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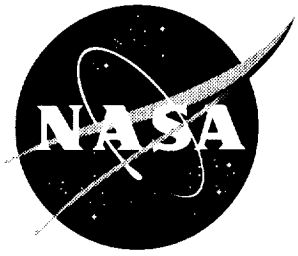


# 1999 NASA-ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program

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## SECTION 1

## ORGANIZATION AND MANAGEMENT

The 1999 Old Dominion University (ODU)-NASA Langley Research Center (LaRC) Summer Faculty Fellowship Research Program, the thirty-fifth 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 Competencies, 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 Competency 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 Program Manager/Administrative Assistant then contacted each selected Fellow by phone extending the individual a verbal appointment, which was followed up with a formal letter of confirmation. Individuals were given ten days to respond in writing to the appointment. Once the letters of acceptance were received, a roster was sent to each SA advising them of their Fellows for the summer program.

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

Each Fellow and Research Associate received a 1999 ASEE Policies, Practices, and Procedures Manual that clarified many commonly asked questions up front regarding the roles, responsibilities, policies, and procedures of both parties. This manual was very beneficial and will be updated annually to be used in the years to come (Appendix XII).

At the Orientation meeting, Dr. Samuel E. Massenberg, Director, Langley Office of Education, welcomed the summer program participants to LaRC. Mr. Edwin J. Prior, Deputy Director, Langley Office of Education, presented an overview of Langley Research Center. Introductions of the Administrative Staff and a program overview was presented by Mr. Roger A. Hathaway, University Affairs Officer. Mr. James R. Hall provided a security briefing followed by a presentation on Export Control and Information Protection provided by Mr. Joseph J. Mathis, Jr., LaRC's Center Export Administrator. An Information Technology Security Briefing was given by Mr. Geoffrey M. Tennille, Information Technology Security Manager for LaRC.

Following a short Library Briefing by Ms. JoAnn Rocker, a program breakout session was next on the agenda, enabling the ASEE administrative staff (Dr. Surendra N. Tiwari-ASEE Co-Director, and Mrs. Debbie Murray-ASEE Program Manager/Administrative Assistant) to meet with the 1999 Fellows to discuss administrative procedures and answer questions. Following the breakout session, the Fellows were greeted by their LaRC Associates who then escorted them to their respective work sites. An evaluation of the orientation meeting was completed; refer to Section VI for results.

Throughout the program, the University Co-Director served as the principal liaison person and had frequent contacts with the Fellows. The University Co-Director also served as the principal administrative officer. At the conclusion of the program, each Fellow submitted an abstract describing his/her accomplishments (Appendix IX). Each Fellow gave a talk on his/her research within the Division. The Competency SAs then forwarded to the Co-Director the names of the Fellows recommended within their Competencies for the Final Presentations. Five excellent papers were presented to the Fellows, Research Associates, and invited guests. For the fifth 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 where the winner was announced and presented with a certificate and invitation to return to LaRC for a visit during the academic year.

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

## SECTION II

## RECRUITMENT AND SELECTION OF FELLOWS

### Returning Fellows

An invitation to apply and possibly participate in the Old Dominion University (ODU)-NASA Langley Research Center (LaRC) Program was extended to the individuals who held 1998 fellowship appointments and were eligible to participate for a second year. Out of the individuals responding to the invitation, twelve accepted offers of appointment (Table 1). Four Fellows from previous years accepted offers of appointment.

### First Year Fellows

For the 1999 program, ASEE Headquarters provided a web site for the summer program application materials in lieu of brochures being mailed out. Many personal contacts to deans and department heads of various engineering schools in the East, South, and Midwest, were made by Dr. Surendra N. Tiwari of Old Dominion University (ODU) and Dr. William P. Marable of Hampton University (HU) requesting their assistance in bringing to the attention of their faculties the ODU-HU-NASA LaRC program. In addition to the above, a number of departments of chemistry, physics, computer science, and mathematics at colleges (including community colleges and minority institutions) and universities in the state of Virginia, as well as, neighboring states were contacted regarding this program (Table 2). Additional recruiting efforts included either attendance at or providing information for several of the minority conferences. These efforts resulted in a total of sixty-six formal applications indicating the ODU-HU-NASA LaRC program as their first choice, and a total of twelve applications indicating the aforementioned as their second choice. The total number of applications received came to seventy-eight (Table 3).

Thirty-nine applicants formally accepted the invitation to participate in the program. Four 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. Sixteen positions were initially budgeted by NASA Headquarters. Twenty-three positions were funded by the LaRC Divisions (Table 4).

The average age of the participants was 46.

**Table 1 - Distribution of 1999 ASEE Fellows by Year in Program**

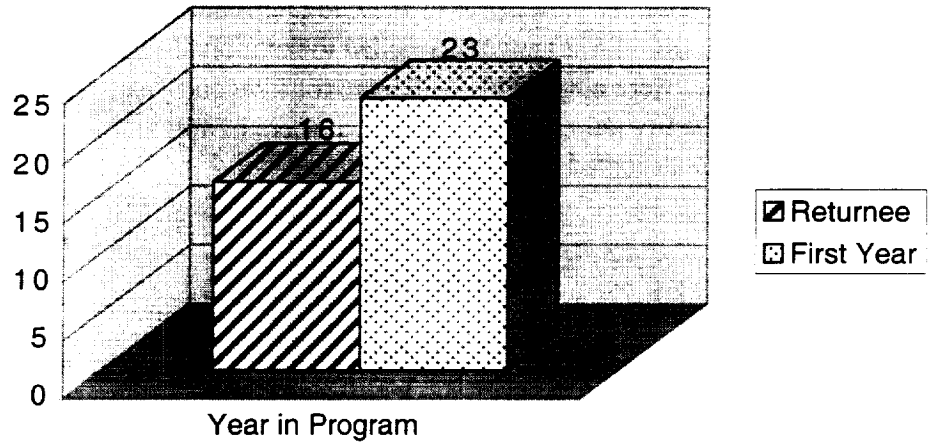
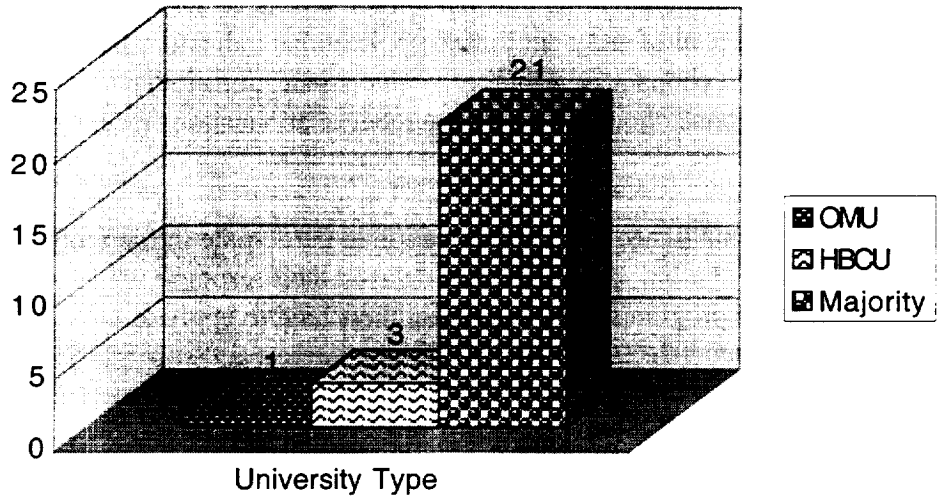
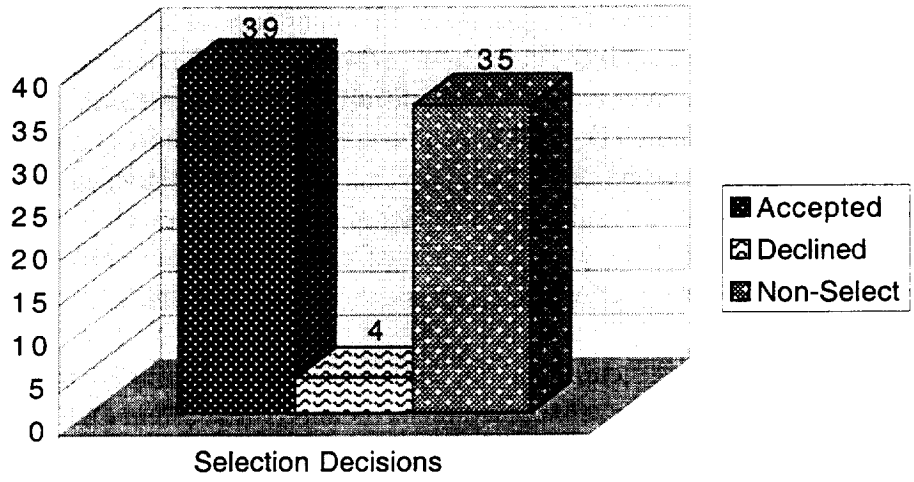


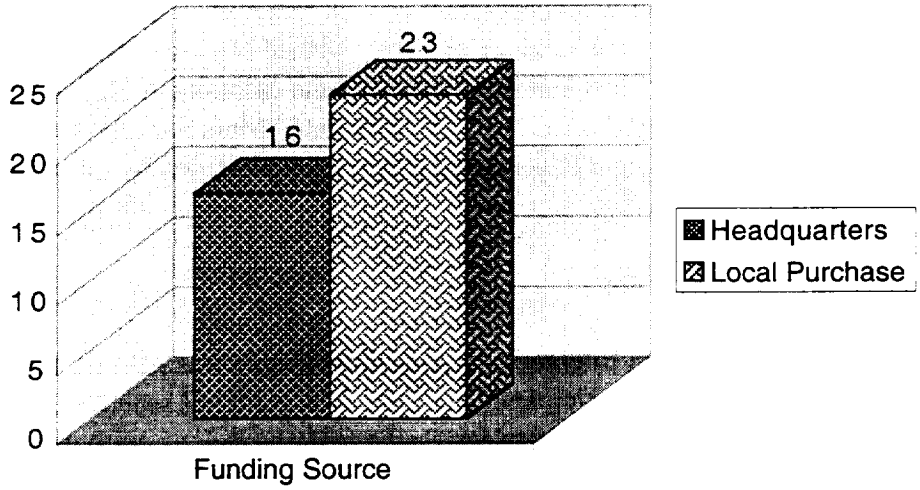

**Table 2 - Distribution of 1999 ASEE Fellows by University**



## Table 3 - Distribution of 1999 ASEE Fellows by Selection




## Table 4 - Distribution of 1999 ASEE Fellows by Funding



## SECTION III

## STIPEND AND TRAVEL

A ten-week stipend of $10,000.00 was awarded to each Fellow. Thirty-four percent of the Fellows indicated that the stipend was not the primary motivator in their participating in the ASEE program. This continues to suggest that the importance of the stipend amount is quite significant based on the other sixty-six percent. While twenty-one percent deemed the current stipend as adequate, the greater majority of the faculty, sixty-four percent, suggested an increase was in order (Survey-Section VI). This stipend continues to fall short of matching what most professors could have earned based on their university academic salaries or participating in other fellowships. The decision to participate in the summer faculty research program continues to reflect the willingness of the Fellow to make some financial sacrifice in order to have the experience of working with NASA's finest scientists and researchers.

Mileage or air fare expenses incurred by the Fellows from their institution to Hampton, Virginia, as well as their return trip, were reimbursed in accordance with current ODU 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

## 1999 ASEE SFFP ACTIVITIES

### Lecture Series

The Lecture Series this summer was successful and well received. There was a total of five lectures presented. The lectures were given by distinguished NASA scientists and researchers. Some of the topics included "Mars and the Mars Airplane Mission: A New Chapter in Planetary Exploration," presented by LaRC's Dr. Joel S. Levine, and "Mars Sample Return: A Crowing Achievement for NASA's Robotic Exploration Program, " presented by LaRC's Dr. Robert D. Braun (Appendix II).

### Interaction Opportunity/Picnic

The annual Office of Education Interaction Opportunity/Picnic was held on Tuesday, June 22, 1999, for the summer program participants, their families, NASA Associates, and invited guests. This allowed for informal interaction between the Fellows, as well as, with the administrative staff. The participants were also given the opportunity to purchase T-shirts with the 1999 ASEE design.

**Proposal Seminar**

A Proposal Seminar was held for the Fellows on Tuesday, July 27, 1999. Dr. Samuel E. Massenberg, Director, Office of Education, presented an overview of the proper procedures to adhere to in submitting an unsolicited proposal to NASA. The program covered both the NASA and university perspectives. Mr. Fred Morrell gave a presentation on the Small Business Innovative Research program with emphasis on STTR "Small Business Technical Transfer Pilot Program." There was also a panel question and answer session. The panel members included Langley researchers who frequently review proposals that are submitted, and in the audience were representatives from the grants and contracting offices who also responded to questions in their field. This aspect of the proposal seminar was very well received. They received packages with information including the most current Research Grant Handbook information and web site locations. (Appendix XI).

**Seminar/Banquet**

On Friday, July 30, 1999, a seminar/banquet was held for the Fellows and their spouses. The banquet took place at the beautiful Langley Air Force Base Officer's Club. ASEE end of the program information, certificates, and group pictures were presented to each Fellow at the banquet. Remarks were presented by Dr. Samuel E. Massenberg, Director, Office of Education.

**ASEE Activities Committee**

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

## SECTION V

## RESEARCH PARTICIPATION

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

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

| Number of Fellows Assigned | Competency/Program Office |
|---|---|
| 11 | Aerodynamics, Aerothermodynamics, and Acoustics Competency |
| 2 | Aerospace Systems, Concepts, and Analysis Competency |
| 5 | Airborne Systems Competency |
| 2 | Atmospheric Sciences Competency |
| 8 | Business Management |
| 1 | High Speed Research Program Office |
| 1 | Space Access and Exploration Program Office |
| 6 | Structures and Materials Competency |
| 3 | Systems Engineering Competency |

Thirty-two (82%) of the participants were holders of the doctorate degree. Six (15%) held masters degrees and one (3%) held bachelor's degrees. The group was again highly diversified with respect to background. Following are the areas in which the last degree was earned (twenty-three different disciplines):

| Number | Area of Degree |
|---|---|
| 1 | Accounting |
| 5 | Chemistry (including 1 Analytical and 2 Inorganic) |

**Continued:**

| Number | Area of Degree |
|---|---|
| 1 | Computer Science |
| 1 | Control Science and Dynamic Systems |
| 4 | Education<br>(including 1 Higher Education Admin. and 2 Education Admin, and Supervision) |
| 19 | Engineering<br>(including 1 Aerospace; 5 Electrical; 1 General; 1 Engineering Management; 1 Engineering Mechanics; 1 Engineering Technology; 1 Industrial; 2 Mechanical and Aerospace; 6 Mechanical) |
| 1 | Fine Arts and Theater |
| 2 | Fluid Mechanics |
| 1 | Geography |
| 1 | Health Education |
| 1 | History of Science |
| 3 | Mathematics<br>(including 1 Applied Mathematics) |
| 1 | Physics |

## Extensions

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

Dr. David J. Gosselin
Ms. Mary E. Ingham

## 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 Competency. 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**

**Ponnampalam Balakumar**: 30th AIAA Fluid Dynamic Conference, Norfolk, VA.

**Oktay Baysal**: AIAA Computational Fluid Dynamics Conference, Norfolk, VA, June 28-July 1.

**Lee A. Belfore, II**: FTS Model Training, July 6-8.

**Janice D. Cawthorn**: CORSE (Remote Sensing Conference), Boulder, CO. Fellow also presented at this conference.

**Ayodeji Demuren**: 3rd ASME/JSME Fluids Engineering Summer Meeting, San Francisco, CA, July 18-23.

**David J. Gosselin**: 4 Day Course on Appropriation Law Held by the Office of the Chief Financial Officer, June.

**Rustin Greene**: 10 Day Intensive Italian Immersion Program, "ALPS Program," at Dartmouth.

**Taj O. Mohieldin**: 14th Computational Fluid Dynamics Conference, Norfolk, VA, June 28-July 1.

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

**George T. Rublein**: Virginia Math and Science Coalition, Spring Meeting at George Mason University.

**Mir S. Shirvani**: Electrostatic Discharge Control Seminar.

**Chelakara S. Subramanian**: Seminar on "Accuracy of PSP Measurements," provided by J. P. Sullivan.

**N. Eva Wu**: 14th World Congress of Automatic Control; Aviation Safety from Airline's Perspective.

## Papers Presented or Anticipated

**Lee A. Belfore, II**: "Data Compression of Science Data Using a Priority Sorting and Wavelet Interpolation," IEEE, expected submission in December, 1999.

**Frank W. Chambers**: Anticipated paper, "Hot Wire Anemometer Calibration Sensitivities for Low Density Subsonic Flow," AIAA Journal.

**George S. Devendorf**: "Biogenic NO and $N_2O$ Soil Emissions from a North Carolina Cornfield."

**Amitabha Ghosh**: Anticipated paper submission to the Journal of Fluid Mechanics.

**Rustin Greene**: Anticipated paper submission to the Broadcast Education Association, November, 1999.

**James M . Hereford**: "Analysis of Thermal Gradients in Test Section of National Transonic Facility (NTF)."

**Jiashi Hou**: "Effect of Fiber Deformation of Pultrusion Process of Polymer," SAMPE (Society of American Material and Polymer Engineering).

**Paul J. Kauffmann, Jr.**: "Estimating the Rate of Technology Adoption for Cockpit Weather Information Systems," American Society for Engineering Management.

**Taj O. Mohieldin**: "Numerical Study of Supersonic and Dual Mode Mixing and Combustion Using Unstructured Grid," T. O. Mohieldin and C. R. McClinton, 38th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, January, 2000.; "Supersonic and Dual Mode Combustion: Effects of Sealing on Numerical Modeling," T. O. Mohieldin and C. R. McClinton, 38th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, January, 2000.

**Jacob Savir**: "On-line and Off-line Test of Digital Avionic Systems."

**Douglas R. Smith**: "An Experimental Study of the Formation and Interaction of Zero-Mass-Flux Jet Arrays," American Physical Society, Fluid Dynamics Meeting, November, 1999.

**Chelakara S. Subramanian**: An abstract will be sent to the 21st AIAA Advanced Measurement Technology and Ground Testing Conference. A complete paper will be submitted to the AIAA Journal soon.

**Linda A. Wilson**: "Comparison of Outgassing and Optical Characterization of Flown and Unflown Mir Solar Cells," G. A. Harvey, L. Wilson, W. Kinard, J. Visentine, 21st Space

Simulation Conference, Annapolis, MD, October 24-26, 2000.

**N. Eva Wu**: Presented the following: "Reliability of Fault Tolerant Control Systems;" "Fault Detection and Estimation Using an Adaptive 2-Stage Filter,"; To be Submitted: "Reliability Assessment of Flight Control Systems Using a Semi-Markov Modeling Tool."

