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# **Air Force Institute of Technology**

## **Research Report 2019**

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Graduate School of Engineering and Management

**GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT**  
**AIR FORCE INSTITUTE OF TECHNOLOGY**  
**WRIGHT-PATTERSON AIR FORCE BASE, OHIO**

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# AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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## Air Force Institute of Technology Research Report 2019 Foreword

The Air Force Institute of Technology (AFIT) actively aligns our faculty and student research activities with national defense priorities to deliver dual purpose results: valuable educational experiences to enhance our graduates' performance throughout their careers, and innovative solutions of importance to our sponsors. AFIT works closely with research sponsors from many Air Force and DOD organizations to identify high interest problems that match our faculty expertise and educational requirements to maximize value.

AFIT initiated the new Nuclear Events Analysis and Testing Center in 2019 to contribute to nuclear modernization priorities and build upon our 60+ years of nuclear programming. AFIT's Autonomy and Navigation Technology Center, Center for Cyberspace Research, Center for Directed Energy, Center for Operational Analysis, Center for Technical Intelligence Studies and Research, Center for Space Research and Assurance and other research groups continue to serve as focal points for many of our research initiatives. Emerging research groups are addressing game-changing technologies including hypersonics, human-machine systems, data sciences, and developing defense-related additive manufacturing applications. AFIT advises over 40 major acquisition programs through the Scientific Test & Analysis Techniques Test & Evaluation Center of Excellence to achieve maximum effectiveness of test resources. New consultation efforts include exploration of multi-domain approaches to the Air Force's core missions.

AFIT has strategic partnerships with the Air Force Research Laboratory, the National Air and Space Intelligence Center, the Air Force Life Cycle Management Center, the United States Transportation Command, and many other organizations and operational communities to maximize the contributions of our research programs to national defense needs. Our faculty and students also engage in collaborations with researchers at universities throughout the nation to advance the state-of-the-art in a variety of disciplines. AFIT cooperates with commercial enterprises to ensure timely transfer of new technology to US industry through Cooperative Research and Development Agreements (CRADAs).

AFIT welcomes new opportunities to engage in research projects that are of mutual interest to our customers, faculty, and students. Additional information is available at <http://www.afit.edu/ENR/>.

**Heidi R. Ries, Ph.D.**  
**Dean for Research**  
**Graduate School of Engineering**  
**and Management**



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# 1. INTRODUCTION

## 1.1 OVERVIEW

This Research Report presents the FY19 research statistics and contributions of the Graduate School of Engineering and Management (EN) at AFIT. AFIT research interests and faculty expertise cover a broad spectrum of technical areas related to USAF needs, as reflected by the range of topics addressed in the faculty and student publications listed in this report. In most cases, the research work reported herein is directly sponsored by one or more USAF or DOD agencies.

AFIT welcomes the opportunity to conduct research on additional topics of interest to the USAF, DOD, and other federal organizations when adequate manpower and financial resources are available and/or provided by a sponsor. In addition, AFIT provides research collaboration and technology transfer benefits to the public through Cooperative Research and Development Agreements (CRADAs). Interested individuals may discuss ideas for new research collaborations, potential CRADAs, or research proposals with individual faculty using the contact information in this document or via the AFIT Directory at <https://www.afit.edu/BIOS/>.

Additional information on the research programs at AFIT may also be found on the research web home page at <http://www.afit.edu/ENR/>. The Office of Research and Sponsored Programs, Graduate School of Engineering and Management can be reached at 937-255-3633, (DSN 785-3633) or by Email: [research@afit.edu](mailto:research@afit.edu). The primary points of contact are Ms. Bobbie J. Bowling, the Director of Sponsored Programs, 937-255-3636 x4396, DSN 785-3636 x4396 and Dr. Heidi R. Ries, Dean for Research, 937-255-3636 x4544, DSN 785-3636 x4544.

## 1.2 THE GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT RESEARCH COLLABORATION

As detailed in the 2019-2020 catalog at <https://www.afit.edu/ENER/doclib.cfm?dl=31>, AFIT offers Master's and Doctoral programs in a variety of disciplines through six departments: Department of Aeronautics and Astronautics (ENY), Department of Electrical and Computer Engineering (ENG), Department of Engineering Physics (ENP), Department of Mathematics and Statistics (ENC), Department of Operational Sciences (ENS), and Department of Systems Engineering and Management (ENV). In all of these disciplines, research is an integral component of graduate education, developing an individual student's skills and providing new knowledge of interest to many.

A brief listing of each department's research areas of emphasis appears below. Please contact the faculty or relevant departmental office for further information, or visit the Graduate School of Engineering and Management departmental websites at <http://www.afit.edu/en/>.

The [Department of Aeronautics and Astronautics](#), as well as its resident **Center for Space Research & Assurance**, invites research topic proposals and collaborative suggestions for the Aeronautical Engineering, Astronautical Engineering, Materials Science, and Space Systems programs. The following list highlights the Department's research specialties:

- Aeroelasticity and Design Optimization**
- Aerospace Structures and Materials**
- Aircraft Survivability**
- Autonomous Control of UAVs**
- Compact Combustor Development**
- Computational Fluid Dynamics**
- Control of High Performance Aircraft**
- Dynamic Flight Simulation**
- Experimental Fluid Dynamics**
- High Velocity Impact**
- Impact Dynamics**
- Inflatable Space Structures**
- Materials and Structural Analysis**

- Mechanics of Materials and Structures**
- Micro Air Vehicles**
- Non-Linear Dynamics**
- Re-entry Dynamics**
- Rocket & Space Propulsion**
- Rotocraft Aeromechanics**
- Satellite Cluster Dynamics, Navigation, & Control**
- Spacecraft Dynamics & Control**
- Spacecraft/Sensor Integration and Testing**
- Thermal Control of Spacecraft**
- Turbine Heat Transfer**
- Weapon Aerodynamics**

The [Department of Electrical and Computer Engineering](#), as well as its resident **Autonomy and Navigation Technology Center** and **Center for Cyberspace Research**, invites research topic proposals and collaborative suggestions for the Electrical Engineering, Computer Engineering, Computer Science, Cyber Operations, and Cyber Warfare programs. The following list highlights the Department's research specialties:

- |  |  |
|--|--|
| <b>Advanced Security-Focused Computing Architectures</b> | <b>Evolutionary Algorithms</b>             |
| <b>Artificial Intelligence</b>                           | <b>Guidance, Navigation, and Control</b>   |
| <b>Automatic Target Recognition</b>                      | <b>Hardware Assurance</b>                  |
| <b>Communications/Radar</b>                              | <b>Information Visualization</b>           |
| <b>Computer Communication Networks</b>                   | <b>Micro-and Nano-Systems</b>              |
| <b>Cryptography</b>                                      | <b>Navigation Warfare</b>                  |
| <b>Cyber Operations and Security</b>                     | <b>Parallel and Distributed Processing</b> |
| <b>Electromagnetics/Low Observables</b>                  | <b>Signal and Image Processing</b>         |
| <b>Electro-Optics</b>                                    | <b>Software Protection</b>                 |
| <b>Electronic Warfare</b>                                | <b>Wireless Networks</b>                   |
|  | <b>Wireless Sensor Networks</b>            |

The [Department of Engineering Physics](#), as well as its resident **Center for Directed Energy** and **Center for Technical Intelligence Studies and Research**, invites research topic proposals and collaborative suggestions for the Applied Physics, Nuclear Engineering, Optical Sciences and Engineering, Materials Science (jointly operated with the Department of Aeronautics and Astronautics), and Combating Weapons of Mass Destruction programs. The following list highlights the Department's research specialties within these programs:

- |   |   |
|---|---|
| <b>Adaptive Optics, Aero-Optics and Beam Control</b>  | <b>Nanomechanics</b>                                  |
| <b>Atmospheric Characterization and Compensation</b>  | <b>Nuclear Forensics</b>                              |
| <b>Atmospheric Effects on Weapons Systems</b>         | <b>Nuclear Survivability</b>                          |
| <b>Computational Physics</b>                          | <b>Nuclear Weapons Effects</b>                        |
| <b>Defects in Crystalline Solids</b>                  | <b>Positron Spectrometry</b>                          |
| <b>Directed Energy Weapons Effectiveness</b>          | <b>Radiation and Particle Detection</b>               |
| <b>Imaging Science</b>                                | <b>Radiation Effects on Materials and Electronics</b> |
| <b>Lasers and Electro-Optics</b>                      | <b>Radiation Transport</b>                            |
| <b>Microscopic Imaging of Surfaces</b>                | <b>Remote Sensing and Signature Analysis</b>          |
| <b>Modeling and Simulation of Atmospheric Effects</b> | <b>Satellite Meteorology</b>                          |
| <b>Molecular Reaction Dynamics</b>                    | <b>Semiconductors</b>                                 |
| <b>Nanomaterials</b>                                  | <b>Space Physics</b>                                  |

The [Department of Mathematics and Statistics](#) invites research topic proposals and collaborative suggestions for the following research specialties:

- |                                  |                                       |
|----------------------------------|---------------------------------------|
| <b>Acoustic Wave Scattering</b>  | <b>Network Analysis</b>               |
| <b>Bayesian Analysis</b>         | <b>Nonlinear Waves</b>                |
| <b>Biostatistics</b>             | <b>Numerical Analysis</b>             |
| <b>Categorical Data Analysis</b> | <b>Optimization</b>                   |
| <b>Control Theory</b>            | <b>Partial Differential Equations</b> |
| <b>Data Analytics</b>            | <b>Rarefied Gas Dynamics</b>          |
| <b>Design of Experiments</b>     | <b>Regression Modeling</b>            |
| <b>Electromagnetics</b>          | <b>Stochastic Processes</b>           |
| <b>Fluid Dynamics</b>            | <b>Structural Health Monitoring</b>   |
| <b>Human Performance</b>         | <b>Wavelets</b>                       |
| <b>Information Fusion</b>        |                                       |

The [Department of Operational Sciences](#), as well as its resident **Center for Operational Analysis**, invites research topic proposals and collaborative suggestions within the areas of Operations Research, Logistics, and Supply Chain Management programs. The following list highlights the Department's research specialties:

- |  |   |
|--|---|
| <b>Agile Combat Support Prioritization</b> | <b>Autonomous System Operations and Testing</b> |
| <b>Automatic Target Recognition</b>        | <b>Big Data and Analytics</b>                   |

**Combat Modeling**  
**Decision Analysis**  
**Design and Analysis of Experiments**  
**Enterprise Level Depot Sustainment**  
**Evaluation of Autonomous Systems**  
**Facility Location Optimization**  
**Force Structure Analysis Tool Development**  
**Information Modeling**  
**Inventory Analysis**  
**Irregular Warfare**  
**Irregular Warfare Model Development**  
**Lean Operations**  
**Logistics**  
**Machine Learning**  
**Maintenance and Production Management**  
**Managerial Economics**  
**Manpower Modeling and Forecasting**  
**Materials Research Test Planning**  
**Mathematical Programming**  
**Modeling and Simulation**  
**Network Analysis**  
**Neural Networks**

**Operations Management**  
**Operations Research**  
**Optimization**  
**Organization Behavior**  
**Petroleum Management**  
**Repair Network Integration**  
**Robust Decision Making**  
**Robust Design**  
**Robust Mobility Modeling**  
**Scheduling**  
**Service Operations Management**  
**Social Network Modeling and Analysis**  
**Statistical Process Monitoring**  
**Stochastic Modeling**  
**Strategic Sourcing**  
**Supply Chain Management and Resource  
Optimization**  
**Test and Evaluation**  
**Test Science**  
**Time Series Analysis**  
**Transportation Policy and Strategic Modeling**

The [Department of Systems Engineering and Management](#) is a multidisciplinary department offering graduate degrees in seven different majors and conducting research in collaboration with the wide spectrum of programs throughout AFIT. The mission of the Department is to provide defense-focused graduate education and engage in interdisciplinary research to achieve integrated solutions to current and future Air Force challenges and enhance the interface between technology and human resources by focusing on systems, processes, and management. The following list highlights the Department's research specialties:

**Acquisition Learning Curves**  
**Applied Environmental Sciences**  
**Built Environment Microbiome**  
**Computer and Network Security**  
**Construction Management**  
**Cost Analysis**  
**Cyber Attack on UAS**  
**Data Analytics**  
**Design and Analysis of Experiments**  
**Ecological Engineering**  
**Emergency Management**  
**Facility and Infrastructure Management**  
**Fuels Microbiology**  
**Geographical Information Science**  
**Human Systems Integration**  
**Human-Agent Interaction**  
**Image and Display Science**  
**Indoor Air Quality**  
**Information Assurance and Security**  
**Infrastructure Asset Management**  
**Knowledge Management**  
**Model-Based Systems Engineering**  
**Modeling and Simulation**

**Neck and Injury Biomechanics**  
**Occupational/Environmental  
Operations Research**  
**Permafrost**  
**Photovoltaics**  
**Physiologically-Based Pharmacokinetic  
Modeling Analysis**  
**Product Design and Development**  
**Project Management**  
**Project Delivery**  
**Reliability Engineering**  
**Strategic Decision Support**  
**Structural Health Monitoring**  
**Structural Performance**  
**Surface Science**  
**Sustainability and Life Cycle Assessment**  
**System Architecture**  
**Systems Engineering**  
**Unmanned Air System Design and Test  
Vigilance**  
**Water Quality**  
**Waste-to-Energy Conversion Modeling**

Another avenue for educational and research collaboration with the Graduate School of Engineering and Management is through association with one or more of AFIT's Research Centers. A brief listing of each Center's research or educational areas of emphasis appears below. Please contact the Centers directly (see Chapter 6) or visit <http://www.afit.edu/ENR/page.cfm> for further information.

The [Autonomy and Navigation Technology \(ANT\) Center](#) is a forward-looking research center seeking to identify and solve tomorrow's most challenging navigation and autonomous and cooperative control problems by focusing on three research thrusts: autonomous and cooperative systems, non-GPS precision navigation, and robust GPS navigation/NAVWAR.

The [Center for Cyberspace Research \(CCR\)](#) conducts cyber security and cyber operations research at the Master's and PhD levels. CCR affiliated faculty teach and direct graduate research focusing on understanding and developing advanced cyber-related theories and technologies, such as critical infrastructure protection, cyber-physical systems, network intrusion detection and avoidance, insider threat mitigation, cyberspace situational awareness, malicious software detection and analysis, software protection, and anti-tamper technologies. The CCR is forward-looking and responsive to the changing educational and research needs of the Air Force, Department of Defense, and the federal government. CCR faculty's research and teaching establishes AFIT as a national Center of Academic Excellence in Research (CAE-R) and Center of Academic Excellence in Cyber Operations (CAE-CO), designated by the Department of Homeland Security (DHS) and the National Security Agency (NSA).

The [Center for Directed Energy \(CDE\)](#) is dedicated to Air Force and DOD research in high energy lasers (HELs), high power microwaves (HPMs), and their enabling technologies. The Center is an advocate for transitioning these systems to the battlefield through vigorous scientific and engineering research, graduate education programs and diverse consulting activities.

The [Center for Operational Analysis \(COA\)](#) conducts defense-focused research which directly supports DOD strategic objectives. The COA applies rigorous quantitative and qualitative tools, methodologies and approaches to identify, analyze and solve complex operations and supply chain problems while developing critical and forward-thinking analysts, managers, and leaders.

The [Center for Space Research and Assurance \(CSRA\)](#) is focused on delivering highly-valued resilient, responsive and reliable space capabilities to the DOD and Intelligence Community through executing cutting-edge space technology development, science and space experiments in collaboration with government organizations, to meet the challenges of tomorrow by developing the technical space cadre through world-class research and immersive hands-on graduate education.

The [Center for Technical Intelligence Studies and Research \(CTISR\)](#) is focused on Air Force, DOD and Intelligence Community's scientific, technical and operational activities through graduate research programs. Activities are directed on improving technical intelligence gathering via remote sensing. Current research is focused on signature measurement, phenomenological understanding, and algorithm development for target detection and tracking, battle space combustion characterization, event classification, and material identification.

The [Center of Excellence \(COE\) for Scientific Test and Analysis Techniques \(STAT\) in Test & Evaluation \(T&E\)](#) is a reach-back T&E capability that provides advice and assistance in the application of scientific test and analysis techniques in the development of Test & Evaluation Master Plans (TEMP). The COE provides value to the PEOs/PMs across the DOD through assistance provided to the Chief Developmental Tester (T&E Program Leads) during the T&E planning, execution and assessment. The COE provides an additional resource of subject matter expertise for the program managers and chief developmental testers of Major Defense Acquisition Programs (MDAP) and Major Automated Information Systems (MAIS) during the T&E planning, execution, and assessment process.

The [Nuclear Expertise for Advancing Technologies \(NEAT\) Center](#) is a new AFIT center established on 1 May 2019. The NEAT Center's mission is to provide the nation with relevant expertise to address emergent and future nuclear warfighting capabilities across all domains. The NEAT Center will be the first place organizations turn to when they require intellectual capital, knowledge, or assistance in solving technical nuclear acquisition and warfighting challenges. The NEAT Center's vision is to be the recognized center for the development of competent and knowledgeable technical expertise and innovative research in support of present and future strategic operations.

## 2. SPECIAL RECOGNITIONS

### 2.1 FACULTY FELLOWS

**COLLINS, PETER J.**, Professor of Electrical Engineering, Department of Electrical and Computer Engineering  
Fellow of Antenna Measurement and Techniques Association

**DECKRO, RICHARD F.**, Distinguished Professor of Operations Research, Department of Operational Sciences  
Fellow of the Military Operations Research Society

**\*ELROD, WILLIAM E.**, Professor Emeritus of Aerospace Engineering, Department of Aeronautics and  
Astronautics, Fellow of the American Society of Mechanical Engineers International

**\*FRANKE, MILTON E.**, Professor Emeritus of Aerospace Engineering, Department of Aeronautics and  
Astronautics, Fellow of the American Society of Mechanical Engineers

**GRMAILA, MICHAEL R.**, Professor and Head, Department of Systems Engineering and Management, Fellow of  
the Information System Security Association.

**\*HENGEHOLD, ROBERT L.**, Professor Emeritus of Physics, Department of Engineering Physics, Fellow of the  
American Physical Society

**HILL, RAYMOND R.**, Professor of Operations Research, Department of Operational Sciences; Program Chair,  
Operations Research Doctoral Program, Fellow of Eastern Connecticut State University

**\*HOUPIS, CONSTANTINE H.**, Professor Emeritus of Electrical Engineering, Department of Electrical and  
Computer Engineering, Professional Engineer (State of Ohio), Fellow of the Institute of Electrical and Electronic  
Engineers

**\*MAYBECK, PETER S.**, Professor Emeritus of Electrical Engineering, Department of Electrical and Computer  
Engineering, Fellow of the Institute of Electrical and Electronic Engineers

**PACHTER, MEIR**, Professor of Electrical Engineering, Department of Electrical and Computer Engineering, Fellow  
of the Institute of Electrical and Electronic Engineers.

**PALAZOTTO, ANTHONY N.**, Distinguished Professor, Aerospace Engineering, Department of Aeronautics and  
Astronautics, Fellow of the American Institute of Aeronautics and Astronautics, Fellow of the American Academy of  
Mechanics, Fellow of the American Society of Civil Engineers, Fellow of the Engineering Mechanics Institute

**PERRAM, GLEN P.**, Professor of Physics, Department of Engineering Physics, Fellow of the Optical Society  
of America, Fellow of the Directed Energy Professional Society

**PIGNATIELLO, JOSEPH J.**, Professor of Operations Research, Head, Department of Operational Sciences, Fellow  
of the Institute of Industrial Engineers, Fellow of the American Society for Quality

**POLANKA, MARC D.**, Professor of Aerospace Engineering, Department of Aeronautics and Astronautics  
Fellow of the American Society of Mechanical Engineers International

**RUGGLES-WRENN, MARINA B.**, Professor of Aerospace Engineering, Department of Aeronautics and  
Astronautics, Fellow of the American Society of Mechanical Engineers International

**TERZUOLI, ANDREW J.**, Associate Professor of Electrical Engineering, Department of Electrical and Computer  
Engineering, Fellow of the Electromagnetics Academy

**\*TORVIK, PETER J.**, Professor Emeritus of Aerospace Engineering and Engineering Mechanics, Department of  
Aeronautics and Astronautics, Fellow of the American Institute of Aeronautics and Astronautics, Life Fellow of the  
American Society of Mechanical Engineers International, Fellow of the Ohio Academy of Science

**WEIR, JEFFERY W.**, Professor of Operations Research, Associate Department Head, Department of Operational

Sciences, Fellow of the Southwestern Ohio Council for Higher Education. America, Fellow of the Directed Energy Professional Society

\*Emeritus faculty

## **2.2 PROFESSIONAL CERTIFICATIONS**

**AHNER, DARRYL K.**, Professional Engineer (Commonwealth of Virginia)

**ANDERSON, JASON R.**, MIT Leadership Academy for Engineering and Science Research Certification

**BADIRU, ADEDEJI B.**, Certified Project Management Professional (PMP), Leadership Certificate (University of Tennessee Leadership Institute), Professional Engineer (State of Oklahoma)

**BURGI, KENNETH W., Lt Col**, (FAA) Airline Transport Pilot – Multiengine Land, Certified Flight Instructor Multiengine Land, Instrument, Commercial Pilot – Single Engine Land, Instrument, (APDP) Program Manager–Level 1 Certified, System Planning, Research, Development and Engineering–Level 1 Certified, Test and Evaluation–Level 1 Certified

**BUTLER, SAMUEL D., Lt Col**, Systems, Planning, Research, Development and Engineering Systems Engineer–Level 2 Certified

**COOPER, CASEY W.**, Certified Industrial Hygienist

**DELORIT, JUSTIN D., Maj**, Professional Engineer (State of Ohio), Registered Environmental Professional

**DEXTER, MICHAEL L., Lt Col**, (APDP) Engineer–Level 3 Certified; Program Manager–Level 1 Certified, Science and Technology Manager–Level 1 Certified

**ENINGER, ROBERT M., Lt Col**, Certified Industrial Hygienist

**FASS, ROBERT D.**, Certified Cost Estimator/Analyst (International Cost Estimating and Analysis Association)

**FREELS, JASON K., Maj**, Systems Planning, Research, Development and Engineering (SPRDE) Certification, Level III

\***GOLTZ, MARK N.**, Board Certified Environmental Engineer (American Academy of Environmental Engineers), Professional Engineer (State of Minnesota)

**GRMAILA, MICHAEL R.**, Certified Information Security Manager (CISM), Information Systems Audit and Control Association (ISACA), Certified Information Systems Security Professional (CISSP), International Information Systems Security Certification Consortium, Inc. (ISC), National Security Agency INFOSEC Assessment Methodology (IAM) Certification, National Security Agency (INFOSEC), Evaluation Methodology (IEM) Certification, National Security Agency 4011/4012/4013 Certification

**GREENDYKE, ROBERT B.**, Professional Engineer (State of Texas)

**HARPER WILLIE F., Jr.**, Professional Engineer (State of Arizona)

\***HOUPIS, CONSTANTINE H.**, Professional Engineer (State of Ohio)

**KEMPISTY, DAVID Lt Col**, Professional Engineer (State of Michigan)

**KUNZ, DONALD L.**, Professional Engineer (Commonwealth of Virginia)

**LOPER, ROBERT D.**, APDP Level II Certification–SPRDE, APDP Level II Certification–S&T Management, APDP Level I Certification–Program Management

**MARCINIAK, MICHAEL A.,** APDP Level II Certification–SPRDE, APDP Level II Certification–Program Management, APDP Level I Certification–Test and Evaluation, Certified Laser Safety Officer (Board of Laser Safety, Orlando, FL)

**MAYBECK, PETER S.,** Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, Fellow of the Institute of Electrical and Electronic Engineers

**MAILLOUX, LOGAN O., Maj,** Certified Information Systems Security Professional (CISSP), Certified Systems Engineering Professional (CSEP)

**MBONIMPA, ERIC G.,** Professional Engineer (State of Michigan)

**MULLINS, BARRY E.,** Professional Engineer (State of Colorado), Certified SCADA Security Architect (CSSA), National Security Agency INFOSEC Evaluation Methodology (IEM), National Security Agency INFOSEC Assessment Methodology (IAM)

**PARR, JEFFREY C., Lt Col,** Systems Planning, Research, Development and Engineering (SPRDE) Certification, Level III.

**\*QUINN, DENNIS W.,** Professional Engineer, State of Ohio

**REEDER, MARK F.,** Professional Engineer (State of Ohio)

**REITH, MARK G.,** Certified Information Systems Security Professional (CISSP), Certified Ethical Hacker (CEH)

**RITSCHER, JONATHAN, Lt Col,** APDP Business-Cost Estimation Certification, Level II.

**RUTLEDGE, JAMES L., LT COL,** Professional Engineer (State of Texas)

**SHATTAN, MICHAEL B., LTC,** Professional Engineer (State of Virginia)

**SHELLEY, MICHAEL L.,** Certified Air Force Hearing Conservationist

**SLAGLEY, JEREMY M.,** Board Certified Industrial Hygienist, Board Certified Safety Professional

**STEWART, BRYAN J.,** Space Professional Development Program–Level 2 Certified

**TUTTLE, RONALD F.,** APDP Level III Certification–Program Management, APDP Level III Certification–SPRDE

**VALENCIA, VHANCE V., Maj,** Professional Engineer (State of North Carolina)

**WAGNER, TORREY J., Lt Col,** Scaled Agile Framework Agilist, Systems Planning, Research, Development and Engineering (SPRDE) Systems Engineering Certification, Level III; Systems Planning, Research, Development and Engineering (SPRDE) Science & Technology Manager Certification, Level III

\*Emeritus Faculty

## 2.3 RESEARCH AND TEACHING AWARDS

### 2.3.1 FACULTY

**ANDERSON, JASON R.**, 2019 Military Officers Association of America Outstanding Military Professor Award

**BETTINGER, ROBERT A., Maj**, 2019 AU Nominee for Air Force Outstanding Scientist/Engineer – Mid-Career Military Field Grade Officer of the Quarter, Department of Aeronautics & Astronautics, 3rd Quarter, 2019

**BEVINS, JAMES E.**, 2019 Tau Beta Pi Outstanding Thesis Advisor

**BOHAN, BRIAN T., AND POLANKA, MARC D.**, Art in Science Award – 2019 Dayton-Cincinnati Aerospace Symposium (DCASS)

**BORGHETTI, BRETT J., Dr.**, EE/CE Faculty Member of the Year Award

**CHANDRAHALIM, HENGKY**, IEEE NEMS 2019 Best Paper Finalist

**COLLINS, PETER J.**, 2018 Antenna Measurement Techniques Association (AMTA) Distinguished Achievement Award recipient, Awarded at the 40th Annual AMTA Symposium, 4-9 November 2018, Williamsburg, VA: For Outstanding and Pioneering Contributions to the Practice of Antenna Design, Analysis, and Measurements

**DICKENS, JOHN M., Lt Col**, 2019 ENS Educator of the Year

**ELSHAW, JOHN J.**, 2019 Dean's Distinguished Professor Award

**FICKUS, MATTHEW C.**, ENC Instructor of the Quarter, 2019 Spring Quarter

**JACKSON, JULIE A.**, IEEE Aerospace and Electronic Systems Society 2019 Fred Nathanson Memorial Radar Award, Apr 2019.

**HESS, JOSHUAH A., Maj**, Arthur S. Flemming Award: Applied Science & Engineering, Air Education and Training Command Level (2018)

**HODSON, DOUGLAS D.**, Outstanding Achievement Award, the 2019 World Congress in Computer, Science Computer Engineering, and Applied Computing (CSCE 19), July 2019

**\*HOUPIS, CONSTANTINE H.**, Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, Fellow of the Institute of Electrical and Electronic Engineers

**JACKSON, JULIE A.**, IEEE Aerospace and Electronic Systems Society 2019 Fred Nathanson Memorial Radar Award, Apr 2019

**JENKINS, PHILLIP R., Capt**, 2019 General Omar N. Bradley Research Fellowship in Mathematics

**KOMIVES, JEFFREY, Lt Col**, MOAA Outstanding Military Professor Award

**LANGHALS, BRENT T.**, 2018-2019 Sigma Iota Epsilon Outstanding Instructor Award

**LOPER, ROBERT D.**, SOCHE Faculty Excellence Award, Nov 2018

**LUNDAY, BRIAN J.**, 2019 Faculty Excellence Award, Southern Ohio Council of Higher Education, 2019 Professor Ezra Kotcher Award, Wright Memorial Chapter, Air Force Association, 2019 Lessons Learned Senior Civilian Professional of the Year, United States Air Force, 2018 Best Reviewer Recognition, Omega: *The International Journal of Management Science*

**MULLINS, BARRY E.**, Research Advisor for CCR-United States Cyber Command Cyberspace Research Excellence Award (Best Cyber Thesis), L. Stafira, Mar 2019

**NAVA, OMAR A., Maj**, Col Charles A. Stone Award, Apr 2019; AETC Weather Field Grade Officer of the Year, Nov 2018

**NUNNALLY, BEAU A.**, ENC Instructor of the Quarter, 2019 Winter Quarter

**POLANKA, MARC, M.D.**, AIAA Outstanding Section Award, Very Large Category, 1st Place, 2018  
AETC AF Outstanding Scientist/Engineer Educator, 2019, AFIT Innovation Award, Senior Faculty, 2019  
SAE Manly Award Winner: Best Paper, 2019, Appointed Chair of the AIAA Associate Fellows Committee  
Elected Vice-Chair of the ASME IGTI Heat Transfer Committee

**RUTLEDGE, JAMES L., Lt Col**, 2019 Air University Outstanding Scientist/Engineer–Senior Military

**SCHULDT, STEVEN J., Maj**, 2019 AFIT Leslie M. Norton Teaching Excellence Award

**SLAGLEY, JEREMY M.**, 2019 Dean’s Distinguished Professor Awards, ENC Instructor of the Quarter, 2019 Spring Quarter

**WHITE, EDWARD D., III**, ENC Instructor of the Quarter, 2018 Fall Quarter, ENC Instructor of the Year, 2018-2019

**WEIR, JEFFERY D.**, 2019 Instructor of the Year, Advance Studies in Air Mobility

**WRUGGLES-WRENN, M.B.**

Art in Science 1<sup>st</sup> Place Competition Winner, the 44th AIAA Dayton Cincinnati Aerospace Science Symposium, February 2019

**ZAGARIS, COSTANTINOS Maj**, 2018 AIAA SciTech Forum – Best Astrodynamics paper (award presented Jan 2019)

\*Emeritus Faculty

### 2.3.2 STUDENTS

**ANGELL, EMILY E., Capt**, Distinguished Graduate, Department of Systems Engineering and Management

**BEEMER, CODY J., Capt**, 2019 Dean's Award for the most exceptional master's thesis by a graduating student in the Department of Systems Engineering and Management, Thesis title: An Analysis of Built Environment Factors in Residences and the Associated Effects on Mental Health Symptoms of United States Veterans; Distinguished Graduate, Department of Systems Engineering and Management

**BERNER, WILLIAM C., Capt**, Ivan B. Thompson Award

**BEVERIDGE, NATHANAEL R., 2<sup>nd</sup> Lt**, Distinguished Graduate, Department of Operational Sciences

**BOLLER, SCOTT A.**, Best Presentation Award – 2019 Dayton-Cincinnati Aerospace Sciences Symposium (DCASS); Distinguished Graduate, Department of Aeronautics and Astronautics

**BRAMBLETT, LAUREN M., 2<sup>nd</sup> Lt**, Dr. James T. Moore Graduate Research Prize (MORS)

**CHESTER, DAVID, Capt**, Distinguished Graduate Award, Department of Systems Engineering and Management

**CHIARATTI, NICOLAS S., Capt**, Kittyhawk AOC Academic Research Excellence Award in Electronic Defense

**CINTRON, LEWIS A., Capt**, 2019 Dean's Award for the most exceptional master's thesis by a graduating student in the Department of Electrical and Computer Engineering, Thesis title: Modeling a Consortium-Based Distributed Ledger Network with Applications for Intelligent Transportation Infrastructure; Distinguished Graduate Award, Department of Electrical and Computer Engineering

**CONZONETTA, DAVID, 1<sup>st</sup> Lt**, Distinguished Graduate Award, Department of Systems and Engineering Management

**CROUCH, TARA E., Capt**, Best Thesis in Fluid Mechanics, Title: Direct Numerical Simulation of Roughness Induced Hypersonic Boundary Layer Transition on a Seven Degree Half-Angle Cone, Department of Astronautic and Aeronautics

**DALLMAN, WILLIAM, Capt**, Louis F. Polk Award; Distinguished Graduate Award, Department of Electrical and Computer Engineering

**DAVIS, RANDALL, Capt**, Distinguished Graduate, Department of Operational Sciences

**DEMORET, ANNA C., 2<sup>nd</sup> Lt**, 2019 Best International Undergraduate Paper/Presentation – 2019 AIAA SciTech, January 2019

**EGNER, BRYAN V., 2<sup>nd</sup> Lt**, Advanced Technical Intelligence Association (ATIA) Student Award; American Nuclear Society Thesis Award

**ELLIS, ASHLEE N., Capt**, Lt Edwin E. Aldrin Sr. Award

**ENOS, TREVOR A., 1<sup>st</sup> Lt**, Project Management Institute Thesis Award

**EVERETT, NICHOLAS, D., Capt**, Kittyhawk AOC Academic Research Excellence Award in Information Superiority

**GAHAN, KENNETH C., Capt**, 2019 Dean's Award for the most exceptional master's thesis by a graduating student in the Dept of Aeronautics and Astronautics, Thesis title: Multi-Path Automatic Ground Collision Avoidance System for Performance Limited Aircraft with Flight Tests: Project Have MEDUSA; Distinguished Graduate, Department of Aeronautics and Astronautics

**GANITANO, CRAIG S., Capt**, Distinguished Graduate Award, Department of Electrical and Computer Engineering

**GEORGE, BRANDON, Capt**, Distinguished Graduate, Department of Aeronautics and Astronautics

**THOMAS, GRANT, Capt**, Best Presentation Award: “Ground-based, Dayton Modeling and Observations in SWIR for Satellite Custody,” Optical Systems & Instrumentation Session, 2019 Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)

**HARKINS, MEGAN L., Maj**, Art in Science: 1<sup>st</sup> Place Competition Winner: 44th AIAA Dayton-Cincinnati Aerospace Science Symposium, February 2019

**HARRELL, WILLIAM L., Maj**, Field Grade Officer of the Year

**HARRIS, KAREN Y., MSgt**, Non-Commissioned Officer of the Year; Secretary James G. Roche Award

**HINES, PARKER A., 2<sup>nd</sup> Lt**, Dr. Anthony D’Angelo Student Leadership Award

**HORNBERGER, ZACHARY T.**, 2019 Dean’s Award for the most exceptional master’s thesis by a graduating student in the Department of Operational Sciences, Thesis title: Search and Rescue Operations Forecasting and Optimization

**JACKSON, SUNDERLIN, 2<sup>nd</sup> Lt**, Distinguished Graduate, Department of Aeronautics and Astronautics

**JENKINS, PHILLIP R., Capt**, Company Grade Officer of the Year (PhD)

**JORDAN, RAMOANE E., Capt**, George K. Dimitroff Award

**KEANE, MICHAEL, Capt**, 2019 Best Technical Presentation in Materials Science – 44<sup>th</sup> Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), March 2019

**LABEDZ, THEODORE J., Capt**, EN Student Company Grade Officer of the Year (Master’s); Society of American Military Engineers (SAME) Award

**LANGHALS, BRENT T., Dr.**, SIE Instructor of the Year

**LEDWITH, MATTHEW C.**, Distinguished Graduate, Department of Operational Sciences

**LEE, TAYLOR, 1<sup>st</sup> Lt**, Navigation Research Excellence Award

**MARKMAN, MATTHEW R., Capt**, International Cost Estimating and Analysis Association Thesis Award

**McREYNOLDS, BRIAN J., Maj**, Best Light-Based Thesis

**MONTEIRO, LUCIANA M., Capt**, International Student of the Year; Jerome G. Peppers Jr. Outstanding Student Award; Air University International Student Badge (Brazil)

**NUNDU, AILEEN, Capt**, Air University International Student Badge (Australia)

**PETER, TROY, 2<sup>nd</sup> Lt**, Distinguished Graduate, Department of Operational Sciences

**QUARTERMONT, NICOLAS J., Capt**, Tau Beta Pi Thesis Award; Mervin E. Gross Award (AFIT Student of the Year); Distinguished Graduate, Department of Engineering Physics

**RATHSACK, TYLOR C.**, Art in Science Award – 2019 Dayton-Cincinnati Aerospace Sciences Symposium, (DCASS)

**SANDERSON, DAWN L.**, 2019 Dean’s Award for the most exceptional master’s thesis by a graduating student in the Department of Mathematics and Statistics. Thesis title: Modeling the Distribution of Lightning Strike Distances outside a Preexisting Lightning Area., 2019 Chancellor’s Award for the most exceptional master’s thesis by a graduating student. Thesis title: “Modeling the Distribution of Lightning Strike Distances outside a Preexisting Lightning Area.

**SAUNDERS, RYAN, 2<sup>nd</sup> Lt**, AIAA Graduate Student Award for Service Excellence

**SCHMITT, COURTNEY A., 2<sup>nd</sup> Lt**, Distinguished Graduate, Department of Mathematics and Statistics

**SCHULDT, STEVEN J., Maj**, Dr. Leslie M. Norton Teaching Excellence Award

**STAFIRA, LUKAS A., 2<sup>nd</sup> Lt**, Cyberspace Research Excellence Award; Distinguished Graduate Award, Department of Electrical and Computer Engineering

**STEELE, MEGAN L.**, 2019 American Industrial Hygiene Foundation Scholarship

**SITLER, JEFFREY L.**, Lt Col Charles P. Brothers Jr. Outstanding Volunteer Service Award

**TAYLOR, FORREST D., Maj**, Center for Technical Intelligence Studies and Research Outstanding Thesis Award

**THOMAS, GRANT, Capt**, Best Presentation Award: Ground-based, Dayton Modeling and Observations in SWIR for Satellite Custody, Optical Systems & Instrumentation Session, 2019 Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)

**VERGARA, CHRISTOPHER M., Capt**, Air University International Student Badge (Australia)

**VILLARREAL, MICAH, Capt**, Distinguished Graduate, Department of Electrical and Computer Engineering

**WEBB, JEREMIAH M., 1<sup>st</sup> Lt**, 2019 Air Force Historical Foundation Award (General Bryce Poe II Award); General Bryce Poe II Award

**ZOELLICK, CASEY L., Capt**, 2019 Dean's Award for the most exceptional master's thesis for a student graduating in the Department of Engineering Physics, These Title: Source Term Estimation of Atmospheric Pollutants Using an Ensemble of HYSPLIT Concentration Simulations; Distinguished Graduate, Department of Engineering Physics

### 3. RESEARCH STATISTICS

#### 3.1 RESEARCH AND CONSULTING MEASURES

There are measurable indicators of AFIT's contribution to the engineering and scientific community and AFIT's success in staying well informed of technical possibilities and scientific opportunities. These indicators include the number and quality of technical publications accepted by the editors of journals; the number of presentations accepted for regional, national and international conferences; the number of sponsor funded research projects conducted; and finally, the number of student Graduate Research Papers, MS theses, and PhD dissertations completed and submitted to the Defense Technical Information Center. For FY19, these output measures are shown in Tables 3.1a and 3.1b for the Departments and Centers, respectively.

**Table 3.1a Faculty Research and Sponsored Programs Output by Department**

	Graduate School, by Department						
	Graduate School (EN) Total	Math & Stats (ENC)	Electrical & Comp Eng (ENG)	Engineering Physics (ENP)	Operational Sciences (ENS)	Sys Eng & Management (ENV)	Aeronautics & Astro (ENY)
Number of Faculty (FTE)*	137	18	31	22	20	23	23
Number of Research Faculty (FTE)	11	1	2	8	0	0	0
Refereed Publication Authorships**	284	23	48	51	44	62	56
Refereed Conferences on the Basis of Full Paper Review**	138	3	55	37	7	23	13
Refereed Conferences on the Basis of Abstract Review**	227	10	20	78	47	19	53
Sponsor Funded Projects***	247	12	52	75	27	20	61
Books & Chapters in Books**	17	1	7	0	0	8	1
Patents****	36	0	11	11	0	1	13
Doctoral Dissertations Advised	30	4	6	11	5	0	4
Master's Theses Advised	217	4	59	20	44	42	48
Graduate Research Papers Advised	18	0	0	0	18	0	0

\*FTE: Full-time equivalent military and permanent civilian faculty

\*\*Publications/Presentations are counted by faculty authorships.

\*\*\*One project associated with the Office of Research and Sponsored Programs (ENR) is reflected in Graduate School (EN) Total.

\*\*\*\*Includes: Patents awarded, patent applications, and invention disclosures counted by faculty authorships.

**Table 3.1b Faculty Research and Sponsored Programs Output, by Center**

	Total All Centers	ANT	CCR	CDE	COA	CSRA	CTISR	NEAT
Number of Affiliated Faculty*	128	26	18	18	21	40	16	8
Refereed Publication Authorships**	170	23	32	23	6	50	27	9
Refereed Conferences on the Basis of Full Paper Review**	97	16	33	22	5	9	7	5
Refereed Conferences on the Basis of Abstract Review**	151	10	2	41	44	33	15	6
Sponsor Funded Projects	117	27	10	23	10	30	12	5
Books & Chapters in Books**	6	0	6	0	0	0	0	0
Patents***	16	1	5	5	0	1	0	4
Doctoral Dissertations Advised	16	1	3	5	3	2	2	0
Master's Theses Advised	99	20	20	3	22	29	5	0
Graduate Research Papers Advised	10	0	0	0	10	0	0	0

\*Some faculty are affiliated with multiple centers.

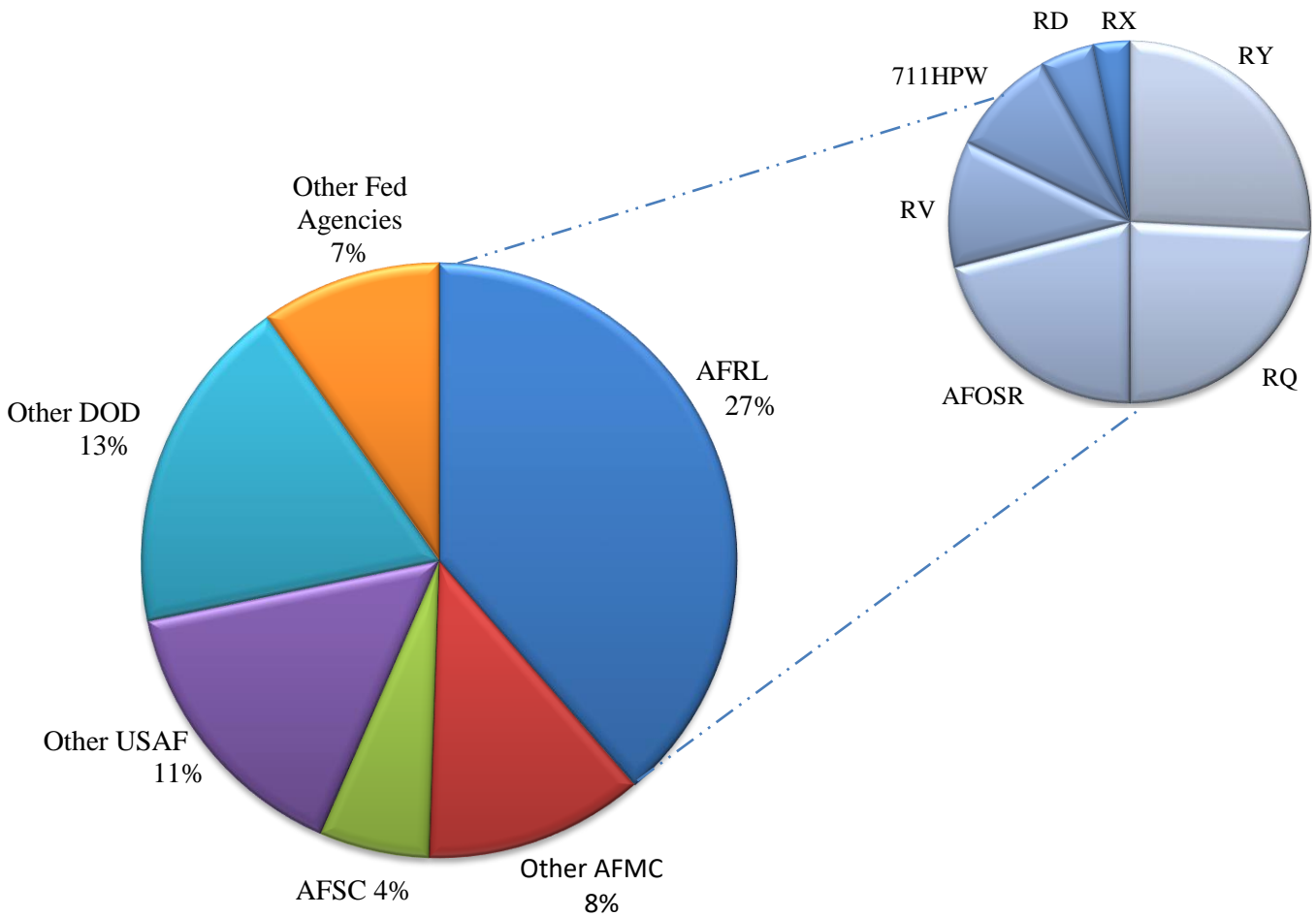
\*\*Publications/Presentations are counted by faculty authorships.

\*\*\*Includes: Patents awarded, patent applications, and invention disclosures counted by faculty authorships.

### 3.2 RESEARCH AND CONSULTING SPONSORSHIP

As part of an Air Force institution, the faculty members of the Air Force Institute of Technology focus their research on current problems as well as future systems of the Air Force and other DOD organizations. Evidence of this focus is that 98% of all theses, dissertations, and graduate research papers listed in Table 3.1a are externally sponsored by Air Force, DOD and government agencies. In addition, most of the research projects and consultations are carried out for Air Force and DOD units. The data are summarized in Figure 3.1 and Table 3.2.

**Figure 3.1 Sponsors of AFIT Theses, Dissertations, and Graduate Research Papers**



\*Pie Chart on the right shows breakdown by AFRL Technology Directorates

**Table 3.2 AFIT External Sponsorship by Organization**

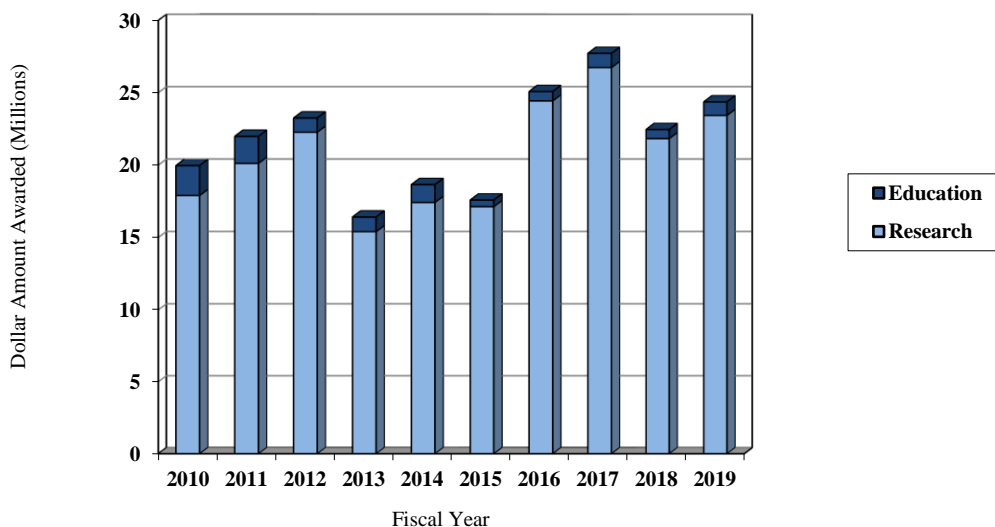
SPONSOR ORGANIZATION	PhD Dissertations	Master's Theses	Graduate Research Papers	Funded Projects
OFFICE OF THE SECRETARY OF THE AIR FORCE		1	1	1
United States Air Force Academy				1
HQ UNITED STATES AIR FORCE		2		1
AIR COMBAT COMMAND		1		
AIR EDUCATION AND TRAINING COMMAND		1		
Air Force Institute of Technology	11	72	1	
AIR FORCE MATERIEL COMMAND	1	2		3
746 <sup>th</sup> Test Squadron				1
Air Force Arnold Engineering Center		1		
Air Force Civil Engineering Center		6		
Air Force Life Cycle Management Center		10		10
Air Force SEEK EAGLE Office		1		
Air Force Security Assessment Center		1		
Air Force Research Laboratory (AFRL)		5		
711 Human Performance Wing (RH)	2	4		5
Air Force School of Aerospace Medicine				1
Air Force Office of Scientific Research (AFOSR)		13		24
Aerospace Systems Directorate (RQ)		15		22
Directed Energy Directorate (RD)	2	1		1
Information Directorate (RI)				3
Materials & Manufacturing Directorate (RX)		2		10
Munitions Directorate (RW)	1	2		3
Sensors Directorate (RY)	2	14		16
Small Business Office (SB)		1		
Space Vehicles Directorate (RV)		7		17
Air Force Installation and Mission Support Center		1		1
Air Force Sustainment Center			1	
Strategic Development Planning and Experimentation				3
AIR MOBILITY COMMAND		1	7	
AIR FORCE SPACE COMMAND		3		
45 <sup>th</sup> Weather Squadron		5		1
Space Security and Defense Program				1
Space and Missile Systems Center		3		1
AIR FORCE SPECIAL OPERATIONS COMMAND		1		
USAF FIELD OPERATING AGENCIES/DIRECT REPORTING UNITS				
Air Force Communications Command				2
Air Force Cost Analysis Agency		2		
Air Force Technical Applications Center		5		1
National Air and Space Intelligence Center	1	3		4
DEPARTMENT OF DEFENSE	1	1	2	
Air Force Specialty Code		1		
Defense Advanced Research Projects Agency		1		3
Defense Intelligence Agency		1		
Defense Threat Reduction Agency	1	2		1
Directed Energy Joint Technology Office	1	1		5
High Performance Computing Modernization Program				1
Joint Aircraft Survivability Program Office				2

Joint Chiefs of Staff		1		2
Joint Warfare Analysis Center		2		1
Missile Defense Agency				1
National Geospatial-Intelligence Agency	1			1
National Guard Bureau				1
Naval Postgraduate School				2
Navy Sea Systems Command				1
Office of the Secretary of Defense		2		7
Office of Naval Research				1
United States Army	1	3		
US Army Combat Capabilities Development Command C5ISR				5
US Army Engineer Research and Development Center				1
US Army Tactical Protection System				1
United States Navy		3		
US Africa Command		3		4
US Pacific Comamnd				2
US Strategic Command	3			
US Transportation Command		2	1	1
<b>OTHER FEDERAL AGENCIES</b>				
Department of Energy				
National Nuclear Security Administration	1			2
Department of Homeland Security	1	3		2
Department of Veterans Affairs		1		
Environmental Protection Agency		3		1
Federal Emergency Management Agency		1		
National Aeronautics and Space Administration				2
<b>INTERNATIONAL ORGANIZATIONS</b>				
Brazilian Air Force Institute of Logistics		1		
<b>NON-FEDERAL ORGANIZATIONS</b>				
Achilles Technologies Solutions – Materials and Electro-chemical Research (NAVY)				1
Create				1
Draper Laboratory				1
Lidomika, LLC				1
Lockheed Martin				2
Lockhead Martin Missiles and Fire Control		2		
Raytheon Space and Airborne Systems		1		
Spectral Sciences				1
The Boeing Company		1		
The Ohio State University Dept of Mechanical and Aerospace Engineering		1		
<b>TOTALS</b>	<b>30</b>	<b>217</b>	<b>18</b>	<b>190</b>

### 3.3 EXTERNAL SPONSOR FUNDING FOR THE GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT

Many of the Graduate School of Engineering and Management’s theses and research projects, completed under faculty supervision, are funded in part by other Air Force, DOD and government units and agencies. Often, this funding results from collaboration between faculty and thesis sponsors and occurs when the research project can be leveraged by the purchase of equipment or services not otherwise available. Figure 3.2 summarizes the past ten fiscal years of sponsored funding. Tables 3.3 and 3.4, and Figure 3.3, summarize external funding for FY19.

**Figure 3.2 New Award History FY10-FY19**



**Table 3.3 FY19 External Funding & Research Expenditures for Academic Departments & Research Centers (\$1,000's)**

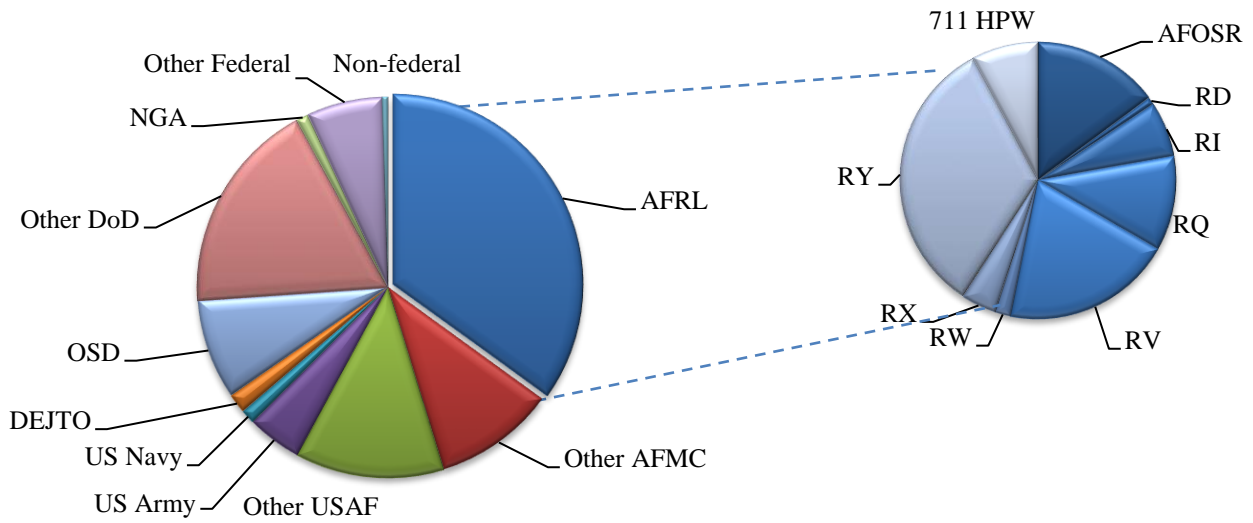
Department	Newly Awarded Research Projects		Newly Awarded Education Projects		Total FY19 Newly Awarded Projects		Total FY19 Research Expenditures
	#	\$k	#	\$k	#	\$k	\$k
Mathematics & Statistics (ENC)	11	827	0	0	11	827	1,308
Electrical & Computer Eng (ENG)	43	5,946	3	347	46	6,293	8,915
Engineering Physics (ENP)	45	5,625	0	0	45	5,625	6,995
Research & Sponsored Programs (ENR)	1	75	0	0	1	75	-
Operational Sciences (ENS)	21	6,105	7	300	28	6,405	6,928
Systems Eng & Management (ENV)	15	975	2	243	17	1,218	1,445
Aeronautical & Astronautical Eng (ENY)	58	3,874	2	49	60	3,923	8,845
<b>TOTAL</b>	<b>194</b>	<b>23,427</b>	<b>14</b>	<b>939</b>	<b>208</b>	<b>24,366</b>	<b>34,436</b>

Center	#	\$k	#	\$k	#	\$k	\$k
Autonomy and Navigation Technology (ANT)	24	3,969	3	347	27	4,316	5,048
Center for Cyberspace Research (CCR)	10	746	0	0	10	746	1,823
Center for Directed Energy (CDE)	23	2,615	0	0	23	2,615	3,107
Center for Operational Analysis (COA)	8	1,465	2	96	10	1,561	3,175
Center for Space Research and Assurance (CSRA)	29	2,589	1	15	30	2,604	3,195
Center for Tech Intel Studies & Research (CTISR)	12	2,027	0	0	12	2,027	2,181
Nuclear Expertise for Advancing Technologies (NEAT)	5	635	0	0	5	635	407
<b>TOTAL</b>	<b>111</b>	<b>14,046</b>	<b>6</b>	<b>458</b>	<b>117</b>	<b>14,504</b>	<b>18,936</b>

Notes: Total research expenditures reported include institutional cost sharing, which is not included in newly awarded projects. Numbers reported to the NSF research expenditure surveys vary somewhat due to differences in definitions. All Center funds are also included in departmental funding.

