Summer is a hectic time, why not start in mid May when college is out and leave us some time for family vacations.
- Please cut the paperwork to absolute minimum.

SECTION VII

CO-DIRECTOR'S RECOMMENDATIONS

1. It is wholeheartedly, and enthusiastically recommended that the program continue. It is a valuable and effective means of contributing to the research objectives of the NASA Research Center, it enriches and refreshes the faculty and their home institutions, and it furthers the professional knowledge of the participating faculty. These conclusions are amply supported with the assessments by participants and NASA researchers.
2. It is recommended that the lecture series continue. It is suggested that a more formalized, or regularly implemented procedure of inviting guest lecturers to a casual luncheon following the presentation be instituted. This was occasionally implemented this year and provided excellent opportunities for the faculty to further discuss the topic in depth, and to develop professional contacts.
3. It is recommended to modify the application distribution to Divisions in order to include ranking of non-selected participants. These rankings should include: 1) relevance to NASA Langley's Divisional Research interest, 2) relevance to NASA research interest, 3) capabilities and research background of the participant. There are three main advantages to this additional information. First, these additional data will be used to assist in the placement of participants when unfilled slots arise. These second tier selections need to occur on a short time frame and should closely match the needs of the research group. Secondly, the non-Langley research projects of high ranking can be shared with colleagues at other NASA Research Centers, to assist in their second tier selections. And finally, these data will augment information used to recruit participants for future summer appointments.
4. It is recommended that the recruitment and advertisement activities of the program be expanded. In addition to the encouragement of high ranking, non-selected applicants to apply for future programs, new pools of candidates should be developed. Geographic proximity of applicants is not unexpected for programs of this type and a concerted effort must be exerted to seek candidates from diverse backgrounds in every sense.
5. It is recommended that the RADIO (Research and Development Interaction Opportunities) activities be expanded. This could be accomplished by identifying participants whose projects will significantly impact their home institution via participation of students, or curricular modifications. The identified faculty members would receive small awards (~\$2000-5,000), to facilitate student presentations at professional meetings or development and dissemination of curricular materials. This recommendation is offered in the spirit of the agency's interest in providing the broadest dissemination of NASA research results to the public. This activity is a cost effective method of providing the E/PO service.

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

1998 NASA Langley ASEE Summer Faculty Fellowship Program Fellows

Name and Institution

NASA Associate and Division

Dr. Jane M. Bailey
Christopher Newport University

Dr. Samuel E. Massenberg
Office of Education

Dr. Lee A. Belfore, II
Old Dominion University

Mr. Stephen G. Jurczyk
Aerospace Electronics Systems

Dr. Mary V. Bicouvaris
Christopher Newport University

Dr. Samuel E. Massenberg
Office of Education

Dr. Jonathan D. Blotter (R)
Idaho State University

Mr. Gary A. Fleming
Fluid Mechanics and Acoustics

Dr. H. Marshall Booker (R)
Christopher Newport University

Dr. Lance B. Bush
Technology Commercialization Team

Mr. Randy K. Buchanan
Pittsburg State University

Mr. Eric G. Cooper
Flight Electronics Technology

Dr. Deborah H. Carey (R)
Marywood University

Dr. Billy T. Upchurch
Experimental Testing Technology

Dr. William A. Crossley
Purdue University

Ms. Sharon L. Padula
Fluid Mechanics and Acoustics

Dr. Lawrence R. Daley (R)
Hampton University

Dr. Jeffrey A. Hinkley
Materials

Dr. Willie L. Darby (R)
Hampton University

Dr. Billy T. Upchurch
Experimental Testing Technology

Dr. Amin N. Dharamsi (R)
Old Dominion University

Dr. William P. Chu
Atmospheric Sciences

Dr. Sonja D. Ebron (R)
Norfolk State University

Dr. Sang H. Choi
Materials

Mr. Charbel T. Fahed (R)
Northern Virginia Community College

Mr. Erik Vedeler
Flight Electronics Technology

Dr. Mark Farris (R)
Midwestern State University

Dr. Fereidoun Farassat
Fluid Mechanics and Acoustics

Dr. Dawit Getachew
Chicago State University

Dr. Thomas B. Gatski
Fluid Mechanics and Acoustics

Dr. Amitabha Ghosh
Rochester Institute of Technology

Dr. Peyman Givi (R)
State University of New York-Buffalo

Dr. David J. Gosselin (R)
Christopher Newport University

Mr. L. Vincent Hale
Christopher Newport University

Dr. Sophia Hassiotis
University of South Florida

Dr. James M. Hereford (R)
Christopher Newport University

Mr. Thomas E. Hopkins (R)
Southwest Virginia Community College

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

Ms. Mary E. Ingham
Valdosta State University

Dr. David P. Johnson
Mississippi State University

Mr. David W. Johnson
Saint Paul's College

Dr. Mou-Liang Kung
Norfolk State University

Dr. Donald L. Kunz (R)
Old Dominion University

Dr. Ellis E. Lawrence (R)
Elizabeth City State University

Dr. Norman W. Loney
New Jersey Institute of Technology

Dr. James A. Lookadoo
Pittsburg State University

Dr. Joel L. Everhart
Aero- and Gas-Dynamics

Dr. J. Philip Drummond
Aero- and Gas-Dynamics

Mr. Joseph R. Struhar
Office of the Chief Financial Officer

Dr. Thomas E. Pinelli
Office of Education

Dr. Lucas G. Horta
Structures

Mr. Ray D. Rhew
Experimental Testing Technology

Mr. Anthony L. Cook
Flight Electronics Technology

Mr. Nelson J. Groom
Flight Dynamics and Control

Mr. William B. Ball
Facilities Program Development

Dr. James H. Starnes, Jr.
Structures

Mr. Michael L. Nelson
Information Systems and Services

Mr. Simon S. Chung
Information Systems and Services

Mr. Paul H. Mirick
Structures

Mr. C. Wayne Williams, Jr.
Fabrication

Mr. Richard L. Puster
Aero- and Gas-Dynamics

Mr. Eric G. Cooper
Flight Electronics Technology

Dr. Taj O. Mohieldin
Old Dominion University

Dr. Lawrence A. Newquist (R)
Cumberland College

Dr. Duc T. Nguyen (R)
Old Dominion University

Mr. Thomas P. O'Connor
James Madison University

Dr. Raouf L. Selim
Christopher Newport University

Dr. Shantilal N. Shah
Norfolk State University

Mr. Mir S. Shirvani (R)
New River Community College

Dr. Denise V. Siegfeldt (R)
Hampton University

Dr. Kathleen VanScoyoc
Hampton University

Dr. William B. Williams, Jr.
Christopher Newport University

Dr. Keith M. Williamson
Old Dominion University

Mr. Charles R. McClinton
Hyper-X Program

Dr. Chris A. Hostetler
Atmospheric Sciences

Dr. James H. Starnes, Jr.
Structures

Dr. Thomas E. Pinelli
Office of Education

Dr. Seun K. Kahng
Experimental Testing Technology

Mr. Calvin E. Mackey
Atmospheric Sciences

Mr. Wayne C. Williams, Jr.
Fabrication

Mr. Roger A. Hathaway
Office of Education

Mr. Anthony J. Maturo, Jr.
Office of Human Resources

Dr. Marchelle Canright
Office of Education

Dr. David S. Dawicke
Materials

R-Designates returnees from 1997

APPENDIX II
LECTURE SERIES
PRESENTATIONS BY RESEARCH FELLOWS
CALENDAR OF ACTIVITIES

1998 OFFICE OF EDUCATION SUMMER LECTURE SERIES

Location: H.J.E. Reid Conference Center, Bldg. 1222
14 Langley Boulevard

Time: 11:00 a.m. - 11:45 a.m. - Lecture
11:45 a.m. - 12:00 m. - Questions and Answer

<u>DATE</u>	<u>TOPIC</u>	<u>SPEAKER</u>
Tuesday, June 16	Water, Air, Earth, and Fire: The Origin and Evolution of the Universe, the Planets, the Atmosphere, and Life	Dr. Joel S. Levine Atmospheric Sciences Division Space and Atmospheric Sciences Program Group NASA Langley Research Center
Tuesday, June 23	Designing the Mind-Centered Flight Deck	Mr. Paul C. Schutte and Dr. Alan T. Pope Flight Dynamics and Control Division NASA Langley Research Center
*Tuesday, June 30	Integrated Vehicle Health Monitoring (IVHM) for Aerospace Vehicles	Mr. Leland D. Melvin Astronaut Candidate Materials Division NASA Langley Research Center
Tuesday, July 7	Research on the Problem of High Precision Deployment for Space Based Telescopes	Dr. Mark S. Lake Structures Division Research and Technology Group NASA Langley Research Center
Tuesday, July 14	Microwave Anisotropy Probe (MAP) Attitude Control System/Sensors and Actuators	Ms. Otilia Rodriguez-Alvarez Guidance, Navigation, and Control Center NASA Goddard Space Flight Center
Tuesday, July 28	Future Strategic Issues	Mr. Dennis M. Bushnell Senior Scientist NASA Langley Research Center

*This lecture will be held at the Pearl I. Young Theater, Building 1202, 5 North Dryden Street.

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

Office of Education Summer Lecture Series



July 28, 1998
11:00 a.m.

ASEE Only

Proposal Seminar
Pearl F. Young Theater
July 29, 1998 2-3:30 p.m.

Final Presentations

H.J.E. Reid Conference Center
August 4, 1998

LARSS Only

Graduate School Seminar
H.J.E. Reid Conference Center
July 30, 1998 12:30 p.m.

**Leland Devon Melvin
Astronaut Candidate
NASA Langley Research Center**

Leland D. Melvin, a research scientist in Langley's Non-Destructive Evaluation Sciences Branch, is among 25 people chosen for astronaut training by the Lyndon B. Johnson Space Center in Houston, Texas. Leland will begin training at the Johnson Space Center Aug. 24 with the rest of the Astronaut Class of 1998.

Prior to his selection as an astronaut candidate, Mr. Melvin served as the program manager for the X-33 Reusable Launch Vehicle (RLV) since January of 1995. As such, he is responsible for development and delivery of a Vehicle Health Monitoring (VHM) system to Lockheed Martin Manned Space Systems for strain, temperature, hydrogen, and acoustic event detection on the cryogenic tanks of the X-33 RLV demonstrator. VHM will prove technologies that reduce the vehicle operational costs and monitor the performance and "health" of the composite tank structure and cryogenic insulation throughout the X-33's operational life.

Mr. Melvin has also worked as an Aerospace research engineer conducting research in the area of physical measurements for the development of advanced instrumentation for Nondestructive Evaluation (NDE). His responsibilities included using optical fiber sensors to measure strain, temperature, and chemical damage in both composite and metallic structures. Additional projects included developing optical interferometric techniques for quantitative determination of damage in aerospace structures and materials.

A Ph.D. candidate in Mechanical Engineering at the University of Maryland in College Park, MD, Mr. Melvin earned a M.S. degree in Materials Science Engineering in December of 1990, from the University of Virginia, Charlottesville, VA, and a B.S. in Chemistry in May of 1986 from the University of Richmond, Richmond, VA.

Mr. Melvin has won numerous awards and honors including the NASA LaRC Performance Award, for outstanding program development and successful advocacy of the structural health monitoring system for the X-33 RLV demonstrator in 1996, and the NASA LaRC Superior Accomplishment Award for Outstanding achievement, initiative, and participation in inter-divisional and cross-disciplinary teaming that impacted the development of composite materials 1992.

Mr. Melvin has authored more than a dozen publications and presentations. Mr. Melvin is a member of the American Chemical Society, The Society for Experimental Mechanics, and The National Technical Association- (Secretary: Hampton Roads Chapter, 1993).

Mr. Melvin was born February 15, 1964, in Lynchburg, VA. His hobbies include cycling, reading and playing the piano. A tremendous football talent, Mr. Melvin was chosen by the Detroit Lions in the 11th round of the 1986 NFL college draft. He also participated in the Toronto Argonauts and Dallas Cowboys football training camps.

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**Integrated Vehicle Health Monitoring (IVHM)
for Aerospace Vehicles**

The vehicle launch community is evaluating methods for reducing the excessive costs associated with access to space. System design strategies for future launch vehicles, like the X-33 Reusable Launch Vehicle (RLV) demonstrator, focus on providing easy repair access for simplified servicing of infrastructures and expedited decision making from detected faults and anomalies. The Integrated Vehicle Health Monitoring (IVHM) system supports these strategies by providing reliable and low cost maintainability for the Single Stage to Orbit (SSTO) RLV. This presentation will discuss the sensor components, fiber optic and acoustic emission, of IVHM and their application to the X-33 demonstrator and their extension to the RLV and the Space Shuttle.

