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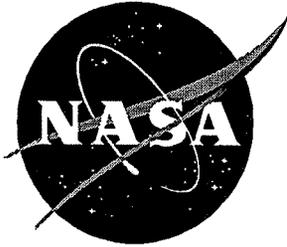
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1996 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program

Compiled By:

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SECTION 1

ORGANIZATION AND MANAGEMENT

The 1996 Hampton University (HU)-NASA Langley Research Center (LaRC) Summer Faculty Fellowship Research Program, the thirty-second such institute to be held at LaRC, was planned by a committee consisting of the University Co-Director, LaRC Staff Assistants (SAs) from the research Groups, and the Office of Education.

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

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

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

Each Fellow and Research Associate received a 1996 ASEE Policies, Practices, and Procedures Manual which clarified many commonly asked questions up front regarding the roles, responsibilities, policies, and procedures of both parties. This manual was very beneficial and will be updated annually to be used in the years to come (Appendix XII).

At the Orientation meeting, Dr. Samuel E. Massenberg, Director, Langley Office of Education, officially started the first day of the summer program by welcoming everyone to LaRC. He was followed by Mr. Edwin J. Prior, Deputy Director, Langley Office of Education, who introduced the Administrative Staff and presented an overview of Langley Research Center. The program overview was presented by Mr. Roger A. Hathaway, University Affairs Officer. A program breakout session was next on the agenda, enabling the ASEE administrative staff (Prof. John H. Spencer-ASEE Co-Director, and Ms. Debbie Young-ASEE Administrative Assistant) to meet with the 1996 Fellows to discuss

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

Throughout the program, the University Co-Director served as the principal liaison person and had frequent contacts with the Fellows. The University Co-Director also served as the principal administrative officer. At the conclusion of the program, each Fellow submitted an abstract describing his/her accomplishments (Appendix IX). Each Fellow gave a talk on his/her research within the Division. The Group SAs then forwarded to the Co-Director the names of the Fellows recommended within their Group for the Final Presentations. Seven excellent papers were presented to the Fellows, Research Associates, and invited guests. For the second 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 1995 fellowship appointments and were eligible to participate for a second year. Twenty-five individuals responded to the invitation and twelve accepted offers of appointment (Table 1). Fifteen applications were received from Fellows from previous years. Five were selected.

First Year Fellows

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

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

The average age of the participants was 42.6.

Table 1 - Distribution of 1996 ASEE Fellows by Year in Program
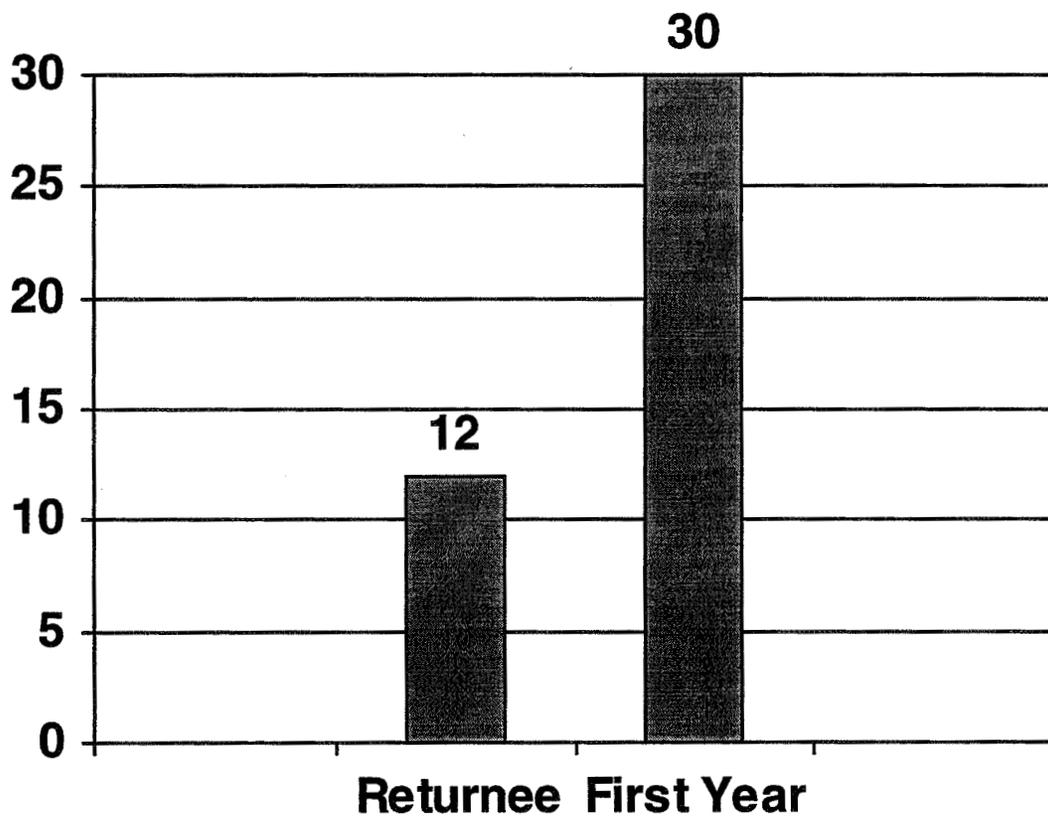
Table 2 - Distribution of 1996 ASEE Fellows by University
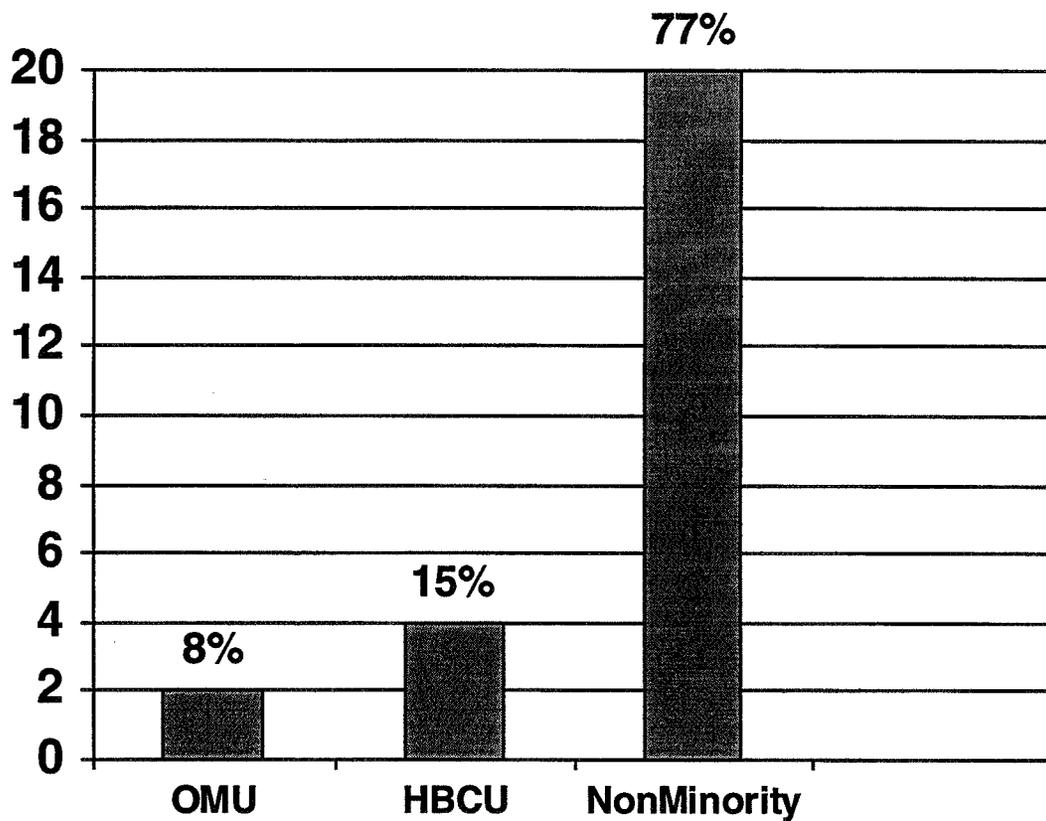
Table 3 - Distribution of 1996 ASEE Fellows by Selection
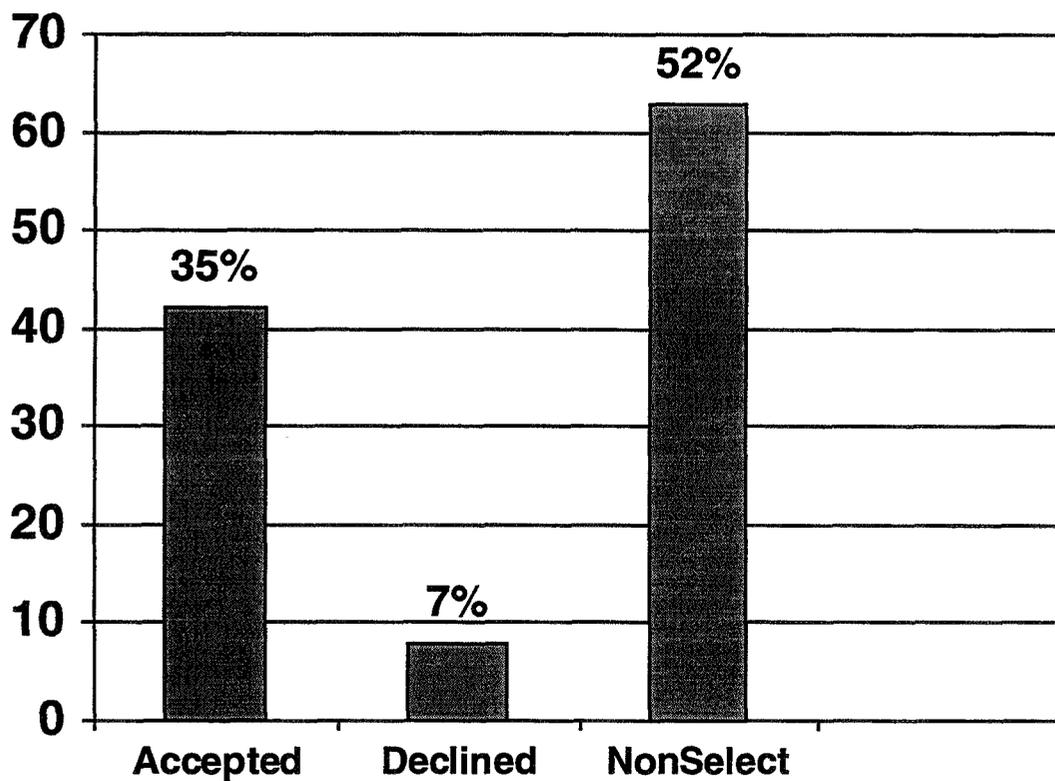
Table 4 - Distribution of 1996 ASEE Fellows by Funding
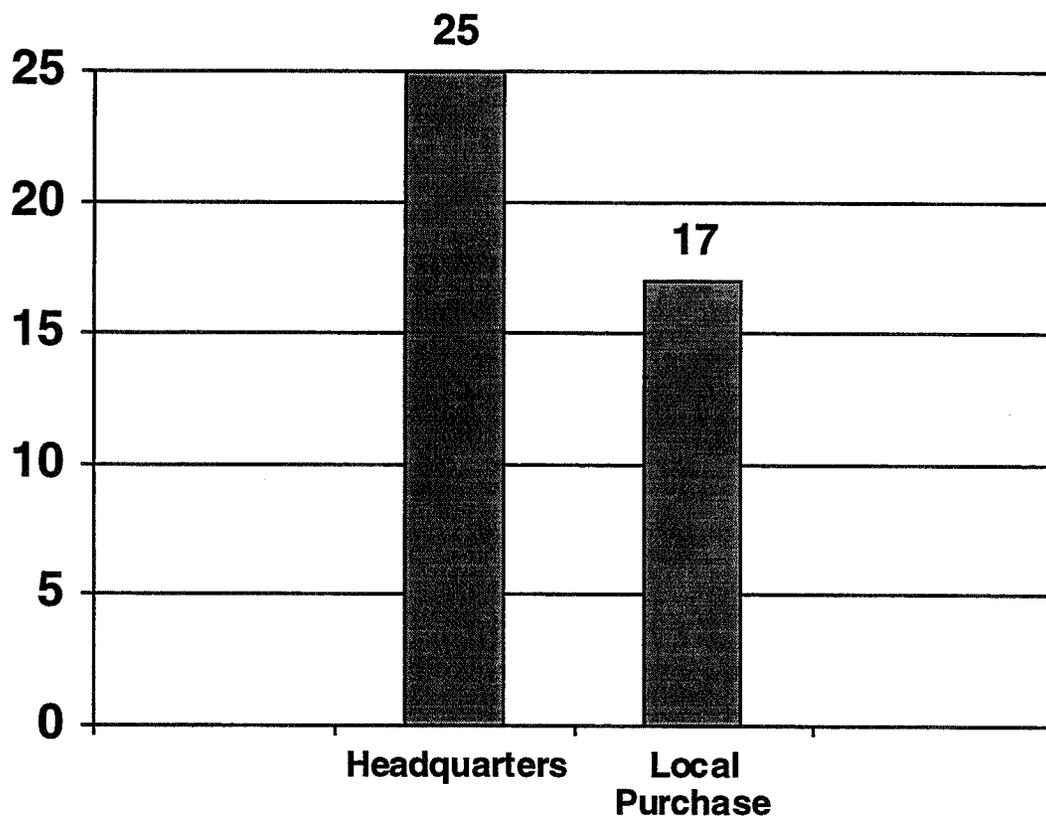
SECTION III

STIPEND AND TRAVEL

A ten week stipend of $10,000.00 was awarded to each Fellow. Although 57% of the Fellows indicated that the stipend was not the primary motivator in their participating in the ASEE program (up from 1995 with 39% and 52% for 1994), only 38% indicated this amount as being adequate (Survey-Section VI). This stipend still falls short of matching what most professors could have earned based on their university academic salaries. The decision to participate in the summer faculty research program clearly reflects the willingness of the Fellow to make some financial sacrifice in order to have the experience of working with NASA's finest scientists and researchers.

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

SECTION IV

1996 ASEE SFFP ACTIVITIES

Lecture Series

The Lecture Series this summer was extremely successful and well received. There was a total of seven lectures scheduled with one cancellation by The Honorable Robert Scott (D-3rd District), United States House of Representatives. Five lectures were given by distinguished Langley scientists and researchers and one was given by an invited guest speaker. Topics included Mission to Planet Earth, Globalization of the Aerospace Industry, and a SAGE III Overview with a Mock Russian Negotiation (Appendix II).

Interaction Opportunity/Picnic

An annual Office of Education Interaction Opportunity/Picnic was held on Wednesday, June 12, 1996, for the summer program participants, their families, and invited guests. This allowed for informal interaction between the Fellows, as well as, with the administrative staff. The participants were also given the opportunity to purchase T-shirts with an ASEE design by one of the summer students.

Proposal Seminar

A Proposal Seminar was held for the Fellows on Thursday, July 18, 1996. Dr. Samuel E. Massenberg, Director, Office of Education, presented an

overview of the proper procedures to adhere to in submitting an unsolicited proposal to NASA. The program covered both the NASA and university perspectives. This year, Mr. Thayer Sheets gave an extensive presentation on the Small Business Innovative Research program. For the second year, there was also a panel question and answer session. The panel members included Langley researchers who frequently review proposals that are submitted. This aspect of the proposal seminar was very well received. The most current .Research Grant Handbook was distributed. (Appendix XI).

Seminar/Banquet

On Thursday, July 25, 1996, a seminar/banquet was held for the Fellows and their spouses. The banquet took place at the beautiful Langley Air Force Base Officer's Club. ASEE end of the program information, certificates, and group pictures were presented to each Fellow at the banquet.

ASEE Activities Committee

As in the past, an ASEE Activities Committee was formed to plan social outings for the program participants and their families (Appendix II). The head of this committee developed a newsletter to share planned events, as well as local events, festivals, entertainment, and so forth. This was very well received by the Fellows, particularly those from outside the Tidewater area. The Office of Education also sponsored a Moonlight Cruise 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
1	Aeronautics Systems Analysis Division
2	Atmospheric Sciences Division
1	Computational Aerosciences Team
3	Experimental Testing Technology Division
1	Fabrication Division
1	Facilities Program Development Office
2	Facilities Systems Engineering Division
2	Flight Dynamics and Control Division
2	Flight Electronics Technology Division
5	Fluid Mechanics and Acoustics Division
3	Gas Dynamics Division
2	Information Systems and Services Division
6	Materials Division
4	Office of Education
2	Office of Human Resources
2	Office of Chief Financial Officer
2	Space Systems and Concepts Division
1	Structures Division

Thirty-eight (90%) of the participants were holders of the doctorate degree. Four (10%) held masters degrees. The group was again highly diversified with respect to background. Following are the areas in which the last degree was earned (twenty-eight different disciplines):

Number	Area of Degree
1	Accounting and Information Systems
1	Aeronautical Engineering
1	Aeronautics and Astronautics
1	Aerospace Engineering
1	Applied Mathematics
1	Applied Mechanics
2	Chemical Engineering
3	Chemistry (including 1 Inorganic)
2	Computer Science
2	Education (including 1 International)
2	Electrical Engineering
1	Engineering Mechanics
1	Engineering Physics
1	Flight Science
1	Hydrodynamics
1	Industrial Engineering
1	Instructional Design
1	Materials Science and Engineering
1	Mathematics and Computer Science
2	Mathematics Education
7	Mechanical Engineering
1	Operations Research
1	Organizational Development
1	Physics
1	Political Economy
1	Social and Philosophical Foundations of Education
1	Systems and Information Science
2	Vocational Technology Education

Extensions

Per special written request by the LaRC Associate and the approval of the ASEE Co-Director, following individuals were granted extensions of tenure:

Dr. Macarena Aspillaga
Dr. Linda Deans
Dr. Abel Fernandez
Dr. David Gosselin
Dr. Irina Nelson
Dr. Sandra Proctor
Dr. Kyo Song

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

Sebastian Y. Bawab: ASME 1996 Design Engineering Technical Conference.

H. Marshall Booker: NASA-Chief Financial Officers Conference, June 11-13, 1996.

Linda W. Deans: Training Officers Conference and Internet Training.

David J. Gosselin: NASA-Chief Financial Officers Conference, June 11-13, 1996. Full Cost in NASA Working Group, May 20-24, 1996, in Los Angeles, CA, and July 30 - Aug. 1, 1996, in Houston, TX. Three Short Courses: Fundamentals of Appropriation Law and Concepts for Cost Management, June 12-13, 1996, and Resources and Financial Management Overview, July 18 -19, 1996.

Linda B. Hayden: Technology 2000 Conference, Norfolk, VA; Teacher Training for HorizonNet (ATLAS).

George R. Inger: AIAA Fluid Mechanics/Thermophysics Conference, New Orleans, LA, June 17-20, 1996.

Mou-Liang "Jim" Kung: Networking Workshop conducted for NASA Network Resources and Training Site at Elizabeth City State University, NC.

Ellis E. Lawrence: Three day course on computer aided printed circuit board design - ACCEL Schematic, ACCEL PCB, ACCEL Pro Route Version 12.10.

