

CURRICULUM VITAE – RYAN P. STARKEY

Department of Aerospace Engineering Sciences
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EDUCATION

- Oct. 2000 **Ph.D.** in *Aerospace Engineering*, University of Maryland, for “Investigation of Air-Breathing, Hypersonic Missile Configurations Within External Box Constraints”.
- Aug. 1998 **M.S.** in *Aerospace Engineering*, University of Maryland, for “A Parametric Study of L/D and Volumetric Efficiency Trade-Offs for Waverider Based Vehicles”.
- May 1996 **B.S.** in *Mechanical Engineering* (with Distinction), University of Alberta, Canada.

PROFESSIONAL EXPERIENCE

- Aug. 2007 – **Assistant Professor/McAnally Faculty Fellow**, *DEPARTMENT OF AEROSPACE ENGINEERING SCIENCES, University of Colorado, Boulder, CO*

Leads the Busemann Advanced Concept (BAC) Lab and is currently advising 6 Ph.D. and 3 M.S. thesis students, as well as, 2 design projects totaling 9 seniors and 12 AE/EE grad students. Areas of research include high-speed aerodynamic and propulsion system design, Unmanned Aerial Vehicle design and flight testing, sonic-boom modeling, computational fluid dynamics, optimization under uncertainty, and advanced mathematical modeling algorithms. Research is conducted as a member of both the *CENTER FOR AEROSPACE STRUCTURES (CAS)* and the *RESEARCH AND ENGINEERING CENTER FOR UNMANNED VEHICLES (RECUV)*.

- Sept. 2004 – **Associate Director**, *SPACE VEHICLE TECHNOLOGY INSTITUTE (SVTI), University of Maryland, College Park, MD*
Aug. 2007

The SVTI is a NASA Constellation University Institutes Program (CUIP) member (with joint funding from the Department of Defense) teamed with faculty from University of Michigan, John Hopkins University/Applied Physics Lab, University of Washington, and North Carolina A&T. Responsible for students/research oversight and assisting in center coordination and operation. From 2002 until leaving in 2007, was responsible for directing the daily research activities of 13 graduate students (6 Ph.D. and 7 M.S.) in the following topics:

- Turbine-Based Combined-Cycle Engine Modeling and Inlet Integration
- Horizontal Versus Vertical Launch Vehicle Options
- Horizontal Launch Vehicle Structural Weight Modeling
- Nuclear Thermal Rocket Cycle Analysis for Moon-Mars Applications
- Earth-Moon Trajectory Modification with Existing Propulsion and Shielding
- Ablation Modeling for Re-entry Applications
- Plasma Telemetry for Hypersonic Flight
- Optimization of Blunt Body Re-entry Configurations

- Alternative Re-entry Configurations
- Unsteady Shock/Shock and Shock/Boundary Layer Interaction Effects
- Mars Trajectory Abort Scenarios for a Crew Exploration Vehicle
- Trajectory Optimization for Morphing Vehicles
- Boundary-Layer Transition Modeling for Earth/Mars Entry
- Multidisciplinary Design, Analysis, and Optimization of Hypersonic Vehicles
- 6 Degree-of-Freedom Re-Entry Vehicle Modeling

Sept. 2003 – **Assistant Research Scientist**, *DEPARTMENT OF AEROSPACE ENGINEERING, University of Maryland, College Park, MD*

Managed research activities through the *CENTER FOR HYPERSONIC EDUCATION AND RESEARCH* (which included numerous SVTI funded students), as well as performed research on topics related to the design, analysis, and optimization of high-speed aerodynamic and propulsion systems.

Nov. 2000 – **Research Associate**, *DEPARTMENT OF AEROSPACE ENGINEERING, University of Maryland, College Park, MD*

Managed research activities through the *CENTER FOR HYPERSONIC EDUCATION AND RESEARCH* (which included numerous SVTI funded students), as well as performed research on topics related to the design, analysis, and optimization of high-speed aerodynamic and propulsion systems.

Sept. 1996 – **Graduate Research Assistant**, *DEPARTMENT OF AEROSPACE ENGINEERING, University of Maryland, College Park, MD*

As a student in the *CENTER FOR HYPERSONIC EDUCATION AND RESEARCH*, I generated analytical hypersonic waverider models, developed hypersonic airbreathing missile scale vehicles, developed a hydrogen/hydrocarbon finite-rate chemistry modeling methodology for scramjet engines, created a modified shock-expansion method, performed CFD validation studies, developed parallelized genetic algorithm optimization software, and developed concept vehicles for Boeing Space Transportation Concepts and Analysis Business Development Division.

May 1995 – **Engineering Assistant**, *DRILLING AND COMPLETIONS DEPARTMENT, PAN CANADIAN PETROLEUM, Calgary, Canada*

Developed completion programs (bringing wells on-line after drilling) for deep sour gas wells and multi-zonal oil wells. In daily contact with field operations personnel troubleshooting real-time problems and involved with perforating, fracturing, swabbing, testing, and bringing wells on-line. Developed database model for analysis of completions of numerous types of gas and oil wells.

May 1994 – **Engineering Assistant**, *OPERATIONS – WATERTON – ENGINEERING SERVICES, SHELL CANADA LIMITED, Waterton, Alberta, Canada*

Developed computer model of Waterton Plant sour gas gathering network. Analyzed and exploited field gathering system (i.e., de-bottlenecked gas flow) by optimizing in-line fuel heaters. Determined and confirmed locations of liquid hold-up (high corrosion locations) in field piping network. Quantified benefits were \$10.7M per year increased profit and \$660K per year in fuel gas savings.

PROJECTS AND GRANTS

- April 2010 – Dec. 2010 **TITLE: Dream Chaser Dynamically Scaled Model**
P.I.: Dr. Ryan P. Starkey
SPONSOR: Sierra Nevada Corporation (SNC) Phase-I for NASA Commercial Crew Development (CCDev) Program
RESEARCH: Low-speed flight design, analysis, construction, and flight testing of a 15% dynamically scaled model of the SNC Dream Chaser Vehicle for aerodynamic validation and stability augmentation system testing. Co-I is Dr. Argrow of ASEN.
FUNDS: \$184,285
- Aug. 2010 – Aug. 2011 **TITLE: Technology Maturation for Auxiliary Spacecraft Propulsion Systems: Evaluation and Modeling of High Thrust to Weight Miniature Auxiliary Rocket Thrusters**
P.I.: Dr. Ryan P. Starkey
SPONSOR: NASA Graduate Student Researchers Program (GSRP)
RESEARCH: Evaluation and modeling of novel reaction control system (RCS) rocket thrusters for in-space station-keeping and orientation maneuvers for both satellites and spacecraft.
FUNDS: \$30,000
- Aug. 2010 – Aug. 2011 **TITLE: Supersonic Unmanned Aerial Vehicle Design**
P.I.: Dr. Ryan P. Starkey
SPONSOR: eSpace
RESEARCH: This is the continuation of the combined GOJETT/DANTE engine development projects with the goal of designing, and eventually testing a supersonic unmanned aerial vehicle with uses of: 1) setting the world speed record, 2) providing an in-situ resource for measurements and/or sensor deployment within or around hurricanes/tornadoes, 3) sub-scale sonic-boom testing, and 4) as a military drone.
FUNDS: \$30,000
- Aug. 2010 – Aug. 2015 **TITLE: Space Technology Research and Development (STRAD)**
P.I.: Dr. Ryan P. Starkey
SPONSOR: ERC, Inc. for NASA Ames Research Center, Space Technology Division (STD)
RESEARCH: The contract provides engineering services to STD related to their mission, which is to support all of NASA in the development of thermal protection systems for space reentry vehicles. The maximum value for ERC is \$45,000,000. I am ERC's strategic partner for basic research resources needs associated with hypersonics. The MOU indicates the intention of ERC, as the prime contractor, to:
1. Give preference to summer intern and co-op to students from CU for openings related to hypersonics.
 2. Give preference to fill hypersonics-related openings on their contract to students graduating from CU.
 3. Have access to and utilize on a task order basis Basic Research support from CU in areas associated with hypersonics.
- FUNDS:* \$0 to date