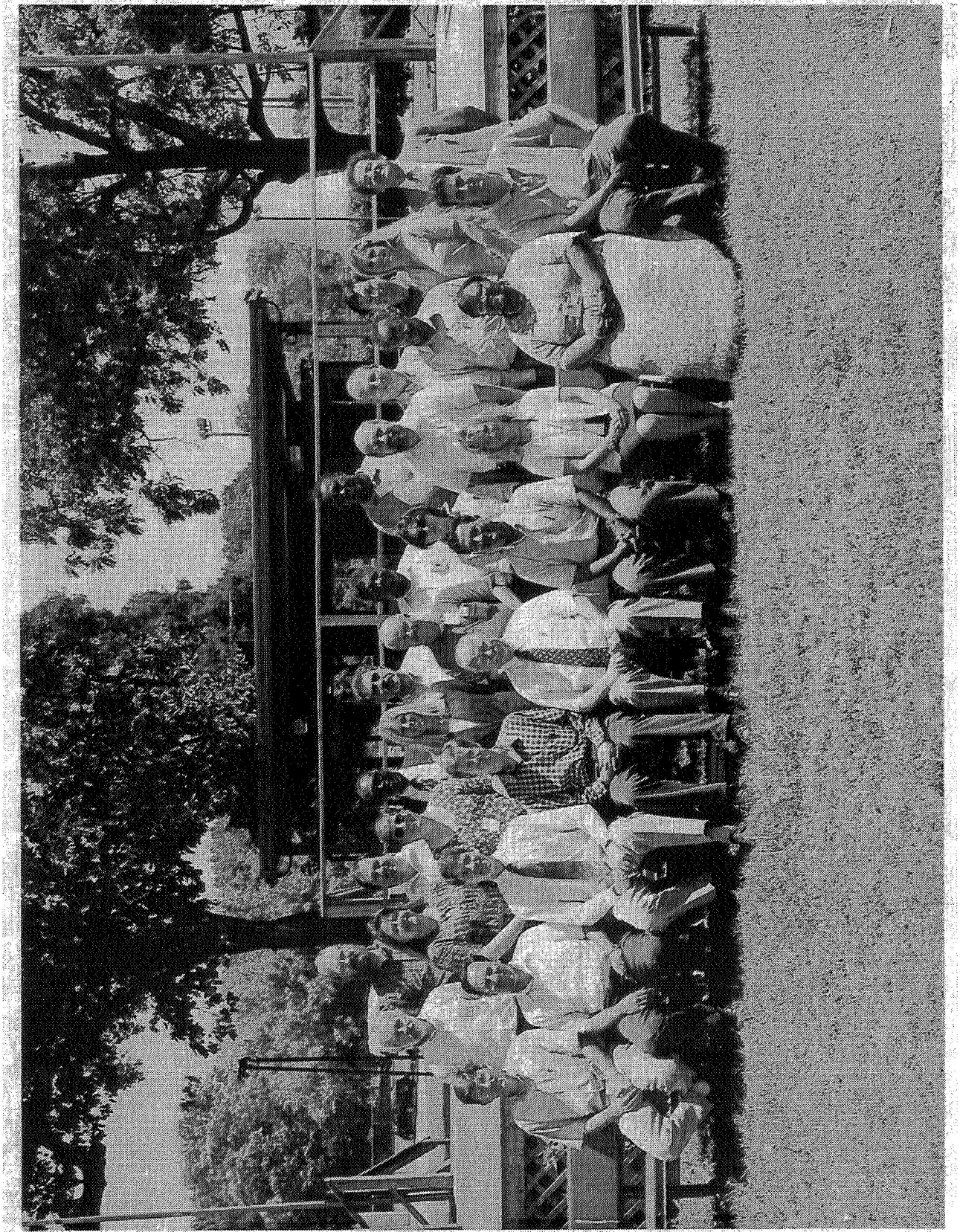
1998 American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program
Final Presentations
and
Best Research Presentation Competition
Tuesday, August 4, 1998
H. J. E. Reid Conference Center
8:30 a.m. - 12:30 p.m.

8:30 a.m.	Welcome	Dr. William P. Marable ASEE Co-Director
8:35 a.m.	Comments	Dr. Samuel E. Massenberg Director LaRC Office of Education
8:40 a.m.	“Extension of a Bond Fluctuation Model for LaRC PETI-5”	Dr. Lawrence R. Daley Research and Technology Group Materials Division Hampton University
9:10 a.m.	“Detection and Measurement of Hidden Corner Cracks Using a Portable NDI Probe”	Dr. Keith M. Williamson Research and Technology Group Materials Division Old Dominion University
9:40 a.m.	“Tristimulus Colorimetry Measurements of Temperature Sensitive Paints”	Dr. Willie L. Darby Internal Operations Group Experimental Testing Technology Division Hampton University
10:10 a.m.	Break	
10:20 a.m.	“TIGER MANE: Thermally-Induced Gradient Effects Research, Model Analysis and Nontransferability Evaluation”	Dr. James M. Hereford Internal Operations Group Experimental Testing Technology Division Christopher Newport University
10:50 a.m.	“Update of the Starship-Aircraft Finite Element Model Using Model Data”	Dr. Sophia Hassiotis Research and Technology Group Structures Division University of South Florida
11:20 a.m.	“A Study of Data Compression for Spectral and Hyperspectral Data”	Dr. Lee A. Belfore, II Internal Operations Group Aerospace Electronic Systems Division Old Dominion University
11:50 a.m.	Presentation of Certificates	
12:00 p.m.	Closing Comments	Mr. Edwin J. Prior Deputy Director LaRC Office of Education
12:10 p.m.	Group Photo of Presenters	
12:30 p.m.	Dutch Lunch for ASEE Fellows at the LAFB Officer’s Club	

1998 ASEE/LARSS Calendar of Activities

Date	Function
Monday, June 1, 1998	ASEE/LARSS Orientation Program* H.J.E. Reid Conference Center, 14 Langley Blvd.
Thursday, June 4 1998	LARSS Center Tour of Three Facilities (Fab Division, Landing Dyn. Facility, Wind Tunnel)
Friday, June 5, 1998 11:30 a.m.	Spouses Luncheon-Golden Corral Restaurant 1123 W. Mercury Boulevard
Thursday, June 11, 1998 4:00 p.m. - 8:00 p.m.	Picnic-H.J.E. Reid Conference Ctr. Picnic Grounds
Thursday, June 11, 1998 1:10 p.m. - 3:40 p.m.	ASEE Center Tour of Three Facilities (Fab Division, Landing Dyn. Facility, Wind Tunnel)
Tuesday, June 16, 1998	Lecture-H.J.E. Reid Conference Center
Thurs/Fri, June 18-19	Simulator Tours (6/18 - ASEE; 6/19 - LARSS)
Tuesday, June 23, 1998	Lecture - Pearl I. Young Theater, Bldg. 1202A
Friday, June 26, 1998	Spirit of Norfolk Moonlight Cruise
Tuesday, June 30, 1998	Lecture-H.J.E. Reid Conference Center
Friday, July 3, 1998	Holiday
Tuesday, July 7, 1998	Lecture-H.J.E. Reid Conference Center
Thursday, July 9, 1998	Langley Air Force Base F-15 Tour
Tuesday, July 14, 1998	Lecture-H.J.E. Reid Conference Center
Tuesday, July 21, 1998	ASEE Proposal Seminar-H.J.E. Reid Conference Ctr.
Tuesday, July 22, 1998	Lecture-Pearl Young Theater
Friday, July 24, 1998	ASEE/LARSS Banquet-LAFB O'Club
Tuesday, July 28, 1998	Lecture-H.J.E. Reid Conference Center
Thursday, July 30, 1998	LARSS Graduate School Seminar
Sunday, August 2, 1998	Spirit of Norfolk Dinner Cruise
Tuesday, August 4, 1998	ASEE Final Presentations
Friday, August 7, 1998	Last Day of Program

APPENDIX III
GROUP PICTURE OF RESEARCH FELLOWS



Those pictured in group photograph from left to right are:

Front Row Sitting: Dr. Jonathan D. Blotter, Dr. Raouf L. Selim, Dr. William A. Crossley, Dr. James M. Hereford, Dr. H. Marshall Booker, Dr. Amitabha Ghosh, Dr. Deborah H. Carey, Dr. Willie L. Darby, Dr. David P. Johnson

Second Row: Dr. Donald L. Kunz, Ms. Debbie Young (ASEE Admin. Asst.), Ms. Sara R. Williams (Co-op for ASEE), Dr. Denise V. Siegfeldt, Dr. Lawrence R. Daley, Dr. Sophia Hassiotis, Dr. Lawrence A. Newquist, Dr. Dawit Getachew, Dr. Kathleen VanScoyoc, Mr. Charbel Fahed

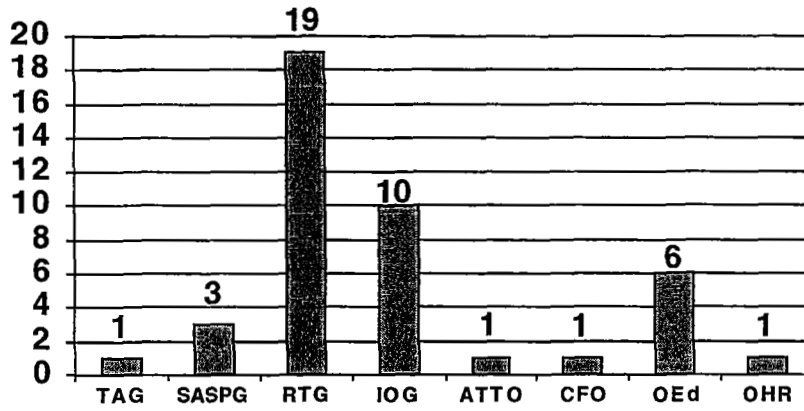
Third Row: Dr. Mark Farris, Dr. Lee A. Belfore, Dr. Norman W. Loney, Mr. Mir S. Shirvani, Dr. Ellis Lawrence, Dr. Keith M. Williamson, Mr. Thomas E. Hopkins, Dr. Mou-Liang Kung

Not Pictured: Dr. Jane M. Bailey, Dr. Mary V. Bicouvaris, Mr. Randy K. Buchanan, Dr. Amin N. Dharamsi, Dr. Peyman Givi, Mr. Vince L. Hale, Dr. Jen-Kuang Huang, Ms. Mary E. Ingham, Mr. David W. Johnson, Dr. James A. Lookadoo, Dr. Taj O. Mohieldin, Dr. Duc T. Nguyen, Mr. Thomas P. O'Connor, Dr. Shantilal N. Shah, Dr. William B. Williams

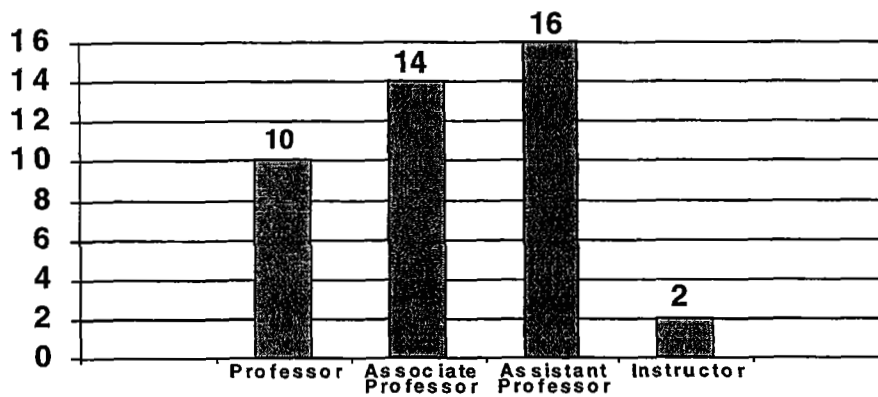
APPENDIX IV

DISTRIBUTION OF FELLOWS BY GROUP
and
DISTRIBUTION OF FELLOWS BY UNIVERSITY RANK

Distribution of 1998 ASEE Fellows by Group



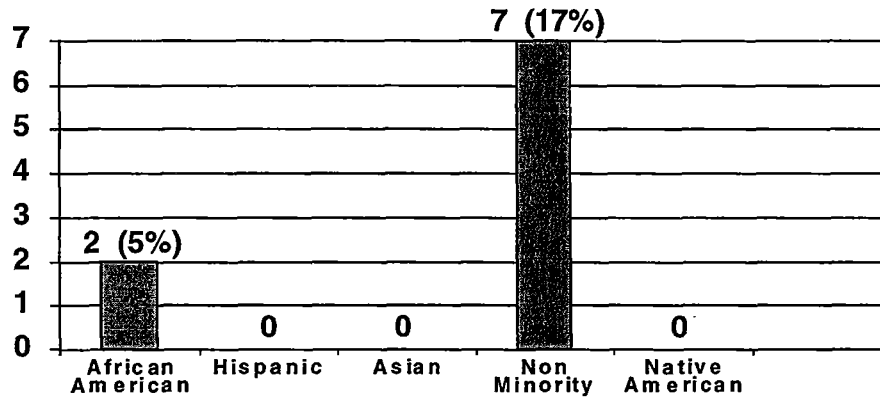
Distribution of 1998 ASEE Fellows by University Rank



APPENDIX V
DISTRIBUTION OF FELLOWS BY ETHNICITY/FEMALE
and
DISTRIBUTION OF FELLOWS BY ETHNICITY/MALE

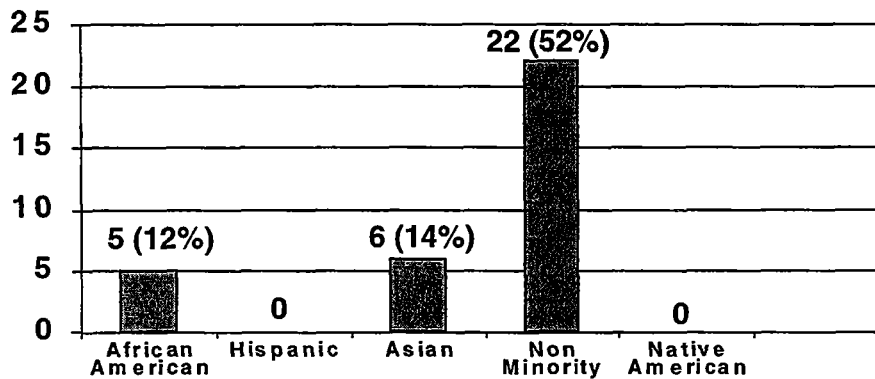
Distribution of 1998 ASEE Female Fellows by Ethnicity

9 Female Participants
(Represents 22% of all participants)



Distribution of 1998 ASEE Male Fellows by Ethnicity

33 Male Participants
(Represents 78% of all participants)



APPENDIX VI
DISTRIBUTION OF FELLOWS BY UNIVERSITY

**1998 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM
INSTITUTION PARTICIPATION**

<u>UNIVERSITY/COLLEGE</u>	<u>NO. OF FELLOWS</u>
Chicago State University	1
Christopher Newport University	8
Cumberland College	1
*Elizabeth City State University	1
*Hampton University	4
Idaho State University	1
James Madison University	1
Marywood University	1
Midwestern State University	1
Mississippi State University	1
New Jersey Institute of Technology	1
New River Community College	1
*Norfolk State University	3
Northern Virginia Community College	1
Old Dominion University	7
Pittsburg State University	2
Purdue University.	1
Rochester Institute of Technology	1
*Saint Paul's College	1
Southwest Virginia Community College	1
State University of New York-Buffalo	1
University of South Florida	1
Valdosta State University	<u>1</u>
Total Number of Fellows	42
Total Number of Institutions Represented	23

*Indicates a **H**istorically **B**lack **C**ollege or **U**niversity (HBCU).