**Rochelle Young**: Technical Report to NASA LaRC, December 20, 1999; "Technology Policy Development in Federal Agencies," IEEE Engineering Management; "Distance Learning Insights--Technology and Society."

**Ye K. Zhou**: "Time Correlation Function in Noise Frequency," submitted to technical publication; "A Model for Subgrid Noise," submitted to the Journal of Aircraft.

## Anticipated Research Proposals

**Charles M. Bump**: "Synthesis of Polar Diamines," NASA Langley Research Center (LaRC).

**Janice D. Cawthorn**: Plans to submit grant proposals related to the DEVELOP Center and education.

**Frank W. Chambers**: "Velocity and Acoustic Fields of Flow Control Actuators," Agency to be determined.

**Amitabha Ghosh**: "Wind Tunnel University," NASA Langley Research Center (LaRC).

**James M. Hereford**: "Thermal Gradient Effects Research," NASA Langley Research Center (LaRC).

**Jiashi Hou**: "Model Simulation of Non-Autocrate Processing of Fiber-Reinforced Polymer Composites," NASA/HBCU/ICASE.

**Taj O. Mohieldin**: "Numerical Simulations of Mixing and Combustion in Scramjet Engines," Hyper-X Program Office, LaRC.

**Jacob Savir**: "On-line and Off-line Test of Digital Avionic Systems," submitted 7/27/99 to Dr. Celeste M. Belcastro, LaRC.

**Gregory V. Selby**: "Effect of Distance Learning on the Academic Success of African-American and Hispanic-American Students in Science and Engineering."

**Chelakara S. Subramanian**: "Development of the Intensity Biased PSP Measurement for Wind Tunnel Testing," NASA LaRC, AEDC, NSF; "Global Force from Global PSP Measurements in Wind Tunnels," NASA LaRC; "Improving PSP Sensitivity at Normal Flow Pressures," NASA LaRC.

**N. Eva Wu**: "Flight Critical System Design," NASA.

**Rochelle K. Young**: "Technology Policy and Technology Supported Learning," NSF, October 1, 1999; "Technology Policy and Technology Supported Learning," NASA, December 1, 1999.

**Ye K. Zhou**: "Noise Generated from Subgrid Scales in CAA," NASA.

## Funded Research Proposals

**Ponnampalam Balakumar**: "Transition in Supersonic Flows with Corners," NASA LaRC.

**Lee A. Belfore, II**: "Development of Data Compression Methodologies for FTS Imagery," funded (2-1-99 to 8-31-99), NASA LaRC; "Geostationary Imaging Fourier Transform Spectrometer (GIFTS) Date Compression Study Contract, NASA LaRC.

**Janice D. Cawthorn**: "Title III - Technology in Education," U.S. Department of Education; "Microsoft Software in Education," Microsoft Corporation; "Excellence (Special Education)," U.S. Department of Education (OSEd); "Excel (Special Education)," U.S. Department of Education (OSEd).

**Frank W. Chambers**: "Automotive Air Filter Design," Oklahoma Center for the Advancement of Science and Technology.

**Amitabha Ghosh**: "Implementation of TWNTN4A at the 0.3M Transonic Cryogenic Tunnel," NASA LaRC.

**Paul J. Kauffmann, Jr.**: "Feasibility Study," Center for Innovative Technology; "Study of Cost Claim," RCI; "Geographical Data Error Measurement," NASA.

**Jacob Savir**: "Extension to FIRES and GENTEST," Lucent Technologies; "Full System on a Chip Design," New Jersey Commission on Science and Technology.

**Chelakara S. Subramanian**: "Wind Loading on High-way Sign Connections," Florida Department of Transportation; "Development of Low-Cost Miniature LDV System Using Laser Diode," Florida Institute of Technology.

**James P. Withington**: "Low-Cost Mechanical Engineering Laboratory," National Science Foundation.

**N. Eva Wu**: "Optimal Redundancy Management," National Science Foundation; "Normal Adaptive Control of F-15," Lockheed Martin; "Advanced Diagnosis of Printing Machines," Xerox; "Reliability Criteria-Based Flight System Design," NASA.

## 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 thirty-nine of thirty-nine 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 | 37 | (95%) |
| No | 2 | (5%) |

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

| | | |
|---|---|---|
| Yes | 39 | (100%) |
| No | | |
| No Response | | |

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 | (82%) |
| No | 1 | ( 3%) |
| Uncertain | 6 | (15%) |

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 | 27 | (69%) |
| No | 6 | ( 15%) |
| Uncertain | 4 | ( 10%) |
| N/A | 2 | ( 5%) |

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

| | | |
|---|---|---|
| Very much so | 37 | (95%) |
| Somewhat | 2 | ( 5%) |

## 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 | 16 | (41%) |
| Redirected | 9 | (23%) |
| Advanced | 27 | (69%) |
| Barely maintained | 2 | ( 5%) |
| Unaffected | 1 | ( 3%) |

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 | 39 | (100%) |
| Not at all | | |
| No Reply | | |

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 | 27 | (69%) |
| By starting new courses | 3 | ( 8%) |
| By sharing your research experience | 36 | (92%) |
| By revealing opportunities for future employment in government agencies | 18 | (46%) |
| By deepening your own grasp and enthusiasm | 21 | (54%) |
| Will affect my teaching little, if at all | 2 | ( 5%) |
| No Response | | |

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 | 25 | (64%) |
| No | 13 | (33%) |
| No Answer | 1 | ( 3%) |

## C. Administration

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

| | | |
|---|---|---|
| Received announcement in the mail | 16 | (41%) |
| Read about in a professional publication | 3 | ( 8%) |
| Heard about it from a colleague | 16 | (41%) |
| Other (Explain below) | 5 | (13%) |

Director, LaRC OEd; Tennessee Recruiting Initiative; Prior Participant; Called by researcher; E-mail announcement; Director of Career Placements with University

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

Yes 8 (21%) No 31 (79%)

| | |
|---|---|
| ___ | DOE |
| 3 | Another NASA Center |
| ___ | Air Force |
| ___ | Army |
| 5 | Navy |

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

Yes 3 (8%) No 31 (79%) No Answer 5 (13%)

Goddard Space Flight Center; Navy

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

| | | |
|---|---|---|
| Many | 5 | (13%) |
| A few | 31 | (79%) |
| None | 3 | ( 8%) |
| No reply | ___ | |

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 (67%) No 12 (31%) N/A 1 (3%)

   If not, why? Although the money is nice, I mainly do it for the experience; Research interest; I live locally and do not have extra housing costs; The $1,000/wk was sufficient and it is good to cover expenses plus a little more; however, the full $1,000/wk is not a requirement for me although it may be for younger faculty; Opportunity is greater than the money; Object is to grow and develop research; Compensation is adequate.

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

| | | |
|---|---|---|
| Yes | 27 | (69%) |
| No | 11 | (28%) |
| No reply | 1 | ( 3%) |

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

| | | |
|---|---|---|
| Yes | 33 | (85%) |
| No | 0 | ( 0%) |
| Somewhat | 0 | ( 0%) |
| Not Applicable | 6 | (15%) |

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

| | | |
|---|---|---|
| Yes | 35 | (90%) |
| No | 2 | ( 5%) |
| Somewhat | 0 | ( 0%) |
| No Answer | 2 | ( 5%) |

9. How do you rate the seminar program?

| | | |
|---|---|---|
| Excellent | 24 | (62%) |
| Good | 11 | (28%) |
| Fair | 2 | ( 5%) |
| Poor | 1 | ( 3%) |
| No reply | 1 | ( 3%) |

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

Check one per activity

| Activity | Adequate | Too Brief | Excessive | Ideal |
|---|---|---|---|---|
| Research | 22 (56%) | 4 (10%) | 0 ( 0%) | 12 (31%) |
| Lectures | 23 (59%) | 1 ( 3%) | 2 ( 5%) | 10 (26%) |
| Tours | 23 (59%) | 1 ( 3%) | 0 ( 0%) | 9 (23%) |
| Social/Rec. | 22 (56%) | 2 ( 5%) | 1 ( 3%) | 7 (18%) |
| Meetings | 25 (64%) | 1 ( 3%) | 0 ( 0%) | 9 (23%) |

11. What is your overall evaluation of the program?

| | | |
|---|---|---|
| Excellent | 30 | (77%) |
| Good | 8 | (21%) |
| Fair | 1 | ( 3%) |
| 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?

$ 57,076* per Academic year x or Full year ____.
Median Range **Based on 34 professors' salaries provided.*

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

   Yes 1 (3%) No 20 (54%) In Part 16 (41%) No Answer 2 ( 5%)

3. What, in your opinion, is an adequate stipend for the ten-week program during the summer of 2000?

   $10K-8 (21%); $11K-1 (3%); $12K-9 (23%); $12.5K-2 (5%); $13K-2 (5%); $15K- 9 (23%); $16K-1 (3%); $20K- 1 (3%); Not Indicated-6 (15%)
   Several suggested that the relocation allowance was inadequate for those having to maintain two households during the summer. It was recommended that either the stipend be significantly increased, the relocation allowance be significantly increased, or a combination of the two.

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

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

   Yes 9 ( 23%) No 30 (77%)

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

   Yes 12 (31%) No 24 (62%) Not Indicated 3 (8%)

## Fellows' Comments and Recommendations

- Langley is a great place to spend the summer.
- Everything was excellent. I can't think of anything that would improve the program further.
- Housing and programmatic information was excellent.
- Raise the salary - $1,000 is barely enough to meet expenses. Include a list of LaRC Group leaders and their missions.
- Extended instruction on proposal process.
- Provide more local housing options.
- Invite NASA Associates to social activities early. Finalize plans for Division presentations early.
- ASEE program should get involved in evaluating work space accommodations for Fellows. In some cases accommodations are very marginal. In some cases there may be a need to request alternate Associates in the event a primary Associate leaves the agency.
- Provide some incentives for good work such as guaranteeing follow-on funding for good quality work. Make sure that e-mail and internet services are available to the Fellows as soon as they begin work at NASA.
- Map of Hampton Roads area in Orientation package mailed in advance. Open access to the credit union.
- One suggestion is to offer a 6-week, instead of a 10-week option. Presumably, a 2nd Year Fellow needs less time to "wrap up" on the research. The 6 weeks would (a) allow the Fellow to exchange ideas with the Associate, and (b) not be so constraining/consuming of the Fellow's summer time.
- I believe the program could be reduced to eight weeks. The ten weeks rush some Fellows whose home institutions begin their fall schedules early.
- The only problem is the ten week window-but there are few other alternatives - it is summer!
- Up-to-date web site showing activities/speakers/tours. Tours spread through the summer. As a second year Fellow, because I was familiar with Langley and the flow of activities, I found it difficult to feel linked with other participants.
- I would prefer some flexibility for starting and ending dates.
- Inadequate equipment to support my work. Nearly impossible to buy small items for my work. Meetings with my Associate were too infrequent. Insufficient guidance from my Associate.
- Mini-grant follow up; ASEE Final Presentations on the last day; Earlier starting time.
- More scientific seminars that focus on the science and less on personal aspects or views; more enthusiastic presenters.
- The seminars need to be improved. The proposal seminar was rather superficial.
- Increase the stipend. Introduce mid-term presentations at about 10 minutes each.
- Increase the stipend and make it easier to work evenings and weekends.
- I would enjoy more opportunities to explore NASA LaRC branch and learn more about their activities.

## Fellows' Comments and Recommendations Continued

- Provide listing of current research topics in detail at NASA Center.
- Help Fellows with funding to follow up with the research topic started.
- The NASA/ASEE Summer Faculty Fellowship Program provides an excellent opportunity for the participants to gain new knowledge, form partnerships with NASA/LaRC, network with other professionals with similar and very different interests and capabilities, and pursue research in special areas. The uniqueness of NASA/LaRC's specialized facilities and personnel provide experiences that could never be replicated in an academic setting. The LaRC associates and staff members make extraordinary efforts to assist the Fellows and to make their summer experiences worthwhile and enjoyable. The program is well-planned and efficiently executed. The ASEE staff at LaRC is accessible, helpful, and always willing to take any steps to assist the Fellows.
- While participation will likely be noted in promotion and tenure decisions, the real, concrete metric for participation in this program are research, funding, and publications. I feel I accomplished more this second summer both for my branch and for my career. I am more satisfied with my experience this second summer.
- The ASEE Final Presentations were interesting - I could see how my work fits into some seemingly unrelated project. But...schedule the presentations for Friday. It is a fitting close to a most enjoyable summer. Wednesday should be available for work in the lab. The report can be written on Thursday. The last day is always a difficult one - what to do? The report is written, desks and work areas area cleared - why not talk about your work? I "lost" half a day that I could have used more profitably in the lab. Having the Final Presentations on Wednesday effectively shortens the time available for research.
- Excellent job! Keep up the good work! Increase the stipend a bit! (Well actually - a lot!). Allow easier off-hours access. Make the ASEE T-shirt a bit more colorful than just boring white! The design on it, however, was excellent! My compliments to the designer! Make the socials much more exciting. How? Perhaps by inviting other groups.
- This is a phenomenal program, which has stimulated me professionally,and rejuvenated me both professionally and personally. My colleagues in the Office of Education are wonderful, and have been a great asset. Thank you very much.

## SUMMARY OF ASSOCIATES' EVALUATION

The following comments and recommendations were taken from the questionnaire distributed to the ASEE Associates requesting them to evaluate the overall performance of their ASEE Fellow. Most all of the Associates responding indicated an overwhelming satisfaction with the Fellow's knowledge of their subject, diligence, interest in assignment, and enthusiasm. A total of 27 evaluations were returned. See statistics based on the number returned below:

- 96% aware of participation as Associate prior to start of program
- 93% contacted Fellow prior to start of program
- 85% stated Fellows accomplished established research goals
- 81% interested in serving as Associate again (one-no due to retirement)
- 59% indicated there was discussion of possible follow on research via submission of a proposal
- 81% with first year Fellows indicated a desire to continue research with the 2000 program
- 67% indicated their Fellow was above average when compared overall with other faculty researchers they had worked with before
- 75% indicated the programmatic support/operations of the Office of Education was above average.

### Research Associates' Comments

- Excellent Program.
- Program is good. Keep up the good work.
- Programmatic support/operations outstanding as usual.
- Too many external meetings and Seminars - Research Fellow was not enamored with attending them.
- Program is working well, support and Fellows have been very helpful.

### Research Associates' Recommendations

- Need to recruit larger pools of educators.
- Notification ahead of time of Fellows acceptance so planning can take place.
- Provide additional tours and exposure to LaRC programs and facilities for ASEE Fellows.

## SECTION VII

## CO-DIRECTOR'S RECOMMENDATIONS

1. It is wholeheartedly, and enthusiastically recommended that the program continue. It is a valuable and effective means of contributing to the research objectives of the NASA Research Center, it enriches and refreshes the faculty and their home institutions, and it furthers the professional knowledge of the participating faculty. These conclusions are amply supported with the assessments by participants and NASA researchers.

2. It is recommended that the lecture series continue. It is suggested that a more formalized, or regularly implemented procedure of inviting guest lecturers to a casual luncheon following the presentation be instituted. This was occasionally implemented this year and provided excellent opportunities for the faculty to further discuss the topic in depth, and to develop professional contacts.

3. It is recommended to modify the application distribution to Competencies in order to include ranking of non-selected participants. These rankings should include: 1) relevance to NASA Langley's Research interest, 2) relevance to NASA research interest, 3) capabilities and research background of the participant. There are three main advantages to this additional information. First, these additional data will be used to assist in the placement of participants when unfilled slots arise. These second tier selections need to occur on a short time frame and should closely match the needs of the research group. Secondly, the non-Langley research projects of high ranking can be shared with colleagues at other NASA Research Centers, to assist in their second tier selections. And finally, these data will augment information used to recruit participants for future summer appointments.

4. It is recommended that the recruitment and advertisement activities of the program be expanded. In addition to the encouragement of high ranking, non-selected applicants to apply for future programs, new pools of candidates should be developed. Geographic proximity of applicants is not unexpected for programs of this type and a concerted effort must be exerted to seek candidates from diverse backgrounds in every sense.

5. It is recommended that the RADIO (Research and Development Interaction Opportunities) activities be expanded. This could be accomplished by identifying participants whose projects will significantly impact their home institution via participation of students, or curricular modifications. The identified faculty members would receive small awards (~$2,000-5,000), to facilitate student presentations at professional meetings or development and dissemination of curricular materials. This recommendation is offered in the spirit of the agency's interest in providing the broadest desalination of NASA research results to the public. This activity is a cost effective method of providing the E/PO service.