**Figure 3.3 New FY19 Awards by Sponsor**



\*Pie Chart on the right shows breakdown by AFRL Technology Directorates

**Table 3.4 New FY19 Awards to Academic Departments & Research Centers by Sponsor**

Dept.	AFRL \$k	AFMC (Non-AFRL) \$k	Other USAF \$k	Other DOD \$k	Other Federal \$k	Non- Federal \$k	Total \$k
ENC	578	-	249	-	-	-	827
ENG	4,346	100	591	1,236	-	20	6,293
ENP	782	100	1486	2,766	491	-	5,625
ENR	75	-	-	-	-	-	75
ENS	990	1,994	112	2,319	940	50	6,405
ENV	469	243	237	199	70	-	1,218
ENY	1,281	70	404	2,058	70	40	3,923
<b>TOTAL</b>	<b>8,521</b>	<b>2,507</b>	<b>3,079</b>	<b>8,578</b>	<b>1,571</b>	<b>110</b>	<b>24,366</b>

Note: "Other DOD" in this table includes the DEJTO, OSD, NGA, NSA, US Army, and US Navy pie slices from Figure 3.3, plus funding from other DOD organizations.

Center	AFRL \$k	AFMC (Non-AFRL) \$k	Other USAF \$k	Other DOD \$k	Other Federal \$k	Non- Federal \$k	Total \$k
ANT	2,696	-	380	1,220	-	20	4,316
CCR	520	-	211	15	-	-	746
CDE	378	100	45	2,066	26	-	2,615
COA	285	696	2	528	-	50	1,561
CSRA	456	7	315	1,826	-	-	2,604
CTISR	181	-	1,415	431	-	-	2,027
NEAT	-	-	100	110	425	-	635
<b>TOTAL</b>	<b>4,516</b>	<b>803</b>	<b>2,468</b>	<b>6,196</b>	<b>451</b>	<b>70</b>	<b>14,504</b>

Note: All Center funds are also included in departmental funding

## **4. SPONSORSHIP OF STUDENT RESEARCH**

### **4.1 OFFICE OF THE SECRETARY OF THE AIR FORCE**

#### **Master's Theses**

ADDERLEY, NIKOLAI A., Graph-Based Temporal Analysis in Digital Forensics. AFIT-ENG-MS-19-M-005.  
Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: DC3/DC. [CCR]

#### **Graduate Papers**

RUSSELL, KRISTIN M., An Evaluation of Total Force C-130 Fleet Utilization. AFIT-ENS-MS-19-J-048. Faculty  
Advisor: Dr. Daniel W. Steeneck. Sponsor: USAF/A3. [COA]

### **4.2 HEADQUARTERS OF THE UNITED STATES AIR FORCE**

#### **Master's Theses**

BOWERS, BRETT, A Study of Onboarding and Turnover Mediating Variables in US Air Force Officers. AFIT-ENV-  
MS-19-S-053. Faculty Advisor: Dr. Alfred E. Thal. Sponsor: USAF HQ/A4.

CARBONI, JOHN, The Effect of Modeling Simultaneous Events on Simulation Results. AFIT-ENG-MS-19-M-014.  
Faculty Advisor: Dr. Douglas D. Hodson. Sponsor: HQ USAF.

### **4.3 AIR COMBAT COMMAND**

#### **49<sup>th</sup> OPERATIONS GROUP**

#### **Master's Theses**

GILTS, ERIKA, A Simulation Approach to Address MQ-9 Flying Training Unit Manning Shortfalls. AFIT-ENS-MS-  
19-M-116. Faculty Advisor: Maj Thomas P. Talafuse. Sponsor: 9<sup>th</sup> Attack Squadron.

### **4.4 AIR EDUCATION AND TRAINING COMMAND**

#### **Master's Theses**

MEYER, KEISHA A., Does Age, Gender, or Race Affect Undergraduate Pilot Training Attrition or Composite  
Scores? AFIT-ENS-MS-19-M-140. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: AETC/Det21. [COA]

#### **AIR FORCE INSTITUTE OF TECHNOLOGY**

#### **Doctoral Dissertations**

DODSON, TABITHA, Investigations of Point Defects in KH<sub>2</sub>PO<sub>4</sub> Crystals Using Ab Initio Quantum Methods.  
AFIT-ENP-DS-19-S-021. Faculty Advisor: Dr. Nancy C. Giles. Sponsor: N/A.

EVERS, AARON, A Generalized Phase Gradient Autofocus Algorithm. AFIT-ENG-DS-19-M-025. Faculty Advisor:  
Dr. Julie A. Jackson. Sponsor: N/A.

HAMILTON, NICOLAS S., Adaptive-Hybrid Redundancy for Radiation Hardening. AFIT-ENG-DS-19-S-005.  
Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A. [CCR]

JURADO, JUAN D., Autonomous and Resilient Management of All-Source Sensors for Navigation Assurance. AFIT-ENG-DS-19-S-006. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: N/A. [ANT]

KEMNITZ, RYAN A., Mechanical Behavior and the Effects of the Space Environment. AFIT-ENY-DS-18-D-036. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

LENYK, CHRISTOPHER, Point Defects in Lithium Gallate and Gallium Oxide. AFIT-ENP-DS-19-S-023. Faculty Advisor: Dr. Nancy C. Giles. Sponsor: AFIT/EN.

LLOYD, ROBERT L., Numerical Simulation of Unstable Laser Resonators with a High-Gain Medium. AFIT-ENP-DS-19-S-024. Faculty Advisor: Dr. David E. Weeks. Sponsor: N/A. [CDE]

SCHERRER, ELIZABETH, Optical and Electron Paramagnetic Resonance Characterization of Point Defects in Semiconductors. AFIT-ENP-DS-19-M-091. Faculty Advisor: Dr. Nancy C. Giles. Sponsor: N/A.

SEIDERS, MATTHEW, Dimension-Breaking for Traveling Waves in Interfacial Flows. AFIT-ENC-DS-19-S-002. Faculty Advisor: Dr. Benjamin F. Akers. Sponsor: N/A.

STONE, BRENT J., Enabling Auditing and Intrusion Detection for Proprietary Controller Area Networks. AFIT-ENG-DS-18-D-003. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A. [CCR]

TURNER, JONATHAN, An Efficient Search-Based Algorithm. AFIT-ENC-DS-19-J-074. Faculty Advisor: Lt Col Andrew J. Geyer. Sponsor: N/A.

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ALAJMI, ABDULAZIZ, RSAF C-130 Part Cancellation Process Analysis. AFIT-ENS-MS-19-S-032. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

ALSHAMMARI, DHAHER M., Trust and Suspicion as a Function of Cyber Security in Human Machine Team (HMT) of Unmanned Systems. AFIT-ENV-MS-19-S-051. Faculty Advisor: Dr. John J. Elshaw. Sponsor: N/A. [CCR]

ALQAHTANI, AHMED, Saudi Arabia Progression Toward Renewable Energy According to its Vision 2030. AFIT-ENV-MS-19-S-050. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

ALZAHIRANI, MAJED, The Potential Socio-Economic Impacts of the New Public Transport System on the Saudi Economy (Jeddah Metro). AFIT-ENS-MS-19-S-033. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

ARNOLD, CHRISTIAN, High Resolution, Low-Bandwidth, Real-Time Reconnaissance Using Structure from Motion with Planar Homography Estimation. AFIT-ENG-MS-18-M-007. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: N/A.

BEARGIE, DAVID W., Assessment of Camera Pose Estimation Using Geo-Located Images from Simultaneous Localization and Mapping. AFIT-ENG-MS-19-M-009. Faculty Advisor: Capt Aaron J. Canciani. Sponsor: N/A. [ANT]

BITTEL, THOMAS P., Modeling and Design Optimization of a Water Electrolysis Thruster. AFIT-ENY-MS-19-J-069. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

BRAMLETTE, CLINT M., Cyber-Attack Drone Payload Development and Geolocation Via Directional Antennae. AFIT-ENG-MS-19-M-012. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: N/A. [CCR]

BRAUN, ANDREW D., High Fidelity Satellite Navigation Receiver Front-End for Advanced Signal Quality Monitoring and Authentication. AFIT-ENG-MS-19-M-013. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: N/A. [CCR ANT]

BROWN, DOUGLAS, Applying Survival Analysis with Frailty to Aircraft Reliability. AFIT-ENS-MS-19-M-103. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: N/A.

CATCHPOLE, MARCUS, Machine Learning Models of C-17 Specific Range Using Flight Recorder Data. AFIT-ENG-MS-13-M-016. Faculty Advisor: Dr. Laurence D. Merkle. Sponsor: N/A.

COLE, TIFFANY D., Satellite On-Orbit Characterization Based on Inspection Relative Orbit Parameters. AFIT-ENY-MS-18-D-033. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: N/A. [CSRA]

DELA CRUZ, MICHAEL, Designing Liquid Crystal For Optoacoustic Detection. AFIT-ENG-MS-19-M-023. Faculty Advisor: Dr. Hengky Chandralalim. Sponsor: N/A.

DELONG, BRANDEN, Quantifying Resiliency Risk Metrics through Facility Dispersion. AFIT-ENV-MS-19-M-170. Faculty Advisor: Maj Steven J. Schuldt. Sponsor: N/A.

EVERETT, NICHOLAS D., Instantaneous Bandwidth Expansion Using Software Defined Radios. AFIT-ENG-MS-19-M-024. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A. [CSRA]

FLORES, ENOC, Improved Fabrication For Micromirror Arrays. AFIT-ENG-MS-19-M-027. Faculty Advisor: Maj Tod Laurvick. Sponsor: N/A.

GARLISI, CHARLES J., Performance Characterization of an Accion Systems TILE Colloid Thruster Using a Force Balance Test Stand. AFIT-ENY-MS-19-M-214. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

GILLILAND, SHARON, The First Step Towards an Interchangeable Aircraft Management Construct. AFIT-ENS-MS-19-J-030. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

HACKER, KENNETH L., Preserving Privacy In Automotive Tire Pressure Monitoring Systems. AFIT-ENG-MS-19-M-031. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A. [CCR]

HANSON, WILLIAM, Analysis of the Gálvez-Davison Index for Convective Forecasting over Africa Using the GALWEM. AFIT-ENP-MS-19-M-081. Faculty Advisor: Lt Col Hsien-Liang Tseng. Sponsor: N/A.

HARKINS, MEGAN, Creep of Nextel 720/Alumina Ceramic Matrix Composite with Diamond-Drilled Effusion Holes at 1200°C in Air and in Steam. AFIT-ENY-MS-19-M-218. Faculty Advisor: Dr. Marina B. Ruggles-Wrenn. Sponsor: N/A.

HARRIS, RYAN, Side Channel Anomaly Detection in Industrial Control Systems Using Physical Characteristics of End Devices. AFIT-ENG-MS-19-M-032. Faculty Advisor: MSG Robert Mills. Sponsor: N/A.

HEMKEN, KATHERINE B., Forecasting Sustainment Cargo Requirements. AFIT-ENS-MS-19-J-035. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: N/A. [COA]

HERTWIG, FRED D., Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes. AFIT-ENV-MS-19-M-178. Faculty Advisor: Dr. John Colombi. Sponsor: N/A. [CSRA ANT]

HINES, PARKER, Analyzing the Efficiency of Horizontal Photovoltaic Cells at Air Force Installations in Various Climate Regions. AFIT-ENV-MS-19-M-179. Faculty Advisor: Lt Col Torrey J. Wagner. Sponsor: N/A.

HOHNBAUM, CHARLES C., Fracture Toughness and Fatigue Crack Growth Rate Characterization of Inconel 718 Formed by Laser Powder Bed Fusion. AFIT-ENY-MS-19-M-220. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: AFIT/ENY. [CSRA]

JACKOVICH, PETAR, Solving the Traveling Salesman Problem Using Ordered-Lists. AFIT-ENS-MS-19-M-127. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: N/A.

JAMES, KENNETH, Testing the Fault Tolerance of a Wide Area Backup Protection System using SPIN. AFIT-ENG-MS-19-M-034. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A.

KILGORE, TERRENCE R., Woman and Minority-Owned Businesses as Department of Defense Suppliers: Challenges and Opportunities. AFIT-ENS-MS-19-M-131. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

KROTT, MATTHEW J., CubeSat Payload Thermal Management Optimization. AFIT-ENY-MS-19-M-225. Faculty Advisor: Maj Robert A. Bettinger Sponsor: N/A. [CSRA CCR]

KULM, JUSTIN, A Hybrid Anomaly Detection System Using a Rules-Base. AFIT-ENG-MS-19-M-037. Faculty Advisor: Dr. Douglas D. Hodson. Sponsor: N/A.

LABEDZ, THEODORE, Quantifying Permafrost Extent, Condition, and Degradation at Eielson Air Force Base. AFIT-ENV-MS-19-M-184. Faculty Advisor: Maj Steven J. Schuldt. Sponsor: N/A.

LEE, TAYLOR N., Aerial Simultaneous Localization and Mapping Using Earth's Magnetic Anomaly Field. AFIT-ENG-MS-19-M-039. Faculty Advisor: Capt Aaron J. Canciani. Sponsor: N/A. [ANT]

LESIEUR, ALEXANDER, Fragmentation Properties of Explosively Driven Additively Manufactured 15-5 PH Stainless Steel Cylinders. AFIT-ENY-MS-19-M-228. Faculty Advisor: Capt Andrew J. Lingenfelter. Sponsor: N/A.

MACCHIA, MICHAEL, Application of Metamaterials for Multifunctional Satellite Bus Enabled via Additive Manufacturing. AFIT-ENY-MS-19-M-230. Faculty Advisor: Maj Ryan O'Hara. Sponsor: N/A.

MACGREGOR, KATIE, Analysis of Cross-Cultural Training Efforts, Competencies, and Implications, and How Cross-Cultural Competency Affects the Success of Construction Projects on Air Force Installations Overseas. AFIT-ENV-MS-19-M-186. Faculty Advisor: Dr. John J. Elshaw. Sponsor: N/A.

MAIKELL, MEGAN, Characterization and Anomalous Diffusion Analysis of a 100W Low Power Annular Hall Effect Thruster. AFIT-ENY-MS-19-M-231. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

MANGEN, MATTHEW, An Analysis of Changing the Federal Age Requirement for a Commercial Driver's License. AFIT-ENS-MS-19-J-038. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

MARTIN, SETH A., Unguided Cyber Education Techniques Of the Non-Expert. AFIT-ENG-MS-19-M-041. Faculty Advisor: Mark A.Reith. Sponsor: N/A. [CCR]

MAUS, JOCELIN, Applying the Multiple Multidimensional Knapsack Assignment Problem to a Cargo Allocation and Transportation Problem with Stochastic Demand. AFIT-ENS-MS-19-M-137. Faculty Advisor: Maj Thomas P. Talafuse. Sponsor: N/A.

MCFADDEN, MICHAEL P., The Introduction of Open Source Initiatives in Supply Chain Management Software. AFIT-ENS-MS-19-M-138. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

MCQUAID, IAN, Autonomous Association of GEO RSO Observations Using Deep Neural Networks. AFIT-ENG-MS-19-M-042. Faculty Advisor: Dr. Laurence D. Merkle. Sponsor: N/A.

MCREYNOLDS, BRIAN J., A Comprehensive Test Methodology and Physics-Based Camera Model for Characterizing Neuromorphic Imagers. AFIT-ENP-MS-19-M-085. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: N/A. [CTISR]

MICHAUD, PAUL, Micro-Contacts With 3-D Surfaces Made With Grayscale Lithography. AFIT-ENG-MS-19-M-043. Faculty Advisor: Tod Laurvick. Sponsor: N/A.

MILTON, MICHAEL, A Quantitative Analysis Of the Fusion Of 3-D Scanning LIDAR Systems and 2-D Imaging Systems. AFIT-ENG-MS-19-M-044. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: N/A.

NUNDU, AILEEN, Direct Path Interference Suppression and Received Signal Processing For OFDM Passive Radar. AFIT-ENG-MS-19-M-049. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: AFIT/ENG.

O'KEEFE, JAMES C., Mechanical and Vibration Damping Characterization of Hybrid Carbon Nanotube Laminates. AFIT-ENY-MS-19-M-235. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: N/A. [CSRA]

OSTMAN, JOSHUA A., Cislunar Trajectory Generation with Sun-Exclusion Zone Constraints Using a Genetic Algorithm and Direct Method Hybridization. AFIT-ENY-MS-19-S-081. Faculty Advisor: Maj Joshua A. Hess. Sponsor: N/A. [CSRA]

PALMER, BRIAN O., Thermal Management of Satellite Electronics Via Gallium Phase Change Heat Sink Devices. AFIT-ENY-MS-18-D-038. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

PAMILAGAS, KEVIN, Analyzing a Method to Determine the Utility of Adding a Classification System to a Sequence for Improved Accuracy. AFIT-ENC-MS-19-M-002. Faculty Advisor: Dr. Christine Schubert Kabban. Sponsor: N/A.

PASION, CHRISTIL, Modeling Power Output of Horizontal Solar Panels Using Multivariate Linear Regression and Random Forest Machine Learning. AFIT-ENV-MS-19-M-192. Faculty Advisor: Lt Col Torrey Wagner. Sponsor: The Civil Engineer School.

POPE, TALON M., A Cost-Benefit Analysis of Pilot Training Next. AFIT-ENS-MS-19-M-144. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: N/A. [COA]

PRUDHOMME, DANIEL, Project HAVE BASS. AFIT-ENY-MS-19-M-237. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: N/A.

RAMOS, JENNIFER N., Uranium Dioxide Actinide Detection Device Support Design For Space Applications. AFIT-ENG-MS-19-M-050. Faculty Advisor: Tod Laurvick. Sponsor: N/A. [CSRA]

REYNOLDS, THOMAS, From the APOD to the Point of Need. AFIT-ENS-MS-19-J-045. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: N/A.

ROBINSON, TORY, Characterization of Metal Contacts on Hydrothermally Synthesized Uranium Dioxide For Novel Semiconductor Applications. AFIT-ENG-MS-19-M-052. Faculty Advisor: Tod Laurvick. Sponsor: N/A.

RUNCO, JOHN J., Computational Aerothermodynamic Analysis of Satellite Trans-Atmospheric Skip Entry Survivability. AFIT-ENY-MS-19-M-243. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A. [CSRA]

RUPPEL, RENEE L., The Importance of Defining an Organization's Core Competencies. AFIT-ENS-MS-19-J-047. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

SANDS, BRENDON, Time Series Analysis of Stochastic Networks with Correlated Random Arcs. AFIT-ENS-MS-19-M-147. Faculty Advisor: Lt Col Andrew J. Geyer. Sponsor: N/A.

SCHMITT, COURTNEY, Harmonic Equiangular Tight Frames Comprised of Regular Simplices. AFIT-ENC-MS-19-M-004. Faculty Advisor: Dr. Matthew C. Fickus. Sponsor: N/A.

SINN, YONG U., Unresolved Object Detection Using Synthetic Data Generation and Artificial Neural Networks. AFIT-ENG-MS-19-M-055. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A. [CSRA CTISR]

SMITH, JONATHAN, Three-D Multifunctional Sensors Fabricated on Fiber Tips Using a Two-Photon Polymerization Process. AFIT-ENG-MS-19-M-056. Faculty Advisor: Dr. Hengky Chandralalim. Sponsor: N/A.

TAYLOR, FORREST, Orthogonal Frequency Division Multiplexed Waveform Effects on Passive Bistatic Radar. AFIT-ENG-MS-19-M-058. Faculty Advisor: Maj James R. Lievsay. Sponsor: N/A.

TOMCHO, LANDON G.M., Experimentation and Analysis Using Modern Gamification Techniques. AFIT-ENG-MS-19-M-061. Faculty Advisor: Dr. Mark A. Reith. Sponsor: N/A. [CCR]

TYHURST, JAMES, Non-Intrusive Occupancy Detection Methods and Models. AFIT-ENV-MS-19-M-200. Faculty Advisor: Lt Col Andrew J. Hoisington. Sponsor: N/A.

UNDERWOOD, GEORGE, A MEMS Dual Vertical Electrometer and Electric Field-Mill. AFIT-ENG-MS-19-M-063. Faculty Advisor: Maj Tod Laurvick. Sponsor: N/A.

VERGARA, CHRISTOPHER, Multi-Sensor Data Fusion between Radio Tomographic Imaging and Noise Radar. AFIT-ENG-MS-19-M-064. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

WEBB, JEREMIAH M., Comprehensive Study of Optimal Synergetic Skip Entries with Dynamic Thrust Vectoring Control. AFIT-ENY-MS-19-M-251. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A. [CSRA]

WALKUSKY, MARK M., Optimizing the Forward Presence of PACAF's Expeditionary Communications. AFIT-ENS-MS-19-J-054. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

WALLIS, TYLER, Interlaminar Shear Performance of High Temperature Composites. AFIT-ENY-MS-19-M-250. Faculty Advisor: Dr. Marina B. Ruggles-Wrenn. Sponsor: N/A.

WILLBURN, ZANE A., Manufacture of Fused Deposition Modeling Joints Using ULTEM 9085. AFIT-ENY-MS-19-M-252. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

#### **Graduate Research Papers**

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### **4.5 AIR FORCE MATERIEL COMMAND**

#### **Doctoral Dissertations**

BRADSHAW, CALVIN J., Using Manpower to Assess USAF Strategic Risk. AFIT-ENS-DS-19-J-021. Faculty Advisor: Dr. Alan B. Johnson. Sponsor: HQ AFMC/A9A. [COA]

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LEDWITH, MATTHEW, An Application of Absorbing Markov Chains to the Assessment of Education Attainment Rates within Air Force Materiel Command Civilian Personnel. AFIT-ENS-MS-19-M-134. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: AFMC/A9A.

LUBIANO, HESTON JOHN D., A Qualitative Approach in Measuring Inclusion. AFIT-ENS-MS-19-M-135. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AFMC/A1. [COA]

### **AIR FORCE ARNOLD ENGINEERING DEVELOPMENT CENTER**

#### **Master's Theses**

CROUCH, TARA, Direct Numerical Simulation of Roughness-Induced Hypersonic Boundary Layer Transition on a Seven Degree Half-Angle Cone. AFIT-ENY-MS-19-M-211. Faculty Advisor: Lt Col Jeffrey R. Komives. Sponsor: Arnold Development Engineering Center.

### **AIR FORCE CIVIL ENGINEERING CENTER**

#### **Master's Theses**

CHESTER, DAVID, A Life Cycle Analysis of DOD Expeditionary Waste Management Strategies in SimaPro. AFIT-ENV-MS-19-M-167. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CX.

COWEN, LUKAS, A Techno-Economic Analysis. AFIT-ENV-MS-19-M-169. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CX.

GLASS, JOSHUA, Toxicological Life Cycle Impact Analysis of Short and Long Chain Perfluorinated Compounds Compared to Impacts of Treatment Techniques. AFIT-ENV-MS-19-M-176. Faculty Advisor: Dr. Eric G. Mbonimpa. Sponsor: AFCEC/CZ.

HAYES, AUSTIN, The Evaluation of High-Molecular-Weight Methacrylate as a Treatment Option for Shrinkage Cracks in Airfield Pavement. AFIT-ENV-MS-19-M-177. Faculty Advisor: Dr. Alfred E. Thal. Sponsor: AFCEC.

JORDAN, RAMOANE, Fate and Transport Modeling of Perfluoroalkyl Substances (PFAS) in Groundwater from Aqueous Film Forming Foam (AFFF) Impacted Sites. AFIT-ENV-MS-19-M-181. Faculty Advisor: Dr. Willie F. Harper. Sponsor: AFCEC/CZOM.

SPRANGER, ZACHARY, Analysis and Design of Modular Overhead Protection System Utilizing Readily Available Materials. AFIT-ENV-MS-19-M-198. Faculty Advisor: Dr. Alfred Thal. Sponsor: AFCEC.

### **AIR FORCE SEEK EAGLE OFFICE**

#### **Master's Theses**

PUNG, JUSTIN, Tracking Shock Movement on the Surface of an Oscillating, Straked Semispan Delta Wing. AFIT-ENV-MS-19-M-238. Faculty Advisor: Lt Col Darrell S. Crowe. Sponsor: 46 SK/SKC.

### **AIR FORCE SECURITY ASSISTANCE CENTER**

#### **Master's Theses**

SHULER, ROBERT, Selecting a Construction Contract Acquisition Strategy to Support Foreign Military Sales Facility Construction. AFIT-ENV-MS-19-M-196. Faculty Advisor: Dr. Alfred E. Thal. Sponsor: AFSAC.

### **AIR FORCE LIFE CYCLE MANAGEMENT CENTER**

#### **Master's Theses**

BONENFANT, BENJAMIN, An Analysis of Estimate Variance in Program Office Estimates. AFIT-ENV-MS-19-M-163. Faculty Advisor: Lt Col Clay M. Koschnick. Sponsor: AFLCM/FM.

ENOS, TREVOR, A Case Study of EPA Clauses as they Apply to Fixed Price Contracts. AFIT-ENV-MS-19-M-173. Faculty Advisor: Dr. Jonathan Ritschel. Sponsor: AFLCMC/FZ.

GILL, ANDREW, Examining the Drivers of C-130J Maintenance Requirements. AFIT-ENV-MS-19-M-115. Faculty Advisor: Dr. William A. Cunningham. Sponsor: AFLCMC/LZ.

JESTICE, CHRISTINE, A Human Capital Perspective. AFIT-ENV-MS-19-M-180. Faculty Advisor: Dr. John J. Elshaw. Sponsor: AFLCMC/CV.

KEANE, MICHAEL, Ballistic Limit Shot Dependency Testing in Composite Materials. AFIT-ENV-MS-19-M-071. Faculty Advisor: Lt Col Michael M. Walker. Sponsor: AFLCMC.

KELLY, PATRICK J., Methodology for Including Base Infrastructure in Conceptual System Analysis. AFIT-ENV-MS-19-M-182. Faculty Advisor: Dr. John M. Colombi. Sponsor: AFLCMC/XZ. [ANT]

KOLANO, BRYAN, Multivariate Analysis of Diversity and Inclusion Data. AFIT-ENV-MS-19-M-132. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: 88th ABW.

MARKMAN, MATTHEW, Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms. AFIT-ENV-MS-19-M-187. Faculty Advisor: Dr. Jonathan Ritschel. Sponsor: AFLCMC/FZ.

TYSON, ROBERT, An Assessment of the Air Force's Return on Investment for Product Support Business Case Analysis Processes. AFIT-ENV-MS-19-M-201. Faculty Advisor: Dr. R. David Fass Sponsor: AFLCMC.

WILSON, PAUL, Tactical Missile Performance for Single and Multi-Wire Embedded Propellant Configurations with Discontinuities. AFIT-ENV-MS-19-M-253. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: AFLCMC/EB.

### **AIR FORCE RESEARCH LABORATORY**

#### **Master's Theses**

CHIARATTI, NICHOLAS S., Software Defined Radio (SDR) Device Discrimination Using Chip Shape-Distinct Native Attribute (CS-DNA) Features. AFIT-ENG-MS-19-M-018. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL AFMC. [CCR]

HEBERT, TERRY R., The Impacts of Using Augmented Reality to Support Aircraft Maintenance. AFIT-ENS-MS-19-M-121. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AFRL/AFMC. [COA]

KEESLING, RICHARD B., Exploratory Analysis of the Potential Use of Augmented Reality in Aircraft Maintenance. AFIT-ENS-MS-19-M-129. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: AFRL. [COA]

KEILBARTH, CASEY, Ballistic Evaluation of Carbon Nanotube Sheet Material in Multifunctional Applications. AFIT-ENV-MS-19-M-224. Faculty Advisor: Maj Andrew J. Lingenfelter. Sponsor: AFRL.

PLOURDE, TIMOTHY, Analysis of the Effect of Corrosion on the Surface Chemistry of Mild Steel Exposed to Biofuel. AFIT-ENV-MS-19-M-193. Faculty Advisor: Dr. Jeremy Slagley. Sponsor: AFRL.

### **AFRL: 711<sup>th</sup> HUMAN PERFORMANCE WING**

#### **Doctoral Dissertations**

ANDERSON, TIMOTHY, Statistical L-Moment and L-Moment Ratio Estimation and Their Applicability in Network Analysis. AFIT-ENC-DS-19-S-001. Faculty Advisor: Dr. Christine M. Schubert Kabban. Sponsor: 711 HPW/RHCML.

LOPEZ, JENNIFER, Sample Size Requirements and Considerations for Models to Assess Human-Machine System Performance. AFIT-ENC-DS-19-S-003. Faculty Advisor: Dr. Christine M. Schubert Kabban. Sponsor: 711 HPW/RH.

#### **Master's Theses**

BUCK, JENNIFER, Pay-Setting Analysis of Laboratory Demonstration Workforce. AFIT-ENS-MS-19-M-104. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: 711th HPW.

CHAVEZ, SENOBIO, Serious Game Design Using MDA and Bloom's Taxonomy. AFIT-ENG-MS-19-M-017. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: 711th HPW/RH.

GANITANO, GRAIG S., Confidence Inference in Defensive Cyber Operator Decision Making. AFIT-ENG-MS-19-M-028. Faculty Advisor: Dr. Brett J. Borghett. Sponsor: 711HPW/CL. [CCR]

NOVITSKE, ZACHARY A., Measuring Human Systems Integration in Directed Energy Weapon Acquisition Programs. AFIT-ENS-MS-19-M-142. Faculty Advisor: LTC Christopher Smith. Sponsor: 711th HPW/HP. [COA]

## **AFRL: AIR FORCE OFFICE OF SCIENTIFIC RESEARCH**

### **Master's Theses**

- CANZONETTA, DAVID, Assessing Artificial-Agent Response Time Effects on Human-Agent Teams in Variable Inter-Arrival Time Environments. AFIT-ENV-MS-19-M-166. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFOSR.
- CHOE, KEVIN, Displacement Damage Effects in GeSn Light Emitting Diodes. AFIT-ENP-MS-19-M-073. Faculty Advisor: Lt Col Michael R. Hogsted. Sponsor: AFOSR/RT.
- ETHRIDGE, JAMES A., Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials. AFIT-ENP-MS-19-M-077. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFOSR/RT. [CDE CTISR]
- GAHAN, KENNETH, Project Have Medusa. AFIT-ENY-MS-19-M-213. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFOSR.
- GRAVES, DUSTIN, Initial Stage of Fluid-Structure Interaction of a Celestial Icosahedron-Shaped Vacuum Lighter-Than-Air Vehicle. AFIT-ENY-MS-19-M-216. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFOSR/RT.
- JOHNSON, BROOKE, Machine Translation with Image Context from Mandarin Chinese to English. AFIT-ENG-MS-19-M-035. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR.
- LEONARD, AVERY W., Sheet Velocity Measurements Using Laser Absorption Spectroscopy in a Xenon Hall Effect Thruster Plume. AFIT-ENY-MS-19-M-227. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: AFOSR. [CSRA]
- LIN, KEVIN, Piezoelectric Sensor Crack Detection on Airframe Systems. AFIT-ENC-MS-19-M-001. Faculty Advisor: Capt Richard P. Uber. Sponsor: AFOSR.
- NAGAMINE, ERIC, The Non-Mechanical Beam Steering of Light in Reflective Inverse Diffusion. AFIT-ENP-MS-19-M-086. Faculty Advisor: Lt Col Kenneth W. Burgi. Sponsor: AFOSR/RT.
- SAUNDERS, RYAN, Influence of Leading Edge Oscillatory Blowing on Time-Accurate Dynamic Store Separation. AFIT-ENY-MS-19-M-244. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFOSR/RT.
- SIGALA, ALBERTO, A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities. AFIT-ENV-MS-19-M-197. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFOSR.
- STANKOWSKI, KYLE, Target Detection in Heterogeneous Clutter with Low Resolution Radar. AFIT-ENG-MS-19-S-011. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: AFOSR/RT.
- VILLARREAL, MICAH, Confirmation Bias Estimation from Electroencephalography with Machine Learning. AFIT-ENG-MS-19-M-065. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR/RT.

## **AFRL: AEROSPACE SYSTEMS DIRECTORATE**

### **Master's Theses**

- BABCOCK, HORATIO, Investigation of Endwall Vortex Manipulation in High Lift Turbines Caused by Active Endwall Forcing. AFIT-ENY-MS-19-M-202. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQ.
- BOLLER, SCOTT, Flow Behavior in Radial Rotating Detonation Engines. AFIT-ENY-MS-19-M-205. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: AFRL/RQ.
- CALLAGHAN, PATRICK, Evaluation of Unmanned Aircraft Flying Qualities Using a Stitched Learjet Model. AFIT-ENY-MS-19-M-206. Faculty Advisor: Dr. Donald L. Kunz. Sponsor: AFRL/RQ.

CARPENTER, JAMES, Simulation and Piloted Simulator Study of an Automatic Ground Collision Avoidance System for Performance Limited Aircraft. AFIT-ENY-MS-19-M-207. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFOSR, AFRL/RQ.

DALLMANN, WILLIAM E., Infrared and Electro-Optical Stereo Vision For Automated Aerial Refueling. AFIT-ENG-MS-19-M-022. Faculty Advisor: Scott L. Nykl. Sponsor: AFRL/RQ. [ANT]

DRUSS, RYAN, Low Mass Flow RDE Operating on Gaseous Air and Ethylene for Future Scramjet Integration. AFIT-ENY-MS-19-S-084. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: AFRL/RQ.

HARRIS, KAREN, A Comparative Analysis on UAS Operating Procedures within Military Airspace. AFIT-ENS-MS-19-M-120. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: AFRL/RQ.

JACKSON, SUNDERLIN D., Control Strategies for Multi-Evaporator Vapor Compression Cycles. AFIT-ENY-MS-19-M-221. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQ. [CSRA]

JOHNSON, GRANT, Flow Control and Slender Body Dynamics for Store Separation into Subsonic and Supersonic Freestreams. AFIT-ENY-MS-19-M-222. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQ.

LABUDA, DAVID, Schlieren Imaging and Flow Analysis on a Cone/Flare Model in the AFRL Mach 6 Ludwig Tube Facility. AFIT-ENY-MS-19-M-226. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQ.

MCNAMARA, LUKE, Scaling Gas Turbine Adiabatic Effectiveness with Mass Transfer and Thermal Experimental Techniques. AFIT-ENY-MS-19-M-233. Faculty Advisor: Lt Col James L. Rutledge. Sponsor: AFRL/RQ.

MONTGOMERY, MADISON J., Active Control of a Morphing Wing Aircraft and Failure Analysis For System Reliability. AFIT-ENG-MS-19-M-045. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RQ. [ANT]

POOLE, JONATHAN D., Product Development Process for Small Unmanned Aerial Systems. AFIT-ENV-MS-19-M-194. Faculty Advisor: Lt Col Amy Cox. Sponsor: AFRL/RQ. [ANT]

RATHSACK, TYLOR, Examination of Flow Dynamics and Passive Cooling in an Ultra Compact Combustor. AFIT-ENY-MS-19-M-239. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: AFRL/RQ.

RIVERA, JUAN A., Design and Flight Test of a Path Planning Algorithm Utilizing Graph Theory for Real-Time Applications. AFIT-ENY-MS-19-M-241. Faculty Advisor: Dr. David R. Jacques. Sponsor: AFRL/RQ. [ANT]

#### **AFRL: DIRECTED ENERGY DIRECTORATE**

##### **Doctoral Dissertations**

THOMAS, GRANT M., Daytime Satellite Detection for Persistent Ground-Based Custody. AFIT-ENY-DS-19-S-083. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: SatAC. [CDE CSRA CTISR]

THORNTON, DOUGLAS E., Digital Holography Efficiency Experiments for Tactical Applications. AFIT-ENP-DS-19-S-029. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD. [CDE CTISR]

##### **Master's Theses**

MAO, DAVIN, Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System. AFIT-ENP-MS-19-M-084. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD. [CDE CTISR]

#### **AFRL: MATERIALS AND MANUFACTURING DIRECTORATE**

##### **Master's Theses**

GOROSPE, ANDREW, Non-Contact Height Estimation for Material Extrusion Additive Systems via Monocular Imagery. AFIT-ENG-MS-19-M-029. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/RX.

HAGER, ERIN, Process Parameter Development of Additively Manufactured AF9628 Weapons Steel. AFIT-ENY-MS-19-M-217. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: AFRL/RX.

### **AFRL: MUNITIONS DIRECTORATE**

#### **Doctoral Dissertations**

ELLIOTT, OLIVIA, Effects of Carbon-Based Ablation Products on Hypersonic Boundary Layer Stability. AFIT-ENY-DS-19-S-074. Faculty Advisor: Dr. Robert B. Greendyke. Sponsor: AFRL/RW.

#### **Master's Theses**

BARBER, TAYLOR S., Performance Analysis of Angle of Arrival Algorithms Applied to Radiofrequency Direction Finding. AFIT-ENG-MS-19-M-008. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: AFRL/RW. [ANT]

SCHMIDT, KYRA L., Analytical Models and Control Design Approaches for a 6 DOF Motion Test Apparatus. AFIT-ENY-MS-19-M-245. Faculty Advisor: Dr. Richard Cobb. Sponsor: AFRL/RW. [CSRA]

### **AFRL: SENSORS DIRECTORATE**

#### **Doctoral Dissertations**

BROOKS, ADAM, Nondestructive Electromagnetic Characterization of Perfect-Electric-Conductor-Backed Uniaxial Materials. AFIT-ENG-DS-19-S-004. Faculty Advisor: Dr. M. J. Havrilla. Sponsor: AFRL/RW.

VAN WOERKOM, TODD A., On the Pulsed Ablation of Metals and Semiconductors. AFIT-ENP-DS-19-S-030. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RW. [CDE]

#### **Master's Theses**

BERHOLD, JEDEDIAH M., Convolutional Neural Network Architecture Study for Aerial Visual Localization. AFIT-ENG-MS-19-M-010. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RW. [ANT]

BOGGS, BRANDON N., RF-DNA Fingerprinting Ping 2020i ADS-B UAT Devices Using a Low-Cost SDR. AFIT-ENG-MS-19-M-011. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL/RW. [CCR]

CHON, STEVEN H., Hyper-Parameter Optimization of a Convolutional Neural Network. AFIT-ENS-MS-19-M-105. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: AFRL/RW. [COA]

CINTRON, LUIS A., Modeling a Consortium-Based Distributed Ledger Network with Applications for Intelligent Transportation Infrastructure. AFIT-ENG-MS-18-M-019. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RW. [CCR]

COMBS, COREY A., DT&E of an Autonomous UAS Swarming Algorithm. AFIT-ENV-MS-19-M-168. Faculty Advisor: Dr. John M. Colombi. Sponsor: AFRL/RW. [ANT]

CRUZ, FRANKIE A., Near Real-Time RF-DNA Fingerprinting for ZigBee Devices Using Software Defined Radios. AFIT-ENG-MS-19-M-021. Faculty Advisor: Maj Joan A. Betances Jorge. Sponsor: AFRL/RW. [CCR]

GRIMM, MATTHEW A., Imitating Human Responses Via a Dual-Process Model Approach. AFIT-ENG-MS-19-M-030. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/RW. [CCR]

HUGHES, AVIAN, Electromagnetic Characterization of Conductor-backed Media Using Stepped-iris Rectangular Waveguide. AFIT-ENG-MS-19-M-033. Faculty Advisor: Dr. Michael J. Havrilla. Sponsor: AFRL/RW.

KIM, KYUNG M., Monocular Visual Odometry For Fixed-Wing, Small Unmanned Aircraft Systems. AFIT-ENG-MS-19-M-036. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RW. [ANT]

LASSITER, RAHN M., Physical Layer Discrimination Of Electronic Control Units Using Wired Signal Distinct Native Attribute (WS-DNA) Fingerprints. AFIT-ENG-MS-19-M-038. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RV. [CCR]

NELSON, KALEB J., Event-Based Visual-Inertial Odometry on a Fixed-Wing Unmanned Aerial Vehicle. AFIT-ENG-MS-19-M-048. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RV. [ANT]

SCHMITT, DARYL W., A Framework for Cyber Vulnerability Assessments of InfiniBand Networks. AFIT-ENG-MS-19-M-054. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RV. [CCR]

UNDERWOOD, BLAINE, Plasma Treatment Method for Ohmic Contacts on Zinc Oxide Thin Film Transistors. AFIT-ENG-MS-19-M-062. Faculty Advisor: Maj Tod Laurvick. Sponsor: AFRL/RV.

WALLACE, SCOUT T., Extended Kalman Filtering for Missile Live-Fire Data Analysis. AFIT-ENG-MS-18-D-004. Faculty Advisor: Lt Col Scott J. Pierce. Sponsor: AFRL/RV. [ANT]

### **AFRL: SMALL BUSINESS OFFICE**

#### **Master's Theses**

RASK, THEODORE A., Commercialization Analysis of SBIR-Funded Technologies. AFIT-ENV-MS-19-M-195. Faculty Advisor: Lt Col Amy Cox. Sponsor: AFRL/SB. [ANT]

### **AFRL: SPACE VEHICLES DIRECTORATE**

#### **Master's Theses**

CHAVEZ, CHRISTIAN M., Optimal Natural Motion Circumnavigation Orbit Transfer Trajectories for Satellite Proximity Operations. AFIT-ENV-MS-19-M-208. Faculty Advisor: Maj Joshua A. Hess. Sponsor: AFRL/RV. [CSRA]

DONTIGNEY, TROY B., Space Surveillance Network Design. AFIT-ENG-MS-19-J-003. Faculty Advisor: Dr. Laurence D. Merkle. Sponsor: AFRL/RV. [CCR]

GEORGE, BRANDON C., Optimal and Robust Neural Network Controllers for Proximal Spacecraft Maneuvers. AFIT-ENV-MS-19-M-215. Faculty Advisor: Maj Joshua A. Hess. Sponsor: AFRL/RV. [CSRA]

GOOCH, JOSHUA Y., Global Ionosonde and GPS Radio Occultation Sporadic-E Intensity and Height Comparison. AFIT-ENP-MS-19-M-079. Faculty Advisor: Maj Daniel J. Emmons. Sponsor: AFRL/RV. [CSRA]

RAQUET, NATHANIEL J., Analysis of Satellite Timing and Navigation Receiver Pseudorange Biases Due to Spreading Code Puncturing and Phase Optimized Constant Envelope Transmission. AFIT-ENG-MS-19-M-051. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: AFRL/RV. [ANT]

ROUND, JOSEPH F., Variations of Heavy Ion Abundances Relative to Proton Abundances in Large Solar Energetic Particle Events. AFIT-ENP-MS-19-M-090. Faculty Advisor: Dr. Robert D. Loper. Sponsor: AFRL/RV. [CSRA]

WASZ, PATRICK J., Two-On-One Pursuit with a Non-Zero Capture Radius. AFIT-ENG-MS-19-M-066. Faculty Advisor: Dr. Meir Pachter. Sponsor: AFRL/RV. [ANT]

### **AIR FORCE INSTALLATION AND MISSION SUPPORT CENTER**

#### **Master's Theses**

BERNER, WILLIAM, Estimating Total Cost of Ownership for United States Air Force Chiller Assets. AFIT-ENV-MS-19-M-162. Faculty Advisor: Maj Steven J. Schuldt. Sponsor: AFIMC.

## **AIR FORCE SUSTAINMENT CENTER**

### **Graduate Research Papers**

STEWART, JESSICA, Lessons Learned from Operation Inherent Resolve. AFIT-ENS-MS-19-J-051. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: 448 SCMW/DV.

## **4.6 AIR MOBILITY COMMAND**

### **Master's Theses**

ALFORD, PARKER H., Strengths, Challenges, Opportunities, and Threats. AFIT-ENS-MS-19-M-098. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AMC/A4. [COA]

### **Graduate Research Papers**

COBURN, ZACHARY, A Qualitative Study of Air Mobility Command's Phoenix Horizon-Reach Program. AFIT-ENS-MS-19-J-024. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: USAF EC/EC.

GILMER, JARED, KC-46 Comparative Cargo Capability and What it Means to the MAF. AFIT-ENS-MS-19-J-031. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: 22<sup>nd</sup> Operations Group/CC.

MCCONVILLE, SEAN, Tailoring C-17 Training and Apportionment for the Evolving Mission Environment. AFIT-ENS-MS-19-J-040. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: AMC.

RANKIN, DEREK R., The KC-10 Divestment, Personnel Movement Plan. AFIT-ENS-MS-19-J-043. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: 22nd Operations Group. [COA]

RATCLIFFE, MATTHEW T., Identifying Operational and Fiscal Inefficiencies. AFIT-ENS-MS-19-J-044. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: AMC/IG. [COA]

RUST, AUSTIN D., A Missing Link in AMC's Data Chain. AFIT-ENS-MS-19-J-049. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: 314 AW/CC. [COA]

SUSTELLO, DAVID, An Analysis of the Inbound Aircraft Notification Process. AFIT-ENS-MS-19-J-052. Faculty Advisor: Dr. William A. Cunningham. Sponsor: 618AOC/CC.

## **4.7 AIR FORCE SPACE COMMAND**

### **Master's Theses**

DARARUTANA, KANIT, Comparison of Novel Heuristic and Integer Programming Schedulers for the US Air Force Space Surveillance Network. AFIT-ENS-MS-19-M-108. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: AFSPC/A36Z. [CSRA]

LEVALLEY, ANDREW S., A Mixed Integer Programming Framework for the Fuel Optimal Guidance of Complex Spacecraft Rendezvous and Proximity Operation Missions. AFIT-ENV-MS-19-M-185. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFSPC/A2/3/6TW. [CSRA]

MERCIER, MARK R., Optimal Inspection of a Satellite with Dynamic Zone Constraints. AFIT-ENY-MS-19-M-234. Faculty Advisor: Lt Col Kirk W. Johnson. Sponsor: AFSPC. [CSRA]

## **45<sup>th</sup> WEATHER SQUADRON**

CROUCH, SAMUEL T., Modeling Electrical Conductivity of Chemical Rocket Exhaust Plumes. AFIT-ENY-MS-19-M-210. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: 45 WS. [CSRA]

GOLD, SARAH, Effect of Using Probabilistic Contingency Tables to Modify Forecast Predictions. AFIT-ENS-MS-19-M-117. Faculty Advisor: Dr. Edward D. White. Sponsor: 45 WS.

KATUZIENSKI, DANIEL, Comparing Dual-Polarization Radar Lightning Forecast Methods across Southwest Utah. AFIT-ENP-MS-19-M-083. Faculty Advisor: Maj Omar A. Nava. Sponsor: 45 WS.

SANDERSON, DAWN, Modeling the Distribution of Lightning Strike Distances outside a Preexisting Lightning Area. AFIT-ENC-MS-19-M-003. Faculty Advisor: Dr. Edward D. White. Sponsor: 45 WS.

SPERANZA, DOMINICK, Lightning Prediction Using Recurrent Neural Networks. AFIT-ENS-MS-19-M-150. Faculty Advisor: Maj Andrew J. Geyer. Sponsor: 45th Weather Squadron.

### **SPACE AND MISSILE SYSTEMS CENTER**

#### **Master's Theses**

BRADLEY, LOYD, Investigating Schedule Length of Space and Missile Systems Center Contracts. AFIT-ENV-MS-19-M-164. Faculty Advisor: Dr. Edward D. White. Sponsor: SMC/PI.

ELWORTH, CHRISTOPHER, Comparing Estimated-to-Actual Development Budgets for Air Force Space Programs. AFIT-ENV-MS-19-M-172. Faculty Advisor: Dr. Edward D. White. Sponsor: SMC/RFM.

FERNANDEZ, FERNANDO D., A Focal Plane Array and Electronics Model for CMOS and CCD Sensors in the AFIT Sensor and Scene Emulation Tool (ASSET). AFIT-ENG-MS-19-M-026. Faculty Advisor: Dr. Bryan J. Steward. Sponsor: SMC/RS. [CTISR]

## **4.8 AIR FORCE SPECIAL OPERATIONS COMMAND**

#### **Master's Theses**

BEVERIDGE, NATHANAEL, Social Network Threat Detection. AFIT-ENS-MS-19-M-101. Faculty Advisor: Lt Col Andrew J. Geyer. Sponsor: USSOCOM SOC/North Peterson AFB.

## **4.9 USAF FIELD OPERATING AGENCIES/DIRECT REPORTING UNITS**

### **AIR FORCE COST ANALYSIS AGENCY**

#### **Master's Theses**

ANGELL, EMILY, Analysis of Military Construction Cost Growth in Major Defense Acquisition Programs. AFIT-ENV-MS-19-M-159. Faculty Advisor: Dr. Edward D. White. Sponsor: AFCAA.

KLINE, SETH, Text Analysis of Air Force References in Twitter. AFIT-ENV-MS-19-M-183. Faculty Advisor: Dr. Jonathan Ritschel. Sponsor: AFCAA.

### **AIR FORCE TECHNICAL APPLICATIONS CENTER**

#### **Master's Theses**

BAZEMORE, DANIEL, Quantifying Uncertainty of Ensemble Transport and Dispersion Simulations Using HYSPLIT. AFIT-ENP-MS-19-M-065. Faculty Advisor: Lt Col Hsien-Liang Tseng. Sponsor: AFTAC.

HALL, AMY, Development of a Model for C-11 Production Via the N-14 (p,α) Reaction Using a GE PETtrace Cyclotron. AFIT-ENP-MS-19-M-080. Faculty Advisor: Maj James E. Bevins. Sponsor: AFTAC.

QUARTEMONT, NICHOLAS, Nuclear Data Covariance Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments. AFIT-ENP-MS-19-M-089. Faculty Advisor: Maj James E. Bevins. Sponsor: AFTAC.

TORZILLI, ROBERT, Developing and Testing of a Simulated NUDET Optical Detection Model Using Realistic Weather Conditions. AFIT-ENP-MS-19-M-093. Faculty Advisor: Dr. James C. Petrosky. Sponsor: AFTAC.

ZOELLICK, CASEY, Source Term Estimation of Atmospheric Pollutants Using an Ensemble of HYSPLIT Concentration Simulations. AFIT-ENP-MS-19-M-096. Faculty Advisor: Lt Col Hsien-Liang Tseng. Sponsor: AFTAC.

## **NATIONAL AIR AND SPACE INTELLIGENCE CENTER**

### **Doctoral Dissertations**

DONEGAN, BRIAN, Experimental and Computational Analysis of the Interaction of Carbon and Silicon Ablation Products in Expanding Hypersonic Flows. AFIT-ENY-DS-18-D-035. Faculty Advisor: Dr. Robert B. Greendyke. Sponsor: NASIC.

### **Master's Theses**

BADUI, JAIME M., Geosynchronous Satellite Systems' Delta V Allocation for Collision Avoidance Maneuvers. AFIT-ENY-MS-19-M-203. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: NASIC. [CSRA]

BRAMBLETT, LAUREN M., Turbojet Range, Loiter, and Altitude Tradeoff Estimations in Efficient Modeling and Optimization Formulations. AFIT-ENS-MS-19-M-102. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: NASIC. [COA]

LIBRANDI, ROCCO, Variable Type Inference Based On Statistical and Architectural Indications. AFIT-ENG-MS-19-M-040. Faculty Advisor: Dr. Andrew J. Terzuoli. Sponsor: NASIC/AC.

## **4.10 DEPARTMENT OF DEFENSE**

### **Doctoral Dissertations**

KING, DAVID W., Emergent Behavior Development and Control in Multi-Agent Systems. AFIT-ENG-DS-19-S-007. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AF Pentagon, Studies, Analyses and Assessments. [CCR]

### **Master's Theses**

LARKIN, MICHAEL T., A Stochastic Game Theoretical Model for Cyber Security. AFIT-ENS-MS-19-M-133. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: USD (R&E) DTEP. [COA]

### **Graduate Research Papers**

DIEMER, DANIEL P., Interagency Coordination between FEMA, USNORTHCOM, and USTRANSCOM during a Hurricane Response. AFIT-ENS-MS-19-J-025. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: 7000 Defense Pentagon. [COA]

MCDADE, GREGORY A., A Case Study in Requirements Prioritization. AFIT-ENS-MS-19-J-041. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: 86 AW/CC. [COA]

## **AIR FORCE SPECIALTY CODE**

### **Master's Theses**

ST PETER, TROY, Implementing an Autoregressive Distributed Lag Approach with Air Force Maintenance Data. AFIT-ENS-MS-19-M-151. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: AFSC/LG.

## **DEFENSE ADVANCED RESEARCH PROJECTS AGENCY**

### **Master's Theses**

SCHWALBE, SOPHIA, Modeling High-Altitude Nuclear Detonations Using Existing Ionospheric Models. AFIT-ENP-MS-19-M-092. Faculty Advisor: Dr. Robert D. Loper. Sponsor: DARPA/DS.

## **DEFENSE INTELLIGENCE AGENCY**

### **Master's Theses**

WALTON, RYAN B., Simulating Maritime Chokepoint Disruption in the Global Food Supply. AFIT-ENS-MS-19-M-153. Faculty Advisor: Dr. John O. Miller. Sponsor: DIA/DRI-8. [COA]

## **DEFENSE THREAT REDUCTION AGENCY**

### **Doctoral Dissertations**

RECKER, MATTHEW, Enabling Mobile Neutron Detection Systems with CLYC. AFIT-ENP-DS-19-S-028. Faculty Advisor: Dr. John W. McClory. Sponsor: DTRA.

### **Master's Theses**

EGNER, BRYAN, Development of a Mixed-Radiation Directional Rotating Scatter Mask Detection System. AFIT-ENP-MS-19-M-075. Faculty Advisor: Dr. Larry W. Burggraf. Sponsor: DTRA.

JOHNSTON, WILL, Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations. AFIT-ENP-MS-19-M-082. Faculty Advisor: Lt Col Michael L. Dexter. Sponsor: DTRA.

## **DIRECTED ENERGY JOINT TECHNOLOGY OFFICE**

### **Doctoral Dissertations**

WALLERSTEIN, AUSTIN J., Kinetics of Higher Lying Potassium States After Excitation of the D2 Transition in the Presence of Helium. AFIT-ENP-DS-18-D-009. Faculty Advisor: Dr. Glen P. Perram. Sponsor: DEJTO. [CDE]

### **Master's Theses**

WOLFMAYER, SCOTT S., Coupled Atmospheric Surface Observations with Surface Aerosol Particle Counts for Daytime Sky Radiance Quantification. AFIT-ENP-MS-19-M-095. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO. [CDE]

## **JOINT CHIEFS OF STAFF**

### **Master's Theses**

KANE, ZACHARY J., An Imputation Approach to Developing Alternative Futures of Country Conflict. AFIT-ENS-MS-19-M-128. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: JCS J-7. [COA]

## **JOINT WARFARE ANALYSIS CENTER**

### **Master's Theses**

NELSON, CURTIS B., Fuzzy Inference Systems for Risk Appraisal in Military Operational Planning. AFIT-ENS-MS-19-M-141. Faculty Advisor: Dr. Richard F. Deckro. Sponsor: JWAC. [COA]

SCHLICHT, JOHN A., Operations Research Methods for Multi-Domain Campaign Phase Planning. AFIT-ENS-MS-19-M-148. Faculty Advisor: Dr. Richard F. Deckro. Sponsor: JWAC. [COA]

## **NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY**

### **Doctoral Dissertations**

YOUNG, SHANNON, Optimization of a Moment-Based Detection Algorithm. AFIT-ENP-DS-18-D-010. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: NGA.