David MacInnes: Middle Atlantic Regional ACS (American Chemical Society) Conference, May 27-29, 1996. Advances in Polymer Chemistry Meeting. Second Annual Computational Polymer Chemistry Meeting held at the College of William and Mary.

James E. Martin: Second Airframe Noise CFD/Modeling Workshop, NASA LaRC.

Thomas P. Miller: Two presentations on Formal Methods for Verification of Flight Critical Systems by R. Butler and P. Miner.

Irina Nelson: Workshop with a Japanese

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

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

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

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

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

Papers Presented or Anticipated

Daniel O. Adams: Contractor Report submitted to NASA.

Thomas E. Alberts: "End Point Control Unit for Large Flexible Space Manipulators."

Bobbye H. Bartels: Paper presented at Virginia Academy of Science Annual Meeting: "Aeronautics Content and Problem-Based Learning in Elementary and Middle School".

Sebastian Y. Bawab: "A New Circuit Rectification Method in Four Bar Linkages", American Society of Mechanical Engineers.

H. Marshall Booker: "Economic Impact Studies: Comparative Values", Atlantic Economic Association.

Steve R. Daniewicz: "Prediction of Plasticity-Induced Closure in Surface Flaws Using a Modified Strip-Yield Model", ASTM 29th National Symposium on Fatigue and Fracture Mechanics.

Jose B. Davila-Acaron: Possibly "Measurements of Energy Spectrum as a Function of Wavenumber and Frequency in the Free Stream", The journal: Experiments in Fluids.

Linda W. Deans: Journal Article: (1) Internal NASA Publications, and (2) George Washington Newsletter.

Amin N. Dharamsi: Three papers co-authored with A. M. Bullock: Applied Physics, B63, 283-292, 1996; Invited Paper at SPIE Optoelectronics, 1997; International Conference in Lasers, Lasers '96, Portland, OR, December, 1996.

Abel A. Fernandez: "A Benefit Analysis of a NASA Research Program", to be submitted to the Engineering Economist.

Mark A. Fleischer: "The Unseen Hand of Ergodicity: Applying Cybernetic Optimization to Continuous Variable Problems", Kluwer Academic Publishers.

Gary P. Gibbs: G. P. Gibbs and R. L. Clark, "Active Control of Panel Transmission Loss Using Piezoelectric Sensoriactuators", to be submitted to the Journal of Acoustical Society of America.

David J. Gosselin: "Capital Asset Accounting in the Federal Government" and "Full Cost Accounting-Implementation", both to NASA Headquarters and for journal publication.

Venkat N. Gudivada: "An Efficient and Robust Algorithm for Shape Similarity-Based Retrieval", submitted to Advanced Computing '96 Conference. "A Retrieval Technique for Virtual World Databases-Under", to be submitted to IEEE Date Engineering Conference.

Linda B. Hayden: "K-12 Connectivity and Training", National Education Computing Conference; "Implementation of the ATLAS Program for Secondary School Connectivity within the ECSU/NRTS Region", NASA-MUSPID Annual Conference; "ATLAS Connectivity Model", NSU Guiding Gifted Talent in Science and Technology Conference.

George R. Inger: "Hypersonic Entry Heating with Discontinuous Surface Catalycity: A Combined Analytical/CFD Approach", AIAA Paper 2150-96; "Analytic Corrections to CFD Heating Predictions Accounting for Changes in Surface Catalysis", co-authored with Peter Gnoffo, AIAA Paper 96-1800

Mou-Liang "Jim" Kung: "Porting Thermally Perfect Gas Code to PCs", to NASA Langley Research Center.

Jeffrey B. Layton: "Unstructured Grid Generation and Approximation Concepts for Interior Response Recovery of Elastic Problems", International Journal of Numerical Methods in Engineering.

Norman W. Loney: "Heat Conduction in an Irregular Geometry Consisting of Several Composite Layers", International Journal of Heat and Mass Transfer.

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Tina Marshall-Bradley: "Effective Professional Development Models: TEI as a Case Study", <u>Contemporary Education</u>.

James E. Martin: "Flap Side-Edge Noise: Acoustic Analysis of Sen's Model", AIAA paper No. 96-1674. Extended version of this paper submitted to the <u>AIAA Journal</u>.

Thomas P. Miller: Technical Briefing on Boeing 757 Avionics presented to FETD at NASA Langley, July 8-12, 1996. Technical Briefing on same subject scheduled for October, in support of NASA flight research programs at LaRC and Dryden.

Irina Nelson: "Synthesis of LiAe Intermetallic Compound in Microgravity", LaRc Microgravity Research Group; Simulated "On-Line ear Metal Anlaysis of Lubricating Oils by X-Ray Fluorescence Spectroscopy", LaRC FSED, PSB Division; LarC-IOG Management; and "Proposal for the Design, Construction, and Testing of a Miniature XFS Instrument", NASA-LaRC-IOG Management.

Brett A. Newman: "Modeling of Forward Vanes for Aeroelastic Vehicles" and "Effects from Forward Vanes on Open-Loop Characteristics", both at AIAA Guidance, Navigation, and Control Conference.

Robert P. Smith: "Optimal Iterative Rework", AIAA MDO Conference, Sept., 1996.

Chelakara S. Subramanian: "Performance Analysis of Temperature Sensitive Paints", plan to submit to <u>Experimental Methods in Fluids Journal</u>.

David Suleiman Rosado: "Understanding and Predicting Solubilities of Polyimide Films in Polar Aprotic Solvents", co-authored with J. Hinkley, to be submitted to either: <u>Macromolecules</u> or <u>Journal of Polymer Science</u>, Aug. 1996. "Thermal Diffusivity and Conductivity Measurements of Polyimide Films and Composites", co-authored with J. Hinkley, to be submitted to either: <u>Journal of Polymer Science</u> or <u>Journal of Applied Polymer Science</u>, Aug. 1996.

Anticipated Research Proposals

Daniel O. Adams: Plans to submit a proposal to the NASA, Fall 1996.

Sebastian Y. Bawab: "Active Orifice Using Smart Material", NASA LaRC.

Steve R. Daniewicz: "Prediction of Plasticity-Induced Closure in Surface Flaws Using a Modified Strip-Yield Model: To potentially be submitted to NASA LaRC, Spring 1997, for the aging aircraft program.

Jose B. Davila-Acaron: "Wavenumber Resonant Forcing in Laminar Boundary Layer Receptivity", NASA LaRC for next summer.

Amin N. Dharamsi: "Applications of Wavelength Modulation Spectroscopy for Oxygen A Band Line Characterization", NASA and NSF.

Abel A. Fernandez: Plans to submit a proposal to NASA LaRC.

Mark A. Fleischer: Plans to submit proposals to the United States Air Force and the National Science Foundation's Career Development Program.

Venkat N. Gudivada: Preliminary Discussions made in person with:
(1) Tenneco: Newport News Shipbuilding, (2) Smithsonian Institution, Washington, DC, (3) Spot Image Corporation, Reston, VA.

Linda B. Hayden: "Expansion of NRTS at ECSU to include Elizabeth City Middle School", Eisenhower; "Expansion of NRTS at ECSU/PSU to include Purnell Sweet High", Eisenhower; "Connecting Secondary Schools in N.E. North Carolina", Bell South; "NRTS Support for C. Waldo Scott Center for H.O.P.E. Connectivity", HUD.

Mou-Liang "Jim" Kung: "Cross-Platform Software Development", to NASA Langley Research Center.

Ellis E. Lawrence: "process for Making Adhesiveless Flex Circuits Using LaRC-SI", submitted to NASA Langley Research Center.

Jeffrey B. Layton: National Science Foundation, Mechanics Division of Engineering.

Norman W. Loney: "Mathematical Modeling on CVD Processes Using Fluent", to Fulbright Award Committee.

David MacInnes: "Polyimide Piezoelectric Polymers", NASA Langley Research Center, Materials Division, Polymers and Composites Branch.

Irina Nelson: Proposal for the Design, Construction and Testing of a High-Performance, Miniature XFS Spectrometer for On-Line, Real-Time Monitoring of Lubricating Oils in Operating Engines. Synthesis of LiAe Intermetallic Compound in Microgravity, NASA, LaRC. FETD Sensors Research Branch.

Brett A. Newman: "HSR Flight Control Design Using Forward Vanes", NASA Langley Research Center.

Lynn S. Penn: "Adhesion to Glass", to be submitted to PPG & Company. "Fundamental Interactions at Interface", to be submitted to Petroleum Research Foundation.

Kyo D. Song: "Diagnostics of Hypersonic Flow", NASA.

Chelakara S. Subramanian: "Dynamic Performance Analysis of Temperature Sensitive Paints", to NASA Langley Research Center. "Uncertainty Analysis of Wind Tunnel Measurements", NASA Langley Research Center.

Funded Research Proposals

Daniel O. Adams: Currently has two funded proposals through the National Science Foundation.

Karim Altaii: "Solar Detoxification Project", Johnson & Johnson; "Natural Convection Controlled Periodically illuminated Photocatalytic Reactor", INDUNIV; "Solar Monitoring Study in Puerto Rico", Administration of Energy Affairs, PR.

Sebastian Y. Bawab: AMF/TAC; Aeriolscope/TAC; Norfolk International Terminal/TAC.

Willie L. Darby: "Thermochromism in Transition Metal Complexes".

George R. Inger: "Analytical Studies of Dissociated Hypersonic Flows", NASA Langley Grant Awarded, Feb. 1996.

Ellis E. Lawrence: "NASA Network Training Grant", funded by NASA.

Chelakara S. Subramanian: "Wind Tunnel Testing of Break-Away Sign Supports", Florida Department of Transportation. "A Refrigerant Free Air Conditioning System", Florida Solar Energy Center.

Robert L. Tureman: "A Virtual Museum of Computing History", funded by the Virginia Community College System.

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   38   (90%)
    No   4   (10%)

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

    Yes   39   (93%)
    No   0   (0%)
    No Response   3   (7%)

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

    Yes   32   (76%)
    No   2   (5%)
    Uncertain   8   (19%)

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   28   (67%)
    No   9   (21%)
    Uncertain   4   (10%)
    No Answer   1   (2%)

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

    Very much so   39   (93%)
    Somewhat   3   (7%)

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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	23	(55%)
Redirected	11	(26%)
Advanced	28	(67%)
Barely maintained	2	(2%)
Unaffected	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	41	(98%)
Not at all	1	(2%)

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	36	(86%)
By starting new courses	7	(17%)
By sharing your research experience	35	(83%)
By revealing opportunities for future employment in government agencies	18	(43%)
By deepening your own grasp and enthusiasm	22	(52%)
Will affect my teaching little, if at all	3	(7%)
No Response	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	27	(64%)
No	13	(31%)
Possibly	2	(5%)
Already tenured at highest rank	0	

C. Administration

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

Received announcement in the mail	15	(33%)
Read about in a professional publication	3	(7%)
Heard about it from a colleague	23	(55%)
Other (Explain below)	4	(10%)

    Dr. Massenberg; Internet site; Grants Office; Research Associate; Dean; Prior NASA Associate and Employee.

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

    Yes ___12___ (29%)   No ___30___ (71%)

1	(2%)	DOE
9	(21%)	Another NASA Center
2	(5%)	Air Force
1	(2%)	Army
3	(7%)	Navy

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

    Yes __4__ (10%)   No __31__ (74%)   No Answer __31__ (74%)

    DOE; Sandia National Labs; Air Force; MSFC

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

Many	9	(21%)
A few	33	(71%)
None	3	(7%)
Other	1	(2%)

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

    Yes __26__ (62%)   No __14__ (33%)   No Answer __2__ (5%)

    If not, why? Adequate amount to bring in only scientifically motivated people as opposed to unambitious dabblers who just want the summer salary; Good amount for this purpose; Research opportunities equal to monetary reward; Real attraction is opportunity for long term relationships; Would accept any stipend considered adequate by program managers; Experience is more valuable.

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

Yes	34	(81%)
No	8	(19%)

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

Yes	36	(86%)
No	1	(2%)
Not Applicable	5	(12%)

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

Yes	38	(90%)
No	4	(10%)

9. How do you rate the seminar program?

Excellent	21	(51%)
Good	17	(40%)
Fair	3	(7%)
Poor	1	(2%)

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

Check one per activity		Time Was:		
Activity	Adequate	Too Brief	Excessive	Ideal
Research	17 (40%)	12 (29%)	0 (0%)	13 (31%)
Lectures	28 (67%)	0 (0%)	6 (14%)	7 (17%)
Tours	29 (69%)	7 (17%)	1 (2%)	3 (5%)
Social/Rec.	29 (69%)	2 (5%)	3 (5%)	7 (17%)
Meetings	28 (67%)	3 (7%)	1 (2%)	7 (17%)

11. What is your overall evaluation of the program?

Excellent	32	(77%)
Good	9	(21%)
Fair	1	(2%)
Poor	0	(0%)

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

See Fellows' Comments and Recommendations

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

See Fellows' Comments and Recommendations

D. Stipend

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

$ 48,774   per Academic year __x__   or   Full year _____.
Median Range

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

Yes _4_ (10%)   No _24_ (57%)   In Part __13__   (31%)

Not Indicated __1__ (2%)

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

    $10K-16 (38%); $11K-2 (5%); $12K-6 (14%); $13K-3 (7%); $15K-7 (17%); $150/day-1 (2%); Not Indicated-7 (17%)
    One-(2%) Said: Should double relocation allowance and travel.

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

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

    Yes ___3___ (7%)   No ___39___ (93%)

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

    Yes ___28___ (67%)   No ___14___ (33%)

Fellows' Comments and Recommendations

- It would be nice to have a luncheon with the Associates to recognize their contribution.

- Faculty <u>only</u> seminars tailored to faculty; more opportunities to see what Langley offers.

- If NASA desires a second year participation, ensure that point is made prior to the end of the program.

- Fellows should be paid according to their academic rank; Relocation allowance and travel are not adequate for long distance relocation.

- Lengthen to 12 weeks.

- Provide references on where to get proper tax information or provide it to the Fellows directly.

- Stipends too small, too many lectures and activities. Should be more emphasis on follow up visits.

- Clearly define the "Best Research Presentation Competition" to both the Fellows and Divisions, more tours of NASA facilities so the Fellows are exposed to other Divisions.

- Allow more time for writing.

- Make it less expensive to cash stipend checks at the Credit Union, provide access to the gym, and provide tax information.

- Fellows should be brought for 2-3 weeks in January to iron out a project to be completed in 7-8 weeks over the summer with intervening time left to interact and prepare.

- Provide opportunities to interact with LARSS students and SHARP students; Provide linkages between lectures and ASEE projects; Special seminars on General Personal Development - Internet, resumes; Mandatory meetings for networking between Fellows and Associates.

- Provide more technical content in lectures. I realize this is difficult because LARSS and ASEE both must be accommodated.

- Greater emphasis on defining project prior to the summer.

- Form a "Coffee Club" with Fellows broken out into various groups based on areas of interest for an informal exchange of ideas.

- Number of proposal seminars should be increased - include representatives from MTPE and HUD.

- Provide more time on the first day for each Fellow to introduce her/himself and area of research.

- Provide better access to computer facilities and labs after hours.

- Assign e-mail accounts to all Fellows prior to arrival and use more e-mail communication from program administrators versus Mail Stops.

- Allow more flexibility in time of tenure, i.e.-6 weeks or 12 weeks.

- Have a technical lecture on "The Business of NASA."

- Get 2nd year Fellows together to determine what we want to get from our 2nd year.

- Divisions should consider providing a small research grant to support one student for one year after the Fellow returns to the home institution. This will ensure continued progress of the work initiated at the Center and helps to seek funding from other sources. The idea suggested here is used by the Air Force for their summer Fellows.

- Get a better speaker system for the banquet.

- This was an excellent program. I am very grateful for the opportunity to participate. I would strongly encourage my peers to take advantage of this program. The staff (Debbie Young and John Spencer) were wonderful. They did a very good job running the program. My Associate, Dr. Lamont Poole, was wonderful to work for, as were the people in the ARB. Thank you for the opportunity.

- The program was wonderful. I wanted to get intellectual stimulation and to add to my laboratory skills. Both goals were achieved. The NASA people in the Polymers Branch are well-trained, interested in what they're doing, helpful, hardworking, and knowledgeable. I learned so much from them. I am going back to the University of Kentucky with greater knowledge (both theoretical and practical), and I am reinvigorated. I am grateful to this ASEE program and the people who run it.

- Final presentation are nice, but very formal and we only learn about a few people. How about an informal evening session with more people speaking (very short-5 minutes each)? Have everyone speak or have the entire group vote on the topics they want to have. Take over the bar at the Reid Center.

- The NASA/ASEE Summer Faculty Program managers and officials as well as

the managers of the host NASA Division have been extremely helpful in solving all our problems related to both work and relocation to the Hampton area. Their assistance is greatly appreciated. The program is very valuable and well organized.

- An excellent program and unique opportunity. Exciting to see NASA from the inside.

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. See statistics below:

- 91% aware of participation as Associate prior to start of program

- 91% contacted Fellow prior to start of program

- 100% stated Fellows accomplished research goals established at onset of program

- 97% interested in serving as Associate again (one-no due to retirement)

- 73% discussed follow on research and proposal submission

- 87% Associates with first year Fellows would recommend for a second year

- 86% indicated their Fellow was above average when compared overall with other faculty researchers they had worked with before.

Research Associates' Comments

- Senior staff member said no recommended improvements - "I found the program to meet all organizational goals."

- This is a very good program for interacting with the university community.

- Both NASA and the Fellows benefit from the interactions during the program.

- The Fellow was exposed to very high level technology that will go a long way in the Technology Department of his university.

Research Associates' Recommendations

- I would like to see the duration of the program be more flexible if additional time is needed. If 12 weeks is needed to complete the project, then extend to 12 weeks.

- We would recommend close-out interviews with Fellows be a mandatory process.

- Reduce the mandatory attendance to various presentations.

SECTION VII

CO-DIRECTOR'S RECOMMENDATIONS

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

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

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

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

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

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

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

8. Determine a somewhat formalized agenda for the reception/interaction opportunity which will facilitate more extensive introductions with a short time allowed to speak to the research interest of each Fellow on the first evening.