# APPENDIX I

# PARTICIPANTS - ASEE/NASA LANGLEY

# SUMMER FACULTY RESEARCH PROGRAM

**1999 NASA Langley ASEE Summer Faculty Fellowship Program Fellows**

| Name and Institution | | NASA Associate & Competency/Program Office |
|---|---|---|
| Dr. Ponnampalam Balakumar<br>Old Dominion University | | Mr. Richard A. Thompson<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Prof. Effi S. Barry<br>Hampton University | | Mr. Roger A. Hathaway<br>Office of Education |
| Dr. Oktay Baysal<br>Old Dominion University | | Dr. James L. Thomas<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Dr. Lee A. Belfore, II<br>Old Dominion University | (R) | Mr. Stephen G. Jurczyk<br>Systems Engineering |
| Dr. Gladys Brignoni<br>Old Dominion University | | Mr. Roger A. Hathaway<br>Office of Education |
| Dr. Charles M. Bump<br>Hampton University | | Dr. Joseph G. Smith<br>Structures and Materials |
| Dr. Deborah H. Carey<br>Marywood University | (R) | Mr. David R. Schryer<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Prof. Janice D. Cawthorn<br>Hampton University | | Mr. Michael L. Ruiz<br>Atmospheric Sciences |
| Dr. Frank W. Chambers<br>Oklahoma State University | | Dr. Gregory S. Jones<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Dr. Ayodeji O. Demuren<br>Old Dominion University | | Dr. Mark H. Carpenter<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Dr. George S. Devendorf<br>Middle Tennessee State University | | Dr. Joel S. Levine<br>Atmospheric Sciences |
| Dr. Amitabha Ghosh<br>Rochester Institute of Technology | (R) | Dr. Joel L. Everhart<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Dr. Peyman Givi<br>State University of New York-Buffalo | (R) | Dr. J. Philip Drummond<br>Aerodynamics, Aerothermodynamics and Acoustics |

**1999 NASA Langley ASEE Summer Faculty Fellowship Program Fellows Continued:**

| Name and Institution | NASA Associate & Competency/Program Office |
|---|---|
| Dr. David J. Gosselin (R)<br>Christopher Newport University | Mr. Joseph R. Struhar<br>Business Management |
| Dr. Roy F. Gratz<br>Mary Washington College | Dr. Joseph G. Smith<br>Structures and Materials |
| Dr. Rustin Greene<br>James Madison University | Dr. Thomas Pinelli<br>Office of Education |
| Dr. Roger L. Haggard<br>Tennessee Technological University | Mr. Daniel B. Shafer<br>Airborne Systems |
| Dr. James M. Hereford (R)<br>Christopher Newport University | Mr. Ray D. Rhew<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Mr. Thomas E. Hopkins (R)<br>Southwest Virginia Community College | Mr. Anthony L. Cook<br>Airborne Systems |
| Dr. Jiashi Hou<br>Hampton University | Dr. Tan-Hung Hou<br>Structures and Materials |
| Ms. Patricia L. House<br>Virginia Best Practice Center | Dr. Samuel E. Massenberg<br>Office of Education |
| Ms. Mary E. Ingham (R)<br>Valdosta State University | Mr. W. Brad Ball<br>Systems Engineering |
| Dr. Paul J. Kauffmann, Jr. (R)<br>Old Dominion University | Mr. H. Paul Stough, III<br>Airborne Systems |
| Dr. Anne Millbrooke<br>University of Alaska-Fairbanks | Mr. David E. Hahne<br>High Speed Research Program Office |
| Dr. Taj O. Mohieldin (R)<br>Old Dominion University | Mr. Charles R. McClinton<br>Space Access & Exploration Program Office |
| Dr. Ollie J. Rose<br>Mt. Olive College | Mr. Jonathan B. Ransom<br>Structures and Materials |

**1999 NASA Langley ASEE Summer Faculty Fellowship Program Fellows Continued:**

| Name and Institution | NASA Associate & Competency/Program Office |
|---|---|
| Dr. George T. Rublein (R)<br>College of William and Mary | Dr. Samuel E. Massenberg<br>Office of Education |
| Dr. Jacob Savir<br>New Jersey Institute of Technology | Dr. Celeste M. Belcastro<br>Airborne Systems |
| Dr. Gregory V. Selby (R)<br>Old Dominion University | Mr. George D. Allison<br>Business Management |
| Dr. Shantilal N. Shah (R)<br>Norfolk State University | Mr. Jeffrey M. Seaton<br>Aerospace Systems, Concepts, and Analysis |
| Mr. Mir S. Shirvani<br>New River Community College | Mr. C. Wayne Williams, Jr.<br>Systems Engineering |
| Dr. Douglas R. Smith<br>University of Wyoming | Dr. Ronald D. Joslin<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Dr. Chelakara S. Subramanian (R)<br>Florida Institute of Technology | Ms. Tahani R. Amer<br>Aerodynamics, Aerothermodynamics and Acoustics |
| Dr. Keith M. Williamson (R)<br>Old Dominion University | Dr. David S. Dawicke<br>Structures and Materials |
| Dr. Linda A. Wilson<br>Middle Tennessee State University | Mr. Donald H. Humes<br>Structures and Materials |
| Dr. James P. Withington<br>Inter American University-Puerto Rico | Mr. Jeffrey M. Seaton<br>Aerospace Systems, Concepts, and Analysis |
| Dr. N. Eva Wu<br>Binghamton University | Dr. Christine M. Belcastro<br>Airborne Systems |
| Dr. Rochelle Young<br>Old Dominion University | Dr. Janet M. McKenzie<br>Business Management |
| Dr. Ye K. Zhou<br>Tuskegee University | Dr. Michele G. Macaraeg<br>Aerodynamics, Aerothermodynamics and Acoustics |

**R-Designates returnees from 1998**

# APPENDIX II

## LECTURE SERIES

## PRESENTATIONS BY RESEARCH FELLOWS

## CALENDAR OF ACTIVITIES

# 1999 OFFICE OF EDUCATION SUMMER LECTURE SERIES

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

14 Langley Boulevard

Time: 11:00 a.m. - 11:45 a.m. - Lecture

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

| DATE | TOPIC | SPEAKER |
|---|---|---|
| Tuesday, June 15 | Mars and the Mars Airplane Mission: A New Chapter in Planetary Exploration | Dr. Joel S. Levine<br>Atmospheric Sciences Division<br>Langley Research Center |
| **Tuesday, June 22 | Technology - Our Future or We Are History | Dr. Robert L. Norwood<br>Director, Commercialization<br>Technology Division<br>NASA Headquarters |
| Tuesday, June 29 | No Lecture Scheduled | |
| Tuesday, July 6 | Mars Sample Return: A Crowing Achievement for NASA's Robotic Exploration Program | Dr. Robert D. Braun<br>Manager, Mars Sample Return<br>Earth Entry Vehicle Program<br>Space Exploration Project Office |
| Tuesday, July 13 | Career Development in a Research and Technology Environment | Ms. Ruth M. Martin<br>Assistant to the Director for Program Integration<br>LaRC's Office of the Director |
| Tuesday, July 20 | From the NASA 30 by 60 to the ODU Full Scale Tunnel | Dr. E. James Cross<br>Manager, Langley Full-Scale Tunnel<br>Professor, Aerospace Engineering<br>Old Dominion University |

***Lecture for June 22 to be held at the Pearl I. Young Theater, 5A N. Dryden Street, Building 1202A****

# Upcoming Activities

**For LARSS Only**
Graduate Seminar

July 22, 1999 12:30-4:00
**H. J. E. Reid Conference Center**

**For ASEE Only**
Proposal Seminar

July 27, 1999 11:00
**H. J. E. Reid Conference Center**



NASA Langley Research Center

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

# Office of Education Summer Lecture Series

July 20, 1999
11:00 a.m.

# Dr. James Cross

## Manager of the Langley Full Scale Wind Tunnel
## Old Dominion University

Dr. E. James Cross is Manager of the Langley Full Scale Tunnel. Prior to this assignment, he was Dean of the College of Engineering and Technology at Old Dominion University in Norfolk, Virginia for 13 years from 1984. He was Head of the Aerospace Engineering Department at Texas A&M from 1979 to 1984 and for the years 1973 to 1979 he was Director of the Raspet Flight Research Laboratory at the Mississippi State University. He retired in 1973 after 22 years in the U.S. Air Force. His last Air Force duty assignment was as Head, Prototype Division, Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio. His degrees are BS, Aeronautical Engineering, Penn State University 1959, MS and PhD, University of Texas-Austin, 1965 and 1968 respectively.



**From the NASA 30 x 60 to the ODU Full Scale Tunnel**

Old Dominion University (ODU) negotiated a long-term operating agreement with the NASA Langley Research Center that allowed ODU to re-open and operate the 30 by 60 wind tunnel as an independent, self-financed and not-for-profit business enterprise. The ODU College of Engineering and Technology is the management agency for the tunnel operation. This tunnel, formerly known as the NACA/NASA Full Scale Tunnel and later as the NASA 30 by 60, is the second largest in the United States in terms of test section size, and now is the largest university-operated facility in the world.

The long and colorful history of this unique facility is reviewed, and the amazing range of testing throughout the 64 years of service with the NACA and NASA is discussed. The University interest and motivation for re-opening and the potential applications of this category facility are reviewed. These applications include aerospace and ground vehicle tests, with full-scale road vehicle (racecars, heavy trucks, racing motorcycles) testing as the primary focus. The tunnel metamorphosis, from aircraft testing to full-scale racecar testing is discussed. The management and operating organization of the facility involves an unusual partnership between federal and state government, military, academia, not-for-profit foundation, and private industry. The unexpected difficulties, and complexities of this first-time privatization venture are briefly discussed. Finally, the educational and training goals and objectives are reviewed.

**1999 American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program Final Presentations**

**and**

**Best Research Presentation Competition**

**H.J.E. Reid Conference Center**

**8:30 a.m. - 12:00 noon**

| | | |
|---|---|---|
| 8:30 a.m. | Welcome | Dr. Surendra N. Tiwari, ASEE Co-Director |
| 8:35 | Comments | Dr. Samuel E. Massenberg, Director<br>LaRC Office of Education |
| 8:40 | "Analysis of Contamination on Solar Panels Returned from the Mir Space Station" | Dr. Linda A. Wilson<br>Structures and Materials Competency<br>Materials Division<br>Middle Tennessee State University |
| 9:15 | "User-Interface and Educational Improvements to a Web-based Aircraft Design Module" | Dr. James P. Withington<br>Aerospace Systems, Concepts, and Analysis Competency<br>Aeronautics Systems Analysis Division<br>Inter American University of Puerto Rico |
| 9:50 | "The DEVELOP Center: Digital Earth Virtual Environment and Learning Outreach Project" | Ms. Janice D. Cawthorn<br>Space Projects Office<br>Hampton University |
| 10:25 | | Break |
| 10:35 | "A Study of Zero-Mass-Flux Actuator Arrays for Flow Control Applications" | Dr. Douglas R. Smith<br>Aerodynamics, Aerothermodynamics, and Acoustics Competency<br>Fluid Mechanics and Acoustics Division<br>University of Wyoming |
| 11:10 | "Design Optimization Towards Quieter and More Efficient Aircraft" | Dr. Oktay Baysal<br>Aerodynamics, Aerothermodynamics, and Acoustics Competency<br>Fluid Mechanics and Acoustics Division<br>Old Dominion University |
| 11:40 | Presentation of Certificates and Closing Comments | Dr. Surendra N. Tiwari, ASEE Co-Director |
| 11:50 | Group Photo of Presenters | |
| 12:15 p.m. | Dutch Lunch for ASEE Fellows at the LAFB Officers' Club | |

# 1999 ASEE/LARSS Calendar of Activities

| Date | Function |
|---|---|
| Monday, June 7 | ASEE/LARSS Orientation Program<br>H.J.E. Reid Conference Center, 14 Langley Boulevard |
| Thursday, June 10 | ASEE Center Tour of Three Facilities |
| Tuesday, June 15 | *Lecture-H.J.E. Reid Conference Center |
| Friday, June 18 | ASEE Simulator Tour |
| Tuesday, June 22 | *Lecture-Pearl I. Young Theater<br>(B. 1202A, 5A N. Dryden Street) |
| Tuesday, June 22 | ASEE/LARSS Picnic-H.J.E. Reid Conference Center Picnic Grounds 4:00 - 8:00 p.m. |
| Thursday, June 24 | ASEE/LARSS Langley Air Force Base F-15 Tour |
| Friday, June 25 | Spirit of Norfolk Moonlight Cruise |
| Tuesday, June 29 | No Lecture Scheduled |
| Monday, July 5 | Holiday |
| Tuesday, July 6 | *Lecture-H.J.E. Reid Conference Center |
| Thursday, July 8 | LARSS Center Tour of Three Facilities |
| Tuesday, July 13 | *Lecture-H.J.E. Reid Conference Center |
| Thursday, July 15 | LARSS Tour of Flight Simulator |
| Monday, July 19 | LARSS Individual Pictures at Hangar (9:00 a.m.) |
| Tuesday, July 20 | *Lecture-H.J.E. Reid Conference Center |
| Thursday, July 22 | LARSS Graduate School Seminar |
| Tuesday, July 27 | ASEE Proposal Seminar-H.J.E. Reid Conference Center |
| Tuesday, July 28 | ASEE Individual Pictures at Hangar (9:30 a.m.) |
| Friday, July 30 | ASEE/LARSS Banquet-LAFB O'Club |
| Thurs/Fri, August 5 & 6 | LARSS completion of EDCATS On-Line Evaluation |
| Sunday, August 8 | Spirit of Norfolk Dinner Cruise |
| Wednesday, August 11 | ASEE Final Presentations |
| Friday, August 13 | Last Day of Program |

*Lectures will be at 11:00 a.m. at the facility indicated.

# APPENDIX III

# GROUP PICTURE OF RESEARCH FELLOWS

Those pictured in group photograph from left to right are:

Front Row Standing: Dr. Surendra N. Tiwari (ASEE Co-Director), Dr. Ponnampalam Balakumar, Dr. Anne Millbrooke, Dr. N. Eva Wu, Dr. Jacob Savir, Ms. Patricia L. House, Dr. Gladys Brignoni, Dr. Deborah H. Carey, Dr. Ollie J. Rose, Prof. Effi S. Barry

Second Row Sitting: Dr. Taj O. Mohieldin, Dr. Keith M. Williamson, Dr. Lee A. Belfore, II, Dr. James M. Hereford, Prof. Thomas E. Hopkins, Dr. George S. Devendorf, Dr. Linda A. Wilson, Dr. Charles M. Bump, Dr. Roger L. Haggard, Prof. Rustin Greene

Third Row: Dr. Rochelle Young, Dr. Frank W. Chambers, Dr. Jiashi Hou, Dr. Amitabha Ghosh, Prof. Janice D. Cawthorn, Mrs. Debbie Murray (ASEE Program Manager/Admin. Asst.), Dr. James P. Withington, Dr. Chelakara S. Subramanian, Dr. Gregory V. Selby, Dr. Douglas R. Smith, Prof. Mir S. Shirvani, Dr. Roy F. Gratz

Not Pictured: Dr. Oktay Baysal, Dr. Ayodeji O. Demuren, Dr. Peyman Givi, Dr. David J. Gosselin, Ms. Mary E. Ingham, Dr. Paul J. Kauffmann, Jr., Dr. George T. Rublein, Dr. Shantilal N. Shah, Dr. Ye K. Zhou