## **OFFICE OF THE SECRETARY OF DEFENSE**

### **Master's Theses**

BAKER, JERRY, An Analysis of Profit Margin in Relation to the Better Buying Power Initiative. AFIT-ENV-MS-19-M-160. Faculty Advisor: Lt Col Scott T. Drylie. Sponsor: OSD/CAPE.

O'CONNOR, SARA, An Analysis of Defense Contractor Profit Margins. AFIT-ENV-MS-19-M-191. Faculty Advisor: Maj Scott Drylie. Sponsor: OSD/CAPE.

## **UNITED STATES AFRICA COMMAND**

### **Master's Theses**

BAKER, JADE, West Africa Logistics Networks. AFIT-ENS-MS-19-M-100. Faculty Advisor: Dr. Bruce A. Cox. Sponsor: US AFRICOM.

DAVIS, RANDALL, Network Modeling and Analysis of United States Africa Command West African Regional Logistics Network. AFIT-ENS-MS-19-M-109. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: US AFRICOM.

PENDERGRASS, MICHAELA A., A Topological View of the Relationship between Women and Armed Conflict in West Africa. AFIT-ENS-MS-19-M-143. Faculty Advisor: LTC Christopher M. Smith. Sponsor: USAFRICOM. [COA]

## **UNITED STATES ARMY**

### **Doctoral Dissertations**

JENKINS, PHILLIP, Strategic Location and Dispatch Management of Assets in a Military Medical Evacuation Enterprise. AFIT-ENS-DS-19-J-037. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: MEPD.

### **Master's Theses**

MCWHIRTER, TRAVIS, Ground Vehicle Physics-Based Energy Modeling and Series Hybrid System Optimization. AFIT-ENV-MS-19-M-189. Faculty Advisor: Lt Col Torrey Wagner. Sponsor: TARDEC.

MORA, EDWIN A., A Multi-Vehicle Cooperative Localization Approach For an Autonomy Framework. AFIT-ENG-MS-19-M-046. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: RDECOM/CERDC. [ANT]

WESTMAN, MARYDELL V., Using Simulation to Model Reserve Officer Training Corps Cadet Flow. AFIT-ENS-MS-19-M-155. Faculty Advisor: O. Miller. Sponsor: USACC. [COA]

## **UNITED STATES NAVY**

### **Master's Theses**

HORNBERGER, ZACHARY, Search and Rescue Operations Forecasting and Optimization. AFIT-ENS-MS-19-M-123. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: CG RDC.

NELSON, AMANDA, Characterization of Tropical Cyclone Intensity Using Microwave Imagery. AFIT-ENP-MS-19-M-087. Faculty Advisor: Maj Omar A. Nava. Sponsor: JTWC.

TOWNLEY, TALON A., Limited-Duty-Cycle Satellite Formation Control Via Differential Drag. AFIT-ENY-MS-19-M-249. Faculty Advisor: Lt Col Kirk W. Johnson. Sponsor: SPAWAR SSC Pacific SIS Division. [CSRA]

## **UNITED STATES STRATEGIC COMMAND**

### **Doctoral Dissertations**

CABALLERO, WILLIAM, Behavioral and Behaviorally Robust Models. AFIT-ENS-DS-19-J-022. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USSTRATCOM.

KEITH, ANDREW J., Inferential, Sequential, and Adversarial Approaches. AFIT-ENS-DS-19-S-041. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: STRATCOM. [COA]

KLINE, ALEXANDER G., Real-Time Heuristics and Metaheuristics for Static and Dynamic Weapon Target Assignments. AFIT-ENS-DS-18-D-016. Faculty Advisor Dr. Darryl K. Ahner. Sponsor: STRATCOM/JWAC. [COA]

## **UNITED STATES TRANSPORTATION COMMAND**

### **Master's Theses**

HUGHES, MICHAEL S., A Port-Based Analysis of USTRANSCOM Shipping Network Vulnerability. AFIT-ENS-MS-19-M-124. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USTRANSCOM/JDPAC. [COA]

HYDER, DYLAN A., Liner Sustainment Workload Forecasting Using Exogenous Data. AFIT-ENS-MS-19-M-126. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USTRANSCOM/JDPAC. [COA]

### **Graduation Research Projects**

HAWKINS, STEVEN, Time Series Forecasting of Tanker Training Demand. AFIT-ENS-MS-19-J-033. Faculty Advisor: Dr. William A. Cunningham. Sponsor: USTC/J-3.

## **4.11 OTHER FEDERAL AGENCIES**

### **DEPARTMENT OF ENERGY**

#### **Doctoral Dissertations**

MACE, MELANIE, Targeted Germanium Ion Irradiation of Aluminum Gallium Nitride/Gallium Nitride High Electron Mobility Transistors. AFIT-ENP-DS-19-S-025. Faculty Advisor: Dr. John W. McClory. Sponsor: NNSA.

## **DEPARTMENT OF HOMELAND SECURITY**

### **Doctoral Dissertations**

DUGAN, CHRISTINA, Electrical Characterization of Crystalline UO<sub>2</sub>, ThO<sub>2</sub>, and U<sub>0.71</sub>Th<sub>0.29</sub>O<sub>2</sub>. AFIT-ENP-DS-18-D-007. Faculty Advisor: Dr. James C. Petrosky. Sponsor: DHS/DNDO.

### **Master's Theses**

ARAGON, ANGELITO E., Evaluating Machine Learning Techniques for Smart Home Device Classification. AFIT-ENG-MS-19-M-006. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR ANT]

MOSBY, JOSHUA K., A Blockchain-Based Anomalous Detection System For Internet Of Things' Devices. AFIT-ENG-MS-19-M-047. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR]

STAFIRA, LUKAS A., Examining Effectiveness of Web-Based Internet of Things' Honey pots. AFIT-ENG-MS-19-M-057. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR]

## **DEPARTMENT OF VETERANS AFFAIRS**

### **Master's Theses**

BEEMER, CODY, An Analysis of Built Environment Factors in Residences and the Associated Effects on Mental Health Symptoms of United States Veterans. AFIT-ENV-MS-19-M-161. Faculty Advisor: Lt Col Andrew J. Hoisington. Sponsor: MIRECC.

## **ENVIRONMENTAL PROTECTION AGENCY**

### **Master's Theses**

ELLIS, ASHLEE, Interactions between Bacteriophage MS2, Kaolinite, and Fiberglass. AFIT-ENV-MS-19-M-171. Faculty Advisor: Dr. Willie F. Harper. Sponsor: US EPA.

GEISER, PHILICIA, Evaluation of Guar Gum as a Novel Adsorbent. AFIT-ENV-MS-19-M-174. Faculty Advisor: Lt Col John E. Stubbs. Sponsor: US EPA.

MARTINEZ SANCHEZ, JOSE, Electrochemical Modification of Granular-Activated Carbon and Carbon Nanofibers to Determine Effect on Adsorption. AFIT-ENV-MS-19-M-188. Faculty Advisor: Lt Col John E. Stubbs. Sponsor: US EPA.

## **FEDERAL EMERGENCY MANAGEMENT AGENCY**

### **Master's Theses**

GREEN, NICHOLAS, Shipping Designs for the Post-Disaster Cargo Surge. AFIT-ENS-MS-19-M-118. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: FEMA.

## **4.12 INTERNATIONAL ORGANIZATIONS**

### **BRAZILIAN AIR FORCE INSTITUTE OF LOGISTICS**

#### **Master's Theses**

MONTEIRO, LUCIANA M., Predicting Failures of the Brazilian Air Force Tucano Fleet Using Survival Analysis. AFIT-ENS-MS-19-M-139. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: ILA. [COA]

## **4.13 NON-FEDERAL SPONSORS**

### **LOCKHEED MARTIN MISSILES AND FIRE CONTROL**

#### **Master's Theses**

CLEMENS, SAMUEL T., Maximizing a Cruise Missile Attack Using Variable Strategies and Salvo Firing. AFIT-ENS-MS-19-M-107. Faculty Advisor: Dr. John O. Miller Sponsor: LM MFC. [COA]

SHALD, DAVID, Pitch Characterization of a Self-Defense Missile Using System Identification Applied to Computational Maneuvers. AFIT-ENY-MS-19-M-246. Faculty Advisor: Lt Col Darrell S. Crowe. Sponsor: Lockheed Martin MFC.

### **RAYTHEON SPACE AND AIRBORNE SYSTEMS**

#### **Master's Theses**

BROWNLEE, LAUREN E., Battle Damage Assessment with Optical Cross Section Measurements. AFIT-ENP-MS-19-S-018. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: Raytheon SAS. [CDE]

### **THE BOEING COMPANY**

#### **Master's Theses**

THOMPSON, RYAN, Wall Model Large Eddy Simulation of a Diffusing Serpentine Inlet Duct. AFIT-ENY-MS-19-M-248. Faculty Advisor: Lt Col Jeffrey R. Komives. Sponsor: The Boeing Company.

### **THE OHIO STATE UNIVERSITY**

#### **Master's Theses**

YNCH, RYAN, Investigation of Thermal Scaling Effects for a Turbine Blade Leading Edge and Pressure Side Model. AFIT-ENY-MS-19-J-072. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: OSU/Department of Mechanical and Aerospace Engineering.

## **5. ACADEMIC DEPARTMENT PUBLICATIONS AND FUNDING INFORMATION**

## **5.1 DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS**

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### **5.1.1 DOCTORAL DISSERTATIONS**

DONEGAN, BRIAN, Experimental and Computational Analysis of the Interaction of Carbon and Silicon Ablation Products in Expanding Hypersonic Flows. AFIT-ENY-DS-18-D-035. Faculty Advisor: Dr. Robert B. Greendyke. Sponsor: NASIC.

ELLIOTT, OLIVIA, Effects of Carbon-Based Ablation Products on Hypersonic Boundary Layer Stability. AFIT-ENY-DS-19-S-074. Faculty Advisor: Dr. Robert B. Greendyke. Sponsor: AFRL/RW.

KEMNITZ, RYAN A., Mechanical Behavior and the Effects of the Space Environment. AFIT-ENY-DS-18-D-036. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

THOMAS, GRANT M., Daytime Satellite Detection for Persistent Ground-Based Custody. AFIT-ENY-DS-19-S-083. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: SatAC. [CDE CSRA CTISR]

### 5.1.2 MASTER'S THESES

- BABCOCK, HORATIO, Investigation of Endwall Vortex Manipulation in High Lift Turbines Caused by Active Endwall Forcing. AFIT-ENY-MS-19-M-202. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQ.
- BADUI, JAIME M., Geosynchronous Satellite Systems' Delta V Allocation for Collision Avoidance Maneuvers. AFIT-ENY-MS-19-M-203. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: NASIC. [CSRA]
- BITTEL, THOMAS P., Modeling and Design Optimization of a Water Electrolysis Thruster. AFIT-ENY-MS-19-J-069. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]
- BOLLER, SCOTT, Flow Behavior in Radial Rotating Detonation Engines. AFIT-ENY-MS-19-M-205. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: AFRL/RQ.
- CALLAGHAN, PATRICK, Evaluation of Unmanned Aircraft Flying Qualities Using a Stitched Learjet Model. AFIT-ENY-MS-19-M-206. Faculty Advisor: Dr. Donald L. Kunz. Sponsor: AFRL/RQ.
- CARPENTER, JAMES, Simulation and Piloted Simulator Study of an Automatic Ground Collision Avoidance System for Performance Limited Aircraft. AFIT-ENY-MS-19-M-207. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFOSR, AFRL/RQ.
- CHAVEZ, CHRISTIAN M., Optimal Natural Motion Circumnavigation Orbit Transfer Trajectories for Satellite Proximity Operations. AFIT-ENY-MS-19-M-208. Faculty Advisor: Maj Joshua A. Hess. Sponsor: AFRL/RV. [CSRA]
- COLE, TIFFANY D., Satellite On-Orbit Characterization Based on Inspection Relative Orbit Parameters. AFIT-ENY-MS-18-D-033. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: N/A. [CSRA]
- CROUCH, SAMUEL T., Modeling Electrical Conductivity of Chemical Rocket Exhaust Plumes. AFIT-ENY-MS-19-M-210. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: 45 WS. [CSRA]
- CROUCH, TARA, Direct Numerical Simulation of Roughness-Induced Hypersonic Boundary Layer Transition on a Seven Degree Half-Angle Cone. AFIT-ENY-MS-19-M-211. Faculty Advisor: Lt Col Jeffrey R. Komives. Sponsor: Arnold Engineering Center.
- DRUSS, RYAN, Low Mass Flow RDE Operating on Gaseous Air and Ethylene for Future Scramjet Integration. AFIT-ENY-MS-19-S-084. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: AFRL/RQ.
- GAHAN, KENNETH, Project Have Medusa. AFIT-ENY-MS-19-M-213. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFOSR.
- GARLISI, CHARLES J., Performance Characterization of an Accion Systems TILE Colloid Thruster Using a Force Balance Test Stand. AFIT-ENY-MS-19-M-214. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]
- GEORGE, BRANDON C., Optimal and Robust Neural Network Controllers for Proximal Spacecraft Maneuvers. AFIT-ENY-MS-19-M-215. Faculty Advisor: Maj Joshua A. Hess. Sponsor: AFRL/RV. [CSRA]
- GRAVES, DUSTIN, Initial Stage of Fluid-Structure Interaction of a Celestial Icosahedron-Shaped Vacuum Lighter-Than-Air Vehicle. AFIT-ENY-MS-19-M-216. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFOSR/RT.
- HAGER, ERIN, Process Parameter Development of Additively Manufactured AF9628 Weapons Steel. AFIT-ENY-MS-19-M-217. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: AFRL/RX.
- HARKINS, MEGAN, Creep of Nextel 720/Alumina Ceramic Matrix Composite with Diamond-Drilled Effusion Holes at 1200°C in Air and in Steam. AFIT-ENY-MS-19-M-218. Faculty Advisor: Dr. Marina B. Ruggles-Wrenn. Sponsor: AFRL/RX.

HOHNBAUM, CHARLES C., Fracture Toughness and Fatigue Crack Growth Rate Characterization of Inconel 718 Formed by Laser Powder Bed Fusion. AFIT-ENY-MS-19-M-220. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: AFIT/ENY. [CSRA]

JACKSON, SUNDERLIN D., Control Strategies for Multi-Evaporator Vapor Compression Cycles. AFIT-ENY-MS-19-M-221. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQ. [CSRA]

JOHNSON, GRANT, Flow Control and Slender Body Dynamics for Store Separation into Subsonic and Supersonic Freestreams. AFIT-ENY-MS-19-M-222. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQ.

KEANE, MICHAEL, Ballistic Limit Shot Dependency Testing in Composite Materials. AFIT-ENY-MS-19-J-071. Faculty Advisor: Lt Col Michael M. Walker. Sponsor: AFLCMC.

KEILBARTH, CASEY, Ballistic Evaluation of Carbon Nanotube Sheet Material in Multifunctional Applications. AFIT-ENY-MS-19-M-224. Faculty Advisor: Maj Andrew J. Lingenfelter. Sponsor: AFRL.

KROTT, MATTHEW J., CubeSat Payload Thermal Management Optimization. AFIT-ENY-MS-19-M-225. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A. [CSRA]

LABUDA, DAVID, Schlieren Imaging and Flow Analysis on a Cone/Flare Model in the AFRL Mach 6 Ludwig Tube Facility. AFIT-ENY-MS-19-M-226. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQ.

LEONARD, AVERY W., Sheet Velocity Measurements Using Laser Absorption Spectroscopy in a Xenon Hall Effect Thruster Plume. AFIT-ENY-MS-19-M-227. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: AFOSR. [CSRA]

LESIEUR, ALEXANDER, Fragmentation Properties of Explosively Driven Additively Manufactured 15-5 PH Stainless Steel Cylinders. AFIT-ENY-MS-19-M-228. Faculty Advisor: Capt Andrew J. Lingenfelter. Sponsor: N/A.

LYNCH, RYAN, Investigation of Thermal Scaling Effects for a Turbine Blade Leading Edge and Pressure Side Model. AFIT-ENY-MS-19-J-072. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: OSU/Dept of Mechanical and Aerospace Engineering.

MACCHIA, MICHAEL, Application of Metamaterials for Multifunctional Satellite Bus Enabled Via Additive Manufacturing. AFIT-ENY-MS-19-M-230. Faculty Advisor: Maj Ryan O'Hara. Sponsor: N/A. [CSRA]

MAIKELL, MEGAN, Characterization and Anomalous Diffusion Analysis of a 100W Low Power Annular Hall Effect Thruster. AFIT-ENY-MS-19-M-231. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

MCNAMARA, LUKE, Scaling Gas Turbine Adiabatic Effectiveness with Mass Transfer and Thermal Experimental Techniques. AFIT-ENY-MS-19-M-233. Faculty Advisor: Lt Col James L. Rutledge. Sponsor: AFRL/RQ.

MERCIER, MARK R., Optimal Inspection of a Satellite with Dynamic Zone Constraints. AFIT-ENY-MS-19-M-234. Faculty Advisor: Lt Col Kirk W. Johnson. Sponsor: AFSPC. [CSRA]

O'KEEFE, JAMES C., Mechanical and Vibration Damping Characterization of Hybrid Carbon Nanotube Laminates. AFIT-ENY-MS-19-M-235. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: N/A. [CSRA]

OSTMAN, JOSHUA A., Cislunar Trajectory Generation with Sun-Exclusion Zone Constraints Using a Genetic Algorithm and Direct Method Hybridization. AFIT-ENY-MS-19-S-081. Faculty Advisor: Maj Joshua A. Hess. Sponsor: N/A. [CSRA]

PALMER, BRIAN O., Thermal Management of Satellite Electronics Via Gallium Phase Change Heat Sink Devices. AFIT-ENY-MS-18-D-038. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

PRUDHOMME, DANIEL, Project HAVE BASS AFIT-ENY-MS-19-M-237. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: N/A.

PUNG, JUSTIN, Tracking Shock Movement on the Surface of an Oscillating, Straked Semispan Delta Wing. AFIT-ENY-MS-19-M-238. Faculty Advisor: Lt Col Darrell S. Crowe. Sponsor: 46 SK/SKC.

RATHSACK, TYLOR, Examination of Flow Dynamics and Passive Cooling in an Ultra Compact Combustor. AFIT-ENY-MS-19-M-239. Faculty Advisor: Dr. Marcus D. Polanka. Sponsor: AFRL/RQ.

RIVERA, JUAN A., Design and Flight Test of a Path Planning Algorithm Utilizing Graph Theory for Real-Time Applications. AFIT-ENY-MS-19-M-241. Faculty Advisor: Dr. David R. Jacques. Sponsor: AFRL/RQ. [ANT]

RUNCO, JOHN J., Computational Aerothermodynamic Analysis of Satellite Trans-Atmospheric Skip Entry Survivability. AFIT-ENY-MS-19-M-243. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A. [CSRA]

SAUNDERS, RYAN, Influence of Leading Edge Oscillatory Blowing on Time-Accurate Dynamic Store Separation. AFIT-ENY-MS-19-M-244. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFOSR/RT.

SCHMIDT, KYRA L., Analytical Models and Control Design Approaches for a 6 DOF Motion Test Apparatus. AFIT-ENY-MS-19-M-245. Faculty Advisor: Dr. Richard Cobb. Sponsor: AFRL/RW. [CSRA]

SHALD, DAVID, Pitch Characterization of a Self-Defense Missile Using System Identification Applied to Computational Maneuvers. AFIT-ENY-MS-19-M-246. Faculty Advisor: Lt Col Darrell S. Crowe. Sponsor: Lockheed Martin MFC.

THOMPSON, RYAN, Wall Model Large Eddy Simulation of a Diffusing Serpentine Inlet Duct. AFIT-ENY-MS-19-M-248. Faculty Advisor: Lt Col Jeffrey R. Komives. Sponsor: The Boeing Company.

TOWNLEY, TALON A., Limited-Duty-Cycle Satellite Formation Control Via Differential Drag. AFIT-ENY-MS-19-M-249. Faculty Advisor: Lt Col Kirk W. Johnson. Sponsor: SPAWAR SSC Pacific SIS Division. [CSRA]

WALLIS, TYLER, Interlaminar Shear Performance of High Temperature Composites. AFIT-ENY-MS-19-M-250. Faculty Advisor: Dr. Marina B. Ruggles-Wrenn. Sponsor: AFRL/RX.

WEBB, JEREMIAH M., Comprehensive Study of Optimal Synergetic Skip Entries with Dynamic Thrust Vectoring Control. AFIT-ENY-MS-19-M-251. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A. [CSRA]

WILLBURN, ZANE A., Manufacture of Fused Deposition Modeling Joints Using ULTEM 9085. AFIT-ENY-MS-19-M-252. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

WILSON, PAUL, Tactical Missile Performance for Single and Multi-Wire Embedded Propellant Configurations with Discontinuities. AFIT-ENY-MS-19-M-253. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: AFLCMC/EB.

### 5.1.3 FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

#### **BETTINGER, ROBERT A., Maj**

Assistant Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2017 (AFIT/ENY); BS, Astronautical Engineering, United States Air Force Academy, 2007; MA, History, American Public University, 2010; MS, Astronautical Engineering, Air Force Institute of Technology, 2011; PhD, Astronautical Engineering, Air Force Institute of Technology, 2014. Maj Bettinger's research interests include reentry dynamics, spacecraft safety and survivability, as well as optimization and control for aerospace applications. Recent research includes developing uncontrolled reentry prediction algorithms and skip reentry maneuver optimization. Maj Bettinger is a member of Tau Beta Pi and Sigma Gamma Tau. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4578, Email: [Robert.Bettinger@afit.edu](mailto:Robert.Bettinger@afit.edu)

#### **Sponsor Funded Research Projects**

- “Launch Site Optimization Study for Launch-On-Demand System.” Sponsor: SDPE. Funding: \$20,002. [CSRA]
- “Spacecraft Survivability, Reliability, and Rendezvous (S2R2) Short Course.” Sponsor: NASIC. Funding: \$7,500 - Bettinger 50%, Hess 50%. [CSRA]
- “Policy and Geopolitical Implications of Launch-on-Demand Capabilities.” Sponsor: Air University. Funding: \$2,453.
- “Attitude Determination using Terrestrial Illumination Matching.” Sponsor: AFRL/RV. Funding: \$40,000. [CSRA]
- “Jetson TX2 PC104 Board.” Sponsor: Undisclosed. FundBoardg: \$90,556 - Bettinger 40%, Hartsfield 30%, Cobb 30%. [CSRA]

#### **Refereed Journal Publications**

- Bettinger, R.A., “Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low Earth Orbits,” *Journal of Spacecraft and Rockets*, Vol. 56, No. 5, pp. 1300-1311, September-October 2019. [CSRA]
- Schmitt, S., and Bettinger, R.A., “The Potentiality of Space Enterprise Force Reconstitution: Nationalizing Civilian Satellites during Kinetic Conflicts,” *Air & Space Power Journal*, Vol. 33, No. 2, pp. 61-72, Summer 2019. [CSRA]

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

- Shockley, L.M. and Bettinger R.A., “Policy Implications of Launch-on-Demand Employment,” *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019. [CSRA]
- Tatman, L.A., Bettinger R. A., Hess, J.A., Lingenfelter, A.J., “Orbital Debris Propagation in Solwind Anti-Satellite Event,” 2019 AIAA Science and Technology Forum and Exposition, San Diego, CA, January 2019. [CSRA]
- Hess, J.A., Bettinger, R.A., Lingenfelter, A.J., “Spacecraft Survivability in a Catastrophic Formation Mishap,” *AIAA Science and Technology Forum and Exposition*, San Diego, CA, January 2019. [CSRA]

#### **Patent Applications**

- Bettinger, R.A., “Early Warning Reentry System Comprising High Efficiency Module for Determining Spacecraft Reentry Time,” U.S. Provisional Patent No. 16/352,936, March 2019. [CSRA]

#### **Other Significant Research Productivity**

- Bettinger, R.A., “Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low Earth Orbits,” *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]
- Bettinger, R.A., “Atmospheric Reentry Hemisphere Prediction for Prograde Orbits Using Logical Disjunction,” *44<sup>th</sup> AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]

Krott, M.J., and Bettinger, R.A., "CubeSat Payload Thermal Management Optimization," *14th Dayton Engineering Sciences Symposium (DESS)*, Dayton, OH, October 2018. [CSRA]

Krott, M.J., and Bettinger, R.A., "CubeSat Payload Thermal Management Optimization," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]

Lomanno, C.P., and Bettinger, R.A., "Utility of Modular Attitude Determination and Control Subsystems for Small Satellites," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]

Runco, J.J., and Bettinger, R.A., "Computational Aerothermodynamic Analysis of Satellite Trans-Atmospheric Skip Entry Survivability," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]

Webb, J.M., and Bettinger, R.A., "Comprehensive Study of Optimal Synergetic Skip Entries with Dynamic Thrust Vectoring Control," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]

### **BOHAN, BRIAN T., Maj**

Assistant Professor of Aeronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); BS, Aeronautical Engineering, Clarkson University - Potsdam, NY, 2005; MS, Aeronautical Engineering, Air Force Institute of Technology, 2011; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2018. Major Bohan's research interests include turbomachinery, combustion, heat transfer, applied fluid dynamics, and computational fluid dynamics. Major Bohan teaches courses on turbomachinery, computational fluid dynamics, and aircraft design. He has experience in Air Force test and evaluation, propulsion integration, aerodynamic configuration, and as a propulsion subject matter expert for weapon system development. Maj Bohan is a member of Tau Beta Pi, Sigma Gamma Tau, AIAA, and ASME. Tel. 937-255-3636 x4773, Email: [Brian.Bohan@afit.edu](mailto:Brian.Bohan@afit.edu)

### **Sponsor Funded Research Projects**

"Development of a New UCC Powered Engine Configuration (Revised)." Sponsor: AFLCMC. Funding: \$49,938 - Bohan 80%, Polanka 20%.

"Development of an Integrated UCC into a Cruise Missile." Sponsor: AFRL/RQ. Funding: \$5,000 - Bohan.

### **Refereed Journal Publications**

Bohan B.T., and Polanka, M.D., "A New Spin on Small-Scale Combustor Geometry," *Journal of Engineering for Gas Turbines and Power*, Vol. 141 (1), Jan 2019, pages 011504, doi: 10.1115/1.4040658

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Bohan B.T., and Polanka M.D., "Experimental Analysis of an Ultra Compact Combustor Powered Turbine Engine," *Conference Proceedings of the ASME Turbo Expo*, Phoenix, AZ, June 2019.

Rathsack, T.C., Bohan, B.T., Polanka, M.D., and Rutledge, J.L., "Experimental Analysis of an Additively Manufactured Ultra Compact Combustor Vane," *Conference proceedings of the ASME Turbo Expo 2019*, Phoenix, AZ, June 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Rathsack, T.C., Bohan, B.T., Polanka, M.D., and Goss, L.P., "Experimental Investigation of Flow Characteristics in an Ultra Compact Combustor," *AIAA SciTech Forum*, San Diego, CA, Jan 2019. <https://doi.org/10.2514/6.2019-0117>

### **Patent Applications**

Bohan, B.T., Polanka, M.D., and Staton, B.M., "Disk Engine with Circumferential Swirl Radial Combustor," *Provisional Patent Application*, 5 June 2019.

## Other Significant Research Productivity

Holobeny, D., Polanka, M.D, and Bohan, B.T., “Computational Analysis of an Ultra Compact Combustor Using Swirl Stabilization,” *Presentation: DCASS, Dayton, OH, March 2019.*

### COBB, RICHARD G.

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2001 (AFIT/ENY); BS, Pennsylvania State University, 1988; MS, Air Force Institute of Technology, 1992; PhD, Air Force Institute of Technology, 1996. While at AFIT, Dr. Cobb has taught graduate level courses in satellite design, optimal control, trajectory optimization, system identification, and spacecraft control systems. His research focuses on dynamics and control of aerospace systems, including control of aircraft, spacecraft, large flexible structures, and optical systems. Recent work includes developing optimal trajectory plans for Global Strike missions, optimal aircraft air and ground collision avoidance algorithms for manned and unmanned systems, active buffet alleviation using piezoelectric actuators for F-16 aircraft, maneuver planning for satellite proximity operations, dynamics and control techniques for lightweight space optics and optimal/novel sensor systems, and architectures for enhancing Space Situational Awareness. While on active duty, Dr. Cobb served as the technical advisor for AFRL’s Space Vehicles’ Technology Branch, and led several space flight experimental programs, including the Vibration Isolation and Suppression System, sponsored by BMDO, and the Satellite Ultra-quiet Isolation Technology Experiment. Dr. Cobb also served as a launch operations officer at Cape Canaveral AFS on the Global Positioning System program, responsible for the integration and launch of the GPS Block II satellite constellation. He is an Associate Fellow of AIAA. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4559, Email: [Richard.Cobb@afit.edu](mailto:Richard.Cobb@afit.edu)

### Sponsor Funded Research Projects

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$140,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$160,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

“Developing Artificial Intelligence Opponents for Contested Space Simulations.” Sponsor: AFRL/RV. Funding: \$100,000 - Cobb 25%, Hess 25%, Johnson 25%, Curro 25%. [CSRA/ANT]

“Multi-slew Constrained Dynamic Optimization.” Sponsor: Undisclosed. Funding: \$40,000. [CSRA]

“Satellite Attitude Control Testbed Upgrades.” Sponsor: Undisclosed. Funding: \$38,000 - Cobb 34%, Johnson 33%, Zagaris 33%. [CSRA]

“Space Domain Modeling & Simulation via High Performance Computing.” Sponsor: Undisclosed. Funding: \$212,500 - Cobb 50%, Meyer 50%. [CSRA]

“Timely Path Optimization for Enhanced Autonomy.” Sponsor: AFRL/RQ. Funding: \$25,000. [ANT]

### Refereed Journal Publications

Curtis, D. and Cobb, R., “Satellite Articulation Tracking Using Computer Vision,” Published Online: *AIAA Journal of Spacecraft and Rockets*, 0, 0:0, 1-14, 16 Jun 2019, <https://doi.org/10.2514/1.A34343> [CSRA]

Denton, J.C., Hodson, D.D., Cobb, R.G., Mailloux, L.O., Grimaila, M.R., and Baumgartner, G., “A Model to Estimate Performance of Space-Based Quantum Communication Protocols including Quantum Key Distribution Systems,” *Journal of Defense Modeling and Simulation*, 16(1):5-13, Jan 2019. [CSRA]

Felten, M.S., Colombi, J.M., Cobb, R.G., and Meyer D.W., “Multi-Objective Optimization Using Parallel Simulation for Space Situational Awareness,” *Journal of Defense Modeling and Simulation*, 16(2):145-57, Apr 2019. [CSRA]

Prince, E.P., Hess, J.A., Cobb, R.G., and Carr, R.W., “Elliptical Orbit Proximity Operations Differential Games.” Published Online: *Journal of Guidance, Control, and Dynamics*, 19 Mar 2019, <https://doi.org/10.2514/1.G004031> [CSRA]

Zollars, M.D., Cobb, R.G., Grymin, D.J., “Optimal Path Planning for Unmanned Aircraft Target Observation through Constrained Urban Environments,” Published Online: *AIAA Journal of Air Transportation*, 21 Apr 2019, <https://doi.org/10.2514/1.D0141>

Zollars, M.D., Cobb, R.G., and Grymin, D.J., “Optimal SUAS Path Planning in Three-Dimensional Constrained Environments,” *Unmanned Systems*, Feb 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Carpenter, J., Gahan, K., and Cobb R., “Automatic-Ground Collision Avoidance System (Auto-GCAS) for Performance Limited Aircraft,” *AIAA Aviation Forum*, (p. 3657), Dallas, TX, 17-21 June 2019.

Dontigney, T., Merkle, L., Cobb, R., Colombi, J., and Lamont, G., “Methodology for Comparison of Algorithms for Real-World Multi-Objective Optimization Problems: Space Surveillance Network Design,” *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019. [CSRA]

George, C., Hess, J., and Cobb, R., “Evolutionary Neurocontrol for Spacecraft Proximity Operations,” *29th AAS/AIAA Space Flight Mechanics Meeting*, Kaanapali, HI, January 2019. [CSRA]

Hertwig, F., Colombi, J., Cobb, R., and Meyer, D., “Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes,” *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019. [CSRA]

Kunz, D.L., Reeder, M.F., Cobb, R., and Crowe, D.S., “Flight Testing at the Air Force Institute of Technology,” *AIAA Aviation Forum*, (p. 3547), Dallas, TX, 17-21 June 2019.

Spendel, D.F., Hess, J.A., Johnson, K.W., and Cobb, R.G., “Parameter Study of an Orbital Debris Defender Using Two Team, Three Player Differential Game Theory,” *42nd Annual AAS Guidance, Navigation, and Control Conference*, Breckenridge, CO, 31 January – 6 February 2019.

Thomas, G., and Cobb, R., “Ground-Based, Daytime Modeling and Observations in SWIR for Satellite Custody,” *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019. [CDE] [CSRA]

Thomas, G.M., R.G. Cobb, S.T. Fiorino, and M.R. Hawks, “SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites in the SWIR,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

### **GRANDHI, RAMANA V.**

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); Previously Dr. Grandhi was a Distinguished Professor at Wright State University, and also served as its Director of Engineering PhD program for 15 years, as well as Executive Director of International Collaborations and Graduate Programs for 4 years. His research interests focus in multidisciplinary analysis and optimization, aircraft structures, risk-based design, and advanced manufacturing processes. Dr. Grandhi is a Fellow of the American Society of Mechanical Engineering, and a Fellow of the American Institute of Aeronautics and Astronautics. Tel. 937-255-3636 x4723, Email: [Ramana.gGrandhi@afit.edu](mailto:Ramana.gGrandhi@afit.edu)

### **Sponsor Funded Research Projects**

“Computational Tools for Hypersonic Vehicle Design.” Sponsor: AFRL/RQ. Funding: \$75,000.

### **Refereed Journal Publications**

Gorgularslan, R.M., Choi, H.J., Grandhi, R.V., and Choi, S.K., “Prediction Assessment and Validation of Multiscale Models for Additively Manufactured Lattice Structures under Uncertainty,” *Journal of Mechanical Science and Technology*, Vol. 33, No. 3, pp. 1365-1379, March 2019.

## **Editorships in Professional Journals**

Editorial Board, *International Journal of Peening Science and Technology*.

Editorial Board, *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems*.

Editorial Board, *Journal of Manufacturing Review*.

Editorial Board, *International Journal of Vehicle Structures & Systems*.

Editorial Board, *International Journal of Reliability and Safety*.

Associate Editor, *Journal of Structural and Multidisciplinary Optimization*.

Editorial Board, *Journal for Finite Elements in Analysis and Design*.

## **GREENDYKE, ROBERT B.**

Associate Professor of Aeronautics and Astronautics and Director, AFIT Scientist and Engineer Education Programs at Kirtland AFB, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2005 (AFIT/ENY); BBA, Economics, Baylor University, 1979; BS, Aerospace Engineering, Texas A&M University, 1986; MS, Aerospace Engineering, Texas A&M University, 1988; PhD, Interdisciplinary Engineering, Texas A&M University, 1998. Dr. Greendyke's research interests include computational fluid dynamics, Direct Simulation Monte Carlo methods, hypersonic and reacting flows, radiation simulation, thermophysics, and plasma simulation. He was a research scientist at NASA-Langley Research Center studying re-entry and aerobraking flows, as well as an Associate Professor at the University of Texas at Tyler where he established a start-up Mechanical Engineering Program from concept through accreditation. Dr. Greendyke has published more than 30 journal articles, technical reports, and conference publications in multiple fields. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics. Tel. 937-255-3636 x4567, Email: [Robert.Greendyke@afit.edu](mailto:Robert.Greendyke@afit.edu)

## **Refereed Journal Publications**

Clarey, M.P., and Greendyke, R.B., "Thermochemical Nonequilibrium Processes in Weakly Ionized Air Using Three-Temperature Models," *Journal of Thermophysics and Heat Transfer*, Vol. 33, No. 2, pp. 425-440, Jan 2019.

Clarey, M.P., and Greendyke, R.B., "Three-Temperature Thermochemical Nonequilibrium Model with Application to Slender-Body Wakes," *Journal of Thermophysics and Heat Transfer*, Vol. 33, No. 3, pp. 721-737, Feb 2019.

## **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Elliott, O.S., Greendyke, R.B., Jewell, J.S., and Komives, J.R., "Effect of Carbon-Based Ablation Products on Hypersonic Boundary Layer Stability," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

## **HARTSFIELD, CARL R.**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2015 (AFIT/ENY); B, Aerospace Engineering, Georgia Institute of Technology, 1991; MS, Aeronautical Engineering, Air Force Institute of Technology, 2001; PhD, Astronautical Engineering, Naval Postgraduate School, 2006. Dr. Hartsfield is a former faculty member of The Ohio State University, a former space sensor payload program manager, and retired USAF Lt Col. His research interests include space and rocket propulsion and optimal design of spacecraft, including integration and testing of spacecraft. Dr. Hartsfield's research focuses on experimental evaluation and diagnostics for space propulsion, analytic evaluation of spacecraft design, and applications of additive manufacturing for optimal spacecraft structures. He served as an invited space propulsion session co-chair at the 2011 NASA GRC HBCUOMI Outreach Symposium, as a session chair at the 2011 and 2012 Dayton/Cincinnati Aerospace Sciences Symposia, as chair for the technical program and session chair at the 2017 Dayton/Cincinnati Aerospace Sciences Symposium, and as Executive Chair for the 2018 Dayton/Cincinnati Aerospace Sciences Symposium. Dr. Hartsfield is a member of AIAA, Sigma Gamma Tau, and the American Society for Engineering Education. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4667, Email: [Carl.Hartsfield@afit.edu](mailto:Carl.Hartsfield@afit.edu)

### **Sponsor Funded Research Projects**

“Evaluation of Process Impacts on Carbon Nanotube Properties.” Sponsor: Undisclosed. Funding: \$97,750 - Hartsfield 50%, O'Hara 50%. [CSRA]

“Satellite Structures Built in Space.” Sponsor: Undisclosed. Funding: \$96,250. [CSRA]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Shelton, T., Hartsfield, C., and Cobb, G., “Additive Manufacturing Designing to Withstand Space Launch,” *57<sup>th</sup> AIAA Aerospace Sciences Meeting*, 7, Jan 2019. [CSRA]

Anderson, W., Heister, S., and Hartsfield, C., “Experimental Study of a Hypergolically Ignited Liquid Bipropellant Rotating Detonation Rocket Engine,” *57<sup>th</sup> Aerospace Sciences Meeting*, 6, Jan 2019. [CSRA]

Winter, M., Koch, H., Green, R., and Hartsfield, C., “Direct Inertial Electrostatic Confinement Propulsion at Low Power Levels,” *36<sup>th</sup> International Electric Propulsion Conference*, 15, Sep 2019. [CSRA]

### **Other Significant Research Productivity**

Leonard, A., and Hartsfield, C., “Sheet Velocity Measurements using Laser Absorption Spectroscopy in the Plume of a Hall Effect Thruster,” Presentation: *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

Willburn, Z., and Hartsfield, C., “Manufacture of Fused Deposition Modeling Joints Using Ultem 9085,” Presentation: *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

Maikell, M., and Hartsfield, C., “Characterization and Anomalous Diffusion Analysis of a 100W Hall Effect Thruster,” Presentation: *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

Garlisi, C., and Hartsfield, C., “Colloid Thruster Performance Characterization Using a Force balance Test Stand,” Presentation: *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

### **HESS, JOSHUAH, A., Maj**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Aerospace Engineering, Virginia Polytechnic and State University, 2009; MS, Astronautical Engineering, Air Force Institute of Technology, 2011; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2016. Major Hess's research interests include relative satellite motion and spacecraft proximity operations, spacecraft attitude determination, optimal control, differential pursuit/evasion games, and estimation theory. He has investigated adaptive estimation of nonlinear spacecraft attitude dynamics, as well as the relative navigation between satellites conducting proximity operations. Previously, Major Hess worked as a space system engineer at the National Air and Space Intelligence Center (NASIC) and has deployed to Southwest Asia in support of Operation Enduring Freedom. He is a member of Tau Beta Pi, Sigma Gamma Tau, and AIAA. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4713, Email: [Joshuah.Hess@afit.edu](mailto:Joshuah.Hess@afit.edu)

### **Sponsor Funded Research Projects**

“Satellite Pursuit-Evasion Differential Games.” Sponsor: AFRL/RV. Funding: \$20,000. [CSRA]

### **Refereed Journal Publications**

Nesmith, A., Lingenfelter, A., Hess, J.A., and Liu, D., “Applications of Second-Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity,” *Journal of Aircraft Survivability*, Fall 2019. [CSRA]

Newell, D.J., O'Hara R., Cobb, G.R., Palazotto, A.N., Kirka, M.M., Burggraf, L.W., and Hess, J.A., "Mitigation of Scan Strategy Effects and Material Anisotropy through Supersolvus Annealing in LPBF IN718," *Materials Science and Engineering: A*, doi 10.1016/j.msea.2019.138230. [CSRA]

Prince, E., Hess, J.A., Carr, R., and Cobb, R.G., "Elliptical Orbit Proximity Operations Differential Games," *Journal of Guidance, Control, and Dynamics*. DOI 10.2514/1.G004031. [CSRA]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Scarcella, P.C., Johnson, K.W., Hess, J.A., "Consider Filtering Applied to Maneuver Detection for Relative Orbit Determination," 2019 AAS/AIAA Astrodynamics Specialist Conference, August 2019, AAS 19-872. [CSRA]

George, B.C., Hess, J.A., and Cobb, R.G., "Evolutionary Neurocontrol for Spacecraft Proximity Operations," 29<sup>th</sup> AAS/AIAA Space Flight Mechanics Meeting, Kaanapali, Maui, HI, 13-17 January 2019. [CSRA]

Spendel, D.F., Hess, J.A., Johnson, K.W., and Cobb, R.G., "Parameter Study of an Orbital Debris Defender Using Two Team, Three Player Differential Game Theory," 42nd Annual AAS Guidance, Navigation, and Control Conference, Breckenridge, CO, 31 January – 6 February 2019. [CSRA]

Bettinger, R.A., Hess, J.A., Lingenfelter, A.J., and Tatman, L., "Spacecraft Survivability in a Catastrophic Formation Mishap," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

Hudson, K., Lingenfelter, A.J., and Hess, J.A., "Dynamic Mass Balancing of a Spacecraft Test Platform," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

Tatman, L., Bettinger, R., Hess, J.A., and Lingenfelter, A.J., "Orbital Debris Propagation in Solwind Anti-Satellite Event," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

Nesmith, A.D., Lingenfelter, A.J., Hess, J.A., and Liu, D., "Applications of Second Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

### **Other Significant Research Productivity**

George, B.C., Hess, J.A., and Cobb, R.G., "Open-and Closed-Loop Neural Network Control for Spacecraft Proximal Spacecraft Maneuvers," 44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 2019. [CSRA]

### **JOHNSON, KIRK W., Lt Col**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Mechanical Engineering, Worcester Polytechnic Institute, 2000; MS, Astronautical Engineering, Air Force Institute of Technology, 2010; PhD, Aerospace Engineering, Texas A&M University, 2016. Lt Johnson's research interests include orbital mechanics and astrodynamics, focusing on satellite relative motion, formation flying, general perturbation methods, and space navigation. He has led engineering teams performing analysis and modeling, and simulation for the National Air and Space Intelligence Center and for the Missile Defense Agency. He is a member of Tau Beta Pi, Sigma Gamma Tau, and the American Astronautical Society. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4285, Email: [Kirk.Johnson@afit.edu](mailto:Kirk.Johnson@afit.edu)

### **Sponsor Funded Research Projects**

"Image Processing and OD for SSA." Sponsor: AFRL/RV. Funding: \$16,000. [CSRA]

"Localization of Gnd/Space RF trans." Sponsor: AFRL/RV. Funding: \$16,000. [CSRA]

"Noise Radar CubeSat 6U CubeSat Flight Model - Phase 1." Sponsor: Undisclosed. Funding: \$779,916 - Johnson 35%, Collins 35%, Hartsfield 10%, Albrecht 10%, Cobb 10%. [CSRA]

"Orbit-Dynamics Visual Servoing." Sponsor: AFRL/RV. Funding: \$16,000. [CSRA]

"Rapid CubeSat Build and Test." Sponsor: AFRL/RV. Funding: \$50,000. [CSRA]

"Rapid CubeSat Design, Fabrication, and Test." Sponsor: Undisclosed. Funding: \$90,041 - Johnson 25%, Albrecht 25%, Cobb 25%, Hartsfield 25%. [CSRA]

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$140,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$160,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

“Developing Artificial Intelligence Opponents for Contested Space Simulations.” Sponsor: AFRL/RV. Funding: \$100,000 - Cobb 25%, Hess 25%, Johnson 25%, Curro 25%. [CSRA]

“Satellite Attitude Control Testbed Upgrades.” Sponsor: Undisclosed. Funding: \$38,000 - Cobb 34%, Johnson 33%, Zagaris 33%. [CSRA]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Scarcell, P., Johnson, K.W., and Hess, J.A., “Consider Filtering Applied to Maneuver Detection for Relative Orbit Determination,” *Astrodynamics Specialist Conference*, Portland, ME, 11-15 Aug 2019. [CSRA]

Mercier, M., and Johnson, K.W., “Optimal Inspection Trajectories with Enforcement of Chief and Inspector-Centered Dynamic Zone Constraints,” *Astrodynamics Specialist Conference*, Portland, ME, 11-15 Aug 2019. [CSRA]

Spendel, D.F., Hess, J.A., Johnson, K.W., and Cobb, R.G., “Parameter Study of an Orbital Debris Defender Using Two-Team, Three-Player Differential Game Theory,” *42nd Annual AAS Guidance, Navigation, and Control Conference*, Breckenridge, CO, 31 January–6 February 2019. [CSRA]

Mercier, M., and Johnson, K.W., “Optimal Inspection of a Nadir-Pointing Satellite with Dynamic Angle Constraints,” *29th AAS/AIAA Space Flight Mechanics Meeting*, Kaanapali, Maui, HI, 13-17 January 2019.

### **Other Significant Research Productivity**

Mercier, M., and Johnson, K. W., “6-DOF Constrained Optimal Satellite Inspection Trajectories,” *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019. [CSRA]

### **KEMNITZ, RYAN A., Maj**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: September 2018 (AFIT/ENY); BS, Mechanical Engineering, United States Air Force Academy, 2008; MS, Mechanical Engineering, University of Utah, 2012; PhD, Materials Science, Air Force Institute of Technology, 2018. Major Kemnitz’s research interests include process parameter and laser scanning strategy development for additive manufacturing of metal alloys, mechanical and microstructural characterization of additively manufactured materials, and the use of finite element analysis to predict the impact of defects on the mechanical behavior of additively manufactured materials. He is a member of Tau Beta Pi and AIAA. Tel. 937-255-3636 x4775, Email: [Ryan.Kemnitz@afit.edu](mailto:Ryan.Kemnitz@afit.edu)

### **Sponsor Funded Research Projects**

“Novel Hypersonic Structural Design Using AM.” Sponsor: AFRL/RQ. Funding: \$33,000 - Kemnitz 50%, Hartsfield 50%.

“Novel Hypersonic Structural Design Using AM.” Sponsor: AFRL/RQ. Funding: \$75,000 - Kemnitz 50%, Hartsfield 50%.

“Process Development for Additive Manufacturing of Refractory Metals.” Sponsor: AFRL/RX. Funding: \$75,000.

### **Refereed Journal Publications**

Cobb, G. R., O’Hara, R.P., Kemnitz, R.A., Sabelkin, V.P., and Doane, B.M., “Quantifying the Effects of Ultraviolet Type C Radiation on the Mechanical and Electrical Properties of Carbon Nanotube Sheet for Space-Based Applications,” *Materials Today Communications*, 18, 7-13 March 2019.

Singh, A.K., Cobb, G.R., and Kemnitz, R.A., “*In-situ* Characterization of Bulk Carbon Nanotube Behavior in a Sheet Under Tensile Load,” *Materials Today Communications*, 17, 493-500, December 2018.

#### **KEYS, ANDREW S.**

Associate Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2019 (AFIT/ENY); Dr. Keys earned his bachelor's and master's degrees in electrical engineering from Auburn University in 1988 and 1990, respectively, and earned his doctorate of philosophy in electrical engineering from the University of Alabama in Huntsville in 2002. Prior to joining the AFIT faculty in February of 2019, Dr. Keys was employed for more than 27 years with the National Aeronautics and Space Administration's (NASA's) Marshall Space Flight Center (MSFC), where he served in multiple leadership and technology management positions. His research interests include the development of sensors and detectors for the purpose of space-based remote sensing, electro-optics and photonic technologies, optical and laser systems, radiation hardening of avionics and electronics, and the advancement of related space technologies. Tel. 937-255-3636 x4747, Email: [Andrew.Keys@afit.edu](mailto:Andrew.Keys@afit.edu)

#### **KOMIVES, JEFFREY R., Lt Col**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Aeronautical & Astronautical Engineering, Purdue University, 2003; MS, Aeronautical Engineering, Air Force Institute of Technology, 2009; PhD, Aerospace Engineering & Mechanics, University of Minnesota, 2016. Lt Col Komives' research interests include aerodynamics, hypersonics, and computational fluid dynamics. He is a developmental engineer with experience in simulation, test and evaluation, and electronic warfare. During his deployment to Operation Enduring Freedom he was responsible for Counter Remote Controlled-IED Electronic Warfare training across most of Afghanistan. Lt Col Komives is a member of Sigma Gamma Tau, AIAA, and the Association of Old Crows. AFIT research center affiliation(s): CSRA and CTISR. Tel. 937-255-3636 x4744, Email: [Jeffrey.Komives@afit.edu](mailto:Jeffrey.Komives@afit.edu)

#### **Sponsor Funded Research Projects**

“PACAF/PACOM Training, Consultation and Modeling & Simulation for Hypersonics.” Sponsor: PACOM/J85. Funding: \$32,025.

“Signature Codes for Hypersonic Modeling.” Sponsor: AFRL/RV. Funding: \$46,000 - Komives 60%, Emmons 40%. [CSRA]

“Turbulence Modeling in Hypersonic Flows.” Sponsor: USAFA. Funding: \$73,925 - Komives 34%, Reeder 33%, Gross 33%.

“Uncertainty Quantification for SCRAMJET Engineering Models.” Sponsor: DARPA. Funding: \$20,002.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Thompson, R.J., and Komives, J.R., “Compressible Flow through a Diffusing Serpentine Inlet Duct Assessed with Wall-Modeled Large Eddy Simulation,” *AIAA Aviation 2019 Forum* (p. 3702), June 2019.

Elliott, O.S., Greenydyke, R., Jewell, J.S., and Komives, J.R., “Effect of CO<sub>2</sub> Concentration in the Hypersonic Boundary Layer on Second Mode Disturbances,” *AIAA Aviation 2019 Forum* (p. 2851), June 2019.

Elliott, O.S., Greenydyke, R., Jewell, J.S., and Komives, J.R., “Effect of Carbon-based Ablation Products on Boundary Layer Stability,” *AIAA Scitech 2019 Forum* (p. 0625), January 2019.

#### **Other Significant Research Productivity**

Komives, J.R., “Hypersonics in the Indo-Pacific,” Presentation: *1st NDIA Hypersonics Capabilities Conference*, July 2019.

Crouch, T.E. and Komives, J.R., “Direct Numerical Simulation of Roughness Induced Boundary Layer Transition on a 7° Half-Angle Cone at Mach 10,” *AIAA Defense Conference*, May 2019.

## **KUNZ, DONALD L.**

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2003 (AFIT/ENY); BS, Syracuse University, 1971; MS, Georgia Institute of Technology, 1972; PhD, Georgia Institute of Technology, 1976; Dr. Kunz's research interests include rotorcraft dynamics, vibrations and loads, structural dynamics, aeroelasticity, flying qualities of UAVs, multibody dynamics, and computational structural mechanics. He has published more than 100 journal articles, conference papers, and technical reports. Prior to coming to AFIT, Dr. Kunz worked at the US Army Aeroflightdynamics Directorate, McDonnell Douglas Helicopter Company, Old Dominion University, and the US Army Aviation and Missile Command. He is an Associate Fellow of AIAA, a member of AHS, and a licensed professional engineer in the Commonwealth of Virginia. Tel. 937-255-3636 x4548, Email: [Donald.Kunz@afit.edu](mailto:Donald.Kunz@afit.edu)

### **Sponsor Funded Research Projects**

"Basic Research with Integrated Flight Test." Sponsor: AFOSR. Funding: \$94,377 - Kunz 60%, Reeder 20%, Cobb 20%.

"Research Support for Joint AFIT/TPS Test Management Projects." Sponsor: USAF/TPS. Funding: \$15,000.

### **Refereed Journal Publications**

Olsen, C.C., Kalyanam, K., Baker, W.P., and Kunz, D.L., "Maximal Distance Discounted & Weighted Revisit Period: A Utility Approach to Persistent Unmanned Surveillance," *Unmanned Systems*, Vol. 7, No. 4, pp 1-18, July 2019. <http://doi.org/10.1142/S2301385019500079>

Harris, M.J., Kunz, D.L., and Hess, J.A., "Analytical Determination of a Helicopter Height-Velocity Diagram," *Journal of DOD Research and Engineering*, Vol. 2, No. 1, pp. 2-13, February 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Stephens, S., Manyam, S.G., Casbeer, D.W., Cichella, V., and Kunz, D.L., "Randomized Continuous Monitoring of a Target by Agents with Turn Radius Constraints," *International Conference on Unmanned Aircraft Systems*, Atlanta, GA, June 2019. DOI: 10.1109/ICUAS.2019.8798373

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Kunz, D.L., Reeder, M.F., Cobb, R.G., and Crowe, D.S., "Flight Testing at the Air Force Institute of Technology," *AIAA Aviation and Aeronautics Forum and Exposition*, Dallas, TX, June 2019. DOI: 10.2514/6.2019-3547

Callaghan, P.M., and Kunz, D.L., "Evaluation of Unmanned Aircraft Flying Qualities Using a Stitched Learjet Model," *AIAA Aviation and Aeronautics Forum and Exposition*, Dallas, TX, June 2019. DOI: 10.2514/6.2019-3548

### **Books and Chapters in Books**

Kunz, D.L., "Intermediate Dynamics for Aeronautics & Astronautics," Second Edition, Headmaster Press, ISBN: 978-1687350664, September 2019.

### **Other Significant Research Productivity**

Hope, D.N., and Kunz, D.L., "LCO Shock Motion on an Oscillating, Straked, Delta Wing in Transonic Flow," Aerospace Flutter and Dynamics Council, Blacksburg, Virginia, April 2019.

Callaghan, P.M., and Kunz, D.L., "Evaluation of Unmanned Aircraft Flying Qualities Using a Stitched Learjet Model," *Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019.

Kunz, D.L., "A Rigorous, Analytical Discussion of Rigid Body Kinematics," *Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019.

Merrick, J.D., and Kunz, D.L., "Deep Reinforcement Learning for Aircraft Control," *Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019.

Stephens, S.S., Kunz, D.L., Casbeer, D., and Manyam, S.G., “Coordinated Time of Arrival Using Dubins Paths,” *Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019.

