CORE PROGRAM

in the

JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES

at the

NASA Langley Research Center

NCC1-01-020

Final Report

December 1, 2000 – August 31, 2003

School of Engineering and Applied Science
The George Washington University
Washington, DC 20052
The objectives of the "Core Program in the Joint Institute for Advancement of Flight Sciences (JIAFS) at the NASA Langley Research Center" are described in the original proposal awarded November 1980. Funding for this program is given in Appendix A.

Participants and Activities

Participants in the "Core Program" during this period included:
- Professor J. L. Whitesides
- Ms. Jessie Coates
- Ms. Carolyn F. Stough

Professor Whitesides has administered and provided technical direction for the JIAFS.

Research Activities

Following the precedent started several years ago, each of the graduating MS and DSc candidates in JIAFS present a seminar which is advertised throughout the area. Following the formal seminar the attendees are excused and the review committee examines the student as in a standard thesis defense. This allows the students to gain experience in presenting their research and disseminating the Institute's research results to a wider audience. A list of seminars are given in Appendix B.

Some 172 excellent applications for the Graduate Research Scholar Assistantships were received during this period. Forty-nine new GRSA were appointed by Professor Whitesides to JIAFS under the various research grants and contracts.

A list of the publications and presentations by members of JIAFS is given in Appendix C.

During this period there were 54 graduates from the academic programs in JIAFS. A list of these graduates and their initial employer upon graduation from GW is included as Appendix D. A list of the courses offered during the period Fall 2000 through Summer, 2003 is given in Appendix E.
APPENDIX A

Period of Performance
December 1, 2000 through August 31, 2003

Summary

12/01/00 – 11/30/01
New Cooperative Agreement – Funding: 102,446.00
08/09/01 – 11/30/01
Supplement 1 – Augmentation/correct award history – Funding:
12/01/01 – 12/31/02
Supplement 2 – Augment award history, add incremental funding and extend period – Funding:
01/01/03 – 08/31/03
Supplement 3 – No Cost Time Extension

Award History

Funding History
Total: 
APPENDIX B

SEMINARS PRESENTED

1. M. A. Bene, "Investigating the Application of a Confidence Interval Methodology to Assessing Neural Network Surrogates."

2. G. C. Harding, "A High-Frequency Supersonic Pulsed Injector with Applications to Supersonic Combustors."


4. R. L. Stephens, "Recursive Attitude and Rate Estimator."


16. J. L. Hanna, “Approaches to Autonomous Aerobreaking at Mars.”

17. J. P. Hundley, “A Thermography System for Imaging Reusable Launch Vehicles.”


29. P. P. Zomkowski, “Preliminary Design and Analysis of the GIFTS Instrument Pointing System.”


34. L. Kay-Bunnell, "Orbit Determination Accuracy for Comets on Earth-Impacting Trajectories."

35. B. P. Anderson, "Spacecraft-Ballute Interactions Using Continuum and Rarefied Computational Analysis."


37. A. L. Martin, "Methodology for Reduced Monte Carlo Simulations with Application to Mars Science Laboratory Entry."


40. M. C. Bastow, "A Telescope Tracking and Thermal Imaging System for High-Speed Vehicles."


42. R. M. Lunceford, "Crash Test and Analysis Validation of Aircraft Seat Structures."

APPENDIX C

PUBLICATIONS AND PRESENTATIONS


37. B. P. Anderson, "Computational Continuum and Rarefied Flow Results for Ballute Applications." Presented: AIAA Mid-Atlantic Region 1 Student Conference, College Park, MD, April 11-12, 2003.