- Sept. 2009 – Dec. 2009
TITLE: Feasibility Assessment of Airbreathing Strap-On Booster Concept
P.I.: Dr. Ryan P. Starkey
SPONSOR: United Launch Alliance
RESEARCH: The objective of this work is a preliminary estimate of the viability of airbreathing propulsion strap-on boosters on a launch vehicle configuration. The viability was assessed in terms of impacts to vehicle performance, strap-on engine performance, and technology maturity. A launch vehicle optimization analysis was performed to assess the feasibility of using strap-on ramjet/scramjet booster motors on a Delta IV M+(5,4)-class launch vehicle.
FUNDS: \$7,500
- June 2009 – April 2010
TITLE: Mini-Turbojet Engine Test Stand Development
P.I.: Dr. Lakshmi Kantha
SPONSOR: Engineering Excellence Fund (EEF)
RESEARCH: Worked with Dr. Kantha for the development of a test stand for small turbojet engines for use in ASEN courses: senior Introduction to propulsion, senior design, graduate projects, and eventually, sophomore thermodynamics. I was a matching sponsor for this grant by providing an engine, as well as additional resources (money, expertise) to see it through to completion.
FUNDS: \$15,000
- Jan. 2009 – April 2010
TITLE: Mini-Turbojet Engine Design
P.I.: Dr. Ryan P. Starkey
SPONSOR: eSpace
RESEARCH: The design, analysis, testing, and marketability of a miniature turbojet engine were performed by 3 semesters of graduate projects (GOJETT – Graduate Organization Jet Engine Technology Team) and 2 semesters of senior design (DANTE – Demonstration of an Afterburner and Nozzle on a mini-Turbojet Engine).
FUNDS: \$50,000
- Oct. 2006 – Dec. 2009
TITLE: Optimization of Blunt-Body Reentry Configurations
P.I.: Dr. Ryan P. Starkey
SPONSOR: NASA Constellation University Institute Program (CUIP)
RESEARCH: Advanced multi-disciplinary blunt-body reentry configuration design, analysis, and optimization. Considerations for lunar and Martian return trajectories on heat shield optimizations were included.
FUNDS: \$360,000
- Mar. 2007 – Sept. 2009
TITLE: Aero-Servo-Thermo-Propulsive-Elasticity (ASTPE) for Hypersonic Vehicle Design and Analysis [Phase II STTR]
P.I.: Dr. Ryan P. Starkey
SPONSOR: Zona Technology, Inc. for Air Force Air Vehicles Directorate
RESEARCH: Responsible for all aspects of vehicle aerodynamic, propulsion, and control modeling for a scramjet powered missile configuration similar to the Air Force's Single Engine Demo (SED) vehicle. Maryland/Colorado models were integrated with Zona Technologies aeroservoelastic analysis software (ZonAir).
FUNDS: \$225,000

- Aug. 2005 – Apr. 2006 **TITLE: Aero-Servo-Thermo-Propulsive-Elasticity (ASTPE) for Hypersonic Vehicle Design and Analysis [Phase I STTR]**
P.I.: Dr. Ryan P. Starkey
SPONSOR: Zona Technology, Inc. for Air Force Air Vehicles Directorate
RESEARCH: Same as Phase II STTR above.
FUNDS: \$30,000
- Apr. 2005 – Sept. 2007 **TITLE: Aero-Assist Mars Transfer Vehicle (AAMTV) System Technology Design Program**
P.I.: Dr. Ryan P. Starkey
SPONSOR: NASA Dryden
RESEARCH: Responsible for developing and validating a 6-degree-of-freedom geometric/aerodynamic/aerothermodynamic vehicle model for Lunar return and aero-assist/aero-gravity assist maneuvers in Venusian/Martian atmospheres. Model was to be used in the NASA Dryden Manned Flight Simulator, but second year option was retracted by NASA during Project Constellation start-up.
FUNDS: \$150,000
- 2005 – 2006 **TITLE: Affordable REsponsive Spacelift (ARES) Program**
P.I.: Dr. A. J. Kothari, Astrox Corporation
SPONSOR: United States Air Force
RESEARCH: UMD P.I. on Astrox led team for Modeling and Simulation in support ARES program. Our team was down-selected (2005) as one of three teams for future proposal requests. ARES was cancelled before any RFPs were issued.
FUNDS: \$0
- Oct. 2002 – Sept. 2009 **TITLE: Space Vehicle Technology Institute CUIP Program**
P.I.: Dr. Mark J. Lewis, Dr. Ken Yu, Dr. Darryll Pines, University of Maryland
SPONSOR: NASA / Department of Defense
RESEARCH: Performed research as part of the cooperative effort (University of Maryland, University of Michigan, University of Washington, Johns Hopkins University/Applied Physics Lab) which begun as the Reusable Launch Vehicle Institute with a focus on air-breathing/rocket propulsion system design and analysis. In 2003, this contract was re-vectored to rocket based propulsion and re-entry vehicle design in support of NASA Constellation initiative. As of 2009, NASA was funding more than 20 universities through the University of Maryland.
FUNDS: \$2,000,000/year NASA funding and \$1,000,000/year DoD funding
- 2004 **TITLE: Aerodynamic Configuration Analysis**
P.I.: Dr. Ryan P. Starkey
SPONSOR: Northrop Grumman
RESEARCH: P.I. responsible for aerodynamic/aerothermodynamic design and optimization of a small waverider-based re-entry geometry.
FUNDS: \$50,000