APPENDIX I

PARTICIPANTS - ASEE/NASA LANGLEY

SUMMER FACULTY RESEARCH PROGRAM

1996 NASA Langley ASEE Summer Faculty Fellowship Program Fellows

Name and Institution		NASA Associate and Division
Dr. Daniel O. Adams Iowa State University	(R)	Mr. Clarence C. Poe Materials
Dr. Thomas E. Alberts Old Dominion University		Dr. Raymond C. Montgomery Flight Dynamics and Control
Dr. Karim Altaii Turabo University		Mr. Dale A. Babcock Facility Systems Engineering
Dr. Macarena Aspillaga Old Dominion University		Mr. William "Brad" Ball Facilities Program Development
Dr. Bobbye H. Bartels Christopher Newport University	(R)	Dr. Marchelle D. Canright Office of Education
Dr. Sebastian Y. Bawab Old Dominion University	(R)	Dr. John A. Tanner Structures
Dr. H. Marshall Booker Christopher Newport University		Mr. Joseph R. Struhar Office of the Chief Financial Officer
Dr. Steve R. Daniewicz Mississippi State University		Dr. James C. Newman Materials
Dr. Willie L. Darby Hampton University		Dr. Billy T. Upchurch Experimental Testing Technology
Dr. Jose B. Davila-Acaron University of Puerto Rico-Mayaguez		Dr. Richard W. Wlezien Fluid Mechanics and Acoustics
Dr. Linda W. Deans George Washington University	(R)	Ms. Janet M. McKenzie Office of Human Resources
Dr. Amin N. Dharamsi Old Dominion University		Dr. William P. Chu Atmospheric Sciences
Dr. Abel A. Fernandez Old Dominion University		Mr. Joe H. Shockcor, Jr. Aeronautics Systems Analysis
Dr. Mark A. Fleischer Old Dominion University		Mr. Charles H. Eldred Space Systems and Concepts
Dr. Gary P. Gibbs Old Dominion University		Mr. Richard J. Silcox Fluid Mechanics and Acoustics

Name and Institution	NASA Associate and Division
Dr. David J. Gosselin (R) Christopher Newport University	Mr. Joseph R. Struhar Office of the Chief Financial Officer
Dr. Venkat N. Gudivada Ohio University	Mr. Kurt Severance Information Systems and Services
Dr. Linda B. Hayden Elizabeth City State University	Mr. Jeffrey M. Seaton Computational Aerosciences Team
Dr. George R. Inger (R) Iowa State University	Dr. Peter A. Gnoffo Gas Dynamics
Dr. Mou-Liang "Jim" Kung Norfolk State University	Mr. David W. Witte Gas Dynamics
Dr. Ellis E. Lawrence (R) Elizabeth City State University	Mr. S. Stewart Harris Fabrication
Dr. Jeffrey B. Layton Clarkson University	Dr. Robert E. Smith Information Systems and Services
Dr. Byung-Lip Lee Pennsylvania State University	Mr. Timothy W. Towell Materials
Dr. Norman W. Loney (R) New Jersey Institute of Technology	Mr. Richard L. Puster Gas Dynamics
Ms. Jacquelyn E. Long Norfolk State University	Mr. Ricky W. Butler Flight Electronics Technology
Dr. David MacInnes (R) Guilford College	Dr. John W. Connell Materials
Dr. Tina Marshall-Bradley South Carolina State University	Dr. Marchelle D. Canright Office of Education
Dr. James A. Martin University of Alabama	Mr. Charles H. Eldred Space Systems and Concepts
Dr. James E. Martin (R) Christopher Newport University	Dr. Jay C. Hardin Fluid Mechanics and Acoustics
Mr. Thomas P. Miller University of Alaska-Anchorage	Ms. Celeste M. Belcastro Flight Electronics Technology
Dr. Irina Nelson Salt Lake Community College	Mr. Warren C. Kelliher Facility Systems Engineering

Name and Institution		NASA Associate and Division
Dr. Brett A. Newman Old Dominion University		Mr. Carey S. Buttrill Flight Dynamics and Control
Dr. Lawrence A. Newquist Cumberland College		Dr. Lamont R. Poole Atmospheric Sciences
Dr. Lynn S. Penn University of Kentucky		Dr. Ruth H. Pater Materials
Dr. Sandra B. Proctor Norfolk State University	(R)	Dr. Samuel E. Massenberg Office of Education
Mr. J. Murray Ritter, Jr. Thomas Nelson Community College		Dr. Marchelle D. Canright Office of Education
Dr. Robert P. Smith University of Washington		Mr. James L. Rogers Fluid Mechanics and Acoustics
Dr. Kyo D. Song Norfolk State University		Dr. Leonard M. Weinstein Fluid Mechanics and Acoustics
Dr. Chelakara S. Subramanian Florida Institute of Technology		Ms. Tahani R. Amer Experimental Testing Technology
Dr. David Suleiman-Rosado University of Puerto Rico-Mayaguez		Dr. Jeffrey A. Hinkley Materials
Dr. George Trevino Michigan Technological University	(R)	Mr. Michael Mitchell Experimental Testing Technology
Mr. Robert L. Tureman, Jr. Paul D. Camp Community College		Ms. Alice C. Massey Office of Human Resources

R-Designates returnees from 1995

APPENDIX II

LECTURE SERIES

PRESENTATIONS BY RESEARCH FELLOWS

CALENDAR OF ACTIVITIES

1996 OFFICE OF EDUCATION SUMMER LECTURE SERIES

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

DATE	TOPIC	SPEAKER
Tuesday, June 11	The Atmospheric, Climatic, and Biospheric Implications of Global Burning	Dr. Joel S. Levine Atmospheric Sciences Division Space and Atmospheric Sciences Program Group NASA Langley Research Center
Friday, June 21	Canceled	The Honorable Robert Scott (D-3rd District) United States House of Representatives
Tuesday, June 25	Mission To Planet Earth (MTPE)	Mr. Mark Pine Office of Mission to Planet Earth NASA Headquarters
Tuesday, July 2	Globalization of the Aerospace Industry: Implications to the High-Speed Research Program	Dr. Christine M. Darden High-Speed Research Project Office NASA Langley Research Center
Wednesday, July 10	The Ingredients for a Renaissance A Vision and Technology Strategy for U.S. Industry, NASA, FAA, Universities	Dr. Bruce J. Holmes Subsonic Transportation Office Aeronautics Program Group
Tuesday, July 16	NASA Langley Research Center - A National Lab Resource for U. S. Competitiveness	Dr. Joseph S. Heyman Director Technical Applications Group NASA Langley Research Center
Tuesday, July 23	Overview and SAGE III Presentation	Mr. Michael L. Ruiz Space Projects Office Space and Atmospheric Sciences Program Office NASA Langley Research Center

Next Lecture
July 10, 1996
10:00 a.m.

Dr. Bruce J. Holmes
Subsonic Transportation Office
Aeronautics Program Group
NASA Langley Research Center

The Ingredients for a Renaissance
A Vision and Technology Strategy
for
U.S. Industry, NASA, FAA, Universities

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

Office of Education
Summer Lecture Series

July 2, 1996
10:00 a.m.

Dr. Christine M. Darden
Senior Project Engineer
High-Speed Project Office
NASA Langley Research Center

Christine Voncile Mann Darden grew up in Monroe, North Carolina, where she was the youngest of five children. She attended Allen High School in Asheville, NC, from 1956 - 1958, when she graduated as Valedictorian of her class. She attended Hampton Institute (now University) in Hampton, Virginia, where she received in 1962, a B.S. Degree with a major in Mathematics and a Minor in Physics. After teaching high school mathematics for one year in Lawrenceville, Virginia, and one year in Portsmouth, Virginia, she returned to school at Virginia State College (now University) and received the Master's Degree in Applied Mathematics. Darden then began her career with the NASA Langley Research Center in Hampton, Virginia, as a Data Analyst. In 1972, upon the completion of several engineering classes, Darden was reclassified as an Engineer. While working as an Engineer, Darden continued to take classes from George Washington University where she earned the Ph.D. Degree in Mechanical Engineering in 1983.

Darden currently serves as a Senior Project Engineer in NASA's High-Speed Research Program--a program to develop the technology for building a supersonic airplane by the year 2005. In her current position, Darden serves as Deputy Program Manager for the Tu-144 Program - a Program to conduct several flight experiments on the Russian built supersonic airplane; works in the Sonic Boom Element of the Aerodynamics Program, and is currently managing an effort to plan Phase III of the High-Speed Research Program. Darden has been responsible for planning technical work for NASA engineers, and through

contracts and grants, for developing work for engineers at major airframe companies and at universities. Darden has authored over 54 technical papers and articles, mostly in the areas of sonic boom prediction, sonic boom minimization, and supersonic wing design, and is recognized as a national expert in these areas. Darden has been recognized with dozens of awards and honors-- including two NASA Medals, several Outstanding Performance Awards, the Black Engineer of the Year Outstanding Achievement in Government Award and the Women in Engineering Lifetime Achievement Award.

"Globalization of the Aerospace Industry: Implications to the High-Speed Research Program"

The talk will address in general the elements of NASA's High-Speed Research Program; prevalent use of "offsets" by the aerospace industry--a practice which speeds the flow of U.S. technologies into the global marketplace; and, strategies for maintaining U.S. aerospace leadership amidst keen global competition.

1996 American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program Final Presentations
and
Best Research Presentation Competition

Tuesday, August 6, 1996
H.J.E. Reid Conference Center
8:30 a.m. - 12:30 p.m.

8:30 a.m.	Welcome	**Professor John H. Spencer** ASEE Co-Director
8:40 a.m.	"A Benefit Analysis of a NASA Aeronautics Research Project: The Integrated Wing Design Project"	**Dr. Abel A. Fernandez** Aeronautics Program Group Old Dominion University
9:10 a.m.	"Nonequilibrium Boundary Layer Effects on Aerodynamic Heating Analyses of X-33"	**Dr. George R. Inger** Research and Technology Group (GDD) Iowa State University
9:40 a.m.	"Simulated 'On-Line' Wear Metal Analysis of Lubricating Oils by X-ray Fluorescence Spectroscopy (XFS)"	**Dr. Irina Nelson** Internal Operations Group FSED Salt Lake Community College
10:10 a.m.	"Rocket-Based Combined-Cycles for Earth-to-Orbit Vehicles"	**Dr. James A. Martin** Space and Atmospheric Sciences Program Group (SSCD) University of Alabama
10:40 a.m.	Break	
10:50 a.m.	"Verification of Fault Tolerant Design of Flight Critical Digital Systems"	**Mr. Thomas P. Miller** Research and Technology Group (FETD) University of Alaska
11:20 a.m.	"Performance Analysis of Temperature Sensitive Paints"	**Dr. Chelakara S. Subramanian** Internal Operations Group ETTD Florida Institute of Technology
11:50 a.m.	"A Computational Investigation of Flap Side-Edge Flow Noise"	**Dr. James E. Martin** Research and Technology Group (FMAD) Christopher Newport University
12:20 p.m.	Closing Comments	**Mr. Roger A. Hathaway** NASA University Affairs Officer
12:30 p.m.	Dutch Lunch for ASEE Fellows at the LAFB Officer's Club	

1996 ASEE/LARSS Calendar of Activities

Date	Function
Monday, June 3, 1996	ASEE/LARSS Orientation Program H.J.E. Reid Conference Center
Monday, June 3, 1996	ASEE Social-Get to know your colleagues.
Tuesday, June 11, 1996	Lecture-H.J.E. Reid Conference Center
Wednesday, June 12, 1996	Picnic-H.J.E. Reid Conference Center Picnic Grounds
Tuesday, June 18, 1996	Lecture-H.J.E. Reid Conference Center
Tuesday, June 25, 1996	Lecture-H.J.E. Reid Conference Center
Friday, June 28, 1996	Moonlight Cruise
Tuesday, July 2, 1996	Lecture-H.J.E. Reid Conference Center
Thursday, July 4, 1996	Free Day, No work-Happy July 4th Holiday
Tuesday, July 9, 1996	Lecture-H.J.E. Reid Conference Center
Thursday, July 11, 1996	ASEE Proposal Seminar
Tuesday, July 16, 1996	Lecture-H.J.E. Reid Conference Center
Tuesday, July 23, 1996	Lecture-H.J.E. Reid Conference Center
Thursday, July 25, 1996	ASEE/LARSS Banquet
Tuesday, July 30, 1996	LARSS Graduate School Seminar
Wednesday, July 31, 1996	GSRP Orientation and Workshop
Tuesday, August 6, 1996	ASEE Final Presentations
Friday, August 9, 1996	Last Day of Program

APPENDIX III

GROUP PICTURE OF RESEARCH FELLOWS
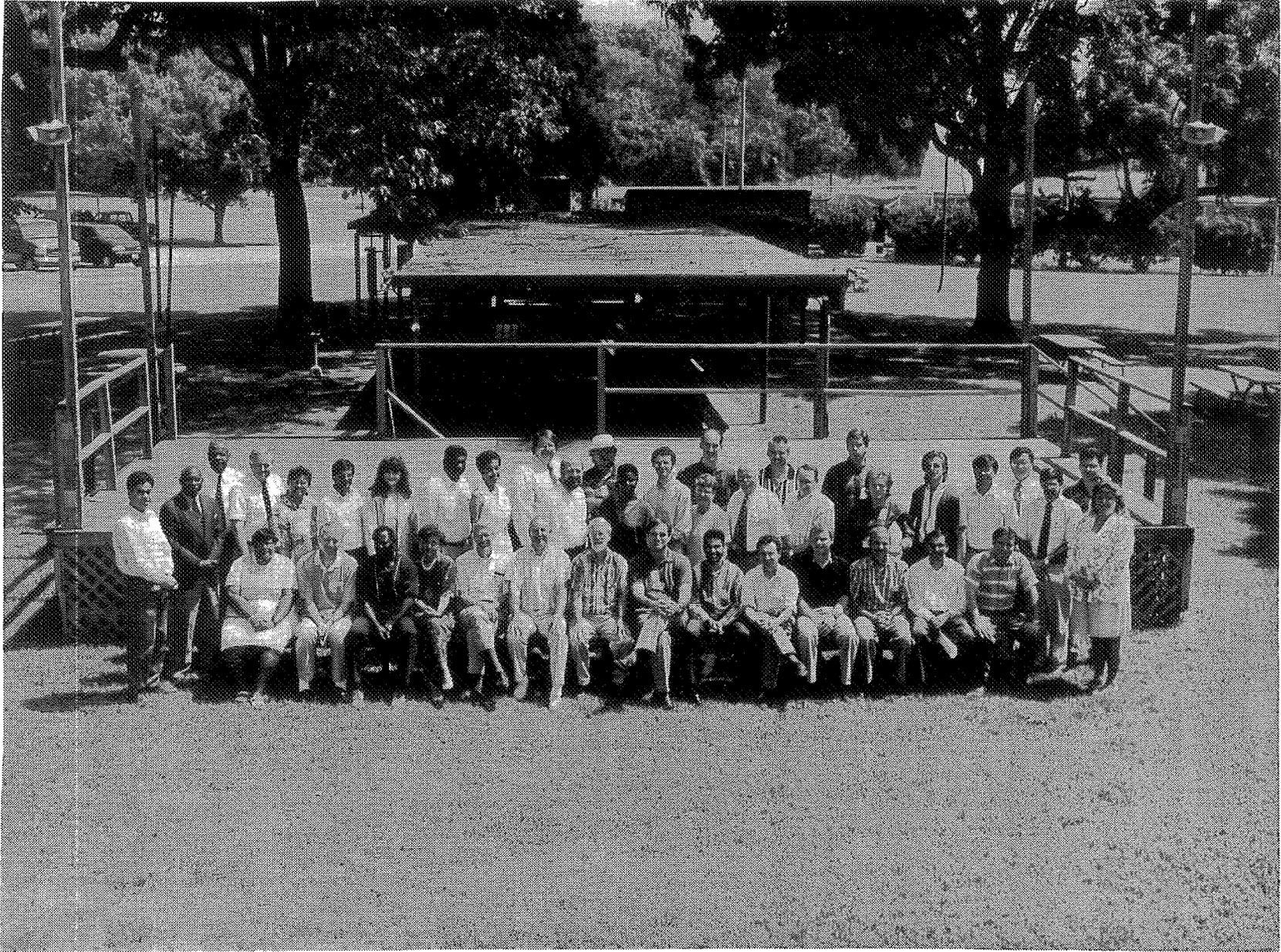
Those pictured in group photograph from left to right are:

Front Row Sitting: Dr. Willie L. Darby, Mr. Thomas P. Miller, Dr. Norman W. Loney, Dr. Macarena Aspillaga, Dr. James A. Martin, Dr. George R. Inger, Dr. David MacInnes, Mr. J. Murray Ritter, Jr., Dr. David Suleiman-Rosado, Dr. Mark A. Fleischer, Dr. Daniel O. Adams, Dr. Abel A. Fernandez, Dr. Chelakara S. Subramanian, Dr. Jose B. Davila-Acaron

Second Row: Dr. Karim Altaii, Prof. John H. Spencer (ASEE Co-Director), Mr. Edwin J. Prior (Deputy Director, Office of Education), Dr. Sandra B. Proctor, Dr. Venkat N. Gudivada, Dr. Karen Panetta Lentz (JOVE), Dr. Ellis E. Lawrence, Ms. Jacquelyn E. Long, Dr. Lawrence A. Newquist, Dr. Tina Marshall-Bradley, Dr. James E. Martin, Dr. Bobbye H. Bartels, Dr. Henry Marshall Booker, Dr. Jeffrey B. Layton, Dr. Irina Nelson, Dr. Thomas E. Alberts, Dr. Kyo D. Song, Dr. David J. Gosselin, Ms. Debbie Young (ASEE Admin. Asst.)