**LIEBST, BRADLEY S.**

Professor of Aerospace Engineering and Head, Department of Aeronautics and Astronautics, AFIT Appointment Date: 1989 (AFIT/ENY); BS, Wichita State University, 1978; MS, Massachusetts Institute of Technology, 1979; PhD, Massachusetts Institute of Technology, 1981. Dr. Liebst's research interests include Eigen structure assignment and control, stability and control of aerospace vehicles, passive and active control of large flexible structures, and aircraft handling qualities. He has published more than 30 articles and reports and chaired more than 40 theses and dissertations. Prior to teaching at AFIT, Dr. Liebst was Assistant Professor of Aerospace Engineering for six years at the University of Minnesota where he was voted the 1987 Best Institute of Technology (U of M) Professor. Tel. 937-255-3636 x4636, Email: [Bradley.Liebst@afit.edu](mailto:Bradley.Liebst@afit.edu)

**LINGENFELTER, ANDREW J., Maj**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Mechanical Engineering, University of Nebraska – Lincoln, 2008; MEng, Industrial and Systems Engineering, University of Florida, 2011; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2016. Maj Lingenfelter's research interests include aircraft survivability, weapons, weapons testing, and additive manufacturing. His previous research has focused on flow visualization and ballistically induced failure of aircraft fuel tanks. Maj Lingenfelter is a member of AIAA, Tau Beta Pi, and Sigma Gamma Tau. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4348, Email: [Andrew.Lingenfelter@afit.edu](mailto:Andrew.Lingenfelter@afit.edu)

**Sponsor Funded Research Projects**

“Ballistic Properties of Additively Manufactured Structures.” Sponsor: JASPO. Funding: \$74,000 - Lingenfelter 70%, O'Hara 30%.

“Combat Aircraft Survivability Education.” Sponsor: JASPO. Funding: \$34,000.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Bettinger, R.A., Hess, J.A., Lingenfelter, A.J., and Tatman, L., “Spacecraft Survivability in a Catastrophic Formation Mishap,” *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

Hudson, K., Lingenfelter, A. J., and Hess, J.A., “Dynamic Mass Balancing of a Spacecraft Test Platform,” *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

Tatman, L., Bettinger, R., Hess, J.A., Lingenfelter, A.J., “Orbital Debris Propagation in Solwind Anti-Satellite Event,” *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

Nesmith, A.D., Lingenfelter, A.J., Hess, J.A., and Liu, D., “Applications of Second Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity,” *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019. [CSRA]

**LITTLE, BRYAN D., Lt Col**

Assistant Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2019 (AFIT/ENY); BS, Aerospace Engineering, University of Washington, 2004; MS, Astronautical Engineering, Air Force Institute of Technology, 2009; PhD, Astronautical Engineering, Purdue University, 2019. Lt Col Little's research interests include space situational awareness, astrodynamics, cis-lunar orbits, and satellite systems. Lt Col Little is a member of the American Astronautical Society and AIAA. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4901, Email: [Bryan.Little@afit.edu](mailto:Bryan.Little@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Frueh, C.E., Little, B.D., McGraw, J.T., “Optical Sensor Model and its Effects on the Design of Sensor Networks and Tracking,” *Advanced Maui Optical and Space Surveillance Technologies Conference*, Wailea, HI, 17-19 September 2019.

Frueh, C.E., Little, B.D., “No Feedback Multi-Sensor Tasking,” *AAS/AIAA Astrodynamics Specialist Conference*, Portland, ME, 11-15 August 2019.

#### **MEYER, DAVID W.**

Adjunct Instructor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date Sep 2019 (AFIT/ENY); BS, Mechanical Engineering, the Ohio State University, 1987; MS, Mechanical Engineering, Naval Postgraduate School, 1994; MS Operations Research, Naval Postgraduate School, 2007. Mr. Meyer’s research interests include space domain awareness, space warfighting and strategy, modeling and simulation, combat modeling and high performance computing. Tel. 937-255-3636 x4512, Email: [David.Meyer@afit.edu](mailto:David.Meyer@afit.edu)

#### **Sponsor Funded Research Projects**

“Space Modeling and Simulation.” Sponsor: JWAC. Funding: \$60,000.

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$140,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$160,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

“Space Domain Modeling & Simulation via High Performance Computing.” Sponsor: Undisclosed. Funding: \$212,500 - Cobb 50%, Meyer 50%. [CSRA]

#### **Refereed Journal Publications**

Felten, M.S., Colombi, J.M., Cobb, R.G., and Meyer D.W., “Multi-Objective Optimization Using Parallel Simulation for Space Situational Awareness,” *Journal of Defense Modeling and Simulation*, 16(2):145-57, Apr 2019. [CSRA]

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Hertwig, F., Colombi, J., Cobb, R., and Meyer, D., “Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes,” *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019. [CSRA]

#### **PALAZOTTO, ANTHONY N.**

Distinguished Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 1975 (AFIT/ENY); BS, New York University, 1955; MS, Brooklyn Polytechnic Institute, 1961; PhD, New York University, 1968. Dr. Palazotto’s interests include nonlinear mechanics, shell analysis, finite elements, composite materials, viscoplasticity, and nonlinear dynamics. Dr. Palazotto is the co-author of a textbook, “The Nonlinear Analysis of Shell Structures,” published in 1992 by the AIAA. In addition, he has authored 248 archival technical publications and more than 600 technical presentations and manuscripts. Dr. Palazotto received the Hetanyi Award in 1982 from the Society of Experimental Mechanics, the Cleary Award in 1981 from the Air Force Materials Lab, the Structures and Materials Award from the ASCE in 1986, and the AIAA Sustained Service Award in 2004. Dr. Palazotto is a Fellow of the ASCE, a Fellow of the AIAA, a Fellow of the American Academy of Mechanics, and a Fellow of the Engineering Mechanics Institute. He has advised more than 180 MS theses, 35 Doctoral dissertations and 15 Post Docs. He is a registered Professional Engineer in the State of Ohio. Tel. 937-255-3636 x4599, Email: [Anthony.Palazotto@afit.edu](mailto:Anthony.Palazotto@afit.edu)

#### **Sponsor Funded Research Projects**

“A Study of the Point-wise Effects of Laser Shock Peening.” Sponsor: AFRL/RQ. Funding: \$25,119.

“High Strain Rate Wear Model.” Sponsor: AFRL/RQ. Funding: \$25,000.

“Investigation of Blunt and Ogive-Nose Projectiles Impact at High Velocity.” Sponsor: AFOSR. Funding: \$47,088.

“Predictive Model for Behavior of Bolted Composite/Metallic Laminate Joint.” Sponsor: AFRL/RQ. Funding: \$21,714.

## Refereed Journal Publications

- Newell, D.J., O'Hara, R.P., Cobb, G.R., Palazotto, A.N., Kirka, M.M., Burggraf, L.W., and Hess, J.A., "Mitigation of Scan Strategy Effects and Material Anisotropy through Supersolvus Annealing In LPBF IN718," *Material Science and Engineering: A*, Vol. 764, Sep 2019.
- Demasi, L., Palazotto, A., and Santarpia, E., "Starred Polyhedral Shell Reinforced with Internal Pockets Considering an Internal Vacuum," *Journal of Engineering Mechanics*, Vol. 145, Issue 9, Sep 2019.
- Palazotto, A.N., "Analysis of Nonlinear Free-Response of a Thin Plate Using Finite Elements," *Journal of Engineering Mechanics*, Vol. 145, Issue 7, Jul 2019.
- Al-Ketan, O., Rowshan, R., Palazotto, A.N., and Abu Al-Rub, R.K., "On Mechanical Properties of Cellular Steel Solids with Shell-Like Periodic Architectures Fabricated by Selective Laser Sintering," *Journal of Engineering Materials and Technology*, Vol. 141, Issue 2, Apr 2019.
- Patel, A.A., and Palazotto, A.N., "Design Methodology for Topology Optimization of Dynamically Loaded Structure," *Journal of Dynamic Behavior of Materials*, Vol. 5, Issue 1, pp. 59-64, Mar 2019.
- Knapp, K., Palazotto, A., Scott-Emuakpor, O., and Holycross, C., "Enhanced Pre-Strain Application for Goodman Data Generated with Vibration-Based Testing," *Experimental Mechanics*, Vol. 59, Issue 2, pp. 263-276, Feb 2019.
- DeLeon, A., Baker, W.P., and Palazotto, A.N., "Modeling a Nonlinear Melt Region as a Result of High-Speed Sliding," *Journal of Thermophysics and Heat Transfer*, Vol. 33, Issue 3, pp. 808-816, Jul 2019.
- Liu, B.C., Palazotto, A.N., Nassiri, A., Vivek, A., and Daehn, G.S., "Experimental and Numerical Investigation of Interfacial Microstructure in Fully Age-Hardened 15-5 PH Stainless Steel During Impact Welding," *Journal of Material Science*, Vol. 54, Issue 13, pp. 9824-9842, Mar 2019.

## Refereed Conference Papers Accepted on the Basis of Abstract Review

- Lee, J., and Palazotto, A., "The Comparison of an Airfoil to Experimental Limit Cycle Oscillation," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.
- Brewer, J., Palazotto, A., and Falugi, M., "Optimization of the Bearing Stress of a Hybrid Composite," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.
- Engelbrechtsen, C.C., Palazotto, A.N., and Langer, K., "Laser Shock Impulse Modeling via Data Matching," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.
- Graves, D.P., Palazotto, A.N., and Moore, K.D., "Analysis of a Celestial Shell-Like Structure," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.
- Jackson, S., Palazotto, A., Pachter, M., and Niedbalski, N., "Control of Vapor Compression Cycles under Transient Thermal Loads," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

## **POLANKA, MARC D.**

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2009 (AFIT/ENY); BS, Mechanical Engineering, University of Dayton, 1992; MS, Mechanical Engineering, Stanford University, 1993; PhD, Mechanical Engineering, University of Texas, 1999. Prior to accepting a position with AFIT, Dr. Polanka served 17 years in the Turbine Engine Division of the Air Force Research Laboratory's Propulsion Directorate. His research interests include aspects of heat transfer, combustion, and fluid mechanics including experimental applications involving turbine and combustor aerodynamics, and cooling techniques. He has been published in a variety of journals including the AIAA Journal of Propulsion and Power, the ASME Journal of Turbomachinery, and the Journal of Engineering for Gas Turbines and Power. Dr. Polanka has two patents to his credit. He is an Associate Fellow of the AIAA, the past Section Chair of the Dayton-Cincinnati Section of the AIAA, and the Honors and Awards Chair for the same section. Dr. Polanka serves as the Chair of the AIAA Associate Fellows Selection Committee and is the Faculty Representative for the AFIT Student Section branch of AIAA. Additionally, he is a Fellow of the ASME and serves as the Vice Chair of the K-14 Heat Transfer Committee of the International Gas Turbine Institute where he is also a past Point Contact for the annual Turbo Expo conference. He is currently serving as an Associate Editor of the ASME Journal of Engineering for Gas Turbines and Power. Tel. 937-255-3636 x4714, Email: [Marc.Polanka@afit.edu](mailto:Marc.Polanka@afit.edu)

### **Sponsor Funded Research Projects**

"Combustion Physics under High Centripetal Acceleration." Sponsor: AFOSR. Funding: \$55,983 - Polanka 85%, Rutledge 15%.

### **Refereed Journal Publications**

Ausserer, J.K., Polanka, M.D., Litke, P.J., and Baranski, J.R., "Engine-Control Impact on Energy Balances for Two-Stroke Engines for 10-25 kg Remotely-Piloted Aircraft," *Journal of Engineering for Gas Turbines and Power*, Vol. 140 (11), pp. 112803 1-18, Nov 2018.

Greiner, N.J., Polanka, M.D., and Rutledge, J.L., "Impact of Wall Boundary Condition on Scaling Film Cooling Performance from Near Ambient to Engine Temperatures," *International Journal of Thermal Sciences*, Vol. 132, pp. 378-386, October 2018.

Wiese, C.J., Bryant, C.E., Rutledge, J.L., and Polanka, M.D., "Influence of Scaling Parameters and Gas Properties on Overall Effectiveness on a Leading-Edge Showerhead," *Journal of Turbomachinery*, Vol. 140 (11), pg. 111007 1-12, Nov 2018. DOI:10.1115/1.4041292.

Bohan, B.T., and Polanka, M.D., "A New Spin on Small-Scale Combustor Geometry," *Journal of Engineering for Gas Turbines and Power*, Vol. 141 (1) pp. 011504 1-10, Jan 2019. doi: 10.1115/1.4040658.

Bryant, C.E., Wiese, C.J., Rutledge, J.L., and Polanka, M.D., "Experimental Evaluations of the Relative Contributions to Overall Effectiveness in Turbine Blade Leading-Edge Cooling," *Journal of Turbomachinery*, Vol.141 (4), pp. 041007 1-15, April 2019. doi:10.1115/1.4041645.

Ausserer, J.K., Polanka, M.D., Litke, P.J., and Baranski, J.R., "Experimental Investigation of Fuel Anti-Knock-Index Requirements in Three Small Two-Stroke Engines for Remotely Piloted Aircraft," *Journal of Engineering for Gas Turbines and Power*, Vol. 141 (5) pp. 051502 1-8, May 2019.

Ausserer, J.K., Polanka, M.D., Baranski, J.R and Litke, P.J., "Mapping of Fuel Anti-Knock Requirements for a Small Remotely Piloted Aircraft Engine," *SAE Int. Journal of Aerospace*, 12(1) pp.1-17, June 2019. DOI:10.4271/2016-32-0045.

Ausserer, J.K., Polanka, M.D., Litke, P.J., and Baranski, J.R., "The Control Space for Knock Mitigation in Two-Stroke Engines for 10-25 kg Remotely Piloted Aircraft," *Journal of Engineering for Gas Turbines and Power*, Vol. 141 (9) pp. 091010 1-13, Sep 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Bohan, B.T., and Polanka, M.D., "Experimental Analysis of an Ultra Compact Combustor Powered Turbine Engine," *ASME Turbo Expo*, Phoenix, AZ, 17-21 June 2019.

Akbari, P.J., Tait, C.J., Polanka, M.D., and Sell, B.C., "Development and Initial Testing of a Radial Wave Engine," *ASME Turbo Expo*, Phoenix, AZ, 17-21 June 2019.

Fischer, J.P., Rutledge, J.L., McNamara, L.J., and Polanka, M.D., "Scaling Flat Plate, Low Temperature Adiabatic Effectiveness Results Using the Advective Capacity Ratio," *ASME Turbo Expo*, Phoenix, AZ, 17-21 June 2019.

Rathsack, T.C., Bohan, B.T., Polanka, M.D., and Rutledge, J.L., "Experimental Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane," *ASME Turbo Expo*, Phoenix, AZ, 17-21 June 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Rathsack, T.C., Bohan, B.T., Polanka, M.D., and Goss, L.P., "Experimental Investigation of Flow Characteristics in an Ultra Compact Combustor," *AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*, 7-11 Jan 2019

Druss, R.I., Polanka, M.D., Ombrello, T.M., and Schauer, F.R., "Low Mach Operation of a Scramjet Piloted by a Rotating Detonation Engine," *AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*, 7-11 Jan 2019.

Huff, R., Schauer, F.R., Boller, S.A., Polanka, M.D., Fotia, M.L., and Hoke, J.L., "Exit Condition Measurements of a Radial Rotating Detonation Engine Bleed Air Turbine," *AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*, 7-11 Jan 2019.

Boller, S.A., Polanka, M.D., Huff, R., Schauer, F.R., Fotia, M.L., and Hoke, J.L., "Experimental Flow Visualization in a Radial Rotating Detonation Engine," *AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*, 7-11 Jan 2019.

Lynch, R.A., Macias, R.A., and Polanka, M.D., "Investigation of Thermal Scaling Effects on a Simulated Turbine Leading Edge Model," *AIAA Regional Student Conference*, 6 April 2019.

Mayeux, A.N., Polanka, M.D., and Blantin, J.R., "Impact on Performance of Single and Dual Cylinder Internal Combustion Engines at Altitude," *JANNAF Meeting*, 3-7 Jun 2019.

Boller, S.A., Polanka, M.D., Huff, R., Schauer, F.R., Fotia, M.L., and Hoke, J.L., "Ignition for Operational RDEs," *JANNAF Meeting*, 3-7 Jun 2019.

Druss, R.I., Polanka, M.D., Ombrello, T.M., and Fotia, M.L., "Low Mach Operation of a Scramjet Piloted by a Rotating Detonation Engine," *JANNAF Meeting*, 3-7 June 2019.

### **Editorships in Professional Journals**

Associate Editor: *ASME Journal of Engineering for Gas Turbines and Power*

Associate Editor: *The JANNAF Journal*

### **Patent Applications**

Tait, C.J., Akbari, P.J., Polanka, M.D., and Sell, B.C., "Seal for a Wave Rotor Disk Engine," Filed 13 Mar 2019, Application AFD 1878P.

Bohan, B.T., Polanka, M.D., Staton, B.M., "Disk Engine with Circumferential Swirl Radial Combustor," Filed 5 Jun 2019, Application AFD 1976P.

### **Other Significant Research Productivity**

- Boller, S. A., Polanka, M.D., Schauer, F.R., Huff, R., and Fotia, M.L., "Experimental Flow Visualization in a Radial Rotating Detonation Engine," 44DCASS-035, *Sinclair Community College*, Dayton, OH, 5 Mar 2019.
- Rathsack, T.C., Polanka, M.D., Bohan, B.T., Goss, L.P., "Experimental Investigation of Flow Characteristics in an Ultra Compact Combustor," 44DCASS-036, *Sinclair Community College*, Dayton, OH, 5 Mar 2019.
- Holobeny, D., Bohan, B.T., Polanka, M.D., "Computational Analysis of an Ultra Compact Combustor Using Swirl Stabilization," 44DCASS-037, *Sinclair Community College*, Dayton, OH, 5 Mar 2019.
- Druss, R.I., Polanka, M.D., Ombrello, T.M., and Fotia, M.L., "Scramjet Operability and RDE Design for RDE Piloted Scramjet," 44DCASS-038, *Sinclair Community College*, Dayton, OH, 5 Mar 2019.
- Mayeux, A.N., Polanka, M.D., and Blantin, J.R., "Development of a Test Bench to Study the Impact on Performance of Single and Dual Cylinder Internal Combustion Engines at Altitude," 44DCASS-039, *Sinclair Community College*, Dayton, OH, 5 Mar 2019.
- McNamara, L.J., Rutledge, J.L., Polanka, M.D., "Experimental Evaluations for Scaling Gas Turbine Cooling Effectiveness on Flat Plate Geometry," 44DCASS-040, *Sinclair Community College*, Dayton, OH, 5 Mar 2019.

### **REEDER, MARK F.**

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2002 (AFIT/ENY); BS, Mechanical Engineering, West Virginia University, 1989; MS, Mechanical Engineering, The Ohio State University, 1991; PhD, Mechanical Engineering, The Ohio State University, 1994. Prior to accepting a position with AFIT, Dr. Reeder served as an NRC Research Associate at NASA Glenn and subsequently as the manager of Research and Development for a manufacturer of industrial mixing equipment. His research interests include all aspects of fluid mechanics with an emphasis on experimental applications involving external aerodynamics, mixing enhancement, and propulsion. His publications include characterizations of store separation from a cavity utilizing pressure sensitive paint and measurements relating to several types of aircraft using 6-DOF balances, particle image velocimetry, filtered Rayleigh scattering, and other diagnostic tools. Dr. Reeder has also recently published in the area of low temperature ablation in a supersonic flow as applied to thermal management systems for space access vehicles. He has been published in a variety of journals including *Experiments in Fluids*, *Journal of Fluid Mechanics*, *AIAA Journal*, *AIAA Journal of Propulsion and Power*, *AIAA Journal of Aircraft*, *AIAA Journal of Spacecraft and Rockets*, *Physics of Fluids*, *NASA Tech Briefs*, *AICHE Journal*, and *Chemical Engineering Progress*. Dr. Reeder also has four patents to his credit, is a licensed Professional Engineer in the State of Ohio and is an elected member of the Academy of Distinguished Alumni, Department of Mechanical and Aerospace Engineering, West Virginia University. He currently serves on the editorial board of the *International Journal of Micro Air Vehicles*. Dr. Reeder is an Associate Fellow of the AIAA and a member of ASME. Tel. 937-255-3636 x4530, Email: [Mark.Reeder@afit.edu](mailto:Mark.Reeder@afit.edu)

### **Sponsor Funded Research Projects**

- "Drop Testing in the AFIT Small Supersonic Tunnel with Ejection Mechanism." Sponsor: AFRL/RQ. Funding: \$28,277 - Reeder 40%, Freeman 30%, Walker 30%.
- "Force and Moment Coefficients for Miniature Self-Defense Munition (MSDM) Geometry." Sponsor: Lockheed Martin. Funding: \$40,000 - Reeder 50%, Crowe 50%.
- "Hypersonic Aerodynamic Studies using AFRL Facilities." Sponsor: AFRL/RQ. Funding: \$15,000 - Reeder 50%, Komives 50%.
- "Measurements and Analysis of Wall Effects on Rotating Engine Components." Sponsor: AFRL/RQ. Funding: \$20,000.
- "Support of High Speed Strike Weapon Technology Maturation Activities." Sponsor: AFRL/RW. Funding: \$50,000.

## Refereed Journal Publications

Chin, D., Granlund, K., Maatz, I., Schmit, R.F., and Reeder, M.F., “Stochastic Store Trajectory of Ice Models from a Cavity into Supersonic Flow,” *Journal of Aircraft*, Vol. 56, No. 4, pp. 1313-1319, Feb 2019.

Freeman, J.A., Reeder, M.F., Demoret, C., “Experimental Validation for Globally Optimized Tractor-Trailer Base Flaps,” *AIAA Scitech Form*, San Diego, CA, 7-11 Jan 2019.

## RUGGLES WRENN, MARINA B.

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2003 (AFIT/ENY); BS, Polytechnic Institute of New York, 1981; MS, Rensselaer Polytechnic Institute, 1983; PhD, Rensselaer Polytechnic Institute, 1987. Dr. Ruggles-Wrenn’s interests center on mechanics of materials and structures, including experimental investigation of material behavior in extreme environments, advanced structural materials, high-temperature structural design methods, and viscoplasticity. She has published more than 150 peer reviewed scientific publications. Dr. Ruggles-Wrenn received several research and best paper awards, including Stinson Trophy of the National Aeronautic Association, Col Gage H. Crocker Outstanding Professor Award, and the AFIT Instructor of the Quarter Award. Prior to joining AFIT, she was a research scientist at the Oak Ridge National Laboratory (1987-2003). Dr. Ruggles-Wrenn is a member of the Editorial Board of *Applied Composite Materials* and an Associate Technical Editor of the *ASME Journal of Pressure Vessel Technology*. She is a Fellow of the American Society of Mechanical Engineers (ASME), and a member of the American Ceramic Society. Tel. 937-255-3636 x4641, Email: [Marina.Ruggles-Wrenn@afit.edu](mailto:Marina.Ruggles-Wrenn@afit.edu)

## Sponsor Funded Research Projects

“Characterization of Creep Behavior of an EBC Coated SiC/SiC CMC in Air and in Steam Environment.” Sponsor: AFRL/RX. Funding: \$20,000.

“Durability of Bonded CMC Joints under Sustained Loading at Elevated Temperature in Air and in Steam Environment.” Sponsor: AFRL/RX. Funding: \$20,000.

“Static Fatigue of SiC Fiber in Air and Si(OH)<sub>4</sub> Saturated Steam.” Sponsor: AFRL/RX. Funding: \$10,000.

## Refereed Journal Publications

S. J. Robertson, M. B. Ruggles-Wrenn, R. S. Hay, T. Shillig, R. Mitchell, B. Kroeger, and L. Gumucio, “Static Fatigue of Hi-Nicalon™-S Fiber at Elevated Temperature in Air, Steam and Silicic-Acid-Saturated Steam,” *Journal of the American Ceramic Society*, Sep 2019. DOI:10.1111/jace.16799

M. B. Ruggles-Wrenn, S. N. Minor, C. P. Przybyla, and E. L. Jones, “Creep of a Nextel™720/alumina Ceramic Composite Containing an Array of Small Holes at 1200°C in Air and in Steam,” *International Journal of Applied Ceramic Technology*, Vol. 16, pp. 3-13, Jan 2019.

M. B. Ruggles-Wrenn, and M. Noomen, “Fatigue of Unitized Polymer/Ceramic Matrix Composites with 2D and 3D Fiber Architecture at Elevated Temperature,” *Polymer Testing*, Vol. 72, pp. 244-256, Nov 2018.

## Refereed Conference Papers Accepted on the Basis of Full Paper Review

M.B. Ruggles-Wrenn, S.N. Minor, C.P. Przybyla, and E.L. Jones, “Creep of a Nextel™720/alumina Ceramic Composite Containing an Array of Small Holes at 1200°C in Air and in Steam,” *Proceedings of the 43rd International Conference & Exposition on Advanced Ceramics & Composites*, Daytona Beach FL, 27 January–1 February 2019.

G. Pry, and M.B. Ruggles-Wrenn, “Creep of HfB<sub>2</sub>- 20 vol% SiC at Elevated Temperature in Air,” *Proceedings of the 43rd International Conference & Exposition on Advanced Ceramics & Composites*, Daytona Beach FL, 27 January–1 February 2019.

S.J. Robertson, M.B. Ruggles-Wrenn, R.S. Hay, T. Shillig, R. Mitchell, B. Kroeger, and L. Gumucio, “Static Fatigue of Hi-Nicalon™-S Fiber at Elevated Temperature in Air, Steam and Silicic-Acid-Saturated Steam,” *Proceedings of the 2nd Global Forum on Advanced Materials and Technologies for Sustainable Development*, Toronto, Canada, 21–26 July 2019.

### **Editorships in Professional Journals**

Assistant Editor-in-Chief: Applied Composite Materials – *International Journal for the Science and Application of Composite Materials*

Member of the Editorial Board: Applied Composite Materials – *International Journal for the Science and Application of Composite Materials*

Associate Technical Editor: *ASME Journal of Pressure Vessel Technology*

### **RUTLEDGE, JAMES L., Lt Col**

Associate Professor of Aerospace Engineering; Department of Aeronautics and Astronautics, AFIT Appointment Date: 2011 (AFIT/ENY); BS, Mechanical Engineering, University of Texas at Austin, 2002; MS, Mechanical Engineering, University of Texas at Austin, 2004; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2009. Lt Col Rutledge’s research interests include experimental and computational investigations of gas turbine heat transfer, unsteady fluid mechanics, inverse heat transfer, and aerothermodynamics. He holds a patent, has published 28 archival journal articles and was awarded the Rohsenow Prize in 2008 by ASME, as well as an ASME Best Paper award in 2017. Lt Col Rutledge is a member of the ASME K-14 Gas Turbine Heat Transfer Committee, ASME, AIAA, and Tau Beta Pi. He is an associate editor for the ASME *Journal of Turbomachinery*, a registered professional engineer in the State of Texas, and has deployed to Afghanistan in support of Operation Enduring Freedom. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4734, Email: [James.Rutledge@afit.edu](mailto:James.Rutledge@afit.edu)

### **Sponsor Funded Research Projects**

“Advanced Film Cooling Technique Development.” Sponsor: AFRL/RQ. Funding: \$36,000.

### **Refereed Journal Publications**

Bryant, C.E., Wiese, C.J., Rutledge, J.L., and Polanka, M.D., “Experimental Evaluations of the Relative Contributions to Overall Effectiveness in Turbine Blade Leading Edge Cooling,” *Journal of Turbomachinery*, Vol. 141, No. 4, pp. 041007-1 – 041007-15, April 2019. DOI: 10.1115/1.4041645

Rutledge, J.L., and Baker, W.P., “Unsteady Effects on the Experimental Determination of Overall Effectiveness,” *Journal of Turbomachinery*, Vol. 140, No. 12, pp. 121005-1 – 121005-10, December 2018. DOI: 10.1115/1.4041233

Wiese, C.J., Bryant, C.E., Rutledge, J.L., and Polanka, M.D., “Influence of Scaling Parameters and Gas Properties on Overall Effectiveness on a Leading-Edge Showerhead,” *Journal of Turbomachinery*, Vol. 140, No. 11, pp. 111007-1 – 111007-12, November 2018. DOI: 10.1115/1.4041292

Greiner, N.J., Polanka, M.D., and Rutledge, J.L., “Impact of Wall Boundary Condition on Scaling Film Cooling Performance from Near Ambient to Engine Temperatures,” *International Journal of Thermal Sciences*, Vol. 132, pp. 378-386, October 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Bryant, C.E., and Rutledge, J.L., “A Computational Technique to Evaluate the Relative Influence of Internal and External Cooling on Overall Effectiveness,” *ASME Turbo Expo*, Paper No. GT2019-90999, Phoenix, AZ, June 2019.

Fischer, J.P., Rutledge, J.L., McNamara, L.J., and Polanka, M.D., “Scaling Flat Plate, Low Temperature Adiabatic Effectiveness Results Using the Advective Capacity Ratio,” *ASME Turbo Expo*, Paper No. GT2019-90997, Phoenix, AZ, June 2019.

Rathsack, T.C., Bohan, B.T., Polanka, M.D., and Rutledge, J.L., “Experimental Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane,” *ASME Turbo Expo*, Paper No., GT2019-91425, Phoenix, AZ, June 2019.

### **Editorships in Professional Journals**

Associate Editor: *ASME Journal of Turbomachinery*.

### **Patent Applications**

Rutledge, J.L., Fuqua, M.N., Bryant, C.E., “Energy Separation Turbine Cooling Method,” Provisional Application filed June 2019.

### **SCHAUER, FRED R.**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: Jan 2019 (AFIT/ENY); BS, Mechanical Engineering, University of Dayton, 1993; PhD, Mechanical Engineering, University of Illinois at Urbana-Champaign, 1998; Air War College, 2008. Dr Schauer’s research interests include energy, propulsion, and power. In particular, he is active in developing novel cycles. From 1997 – 2019, he served as the principal investigator for AFRL’s in-house detonation propulsion research program. Starting from AF sponsored dissertation research on laser diagnostics and modeling flame/turbulence interactions, he eventually led the Propulsion and Power Advanced Concepts Group, which includes the Detonation Engine Research Facility and the Small Engine Research Laboratory. Prior to joining AFIT fulltime, Dr. Schauer served as a research advisor for numerous MS and PhD students, and he maintains collaborations with other research institutions including AFRL, NASA, DOE, and other academic institutions. His research group has published extensively and been recognized by AIAA, ASME, AFOSR, and AFRL, including the AFRL Commander’s Cup and Innovation Award, the AFRL Science & Technology Achievement Award (two times), the ASME Airbreathing Propulsion Award, and as finalists for both the Collier Trophy and Aviation Laureate. Dr. Schauer is an AFRL Fellow and was named both the Air Force Scientist of the Year and AIAA Engineer of the Year. Tel. 937-255-3636 x4204, Email: [Fred.Schauer@afit.edu](mailto:Fred.Schauer@afit.edu)

### **Sponsor Funded Research Projects**

“Novel Cycle Research.” Sponsor: AFRL/RQ. Funding: \$20,000.

### **Refereed Journal Publications**

A. Naples, J. Hoke, R. Battelle, and F. Schauer, “T63 Turbine Response to Rotating Detonation Combustor Exhaust Flow,” GTP-18-1424, *Journal for Engineering, Gas Turbines, and Power*, Vol. 141(2):021029-021029-8, Feb 2019. DOI: 10.1115/1.4041135

Riley Huff, Marc D. Polanka, Michael J. McClearn, Frederick R. Schauer, Matthew L. Fotia, and John L. Hoke, “Design and Operation of a Radial Rotating Detonation Engine,” *Journal of Propulsion and Power*, Vol. 35, Issue 6, Sep 2019. <https://doi.org/10.2514/1.B37578>

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Scott A. Boller, Marc D. Polanka, Riley Huff, Frederick Schauer, Matthew Fotia, and John Hoke, “Experimental Flow Visualization in a Radial Rotating Detonation Engine,” *AIAA Scitech Forum*, Jan 2019.

Riley Huff, Frederick Schauer, Scott A. Boller, Marc D. Polanka, Matthew Fotia, and John Hoke, “Exit Condition Measurements of a Radial Rotating Detonation Engine Bleed Air Turbine,” *AIAA Scitech Forum*, Jan 2019.

Matthew Fotia, Thomas A. Kaemming, Joshua R. Codoni, John Hoke, and Frederick Schauer, “Experimental Thrust Sensitivity of a Rotating Detonation Engine to Various Aerospike Plug-Nozzle Configurations,” *AIAA Scitech Forum*, Jan 2019.

Robert T. Fievisohn, John Hoke, Frederick Schauer, and Kevin Y. Cho, “Experimental Study of a Linear RDE Section Coupled to an Operating RDE,” *AIAA Scitech Forum*, Jan 2019.

Ryan I. Druss, Marc D. Polanka, Timothy Ombrello, and Frederick Schauer, "Scramjet Operability and RDE Design for RDE Piloted Scramjet," *AIAA Scitech Forum*, Jan 2019.

Andrew Naples, Andrew M. Knisely, John Hoke, and Frederick Schauer, "Infinite Line Pressure Probe and Flush Transducer Measurements in a Rotating Detonation Engine Channel," *AIAA Scitech Forum*, Jan 2019.

Kaitlin Moosmann, Nicholas D. Grannan, John Hoke, and Frederick Schauer, "Recuperator Integration with Small Turbine Engine," *AIAA Scitech Forum*, Jan 2019.

Christopher A. Stevens, Matthew Fotia, John Hoke, and Frederick Schauer, "An Experimental Comparison of the Inner and Outer Wall Heat Flux in an RDE," *AIAA Scitech Forum*, Jan 2019.

Kevin Y. Cho, Christopher A. Fugger, Robert T. Fievisohn, Brian Sell, John Hoke, Sean P. Kearney, Andrew W. Caswell, James R. Gord, and Frederick Schauer, "Burst-mode 355 nm PLIF for Detonation Wave Front Visualization and 100–300 kHz Particle Image Velocimetry," *AIAA Scitech Forum*, Jan 2019.

### **THOMAS, LEVI M., Maj**

Associate Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2017 (AFIT/ENY); BS, Aeronautical Engineering, United States Air Force Academy, 2006; MS, Aeronautical Engineering, Air Force Institute of Technology, 2009; AA, Foreign Language, Defense Language Institute, 2011; PhD, Mechanical Engineering, Purdue University, 2017. Maj Thomas' research interests include optical diagnostics, high-speed measurement techniques, and combustion. Maj Thomas has experience as an intelligence analyst (air-to-air weapons), as a combustion research engineer (detonation combustion), and as an exchange officer working with the German Aerospace Center (combustion physics). His previous research includes detonation measurements, as well as laser-based velocity and temperature measurements. Maj Thomas' professional memberships include AIAA, ASME, and the Combustion Institute. He is also a registered professional engineer in the state of Colorado. Maj Thomas deployed to Iraq in 2018 in support of Operation Inherent Resolve. Tel. 937-255-3636 x4500, Email: [Levi.Thomas@afit.edu](mailto:Levi.Thomas@afit.edu)

### **Sponsor Funded Research Projects**

"RhoDE Injector Development using Laser Absorption & Computational Fluid Dynamics." Sponsor: AFRL/RQ. Funding: \$5,000 - Thomas.

### **Refereed Journal Publications**

Thomas, L.M., Lowe, A., Satija, A., Masri, A.R., and Lucht, R.P., "Five kHz Thermometry in Turbulent Spray Flames Using Chirped-Probe Pulse Femtosecond CARS, Part I: Processing and Interference Analysis," *Combustion and Flame*, 405-416, Nov 2018. DOI: 10.1016/j.combustflame.2018.11.004

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Lowe, A., Thomas, L.M., Satija, A., Lucht, R.P., and Masri, A.R., "Chirped-Probe-Pulse Femtosecond CARS Thermometry in Turbulent Spray Flames," *Proceedings of the Combustion Institute* 37, 1383-1391, 2019. DOI: 10.1016/j.proci.2018.06.149

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

"Investigation of Loss Reduction in a High Lift Turbine by Localized Endwall Jets," *AIAA Propulsion and Energy Forum*, Indianapolis, IN, 19-22 Aug 2019. DOI: 10.2514/6.2019-4005

**WALKER, MICHAEL M., Lt Col**

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); BS, Aeronautical Engineering, United States Air Force Academy, 2003; MS, Aeronautical Engineering, Air Force Institute of Technology, 2007; MBA, Amberton University, 2008; PhD, Aerospace Engineering, The Ohio State University, 2018. Lt Col Walker's research interests include low-speed aerodynamics, swept-wing performance, active flow control, experimental fluid mechanics, combat aircraft survivability, and composite armor testing. He is a developmental engineer with experience at the Air Force Research Laboratory (AFRL), Hanscom AFB, the National Air and Space Intelligence Center (NASIC), Wright-Patterson AFB, and the Launch and Range Systems Directorate (LRS), Los Angeles AFB. Lt Col Walker deployed to Kandahar Airfield, Afghanistan in support of Operation Enduring Freedom, and is a member of Sigma Gamma Tau and AIAA. Tel. 937-255-3636 x4745, Email: [Michael.Walker@afit.edu](mailto:Michael.Walker@afit.edu)

**WIESEL, WILLIAM E., Jr.**

Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 1977 (AFIT/ENY); BS, University of Massachusetts, 1970; MS, Harvard University, 1972; PhD, Harvard University, 1974. Dr. Wiesel's research interests include applications of dynamical systems theory to orbital mechanics and astrodynamics, especially KAM theory, estimation and control, planetary astronomy, stability theory, and optimal control. He is the author of *Spaceflight Dynamics*, a leading introductory text on astronautical engineering. Dr. Wiesel has authored more than 50 technical papers and has been a member of the Department of Aeronautics and Astronautics for 40 years. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4312, Email: [William.Wiesel@afit.edu](mailto:William.Wiesel@afit.edu)

**Sponsor Funded Research Projects**

"Onboard SmallSat Navigation and Mission Planning." Sponsor: AFRL/RV. Funding: \$40,000. [CSRA]

**Refereed Journal Publications**

Craft, C. and Wiesel, W., "Impulsive Control of Earth Satellites on Low-Eccentricity Kolmogorov–Arnold–Moser Tori," *Journal of Guidance, Control, and Dynamics*, Vol. 42, pp. 2297-2304, 2019. [CSRA]

**ZAGARIS, COSTANTINOS, Maj**

Assistant Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); B.S. Aerospace Engineering, Virginia Tech, 2007; MS, Astronautical Engineering, Air Force Institute of Technology, 2012; PhD, Astronautical Engineering, Naval Postgraduate School, 2018. Maj Zagaris' research interests include autonomous spacecraft guidance, spacecraft relative motion dynamics, optimal control, and reachability. Tel. 937-255-3636 x4774, Email: [Costantinos.Zagaris@afit.edu](mailto:Costantinos.Zagaris@afit.edu)

**Sponsor Funded Research Projects**

"Multiagent Robotics for On-orbit Servicing." Sponsor: AFRL/RV. Funding: \$50,008 - Zagaris 50%, Leishman 50%. [CSRA/ANT]

**Refereed Journal Publications**

J. Virgili-Llop, C. Zagaris, R. Zappulla, II, A. Bradstreet, and M. Romano, "A Convex-Programming-Based Guidance Algorithm to Capture a Tumbling Object On Orbit Using a Spacecraft Equipped with a Robotic Manipulator," *International Journal of Robotics Research*, Vol. 38, No. 1, pp 40-72, Dec 2018.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

C. Zagaris, and M. Romano, "Applied Reachability Analysis for Spacecraft Rendezvous with a Tumbling Object," *Astrodynamic Specialist Conference*, Portland, ME, August 2019.

## **5.2 DEPARTMENT OF ENGINEERING PHYSICS**

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### 5.2.1 DOCTORAL DISSERTATIONS

DODSON, TABITHA, Investigations of Point Defects in  $\text{KH}_2\text{PO}_4$  Crystals Using Ab Initio Quantum Methods. AFIT-ENP-DS-19-S-021. Faculty Advisor: Dr. Nancy C. Giles. Sponsor: N/A.

DUGAN, CHRISTINA, Electrical Characterization of Crystalline  $\text{UO}_2$ ,  $\text{ThO}_2$ , and  $\text{U}_{0.71}\text{Th}_{0.29}\text{O}_2$ . AFIT-ENP-DS-18-D-007. Faculty Advisor: Dr. James C. Petrosky. Sponsor: DHS/DNDO.

LENYK, CHRISTOPHER, Point Defects in Lithium Gallate and Gallium Oxide. AFIT-ENP-DS-19-S-023. Faculty Advisor: Dr. Nancy C. Giles. Sponsor: AFIT/EN.

LLOYD, ROBERT L., Numerical Simulation of Unstable Laser Resonators with a High-Gain Medium. AFIT-ENP-DS-19-S-024. Faculty Advisor: Dr. David E. Weeks. Sponsor: N/A. [CDE]

MACE, MELANIE, Targeted Germanium Ion Irradiation of Aluminum Gallium Nitride/Gallium Nitride High Electron Mobility Transistors. AFIT-ENP-DS-19-S-025. Faculty Advisor: Dr. John W. McClory. Sponsor: NNSA.

RECKER, MATTHEW, Enabling Mobile Neutron Detection Systems with CLYC. AFIT-ENP-DS-19-S-028. Faculty Advisor: Dr. John W. McClory. Sponsor: DTRA.

SCHERRER, ELIZABETH, Optical and Electron Paramagnetic Resonance Characterization of Point Defects in Semiconductors. AFIT-ENP-DS-19-M-091. Faculty Advisor: Dr. Nancy C. Giles. Sponsor: N/A.

THORNTON, DOUGLAS E., Digital Holography Efficiency Experiments for Tactical Applications. AFIT-ENP-DS-19-S-029. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD. [CDE CTISR]

VAN WOERKOM, TODD A., On the Pulsed Ablation of Metals and Semiconductors. AFIT-ENP-DS-19-S-030. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD. [CDE]

WALLERSTEIN, AUSTIN J., Kinetics of Higher Lying Potassium States After Excitation of the D2 Transition in the Presence of Helium. AFIT-ENP-DS-18-D-009. Faculty Advisor: Dr. Glen P. Perram. Sponsor: DEJTO. [CDE]

YOUNG, SHANNON, Optimization of a Moment-Based Detection Algorithm. AFIT-ENP-DS-18-D-010. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: NGA.

## 5.2.2 MASTER'S THESES

- BAZEMORE, DANIEL, Quantifying Uncertainty of Ensemble Transport and Dispersion Simulations Using HYSPLIT. AFIT-ENP-MS-19-M-065. Faculty Advisor: Lt Col Hsien-Liang Tseng. Sponsor: AFTAC.
- BROWNLEE, LAUREN E., Battle Damage Assessment with Optical Cross Section Measurements. AFIT-ENP-MS-19-S-018. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: Raytheon SAS. [CDE]
- CHOE, KEVIN, Displacement Damage Effects in GeSn Light Emitting Diodes. AFIT-ENP-MS-19-M-073. Faculty Advisor: Lt Col Michael R. Hogsted. Sponsor: AFOSR/RT.
- EGNER, BRYAN, Development of a Mixed-Radiation Directional Rotating Scatter Mask Detection System. AFIT-ENP-MS-19-M-075. Faculty Advisor: Dr. Larry W. Burggraf. Sponsor: DTRA.
- ETHRIDGE, JAMES A., Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials. AFIT-ENP-MS-19-M-077. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFOSR/RT. [CDE CTISR]
- GOOCH, JOSHUA Y., Global Ionosonde and GPS Radio Occultation Sporadic-E Intensity and Height Comparison. AFIT-ENP-MS-19-M-079. Faculty Advisor: Maj Daniel J. Emmons. Sponsor: AFRL/RV. [CSRA]
- HALL, AMY, Development of a Model for C-11 Production Via the N-14(p,α) Reaction Using a GE PETtrace Cyclotron. AFIT-ENP-MS-19-M-080. Faculty Advisor: Maj James E. Bevins. Sponsor: AFTAC.
- HANSON, WILLIAM, Analysis of the Gálvez-Davison Index for Convective Forecasting over Africa Using the GALWEM. AFIT-ENP-MS-19-M-081. Faculty Advisor: Lt Col Hsien-Liang Tseng. Sponsor: N/A.
- JOHNSTON, WILL, Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations. AFIT-ENP-MS-19-M-082. Faculty Advisor: Lt Col Michael L. Dexter. Sponsor: DTRA.
- KATUZIENSKI, DANIEL, Comparing Dual-Polarization Radar Lightning Forecast Methods Across Southwest Utah. AFIT-ENP-MS-19-M-083. Faculty Advisor: Maj Omar A. Nava. Sponsor: 45 WS.
- MAO, DAVIN, Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System. AFIT-ENP-MS-19-M-084. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD. [CDE CTISR]
- MCREYNOLDS, BRIAN J., A Comprehensive Test Methodology and Physics-Based Camera Model for Characterizing Neuromorphic Imagers. AFIT-ENP-MS-19-M-085. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: N/A. [CTISR]
- NAGAMINE, ERIC, The Non-Mechanical Beam Steering of Light in Reflective Inverse Diffusion. AFIT-ENP-MS-19-M-086. Faculty Advisor: Lt Col Kenneth W. Burgi. Sponsor: AFOSR/RT.
- NELSON, AMANDA, Characterization of Tropical Cyclone Intensity Using Microwave Imagery. AFIT-ENP-MS-19-M-087. Faculty Advisor: Maj Omar A. Nava. Sponsor: JTWC.
- QUARTEMONT, NICHOLAS, Nuclear Data Covariance Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments. AFIT-ENP-MS-19-M-089. Faculty Advisor: Maj James E. Bevins. Sponsor: AFTAC.
- ROUND, JOSEPH F., Variations of Heavy Ion Abundances Relative to Proton Abundances In Large Solar Energetic Particle Events. AFIT-ENP-MS-19-M-090. Faculty Advisor: Dr. Robert D. Loper. Sponsor: AFRL/RV. [CSRA]
- SCHWALBE, SOPHIA, Modeling High-Altitude Nuclear Detonations Using Existing Ionospheric Models. AFIT-ENP-MS-19-M-092. Faculty Advisor: Dr. Robert D. Loper. Sponsor: DARPA/DS.

TORZILLI, ROBERT, Developing and Testing of a Simulated NUDET Optical Detection Model Using Realistic Weather Conditions. AFIT-ENP-MS-19-M-093. Faculty Advisor: Dr. James C. Petrosky. Sponsor: AFTAC.

WOLFMAYER, SCOTT S., Coupled Atmospheric Surface Observations with Surface Aerosol Particle Counts for Daytime Sky Radiance Quantification. AFIT-ENP-MS-19-M-095. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO. [CDE]

ZOELLICK, CASEY, Source Term Estimation of Atmospheric Pollutants Using an Ensemble of HYSPLIT Concentration Simulations. AFIT-ENP-MS-19-M-096. Faculty Advisor: Lt Col Hsien-Liang Tseng. Sponsor: AFTAC.

### 5.2.3 FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

#### **BAILEY, WILLIAM F.**

Associate Professor Emeritus of Physics, Department of Engineering Physics, AFIT Appointment Date: 1978 (AFIT/ENP); BS, United States Military Academy, 1964; MS, The Ohio State University, 1966; PhD, Air Force Institute of Technology, 1978. Dr. Bailey's research interests center on weakly ionized gases and reactive kinetics with special applications to semiconductor processing in gas discharges, shock characterization in ionized flows, and solutions of the inhomogeneous electron kinetic equation. Dr. Bailey has published more than 20 papers in refereed conference proceedings and international journals, and has chaired more than 25 theses and dissertations. He is a member of Tau Beta Pi, Sigma Pi Sigma, and Sigma Xi. Tel. 937-255-3636 x4501, Email: [William.Bailey@afit.edu](mailto:William.Bailey@afit.edu)

#### **BEVINS, JAMES E., Maj**

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Nuclear Engineering, University of Tennessee, 2009; MS, Nuclear Engineering, Air Force Institute of Technology, 2011; PhD, Nuclear Engineering, University of California – Berkeley, 2017. Maj Bevins' research interests include experimental and modeling research in the areas of nuclear forensics, nuclear detection, nuclear data, radiation transport, and applied optimization design of nuclear systems. Maj Bevins has authored 12 refereed archival journal publications and 22 refereed conference proceedings. He holds two notices of invention and two provisional patents. He has successfully advised five MS students and is currently advising two MS students and four PhD students. AFIT Research affiliation(s): NEAT. Tel. 937-255-3636 x4767, Email: [James.Bevins@afit.edu](mailto:James.Bevins@afit.edu)

#### **Sponsor Funded Research Projects**

“Endowed Term Chair.” Sponsor: AFTAC/AFTAC. Funding: \$33,333.

“Nuclear Survivability Experimentation, Modeling, and Data Verification.” Sponsor: NNSA. Fund: \$200,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%.

#### **Refereed Journal Publications**

M.C. Recker, E.J. Cazalas, J.W. McClory, and J.E. Bevins, “Comparison of SiPM and PMT Performance Using a Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC) Scintillator with Two Optical Windows,” *IEEE Transactions on Nuclear Science*, Vol. 66, No. 8, pp. 1959–1965, 2019. [NEAT]

Bethany L. Goldblum, Andrew W. Reddie, Thomas C. Hickey, James E. Bevins, et al., “The Nuclear Network: Multiplex Network Analysis for Interconnected Systems,” *Applied Network Science*, Vol. 4, No. 36, 2019.

J.E. Bevins, Z. Sweger, N. Munshi, B.L. Goldblum, et al., “Performance evaluation of an energy tuning assembly for neutron spectral shaping,” *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment*, Vol. 923 pp. 79-87, 2019. [NEAT]

R.J. Olesen, B.E. O'Day, D.E. Holland, L.W. Burggraf, and J.E. Bevins, “Characterization of Novel Rotating Scatter Mask Designs for Gamma Direction Identification,” *Nuclear Instrumentation and Methods in Physics Research Section A*, Sep 2018.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Robert J. Olesen, D.E. Holland, Erik Brubaker, James Cole, and James E. Bevins, “Advanced Radiation Imaging Algorithms with Rotating Scatter Masks,” *International Nuclear Materials Management Conference*, Palm Desert, CA, 18 July, 2019. [NEAT]

B.V. Egner, D.E. Holland, L. W. Burggraf, J.E. Bevins, and V.M. Martin, “Development of a Dual-Particle Directional Detection System Using a Rotating Scatter Mask,” *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 11 April, 2019. [NEAT]

N.J. Quartemont, R. Slaybaugh, L. Bernstein, and J.E. Bevins, "Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments at the National Ignition Facility," *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 11 April, 2019. [NEAT]

W.D. Johnston, M.L. Dexter, J.W. McClory, and J.E. Bevins, "Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations," *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 10 April, 2019. [NEAT]

N.J. Quartemont, R. Slaybaugh, L. Bernstein, and J.E. Bevins, "Development of a Novel National Ignition Facility Platform for Simulating Nuclear Relevant Neutron Environments," *IEEE Nuclear Science Symposium and Medical Imaging Conference*, Sydney, Australia, 14 November, 2018. [NEAT]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

M.C. Recker, E.J. Cazalas, J.W. McClory, and J.E. Bevins, "Comparison of SiPM and PMT Performance Using Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC) Scintillator with Two Optical Windows," *IEEE Nuclear Science Symposium*, November 2018.

### **Patent Applications**

Holland, D.E., Olesen, R.J., Burggraf, L.W., O'Day, B.E., Bevins, J.E., "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,816,435, filed 11 March, 2019. Patent Pending. [NEAT]

Olesen, R.J., Egner, B.V., Holland, D.E., Martin, V.M., Bevins, J.E., "An Efficient, Dual-Particle Directional Detection System Using a Rotating Scatter Mask." U.S. Patent Application 62,816,451, filed 11 March, 2019. Patent Pending. [NEAT]

### **BICKLEY, ABIGAIL A.**

Research Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BA, Dartmouth College, 2000; PhD, University of Maryland, 2004. Dr. Bickley's expertise is in nuclear forensics and radiation transport. Her current research focuses on the characterization of radiological and nuclear samples for nuclear forensics signature identification and software development of statistical analysis tools for nuclear forensics applications. In addition, Dr. Bickley is examining neutral particle transport in the space environment. Before joining AFIT, she was on the faculty of Michigan State University and worked in nuclear treaty monitoring. Dr. Bickley is a member of the American Physical Society (APS) and American Chemical Society (ACS). Tel. 937-255-3636 x4555, Email: [Abigail.Bickley@afit.edu](mailto:Abigail.Bickley@afit.edu)

### **Sponsor Funded Research Projects**

"Support for the US Nuclear Detonation Detection System." Sponsor: DOE/NNSA. Funding: \$50,000. Bickley 50%, McClory 50%. [NEAT]

### **Other Significant Research Productivity**

G. Varshney, J.R. Cezeaux, A.A. Bickley, and J.C. Petrosky, "Morphological and Elemental Characterization of Environmental Actinide Bearing Particles Formed by Non-Nuclear Weapon Accidents," Presentation: *American Chemical Society Conference*, Orlando, FL, USA, April, 2019.

J.R. Cezeaux, G. Varshney, A.A. Bickley, and J.C. Petrosky, "Morphological Classification and Analysis of Fuel Bearing Debris from a Non-Critical Event," Presentation: *Hardened Electronics and Radiation Technology Conference*, USA, April, 2019

## **BOSE-PILLAI, SANTASRI R.**

Research Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2011 (AFIT/ENP); BE, Electrical Engineering, Jadavpur University (India), 2000; MS, Electrical Engineering, New Mexico State University, 2005; PhD, Electrical Engineering (with emphasis on Optics), New Mexico State University, 2008. Dr. Bose-Pillai's research interests are in propagation and imaging through the atmosphere, generation of partially coherent sources, telescope pointing and tracking, and laser communications through free space. At AFIT, she has been working on remote characterization of atmospheric turbulence using imaging and other optical techniques. She has also been investigating methods for generation of different types of partially coherent sources. Dr. Bose-Pillai has more than fifty journal and conference publications to her credit. Prior to joining AFIT, she was a Visiting Assistant Professor in the Physics and Optical Engineering Department at Rose-Hulman Institute of Technology, Terre Haute, IN. She is a Senior Member of SPIE, and a regular member of OSA and DEPS. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4903, Email: [Santasri.Bosepillai.ctr@afit.edu](mailto:Santasri.Bosepillai.ctr@afit.edu)

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Steven Fiorino, Santasri R. Bose-Pillai, and Kevin J. Keefer, "In-situ Field Profiling of Optical Turbulence Using 3D Sonic Anemometers," Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), OSA Imaging and Applied Optics Congress, Munich, Germany, June 2019. [CDE]

Santasri R. Bose-Pillai, Jack E. McCrae, Aaron J. Archibald, Christopher A. Rice, and Steven T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE 11001, Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019. [CDE]

Steven T. Fiorino, Santasri R. Bose-Pillai, Jaclyn E. Schmidt, Brannon J. Elmore, and Kevin J. Keefer, "Implications of 4D Weather Cubes for Improved Cloud Free Line of Sight Assessments of Free Space Optical Communications Link Performance," *Proc. SPIE 10981, Laser Technology for Defense and Security XV*, 109810S, 13 May 2019. [CDE]

Santasri R. Bose-Pillai, Jack E. McCrae, Michael A. Rucci, Eric M. Kwasniewski, and Steven T. Fiorino, "Estimation of Fried's Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

Jack E. McCrae, Santasri R. Bose-Pillai, Christopher A. Rice, and Steven T. Fiorino, "Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

Steven T. Fiorino, Santasri R. Bose-Pillai, Josiah E. Bills, Jaclyn E. Schmidt, Brannon J. Elmore, and Kevin J. Keefer, "Assessing Free Space Optical Communications Through 4D Weather Cubes," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J. Meoak, B.J. Elmore, T.P. Kesler, C.A. Rice, and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "First Look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating Diffractive Effects in Tilt-Based Turbulence Estimation Through Simulation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019. [CDE]

## Patent Applications

Milo W. Hyde, and Santasri R. Bose-Pillai, "Generation of Vector Partially Coherent Optical Sources Using Phase-Only Spatial Light Modulators," non-provisional application filed in Oct 2018. [CDE]

## Invention Disclosures

Santasri R. Bose-Pillai, Jack E. McCrae, Christopher A. Rice, and Steven T. Fiorino, "Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-lapse Imagery," provisional application filed in June 2019. [CDE]

## BURGGRAF, LARRY W.

Professor of Engineering Physics and Chemical Physics, Department of Engineering Physics, AFIT Appointment Date: 1994 (AFIT/ENP); BA, Chemistry, Olivet Nazarene University, 1968; MS, Chemistry, The Ohio State University, 1971; MA, Applied Mathematics, University of West Florida, 1977; PhD, Chemistry, University of Denver, 1981; Post-doctoral Associate, Computational Chemistry, Iowa State University, 1993. Dr. Burggraf conducts experimental and theoretical research in physical chemistry and materials chemistry including radiation biophysics, exotic atom chemistry, positron spectroscopy, surface and cluster spectroscopy, excitonic nanomaterials, atomic force microscopy, gamma spectroscopy, and gamma imaging to solve DOD, DHS, and DOE problems in WMD non-proliferation. Theoretical research to model surfaces, clusters, nanomaterials and exotic-atom molecules applies quantum mechanics modeling to interpret experimental results. Dr. Burggraf has authored more than 55 refereed archival publications. He holds one patent. He has successfully advised 45 Master's students, eight PhD students, and is currently advising one MS and one PhD student. Tel. 937-255-3636 x4507, Email: [Larry.Burggraf@afit.edu](mailto:Larry.Burggraf@afit.edu)

## Sponsor Funded Research Projects

"Materials Science of Defect Centers for Quantum Sensing; First-principles Design of Defect Centers for Quantum Sensing." Sponsor: AFRL/RX. Funding: \$25,000.