- 2003 – 2004 **TITLE: Force Application and Launch from the Continental U.S. (FALCON) Hypersonic Cruise Vehicle (HCV) [Phase I]**
P.I.: Dr. Ryan P. Starkey
SPONSOR: Andrews Space for DARPA
RESEARCH: Responsible for aspects relating to aerodynamic configuration design, propulsion system design, and propulsion/airframe integration for the HCV. Co-I was Christopher (Kip) Tarpley from Astrox Corporation.
FUNDS: \$25,000
- 2000 – 2003 **TITLE: Plasma Field Telemetry for Hypersonic Flight**
P.I.: Dr. Mark J. Lewis, University of Maryland
SPONSOR: US Air Force Flight Test Center
RESEARCH: Non-equilibrium plasma modeling and Direct Simulation Monte Carlo software development for reentry plasma blackout mitigation techniques.
FUNDS: \$300,000
- 1999 – 2001 **TITLE: Slender Hypervelocity Aerothermodynamic Re-entry Probe (SHARP) Program**
P.I.: Dr. Mark J. Lewis, University of Maryland
SPONSOR: NASA Ames Research Center
RESEARCH: Responsible for aerodynamic analysis and redesign recommendations for the NASA SHARP-L1 configuration for re-entry survivability.
FUNDS: \$67,000
- 1997 – 1998 **TITLE: Waverider-Based Vehicle Design**
P.I.: Dr. Mark J. Lewis, University of Maryland
SPONSOR: Boeing Space Transportation Concepts and Analysis Business Dev. Division
RESEARCH: Developed waverider-based vehicle concepts for a horizontal take-off and landing, rocket powered, boost-glide delivery system. Novel analytical methods were developed for analyzing hypersonic waveriders.

HONORS AND AWARDS

- 2010 **AIAA Best Paper Award 2009/2010 in Hypersonic Air-Breathing Propulsion:**
Starkey, R. P., Liu, D., Chen, P., Sengupta, A., and Rankins, F., “Integrated Aero-Servo-Thermo-Propulso-Elasticity (ASTPE) Methodology for Hypersonic Scramjet Vehicle Design/Analysis”, AIAA-2010-1122.
- 2010 **Invited Participant** to the *National Academy of Engineering* (NAE) 2010 US Frontiers of Engineering (USFOE) Symposium, 22-25 Sept 2010, Armonk, NY. There are a total of only 87 participants including organizers and guest speakers. Invitation is through a competitive nomination and selection process.
- 2010 **DANTE - Demonstration of an Afterburner and Nozzle on a mini-Turbojet Engine:**
 Senior Design team I sponsored was 3rd place winner in the team division, AIAA Region V regional conference, April 2010.
- 2007-2010 **McAnally Faculty Fellow**, University of Colorado, Boulder, CO

- 2008 **AIAA Lawrence Sperry Award:**
 International award for notable achievement by a young person (under 35) in the advancement in aeronautics or astronautics. The citation reads, "*For outstanding contributions in multidisciplinary hypersonic vehicle design and propulsion/airframe integration/optimization for both access to space and hypersonic cruise vehicles, and computational chemistry for combustion and plasma analysis*". Laureates of this prestigious award include notable figures such as Kelly Johnson (famed pioneer of the Lockheed Martin Skunkworks; ranked by Aviation Week and Space Technology as 8th on its list of the top 100 "most important, most interesting, and most influential people" in the first century of aerospace); Scott Crossfield (Astronaut; first man to fly at twice the speed of sound); Eugene Kranz (Apollo 13 Flight Director; Presidential Medal of Freedom winner); and more recently, Sheila Widnall (first woman to head a military service as Secretary of the Air Force).
- 1999 **AIAA Abe M. Zarem Award**
 For distinguished student achievement in aeronautics for the paper entitled, "A Simple Analytical Model for Parametric Studies of Hypersonic Waveriders".
- 1999-2000 **Minta Martin Graduate Student Fellowship**, University of Maryland, College Park, MD
- 1999 **International Conference of the Aeronautical Sciences (ICAS) McCarthy Award Finalist**

PRIMARY GRADUATE STUDENT ADVISOR

Doctor of Philosophy Students:

1. Eric Paulson: 2006 – 2011, passed PhD Comprehensive Exam (Sept. 2008)
TOPIC: Optimization Under Uncertainty for Reusable Launch Vehicles
2. Tim Jung: 2009 – 2012 (estimated), passed PhD Preliminary Exam (Sept. 2010)
TOPIC: Sub-Scale Aircraft Sonic-Boom Testing
AWARDS:
 1. Dean's Fellowship (2009)
3. Nathan Woods: 2008 – 2012 (expected), passed PhD Preliminary Exam (Nov. 2009)
TOPIC: Meshless Unified Coordinate CFD Method
4. Ben Dunham: 2009 – 2013 (expected), passed PhD Preliminary Exam (Sept. 2010)
TOPIC: Quasi-Complex Derivatives for Rapid Optimization
AWARDS:
 1. Smead Fellowship (Aug. 2009)
 2. NSF Graduate Student Fellowship Honorable Mention (2009)
5. Dustin Wood: 2009 – (degree currently on hold for personal reasons)
TOPIC: Mode Transition Control for Turbine-Based Combined-Cycle Engines
AWARDS:
 1. GAANN Fellowship (2009-2010)
 2. AIAA Young Professional Liaison to the Board of Directors (2008-2010)
 3. AIAA Open-Topic Graduate Fellowship for "Turbine-Based Combined-Cycle Engines"

6. Matthew Cannella: 2010 –
TOPIC: Technology Maturation for Auxiliary Spacecraft Propulsion Systems: Evaluation and Modeling of High Thrust to Weight Miniature Auxiliary Rocket Thrusters
AWARDS:
 1. NASA Graduate Student Research Program (GSRP) Fellowship (2010-2011)
7. Sibylle Walter: 2010 –
TOPIC: Scaling Issues for Turbine-Based Combined-Cycle Engines

Master of Science (Thesis) Students:

1. Nathan Calvert: 2005 – 2009 (BS/MS); Currently PhD student in Aerospace Engineering, Princeton
TOPIC: Atmospheric Re-Entry Non-Equilibrium Shock Layer Radiation Heating
AWARDS:
 1. National Science Foundation Graduate Research Fellowship Program (2009-2012)
 2. College of Engineering Graduate of the Year (Dec. 2009)
2. Kevin Basore: 2005-2011 (BS/MS)
TOPIC: Multi-Fidelity Scramjet Chemistry Modeling
3. Greg Rancourt: 2006 – 2012 (BS/MS)
TOPIC: Unmanned Aerial Vehicle Design
4. Steve Gipe: 2006 – 2012 (BS/MS)
TOPIC: Uncertainty Modeling for Scramjet Engines

Master of Science (Non-Thesis) Students:

1. Tara Scarborough: 2008 – 2010; Currently PhD student in Physics, Baylor University
TOPIC: Reduced-Order Modeling Using Grassmann Manifolds
2. Jared Russell: 2006-2011 (BS/MS)
TOPIC: Viscous Carving for Hypersonic Vehicle Design

GRADUATE DEGREE ADVISORY COMMITTEE MEMBER

Doctor of Philosophy Students:

1. Josh Clough, “Integrated Propulsion and Power Modeling for Bimodel Nuclear Thermal Rockets”, University of Maryland, 2007.
2. Adam Dissell, “Departure Phase Aborts for Manned Mars Missions”, University of Maryland, 2007.
3. Joshua Johnson, “Multi-Disciplinary Optimization of Blunt-Body Reentry Configurations”, University of Maryland, 2010”
4. Vijay Ramasubramian, “Busemann Inward Turning Hypersonic Inlets”, University of Maryland, Spring 2011 (expected).
5. Kevin Higdon, “A Systematic Process for Coupling Rapidly Reconfigurable Prototyping and Metamodeling in the Conceptual Design Phase for Human Spacecraft”, University of Colorado, 2011 (expected).
6. Falcon Rankins, “Hypersonic Vehicle Trajectory Modeling”, University of Maryland, 2011 (expected).