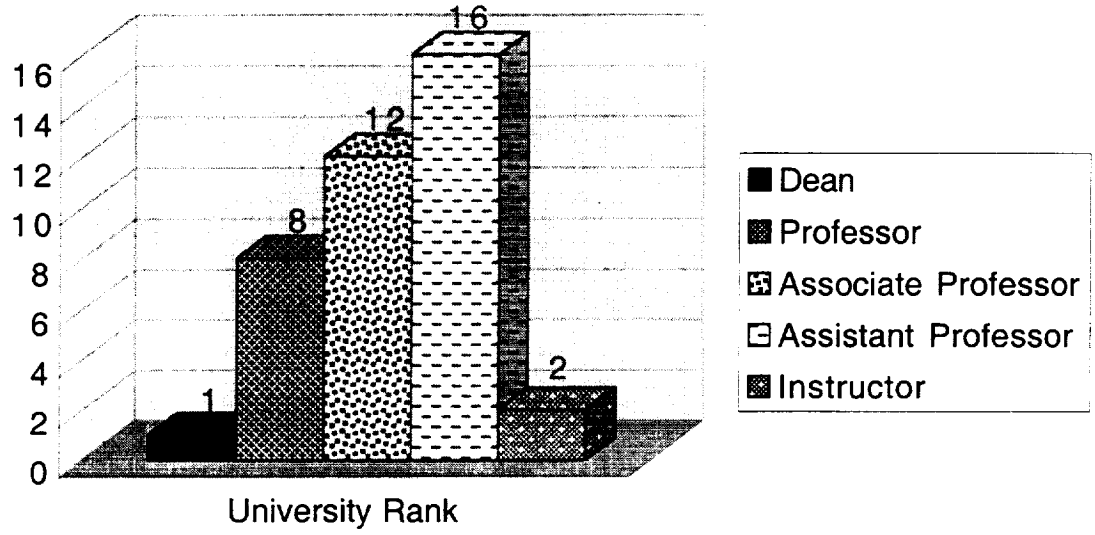
# APPENDIX IV

## DISTRIBUTION OF FELLOWS BY GROUP

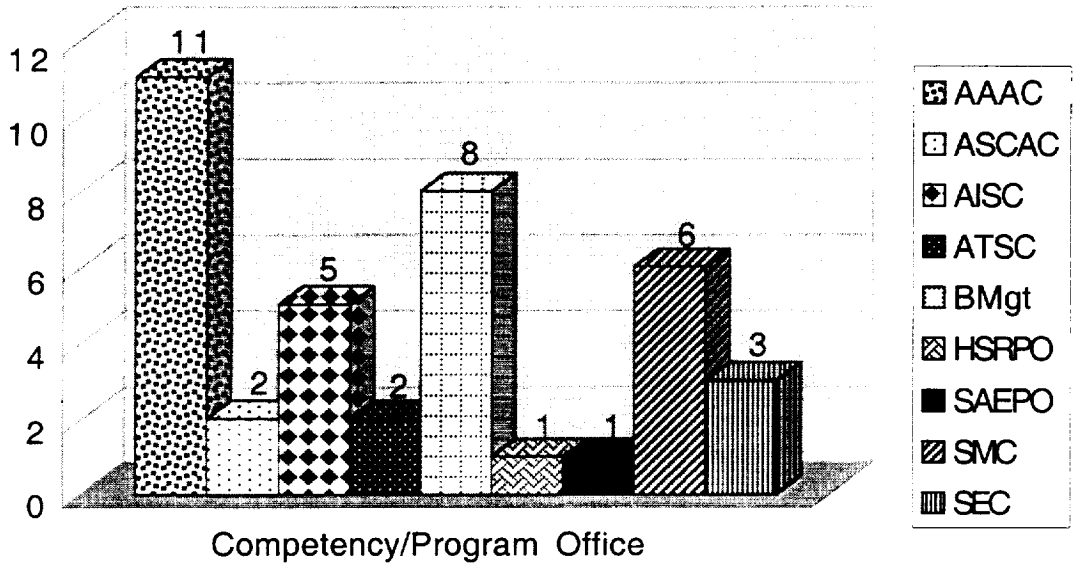
## and

## DISTRIBUTION OF FELLOWS BY UNIVERSITY RANK

## Distribution of 1999 ASEE Fellows by University Rank




## Distribution of 1999 ASEE Fellows by Competency/Program Office

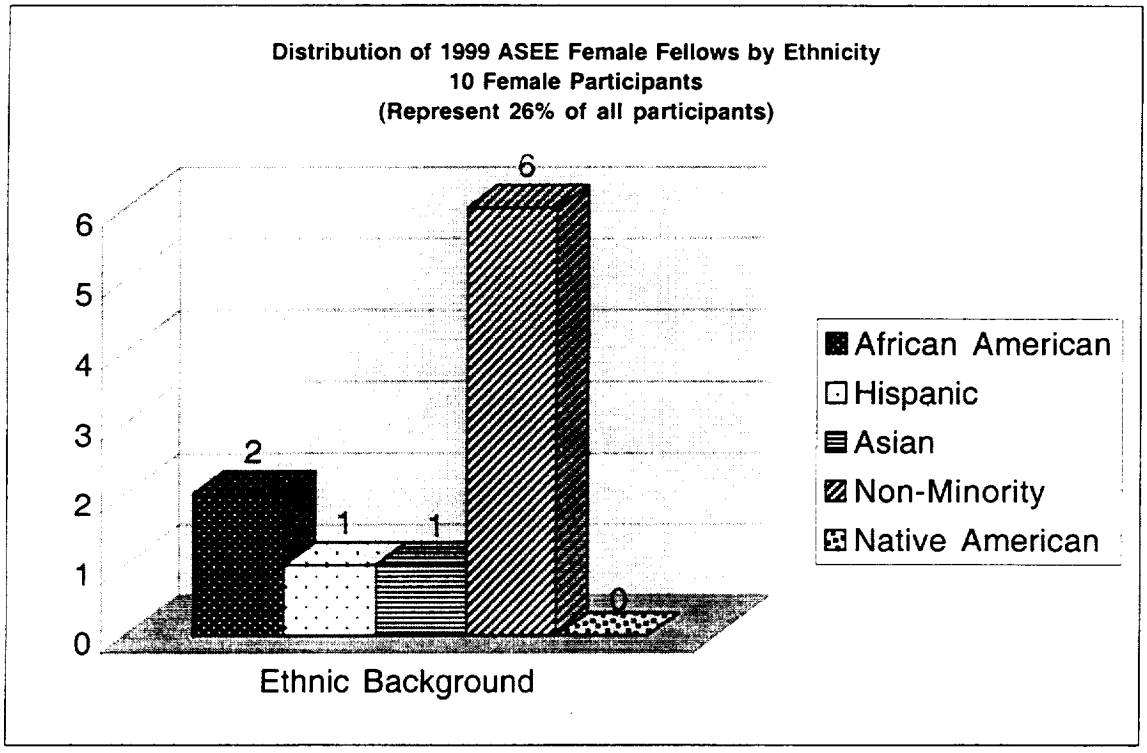


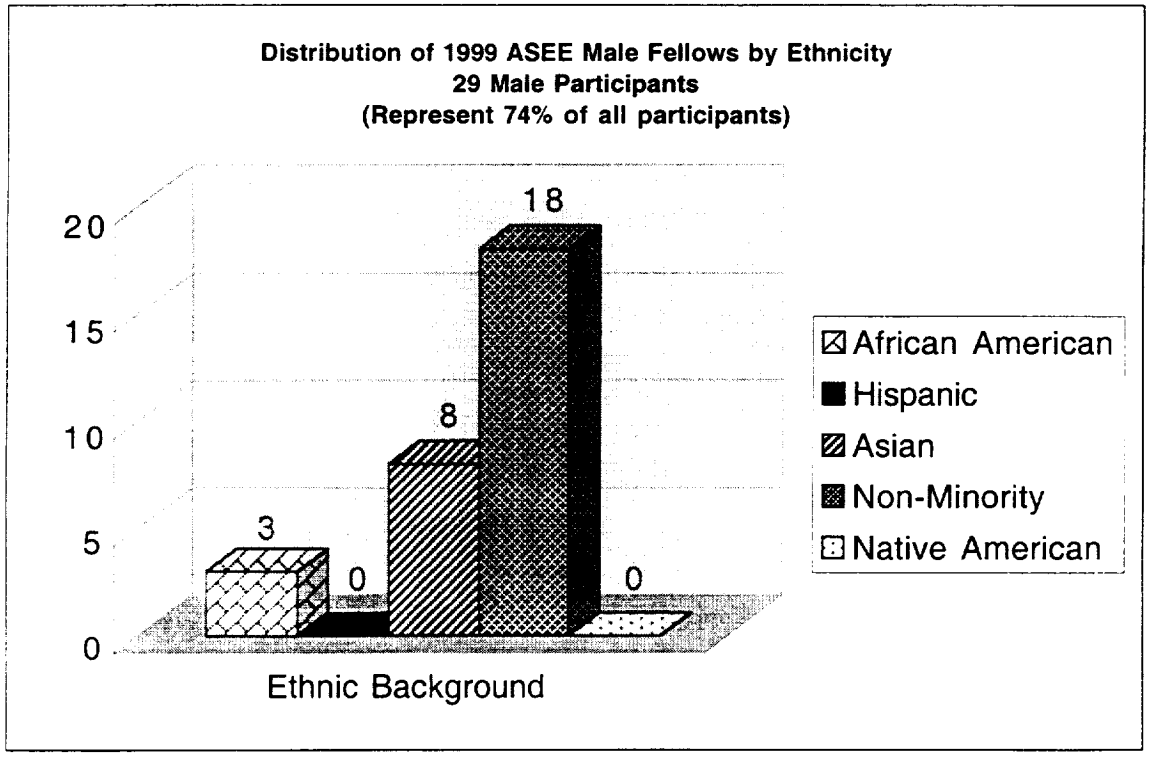
# APPENDIX V

## DISTRIBUTION OF FELLOWS BY ETHNICITY/FEMALE

## and

## DISTRIBUTION OF FELLOWS BY ETHNICITY/MALE


Distribution of 1999 ASEE Female Fellows by Ethnicity
10 Female Participants
(Represent 26% of all participants)
6
5
4
3
2
1
0
2
1
1
6
0
African American
Hispanic
Asian
Non-Minority
Native American
Ethnic Background


Distribution of 1999 ASEE Male Fellows by Ethnicity
29 Male Participants
(Represent 74% of all participants)
20
15
10
5
0
3
0
8
18
0
African American
Hispanic
Asian
Non-Minority
Native American
Ethnic Background

# APPENDIX VI

# DISTRIBUTION OF FELLOWS BY UNIVERSITY

# 1999 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM INSTITUTION PARTICIPATION

| UNIVERSITY/COLLEGE | NO. OF FELLOWS |
|---|---|
| Binghamton University | 1 |
| Christopher Newport University | 2 |
| College of William and Mary | 1 |
| Florida Institute of Technology | 1 |
| *Hampton University | 4 |
| Inter American University - Puerto Rico | 1 |
| James Madison University | 1 |
| Mary Washington College | 1 |
| Marywood University | 1 |
| Middle Tennessee State University | 2 |
| Mt. Olive College | 1 |
| New Jersey Institute of Technology | 1 |
| New River Community College | 1 |
| *Norfolk State University | 1 |
| Oklahoma State University | 1 |
| Old Dominion University | 10 |
| Rochester Institute of Technology | 1 |
| Southwest Virginia Community College | 1 |
| State University of New York-Buffalo | 1 |
| Tennessee Technological University | 1 |
| Tuskegee University | 1 |
| University of Alaska - Fairbanks | 1 |
| University of Wyoming | 1 |
| Valdosta State University | 1 |
| Virginia Best Practice Center | 1 |
| **Total Number of Fellows** | **39** |

**Total Number of Institutions Represented** **25**

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

# APPENDIX VII

# ABSTRACTS - RESEARCH FELLOWS

# Proposed Research Work

## Prediction of the transition front for Pegasus transition flight experiments

Successful flight experiments were conducted using the Pegasus vehicle to obtain the transition fronts and other characteristics of the transition process in three-dimensional hypersonic boundary layers. The objectives of the experiments are to validate the existing computational transition prediction methods against the experimentally obtained transition fronts in flight conditions. At present, there exist three possible methods of predicting transition onset points in flows over aero-dynamic bodies. One is the empirical $e^N$ method, the second is the Parabolized Stability Equations (PSE) approach, and the third is the DNS approach. The DNS approach, at this time, is not practical and is only used to investigate the transition process in simple model problems. The PSE approach can currently predict the transition process accurately and very efficiently in two-dimensional and in quasi three-dimensional problems. The $e^N$ method is an empirical method based on the linear stability theory and a correlation technique. This is the widely used method in predicting transition and our objectives of this work are:

1. to compute the transition fronts over the glove part of the wing using the $e^N$ method and to compare them with the experimentally obtained results. To this effort, we will use the transition prediction code $e^{Malik.}$. It is assumed that the mean boundary layer profiles are available at the start of the project or the mean flow profiles will be computed as part of the project.
2. to compute the transition front using the newly developed three-dimensional stability code (Jeyasingham and Balakumar 1999). In this method, the meanflow variations in the mormal and in the azimuthal directions are included in the stability analysis and is expected to predict the transition better than the current methods.

## References

Jeyasingham, S. and Balakumar, P., " Stability of Three-Dimensional Compressible Boundary Layers", AIAA 99–0406, 37th AIAA Aerospace Sciences Meeting and Exhibit, January 11–14, 1999, Reno, NV.

Summary of Program Activities
Submitted by Effi Barry

Being an ASEE scholar this summer was a very unique experience for me. I think the most valuable aspect of the program, for me, was the development of a greater appreciation of the human endeavors required to make the space exploration program so successful and how the knowledge gained from this program has made such a vital difference in our lives today.

My assignments in the Office of Education were varied and quite interesting. I worked with Dr. Thomas Pinelli, Director of the Distance Learning Program. I assisted in the development of strategies to increase educators' and student awareness of availability and access to, and utilization of distance learning K-12 innovative educational programs developed by this office to enhance the teaching and learning of science and mathematics. These programs include NASA CONNECT, The Why Files, and Destination Tomorrow. The articles I wrote about these programs were submitted to educational organizations for publication in their newsletters as well as placement on their websites.

My other assignment included working with the Preservice Teacher Training Institute, a program developed through the Office of University Programs under the direction of Mr. Roger Hathaway. This program conducted a series of very intense workshops developed to enhance preservice teachers' knowledge of scientific and mathematical principles, the provision of creative techniques to teach children math and science, as well as exposure to utilizing technology that can be integrated into daily teaching. Space exploration was used as the basis for these workshops.

I had the interesting task of developing a unit on the impact of space travel on the function of the human body. This was accomplished through the development of teaching materials, compilation of classroom experiments, and skit development to allow the participants to focus on the interpersonal dynamics of living and working is space.

Another interesting task I was involved with was the development of a video presentation to inform the education community of the innovative science and math education programs developed by the Office of Education.This presentation was shown at a major cable television conference. As a result of this presentation, there has been an increase in inquiries about the educational programs. This experience was very challenging but stimulating, as I was introduced to the use new technology.

# Design Optimization Towards Quieter and More Efficient Aircraft

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The motivation is to develop automated optimization tools that would ultimately allow one to design quieter and aerodynamically more efficient aircraft. The current design practices, which mostly rely on the "cut-and-try" approaches, are a major contributor to the prolonged design cycles, hence are not desirable to use.

The critical building block to this end, when a gradient-based optimization is to be used, are the sensitivities of the equations governing the underlying physics with respect to the design variables. Although much research has recently been published on the efficient analytical sensitivities, practically all of them are limited to the steady-state flowfield equations. However, it is the unsteady flows that are responsible for the dynamic loads on the aircraft and for the generation of the non-propulsive noise, also known as the airframe noise. Further, an aerodynamic shape optimally designed for steady flows, even when multipoint objectives are used, has inferior unsteady aerodynamic characteristics, as compared to one designed for unsteady flows.

Therefore, time-dependent sensitivities are necessitated both by the unsteady flowfield around the aircraft and the propagation of the noise. This constitutes the main objective of the present investigation. Borrowing some of the concepts from control theory, a cost functional deemed as the objective is first augmented by the equations governing the fluid and the wave motions. Then, the material derivatives for the volume and the surface integrals are used to derive the first variations. For the shape optimizations, these variations are then linked to the control points of the parameterized design surfaces.

Two examples are given as the proof-of-concept. First, starting with a symmetric airfoil, a transonic airfoil is designed to match the "desirable" lift characteristics during a complete cycle of a periodic pitching motion. The second example involves a favorable scattering problem of aeroacoustics. The acoustic waves generated by a periodic source are scattered over a noise barrier. The top-edge shape of the barrier is optimized to reduce the sound-pressure-level at a distant receiver location. The methodology will be extended and then directed for more realistic problems.

# A Study of Data Compression for the GIFTS Instrument

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Satellite based instrumentation is capable of providing extensive and detailed data for use in weather forecasting, earth science, and space science. Analysis of infrared spectral data and the subsequent retrieval of atmospheric conditions form the foundation for weather prediction at a wide range of geographic scales. The proposed New Millennia Project, the Geostationary Imaging Fourier Transform Spectrometer (FTS) [GIFTS], will incorporate FTS technology. The GIFTS instrument will collect hyperspectral images that can be used in forecasting weather patterns and in performing remote sensing on the effect of both natural and man made atmospheric perturbations. The GIFTS instrument can generate a huge volume of data. For example, one measurement mode requires, every 25 seconds, a hyperspectral image of $128 \times 128$ pixels with 5000 spectral components per pixel. Assuming 14 bits per sample, the required data rate is 46 million bits per second (MBPS). Given a satellite link of 6 MBPS, a compression rate in the neighborhood of 8:1 is necessary. If raw data is desired, the compression rate required is more than 40:1.

Due to the large data volume, several options are available, some desirable and some not. Ideally, no information is desired to be lost, but the best available space qualified lossless compression for science data is the USES chip designed by a team at the University of New Mexico. The USES chip will compress data to 4:1 under the best of circumstances and more realistically 1.5:1 for expected hyperspectral data produced by the GIFTS instrument. Consequently, the two possible options are to employ lossy data compression or to select specific data products. Since it was desired to receive information over the entire range of measurements, lossy data compression approaches were investigated.

My responsibilities in this project were three-fold. First, I was to develop a deeper understanding of the data requirements and properties and also to develop a deeper understanding of data compression methodologies. My data compression studies included an investigation on how well noise can be compressed by the USES chip. In general, uniformly distributed noise is incompressible, but Gaussian noise can be compressed provided the variance is not too large. By assuming noise and compression residuals look Gaussian, we can infer a noise compression rate, and therefore a bound on the overall compression rate. Second, I was to evaluate compression methods proposed by members from the GIFTS team that included solutions from both the science and engineering sides. At present, the compression algorithms are still under evaluation and no firm results are yet available. Third, I developed a lossy compression algorithm that employed a priori data reordering and wavelet analysis that in preliminary studies achieved lossy compression in the range of 2:1 up to 6:1 while still meeting required noise margins.

# NASA/NSU/NSF Pre-Service Teacher Institute

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Over the past decade, American citizens have become increasingly aware of the quality of education provided to the nation's youth and the resultant state of their intellectual skills. Several factors have pushed concern about the quality of the nation's science and mathematics education to the fore. First, test results of student performance in science and mathematics and related subject areas indicate that America's students perform poorly in comparison to students of other Western industrialized countries. Second, the United States appears to be losing its competitive advantage in the world economy and a portion of this loss relates to technology-intensive industries and services. Related to these concerns, the average citizen needs to understand science and mathematics better as we enter a more technologically intensive, global economy in the 21st century.

On July National Science Board issued a statement urging "all stakeholders 1998, the in our vast grass-roots system of K-12 education to develop a nation-wide consensus for a common core of knowledge and competency in mathematics and science". In response to this drive, NASA and Norfolk State University combined their efforts to design and offer a Pre-service Teacher Institute to increase participants' skills in teaching mathematics and science while incorporating technology in the curriculum. It was hoped that this would be achieved through the development of a problem-based Aeronautics theme. This year's theme was *"To Mars and Back"*. This particular mission entailed the following scenario: "There are rocks on Mars that have medicinal properties, which will cure all of the ills on Earth. Your job is to harvest those rocks and return them safely to Earth". Students were randomly divided into various flight teams. Each flight team had to address one aspect of this mission and present it to the class.

In addition to offering this institute to pre-service teachers, NASA, NSU and NSF decided to initiate a similar institute for university faculty members, involved in k-12 teacher preparation and enhancement. My particular involvement in this project entailed the design and the implementation of such institute. In order to develop this institute, I first conducted an extensive literature review in the area of science and math faculty enhancement. As the National Research Council stated in 1995, "Becoming an effective science teacher is a continuous process that stretches from pre-service experiences in undergraduate years to the end of a professional career". If learning and intellectual development is to become a lifelong activity of our students, it must first become a lifelong priority of our teachers. As a result of my investigation, I conceived the following objectives for the faculty participants: to raise awareness of NASA's mission, programs and activities; to access NASA data and resources; to interact with pre-service teachers; to obtain information and ideas in order to develop their own pre-service and in-service programs; to participate in various theme-related activities such as the mission *"To Mars and Back"*. Based on the positive feedback and evaluation received, the institute was very successful. Thus, faculty participants indicated that their newly acquired knowledge and resources would be incorporated in their courses to enhance teacher preparation.

# Synthesis of Monomer Precursors for Piezoelectric Polymers

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Polar groups in polymers may be aligned in the same direction by heating the polymer above its glass transition temperature $T_g$ in the presence of an electric field. Polymers thus treated may exhibit piezoelectric properties, viz. a deformation of the polymer may generate an electric potential. Such a property would permit the polymer to serve as a sensor to detect changes in the shape of aircraft or spacecraft. Diamine monomers containing bis aryl ethers with a nitrile functional group have shown promise of affording piezoelectric polymers when coupled with dicarboxylic acids.

The present investigation has focused on the preparation of the following diamines:

**(1)** 2,5-diamino benzonitrile
**(2)** 6-cyano-1,3-bis(3-aminophenyl) benzene
**(3a)** 5-acetamido-2-cyano-1,3-bis(3-aminophenyl) benzene
**(3b)** 5-(1-methylethoxy)-2-cyano-1,3-bis(3-aminophenyl) benzene

The synthesis of **(1)** starting from 5-nitroanthranilonitrile (2-amino-5-nitrobenzonitrile) established a convenient method for the selective reduction of a nitro group to an amine without the concomitant reduction of a nitrile.

The synthesis of **(2)** from 2,4-difluorobenzonitrile and 3-aminophenol was carried out to familiarize the investigator with reaction techniques routinely employed in the laboratory. The successful synthesis of **(2)** was important as a means of adding the bis aryl ether functionality to a benzene ring with polar functionality.

The synthesis of **(3a)** and **(3b)** require a common precursor 2,6-dichloro-4-aminobenzonitrile. That precursor is prepared from 2,6-dichloro-4-nitroaniline. The amine is diazotized and replaced with a nitrile function. The nitro group is selectively reduced to the corresponding amine. The amine is treated with acetic anhydride and coupled with 3-aminophenol to give **(3a)** or diazotized and treated with 2-propanol and coupled with 3-aminophenol to give **(3b)**.

# Temperature Independent Pressure Sensitive Paints

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## ABSTRACT

Pressure sensitive paints (PSPs) are used to provide a continuous pressure mapping of aerodynamic surfaces in wind tunnels. The PSP, which consists of a polymer and luminophore, is capable of providing a detectable qualitative method for surface flow visualization. When the paint is irradiated with a light source *in vacuo,* the luminophore molecules contained in the polymer matrix will luminesce. In the presence of oxygen, however, the luminophore molecules can become "quenched" that interferes with the luminescent process.

It has been demonstrated experimentally that the partial pressure of oxygen through the polymer matrix is inversely proportional to the emission intensity of the luminophore, which is the parameter that can be used to measure changes in pressure under airflow. The polymer matrix, therefore, is an important component of the paint mixture because it must be permeable to oxygen. In addition, the polymer must also possess certain physical properties that allow for easy application to the model surface, and that it cures to a smooth, transparent finish. The purpose of this research project was to synthesis a polymer that could maintain a constant luminescence intensity at atmospheric pressure that was independent of temperature changes ' above 25 °C.

For each of the polymer samples, the Stern-Volmer constant ($A_1$), which describes how sensitive the paint is to changes in the partial pressure of oxygen, was determined by the slop (K) of the linear equation:

$$I_{ref}/I = A_o + A_1(P/P_{ref})$$

In our calculations, $P_{ref}$ was the pressure set to a reference point of 10 psia and the Stern-Volmer reference constant, $A_o$, had been normalized to equal 1.00. A plot of the ratioed luminescence emission intensities of the PSP against the change in partial pressure of oxygen at any given temperature should yield a linear line, where the slope is equal to $A_1$. In these experiments, if the PSP showed a temperature independence, then the series of Stern-Volmer plots yielded linear lines that were superimposable. In most cases, however, the polymer sample did show a temperature dependence that was most likely due to the mobility of the polymer chains above room temperature, thus altering the permeability properties of the PSP.