"Materials Science of Defect Centers for Quantum Sensing; First-principles Design of Defect Centers for Quantum Sensing." Sponsor: AFRL/RX. Funding: \$40,000.

## Refereed Journal Publications

J.J. Lutz and Larry W. Burggraf, "The Lowest-Energy Isomer of  $C_2Si_2H_4$  is a Bridged Ring: Reinterpretation of the Spectroscopic Data Based on DFT and Coupled-Cluster Calculations," *Inorganics*, Vol. 7, Issue 4, April 2019.

Julie V. Logan, Darren E. Holland, Larry W. Burggraf, Justin A. Clinton, and Buckley E. O'Day, "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System," *Nuclear Instruments and Methods in Physics Research Section A*, Vol. 947, 2019.

## Refereed Conference Papers Accepted on the Basis of Full Paper Review

B.V. Egner, D.E. Holland, L.W. Burggraf, J.E. Bevins, and V. M. Martin, "Development of a Dual-Particle Directional Detection System Using a Rotating Scatter Mask," *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 11 April, 2019.

## Patent Applications

Holland, D.E., Olesen, R.J., Burggraf, L.W., O'Day, B.E., Bevins, J.E., "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,816,435, filed March 11, 2019. Patent Pending.

Egner, B.V., Olesen, R.J., Holland, D.E., Martin, V.M., O'Day, B.E., Burggraf, L.W., Bevins, J.E., 2019. "An Efficient, Dual-Particle Directional Detection System Using a Rotating Scatter Mask." U.S. Patent Application 62,816,451, filed 11 March, 2019. Patent Pending.

## Other Significant Research Productivity

J.J. Lutz, X.F. Duan, and L.W. Burggraf, "Towards a Mechanism for Formation of Silicon Carbide Crystals in AGB Stars," Presentation: *74th International Symposium on Molecular Spectroscopy*, University of Illinois Urbana-Champaign, 19 June, 2019.

J.J. Lutz, X.F. Duan, and L.W. Burggraf, "Computational Design of Defect Spin Centers for Quantum Information Processing," Presentation: *Center for Computing Research, Sandia National Laboratories*, 5 June 2019.

### **BURGI, KENNETH W., Lt Col**

Assistant Professor of Optical Engineering, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, Michigan Technological University, 2002; MS, Michigan Technological University, 2010; PhD, Air Force Institute of Technology, 2016. Lt Col Burgi's research focus is primarily the development of methods to control reflectively scattered light from rough surfaces. These methods could be used to reconstruct images of objects without direct line-of-sight using scattered light. As a former instructor pilot, Lt Col Burgi has deployed three times in support of Operation Enduring Freedom and Operation Iraqi Freedom. He has flown 1,295 combat flight hours in 363 combat sorties in the C-17 and MC-12 aircraft. He has published two referred journal articles and three conference publications. Lt Col Burgi is a member of SPIE and the current Engineering Physics Interim Department Head. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4696, Email: [Kenneth.Burgi@afit.edu](mailto:Kenneth.Burgi@afit.edu)

### **Sponsor Funded Research Projects**

"Dynamic Data Driven Phase Optimization for Controlling Light Scattered by a Rough Surface." Sponsor: AFOSR. Funding: \$37,290 - Burgi 75%, Marciniak 15%, Oxley 10%. [CDE/CTISR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Nagamine, E.K., Burgi, K.W., Butler, S.D., and Marciniak, M.A., "Non-Mechanical Beam-Steering in Reflective Inverse Diffusion," *Laser Beam Shaping XIX*, Vol. 11107, Page. 1110706). *International Society for Optics and Photonics*, Sep 2019. [CDE]

### **BUTLER, SAMUEL D., Lt Col**

Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Applied Physics (Computer Science Emphasis), Brigham Young University, 2004; MS, Physics, Air Force Institute of Technology, 2010; PhD, Physics, Air Force Institute of Technology, 2015. Lt Col Butler's research is primarily focused on development of optical scatter models for use in remote sensing applications, particularly in the IR. He has also previously been involved in munitions development, quantum mechanical scattering, cryptography, and quantum information. Lt Col Butler has published two refereed journal articles and eight conference presentations. He has also deployed to Afghanistan as a deputy IG in support of Operation Enduring Freedom in 2011, and to Southwest Asia in 2016. Lt Col Butler is a member of SPIE, and is the AFIT chapter co-advisor of SPIE. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4385, Email: [Samuel.Butler@afit.edu](mailto:Samuel.Butler@afit.edu)

### **Sponsor Funded Research Projects**

"Analysis of Modified Microfacet BRDF Models for Polarimetric Optical Scatter." Sponsor: AFOSR. Funding: \$45,200 - Butler 75%, Marciniak 25%. [CDE/CTISR]

### **Refereed Journal Publications**

Ewing, B.E., Butler, S.D., and Marciniak, M.A., "Improved Grazing Angle Bidirectional Reflectance Distribution Function Model Using Rayleigh-Rice Polarization Factor and Adaptive Microfacet Distribution Function," *Opt. Eng.* 57, 1, 2018. [CDE]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sloan, J.A., Butler, S.D., Ullom, J.M., and Wander, J.D, “Experimental Determination of Glass Bead Retroreflectivity for Aircraft Geometries,” *Airfield and Highway Pavements: Innovation and Sustainability in Highway and Airfield Pavement Technology*. Reston, VA, pp. 436-446, 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

E.K. Nagamine, K.W. Burgi, S.D. Butler, and M.A. Marciniak, “Nonmechanical Beam-Steering in Reflective Inverse Diffusion,” *Proc. SPIE*, 1110706, 2019. [CDE]

S.D. Butler, and M.A. Marciniak, “Analysis of Modified Microfacet BRDF Models for IR Remote Sensing Applications,” *Presentation: SPIE Optics and Photonics*, 12 Aug 2019. [CDE]

A.M. Lanari, S.D. Butler, M.A. Marciniak, and B.E. Ewing, “Polarimetric Evaluation of Oblique and Grazing Angle Microfacet BRDF Model Modification Using Experimental Data,” *Presentation: SPIE Optics and Photonics*, Oct 2018. [CDE]

### **CAYLOR, MICHAEL J.**

Associate Director, Center for Technical Intelligence Studies and Research, and Research Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Aerospace Engineering, University of Notre Dame, 1981; MS, Aerospace Engineering, University of Notre Dame, 1983; MS, Engineering Management, Florida Institute of Technology, 1985; PhD, Aerospace Engineering, University of Notre Dame, 1993. AFIT research center affiliation(s): CTISR. Tel. 937-255-3636 x4565, Email: [Michael.Caylor@afit.edu](mailto:Michael.Caylor@afit.edu)

### **CLINTON, JUSTIN A.**

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2013 (AFIT/ENP); BS, Nuclear Engineering, Rensselaer Polytechnic Institute, 2004; PhD, Nuclear Engineering, Rensselaer Polytechnic Institute, 2011. Dr. Clinton’s research interests are in the areas of computational methods for radiation transport, mixed radiation production using pulsed power sources, and developing a strategic-level nuclear wargaming framework. Research conducted in these areas has resulted in verification of an updated industry standard transport code, providing confidence in ongoing radiation protection characterization of military vehicles. Collaborators include government laboratories such as the Army and Air Force Research Laboratories, Air Force Office of Scientific Research, the Defense Threat Reduction Agency, The Ohio University, University of Michigan, and DOE Laboratories. Dr. Clinton is a member of the American Nuclear Society, as well as the Institute of Electrical and Electronics Engineers. AFIT research center affiliation(s): ANT, NEAT. Tel. 937-255-6565 x4586, Email: [Justin.Clinton@afit.edu](mailto:Justin.Clinton@afit.edu)

### **Sponsor Funded Research Projects**

“AFIT/ENP Research in Support of Defense Threat Reduction Agency Nuclear Technologies.” Sponsor: DTRA. Funding: \$110,000 - McClory 30%, Bevins 40%, Clinton 30%.

### **Refereed Journal Publications**

Julie V. Logan, Darren E. Holland, Larry W. Burggraf, Justin A. Clinton, and Buckley E. O’Day, “Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System,” *Nuclear Instruments and Methods in Physics Research Section A*, Vol. 947, 2019.

W.J. Erwin, E. Cazalas, A. Cahill, J.A. Clinton, J.W. McClory, and A.W. Decker, “The Gamma Emission Spectrum from the Fast Burst Reactor,” *Journal of Radiation Effects, Research and Engineering*, Vol. 37, No. 1, pp. 50-56, April 2019.

**DEXTER, MICHAEL L., Lt Col**

Deputy Department Head, Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Applied Physics, University of Nebraska at Omaha, 2004; MS, Applied Physics, Air Force Institute of Technology, 2009; PhD, Nuclear Physics, Air Force Institute of Technology, 2015. Lt Col Dexter's research interests include the physics of high density plasmas, intense light physics, nuclear forensics, nuclear effects modelling and simulation, laser effects on materials, digital image processing, and advanced technology development. Tel. 937-255-3636 x4742, Email: [Michael.Dexter@afit.edu](mailto:Michael.Dexter@afit.edu)

**Sponsor Funded Research Projects**

"Nuclear Survivability Experimentation, Modeling, and Data Verification." Sponsor: NNSA. Fund: \$200,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%.

**Refereed Journal Publications**

Will D. Johnston, Michael L. Dexter, John W. McClory, and James E. Bevins, "Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations," *Hardened Electronics and Radiation Technology Conference, JREER*, San Diego, CA, April 2019. [NEAT]

Robert S. Torzilli, James C. Petrosky, William L. Harrell, Steven T. Fiorino, and Michael L. Dexter, "Developing and Testing of a Simulated NUDET Optical Detection Model Using Realistic Weather Conditions," *Hardened Electronics and Radiation Technology Conference, JREER*, San Diego, CA, April 2019.

**EMMONS, DANIEL J., Maj**

Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Physics, San Diego State University, 2007; MS, Applied Physics, Air Force Institute of Technology, 2012; PhD, Applied Physics, Air Force Institute of Technology, 2017. Maj Emmons' research interests center on computational gas discharge modeling, plasma kinetics, and the effects of ionospheric disturbances on high frequency radio wave propagation. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4571, Email: [Daniel.Emmons@afit.edu](mailto:Daniel.Emmons@afit.edu)

**Sponsor Funded Research Projects**

"GPS Radio Occultation Data." Sponsor: AFRL/RV. Funding: \$16,100. [CSRA]

"Modeling and Characterization of the Hypersonic Vehicle Operations Environment." Sponsor: DARPA. Fundofg: \$158,947 - Tseng 31%, Loper 23%, Emmons 23%, Tournay 23%.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Nava, O.A., Emmons, D.J., and Loper, R.D. (2019), "Influence of Thunderstorms on the Structure of the Ionosphere over North America," Abstract EGU2019-6057, Presentation: *EGU General Assembly*, Vienna, Austria, 7-11 Apr, 2019.

Tseng, H.R., Kanipe, M., Urbancic, B., Nava, O.A., Tournay, R.C., Loper, R.D., Emmons, D.J., and Lewis, C.D., "Environmental Characterization of the Atmosphere Using WACCM-X," Abstract EGU2019-18650, Presentation: *EGU General Assembly*, Vienna, Austria, 7-11 Apr 2019.

**Other Significant Research Productivity**

Presented research at classified Technical Exchange Meeting held at AFRL with 50+ participants from MIT/LL, SMC, Naval Research Laboratory, IARPA, and several universities.

Nava, O.A., Emmons, D.J., and Loper, R., "Modulation of Lightning Occurrence by the Solar Wind," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019. [CSRA]

Nava, O.A., Emmons, D.J., and Loper, R.D., "Influence of Thunderstorms on the Structure of the Ionosphere over North America," *European Geosciences Union General Assembly*, Vienna, Austria, Apr 2019.

**FEE, JAMES R., Jr., Col**

Section Commander, AU Det 1; Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Purdue University, 1997; MS, Air Force Institute of Technology, 2002; PhD, Air Force Institute of Technology, 2015. Col Fee's research is primarily focused on computational simulation of nuclear weapon effects with a focus in electromagnetic pulse. He has also previously managed radiation hardened microelectronics programs for satellite and missile systems. Col Fee has published two refereed journal articles in open literature, one refereed journal article in classified literature, and one conference presentation. He also deployed to Iraq as an Intelligence Advisor in support of Operation New Dawn. Col Fee holds a Master of Military Operational Art and Science from Air University (2012). Tel. 937-255-3636 x4438, Email: [James.Fee@afit.edu](mailto:James.Fee@afit.edu)

**FERDINANDUS, MANUEL R.**

Research Assistant Professor of Optical Sciences, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Seattle University, 1999; MS, Rochester Institute of Technology, 2007; PhD, University of Central Florida, 2014. Dr. Ferdinandus performs research on nonlinear optics, optical limiting, infrared laser sources, and hyperspectral target detection. Previously, he worked in space operations and satellite system acquisition. Dr. Ferdinandus is a member of the Optical Society of America. AFIT research center affiliation(s): CDE. Tel. 937-255-6565 x4339, Email: [Manuel.Ferdinandus@afit.edu](mailto:Manuel.Ferdinandus@afit.edu)

**Sponsor Funded Research Projects**

"Airy and Non-Gaussian Beam Testbed." Sponsor: AFRL/RV. Funding: \$63,024 - Ferdinandus 90%, Perram 10%. [CDE]

"Mid-IR Nonlinear Measurements of Optical Materials." Sponsor: AFRL/RX. Funding: \$61,128.

**Refereed Journal Publications**

George, H., et al., "Nonlinearities and Carrier Dynamics in Refractory Plasmonic TiN Thin Films." *Optical Materials Express* 9, (10): 3911-3924.

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Ferdinandus, M., et al., "Modified Z-scan Technique Using a Segmented Photodiode," *Nonlinear Frequency Generation and Conversion: Materials and Devices XVIII*, International Society for Optics and Photonics, 2019.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Ferdinandus, M.R., et al., "Comparison of Ultrafast Nonlinear Refraction and Absorption Measurements of Single-Layer and Multi-layer Graphene," *Frontiers in Optics + Laser Science APS/DLS*, Washington, DC, Optical Society of America 2019.

Ferdinandus, M.R., et al., "Measurements of Optical Nonlinearities at Mid-IR Wavelengths Using a Modified Z-Scan Technique," *Conference on Lasers and Electro-Optics*, San Jose, California, Optical Society of America, 2019. [CDE]

## **FIORINO, STEVEN T.**

Director, Center for Directed Energy, and Professor of Atmospheric Physics, Department of Engineering Physics, AFIT Appointment Date: 2003 (AFIT/ENP); BS, Geography (Climatology), The Ohio State University, 1987; BS, Meteorology, Florida State University, 1989; MS, Atmospheric Dynamics, The Ohio State University, 1993; PhD, Physical Meteorology, Florida State University, 2002. Dr. Fiorino's research interests include retrieving environmental parameters via microwave remote sensing, developing signal processing algorithms to fuse meteorological data collection with non-weather ISR platforms, evaluating uncertainty in high-energy laser engagement due to atmospheric effects, and improving microphysical characterizations for nuclear fallout, transport, and dispersion. He has published broadly in meteorological, directed energy, and military journals. Dr. Fiorino is a member of the American Meteorological Society (AMS), American Institute of Aeronautics and Astronautics (AIAA), the Directed Energy Professional Society (DEPS), Society of Photo-Instrumentation Engineers SPIE), and the Optical Society (OSA). He also holds a Master of Military Operational Art and Science from Air University (2003). AFIT research center affiliation(s): CDE and CSRA. Tel. 937-255-3636 x4506, Email: [Steven.Fiorino@afit.edu](mailto:Steven.Fiorino@afit.edu)

### **Sponsor Funded Research Projects**

"2019 AFIT Center for Directed Energy Summer Intern (DESI) Program." Sponsor: DEJTO. Funding: \$125,000. [CDE]

"2019 AFIT Center for Directed Energy DoD HPCMP HPC Internship Program (HIP)." Sponsor: HPCMP. Funding: \$25,000. [CDE]

"AFIT Research in Support of ONR's US-India OSD-DRDO Collaborations." Sponsor: ONR. Funding: \$21,727. [CDE]

"Airborne Aero-Optics Laboratory-Beam Control." Sponsor: DEJTO. Funding: \$120,000. [CDE]

"Atmospheric Effects Inputs for HEL JWS and JLaSE." Sponsor: OSD. Funding: \$110,000. [CDE]

"CY2019 DE JTO AP TAWG Research and Analysis." Sponsor: DEJTO. Funding: \$400,000. [CDE]

"CY2019 DE JTO M&S TAWG Research and Analysis." Sponsor: DEJTO. Funding: \$400,000. [CDE]

"Extended-Range Comprehensive Atmospheric Optics Sensing (ERCAOS) Experimental Campaign." Sponsor: DARPA. Funding: \$150,000. [CDE]

"Probabilistic and Predictive HEL Performance Analyses for SDPE." Sponsor: AFLCMC. Funding: \$100,000. [CDE]

"Sensor Weather Effects Modeling." Sponsor: AFRL/Ry. Funding: \$125,000. [CDE]

### **Refereed Journal Publications**

Van Zandt, N.R., M.F. Spencer, and S.T. Fiorino, "Speckle Mitigation for Wavefront Sensing in the Presence of Weak Turbulence," *Appl. Opt.* 58, 2300-2310. [CDE]

Burley, J.L., S.T. Fiorino, B.J. Elmore, and J.E. Schmidt, "A Remote Sensing and Atmospheric Correction Method for Assessing Multispectral Radiative Transfer Through Realistic Atmospheres and Clouds," *J. Atmos. Oceanic Technol.*, 36, 203-216, DOI.org/10.1175/JTECH-D-18-0078.1. [CDE] [CSRA]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Fiorino, S.T., S.R. Bose-Pillai, and K.J. Keefer, "In-situ Field Profiling of Optical Turbulence Using 3D Sonic Anemometers," *Propagation Through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), OSA Imaging and Applied Optics Congress*, Munich, Germany, June 2019. [CDE]

Fiorino, S.T., S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, "Implications of 4D Weather Cubes for Improved Cloud Free Line of Sight Assessments of Free Space Optical Communications Link Performance," *Proc. SPIE* 10981, *Laser Technology for Defense and Security XV*, 109810S, 13 May 2019. [CDE] [CSRA]

Wolfmeyer, S.G. Thomas, S.T. Fiorino, "Coupled Atmospheric Surface Observations with Surface Aerosol Particle Counts for Daytime Sky Radiance Quantification," *Proc. SPIE* 10986, *Algorithms, Technologies, and Applications for Multispectral and Hyperspectral Imagery XXV*, 1098618, 14 May 2019. [CDE]

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE* 11001, *Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019. [CDE]

Fiorino, S.T., S.R. Bose-Pillai, J.E. Bills, J.E. Schmidt, B.J. Elmore, and K.J. Keefer, "Assessing Free Space Optical Communications through 4D Weather Cubes," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE] [CSRA]

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, "Estimation of Fried's Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

Thomas, G.M., R.G. Cobb, S.T. Fiorino, and M.R. Hawks, "SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites in the SWIR," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE] [CSRA]

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Fiorino, S.T., J.E. Schmidt, and K.J. Keefer, "Multi-Spectral Transmission and Extinction Quantification for HEL Test and Evaluation," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

Fiorino, S.T., J.E. Schmidt, B. J. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for EHEL PA using Weather Cubes," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J. Meoak, B.J. Elmore, T. Kesler, C.A. Rice and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling," *UK/US Directed Energy Workshop*, Swindon, UK, 25, July 2019. [CDE]

Fiorino, S.T., K.J. Keefer, J.E. Schmidt, and B.J. Elmore, "The Apparent Coupling of Surface Layer Turbulence and PM2.5 Aerosol Concentrations and Effects on HEL Propagation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019. [CDE]

Schmidt, J.E., S.T. Fiorino, J.L. Burley, and B.J. Elmore, "Global Cloud Free Line of Sight (CFLOS) Characterizations using Numerical Weather Prediction Data," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019. [CDE]

Schmidt, J.E., S.T. Fiorino, K.J. Keefer, A.J. Archibald, and B.J. Elmore, "HEL Performance Forecasting for Field Experiments using Weather Cubes," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019. [CDE]

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "First Look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, “Investigating Diffractive Effects in Tilt-Based Turbulence Estimation Through Simulation,” *21st Annual DEPS S+T Symposium*, Destin, FL, 8–12 Apr, 2019. [CDE]

Schmidt, J.E., S.T. Fiorino, S. Peckham, and K.J. Keefer, “Evaluation of Aerosol Characterizations in Numerical Weather Modeling for Emerging DOD Technologies and Climate Change Studies,” 23<sup>rd</sup> Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), *99th Annual American Meteorological Society Meeting*, Phoenix, AZ, Jan 2019.  
<https://ams.confex.com/ams/2019Annual/meetingapp.cgi/Paper/356249>. [CDE]

### **Editorships in Professional Journals**

Guest Editor, Atmospheric Propagation Special Section of *Optical Engineering*, Vol. 59, Issue 8.

### **Patent Applications**

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, “Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-lapse Imagery,” provisional application, filed Jun 2019.

### **FRANZ, ANTHONY L., Lt Col**

Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2012 (AFIT/ENP); BS, United States Air Force Academy, 1992; MS, Air Force Institute of Technology, 1997; PhD, University of Maryland, 2007. Lt Col Franz’s research focuses on lasers and optics. His recent work has focused on developing light weight diffractive optics for use on satellites and novel approaches for imaging and hyperspectral imaging systems. Before joining AFIT, he was a physics faculty member at the Air Force Academy for eight years, and deployed to Iraq and Afghanistan. He has also worked in nuclear treaty monitoring, and infrared missile engagement modeling and simulation. Lt Col Franz is a member of the American Association of Physics Teachers (AAPT), the American Physical Society (APS), the International Society for Optics and Photonics (SPIE), and the Optical Society of America (OSA). AFIT research center affiliation(s): CTISR. Tel. 937-255-3636 x4429, Email: [Anthony.Franz@afit.edu](mailto:Anthony.Franz@afit.edu)

### **Sponsor Funded Research Projects**

“Meta-Optic Microlenses for Severe-Axial-Chromatic-Aberration Imaging Systems Phase 1: Metamaterial Development.” Sponsor: Undisclosed. Funding: \$65,067 - Marciniak 75%, Franz 25%. [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Carlos D. Diaz, Anthony L. Franz, Michael A. Marciniak, “Frequency Analysis and Optimization of the Diffractive Plenoptic Camera,” *Presentation: Proc. SPIE 10986, Algorithms, Technologies, and Applications for Multispectral, Hyperspectral, and Ultraspectral Imagery XXV*, 109861G, 14 May 2019. [CTISR]

### **GILES, NANCY C.**

Executive Associate Dean for Strategies, Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2009 (AFIT/ENP); and 2019 (AFIT/EN); BS, University of North Carolina at Chapel Hill, 1981; PhD, North Carolina State University, 1987. Dr. Giles’ research focuses on solid-state physics: photoluminescence (PL), absorption, Raman, and magnetic resonance (EPR) spectroscopy leading to identification of point defects in semiconducting and optical materials, PL excitation and time-resolved PL spectroscopies, nonlinear optical materials, laser-host materials, and scintillators. She is the author of 198 archival publications in refereed journals and two book chapters. Before joining AFIT, she was a physics faculty member at West Virginia University for 19 years. She has over 5,000 citations of her papers; her h-index is 37. Current work includes wide bandgap materials for power electronics, scintillator and radiation detection materials, photorefractives, and nonlinear optical materials of interest to AFRL/RX for infrared countermeasures. Dr. Giles is a member of the Optical Society of America, American Physical Society, and Materials Research Society. Tel. 937-255-3636 x4601, Email: [Nancy.Giles@afit.edu](mailto:Nancy.Giles@afit.edu)

## Sponsor Funded Research Projects

“Optical and EPR Characterization of CdSiP<sub>2</sub> Crystals.” Sponsor: AFRL/RX. Funding: \$30,000.

## Refereed Journal Publications

Dodson, T.E.R., Halliburton, L.E., Kedziora, G.S., Lenyk, C.A., and Giles, N.C., “Self-Trapped Holes (small polarons) in Ferroelectric KH<sub>2</sub>PO<sub>4</sub> Crystals,” *Journal of Physics: Condensed Matter*, Vol. 31, Article No. 505503 (9 pages), Sept 2019.

Lenyk, C.A., Giles, N.C., Scherrer, E.M., Kananen, B.E., Halliburton, L.E., Stevens, K.T., Foundos, G.K., Blevins, J.D., Dorsey, D.L. and Mou, S., “Ir<sup>4+</sup> Ions in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Crystals: An Unintentional Deep Donor,” *Journal of Applied Physics*, Vol. 127, Article No. 045703 (8 pages), Jan 2019.

Lenyk, C.A., Holston, M.S., Kananen, B.E., Halliburton, L.E., and Giles, N.C., “Lithium and Gallium Vacancies in LiGaO<sub>2</sub> Crystals,” *Journal of Applied Physics*, Vol. 124, Article No. 135702 (6 pages), Oct 2018.

## Other Significant Research Productivity

L.E. Halliburton, B.E. Kananen, C.A. Lenyk, E.M. Scherrer, N.C. Giles, “Identification and Characterization of Donors and Acceptors in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Crystals,” Presentation: *ICCGE-19*, 1 August 2019.

L.E. Halliburton, T.E.R. Dobson, G.S. Kedziora, C.A. Lenyk, and N.C. Giles, “Investigation of Self-Trapped Holes (small polarons) in KH<sub>2</sub>PO<sub>4</sub> Crystals Grown for Nonlinear Optical Applications,” Presentation: *International Conference on Crystal Growth and Epitaxy (ICCGE)*, 30 July 2019.

C.A. Lenyk and N.C. Giles, “Electron Paramagnetic Resonance (EPR) and Optical Studies of Extrinsic Point Defects in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>,” Poster Presentation: *61<sup>st</sup> Electronic Materials Conference (EMC)*, University of Michigan, Ann Arbor, MI, 26-28 June 2019.

## GROSS, KEVIN C.

Director, Center for Technical Intelligence Studies and Research, and Associate Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2008 (AFIT/ENP); BS, Wright State University, 1998; MS, Wright State University, 2001; PhD, Air Force Institute of Technology, 2007. Dr. Gross’ main interests are remote sensing, spectroscopy, radiative transfer, and developing physics-based algorithms to exploit electro-optical data. He has chaired eleven MS thesis efforts and six PhD dissertations, co-authored 94 papers (32 archival publications), and served as co-PI on externally-funded research projects exceeding \$9M. He has taught graduate courses in electrodynamics, quantum mechanics, atomic and molecular spectroscopy, radiative transfer, radiometry and detection, and hyperspectral imaging. His diverse research background includes: (1) field measurements of transient battlespace combustion events (munition and IED detonations, afterburning aircraft, rocket motors); (2) development of hyperspectral combustion diagnostics (lab flames; scramjets); (3) environmental remote sensing (smokestack effluents); (4) algorithm development for persistent infrared target tracking and detection; (5) polarimetric hyperspectral imaging for material discrimination and identification; (6) field measurements of disturbed earth (buried IED’s); (7) atmospheric compensation of hyperspectral imagery; (8) non-destructive evaluation of materials; (9) architecting, training, and hardening AI/ML algorithms for sensor data exploitation via physics-based machine learning. AFIT research center affiliation(s): CTISR. Tel 937-255-3636 x4558, Email: [Kevin.Gross@afit.edu](mailto:Kevin.Gross@afit.edu)

## Sponsor Funded Research Projects

“Algorithm Development for WFOV Mission Data Processing (Phase 2 SBIR).” Sponsor: AFRL/RV. Funding: \$140,000 - Gross 20%, Steward 40%, Hawks 40%. [CTISR]

“Open Skies IR Target Study.” Sponsor: NASIC. Funding: \$250,000 - Gross 5%, Hawks 75%, Marciniak 10%, Franz 10%. [CTISR]

“Performance Analysis and Sensor Toolkit for ASSET (PASTA).” Sponsor: Undisclosed. Funding: \$79,000 - Gross 10%, Steward 10%, Hawks 50%, Oxley 30%. [CTISR]

“Spectro-polarimetric Imaging of Disturbed Earth - Phase III.” Sponsor: USA ERDC. Funding: \$176,250 - Gross 50%, Hawks 50%. [CTISR]

### **Refereed Journal Publications**

Westing, N., Borghetti, B., Gross, K.C., “Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension-Reduction Approach,” *Remote Sens.* 2019, *11*, 1866. <https://doi.org/10.3390/rs111618666> [CTISR]

W.L. Harrell, J.C. Petrosky, M.E. Oxley, and K.C. Gross, “Identification Algorithm Development for a Data-Fused Optical Nuclear Detonation Monitoring System,” *Journal of Radiation Effects Research and Engineering*, Vol. 37, No. 1, April, 2019. [CTISR]

[Mason Paulec](#), [Michael Marciniak](#), [Kevin Gross](#), [Benjamin Akers](#), and [David Azevedo](#), “Tomographic Reconstruction of a Jet Engine Exhaust Plume Using an Infrared Hyperspectral Imager,” *Optical Engineering*, 57(10), 103103, 16 October 2018. <https://doi.org/10.1117/1.OE.57.10.103103> [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Fernando D. Fernandez, Bryan J. Steward, Kevin C. Gross, Michael Hawks, “Implementation of a Non-Linear CMOS and CCD Focal Plane Array Model in ASSET,” *Proc. SPIE*, 110010C, 2019. [CTISR]

Nicholas M. Westing, Brett J. Borghetti, Kevin C. Gross, Jacob A. Martin, “Analysis of Long-Wave Infrared Hyperspectral Classification Performance Across Changing Scene Illumination,” *Proc. SPIE*, 109860V, 2019. [CTISR]

F.D. Fernandez, B.J. Steward, A.S. Kondrath, J.N. Patel, and K.C. Gross, “AFIT Sensor and Scene Emulation Tool (ASSET): FPA and Electronics Sub-Model Improvements,” *MSS Parallel Conference*, Orlando, FL, 25-28 Feb 2019. [CTISR]

### **HAWKS, MICHAEL R.**

Research Assistant Professor of Optical Engineering (through Perduco), Department of Engineering Physics, AFIT Appointment Date: 2008 (AFIT/ENP); BS, Astrophysics, Michigan State University, 1991; MS, Engineering Physics, AFIT, 1993; PhD, Optical Sciences, AFIT, 2006. Dr. Hawks’ main research interests include electro-optic and infrared (EO/IR) remote sensing. Specific application areas include monocular passive ranging, hyperspectral and polarimetric imaging, and computational imaging. He previously taught at the United States Air Force Academy, and has conducted research in chemical lasers, space object identification, chem/bio agent detection, infrared countermeasures, nuclear detonation detection, and other remote sensing applications at the Air Force Research Laboratory and other assignments. He has received 12 research grants, chaired nine MS committees, and published 38 technical papers and reports. He is a member of the Optical Society of America and SPIE, and is a retired USAF Lt Col. AFIT research center affiliation(s): CTISR. Tel. 937-255-3636 x4828, Email: [Michael.Hawks.ctr@afit.edu](mailto:Michael.Hawks.ctr@afit.edu)

### **Sponsor Funding Projects**

“Algorithm Development for WFOV Mission Data Processing (Phase 2 SBIR).” Sponsor: AFRL/RV. Funding: \$140,000 – Hawks 40%, Gross 20%, Steward 40%. [CTISR]

“Open Skies IR Target Study.” Sponsor: NASIC. Funding: \$250,000 – Hawks 75%, Gross 5%, Marciniak 10%, Franz 10%. [CTISR]

“Performance Analysis and Sensor Toolkit for ASSET (PASTA).” Sponsor: Undisclosed. Funding: \$79,000 – Hawks 50%, Gross 10%, Steward 10%, Oxley 30%. [CTISR]

“Spectro-polarimetric Imaging of Disturbed Earth - Phase III.” Sponsor: USA ERDC. Funding: \$176,250 – Hawks 50%, Gross 50%. [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

G. Thomas, R. Cobb, S.T. Fiorino, and M.R. Hawks, "SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites the SWIR," *2019 IEEE Aerospace Conference*, 2019, DOI: 10.1109/AERO.2019.8742185. [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

F.D. Fernandez, B.J. Steward, K.C. Gross, and M.R. Hawks, "Implementation of a Non-Linear CMOS and CCD Focal Plane Array Model in ASSET," *Proceedings of the SPIE*, Vol. 11001, 2019, DOI: 10.1117/12.25189072019. [CTISR]

### **HENGHELD, ROBERT L.**

Professor Emeritus of Physics, Department of Engineering Physics, AFIT Appointment Date: 1961 (AFIT/ENP); AB, Thomas More College, 1956; MS, University of Cincinnati, 1961; PhD, University of Cincinnati, 1965. Dr. Hengehold's research areas center on experimental solid state physics, semiconductor physics, optical diagnostics, and electron and laser spectroscopy. He is the author of more than 100 archival publications and more than 215 presentations at technical meetings. He has served as an advisor on more than 17 doctoral dissertations and 80 master's theses. He is currently carrying out studies of (1) depth resolved cathodoluminescent spectroscopy of materials suitable for neutron absorbing semiconductor solid state detectors, and (2) optical characterization of compound semiconductor materials and super lattice structures for mid-infrared diode lasers and detectors. This work involves collaborative efforts with the Directed Energy and Sensors Directorates at AFRL, and the DTRA. Dr. Hengehold received the Air University Commander's Award for Faculty Achievement in 1982, the Gage H. Crocker Outstanding Professor Award in 1996, the Outstanding Professional Achievement Award from the Affiliate Society Council of the Engineering and Science Foundation of Dayton in 1997, and the General Bernard A. Schriever Award in 1999. He was elected a Fellow of the American Physical Society in 2008. Tel. 937-255-3636 x4502, Email: [Robert.Hengehold@afit.edu](mailto:Robert.Hengehold@afit.edu)

### **HERR, NICHOLAS C., Maj**

Assistant Professor of Materials Science, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, United States Air Force Academy, 2008; MS, Air Force Institute of Technology, 2010; PhD, Air Force, 2016. Maj Herr's research focuses on high-power laser damage of carbon composites, remote sensing, and atomic force microscopy. Tel. 937-255-3636 x4524, Email: [Nicholas.Herr@afit.edu](mailto:Nicholas.Herr@afit.edu)

### **HOBBS, EDWARD L., Lt Col**

Deputy Director of the Nuclear Event Analysis and Testing Center for Specialized Research, established 1 May 2019, and Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); Lt Col Hobbs' research interests are primarily focused on deterministic neutron transport. Most recently, he developed methods to address the difficulties of the non-linear characteristics associated with the time-eigenvalue diffusion and even-parity transport equations. His calculations currently provide the time-eigenvalue used to model the burst characteristics associated with a Fast Burst Reactor (FBR). Additional research interests include non-proliferation, counter-proliferation, and consequence management, specifically as they relate to the military and Nuclear and Counter-Proliferation Officer (NCP/52) missions. Lt Col Hobbs is also interested in improved methods to determine accurate nuclear data (material), stochastic transport methods, and health physics (radiation safety). Tel. 937-255-3636 x4609, Email: [Edward.Hobbs@afit.edu](mailto:Edward.Hobbs@afit.edu)

### **Sponsor Funded Research Projects**

"Nuclear Survivability Experimentation, Modeling, and Data Verification." Sponsor: NNSA. Fund: \$200,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%.

### **HOGSED, MICHAEL R., Lt Col**

Assistant Professor of Engineering Physics, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Baylor University, 1997; MS, Oklahoma State University, 1999; PhD, Air Force Institute of Technology, 2005. Lt Col Hogsed's research focuses on semiconductor device characterization and radiation effects on advanced microelectronic materials and devices. He has published six refereed journal articles. Currently under investigation are materials in the germanium-silicon-tin system ( $\text{Ge}_{1-x-y}\text{Si}_x\text{Sn}_y$ ) for photonic applications. Other research includes radiation hardness assurance testing of novel electronic components and COTS microprocessors. Lt Col Hogsed also has 10 years' experience in the Air Force nuclear enterprise as an analyst and S and T manager for a variety of nuclear matters, to include treaty monitoring, weapon employment planning factors, and counter proliferation intelligence. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4547, Email: [Michael.Hogsed@afit.edu](mailto:Michael.Hogsed@afit.edu)

### **Refereed Journal Publications**

Buguo Wang, M.R. Hogsed, T.R. Harris, P.M. Wallace, and J. Kouvetakis, "Enhanced Optical and Electrical Performance of  $\text{Ge}_{1-x}\text{Sn}_x/\text{Ge}/\text{Si}(100)$  ( $x=0.062$ ) Semiconductor via Inductively Coupled H<sub>2</sub> Plasma Treatments," *Semiconductor Science and Technology*, Vol. 34, 045014, 2019.

Buguo Wang, T.R. Harris, M.R. Hogsed, Y.K. Yeo, Mee-Yi Ryu, and J. Kouvetakis, "Comparison Study of Temperature Dependent Direct/indirect Bandgap Emissions of  $\text{Ge}_{1-x-y}\text{Si}_x\text{Sn}_y$  and  $\text{Ge}_{1-y}\text{Sn}_y$  Grown on Ge Buffered Si," *Thin Solid Films*, Vol. 673, pp. 63-71, 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Kevin Choe, Michael Hogsed, Norman Miguel, John McClory, and John Kouvetakis, "Displacement Damage Effects in  $\text{Ge}_{1-x}\text{Sn}_x$  Light Emitting Diodes," *Hardened Electronics and Radiation Technology Conference*, San Diego, California, 2019.

### **HOLLAND, DARREN E.,**

Research Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); BA, Cedarville University, 2006; MS, University of Michigan, 2008; PhD, University of Michigan, 2012. Dr. Holland's expertise focuses on optimization and radiation transport. His current research focuses on optimizing a gamma and neutron rotating scatter mask for source location identification and imaging. Before joining AFIT, he was on the faculty of Cedarville University. Dr. Holland is a member of the American Society of Mechanical Engineers (ASME). AFIT Research center affiliations(s): NEAT. Tel. 937-255-3636 x4697, Email: [Darren.Holland.ctr@afit.edu](mailto:Darren.Holland.ctr@afit.edu)

### **Refereed Journal Publications**

Julie V. Logan, Darren E. Holland, Larry W. Burggraf, Justin A. Clinton, and Buckley E. O'Day, "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System," *Nuclear Instruments and Methods in Physics Research Section A*, Vol. 947, 2019

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Olesen, R.J., Holland, D.E., Brubaker, E., Cole, J., and Bevins, J.E., "Advanced Radiation Imaging Algorithms with Rotating Scatter Masks," *INMM 60<sup>th</sup> Annual Meeting*, Jul 2019. [NEAT]

B.V. Egner, D.E. Holland, L.W. Burggraf, J.E. Bevins, and V.M. Martin, "Development of a Dual-Particle Directional Detection System Using a Rotating Scatter Mask," *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 11 April, 2019.

## Patent Applications

Holland, D.E., Olesen, R.J., Burggraf, L.W., O'Day, B.E., and Bevins, J.E., "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,816,435, filed 11 March 2019. Patent Pending. [NEAT]

Egner, B.V., Olesen, R.J., Holland, D.E., Martin, V.M., O'Day, B.E., Burggraf, L.W., and Bevins, J.E., "An Efficient, Dual-Particle Directional Detection System Using a Rotating Scatter Mask." U.S. Patent Application 62,816,451, filed March 11, 2019. Patent Pending. [NEAT]

## JAMES, ROYCE W., CDR

Visiting Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2019, (AFIT/ENP); CG Academy Appointment Date: 2004, (CGA/dsp); BS, New Mexico State University, 1999; MS, Columbia University, 2003; PhD, Stephens Institute of Technology, 2009. CDR James' research focus is primarily focused on laboratory and space based magnetized plasmas, plasma interactions with electromagnetic radiation (with emphasis on high energy lasers), fusion energy, and plasma water treatment. CDR James recently served as the Head of Physics at the Coast Guard Academy, is a co-founder of the New London Freedom School, a Science Technology and Mathematics Magnet School Board Member, and Member of the Nuclear Energy Advisory Council for the state of CT. CDR James has published three refereed journal articles and twenty conference publications. CDR James is a member of APS-DPP, and the current Engineering Physics Interim Department Head. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4339, Email: [Royce.James@afit.edu](mailto:Royce.James@afit.edu)

## Refereed Conference Papers Accepted on the Basis of Abstract Review

James, R.W., "Progress on Development of Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX)," American Physical Society's 60th Annual Meeting of the Division of Plasma Physics, Portland, OR, 5 – 9 November, 2018.

## LENYK, CHRISTOPHER A., Lt Col

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Nuclear Engineering, Rensselaer Polytechnic Institute, 2002; MS Nuclear Engineering, Air Force Institute of Technology, 2014; PhD Nuclear Engineering, Air Force Institute of Technology, 2019. Lt Col Lenyk's research focuses on solid-state physics, radiation effects, and nuclear weapon effects using a variety of experimental techniques, including photoluminescence (PL), absorption and electron paramagnetic resonance (EPR), thermoluminescence (TL), and wavelength-dependent TL leading to identification of point defects in ultra-wide bandgap and optical materials, laser-host materials, and scintillators for radiation detection. He is the author of four archival publications in refereed journals. Before joining AFIT, he held a variety of assignments and leadership positions in the areas of directed energy weapons, nuclear treaty monitoring, space intelligence, and countering weapons of mass destruction. Current research includes wide bandgap materials for power electronics, scintillator and radiation detection materials, photorefractives, and nonlinear optical materials. Lt Col Lenyk is a member of SPIE. Tel. 937-255-3636 x4558, Email: [Christopher.lenyk@afit.edu](mailto:Christopher.lenyk@afit.edu)

## Refereed Journal Publications

Dodson, T.E.R., Halliburton, L.E., Kedziora, G.S., Lenyk, C.A., and Giles, N.C., "Self-Trapped Holes (small polarons) in Ferroelectric  $\text{KH}_2\text{PO}_4$  Crystals," *Journal of Physics: Condensed Matter*, Vol. 31, Article No. 505503 (9 pages), Sept 2019.

Lenyk, C.A., Giles, N.C., Scherrer, E.M., Kananen, B.E., Halliburton, L.E., Stevens, K.T., Foundos, G.K., Blevins, J.D., Dorsey, D.L., and Mou, S., " $\text{Ir}^{4+}$  ions in  $\beta\text{-Ga}_2\text{O}_3$  crystals: An Unintentional Deep Donor," *Journal of Applied Physics*, Vol. 127, Article No. 045703 (8 pages), Jan 2019.

Lenyk, C.A., Holston, M.S., Kananen, B.E., Halliburton, L.E., and Giles, N.C., "Lithium and Gallium Vacancies in  $\text{LiGaO}_2$  Crystals," *Journal of Applied Physics*, Vol. 124, article No. 135702 (6 pages), Oct 2018.

## Other Significant Research Productivity

L.E. Halliburton, B.E. Kananen, C.A. Lenyk, E.M. Scherrer, and N.C. Giles, "Identification and Characterization of Donors and Acceptors in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub> Crystals," Presentation: *ICCGE-19*, 1 August 2019.

L.E. Halliburton, T.E.R. Dobson, G.S. Kedziora, C.A. Lenyk, and N.C. Giles, "Investigation of Self-Trapped Holes (small polarons) in KH<sub>2</sub>PO<sub>4</sub> Crystals Grown for Nonlinear Optical Applications," Presentation: *International Conference on Crystal Growth and Epitaxy (ICCGE)*, 30 July 2019.

C.A. Lenyk, and N.C. Giles, "Electron Paramagnetic Resonance (EPR) and Optical Studies of Extrinsic Point Defects in  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>," Presentation: *61<sup>st</sup> Electronic Materials Conference (EMC)*, University of Michigan, Ann Arbor, 26-28 June 2019.

## LOPER, ROBERT D.

Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2014 (AFIT/ENP); BS, University of Dayton, 1994; MS, University of Texas at Dallas, 1998; MTS, United Theological Seminary, 2011; PhD, Air Force Institute of Technology, 2013. Dr. Loper's research interests are focused on space physics, centering on solar astrophysics, magnetospheric physics, and the near-Earth space environment. Dr. Loper is a member of Tau Beta Pi and Sigma Pi Sigma. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4333, Email:

[Robert.Loper@afit.edu](mailto:Robert.Loper@afit.edu)

## Sponsor Funded Research Projects

"Reconnection Signatures in Solar Magnetograms." Sponsor: AFOSR. Funding: \$27,456.

"Modeling and Characterization of the Hypersonic Vehicle Operations Environment." Sponsor: DARPA. Funding: \$158,947 - Tseng 31%, Loper 23%, Emmons 23%, Tournay 23%.

## Refereed Journal Publications

Loper, R.D., "Carrington-Type Events as a Great Filter for Electronic Civilizations in the Drake Equation," *Publications of the Astronomical Society of the Pacific*, 131, 044202, Apr 2019, DOI:10.1088/1538-3873/ab028e

## Refereed Conference Papers Accepted on the Basis of Full Paper Review:

Round, J. F., R. D. Loper, O. A. Nava, and S. W. Kahler, "Variations of H-Normalized Heavy Ion Abundances in Large Solar Energetic Particle Events," *36th International Cosmic Ray Conference*, 2019  
<https://pos.sissa.it/358/1090/pdf>

## Refereed Conference Papers Accepted on the Basis of Abstract Review

Round, J.F., Loper, R.D., Nava, O.A., and Kahler, S.W., "Variations of H-Normalized Heavy Ion Abundances in Large Solar Energetic ( $E > 10$  MeV) Particle Events," *36th International Cosmic Ray Conference*, Madison, WI, Jul 2019.

Tseng, H.R., Kanipe, M., Urbancic, B., Tournay, R.C., Nava, O.A., Emmons, D.J., Loper, R., and Lewis, C., "Environmental Characterization of the Atmosphere Using WACCM-X," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

Nava, O.A., Emmons, D.J., and Loper, R.D., "Influence of Thunderstorms on the Structure of the Ionosphere over North America," *European Geosciences Union General Assembly*, Vienna, Austria, Apr 2019.

Nelson, A.M., Nava, O.A., Kucas, M.E., Kosar, B., and Loper, R.D., "Characterization of Tropical Cyclone Intensity Using Microwave Imagery," Presentation: *American Meteorological Society Annual Meeting*, Phoenix, AZ, 6-10 Jan, 2019.

### Other Significant Research Productivity

Loper, R.D., "Plasma Structure of the Deep Solar Interior," Dynamics of the Sun and Stars: Honoring the Life and Work of Michael Thompson," High Altitude Observatory, Boulder, CO, Sep 2019.

Nava, O.A., Emmons, D.J., and Loper, R.D., "Modulation of Lightning Occurrence by the Solar Wind," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

Loper, R.D., "Reconnection Signatures in Solar Magnetograms During the Solar Storms of 4-10 September 2017," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

Loper, R.D., "Carrington-Type Events as a Great Filter for Electronic Civilizations in the Drake Equation," *Space Weather Workshop*, Boulder, CO, Apr 2019.

Loper, R.D., "Reconnection Signatures in Solar Magnetograms," *American Geophysical Union Fall Meeting*, Washington, DC, Dec 2018.

Round, J., Loper, R.D., and Kahler, S., "Variations of Heavy Ion Abundances Relative to Proton Abundances in Large Solar Energetic ( $E > 10$  MeV) Particle Events," *American Geophysical Union Fall Meeting*, Washington, DC, Dec 2018.

Schwalbe, S., Loper, R.D., Nava, O.A., and Lewis, C., "Modeling the Effects of a Second Sun on Ionospheric Composition and Structure," *American Geophysical Union Fall Meeting*, Washington, DC, Dec 2018.

Tseng, H.R., Nava, O.A., Lewis, C.D., Loper, R.D., and Tournay, R.C., "Environmental Modeling and Characterization of the Atmosphere Using WACCMX," Workshop on Space Environment Applications, Systems, and Operations for National Security (SEASONS), Johns-Hopkins University Applied Physics Laboratory, Laurel, MD, Nov 2018.

### LUTZ, JESSE J.

Research Assistant Professor, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Chemistry, Grand Valley State University, 2006; PhD, Physical Chemistry, Michigan State University, 2011. Dr. Lutz is a member of the Quantum Computer Science group within SNL's Center for Computing Research. His current research interests include fundamental quantum algorithm development, and the investigation of solid-state spin-qubit decoherence by modeling the dynamics of its nuclear spin-bath environment. His previous research focused on characterization of the structure and spectral signatures of silicon carbide clusters, modeling relativistic and finite-nucleus effects in molecules containing lanthanides, and development of ab initio many-body electronic structure methods for the accurate prediction of energies and properties of atomic and molecular systems.

### Refereed Journal Publications

J.J. Lutz, and Larry W. Burggraf, "The Lowest-Energy Isomer of  $C_2Si_2H_4$  is a Bridged Ring: Reinterpretation of the Spectroscopic Data Based on DFT and Coupled-Cluster Calculations," *Inorganics*, Vol. 7, Issue 4, April 2019. DOI: 10.3390/inorganics7040051.

### Other Significant Research Productivity

J.J. Lutz, X.F. Duan, and L.W. Burggraf, "Towards a Mechanism for Formation of Silicon Carbide Crystals in AGB Stars," Presentation: *74th International Symposium on Molecular Spectroscopy*, University of Illinois Urbana-Champaign, 19 June, 2019.

J.J. Lutz, X.F. Duan, and L.W. Burggraf, "Computational Design of Defect Spin Centers for Quantum Information Processing," Presentation: Center for Computing Research, Sandia National Laboratories, 5 June 2019.

## **MARCINIAK, MICHAEL A.**

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1999 (AFIT/ENP); BS, St. Joseph's College, 1981; BSEE, University of Missouri, 1983; MSEE, Air Force Institute of Technology, 1987; PhD, Air Force Institute of Technology, 1995. Dr. Marciniak's research interests include various aspects of light-matter interaction, including (1) polarimetric scatterometry of nanostructured materials, such as photonic crystals and infrared meta-surfaces; (2) bidirectional reflectance distributions for optical signatures; and (3) high-energy laser damage assessment. He has published 30 refereed and 75 other publications, and chaired 11 PhD and more than 50 MS thesis committees. He holds one patent. He is a retired Lt Col, USAF with 22 years of service. AFIT research center affiliation(s): CDE and CTISR. Tel. 937-255-3636 x4529, Email: [Michael.Marciniak@afit.edu](mailto:Michael.Marciniak@afit.edu)

### **Sponsor Funded Research Projects**

"2D Photonic Crystals from Birefringent Nanorod Thin-Films for Nanophotonic Component Applications." Sponsor: AFOSR. Funding: \$39,142. [CDE]

"Meta-Optic Microlenses for Severe-Axial-Chromatic-Aberration Imaging Systems Phase 1: Metamaterial Development." Sponsor: Undisclosed. Funding: \$65,067 - Marciniak 75%, Franz 25%. [CTISR]

"Open Skies IR Target Study." Sponsor: NASIC. Funding: \$250,000 - Gross 5%, Hawks 75%, Marciniak 10%, Franz 10%. [CTISR]

"Analysis of Modified Microfacet BRDF Models for Polarimetric Optical Scatter." Sponsor: AFOSR. Funding: \$45,200 - Butler 75%, Marciniak 25%. [CDE/CTISR]

"Dynamic Data Driven Phase Optimization for Controlling Light Scattered by a Rough Surface." Sponsor: AFOSR. Funding: \$37,290 - Burgi 75%, Marciniak 15%, Oxley 10%. [CDE/CTISR]

### **Refereed Journal Publications**

Mason Paulec, Michael Marciniak, Kevin Gross, Benjamin Akers, and David Azevedo, "Tomographic Reconstruction of a Jet Engine Exhaust Plume Using an Infrared Hyperspectral Imager," *Optical Engineering*, 57(10), 103103, 16, October 2018. <https://doi.org/10.1117/1.OE.57.10.103103> [CTISR]

Ewing, B.E., Butler, S.D., and Marciniak, M.A., "Improved Grazing Angle Bidirectional Reflectance Distribution Function Model Using Rayleigh-Rice Polarization Factor and Adaptive Microfacet Distribution Function," *Opt. Eng.* 57, 1, 2018. [CDE]

P.J. Plummer, K.J. Barnard, and M.A. Marciniak, "Investigation of Speckle Imagery Spectral Estimation Challenges for Modulation Transfer Function Measurements," *Optical Engineering*, 58(7), 077106 (1-10), Jul 2019. [CDE] [CTISR]

B. Adomanis, D.B. Burckel, and M. Marciniak, "3D Plasmonic Design Approach for Efficient Transmissive Huygens Metasurfaces," *Optics Express* 27(15), 20928-20937, Jul 2019. [CDE] [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

J.A. Ethridge, M.A. Marciniak, and A.M. Sarangan, "Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials," *Proc. SPIE* 11089, 110890T (1-14), 2019. [CDE] [CTISR]

E.K. Nagamine, K.W. Burgi, S.D. Butler, and M.A. Marciniak, "Non-Mechanical Beam-Steering in Reflective Inverse Diffusion," *Proc. SPIE* 11107, 1110706, (1-7), 2019. [CDE] [CTISR]

C.D. Diaz, A.L. Franz, and M.A. Marciniak, "Frequency Analysis and Optimization of a Spectral Intermediate Image Diffractive Plenoptic Camera," *Proc. SPIE* 10986, 10986-51, 2019. [CDE] [CTISR]

P. Plummer, K.J. Barnard, and M.A. Marciniak, "Parameter Exploration for Spectral Estimation of Speckle Imagery in Modulation Transfer Function Measurements," *Proc. SPIE* 11001, 11001-26, 2019. [CDE] [CTISR]

**MATHEWS, KIRK A.**

Professor Emeritus of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 1987 (AFIT/ENP); BS, California Institute of Technology, 1971; MS, Air Force Institute of Technology, 1982; PhD, Air Force Institute of Technology, 1983. Dr. Mathews' research interests center on computational methods for neutral particle radiation transport and modeling and analysis of nuclear phenomena and measurements, including enrichment cascade modeling, high altitude radiation transport, blast and shock, nuclear thermal radiation, deconvolution of radiation spectra, and statistical analysis of nuclear measurements. Dr. Mathews has published 20 papers in refereed journals and 21 conference proceedings, and has chaired 35 theses and 13 dissertations. He is a member of the American Nuclear Society and Tau Beta Pi.