## APPENDIX D

### GRADUATES - 2000-2003

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Employed by</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Fall 2000</strong></td>
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</tr>
<tr>
<td>Michael A. Benes</td>
<td>Aero, GRSA, Visteon Steering Systems, MI</td>
</tr>
<tr>
<td>Gregory C. Harding</td>
<td>Aero, GRSA, Schweizer Aircraft Corp, NY</td>
</tr>
<tr>
<td>Timothy M. Mauery</td>
<td>Aero, GRSA, Lockheed Martin Aircraft &amp; Logistics, SC</td>
</tr>
<tr>
<td>Robert L. Stephens</td>
<td>SDyn, GRSA, Swales &amp; Assoc @ NASA Langley</td>
</tr>
<tr>
<td>Javier Velez</td>
<td>Aero, GRSA, Raytheon Missile Systems, AZ</td>
</tr>
<tr>
<td><strong>Spring 2001</strong></td>
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</tr>
<tr>
<td>Michael S. Bonner</td>
<td>Aero, GW, Naval Air Warfare Ct, CA</td>
</tr>
<tr>
<td>Timothy J. Bozung</td>
<td>Astro, GRSA, Stryker Instruments, MI</td>
</tr>
<tr>
<td>Jeffrey S. Parker</td>
<td>Astro, GRSA, Allied Signal Technical Services, MD</td>
</tr>
<tr>
<td>James P. Tomey</td>
<td>SDyn, GRSA, Ford Motor Co, MI</td>
</tr>
<tr>
<td>Kenrick A. Waithe</td>
<td>Aero, GRSA, AS&amp;M @ NASA Langley</td>
</tr>
<tr>
<td><strong>Summer 2001</strong></td>
<td></td>
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<tr>
<td>Marcus D. Billings</td>
<td>SDyn, GRSA, ATA Engineering, CA</td>
</tr>
<tr>
<td>Alicia M. Dwyer</td>
<td>Astro, GRSA, ICASE @ NASA Langley</td>
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<tr>
<td>Louis R. Giersch</td>
<td>Astro, GRSA, University of Kentucky, KY</td>
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<tr>
<td>Kristopher R. Horne</td>
<td>SDyn, GRSA, Lockheed Martin, CA</td>
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<tr>
<td>Alan D. Sullins</td>
<td>Astro, GRSA, Aerospace Corp, CA</td>
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<tr>
<td><strong>Fall 2001</strong></td>
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<tr>
<td>Stephen J. Alter</td>
<td>Aero, NASA, NASA Langley</td>
</tr>
<tr>
<td>Brooke M. Anderson</td>
<td>Astro, GW, Swales @ NASA Langley</td>
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<tr>
<td>Frederico R. Garza</td>
<td>Aero, GW, Swales @ NASA Langley</td>
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<tr>
<td>Benjamin E. George</td>
<td>Astro, GRSA, USAF</td>
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<tr>
<td>Govinda B. Haines</td>
<td>Aero, GRSA, Unknown</td>
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<tr>
<td>Jill L. Hanna</td>
<td>Astro, GRSA, ICASE @ NASA Langley</td>
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<td>Scott A. Hill</td>
<td>S/Dyn, N, NASA Langley</td>
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<tr>
<td>Jason P. Hundley</td>
<td>Aero, GRSA, Northrop-Grumman, CA</td>
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<tr>
<td>Craig A. Hunter (DSc)</td>
<td>Aero, GRSA, NASA Langley</td>
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<tr>
<td>Byron R. Monzon</td>
<td>Aero, GRSA, Pratt &amp; Whitney, CT</td>
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<td>Matthew T. Phillips</td>
<td>Aero, GRSA, USAF</td>
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<td>Michael T. Powers</td>
<td>S/Dyn, GRSA, Lockheed Martin Missiles &amp; Space Systems, CA</td>
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<td>Jason B. Prince</td>
<td>Aero, GRSA, Aerotech Research, USA Inc., VA</td>
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<tr>
<td>Yelena M. Savranskaya</td>
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### Spring 2002

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<thead>
<tr>
<th>Name</th>
<th>Discipline</th>
<th>Company/Institution</th>
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<tbody>
<tr>
<td>Troy D. Altus</td>
<td>Aero</td>
<td>ATK Tactical Systems Co., MD</td>
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<tr>
<td>Adam C. Olsen</td>
<td>Aero</td>
<td>Unknown</td>
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### Summer 2002