APPENDIX VII
ABSTRACTS - RESEARCH FELLOWS

Functional Management Self-Assessment Report for the NASA Langley Research Center Office of Education

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This project facilitated a Langley Research Center Office of Education (LaRC OEd) self-study of four specific program areas of the LaRC Office of Education: Educational Technology/Distance Learning; Precollege Programs; University Programs; and Special Institutes. The self-assessment process enabled OEd to review its programs, goals, organization, and operation. Though summative in nature, the assessment report serves in a formative capacity by providing a set of recommendations for a self-improvement action plan.

The LaRC OEd self-assessment team held four bi-weekly meetings to: 1) plan the assessment procedure; 2) design a self-assessment survey; 3) analyze survey results and formulate recommendations; and 4) review and approve the Self-Assessment Summary Report draft.

A Self-Assessment Survey was designed to answer questions posed by the NASA Headquarters self-assessment directive. All program managers and key program staff were surveyed (n=15). Fifteen responses were returned for a response rate of 100%. Thirteen members of the support staff were also surveyed, resulting in a response rate of 62%. Survey perceptions were validated by a non-random sampling of FY 1997 EDCATS data compiled from twelve LaRC education programs representing 444 program participants. In addition to the survey data, other information used by the assessment team included: EDCATS data for LaRC OEd programs; summative evaluation reports; analyses of pertinent Agency, Center, and Program documents; and interview comments from OEd program managers and key program personnel. Ten documents were reviewed to determine the level of integration between LaRC education objectives and NASA's education framework.

The self-assessment report documents the status of the education function, Center education priorities, key stakeholder issues, major program strengths and weaknesses, and responsiveness to NASA Headquarters' guidance. The Center Oed evaluation processes are identified, the operation, management, and budgeting processes are tracked, and the education organization is outlined. Specific requests for Headquarters assistance and an action plan are delineated in terms of specific recommendations.

Single Scan

A Study of Data Compression for Spectral and Hyperspectral Data

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Satellite based instrumentation is capable of providing extensive and detailed data for use in weather forecasting and science. The next generation weather satellite will likely deploy Fourier transform spectroscopy (FTS) instrumentation to enhance observing capabilities. The FTS is based on the Michelson interferometer which was used in the nineteenth century by Michelson and Morley in a failed attempt to determine the relative velocity of earth with respect to the ether. By moving one of the mirrors in the interferometer and observing the intensity of the interference patterns through the interferometer as a function of mirror displacement, the Fourier transform of the spectrum can be measured directly. This is true because for each mirror position, one wavelength shows constructive interference while all the rest show destructive interference, assuming that wavelengths at integer multiples are filtered out. The desired spectrum is recovered by taking the inverse Fourier transform of the interferogram. If light is collected from an astronomical object or earthly specimen, the spectral properties of object can be measured. FTS devices can provide spectral measurements over a broad range of wavelengths and resolutions. Indeed, FTS devices can be constructed to simultaneously collect an array of interferograms over an area, producing an image where each pixel is a spectrum, hence hyperspectral imagery. Indeed, a very large number of bits is necessary to represent an hyperspectral image. This suggests high demands on the satellite electronics to store, process, and downlink the image data.

In order to reduce data transmission demands, compression algorithms can be applied to reduce the number of bits that must be transmitted, while retaining the ability to restore the data to an exact replica of the measurements. Unfortunately, the number of bits that must be transmitted after even the most optimistic assumptions for lossless data compression may be insufficient. As a result, lossy data compression algorithms were studied to determine their performance and impact on the measured data. In lossless compression approaches, it was found that spectra compress better than interferograms. However, in order to compute the spectra, a sustained computation rate in the neighborhood of 900 MFLOPS may be necessary to transform the interferograms using the inverse FFT. Using single interferograms and transformed spectra, two lossy compression algorithms were studied: 1) the Rice Algorithm and 2) wavelet compression methodologies. In this study, it was determined that the Lossy Rice algorithm was superior from an information theoretic perspective, resulting in smaller distortions to the data that are being compressed. In addition, two hyperspectral images were available for study. The data forms a three dimensional array, or cube, with two spatial dimensions and one spectral dimension. Different compression performance is achieved depending on how the data is presented to the compression algorithm. Using lossless Rice compression, three cases were investigated with data compressed in units consisting of isospectral images (2D), pixel compression (1D), and spatial/spectral images (2D). It was found that the spatial/spectral images compressed the best, followed by pixel compression, and isospectral images. Finally, it has been observed in the literature and in this study that wavelets can provide a measure of noise suppression to complement compression. This suggests that wavelets may be able to simultaneously provide both data compression and noise suppression resulting in an higher signal quality compared with the original measurements.

Assessing the Needs for Resources for Improved Performance of Virginia Students in Mathematics, Science, and Technology

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This paper assesses the resources needed in Virginia's schools for improved student performance in science, mathematics, and technology and examines the importance of improved instructional materials, the needs in teacher preparation, and the feasibility of developing a cadre of lead teachers in Virginia schools. In addition, this paper examines the need for professional development for teachers, the changes required in instruction and assessment vis-à-vis Virginia's high-stakes testing, and the potential role of regional centers for Mathematics and Science.

In approaching this task, a tactical decision was made to not only enumerate the needs of Virginia's schools in the above mentioned areas, but to frame that information both in a historical context and to make evaluative comments based on research and practice.

Sources of information for this report include actual research done through surveys and interviews, the examination of official state and national documents, a review of literature on pertinent issues in order to offer a balanced view of each issue, and anecdotal sources based on teachers' actual experiences.

This paper, being one of several sources of information for the Virginia Mathematics and Science Coalition may overlap with other reports. Such overlapping, we believe, accentuates the significance and complexity of the type of integration related to the improvement of mathematics and science education for all children. While it offers answers to the questions posed, this paper also raises a number of questions for which there are no easy answers and makes recommendations to the Virginia Mathematics and Science Coalition for future action and research.

SINGLE SCAN

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Fringe Control using Electro-Optic Holography

Jonathan D. Blotter

Acknowledgement: Gary A. Fleming and James F. Meyers

ABSTRACT

Electro-Optic Holography (EOH) is a whole field, laser-based, displacement measurement technique. The EOH technique produces a hologram that contains a fringe pattern from which the surface displacements of the structure can be extracted. For out-of-plane measurements, one complete fringe cycle represents a displacement magnitude equal to the wavelength of the laser. Infrared laser diodes are a low cost light source for an EOH system. The wavelength of these laser diodes typically ranges from 800-900 nm. With this high of a wavelength and the relatively large magnitudes present in many vibrating structures, the fringe density of an EOH hologram is often so high that it is impossible to separate or detect the individual fringes.

The research presented in this paper extends the displacement measurement range of a laser diode based EOH system. This is done by frequency translating the reference beam using laser diode current modulation. A sawtooth modulation signal is used to modulate the laser diode because it provides a single sideband suppressed carrier (SSSC) signal. The frequency translated reference beam combines with the object beam and produces a fringe pattern governed by higher order Bessel functions. The order of the Bessel function is determined by the frequency of the modulation provided to the laser diode current controller. Using this technique the sensitivity of the EOH system can be increased or decreased compared to the typical zero order Bessel function EOH systems. Using this technique it is also possible to separate the modes and compute the displacement under multi-frequency excitation.

Technology-Commercialization-Economic Development Connections

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The new economy is well underway. The United States has moved quickly from agrarian to industrial to an information high technology/service driven economy. There is little doubt that high technology is the main driving force for economic growth in a regional economy. The Mission and content of this study are described below.

Mission: a) to outline and evaluate the major costs and benefits of technology transfer and application in a major metropolitan area (The Norfolk-Virginia Beach-Newport News, Virginia Metropolitan Statistical Area), b) to increase the understanding of closely related phenomena within the general sphere of economic development, c) to identify and explain the interrelatedness of a broad range of technology transfer mechanisms, collaboration, deployment and utilization activities that are encompassed in that development sphere and d) to develop a series of long range economic outlook scenarios for the area within the scope of those parameters.

The problem addressed required the development of several stages in a typical ROADMAP format beginning with the identification of the scope and parameters of technology, commercialization and economic development and their interrelatedness. A model was developed to identify the major costs and benefits of technology transfer and to identify the major stakeholders and their mutually interdependent roles in economic development. Various techniques of economic and business modeling were explored to develop a series of long range outcomes for the Hampton Roads, Virginia, MSA given various levels and components of technology transfer and commercialization and classifying the effects of various changes in the economic and business base of operations.

As the new economy unfolds, the models explored will be helpful in determining the possible futures being generated by high-technology industries and services which have a larger multiplier effect in the United States than the manufacturing/agrarian based economies of the past. The analysis attempts to determine the role education, research, and economic development activities and benchmarks play in determining the pace, direction, and composition of economic growth of the Hampton Roads area in its quest to improve the welfare of its population, present and future.

Simple Scan

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**Engineering Study For Reactivation
Of A Six Degrees Of Freedom Platform
For Aeronautical Safety Investigations**

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The Systems Integration Branch of the Flight Electronics Technology Division at NASA/Langley Research Center possesses a hydraulically operated six degrees of freedom (Stewart) platform that had previously supported microgravity robotics investigations. New directions for NASA's Aeronautical enterprise are driving new initiatives throughout Langley. Future branch operations may incorporate a variety of aeronautical safety investigations. This expectation generated the need to reengineer the platform as a test bed for new experiments.

Suitability issues extend beyond the inherent physical and performance parameters of the platform. These operational characteristics were found to be adequate for most of the new testing regimens envisioned. The problem investigated also had constraints in economics and maintainability characteristics. In the leaner budget environment, the platform must not prove too costly to operate or to upgrade. Finally, a wider customer base of users beyond the Systems Integration Branch is anticipated. The facility must incorporate a researcher-friendly interface for these potential new users.

Meeting all of the constraints for the problem indicated a solution saving all of the current actuator and sensor elements on the platform. Additionally, most of the existing control hardware and control software elements were identified as replaceable with newer and more robust solutions. Meeting the economic guidelines suggested a Pentium grade of PC with appropriate I/O enhancements as the optimal controls environment for a refurbished platform. This machine would host any necessary kinematics calculations, control algorithms, experiment stimulus generation and resident safety monitoring software elements. Additionally, network capability would allow the platform control PC to support either local or remote computing facilities operating as research interfaces. These ancillary machines would also host the instrumentation systems supporting the experiments mounted on the platform. The final recommendation actually contains a set of potential but workable solutions for implementation. In this fashion, a wider set of experiments and customers may be accommodated.

omit

**The Synthesis of Copolymers Used
in Pressure Sensitive Paints**

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Patent Pending

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Genetic Algorithm Actuator Placement for Flow Control for Maneuverability

364346
LP

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The Aircraft Morphing program is an effort to develop smart devices for aircraft applications, making use of active component technologies. One of the technology areas for this program is Multidisciplinary Design Optimization (MDO), and a focus effort in MDO is to investigate and subsequently develop methods for optimal placement of sensors and actuators for aeroelastic control, flow control and acoustic control. A promising approach for actuator placement is the Genetic Algorithm (GA), a global optimization technique well suited to discrete optimization.

Smart devices that can produce a quasi-static shape change in an aircraft wing may be able to provide three-axis flight control; this could eliminate the need for conventional control surfaces. Surfaces like ailerons, flaps, etc., have gaps between the wing and the surfaces that contribute to leakage and protuberance drag and can be a source of aerodynamic noise. The focus of this study was to investigate GA approaches to place discrete actuators on a wing to provide three-axis flight control.

The genetic algorithm is a computational representation of natural selection and reproduction observed in biological populations. The mimicry of nature in a GA includes representing points in a design space as if they were individual organisms. Design variables are generally mapped into binary strings that provide the *genes* of a given design. These strings are then concatenated to form a *chromosome* representing the traits of an individual design point. The GA works with these binary chromosomes, which allows for discrete optimization. In this application, the binary "1" represented an "on" actuator, while the "0" represented an "off" actuator.

A problem description was developed for a "three-condition" flight control design, where the number of unique actuators is to be minimized, subject to constraints on the pitch, roll and yaw moments. The first condition is a "pitch" condition where a limit is placed upon the pitching moment to reflect a pitch capability and limits are placed upon the magnitude of the roll and yaw moments to ensure that the pitching motion is uncoupled from roll and yaw. The other two conditions provide for uncoupled roll and yaw. The genetic algorithm determined actuator placements to meet the pitch condition for a simplified untapered, unswept wing. A 3-D panel code predicted aerodynamic force and moment coefficients for the various actuator placements. Results of this work have illustrated that the GA is suited to the task of actuator placement, and these results have highlighted areas for future research and development of this approach.

Extension of a Bond Fluctuation Model for LaRC PETI-5

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One objective of the computational materials program at NASA is to use advanced computational tools to design optimum polymeric matrix composites by developing mathematical models that describe the polymer synthesis process.

The bond fluctuation model puts polymer segments on a lattice, and allows randomly chosen segments to jump to nearby lattice sites after assuring that the new site is unoccupied, and that criteria for new bond lengths and angles and, in the case of polymerization and cross-linking, reactivity are met. Such a model was implemented for phenylethynyl-terminated polyimide (PETI-5) in a computer program written in compiled BASIC. The program's strongest feature is the use of segment descriptors which describe a given segment's functionality, lattice coordinates, and to which other segments it is bonded.