Third Row: Mr. Roger A. Hathaway (LaRC University Affairs Officer), Mr. Robert L. Tureman, Jr., Dr. George Trevino, Dr. Brett A. Newman, Dr. Gary P. Gibbs, Dr. Steve R. Daniewicz, Dr. Mou-Liang "Jim" Kung, Dr. Sebastian Y. Bawab

Not Pictured: Dr. Linda W. Deans, Dr. Amin N. Dharamsi, Dr. Linda B. Hayden, Dr. Byung-Lip Lee, Dr. Lynn S. Penn, Dr. Robert P. Smith

APPENDIX IV

DISTRIBUTION OF FELLOWS BY GROUP

Distribution of 1996 ASEE
Fellows by Group
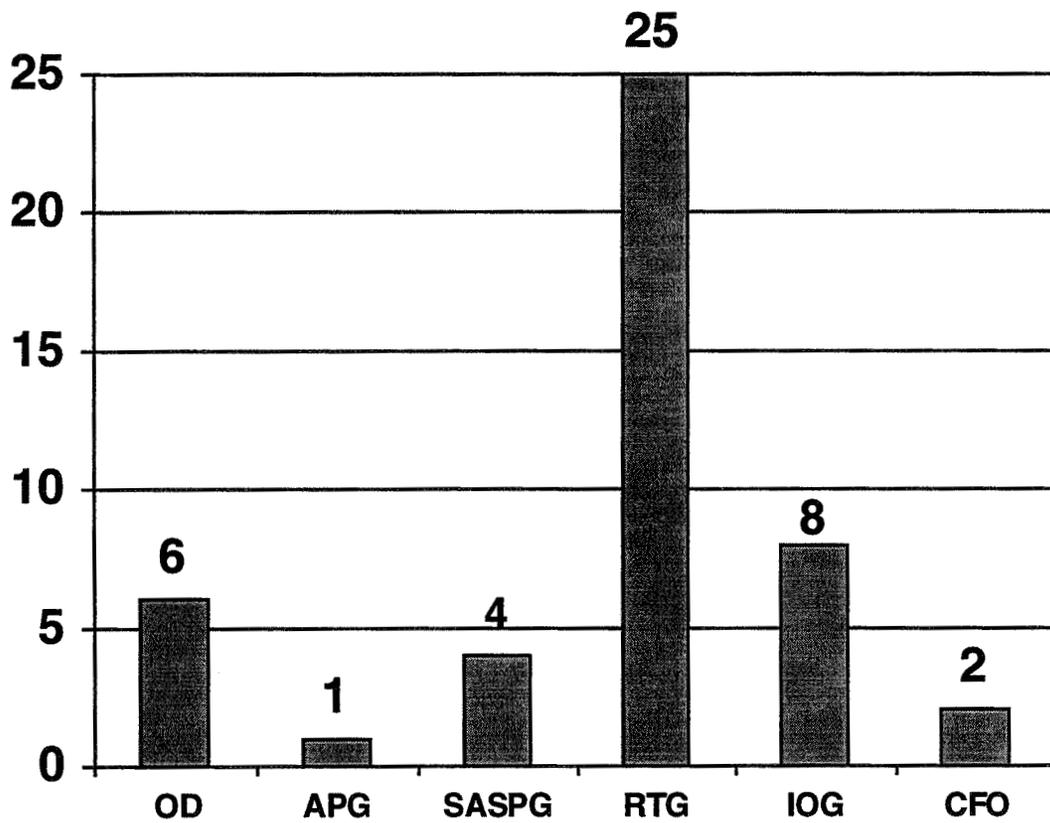
APPENDIX V

DISTRIBUTION OF FELLOWS BY ETHNICITY/FEMALE

Distribution of 1996 ASEE Female Fellows by Ethnicity
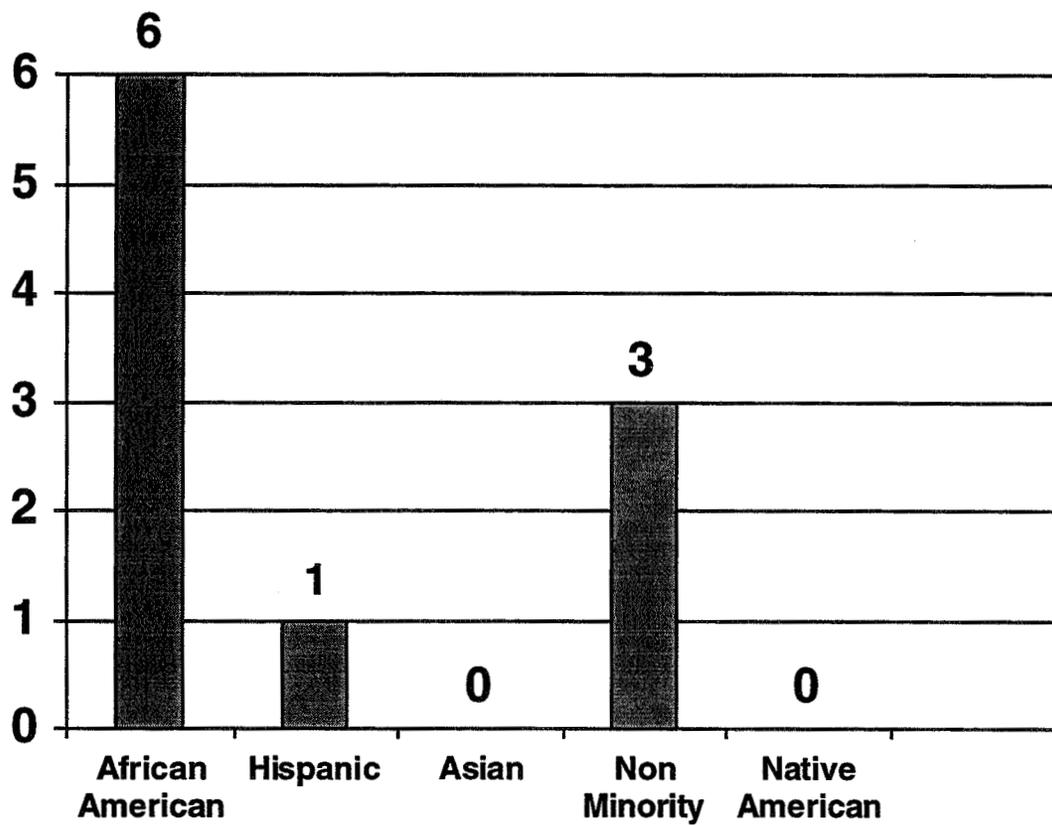
APPENDIX VI

DISTRIBUTION OF FELLOWS BY ETHNICITY/MALE

Distribution of 1996 ASEE Male Fellows by Ethnicity
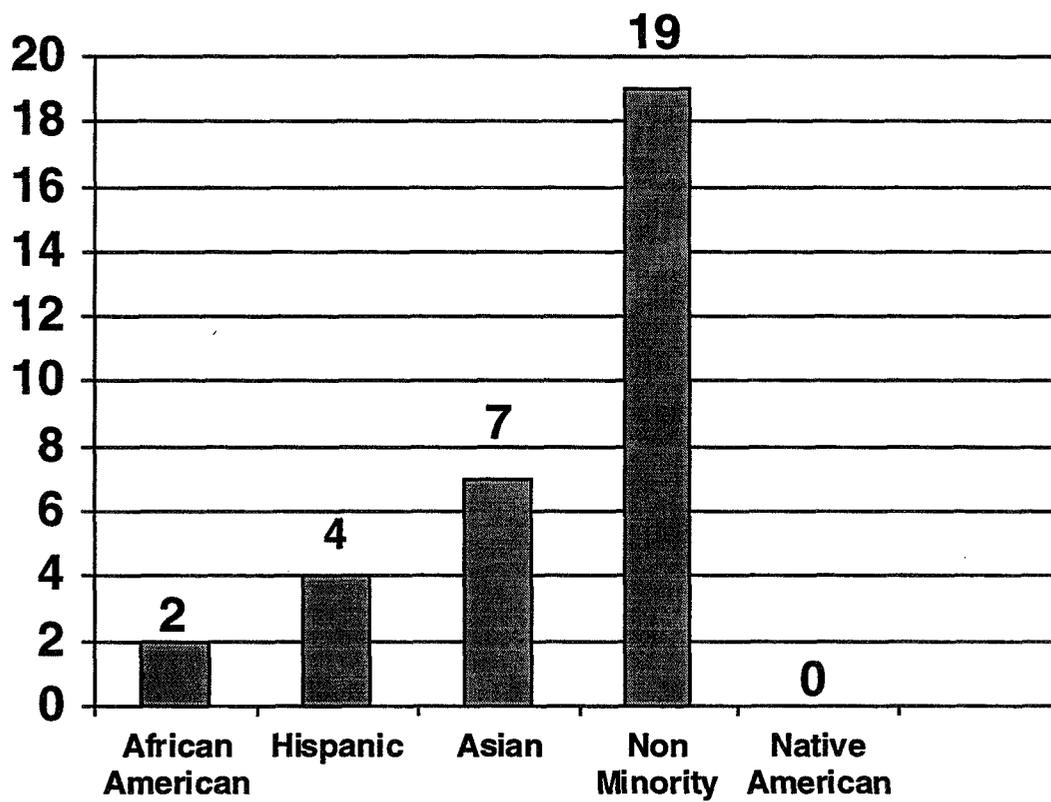
APPENDIX VII

DISTRIBUTION OF FELLOWS BY UNIVERSITY RANK

Distribution of 1996 ASEE Fellows by University Rank
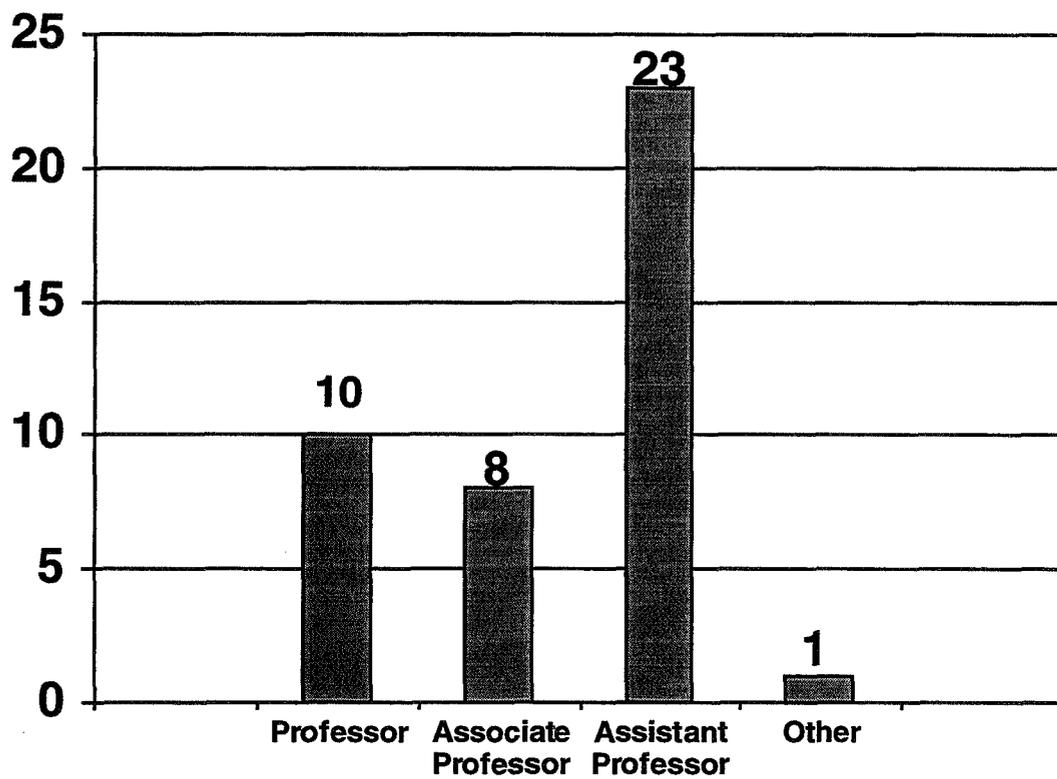
APPENDIX VIII

DISTRIBUTION OF FELLOWS BY UNIVERSITY

1996 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM
INSTITUTION PARTICIPATION

UNIVERSITY/COLLEGE	NO. OF FELLOWS
Christopher Newport University	4
Clarkson University	1
Cumberland College	1
*Elizabeth City State University	2
Florida Institute of Technology	1
George Washington University	1
Guilford College	1
*Hampton University	1
Iowa State University	2
Michigan Technological University	1
Mississippi State University	1
New Jersey Institute of Technology	1
*Norfolk State University	4
Ohio University	1
Old Dominion University	8
Paul D. Camp Community College	1
Pennsylvania State University	1
Salt Lake Community College	1
South Carolina State University	1
Thomas Nelson Community College	1
Turabo University	1
University of Alabama	1
University of Alaska-Anchorage	1
University of Kentucky	1
^University of Puerto-Rico-Mayaguez	2
University of Washington	1
Total Number of Fellows	**42**

Total Number of Institutions Represented   **26**

*Indicates a **Historically Black College or University (HBCU)**.
^Indicates an **Other Minority University (OMU)**

52

APPENDIX IX

ABSTRACTS - RESEARCH FELLOWS

STITCH COMPLIANCE IN DELAMINATED COMPOSITES:
AN EXPERIMENTAL STUDY

Daniel O. Adams
Iowa State University
Aerospace Engineering and Engineering Mechanics Department
Ames, Iowa 50011
email: adamsd@iastate.edu

Stitched composite materials are currently being evaluated for use in wing structures for commercial aircraft. These carbon-fiber/epoxy composites are stitched through-the thickness with Kevlar yarns to provide greater damage tolerance and allow for low-cost manufacturing. Although stitching has been shown to increase damage tolerance, delaminations may still occur during manufacturing or as a result of an impact. Thus, it remains necessary to analyze delaminations in stitched composites to predict their effects on structural performance. For such analysis, a procedure must be developed for properly modeling stitches and the effective stitch compliance must be determined.

The objective of this study was to determine the compliance of stitches in delaminated composites under out-of-plane tension as well as interlaminar shear loading. Test methods were developed for determining stitch compliance under each loading condition. Stitched composite panels were fabricated with teflon-coated fiberglass layers at two locations through the thickness which served as delaminations. For out-of-plane tensile testing, a conventional flatwise tensile test procedure was followed with corrections made to account for load train compliance. For interlaminar shear testing, a double-lap shear specimen configuration was used. Moire interferometry was used to assess the local shearing deformation at the location of each stitch row. Additionally, a shearing-mode extensometer was configured for use in determining the relative displacements across the delamination during shear loading. Results show that a high degree of variability exists in the stitch shear compliance due to mechanical interlocking of the delamination surfaces. For out-of-plane tensile loading, however, the stitch compliance was unaffected by surface roughness and was established with greater uniformity. Examination of failed specimens suggest that the through-the-thickness Kevlar stitches remain bonded to the surrounding carbon/epoxy composite throughout a majority of their length. However, x-ray inspection performed for confirmation was inconclusive. Further research is planned to section specimens and examine stitch bonding both prior to failure and in failed specimens. This research will provide stitch compliance and stitch debond length associated with both out-of-plane tensile and interlaminar shear loading for use in future modeling.

End-Point Control Unit for Large Flexible Space Manipulators

Thomas E. Alberts
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Old Dominion University
Norfolk, Virginia 23529-0247, USA
Phone: (804) 683-3736
Email: talberts@aero.odu.edu

This project investigates the dynamic modeling and control of a large scale manipulator, such as the space station SSRMS combined with a smaller, higher bandwidth manipulator mounted at its endpoint. The large arm will be referred to as the host manipulator, the smaller arm held by the host is referred to as an *End Point Control Unit* (EPCU). The primary function of the EPCU is high bandwidth precise positioning whereas the primary function of the host arm is gross positioning. The EPCU concept is intended as a "strap-on" enhancement to existing systems such as RMS or SSRMS. The EPCU would have access to data from the host arm such as joint angles and rates, force/torque measured at the host to EPCU interface, and possibly EPCU base acceleration. Based upon this data it is of interest to develop an EPCU controller which acts independently of the host arm. In keeping with the principle of representing the arms as separate entities, separate models were developed for the host arm and the EPCU. The host is essentially a conventional serial manipulator, the kinematics and dynamics of which have been treated in many prior publications. The interaction of the EPCU with the host is represented by a generalized force vector h acting on the host manipulator's end-point. The EPCU is also similar to a conventional manipulator however, the base frame of the EPCU is moving with the host manipulator's end-effector and regarded as rigidly attached to it. The EPCU has a for h acting on its base and possibly a force h_E acting on its end-effector due to contact with the environment. Dynamic models for the two arms are developed using a Lagrangian approach and employing the method of Lagrange multipliers to account for the constraint force h.

An example was prepared using a planar RR host manipulator with two rigid links and flexible gear drives. The EPCU is modeled as rigid two-link RP manipulator. The intention is to employ this model in an investigation of control schemes for the EPCU. The EPCU strategy is reminiscent of what is commonly referred to as micro-macro manipulator architecture however generally the literature has treated such problems using centralized control schemes whereby the host arm and the EPCU would be controlled together toward the achievement of a common task. The present interest is to employ decentralized control if feasible, that is, to achieve the desired performance improvement while allowing the host and the EPCU act under independent controllers. It is of interest to conduct a comparison of centralized versus decentralized control and to evaluate the sensing (for example measured interface force or EPCU base acceleration) requirements for effective use of an EPCU.

NASA 8-Foot High Temperature Tunnel: Combustor Internal Flow Conditioning

Dr. Karim Altaii, PE

Turabo University
School of Engineering
Gurabo, PR 00778
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kaltaii@turabo1.turabo1.suagm.edu

The NASA 8-Foot High Temperature Tunnel (8' HTT) is a unique national resource for testing of hypersonic air-breathing propulsion systems. The high enthalpy conditions upstream of the convergent divergent nozzle are reached by burning methane in the presence of oxygen enriched air such that the products of combustion are 21% O_2 mole fraction. The temperature profile in the test-section of this tunnel was judged of poor quality for current testing needs. One of the problems was the presence of "Hot Spots" in the thermal profile as a result of large scale flow blockage (fuel flanges) upstream of the fuel injector. The low velocities in the flanges' wake causes a localized increase in the air/fuel ratio which in turn causes the presence of the hot spots.

The objective of this study was to reduce or eliminate the velocity deficit downstream of the fuel flanges. Fluid flow simulation inside the combustor was conducted using computational fluid dynamics (CFD) codes (Fluent and Fluent/UNS). Two-dimensional flow simulation was conducted for three geometries: 1) the original flange geometry, 2) streamlined flanges "downstream fairing" and 3) streamlined flanges "upstream and downstream fairings". The results of this simulation showed that streamlining the flanges, both upstream and downstream, improves the velocity field downstream considerably. This streamlining will also improve the temperature field in the test section.

Recommendations for future work:

1) To conduct a three-dimensional flow simulation of different fairings to obtain an optimum fairing profile. 2) To relocate the baffle plate to a position downstream of the flanges. This will give a more uniform velocity field upstream of the fuel injectors. 3) A new baffle plate with new hole size and distribution is needed. The optimum location of the baffle plate, hole size and distribution needs to be determined and is dependent on the results of the three-dimensional flow simulation.

Assessment System Aircraft Noise (ASAN):
A Training Course for the United States Air Force

Macarena Aspillaga, Ph.D.
Manager, Instructional Design
Old Dominion University
Academic Television Services
Norfolk, VA 23529-0228

54-71
ABS ONLY

021 903
273772
P2

This project came as the result of a needs assessment performed by Langley's Air Force Base Environmental Office. The goal set by the Air Force for the ASAN system is to have a more efficient and effective teaching tool for the instructor. Environmental officers decided to put ASAN on-line to increase efficiency. This was accomplished through the use of PowerPoint presentations.

Two instructional designers (Paul Willner & Macarena Aspillaga) were in charge of meeting with Andrew Kugler, ASAN instructor and subject matter expert. The course was reviewed and designed according to its audience. The first step was reorganizing its content according to its overall importance within the subject matter, degree of difficulty, learning type, instructional strategies, instructional objectives, and assessment. After looking carefully at the way ASAN was being taught and presented through a training manual, or team found that the course in its initial state lacked: instructional objectives, overall organization, visualization of ASAN screen. In addition, each class was missing: objectives, organization, examples, practice items, interaction between instructor & learners, and acronyms' definition. The manual made by handouts did not have clarity, color, arrows or clipart , explanation for accessing screen dumps, and page numbers for reference. The lab was also missing the objectives, clarity, interaction between instructor and learners, and examples relevant to the learner's daily activities.

After ten days of meetings by the instructional design team with the subject matter expert, the following was accomplished: reorganization each of the five days of instruction adding examples to abstract concepts or ideas that needed to be reinforced by practice, defining how each day would be organized to meet the course goals and objectives set by the team. The inclusion of all material that was identified as missing was part of the new design, as well.

The team also met to identified the best way to use visuals by applying five principles of screen design: (1) clear perception determines continuity of flow of information; (2) perceptual grouping establishes screen sequencing; (3) placement of information aids recall; (4) distinctiveness increases retention and retrieval; and (5) consistency in the perception of motion facilitates recall (Aspillaga, in press).

Each day consists of a morning presentation and an afternoon lab session, both having one or two fifteen minute breaks. The training manual will be the result of the PowerPoint screens. Problem presentatios will be done in class. The manual will not contain the problem solutions screens. All graphics will be printed in color for clarity. Complicated figures will be the result of multiple screens that will add or highlight content step-by-step, according to difficulty.