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<th>Name</th>
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<tr>
<td>Dustin J. Bouch</td>
<td>Aero</td>
<td>Eidetics Corp, CA</td>
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<tr>
<td>Zachary Q. Chavis</td>
<td>Astro</td>
<td>Pratt &amp; Whitney, CT</td>
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<tr>
<td>Christopher G. Lang</td>
<td>Astro</td>
<td>NASA Langley</td>
</tr>
<tr>
<td>Dawn R. Phillips</td>
<td>Aero</td>
<td>Lockheed Martin Space Operation @ NASA Langley</td>
</tr>
<tr>
<td>Brendan R. Rogillio</td>
<td>Astro</td>
<td>Unknown</td>
</tr>
<tr>
<td>Joshua E. VerHage</td>
<td>Astro</td>
<td>Unknown</td>
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<tr>
<td>Paul P. Zomkowski</td>
<td>Astro</td>
<td>Aerospace Corp, CA</td>
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### Fall 2002

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<th>Discipline</th>
<th>Company/Institution</th>
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<tbody>
<tr>
<td>David W. Fiala</td>
<td>Astro</td>
<td>Unknown</td>
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<tr>
<td>Corey D. Hernandez</td>
<td>Astro</td>
<td>Swales &amp; Associates @ NASA LaRC</td>
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<tr>
<td>Micah J. Soltear</td>
<td>Astro</td>
<td>Lockheed Martin Missiles &amp; Space, CA</td>
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<tr>
<td>Michael P. Strauss</td>
<td>Aero</td>
<td>Sikorsky Aircraft Corp, CT</td>
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<tr>
<td>Jeffrey I. Walters</td>
<td>Aero</td>
<td>Lockheed Martin Missiles &amp; Space, CA</td>
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### Spring 2003

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<th>Discipline</th>
<th>Company/Institution</th>
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<tbody>
<tr>
<td>Paul E. Escalera</td>
<td>Astro</td>
<td>Orbital Sciences Corp, VA</td>
</tr>
<tr>
<td>Linda Kay-Bunnell</td>
<td>Astro</td>
<td>Analytical Mechanics Assoc @ NASA LaRC</td>
</tr>
<tr>
<td>Derek S. Liechty</td>
<td>Aero</td>
<td>NASA Langley</td>
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### Summer 2003

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<tr>
<th>Name</th>
<th>Discipline</th>
<th>Company/Institution</th>
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<tbody>
<tr>
<td>Brian P. Anderson</td>
<td>Astro</td>
<td>Combustion Research &amp; Flow Technology, PA</td>
</tr>
<tr>
<td>Jonathan T. Black</td>
<td>Astro</td>
<td>University of Kentucky</td>
</tr>
<tr>
<td>Craig P. Hugger</td>
<td>Aero</td>
<td>Unknown</td>
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<tr>
<td>Alex L. Martin</td>
<td>Astro</td>
<td>Aerospace Corporation, CA</td>
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<tr>
<td>Kyle G. Moss</td>
<td>Aero</td>
<td>Swales Aerospace @ NASA Langley</td>
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<td>Michael E. Theriot</td>
<td>Astro</td>
<td>George Washington University</td>
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<tr>
<td>David T. Walker</td>
<td>SDyn</td>
<td>Thiokol, UT</td>
</tr>
<tr>
<td>Martin R. Werner</td>
<td>Astro</td>
<td>Spectrum Astro, AZ</td>
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### APPENDIX E

#### ACADEMIC PROGRAM

**FALL 2000**

- ApSc 212  Analytical Methods in Engineering II
- ApSc 213  Analytical Methods in Engineering III
- MAE 207  Theory of Elasticity
- MAE 221  Fluid Mechanics
- MAE 224  Viscous Flow
- MAE 248  Aircraft Design II
- MAE 253  Aircraft Structures
- MAE 274  Spacecraft Dynamics
- MAE 275  Stability and Control of Aircraft
- MAE 276  Space Flight Mechanics
- MAE 286  Numerical Solution Techniques in MAE
- MAE 292  Special Topics in Aerospace Engineering
- MAE 298  Research (arr.)