The present work extends the model to incorporate: (1) reaction of anhydrides and amines to form the polyimide, rather than simply modeling a fixed chain length; (2) differentiating among segments as to their chemical type; (3) incorporating a Boltzmann distribution of bond energies as a function of temperature; (4) attempting to restrict bond angles to favor larger angles, i.e., stiffer polymer chains.

Reaction of anhydrides and amines to form the polyimide was accomplished by setting a particular element of the segment descriptor to indicate whether the segment is a diamine, a dianhydride, or an ethynyl anhydride. Then the criteria for allowing segment (monomer) reaction with adjacent segments (monomers) included chemical type. In this way, a distribution of chain lengths was obtained.

Incorporating a Boltzmann distribution of bond energies was done by calculating bond angles before and after a proposed random segment move based on lattice coordinates of the affected segments, allowing the move if the new bond energy would be lower (larger bond angle), and giving a proposed higher energy (smaller bond angle) a certain probability of occurrence depending on temperature.

Refinements of the model to show increasing average square end-to-end distances at decreasing temperatures are currently in progress.

Future work will incorporate a Boltzmann distribution of energies into the imidization and cross-linking reactions, and determine the effect of distribution of chain lengths vs. uniform chain length on end-to-end distance.

Since SCAN

Tristimulus Colorimetry Measurements of Thermochromic Temperature Sensitive Paints

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The measurement of heat transfer is a very important research tool used in the study of thermal properties of the surfaces of various materials. To this end, liquid crystal techniques, infrared imaging and thermographic phosphors have been used. Recently considerable attention has been given to temperature sensitive paints. The temperature sensitivity of the paints currently in use is based on fluorescence. The development of temperature sensing paints based on thermochromic transition metal complexes would add a new source of TSP's.

The transition temperature (the temperature at which the color change occurs) is dependent on the transition metal used and the ligands and counterions attached to it. The thermochromism has been attributed to temperature-dependent changes in the stereochemistry of the complex and depends on the nature of the central metal ion and the ligand.

Colorimetry is defined as the science of the quantitative measurement of color. Color can be described by three characteristics: hue, value, and chroma. Tristimulus colorimetry is a method used to measure changes in the three color characteristics, therefore it can be used to detect slight changes in "color". There are several methods used to arrange colors in some orderly fashion. These arrangements are called color spaces. The color space used in this project was the CIELab.

The temperature dependent color changes of the complexes, bis(N,N'-diethylethylenediamine)copper perchlorate, $[\text{Cu}(\text{dieten})_2](\text{ClO}_4)_2$, bis(N,N'-diethylethylenediamine)nickel perchlorate, $[\text{Ni}(\text{dieten})_2](\text{ClO}_4)_2$ and bis(N,N'-diethylethylenediamine)nickel bromide, $[\text{Ni}(\text{dieten})_2]\text{Br}_2$ were measured. "Paints" were prepared by mixing the above complexes with an appropriate polymer. The tristimulus values of these "paints" were measured using a MacBeth "Color Eye" 580 Colorimeter. The temperature was varied using a copper topped hot plate fitted with a West 2810 Temperature Controller. It was determined that there is a correlation between the tristimulus values and temperature. Therefore, colorimetry can be used to evaluate temperatures of thermochromic paints.

1998 NASA-ASEE SUMMER FACULTY FELLOWSHIP

Final Report

Dr. Amin N. Dharamsi

Department of Electrical and Computer Engineering

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LINE NARROWING PARAMETER MEASUREMENT BY MODULATION SPECTROSCOPY

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Accurate Characterization of Oxygen A-Band Line Parameters by Wavelength Modulation Spectroscopy with tunable diode lasers is an ongoing research at Old Dominion University, under sponsorship from NASA Langley research Center. The work proposed here will be undertaken under the guidance of Dr. William Chu and Dr. Lamont Poole of the Aerosol Research Branch at NASA Langley-Research Center in Hampton, Virginia.

The research was started about two years ago and utilizes wavelength modulation absorption spectroscopy with higher harmonic detection, a technique that we developed at Old Dominion University [1-4], to obtain the absorption line characteristics of the Oxygen A-band rovibronic lines. Accurate characterization of this absorption band is needed for processing of data that will be obtained in experiments such as the NASA Stratospheric Aerosol and Gas Experiment III (SAGE III) as part of the US Mission to Planet Earth.

The research work for Summer Fellowship undertook a measurement of the Dicke line-narrowing parameters of the Oxygen A-Band lines by using wavelength modulation spectroscopy. Our previous theoretical results had indicated that such a measurement could be done sensitively and in a convenient fashion by using this type of spectroscopy. In particular, theoretical results had indicated that the signal magnitude would depend on pressure in a manner that was very sensitive to the narrowing parameter. One of the major tasks undertaken during the summer of 1998 was to establish experimentally that these theoretical predictions were correct. This was done successfully and the results of the work are being prepared for publication [5]. Experimental Results were obtained in which the magnitude of the signal was measured as a function of pressure, for various harmonic detection orders ($N = 1, 2, 3, 4, 5$). A comparison with theoretical results was made, and it was shown that the agreement between theory and experiment was very good. More importantly, however, it was shown that the measurement was yielded a very sensitive technique for obtaining the narrowing parameter that describes the deviation of Oxygen A-band lines from the Voigt profile. In particular, it was seen that the best fits were obtained consistently when the narrowing parameter value used was $0.022 \text{ cm}^{-1} \text{ Atm}^{-1}$

Previous work, upon which the current work was based has resulted [6-10] in several accurate measurements of properties of particular lines of the Oxygen A band. For example, this work has resulted in the measurement of the collision cross sections of several lines including the RQ(13,14) and the RR(15,15) lines. A major achievement of achievement of the work was also the demonstration that the technique we have developed can accurately probe the structure of the absorption lineshape function. In particular, the method we have developed is very well suited for experimentally probing the characteristics of lines in their wings. This work was accepted for publication in the Journal of Applied Physics [11], and is scheduled to appear in the December 15, 1998 issue.

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Modeling and Optimization of Carbon-Based Thermal Dissipators for Laser Diode Arrays

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Laser diodes are semiconductor photon sources that are used in medicine, optical communications, navigation, material processing, and a variety of other applications. Diode-pumped solid state lasers are the preferred source for probing purposes in surveying, target location and marking, and space applications. For high power uses, laser diode arrays are fabricated with conduction- or liquid-cooled copper leads for heat dissipation.

The primary barriers to high-power laser diode development are insufficient thermal conductivity (TC) and failure due to coefficient of thermal expansion (CTE) mismatches between package components. Increases in temperature severely distort the optical characteristics of laser diodes and can cause jumps in longitudinal mode. Differing CTE's create mechanical stress between the semiconductor die, insulation materials, and the thermal dissipator. Diamond-like compounds and graphitic fiber matrices have high TC's and CTE's that can be matched to other components; as such, they are likely candidates for laser diode packaging. This work involves the thermal analysis of laser diode configurations that use carbon composite materials for heat dissipation. The long-term objective is the development of a conduction-cooled laser diode package with small pitch, high TC, and matched CTE's.

Of particular interest are laser diode arrays for pumping Ho:Tm lasers in lidar applications. Previous work at NASA Langley has shown the efficacy of room-temperature diode-pumped Ho:Tm lasers using copper heatsinks with thermoelectric cooling. This report describes a tradeoff study of laser diode array amplifiers fabricated with candidate thermal dissipators, along with dimensional optimization of the dissipators. The primary results include thermal models and comparative heat distributions for laser diode array amplifiers configured with carbon composite materials.

Future work includes modeling of alternate laser diode array configurations, a closer look at package interface materials, and parametric evaluation of laser diodes under heat load. Expected benefits include increased laser output power with improved heat dissipation, stability of the output beam, increases in operational life, and smaller package volume and weight. The latter supports miniaturization in the electronics industry and reduced payloads for space applications.

SINGLE SCAN

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Probing in the New ETR Low Frequency Facility to Optimize the Quiet Zone

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The Electromagnetic Research Branch is upgrading the ETR facility to cover a wider frequency range, especially on the low frequency end, because there is currently a larger demand for low frequency RCS measurements. This summer, the range is near completion.

To Characterize the field quality in this range, it is necessary to do field probing. Using a 14 ft composite prober made of carbon graphite, which is very stiff and, at the same time, lighter than other metals, the positioner was placed on a 20-ft tower to probe across the middle of the quiet zone. In addition, the prober was able to move on rails, about 20 ft up and down range.

Probing scans were made in two polarization and two directions. For each probing position there were 4 sets of data.

There were problem issues to solve with the synthesizer to communicate with the controlling computer. The software was written for an 8753 synthesizer, whereas, the machine available was 8752A. An 8721 machine was borrowed and tried. It works fine except we were limited in the scan times due to the slower sweep rate. The RF front end, however, limited the frequency range from 0.3 to 2.0 GHz.

The data obtained proved that the 26' sq. reflector worked fine instead of the larger previous design. The results came out surprisingly good, with about 1/2 dB ripple, which is quite acceptable.

A temporarily blocking wall of absorber near the feed reduced stray signals. Next, the other half end of the room will be covered with absorber, and more data will be taken to minimize other scattering.

Review and Extension of the Definition of the Acoustic Energy in Inhomogeneous Moving Media

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The acoustic energy in a moving inhomogeneous medium is a very useful tool for application to many problems of aeroacoustics such as ducted fans, helicopter rotors and high speed propellers. Intuitively, one expects that some conservation laws hold for an energy quantity. We could then use energy conservation laws to understand and control the noise level of these machines in the near and far fields. The concept of the acoustic energy in a moving medium is particularly useful in active noise control of ducted fan engines because the transducers used for noise control operate in a nonlinear flow regime. The amount of energy needed by the transducers to affect the radiated noise of these engines can then be calculated precisely.

The definition of acoustic energy in moving media is complicated because of the fact that there are three kinds of perturbation that propagate in inhomogeneous moving media. These are acoustic, vortical and entropic perturbations that travel at different speed in the fluid medium. Furthermore, the task of the definition of an acoustic energy expression is difficult because of the interaction between these three perturbation modes and the transfer of the acoustic energy to the mean flow.

This investigation involves a review of the current state of the knowledge of the acoustic energy in inhomogeneous moving media. The basic energy conservation law is interpreted in several forms that may prove to be useful in isolating the acoustic energy and its interaction with the background flow.

Since 2000

ASSESSMENT OF TURBULENT MODELS FOR SINGLE-ELEMENT AIRFOIL AT HIGH-LIFT

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ABSTRACT

The present study consists of: flow calculations around an AEROSPATIALE A-airfoil at high angles of attacks, and assessing different turbulence models by comparing numerically predicted turbulent flow characteristics over the airfoil against reference experimental values. The turbulence models investigated include: (i) the Spalart-Allmaras (SA) one equation mode (ii) the Mentr's k-Omega Shear Stress Transport (MSST) model and (iii) the $k - \epsilon$ version of the Explicit Algebraic model of Gateski and Spezial with variable ($\frac{P}{\epsilon}$).

To attain this goal, a series of computations, using CFL3Dv5 code of NASA Langley Research Center, have been performed for a $M = 0.15$, angles of attacks at 3.4° , 10.1° , 14.1° and 17.1° and $Re = 3.13 \times 10^6$, as well as a low Reynolds number test case $Re = 2 \times 10^6$ and at incidence $\alpha = 13.3^\circ$. For all the calculations performed in this investigation, the location of transition points on the suction and pressure sides are fixed at 12% and 30% of the chord, respectively, and we used the mandatory structured C-mesh consisting of 512 cells in the wrap-around directions and 128 cells in wall-normal direction. The wake was covered by 64 cells and 384 cells were located on the airfoil surface.

The results of this investigation show that the performance of the two linear eddy viscosity models, namely SA and MSST, is the same for most of the test cases considered. Furthermore, for the low Reynolds number test case, these two models did perform better than the nonlinear eddy viscosity model (EASM), whereas for the high Reynolds number test case the EASM perform well. Since the grid independence study, to generate the fine mesh used in the present investigation, was performed using linear eddy viscosity models, it is difficult to draw, using the aforementioned results, any conclusion about the overall performance of EASM as compared to the other two linear eddy viscosity models.

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Implementation of TWNTN4A at the 0.3 Meter Transonic Cryogenic Tunnel

by

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TWNTN4A is a nonlinear, transonic, small disturbance code for correcting wall interference effects in 2-D wind tunnels. Incorporated into this potential flow solver is the capability to account for the important effects of the boundary layer growths on the wind tunnel sidewalls. The original TWINTAN code was developed about 20 years ago for post-test use; however, improved computer technology now allows on-line implementation. The object of this research is to implement the code in the test cycle and enhance capabilities of the 0.3 m. Transonic Cryogenic Tunnel (TCT) at NASA-Langley.

TWNTN4A has three calculation cycles - tunnel calculations, free-air calculations and perturbation flow calculations. The tunnel calculations are an inverse design procedure to generate an effective inviscid body using the tunnel wall pressure measurements as boundary conditions with the free stream velocity and Mach number the same as the experimental test case. The effective inviscid body shape which produces the same blockage effect (drag coefficients) then undergoes the second cycle of calculation. In this cycle the flow of free-air is calculated around the equivalent shape while the angle of attack is corrected to satisfy the Kutta condition for lift corresponding to the tunnel flow. During the convergence process, the far field velocity and Mach number are upgraded using an optimization algorithm which tries to match the free-airflow pressure distribution around the airfoil. When the second cycle is complete the correction quantities for angle of attack and Mach number are available. However to determine further the effect of the model and wall effects, a third cycle is run which solves the free-air flow with the singularity distribution obtained in the first cycle and the corrected free-stream conditions obtained from the second. Wall effects are the difference between the total perturbation from the first cycle and model perturbations from the second.