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1996 SUMMER TEACHER ENHANCEMENT INSTITUTE
CHANGING TEACHER PERCEPTION AND PRACTICE

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Two important goals of professional development programs are changing teachers' instructional perceptions and practice and increasing their content knowledge. The 1996 Summer Teacher Enhancement Institute at NASA Langley Research Center (TEI) was a resource for investigating how teachers perceptions, practice and content knowledge changed as a result of their participation in this professional development activity. The 1996 TEI, in its third year, is designed to provide aeronautics experiences and instruction so teachers can use aeronautics as a topic to teach science and mathematics. During this two-week workshop, teachers also are taught to use a new pedagogical tool called problem-based learning.   Problem-based learning is an inquiry-based methodology that requires students to be active participants who do research to solve an authentic problem.

Through an application and competitive selection process, 60 elementary and middle school teachers were selected to participate in the Institute. They represented six eastern states and the Philippines. Five faculty members worked as a team to design the curriculum, determine the schedule and manage and evaluate the Institute.

TEI experiences included presentations, tours, hands-on activities, and modeling. NASA scientists made presentations relating their area of research to elementary and middle school curricula, and tours of NASA facilities demonstrated the scientific environment of aeronautics. Teachers performed aeronautics based experiments and spent one day at a local airport learning about pilot training. Spacelink accounts were given so the teachers could communicate through e-mail and explore the instructional resources on the Internet. Not only did the teachers learn about problem-based learning, but they experienced it as the faculty modeled the process during the Institute.

Survey assessment tools, journal entries and anecdotal records showed that changing instructional perceptions is a painful and difficult process for teachers. During the process of change they passed through four stages: (1) disequilibrium (What is this?), (2) denial (This won't work!), (3) defeat (I can't do this!),and (4) acceptance (This is worth a try!). By the end of the two-weeks, most teachers felt empowered for and enthusiastic about making changes in their classroom instruction, however actual changes in classroom practice will be monitored during the academic year. Based on the results of pre- and posttest assessment, participants' knowledge of aeronautics content increased significantly during the two weeks.

Economic Impact of NASA Langley Research Center

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Many major organizations and institutions initiate and/or conduct impact studies to assess the economic, cultural, and technological effects the organizations have on variously defined geographical regions. There are several valid approaches that can be used to assess and quantify the economic benefits of an organization such as NASA Langley Research Center (LaRC) as a major component of the civilian space program. LaRC is interconnected to the economy through numerous links in both a macroeconomic and microeconomic sense.

Impact studies traditionally address the measurement of the expenditures, employment, and earnings attributable to the presence of the organization in the community. This type of measurement includes both the direct and indirect impacts of the organization. **Direct impact** refers to an organization's spending on goods and services, its sources of income, employment and taxes. The **indirect impact** measures the so-called echo effect on the surrounding economy due to this initial (direct) economic activity. The **total impact** is therefore the quantitative combined effect of the direct and indirect impacts.

In examining the total impact of LaRC an economic base technique is used for analytical purposes which is a generally accepted methodology in use for regional and area impact analysis. This method is similar in design to neural networking with the exception that it is impossible that activation and processing begin with the entire network in a quiescent state. Nonetheless, each expenditure, each purchase, etc ripples through the economy being processed, reprocessed, and repeated. The activation value generated by the initial spending is known as the multiplier effect.

Area multipliers for various categories of financial activity are calculated using adjusted Bureau of Economic Analysis and Commonwealth of Virginia data base material and applied to estimate the echo effects of LaRC on earning, output and jobs in those businesses and industries interconnected to the activities of LaRC. Input-output analysis is invaluable in measuring the interindustry relationships which show how one dollar or one job opportunity ripples throughout the economy, in turn creating additional levels of expenditure, income and jobs.

LaRC significantly shapes the economic character of the Hampton Roads Area and the Commonwealth of Virginia. As a nationally recognized research facility LaRC is an enrichment Agency whose scope goes far beyond normal economic and cultural boundaries.

Identification of the Strut Characteristics of an A6 Landing Gear

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With the design of the High Speed Civil Transport (HSCT), the light material used and the length of the fuselage cause a great magnitude of flexibility which causes a great deal of vibration during ground operations. In addition, the location of the landing gears, in particular the nose gear with respect to the cockpit, intensifies this vibration problem. Therefore, it is imperative to do so by actively controlling the landing gears, in particular the nose gear, to absorb energy with a minimum disturbance effect on the fuselage. This is achieved by varying the strut orifice (semi-active control) to control the damping factor and by adding or eliminating external energy through the strut (active control).

The objective of this research is to assist in designing an active control strut of the nose landing gear of the High Speed Civil Transport and analyzing its performance. This is achieved by experimentally studying the characteristics of an A6 aircraft landing gear and analytically modeling it to further enhance its performance by controlling the critical parameters. The parameters include active changes to the characteristics of the strut such as the stiffness, the damping, or the addition of external energy sources in a hydraulic form. Once the system is well understood and the analytical model conforms with the physical model, the results are documented and different control schemes can then be implemented to the analytical strut where they can be verified experimentally.

The landing gear is set up on a head shaker in the Aircraft Landing Dynamics Facility. The critical variables, such as the oil pressure in the chambers and acceleration of the different components are measured with sensors when the strut is activated. These values are transformed into digital results with the aid of LabVIEW, an instrumentation software, and the results are compared to the analytical model. Once this technology is validated, it will be implemented to the HSCT landing gear strut.

Prediction Of Plasticity-Induced Closure In Surface Flaws Using A Modified Strip-Yield Model

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The part-through semi-elliptical surface flaw is commonly encountered in engineering practice. Models enabling the accurate prediction of the growth of this type of flaw under cyclic loading represent an essential element in any damage tolerant design methodology. In metallic materials, a growing surface flaw will remain closed or partially closed along the crack front for a portion of the applied cyclic load as a consequence of plastically deformed material left in the wake of the growing crack. Proper characterization of this plasticity-induced crack closure is needed when predicting flaw shape development and growth rate in the part-through semi-elliptical surface flaw.

Surface flaws exhibit a level of closure which varies along the crack front. Both the extent and variation of this closure have not been well characterized. Plasticity-induced fatigue crack closure has attracted the interest of many researchers. However, due to the complex nature of the surface flaw, the majority of this research activity has focused on through-crack geometries such as the compact tension specimen and the center-cracked panel. The amount of crack closure information available for surface flaws is relatively small in comparison to that for through-cracks.

Modeling the plasticity-induced closure generated by the semi-elliptical surface flaw may be performed using three dimensional nonlinear finite element analysis. However, from an engineering perspective this type of an approach is impractical. Modified strip-yield models have found wide application for prediction of crack closure and subsequent fatigue crack growth in planar geometries with through-cracks. While approximate in nature, these type of models exhibit high computational efficiency when compared to more rigorous finite element based models. A slice synthesis methodology was used to construct a modified strip-yield model for the surface flaw, enabling prediction of plasticity-induced closure and subsequent fatigue crack growth. Using coupled modified strip-yield model analyses, concurrent crack closure assessments for the surface flaw at both the free surface and at the deepest point of penetration were performed. Model predictions of aspect ratio evolution were found to correlate well with experimental measurements for uniformly loaded aluminum specimens under constant amplitude loading.

Development Of Thermochromic Transition Metal Complexes For Use In 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 visible and near IR spectra of transition metal complexes offer a convenient method for studying the changes in their electronic and structural environment. One should be able to observe the color of a compound and correlate this with a change in the structural and/or electronic environment. This change of color should be detected not only by the naked eye but also by a change in the visible spectrum of the compound.

Thus, the electronic spectra of several first row transition metal complexes were recorded in order to monitor color changes in the complexes as a function of temperature. The spectra of powdered solid samples were recorded using a diffuse reflectance sphere attachment to a Perkin-Elmer 330 UV/VIS/NIR Spectrophotometer. The temperature was varied using a specially designed diffuse reflectance cell and cell holder.

The high energy bands shifted to longer wavelengths (red shift). However, there were no significant changes in the shapes or energies of the bands in the visible and near infrared regions. The one exception was dibromobis(N, N, N', N'-tetramethylethylenediamine)nickel (II). A new peak appeared around 525 nanometers as the sample was heated.

Other methods of monitoring the temperature dependent color changes of the complexes are being investigated. The most promising seems to be colorimetry, which involves the measurement of the intensity and hue of a colored sample

Abstract

José B. Dávila-Acarón

Determination of Local Energy Spectrum as a Function of Wavenumber and Frequency for Receptivity Experiments

During the late 1980's a method was developed at the University of Texas at Austin to locally measure energy spectrum of velocity fluctuations in a medium where no deterministic relationship exists between wavenumber and frequency. The method utilizes simultaneous, two-point, time-series calculations to obtain spatial phase difference. It was employed in the transitioning wake of a flat plate and in drift-wave experiments with rf-excited plasmas.

The proposed research is to utilize the technique to determine spatial spectral characteristics of low-level turbulence in the free stream, and then apply it to laminar boundary layer fluctuations in receptivity experiments at NASA-Langley. It is expected that the technique will reveal details of the receptivity mechanisms, possibly including wavenumber resonance between the surface roughness and the free-stream fluctuations.

A MODEL FOR THE ASSESSMENT OF ORGANIZATIONAL AND EMPLOYEE DEVELOPMENT AT THE NASA-LANGLEY RESEARCH CENTER

Developed by Linda W. Deans, Ph.D. 1996 NASA-ASEE Summer
Faculty Fellow

Background

The mission of the Employee Development Branch (EDB) is to design and implement a strategy of continuous organizational and individual development through planned learning which is inextricably linked to the NASA-Langley Research Center's business goals. On a functional level, EDB's goal is to provide leader's with a broad range of concepts, models, and planned learning experiences which enable organizations and employees to achieve professional synergy in meeting/exceeding the performance requirements of the organization.

The Research Question

The ultimate objective of training and development interventions is to enable the Center to be responsive to today's environment with a vision toward capitalizing on the opportunities of the future. How then, are these philosophical goals and objectives translated into concrete initiatives to deliver an effective and efficient program of organizational and individual development?

Results of the Research Assignment

When exploring this very critical question, emphasis was placed on the organization's roles, mission, and business processes. From this point, a rational approach was developed to link the Center's performance requirements to the training and development needs. To be effective, linkage analysis must represent a comprehensive and systematic process for the design of human resource development. The steps of the process are: Identify Langley's business goals; articulate specific performance requirements; link Langley's business goals to performance requirements to individual development; design a Tactical Plan for Organizational/Employee Development; facilitate the development of performance leadership; and assess the contribution of developmental initiatives to business performance. From this process, a model was developed for implementation Center-wide.

Outcome and Recommendations for Further Study

This model has been presented to the Leader of the Employee Development Branch. Further collaboration resulted in the Leader developing an implementation plan for each of the Groups at the Center. This researcher will assist in the piloting of these plans over the next year.

During the piloting efforts, Groups will be submitting plans and at the same time, subunits will be making additional requests. As a part of this effort the EDB has initiated a computerized method of collecting data and responding to the various Groups regarding the status of their requests.

The last on-site actions of this researcher involved strategies to assess the contributions of developmental initiatives to business performance. It is believed that this model and process will serve as the impetus for EDB and Group offices to work collaboratively to ensure the accomplishment of the Center's mission.

Accurate Characterization of Oxygen A-Band Line Parameters for Applications in Remote Sensing of the Atmosphere

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Accurate characterization of absorption lines is necessary for interpretation of the data from experiments that perform measurements of the constituents of the Earth's Atmosphere. For instance, the NASA Stratospheric Aerosol and Gas Experiment III (SAGE III) instrument to be flown under the US Mission to Planet Earth, and the Global Ozone Monitoring by Occultation of Stars (GOMOS) experiment that is anticipated to be flying on ENVISAT in 1998 require accurate characterization of the Oxygen A-band rovibronic lines. This absorption band originates from an electric-dipole forbidden as well as a spin forbidden electronic transition, deriving its cross-section from a magnetic-dipole change, and therefore results in line-strengths that are very small. Accurate characterization of such lines is, therefore, a challenging task. While there exist data bases, such as HITRAN, which contain information on the Oxygen A-Band lines, there still remains a great need to reduce the error intervals to which these values can be specified with confidence.

The research undertaken uses a very sensitive method for accurate characterization of gaseous molecular absorption lines. The technique employs wavelength modulation spectroscopy using diode lasers to obtain line-widths, radiative cross-sections and variations of the line-widths as well as line-centers with pressure. The method uses modulation of a diode laser beam by injecting a modulated current, followed by phase-sensitive detection. Demodulation is performed at one of the harmonics of the modulation frequency.

We have found that when one employs demodulation at harmonics greater than the commonly-used second, there are several advantages that accrue: greater sensitivities to density, pressure and temperature fluctuations are obtained; greater wavelength resolution of overlapping lines is achieved; and, several (N) independent measurements of the line-width are obtained from an Nth harmonic measurement. All these characteristics make the method of wavelength modulation, using higher harmonic detection, ideally suited for the task of characterizing Oxygen A-Band lines. The work performed under the sponsorship of the NASA-ASEE Fellowship applies the higher harmonic detection innovation [1-4] to wavelength modulation spectroscopy to obtain the line characteristics of several Oxygen A-Band lines. It is anticipated that further future collaboration with the NASA Langley Research Center Aerosol Research Branch will enable accurate characterization of all the lines of interest in the Oxygen A-Band by this method.

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A Benefit Analysis of a NASA Aeronautics Research Project:
The Integrated Wing Design Project

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Assessing the projected benefits of NASA's research projects is an indispensable first step towards effective management decision making. The results of such studies can be used as a basis for resource allocation, project management trade-offs and other similar decision analysis problems. Although conceptually simple, estimating the economic impact of a public sector research project oftentimes poses significant modeling challenges. The present analysis examines the potential market and socioeconomic impacts from the Integrated Wing Design (IWD) element of NASA's Advanced Subsonic Technology program.

The IWD project has two principal technical performance goals: a 4% reduction in aircraft TAROC (Total Aircraft Related Operating Cost), and a one year reduction in the design cycle time for new aircraft. (These technical performance goals were defined as part of a previous system analysis study.) The former goal impacts U.S. carriers since it reduces their costs of operating an aircraft, while the latter goal impacts U.S. manufacturers of large civil transports since it reduces their product development design cycle for new aircraft. A study conducted by the Logistics Management Institute (LMI) in June of 1995 created a market impact model for the TAROC reduction, and a qualitative "order of magnitude" market impact model for the design cycle reduction. The present study enhances the previous market impact model for TAROC, creates a market impact model for design cycle reduction, extends the benefits to socioeconomic impacts, and includes uncertainty by modeling appropriate values as random variables. The enhancements to the existing TAROC model consist principally of updating with more recently available data and enhancing with additional features (most notably the inclusion of random variables within the models).

The market impact model for the design cycle reduction is based on the premise that a shortened product development time increases the market share of the corresponding U.S. aircraft manufacturer. Linear regression or neural network modeling techniques are not readily usable due to the absence of relevant data (stemming from such unique characteristics of the aircraft industry as 20+ year aircraft generation times and the process change undergone because of the emergence of Airbus Industries as a mature manufacturer). A cumulative market share model for a potential new aircraft (in the greater than 350 passenger class) was created by examining the form of similar curves for previous aircraft (the A310 and the B767, and the A320 and the B757).

The socioeconomic impact (the benefits at the National level) of the IWD technologies are estimated based on the outputs from the market impact models. The metrics used to quantify these benefits are the incremental tax revenues resulting from increased corporate profits, the number of jobs associated with the increased economic activity, and the improvement in the balance of trade resulting from the increase in sales by U.S. aircraft manufacturers (with a corresponding decrease by foreign competitors). The study concludes that the IWD research project has the potential to result in significant benefits from both a market (the users of the technology) and socioeconomic basis (the Nation at large). Furthermore, the magnitude of these benefits highlights the importance of the commercial aerospace industry to the U.S. economy.

COSA Version 2.0:
Using Cybernetic Optimization by Simulated Annealing
to Solve Generalized, Mixed Integer, Nonlinear Optimization Problems

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Abstract

Finding the global optimum to generalized math programs is often a daunting task. Such problems arise in numerous contexts including the area known as "Design Optimization". These problems are often difficult because they contain numerous local minima. Several methods exist that can find or approximate the optimal solutions. The goal of this research was to further develop theoretical aspects of *cybernetic optimization by simulated annealing* (COSA) and to develop a generalized optimization package that can solve continuous and mixed integer optimization problems.

The COSA scheme has several advantages associated with the use of parallel processors and probabilistic feedback control. The COSA scheme is a method of parallel processing that uses a network of self-similar, self-reflexive, and self-referential processors in a *probabilistic feedback control* (PFC) network. This architecture provides a negative feedback control mechanism for the simulated annealing (SA) algorithm that accelerates the convergence of SA to the global optima.

This research extends the theory of COSA to non-linear, *continuous* variable problems. Applying this method to continuous variable problems raises several new issues and problems regarding candidate selection. This research shows how a scaling property inherent in SA and the use of a secondary feedback mechanism that probabilistically restricts the generation of candidate solutions accelerates convergence to an arbitrarily small neighborhood of the globally optimal solution in the continuous domain. Network architectures, implementation schemes, feedback mechanisms and theoretical and experimental results are presented.

Coupling aspects of TABU search techniques and adaptive memory techniques with the COSA scheme permit an efficient and intelligent search of the configuration space. The performance of this software has compared favorably to other global optimization techniques and is readily applied to a wide range of problems.

Proposal for the Active Control of Flat Panel Response
Due to Turbulent Boundary Layer Excitation

by

Gary P. Gibbs

Abstract

The objective of the proposed program is to experimentally investigate the active control of a flat panel subjected to TBL excitation. In this case, the panel response will be controlled via local feedback techniques using piezoelectric sensoriactuators to act simultaneously as a sensor and an actuator. The control system will actively add damping to the structure. The panel response will be monitored with a scanning laser vibrometer. The work will study the effect of the various currently available feedback compensation schemes on the control performance. The number of independent sensoriactuators will be studied as a function of control performance over some defined bandwidth.

DAVID J. GOSSELIN

Capital Asset and Depreciation
Accounting in the Federal Government

The research project is dealing with the treatment of property, plant, and equipment (PP&E) in NASA as a Government Agency. Recent pronouncements have decreed that Government entities should account for PP&E in a more traditional manner (i.e., private industry). This project is looking at background, precedence, and implications to financial statements and management behavior. Since NASA has PP&E that falls into two categories (general and Federal mission), there is a concern that this will have large operating ramifications. This project continues to assess future impact on financial statements and perceived cost to programs and projects in NASA. The adoption of this type of fixed asset accounting and treatment is supposed to lead to better stewardship of Government funds and taxpayer dollars--this is yet to be determined.

Full Costing in NASA

This ongoing project deals with the design and implementation of Full Costing in budget, management, and accounting in NASA. Have been an active member in the Headquarters teams since its inception. This project is in the prototyping stage. The effects on the prototype Centers are being analyzed for commonalties, differences, positives, and negatives. The results of the analysis will be used to implement an Agencywide test in the coming year.