# The DEVELOP Center

## (What I Did and Where I Went on My Summer Vacation)

Janice Cawthorn, ASEE Fellow, 1999

Yes, yes! I know! I know that I was paid to work this summer, and I did. But I also had lots of fun! Such an exciting and challenging summer! I dreamed for years about helping to create an educational initiative such as the DEVELOP Center (Digital Earth Virtual Environment and Learning Outreach Project). The educational implications for the center are enormous as is the potential for learning by both students and teachers. This is just the kind of enterprise with which I wanted to be associated.

So WHAT did I do? I acted as a faculty advisor to six LARSS students, five SHARP students and two Governor's School students. We worked together to produce sites, real and virtual, that can display and provide uses for remotely sensed federal data that has been collected since the late '60's via satellite and since the late 1800's by aerial photography. The current research indicated very limited use of remotely sensed data by the general public and the education community. As we have worked on the Center, we have explored the national learning standards for mathematics, science, geography, social studies and technology and have related the Virginia SOL's (Standards of Learning) to the national standards and to the activities in the Center and on its web page.

Students created the activities based on the learning standards and using the federal data that is available. I supplied input about format and content for the activities and generated a list of possible additional activities that might be of interest to both students and teachers at the middle and high school levels. Some of the activities are on line, and some are actually completed at the Center. I arranged for the first groups of rising middle school students to visit the Center where they tried they tried the activities, real and virtual. I had to pry them away to return them to their school.

I visited most middle and high schools in the city of Hampton and others in the area. Our goal for the summer was to enlist the support of Hampton City Schools. I took students with me so that they could be a part of the introduction of the contents and outreach missions of the Center. We talked with principals, and assistant principals who exhibited interest and asked that we schedule return visits after school begins so that the teachers can learn about the DEVELOP Center. Each principal with whom we talked asked about the Virginia SOL's correlation with the materials and concepts. One principal asked that we return to speak with the technology, earth science and oceanography classes, too.

I presented the DEVELOP Center at a Remote Sensing Conference in Boulder, CO. Again, the Center was well received and much interest was generated. I met Tim Foresman, Chairman of the Digital Earth Interagency Committee, at the conference. He suggested that the students and I come to the next meeting to present our center to the full committee. I also presented the concepts of the DEVELOP Center to an Infant School in Bath, England as well a Study Abroad Program. Students and teachers in both settings evidenced strong interest in what we might be able to provide via the Internet.

I collected posters, flyers, activities, pictures and soft ware from vendors and various sources, especially the conference in Colorado. The materials are now a permanent part of the Center. I also collected sets of web sites that will be of help to the users of the DEVELOP web site. Most of those are linked to our site.

Finally, did I have fun on my summer vacation at NASA-Langley? Yes!! YES!! **YES!!** The summer provided many growth opportunities for me and helped me decide to continue the pursuit of my doctoral degree but to follow a different direction which promises to be fulfilling and interesting. I plan to continue to pursue grants and other moneys to assist the further growth of the DEVELOP Center. My teaching and further studies will demonstrate the value of the ASEE Program as well as the value of the DEVELOP Center because they will become integral parts of my classes at Hampton University in the fall semester.

# Calibration of Hot Wire Anemometer Probes for Applications in Very Low Density Subsonic and Transonic Flow

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The "Mars Flyer" exploratory vehicle is designed to fly in the very low density carbon dioxide atmosphere of Mars. The very low chord Reynolds numbers for the airfoil may make it susceptible to leading edge separation and stall. Wind tunnel tests to define the acceptable flight envelope must include measurements that identify separation regions and the laminar or turbulent character of the flow downstream. Furthermore, the wind tunnels used to perform these tests will operate at unusual conditions at which the turbulence reduction screens designed to reduce test section turbulence for higher density flows may prove much less effective. The tunnel turbulence intensity must be measured to insure accurate test results. The hot wire anemometer is a device that long has been used to measure turbulent flows and to evaluate wind tunnel test section flow quality. The hot wire anemometer uses a probe with a very fine, electrically-heated wire. The heat transfer from the wire to the flow must be correlated with the local velocity, density and temperature through an individual probe calibration. The anemometer is well suited to subsonic measurements at near atmospheric densities and to supersonic measurements. For such subsonic flows, the hot wire calibrations provide local flow velocity and velocity fluctuations, while for supersonic flows, the probe senses the product of density and velocity, the local mass flow. For transonic flows and for low density flows, the hot wire loses sensitivity to velocity and increases sensitivity to flow density. For very low density flows, the flow regime of the probe shifts from continuum flow through slip flow to free molecule flow. The objective of the project was to perform hot wire anemometer probe calibrations at flow conditions corresponding to the flight regimes of the Mars Flyer and to evaluate the use of such calibrations for measurements of airfoil flow fields and wind tunnel test section flow quality.

Hot wire anemometer calibrations were performed in the Probe Calibration Tunnel with 5 μm diameter wire probes operated at two different wire temperatures. The calibrations covered Mach numbers to 1 and probe Reynolds numbers ranging to 10. The static pressures reached values as low as 270 Pa. The Knudsen numbers, the ratios of the molecular mean free path to the wire diameter, reached values approaching 4 for the lowest static pressure case. Thus the flow regimes of the calibrations extended from continuum flow through slip flow to free molecule flow. Hot wire anemometer calibration correlations for slip flow and free molecule flow have received little study. We scaled the anemometer output voltage with the difference between the wire temperature and the flow recovery temperature in an approximation to the wire Nusselt number. In order to perform this scaling, a recovery temperature relation was developed that covers the flow regimes studied. We have found that as the density of the flow decreases and the probe moves into the free molecule flow regime, the calibrations display a very significant loss of sensitivity to velocity, particularly at the higher Mach numbers. Sensitivity relations for the determination of flow fluctuations remain under development.

# Parallel Computations of Complex 3D Turbulent Free Jets

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Three-dimensional turbulent free jets issuing from non-circular orifices or pipes have been observed to exhibit complex geometrical evolutions in the near-to-medium field such as repeated switching of major and minor axes which is accompanied by entrainment rates which are far in excess of those for plane or axi-symmetric jets. A major application of topical interest and national priority in aeronautics is the prediction and minimization of jet noise. The increased entrainment of complex jets should lead to decreased acoustic radiation. It is believed that both the directivity pattern and intensity of acoustic radiation can be altered by passive manipulation of the large scale structures by geometrical modifications. The prerequisite for these is the resolution of the large-scale turbulent structures in the jets via large-eddy simulation (LES) which then act as acoustic sources for computational aero-acoustics (CAA) to simulate the far-field sound radiation. Acoustic radiation from the small scales is modeled in a manner analogous to the sub-grid scale (SGS) for the turbulent simulation. Thus two sets of large scale computations are required: LES to generate the turbulence field and CAA to generate the sound field. Both computations use the same suite of codes, but solve different systems of equations over different domain sizes, and using different mesh sizes. Problem sizes dictate extensive use of parallelization. In particular, the acoustic problem requires solution over very large domains, but the system of equations can be linearized, which will facilitate massive parallelization suitable for solution on distributed memory machines.

The research task was to convert a previously developed higher-order-accurate numerical formulation for the simulation of complex jets to enable parallel simulation via domain decomposition, both in the LES mode and in the CAA mode. This involved the parallelization of the code to run on multiple processors on distributed memory machines such as the SGI Origin 2000 or Beowulf cluster systems. MPI library calls are used for communication between processors or between domains. Stability of the multi-domain simulation is assured by use of difference operators which satisfy summation by parts (SBP) criteria. The numerical formulation used for serial computations is not guaranteed to be stable in parallel mode using domain decomposition with inter-domain communication via message passing. The requirement for stability is that the difference schemes, including boundary conditions and operators should satisfy summation by parts criteria. Thus formal stability criteria can be derived. Multi-domain solutions are then coupled together via penalty functions and are guaranteed not to drift apart.

# Modeling Agricultural Soil Emissions of Nitric Oxide (NO) and Nitrous Oxide ($N_2O$)

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Nitric Oxide (NO) and nitrous oxide ($N_2O$) are important trace gas components in the earth's atmosphere, both being involved in ozone chemistry in the troposphere (NO) or stratosphere ($N_2O$). Additionally, NO contributes to acid rain, and $N_2O$ is of concern as a greenhouse gas, exerting a much larger greenhouse effect than $CO_2$ on a per molecule basis. Although both gases are natural products of microbial processes taking place in the soil, anthropogenic activities, particularly heavy fertilization of agricultural fields, greatly enhances the natural production of these gases. Much uncertainty exists however, over the total biogenic contributions of these gases, primarily because observed emissions are highly variable both across different land types as well as within given type.

Simultaneous measurements of NO and $N_2O$ emissions, and soil temperature, moisture, and nitrogen (as $NO_3^-$ and $NH_4^+$), were made in a North Carolina agricultural field in 1995 and 1996 as part of the NASA/EPA/North Carolina State University NOVA project. Analysis of the 1995 data reveals diurnal trends in both NO and $N_2O$ flux that suggests general rules for accurately estimating integrated 24 hr daily emissions. Diurnal measurements of NO flux are also applied to a temperature dependent exponential model, providing new insights into the details of the temperature dependent NO flux. Specifically, both the preexponential factor, A, and exponential factor, k, are observed to vary with the average NO flux. The variation of the factor, A, is correlated with the water content and available nitrogen in the soil and thus carries the observed dependence of NO flux on these soil variables. The detailed temperature dependent model thus describes some of the local and temporal variability of NO flux, and provides fair estimates of NO flux based on soil water and nitrogen content. It also remains consistent with more general observations in which the value of A is dependent upon the specific land type while k is approximately constant across all land types.

Correlations of NO flux with $N_2O$ flux, particularly with respect to water saturated vs. non-saturated soil, provide a route for estimating $N_2O$ emissions based on NO emissions. This is especially important for water saturated soils, in which extremely high values of $N_2O$ flux are observed, and may comprise a substantial uncounted contribution to total atmospheric $N_2O$.

# Improved Drag Calculations using a Wake Survey at the 0.3M TCT

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The goals of this project were to improve the experimental wake-rake data acquisition and analysis at the 0.3-Meter Transonic Cryogenic Tunnel (TCT). The objective was to develop an automated optimization algorithm that would minimize the number of survey steps required to characterize the wake profile. An improved analysis tool was developed consisting of several FORTRAN programs, which can check the quality of experimental data and significantly reduce acquisition and processing time. With this method and reduced data acquisition, drag coefficients calculated using 25 survey steps are within 0.01 % of the original 100-step data set. Thus the wake survey time has been reduced by a factor of 4.

To develop the algorithm the test gas was treated as ideal; the Beattie Bridgeman Gas Law will be used in the final version. Unlike the existing drag calculation, the present work computes and displays of results using non-dimensional variables. Thus the displayed data profiles are invariant of change of units and tunnel conditions. The program asks the user to interactively input the test, run and the point numbers to be processed for computing drag. It calculates drag coefficient using all the rake positions, and then the user is given a choice to process a subset of the total number of positions. Once the user inputs the required number of points, the program smoothes the experimental data and re-computes drag after re-distributing the points. The two calculations are compared and resulting plots are stored in TECPLOT format for display.

The 0.3-meter Transonic Cryogenic Tunnel is currently inoperative due to the installation of new adaptive walls. Thus existing experimental data were used for testing the programs. However the improved technique can be easily implemented into the TCT's data reduction algorithms. It offers a quick check of data quality by calculating the mean and standard deviations in 6 key physical quantities. A total of 30 different input files were used to validate the results.

Results show that significant reduction of data acquisition time can be achieved without sacrificing accuracy. The goal was to obtain an accuracy of 1/4 drag count. However the program achieves much better than that. Finally recommendations are made on screen for the engineer to gather data at reduced number of prescribed rake positions to obtain the same accuracy.

# Velocity-Scalar Filtered Density Function (VSFDF) for Large Eddy Simulation of Turbulent Combustion

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**Abstract**

We have previously developed a methodology, termed the filtered density function (FDF) [1,2] for large eddy simulation of turbulent reacting flows. The basic element of the FDF is to account for the effects of subgrid scales (SGS) in a probabilistic manner, and to simulate the large scales deterministically. Our previous work indicate that the FDF provides a powerful means of facilitating LES of scalar transport in reactive flows. The objective of the present work is to extent the FDF methodology to also include the velocity transport. This is accomplished by considering the joint velocity-scalar (VSFDF). A transport equation is developed for the VSFDF in which it is shown that the effects of convection and chemical reaction appear in a closed form. The equivalent Langevin form of the stochastic differential equations (SDEs) which yield a transitional probability density function (PDF) equation compatible with the VSFDF is constructed. The unknown terms in the VSFDF is modeled. The marginal velocity FDF (VFDF) is, at least, as accurate as a second-order conventional SGS closure. The VSFDF transport equation is solved numerically by a Lagrangian Monte Carlo scheme. The consistency, convergence, and accuracy of the FDF and the Monte Carlo solution of its equivalent SDEs are assessed. These results are being appraised by comparisons with direct numerical simulation (DNS) and laboratory data.

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1999 – ABSTRACT

# IMPLEMENTATION OF THE FULL COST PROGRAM IN THE NEW IFM SYSTEM

**Conducted a review of the Full Cost in NASA process as it will interface in the new Integrated Financial Management (IFM) system. Federal government standards require agencies to begin Full Cost reporting in FY 2000. An investigation was conducted as to just what the new IFM system will provide in the way of Full Cost data reporting and whether it conforms to the requirements of the NASA Full Cost Implementation Guide. The evaluation of this process is still ongoing at this time.**

# Synthesis of Monomers and Polymers for Piezoelectric Applications

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Piezoelectric organic polymers have potential for applications in sensing and control devices for aircraft and space vehicles. Most piezoelectric materials currently in use are ceramics or organic or inorganic salts, which are brittle and difficult to process. Although many polymers exhibit piezoelectric behavior, only polyvinylidene fluoride (PVDF) and some related copolymers are used for commercial applications. The structural feature that gives these polymers their piezoelectric activity is the presence in the polymer backbone of strong dipoles that can be forced into alignment by applying an external electrical field while the polymer is above its glass transition temperature. The dipoles retain their alignment after the polymer is cooled.

Squaric acid (3,4-dihydroxy-3-cyclobutene-1,2-dione) and compounds derived from it containing the 3-cyclobutene-1,2-dione unit exhibit a high degree of polarity due in part to resonance involving a $2\pi$ electron aromatic system. There are reports of dyes and polymers derived from squaric acid, which have formal separation of charge in their structures. These types of structures appeared to be good candidates for incorporation into polymers that would exhibit piezoelectric properties.

Most of the research during this period involved the synthesis of 3,4-bis(4-fluorophenyl)-3-cyclobutene-1,2-dione, **1**, and attempts to prepare poly(arylene ethers) from it. Compound **1** was prepared by a Friedel-Crafts reaction between squaryl chloride and fluorobenzene. The reaction was done in one flask without isolating squaryl chloride. Compound **1** is reported to form poly(arylene ethers) with several bisphenols, and two of these reactions were repeated several times using either dimethylacetamide or sulfolane as the solvent. The resulting polymers were either low molecular weight materials, or they exhibited broad molecular weight distributions. One of the polymers derived from bisphenol A was subjected to fractionation in an effort to isolate the higher molecular weight material. In addition to the homopolymers several copolymers were made by substituting 75-80% 4-fluorophenylsulfone for compound **1** in the reaction with bisphenol A; the results were similar to those obtained for the homopolymers. One potentially useful modification of the polymers was tested on compound **1**. The cyclobutenedione ring is reported to open when heated above 160°C in a high boiling alcohol to form a diester. The reaction was performed on compound **1** using refluxing cyclohexanol, and the diester was recovered. Its infrared and proton magnetic resonance spectra were consistent with the structure proposed.

Several attempts were made to synthesize diamine monomers from compound **1** containing bis(aminophenoxy) groups. Three reactions were attempted. An amino or nitro substituted phenol was converted to its phenoxide ion, and compound **1** was added to the reaction mixture, which was then heated for varying lengths of time. Although reactions had clearly occurred, no identifiable bisethers were recovered.

Finally, an attempt was made to polymerize squaric acid with bis(3-aminophenoxy)-benzene. The reaction gave an intractable black polymer.

# Creative Development of "NASA'S KIDS SCIENCE NEWS NETWORK" A Children's Educational Television Series

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NASA Langley Research Center's Office of Education and WVEC-TV (ABC in Norfolk, VA) agreed to develop and produce a new basic science and math television series for elementary-age children, called "NASA'S KIDS SCIENCE NEWS NETWORK". This new educational outreach program was conceived to provide children with basic concepts in math and science presented in short "newsbreaks" broadcast during Saturday morning children's programming. I was given the responsibility of developing the creative concept for this new series, selecting the content and writing the five "pilot" episodes, and assisting with their production.

The target audience for "NASA'S KIDS SCIENCE NEWS NETWORK" is 3rd - 5th grade children. The challenge is to select fundamental science and math concepts that complement what these children are learning in school, and that can be effectively addressed within a one-minute program. The LaRC Office Of Education has provided ample resources to assist with the development of this content. The first five ("pilot") episodes are: What Makes Things Go?, What Is Sound?, Why Does Popcorn Pop?, How Long Is A Meter?, and What Is Humidity? (or another topic developed with a WVEC-TV meteorologist, who will present this program.)

The spirit of discovery and of participation are critical presentation elements for this series. Therefore, the principle methods of inquiry and thematic categories will be "Figure It Out", in which the host demonstrates the science or math principle, and "Did You Know", in which the host (or an adult expert) presents and explains the principle.

Most of the experiments used to demonstrate each program's principle will be presented by the host, and will be easily re-created at home; however, animation and graphics will be incorporated whenever appropriate to supplement and complement the live demonstrations.

The program has been conceived as a "newsbreak", so the basic presentation style attempts to incorporate some television news production elements (especially composition and graphics) while retaining a light-hearted, humorous visual style.

"THE WHY FILES" is another elementary-age program currently being produced by LaRC. One of the major elements informing the program's characters and stimulating their investigation are news stories broadcast by television station KSNN (KIDS SCIENCE NEWS NETWORK). NASA'S KIDS SCIENCE NEWS NETWORK uses this name for its title, and it was decided to incorporate the "WHY FILES" set, too, because it is so colorful and bright, and to attempt to create a subtle link between the two programs.

It was determined that a child should be used to present the program's content whenever possible, because of the credibility children have with other children. However, some content will involve adult experts (i.e., "What Is Humidity", with the WVEC-TV meteorologist), but most of the programs will feature one or two children.