Master of Science (Thesis) Students:

1. Marie-Laure Chauffour, "Shock-Based Waverider Design with Pressure Gradient Corrections and Computational Simulations", University of Maryland, 2004
2. Josh Clough, "Modeling and Optimization of Turbine-Based Combined-Cycle Engine Performance", University of Maryland, 2004.
3. Adam Dissel, "Comparative System Analysis of Reusable Rocket and Air-Breathing Launch Vehicles", University of Maryland, 2005.
4. Jesse Colville, "Axisymmetric Inlet Design for Combined Cycle Engines", University of Maryland, 2005.
5. Joshua Johnson, "Multidisciplinary Optimization of Non-Spherical, Blunt-Body Heat Shields for a Planetary Entry Vehicle", University of Maryland, 2006.
6. David Beksinski, "Abort Trajectories for Manned Lunar Missions", University of Maryland, 2007.
7. Jamie Meeroff, "Computational Fluid Dynamic Solutions of Optimized Heat Shield Designs for Earth Entry", University of Maryland, 2010

OTHER ADVISING:

ASEN 4018/4028 Senior Design Customer/Advisor:

Fa09/Sp10 **DANTE:** Demonstration of an **A**fterburner and **N**ozzle on a **T**urbojet Engine

Fa10/Sp11 **BIOMITE:** Biofueled **M**iniature **T**urbojet Engine

Undergraduate Research Assistant (URA):

Su/Fa 2008 **Jason Farmer:** Advanced Geometric Representations for Hypersonic Aircraft Design

Su/Fa 2008 **Cody Humbargar:** Uncertainty Quantification of Scramjet Engine Design Software
Su/Fa 2009

Su/Fa 2008 **Jared Russell:** Rapid Mesh Development for Computational Fluid Dynamics Applications
Su/Fa 2009

Su/Fa 2008 **Joseph Sweeney:** Incorporating Hypersonic Vehicle Design Software Physics Models
Su/Fa 2009 into X-Plane Flight Simulator

Su/Fa 2008 **Ryan Mayerle:** Advanced Trajectory Optimization Using the DAKOTA Toolkit

Su/Fa 2008 **Dan Ambrosio:** User Interface Development for Scramjet Performance Software
Su/Fa 2009

Fa 2008 **Gautham Gopakumar:** Incorporating Hypersonic Vehicle Design Software Geometries
Fa 2009 Into X-Plane Flight Simulator

Su/Fa 2009 **Joe Sweeney/Chris Saro:** Mini-Jet Engine Test Stand Design and Construction

Su/Fa 2010 **Dan Ambrosio/Tyler Thomas/Gautham Gopakumar:** Sierra Nevada Corporation Dream
Chaser Stability Augmentation System Simulator Test and Integration

Engineering Excellence Fund (EEF):

Su09/Fa09 Mini-Jet Engine Test Stand Development
Sp10 DANTE
Fa10 Biomite

Discovery Learning Apprenticeships (DLA):

Fa09/Sp10 **Jared Russell:** Inverse Design of Hypersonic Vehicles Using Viscous Carving
Fa09/Sp10 **Eric Serani:** Aircraft Design and Simulator Flight System

Undergraduate Research Opportunities Program (UROP):

Su 2008 **Jason Farmer:** Advanced Geometric Representations for Hypersonic Aircraft Design
Su 2008 **Cody Humbargar:** Uncertainty Quantification of Scramjet Engine Design Software
Fa09/Sp10 **Dan Ambrosio/Cody Humbargar:** Propulsion Model Uncertainty Quantification and Interface Development
Fa09/Sp10 **Greg Rancourt:** Design Study of a Gas Turbine Engine for a Hybrid Automobile
Fa09 **DANTE**
Fa10/Sp11 **BioMITE**

Summer Undergraduate Research Experience (SURE):

Su 2008 **Gautham Gopakumar:** Incorporating Hypersonic Vehicle Design Software Geometries Into X-Plane Flight Simulator

Graduate Independent Study Students (ASEN 5849):

Fa 2009 **Chris Saro:** Analytical Modeling, Validation, and Optimization of a Turbine Wheel for a Miniature Jet Engine – 3 credit hours
Fa 2009 **Chris van Poolen:** Analytical Modeling, Validation, and Optimization of a Centrifugal Compressor Wheel and Guide Vanes for a Miniature Jet Engine – 3 credit hours
Sp 2011 **Cody Humbargar:** Novel, Passive Variable-Sweep Wing Design for UAVs
Sp 2011 **Jared Russell:** Viscous Carving for Hypersonic Applications

Undergraduate Independent Study Students (ASEN 4849):

Fa 2009 **Kevin Basore:** Multi-Fidelity Modeling of a Generic Diamond Airfoil at Hypersonic Velocities – 3 credit hours

- Fa 2009 **Steve Gipe:** Miniature Turbojet Engine Modeling in Numerical Propulsion Simulation System (NPSS) – 3 credit hours
- Sp 2011 **Jacob Cook:** Supersonic Wind and Flow Imaging Tunnel (SWIFT) Modifications – 3 credit hours

PUBLICATIONS

Professional Publications, Theses, and Dissertation:

1. **Starkey, R. P.**, "Investigation of Air-Breathing, Hypersonic Missile Configurations Within External Box Constraints," UM-AERO 2000-18, *Doctoral Dissertation*, University of Maryland, College Park, MD, October 2000.
2. **Starkey, R. P.**, "A Parametric Study of L/D and Volumetric Efficiency Trade-Offs for Waverider Based Vehicles," UM-AERO 98-01, *Master's Thesis*, University of Maryland, College Park, MD, March 1998.
3. **Starkey, R. P.**, "Crossfield Basal Quartz Frac Analysis," PanCanadian Petroleum, Drilling and Completions Department, September 1995.
4. **Starkey, R. P.**, "Predicting Corrosion Susceptibility with Respect to Liquid Holdup in Pipelines," Shell Canada Limited, Operations – Foothills – Waterton – Engineering Services, August 1994.
5. **Starkey, R. P.**, "Gas Gathering System Temperature Optimization," Shell Canada Limited, Operations – Foothills – Waterton – Engineering Services, August 1994.