Retrieving Images by Content

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Without an effective system for management and retrieval of image data, the full value of the visual information and semantics manifested in the images cannot be exploited. The traditional approach for image database management has been to use a relational database management system (DBMS) to store extrinsic attributes associated with the images. The extrinsic attributes constitute image id (ID), latitude and longitude, date of image acquisition, information relative to viewing geometry, processing history, among others. The recent trend has been to make use of the "BLOB"[1] or "IMAGE" data types provided by the underlying (relational, object-relational, or object-oriented) DBMS. This entails storing the extrinsic attributes and the images under the control of the DBMS. This facilitates concurrent data sharing and update (through transaction control), integrity constraints enforcement, and recovery. However, these approaches provide only primitive querying capability since queries are processed using only extrinsic attributes. The extrinsic attributes manifest neither the visual nor the semantic content of the image. If the saying "a picture is worth a thousand words" holds true, the search for relevant images should also be based on the visual and semantic information manifested in the images (i.e., content-based image retrieval).

Content-based retrieval is facilitated by the following generic query classes: color, texture, sketch, shape, volume, spatial and topological relationships, browsing, extrinsic attributes, subjective attributes, sequences, keywords, and natural language text. More complex and domain-specific queries can be expressed using the generic query classes. These classes can be thought of as being similar to fundamental relational algebra operations in relational DBMS.

Spatial and topological relationships query class retrieves images that have domain objects conforming to the spatial and topological relationships specified in the query. To retrieve images that have objects whose shape is similar to the objects specified in the query, shape query class is used. We have developed an efficient and robust algorithm for processing shape similarity queries. The algorithm is based on polyline representation of the boundary of the shape and requires linear time in terms of the number of vertices in the polyline approximation. We have also developed an efficient algorithm for retrieving images based on the spatial relationships among the domain objects in $3D$ images.

Our future goal is to apply these results and our previous work in developing an image archiving and retrieval system for managing large collections of remote sensing images of the earth.

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[1]Binary Large Object Boxes.

Implementation of the ATLAS model for Connectivity of Secondary School Partners in the NASA Network Resources and Training Sites

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Omit

Tasks were designed to promote the IITA K-12 Program Mission and Objectives. The IITA K-12 Program Vision seek to revolutionize the classroom through the evolving National Infrastructure by transforming teaching and learning for all students, including the disadvantaged and underserved. IITA K-12 Program Objectives include development of low cost scalable innovative K-12 technologies and applications that can be deployed in a broad range of educational communities.

Proposals to NSF, NASA, and the Eisenhower Foundation were submitted to secure funds to implement the ATLAS program in secondary schools in the North Carolina and Virginia Region. Industrial, university and government partners for these proposal include ADNET Systems Inc., WHRO-TV, LaRC Office of Education, MUSPIN Office of Goddard Space Flight Center, The U.S. Department of Housing and Urban Development, Pembroke State University, Norfolk State University and ECSU.

Considerable attention was paid to K-12 Outreach Activities which involved identifying and training educators/staff within targeted schools that will serve as connectivity coordinators. An Intensive four week precollege summer workshop in computer networks and webpage design was held at the NRTS site at ECSU. Participating educators received assistance with designing the LAN and the implementation plan for their schools. ATLAS coordinator, Jeff Seaton, educators/administrators from each school and ECSU technical personnel met with HorizonNet staff to identify other logistical considerations to be addressed.

A Curriculum and Pedagogy Website on Umfort.ecsu.edu node (http://www.ecsu.edu/nrts.html) documents the VA/NC ATLAS connectivity project. Included are links to existing curriculum ideas and Pedagogy sites available on the Web including results from other IITA programs.

A Memorandum of Agreement is now in place which support the future participation of LaRC and the role of ECSU as flagship for other NRTS sites seeking to replicate regional secondary connectivity via ATLAS.

Nonequilibrium Boundary Layer Effects on Aerodynamic Heating Analyses of X-33

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NASA has laid the groundwork for the next generation space transportation system via the Reusable Launch Vehicle (RLV), X-33 program. The main goal of the RLV is to substantially reduce the cost of payloads to Earth orbit. Envisioned is a family of fully reusable robust rocket vehicles that operate like commercial aircraft with a ten-fold reduction in life cycle cost compared to the Space Shuttle Orbiter.

Because of the advantages of this concept, a substantial effort was undertaken to assess and optimize the aerodynamic performance from entry to landing and to determine aeroheating characteristics for design of the thermal protection system. The Aerothermodynamics Branch at Langley had already shown that computational fluid dynamics (CFD) provides accurate predictions of vehicle heating over the Shuttle Orbiter through the proper modeling of the reacting gas chemistry in the flowfield and its interaction with the surface material. Such CFD analyses are particularly helpful when predicting heating in localized surface areas of topological complexity or in regions with rapid changes in surface properties. Although historically the Shuttle Orbiter has operated well within the limits of it's thermal protection system (TPS), the operational demands of the next generation RLV will require an even more thorough knowledge of the thermal environment. This new class of vehicle is also more complex and hence may see local surface temperatures several hundred degrees higher than the Orbiter.

The present work is a case in point: it deals with an aerodynamic heating problem occurring in the regime of nonequilibrium-dissociated flow with finite surface catalycity. In particular, it describes an approach for combining a new boundary-layer analytical method with comprehensive (but time intensive) CFD flowfield solutions of the thin-layer Navier-Stokes equations. The approach extracts CFD-derived quantities for inclusion in a post-processing boundary layer analysis. It allows a designer at a workstation, using a single CFD solution, to determine the change in heating across the interface of two different thermal protection materials due to a jump in catalytic efficiency. This is particularly important, because abrupt changes from low to high catalytic efficiency can lead to localized increase in heating which exceeds usually conservative estimates. For a given trajectory point, the approach uses a single baseline CFD solution with changes in heating levels calculated as a function of the catalytic jump using the boundary layer analytical solution. This provides a stand-alone post-processing tool which can be used in preliminary design of thermal protection systems (TPS), involving only a small number of CFD runs. Improved physical insight and 100-fold reduced computational costs are thereby attained.

Title: Porting Thermally perfect Gas Code to PCs
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Date: August 1, 1996

Abstract

The Thermally perfect Gas (TPG) Code is a software developed (David W. Witte and Kenneth E. Tatum, NASA Technical Paper 3447) to compute the compressible flow gas property measurements for thermally perfect, calorically imperfect gases. The TPG code generates tables similar to NACA Report 1135 for air but also extends their validity for various gas mixtures. The TPG code is currently available in two versions: a text version coded in FORTRAN (Witte and Tatum), and a GUI version (by S. Blake Williams) with MOTIF interface coded in FORTRAN and C for the Sun Workstations. With the proliferation of Intel-based PCs running Windows, Win 95, and Win NT, there is a need to disseminate the TPG code on the PC platform as well.

The text version, coded in conformance to FORTRAN 77 is recompiled with few changes on Microsoft FORTRAN Powerstation to run under DOS. However, the GUI version must have its GUI totally reconstructed. The source code for the GUI version was studied and analyzed. The subroutine calling and called relationship among the FORTRAN subroutines and the C source code was analyzed, despite the fact that the C source code was not documented. Several porting strategies as well as new development using cross-platform development tools are derived and compared.

At a minimal cost with a minimal effort, we decided to use the Microsoft Visual BASIC to create a MOTIF GUI interface look-alike to call the TPG FORTRAN subroutines which were first compiled into a DLL file using Microsoft Fortran Powerstation. The interface is created with the flexibility in mind to allow more functionality to be added in the future. In addition, the whole porting process is documented so that any computational intensive software coded in FORTRAN can be similarly ported to PCs.

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Process for Making Adhesiveless
Flex Circuits Using
Langley Research Center Soluble Imide (LaRC-SI)

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The avionics industry, an area where space and weight is a premium concern, is constantly trying to produce efficient, lighter, smaller systems. The electronics industry has offered flexible-circuits as one means of fulfilling this goal. However, there are disadvantages or concerns with flex circuits. The traditional flex circuits use an adhesive-based laminate to join the copper or conductors to the substrate or dielectric. Often it is the adhesive's flexing ability that limits or reduces the flexing of a circuit. The solution to this problem is to find a material that reduces or eliminates the need for adhesives.

NASA/LaRC has developed a new dielectric material, Langley Research Center Soluble Imide (LaRC™ -SI) which is self-bonding. This polymer is now being researched to determine its place in electronics.

LaRC-SI is a wholly aromatic high performance thermoplastic polyimide that is a self-bonding/non-curing resin that is made from commercially available monomers. This polyimide possess superior electrical properties and an extensive range of processing choices which allow it to serve as both a dielectric innerlayer, substrate coating or the substrate.

LaRC-SI film is made by casting or spraying a solution consisting of xylene, N-methyl-pyrrolidinone (NMP) and LaRC-SI powder. At different drying temperatures, various amounts of solvent are removed. One drawback is that the NMP (the major solvent) is hydroscopic in nature requiring that care must be taken to insure that any absorbed water is removed during drying. The presence of moisture can adversely effect the electrical performance by reducing the dielectric strength, increasing the dielectric constant and forming voids upon vaporization which would lead to blistering and delamination. Hence, developing a drying schedule which eliminates the water and other solvents while allowing for rapid processing and repair are essential.

Research has shown approximately 2.7% NMP retention in LaRC-SI film dried at 200°C. Therefore, a range between 150°C and 210°C at different times was investigated to determine the point where the least amount of NMP was retained.

Unstructured Grid Generation for Visualization of the Stress Response of Elastic Bodies on PCs

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With the advent of very powerful and cheap PCs, sophisticated computer simulations can be brought to the undergraduate science and engineering level. Making these simulations tools easy to use and with a very small learning curve, allows the routine use of computer simulations in undergraduate courses as part of homeworks, and exams. A key component of these simulators is visualization. That is, the ability to graphically depict the subject under consideration in a manner that improves learning. The goal of this research is to develop a robust unstructured grid generator which can be used with an elastic simulator to visualize the stress field inside an object that is under some kind of loading. Moreover, with an eye towards the future, this grid generator will be easily adaptable to fluid dynamics type problems (obstensively, Euler equations). The resulting grid generator should be automatic and robust enough so the student does not have to worry about the concepts of grid generation and can focus what the visual image means and on understanding the subject under consideration.

A possible scenario for using such a simulator is teaching the concept of stress concentration in a sophomore strength of materials course. Teaching this concept is very difficult because it really emphasizes the idea of stress as a *field* quantity rather than a point or scalar quantity. Consequently, the subject is very visual. Showing the students the effect of changing materials, geometry, and loading on stress concentrations and how it impacts strength of materials is virtually impossible with conventional chalk on the chalkboard or even color transparencies. What is needed is a computer simulator that the students could learn to use in the time frame of a homework problem and yet could quickly compute the stress response of the entire object and quickly *visually* depict it. Commercial programs typically have a very long learning curve and require very powerful workstations. The simulator discussed here would not compete with commercial programs, but rather fill in the gap between commercial quality programs and "toy" simulators that are typically used in undergraduate courses. These simulators could be used to allow students to play out "what-if" scenarios, to solve problems that lie outside the simple formulae in the typical textbook, or to solve more "real-world" problems, even in a sophomore level course.

This project developed a simple to use, robust, unstructured grid generator for use in an elastic simulator that has been developed at Clarkson. More precisely, it implements a two-dimensional, triangular, unstructured grid method using a Delaunay triangulation with Steiner boundary point insertion. An unstructured grid was chosen so that very arbitrary geometries could be created and analyzed by the student. The three important features of the program development are robustness, speed, and low memory usage. Robustness is a desirable feature because of the wide range of shapes the student can create. In addition to robustness, another desirable feature is speed. Even though today's PC is extremely capable, any program that is too slow is liable to anger the student who is in the midst of a very pressured curriculum. Low memory usage is desirable because it is being designed for PC class computers.

1996 Summer Faculty Research Program
at NASA-Langley Research Center

Development of Structural Foams for High Temperature Use Based on Polyimide Resins

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Abstract

An experimental study was performed to develop structural foams which are resistant to extreme cyclic changes of temperature and *less* susceptible to thermoplastic failure at elevated temperatures. The following polyimide resins were evaluated: LaRC-RP46's with different Mc, LaRC-SI, LaRC-IA, physical blend of RP46 with LaRC-SI or IA, and semi-IPN of RP46 with LaRC-IA. The effectiveness of residual solvents, imidization volatile, chemical blowing agent in foaming process were examined in the study. Three foaming techniques under evaluation included: *paste* process (based on imidization of monomer or amic acid paste with entrapment of condensation volatile); *slurry* process (based on controlled evaporation of solvents from high-viscosity slurry of imidized resin powders); *powder* process (based on the activation of chemical blowing agents in the presence of imidized resin powders at high temperature). Among the foaming techniques studied, the paste process could be established most readily. In this process, high resin viscosity *during* imidization was found to be the most critical factor in achieving effective entrapment of condensation volatile. Since most solvents were evaporated before the onset of imidization, either initial solution viscosity or initial solid content of resin had a minimal influence on foaming capability. Because of high resin viscosity during the imidization process, both LaRC-SI and LaRC-IA thermoplastic polyimides produced the foams of a reasonable quality. On the other hand, thermosetting polyimide of Standard LaRC-RP46 could not produce structural foam, because low resin viscosity during imidization hindered effective entrapment of condensation volatile. Despite their excellent foaming capability, thermoplastic polyimides such as LaRC-SI or IA exhibited several limitations. At elevated temperatures exceeding ~260°C, both LaRC-SI and LaRC-IA polyimides were found to suffer the collapse of foam due to thermoplastic failure. One important finding of this study was that the increase of molecular weight for LaRC-RP46 thermosetting polyimide leads to higher resin viscosity during imidization resulting in more effective entrapment of condensation volatile. As a consequence, RP46 resins with *higher Mc* (7,000 and 10,000) produced structural foams with a reasonable quality, in contrast to the case of Standard LaRC-RP46 (F.M.W.= 1,500). In producing structural foams from RP46 resins with higher Mc, thorough removal of solvent before imidization was found to be essential to avoid overflow of resins which often causes poor quality of the foam.

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Heat Transfer From Mach 5 Nozzle

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ABSTRACT

The Mach 4 and 5 nozzles are heat sink design. How long after a run will it take for the nozzle to cool before another run can be made? What is the effect of the hot nozzle on the test section and plastic insulation for wiring? These are the issues that one would like to have clarified prior to a run of the 8-Foot High Temperature Tunnel. The problem is expected to be acute for the Mach 5 nozzle since the surface temperature can reach 1800^0R during a run with a mean temperature of 800^0R. Estimates of the heat transfer under such severe conditions have revealed that about 30 - 48 hours are required for the system to cool down.

With the use of the computational fluid dynamics code, Fluent, we expect to derive a more accurate assesment of these issues and address the effect of the intense heat expected in the test section. At this point we anticipate the need for large fans of 40 - 100 HP to provide cooling using ambient air.

Formal Methods
for
Software Verification:
Using PVS

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Software reliability has become increasingly important, especially in life-critical situations. Equally important are the design and applications of methods used to obtain or ensure this "ultra-reliability", generally considered to have a probability of failure less than 10^{-7}. Some methods utilize statistical models or ways to quantify the reliability of the software. These methods and some others require an enormous, possibly infeasible, amount of testing and deal with the software in the last stages of development. A different approach to establishing software reliability is the use of formal methods. The term "formal methods" refers to the use of concepts from discrete mathematics and logic in the development of computer systems.

PVS, Prototype Verification System, is an interactive system for writing formal specifications and checking formal proofs. It is currently run on Sun SPARC workstations and requires GNU EMACS. PVS has a rigorous typechecking system and has an effective theorem prover. By writing the requirements specifications in PVS, certain properties of the specification must be proved through the mechanical theorem prover. During such proofs, errors may be detected by the PVS typechecker or theorem prover and corrections can be made at this early stage of the software lifecycle. If no errors are detected during this process, the particular function described by the specification will be proved correct.

New libraries are being added to the PVS system. The algorithms contained in these libraries are viewed as theorems that must be proved correct before they can be used. In using PVS to prove these theorems, often other properties or "obligations" detected by PVS must be proved also. Several of these were proved. Understanding and appropriately using PVS requires a knowledge of logic and discrete mathematics to do the proof unassisted by the computer, and then the extensive practice of working with a mechanical theorem prover.

Piezoelectric Polyimides:
Smart Materials for Aeronautics

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Among the compounds known as smart materials are piezoelectrics. Already in use for sensors and actuators, most piezoelectrics are based on ceramics. There is a need in aeronautics for lightweight polymer based piezoelectrics for vibration and noise suppression, flutter suppression, and pressure, stress or strain sensing. The goal of this research was to develop methods to prepare monomers, (the starting materials for polymers), synthesize some monomers and use them to make piezoelectric polyimides suitable for use in aeronautics.

When pressure is applied to a piezoelectric material it generates an electrical charge (can be used as a sensor). Conversely, when a voltage or charge is applied to a piezoelectric material it will change its dimensions (can then be used as an actuator). Polyimides were chosen as the base polymer because they are strong, flexible, stable to heat or vacuum and have very high glass transition temperatures (which allows them to keep their piezoelectric properties in most environments). Ceramic piezoelectric materials contain electron rich, highly polar groups. For this reason, monomers which have several of these polar groups were synthesized in order to prepare polyimides that should exhibit piezoelectric behavior.

An aromatic amino moiety was selected as a stable base on which to hang the piezoelectric inducing groups. Two of these groups were attached to each monomer in hopes of making a polymer with especially strong piezoelectric properties. A total of ten compounds were synthesized. After purification, these monomers will be used to prepare polyimides. These polyimides will subsequently be checked for piezoelectric properties.

The Teacher Enhancement Institute (TEI):
A Model for Professional Development Programs

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It has been noted that common professional development requires little of teachers in the way of intellectual struggle or emotional engagement, and takes only superficial account of their histories or circumstances. That is not to say that the training model that has historically been used in professional development does not have a place in the area of education reform. These programs, whose purpose it is to, improve, broaden, and deepen the disciplinary and pedagogical knowledge of elementary and secondary teachers employed in the public schools - are being examined in order to determine what impact they are having on developing the educator as a professional.

As a new model for professional development, the Teacher Enhancement Institute (TEI) was designed to blend best practices in education with the rich resources of a government facility. The Teacher Enhancement Institute is a series of three, two-week workshops for elementary and middle school teachers in science, mathematics and technology using the Problem-Based Learning Model through the theme, aeronautics. Participants are exposed to instruction by educators and NASA researchers in theoretical and experimental foundations in problem solving. They also receive hands-on telecommunications experiences, research experiences, special presentations and tours. Post-institute follow-up activities are programmed to ensure implementation of Institute strategies and to provide modeling standards among teachers for successful NASA technology and pedagogy transfer to school systems.

Professional development programs that appear to have the most merit provide opportunities for educators to participate in activities designed as "pure" intellectual experiences, divorced from the practical considerations of teachers' jobs. Collaboratives underscore teachers' involvement in the construction of subject knowledge. They prepare teachers to make informed responses to reforms in subject matter teaching and student assessment. The Teacher Enhancement Institute utilizes these practices as the back drop for the development of educational experiences for teachers.