The focus of this work was to convert a research code into a production code, streamline the process where possible, prepare on-line documentation, upgrade input and output capabilities and deliver a single code for different operating systems. The program which used to take several hours for convergence in the old system now runs under 10 seconds in the DEC Alpha system available at TCT. Thus, TWNTN4A will be available for real-time data correction for future tests. Additionally, new TECPLOT plotting capabilities which are readily available on multiple systems have been added. New and extensive documentation adds comments on program variables and input requirements.

Future directions of this research will include comparison of several testing runs with Navier-Stokes calculations. A major interest in this research is to determine the exact effect of free-stream flow angularity. Since wind tunnel test sections are finite in size the effects on flow angularity may not be fully correctable. Shock wave boundary layer interaction is another phenomenon which will limit the capabilities of TWNTN4A. Testing with different size models must be conducted to assess program limitations.

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Filtered Density Function of Velocity in Large Eddy Simulation of Turbulent Flows

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Abstract

The primary objective of this research is to extend our previously developed methodology "filtered density function" (FDF) to include the transport of velocity in large eddy simulation (LES) of turbulent flows. This new FDF represents the single point joint probability density function of the subgrid scale (SGS) velocity and is obtained by solution of its modeled transport equation. In this equation, the effect of convection appears in a closed form but the influence of SGS mixing is modeled. The stochastic differential equations (SDEs) which yield statistically equivalent results to the of the FDF transport equation are derived and are solved via a Lagrangian Monte Carlo scheme. The consistency, convergence, and accuracy of the FDF and the Monte Carlo solution of its equivalent SDEs are assessed. These results are being appraised by comparisons with direct numerical simulation (DNS) data.

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**RESEARCH
ABSTRACT**

DAVID J. GOSSELIN Ph.D.

FULL COST IMPLEMENTATION IN NASA

In conjunction with the agencywide IFMP initiative, full costing as a way of doing business in NASA is being introduced in phases. As one of the original designers of the project it has been my responsibility to integrate the concept and functions at the center level. It has also been my responsibility to make sure that the basic tenants of full costing can be carried out by the new IFMP system being developed for NASA.

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**INTERPRETATION AND EDUCATION FOR
STATEMENTS OF FEDERAL FINANCIAL
ACCOUNTING STANDARDS**

Many new financial and operational reporting requirements go into effect this fiscal year. New standards dealing with property, plant, and equipment ; full costing and stewardship reporting have been instituted. These new standards were evaluated as to meaning so as to meet what really does have to be presented. Educational programs were designed and held for those responsible for meeting these requirements.

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NASA Educator Workshop (NEW) Abstract

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This summer 20 K-12 grade teachers traded in chalkboards, hall passes, and dismissal bells for wind tunnel tests, flight simulators, and aeronautic-related briefings as they attended a 2 week NASA Educator Workshop (NEW). The objectives of NEW were:

- To share information about NASA resources, programs, and services.
- To provide an opportunity for the teams of educators to develop and implement an action plan that will support standards-based teaching and learning of science, mathematics, and technology in a problem-based learning (PBL) environment.
- To strengthen partnership with NASA by sustaining interaction and collaboration.
- To provide an opportunity for the teams to exchange ideas.

Problem-based learning is an instructional method using a real world problem also known as an ill-structured problem, as the context for an in-depth investigation. Most real life problems are ill-structured, as are all the really important social, political, and scientific problems. When students take ownership of the problem and are empowered to generate solutions, it is rewarding to watch the serious thinking that follows. The participants were immersed in two problems during the 2 weeks. During the first problem, they researched Space Science Missions and developed activities appropriate for future missions. A second PBL introduced week two also addressed NASA's strategic outcome to communicate widely the content, relevancy and excitement of its missions and discoveries to the general population. Further, the PBL scenario addressed the technological challenges being taken up by NASA.

With a "real" need-to-know problem facing them, the teachers set out to gather information and to better understand the problem using inquiry-based and scientific methods. The learning in these scenarios was driven by the direction taken by participants as PBL situations have no preconceived outcomes.

NASA and educators are alike in that both like to stretch the boundaries and prove that things that couldn't be done yesterday will be done tomorrow. With this mind-set, the NEW participants have picked up the challenge to immerse their next class of students in problem-based learning and NASA materials.

As a follow-up during the 1998-99 academic year, the NEW faculty will communicate with the participants through a newsletter. In addition, electronic follow-up sessions will be conducted to support teachers' efforts in developing PBL and the integration of technology in math and science instruction.

NASA Educator Workshop is funded by NASA Education Division and is a collaborative effort between NASA Langley's Office of Education and the National Science Teachers Association. Selected teacher teams were drawn from Langley's 5-state precollege service region, which includes Kentucky, North Carolina, South Carolina, Virginia, and West Virginia.

Update of the Starship Fuselage Finite Element Model
Using Modal Data

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An accurate analytical model of the Beechcraft Starship fuselage is needed to design the acoustic response in the main cabin of the aircraft. The initial dynamic response produced by a finite element model did not agree with measured data. This is due to the complexity of the aircraft. In this project, numerous parameters were identified and updated to achieve agreement between the analytical and measured response.

The Starship is a new 10-passenger aircraft with a unique all-composite construction. The composite consists of a honeycomb which is sandwiched on either side by four graphite epoxy plies. Aluminum stiffeners, reinforcements placed on the floor and around windows, and an unknown distribution of the mass added to the overall complexity of the structure.

An initial MSC/NASTRAN finite element model produced errors in the natural frequencies in excess of 40% of those measured in laboratory tests. In addition, the weight of the aircraft given by the model was 449 lbs less than measured. First, the model was updated to correct the amount and distribution of mass. Examination of core samples indicated that two additional composite plies needed to be included in the main cabin area. IN addition, weight was added to compensate for paint, rivets, epoxy, and concentrated masses. Finally, the thickness of each ply was increased to account for numerical error in measurement. The updates added the necessary weight.

Parameters which defined the structural stiffness were modified to produce better agreement between model and measured frequencies. Namely, the elastic constants he composite were changed to more accurately reflect the values found in the literature. The mass and stiffness updates produced a model which predicted the natural frequencies measured in the laboratory.

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TIGER MANE: Thermally-Induced Gradient Effects Research, Model Analysis and Nontransferability Evaluation

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When wind tunnel measurements are made at non-ambient temperatures (e.g., at the National Transonic Facility), temperature differences on the measurement balance cause a strain that affects the measured load on the model. The strain from the thermal gradient affects all six measurements but its greatest impact is on the axial force (drag) measurement. (Current NTF balances have uncorrected thermal effects of approximately 1% of the full scale component load.) Correction of the thermal gradient effects requires a timely and expensive conditioning process. The goals of this program are to (a) understand the physics of the thermally-induced strain and its subsequent impact on load measurements and (b) develop a robust thermal gradient compensation algorithm. The net effect will be more accurate and precise data, more efficient use of the NTF, and an overall cost savings to NASA.

One part of the TIGER program is a Model Assessment and Nontransferability Evaluation (MANE). The goal of MANE is to determine the model for how the temperature gradients affect the strain measurements. In addition, it is important to understand why a model that works well for lab data does not work well when an aircraft model is on the balance (transferability evaluation).

The first step was to evaluate a wide assortment of mathematical models to determine how combine the (nine) temperature measurements into a prediction of the output of the axial force. Several models were considered: linear, sin, exponential, natural log, 2nd order models and several autoregressive moving average (ARMA) models which take into account past data samples. The ARMA models worked great but are impractical to implement in real-life wind tunnel applications because they would also cancel out a constant applied force. Hence, after considering 14 different models and almost 11,000,000 test cases, we determined a linear combination of temperature sensors gives the best approximation of axial force output.

Data analysis from a standard balance with nine temperature sensors does not lead directly to an applicable thermal gradient compensation algorithm. Thus, physical affects of thermal gradients were considered. From the physical affects, two possible compensation techniques have been determined. The first technique, the front-back technique, determines the impact on the axial force output of a thermal gradient from the front of the balance to the back. (A similar analysis shows that left to right thermal gradients will have no affect on axial force output). The resulting front-back thermal gradient equation gives a clear technique to correct for the gradient once certain key temperatures are known. The second technique, the thermomechanical technique, looks at how thermal gradients will affect the flex beams on the balance. For the simple gradients considered, there is a large difference between how the flex beams deflect when subjected to thermal gradients versus when they are subjected to an applied force. Monitoring the flex beams, therefore, could lead to a thermal gradient compensation technique. To verify these techniques, data from a special research balance must be obtained.

Utilizing Fiber Optics as a Methane Gas Sensor
Impartially the Effects of Methane on the Fiber Cladding

364362

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One reason to measure the level of methane gas is to ensure that the level of gas is not in the explosive range. A second reason to measure the level of methane gas is to ensure the level of gas is not at a level that causes the depletion of oxygen for sustaining life. The present methods of measuring methane gas are using an electrochemical cell or measuring the change of resistance caused by the heating of a noble-metal filament or catalyst bead. The heating is caused by catalytic combustion of a methane-air mixture. Since methane is an explosive gas the instruments used must meet certain criteria for intrinsically safe operation. With the utilization of fiber optic sensors we take advantage of its intrinsically safe characteristics. The mining and petroleum production, land fill monitoring, and waste water treatment plants requires methane gas detection. The detection of the build up of methane gas in utility man-holes and ship voids is required.

A literature search revealed that there is on-going research in the utilization of fiber optics for the sensing methane gas. The following is a list of methods used to sense methane gas using fiber optics.

1. The absorption band method that uses a 1660 nm wavelength source passing through a chamber where the methane gas has been collected. The light intensity detected determines the amount of methane gas.
2. The evanescent wave spectroscopy method is when a section of cladding is removed to access the evanescent wave. When this area is exposed to methane gas the evanescent wave intensity is disturbed. This disturbance produces a modulation in the intensity of the core light.
3. One sensor method uses a sol-gel layer covering an uncladded fiber. The sol-gel is a derived porous glass coating that absorbs methane gas and causes a change in the refractive index. This causes a change in the intensity of the light in the core.
4. Another sensor method uses a sol-gel layer covering an uncladded fiber. The sol-gel layer absorbs methane gas and causes a disturbance of the intensity of the evanescent wave. This disturbance produces a modulation in the intensity of the core light.
5. The fluorescence method applies a polydimethyl siloxane with a fluorescent dye that has been dissolved and is used as the cladding of an optical fiber. The cladding is illuminated by wavelength within the excitation range of the dye. The cladding of the fiber fluoresces. Some of the fluorescence is coupled into the fiber core by the evanescent wave of cladding fluorescence. In the presence of a gas the fluorescent emission of the dye is reduced causing the light detected to be reduced.

The literature search revealed two areas of concern in the application of fiber optics for sensing methane gas. One, the response time to the detection and change in the quantity of methane gas and two, the sensitivity to the lower levels of methane gas. Work is being done on the development of a more stable LED operating at 1640 nm and 1660 nm wavelengths and a DFB laser operating at 1650 nm wavelength.

SINGLE SCAN

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Identification of Large-Gap Magnetic Suspension Systems

521-37

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This investigation focuses on study of a new linear system identification method to provide state space models of magnetic suspension systems. The Large Angle Magnetic Suspension Test Fixture (LAMSTF) has been assembled by NASA Langley Research Center for a ground-based experiment that will be used to investigate the technology issues associated with magnetic suspension at large gaps, accurate suspended-element control at large gaps, and accurate position sensing at large gaps. This technology is applicable to future efforts that range from magnetic suspension of wind-tunnel models to advanced spacecraft experiment isolation and pointing systems.

In this project, the accuracy of the system model during the identification process for dynamics systems under closed-loop operation is first studied. The simulation results show that most of the model error comes from the approximated system description by using a finite difference model which is called the auto-regressive with exogeneous input model. Then a residual whitening method is proposed to improve the model accuracy. An iterative procedure for minimizing and whitening the residual of the auto-regressive moving average with exogeneous input model is provided. By using residual whitening approach, one can enforce the optimal properties of Kalman filter for a finite set of data, the residual of the identified system and observer is minimized, orthogonal to the time-shifted versions of itself and to the given set of input-output data, and the requirement of model order can also be reduced. Although the iterative procedure can be used for whitening the residual, the computation cost is increased.

Numerical simulations of the LAMSTF system show that this new identification algorithm generates small modeling errors for linear stochastic systems corrupted by system disturbances and measurement noises.

**Implementation of Geographic Information Systems for
Air Combat Command Bases**

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Geography and spatial data are playing an ever-increasing role in our evolving information society. Participation in the National Spatial Data Infrastructure initiative, adherence to applicable standardized formats, and appropriate management/leadership are issues facing all agencies. Geographic Information Systems (GIS) are tools which have the capability to store and manipulate large amounts of geospatial data, allowing quick retrieval of information, analysis of various databases, and a graphic display of results.

The development of GIS applications to meet the specific needs of Air Force bases is a means to implement base-wide GIS use. Technical support by NASA is enhanced by cooperative agreements with local universities. The inclusion of universities benefits the government by (1) providing cost reduction as contract work is reduced, (2) obtaining high quality work performed by students in educational programs tailored to meet the needs of cutting-edge technology, (3) cultivating labor resources as trained students enter job market, and (4) encouraging civilian support in developing and maintaining data when military personnel relocate. As federal budgets are cut and military bases are undergoing downsizing, it is important to develop new procedures for work.

Moody Air Force Base and Valdosta State University in south-central Georgia are the prototype for this project. The Moody/VSU model has been coordinated through NASA's GIS Team and Air Combat Command. Over the past year, the natural resources and infrastructure of Moody AFB have been integrated into a GIS, and a designated GIS lab has been established at the University. Currently, students and base personnel are collecting data utilizing global positioning systems (GPS) to correct and update the GIS databases. This is a valuable initiative which may also prove beneficial to other bases and NASA centers.