To date, four scripts have been completed (the fifth awaits the WVEC-TV meteorologist's involvement), two programs have been completed, and the remaining programs have been scheduled for production. The programs are scheduled for broadcast on WVEC-TV beginning in mid-August.

# Development of the AWIN Integration and Technology Laboratory

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The goal of the national Aviation Safety Program is to reduce the fatal accident rate for aviation by 80% within ten years. One component of this program at NASA, the Aviation Weather Information (AWIN) project, was created to develop and evaluate new technologies for the presentation of weather hazards to aviation personnel, both ground-based and in-flight. The work presented here primarily details the development of a technology demonstration laboratory, wherein current state-of-the-art weather information display systems are integrated and evaluated. These systems will serve as the framework for defining future display systems with regard to desirable types of weather content and display formats, including factors such as color, symbols, display size, and resolution.

Three specific areas of investigation are presented in this study: development of the hardware lab, collection and evaluation of weather sources, and data extraction from flight simulators. The first area, development of the hardware lab, includes the installation and debugging of four weather-related display avionics systems (Echo Flight StratoCheetah, J.P. Instruments NAV-2000, Honeywell/Northstar CT1000H, and Datatest FlightVue 640). All of these are compact portable PCs with small color LCD screens, suitable for cockpit use. Most of them include a GPS moving map display and some include hardware/software to collect and display weather information via satellite or Internet. Future hardware and software needs for the lab are also examined.

Actual weather information is needed to produce canned weather scenarios for use in the evaluation and testing of the weather display equipment. This second area involves research into the types of weather information needed, a search for appropriate sources of this information, and their evaluation. A summary of suggested weather products is derived. Numerous sources of weather data are examined, including Internet and satellite sources, both free and paid, current and archived.

The collection of flight and performance data from commercial flight simulators for performing weather-related human factors evaluations is the third area of investigation. Specifications are established for purchasing the needed software technology from one simulator vendor, and data extraction software is developed in-house for another simulator.

# Analysis of wind tunnel temperature profiles

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The goal of this research was to analyze the temperature profiles on an internal balance during an actual test at the National Transonic Facility (NTF). We have previously looked at several temperature cycles from the Model Prep Area (MPA) as well as temperature cycles from the laboratory. The MPA and lab temperature cycles have the characteristic that there is no aerodynamic load on the balance so any change in output must be due to the thermal profile. However, there has not been a study that investigates whether these temperature cycles approximate the actual temperature conditions in the test area of NTF.

This research project examined data from two tests at the NTF. The analysis was both qualitative and quantitative. The qualitative analysis highlighted the followed characteristics about the temperature profiles: (a) there is a rear (warm) to front (cold) gradient on the balance during tunnel tests; (b) there is a bottom-to-top gradient; (c ) the sensors tend to get warmer (rather than cooler) during the runs; (d) the nine temperature measurements do not converge to a particular value but instead tend to stay "parallel".

The quantitative analysis tried to characterize the impact of the thermal gradients on the overall accuracy of the data. To do that, we had to use data from the MPA (or the lab) since we do not know axial force (AF) output due to thermal gradients for the tunnel data. For the MPA and lab data, we assumed that all variation in AF output is due to temperature.

For the quantitative analysis, we defined two gradient vectors: (TF-TR) and (T4+T7-T5-T6). (Note: we also considered two gradient vectors that were derived using the Karhunen-Loeve transformation but those vectors did not have any physical significance so they were not used to determine accuracy.) From the MPA data, we derived an equation that gives the error in the AF measurement as a function of the two gradient vectors. We then measured the thermal gradients present in the tunnel test section and computed AF error. The result is that the AF error due to uncompensated thermal gradients is not large. For one data set the error is 0.360 lbs (.09% of full scale) and for the other data set it is 0.137 lbs (.034 % of full scale).

Another aspect of this research is to apply the temperature gradients that occur in the tunnel on a balance under controlled conditions in the lab. Progress was made this summer on the data acquisition system to measure temperature and strain from a special-purpose research balance.

# Comparison of the Sensitivity of Systems for the Detection of Light in the Infrared Wavelengths When Used With a Monochromator

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The specific problem addressed in this investigation was the best method of measuring the spectral properties of the fluorescence out of a fiber laser near 940 nm. The investigation began when the level of detection of the fluorescence was not satisfactory when using the Hewlett Packard Optical Spectrum Analyzer with a multimode fiber. We wanted to investigate whether the measurement could be accomplished better with a monochromator using an APD, PMT, etc. Two methods using the monochromator were employed. The first method was using a laser, monochromator with a chopper, a lock-in amplifier, x-y recorder and a photodetector. The detectors employed were the photomultiplier tube (PMT), small-area PIN photodiode, and large-area PIN photodiode. The sensitivity of these configurations were from 100 pw to 1.14 nW for wavelengths near 830 nm. The sensitivity for these methods were insufficient by 1 - 2 orders of magnitude. The reason for the insufficient sensitivity was the noise induced by the lock-in amplifiers onto the signal from the detector. This phenomenon caused further investigation into using a laser, monochromator without a chopper, a transimpedence amplifier, x-y recorder and a photodetector. The detectors employed were the small-area PIN photodiode, large-area PIN photodiode, avalanche photodetector (APD), and photomultiplier tube. The sensitivity of these configurations were from 2.5 pW to 200 pW for wavelengths near 830 nm.

The systems that produced the best sensitivity of 5 pW to 2.5 pW for wavelengths near 830 nm were the large and small area PIN photodiode with two different transimpedence amplifiers. The avalanche photodetector was the second with 5 pW sensitivity. The photomultiplier sensitivity was 10 pW. The large-area PIN photodiode system was the easiest to operate and align. The small area PIN photo detector was more sensitive (2.5 pW) but harder to align. The APD was cumbersome to operate and the PMT incident light level was low (<=1uW).

The monochromator and large-area PIN photodiode with the ILX transimpendance amplifier system was selected to measure the fluorescence near 940 nm out of the fiber laser. The fluorescence light from the multimode fiber was focused through the slit of the monochromator by using a lens system. The monochromator and large-area PIN photodiode system was able to measure 6 pW of fluorescence power.

# A Mixture Model for Resin Flow and Fiber Deformation In Composite Processing

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The design of manufacturing device and procedure of fiber-reinforced composites requires deep understanding of the resin flow, temperature distribution, pressure and deformation and their co-relations during the process. Computer simulation based on models provides an economical and timesaving tool for the designing process. A continuum mixture model is adopted to the composite processing in this project. The models proposed so far considered only one or several characteristics using separate submodels, such as Darcy's law, heat transfer and curing model. The deformation of the fiber network and non-uniformity of fiber density in the products as a result have been reported, but it has yet to be accounted for. The deformation is usually small, but it may have significant effect on other aspects, such as resin flow and pressure, especially in pultrusion. A thermodynamic mixture model considers all those aspects and their coupling effects. Equations of motion and energy are derived. Special and simplified models can be reduced from the set of general equations according to different geometric, material and processing conditions.

As a first step of application of the model, asymptotic analysis is carried out for a pultrusion process of thermoplastic composite. Pultrusion is a continuous manufacturing process of fiber-reinforced composites by pulling fibers through a bath of liquid resin and then through a die. A typical die consists two main parts: A tapered and heated entrance in which the wetted out preform is consolidated and the excessive resin is squeezed out, and a passage with no slope where the resin is cured or cooled down for the resin to solidify. The analysis uses the special geometry of a tapered cylindrical heated die with large aspect ratio (length over radius) and a set of typical material parameters to reduce the general model to a set of simple, but coupled equations. Computer simulation and parametric studies can be relatively easily carried out. However, those coupled equations require special numerical iteration scheme to be developed before adopting numerical codes to solve each equation. Analytical results of linearized equations may give some qualitative insights, the highly temperature sensitive viscosity requires numerical analysis. The result will be able to describe the temperature distribution, resin flow and pressure profile in the die during processing. Since deformation of the fiber network is considered in the model, the study of non-uniform fiber distribution in product can be carried quantitatively.

Computer simulation of another composite process, pressure-injected resin transfer molding (PI-RTM) is also under consideration. We seek to implement the computer codes at NASA Langley Research Center, which were developed by A. C. Loos and co-workers in the three years sponsored by NASA. Once the code is run properly at the facilities as LaRC, series of special cases will be tested before application to actual processing. Utilization of this existing complicated code for the mixture model with non-regular geometry is also a goal of the project.

# Educational Outreach and Advocacy Plan

## Cultivating Langley Research Center Advocacy Through Educational Opportunities

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At no time in American history has education and the acquisition of knowledge been more in the forefront than in the present. At the same time, many challenges confront public and private educational organizations requiring them to adjust to profound and rapid technological and social changes. Perhaps one of the greatest challenges is determining how to function and operate in a national "knowledge-based" economy that is constantly being reshaped by advances made in information and communications technology. The new economy is redefining the classroom, educator, and learner. With worldwide access to knowledge through the Internet and the World Wide Web, schools will be thought of less as buildings or facilities and more as communities of knowledge and learners. The challenges facing education are further complicated by an accelerating rate of technological and social change that dramatically increases the rate at which data, information, and knowledge are rendered obsolete.

Since its creation in 1958, the National Aeronautics and Space Administration (NASA) has had a strong commitment to education. This emphasis has been reinforced in NASA Administrator Daniel Goldin's congressional address, the *NASA Strategic Plan 1998*, and the *NASA Implementation Plan for Education 1999-2003*. NASA and the Langley Research Center (LaRC) are natural partners in the educational efforts of the educational community, especially in the areas of science, mathematics, geography, engineering, and technology. LaRC's specialized facilities and personnel, close working relations with the research and development community, and technological capabilities are leading factors in LaRC's Office of Education's efforts to cultivate and advance its advocacy role in education and outreach.

An outreach and advocacy plan for cultivating LaRC advocacy through educational opportunities was designed. Input from representatives of all programs within the LaRC Office of Education, research investigations, and data analysis and interpretation were utilized in the plan's development. The plan includes background information, a rationale, advocacy considerations, goals, objectives, major actions, and recommendations. Specific initiatives categorized for students, educators, and national community leaders are proposed in the plan. Each initiative contains strategies, timelines, estimated costs, and anticipated impacts. Functional responsibilities within the Office of Education are designated for each initiative. The plan was submitted to the Director of the Office Education, who, in turn, presented it to the LaRC Senior Council. An implementation plan will be developed for executing the research and advocacy plan.

# Supporting NASA Facilities Through GIS

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The NASA GIS Team supports NASA facilities and partners in the analysis of spatial data. Geographic Information System (GIS) is an integration of computer hardware, software, and personnel linking topographic, demographic, utility, facility, image, and other geo-referenced data. The system provides a graphic interface to relational databases and supports decision making processes such as planning, design, maintenance and repair, and emergency response.

In response to downsizing and reorganization within NASA, accurate facility information has gained importance. Three major areas of spatial data relating to facilities have been addressed this summer. These areas are locational data of buildings, space utilization, and accessibility by disabled individuals.

Each of the areas has the common feature of buildings. A wealth of information was collected regarding location and size of buildings and rooms, associated personnel and equipment, and handicap accessibility accommodations. The decision to utilize GIS was based on the premise that "pictures are worth thousands of words" and data can be related to a map or other easily understood graphic.

The resulting products are being used both by NASA through specific applications developed for internal use, and by NASA personnel and the general public through the web. The building and room locator is a web-based query application. It allows an individual to specify a building and/or room to locate. A map is generated indicating the location of the building with a large-scale inset for more detail. Space utilization tracks the size and use of all rooms and buildings, drawing from building floor plans, personnel records, and building management data. A specific application developed, the move tool, facilitates planning changes associated with NASA reorganization. Supplemental information on buildings regarding handicap accessibility is near completion. Accommodations for NASA facilities will be indicated at the building level. Features surveyed are reserved parking, ramps, electronic doors, and restroom accommodations.

GIS provides the means not only to store vast amounts of data and retrieve it in a timely manner, it also supports spatial query and manipulation for 'what if' scenarios. The data at NASA is widely accessible through the web (http://gis-www.larc.nasa.gov) and user specific applications developed by the GIS Team.

# ESTIMATING THE RATE OF TECHNOLOGY ADOPTION FOR COCKPIT WEATHER INFORMATION SYSTEMS

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In February 1997, President Clinton announced a national goal to reduce the weather related fatal accident rate for aviation by 80% in ten years. To support that goal, NASA established an Aviation Weather Information Distribution and Presentation Project to develop technologies that will provide timely and intuitive information to pilots, dispatchers, and air traffic controllers. This information should enable the detection and avoidance of atmospheric hazards and support an improvement in the fatal accident rate related to weather.

A critical issue in the success of NASA's weather information program is the rate at which the market place will adopt this new weather information technology. This paper examines that question by developing estimated adoption curves for weather information systems in five critical aviation segments: commercial, commuter, business, general aviation, and rotorcraft. The paper begins with development of general product descriptions. Using this data, key adopters are surveyed and estimates of adoption rates are obtained. These estimates are regressed to develop adoption curves and equations for weather related information systems.

The paper demonstrates the use of adoption rate curves in product development and research planning to improve managerial decision processes and resource allocation.

# CLOSING THE DOOR?

## HIGH SPEED RESEARCH AT NACA/NASA

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Speeds gradually increased during the early days of airplanes. In the 1920s and '30s the National Advisory Committee on Aeronautics (NACA) worked on cowlings, propellers, and streamlining as factors contributing to higher speeds. The wartime introduction of jet- and rocket-powered aircraft accelerated the trend toward faster planes. Was there a limit to how fast an aircraft could fly? In the 1940s NACA researchers conducted dive-flight research, dropped airplane models from airplanes, fired small solid-propellant rockets, and experimented with rocket-propelled aircraft. The research plane became the research tool of choice for studying supersonic flight in the late '40s and early '50s. The military services sponsored the development of the research planes, contractors built the planes, and the NACA served as research coordinator. NACA's duties included data collection and analysis and therefore the instrumentation of the research planes and the monitoring of flights. These parties developed and tested specialized aerodynamic research airplanes, the first of which was the Bell X-1. Air Force Captain Chuck Yeager flew the X-1 faster than the speed of sound on 14 October 1947. Fast flight was safe! The initial phase of supersonic research using research planes continued through the 1950s. By this time NACA had developed, constructed and placed into operation high-speed wind tunnels and initiated research into supersonic cruise technology, research continued by NACA's successor — NASA.

In 1960 NASA established a Supersonic Transport (SST) research program. Concurrent with the SST, the British and French governments cooperated on a supersonic program, and the Soviet Union sponsored its own supersonic program. The United States canceled its SST program in 1971 because of environmental and economic concerns, while the Anglo-French team produced the Concorde, and the Soviet Union the Tupolev Tu-144. After the SST program, NASA maintained a core competency and continued research in the supersonic field. In the late 1980s NASA focused that research in a High Speed Research Program to explore the feasibility of a second-generation supersonic High Speed Civil Transport. Phase I research suggested that the technology necessary for an environmentally acceptable supersonic transport could be developed. Phase II focused on the economic viability issues. This phase began with fiscal year 1993. The research involved enabling propulsion materials, critical propulsion components, aerodynamic performance, airframe materials and structures, flight deck systems, technology integration, environmental impact, and environmental research. In December 1995 the High Speed Research Program selected a single aircraft concept for intensive development. This Technology Concept Airplane (TCA) combined the results of computer modeling and wind tunnel tests with environmental goals. It focused further research and development on a more narrow path. Overall, the High Speed Research Program produced impressive results, but the program closed in 1999. This time the core competency went with the program, as the engineers and scientists dispersed to other jobs on other projects inside and outside of NASA. Did the total cancellation of High Speed Research close the United States door on a civil supersonic transport?

# NUMERICAL SIMULATIONS OF MIXING AND COMBUSTION IN SCRAMJET ENGINES

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The successful development of the supersonic combustion ramjet(scramjet) for use on future hypersonic vehicles is reliant on detailed understanding of the complex flowfields present in different regions of the system over a range of operating conditions. Constraints on system size and weight have led to the need of improving the technology for analyzing and designing such system. Considerable experimental and numerical research in the United States and abroad, have been conducted in the past thirty years to analyze and design various systems of hypersonic vehicles. Because of constraints on system size and weight, a strong motivation exists to improve combustion systems. Significant amount of experimental and numerical research have been developed towards designing lighter weight and shorter supersonic combustors.

For the actual scramjet engine, at high fuel equivalence ratios, the combustor may be operating in the dual-mode regime (with mixed subsonic and supersonic flow). In fact all airbreathing scramjet propulsion systems must pass through this mode of transition, whether accelerating to a hypersonic cruise condition or on a trajectory into orbit. In the dual-mode regime, a shock train is located downstream of the fuel injection locations to provide the pressure rise required by the combustion heat release. At lower Mach numbers, or higher fuel equivalence ratios, this shock train moves upstream and interacts with the fuel injectors to alter the rate of fuel/air mixing. Because of the mixed subsonic/supersonic nature of the flow, it is very difficult to predict the mixing and combustion in this regime using CFD. This is due to the large region of separated flow downstream of the shock train and the unsteadiness associated with the shock train.

The Objectives of the proposed research are to investigate and accurately model the mixing and combustion/ignition characteristics in supersonic and dual mode combustion flowfileds in Scramjet engine. Efforts are directed first on validation of the CFD codes, RAMPANT (FLUENT 5) for mid-speed combustor applications (flight Mach 5-7) by numerically reproducing the experimental data for different supersonic and dual-mode scramjet combustor configurations utilizing both parallel and transverse fuel injections. Basic issues concerning applications and optimizations of unstructured versus structured grids using different turbulence models are also addressed. This would reveal the capability of the computer code for predicting the consequences associated with these combustion systems. Next, effects of geometrical scaling on numerical modeling using unstructured grid are analyzed. Finally, extensive parametric analysis is performed to address the differences in ignition delay time using vitiated and clean air.

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# Rapid Robust Modeling Based on Parametric Interface Representation

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Over the past few years the development of interface technology has provided an analysis framework for embedding detailed finite element models within finite element models that are less refined. This development has enabled the use of substructure domains without the restriction of coincident nodes along the substructure boundaries. The approach used for the interface element is based on an alternate variational principle often used in deriving hybrid finite elements. The resulting system of equations exhibits a high degree of sparsity but gives rise to a non–positive definite system which causes difficulties with many of the equation solvers in general–purpose finite element codes. Hence the global system of equations is generally solved using a decomposition procedure with pivoting.

The research reported to–date includes one– and two–dimensional interface elements. Several simulations, including geometrically non–linear problems, have been reported. In the applications reported, the geometric definition of the interface is based on fitting splines to a subset of nodes which form the interface portion of adjacent subdomains in a given finite element model. The research reported to–date allows for a limited magnitude of inaccuracy in the node locations making up the interface definition.

The present research is focussed on a rapid modeling procedure based on a parametric representation of independently defined subdomains that are also independently descretized. The methodology allows for inaccuracies in the node locations that may be of nearly arbitrary magnitude. In many cases, this approach can expedite the modeling task as well as essentially eliminate any inaccuracies in the interface–node locations.