**MCCLORY, JOHN W.**

Associate Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2008 (AFIT/ENP); BS, Physics, Rensselaer Polytechnic Institute, 1984; MS, Physics, Texas A&M University, 1993; PhD, Nuclear Engineering, Air Force Institute of Technology, 2008. Dr. McClory's expertise is in radiation effects, radiation detector development, and nuclear weapon effects. His research includes determining the effect of space and nuclear weapon radiation on electronic and structural materials, the interaction of radiation with matter, and the use of nuclear reactions to inform nuclear forensics techniques. He has advised 16 PhD students (five current) and 33 MS students (two current), received 17 research grants, and published 90 journal articles during his time on the AFIT faculty. He is a member of the IEEE Nuclear and Plasma Sciences Society, American Nuclear Society, and Materials Research Society. AFIT research center affiliation(s): CSRA, CTISR, and NEAT. Tel. 937-255-3636 x7308, Email: [John.McClory@afit.edu](mailto:John.McClory@afit.edu)

**Sponsor Funded Research Projects**

"AFIT/ENP Research in Support of Defense Threat Reduction Agency Nuclear Technologies." Sponsor: DTRA. Funding: \$110,000 - McClory 30%, Bevins 40%, Clinton 30%.

"Endowed Term Chair." Sponsor: AFTAC/AFTAC. Funding: \$16,667.

"Support for the US Nuclear Detonation Detection System." Sponsor: DOE/NNSA. Funding: \$50,000. McClory 50%, Bickley 50%. [NEAT]

"Nuclear Survivability Experimentation, Modeling, and Data Verification." Sponsor: NNSA. Fund: \$200,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%.

**Refereed Journal Publications**

M.C. Recker, E.J. Cazalas, J.W. McClory, and J.E. Bevins, "Comparison of SiPM and PMT Performance Using a CLYC Scintillator with Two Optical Windows," *IEEE Transactions on Nuclear Science*, Vol. 66, No. 8, pp., 1959-1965, August 2019. <http://dx.doi.org/10.1109/TNS.2019.29262466> [NEAT]

W.J. Erwin, E. Cazalas, A. Cahill, J.A. Clinton, J.W. McClory, and A.W. Decker, "The Gamma Emission Spectrum from the Fast Burst Reactor," *Journal of Radiation Effects, Research and Engineering*, Vol. 37, No. 1, pp. 50-56, April 2019. [NEAT]

B.D. Campbell, J.W. McClory, B. Barber, and G. Hansen, "Integration of Protection for Multiple Threats in Composite Materials," *Journal of Radiation Effects, Research and Engineering*, Vol. 37, No. 1, pp. 32-40, April 2019.

Christina Dugan, Christopher Young, Rodney Carmona, Mitchell Schneider, James C. Petrosky, J. Matthew Mann, Eric Hunt, and John W. McClory, "The Debye Temperature of a Single Crystal Thorium Uranium Dioxide Alloy," *Physica Status Solidi - Rapid Research Letters*, Vol. 12, No. 12, 1800436 (5 pages), December 2018. <https://doi.org/10.1002/pssr.2018004366>

Michael A. Ford, Buckley E. O'Day, John W. McClory, and Manish K. Sharma, Areg Danagoulian, "Evaluation of Eu:LiCAF for Neutron Detection Utilizing SiPMs and Portable Electronics," *Nuclear Instruments and Methods in Physics Research A*, Vol. 908, pp. 110-116, November 2018. <https://doi.org/10.1016/j.nima.2018.08.0166> [NEAT]

Michael A. Ford, Buckley E. O'Day, John W. McClory, and Areg Danagoulian, "Development of a Neutron Spectrometer Utilizing Rubberized Eu: LiCAF Wafers," *Nuclear Instruments and Methods in Physics Research*, November 2018. <https://doi.org/10.1016/j.nima.2018.11.1444> [NEAT]

M.C. Recker, E. Cazalas, J.W. McClory, "Pulse Shape Discrimination with a Low-Cost Digitizer Using Commercial Off-the-Shelf Components," *Nuclear Instruments and Methods in Physics Research A*, October 2018. <https://doi.org/10.1016/j.nima.2018.10.1577> [NEAT]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

W.D. Johnston, M.L. Dexter, J.W. McClory, and J.E. Bevins, "Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019. [NEAT]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

M.E. Mace, J.W. McClory, J.C. Petrosky, E. Heller, and G. Vizkelethy, "Targeted Ion Radiation of AlGaIn/GaN HEMTs," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019. [NEAT]

M.C. Recker, and J.W. McClory, "Comparison of Clustering Algorithms for Analysis of Pulse Shape Data from Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC)," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019. [NEAT]

Kevin Choe, Michael Hogsed, Norman Miguel, John McClory, and John Kouvetakis, "Displacement Damage Effects in Ge-Sn Light Emitting Diodes," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019.

Melanie Mace, John McClory, and Eric Heller, "Targeted Ion Radiation of AlGaIn/GaN High Electron Mobility Transistors," Presentation: *44th Dayton-Cincinnati Aerospace Sciences Symposium*, February 2019. [NEAT]

M.C. Recker, E.J. Cazalas, J.W. McClory, and J.E. Bevins, "Comparison of SiPM and PMT Performance Using Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC) Scintillator with Two Optical Windows," Presentation: *IEEE Nuclear Science Symposium*, November 2018. [NEAT]

### **MCCRAE, JACK E., Jr.**

Research Assistant Professor, Department of Engineering Physics, AFIT Appointment Date: 2013 (AFIT/ENP); BS, Physics, Massachusetts Institute of Technology, 1984; MS, Physics (Optics), Air Force Institute of Technology, 1993; PhD, Physics, Air Force Institute of Technology, 1997. Dr. McCrae's research interests include optics, lasers, quantum and non-linear optics, quantum computing, laser radar, atmospheric propagation, and imaging. He is a retired USAF Col with 27 years of service. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4739, Email: [Jack.Mccrae@afit.edu](mailto:Jack.Mccrae@afit.edu)

### **Sponsor Funded Research Projects**

"Novel Characterization Measurements and Meteorological-Driven Modeling of Turbulence and Refraction in the Lower Atmosphere for Directed Energy Applications." Sponsor: DEJTO. Funding: \$280,000 - McCrae 80%, Fiorino 20%. [CDE]**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE 11001, Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019. [CDE]

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, "Estimation of Fried's Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J., Meoak, B.J. Elmore, T. Kesler, C.A. Rice, and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling," *UK/US Directed Energy Workshop*, Swindon, UK, 25, July 2019. [CDE]

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "First Look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating Diffractive Effects in Tilt-Based Turbulence Estimation through Simulation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019. [CDE]

### **Patent Applications**

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-Lapse Imagery," provisional application filed in Jun 2019.

### **NAVA, OMAR A., Maj**

Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, United States Air Force Academy, 2005; BS, Naval Postgraduate School, 2006; MS, Southern Methodist University, 2010; MS, Air Force Institute of Technology, 2011; PhD, University of California Los Angeles, 2016. Maj Nava's research interests cover a variety of topics in atmospheric science to include problems in numerical weather prediction, tropical meteorology, mesoscale processes, and space physics. He has advised three MS students during his time on the AFIT faculty. Before joining AFIT, he was the Chief of Weather Operations at the Joint Space Operations Center at Vandenberg AFB, CA. He has seven archival publications and presentations, and is a member of the American Meteorological Society and American Geophysical Union. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4518, Email: [Omar.Nava@afit.edu](mailto:Omar.Nava@afit.edu)

### **Sponsor Funded Research Projects**

"Correlating Lightning Obs w/ HF Noise." Sponsor: AFRL/RV. Funding: \$16,100. [CSRA]

"Modulation of Lightning Occurrence by the Solar Wind." Sponsor: AFOSR. Funding: \$41,319.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Round, J.F., Loper, R.D., Nava, O.A., and Kahler S.W., "Variations of H-Normalized Heavy Ion Abundances in Large Solar Energetic ( $E > 10$  MeV) Particle Events," *36th International Cosmic Ray Conference*, Madison, WI, Jul 2019.

Nava, O.A., Emmons, D.J., and Loper, R.D., "Influence of Thunderstorms on the Structure of the Ionosphere over North America," *Abstract EGU2019-605*, Presentation: EGU General Assembly, Vienna, Austria, 7-11 Apr 2019.

Merriman, D.K., Nava, O.A., Meehan, J.L., and Tseng, H.R., "Exploring the Use of Cell Phone GNSS Receivers for Global Monitoring of the Ionosphere," *Abstract EGU2019-18445*, Presentation: EGU General Assembly, Vienna, Austria, 7-11 Apr 2019.

Tseng, H.R., Kanipe, M., Urbancic, B., Nava, O.A., Tournay, R.C., Loper, R.D., Emmons, D.J., and Lewis, C.D., "Environmental Characterization of the Atmosphere Using WACCM-X," *Abstract EGU2019-18650*, Presentation: *EGU General Assembly*, Vienna, Austria, 7-11 Apr 2019.

Nava, O.A., Merriman, D.K., Meehan, J.L., and Tseng, H.R., "Real-time Monitoring of the Ionosphere Using Cell Phone GNSS Technology," Presentation: *AGU Chapman Conference*, Pasadena, CA, 11-15 Feb 2019.

Katuzienski, D.O., Nava, O.A., Roeder, W.P., and Holden, N.M., "Forecasting Lightning Initiation Using Dual-Polarization Radar and Lightning Mapping Array in Southwest Utah," Presentation; *American Meteorological Society Annual Meeting*, Phoenix, AZ, 6-10 Jan 2019.

Nelson, A.M., Nava, O.A., Kucas, M.E., Kosar, B., and Loper, R.D., "Characterization of Tropical Cyclone Intensity Using Microwave Imagery," Presentation: *American Meteorological Society Annual Meeting*, Phoenix, AZ, 6-10 Jan 2019.

### **Other Significant Research Productivity**

Nava, O.A., Emmons, D.J., and Loper, R.D., "Modulation of Lightning Occurrence by the Solar Wind," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019. [CSRA]

Schwalbe, S., Loper, R.D., Nava, O.A., and Lewis, C., "Modeling the Effects of a Second Sun on Ionospheric Composition and Structure," *American Geophysical Union Fall Meeting*, Washington, DC, Dec 2018.

### **PAK, MICHAEL V.**

Research Assistant Professor, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); MS, Quantum Chemistry, St. Petersburg State University, 1992; PhD, Theoretical Physics, St. Petersburg State University, 1996; PhD, Quantum Chemistry, Iowa State University, 2002. Dr. Pak's research interests include the theory of quantization, topological quantum computing and quantum theory of multi-component systems. Of particular interest is the development of new methods to accurately describe matter-antimatter interactions, and specifically positron annihilation in complex multi-electron environment. New research interests include modelling of Majorana states for topological quantum computation and development of theoretical methods to accurately predict temperature dependent short lifetime beta decay and electron capture decay at temperatures attained during nuclear explosions. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4501, Email: [Michael.Pak@afit.edu](mailto:Michael.Pak@afit.edu)

**PATNAIK, ANIL K.** Associate Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Physics, Utkal University (India), 1993; MS, Utkal University (India), 1995; PhD, Physics, Physical Research Laboratory (India), 2001; Post-doc, University of Electro-Communications (Japan), 2003. Dr. Patnaik specializes in the theory and experimentation of fundamental laser-matter interactions, both in the realm of classical and quantum regime, and their applications. He has worked on a wide range of topics in quantum optics, non-linear optics, laser-based diagnostics, and state-of-art AF applications, leading to about 190 publications and presentations, including highly-cited peer-reviewed journal publications, book chapters, plenary and invited talks, and seminars and conference presentations. He has authored two authoritative review articles on the optical diagnostics techniques for reacting flows and plasmas, one of which has been in the top 1% cited engineering journal paper status in web of science for the last few years. His theoretical work on fiber-based slow light has been in international news. Dr. Patnaik has successfully led many AFRL- and AFOSR-funded projects as PI or co-PI. He has held several academic and visiting positions at prestigious institutions such as Princeton University, Texas A&M, Purdue, and Max-Planck Institute for Quantum Optics, Garching (Germany). He worked with Professor Glauber (Nobel Laureate in Quantum Optics) on fundamental laser-matter interactions. He has been actively involved with professional societies such as APS, OSA and AIAA. Tel. 937-255-3636 x4532, Email: [Anil.Patnaik@afit.edu](mailto:Anil.Patnaik@afit.edu)

### **Refereed Journal Publications**

Puja Singh, Anil K. Patnaik, Sukesh Roy, James R. Gord, and Yuri V. Rostovtsev, "Influence of Coherent Population Trapping on Raman Scattering," *Phys. Rev. A* 100, 023808, 2019.

A.K. Patnaik, Y. Wu, P.S Hsu, M. Gragston, Z. Zhang, J.R. Gord, and S. Roy, "Simultaneous LIBS and Plasma Density Measurement for Quantitative Insight into LIBS Signal Instability at Elevated Pressures," *Optics Express* 26(10), 25750-25760, Sep 2018.

P.S. Hsu, A.K. Patnaik, A.J. Stolt, J. Estevadeordal, S. Roy, and J.R. Gord, "Enhanced Stability of Spectroscopic Signal of Femtosecond-Laser-Induced Plasmas (FLIPs) for High-Pressure Gas Sensing," *Applied Physics Letters* 113, 214103, Nov 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

A.K. Patnaik, H.U. Stauffer, P.S. Hsu, N. Jiang, P. J. Wrzesinski, J.R. Gord, and S. Roy, "Ultrafast Diagnostics of Reacting Flows and Plasmas," *International Conference on Thermal Engineering, AIP Conf Proc* 2121, 020003, 2019.

### **PERRAM, GLEN P.**

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1989 (AFIT/ENP); BS, Cornell University, 1980; MS, Air Force Institute of Technology, 1981; PhD, Air Force Institute of Technology, 1986. Dr. Perram's research interests include high power chemical lasers, optically pumped gas phase lasers, laser-material interactions, hyperspectral imaging, reaction kinetics, atomic and molecular spectroscopy, environmental science, , and remote sensing. He has advised 36 PhD and 51 MS students, received 50 research grants, and published more than 100 journal articles during his 30 years on the AFIT faculty. Dr. Perram is a fellow of the Optical Society of America and the Directed Energy Professional Society, and is a Registered Professional Engineer in the State of Ohio. AFIT research center affiliation(s): CDE and CTISR. Tel. 937-255-3636 x4504, Email: [Glen.Perram@afit.edu](mailto:Glen.Perram@afit.edu)

### **Sponsor Funded Research Projects**

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: \$72,811 - Perram 50%, Rice 50%. [CTISR]

"Digital Holography: Recording Geometry." Sponsor: Undisclosed. Funding: \$37,914 - Perram 50%, Rice 50%. [CTISR]

"Diode Pumped Alkali Laser Kinetics: Rb-He System." Sponsor: MDA. Funding: \$250,000 - Perram 50%, Rice 50%. [CDE]

"High Energy Laser Analysis Tool: Advanced Kinetics." Sponsor: Creare. Funding: \$128,520. [CDE]

"Hollow Core Raman Fiber Laser for Mid-IR Applications." Sponsor: Lidomika, LLC. Funding: \$45,015 - Perram 50%, Rice 50%. [CDE]

"In-Process Monitoring of Additive Manufacturing: Phase IIX, Inconel Spectra and Imagery." Sponsor: NASA/UTC. Funding: \$25,600. [CDE]

"Melt Pool Monitoring for Metal Additive Manufacturing." Sponsor: ATS LLC. Funding: \$5,000. [CDE]

"Wave Front Sensing for Laser Weapon Applications." Sponsor: AFRL/RD. Funding: \$75,181 - Perram 80%, Rice 20%. [CDE]

"Airy and Non-Gaussian Beam Testbed." Sponsor: AFRL/RD. Funding: \$63,024 - Ferdinandus 90%, Perram 10%. [CDE]

### **Refereed Journal Publications**

AJ Wallerstein, Glen P. Perram, and Christopher A. Rice, "Excitation of Higher Lying States in a Potassium Diode Pumped Alkali Laser," *Appl Phys B*, 124, 145, July 2019. [CDE]

T.A. Van Woerkom, G.P. Perram, B.D. Dolasinski, P.A. Berry, and C.D. Phelps, "Laser Ablation of Metals and Semiconductors with 100 ps - 100  $\mu$ s Pulses," *Optical Engineering*, 58, 08611, August 2019. [CDE]

Christopher A Rice, Kevin Lapp, Anthony Rapp, Woody Miller, and Glen P. Perram, "Rubidium D1 and D2 Far Wing Line Shapes Induced by Rare Gases," *Journal of Quantitative Spectroscopy and Radiative Transfer*, 224, 550-555, Feb 2019. [CDE]

Douglas E. Thornton, Mark F. Spencer, and Glen P. Perram, "Deep-Turbulence Wavefront Sensing Using Digital Holography in the On-axis Phase Shifting Recording Geometry with Comparisons to the Self-Referencing Interferometer," *Applied Optics*, 58, A179-A189, Feb 2019. [CDE]

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

D.E. Thornton, M.F. Spencer, C.A. Rice, G.P. Perram, "Digital Holography Efficiency Measurements with Excess Noise," *Appl. Opt.*, Vol. 58, No. 34, p. G19, 2019. [CDE] [CTISR]

Rice, C.A., Lapp, K., Rapp, A., Miller, W.S., and Perram, G.P., "Rubidium D1 and D2 Far Wing Line Shapes Induced by Rare Gases," *Journal of Quantitative Spectroscopy and Radiative Transfer*, 224, 550-555. <https://doi.org/10.1016/J.JQSRT.2018.12.014> [CDE]

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

D. Mao, D.E. Thornton, C.A. Rice, M.F. Spencer, and G.P. Perram, "Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System," *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 14, 2019. [CDE] [CTISR]

D.E. Thornton, M.F. Spencer, C.A. Rice, and G.P. Perram, "Laser Line Width Measurements Using Digital Holography," *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 15. [CDE] [CTISR]

#### **PETROSKY, JAMES C.**

Director, Nuclear Event Analysis and Testing Center for Specialized Research, Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2000 (AFIT/ENP); BA, Engineering Physics/Computer Science, Millersville University of Pennsylvania, 1984; MS, Engineering Physics, Rensselaer Polytechnic Institute, 1992; PhD, Engineering Physics, Rensselaer Polytechnic Institute, 1995. Dr. Petrosky has expertise in radiation effects on electronic devices, EMP, experimental design, radiation detection, and nuclear weapon effects. His research spans narrow and wide band gap materials using combinations of electrical, optical, and absorption spectroscopy to gain information on the damaging effects of ionizing and non-ionizing radiation. Experimental techniques include I-V(T), C-V(T), photoluminescence spectroscopy, Hall Effect, x-ray and UV photo spectroscopy, applications of measurement techniques in harsh environments/in-situ measurements, and obtaining real-time data. Applications include electronic switches and actuators, RF/IR sensors, force transducers, and electronics controls for use in the space and nuclear weapons environment. Dr. Petrosky has successfully chaired 11 PhD students, 45 Master's students, and mentored and supported six post-doctoral researchers. AFIT research center affiliation(s): CSRA and NEAT. Tel. 937-255-3636 x4562, Email: [James.Petrosky@afit.edu](mailto:James.Petrosky@afit.edu)

#### **Sponsor Funded Research Projects**

"Support Activities to Homeland Security." Sponsor: DHS. Funding: \$200,000. [NEAT]

"Support to NNSA for QASPR Independent Review." Sponsor: DOE/NNSA. Funding: \$15,000.

## Refereed Journal Publications

Alyssa Mock, Christina Dugan, Sean Knight, Rafa Korlacki, J. Matthew Mann, Martin M. Kimani, James C. Petrosky, Peter A. Dowben, and Mathias Schubert, "Band-to-Band Transitions and Critical Points in the Near-Infrared to Vacuum Ultraviolet Dielectric Functions of Single Crystal Urania and Thoria," *Applied Physics Letters* 114, pp. 211901, 5 2019.

W.L. Harrell, J.C. Petrosky, M.E. Oxley, and K.C. Gross, "Identification Algorithm Development for a Data-Fused Optical Nuclear Detonation Monitoring System," *Journal of Radiation Effects Research and Engineering*, Vol. 37, No. 1, April, 2019. [NEAT]

Richert, K., Prusnick, T.A., Hunt, E., Kimani, M.M., Chastang, S., Brooks, D.L., Moore, E.A., Petrosky, J.C., and Mann, J.M. "Inhibiting Laser Oxidation of UO<sub>2</sub> via The Substitution," *Journal of Nuclear Materials* 517, 254-262, 2019.

Christina Dugan, Christopher Young, Rodney Carmona, Mitchell Schneider, James C. Petrosky, J. Matthew Mann, Eric Hunt, and John W. McClory, "The Debye Temperature of a Single Crystal Thorium Uranium Dioxide Alloy," *Physical Status Solidi - Rapid Research Letters*, Vol. 12, No. 12, 1800436 (5 pages), December 2018.  
<https://doi.org/10.1002/pssr.201800436>

## PHILLIPS, GRADY T.

Research Assistant Professor of Engineering Physics (through ORISE), Department of Engineering Physics, AFIT Appointment Date: 2014 (AFIT/ENP); BS, Physics, Wofford College, 1990; BA, Mathematics, Wofford College, 1990; MS, Physics, Clemson University, 1993; PhD, Applied Physics, Air Force Institute of Technology, 2006. Dr. Phillips' research interests include remote sensing encompassing spectral signatures from laser/material interactions, hyperspectral imagery, and environmental monitoring; experimental research utilizing laser physics, spectroscopy, chemical kinetics, and flow dynamics to advance technologies in high power chemical lasers, gas phase lasers, and optical diagnostics. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4743, Email: [Grady.Phillips.ctr@afit.edu](mailto:Grady.Phillips.ctr@afit.edu)

## RICE, CHRISTOPHER A.

Research Assistant Professor, Department of Engineering Physics, AFIT Appointment Date: 2012 (AFIT/ENP); BS, Electrical Engineering, Cedarville University, 2004; MS, Electrical Engineering, Air Force Institute of Technology, 2006; PhD, Applied Physics, Air Force Institute of Technology, 2012. Dr. Rice is interested in topic areas related to high energy lasers, remote sensing, and optical diagnostics. His work on specific research topics currently includes atmospheric propagation of diode pumped alkali lasers, diode pumped alkali and rare gas laser gain construction, aerosol measurement and validation, modeling, simulation and validation of directed energy simulations, and remote sensing. AFIT research center affiliation(s): CDE and CTISR. Tel. 937-255-6565 x4375, Email: [Christopher.Rice@afit.edu](mailto:Christopher.Rice@afit.edu)

## Sponsor Funded Research Projects

"The Enhanced Navy Simulation of the Extended MBL Environment (ENSEMBLE) Toolkit – Phase II Support to Spectral Sciences, Inc." Sponsor: Spectral Sciences. Funding: \$150,000. [CDE]

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: \$72,811 - Perram 50%, Rice 50%. [CTISR]

"Digital Holography: Recording Geometry." Sponsor: Undisclosed. Funding: \$37,914 - Perram 50%, Rice 50%. [CTISR]

"Diode Pumped Alkali Laser Kinetics: Rb-He System." Sponsor: MDA. Funding: \$250,000 - Perram 50%, Rice 50%. [CDE]

"Hollow Core Raman Fiber Laser for Mid-IR Applications." Sponsor: Lidomika, LLC. Funding: \$45,015 - Perram 50%, Rice 50%. [CDE]

“Wave Front Sensing for Laser Weapon Applications.” Sponsor: AFRL/RD. Funding: \$75,181 - Perram 80%, Rice 20%. [CDE]

### **Refereed Journal Publications**

D.E. Thornton, M.F. Spencer, C.A. Rice, G.P. Perram, “Digital Holography Efficiency Measurements with Excess Noise,” *Appl. Opt.*, Vol. 58, No. 34, p. G19, 2019. [CDE]

Rice, C.A., Lapp, K., Rapp, A., Miller, W.S., and Perram, G.P., “Rubidium D1 and D2 Far Wing Line Shapes Induced by Rare Gases,” *Journal of Quantitative Spectroscopy and Radiative Transfer*, 224, 550–555. <https://doi.org/10.1016/J.JQSRT.2018.12.014> [CDE]

AJ Wallerstein, Glen P. Perram, and Christopher A. Rice, “Excitation of Higher Lying States in a Potassium Diode Pumped Alkali Laser,” *Appl Phys B*, 124, 145, July 2019. [CDE]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Santasri R. Bose-Pillai, Jack E. McCrae, Aaron J. Archibald, Christopher A. Rice, and Steven T. Fiorino, “Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras,” *Proc. SPIE 11001, Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019. [CDE]

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, “Estimation of Fried’s Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

Jack E. McCrae, Santasri R. Bose-Pillai, Christopher A. Rice, and Steven T. Fiorino, “Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CDE]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

D. Mao, D.E. Thornton, C.A. Rice, M.F. Spencer, and G.P. Perram, “Effects of Sinusoidal Phase Modulation on the Signal-To-Noise Ratio in a Digital Holography System,” in *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing 2019*, 2019, Vol. 11135, p. 14. [CDE] [CTISR]

D.E. Thornton, M.F. Spencer, C.A. Rice, and G.P. Perram, “Laser Linewidth Measurements Using Digital Holography,” *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 15, 2019. [CDE] [CTISR]

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J. Meoak, B. Elmore, T. Kesler, C.A. Rice, and S.T. Fiorino, “Initial Results for Turbulence Measurement Experiment on 149 km Path,” *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019. [CDE]

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, “Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling,” *UK/US Directed Energy Workshop*, Swindon, UK, 25, July 2019. [CDE]

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram, “Heterodyne Mixing Efficiency of a Digital Holography System,” *Imaging and Applied Optics Congress*, Optical Society of America, Munich, Germany, June 2019. [CDE]

Tim True, Christopher A. Rice, and Glen P. Perram, “Excited State Cesium Line Shapes with High Pressure Rare Gases,” *21st Annual DEPS S+T Symposium*, Destin, FL, 8–12 Apr, 2019. [CDE]

Santasri R. Bose-Pillai, Jack E. McCrae, Aaron J. Archibald, Christopher A. Rice, and Steven T. Fiorino, “First look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras,” *21st Annual DEPS S+T Symposium*, Destin, FL, 8–12 Apr, 2019. [CDE]

Jack E. McCrae, Santasri R. Bose-Pillai, Christopher A. Rice, and Steven T. Fiorino, “Investigating Diffractive Effects in Tilt-Based Turbulence Estimation through Simulation,” *21st Annual DEPS S+T Symposium*, Destin, FL, 8–12 Apr, 2019. [CDE]

### **Patent Applications**

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, “Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-Lapse Imagery,” provisional application filed Jun 2019. [CDE]

### **RIES, HEIDI R.**

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1999 (AFIT/ENP); Interim Chief Academic Officer, AFIT; Dean for Research, Graduate School of Engineering and Management (AFIT/ENR); Interim Dean, Graduate School of Engineering and Management (2013); BS, Physics, The Ohio State University, 1982; MS, Physics, The Ohio State University, 1984; PhD, Applied Physics, Old Dominion University, 1987. Dr. Ries serves as AFIT’s interim chief academic officer, chief research officer, primary liaison to the Air Force Research Laboratory, and served as Interim Dean during FY13. Dr. Ries’ research interests include radiation effects, nonlinear optical materials, electron paramagnetic resonance spectroscopy, and laser processing of materials. Prior to joining the AFIT faculty, Dr. Ries served as Director of the Center for Materials Research at Norfolk State University in Norfolk, Virginia, and as Associate Director of the Applied Research Center at the Jefferson Center for Research and Technology Research Park in Newport News, Virginia. Dr. Ries was elected to the ASEE Engineering Research Council Board of Directors in 2008 and served a two-year term as Secretary/Treasurer (2011-2013). She has served on the Engineering and Science Foundation of Dayton Board since 2005, and as its Chair since 2015. Dr. Ries serves as a peer evaluator and team chair for Higher Learning Commission accreditation processes. She was recognized by the *Dayton Daily News* as one of the region’s 2009 Ten Top Women, and was the Air Force’s civilian winner of the 2011 Department of Defense Women’s History Month Foreign Language and Science, Technology, Engineering and Math (STEM) Role Model Award. Tel. 937-255-3636 x4544, Email: [Heidi.Ries@afit.edu](mailto:Heidi.Ries@afit.edu)

### **Sponsor Funded Research Projects**

“AFRL-AFIT MOA Partnership Agreement.” Sponsor: AFOSR. Funding: \$74,699

### **SAMIN, ADIB J.**

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Chemistry (math minor), Wayne State University, 2008; MS, Chemical Physics, The Ohio State University, 2012; PhD, Mechanical Engineering, The Ohio State University, 2017. Dr. Samin was awarded a graduate student fellowship in 2010, and was the recipient of The Director’s Postdoctoral Fellowship at Los Alamos National Laboratory (LANL) in 2018. He spent three years as a postdoctoral researcher at The Ohio State University working on modeling materials for next generation nuclear reactor concepts and corrosion. He also spent a year at LANL examining structural materials for nuclear reactors. Dr. Samin’s research interests include multi-scale modeling of materials in extremes, and electrochemistry with applications focused on corrosion and nuclear energy. Dr. Samin has authored more than thirty refereed archival journal publications. Tel. 937-255-4535 x4767, Email: [Adib.Samin@afit.edu](mailto:Adib.Samin@afit.edu)

### **Refereed Journal Publications**

Samin, A.J., Andersson, D.A., Holby, E.H., and Uberuaga, B.P., “Ab Initio Based Examination of the Kinetics and Thermodynamics of Oxygen in Fe-Cr Alloys,” *Physical Review B*, 99, 174202, 2019.

### **SHATTAN, MICHAEL B., Lt Col**

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); BS, United States Military Academy, 1999; MS, Massachusetts Institute of Technology, 2008; PhD, University of Tennessee, 2018. Lt Col Shattan's research interests focus on the use of Laser-Induced Breakdown Spectroscopy (LIBS) for nuclear forensics purposes, as well as studying the physics and chemistry of simulated nuclear fireball environments via laser spectroscopy techniques. Additionally, Lt Col Shattan is interested in Resonance Enhanced Multiphoton Ionization (REMPI) techniques for trace gas and particulate detection. Before joining AFIT, he was a PhD candidate at the University of Tennessee. He also holds a Professional Engineer license in the commonwealth of Virginia. Tel. 937-255-3636 x4587, Email [Michael.Shattan@afit.edu](mailto:Michael.Shattan@afit.edu)

### **Refereed Journal Publications**

Ashwin P. Rao, Matthew T. Cook, Howard L. Hall, and Michael B. Shattan, "Quantitative Analysis of Cerium Gallium Alloys Using a Hand-Held Laser Induced Breakdown Spectroscopy Device," *Atoms* 7, 1–10, 2019.

Michael B. Shattan, Mark Gragston, Zhili Zhang, John D. Auxier II, Kathryn G. McIntosh, and Christian G. Parigger. "Mapping of Uranium in Surrogate Nuclear Debris Using Laser-Induced Breakdown Spectroscopy (LIBS)," *Appl. Spectrosc.* 73, 591–600, 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Shattan M.B., Auxier J.D. II, Stowe A.C., Parigger C.G., "Laser-Induced Plasma Analysis for Surrogate Nuclear Debris," *J. Phys.: Conf. Ser.*, 1289, 012040, 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Rao, A.P., Cook, M.T., Auxier, J.D., Howard, H.L., "Detection of Gallium Using a Hand Held Laser Induced Breakdown Spectroscopy Device," *ACS National Meeting*, San Diego, CA, August 2019.

Shattan, M.B., "Laser-Induced Breakdown Spectroscopy for Nuclear Forensics – Current Trends, Advancements and Challenges," *ACS National Meeting*, San Diego, CA, August, 2019.

Shattan, M.B., et al., "Mapping of Uranium in Surrogate Nuclear Debris Using Laser-Induced Breakdown Spectroscopy," *SCIX 2018*, Atlanta, GA, October, 2018.

### **STEWART, BRYAN J.**

Research Assistant Professor of Optical Engineering, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Optical Sciences and Engineering, University of Arizona, 2004; MS, Applied Physics, Air Force Institute of Technology, 2006; PhD, Optical Sciences and Engineering, Air Force Institute of Technology, 2011. Dr. Stewart's current research interests include infrared and electro-optical remote sensing, physics-based sensor and scene modeling, and algorithm development primarily for application to technical intelligence problems. Additional interests include characterization of battlespace combustion (e.g. muzzle flash, detonations, and rocket plumes), methods for assessing on-orbit sensor performance, and machine learning. He has 16 archival publications and presentations. Before joining AFIT, he spent more than nine years at the National Air and Space Intelligence Center (NASIC) where he most recently led R and D activities as a Principal Intelligence Analyst in the Persistent Infrared Squadron. AFIT research center affiliation(s): CTISR. Tel. 937-255-3636 x4639, Email: [Bryan.Stewart@afit.edu](mailto:Bryan.Stewart@afit.edu)

### **Sponsor Funded Research Projects**

"Persistent Infrared Scientific and Analytical Support." Sponsor: NASIC. Funding: \$180,000 - Stewart 60%, Gross 10%, Hawks 30%. [CTISR]

"Support to TAP Lab Effort (STAPLES)." Sponsor: SMC. Funding: \$248,255 - Stewart 95%, Hodson 5%. [CTISR]

"Support to TAP Lab Effort (STAPLES)." Sponsor: SMC. Funding: \$663,000 - Stewart 90%, Gross 10%. [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Yong U., Hopkinson, Kenneth M., Borghetti, Brett J., Steward, Bryan J., “IR Small Target Detection and Prediction with ANNs Trained Using ASSET,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CTISR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

F.D. Fernandez, B.J. Steward, M.R. Hawks, and K.C. Gross, “Implementation of a Non-Linear CMOS and CCD Focal Plane Array Model in ASSET,” *SPIE Defense + Commercial Sensing*, Baltimore, MD, 14-18 Apr 2019. [CTISR]

K D. Anthony, B.J. Borghetti, and B.J. Steward, “Initial Investigation into the Effect of Image Degradation on the Performance of a 3-Category Classifier Using Transfer Learning and Data Augmentation,” *SPIE Defense + Commercial Sensing*, Baltimore, MD, 14-18 Apr 2019. [CTISR]

F.D. Fernandez, B.J. Steward, A. Kondrath, J.N. Patel, and K.C. Gross, “AFIT Sensor and Scene Emulation Tool (ASSET): FPA and Electronics Sub-Model Improvements,” *MSS Parallel Conference*, Orlando, FL, 25-28 Feb 2019. [CTISR]

### **Other Significant Research Productivity**

M.J. Rensing, A.J. Niklas, and B.J. Steward, “Algorithm Development for WFOV Mission Data Processing,” Air Force Research Laboratory, Space Vehicles Directorate, Kirtland AFB, NM, August 2019. [CTISR]

### **TOURNAY, ROBERT C., Lt Col**

Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); BS, University of Maryland, College Park, 2000; MS, Naval Postgraduate School, 2008; PhD, Colorado State University, 2016. Lt Col Tournay’s research interests include land surface-atmosphere interaction, numerical weather modeling, hydrology and flooding, as well as applying artificial intelligence and machine learning to weather forecasting. Prior to his PhD studies, Lt Col Tournay served as Commander, Sixteenth Weather Squadron, Offutt AFB, Nebraska as well as Commander, Forty-sixth Weather Squadron, Eglin AFB, Florida. Lt Col Tournay deployed to Iraq in support of Operation IRAQI FREEDOM, as well as to Qatar in support of AF Central Command operations. He is a member of the American Meteorological Society. Tel. 937-255-3636 x4743, Email: [Robert.Tournay@afit.edu](mailto:Robert.Tournay@afit.edu)

### **Sponsor Funded Research Projects**

“Endowed Term Chair.” Sponsor: AFTAC/AFTAC. Funding: \$33,333.

“Modeling and Characterization of the Hypersonic Vehicle Operations Environment.” Sponsor: DARPA. Funding: \$158,947 - Tseng 31%, Loper 23%, Emmons 23%, Tournay 23%.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Zoellick, C.L, H.R. Tseng, and R.C. Tournay, “Source Term Estimation of Atmospheric Pollutants Using an Ensemble of HYSPLIT Concentration Simulations,” *American Meteorological Society Annual Meeting*, Jan, 2019.

Bazemore, D.W., H.R. Tseng, R.C., Tournay, “Quantifying Uncertainty of Ensemble Transport and Dispersion Simulations Using HYSPLIT,” *American Meteorological Society Annual Meeting*, Jan, 2019.

Tseng, Rose H., Michelle Kanipe, Brian Urbancic, Omar Nava, Robert Tournay, Robert Loper, Daniel Emmons, and Charlton Lewis, “Environmental Characterization of the Atmosphere Using WACCM-X,” *European Geosciences Union General Assembly*, Apr, 2019.

Tseng, H.R., Kanipe, M., Urbancic, B., Tournay, R.C., Nava, O.A., Emmons, D.J., Loper, R., and Lewis, C., “Environmental Characterization of the Atmosphere Using WACCM-X,” *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

### **Other Significant Research Productivity**

Tseng, H.R., O.A. Nava, C.D. Lewis, R.D. Loper, and R.C. Tournay 2018. "Environmental Modeling and Characterization of the Atmosphere Using WACCMX," *Workshop on Space Environment Applications, Systems, and Operations for National Security (SEASONS)*, Oct, 2018.

### **TSENG, ROSE H., Lt Col**

Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, University of California at Los Angeles (UCLA), 2004; MS, Naval Postgraduate School, 2010; PhD, UCLA, 2016. Lt Col Tseng's research interests include future climatological changes, the influence of aerosols on precipitation and tropical cyclones, and the Arctic sea ice decline, as these topics pertain to future political, societal and environmental impacts. Prior to her PhD studies, Lt Col Tseng served as Commander, Detachment 1, 607th Weather Squadron at Camp Red Cloud, Republic of Korea. Lt Col Tseng has given a number of talks regarding her research on the effects of black carbon on precipitation, including the University of California (Carbon Neutrality Initiative), and the Pardee RAND Graduate School (LA Policy Symposium). Lt Col Tseng also serves as Board Advisor for Women Veteran Issues for The BREATH Center in San Clemente, CA. Lt Col Tseng served a deployment tour as USAF Joint Meteorological and Oceanographic Officer- Afghanistan and NATO Headquarters Resolute Support Chief Meteorological Officer from April - October 2017 in Kabul, Afghanistan. Tel. 937-255-3636 x4520, Email: [hsteng@afit.edu](mailto:hsteng@afit.edu)

### **Sponsor Funded Research Projects**

"Modeling and Characterization of the Hypersonic Vehicle Operations Environment." Sponsor: DARPA. Funding: \$158,947 - Tseng 31%, Loper 23%, Emmons 23%, Tournay 23%.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Zoellick, C.L, H.R. Tseng, R.C. Tournay, "Source Term Estimation of Atmospheric Pollutants Using an Ensemble of HYSPLIT Concentration Simulations," *American Meteorological Society Annual Meeting*, Jan, 2019.

Bazemore, D.W., H.R. Tseng, R.C. Tournay, "Quantifying Uncertainty of Ensemble Transport and Dispersion Simulations Using HYSPLIT," *American Meteorological Society Annual Meeting*, Jan, 2019.

Tseng, Rose H., Michelle Kanipe, Brian Urbancic, Omar Nava, Robert Tournay, Robert Loper, Daniel Emmons, and Charlton Lewis, "Environmental Characterization of the Atmosphere Using WACCM-X," *European Geosciences Union General Assembly*, Apr, 2019.

Merriman, D.K., Nava, O.A., Meehan, J.L., and Tseng, H.R., "Exploring the Use of Cell Phone GNSS Receivers for Global Monitoring of the Ionosphere," Presentation: *Abstract EGU2019-18445, EGU General Assembly*, Vienna, Austria, 7-11 Apr.

Nava, O.A., Merriman, D.K., Meehan, J.L., and Tseng, H.R., "Real-Time Monitoring of the Ionosphere Using Cell Phone GNSS Technology," Presentation: *AGU Chapman Conference*, Pasadena, CA, 11-15 Feb, 2019.

### **Other Significant Research Productivity**

Tseng, H.R., O.A. Nava, C.D. Lewis, R.D. Loper, and R.C. Tournay, "Environmental Modelling and Characterization of the Atmosphere Using WACCMX," *Workshop on Space Environment Applications, Systems, and Operations for National Security (SEASONS)*, Oct, 2018.

**TUTTLE, RONALD F.**

Associate Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2001 (AFIT/ENP); BS, Chemical Engineering, University of Missouri (Columbia), 1968; MS, Nuclear Engineering, University of Missouri (Columbia), 1970; PhD, Nuclear Engineering, University of Missouri (Columbia), 1980. Dr. Tuttle's research areas include applications of active and passive remote sensing, spectroscopy, diagnostics, and signals processing to problems in intelligence collection and exploitation. Other areas of interest include nuclear weapon effects and space nuclear power systems modeling, and mechanics of aerosols. He has published in both unclassified and classified refereed archival journals and conference proceedings. Dr. Tuttle served as Director, Center for Technical Intelligence Studies and Research, AFIT, until Aug 2012. Tel. 937-255-3636 x4536, Email: [Ronald.Tuttle@afit.edu](mailto:Ronald.Tuttle@afit.edu)

**VARSHNEY, GAIVEN**

Research Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT; Appointment Date: 2019 (AFIT/ENP); Post-Doctoral Research Associate, 2016 (AFIT/ENP); BS (Honors), Chemistry, Aligarh Muslim University, India, 2001; MS, Analytical Chemistry, Aligarh Muslim University, India, 2003; M. Phil., Applied Chemistry, Z.H. College of Engineering and Technology, A.M.U, India, 2004; PhD, Applied Chemistry, Z.H. College of Engineering and Technology, A.M.U., India, 2008. Dr. Varshney's current research interests involve several nuclear forensic areas, including but not limited to: detection of radioactive elements, experimental separation and analysis of nuclear debris from different nuclear accidents and tests, radiation detection, and materials characterization. AFIT research center affiliation(s): NEAT. Tel. [937-255-3636](tel:937-255-3636) x4574, Email: [gaiven.varshney@afit.edu](mailto:gaiven.varshney@afit.edu)

**Refereed Journal Publications**

G. Varshney, J.R. Cezeaux, and J.C. Petrosky, "Investigation of Fissile Materials Collected from a Non-Critical Nuclear Explosion Site Using Non-destructive Analytical Techniques," *Journal of Radioanalytical and Nuclear Chemistry*, 318 (1) 505-513, Nov 2019. [NEAT]

**Other Significant Research Productivity**

Gaiven Varshney, Jason R Cezeaux, Abigail Bickley, and James C. Petrosky, "Morphological and Elemental Characterization of Environmental Actinide Bearing Particles Formed by a Non-Nuclear Weapon Accidents," Presentation: *ACS Conference*, Orlando, FL, April 2019. [NEAT]

Jason Cezeaux, Gaiven Varshney, Abigail Bickley, and James C. Petrosky, "Morphological Classification and Analysis of Fuel Bearing Debris from a Non-Critical Event," Presentation: *HEART conference*, April, 2019. [NEAT]

Gaiven Varshney: research focusing on "Detection, Morphological Characterization and Classification of Actinide Bearing Particles Formed by a Non-Critical Weapon Test," Presentation: *Joint Defense Threat Reduction Agency (DTRA) and the Department of Homeland Security Countering Weapons of Mass Destruction Office (CWMD) Nuclear Program Technical Review (NPTR)*, SAIC Crown Conference Center, Lorton, VA, September 23-27, 2019. [NEAT]

**WEEKS, DAVID E.**

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1993 (AFIT/ENP); BA, Physics, Colgate University, 1983; MS, Physics, Georgia Institute of Technology, 1985; PhD, Physics, University of Arkansas, 1989. Dr. Weeks' research interests include the development of time dependent wave packet methods to model the quantum mechanics of simple chemical reactions and compute associated state to state reactive scattering matrix elements. Of particular interest are new methods that incorporate non-adiabatic coupling between electronic and nuclear degrees of freedom. His new research interests include fiber laser modeling and the development of plasma models to improve the operation of noble gas laser systems. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4561, Email: [David.Weeks@afit.edu](mailto:David.Weeks@afit.edu)

**WOLF, PAUL J.**

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1994 (AFIT/ENP); Associate Dean for Academic Affairs, Graduate School of Engineering and Management (AFIT/EN); BS, Regis College, 1978; MS, Air Force Institute of Technology, 1979; PhD, Air Force Institute of Technology, 1985. Dr. Wolf serves as the Associate Dean for Academic Affairs responsible for administrative leadership for all academic matters in the Graduate School and serves as AFIT's accreditation liaison to the Higher Learning Commission and ABET. Dr. Wolf's current scholarly interests include emergent behaviors of complex systems, foundations of quantum mechanics, and existential threat analyses. Dr. Wolf has made experimental contributions to atomic/molecular spectroscopy, reactive and non-reactive collision kinetics, laser-based thin film deposition processes, ionospheric and atmospheric chemistry, and environmental monitoring. Prior to joining the AFIT faculty in 1994, Dr. Wolf served as Chief for the Visible Chemical Laser Section at the Air Force Weapons Laboratory, Kirtland AFB, NM, Director/Principal Investigator of the Materials Physics Division at the F.J. Seiler Research Laboratory, USAFA, CO, Assistant Professor of Physics in the Physics Department at the U.S. Air Force Academy, and Research Director for Impulse Laser Effects at the Defense Nuclear Agency. He has over 20 publications in refereed archival journals. Tel. 937-255-3636 x4560, Email: [Paul.Wolf@afit.edu](mailto:Paul.Wolf@afit.edu)

## **5.3 DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING**

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### 5.3.1 DOCTORAL DISSERTATIONS

BROOKS, ADAM, Nondestructive Electromagnetic Characterization of Perfect-Electric-Conductor-Backed Uniaxial Materials. AFIT-ENG-DS-19-S-004. Faculty Advisor: Dr. M. J. Havrilla Sponsor: AFRL/RV.

EVERS, AARON, A Generalized Phase Gradient Autofocus Algorithm. AFIT-ENG-DS-19-M-025. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: N/A.

HAMILTON, NICOLAS S., Adaptive-Hybrid Redundancy for Radiation Hardening. AFIT-ENG-DS-19-S-005. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A. [CCR]

JURADO, JUAN D., Autonomous and Resilient Management of All-Source Sensors for Navigation Assurance. AFIT-ENG-DS-19-S-006. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: N/A. [ANT]

KING, DAVID W., Emergent Behavior Development and Control in Multi-Agent Systems. AFIT-ENG-DS-19-S-007. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AF Pentagon, Studies, Analyses and Assessments. [CCR]

STONE, BRENT J., Enabling Auditing and Intrusion Detection for Proprietary Controller Area Networks. AFIT-ENG-DS-18-D-003. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A. [CCR]

### 5.3.2 MASTER'S THESES

- ADDERLEY, NIKOLAI A., Graph-Based Temporal Analysis in Digital Forensics. AFIT-ENG-MS-19-M-005. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: DC3/DC. [CCR]
- ARAGON, ANGELITO E., Evaluating Machine Learning Techniques for Smart Home Device Classification. AFIT-ENG-MS-19-M-006. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR ANT]
- ARNOLD, CHRISTIAN, High Resolution, Low-Bandwidth, Real-Time Reconnaissance Using Structure from Motion with Planar Homography Estimation. AFIT-ENG-MS-18-M-007. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: N/A.
- BARBER, TAYLOR S., Performance Analysis of Angle of Arrival Algorithms Applied to Radiofrequency Direction Finding. AFIT-ENG-MS-19-M-008. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: AFRL/RW. [ANT]
- BEARGIE, DAVID W., Assessment of Camera Pose Estimation Using Geo-Located Images from Simultaneous Localization and Mapping. AFIT-ENG-MS-19-M-009. Faculty Advisor: Capt Aaron J. Canciani. Sponsor: N/A. [ANT]
- BERHOLD, JEDEDIAH M., Convolutional Neural Network Architecture Study for Aerial Visual Localization. AFIT-ENG-MS-19-M-010. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RY. [ANT]
- BOGGS, BRANDON N., RF-DNA Fingerprinting Ping 2020i ADS-B UAT Devices Using a Low-Cost SDR. AFIT-ENG-MS-19-M-011. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL/RY. [CCR]
- BRAMLETTE, CLINT M., Cyber-Attack Drone Payload Development and Geolocation Via Directional Antennae. AFIT-ENG-MS-19-M-012. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: N/A. [CCR]
- BRAUN, ANDREW D., High Fidelity Satellite Navigation Receiver Front-End for Advanced Signal Quality Monitoring and Authentication. AFIT-ENG-MS-19-M-013. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: N/A. [CCR ANT]
- CARBONI, JOHN, The Effect of Modeling Simultaneous Events on Simulation Results. AFIT-ENG-MS-19-M-014. Faculty Advisor: Dr. Douglas D. Hodson. Sponsor: HQ USAF.
- CATCHPOLE, MARCUS, Machine Learning Models of C-17 Specific Range Using Flight Recorder Data. AFIT-ENG-MS-13-M-016. Faculty Advisor: Dr. Laurence D. Merkle. Sponsor: N/A.
- CHAVEZ, SENOBIO, Serious Game Design Using MDA and Bloom's Taxonomy. AFIT-ENG-MS-19-M-017. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: 711th HPW/RH.
- CHIARATTI, NICHOLAS S., Software Defined Radio (SDR) Device Discrimination Using Chip Shape-Distinct Native Attribute (CS-DNA) Features. AFIT-ENG-MS-19-M-018. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL AFMC. [CCR]
- CINTRON, LUIS A., Modeling a Consortium-Based Distributed Ledger Network with Applications for Intelligent Transportation Infrastructure. AFIT-ENG-MS-18-M-019. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RY. [CCR]
- CRUZ, FRANKIE A., Near Real-Time RF-DNA Fingerprinting for ZigBee Devices Using Software Defined Radios. AFIT-ENG-MS-19-M-021. Faculty Advisor: Maj Joan A. Betances Jorge. Sponsor: AFRL/RY. [CCR]
- DALLMANN, WILLIAM E., Infrared and Electro-Optical Stereo Vision For Automated Aerial Refueling. AFIT-ENG-MS-19-M-022. Faculty Advisor: Scott L. Nykl. Sponsor: AFRL/RQ. [ANT]

DELA CRUZ, MICHAEL, Designing Liquid Crystal For Optoacoustic Detection. AFIT-ENG-MS-19-M-023. Faculty Advisor: Dr. Hengky Chandralalim. Sponsor: N/A.

DONTIGNEY, TROY B., Space Surveillance Network Design. AFIT-ENG-MS-19-J-003. Faculty Advisor: Dr. Laurence D. Merkle. Sponsor: AFRL/RV. [CCR]

EVERETT, NICHOLAS D., Instantaneous Bandwidth Expansion Using Software Defined Radios. AFIT-ENG-MS-19-M-024. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A. [CSRA]

FERNANDEZ, FERNANDO D., A Focal Plane Array and Electronics Model for CMOS and CCD Sensors In the AFIT Sensor and Scene Emulation Tool (ASSET). AFIT-ENG-MS-19-M-026. Faculty Advisor: Dr. Bryan J. Steward. Sponsor: SMC/RS. [CTISR]

FLORES, ENOC, Improved Fabrication For Micromirror Arrays. AFIT-ENG-MS-19-M-027. Faculty Advisor: Maj Tod Laurvick. Sponsor: N/A.

GANITANO, GRAIG S., Confidence Inference In Defensive Cyber Operator Decision Making. AFIT-ENG-MS-19-M-028. Faculty Advisor: Dr. Brett J. Borghett. Sponsor: 711HPW/CL. [CCR]

GOROSPE, ANDREW, Non-Contact Height Estimation for Material Extrusion Additive Systems via Monocular Imagery. AFIT-ENG-MS-19-M-029. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/RX.

GRIMM, MATTHEW A., Imitating Human Responses Via a Dual-Process Model Approach. AFIT-ENG-MS-19-M-030. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/RV. [CCR]

HACKER, KENNETH L., Preserving Privacy In Automotive Tire Pressure Monitoring Systems. AFIT-ENG-MS-19-M-031. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A. [CCR]

HARRIS, RYAN, Side Channel Anomaly Detection in Industrial Control Systems Using Physical Characteristics of End Devices. AFIT-ENG-MS-19-M-032. Faculty Advisor: MSG Robert Mills. Sponsor: N/A.

HUGHES, AVIAN, Electromagnetic Characterization of Conductor-backed Media Using Stepped-iris Rectangular Waveguide. AFIT-ENG-MS-19-M-033. Faculty Advisor: Dr. Michael J. Havrilla. Sponsor: AFRL/RV.

JAMES, KENNETH , Testing the Fault Tolerance of a Wide Area Backup Protection System using SPIN. AFIT-ENG-MS-19-M-034. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A. [CCR]

JOHNSON, BROOKE, Machine Translation with Image Context from Mandarin Chinese to English. AFIT-ENG-MS-19-M-035. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR.

KIM, KYUNG M., Monocular Visual Odometry For Fixed-Wing, Small Unmanned Aircraft Systems. AFIT-ENG-MS-19-M-036. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RV. [ANT]

KULM, JUSTIN, A Hybrid Anomaly Detection System Using a Rules-Base. AFIT-ENG-MS-19-M-037. Faculty Advisor: Dr. Douglas D. Hodson. Sponsor: N/A.

LASSITER, RAHN M., Physical Layer Discrimination Of Electronic Control Units Using Wired Signal Distinct Native Attribute (WS-DNA) Fingerprints. AFIT-ENG-MS-19-M-038. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RV. [CCR]

LEE, TAYLOR N., Aerial Simultaneous Localization and Mapping Using Earth's Magnetic Anomaly Field. AFIT-ENG-MS-19-M-039. Faculty Advisor: Capt Aaron J. Canciani. Sponsor: N/A. [ANT]

LIBRANDI, ROCCO, Variable Type Inference Based On Statistical and Architectural Indications. AFIT-ENG-MS-19-M-040. Faculty Advisor: Dr. Andrew J. Terzuoli. Sponsor: NASIC/AC.

MARTIN, SETH A., Unguided Cyber Education Techniques Of the Non-Expert. AFIT-ENG-MS-19-M-041. Faculty Advisor: Mark A.Reith. Sponsor: N/A. [CCR]

MCQUAID, IAN, Autonomous Association of GEO RSO Observations Using Deep Neural Networks. AFIT-ENG-MS-19-M-042. Faculty Advisor: Dr. Laurence D. Merkle. Sponsor: N/A.

MICHAUD, PAUL, Micro-Contacts With 3-D Surfaces Made With Grayscale Lithography. AFIT-ENG-MS-19-M-043. Faculty Advisor: Tod Laurvick. Sponsor: N/A.

MILTON, MICHAEL, A Quantitative Analysis Of the Fusion Of 3-D Scanning LIDAR Systems and 2-D Imaging Systems. AFIT-ENG-MS-19-M-044. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: N/A.

MONTGOMERY, MADISON J., Active Control Of a Morphing Wing Aircraft and Failure Analysis For System Reliability. AFIT-ENG-MS-19-M-045. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RQ. [ANT]

MORA, EDWIN A., A Multi-Vehicle Cooperative Localization Approach For an Autonomy Framework. AFIT-ENG-MS-19-M-046. Faculty Advisor: Dr. Robert C.Leishman. Sponsor: RDECOM/CERDC [ANT]

MOSBY, JOSHUA K., A Blockchain-Based Anomalous Detection System For Internet Of Things' Devices. AFIT-ENG-MS-19-M-047. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR]

NELSON, KALEB J., Event-Based Visual-Inertial Odometry on a Fixed-Wing Unmanned Aerial Vehicle. AFIT-ENG-MS-19-M-048. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RV. [ANT]

NUNDU, AILEEN, Direct Path Interference Suppression and Received Signal Processing For OFDM Passive Radar. AFIT-ENG-MS-19-M-049. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: AFIT/ENG.