**SPRING 2001**

- ApSc 214  Analytical Methods in Engineering IV
- ECE 202  Linear Systems Theory
- MAE 225  Computational Fluid Dynamics
- MAE 228  Compressible Flow
- MAE 234  Composite Materials
- MAE 247  Aircraft Design I
- MAE 250  Launch Vehicle Design
- MAE 257  Theory of Vibrations
- MAE 277  Spacecraft Attitude Control
- MAE 286  Numerical Solution Techniques in MAE
- MAE 292  Special Topics in Aerospace Engineering (Astro Project)
- MAE 298  Research (arr.)
ACADEMIC PROGRAM (continued)

FALL 2001

ApSc 212  Analytical Methods in Engineering II
ApSc 213  Analytical Methods in Engineering III
MAE 207  Theory of Elasticity
MAE 221  Fluid Mechanics
MAE 227  Aeroelasticity
MAE 248  Aircraft Design II
MAE 274  Spacecraft Dynamics
MAE 275  Stability and Control of Aircraft
MAE 276  Space Flight Mechanics
MAE 286  Numerical Solution Techniques in MAE
MAE 291  Special Topics in Mechanical Engineering [Heat Transfer]
MAE 292  Special Topics in Aerospace Engineering [Engineering Optimization]
MAE 292  Special Topics in Aerospace Engineering [Orbit and Trajectory Optimization]
MAE 298  Research (arr.)

SPRING 2002

ApSc 214  Analytical Methods in Engineering IV
ECE 202  Linear Systems Theory
MAE 228  Compressible Flow
MAE 234  Composite Materials
MAE 247  Aircraft Design I
MAE 257  Theory of Vibrations
MAE 277  Spacecraft Attitude Control
MAE 286  Numerical Solution Techniques in MAE
MAE 288  Adv Finite Element Methods in Structural Mech
MAE 292  Special Topics in Aerospace Engineering [Spacecraft Navigation]

FALL 2002

ApSc 212  Analytical Methods in Engineering II
ApSc 213  Analytical Methods in Engineering III
MAE 207  Theory of Elasticity
MAE 221  Fluid Mechanics
MAE 229  Propulsion
MAE 248  Aircraft Design II
MAE 249  Spacecraft Design
MAE 253  Aircraft Structures
MAE 274  Spacecraft Dynamics
MAE 275  Stability and Control of Aircraft
MAE 276  Space Flight Mechanics
MAE 286  Numerical Solution Techniques in MAE
MAE 298  Research (arr.)
ACADEMIC PROGRAM (continued)

SPRING 2003

ApSc 214  Analytical Methods in Engineering IV
ECE 202  Linear Systems Theory
MAE 222  Applied Aerodynamics
MAE 228  Compressible Flow
MAE 234  Composite Materials
MAE 247  Aircraft Design I
MAE 257  Theory of Vibrations
MAE 270  Theoretical Acoustics
MAE 271  Time Series Analysis
MAE 277  Spacecraft Attitude Control
MAE 278  Space Flight Guidance and Navigation
MAE 286  Numerical Solution Techniques in MAE
MAE 288  Advanced Finite Element Methods in Structural Mechanics
MAE 292  Special Topics in Aerospace Engineering
MAE 298  Research (arr.)
MAE 298-Z1 Research (arr.)

FALL 2003

ApSc 213  Analytical Methods in Engineering III
ApSc 214  Analytical Methods in Engineering IV
MAE 225  Computational Fluid Dynamics
MAE 229  Propulsion
MAE 248  Aircraft Design II
MAE 249  Spacecraft Design
MAE 275  Stability and Control of Aircraft
MAE 276  Space Flight Mechanics
MAE 286  Numerical Solution Techniques in MAE
MAE 292  Sp Topics in Aerospace Engineering (Engineering Optimization)
MAE 298  Research (arr.)