Refereed Journal Articles:

1. **Starkey, R. P.**, "A Simple Analytical Model for Parametric Studies of Hypersonic Waveriders," *AIAA Student Journal*, Winter 1999, pages 34-44.
2. **Starkey, R. P.**, and Lewis, M. J., "Simple Analytical Model for Parametric Studies of Hypersonic Waveriders," *AIAA Journal of Spacecraft and Rockets*, Volume 36, Number 4, July-August 1999, pages 516-523.
3. **Starkey, R. P.**, and Lewis, M. J., "Analytical Off-Design Lift-to-Drag Ratio Analysis for Hypersonic Waveriders," *AIAA Journal of Spacecraft and Rockets*, Volume 37, Number 5, September-October 2000, pages 684-691.
4. **Starkey, R. P.**, and Lewis, M. J., "Critical Design Issues for Air-Breathing Hypersonic Waverider Missiles," *AIAA Journal of Spacecraft and Rockets*, Volume 38, Number 4, March 2001, pages 510-519.
5. O'Brien, T. F., **Starkey, R. P.**, and Lewis, M. J., "Quasi-One-Dimensional High-Speed Engine Model with Finite Rate Chemistry," *AIAA Journal of Propulsion and Power*, Vol. 17, Num. 6, Nov.-Dec. 2001, pages 1366-1374.
6. **Starkey, R. P.**, and Lewis, M. J., "Sensitivity of Hydrocarbon Combustion Modeling for Hypersonic Missile Design," *AIAA Journal of Propulsion and Power*, Volume 18, Number 1, January-February 2003, pages 89-97.
7. Johnson, J., **Starkey, R. P.**, Lewis, M. J., "Aerodynamic Stability of Re-Entry Heat Shield Shapes for a Crew Exploration Vehicle," *AIAA Journal of Spacecraft and Rockets*, Volume 43, Number 4, July-August 2006, pages 721-730.
8. Colville, J. R., **Starkey, R. P.**, and Lewis, M. J., "Axisymmetric Inlet Design for Combined-Cycle Engines," *AIAA Journal of Propulsion and Power*, Volume 22, Number 5, September-October 2006, pages 1049-1058.
9. Johnson, J., **Starkey, R. P.**, and Lewis, M. J., "Aerothermodynamic Optimization of Re-Entry Heat Shield Shapes for a Crew Exploration Vehicle," *AIAA Journal of Spacecraft and Rockets*, Vol. 44, No. 4, July-August 2007, pp. 849-859.
10. Armellin, R., Lavagna, M., **Starkey, R. P.**, and Lewis, M. J., "Aero-Gravity Assist Maneuvers: Coupled Trajectory and Vehicle Shape Optimization," *AIAA Journal of Spacecraft and Rockets*, Vol. 44, No. 5, September-October 2007, pp. 1051-1059.

11. Beerman, A., Lewis, M. J., **Starkey, R. P.**, and Cybyk, B., "Significance of Nonequilibrium Surface Interactions in Stardust Return Capsule Ablation Modeling", *AIAA Journal of Thermophysics and Heat Transfer*, Vol. 23, No. 3, July-September, 2009, pp. 425-432.
12. Johnson, J., **Starkey, R. P.**, and Lewis, M. J., "Multi-Objective Optimization of Earth Entry Vehicle Heat Shields", accepted to *AIAA Journal of Spacecraft and Rockets*, Dec. 2010.

Refereed Professional Conference Proceedings:

13. Clough, J. A., **Starkey, R. P.**, Lewis, M. J., and Lavelle, T. M., "Tie Tube Heat Transfer Modeling for Bimodal Nuclear Thermal Rockets," presented at the Space Technology and Applications International Forum, 11-15 February 2007, Albuquerque, NM.

Conference Papers and Proceeding Publications:

1. **Starkey, R. P.**, "A Simple Analytical Model for Parametric Studies of Hypersonic Waveriders," ICAS 98-7,3,1, 31st International Confederation of Aerospace Sciences, 13-18 September 1998, Melbourne, Australia.
2. **Starkey, R. P.**, and Lewis, M. J., "A Simple Analytical Model for Parametric Studies of Hypersonic Waveriders," AIAA-98-1616, 8th AIAA International Space Planes & Hypersonic Systems and Technologies Conference, 27-30 April 1998, Norfolk, VA.
3. **Starkey, R. P.**, and Lewis, M. J., "Design of an Engine - Airframe Integrated Hypersonic Missile Within Fixed Box Constraints," AIAA-99-0509, 37th AIAA Aerospace Sciences Meeting & Exhibit, 11-14 Jan 1999, Reno, NV.
4. **Starkey, R. P.**, and Lewis, M. J., "Aerodynamics of a Box Constrained Waverider Missile Using Multiple Scramjets," AIAA-99-3205, 35th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-24 June 1999, Los Angeles, CA.
5. **Starkey, R. P.**, and Lewis, M. J., "Analytical Off-Design L/D Analysis for Hypersonic Waveriders with Planar Shocks," AIAA-99-2378, 17th AIAA Applied Aerodynamics Conference, 28 June - 1 July 1999, Norfolk, VA.
6. **Starkey, R. P.**, and Lewis, M. J., "Performance of Hypersonic Waverider Missiles Using Multiple Scramjets," AIAA-99-4953, 9th AIAA International Space Planes & Hypersonic Systems and Technologies Conference, 1-4 November 1999, Norfolk, VA.
7. **Starkey, R. P.**, and Lewis, M. J., "Sensitivity of Hydrocarbon Combustion Modeling for Hypersonic Missile Design," AIAA-2000-3312, 36th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 17-19 July 2000, Huntsville, AL.
8. **Starkey, R. P.**, and Lewis, M. J., "A Shock-Expansion Method for Determining Surface Properties on Irregular Geometries," AIAA-2002-0547, 40th AIAA Aerospace Sciences Meeting and Exhibit, 14-17 January 2002, Reno, NV.
9. **Starkey, R. P.**, Lewis, M. J., and Jones, C. H., "Active Flowfield Modification for Plasma Telemetry," ITEA 2002 4-3, 6th International Test & Evaluation Association Instrumentation Conference, 29 April - 1 May 2002, Lancaster, CA.
10. **Starkey, R. P.**, and Lewis, M. J., "Aerodynamic Shaping Effects on Reentry Plasma Sheath Telemetry Blackout," AIAA-2002-5267, 11th AIAA International Space Planes & Hypersonic Systems and Technologies Conference, 29 September - 4 October 2002, Orleans, France.
11. **Starkey, R. P.**, Lewis, M. J., and Jones, C. H., "Plasma Telemetry in Hypersonic Flight," ITC 2002-, 2002 International Telemetering Conference, 21-24 October 2002, San Diego, CA.
12. **Starkey, R. P.**, Reuster, J. G., Lewis, M. J., and Kolodziej, P., "Configurational Analysis of the SHARP-L1 Re-Entry Vehicle," AIAA-2003-1099, 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV.
13. Houlton, D. M., **Starkey, R. P.**, and Lewis, M. J., "Direct Simulation of Ionization Around Power-Law Leading Edges in Rarefied Hypersonic Flow," AIAA-2003-3865, 34th AIAA Plasmadynamics and Lasers Conference, 23-26 June 2003, Orlando, FL.