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Modeling the Dynamic Crush Behavior of Composite/Foam Sandwich Structures

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The dynamic failure response of two composite/foam sandwich structures was investigated. The two structures were a plate in 3-point bending , and a cylinder crushed under axial loads. Both structures were fabricated with fiberglass/epoxy skins and rigid, closed-cell polyurethane foam cores. The objective of the work was to determine how well these structures could be modeled using a 3-d, non-linear, dynamic finite element analysis package. Particular attention was paid to available models for describing the mechanical response of structural foams.

Specimens were fabricated and tested to determine their load/deformation behavior. These response curves were compared to those generated by the finite element analysis. It was found that while the finite element analysis cannot accurately predict the peak loads in the structures, the sustained crushing load was predicted reasonably well. Suggestions were made for more accurately predicting the peak loads in the future.

**Characterizing Digital Library User
Behavior from the NASA Technical
Report Server Logfiles**

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Introduction

This study characterizes the behavior of the users of the NASA Technical Report Server (NTRS), a Digital Library providing Scientific and Technical Information both within NASA and the research community throughout the world. During the months of June and July 1998, programming scripts were written to cull data from the systems log files that focused on user searches. Analysis of this data provides insight into the growth in use, the relative utilization of the several collections accessible, search string complexity and how the user is finding this report server.

Study Objectives

The NASA Technical Report Server is a World Wide Web report distribution and NASA technical publication service facilitating over 40,000 searches per month. As a Digital Library, NTRS is also interesting because the user has the option of searching several Wide Area Information Server (WAIS) databases simultaneously, attaching to several distributed servers. The design considerations for optimizing NTRS search time are described in Nelson and Maa (1996). Our goals in this study were to follow on their work by profiling the NTRS users' search behavior some number of months after that design was implemented.

Background

Digital Libraries and their evaluation are still in their infancy and understanding Digital Library use poses socio-technological challenges. There are further difficulties in observing user behavior in systems that use the World Wide Web for access and distribution. Principle among these is that the stateless nature of the protocol means that there is no clear demarcation within the log file of a session. Further, the user is not identified since only the names of the computers used are captured.

Nonetheless, the wide geographical distribution of NTRS users renders their direct observation in a short timeframe neither practical nor economically feasible. More importantly, the analysis of logfile data is not intrusive thus eliminating any user-experimenter interaction bias.

Methodology

This report drew on data covering June 1994 through June 1998. The data for two months (April 1996 and October 1997) were not available and were dropped from the analysis. Data was merged in instances in which there was a change in the logging used in NTRS.

UNIX and Perl programming scripts were created to select log records of NTRS searches, edit fields containing the search phrases, configuration of databases used, and the top and next domain names of the host used. Analysis included frequency of search modifiers, the distribution of the number of search words, the distribution of the number of data bases searched, and an alphabetized list of the search phrases and their frequency.

Results

1. NTRS searches increased twelve fold (from 2,556 to 32,411).
2. Use of quotes, parentheses, "OR", and "NOT" qualifiers were light but use of the "AND" qualifier was much more frequent.
3. Most search phrases are short: one-third were one word searches, another third had two words and a fifth had three terms.
4. When launching an NTRS search, the user has the option of using the default databases, deselecting these or selecting others. Most searches utilized these default collections. A number used only one of these databases, suggesting a knowledgeable user. But a number also used all of them, suggesting very little knowledge of what the collections contain.
5. Of the domain names, not weighted by frequency of use, forty percent were commercial, and ten percent were governmental or educational. As might be expected, heavy users included Boeing, Northrop, Rockwell, TRW, NASA itself, Georgia Tech, MIT, University of Maryland, and Stanford University. It is interesting that twenty percent were networks and thirty percent were other domains, mostly foreign countries. This fact, plus the heavy use by AOL and CompuServe suggests that NTRS now has a wider and, indeed, a global audience.

Reference: Nelson, Michael L. and Ming-Hokng Maa (1996). Optimizing the NASA technical Report Server, Internet Research: Electronic Network Applications and Policy, v6, n1, 64-70.

STI Information System Migration to SGML

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535-82
APR 5, 1997
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NASA Science and Technical Information (STI) Program "provides ready access to over 3 million aerospace and related citations" (<http://www.sti.nasa.gov/>). Due to the recent information explosion, STI program must capture and disseminate STI appeared in different forms and scattered over many disparate information systems internal or external to the Agency. In order to maintain the vast wealth of scientific knowledge throughout the years and years to come, the Standard Generalized Markup Language (SGML. ISO 8879), a platform-independent document/citation standard would be the perfect technology to utilize to assure citations' longevity, integrity, reusability and exchangeability. SGML and its related standards (XML, HyTime, STEP, CGM) can also capture all non-traditional STI and make citations easy and cost-effective to maintain, and easy to access and navigate. SGML and its related standards can also make the information systems to be more agile in accommodating continuing technological innovations, future demands and new citation usage.

The research activities included:

- Gathering background information on STI publishing systems, guidelines and practices;
- Studying current STI archiving operations;
- Analyzing current systems and practices;
- Recommending a specific plan which can help increase the utilization of STI and outlines the strategy to smoothly migrate the current system to a non-intrusive, SGML-based document management system;
- Documenting the findings in two internal reports;
- Presenting findings to STI Program Office and ISSD Division Office.

We concluded that NASA STI program could benefit from utilizing the now maturing and cost-effective SGML technology to streamline STI processing and make STI more accessible and useful to the public.

Autoparametric Control of Helicopter Ground Resonance

381569

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This research focused on using autoparametric absorbers and saturation control to suppress helicopter ground resonance. In virtually every helicopter, ground resonance instabilities are eliminated by incorporating lag dampers in the rotor design to dissipate the energy transferred to the lag motion of the blades when the regressing cyclic lag and rigid-body fuselage modes coalesce. In addition to the blade dampers, it is frequently necessary to incorporate dampers in the landing gear of the aircraft, in order to obtain sufficient energy dissipation. The benefit of replacing the blade-mounted lag dampers with autoparametric absorbers would be to significantly reduce the weight and drag penalty associated with the dampers.

In this investigation, the equations of motion used to model ground resonance were based on the classical equations derived by Coleman and Feingold. Only the minimum number of degrees of freedom were retained, including fuselage longitudinal translation, rotor cosine cyclic lag and rotor sine cyclic lag motions. Three absorber equations were then appended to the ground resonance equations, one for each degree of freedom; and they were coupled to the fuselage equation with quadratic nonlinear terms. The design of the absorbers required an analytical solution of these six, simultaneous, nonlinear, ordinary differential equations. The method of multiple scales was used to obtain the solution.

Obtaining a solution for the equations, and therefore a design for the absorbers, presented difficulties not previously encountered in applications of this type of absorber. First, because of the Coriolis coupling between the rotor lag degrees of freedom, there is no set of principal coordinates that will result in a set of uncoupled natural modes for the system. Second, because of the comparatively large number of equations needed to model ground resonance and the absorbers, the solutions of the equations became very complex and cumbersome.

The solutions of the first-order equations were obtained quite easily, since the rotor equations were not coupled to the three, independent absorber equations. However, the analytical solutions to the rotor/fuselage equations were extremely complex. The solution of the second-order equations presented some difficulties that have yet to be resolved. The fundamental question is how to represent the natural rotor/fuselage modes in the absorber equations. It would be easier to make the coupling implicit by introducing three modal variables, but this approach might not lead to an adequate consideration of the coupling in the second-order solution. The alternative leads to a very complex set of equations. In short, additional work will be required before an adequate design for the absorbers can be obtained.

Stereolithography In Electronics

By

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The electronic instrumentation and development section focused on investigating a method of transforming a conceptual design to an electronic part or model quickly. One proposed approach to this method was the use of stereolithography (SL).

SL uses a photocurable liquid epoxy resin as a building material. To build the part, a low-powered laser was navigated in the shape of the model as directed by a computer aided drawing file or .STL format. The .STL data used webbing of polygons to approximate the part. The laser etched or pre-cured a two-dimensional cross section onto the top layer of resin which yielded a slice. The slice distance was used to lower the part into the vat (usually around .004"). A blade was then passed over the surface of the part to sweep the liquid smooth. The laser moved on to the next slice of the part until the model was formed. Consecutive layers were cured into preceding layers by setting the "cure depth," thus providing a dense prototype.

This investigation was also concerned with eliminating the need to substitute axial lead resistors or capacitors for microelectronic surface mount components. Due to their size, these axial lead parts are used in prototyping circuits rather than the microparts. Through SL, it was possible to design a part for prototyping microelectronic surface mount components. Unlike other models which are often built in inches, the microelectronic part had to be built in thousandths of an inch. Some features of the microelectronic part are only .022 of an inch high. This is a concern when the slicing by the stereolithography machine is in increments of .004 of an inch. The part has to be built in multiples of .004.

SL allowed us to evaluate the part's feasibility, manufacturability and aesthetics, while the model was being built. We were able to test for external loadings, torsion, tension and pressure of the electronic part in the prototype environment. The results of this investigation found that SL has a role to play in microelectronics.

SINGLE SCAN

TURBULENT JET IN A COFLOWING STREAM

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The testing of aircraft models in a wind tunnel is a mature technology at Langley Research Center. However, the issue of mixing the fuel and an oxygen rich stream in the 8 Ft High Temperature tunnel is not quite resolved. There are many approaches that can accomplish the task (mixing a hot and cold fluid), but several of those schemes are not suitable for this unique testing facility.

Therefore a theoretical investigation is underway to develop a model of a two dimensional turbulent jet in a coflowing stream. This incompressible jet flow will be modeled by employing an integral method which includes turbulent shear stress, entrainment and heat transfer. A commercially available computation fluid dynamics (CFD) code is being used to test the theory since experimental data will not be available from the tunnel.

Essentially, one would like to predict the heat transfer to the wall as a function of the jet proximity to that wall, given the size, velocity direction and energy level of the jet.

Hyper-X Research Vehicle Stage Separation: Mach 7 Time Accurate Viscous Computations

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With the present interest in aerospace planes, considerable effort is being devoted to the development of propulsion systems that would power these vehicles. Among the proposed engine systems, scramjet engine (supersonic combustion ramjet) has been expected to be applied as the propulsion system. NASA's hypersonic technology program Hyper-X, has been initiated to elevate scramjet powered hypersonic technology readiness (TRL's) from the wind tunnel to the real flight environment, the last stage preceding prototype development. The program is now concentrating on Mach 7 vehicle development, verification and validation and flight test risk reduction. The desired test condition for the hyper-X in free flight is a dynamic pressure of 1000 pounds per square foot. The research vehicle will be boosted to approximately 95,000 feet for Mach 7. Following drop from the B-52 and boost to the predetermined stage separation point, the hyper-X research vehicle will be ejected from the booster-stack and start the programmed flight test. The stage separation will resume with the ignition of the explodable rivets fastening the vehicle to the arm. Then the arm will swing down about the hinge connected to the Hyper-X Launch vehicle leaving the research vehicle free and air-born at the desired flight speed.

CFD computations and experimental data with the drop-jaw adaptor at several rotation angles predicted significant interference on the hyper-X research vehicle during stage separation. Several dynamic simulation of hyper-X stage separation have been presented using time accurate inviscid computations. However, an adequate prediction of this unsteady hypersonic flowfield should include viscous effects. The focus of this study is to perform dynamic simulations of hyper-X stage separation to assess viscous effects on the transient forces and moments and to compare with the inviscid results. The unstructured grid solver, Rampant, is used to perform the steady state and time accurate analysis. Results for MACH 7 steady state and time accurate inviscid and viscous computations with fixed 0.5 inch cavity openings are presented in this study.

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**Organizing and Analyzing LIDAR Data Obtained from
the Contrails of a Boeing 737**

530-45

1703.0627

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With the production of the High Speed Civil Transport (HSCT) , which will fly in the stratosphere, comes a need to monitor the emissions from these aircraft. With the presence of the ozone layer at the top of the stratosphere, it is important to study the composition and evolution of these emissions as well as the circulation of these emissions throughout the stratosphere to understand their impact on the stratosphere and the ozone layer. In experiments carried out in 1995, 1996, and 1997, a 48 inch zenith Lidar (Light Detection and Ranging) system and a scanning Lidar system were used to detect the backscatter radiation from the contrails of a Boeing 737 jet aircraft as the plumes were advected across the Lidar systems. Radiation at wavelengths of 1064 nm and 532 nm was used on the 48 inch system. Only radiation at 1064 nm was used on the scanning system. This data needs to be processed and organized into a uniform format since the formats changed over the three years due to better ways to acquire and store the data. Also, for some runs, two lasers each running at 10 Hz were interleaved to generate 20 Hz data. Methods for correctly interleaving the two laser signals will be studied. The data then needs to be posted to the Web to make it available to the scientific community. Analysis of this data will include calculating the ratio of the 532 nm return to the 1064 nm return. This will be referred to as the beta ratio since it is essentially the ratio of the backscatter cross sections (typically symbolized using the Greek letter beta) for the two wavelengths. Since small particles will scatter 532 nm radiation more efficiently then 1064 nm radiation a large beta ratio could be indicative of regions of small particle formation which could indicate interesting chemistry within the plume region.

New Out-of-Core Capability For Large-Scale STAGS
(Structural Analysis of General Shells)

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General flow charts for STAGS computer code is briefly described. Important and major time consuming subroutines of STAGS finite element code are identified. A new, Out-of-Core, symmetrical, positive/negative, Sparse Equation Solver (OOC_SES) has been developed, tested and “loosely” integrated into the STAGS code.

Theoretical aspects of our newly developed OOC_SES subroutines are explained (with sufficient details). Two (2) structural mechanic examples (with 486, and 640332 degree-of-freedom finite element linear static models) are used to demonstrate potential benefits of having STAGS’ new sparse out-of-core capability for LARGE-SCALE finite element solutions on different computer platforms (from personal computers, and/or workstations to supercomputers with parallel/vector processing capabilities), especially on the readily available workstations (Mushu, Simba, etc...) at NASA LaRC Structural Mechanics Branch.