Rocket-Based Combined-Cycles
for Earth-to-Orbit Vehicles

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The Space Shuttle has provided transportation to and from space very successfully, but there are several reasons for wanting a new and improved system, including cost reduction. The current NASA and industry cooperative Reusable Launch Vehicle (RLV) Program will develop the X-33 flight vehicle to demonstrate technology that might lead to the development of a single-stage-to-orbit (SSTO) rocket vehicle. Such a vehicle would have significantly reduced costs and other advantages over the Space Shuttle but would not reach the level of costs needed for many space missions, such as space tourism. The NASA has recently selected several organizations or teams to study more advanced vehicle concepts using Rocket-Based Combined-Cycle (RBCC) propulsion and to begin experimental testing of elements of such vehicles.

RBCC propulsion is not a new concept. It has been studied extensively, with some of the most significant work reported in 1966. The basic idea is to combine the advantages of airbreathing propulsion such as ramjets with the advantages of rockets. Typically, airbreathing propulsion provides high specific impulse or low fuel consumption, while rockets provide low engine weight for a given thrust requirement and the ability to provide thrust at all flight conditions, including space vacuum. By combining the characteristics of both types of engines, RBCC engines may provide better vehicle results than either type separately or combinations that are not integrated. The project reported on was to survey the RBCC literature and prepare a commented bibliography.

The RBCC engines fall roughly into four categories. The first category has an ejector, which is basically a rocket inside an airbreathing engine duct. The exhaust of the ejector provides an entrainment of the air that improves the efficiency of combustion of the air. The ejector can be turned off when the extra thrust is not important and can be used as a rocket in space. The second category is the air-turborocket, in which a rocket exhaust is used to power a turbine that in turn powers a compressor in the air stream. This engine has the capability of providing thrust at Mach numbers up to about 5, much higher than turbojets. A third category includes the liquid air cycle engine (LACE), in which cold hydrogen fuel is used to cool and liquefy air, then the liquid air is used in a rocket. A fourth category includes air collection and enrichment (ACE), in which a liquid oxydizer that is mostly oxygen (enriched compared to liquid air) is collected and stored for later use in a rocket.

A Computational Investigation of Flap Side-Edge Flow Noise

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During flight, high speed air flow about the side edges of an airfoil's flaps becomes one of the most intense sources of non-propulsive noise. The significance of this noise source began to be recognized in the late 1970's. Studies showed that the flap side edges were more efficient noise radiators than the trailing edge source, which had been considered to dominate wing-produced noise up to that time.

Recently, Sen of the Boeing Company proposed a physical mechanism for the flap-edge noise source and a two-dimensional model to illustrate it. Sen's model suggests that the vortex which forms off the edge of the flap can be excited into periodic oscillations as it is perturbed by a small secondary vortex or turbulent eddy. Such periodic oscillations of the flap edge vortex would provide a possible explanation for the intense noise producing capabilities of the flap side-edge region. Sen's model has several intriguing mathematical aspects and also appears to have physical plausibility based upon flow visualization tests carried out at NASA Langley Research Center. In the present study, the two-dimensional flap side-edge flow model developed by Sen is analyzed to reveal the noise production potential of the proposed mechanism.

In our study, the flap is taken to be a rectangular slab of finite thickness in the presence of which there exists a potential flow as well as a point vortex to represent the flap-edge vortex. Using conformal mapping techniques, the region exterior to the slab is transformed into the upper half plane. Trajectories of the vortex are determined in the transform plane and then mapped back to the physical plane through the conformal map. For a limited range of the governing flow parameter, closed periodic trajectories of the flap edge vortex occur. For any given value within this range, there exists an equilibrium point of the vortex where the upwash potential flow velocity is just balanced by the image vortex induced velocity. If the vortex is perturbed slightly away from the equilibrium point, it will then follow a closed trajectory.

For values of the governing flow parameter for which the tip vortex performs periodic oscillation, periodic noise will be produced. The resulting sound radiation at locations in the far field is determined by numerically integrating the Ffowcs Williams-Hawkings equation. Although the flow model itself is purely two-dimensional, the noise field is calculated three-dimensionally by taking the flap to have a finite chord. The Ffowcs Williams-Hawkings equation provides the acoustic pressure at any location in the far field based upon the time dependent surface pressures, evaluated at a retarded time. The intensive storage requirements necessary for the retarded time evaluation often leads investigators to ignore the retarded time effect in acoustic calculations. As a part of this investigation, the effect of neglecting the retarded time differences is considered.

Extensive acoustic calculations have been carried out for various values of the governing flow parameter, vortex initial positions, and observer locations. For cases in which the vortex performs periodic oscillation, periodic dipole sound containing the fundamental frequency and several nonnegligible harmonics is produced. Results from this study, suggest that the intensity of sound can be reduced by reducing the chord or increasing the thickness of the flap. Currently, a similar investigation of an analogous three-dimensional version of Sen's flow model has begun. In particular, a numerical study is being conducted in which the point vortex representation of the flap edge vortex is replaced by a fully three-dimensional vortex filament.

Verification of Fault Tolerant Design of Flight Critical Digital Systems

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Many design and manufacturing procedures are currently employed to avoid the introduction of hardware and software faults into flight critical digital systems. These are followed by analyses designed to determine the level of risk of system failure and assure that it falls below a given threshold. During design, construction and analysis there are many assumptions made regarding the probability of arrival and the severity of effects of many types of internal and external disturbances. These assumptions must be tested in order to truly determine the level of risk associated with flight control using these systems.

Since the operational state space is so large there is no way to test every parameter during every conceivable environmental condition. Laboratory tests are therefore directed to investigate given classes of disturbances on realistically modeled full systems that are identified as likely threats by system analyses and operational data. These tests should be supplemented by a much improved and expanded flight and ground operations data base that is suitable for extended analysis. Among these methods assumptions can be verified, confidence can be built in these systems, and developmental needs can be clearly identified.

The Assessment Technology Branch of the Flight Electronics Technology Division has experts in both hardware and software for airborne applications who promote design methods that avoid faulty implementation of desired system behaviors, and who test existing airborne digital equipment in harsh operating environments. The goals of this research is to characterize conditions that cause upset of critical systems and to determine the effectiveness of design or operational methods employed to eliminate them, and to identify new or more capable methods to assure system integrity.

Simulated "On-Line" Wear Metal Analysis of Lubricating Oils by X-ray Fluorescence Spectroscopy (XFS)

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Abstract

The objective of this project was to assess the sensitivity of X-ray Fluorescence Spectroscopy (XFS) for quantitative evaluation of metal particle content in engine oil suspensions and the feasibility of real-time, dynamic wear metal analysis. The study was focused on iron as the majority wear metal component. Variable parameters were: particle size, particle concentration and oil velocity. A commercial XFS spectrometer equipped with interchangeable static/dynamic (flow cell) sample chambers was used. XFS spectra were recorded for solutions of Fe-organometallic standard and for a series of DTE oil suspensions of high purity spherical iron particles of 2μ, 4μ, and 8μ diameter, at concentrations from 5 ppm to 5,000 ppm. Real contaminated oil samples from Langley Air Force Base aircraft engines and NASA Langley Research Center wind tunnels were also analyzed. The experimental data confirm the reliability of XFS as the analytical method of choice for this project. Intrinsic inadequacies of the instrument for precise analytic work at low metal concentrations were identified as being related to the particular x-ray beam definition, system geometry, and flow-cell materials selection.

This work supports a proposal for the design, construction and testing of a conceptually new, miniature XFS spectrometer with superior performance, dedicated to on-line,real-time monitoring of lubricating oils in operating engines. Innovative design solutions include focalization of the incident x-ray beam, non-metal sample chamber, and miniaturization of the overall assembly. The instrument would contribute to prevention of catastrophic engine failures. A proposal for two-year funding has been presented to NASA Langley Research Center Internal Operation Group (IOG) Management, to continue the effort begun by this summer's project.

Modeling And Control Of Forward Vanes For HSR

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The High-Speed Civil Transport (HSCT) is projected to have a pitch divergence due to the relaxation of static stability at subsonic speeds. Further, significant interaction between rigid-body and aeroelastic degrees of freedom is expected. Objectives of the inner most loops of the flight control system (FCS) for HSCT will be to artificially supply the stability inherently lacking in the airframe, augment the key responses with crisp, well damped behavior, and to suppress, or lessen, aeroelastic motions in the rigid-body responses. Attainment of multiple, conflicting closed-loop objectives inherently requires a dexterous FCS architecture, which can sense key motions and apply critical forces/moments at selected points distributed throughout the vehicle. Here, the overall objective is to explore the FCS related benefits from an additional, small, forward aerodynamic control surface applicable to preliminary HSCT concepts. The study is conducted at a rudimentary level to provide rapid progress through the modeling phase, in order to allow sufficient time for the flight control phase and evaluation of benefits. Use of existing dynamic models and flight control architectures for HSCT is given priority.

The current HSCT concept does not allow forward force/moment generation capability, and inclusion of such capability in existing models is the initial activity. A component build-up modeling procedure is used to incorporate the dynamic stability and control power characteristics arising from forward vanes on existing HSCT math models. Vane "angle of attack" is generated by the following motion: rigid plunge rate, rigid pitch rate, structural deflection, structural deflection rate, and control surface rotation. The additional forces/moments generated by the vanes are inserted into the governing rigid and structural equations of motion. The technique makes use of rigid empirical lifting surface predictions and structural vibration characteristics. Comparison of open-loop residues for the vane and wing trailing edge flap reveals nearly an order of magnitude effectiveness increase upon the first structural mode, as well coordination with elevator/relaxed static stability mode relationships. This extra control power does not come free, the price is further destabilization in the static margin.

Utilization of the forward surface in previous FCS milestones is the second activity. These earlier studies considered wing trailing edge flaps as secondary pitch surfaces in a two-loop FCS architecture. However, flaps were found to be ineffective due to their positioning on the vehicle. The analysis revisited the two-loop FCS architecture with forward vanes substituted for flaps and comparisons were made. For the aeroelastic suppression loop, the vane-to-nearby-rate-gyro proved more effective in damping augmentation of the structural modes. An increase in the damping-to-loop-gain sensitivity is observed, as well as a higher upper limit for the achievable closed-loop structural damping ratios. An elevator-to-vane cross channel provided aeroelastic suppression through tailoring of the closed-loop cockpit numerator characteristics. Finally, the rigid pitch augmentation loop, driven by the elevator, stabilized the relaxed stability mode. In this loop, the upper limits of the handling performance were increased. These FCS benefits are a direct result of separating the pitch augmentation and aeroelastic suppression functions into separate loops.

HSCT flight control design activities face hard constraints and challenging hurdles. Useful design freedoms, possibly created with a forward pair of small, aerodynamic control surfaces, are highly sought. Conclusions and data from this study indicate new design space is available with a pair of small, forward aerodynamic control vanes.

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Evaluating the Dependence of the Lidar Backscatter Wavelength Ratio on Particle Shape Using Spheroids for Jet Plume Particles Composed of Soot or Sulfuric Acid

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To study the environmental effect of jet emissions in the troposphere the Atmospheric Science Division (ASD) - Aerosol Research Branch (ARB) at Langley Research Center (LaRC) has obtained data from the jet engine plumes of a Boeing 737 using a fixed Light Detection and Ranging (LIDAR) system. Taking the ratio of data at different wavelengths is believed to be an indicator of scattering particle size. From this ratio there is evidence of small particle formation within the plumes in agreement with *in situ* measurements obtained in other recent field experiments. Typical analysis involves the use of Mie theory, in which the particles are treated as spheres. In this work, oblate and prolate spheroids were used to represent the scattering particles in an attempt to determine if shape had a significant influence on the lidar backscatter wavelength ratio.

Mishchenko[1] has developed a Fortran program that determines the scattering and extinction cross sections, the albedo, the phase function, and the elements of the scattering matrix for spheroidal particles of arbitrary size and composition. The particles were assumed to be randomly oriented nonspherical particles of revolution that are homogeneous and composite axially symmetric of sizes not too large compared with the wavelength of the incident radiation. Using the scattering cross section and the first element of the scattering matrix for a scattering angle of 180°, the backscatter cross section for monodisperse particles was determined. This was performed for a range of sizes as determined from ground based data obtained from the University of Missouri-Rolla (UMR).[2] The UMR data also provided concentration values for each particle size. The volume backscatter coefficient at two wavelengths could then be obtained for a variety of particle shapes. The ratio of the volume backscatter coefficient at two wavelengths is proportional to the backscatter wavelength ratio enabling the scattering particle shape dependence to be investigated.

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[1]M. I. Mishchenko, "Light scattering by randomly oriented axially symmetric particles", J. Opt. Soc. Am. A, **8**, 871-882 (1991)

[2]Don Hagan and Phil Whitefield, University of Missouri-Rolla, Rolla, MO, personal communications.

Enhancing Adhesion - Relative Merits of Different Approaches

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Adhesive performance is improved mainly by manipulation of the bimaterials interface zone, which is only a few molecules thick. There are three approaches to enhancement of interfacial adhesion at the molecular level. They are 1) changing the nonchemically bonded interactions across the interface from weak ones to strong ones, 2) making the true interfacial area much larger than the simple geometric area, and 3) inducing chemical bonding between the two materials forming the interface. Our goal this summer was to question some of the built-in assumptions contained within these approaches and to determine the most promising approach, both theoretically and practically, for enhancing adhesion in NASA structures.

Our computations revealed that all three of these approaches have, in theory, the potential to enhance molecular adhesion approximately ten-fold. Experiments, however, revealed that this excellent level of enhancement is not likely to be reached in practice. Each approach was found to be severely limited by practical problems. In addition, some of the built-in assumptions associated with these approaches were found to be insufficient or inadequate.

The first approach, changing the nonchemically bonded interactions from weak to strong, is an example of one containing inadequate assumptions. The extensive literature on intermolecular interactions, based on solution studies, shows that certain functional group pairs interact much more strongly than others. It has always been assumed that these data can be reliably extended to systems where only one member of the pair is in solution and the other is contained in a solid surface. Our experiments this summer demonstrated that solution data do not adequately predict the strength of functional group interaction at the solid-liquid interface. Furthermore, the strong solvents needed to dissolve the monomers or polymers to which the functional groups of interest are attached compete successfully with the solid surface for the functional group. As a result, functional groups in solution cannot pair with the complementary groups in the solid surface, and the expected enhancement of nonchemically bonded interactions is not realized.

The second approach, increasing the true interfacial area, is an example of one containing inadequate assumptions and suffering from numerous practical problems. First, practitioners have assumed that material removal, such as bead blasting or etching, increases true surface area (and therefore interfacial area) in a meaningful way. Our geometric analysis demonstrated that removal methods increase area by a factor of two at most. To increase interfacial area by an order of magnitude or more, a thin layer of high porosity must be added to the substrate surface prior to application of the adhesive phase. Consistent with this finding, we attempted to create a thin layer of rigid, highly porous glass on the surface of our smooth glass substrate by means of sol-gel technology. We were unable to surmount a wide variety of practical problems and obtained only collapsed, nonporous layers. Thus this approach, appealing in principle, would require long term development and is not promising in the near term.

The third approach, inducing chemical bonding at the interface, is an example of one having neither inadequate assumptions nor insurmountable practical problems. When silicate glass is the substrate, there are only a few chemical reactions that can be successfully conducted to create these chemical bonds, and these reactions usually involve silicon-containing reagents. We compared the silazane reagents to the silane reagents and found through experiment that the silazanes react with the glass surface much more readily, and under milder conditions, than the silanes. The functional groups attached to the glass surface by silazane reactions were not able to be removed by solvent extraction, elevated temperature exposure, or mechanical action. This clearly indicates that the formation of chemical bonds at the interface is the most effective approach for enhancing molecular adhesion.

Space Education and Public Outreach

A Concept Paper

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The NASA Office of Space Science Strategic Plan emphasizes the need for heightened attention on space science for educators and the general public. The purpose of this concept paper was to propose a NASA Langley space science project that would address the needs of elementary/secondary educators in Langley's pre-college region, i.e., Virginia, West Virginia, South Carolina, North Carolina, and Kentucky. A second aim of the project was to increase public scientific literacy in the area of space science.

The need for and design of this project was guided by:
• Current national initiatives, e.g., GOALS 2000, national science, mathematics, and technology standards; the President's Technology Literacy Challenge; and other systemic education reform measures.
• NASA's Office of Space Science Education/Public Outreach Goals.
• National professional associations for science, mathematics, and technology teachers.
• The need for a greater public understanding of science.

The purpose of this project was to establish an exciting interactive electronic space science education/public outreach initiative using computer based and satellite based telecommunications to provide space science information for educators and the general public.

The computer based component will utilize a CD ROM format with online capability and will be directed to two different audiences including educators (educational purposes) and the general public (informational). Educators would also be targeted for the satellite broadcasts where they would be exposed to seminars by space science researchers; an instructional series in space science; and, spotlight videos featuring space science topics.

The concept paper proposing this initiative contained several features including an introduction; statement of need; purpose; project design; project team members; capability statement; evaluation criteria; and budget narrative. Concept paper was reviewed by NASA Langley Office of Education and Space Science personnel for input on soundness, clarity, and feasibility. Upon final completion of project narrative, proposal will be submitted to the Office of Space Science, NASA Headquarters for funding review.

1996 Summer Teacher Enhancement Institute:
Discovering Aeronautics and the Earth's Atmosphere
through Student Directed Learning

J. Murray Ritter, Jr.
Thomas Nelson Community College and Newport News Public Schools

The objective of the 1996 NASA Teacher Enhancement Institute (TEI) was to provide elementary and middle school teachers in mathematics, science and technology with the opportunity to develop new instructional materiel with aeronautics and the earth's atmosphere as the focus for that instruction. The institute was conducted in three, two-week sessions beginning on 16 June and ending on 9 August. Each session was composed of twenty teachers that had applied and were selected to attend on a competitive basis. The majority of teachers were from the Tidewater area, however, teachers from other areas of Virginia, Kentucky, North Carolina, South Carolina, Pennsylvania, West Virginia and the Philippines also participated.

To assist the teachers with their objective of developing new instruction, the TEI provided teachers with a combination of experiences that included:

- Instruction on the use of problem-based learning as a model for achieving student directed learning.
- Use of a student journal.
- Introduction to the operation of a flight training program and the operation of a flight control facility at the Richmond Airport.
- Tours of NASA facilities at the Langley Research Center (LaRC).
- Tour of the Teacher Resource Center and the Virginia Air and Space Museum in Hampton, Virginia.
- Instructional presentations by NASA LaRC personnel.
- Instructional activities conducted by personnel from the Office of Education that demonstrated aeronautic principles, navigation and the conduct of a calculator-based laboratory that were suitable for use in the teacher's own classroom.
- Aspects of computer technology that included accessing NASA Spacelink, e-mail, word processing, draw programs, spreadsheet applications, the Internet as a research tool and homepage construction.
- The planning, conduct and observation of student presentations of unit lesson excerpts.
- A panel discussion with former TEI participants.

The summer program initiates a longer process that includes follow-up group discussions, classroom visits, the presentation of an instructional unit based on the TEI experience and the awarding of three graduate credits from Christopher Newport University. A pre-session and post-session content knowledge test is administered for course evaluation purposes. A one-year follow up survey is planned for next summer.

The TEI program is designed to comply with the four best practices for teacher enhancement institutes in science and technology as described in the November 1995 National Science Foundation report "Best Practice in Action". Teacher participants are introduced and then required to model their instruction using the problem-based approach for student directed learning. They participate in ten different student presentations either as an observer or as a teacher. The content of these student presentations is compared with state standards of learning. Participant follow up is accomplished through subsequent meetings for discussion of attempts at implementation, idea exchange, in a one year follow up survey and through the electronic networking of program participants through Spacelink.