Specific applications addressed in this application, which demonstrate the features of the approach, include: (i) baseline bar in tension using K–arrays computed with and without COMET–AR, (ii) plate with central hole in tension, (iii) plate with square notch showing effect of mis–matched nodes at the boundary of interface, (iv) configuration having large random inaccuracies in the interface–node locations.

Abstract: ASEE Fellowship Program

NASA-Langley Research Center

George Rublein

Department of Mathematics

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The tenure of this fellowship began May 17 and continued through August 13. Several educational projects were undertaken during this time.

1. Delivered lectures as part of the Norfolk State University-National Science Foundation-NASA Pre-service Teacher Institute (PSTI). The material focused on the use of aeronautical weather web-sites and the use of the Microsoft Flight Simulator. In both instances, emphasis was placed on mathematics needed to unravel the data provided by the software.

2. Delivered similar lectures to participating university faculty invited by NSF to observe the PSTI. Faculty came from certain NSF-funded State-wide collaborative programs designed to improve mathematics and science education for prospective teachers.

3. Made substantial editorial revisions in aeronautical/mathematical material already in use for non-science students.

4. Made preparations for inclusion in that material of a more informative account of standard inviscd-incompressible-irrotational airflow models. This account is intended to give non-science students insight into the physics of lift. We expect to provide these students with a mathematically comprehensible version of the circulation-theoretic version of lift.

5. Made preparations to consult with the Hampton City School Superindent's office regarding establishment of an International Baccalaureate Program. Work on this project will continue after the close of the Fellowship program.

# On-Line and Off-Line Test of Airborne Digital Systems

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**Abstract**

This research deals with studying the effects of both on-line and off-line test during flight critical missions where safety is a major issue. The on-line test, in this context, is a test performed on a digital airborne system during some specified windows in time while it is still performing its intended task. An off-line test is a test that is performed on the digital system once it is taken off-line because of a suspected failure. Both the on-line and the off-line tests are performed during flight. The difference between the two is that the off-line test is more effective than an on-line test due to the longer amount of time available for testing. Moreover, the off-line test may be designed to have diagnosis and repair capability built-in. Upon successful repair, the faulty processor may be reconfigured back into the system. This capability will undoubtedly increase the mission reliability.

# Review of Implementation Plans for NASA LaRC's Wind-Tunnel University

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The NASA LaRC Wind-Tunnel University (WTU) initiative has the following objectives, as interpreted by the present author:

1) To serve as a "learning center" for NASA and non-NASA engineering managers, engineers, and technicians to acquire and sustain basic and advanced skills relevant to the management and operation of wind tunnels and design and execution of wind-tunnel experiments, including acquisition, analysis, and presentation/publication of wind tunnel data;
   a) To combine education (broad-based) and training (in-depth, narrow-focused) strategies as appropriate to the skills/knowledge being imparted;
   b) To prepare participants to operate in the wind-tunnel environment expected to exist in the near future; and
2) To serve as a "resource center" for "best practices" in wind-tunnel skills/knowledge with resource persons drawn principally from the NASA LaRC community, but with participation also from the university and industrial communities.

Upon review of the general implementation plans for WTU, the following preliminary recommendations are made:

The WTU Administration and the Curriculum Committee should insure that:

1) Learning opportunities are developed for all audiences of WTU and the instruction presented considers practical and immediate applications;
2) Sequencing of courses reflects careful planning to provide a constructivist approach to learning by the sequential building of knowledge in a single skill area, as well as the appropriate sequential introduction of related skills;
3) Course offerings reflect integration within targeted knowledge/skill areas, as opposed to discretization through the offering of seemingly unrelated courses;
4) Consideration be given to creating/using graphics-based virtual environments for instruction; including the identification of present uses of virtual reality in education, the evaluation of available virtual-reality hardware and software, as well as the evaluation of any existing virtual wind tunnel environments;
5) Consideration be given to the use of technology-based instructional techniques in order to enhance the instructional process in consideration of the variety of learning styles that characterize the targeted community of learners and the desired ability to offer instruction in both synchronous and asynchronous modes; and
6) Instructors should receive an instructor's packet before beginning course preparation, to include: a) Statement of the goals/objectives of WTU and instructional philosophies; b) Sample course syllabus; c) Pedagogical materials relating to "best education practices" in the instruction of technical information; d) Review of applications of audiovisual- and computer-based media and process technologies; and e) Listing of available media and available training opportunities for the development of media presentation skills.

# ATMOSPHERIC SCIENCE DATA AND ITS USAGE IN K-12 EDUCATION

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Dr. Shah's project for the summer 1999 as an ASEE fellow, with the **Learning Technologies Project under Mr. J. Seaton**, involved the study of various satellite data launched by Atmospheric Sciences Division (ASD) at Langley Research Center (LaRC), and its use and application in K-12 science education. Dr. shah intended to study the data from Clouds and Earth's Radiant Energy System (CERES) satellite and how it could be used in school curriculum in the area of mathematics, physics, chemistry and computer science. The initial idea was to develop a program using this satellite data which would increase both teachers' and students' interest in science. Depending on the level of difficulty of the topic and content, the project could be divided into three parts, one for elementary level, one for middle level and one for high school level.

Dr. Shah met with Dr. Dave Young and Dr. Lin Chambers to learn about the Students' Cloud Observation On-Line (S'COOL) project and the current and proposed activities for K-12 education. CERES II satellite launched by ASD at LaRC in 1997 started sending data in January 1998. The data was received from January 1998 through September 1998. The data for January 1998 is processed and is available from Distributed Active Archive Center (DAAC). Data from February through September 1998 will soon be processed. CERES II stopped sending data in September 1998 due to a malfunction in the satellite equipment. The data file of CERES II is in Hierarchical Data Format (HDF) format. These files can be viewed using VIEW_HDF software. The present data files contains daily profiles of various atmospheric gases and radiation data. Under the S'COOL project there are over 250 different schools participating all over the world. The students from these schools go out when the satellite is flying over that region and take visual measurements of the clouds condition and send them back to NASA. These measurements are then compared with actual data from the satellite. Dr. Shah was interested in creating small projects for school children using the CERES satellite data. In particular, temperatures, rainfall, and wind velocity for a particular geographic location and time. CERES data has the information about clouds and radiation. For more information on data from other satellites, Dr. Shah looked at the data from Stratospheric Aerosol and Gas Experiment (SAGE) II satellite. Dr.Larry Thomason had developed software which processed the data and produced file monthly averages instead of daily profiles, to plot the aerosol and ozone levels in earth's atmosphere over a desired period. Dr. Thomason was kind enough to share his knowledge, expertise, software and datafiles with Dr. Shah. He also received some guidance from Dr. Thomason on creating datafiles containing Ozone and Aerosol averages for a desired period from files containing daily profiles. He would like to continue the work on satellite data, and the ways it can be incorporated with school curriculum and how to make the NASA's atmospheric data easily available, easily understandable and easily usable by teachers and students. In addition, techniques need to be developed to make visual graphics of data accessible on a web-site, show students how to make such data visualizations and most important how to interpret the data visualizations.

# Universal Wireless Alarm System

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A research for the development and design of a Universal Wireless Alarm System that can notify both the deaf and hard of hearing as well as those without hearing impairment. This project was intended to be started under the fellowship and then to be completed under a grant or contract. Therefor the following represents only an interim report.

This project focused on a number of major issues concerned primarily with the versatility in the functions, size, and NASA technology, including using NASA's new actuator/sensor (thin unimorph ferroelectric) devices as an integral part of this system.

**FUNCTION:**

The Universal Wireless Alarm System can perform as follows:

1. Can send over 1000 messages to over 250 locations at the same time
2. Does not send messages to locations that do not need to receive the message
3. Can send messages to commercial messaging services
4. Can distinguish between the events such as fire, security, industrial, gas, and any other alarms
5. Can function without any human intervention
6. The notifier receives an alarm if the connection is broken because of the system's two way communication

**SIZE:**

The Universal Wireless Alarm System's dimensions will be identical to the size of a watch, and can be used as a wristband; therefor the size is relatively small.

**NASA's TECHNOLOGY:**

The Unimorph Ferroelectric sensor is a relatively new device, at four years old, developed by NASA's scientist at Langley Research Center. This device can produce different vibrations as well as respond to different frequency's and will be used in this system (UWAS).

The first phase of the project was to determine the above functions, dimensions, while incorporating NASA's new sensor, and also cost. The second phase was to design a network that would provide the above functions efficiently. The third phase was to investigate the availability of the integrated circuit on the market that could be incorporated into our system in order to minimize the dimension and also increase the overall efficiency. The objective of the remainder of this project will be to pro-to-type the components and system, and ending the project with the testing of the finished product.

# A Study of Zero-Mass-Flux Actuator Arrays for Flow Control Applications

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The aerospace community has identified the understanding and control of turbulent and separated flows as vital to the development of innovative strategies for expanding the boundaries of flight. Currently, the design and operation of aircraft are made in such a way as to ensure that undesirable turbulent or separated flows do not occur. For example, during the landing of an airplane, the need to maintain smooth, un-separated flow over the wing requires that a certain air-speed be maintained in the descent. In addition, aircraft have complex, multi-segmented wings that allow landings to occur at the lowest and consequently safest speed. With a better understanding of turbulent flows and a means to control them, airplane designers could reduce the complexity and the weight of wings while retaining or improving the wing performance. This lighter, simpler wing will make the overall aircraft lighter and will allow it to land at yet lower speeds in even safer landings. This work evaluates one type of turbulent flow control device that may ultimately allow lighter, simpler wings to be designed.

A flow control device called a zero-mass-flux actuator has recently been used to control a separated, turbulent flow on an airfoil. To obtain a better understanding for how these actuators control turbulent flows, we have studied experimentally the flow-field created by the actuator when isolated from the separated flow on the airfoil. A zero-mass-flux actuator produces a turbulent fluid jet at a small orifice by periodically pumping a cavity connected to the orifice. By analogy, the operation of the device is not dissimilar from the workings of a bellows. In this work, two experimental techniques were used to explore the formation of the zero-mass-flux jet and the interaction of an array of jets as a function of the spacing of the jets in the array.

In this study, the zero-mass-flux jet issued from a high-aspect-ratio, rectangular orifice with height, b. Digital particle image velocimetry (DPIV) was used to obtain a two-dimensional velocity map in the near-field (less than 10b above the orifice) of the jet. At distances greater than 10b, hotwire anemometry with a single, normal-wire probe was used to obtain the mean and fluctuating streamwise component of the velocity. The data from the near- and far-field will be used to better understand how the periodic flow-field near the orifice evolves to become a steady, turbulent jet in the far-field, and how the interaction between two jets changes as the distance between the jets increases.

# Intensity Biased PSP Measurement

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The current pressure sensitive paint (PSP) technique inherently assumes a linear relationship (Stern-Volmer Equation) between intensity ratio (Io/I) and pressure ratio (P/Po) over a wide range of pressures (vacuum to ambient or higher). Although this may be valid for some custom made PSPs, in most other PSPs the relationship is nonlinear particularly at low pressures (<0.014 atm when the oxygen level is low). This non-linearity can be attributed to variations in the non-oxygen quenching (de-activation) rates (which otherwise is assumed constant) at these pressures, as well as by some heterogeneous (non-uniform) oxygen quenching. Therefore to minimize the measurement uncertainties due to such non-linearities in the calibration relationship an in-situ intensity correction method is developed. A non-oxygen quenched paint (which provides a constant intensity at all pressures, called as non-pressure sensitive paint NPSP is used for the reference intensity ($I_{NPSP}$) with respect to which all the PSP intensities (I) are measured. The advantages of this method over the current method are; an a-priori calibration can be used for wind tunnel testing, a wide range of pressures, including subsonic flow pressures, can be resolved better and, intensity variations due to temperature, photo-degradation of paints and tunnel flow contaminants can be compensated.

Some tests are performed on a painted circular coupon in the Langley labs to demonstrate this technique. Five specimens of different PSP and NPSP combination are tested in a pressure-vacuum chamber over a pressure range 0.0007-2.7 atmosphere, and temperature range 15-35 degrees C. The results show that the technique works well when the PSP and NPSP have distinctly different spectral emissivity (that is, when different luminescence probe molecules are used). The repeatability of the calibration relation is good and the temperature dependence of the calibration is small. However, when PSP and NPSP have the same luminescence probe molecules (in a different binder), spectral interference problems occur. Further, none of the tested polymer binders were completely impermeable to oxygen. A continued research is needed to develop a NPSP that will be totally oxygen impermeable before aforementioned benefits of this new method can be fully realized.

# Development of Hybrid Repair Patches for Damaged Space Structures

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A program for structural repairs in space is based on the premise that a Space Station or other satellite in low earth orbit may sustain some form of structural damage while in orbit for an extended period of time. Damage could occur from micrometeorites, space debris or accidental impact during routine docking operations with a Space Shuttle. Under any of these circumstances, the safety of astronaut crew or the success of various missions could depend on a capability to make structural repairs in space.

Space structures like the International Space Station typically consist of trusses, pressurized modules, and nodes. Of these structural elements, the pressurized module is among the most critical since it provides a living environment and life support systems for the astronaut crew. In the Low Earth Orbit (LEO) environment, space debris and micrometeoroids travelling at hyper-velocities represent significant potential hazards for structural elements like pressure modules. While large debris can be detected and avoided, smaller particles may impact the module and cause local damage in the form of full penetration holes and cracks. Suitable tooling and repair equipment must be readily available; effective in the LEO environment; and, restore both the pressure boundary and structural load bearing capacity. The purpose of this research is to investigate a new hybrid repair concept for thin walled aluminum pressure vessels like an orbiting pressure module.

In general, the damage tolerance of structures depends on the stress intensity of existing defects (or cracks) and the fracture toughness of the structural material. Stress intensity at the crack tip varies with the geometry of the structure, the length of the crack, and the applied stress. Cracks grow as the stress intensity at the tip exceeds the fracture toughness of the structural material. At fixed service loads (constant applied stress) a conventional mechanical repair patch seeks to reduce the stress intensity in the damaged substrate either by providing adhesive shear to restrain crack growth or by load transfer to reduce applied stresses in the immediate vicinity of the crack.

The specific problem addresses in this investigation is an examination of conceptual and quantitative models for hybrid patches. These mechanical patches combine adhesive shear and load transfer mechanisms to reduce stress intensities in a damaged substrate. A two-dimensional finite element model was developed to represent hybrid patch repair on a damaged substrate. Results from the analysis was used to determine how hybrid patches decreased stress intensity during quasi-static crack propagation. These results compared favorably with similar results for welded and bonded patches. During experimental verification of theoretical predictions, coupons were fabricated and tested to simulate damaged substrates and various repair techniques including hybrid patch repair.

# Analysis of Contamination on Solar Panels Returned from the Mir Space Station

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A segment of a solar array consisting of eight panels was removed from the Mir core module by cosmonauts, packaged in a protective bag, and returned by the space shuttle for analysis. After approximately ten years of space exposure in low Earth orbit, the segment was of interest for performance evaluation, micrometeoroid and orbital debris impact study and molecular contamination analyses. One panel was sent to NASA for analysis.

Panel eight measured 122 cm x 69.5 cm and consisted of 306 large and 103 small solar cells. The small cells are 4 cm x 2.4 cm and the larger cells are 4 cm x 4.8 cm. The primary contamination consists of a non-uniform film of oxidized silicones over both the front coverglass and back optical solar reflectors of the cells as well as on the hardware. Previously determined as being produced when outgassing products from the silicone adhesive and potting compound used in the construction of the cells came in contact with atomic oxygen found in low Earth orbit, the film ranged from 0.2 to 5.0 microns in thickness. Unflown solar cells similar to those returned from Mir were obtained. The outgassing of an unflown cell was compared to that of a Mir cell. The cells were placed separately in a high vacuum system coupled to a residual gas analyzer mass spectrometer detector. The unflown cell was found to outgas methyl and phenyl silicones two orders of magnitude higher than the cell returned from Mir. A strip of three unflown cells was placed in a high vacuum chamber for three days and 2.8 mg of outgassing products (~450 $mg/m^2$) were collected on a liquid nitrogen cold finger. The FTIR spectrum of the residue indicated the presence of methyl and phenyl silicones. An FTIR spectrum of the cell adhesive extract indicated the presence of methyl and phenyl polysiloxanes. GC/MS analysis indicated that the outgassing products were lower molecular weight silicones and the adhesive extract consisted primarily of higher molecular weight silicones.

In addition, spots of residue appeared in many forms: iridescent spots that, when present, varied from 150 microns in diameter and 41 $spots/mm^2$ to 600 microns in diameter and 1.3 $spots/mm^2$ and other irregular residue spots of many types and sizes. An electron probe microanalyzer with EDX was used to obtain elemental composition of the residues. The iridescent spots appearing in great numbers were too thin for analysis. Several of the irregular spots contained oxygen, silicon, sodium, potassium, and sulfur, some also contained phosphorus and other elements. Many were either too small or were covered with the $SiO_x$ film and thus no composition analysis was obtained. The sources of these spots have not yet been identified.

This project has important implications for future space missions. Possible sources of contamination include waste dumps, outgassing of materials, and venting of gases. The contamination was neither uniformly distributed over space and time nor is it predictable. Since many experiments and missions may be affected by contaminants (spectroscopic measurements, exposed optics, exposure of materials, etc.), it is essential to continue to monitor the International Space Station and other missions for contamination in order to mitigate risks.

# User-Interface and Educational Improvements to a Web-based Aircraft Design Module

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BadWeb, or Basic Aircraft Design Web Page, is an existing Internet site developed by members of NASA Langley and Ames Research Centers. The purpose of the web page is to enhance interest and awarenes in aeronautics by bringing powerful design and analysis tools in the area of aircraft design to the general public. Using the BadWeb site, users are asked to design a commercial transport aircraft that will result in the lowest ticket price for a flight beween San Francisco and New York. The BadWeb site allows 13 design parameters to be modified to impove the design. The underlying computer program behind BadWeb uses many advanced and professional grade routines that have been adapted for purposes of running from a web server. Very realistic results are obtained as indicated by its current popularity among professional aircraft designers. In order that the educational mission of the project be more successfully address, particularly in the K-12 environment, a number of elements of the web site have been modified.

Improvements include links to an expanded discussion of how the choice of parameters affects issues such as aircraft weight, range, fuel/passenger capacity, lift and drag. By reading these links, a user can determine which of the design parameters are most important, theextent to which each could be used to improve aircraft performance, and the positive and negative design implications of each. In addition to the technical information, references to historical and modern examples of the design parameter are included. Over thirty links to photographs, videos, charts and graphs are available for users to follow and be able to visualize how the different design approaches look and behave. It is envisioned that in an educational setting such as a high school math or physics class, the information provided in this web page could serve as a strong basis for teachers' lectures or for students to follow up on and do more detailed projects or reports. Examples such as breaking the speed of sound, the history of swept wing aircraft, the jet engine or the future of aircraft design are just a few examples of the types of topics that the BadWeb page could lead students to. In addition to the information directly obtainable through the BadWeb site, links are also given to other NASA sites including the photo galleries, on-line versions of printed material and the site for ordering helpful NASA publications.