RAMOS, JENNIFER N., Uranium Dioxide Actinide Detection Device Support Design For Space Applications. AFIT-ENG-MS-19-M-050. Faculty Advisor: Tod Laurvick. Sponsor: N/A. [CSRA]

RAQUET, NATHANIEL J., Analysis of Satellite Timing and Navigation Receiver Pseudorange Biases Due to Spreading Code Puncturing and Phase Optimized Constant Envelope Transmission. AFIT-ENG-MS-19-M-051. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: AFRL/RV. [ANT]

ROBINSON, TORY, Characterization of Metal Contacts on Hydrothermally Synthesized Uranium Dioxide For Novel Semiconductor Applications. AFIT-ENG-MS-19-M-052. Faculty Advisor: Tod Laurvick. Sponsor: N/A.

SCHMITT, DARYL W., A Framework for Cyber Vulnerability Assessments of InfiniBand Networks. AFIT-ENG-MS-19-M-054. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RV. [CCR]

SINN, YONG U., Unresolved Object Detection Using Synthetic Data Generation and Artificial Neural Networks. AFIT-ENG-MS-19-M-055. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A. [CSRA CTISR]

SMITH, JONATHAN, Three-D Multifunctional Sensors Fabricated on Fiber Tips Using a Two-Photon Polymerization Process. AFIT-ENG-MS-19-M-056. Faculty Advisor: Dr. Hengky Chandralalim. Sponsor: N/A.

STAFIRA, LUKAS A., Examining Effectiveness of Web-Based Internet of Things' Honeypots. AFIT-ENG-MS-19-M-057. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR]

STANKOWSKI, KYLE, Target Detection in Heterogeneous Clutter with Low Resolution Radar. AFIT-ENG-MS-19-S-011. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: AFOSR/RT.

TAYLOR, FORREST, Orthogonal Frequency Division Multiplexed Waveform Effects on Passive Bistatic Radar. AFIT-ENG-MS-19-M-058. Faculty Advisor: Maj James R. Lievsay. Sponsor: N/A.

TOMCHO, LANDON G.M., Experimentation and Analysis Using Modern Gamification Techniques. AFIT-ENG-MS-19-M-061. Faculty Advisor: Dr. Mark A. Reith. Sponsor: N/A. [CCR]

UNDERWOOD, BLAINE, Plasma Treatment Method for Ohmic Contacts on Zinc Oxide Thin Film Transistors. AFIT-ENG-MS-19-M-062. Faculty Advisor: Maj Tod Laurvick. Sponsor: AFRL/RV.

UNDERWOOD, GEORGE, A MEMS Dual Vertical Electrometer and Electric Field-Mill. AFIT-ENG-MS-19-M-063. Faculty Advisor: Maj Tod Laurvick. Sponsor: N/A.

VERGARA, CHRISTOPHER, Multi-Sensor Data Fusion between Radio Tomographic Imaging and Noise Radar. AFIT-ENG-MS-19-M-064. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

VILLARREAL, MICAH, Confirmation Bias Estimation from Electroencephalography with Machine Learning. AFIT-ENG-MS-19-M-065. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR/RT.

WALLACE, SCOUT T., Extended Kalman Filtering for Missile Live-Fire Data Analysis. AFIT-ENG-MS-18-D-004. Faculty Advisor: Lt Col Scott J. Pierce. Sponsor: AFRL/RV. [ANT]

WASZ, PATRICK J., Two-On-One Pursuit with a Non-Zero Capture Radius. AFIT-ENG-MS-19-M-066. Faculty Advisor: Dr. Meir Pachter. Sponsor: AFRL/RV. [ANT]

### 5.3.3 FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

#### **BECKER, DAVID J., Maj**

Assistant Professor of Electric Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BSEE, University of Maine, Orono, 2006; MS, Air Force Institute of Technology, 2013; PhD, Electrical Engineering, Air Force Institute of Technology, 2018. Maj Becker's research interests include space object detection from electro-optical sensors, and image processing. Tel. 937-255-3636 x4371, Email: [David.Becker@afit.edu](mailto:David.Becker@afit.edu)

#### **Refereed Journal Publications**

Joseph Tompkins, Stephen Cain, and David Becker, "Near Earth Space Object Detection Using Parallax as Multi Hypothesis Test Criterion," *Opt. Express* 27, pp. 5403-5419, 2019.

#### **BETANCES, JOAN A., Maj**

Electrical Engineering Division Chief , Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BSEE, Walla Walla University, 2003; MS, Air Force Institute of Technology, 2012; PhD, Electrical Engineering, Air Force Institute of Technology, 2016. Maj Betance's research interests include software-defined radios, cognitive radios, and wireless security. He is a member of Eta Kappa Nu and Tau Beta Pi honor societies. AFIT research center affiliation(s): ANT, CCR, CSRA, and CCR. Tel. 937-255-3636 x3305, Email: [Joan.Betancesjorge@afit.edu](mailto:Joan.Betancesjorge@afit.edu)

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Rondeau, Temple, and Betances, "DRA for CB-DNA Fingerprinting to Improve Industrial IoT Wireless Security," *Proc of the 52nd Hawaii Int'l Conf on System Sciences*, pp. 7126-7135, Jan 2019. [CCR]

B. Burfeind, R.F. Mills, S.L. Nykl, J.A. Betances, and C. Sielski, "Confidential ADS-B," *IEEE Aerospace Conference*, Big Sky, MT, Mar 2019, pp. 1-11. [ANT] [CCR]

Matsui, Betances, and Betances, "Detecting Wireless Intrusion with RF Watermarks," *IEEE National Aerospace & Electronics Conference*, Dayton, OH, Jul 2019. [CCR]

#### **Patent Applications**

Rondeau, Temple, Lopez, Betances, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," AFD-1967P, SN 62/856,784, 4 Jun: 2019.

#### **BORGHETTI, BRETT J.**

Associate Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2008 (AFIT/ENG); BSEE, Worcester Polytechnic Institute, 1992; MSCS, Air Force Institute of Technology, 1996; PhD, Computer Science, University of Minnesota, 2006. Dr. Borghetti's research interests include machine learning, autonomous agents, and multi-agent systems. AFIT research center affiliation(s): ANT, CCR, and CTISR. Tel. 937-255-3636 x4612, Email: [Brett.Borghetti@afit.edu](mailto:Brett.Borghetti@afit.edu)

#### **Sponsor Funded Research Projects**

"Information Acquisition Deficit Detection and Mitigation through Neurophysiological-sensed Operator Patterns." Sponsor: AFOSR. Funding: \$80,340 - Borghetti 50%, Oxley 50%.

"Modeling Decision Confidence to Improve Cyber Mission Effectiveness." Sponsor: 711 HPW. Funding: \$12,375. [CCR]

## Refereed Journal Publications

- Dickey, Joshua T., Borghetti, Brett J., Junek, William, and Martin, Richard, "Beyond Correlation: A Path-Invariant Measure for Seismogram Similarity" *Seismological Research Letters*, 6 Nov 2019, DOI: 10.1785/0220190090. <https://pubs.geoscienceworld.org/srl/article-pdf/doi/10.1785/0220190090/4862061/srl-2019009.1.pdf>
- Westing, Nicholas M., Borghetti, Brett J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, 9 Aug 2019, Vol. 11, Issue 6, pp. 1866-1886, DOI: 10.3390/rs11161866. <https://www.mdpi.com/2072-4292/11/16/1866/htm> [CTISR]
- Dickey, Joshua T., Borghetti, Brett J., and Junek, William, "Improving Regional and Teleseismic Detection for Single-Trace Waveforms Using a Deep Temporal Convolutional Neural Network Trained with an Array-Beam Catalog," *Sensors (MDPI)*, 31 Jan 2019, Vol. 19, Issue 3, pp. 597-618. DOI: 10.3390/s19030597.
- Curro, Joseph A., Raquet, John F., Borghetti, Brett J., "Navigation Using VLF Signals with Artificial Neural Networks" *Navigation*, 5 Dec 2018, pp. 1-13. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/navi.2664> [ANT]

## Refereed Conference Papers Accepted on the Basis of Full Paper Review

- Villarreal, Micah N., Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," *Human Factors and Ergonomics Society (HFES) Annual Conference*, Seattle, WA, 28 Oct-1 Nov 2019. [ANT] [CCR]
- Skouson, Mark B., Borghetti, Brett J., Leishman, Robert C., "Ursa: A Neural Network for Unordered Point Clouds Using Constellations," *Computer Vision Conference (CVC) 2019*, Las Vegas, NV, 25-26 Apr 2019. [ANT]
- Sinn, Yong U., Hopkinson, Kenneth M., Borghetti, Brett J., Steward, Bryan J., "IR Small Target Detection And Prediction with ANNs Trained Using ASSET," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019. [CTISR]

## Refereed Conference Papers Accepted on the Basis of Abstract Review

- Westing, Nicholas M., Borghetti, Brett J., Gross, Kevin C., "Analysis of Long-Wave Infrared Hyperspectral Classification Performance Across Changing Scene Illumination," *SPIE Defense and Commercial Sensing* Baltimore, MD, 14-18 April, 2019. [CTISR]
- Anthony, Keith D., Borghetti, Brett J., Steward, Bryan J., "Initial Investigation into the Effect of Image Degradation on the Performance of a 3-Category Classifier Using Transfer Learning and Data Augmentation," *SPIE Defense and Commercial Sensing Conference*, Baltimore, MD, 14-18 April, 2019. [CTISR]
- Berhold, J., Mark, Leishman, Robert C., Borghetti, Brett J., and Venable, Donald T., "Hyperparameter Comparison on Convolutional Neural Network for Visual Aerial Localization," *Institute of Navigation (ION) Pacific Position Navigation Timing (PNT) conference*, Honolulu, HI, 8-11 April 2019. [ANT]

## BROWN, FRANK M.

Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1961 (AFIT/ENG); BS, MS, PhD, The Ohio State University. Dr. Brown's research interests are discrete mathematics, and operations research.

## CAIN, STEPHEN C.

Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2003 (AFIT/ENG); BSEE, University of Notre Dame, 1992; MSEE, Michigan Technological University, 1994; PhD, University of Dayton, 2001. Dr. Cain's research interests include electro-optics, remote sensing, and signal processing. Tel. 937-255-3636 x4716, Email: [Stephen.Cain@afit.edu](mailto:Stephen.Cain@afit.edu)

### **Sponsor Funded Research Projects**

“Non-Linear Photo-Detector Calibration without Calibrated Sources.” Sponsor: AFOSR. Funding: \$18,424.

“Super-Resolution Imaging via an Expectation-Maximization Algorithm Designed for Dim Objects Resident with Brighter Objects.” Sponsor: AFOSR. Funding: \$38,850.

### **Refereed Journal Publications**

Joseph Tompkins, Stephen Cain, and David Becker, "Near Earth Space Object Detection Using Parallax as Multi-Hypothesis Test Criterion," *Opt. Express*, Vol. 27, No. 4, pp. 5403-5419, 4 Feb 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Ronald Aung and Stephen Cain, “Multi-Frame Blind Deconvolution of Closely Spaced Dim Stellar Objects,” *AMOS Technical Conference*, Maui, HI, 15-19 September 2019.

### **CANCIANI, AARON J., Maj**

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BSEE, Air Force Academy, 2010; MSEE, Air Force Institute of Technology, 2012; PhD, Electrical Engineering, Air Force Institute of Technology, 2016. Maj Canciani’s research interests include GPS-alternative navigation systems using environmental signals, SLAM, deep learning, and vision navigation. He is a member of The Institute of Navigation (ION). AFIT research center affiliation(s): ANT. Tel. 937-255-3636 x4618, Email: [Aaron.Canciani@afit.edu](mailto:Aaron.Canciani@afit.edu)

### **Sponsor Funded Research Projects**

“High Resolution Magnetic Mapping over Naval Test Range.” Sponsor: NGA. Funding: \$250,000. [ANT]

“Navigation for A2AD, Long Range, Over Water Ingress.” Sponsor: AFRL/RY. Funding: \$550,796 - Canciani 60%, Leishman 30%, Raquet 10%. [ANT]

### **Other Significant Research Productivity**

Spent summer FY19 onsite collaborating with Lincoln Lab establishing research relationships and initiating AFIT-MIT-Lincoln Lab partnerships.

### **CASEY, DANIEL J., Maj**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BS, Computer Science, United States Air Force Academy, 2006; MS, Computer Science, Southern Methodist University, 2009. Maj Casey’s research interests include software defined networking, and reverse engineering. He is a member of Tau Beta Pi Engineering Honor Society.

### **CHANDRAHALIM, HENGKY**

Director of AFIT Nanofabrication and Characterization Facility, Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2017 (AFIT/ENG); BSC, The Ohio State University, 2000; MEng, Cornell University, 2004; MSc, Cornell University, 2008; PhD, Electrical and Computer Engineering, Cornell University, 2009. Dr. Chandralalim’s research interests include: symbiotically enhancing electronic, phononic, magnonic, and photonic microsystems, fabrication techniques for novel integrated nanosystems, optofluidics, photoacoustics, biophotonics, nonlinear optics, and optomechanics, mutually assisting micro and nanosystems, and molecular scale sensing. He is a lifetime member of the APS and SPIE, a member of the OSA, and senior member of the IEEE. Tel. 937-255-3636 x4483, Email: [Hengky.Chandralalim@afit.edu](mailto:Hengky.Chandralalim@afit.edu)

### **Sponsor Funded Research Projects**

“3-D Nanomachining of Remote Sensors on Optical Fibers.” Sponsor: AFOSR. Funding: \$50,140

“Reconfigurable Nonlinear Optical Media in Metastructural Photonics.” Sponsor: AFRL/RX. Funding: \$20,000.

### **Refereed Journal Publications**

Cong Chen, Jin Yuan, Lei Wan, Hengky Chandralalim, Zhenshi Chen, Naoya Nishimura, Harunobu Takeda, Hiroaki Yoshioka, Weiping Liu, Yuji Oki, Xudong Fan, and Zhaohui Li, “Demonstration of On-Chip Quantum Dots Microcavity Lasers in a Molecularly Engineered Annular Groove,” *Opt. Lett* 44, 2019, pp. 495-498.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Jonathan W. Smith, Joseph S. Suelzer, Nicholas G. Usechak, Vincent P. Tondiglia, and Hengky Chandralalim, “3-D Thermal Radiation Sensors on Optical Fiber Tips Fabricated Using Ultrashort Laser Pulses,” *International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '19)*, 2019.

Michael T. Dela Cruz, Ling Wang, and Hengky Chandralalim, “Free-Spaced-Coupled Liquid Crystalline Broadband Optoacoustic Sensors,” *IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS)*, 2019.

Michael T. Dela Cruz, Ling Wang, and Hengky Chandralalim, “Statistically-Designed Liquid Crystalline Molecular Cell Sensors,” *IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS)*, 2019.

### **Patent Applications**

Hengky Chandralalim and Jonathan W. Smith, “Temperature-Immune Self-Referencing Fabry-Pérot Cavity Sensors,” Filed 13 Feb 2019, Serial No. 62/804,996.

Michael T. Dela Cruz and Hengky Chandralalim, “Statistically-Designed Liquid Crystalline Molecular Cell Sensors,” Filed 11 Feb 2019, Serial No. 62/803,652.

Hengky Chandralalim and Michael T. Dela Cruz, “Noncontact Liquid Crystalline Broadband Optoacoustic Sensors,” Filed 11 Feb 2019, Serial No. 62/803,630.

### **Other Significant Research Productivity**

Talk: “Chip-Scale Reconfigurable Whispering-Gallery Lasers,” Department of Physics, Indiana University-Purdue University, Indianapolis, Indiana, 12 Sep, 2019.

General chair for the Foundation of Nonlinear Optics 2019 (FoNLO'19) conference.

Technical program committee member for the IEEE Transducers/Eurosensors 2019 conference.

### **COLLINS, PETER J.**

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2006 (AFIT/ENG); BA, Bethel College, MN, 1985; BSEE, University of Minnesota, 1985; MSEE, Air Force Institute of Technology, 1990; PhD, Air Force Institute of Technology, 1996. Dr. Collins' research interests include low observables, computational electromagnetics, radar cross section metrology, remote sensing, and electromagnetic material design and analysis. He is a senior member of the IEEE. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x7256, Email: [Peter.Collins@afit.edu](mailto:Peter.Collins@afit.edu)

### **Sponsor Funded Research Projects**

“Enabling Technologies for Radar Scattering Measurements.” Sponsor: AFRL/RX. Funding: \$138,242.

“Enabling Technologies for Advanced Munitions.” Sponsor: AFLCMC. Funding: \$100,000 - Collins 50%, Hartsfield 25%, Lingenfelter 25%.

“Enabling Technologies for Radar Scattering Measurements.” Sponsor: AFRL/RV. Funding: \$138,242.

“Enabling Technologies for Advanced Munitions.” Sponsor: AFLCMC. FundAdvancedg: \$100,000 - Collins 50%, Hartsfield 25%, Lingenfelter 25%.

### **Refereed Journal Publications**

Alex Paul, Collins, P.J., and Temple, M., “Nondestructive Evaluation of Radio Frequency Connector Continuity Using Stimulated Emissions,” *ASME Jour of Nondestructive Evaluation*, Vol. 2, No. 1, Dec 2018. [CSRA]

Alex Paul, Collins, P.J., and Temple, M., “Enhancing Microwave System Health Assessment Using Artificial Neural Networks,” *IEEE Antennas and Wireless Propagation Letters*, Vol. 18, No. 11, Nov 2019. [CSRA]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Nicholas Everett and Collins, P.J., “Instantaneous Bandwidth Expansion Using Software Defined Radios,” *International Radar Conference*, Toulon, France, 23-27 September 2019. [CSRA]

### **Other Significant Research Productivity**

2018 Antenna Measurement Techniques Association (AMTA) Distinguished Achievement Award recipient. Awarded at the 40th Annual AMTA Symposium, 4-9 November 2018, Williamsburg, VA, “For Outstanding and Pioneering Contributions to the Practice of Antenna Design, Analysis, and Measurements.”

Knisley, Alexander, Havrilla, M. J., and Collins, P.J., “A Measurement Exploration of Additively Manufactured Media,” *Material Measurement Working Group Spring Meeting*, Keysight Technologies, Santa Rosa, CA, 1 May 2019.

### **CORBELL, PHILLIP M., Lt Col**

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2014 (AFIT/ENG); BSEE, Southern Illinois University, 1998; MSEE, Air Force Institute of Technology, 2000; PhD, Air Force Institute of Technology, 2006. Lt Col Corbell’s research interests include electronic warfare, navigation warfare, waveform diversity, phased array, adaptive, cognitive, MIMO, multi-static MTI radar architectures, software defined radios, and other disruptive technologies. He is a member of Tau Beta Pi, Eta Kappa Nu, Alpha Lambda Delta, and IEEE. AFIT research center affiliation(s): ANT and CSRA.

### **CURRO, JOSEPH A., Capt**

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BSEE, Clarkson University, 2010; MSEE, Air Force Institute of Technology, 2012; PhD, Electrical Engineering, Air Force Institute of Technology, 2018. Capt Curro’s research interests include GPS-alternative navigation systems using environmental signals. His interests also include using machine learning and neural networks for alternative navigation. He is a member of The Institute of Navigation (ION). AFIT research center affiliation(s): ANT. Tel. 937-255-3636 x4620, Email: [Joseph.Curro@afit.edu](mailto:Joseph.Curro@afit.edu)

### **Sponsor Funded Research Projects**

“Advanced Tactics Development through Deep Reinforcement Learning.” Sponsor: NASIC. Funding: \$300,000. [ANT]

“Android Sensor Framework for ATAK.” Sponsor: AFRL/RI. Funding: \$130,000. [ANT]

“Deep Reinforcement Learning for Air Combat.” Sponsor: AFRL/RQ. Funding: \$30,000 [ANT]

### **Other Significant Research Productivity**

Established new Artificial Intelligence special study class based on emerging urgent needs by multiple sponsors.

**DAVIS, NATHANIEL J., IV**

Professor Emeritus, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2005 (AFIT/ENG); BSEE, Virginia Polytechnic Institute and State University, 1976; MSEE, Virginia Polytechnic Institute and State University, 1977; PhD, Purdue University, 1985. Dr. Davis' research interests include computer communications networks, cyber operations, and large scale computer architectures. He is a Senior Member of the IEEE, and a member of the Sigma Xi, Eta Kappa Nu, and Tau Beta Pi honorary societies.

**DEYOUNG, MARK E., Lt Col**

Assistant Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BS, Columbia College, 2003; MS, Air Force Institute of Technology, 2008; PhD, Computer Engineering, Virginia Tech, 2018. Lt Col DeYoung's research interests include hardware/software co-design, embedded systems, cyber situational awareness, computational statistics, software engineering, and reverse engineering. He is a member of Eta Kappa Nu and Upsilon Pi Epsilon honor societies. AFIT research center Affiliation: CCR. Tel. 937-255-3636 x3368, Email: [Mark.DeYoung@afit.edu](mailto:Mark.DeYoung@afit.edu)

**GRAHAM, SCOTT R.**

Associate Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BS, Electrical Engineering, Brigham Young University, 1993; MS, Electrical Engineering, Air Force Institute of Technology, 1999; PhD, Electrical Engineering, University of Illinois at Urbana-Champaign, 2004. Dr. Graham's research interests include the intersection between real physical systems and the computers that control them. Specific areas of interest include trusted avionics and vehicular computer systems. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4581, Email: [Scott.Graham@afit.edu](mailto:Scott.Graham@afit.edu)

**Sponsor Funded Research Projects**

"Reconnaissance Improvement via Change Detection, Data Compression, & Comm Resilience Using Jetson TX1s & TX2s." Sponsor: Undisclosed. Funding: \$30,780 - Graham 50%, Nykl 50%. [ANT/CCR "Cyber Resiliency at the Component Level." Sponsor: AFRL/R.Y. Funding: \$130,000 – Graham 50%, Betances 50% [CCR]

**Refereed Journal Publications**

Roeber, J.B., Nykl, S.L., and Graham, S.R., "Assessment of Structure from Motion for Reconnaissance Augmentation and Bandwidth Usage Reduction," *Journal of Defense Modeling and Simulation*, Vol. 1, Apr 2019, pp. 1-13. [ANT]

Badenhop, C.W., Graham, S.R., Mullins, B.E., and Mailloux, L.O., "Looking Under the Hood of Z-Wave: Volatile Memory Introspection for the ZW0301 Transceiver," *ACM Transactions on Cyber-Physical Systems*, Vol. 3 Issue 2, Dec 2018. [CCR]

Beyer, S.M., Mullins, B.E., Graham, S.R., and Bindewald, J.M., "Pattern-of-Life Modeling in Smart Homes," *IEEE Internet of Things Journal*, Vol. 5, Issue 6, Dec 2018. [CCR]

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Cintron, L.A., Graham, S.R., and Hodson, D.D., "Modeling Liability Data Collection Systems for Intelligent Transportation Infrastructure Using Hyperledger Fabric," *13th International Conference on Critical Infrastructure Protection*, Mar 2019. [CCR]

Hacker, K.L., Graham, S.R., and Dunlap, S.J., "Vehicle Identification and Route Reconstruction via TPMS Data Leakage," *13th International Conference on Critical Infrastructure Protection*, Mar 2019. [CCR]

Lassiter, R. M., Graham, S.R., Carbino, T.J., and Dunlap, S.J., "Electronic Control Unit Discrimination Using Wired Signal Distinct Native Attributes (WS-DNA)," *13th International Conference on Critical Infrastructure Protection*, Mar 2019. [CCR]

Schmitt, D.J., Graham, S.R., Sweeney, P.J., Mills, R.F., “A Cyber Vulnerability Assessment of Infiniband Networking,” *13th International Conference on Critical Infrastructure Protection*, Mar 2019. [CCR]

Cintron, L.A., Graham, S.R., Hodson, D.D., and Mullins, B.E., “Distributed-Ledger Based Event Attestation for Intelligent Transportation Systems,” *14th International Conference on Cyber Warfare and Security (ICCWS 2019)*, Mar 2019. [CCR]

Hacker, K.L., and Graham, S.R., “Preserving Privacy and Integrity in Automotive Tire Sensors,” *14th International Conference on Cyber Warfare and Security (ICCWS 2019)*, Mar 2019. [CCR]

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Hamilton, N.S., Graham, S.R., Carbino, T.J., Petrosky, J.C., and Betances, J.A., “Adaptive-Hybrid Redundancy for Rad-Hardening,” *Proceedings of the IEEE 2019 National Aerospace and Electronics Conference (NAECON)*, 15-19 Jul 2019. [CCR]

#### **Books and Chapters in Books**

Celebucki, D.J., Graham, S.R., and Gunawardena, S., “Reversing a Lattice ECP3 FPGA for Bitstream Protection,” *Critical Infrastructure Protection XII, Springer*, 2018. [CCR]

Bentjen, K.C., Graham, S.R., Nykl, S.L., “Introducing Persistent Human Control into a Reservation-Based Autonomous Intersection Protocol,” *Critical Infrastructure Protection XII, Springer*, 2018. [CCR]

Wolfe, C.L., Graham, S.R., Mills, R.F., Nykl, S.L., and Simon, P.E., “Securing Data-in-Transit for Power-Limited Sensor Networks Using Two-Channel Communication,” *Critical Infrastructure Protection XII, Springer*, 2018. [CCR]

#### **Editorships in Professional Journals**

Guest Editor, *ACM Digital Threats: Research and Practice*, Special Issue on the Digital Threats of Hardware Security. [CCR]

#### **Patent Applications**

Reber, P.E., Graham, S.R., Sweeney, P.J., and Stephensen, M.M., “Active Attestation of Embedded Systems,” Filed 14 Jan 2019 via AFMC (Based on Provisional patent 62/635204 titled “Runtime Attestation of Embedded Systems,” filed previously on 26 Feb 2018). [CCR]

#### **GUNAWARDENA, SANJEEV**

Research Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT  
Appointment Date: 2014 (AFIT/ENG); BSEE & BS, Engineering Physics, Ohio University, 1997; MSEE, Ohio University, 2000; PhD, Ohio University, 2007. Dr. Gunawardena’s research interests include satellite navigation and timing (SatNav), navigation warfare, software defined radio, reconfigurable computing, and domain-specific programmable ASICs. He is a member of the US Institute of Navigation. AFIT research center affiliation(s): ANT. Tel. 937-255-3636 x4659, Email: [Sanjeev.Gunawardena@afit.edu](mailto:Sanjeev.Gunawardena@afit.edu)

#### **Sponsor Funded Research Projects**

“SatNav Signal Monitoring and Analysis Technology Development.” Sponsor: AFRL/Ry. Funding: \$759,917. [ANT]

### Refereed Journal Publications

Gunawardena, S., Raquet, J., and Carroll, M., "Correlator Beamforming for Multipath Mitigation in High Fidelity GNSS Monitoring Applications," *NAVIGATION: Journal of the Institute of Navigation*, Vol. 66, No. 1, Spring 2019, pp. 169-183. <https://doi.org/10.1002/navi.2886> [ANT]

### Refereed Conference Papers Accepted on the Basis of Abstract Review

Gunawardena, S., Rügamer, A., Hameed, M.S., Arizabaleta, M., Pany, T., and Arribas, J., ION Software-Defined Radio Metadata Standard Final Report, Proceedings of the 32nd International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2019), Miami, Florida, September 2019, pp. 3785-3800. <https://doi.org/10.33012/2019.170227> [ANT]

Raquet, N., Gunawardena, S., Patel, P., and Hinks, E.J., Phase Optimized Constant Envelope Transmission-Induced Pseudorange Biases and Mitigation, Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation, Long Beach, CA, July 2019. [ANT]

Braun, A., and Gunawardena, S., High Fidelity Satellite Navigation Front-End for Signal Quality Monitoring and Advanced Authentication, Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation, Long Beach, CA, July 2019. [ANT]

### HAMILTON, NICOLAS S., Maj

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2019 (AFIT/ENG); BSEE, Rose-Hulman Institute of Technology, 2009; MSEE, Air Force Institute of Technology, 2011; PhD, Electrical Engineering, Air Force Institute of Technology, 2019. Maj Hamilton's research interests include radiation hardening space electronics through hardware and software redundancy, Field Programmable Gate Arrays (FPGA), and Very Large Scale Integrated (VLSI) Circuit design. He is a member of the Eta Kappa Nu, Tau Beta Pi, and IEEE. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4220 Email: [Nicolas.Hamilton@afit.edu](mailto:Nicolas.Hamilton@afit.edu)

### Refereed Journal Publications

Nicolas Hamilton, Scott Graham, Timothy Carbino, James Petrosky, and J. Addison Betances, "Adaptive-Hybrid Redundancy with Error Injection," *MDPI Journal of Electronics*, Vol. 8, No. 11, 1 Nov 2019.

### Refereed Conference Papers Accepted on the Basis of Full Paper Review

Nicolas Hamilton, Scott Graham, Timothy Carbino, James Petrosky, and J. Addison Betances, "Adaptive-Hybrid Redundancy for Rad-Hardening," *Proceedings of the IEEE 2019 National Aerospace and Electronics Conference (NAECON)*. 15-19 Jul 2019.

### Other Significant Research Productivity

Nicolas Hamilton, "Basic MIPS Architecture Version 1.4," *Technical report, Air Force Institute of Technology*, 2019.

Nicolas Hamilton, "Triple Modular Redundancy MIPS Architecture Version 1.4," *Technical report, Air Force Institute of Technology*, 2019.

Nicolas Hamilton, "Adaptive-Hybrid Redundancy MIPS Architecture Version 2.2," *Technical report, Air Force Institute of Technology*, 2019.

Nicolas Hamilton, "DE10 Pins and Connections for Basic MIPS," *Technical report, Air Force Institute of Technology*, 2019.

**HARTRUM, THOMAS C.**

Associate Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1977 (AFIT/ENG); BEE, The Ohio State University, 1969; MS, The Ohio State University, 1969; PhD, The Ohio State University, 1973; MBA, Wright State University, 1979. Dr. Hartrum's field of expertise is software.

**HAVRILLA, MICHAEL J.**

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2002 (AFIT/ENG); BS, Michigan State University, 1987; MSEE, Michigan State University, 1989; PhD, Michigan State University, 2001. Dr. Havrilla's research interests include electromagnetic theory, guided wave theory and applications, electromagnetics of complex media, material characterization, low observables, electromagnetic scattering, and antenna theory. He is a member of HKN and Sigma Xi, a Senior Member of the IEEE, and a Full Member of the International Union of Radio Science-Commission B. Tel. 937-255-3636 x4582, Email: [Michael.Havrilla@afit.edu](mailto:Michael.Havrilla@afit.edu)

**Sponsor Funded Research Projects**

"Material Measurement Laboratory Research." Sponsor: AFRL/R.Y. Funding: \$225,000.

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Brooks, M. Havrilla, "Theory and Measurement of Conductor Backed Bi-Layered Uniaxial Materials," *Antenna Measurement Techniques Association Proceedings*, pp. 361-366, Williamsburg, Virginia, November 2018.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

M. Havrilla, "Accommodating Plane Wave Reflections in the kDB System," *International Symposium on Electromagnetic Theory Proceedings*, pp. 37, San Diego, California, May 2019.

M. Havrilla, "Scalar Potential Depolarizing Dyad Artifact in Bi-isotropic Media," *International Symposium on Electromagnetic Theory Proceedings*, pp. 14, San Diego, California, May 2019.

**Other Significant Research Productivity**

M. Havrilla, "Accommodating Plane Wave Reflections in the kDB System," *International Symposium on Electromagnetic Theory Proceedings*, pp. 37, San Diego, California, May 2019.

M. Havrilla, "Scalar Potential Depolarizing Dyad Artifact in Bi-Isotropic Media," *International Symposium on Electromagnetic Theory Proceedings*, pp. 14, San Diego, California, May 2019.

M. Havrilla, "Field and Potential Based Methods in Anisotropic and Bianisotropic Electromagnetics," *International Symposium on Electromagnetic Theory*, pp. 1-189, May 2019.

**HODSON, DOUGLAS D.**

Associate Professor of Software Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2011 (AFIT/ENG); BS, Physics, Wright State University, 1985; MS, Electro-Optics, University of Dayton, 1987; MBA, University of Dayton, 1999; PhD, Computer Engineering, Air Force Institute of Technology, 2009. Dr. Hudson's research interests include real-time distributed simulation architectures for training, test and analysis, networks, design patterns for modeling radar, and infrared effects. His research interests also include the modeling and simulation of Quantum Key Distribution protocols. Tel. 937-255-3636 x4719, Email: [Douglas.Hodson@afit.edu](mailto:Douglas.Hodson@afit.edu)

**Sponsor Funded Research Projects**

"AFSIM Maturation and Capability Improvements." Sponsor: AFRL/RQ. Funding: \$35,948 - Hodson 50%, Peterson 50%. [ANT/CCR]

“Developing Artificial Intelligence Opponents for Contested Space Simulations.” Sponsor: AFMC/A9. Funding: \$211,047 - Hodson 30%, Gallagher 20%, Peterson 25%, Grimaila 25%. [CCR]

### **Refereed Journal Publications**

C.W. Weimer, J.O. Miller, R.R. Hill, and D.D. Hodson, “Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models,” *Journal of Artificial Societies and Social Simulation (JASSS)*, Vol. 22, No. 4, 2019. [COA]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

J.M. Carboni, D.D. Hodson, and J.R. Millar, “The Effect of Modeling Simultaneous Events on Simulation Results,” *The 17th International Conference on Scientific Computing (CSC'19)*, Las Vegas, NV, 29 Jul–1 Aug 2019.

J.A. Vagedes, D.D. Hodson, S.L. Nykl and J.R. Millar, “ECS Architecture for Modern Military Simulators,” *The 17th International Conference on Scientific Computing (CSC'19)*, Las Vegas, NV, 29 Jul–1 Aug 2019.

P.M. Beach, B.T. Langhals, M.R. Grimaila, D.D. Hodson, and R.D.L. Engle, “Developing a Methodology for the Identification of Alternative NoSQL Data Models via Observation of Relational Data Model Usage,” *The 18th International Conference on Information & Knowledge Engineering (IKE'19)*, Las Vegas, NV, 29 Jul–1 Aug 2019.

L.C. Llewellyn, M.R. Grimaila, and D.D. Hodson, “Modeling Quantum Teleportation with Julia,” *The 17th International Conference on Scientific Computing (CSC'19)*, Las Vegas, NV, 29 Jul–1 Aug 2019.

### **Other Significant Research Productivity**

D.D. Hodson, “Tutorial: Learning Python & Julia—A User and Developer View,” *DATAWorks 2019*, Defense and Aerospace Test and Analysis (DATA) Workshop, 9-11 Apr 2019.

Associate Editor, *Journal of Defense Modeling and Simulation*.

Session Chair and Associate Editor, “Military and Defense Modeling and Simulation,” *2019 International Conference on Scientific Computing (CSC19)*, Las Vegas, NV, 29 Jul–2 Aug 2019.

### **HOPKINS, KENNETH F.**

Adjunct Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BS, Northern Kentucky University, 1975; MS (EE), University of Cincinnati, 1979; MS (Physics), University of Cincinnati, 1980; PhD, Electrical Engineering, University of Cincinnati, 1983; Completed Air War College, Air University, 2008. Dr. Hopkins’ research interests include photonic devices, infrared detectors, and infrared laser sources.

### **Sponsor Funded Research Projects**

“Silicon Photonics for Fiber Lasers.” Sponsor: AFRL/RX. Funding: \$20,000.

### **HOPKINSON, KENNETH M.**

Interim Department Head and Professor, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2004 (AFIT/ENG); BSCS, Rensselaer Polytechnic Institute, 1997; MSCS, Cornell University, 2002; PhD, Cornell University, 2004. Dr. Hopkinson’s research interests include wired and wireless networking, fault tolerant and reliable distributed systems, middleware, operating systems, net-centric warfare, network security, cloud computing, machine learning applied to remote sensing, and the use of networks to enhance critical infrastructures. Dr. Hopkinson is a Senior Member of the IEEE, a Senior Member of the ACM, and a member of the Upsilon Pi Epsilon and the Eta Kappa Nu honorary societies. AFIT research center affiliation(s): ANT, CCR, CSRA, and CTISR. Tel. 937-255-3636 x4579, Email: [Kenneth.Hopkinson@afit.edu](mailto:Kenneth.Hopkinson@afit.edu)

### **Sponsor Funded Research Projects**

“AI-based Strategy for Space Ops.” Sponsor: AFRL/RV. Funding: \$40,000 - Hopkinson 50%, Betances 50%. [CSRA]

“Autonomous Systems Software.” Sponsor: AFRL/RV. Funding: \$40,000 - Hopkinson 50%, Betances 50%. [CSRA]

“Multi-objective Evolutionary Algorithm for Space Surveillance Satellite Allocation.” Sponsor: AFRL/RV. Funding: \$100,000.

### **Refereed Journal Publications**

Compton, A.J., Pecarina, J.M., Hopkinson, K.M., and Lin, A.C., “Peer Appear: A Self-Organizing Distributed Geospatial Index Supporting Collaborative World Model Construction and Maintenance,” *Elsevier Future Generation Computer Systems*, Vol. 95, June 2019, pp. 802-815. [ANT]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Y.U., Hopkinson, K.M., Borghetti, B.J., and Steward, B.J., “IR Small Target Detection and Prediction with ANNs Trained Using ASSET,” *IEEE Aerospace Conference*, 2-9 March 2019, Big Sky, Montana, USA, pp. 1-10. [CSRA] [CTISR]

James, K., and Hopkinson, K.M., “Testing the Fault-Tolerance of a Backup Protection System Using SPIN,” *Proceedings of the 14th International Conference on Cyber Warfare and Security (ICWWS)*, 28 February–1 March 2019, Stellenbosch University, South Africa, pp. 133-141. [CCR]

### **Other Significant Research Productivity**

Hamman, S., and Hopkinson, K.M., “Adversarial Thinking,” NSA Featured Curriculum Module, *National Security Agency's National Cybersecurity Curriculum Program*, 29 November 2018. <https://www.clark.center/details/shamman/Adversarial%20Thinking> [CCR]

### **HOUPIS, CONSTANTINE H.**

Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1952 (AFIT/ENG); BS, University of Illinois, 1947; MS, University of Illinois, 1948; PhD, University of Wyoming, 1971. Dr. Houpis' research interests include guidance and control of aerospace vehicles, application of optimal control theory to engineering systems, flight control systems, digital control systems, computational and numerical methods for control systems design, linear and nonlinear control theory, multivariable theory, and quantitative feedback theory. Dr. Houpis has published numerous technical articles and textbooks. He is a registered professional engineer and a Fellow of the IEEE.

### **JACKSON, JULIE A.**

Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2009 (AFIT/ENG); BS, Electrical Engineering, Wright State University, 2002; MS, Electrical Engineering, The Ohio State University, 2004; PhD, Electrical Engineering, The Ohio State University 2009. Dr. Jackson's research interests include electromagnetic and statistical modeling, radar imaging algorithms, and radar signal exploitation. She is a member of IEEE, Eta Kappa Nu, and Tau Beta Pi. AFIT research center affiliation(s): CTISR. Tel. 937-255-3636 x4678, Email: [Julie.Jackson@afit.edu](mailto:Julie.Jackson@afit.edu)

### **Sponsor Funded Research Projects**

“Multistatic Receiver Optimization and Target Detection.” Sponsor: AFRL/RV. Funding: \$58,000.

“Signal Detection in Linearly Mixed Observations with Background Replacement.” Sponsor: AFOSR. Funding: \$30,537.

### **Refereed Journal Publications**

- J.A. Jackson, "Parametric Models for Signature Prediction and Feature Extraction," *Applied Computational Electromagnetics Society (ACES) Journal*, Special Issue on Advanced Computational Electromagnetic Methodologies and Techniques, Vol. 34, No. 2, pp. 258-260, Feb 2019.
- A. Evers and J.A. Jackson, "SAR Scene Size Limits for Spatially Invariant Defocus with Near-and Far-Field Geometries," *IEEE Transactions on Computational Imaging*, Vol. 4, No. 4, pp. 640-647, Dec 2018.
- J.A. Jackson, "Parametric Models for Signature Prediction and Feature Extraction," *Applied Computational Electromagnetics Society (ACES) Journal*, Special Issue on Advanced Computational Electromagnetic Methodologies and Techniques, Vol. 34, No. 2, pp. 258-260, Feb 2019.
- A. Evers and J.A. Jackson, "SAR Scene Size Limits for Spatially Invariant Defocus with Near-and Far-Field Geometries," *IEEE Transactions on Computational Imaging*, Vol. 4, No. 4, pp. 640-647, Dec 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

- J. Becker, and J.A. Jackson, "Super-Resolution Using Dropped-Channel PolSAR Compressive Sensing," *IEEE Radar Conference*, Boston, MA, 22-26 April, 2019, Paper ID 5195, pp. 1-6.
- J.A. Jackson, "Model Mismatch Effect in Coarse Resolution Heterogeneous Clutter Cells," *IEEE Radar Conference*, Boston, MA, 22-26 April, 2019, Paper ID 5242, pp. 1-6.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

- M.J. Kim, J.A. Jackson, and J.R. Lievsay, "Emitter Selection Optimization for Passive Synthetic Aperture Radar," *MSS Tri-Service Radar Symposium*, Orlando, FL, 24-28 June, 2019, pp. 1-21.

### **Patent Applications**

- J.A. Jackson and F. Lee-Elkin, "Method for Recovering Full Polarization Radar Data from a Subset of Polarization Channel Measurements," Patent pending; Provisional patent application number 62633928, filed 22 Feb 2018, full patent application filed 5 Feb 2019. SN 16/267,444.

### **KING, DAVID W., Lt Col**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2019 (AFIT/ENG); BSCS, University of Maryland, 2005; MSCO, Air Force Institute of Technology, 2012; PhD, Computer Science, Air Force Institute of Technology, 2019. Maj King's research interests include artificial intelligence, bio-inspired algorithms, emergence, and multi-agent systems. He is a member of Tau Beta Pi. AFIT research center affiliation(s): ANT. [David.King@afit.edu](mailto:David.King@afit.edu)

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

- David King and Gilbert Peterson, "Decentralized Control Strategies for Unmanned Aircraft System Pursuit and Evasion," *Proceedings of the IEEE 2019 90<sup>th</sup> Vehicular Technology Conference (VTC2019-Fall)*, 22-25 Sep, 2019.
- David King, Lukas Esterle, and Gilbert Peterson, "Entropy-Based Team Self-Organization with Signal Suppression," *Proceedings of the 2019 conference on Artificial Life*, 29 Jul-2 Aug, 2019.
- David King and Gilbert Peterson, "The Emergence of Division of Labor in Multi-Agent Systems," *Proceedings of the IEEE 2019 13<sup>th</sup> International Conference on Self-Adaptive and Self-Organizing Systems*, 16-20 June 2019.

**LAMONT, GARY B.**

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1970 (AFIT/ENG); Bachelor of Physics, University of Minnesota, 1961; MSEE, University of Minnesota, 1967; PhD, University of Minnesota, 1970. Dr. Lamont teaches courses in computer science and computer engineering. His research interests include: evolutionary computation, artificial immune systems, intrusion and anomaly detection, information security, parallel and distributed computation, combinatorial optimization problems (single objective and multi-objective), software engineering, digital signal processing, and intelligent and distributed control. He has advised many MS and PhD students in these disciplines. Dr. Lamont has authored several textbooks (Multi-Objective EAs, Computer Control), various book chapters, as well as numerous papers. Dr. Lamont was also an engineering systems analyst for the Honeywell Aerospace Division for six years. He is a Senior Member of IEEE, and a member of ACM, ASEE, SIAM, Tau Beta Pi, and Eta Kappa Nu. Tel. 937-255-3636 x4718, Email: [Gary.Lamont@afit.edu](mailto:Gary.Lamont@afit.edu)

**LAURVICK, TOD V., Maj**

Electrical Engineering Deputy Department Head, Assistant Professor of Electric Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BSEE, Michigan Technological University, 1995; MS, Air Force Institute of Technology, 2009; PhD, Electrical Engineering, Air Force Institute of Technology, 2016. Maj Laurvick's research interests include advancement of micro/nanoscale fabrication techniques and material impacts to nano scale devices. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4382, Email: [Tod.Laurvick@afit.edu](mailto:Tod.Laurvick@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

G. Underwood and T. Laurvick, "MEMS Variable Area Capacitor for Room Temperature Electrometry," *Euroensors*, Sep 2018, Proc 2018, 2(13), 1075.

B. Underwood and T. Laurvick, "Plasma Treatment Effects on Nanocrystalline ZnO Thin-Film Transistors," *Euroensors* Sep 2018, Proc. 2018.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

E. Flores and T. Laurvick, "MEMS Mirror Alternatives Using Polymer/Metal Composite Structures," *NAECON*, October 2018.

P. Michaud and T. Laurvick, "Applied Grayscale Lithographic Surfaces in Microcontact Performance Enhancement," *NAECON*, October 2018.

**LEISHMAN, ROBERT C.**

ANT Center Director and Research Assistant Professor of Autonomy, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BS, Utah State University, 2006; MS, Brigham Young University, 2009; PhD, Mechanical Engineering, Brigham Young University, 2013. Dr. Leishman's research interests include: guidance, navigation and control of small unmanned aerial vehicles, GPS-denied navigation using vision systems, and autonomous systems and robotics. He is a member of The Institute of Navigation (ION) and The Institute of Electrical and Electronics Engineers (IEEE), including the IEEE Controls Systems Society (CSS) and IEEE Robotics and Automation Society (RAS). AFIT research center affiliation(s): ANT. Tel. 937-255-3636 x4755, Email: [Robert.Leishman@afit.edu](mailto:Robert.Leishman@afit.edu)

**Sponsor Funded Research Projects**

"ENG18-001 PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: 746 TS. Funding: \$80,000 - Leishman 34%, Canciani 33%, Gunawardena 33%. [ANT]

"ENG18-004 PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: USA CERDEC. Funding: \$80,000 - Leishman 34%, Canciani 33%, Gunawardena 33%, . [ANT]

“Morphing and Shape Adaptable Aircraft Control, Integration, and Flight Test.” Sponsor: AFRL/RQ. Funding: \$24,940 - Leishman 80%, Jacques 20%. [ANT]

“Morphing and Shape Adaptable Aircraft Control, Integration, and Flight Test.” Sponsor: AFRL/RQ. Funding: \$39,127 - Leishman 80%, Jacques 20%. [ANT]

“Morphing and Shape Adaptable Aircraft Control, Integration, and Flight Test.” Sponsor: AFRL/RQ. Funding: \$85,933 - Leishman 80%, Jacques 20%. [ANT]

“Real-Time Path Planning in Constrained, Uncertain Environments.” Sponsor: AFRL/RQ. Funding: \$150,000. [ANT]

“Scorpion Suite Development and Support.” Sponsor: USA/ISR. Funding: \$225,000 - Leishman 50%, Taylor 50%. [ANT]

“Scorpion Support for AgilePod Flight Test.” Sponsor: AFRL/RQ. Funding: \$200,000. [ANT]

### **Other Significant Research Productivity**

Led the development of several new sponsored research endeavors as the new ANT Center Director.

Assumed primary faculty responsibility for GNC-focused DL degree program.

Assumed PI responsibility on 10 sponsored research projects.

Assumed Advisor responsibility for one additional MS thesis research student in addition to three previously assigned students.

### **LIEVSAY, JAMES R., Maj**

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2017 (AFIT/ENG); BSEE, United States Air Force Academy, 2006; MSEE, Air Force Institute of Technology, 2011; PhD, Electrical Engineering, University of Oklahoma, 2017. Maj Lievsay’s research interests include radar and array signal processing. AFIT research center affiliation(s): ANT and CTISR. Tel. 937-255-3636 x3369, Email: [James.Lievsay@afit.edu](mailto:James.Lievsay@afit.edu)

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

B.H. Gessel and J.R. Lievsay, "Three-Dimensional Emitter Selection Optimization for Passive GMTI," *2019 IEEE Radar Conference (RadarConf)*, Boston, MA, USA, Apr 2019, pp. 1-6.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

F.D. Taylor, and J.R. Lievsay, "LTE Bandwidth and Modulation Scheme Effects on Passive Bistatic Radar," *2018 52nd Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Oct, 2018, pp. 916-919.

### **LIN, ALAN C., Maj**

Adjunct Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BSCE, Rutgers University, 2004; MSCS, Air Force Institute of Technology, 2008; PhD, Computer Science, Air Force Institute of Technology, 2015. Maj Lin’s research interests include cyber security and education, serious gaming and gamification, data mining, space systems, and software engineering. He is a member of Tau Beta Pi. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4757, Email: [Alan.Lin@afit.edu](mailto:Alan.Lin@afit.edu)

**MARTIN, RICHARD K.**

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2004 (AFIT/ENG); BS, Electrical Engineering and Physics, University of Maryland, 1999; MS, Electrical Engineering, Cornell University, 2001; PhD, Electrical Engineering, Cornell University, 2004. Dr. Martin's research interests include source localization, radio tomographic imaging, 3D laser radar imaging, and engineering education. AFIT research center affiliation(s): ANT and CCR. Tel. 937-255-3636 x4625, Email: [Richard.Martin@afit.edu](mailto:Richard.Martin@afit.edu)

**Sponsor Funded Research Projects**

"Classification Methods and Passive Augmentation of Spectropolarimetric LADAR." Sponsor: AFRL/RW. Funding: \$67,543.

**Refereed Journal Publications**

Christian K. Keyser, Richard K. Martin, P. Khanh Nguyen, and Arielle M. Adams, "Single-Pulse Mueller Matrix LiDAR Polarimeter: Modeling and Demonstration," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 57, No. 6, pp. 3296-3307, June 2019.

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

J.R. Pennington and R.K. Martin, "Utilization of Inter-Block Interference in MIMO-OFDM Communication Systems," *Proc. IEEE Military Communications Conference (MILCOM)*, Los Angeles, CA, Oct 2018, 6 pages.

**Patents Awarded**

Richard K. Martin, "Methods for Radio Tomographic Image Formation," United States Patent 10,386,499 issued on 20 Aug 2019.

**MAYBECK, PETER S.**

Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1973 (AFIT/ENG); BS, Massachusetts Institute of Technology, 1968; PhD, Massachusetts Institute of Technology, 1972. Dr. Maybeck's research interests include optimal estimation and stochastic control Kalman filtering, adaptive estimation, pointing and tracking, optimally aided inertial navigation systems, and multiple model adaptive filtering. He is the author of the widely recognized three volume reference text, "Stochastic Models, Estimation and Control," and over 100 technical articles. Dr. Maybeck has received numerous national and local awards including the C. Holmes MacDonald Distinguished Young Electrical Engineering Teach and the ASEE Frederick Emmons Terman Award as the outstanding Electrical Engineering Professor in the US in 1985. He is a fellow of the IEEE. AFIT research center affiliation(s): CCR.

**MERKLE, LAURENCE D.**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BS, Computer and Systems Engineering, Rensselaer Polytechnic Institute, 1987; MSCE, Air Force Institute of Technology, 1992; PhD, Computer Engineering, Air Force Institute of Technology, 1996. Dr. Merkle's research interests include quantum computing, space situational awareness, computing education, computational science and engineering, evolutionary computation, serious games, and secure computing. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4526, Email: [Laurence.Merkle@afit.edu](mailto:Laurence.Merkle@afit.edu)

**Refereed Journal Publications**

C. Laxer, L.D. Merkle, and F. Young, "SIGCSE – Who We Are: A Brief History of Conference Registration and Demographics," *ACM Inroads*, Vol. 9, Issue 4 Dec 2018, pp. 53-54. <https://doi.org/10.1145/3231746>

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

T.B. Dontigney, and L.D. Merkle, "Comparison of Multi-Objective Optimization Algorithms for GEO Space Surveillance Network Architecture Design," *20th Annual Advanced Maui Optical and Space Surveillance Technologies Conference*, 2019.

L.A. Hsia, L.D. Merkle, G. Vernizzi, M.Y. Lanzerotti, and D. Langley, "Hardware Verification and Security for Quantum Computing Systems," *Government Microcircuit Applications & Critical Technology Conference*, 2019. [CCR]

Grimes, S. Bommer, and L.D. Merkle, "The New Faculty Orientation: Using Input for Better Outcomes," *38th Annual Original Lilly Conference on College Teaching*, May, 2019.

### **MILLAR, JEREMY R., Maj**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2017 (AFIT/ENG); BS, University of Tennessee, 2000; MS, Air Force Institute of Technology, 2009; PhD, Computer Science, Air Force Institute of Technology, 2017. Maj Millar's research interests include parallel and distributed systems, modeling and simulation, and software engineering. AFIT research center affiliation(s): CCR.

### **MILLS, ROBERT F.**

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2003 (AFIT/ENG); BS, Electrical Engineering, Montana State University, 1983; MS, Electrical Engineering, AFIT, 1987; PhD, Electrical Engineering, University of Kansas, 1994. Dr. Mills' research interests include electronic warfare, network security, and cyber resilience in weapon systems. He is a Senior Member of the IEEE, and is a member of the Eta Kappa Nu and Tau Beta Pi honor societies. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4527, Email: [Robert.Mills@afit.edu](mailto:Robert.Mills@afit.edu)

### **Sponsor Funded Research Projects**

"RF-EW Systems Support." Sponsor: AFRL/RV. Funding: \$40,000. [CCR]

### **Refereed Journal Publications**

Okolica, J.S., Peterson, G.L., Mills, R.F., and Grimaila, M.R., "Sequence Pattern Mining with Variables," *IEEE Transactions on Knowledge and Data Engineering*, pp 1-13, DOI: 10.1109/TKDE.2018.2881675, 20 Nov 2018.

Span, M., Mailloux, L.O., Mills, R.F., and Young, W., "Conceptual Systems Security Requirements Analysis: Aerial Refueling Case Study," *IEEE Access*, pp 1-15. DOI: 10.1109/ACCESS.2018.2865736. [CCR]

### **Conference Papers Accepted on the Basis of Full Paper Review**

Mailloux, L.O., Span, M., Mills, R.F., and Young, W., "A Top Down Approach for Eliciting Systems Security Requirements for a Notional Satellite System," *IEEE International Systems Conference*, pp 1-7, April 2019.