14. **Starkey, R. P.**, "Electromagnetic Wave/Magnetoactive Plasma Sheath Interaction for Hypersonic Vehicle Telemetry Blackout Analysis," AIAA-2003-4167, 34th AIAA Plasmadynamics and Lasers Conference, 23-26 June 2003, Orlando, FL.
15. **Starkey, R. P.**, Lewis, M. J., and Jones, C. H., "Plasma Sheath Characterization for Telemetry in Hypersonic Flight," ITC-2003-057, 2003 International Telemetering Conference, 20-23 October 2003, Las Vegas, NV.
16. Houlton, D., **Starkey, R. P.**, and Lewis, M. J., "DSMC of Power-Law Leading Edge Ionization for Hypersonic Telemetry Applications," AIAA-2003-6964, 12th AIAA International Space Planes & Hypersonic Systems and Technologies Conference, 15-18 December 2003, Norfolk, VA.
17. **Starkey, R. P.**, "Nonequilibrium Plasma Effects on Telemetry Considerations for Air-Breathing Hypersonic Vehicle Design," AIAA-2004-0333, 42nd AIAA Aerospace Sciences Meeting, 5-8 Jan 2004, Reno, NV.
18. **Starkey, R. P.**, "Scramjet Optimization for Maximum Off-Design Performance," AIAA-2004-3343, 40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 11-14 July 2004, Fort Lauderdale, FL.
19. **Starkey, R. P.**, Rankins, F., and Pines, D. J., "Coupled Waverider/Trajectory Optimization for Hypersonic Cruise," AIAA-2005-0530, 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV.
20. **Starkey, R. P.**, "Design and Optimization of Waverider Based Re-Entry Vehicles," AIAA-2005-3390, 13th International Space Planes and Hypersonic Systems and Technologies Conference, Capua, Italy, 16-20 May 2005.
21. Colville, J., **Starkey, R. P.**, and Lewis, M. J., "Extending the Flight Mach Number of the SR-71 Inlet," AIAA-2005-3284, 13th International Space Planes and Hypersonic Systems and Technologies Conference, Capua, Italy, 16-20 May 2005.
22. **Starkey, R. P.**, "Off-Design Performance Characterization of a Variable Geometry Scramjet," AIAA-2005-3711, 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-13 July 2005, Tucson, AZ.
23. Scott, C., **Starkey, R. P.**, and Lewis, M. J., "Horizontal Launch Vehicle Weight Modeling for Future Lunar Exploration-Class Payloads," AIAA-2005-4368, 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-13 July 2005, Tucson, AZ.
24. Barkmeyer, D., **Starkey, R. P.**, and Lewis, M. J., "Inverse Waverider Design for Inward Turning Inlets," AIAA-2005-3915, 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-13 July 2005, Tucson, AZ.
25. Johnson, J., **Starkey, R. P.**, and Lewis, M. J., "Aerodynamic Stability of Re-Entry Heat Shield Shapes for a Crew Exploration Vehicle," AIAA-2005-4112, 41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-13 July 2005, Tucson, AZ.
26. **Starkey, R. P.**, "Off-design Performance Characterization of a Variable Geometry Scramjet," ISABE-2005-1111, 17th International Symposium on Airbreathing Engines, 4-9 September 2005, Munich, Germany.
27. **Starkey, R. P.**, "Aerodynamic and Aerothermodynamic Design of Blunted Leading-Edge Waverider Vehicles," AIAA-2006-1036, 44th Aerospace Sciences Meeting and Exhibit, 9-12 January 2006, Reno, NV.
28. **Starkey, R. P.**, Rankins, F., and Pines, D. J., "Effects of Hypersonic Cruise Trajectory Optimization Coupled with Airbreathing Vehicle Design," AIAA-2006-0337, 44th Aerospace Sciences Meeting and Exhibit, 9-12 January 2006, Reno, NV.
29. Beksinski, D., **Starkey, R. P.**, and Lewis, M. J., "Characterization of Feasibility, Methods, and Requirements for Lunar Mission Abort Trajectories," AAS 06-117, 16th AAS/AIAA Space Flight Mechanics Meeting, 22-26 January 2006, Tampa, FL.
30. Clough, J. A., **Starkey, R. P.**, Lewis, M. J., and Lavelle, T. M., "Reactor Modeling for Bimodal Nuclear Thermal Rockets," AIAA-2006-4556, 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-12 July 2006, Sacramento, CA.
31. **Starkey, R. P.**, "Design Sensitivities of Scramjets Using Finite Rate Chemistry," AIAA-2006-4612, 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-12 July 2006, Sacramento, CA.