Other improvements in the web page involve upgrading the user-interface. The procedure for optimizing a design has been simplified so that the user can re-submit new designs much more quickly and reliably. In addition, reset buttons have been added to allow the user to return to his or her "best" design so far, or to the B737-200 design provided. These improvements should provide for a more productive and enjoyable educational experience for the user. Distribution of information regarding the web site is planned at the national level to increase awreness of its availability.

# Utility of SURE and ASSIST in Reconfigurable Flight Control Systems

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## Abstract

This summarizes the findings of my study this summer on the applicability of software tools SURE (WinSURE) and ASSIST[1] developed here at NASA Langley to the reliability assessment of reconfigurable flight control systems. The full names of SURE and ASSIST are Semi-markov Unreliablity Range Evaluator, and Abstract Semi-markov Specification Interface to the Sure Tool. The purpose of the study is to investigate the potential utility of the software tools in the ongoing effort of the aviation safety program, where the class of systems must be extended beyond the originally intended serving class of electronic digital processors.

The first phase of the study is focused on the properties of the reliability models peculiar to reconfigurable flight control systems. These include larger building blocks with no spares and no repairs due to weight and cost constraints; present of both hardware and analytic redundancies; control performance dependent failures; high risks in reconfiguration decisions due to multiple sources of uncertainties. As a consequence, coverage of failures through redundancy management is low in comparison with systems consisting of digital processors only.

The second phase of the study is focused on obtaining a semi-Markov model of an existing flight control system. An analysis is performed on the model to identify the key limiting factors for achieving a high reliability in the current reconfigurable flight control systems. Model simplifications are pursued along two different avenues to allow possible on-line and more efficient off-line reliability evaluation. Error bounds are provided for these simplifications to better inform the users of the simplified reliability formulae.

This study concludes that SURE and ASSIST are efficient and elaborate tools for reliability assessment of reconfigurable flight control systems with high reliability requirements. Currently however, other aspects of development in such systems are more urgently needed before one can effectively take advantage of these valuable tools.

Reference:

Ricky Butler and Sally Johnson, "Techniques for modeling the reliability of fault tolerant systems with the Markov state-space approach", NASA Reference Publication 1348, 1995.

# AN ANALYSIS OF TECHNOLOGY SUPPORTED LEARNING INFRASTRUCTURE USING TECHNOLOGY POLICY MODELLING TECHNIQUES

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Technology supported and distance learning capability permits many Federal Agencies, including NASA to provide the best and most flexible training opportunities to their employees. Learners have access to multimedia instruction, synchronous and asynchronous instruction, as well as televised instruction from world-renowned experts in a variety of areas.

Administering these programs are challenging because of the amount of resources needed for smooth and effective operations. In order to consider all aspects of TSL, such as web-based instruction, distance learning, and etc., it was necessary to consider how these types of technology affect NASA training operations at every level of the organization.

A Technology Policy Modeling tool was used to explore the possibility of developing TSL collaborative arrangements throughout NASA, though similar models exists in other Federal Agencies, the focus of this study was specific to NASA. This modeling tool sought to determine whether or not one or many governing bodies should monitor NASA training centers; how new policy would affect training throughout NASA, and finally determine what are the economic implications of technology supported learning through NASA. Several research centers participated in surveys that addressed distance learning objectives and goals as well as goals in other input from NASA training centers.

Statistical analysis and contextual interpretations were conducted on the data collected. Based on these analysis tools and supporting literature, it is concluded that more research in technology policy development is needed to determine how to provide technology policy for NASA's training mission.

**Abstract of ASEE fellowship at NASA-LaRC**

# Modeling Resolved Subgrid Scale Noise in CAA

By Prof. Ye Zhou, Tuskegee University

***With a special dedication to the memories of Dr. M.G. Macaraeg***

With the rapid increase in air transportation, the federal government and other countries in the world face increased challenges in associated environmental problems. A chief issue one encounter is the increased landing noise particularly annoying to these residents living near the airport.

As reviewed by my LaRC associate, Dr. Macaraeg, NASA LaRC has played a key role in the NASA's airframe noise reduction effort. Specifically at the request by industry partners, LaRC focused on determining fundamental noise source mechanisms by relating sound generation mechanisms to fundamental fluid mechanics. This effort is truly significant since past predictions on noise generations are essentially based on empirical data that no longer suits the newer classes of aircraft. It has been known for sometime that the primary sources emanate from the high lift system and undercarriage of subsonic aircraft with the dominant source vacillates between flap, slat, and gear.

Recently, it appears that a compromising scheme, combining the method of large-eddy simulations (LES) for the flow field and the Lighthill analogy for sound generation, has been emerged as a promising approach. Since all the energy-containing scales, e.g., the coherent structure, are captured by LES, the location of the peak sound source is computed exactly. As a result, the LES can yield more accurate results than RANS calculations. An important issue related to the noise generation, however, is the effect of the small scales on the source term in Lighthill's analogy. In this case, the acoustic calculation will evaluate the noise generated by the resolved scales along. We would anticipate that this would result in the suppression of high-frequency noise. *A priori* studies by Piomelli, Street, and Sarkar suggest that this type of numerical sound could be quite significant. This motivates the subject of this proposal.

During my ASEE fellowship, I have conducted research in the area of noise generated by fine scale turbulence. The published results include a determination of the Proudman constant of the total power of sound level at high Reynolds number turbulent flows. The early studies by others use either analytical correlation functions or a curve fitted with DNS data; both were only appropriate for low Reynolds number turbulent flows. We have applied the concept of sweeping hypothesis, which is an extremely important concept in high Reynolds number turbulence, into the study of aeroacoustics. This development introduced the large scale sweeping velocity as well as the scale dependence into the time correlation function. As a result, a new prediction of the sound frequency scaling laws was obtained.

We proposed a unique and innovative project to provide models for capturing the subgrid noise that were unable to evaluate in the LES. The recent development, based on sweeping hypothesis, makes it possible to compute the unresolved subgrid scales from the resolved flow fields. This significant result, along with the advanced theory of the space-time properties of turbulence, placed us in a position to construct models of the exact and filtered velocity fields. Two journal articles have submitted on understanding noise generated by high Reynolds number turbulent flows at complex geometry.

# APPENDIX VIII

# PROGRAM ORIENTATION EVALUATION REPORT

## 1999 ASEE PROGRAM ORIENTATION EVALUATION REPORT

(Thirty-two Orientation evaluations were returned.)

1. **Was the Orientation notification received in a timely manner?**
   1 - Poor - 0%
   2 - Fair - 0%
   3 - Average - 2 (6%)
   4 - Good - 2 (6%)
   5 - Excellent - 28 (88%)

2. **Were the meeting facilities adequate?**
   1 - Poor - 0%
   2 - Fair - 0%
   3 - Average - 0%
   4 - Good - 9 (28%)
   5 - Excellent - 23 (72%)

3. **Was the Welcome Package beneficial?**
   1 - Poor - 0%
   2 - Fair - 0%
   3 - Average - 0%
   4 - Good - 6 (19%)
   5 - Excellent - 26 (81%)

4. **How do you rate the Program Breakout Session?**
   1 - Poor - 0%
   2 - Fair - 0%
   3 - Average - 0%
   4 - Good - 13 (41%)
   5 - Excellent -18 (56%)
   No Answer - 1 (3%)

5. **Was the information and knowledge gained at the Orientation helpful?**
   1 - Poor - 0%
   2 - Fair - 0%
   3 - Average - 1 (3%)
   4 - Good - 12 (38%)
   5 - Excellent - 19 (59%)

6. **In general, how do you rate this Orientation?**
   1 - Poor - 0%
   2 - Fair - 0%
   3 - Average - 0%
   4 - Good - 11 (34%)
   5 - Excellent - 20 (63%)
   No Answer - 1 (3%)

7. **Comments:**
   • Very, very helpful and precise. • Glad to see security information was presented. • More chairs would have been nice. • Excellent job, well done. Just one suggestion: A bit too long! • Need a map! • Outstanding Orientation, very informational. Thanks. • The LaRC Overview emphasizes too much "Environmentalism" for my taste. Ozone holes and global warming are still controversial at this time, and not established fact.

# APPENDIX IX

# POLICIES, PRACTICES, AND PROCEDURES MANUAL

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

# 1999

# POLICIES,

# PRACTICES,

# and

# PROCEDURES

# MANUAL

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**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 10 weeks working with professional peers on research.

The ASEE program is administered by a collaborating university. Either a Co-Director from Old Dominion University (ODU) or Hampton University (HU), 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 the award, 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 Competencies 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 Competency and do not perform personal services for either organization.

### 1.2 Langley Research Center

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

### 1.3 ASEE Associate

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

### 1.4 ASEE Co-Director

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

### 1.5 ASEE Program Manager/Administrative Assistant

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

### 1.6 Approval

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

## 2.0 Accepting a Fellowship and Beginning Tenure

### 2.1 Notification of a Fellowship

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

## 2.2 Acceptance Letter

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

If you are requesting an alternate start or end date, please do so in your acceptance letter. The approval of both the Co-Director and the Competency 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 ASEE Personnel Security Paperwork and any other requested items 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 and Signature Form
(b) NASA ASEE Personnel Security Paperwork Package
(c) NASA Fact Sheet
(d) Map of the Area
(e) Directions to NASA
(f) Housing Information
(g) Activities Interest Survey
(h) Federal Regulation Form
(I) NASA Education Evaluation Program Release Form

## 2.4 Working with the ASEE Associate

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

## 2.5 Change of ASEE Associate

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

## 2.6 Conforming to Center Policies

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

## 2.7 Extensions of Tenure

There will be no paid extensions of tenure. The only exception is at the **sole discretion and written approval of the Co-Director**. In order for him to consider an extension, he must receive a written memorandum submitted by the LaRC associate. This memorandum must outline the critical need for the

extension well in advance of the program end date. At that point, the Co-Director will consider the request and may approve depending on funding availability.

## 3.0 Stipend

### 3.1 Federal Funding Regulation

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

### 3.2 Stipend Amount

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

### 3.3 Acceptance Letter

Your acceptance letter must be received before stipend payments can be authorized.

### 3.4 Locator Form

In the orientation package you receive on the day of your arrival, you will receive a Locator Form. This form must be completed and returned to the Program Manager/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 Program Manager/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

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

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

## 4.0 Relocation Allowance and Travel

### 4.1 Relocation Allowance

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

### 4.2 Travel Reimbursement

Fellows are reimbursed for their travel under the following terms:

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

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

## 5.0 Insurance

### 5.1 Health and Medical Insurance

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

### 5.2 Worker's Compensation Type Insurance

ASEE Fellows are not covered by any type of Worker's Compensation Insurance through the ASEE program. If injured while on duty, however slight, immediately notify your associate and the Co-Director at (757) 864-5215. Emergency medical assistance can be obtained from the Occupational Health Services Clinic, Building 1149, from 7:00 a.m. to 3:30 p.m. In a medical emergency, dial 911.

### 5.3 Automobile Insurance and Driver's License

You must have a valid driver's license, automobile insurance, and a current inspection sticker to certify that your automobile is safe and to be issued a Vehicle Pass to drive on-Center.

## 6.0 Taxes

### 6.1 Federal Tax Liability of United States Citizens

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

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

### 6.2 Social Security Taxes

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

### 6.3 State Tax Liability

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

## 7.0 Leave

### 7.1 Leave

As a guest researcher in the 10-week ASEE Program, you are not eligible for annual leave, sick leave, or personal leave.

If there are reasons why you need to be absent from work during the summer research experience, there are a few steps you must take **prior** to the absence. First, you must clear this absence with your LaRC associate. Next, submit a memo to the ASEE Co-Director with your associate's concurrence requesting approval for your absence. This is to include any conferences or presentations of papers. If this absence is directly related to your summer research and a memo to that effect is submitted by your associate, then time approved can be considered a part of your 10 week tenure. If you are approved to attend a conference not related to your summer research, then the time away **must be made up** before receiving your final stipend check. **If you are aware, prior to the start of the summer program, of a meeting or conference you desire to attend during the 10-week period, we ask that you request approval for this absence as soon as possible to allow for timely processing.**

### 7.2 Work Hours

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

### 7.3 Working After Hours

After hours access and work at LaRC after 6 p.m. require an escort. Unescorted 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 LaRC associate sponsor. Your associate must submit to the Office of Security & Public Safety (OSPS) a Request for Unescorted After Hours Access (forms available from the OSPS) for you to work unescorted after hours. Also, a favorable background check and investigation must be completed on you. This information is subject to change.

## 8.0 Housing

### 8.1 Housing Package

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

### 8.2 Disclaimer

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

## 9.0 Lecture Series

### 9.1 Attendance

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

### 9.2 Distribution of Information

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

## 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 ODU assume any responsibility for any events.

## 11.0 Security

### 11.1 Personnel Security Screening Requirements

As a prerequisite for employment and access to NASA Langley Research Center (LaRC) facilities, programs and information, all participants in the American Society for Engineering Education (ASEE) Summer Faculty Fellowship program at LaRC are required to complete the Personnel Security Screening Forms (NASA Form 531, "Name Check Request," OPM Optional Form 306, "Declaration for Federal Employment," and FCRA Credit Release Authorization Form), which are included in your Information Package. All forms are to be completed, per the LaRC Office of Security & Public Safety instructions, and returned to the address listed below no later than 2 weeks prior to reporting to work at NASA LaRC. Completed forms are to be mailed to NASA Langley Research Center, ATTN: Mrs. Debbie Murray, MS 400-ASEE, 100 NASA Road, Hampton, VA 23681-2199. If you have access to a fax, the forms may be faxed to the Office of Education, ATTN: Mrs. Debbie Murray, at 757-864-9701.

### 11.2 LaRC Access Requirements

A LaRC issued Photo Identification Badge is required for access to the Center. This badge permits ASEE Summer Faculty Fellowship program participants unescorted access to the Center during normal duty hours only. Normal duty hours at LaRC are from 6 a.m. to 6 p.m., Monday through Friday. Access during other than normal duty hours must be under escort.

### 11.3 Identification Badges and Vehicle Passes

Upon initial arrival at NASA LaRC, all ASEE Summer Faculty Fellowship program participants will attend a special ASEE Summer Employee Orientation session at the Reid Conference Center.

When entering the Center on initial entry day, inform the Security Officer on duty at the LaRC Main Gate that you are an ASEE Summer Faculty Fellowship program participant and here to attend the ASEE Summer Employee Orientation session at the Reid Conference Center. The Security Officer will give you a Temporary Restricted Area Visitor Pass and direct you to the Conference Center.

A 5-day Temporary LaRC Identification Badge will be issued to ASEE Summer Faculty Fellowship program participants at the ASEE Summer Employee Orientation session. ASEE program participants must then report to the Main Gate Badge & Pass Office within 5 working days after the orientation to receive their extended **Temporary LaRC Photo Identification Badge and Vehicle Pass.** A valid driver's license or other authorized photo identification is required for issuance of a LaRC Identification Badge and Vehicle Pass. NOTE: Before a LaRC Identification Badge can be issued, however, the completed Personnel Security Screening Forms must have been submitted to the Office of Education and the OSPS.

### 11.4 Checkout Requirements

At the end of your work assignment, ASEE Summer Faculty Fellowship program participants are required to check out through the Office of Education and turn in their LaRC Photo Identification Badge and Vehicle Pass at that time.
For additional security information and questions, contact the LaRC Office of Security & Public Safety at 757-864-3420/3535.

## 12.0 Safety

### 12.1 Safety Program

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

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

### 12.2 Hazardous Communications Training

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

### 12.3 Safety Clearance Procedures

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

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

### 12.4 Accident Reporting

Fellows shall immediately report all job-related accidents, injuries, diseases or illnesses to their associate, the Co-Director, and the Office of Safety, Environment and Mission Assurance (OSEMA), 757-864-SAFE (757-864-7233). Emergency medical assistance can be obtained from the Occupational Health Services Clinic, Building 1149, from 7:00 a.m. to 3:30 p.m. In a medical emergency, dial 911.

### 12.5 Personnel Certification

It is LaRC policy to certify Fellows performing tasks which could be potentially hazardous to either the individual or co-workers. These requirements vary with the type of activity being performed, and consequently are described in detail in the LaRC Safety Manual dealing with the specific topic/hazard. Particular research assignments may require training, certification, and medical surveillance requirements. Examples of these types of research assignments are chemical, radiation and/or pyrotechnic operations.

## 13.0 Mail Center

### 13.1 Official Mail

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

are too large for internal mail distribution are made to a designated table located in each facility.

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

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

### 13.2 **Personal Mail**

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

### 13.3 **Additional Items to Remember**:

- Do not use official Government envelopes for personal mail.
- For fastest delivery by the post office: address envelopes in all capital letters, no punctuation, use state abbreviations, and zip code.
- Each piece of mail requiring postage must be stamped with the mail stop of the originating organization for identification.
- Do not use NASA Langley Research Center as a mailing address for personal mail.
- Do not send personal mail (cards, chain letters, job resume, etc.) in the internal mail delivery system.
- When addressing messenger envelopes, use first and last name. Do not use nicknames.
- Do not use room numbers in place of mail stops on messenger envelopes.
- Mail Stops are required for delivery of internal mail.

If you have any questions, please call the Mail Manager, 757-864-8159.

### 13.4 **Electronic Communications**

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

## 14.0 Library

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

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

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

## 15.0 Cafeteria

### 15.1 NASA Exchange Cafeteria

| | |
|---|---|
| Locations: | 16 Taylor Drive, Building 1213 and<br>5 North Dryden, Building 1202 |
| Hours of Service: | Monday thru Friday |
| Breakfast: | 6:15 a.m .- 8:30 a.m. - Main Cafeteria only |
| 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 Taken between 11:30 a.m. - 12:30 p.m.<br>Large groups after 12:30 p.m. |

### 15.2 Check Writing Policies

Checks are accepted from badged summer program participants for amount of purchase only.

### 15.3 Area Tickets Available

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

## 16.0 H.J.E. Reid Conference Center

### 16.1 Conference Center

The Conference Manager serves as a consultant and advisor for conferences and technical meetings. Reservations can be made for the following locations:

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

Pearl I. Young Theater
5A N. Dryden Street

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

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

Call 757-864-6362 for reservations.

### 16.2 Picnic Shelters

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

### 16.3 NASA Gym

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

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

### 16.4 LaRC-sponsored clubs:

Aerobics Club
Amateur Radio Club
Astronomy Club
Apiculture Club
Basketball League
Bicycle Safety Club
Bowling League
Conservation Club
Flag Football
Garden Club
Golf Association
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 a featured film in an IMAX theater, you can visit the Virginia Air & Space Center in downtown Hampton.

# REPORT DOCUMENTATION PAGE

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

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