A preliminary evaluation of the 1996 program indicated that participants leave the two week program with the resources to bring about a change in their classroom. They have the knowledge, encouragement and support needed to try, what for many, is a whole new way to approach student learning.

Robert P. Smith
ASEE Summer Faculty Fellow
June-August 1996
Multidisciplinary Optimization Branch
NASA Langley Research Center

The work completed during this fellowship has built upon ongoing research in engineering design process modeling based on the design structure matrix (DSM). There have been two aspects to this work: mathematical development and application.

The mathematics involve an extension to the DSM known as the work transformation matrix (WTM). The WTM is a method to estimate the total time and effort required to complete an iterative design process. The mathematical development involved a new interpretation of the WTM to allow for multiple decoupled simultaneous groups of tasks. Work is completed within each of the groups independently, and there is a subsequent coordination phase which brings together the results of each of the independent groups. Depending on which tasks are assigned to which groups, the total time and effort required to complete the design process can vary. Expressed as an optimization problem the desire is to minimize the total time and/or effort as a function of how tasks are assigned to groups. This is a difficult discrete optimization problem, and several heuristics have been applied, including greedy local search, simulated annealing, and genetic algorithms. It is desirable to prove that the optimization problems are NP-hard, but this effort has not yet been completed.

These models have been applied to ongoing experiment design efforts at NASA-Langley. The two projects are MEEP–the Mir Environmental Effects Payload, and MIDAS–the Materials in Devices as Superconductors. It was possible to construct the DSM and the WTM for each of these design projects. The WTM optimization model was able to describe decouplings of the project which match expected technical divisions between subproblems. The correspondence between technical expectations and mathematical outcomes lends credibility to the idea that the optimization problem is able to be a useful managerial decision aid for problem decomposition at early stages of large engineering design efforts.

Operation of HFG System and Flow Characterizations

Kyo D. Song (ASEE Summer Faculty), Norfolk State University

June 3 - August 9, 1996

Abstract

The purpose of this task is to measure flow parameters in the HFG system. The HFG system was designed to provide a supersonic/hypersonic flow. The system consists of four major parts, an arc lamp as a heating source, a nozzle with thermal chamber, a test section, and a large vacuum tank with two vacuum pumps which has been installed at Building 1200. The operation of the HFG system was successfully performed for the checking component integration and performance evaluation.

The pumping capacity of the two vacuum pumps for HFG was measured in time. The pumping time to reach the minimum vacuum pressure (~ 10 micron) from the atmospheric pressure was approximately an hour.

Using a dry nitrogen gas, the vacuum pressure and the chamber pressure were measured in terms of the stagnation pressure and the diameter of nozzle. As a result of the measurement, a continue operation of HFG is possible with 1 or 3 mm dia. of nozzle.

The characteristics of the flow in the HFG for various operating conditions using a schlieren method were performed. At the 0.8 torr in the chamber pressure, the barrel shock and jet structure were observed at the 10 atm of the stagnation pressure.

Performance Analysis of Temperature Sensitive Paints

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Temperature sensitive paints (TSP) are being developed at NASA LaRC to study boundary-layer transition on aerospace vehicle geometries. Since the transition process involves small amplitude and high frequency surface temperature changes, the paint should be sensitive to such changes. Therefore the main objective of this work is to assess the performance of TSP paints that are used for the current wind tunnel tests and propose improvement steps to make the TSP technique an effective tool to study transition

The TSP consist of fluorescence particles embedded in a polymer binder and an undercoat layer. The performance of the TSP depends on the photochemical and thermophysical characteristics of its constituents. A heat transfer analysis of the suggests that the paint sensitivity can be improved by (1) minimizing the thermal conductivity of the paint and the substrate (undercoat), (2) maximizing the thickness of the paint and the substrate and (3) increasing the free stream temperature. The latter two, however, have some physical limitations. For example, increasing the thickness beyond a limit causes cracking of the paint. Also, for dynamic measurements, previous studies suggest that a high frequency response can be achieved only with thin TSP coatings. Similarly, the free stream temperature variations may be limited by other experimental constraints. The thermal conductivity is then the only candidate for controlling the paint performance. In the current TSP applications, different types of polymers are used as binders and undercoats. The thickness of the coatings vary between 25 to 150 microns. Unfortunately, no reliable instrument is currently available that can measure the thermal conductivity of such thin-film coatings, especially over a wide range of operating temperatures including the cryogenic conditions. The major problem is the heat losses.

A device called Thin-Film Thermal Conductivity Meter (TFTCM) which can resolve this problem is designed and fabricated. The special design features are; minimum heat losses, wide range of test temperatures (-200 C to 100 C) and pressures (up to 5 atmospheres), large heat transfer area to the film, flexibility of operating in steady state as well as in transient heat conduction conditions, ease of fabrication and use. Testing and assessment of the device is currently underway.

Theoretical and Experimental Studies of Polyimides

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This investigation addressed various topics, related to the processing and design of polyimide films and composites, from a Thermodynamic point of view. The first study evaluated the phase equilibria behavior of polyimide films in polar aprotic solvents. The second project involved the development of an experimental technique to measure the thermal conductivity/diffusivity of various polyimide films and composites. The third and final project looked at the description of the pressure-volume-temperature and composition diagram with a group contribution lattice fluid equation of state (GCLF EOS).

In the first project, the solubility of several aromatic polyimides in various polar aprotic solvents was evaluated. A thermodynamic model that described activity coefficients and Gibbs free energy of mixing was applied. The thermodynamic model was based on a cohesive energy density approach for the enthalpic (residual) contribution, and a Flory-Huggins term for the entropic (combinatorial) part. The calculated Gibbs free energies of mixing were negative. Limiting activity coefficients ranged from values indicative of very strong solvating forces to ideal solution behavior (*e.g.,* $\gamma_i^{\infty} \sim 0.2 - 1.0$). These values should indicate complete solubility (miscibility); however, experimental results do not support these findings. The results are interpreted with two explanations: i) the inability to accurately describe the cohesive energy density for polyimide systems containing very specific interactions, or the inability to properly characterize all specific interactions (inter and intramolecular) with a single parameter. ii) the different degrees of crystalline like order, even in amorphous samples, which provide additional free energy differences. Challenges remain in the measurement of cohesive energy density for these polymers, the development of simple and accurate models for polar molecules, and in the quantification of the different degrees of crystallinity in amorphous polyimides.

The second project involved the development of an experimental technique to measure the thermal diffusivity of various polyimide films and composites. The technique used, *a.c. joule heating technique*, was a phase sensitive technique that allows unsteady state measurements to be obtained fast and accurately over a wide temperature range (*e.g.,* 25°C - 350°C). The technique provides the thermal diffusivity directly. Additional measurements of the heat capacity with differential scanning calorimetry, and density with a densitometer, allow the calculation of the thermal conductivity.

The last study involved the use of a GCLF EOS to describe the PVT diagram of polyimides. Lack of the polyimide groups had inhibited the use of this approach for prediction. However, this is the most sound method up to date for this type of polymers. This study used recent data to regress the particular polyimide group parameters. These parameters can be used to extrapolate and to predict other systems for which there is no data available. This study has major applications in the areas of process optimization and design.

Fundamentals of Laminar-Turbulent Transition on Oscillating Airfoils

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It is well known that a laminar flow will become turbulent when the flow Reynolds number (Re) achieves some critical value. In understanding the nature of laminar-turbulent transition it is important to recognize that theoretical results can predict only the *point of instability* (i.e. that point where the instabilities which eventually lead to the onset of turbulence first begin to appear), while the actual *point of transition* from laminar to turbulent remains at issue. The precise distance between the point of transition and the point of instability depends, among other things, on the rate of amplification of the unstable disturbances and on the intensity of the turbulence in the free stream. The rate of amplification, in turn, is strongly influenced by the pressure gradient.

If the airfoil is some angle of attack other than zero, transition from laminar to turbulent has been studied extensively by Bussman and Ulrich [1] for the case of symmetric Zhukovskii airfoils. These results, however, are all for steady state flows. The case where the airfoil is itself oscillating about some fixed angle of attack has not been reported, although the effect of an oscillating free stream on flat plate laminar-turbulent transition has been studied in references [2] and [3]. In these investigations the free stream oscillates in a direction parallel to the plate. The essential results of those efforts are: (a) the critical Re at the start of transition depends only on the amplitude of the external fluctuations; (b) the dimensionless transition length depends only on the frequency of the external oscillations.

Transition in the case where the airfoil oscillates can potentially be modeled by taking the oncoming flow to be composed of a constant U_∞ and a second component, say $W(t)=W_\infty+\Delta W\cos(\omega t)$, where the fixed angle of attack is given by (W_∞/U_∞). This approach should ideally lead to a result consistent with the analyses of airfoils to transient loads such as gusts, where the lift on an airfoil due to a sinusoidal gust is defined by *Sears' function* [4]. The dependence of the point of instability and the point of transition on the *lift coefficient* is described in reference [1].

[1] K. Bussman and A. Ulrich, NACA TM 1185 (1947) 51-pp.
[2] H. J. Obremski and A. A. Fejer, *JFM* **29**, 93-111, (1967).
[3] J. A. Miller and A. A. Fejer, *JFM* **18**, 438-449 (1964).
[4] Y. C. Fung, *An Introduction to the Theory of Aeroelasticity*, Dover (1969).

The Software Planning Study for the Office of Human Resources

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The use of desktop computers in the daily life of the Office of Human Resources (OHR) has increased over the last few years. The desktop computer has become an important tool in OHR for data collection, correspondence, communication and data analysis. With this growth has come the need to keep pace with software changes, and to assess the possibility of changes that will allow more efficient use of resources. The Software Planning Study has been conducted to help OHR analyze the current computing environment and make organizational computing decisions. The study was designed to identify directions that will help OHR keep pace with current and future technology requirements. In addition, the study contains an analysis of recent work in OHR which was designed to improve desktop computing efficiency.

There are three primary areas that were studied: the current hardware and software environment, new computing requirements, and planning for organizational computing. To gather data on the current computing environment, OHR personnel were surveyed. In addition, an inventory of computers was produced and performance of both the workstations and server was studied. Data collected was compiled and prepared for analysis. New computing requirements were determined by the compiling the specific requests of OHR personnel and analyzing important computing trends both in the industry and with NASA. Finally, the information gathered was used in the development of a detailed plan for organizational computing. The plan presented a proposed computing environment with a tactical plan that could achieve that goal. The proposal is the result of study done by the ASEE fellow to determine software needs, corresponding hardware trends and organizational needs.

The collected data, analysis and proposal was compiled into a report that was presented to management. The report details recommendations for software acquisition, computing environment change and future growth. The report contains detailed sections on the computing environment, assessment of server performance, current software needs, computing environment recommendations and an analysis of the effectiveness of past implementation work.

APPENDIX X

PROGRAM ORIENTATION EVALUATION REPORT

1996 ASEE PROGRAM ORIENTATION EVALUATION REPORT
(Twenty-six Orientation evaluations were returned.)

A. Overall Organization
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 0%
4 - Good - 9 (35%)
5 - Excellent - 17 (65%)

B. Pre-Conference Notification
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 2 (8%)
4 - Good - 7 (27%)
5 - Excellent - 17 (65%)

C. Information and Knowledge Gained
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 2 (8%)
4 - Good - 13 (50%)
5 - Excellent - 11 (42%)

D. Program Breakout Session
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 1 (4%)
4 - Good - 12 (46%)
5 - Excellent - 13 (50%)

E. In General, How Do You Rate This Orientation
1 - Poor - 0%
2 - Fair - 0%
3 - Average - 0%
4 - Good - 11 (42%)
5 - Excellent - 15 (58%)

Comments and Recommendations:
- Very knowledgeable staff. Very informative.
- Per Dr. Massenberg, begin registration at 8:30 a.m..
- Provide IRS handouts
- Provide more time during Break Out Session for Fellows to introduce themselves and share their research interest

APPENDIX XI

POLICIES, PRACTICES, AND PROCEDURES MANUAL

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

1996

POLICIES,

PRACTICES,

and

PROCEDURES

MANUAL

A Handbook for ASEE SFFP Fellows

Table of Contents

Introduction

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

The ASEE Program is administered by a collaborating university. Either a Co-Director from Hampton University (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 or engineer at the Center with whom you will work most closely. All matters relating to your research program will fall under his or her purview. The Associate also assists, as needed, in securing space, equipment, or technical support.

1.4 ASEE Co-Director

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

1.5 ASEE Administrative Assistant

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

1.6 Approval

Throughout this handbook, various procedures are cited that require the exclusive approval of the Co-Director. The use of the word "approval" means written approval. Any document requiring the Co-Director's approval 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 ten weeks.

2.2   Acceptance Letter

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

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

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

2.3   Information Package

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

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

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 $1,000.00 per week. Stipends are paid on the basis of a 5-day 40-hour work week and are issued bi-weekly, 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 two 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 your orientation package you receive on the day of your arrival, you will receive a Locator Form. This form must be completed and returned to the Administrative Assistant as soon as possible following your arrival. On this form, you will be requested to supply your local address and phone number, a person to contact in case of an emergency, and your actual physical location on Center, including Mail Stop, building address, building number, room number, and extension. **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

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

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

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 (804) 864-5215. Medical assistance is provided in the Clinic-Occupational Health Services Facility. Hours of operation are from 7 a.m. to 4:30 p.m. In any medical emergency, dial extension (804) 864-2222 or go directly to Building 1149 at 10 West Taylor Street.

5.3 Automobile Insurance and Driver's License

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

6.0 Taxes

6.1 Federal Tax Liability of United States Citizens

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

indicating your total stipend.

You should refer to the pertinent tax publications and plan ahead to meet any tax obligations, both federal and state, if applicable, and file your returns as required by Federal law. The responsibility for the payment of your income taxes rests solely with you. The 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 withhold Social Security Taxes from your stipend payments. You should refer to the pertinent publications on Social Security Taxes to determine whether you have incurred any tax obligation. Although Social Security Taxes are not withheld from stipend payments, you are nonetheless required to have an assigned Social Security Number.

6.3 State Tax Liability

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

7.0 Leave

7.1 Leave

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

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

7.2   Work Hours

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

7.3   Working After Hours

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

8.0   Housing

8.1   Housing Package

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

8.2   Disclaimer

It is the Fellow's responsibility to contact the apartment complex, etc., to finalize all housing arrangements. You are strongly encouraged to make these arrangements as early as possible since short term leases are in great demand during the summer due to the influx of people into the area. **Neither ASEE, NASA, HU, nor any staff representatives shall intercede in the lease agreement made between the tenant and the landlord.** This information is provided for the sole purpose of assisting you in making your transition to the Tidewater area easier. Once again, the only form of financial assistance provided for your housing is the relocation allowance (See Section 4.1). It is recommended that as soon as you know your departure date, you submit this information **in writing** to the complex management.

9.0   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 Hampton University assume any responsibility for any events.

11.0 Security

11.1 Security Requirements

A NASA National Agency Check (NASA NAC) 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, 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, not initials. It is imperative that you include all information requested in order to prevent any unnecessary delays upon your arrival to LaRC. Even though you are not considered employed by NASA, if you had prior affiliation with LaRC or any other NASA Center, please note under "Employment" on the NASA Form 531. If you have access to a fax, the Form 531 may be faxed to the LaRC Security Office at 804-864-8868.

11.2 Langley ASEE Summer Faculty Fellows

Upon arrival at NASA LaRC, all Fellows must report to the Badge and Pass Office at the Main Gate, Building 1228, 1 Langley Blvd., to obtain identification badges for access to LaRC facilities. At this time, your photo will be taken and a temporary badge will be issued. You will return within three business days to pick up your permanent summer badge. **Please note: Before a badge can be issued, your 531 must have been in with all information being legible and accurate.**

Additionally, when reporting to LaRC, bring your driver's license for the issuance of a vehicle pass. If the vehicle you are driving is registered to another party, a signed letter authorizing you to drive the vehicle will be required. **On the morning of June 3, 1996 only, ASEE Orientation Day, vehicle passes will be issued at the H.J.E. Reid Conference Center.** If you arrive at any other time, the vehicle pass will be issued at the Badge and Pass Office.

If additional information is required, feel free to contact the NASA LaRC Security Office, Michael Rammel or Susan Linton, at 804-864-3420/37.

12.0 Safety

12.1 Safety Program

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

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

12.2 Hazardous Communications Training

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

12.3 Safety Clearance Procedures

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

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

12.4 Accident Reporting

Fellows shall immediately report all job-related accidents, injuries, diseases or illnesses to the supervisor and the Office of Safety, Environment and Mission Assurance (OSEMA), (804) 864-SAFE ((804) 864-7233).
Obtain medical treatment from the Occupational Medical Center, Building 1149, or call extension (804) 864-2222 for emergency medical assistance.

12.5 Personnel Certification

It is LaRC policy to certify Fellows performing tasks which could be potentially hazardous to either the individual, or co-workers. These requirements vary

with the type of activity being performed, and consequently are described in detail in the LaRC Safety Manual dealing with the specific topic/hazard. Particular research assignments may require training, certification, and medical surveillance requirements. Examples of these types of research assignments are chemical, radiation and/or pyrotechnic operations.

13.0 Mail Room

13.1 Official Mail

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

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

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

13.2 Personal Mail

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

13.3 Additional Items to Remember:

- Do not use official Government envelopes for personal mail.

- For fastest delivery by the post office: address envelopes in all capital letters, no punctuation, and use state abbreviations.

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

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

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

internal mail delivery system.

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

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

- Mail Stops are required for delivery of internal mail.

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

14.0 <u>Library</u>

The Langley 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 pursuing the goal of "Electronic Library" to maximize the desktop delivery of 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 science, and management. This includes 60,000 books, 1,200 journals, over 2 million technical reports and access to more than 500 commercial and government electronic databases. At present, the library's information systems include: an on-line catalog and information system, the Scientific and Technical Information Library's Automated System (STILAS); a CD-ROM database network; NASA Research Connection (RECON); and journal "table of contents" current awareness services.

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 and Langley Aerospace Research Summer Scholars (LARSS) rosters issued by the Office of Education. Basic services include loan of books and documents, access to the library's on-line systems, and literature searches by Information Specialists. *All loaned materials must be returned to the library 2 weeks prior to the conclusion of the program.*

15.0 <u>Cafeteria</u>

15.1 **NASA Exchange Cafeteria**

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

| Lunch: | 10:45 a.m. - 1:30 p.m. |
| Holidays: | Closed |

15.2 Additional Items to Remember

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

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

15.2 Check Writing Policies

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

15.3 Area Tickets Available

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

16.0 H.J.E. Reid Conference Center

16.1 Conference Center

The Conference Manager serves as a consultant and advisor for conferences and technical meetings. Reservations can be made for the 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 804-864-6362 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. You are welcome to use a table anytime one is available. For reservations, call (804) 864-6369.

16.3 NASA Gym

The NASA Gym is open from 11:00 a.m. to 1:00 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 7:00 p.m.

16.4 LaRC-sponsored clubs:

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

16.5 Additional Information

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

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

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