32. Johnson, J. A., **Starkey, R. P.**, and Lewis, M. J., "Aerothermodynamic Optimization of Re-Entry Heat Shield Shapes for a Crew Exploration Vehicle", AIAA-2006-6273, AIAA Atmospheric Flight Mechanics Conference and Exhibit, 21-24 August 2006, Keystone, CO.
33. Armellin, R., Lavagna, M., **Starkey, R. P.**, and Lewis, M. J., "Aero-gravity Assist Maneuvers: Coupled Trajectory and Vehicle Shape Optimization", AIAA-2006-6036, AIAA/AAS Astrodynamics Specialist Conference and Exhibit, 21-24 August 2006, Keystone, CO.
34. **Starkey, R. P.**, Liu, D. D., Baldelli, D. H., Chang, R., and Chen, P. C., "Multidisciplinary Design Optimization of a Hypersonic Air-Breathing Missile", AIAA-2007-1854, 3rd AIAA Multidisciplinary Design Optimization Specialist Conference, 23-26 April 2007, Honolulu, HI.
35. Clough, J. A., **Starkey, R. P.**, Lewis, M. J., and Lavelle, T. M., "Integrated Propulsion and Power Modeling for Bimodal Nuclear Thermal Rockets," AIAA-2007-5623, 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 8-11 July 2007, Cincinnati, OH.
36. Johnson, J. A., **Starkey, R. P.**, and Lewis, M. J., "Multi-Objective Optimization of Planetary Entry Vehicle Heat Shields with Reentry Trajectory Analysis", presented at the 58th International Astronautical Congress, 24-28 September 2007, Hyderabad, India.
37. Ramasubramanian, V., **Starkey, R. P.**, and Lewis, M. J., "Parametric Studies of Streamtraced Busemann Inlets," AIAA-2008-0066, 46th Aerospace Sciences Meeting and Exhibit, 7-10 January 2008, Reno, NV.
38. Beerman, A. F., Lewis, M. J., **Starkey, R. P.**, and Cybyk, B. Z., "Nonequilibrium Surface Interactions Ablation Modeling with the Fully Implicit Ablation and Thermal Response Program," AIAA-2008-1224, presented at the 46th Aerospace Sciences Meeting and Exhibit, 7-10 January 2008, Reno, NV.
39. Kang, B., Tang, S., **Starkey, R. P.**, "Optimal Trajectories of Hypersonic Vehicle for Global Reach", AIAA-2008-2595, presented at the 15th AIAA International Space Planes and Hypersonic Systems and Technologies Conference, Dayton, Ohio, 28 April - 1 May 2008.
40. Johnson, J., Lewis, M., and **Starkey, R. P.**, "Analysis of Optimal Earth Entry Heat Shield/Trajectory Configurations", AIAA-2008-2594, presented at the 15th AIAA International Space Planes and Hypersonic Systems and Technologies Conference, Dayton, Ohio, 28 April - 1 May 2008.
41. **Starkey, R. P.**, Liu, D., Baldelli D., Chang, R., and Chen, P., "Rapid Conceptual Design and Analysis of a Hypersonic Air-Breathing Missile", AIAA-2008-2590, 15th AIAA International Space Planes and Hypersonic Systems and Technologies Conference, Dayton, Ohio, April 28 – 1 May, 2008.
42. Johnson, J., Lewis, M., and **Starkey, R. P.**, "Coupled Entry Heat Shield/Trajectory Optimization for Lunar Return", AIAA-2008-6557, AIAA Atmospheric Flight Mechanics Conference and Exhibit, Honolulu, Hawaii, 18-21 August 2008.
43. Ramasubramanian, V., **Starkey, R.P.**, and Lewis, M., "Numerical Simulations of Busemann Hypersonic Inlets At Finite Flight Angles", AIAA-2008-7497, 26th AIAA Applied Aerodynamics Conference, Honolulu, Hawaii, 18-21 August 2008.
44. Johnson, J., Lewis, M. J., and **Starkey, R. P.**, "Entry Heat Shield Optimization for Mars Return", AIAA-2009-0518, 47th Aerospace Sciences Meeting and Exhibit, 5-8 January 2009, Orlando, FL.
45. **Starkey, R. P.**, "Effect of Chemistry Modeling on Scramjet Engine Design", AIAA-2009-4941, 45th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 2-5 August 2009, Denver, CO.
46. Johnson, J., Lewis, M. J., and **Starkey, R. P.**, "Comparison of Optimal Entry Heat Shield Configurations for Lunar and Mars Return", AIAA-2009-7387, 16th AIAA/DLR/DGLR International Space Planes and Hypersonic Systems and Technologies Conference, Bremen, Germany, 19-22 Oct 2009.
47. Meeroff, J., Lewis, M. J., and **Starkey, R. P.**, "Computational Fluid Dynamic Solutions of Optimized Heat Shield Designs for Earth Entry", AIAA-2009-7388, 16th AIAA/DLR/DGLR International Space Planes and Hypersonic Systems and Technologies Conference, Bremen, Germany, 19-22 Oct 2009.

48. Ramasubramanian, V., Lewis, M. J., and **Starkey, R. P.**, "Performance of Various Truncation Strategies Employed on Hypersonic Busemann Inlets", AIAA-2009-7249, 16th AIAA/DLR/DGLR International Space Planes and Hypersonic Systems and Technologies Conference, Bremen, Germany, 19-22 Oct 2009.
49. **Starkey, R. P.**, Liu, D., Chen, P., Sengupta, A., and Rankins, F., "Integrated Aero-Servo-Thermo-Propulso-Elasticity (ASTPE) Methodology for Hypersonic Scramjet Vehicle Design/Analysis", AIAA-2010-1122, 48th Aerospace Sciences Meeting and Exhibit, 4-7 January 2010, Orlando, FL.
50. **Starkey, R. P.**, "Effect of Chemistry Modeling on Multidisciplinary Hypersonic Vehicle Design", AIAA-2010-3007, 6th AIAA Multidisciplinary Design Optimization Specialist Conference, 12-15 April 2010, Orlando, FL.
51. Paulson, E., and **Starkey, R. P.**, "Epitrochoid Power-Law Nozzle Concept for Reducing Launch Architecture Propulsion Costs", RNTS-1694, presented at the JANNAF Joint Propulsion Meeting, Dec 2010, Colorado Springs, CO.
52. Jung, T., **Starkey, R. P.**, and Argrow, B. "Feasibility Study of Using a Small-Scale UAV for Sonic Boom Minimization Research", AIAA-2011-1280, 48th Aerospace Sciences Meeting and Exhibit, 4-7 January 2011, Orlando, FL.
53. Paulson, E., and **Starkey, R. P.**, "Methodology for Variable Fidelity Multistage Optimization Under Uncertainty", to be presented at the 13th AIAA Non-Deterministic Approaches Conference, 4-7 April 2011, Denver, CO.
54. Paulson, E., and **Starkey, R. P.**, "Comparison of Variable Fidelity Simulations of NASA Dual-Bell Altitude Compensating Nozzle Cold Flow Test", to be presented at the May 2011 JANNAF JPM/MSS/LPS/SPS Joint Subcommittee Meeting.
55. Jung, T., **Starkey, R. P.**, and Argrow, B., "Frozen Sonic Booms Revisited", to be presented at the 17th AIAA/CEAS Aeroacoustics Conference, 6-8 June 2011, Portland, OR.
56. Woods, N., and **Starkey, R. P.**, "Unified Coordinate CFD Method", to be presented at the 20th AIAA Computational Fluid Dynamics Conference, 27-30 June 2011, Honolulu, HI.
57. Woods, N., and **Starkey, R. P.**, "Dual-Mode Scramjet Isolator Design Using the Unified Coordinate System", to be presented at the 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 1-3 August 2011, San Diego, CA.

Invited Lectures

1. Workshop on Communication Through Plasma During Hypersonic Flight for the Air Force Office of Scientific Research, Office of the Air Force Chief Scientist, and the Air Force Flight Test Center, "Aerodynamic Shaping Effects on Hypersonic Plasma Telemetry", 29 Aug 2006.
2. The University of Kansas, "Multi-Disciplinary Analysis and Design Optimization of Air-Breathing Hypersonic Vehicles", 30 March 2007.
3. Virginia Polytechnic Institute and State University, "Multi-Disciplinary Analysis and Design Optimization of Air-Breathing Hypersonic Vehicles", 4 April 2007.
4. University of Colorado, Boulder "Multi-Disciplinary Analysis and Design Optimization of Air-Breathing Hypersonic Vehicles", 11 April 2007.
5. University of Tennessee, Knoxville, "Multi-Disciplinary Analysis and Design Optimization of Air-Breathing Hypersonic Vehicles", 1 May 2007.
6. United States Air Force Academy – Department of Aeronautics, Colorado Springs, CO, "Supersonic, Hypersonic, and High-Speed Propulsion Research at CU", 1 Nov 2010.