Finally, suggestions for further improvements of STAGS’ out-of-core capabilities for other important solution options (such as nonlinear statics/dynamics, vibration, buckling, multiple load cases, etc....) will also be presented.

Steve Dean

The Idea Nobody Wanted

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July 30, 1998

ABSTRACT

My ASEE fellowship involved producing, writing and hosting a 27-minute video documentary called *The Idea Nobody Wanted*. The show is intended to document one of Langley's major contributions to NASA in honor of the agency's 40th anniversary this October.

The Idea Nobody Wanted centers on the concept called Lunar Orbit Rendezvous, which was developed at the NASA Langley Research Center. This controversial idea turned out to be key in putting a man on the moon in 1969. The documentary tells the story of the scientists at Langley, headed by Dr. John Houbolt, whose courage and unwavering convictions played a major role in one of the most important historic events of the 20th century.

Auburn University historian Dr. James Hansen states, "Thousands of factors contributed the ultimate success of the Apollo lunar landing missions, but no single factor was more essential than the concept of LOR." George Low, the engineer who oversaw the development of the Apollo program said: "It is my opinion to this day, that had the Lunar Orbit Rendezvous mode not been chosen, Apollo would not have succeeded." Low went on to say that John Houbolt's work in fighting for the LOR concept "was a major contribution to the success of Apollo and, therefore, to the nation."

The documentary is completed and will be initially shown at Langley, then forwarded to NASA headquarters in time for the anniversary celebration. The show also will be submitted to the Discovery Channel for a national broadcast. Should it be accepted, it will air next year in honor of the 30th anniversary of the first manned lunar landing in 1969.

INTERFACE PROPERTIES OF MEMS SENSORS ON AIRFOIL

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One of the primary goals of wind tunnel groups at NASA Langley Research Center is to reduce wind tunnel cycle time and cost while improving data quality collected during the tests. The objective of the Advanced Model Instrumentation Technology (AMIT) program is to develop a prototype in-model instrumentation system that can be retrofitted into existing models or integrated in new models at the time of their design. The program has three major components: 1) Micro Electro Mechanical Systems (MEMS) sensors (shear stress, pressure, temperature and Angle of attack). 2) In-model electronics (Data acquisition systems and signal conditioning). 3) Data transfer capabilities (Fiber optic or telemetry).

MEMS sensors are micron-to-millimeter scale devices with moving parts or containing fluids, fabricated using semiconductor technologies and often directly connected or integrated with ICs. MEMS Sensor Design covers three areas: 1) Layout and process of the sensor itself. 2) Circuitry for interfacing the system with the sensor. 3) The package that will fit the MEMS sensor into an application. The purpose of this study is to characterize the mechanical interface of MEMS sensors mounted on the surface of the model and test the packaging design under simulated conditions (normal stress, vibration, etc...). The study included two types of MEMS sensors, namely pressure sensors and shear stress sensors. A measurement system was developed for characterizing the sensors under normal strain and at different temperatures. Each sensor was mounted on a specially designed cantilever beam that has a maximum strain of 1000 micro in/in. The output voltage of the MEMS pressure sensor was measured as a function of applied static pressure and the strain on the beam (at different temperatures). The resistance of four different resistors on the shear stress sensor was measured as a function of the strain on the beam (also at different temperatures). The resistance of four different resistors on the shear stress sensor was measured as a function of the strain on the beam (also at different temperatures). Results of the experiment show that change in the output voltage of the pressure sensor due to strain is < 80 microvolt and is $< 0.1\%$ of FSO. One can conclude that the strain on the beam has minimal effect on the output of the pressure sensor. Resistance values of the shear stress sensor's resistors increase with the increase in strain. More measurements need to be done to further characterize the relationship between shear stress sensor output and strain on the airfoil. Future studies also may include the effect of pressure and temperature on shear stress sensors.

Single Send

**Storage Area Networking
at ASD, NASA Langley Research Center**

*534-62
ADS ONLY*

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ABSTRACT

The project was to study different technologies available on the market in Storage Area Networking. Six different options were studied. They are:

1. Fibre Channel Arbitrator Loop (FC-AL)
2. Switched Fabric (Fibre channel network with switches)
3. Gigabit Ethernet
4. Hippi-800 (Serial Hippi with Fibre channel)
5. Hippi-6400 (GSN)
6. ATM

The existing storage area networking consists of two SGI storage devices, two Sun storage devices and 11TB tape drive for archival purpose. The existing optimal transfer rate between different storage area is 9MBps. Due to increased demand of the users and 10 to 50 fold expected increase in data storage, the desired optimal rate of data transfer is about 100MBps. Two vendors made the presentation and one of them, DataDirect, installed the net working for trial basis. Other vendor ODS/ESSENTIAL is also planning to install their networking equipment in a near future for trial basis. Based on findings and comparisons of above technologies with respect to transfer rate and cost, a conclusion was reached that either Switched Fabric or the Hippi-800 was the best storage area networking solution for this installation.

THUNDER-MICROPHONE, THUNDER-SPEAKER

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This investigation focuses on the study of a new application of Thunder as a highly sensitive microphone and speaker. The microphone will detect the voice from the neck area, and the speaker will provide a full range of audio frequency. Thunder, a new piezoelectric device, is based on a piezoelectric ceramic wafer attached to a metal backing using a polyimide adhesive. The ferroelectric material used in the manufacture consists of a piezoelectric wafer laminated between layers of materials such as aluminum, stainless steel, beryllium, ect., bonded with a soluble imide adhesive created at NASA. In this manner a more durable and more flexible actuator is obtained. Two clear advantages of this new piezoelectric device class over others are ease of fabrication and the ability to create application specific device.

The first phase of the project dealt with designing a highly sensitive linear prototype multi-stage amplifier system. This system will then amplify extremely small signals that are generated from Thunder due to displacement that is caused by voice. A prototype optical transmitter and receiver was also designed for long distance transmission. The receiver system had to be highly sensitive in order to drive the Thunder speaker.

The second phase of the project was to construct a Thunder that is able to detect a voice (mic) and reproduce the voice (speaker). The characteristics of Thunder in terms of displacement and signal generation are dependent to dimensions, geometry, and fabrication process of their adaptive materials.

The final phase of the project was testing the complete prototype system. The results of the study indicate the system can efficiently replace the conventional sensitive microphone and speaker, while reducing cost and increasing performance.

SMALL SCAN

**Paving the Way for the Wind Tunnel Enterprise
at NASA Langley Research Center**

364/385

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536-09 1P
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The Wind Tunnel Enterprise (WTE) at Langley Research Center (LaRC) is a virtual organization comprised of nine Divisions: Aero- and Gas-Dynamics, Facilities & Systems Support, Experimental Testing Technology, Facility Systems Engineering, Information Systems and Services, Fabrication, Fluid Mechanics and Acoustics, and Structures. Wind tunnel facilities within the WTE include the National Transonic Facility and the 0.3M Cryogenic Tunnel. The WTE was envisioned as an organization that would apply business-like principles to its operations and the way in which customers are handled. Strategic planning for the WTE was based upon the cooperative efforts of customers, stakeholders, and producers/ operators of LaRC's wind tunnels. Due to intense global competition, external customers of the wind tunnels had voiced concern that the test cycle time was too long, which delayed the time for new products to reach the market. They were also concerned about the quality of data that they were receiving. Concerns of internal customers were also taken into consideration.

WTE's mission is to "provide reliable, accurate research information to the aeronautical community in a timely manner. To accomplish this requires a focus on increasing productivity, cost-effective operations, technical support that adds value, and the development of new facility capability and test techniques." There are many technical, operational, cultural and management goals for the WTE. These goals are designed to enable the WTE to have a positive influence on the bottom-line; namely, increased productivity, data quality, customer satisfaction and employee satisfaction, and decreased cost and cycle time. A major component of the WTE is the proposed Wind Tunnel University (WTU). WTU was the focus of this project and is linked to the WTE cultural goals. The project involved creating a framework for the identification of core competencies (i.e., Tunnel Operations and Wind Tunnel Information Technology) and associated skills through involvement of the WTE Curriculum Committee and interviews with LaRC administrators, researchers and technicians.

A Gap Analysis Survey was designed to examine gaps that exist between the skills of WTE employees today verses those that are needed. The survey was fine-tuned through use of an electronic meeting with researchers and technicians who are subject matter experts. The survey will be administered through a Web site designed to assure anonymity to individual respondents. Future skill requirements due to cutting edge technologies and those on the horizon will also be identified. Results will provide a snapshot view of the state of the WTE today in terms of employee skills and will suggest the types of training needed. Experts' descriptions of the skills will be used to develop a course catalog for WTE training at LaRC. Metrics will be created to measure the success of each training program. The WTU will serve as a national model for wind tunnel training and is projected to serve outside customers and government agencies in the future.

Integrated Financial Management Project (IFMP)

Training Needs Assessment

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To improve productivity and efficiency of its business and financial operations, NASA has initiated IFMP with the goal of developing and implementing an Integrated Financial Management System (IFMS) that is in compliance with the Federal Joint Financial Management Improvement Program (JFMIP) requirements. The IFMS will be an Agency-wide standardized and integrated computer based system capable of supporting the financial management and business processes at each Center and Headquarters. The fundamental goal of IFMP is to improve the financial management and business processes within the Agency. In order to accomplish this goal, financial management and business processes must be standardized throughout the Agency. This will allow for an integrated computer application system to process financial and business information, permitting the production of current, accurate and timely financial reports for both internal and external customers. The proposed system is composed of seven modules – Core Financial, Budget Formulation, Time and Attendance, Procurement, Travel, Executive Information System (EIS), and Asset Management – which will allow for integration among and between the various financial and business processes. Training has a significant impact on the successful implementation and acceptance of the IFMS. The requirements include training the entire Langley civil service employee population at various levels, including system operations training and new financial management and business process training. The training responsibility for this major endeavor falls on KPMG as the Contractor providing the new IFMS and Langley's Training Office, as well as the Agency Training Team.

The goal of this project is to gather and analyze existing data about the training population and environment in order to assess the training needs and requirements necessary to support the successful implementation of the IFMS at NASA Langley Research Center. The objective is to develop a comprehensive Training Needs Assessment Document which will provide the IFMP Transition Team with an extensive overview of the training requirements related to IFMP. This document contains facts about IFMP at Langley, including implementation, process/function and user information and training requirements. A description of the various categories of employees that comprise the training population is provided to better understand the different training audiences and their relationship with IFMP and the new proposed system. Strategies describing the management of KPMG training by the Langley IFMP Training Team and various options for training the different categories of users, including resources, are presented and discussed. In addition, proposed employee and training data elements are recommended that would be needed to efficiently manage, schedule and track IFMP training activities.

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NASA Educator Workshop (NEW) Abstract

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This summer 20 K-12 grade teachers traded in chalkboards, hall passes, and dismissal bells for wind tunnel tests, flight simulators, and aeronautic-related briefings as they attended a 2 week NASA Educator Workshop (NEW). The objectives of NEW were:

- To share information about NASA resources, programs, and services.
- To provide an opportunity for the teams of educators to develop and implement an action plan that will support standards-based teaching and learning of science, mathematics, and technology in a problem-based learning (PBL) environment.
- To strengthen partnership with NASA by sustaining interaction and collaboration.
- To provide an opportunity for the teams to exchange ideas.

Problem-based learning is an instructional method using a real world problem also known as an ill-structured problem, as the context for an in-depth investigation. Most real life problems are ill-structured, as are all the really important social, political, and scientific problems. When students take ownership of the problem and are empowered to generate solutions, it is rewarding to watch the serious thinking that follows. The participants were immersed in two problems during the 2 weeks. During the first problem, they researched Space Science Missions and developed activities appropriate for future missions. A second PBL introduced week two also addressed NASA's strategic outcome to communicate widely the content, relevancy and excitement of its missions and discoveries to the general population. Further, the PBL scenario addressed the technological challenges being taken up by NASA.

With a "real" need-to-know problem facing them, the teachers set out to gather information and to better understand the problem using inquiry-based and scientific methods. The learning in these scenarios was driven by the direction taken by participants as PBL situations have no preconceived outcomes.

NASA and educators are alike in that both like to stretch the boundaries and prove that things that couldn't be done yesterday will be done tomorrow. With this mind-set, the NEW participants have picked up the challenge to immerse their next class of students in problem-based learning and NASA materials.

As a follow-up during the 1998-99 academic year, the NEW faculty will communicate with the participants through a newsletter. In addition, electronic follow-up sessions will be conducted to support teachers' efforts in developing PBL and the integration of technology in math and science instruction.

NASA Educator Workshop is funded by NASA Education Division and is a collaborative effort between NASA Langley's Office of Education and the National Science Teachers Association. Selected teacher teams were drawn from Langley's 5-state precollege service region, which includes Kentucky, North Carolina, South Carolina, Virginia, and West Virginia.

Detection and Measurement of Hidden Corner Cracks using a Portable NDI Probe

364388

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001567

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CL65E

Fatigue damage in aircraft structures increase as airplanes are operated beyond their economic design life, typically 20,000 flight cycles. Reduced durability and safety of these aging structures require elaborate inspection and maintenance to ensure continued airworthiness. Cyclic pressure tests on fuselage structures similar to those found on commercial airliners have enabled researchers to characterize the various forms of fatigue damage. These characterizations show the progression of fuselage skin fatigue cracks from the initial stages of multisite damage (MSD) through crack linkup and widespread fatigue damage (WSFD). Detailed tear down examination and fractography of the lap splice joints have revealed crack initiation sites, crack morphology, and crack linkup geometry. Results of these studies have allowed researchers to benchmark critical laboratory simulations, analytical predictions and advanced nondestructive inspection techniques.

Ultimately, the goal is to develop analytical models for estimating the fatigue life of aging structures subject some form of MSD. The quality of analytical models relate directly to types and sizes of cracks which characterize MSD. Although nondestructive inspection (NDI) provides excellent means for detecting flaws, results do not provide data on flaw sizes which are important for characterizing MSD. Generally, NDI results are used to determine the need for repair or to justify airworthiness. Consequently, field data on the sizes of flaws which may define MSD is lacking. The approach used in this investigation is to determine if MSD can be quantified using field data from NDI.

During experiments, data will be recorded for quarter-elliptical corner cracks grown from circular holes in 0.63 inch thick aluminum 2024-T3 specimens. After countersinking holes and riveting specimens to hide fatigue crack damage, a portable NDI probe will be used to detect hidden cracks and establish relationships between NDI results and known crack length data.

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200

APPENDIX VIII
PROGRAM ORIENTATION EVALUATION REPORT

1998 ASEE PROGRAM ORIENTATION EVALUATION REPORT
(Thirty-two Orientation evaluations were returned.)

1. Was the Orientation notification received in a timely manner?

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 11 (34%)
- 5 - Excellent - 21 (66%)

*omit to
EAD*

2. Were the meeting facilities adequate?

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 13 (41%)
- 5 - Excellent - 19 (59%)

3. Was the Welcome Package beneficial?

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 9 (28%)
- 5 - Excellent - 23 (72%)

4. How do you rate the Program Breakout Session?

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 14 (44%)
- 5 - Excellent - 18 (56%)

5. Was the information and knowledge gained at the Orientation helpful?

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 3 (10%)
- 4 - Good - 11 (34%)
- 5 - Excellent - 18 (56%)

6. In general, how do you rate this Orientation?

- 1 - Poor - 0%
- 2 - Fair - 0%
- 3 - Average - 0%
- 4 - Good - 15 (47%)
- 5 - Excellent - 17 (53%)

7. Comments:

• Need earlier break. • The refreshments should include something that is not "sweet". Fresh fruit or a few bagels would be nice. • I found the breakout session to be the key element in information flow - very useful. Procedure, as a newcomer, seems very efficient, a hallmark of quality and committed staff....Kudos for policy manual. • Earlier break and more information on parking. • It was difficult to see the television screen for the safety video. The continental breakfast is very nice, however, it would be good to include fresh fruit for those of us who do not enjoy donuts. • The Orientation is a necessary evil. You might consider starting 30 minutes earlier. How about a key to the Division acronyms on the Roster. • Many apartments listed didn't have available units; maybe more listings would be helpful. Lots of information, hard to keep track. • Welcome package..very extensive. The Orientation was detailed and useful. Helpful is the explanation of the abbreviations of Division names are included.

APPENDIX IX
POLICIES, PRACTICES, AND PROCEDURES MANUAL

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

1998

POLICIES,

PRACTICES,

and

PROCEDURES

MANUAL

A Handbook for ASEE SFFP Fellows

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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 10 weeks working with professional peers on research.

The ASEE program is administered by a collaborating university. Either a Co-Director from Hampton University (HU) or Old Dominion University (ODU), on alternate years, works with the NASA Langley Research Center (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, academia, 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 LaRC's Office of Education (OEd) in supporting and implementing your summer research program.

1.0 Definitions

1.1 ASEE Summer Fellow

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

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

1.2 Langley Research Center

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

1.3 ASEE Associate

An ASEE associate is the scientist, engineer, or other Program support person 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 OEd.

1.5 ASEE Administrative Assistant

The ASEE Administrative Assistant is a support-staff member who works closely with the ASEE Co-Director in the administration of the program, and acts 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 must have the concurrence of the appropriate associate. Any actions taken on the basis of verbal concurrence are not binding on the Co-Director unless followed by appropriate written authorization.

2.0 Accepting a Fellowship and Beginning Tenure

2.1 Notification of a Fellowship

You will be notified of your ASEE Fellowship by an official selection letter that states the conditions of your fellowship, information concerning your stipend, and the period of your tenure at LaRC which will be for 10 weeks.

2.2 Acceptance Letter

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

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

You **must** also return the completed Name Check Request 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) NASA Fact Sheet
- (d) Map of the Area
- (e) Directions to NASA
- (f) Housing Information
- (g) Travel Expense Form
- (h) Tentative Timeline
- (i) Activities Interest Survey
- (j) Federal Regulation Form

2.4 Working with the ASEE Associate

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

2.5 **Change of ASEE Associate**

If for any reason your assigned ASEE associate changes, you and the associate must notify the Co-Director immediately in writing. The change will not be effective until the Co-Director and OEd have concurred with the request.

2.6 **Conforming to Center Policies**

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

2.7 **Extensions of Tenure**

There will be no paid extensions of tenure. The only exception is at the **sole discretion and written approval of the Co-Director**. In order for him to consider an extension, he must receive a written memorandum submitted by the LaRC associate. This memorandum must outline the critical need for the extension well in advance of the program end date. At that point, the Co-Director will consider the request and may approve depending on funding availability.

3.0 **Stipend**

3.1 **Federal Funding Regulation**

*****Please Note: Fellows must understand that it is illegal to receive stipend or salary payments from other Federal funding sources including research grants and contracts while participating in a government-sponsored summer faculty fellowship. Failure to comply with this regulation may, at a minimum, result in termination of your fellowship. In addition, you may want to check the regulations at your institution regarding receipt of supplemental funding.*****

3.2 **Stipend Amount**

The amount of your stipend is \$1,000 per week. Stipends are paid on the basis of a 5-day, 40-hour work week; and are issued biweekly, beginning the third Tuesday of the ASEE program (actual stipend payment schedule provided upon arrival). Therefore, all ASEE Fellows should be prepared to provide for themselves financially the first 2 weeks of the program (Refer to Section 4.0).

3.3 **Acceptance Letter**

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

3.4 **Locator Form**

In the 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. **Once this form has been turned in, this office must be notified immediately if any changes are made.**

3.5 **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 Abstract, 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 if different from your permanent home address.

3.6 **Cashing Your Stipend Checks**

Nations Bank: Your stipend checks are cut from Nations Bank and you may cash it at any of their branches free of charge.

Langley Federal Credit Union (LFCU): LFCU offers check cashing privileges for a fee. 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 who is required to relocate their residence because their home/school address is more than 50 miles from NASA Langley Research Center. This is provided to assist in the additional expenses incurred in relocating to the Tidewater area. No receipts are required.

4.2 Travel Reimbursement

Fellows are reimbursed for their travel under the following terms:

- Round trip coach air fare (receipt required) or,
 - Round trip mileage up to the cost of coach air fare, maximum \$500.
- Meals and overnight accommodations are the Fellow's responsibility. The travel expense form provided in this package should be filled out and returned to the Administrative Assistant at the Orientation in order to ensure prompt processing. Both the relocation allowance and travel reimbursement will be provided at the next pay date following submission of your information if time allows.

5.0 Insurance

5.1 Health and Medical Insurance

It is the responsibility of the ASEE Fellow to have the appropriate health and medical insurance coverage. The ASEE program does not provide any insurance coverage. Experience has shown that coverage for you and your dependents is extremely beneficial. Unless you already have insurance coverage, you are advised to weigh carefully the cost/risk factor in reaching a decision to participate in this program.

5.2 Worker's Compensation Type Insurance

ASEE Fellows are not covered by any type of Worker's Compensation Insurance through the ASEE program. If injured while on duty, however slight, immediately notify your associate and the Co-Director at (757) 864-5215. Medical assistance is provided in the Clinic-Occupational Health Services Facility. Hours of operation are from 7 a.m. to 3:30 p.m. In any medical emergency, dial extension (757) 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 OEd nor HU withholds taxes from stipend payments to you. You will receive from the university, a form 1099

indicating your total stipend.

You should refer to the pertinent tax publications and plan ahead to meet any tax obligations, both federal and state, if applicable, and file your returns as required by Federal law. The responsibility for the payment of your income taxes rests solely with you. The OEd and 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 OEd nor HU withholds 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 10-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 effect is submitted by your associate, then time approved can be considered a part of your 10 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 10-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 **Lecture Series**

9.1 **Attendance**

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

9.2 **Distribution of Information**

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

10.0 **Activities Committee**

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

11.0 **Security**

11.1 **Security Requirements**

A NASA National Agency Check (NASA NAC) background investigation shall be conducted on all summer ASEE Fellows requiring access to LaRC and its facilities. Complete the NASA Form 531, Name Check Request, which is included in your Information Package, and return to the LaRC Office of Security at the address listed below prior to reporting to NASA LaRC. Complete the NASA Form 531, using instructions provided, and return same as soon as possible. To prevent delay in processing NASA Form 531, use your full name, to include middle name, and no initials. It is imperative that you include all information requested in order to prevent any unnecessary delays upon your arrival at LaRC. Even though you are not considered employed by NASA, if you had prior affiliation with LaRC or any other NASA Center, please note under "Employment" on the NASA Form 531. If you have access to a fax, the Form 531 may be faxed to the LaRC Office of Security at 757-864-8868; or mailed to NASA Langley Research Center, Attn: MS 450/Personnel Security-Office of Security, 100 NASA Road, Hampton,VA 23681-2199.

11.2 **Langley ASEE Summer Faculty Fellows**

On the morning of June 1, 1998, all Fellows are to report to the H.J.E. Reid Conference Center. When coming through the gate, tell the security officer you are an ASEE Fellow and here for the ASEE Orientation. They will have a list of Fellows to confirm your name and should instruct you to through the gate and to the Conference Center.

If a Fellow arrives on an alternate start date, he/she should report to the Badge and Pass Office at the Main Gate, Building 1228, 1 Langley Blvd., to obtain identification badges for access to LaRC facilities. **Please note: Before a badge can be issued, your Name Check Request Form 531 must have been in with all information being legible and accurate.**

Additionally, when reporting to LaRC, bring your driver's license for the

issuance of a vehicle pass. If the vehicle you are driving is registered to another party, a signed letter authorizing you to drive the vehicle will be required.

If additional information is required, feel free to contact the NASA LaRC Security Office at 757-864-3437/3535.

12.0 Safety

12.1 Safety Program

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

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

12.2 Hazardous Communications Training

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

12.3 Safety Clearance Procedures

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

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

12.4 Accident Reporting

Fellows shall immediately report all job-related accidents, injuries, diseases or illnesses to the supervisor and the Office of Safety, Environment and Mission Assurance (OSEMA), (757) 864-SAFE ((757) 864-7233). Also notify Ms. Young in OEd. Obtain medical treatment from the Occupational Medical Center, Building 1149, or call extension (757) 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 Center

13.1 Official Mail

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

Messenger envelopes are used to send mail internally. Before placing the envelope in the mail system cross out the previous name and Mail Stop, fill in the addressee's name and Mail Stop. Internal mail cannot 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 it 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, use state abbreviations, and zip code.
- Each piece of 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, 757-864-8159.

13.4 **Electronic Communications**

The LaRC telephone, fax, and electronic mail system is to be used for official use only. LaRC conducts random monitoring of telephone lines and all electronic mail systems for unauthorized use. If you have any questions, please call the Network Support Office at 757-864-7777.

14.0 **Library**

The Technical Library serves the information needs of the NASA Langley personnel with its Technical Information Specialists, information systems for user desktop access, on-site collection, and access to worldwide resources and databases. The library is aggressively dedicated to maximizing the desktop delivery of pertinent, customized information databases, products and services.

Currently the library holds a comprehensive collection of materials in both print and electronic formats, covering the areas of aeronautics, structures and materials, space science, atmospheric sciences, and management. This includes 70,000 books, 800 journal subscriptions, over 2 million technical reports and access to more than 500 commercial and government electronic databases. At present, the library's information systems include NASA Galaxie, an on-line catalog; a CD-ROM database network; Electronic Journals; NASA Research Connection (RECON); and current awareness services. Most of these are accessible through the Technical Library homepage located on the WWW at <http://library-www.larc.nasa.gov>.

To attain access to library services and computer systems, participants must be listed on the official American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program roster issued by the OEd. Basic services include loan of books and documents, access to the library's on-line systems, and literature searches by Information Specialists. ***ASEE participants must return all loaned materials to the library 2 weeks prior to the conclusion of the program. If materials are not returned, there will be a delay in receipt of the final stipend check.***

15.0 Cafeteria

15.1 NASA Exchange Cafeteria

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

15.2 Additional Items to Remember

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

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

15.2 Check Writing Policies

Maximum amount checks are cashed for is \$20. Participants must have a badge and obtain management approval.

15.3 Area Tickets Available

Discount tickets for Busch Gardens, Water Country, Kings Dominion, AMC Theaters, and Colonial Williamsburg can be obtained at the Exchange Shop in the Cafeteria. If you are interested in tickets, call 757-864-1585.

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 following locations:

H.J.E. Reid Conference Center (Auditorium, Langley, Hampton, and Wythe Rooms)
14 Langley Boulevard

Pearl I. Young Theater
5A N. Dryden Street

Executive Conference Center (Rooms 107, 205, & 209)
3 S. Wright Street

7 X 10 Facility - Room 200
17 W. Taylor Road

Call 757-864-6362 for reservations.

16.2 Picnic Shelters

There are two picnic shelters on the grounds of the Reid Conference Center that can be reserved for office picnics. For reservations, call 757-864-6369.

16.3 NASA Gym

The NASA Gym is open from 11 a.m. to 1 p.m. Tuesday and Thursday, and 12:00 noon to 1:30 p.m. Monday, Wednesday, and Friday. Also, there is a free aerobics class from 11:00 a.m. to 11:45 a.m. Monday, Wednesday, and Friday.

The Langley Activities Association sponsors Bingo on Thursday nights, a Social Hour every other Friday evening, and a dance every other Saturday evening beginning at 7 p.m.

16.4 LaRC-sponsored clubs:

Aerobics Club
Astronomy Club
Basketball League
Bowling League
Flag Football
Golf Association
Radio Model Club
Science Fiction Club
Tennis Club

Amateur Radio Club
Apiculture Club
Bicycle Safety Club
Conservation Club
Garden Club
Karate Club
Runners Club
Softball League
Volleyball League

16.5 Additional Information

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

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