TEACHING EXPERIENCE

University of Colorado - ASEN:

- 2004 **Introduction to Aerospace Vehicle Design and Performance:** (Sp08/Sp09/Sp10) A 5-credit hour required sophomore course in which I cover the aircraft design half of the course. (~80 students/yr, 3-hrs lecture and 4-hrs lab per week, 2 lab sections)
- 4018/4028 **Senior Design Sequence:**
1. Project Advisory Board (Fa07/Sp08) for the Mach-SR1 Hybrid Rocket and the Design-Build-Fly Aircraft teams (9 students each).
 2. Project customer and advisor (Fa09/Sp10) for **DANTE: Demonstration of an Afterburner and Nozzle on a Turbojet Engine** project (8 students).
 3. Project customer and advisor (Fa10/Sp11) for **BIOMITE: Biofueled Miniature Turbojet Engine** project (9 students).
- 6013 **High-Speed Propulsion:** (Fa08/Fa10) An advanced graduate course developed from scratch covering all aspects of mission design, propulsion system design, and engine/airframe integration for all types of air-breathing and rockets engines. Offered through CAETE Fall 2010. NOTE: Originally offered as ASEN 5519-004. (~15 students/yr)
- 5018/6028 **Graduate Projects:**
1. Project customer and advisor (Sp09/Fa09/Sp10) for **GOJETT: Graduate Organization Jet Engine Technology Team**. NOTE: Originally offered as ASEN 5519-040, 5519-071/6519-081, and 5519-051 respectively. (8-10 students/semester)
 2. Project customer and advisor (Fa10/Sp11) for **GOJETT-2: Graduate Organization Jet Engine Technology Team, Supersonic Unmanned Aerial Vehicle** project. (11-12 students/semester)
 3. Voluntary (uncredited) project advisor (Fa10/Sp11) for **HySOR: Hybrid Sounding Rocket** project. (8-9 students/semester)

University of Maryland – ENAE:

- 662 **Advanced Propulsion:** (Fa04/Fa06) An advanced graduate course offered both on campus and through the National Institute of Aerospace (NIA) at NASA Langley.
- 202 **Introduction to Programming:** (Sp02) Required sophomore programming course on Matlab, C++, and numerical methods. Taught a lab section.

PROFESSIONAL DEVELOPMENT

1. Leadership Education for Advancement and Promotion (LEAP) Introductory Leadership Workshop, 19-21 May 2008.
2. Faculty Teaching Excellence Program (FTEP) Class Survey ASEN 5519-004, Fall 2008.

OUTREACH

1. Lecture to Tilden Middle School, MD (2006) about Aerospace Engineering profession.
2. Lecture to Tuskegee Airmen's Mile High Flight Club Visit (23 Feb 2008) – a group of about 60 high-school minority students interested in Aerospace Engineering and their parents.

UNIVERSITY SERVICE

- 2007-2008 1. ASEN Fluids Faculty Search Committee Member
- 2008-2009 1. ASEN Graduate Committee Member (chair of ME/MS program restructuring subcommittee)
2. ASEN Marketing Committee
- 2009-2010 1. ASEN Graduate Committee Member (chair of ME/MS program restructuring subcommittee)
2. Author of proposal to restructure the department TA, RA, and CA offers and funding.
3. ASEN ABET Committee Member
- 2010-2011 1. ASEN ABET Committee Member

PROFESSIONAL SERVICE

Affiliations

1. Associate Fellow, Lifetime Member, American Institute of Aeronautics and Astronautics (AIAA)
2. Member, Association for Unmanned Vehicle System International (AUVSI)

Journal/Conference Paper Reviews

1. AIAA Journal of Propulsion and Power
2. AIAA Journal of Spacecraft and Rockets
3. AIAA Journal of Aircraft
4. AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit Air-Breathing Propulsion papers and session arrangements.
5. AIAA Aerospace Sciences Air-Breathing Propulsion papers and session arrangements.
6. AIAA Hypersonic Technologies and Aerospace Planes conference papers and session arrangements.
7. Judge for AIAA Air-Breathing Propulsion Technical Committee undergraduate student design competition, "Air-Breathing Propulsion for Access to Space Reusable Launch Vehicle," 2003.

Committees

- 2003- Member, *AIAA Hypersonic Technologies and Aerospace Planes Program Committee* (HyTASP PC)
1. 2004-2010, AIAA/ASME/SAE/ASEE Joint Propulsion Conference (JPC) Technical Area Organizer
 - a. 2006-2008: 2008 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer
 - b. 2007-2009: 2009 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer
 - c. 2008-2010: 2010 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer
- 2008- Member, *AIAA High-Speed Air-Breathing Propulsion Technical Committee* (HSABP TC)
1. 2010-2012, Vice-Chair
 2. 2008-2010, AIAA/ASME/SAE/ASEE Joint Propulsion Conference (JPC), Air-Breathing Propulsion Group Lead (High-Speed Air-Breathing Propulsion TC, Gas Turbine Propulsion TC, Air-Breathing Propulsion Systems Integration TC)

3. 2008-2010, AIAA/ASME/SAE/ASEE Joint Propulsion Conference (JPC) Technical Area Organizer
 - a. 2006-2008: 2008 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer
 - b. 2007-2009: 2009 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer
 - a. 2008-2010: 2010 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer

2002-2008 Member, *AIAA Air-Breathing Propulsion Technical Committee (ABPTC)*

1. 2004-2008, AIAA/ASME/SAE/ASEE Joint Propulsion Conference (JPC) Organizing Committee Chair
 - a. 2004-2006: 2006 AIAA/ASME/SAE/ASEE JPC Technical Area Organizer

Sessions Chaired

1. 2003 International Space Planes and Hypersonic Systems and Technologies Conference, "*Hypersonic Nozzle Design.*"
2. 2004 AIAA Aerospace Sciences Meeting and Exhibit, "*Inlet/Nozzle & Jet Flows.*"
3. 2004 AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, "*Propulsion System Development II.*"
4. 2005 AIAA Aerospace Sciences Meeting and Exhibit, "*Hypersonic Propulsion – Experimental.*"
5. 2005 AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, "*Novel Pulse and High Speed Engine Concepts.*"
6. 2006 AIAA Aerospace Sciences Meeting and Exhibit, "*Air Breathing Propulsion for High Speed Flight.*"
7. 2008 AIAA Aerospace Sciences Meeting and Exhibit, "*High-Speed Propulsion III.*"
8. 2008 International Space Planes and Hypersonic Systems and Technologies Conference, "*High-Speed Vehicle Design III*"
9. 2009 AIAA Aerospace Sciences Meeting and Exhibit
10. 2009 AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit
11. 2010 AIAA Aerospace Sciences Meeting and Exhibit
12. 2010 AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit
13. 2011 AIAA Aerospace Sciences Meeting, Invited Panel Session, "*Progress in TBCC Inlet Technology*"