Burfeind, B., Mills, R.F., Nykl, S.L., Betances, J.A., and Sielski, C., "Confidential ADS-B: A Lightweight, Interoperable Approach," *IEEE Aerospace Conference*, March 2019. [CCR]

### **Books and Chapters in Books**

Wolfe, C.L., Graham, S.R., Mills, R.F., Nykl, S.L., and Simon, P., "Securing Data in Power-Limited Sensor Networks Using Two-Channel Communications." In: Staggs, J., and Sheno, S., (eds) *Critical Infrastructure Protection XII*, IFIP Advances in Information and Communication Technology, Vol. 542, Springer, Cham, pp 81-90, Dec 2018. [CCR]

## **MULLINS, BARRY E.**

Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2004 (AFIT/ENG); BS, Computer Engineering, University of Evansville, 1983; MS, Computer Engineering, Air Force Institute of Technology, 1987; PhD, Electrical Engineering, Virginia Polytechnic Institute and State University, 1997. Dr. Mullins' research interests include cyber-physical systems security, cyber operations, critical infrastructure protection, computer/network/embedded systems security, and reverse code engineering. Dr. Mullins is a member of Tau Beta Pi, Eta Kappa Nu, American Society for Engineering Education, and a Senior Member of IEEE. He is the recipient of the 2010 IEEE Eta Kappa Nu C. Holmes MacDonald Outstanding Teaching Award. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x7979, Email: [Barry.Mullins@afit.edu](mailto:Barry.Mullins@afit.edu)

### **Refereed Journal Publications**

S.M. Beyer, B.E. Mullins, S.R. Graham, and J.M. Bindewald, "Pattern-of-Life Modeling in Smart Homes," *IEEE Internet of Things Journal*, Vol. 5, No. 6, December 2018, DOI: 10.1109/JIOT.2018.2840451, pp. 5317-5325. [CCR]

C.W. Badenhop, S.R. Graham, B.E. Mullins, and L.O. Mailloux, "Looking Under the Hood of Z-Wave: Volatile Memory Introspection for the ZW0301 Transceiver," *ACM Transactions on Cyber-Physical Systems*, Vol. 3, No. 2, December 2018, Article 20 (pp. 20:1-20:24). [CCR]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Y. Park, R. Dill, and B.E. Mullins, "IoTAMU: Protecting Smart Home Networks via Obfuscation and Encryption," *SECURWARE 2019 The Thirteenth International Conference on Emerging Security Information, Systems and Technologies*, 27-31 October 2019, Nice, France, pp. 101-106. [CCR]

Y. Park, M.G. Reith, and B.E. Mullins, "Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities," *18th European Conference on Cyber Warfare and Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal, pp. 346-353. [CCR]

L.A. Cintron, S.R. Graham, D.D. Hodson, and B.E. Mullins, "Distributed-Ledger Based Event Attestation for Intelligent Transportation Systems," *14th International Conference on Cyber Warfare and Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, South Africa, pp. 565-573. [CCR]

### **Books and Chapters in Books**

L. Bradford, B.E. Mullins, S.J. Dunlap, and T. Lacey, "Variable Speed Simulation for Accelerated Industrial Control System Cyber Training," *Critical Infrastructure Protection XII*, J. Staggs and S. Sheno, eds., Springer, New York, NY, December 2018, pp. 283-306. [CCR]

### **Patents Awarded**

B.W. Ramsey and B.E. Mullins, "Wireless Intrusion Detection and Device Fingerprinting through Preamble Manipulation," Issued 23 October 2018. US Patent No. 10,111,094. [CCR]

### **Other Significant Research Productivity**

B.C. Stone, S.R. Graham, B.E. Mullins, and C.M. Schubert Kabban, "Reverse Engineering 17+ Cars in Less Than 10 Minutes," *DEFCON 27*, Las Vegas NV, 10 Aug 19. [CCR]

**NOEL, GEORGE E.**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2019 (AFIT/ENG); BS, Computer Science, U.S. Air Force Academy, Colorado Springs, CO, 1998; MS, Information Resource Management, Air Force Institute of Technology, 2002; PhD, Computer Science, Air Force Institute of Technology, 2013. Dr. Noel's research interests include natural language processing, topic models, ontology learning, neural networks, machine learning, and big data. Tel. 937-255-3636 x4613, Email: [George.Noel@afit.edu](mailto:George.Noel@afit.edu)

**NYKL, SCOTT L.**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BS, Software Engineering, University of Wisconsin-Platteville, 2006; MS, Computer Science, Ohio University, 2012; PhD, Computer Science, Ohio University, 2013. Dr. Nykl's research interests include computer graphics, interactive 3D graphics, level of detail, image-based rendering, GPGPU programming/parallel computation, distributed real time visualizations, computer vision, computational geometry, sensor fusion, linear algebra, numerical analysis, Synthetic Vision (SVS), Augmented Reality (AR) Parallel/Concurrent Programming, Multi-Core/Multi-Threading, algorithms, big data, and networking, and data structures. AFIT research center affiliation(s): ANT and CCR. Tel. 937-255-3636 x4395, Email: [Scott.Nykl@afit.edu](mailto:Scott.Nykl@afit.edu)

**Sponsor Funded Research Projects**

“Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3.” Sponsor: AFRL/RQ. Funding: \$100,000. [ANT]

“Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3.” Sponsor: AFRL/RQ. Funding: \$50,000. [ANT]

**Refereed Journal Publications**

J. Roeber, S.L. Nykl, and S.R. Graham, “Assessment of Structure from Motion for Reconnaissance Augmentation and Bandwidth Usage Reduction,” *Journal of Defense Modeling and Simulation*, Vol. 1, No.1, pp. 1–13, Apr 2019. <https://doi.org/10.1177/1548512919844021> [ANT]

C. Parsons, Z. Paulson, S.L. Nykl, W. Dallman, B.G. Woolley, and J. Pecarina, “Analysis of Simulated Imagery for Real-Time Vision-Based Automated Aerial Refueling,” *AIAA: Journal of Aerospace Information Systems*, Vol. 16, No. 3, pp. 77–93, Jan 2019. <https://doi.org/10.2514/1.I010658> [ANT]

Z. Paulson, S.L. Nykl, J. Pecarina, and B. Woolley, “Mitigating the Effects of Boom Occlusion on Automated Aerial Refueling Through Shadow Volumes,” *The Journal of Defense Modeling and Simulation*, Vol. 16, No. 2, pp. 175–189, 018. <https://doi.org/10.1177/1548512918808408> [ANT]

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J. Anderson, S.L. Nykl, and T. Wishgoll, “Augmenting Flight Imagery from Aerial Refueling with a Virtual Boom to Test Occlusion,” *Advances in Visual Computing: 12th International Symposium, ISVC*, Lake Tahoe, UT, USA, 7-9 October, 2019, Proceedings, ser. Lecture Notes in Computer Science, G. Bebis, Ed. Springer International Publishing, 2019, Vol. 10073, pp. 605–615.

J.A. Vagedes, D.D. Hodson, S.L. Nykl, and J.R. Millar, “ECS Architecture for Modern Military Simulators,” *Proceedings of the International Conference on Scientific Computing (CSC)*. The Steering Committee of the World Congress in Computer Science, 2019, pp. 118–122. [ANT]

B. Burfeind, R.F. Mills, S.L. Nykl, J. Betances, and C. Sielski, “Confidential ADS-B: A Lightweight, Interoperable Approach,” *IEEE Aerospace Conference*, Big Sky, Montana, 2019. [ANT] [CCR]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

- Lee and S.L. Nykl, "Biologically Inspired Machine Learning to Improve Automated Aerial Refueling Algorithms," *Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC)*, ser. ION JNC '19. Long Beach, CA, USA: Institute of Navigation, July 2019. [ANT]
- B. French, and S.L. Nykl, "Determining Virtually Simulated Aerial Refueling Fidelity Using Physically Collected Stereo Vision Images and DGPS-based Truth Data," *Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC)*, ser. ION JNC '19. Long Beach, CA, USA: Institute of Navigation, July 2019.
- M. Crowl, and S.L. Nykl, "Use of LIDAR in Automated Aerial Refueling (AAR): An Improvement over the Existing Stereo Vision System," *Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC)*, ser. ION JNC '19. Long Beach, CA, USA: Institute of Navigation, July 2019. [ANT]

### **Books and Chapters in Books**

- K. Bentjen, S.R. Graham, S.L. Nykl, and P. Simon, "Introducing Persistent Human Control into a Reservation-Based Autonomous Intersection Protocol," *Critical Infrastructure Protection XII*, J. Staggs and S. Sheno, Eds. New York City: Springer, Feb 2019. ISBN: 978-3-030-04537-1 [CCR]
- C.L. Wolfe, S.R. Graham, R.F. Mills, and S.L. Nykl, "Securing Data-in-Transit for Power-Limited Sensor Networks Using Two-Channel Communication," *Critical Infrastructure Protection XII*, J. Staggs and S. Sheno, Eds. New York City: Springer, Feb 2019. ISBN: 978-3-030-04537-1 [CCR]

### **Patent Applications**

- S.L. Nykl, B. Woolley, and J. Pecarina, "Stereo Vision Relative Navigation of Airborne Vehicles," U.S. Patent Pending 62/886,550, August, 2019. [ANT]

### **PACHTER, MEIR**

Professor, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1993 (AFIT/ENG); BS, Israel Institute of Technology, 1967; MS, Israel Institute of Technology, 1969; PhD, Israel Institute of Technology, 1975. Dr. Pachter's fields of expertise include automatic control of aircraft and missiles, adaptive control and system identification, inertial and GPS navigation, autonomous control/neural networks/fuzzy logic control, nonlinear control, and applied mathematics. Dr. Pachter has published papers in these areas and in differential games, robotics, and theory of computational geometry. Dr. Pachter is interested in the application of mathematics to the solution of engineering and scientific problems. His current areas of interest include military operations optimization, cooperative control, estimation and optimization, statistical signal processing, adaptive optics, inertial navigation, and GPS navigation. AFIT research center affiliation(s): ANT and CCR. Tel. 937-255-3636 x7247, Email:

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### **Sponsor Funded Research Projects**

"Cooperative Control." Sponsor: AFRL/RQ. Funding: \$40,000. [ANT]

"Dynamics and Control in Adversarial and Stochastic Environments." Sponsor: AFOSR. Funding: \$48,600.

### **Refereed Journal Publications**

- M. Pachter, E. Garcia, and D. Casbeer, "Toward a Solution of the Active Target Defense Differential Game," *Dynamic Games and Applications*, Vol. 9, No. 1, pp. 165-2016, February 2019. [ANT] [CCR]
- E. Garcia, D. Casbeer, and M. Pachter, "Design and Analysis of State Feedback Optimal Strategies for the Differential Game of Active Defense," *IEEE Trans. on Automatic Control*, Vol. 64, No. 2, pp. 553-568, February 2019. [ANT] [CCR]

- M. Pachter, and S. Coats, "The Classical Homicidal Chauffeur Differential Game," DOI 10.10007/s13235-018-0264-8, *Dynamic Games and Applications*, March 2019. [ANT] [CCR]
- M. Pachter, A. Von Moll, E. Garcia, and D. Casbeer, "Two-on-One Pursuit," *AIAA Journal of Guidance*, Vol. 42, No. 7, July 2019. [ANT] [CCR]
- M. Pachter, and P. Wasz, "On a Two Cutters and Fugitive Ship Differential Game," *IEEE Control Systems Society Letters*, Vol. 3, No. 4, October 2019. [ANT] [CCR]
- Von Moll, A., D. Casbeer, E. Garcia, D. Milutinovic, and M. Pachter, "The Multi-Pursuer, Single-Evader Game-A Geometric Approach," *Journal of Intelligent & Robotic Systems*, 1 March 2019. [ANT] [CCR]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

- Eloy Garcia, David Casbeer, and Meir Pachter, "Cooperative Two-Pursuer One-Evader Blocking Differential Game," *American Control Conference*, pp.2702-2709, Philadelphia, PA, 10-12 July 2019. [ANT] [CCR]
- Patrick Wasz, Meir Pachter, and Khanh Pham, "Two-On-One Pursuit with a Non-Zero Capture Radius," *Mediterranean Control Conference*, Akko, Israel, 1-4 July, 2019. [ANT] [CCR]
- Meir Pachter, Eloy Garcia, Roger Anderson, and David Casbeer, "Maximizing the Target's Longevity in the Active Target Defense Differential Game," *European Control Conference*, Naples, Italy, 24-28, 2019. [ANT] [CCR]
- Meir Pachter, Alexander Von Moll, Eloy Garcia, David Casbeer, and Dejan Milutinovic, "Singular Trajectories in the Two Pursuers One Evader Differential Game," *ICUAS*, pp. 1153-1160, Atlanta, GA, 11-14 June, 2019. [ANT] [CCR]
- Meir Pachter, Eloy Garcia, and David Casbeer, "Linear-Quadratic Formulation of the Target Defense Differential Game," *ICUAS*, pp.1069-1075, Atlanta, GA, 11-14 June, 2019. [ANT] [CCR]
- R. Anderson, M. Pachter, and R. Murphey, "Defender Assisted Evasion Maneuvers," *Proceedings of the 59th Israel Annual Conference on Aerospace Sciences*, Tel Aviv and Haifa, 6-7 March 2019. [ANT] [CCR]
- S. Jackson, A. Palazotto, M. Pachter, and N. Niedbalski, "Control of Vapor Compression Cycles Under Transient Thermal Loads," *AIAA SciTech Forum*, 7-11 January 2019, San Diego, CA. [ANT]
- E. Garcia, D. Casbeer, and M. Pachter, "The Capture-the-Flag Differential Game," *Conference on Decision and Control*, Miami Beach, FL, pp. 4167-4172, 17-19 December, 2018, pp. 4167-4172. [ANT] [CCR]

### **PETERSON, GILBERT L.**

Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2002 (AFIT/ENG); BS, Architecture University of Texas at Arlington, 1995; MS, Computer Science, University of Texas at Arlington, 1998; PhD, University of Texas at Arlington, 2001. Dr. Peterson's research interests include uncertainty in artificial intelligence, robotics, machine learning, and digital forensics. AFIT research center affiliation(s): ANT and CCR. Tel. 937-255-6565 x4281, Email: [Gilbert.Peterson@afit.edu](mailto:Gilbert.Peterson@afit.edu)

### **Sponsor Funded Research Projects**

- "Autonomy Capability Design and Development." Sponsor: 711 HPW. Funding: \$250,000. [CCR]
- "SensorRE - Analytic Provenance System for Software Reverse Engineering." Sponsor: AFRL/RI. Funding: \$25,000. [CCR]

### **Refereed Journal Publications**

- Okolica, J.S., Peterson, G.L., Mills, R.F., and Grimaila, M.R., "Sequence Pattern Mining with Variables," *IEEE Transactions on Knowledge and Data Engineering*, DOI: 10.1109/TKDE.2018.2881675

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

King, D.W., and Peterson, G.L., “A Macro-Level Order Metric for Self-Organizing Adaptive Systems,” *IEE 12th International Conference on Self-Adaptive and Self-Organizing Systems*, 2018, pp. 60-69. DOI: 10.1109/SASO.2018.00017 [ANT] [CCR]

King, D.W., L. Esterle, and Peterson, G.L., “Entropy-Based Team Self-Organization with Signal Suppression,” *Proceedings of the Artificial Life Conference 2019*. 2019, DOI: 10.1162/isal\_a\_00154 [ANT] [CCR]

Knapp, J.S., and Peterson, G.L., “Natural Evolution Speciation for NEAT,” *IEEE Congress on Evolutionary Computation*, 2019, pp. 1487-1493. DOI: 10.1109/CEC.2019.8790153

### **Books and Chapters in Books**

G. Peterson, and S. Sheno (Eds.) *Advances in Digital Forensics XV*, Springer, Nature Switzerland AG, 2019. [CCR]

### **Editorships in Professional Journals**

Associate Editor, *International Journal of Critical Infrastructure Protection*. [CCR]

### **Invention Disclosures**

Vambrace, Software License for Digital Forensics Abstraction Interface, October 2019. [CCR]

### **Other Significant Research Productivity**

King, D.W., and Peterson, G.L., “A Macro-Level Order Metric for Self-Organizing Adaptive Systems,” *12th IEEE International Conference on Self-Adaptive and Self-Organizing Systems*, Trento, Italy, September 2018.

### **PIERCE, SCOTT J., Lt Col**

Deputy Head, Department of Electrical and Computer Engineering, Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2014 (AFIT/ENG); BS, Electrical Engineering, Brigham Young University, 2002; MSEE, Air Force Institute of Technology, 2008; PhD, Air Force Institute of Technology, 2015. Maj Pierce’s research interests include image-aided navigation, autonomous control, cooperative navigation, sensor fusion, and flight path optimization. He is a member of ION and IEEE.

### **PYATI, VITTAL P.**

Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1983 (AFIT/ENG); BE, University of Madras, India, 1953; MSE, Marquette University, 1962; PhD, Electrical Engineering, University of Michigan, 1966. Dr. Pyati’s fields of expertise include electromagnetics, radar, low observables, and electronic ware. Dr. Pyati has authored more than 40 publications in journals and DOD conferences. He has been a consultant to various US Air Force organizations.

### **RAQUET, JOHN F.**

Adjunct Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1998 (AFIT/ENG); BS, US Air Force Academy, 1989; MS, Massachusetts Institute of Technology, 1991; PhD, University of Calgary, Canada, 1998. Dr. Raquet's areas of interest include Global Positioning System (GPS) precise positioning, non-GPS precision navigation, optically-aided navigation, navigation using signals of opportunity, integration of MEMS-based inertial measurement units with other sensors, autonomous vehicle navigation and control, and electromagnetic interference and mitigation techniques affecting GPS performance.

### **Sponsor Funded Research Projects**

“Alternative Sensors for Non-GPS Navigation.” Sponsor: Draper Laboratory. Funding: \$20,000. [ANT]

“ANT Center and Laboratory Support per MOA between AFIT and AFRL.” Sponsor: AFRL/R.Y. Funding: \$200,000 - Raquet 50%, Pierce 50%. [ANT]

“Multi-Sensor Navigation Demonstration.” Sponsor: USA CERDEC. Funding: \$300,000. [ANT]

“PNT-Focused Distance Learning Electrical Engineering Master's Degree.” Sponsor: AFRL/R.Y. Funding: \$100,000 - Raquet 25%, Canciani 25%, Leishman 25%, Gunawardena 25%. [ANT]

“PNT-Focused Distance Learning Electrical Engineering Master's Degree.” Sponsor: AFRL/R.Y. Funding: \$86,618 - Raquet 25%, Canciani 25%, Leishman 25%, Gunawardena 25%. [ANT]

“Scorpion Suite Development and Support.” Sponsor: USA CERDEC. Funding: \$225,000 - Leishman 50%, Taylor 50%. [ANT]

“Support for PNT Modeling and Simulation.” Sponsor: USA CERDEC. Funding: \$100,000. [ANT]

### **REITH, MARK G.**

Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BS, Computer Science, University of Portland, 1999, MSCS, Air Force Institute of Technology, 2003; PhD, Computer Science, University of Texas at San Antonio, 2009. Lt Col Reith's research interests include cyber warfare theory and operation, software engineering, and software security and exploitation. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4603, Email: [Mark.Reith@afit.edu](mailto:Mark.Reith@afit.edu)

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Park, Y., Reith, M. and Mullins, B. “Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities,” *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal, pp. 346-353. [CCR]

Newlin, M., Reith, M. and DeYoung, M. “Synthetic Data Generation with Machine Learning for Network Intrusion Detection Systems,” *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal. [CCR]

Dukarm, C., Dill, M. and Reith, M. “Improving Phishing Awareness in the United States Department of Defense,” *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal. [CCR]

Flack, N. and Reith. “Self-Directed Learning Tools in USAF Multi-Domain Operations Education,” *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal. [CCR]

Tomcho, L., Reith, M., Long, D., Coggins, M. and Lin, A. “Applying Game Elements to Cyber eLearning,” *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa. [CCR]

Martin, S. and Reith, M. “Rethinking USAF Cyber Education and Training,” *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa. [CCR]

Pendleton, A. and Reith, M. “Quantifying Cyber Vulnerability Risk in Acquisitions,” *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa. [CCR]

Dillon, P. and Reith M. "Building Irrefutable Trust throughout Computer Networks using Blockchains," *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa. [CCR]

#### **SWEENEY, PATRICK J., Lt Col**

Assistant Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BSCpE, Clarkson University, 1999; MS, Air Force Institute of Technology, 2005; PhD, Computer Engineering, Thayer School of Engineering at Dartmouth College, 2014. Lt Col Sweeney's research interests include cybersecurity of commercial and military embedded systems, next-generation avionics, and reverse engineering. He is a member of Eta Kappa Nu honor society. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4757, Email: [Patrick.Sweeney@afit.edu](mailto:Patrick.Sweeney@afit.edu)

#### **Sponsor Funded Research Projects**

"Research Supporting Weapon System Cyber Resiliency." Sponsor: AFRL/R.Y. Funding: \$24,975 - Sweeney 50%, Graham 50%. [CCR]

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Schmitt, D.J., Graham, S.R., Sweeney, P.J., Mills, R.F., "A Cyber Vulnerability Assessment of Infiniband Networking," *13th International Conference on Critical Infrastructure Protection*, Mar 2019. [CCR]

#### **Patent Applications**

Reber, P.E., Graham, S.R., Sweeney, P.J., and Stephensen, M.M., "Active Attestation of Embedded Systems," Filed 14 Jan 2019 via AFMC (Based on Provisional patent 62/635204 titled "Runtime Attestation of Embedded Systems," filed previously on 26 Feb 2018). [CCR]

#### **TEMPLE, MICHAEL A.**

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1996 (AFIT/ENG); BSE, Southern Illinois University, 1985; MSE, Southern Illinois University, 1986; PhD, Air Force Institute of Technology, 1993. Dr. Temple's research interests include the exploitation of signal (wired, wireless, intentional, unintentional, etc.) Distinct Native Attribute (DNA) features to improve device hardware and/or operation discrimination. This includes application to Radio Frequency (RF-DNA), Wired Signal (WS-DNA), and Correlation Based (CB-DNA) Fingerprinting methods that exploit inherent physical features to enhance authentication of hardware bit-level identities and the operational state of selected devices. Sponsored research activity, as adopted by and/or transitioned to Air Force, Department of Defense, and national agencies as provided approximately \$1M annually in R&D Technology benefit. Senior member of IEEE since Jan 2002. AFIT research center affiliation(s): ANT, CSRA and CCR. Tel. 937-255-3636 x4279, Email: [Michael.Temple@afit.edu](mailto:Michael.Temple@afit.edu)

#### **Sponsor Funded Research Projects**

"RF-EW Systems Support." Sponsor: AFRL/R.Y. Funding: \$35,000 [CCR]

#### **Refereed Journal Publications**

T.J. Bihl, T.J. Paciencia, K.W. Bauer, and M.A. Temple, "Cyber-Physical Security with RF Fingerprint Classification Through Distance Measure Extensions of Generalized Relevance Learning Vector Quantization," *Jour of Security and Communication Networks*, Wiley, Sep 2019. [CCR]

B.J. Voetberg, M.A. Temple, T.J. Carbino, P.R. Buskohl, N.R. Glavis, and J.R. Deneault, "Using Active DNA Fingerprinting to Discriminate AJP Conductive Ink Elements Embedded in Integrated Circuits," *Jour of DOD Rsrch & Engr*, Vol. No. 2, Special Edition, pp. 2-12, Aug 2019. [CCR]

A.J. Paul, P.J. Collins, and M.A. Temple, "Enhancing Microwave System Health Assessment Using Artificial Neural Networks," *IEEE Antennas and Wireless Propagation Letters*, DOI: 10.1109/LAWP.2019.2926932, Jul 2019.

C.M. Rondau, M.A. Temple, and J. Lopez, "Industrial IoT Cross-Layer Forensic Investigation", Wiley Interdisciplinary Reviews (WIREs), *Forensic Science*, Vol. 1, No. 1, Dec 2019. <https://doi.org/10.1002/wfs2.1322>,

A.J. Paul, P.J. Collins, and M.A. Temple, "Nondestructive Evaluation of RF Connector Continuity Using Stimulated Emissions," *ASME Jour of Nondestructive Evaluation*, Vol. 2, No. 1, Dec, 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

C.M. Rondeau, M.A. Temple, and C.K Schubert-Kabban, "TD-DNA Feature Selection for Discriminating WirelessHART IIoT Devices," Proc of the 52nd Hawaii Int'l Conf on System Sciences, pp. 6387-6396, Jan 2019. [CCR]

### **Patent Applications**

C.M. Rondeau, M.A. Temple, J. Lopez, J.A. Betances, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," AFD-1967P, SN 62/856,784, 4 Jun: 2019. [CCR]

### **TERZUOLI, ANDREW J., Jr.**

Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT  
Appointment Date: 1982 (AFIT/ENG); BS, Electrical Engineering, Polytechnic Institute of Brooklyn, 1969; MS, Electrical Engineering, Massachusetts Institute of Technology, 1970; PhD, Electrical Engineering, The Ohio State University, 1982. Dr. Terzuoli's research areas have included Antennas and Electromagnetics; Computer Model Based Studies; Application of Parallel Computation, VLSI Technology, and RISC Architecture to Numerical and Transform Methods; Remote Sensing and Communication; Passive RF Sensing; Wave Scattering, Radar Cross Section, and Stealth (LO/CLO) Technology; Machine Vision and Image Processing; and Automated Object Recognition. He has published numerous reports and articles in journals and conference proceedings in these and related areas. His research is funded by various agencies including AFRL and NASIC. Prior to joining AFIT in 1982, Dr. Terzuoli was a research associate at the ElectroScience laboratory at The Ohio State University and was a member of the technical staff at the Bell Telephone Laboratories in New Jersey. He is an active officer of IEEE and a fellow of the Electromagnetics Academy. AFIT research center affiliation(s): CDE and CSRA. Tel. 937-255-3636 x4717, Email: [Andrew.Terzuoli@afit.edu](mailto:Andrew.Terzuoli@afit.edu)

### **Sponsor Funded Research Projects**

"Nuclear Command, Control and Communications." Sponsor: AFRL/RI. Funding: \$400,000.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Andrew Knisely and Andrew Terzuoli, "Numerical Modeling of the Parabolic Wave Equation in Lossless and Lossy Media," *Proceedings of the 41st Progress in Electromagnetics Research Symposium*, Rome, Italy, 17-20 June 2019.

Andrew Knisely and Andrew Terzuoli, "Numerical Dispersion Reduction in the Parabolic Wave Equation," *Proceedings of the International Conference on Electromagnetics in Advanced Applications*, Granada, SP, 9-13 Sept 2019.

## **5.4 DEPARTMENT OF MATHEMATICS AND STATISTICS**

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#### **5.4.1 DOCTORAL DISSERTATIONS**

ANDERSON, TIMOTHY, Statistical L-Moment and L-Moment Ratio Estimation and Their Applicability in Network Analysis. AFIT-ENC-DS-19-S-001. Faculty Advisor: Dr. Christine M. Schubert Kabban. Sponsor: 711 HPW/RHCML.

LOPEZ, JENNIFER, Sample Size Requirements and Considerations for Models to Assess Human-Machine System Performance. AFIT-ENC-DS-19-S-003. Faculty Advisor: Dr. Christine M. Schubert Kabban. Sponsor: 711HPW/RH.

SEIDERS, MATTHEW, Dimension-Breaking for Traveling Waves in Interfacial Flows. AFIT-ENC-DS-19-S-002. Faculty Advisor: Dr. Benjamin F. Akers. Sponsor: N/A.

TURNER, JONATHAN, An Efficient Search-Based Algorithm. AFIT-ENC-DS-19-J-074. Faculty Advisor: Lt Col Andrew J. Geyer. Sponsor: N/A.

#### **5.4.2 MASTER'S THESES**

LIN, KEVIN, Piezoelectric Sensor Crack Detection on Airframe Systems. AFIT-ENC-MS-19-M-001. Faculty Advisor: Capt Richard P. Uber. Sponsor: AFOSR.

PAMILAGAS, KEVIN, Analyzing a Method to Determine the Utility of Adding a Classification System to a Sequence for Improved Accuracy. AFIT-ENC-MS-19-M-002. Faculty Advisor: Dr. Christine Schubert Kabban. Sponsor: N/A.

SANDERSON, DAWN, Modeling the Distribution of Lightning Strike Distances Outside a Preexisting Lightning Area. AFIT-ENC-MS-19-M-003. Faculty Advisor: Dr. Edward D. White. Sponsor: 45 WS.

SCHMITT, COURTNEY, Harmonic Equiangular Tight Frames Comprised of Regular Simplices. AFIT-ENC-MS-19-M-004. Faculty Advisor: Dr. Matthew C. Fickus. Sponsor: N/A.

### 5.4.3 FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

#### **AKERS, BENJAMIN F.**

Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2011(AFIT/ENC); BS, Pennsylvania State University, 2003; MA, University of Wisconsin - Madison, 2005; PhD, University of Wisconsin-Madison, 2008. Dr. Akers' research interests include nonlinear waves, applied mathematics, fluid mechanics, and numerical analysis. Dr. Akers' current research considers the stability and existence of traveling water waves, as well as the fluid flows induced by high energy lasers. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4522, Email: [Benjamin.Akers@afit.edu](mailto:Benjamin.Akers@afit.edu)

#### **Sponsor Funded Research Projects**

"Applications of Radial Basis Functions." Sponsor: AFOSR. Funding: \$34,763 - Akers 50%, Reeger 50%. [CDE]

#### **Refereed Journal Publications**

Gustafsson, J., Akers, B.F., Reeger, J.A., and Sritharan, S.S., "Atmospheric Propagation of High Energy Lasers," *Engineering Mathematics Letters*, Vol. 7, pp. 1-14, 2019. [CDE]

Akers, B.F., and Reeger, J.A., "Numerical Simulation of Thermal Blooming with Laser-Induced Convection," *Journal of Electromagnetic Waves and Applications*, Vol. 33, No. 1, pp. 96-106, 2019. [CDE]

Akers, B.F., Ambrose, D.M., and Sulon, D.W., "Periodic Hydroelastic Waves With or Without Mass II: Multiple Bifurcations and Ripples," *European Journal of Applied Mathematics*, Vol. 30, No. 4, pp. 756-790, Aug 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Morrill, D., and Akers, B., "High Energy Laser Propagation: Modelling Scintillation Effects," *Imaging and Applied Optics*, PW1D.4, 2019. [CDE]

#### **Other Significant Research Productivity**

Akers, B., "Wave Optics Modeling and Simulation for HEL Propagation," UCF/TISTEF, Merritt Island, FL, Dec 2018. [CDE]

Akers, B., "Asymptotics and Numerics for Modulational Instabilities of Traveling Waves," Florida Institute of Technology, Melbourne, FL, Feb 2019.

Akers, B., "Asymptotics and Numerics for Modulational Instabilities of Traveling Waves," *IMACS: Nonlinear Waves Theory and Computation*, Athens, GA, Apr 2019.

Akers, B., "Wave Optics Modeling and Simulation for HEL Propagation," *ONR/DRDO Program Review*, Chitradurga, India, Jun 2019. [CDE]

#### **ANDERSON, TIMOTHY S., Maj**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BS, Midwestern State University, 2006; MA, University of Washington, 2011; PhD, Air Force Institute of Technology, 2019. Maj Andersons' research interests include L-moments, uncertainty estimation, and computational statistics. Maj Andersons' current research looks to maintain custody of satellite objects while decreasing required observations by implementing a sparse graphical representation of the multivariate volatility structure of correlated space objects. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4450, Email: [Timothy.Anderson@afit.edu](mailto:Timothy.Anderson@afit.edu)

**ARMSTRONG, ANDREW M., Maj**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2016 (AFIT/ENC); BS, Michigan Technological University, 2008; MS, Air Force Institute of Technology, 2010; MS, University of Texas at San Antonio, 2011; PhD, Air Force Institute of Technology, 2016. Maj Armstrong's research interests include wavelet analysis, astrostatistics, machine learning, big data, and computational statistics.

**BAKER, WILLIAM P.**

Associate Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1986 (AFIT/ENC); BA, University of California at Irvine, 1969; MA, University of California at Irvine, 1970; PhD, Northwestern University, 1987. Dr. Baker's research interests include asymptotic and perturbation methods, wave propagation and scattering theory, applied mathematics, functional analysis, low observables, and numerical analysis. Dr. Baker's current research focuses on thermal dynamics of high speed wear, vibrational dynamics of thermally loaded materials, and dynamics and control of satellite structures. Dr. Baker is a Master Navigator with prior military assignments in flight test, satellite communications, cruise missile, and radar analysis. Tel. 937-255-3636 x4517, Email: [William.Baker@afit.edu](mailto:William.Baker@afit.edu)

**Refereed Journal Publications**

Rutledge, J.L., and Baker, W.P., "Unsteady Effects on the Experimental Determination of Overall Effectiveness," *Journal of Turbomachinery*, Vol. 140, No. 12, 121005 (10 pages), Dec 2018.

Olsen, C., Kalyanam, K., Baker, W., and Kunz, D., "Maximal Distance Discounted & Weighted Revisit Period: A Utility Approach to Persistent Unmanned Surveillance," *Unmanned Systems*, Vol. 7, No. 4, pp. 215-232, May 2019.

DeLeon, A., Baker, W., and Palozotto, A., "Modeling a Nonlinear Melt Region as a Result of High-Speed Sliding," *Journal of Thermal Physics and Heat Transfer*, Vol. 33, No. 3, pp. 808-816, Jul-Sep 2019.

**BEMROSE, TRAVIS J., Maj**

Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2016 (AFIT/ENC); BS, University of Idaho, 2003; MS, University of Texas at San Antonio, 2012; PhD, University of Missouri-Columbia, 2016. Maj Bemrose's research interests include Hilbert space frame theory, compressive sensing, numerical methods, and modeling and simulation. His current research focuses on the Paulsen problem, adaptive-dictionary image reconstruction, and equiangular frames. Tel. 937-255-3636 x4619, Email: [Travis.Bemrose@afit.edu](mailto:Travis.Bemrose@afit.edu)

**BROOKS, ERIC L., Lt Col**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2018 (AFIT/ENC); BS, University of South Carolina-Aiken, 2001; MS, Rochester Institute of Technology, 2012; PhD, Air Force Institute of Technology, 2018. Lt Col Brooks' research interests include big data, machine learning statistical genetics, compressive sampling. In his current research, he addresses the high-dimensionality challenge associated with DNA data by leveraging concepts of compressive sampling for feature selection and dimensionality reduction. Tel. 937-255-3636 x4398, Email: [Eric.Brooks@afit.edu](mailto:Eric.Brooks@afit.edu)

**BULUTOGLU, DURSUN A.**

Associate Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2004 (AFIT/ENC); BS, University of Maryland at College Park, 1996; PhD, University of California, Berkeley, 2001. Dr. Bulutoglu's research interests include design of experiments and combinatorial problems in statistics. His papers focus on finding generalized minimum aberration (GMA) factorial designs by enumerating all non-isomorphic orthogonal arrays. The tools he uses for enumerating orthogonal arrays are integer programming, constraint programming, and isomorphism rejection. Tel. 937-255-3636 x4704, Email: [Dursun.Bulutoglu@afit.edu](mailto:Dursun.Bulutoglu@afit.edu)

**Sponsor Funded Research Projects**

"Improving Exact Algorithms for Finding Optimal Experimental Designs and Test Suites for Test and Evaluation."  
Sponsor: AFOSR. Funding: \$32,570.

### Refereed Journal Publications

Geyer, A.J., Bulutoglu, D.A., and Ryan, K J., "Finding the Symmetry Group of an LP with Equality Constraints and its Application to Classifying Orthogonal Arrays," *Discrete Optimization*, Vol. 32, pp. 93-119, May 2019.

Morales, L.B., Bulutoglu, D.A., and Arasu, K.T., "The Maximum Number of Columns in Supersaturated Designs with  $s_{\max} = 2$ ," *Journal of Combinatorial Designs*, Vol. 27, No. 7, pp. 448-472, Apr 2019.

### FICKUS, MATTHEW C.

Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2004 (AFIT/ENC); BS, University of Maryland, Baltimore County, 1995; MS, University of Maryland, Baltimore County, 1997; PhD, University of Maryland, College Park, 2001. Dr. Fickus' research interests include applied harmonic analysis, frame theory, and compressed sensing. Tel. 937-255-3636 x4513, Email: [Matthew.Fickus@afit.edu](mailto:Matthew.Fickus@afit.edu)

### Refereed Journal Publications

Fickus, M., Jasper, J., King, E.J., and Mixon, D.G., "Equiangular Tight Frames that Contain Regular Simplices," *Linear Algebra and its Applications*, Vol. 555, pp. 98-138, Oct 2018.

Fickus, M., and Jasper, J., "Equiangular Tight Frames from Group Divisible Designs," *Designs, Codes and Cryptography*, Vol. 87, No. 7, pp. 1673-1697, Jul 2019.

### Other Significant Research Productivity

Fickus, M. and Schmitt, C.A., "Harmonic Equiangular Tight Frames Comprised of Regular Simplices," *Approximation Theory 16*," *Minisymposium on Frames in High-Dimensional Signal and Data Processing*, Vanderbilt University, Nashville, TN, May 2019.

Fickus, M., and Schmitt, C.A., "Equi-Isoclinic Subspaces from Difference Sets," *International Conference on Sampling Theory and Applications*," *Special Session on Frame Theory*, University of Bordeaux, Bordeaux, France, Jul 2019.

Fickus, M., and Jasper, J., "Equiangular Tight Frames from Group Divisible Designs," *SIAM Conference on Applied Algebraic Geometry (AG19)*, *Minisymposium on Algebra, Geometry, and Combinatorics of Subspace Packings*, University of Bern, Bern, Switzerland, Jul 2019.

Fickus, M., "Finite Frames and Optimal Subspace Packings," *Jubilee of Fourier Analysis and Applications: A Conference Celebrating John Benedetto's 80th Birthday*, University of Maryland, College Park, MD, Sep 2019.

### GEYER, ANDREW J., Lt Col

Assistant Professor of Statistics and Deputy Head, Department of Mathematics and Statistics, AFIT Appointment Date: 2014 (AFIT/ENC); BS, North Dakota State University, 2000; MS, Air Force Institute of Technology, 2009; PhD, Air Force Institute of Technology, 2014. Lt Col Geyer's research interests include design of experiments, combinatorial optimization problems in statistics, statistical performance metrics, and statistical classification techniques. The tools he uses are integer programming, constraint programming, graph isomorphism rejection, and multivariate statistical analysis. Lt Col Geyer has served as a weather officer in F-16, AH-64, OH-58D, and CH-47 flying units, as well as in units supporting United States Army and Special Operations ground forces. Tel. 937-255-3636 x4584, Email: [Andrew.Geyer@afit.edu](mailto:Andrew.Geyer@afit.edu)

### Sponsor Funded Research Projects

"Environmental Modeling for Space Launch Support at Patrick AFB, FL." Sponsor: 45 WS. Funding: \$78,650 - Geyer 50%, White 40%, Nava 10%.

### **Refereed Journal Publications**

Geyer, A.J., Bulutoglu, D.A., and Ryan, K.J., “Finding the Symmetry Group of an LP with Equality Constraints and its Application to Classifying Orthogonal Arrays, *Discrete Optimization*, Vol. 32, pp. 93-119, May 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Haac, B.E., Nemirovsky, A., Teeter, W.A., Geyer, A.J., Cross, R.K., Stein, D.M., and Bafford, A.C., “Injury Characteristics and Outcomes of Patients with Inflammatory Bowel Disease after Trauma: A Propensity Score Matched Analysis,” *American Society of Colon and Rectal Surgeons 2019 Annual Scientific Meeting*, Cleveland, OH, Jun 2019.

Speranza, D.V. and Geyer, A.J., “Lightning Prediction at Cape Canaveral AFS, FL, via the Application of Deep Learning to Surface Observations and Field Mill Data,” *American Meteorological Society 99th Annual Meeting*, Phoenix, AZ, Jan 2019.

Sands, B.T. and Geyer, A.J., “Minimizing Fuel Usage in Long-Haul Aircraft with Optimized Flight Planning Using Ensemble Numerical Weather Prediction Models,” *American Meteorological Society 99th Annual Meeting*, Phoenix, AZ, Jan 2019.

### **HARTLAGE, ROBERT B., Lt Col**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BS, University of Louisville, 2002; MS Eng, Wright State University, 2004; MS, Air Force Institute of Technology, 2007; PhD, Air Force Institute of Technology, 2012. Lt Col Hartlage’s research interests include mathematical modeling of transportation systems, metaheuristics for quickly designing dynamic communication networks, and for solving network-type communication and transportation problems. Lt Col Hartlage’s current research uses biologically inspired metaheuristics to solve resource constrained, multi-modal transportation problems. Tel. 937-255-3636 x4630, Email: [Robert.Hartlage@afit.edu](mailto:Robert.Hartlage@afit.edu)

### **JORDAN, JEREMY D., Lt Col**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2016 (AFIT/ENC); BA, Aurora University, 2001; MS, Air Force Institute of Technology, 2007; PhD, Air Force Institute of Technology, 2012. Lt Col Jordan’s research interests include combinatorial optimization, decision analysis, network theory, and big data analysis. Lt Col Jordan has served as an operations research analyst for operational testing and human research, as well as an international program manager for the Air Force Office of Scientific Research (AFOSR). AFIT research center affiliation(s): COA. Tel. 937-255-3636 x4669, Email: [Jeremy.Jordan@us.af.mil](mailto:Jeremy.Jordan@us.af.mil)

### **Sponsor Funded Research Projects**

“Design of Networks in Uncertain Environment with Buffered Probability of Exceedance (bPOE) and Cardinality of Upper Average (CUA) Characteristics.” Sponsor: AFOSR. Funding: \$37,223.

“Latency Reduction for Autonomous Waveform Design in Congested Environments.” Sponsor: AFRL/RV. Funding: \$30,000 - Jordan 50%, Uber 50%.

### **Refereed Journal Publications**

Dillenburger, S.P., Jordan, J.D., and Cochran, J.K., “Pareto-Optimality for Lethality and Collateral Risk in the Airstrike Multi-Objective Problem,” *Journal of the Operational Research Society*, Vol. 70, No. 7, pp. 1051-1064, 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Jordan, J.D., Melouk, S.H., and Perry, M.B., “Temporal Updates with Decision Theory for Military Decision Making with Risk Considerations,” *Proceedings of the 2019 Western Decision Sciences Conference*, Paper #109, Mar 2019.

### **Other Significant Research Productivity**

Jordan, J.D., "Buffered Probability of Exceedance for Shortest Path Problems with Stochastic Arc Costs," *University of Florida, Workshop on Risk Management Approaches in Engineering Applications*, Gainesville, FL, Oct 2018.

Bihl, T., Steeneck, D., and Jordan, J.D., "Multivariate Stochastic Approximation versus Design of Experiments For Learning Vector Quantization Hyperparameter Tuning," *2018 INFORMS Conference*, Phoenix, AZ, Nov 2018.

### **LAIR, ALAN V.**

Professor of Mathematics and Head, Department of Mathematics and Statistics, AFIT Appointment Date: 1982 (AFIT/ENC); BA, North Texas State University, 1970; MS, Texas Tech University, 1972; PhD, Texas Tech University, 1976. Dr. Lair's research interests include parabolic and elliptic partial differential equations, functional analysis, applied mathematics, and nonlinear diffusion. He has published several papers on the properties of solutions of various nonlinear partial differential equations. Tel. 937-255-3636 x4519, Email: [Alan.Lair@afit.edu](mailto:Alan.Lair@afit.edu)

### **Refereed Journal Publications**

Lair, A.V., "Entire Large Solutions to Semilinear Elliptic Systems of Competitive Type," *Journal of Partial Differential Equations*, Vol. 32, No. 1, pp. 52-65, Mar 2019.

### **LIU, TONY, Capt**

Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BA, Rutgers University, 2012; MS, Air Force Institute of Technology, 2014; PhD, Arizona State University, 2019. Capt Liu's research interests include applied mathematics, approximation theory, and numerical analysis. Capt Liu's current research includes finding the optimal placement of sampling nodes for approximation methods. Tel. 937-255-3636 x4722, Email: [Tony.Liu@afit.edu](mailto:Tony.Liu@afit.edu)

### **MAGNUS, AMY L.**

Research Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2017 (AFIT/ENC); BSEE, Rochester Institute of Technology, 1990; MSEE, Air Force Institute of Technology, 1995; PhD, Air Force Institute of Technology, 2003. Dr. Magnus conducts research in distributed intelligence, i.e., the mature work that emerges from human computers teams. Her research combines multiple disciplines including information fusion, near and remote sensing, data analytics, constraint programming, and narrative analysis. Within these disciplines, Dr. Magnus works the seam between sensory organization and natural language processing translating signals to symbols and symbols into stories. Her contributions to artificial intelligence define the computational differences between training and learning; she designs and demonstrates studies where autonomy can be examined as an oscillating signal. AFIT research center affiliation(s): CCR and CSRA. Tel. 937-255-3636 x4454, Email: [Amy.Magnus@afit.edu](mailto:Amy.Magnus@afit.edu)

### **Sponsor Funded Research Projects**

"Distributed Intelligence and the Nature of Mature Work." Sponsor: AFOSR. Funding: \$149,917 - Magnus 90%, Oxley 10%. [CCR]

### **Other Significant Research Productivity**

Magnus, A.L., "Autonomy on the Arrogance Curve," *Presentation, 2018 STIx, Science Technology & Innovation Exchange*, Washington DC, Dec 2018.

Magnus, A.L., "Count by Six: Exercise Coping Skills as We Develop Number Sense," *Hands-On Demonstration, Ohio Educational Technology Conference*, Columbus, OH, Feb 2019.

Magnus, A.L., "Agency in the Classroom," *Technical Session, Ohio Educational Technology Conference*, Columbus, OH, Feb 2019.

Magnus, A.L., "Parallel Learning: Pathways to 3-Sigma Achievement," *Technical Session, Ohio Educational Technology Conference*, Columbus, OH, Feb 2019.

Foster, B., Magnus, A.L., and Lohstroh, C., "Symposium on Wayfinding to Fluency: Navigating Between Specialization and Generalization," *The 2019 IAFOR Conference on Educational Research and Innovation*, Blacksburg, VA, May 2019.

Magnus, A.L. and Berrier, J., "Gross Motor Mathematics: Wayfinding Our Way to Achievement," *2019 Tech and Trek Conference*, Hiram, OH, Jun 2019.

#### **MORRILL, DANA F., Maj**

Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2018 (AFIT/ENC); BS, Weber State University, 2005; MS, Air Force Institute of Technology, 2013; PhD, Air Force Institute of Technology, 2018. Maj Morrill's research interests include optical waves, applied mathematics, fluid mechanics, and numerical analysis. Maj Morrill's current research considers fluid flows induced by high energy lasers. AFIT research center affiliation(s): CDE. Tel. 937-255-3636 x4729, Email: [Dana.Morrill@afit.edu](mailto:Dana.Morrill@afit.edu)

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Morrill, D. and Akers, B., "High Energy Laser Propagation: Modelling Scintillation Effects," *Imaging and Applied Optics*, PW1D.4, May 2019. [CDE]

#### **NUNNALLY, BEAU A., Lt Col**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2018 (AFIT/ENC); BS, Virginia Polytechnic Institute and State University, 2004; MS, Air Force Institute of Technology, 2012; PhD, Air Force Institute of Technology, 2018. Lt Col Nunnally's research interests include classification, diagnostic testing, modeling and prediction, network analysis, regression, MANOVA, decision analysis, and decision support with multiple objectives. Lt Col Nunnally's current research is on inference in classification systems, sequential systems, and multiple-objective response surface methodology. Tel. 937-255-3636 x4394, Email: [Beau.Nunnally@afit.edu](mailto:Beau.Nunnally@afit.edu)

#### **OXLEY, MARK E.**

Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1987 (AFIT/ENC); BS, University of the Cumberland, 1978; MS, Purdue University, 1980; PhD, North Carolina State University, 1987. Dr. Oxley's research interests include partial differential equations, free and moving boundary value problems, finite-time extinction problems, functional analysis, optimization, artificial neural networks, wavelet analysis, classifier fusion, information fusion and evaluation of fusion techniques, receiver operating characteristic (ROC) curves, and ROC manifolds. AFIT research center affiliation(s): ANT and CTISR. Tel. 937-255-3636 x4515, Email: [Mark.Oxley@afit.edu](mailto:Mark.Oxley@afit.edu)

#### **Sponsor Funded Research Projects**

"Fusion in Exploitation of Sensing Technology." Sponsor: AFOSR. Funding: \$58,740 - Oxley 50%, Schubert Kabban 50%.

"The Mathematical Theory of Individual Exposure Health Risk Profile (IEHRP)." Sponsor: USAFSAM. Funding: \$115,104 - Oxley 50%, Schubert Kabban 50%.

"The Mathematical Theory of Individual Exposure Health Risk Profile (IEHRP)." Sponsor: USAFSAM. Funding: \$55,556 - Oxley 50%, Schubert Kabban 50%.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Oxley, M.E. and Schubert Kabban, C.M., "Fusion within a Detection System Family," *Proceedings of FUSION 2019*, Paper No. 1570537583, Jul 2019. [CTISR] [ANT]

## Refereed Conference Papers Accepted on the Basis of Abstract Review

Oxley, M.E., and Schubert Kabban, C.M., "Sequential and Parallel Fusion of Detection and Classification Systems," *Proceedings of SPIE 11018, Signal Processing, Sensor/Information Fusion, and Target Recognition XXVIII*, 110180G, May 2019. [CTISR]

Schubert Kabban, C.M. and Oxley, M.E., "Sequence Theory for Classification in Multi-Label ATR Classification Tasks," *Proceedings of SPIE 11018, Signal Processing, Sensor/Information Fusion, and Target Recognition XXVIII*, 110180H, May 2019.

## Other Significant Research Productivity

Oxley, M.E. and Schubert Kabban, C.M., "Detection System Fusion Based on the Predictive Value Curve and its Variations," *Dayton-Cincinnati AIAA Aerospace Science Symposium*, Sinclair Conference Center, Dayton, OH, Mar 2019. [CTISR]

Oxley, M.E. and Hartman, R.T., "Revolutionizing Precision Medicine w/Big Data: The Individual Exposure Health Risk Profile (IEHRP)," *INFORMS Healthcare 2019*, Boston, MA, Jul 2019.

Hartman, R.T. and Oxley, M.E., "A New Approach to the Exposure Science: The Promise of Total Exposure Health," *The Synergist AIHA (American Industrial Hygiene Association)*, pp 30-33, Jun/Jul 2019.

## QUINN, DENNIS W.

Professor Emeritus of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1974 (AFIT/ENC); BA, Mathematics, University of Delaware, 1969; MS, Applied Mathematics, University of Delaware, 1971; PhD, Applied Mathematics, University of Delaware, 1973. Dr. Quinn's fields of expertise include numerical methods, finite elements, finite differences, integral equation methods, numerical analysis, functional analysis, system identification, and applied mathematics. Dr. Quinn has advised several MS students in modeling toxic chemical exposure. He has also published papers dealing with integral and finite element solutions of acoustic problems, using the telegrapher's equation to model lightning; using the method of characteristics in cancer risk assessment; using the diffusion equation to model diffusion through the skin in pharmacokinetic modeling; and using the boundary element method for moving boundary problems.

## REYNOLDS, DANIEL E.

Assistant Professor Emeritus of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 1974 (AFIT/ENC); BA, University of Rochester, 1965; MS, Air Force Institute of Technology, 1971; MS, Wright State University, 1983. Mr. Reynolds' research interests include management cybernetics, learning theory, and exploring ways computer graphics can support statistical and mathematical education. In 1989, Mr. Reynolds received Tau Beta Phi's Outstanding Professor Award.

## SCHUBERT KABBAN, CHRISTINE M.

Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2010 (AFIT/ENC); BA, University of Dayton, 1992; MBA, Wright State University, 1994; MS, Wright State University, 1995; PhD, Air Force Institute of Technology, 2005. Dr. Schubert Kabban's research interests include classification techniques, diagnostic testing, ROC curve theory and extensions, human performance, information fusion, modeling and prediction, NDE methods, network analysis, regression and regression extensions, survey design and analysis, and general biostatistics. Dr. Schubert Kabban's current research is in evaluating the performance of classification systems and information-fused systems via ROC methodology, sequential strategies for classification, structural health monitoring of airframes, as well as epidemiological applications to disease prediction and medical diagnostics. Tel. 937-255-3636 x4549, Email: [Christine.SchubertKabban@afit.edu](mailto:Christine.SchubertKabban@afit.edu)

## Sponsor Funded Research Projects

"Automated Statistical Exploitation for Artificial Intelligence." Sponsor: 711 HPW. Funding: \$100,000.

"Sequencing Information for Efficient, Accurate Classification." Sponsor: AFOSR. Funding: \$33,136.

### **Refereed Journal Publications**

- Jurado, J., Schubert Kabban, C.M., and Raquet, J., "A Regression-Based Methodology to Improve Estimation of Inertial Sensor Errors Using Allan Variance Data," *Navigation*, Vol. 66, No. 1, pp. 251-263, Spring 2019.
- Roberts, M.D., Douglas, M.A., Overstreet, R.E., Ogden, J.A., and Schubert Kabban, C.M., "Development and Validation of a Multi-Level Air Freight Handling Safety Climate Scale," *Transportation Research Part F: Traffic Psychology and Behavior*, Vol. 59, Part A, pp. 445-462, Nov 2018.
- Grap, M.J., Schubert Kabban, C.M., Munro, C., Wetzel, P., Burk, R., Lucas, V., and Pepperl, A., "OR Time to and Sacral Pressure Injuries in Critically Ill Surgical Patients," *ACORN Journal*, Vol. 109, No. 2, pp. 229-239, Jan 2019.
- McClish, D.M., Wilk, A.R., and Schubert Kabban, C. M., "Choosing Between the BP and BN Sequential Strategies," *Pharmaceutical Statistics*, Vol. 18, No. 5, pp. 533-545, Sep 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

- Oxley, M.E. and Schubert Kabban, C.M., "Fusion within a Detection System Family," *Proceedings of FUSION 2019*, Paper No. 1570537583, Jul 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

- Oxley, M.E. and Schubert Kabban, C.M., "Sequential and Parallel Fusion of Detection and Classification Systems," *Proceedings of SPIE 11018, Signal Processing, Sensor/Information Fusion, and Target Recognition XXVIII*, 110180G, May 2019.
- Schubert Kabban, C.M. and Oxley, M.E., "Sequence Theory for Classification in Multi-Label ATR Classification Tasks," *Proceedings of SPIE 11018, Signal Processing, Sensor/Information Fusion, and Target Recognition XXVIII*, 110180H, May 2019.
- Jurado, J., Raquet, J., and Schubert Kabban, C.M., "Autonomous and Resilient Management of All-Source Sensors for Navigation," *Proceedings of the ION 2019 Pacific PNT Meeting*, Honolulu, HI, Apr 2019.

### **Books and Chapters in Books**

- Derriso, M.M., Bigelow, K., Schubert Kabban, C.M., Downs, E., and Delaney, A., "Human Monitoring Systems For Health, Fitness and Performance Augmentation," *Defense Innovation Handbook: Guidelines, Strategies, and Techniques*. Adedeji Badiru and Cassie Barlow, eds., CRC Press/Taylor and Francis, 2018, pp. 209-230.

### **Other Significant Research Productivity**

- Schubert Kabban, C.M., "Improving Classification Performance through Sequences of Classification Tasks," *Women in Statistics and Data Science Conference*, Cincinnati, OH, Oct 2018.
- Schubert Kabban, C.M., "Considerations and Advantages When Using Sequences of Classification Systems for a Classification Task," *Invited speaker, Air Force Research Laboratory, AFRL/RYP*, Dayton, OH, Mar 2019.
- Schubert Kabban, C.M., "Inverse Estimation for Damage Assessment in SHM: Moving Beyond the Probability of Detection," *Invited speaker, 2<sup>nd</sup> POD Workshop/AA&S 2019 Conference*, Washington DC, Apr 2019.
- Schubert Kabban, C.M., "Considerations and Advantages when Using Sequences of Classification Systems for a Classification Task," *Invited speaker, Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mt. Sinai*, New York, NY, Jun 2019.

Schubert Kabban, C.M., "Sequence Theory for Classification in Multi-Label ATR Classification Tasks," *SPIE Defense and Commercial Sensing, Signal Processing, Sensor/Information Fusion, and Target Recognition XXVIII*, Baltimore, MD, Apr 2019.

Schubert Kabban, C.M., "Confidence Intervals for a Sequence of Diagnostic Tests," *Joint Statistical Meetings (JSM)* Denver, CO, Jul/Aug 2019.

### **SRITHARAN, SIVAGURU S.**

Provost and Vice Chancellor, AFIT Appointment Date: 2015 (AFIT/CL); BSc (Hons.) University of Sri Lanka, 1977; MS, University of Washington, 1979; PhD, University of Arizona, 1982. Dr. Sritharan's research interests include control theory, stochastic analysis, functional analysis, and numerical analysis of aerodynamics at all range of Mach numbers and electromagnetics. Dr. Sritharan's current research focuses on mathematical and computational issues relevant to hypersonics, directed energy weapons, and autonomy. AFIT research center affiliation(s): CDE.

### **TURNER, JONATHAN S., Capt**

Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BS, Texas State University, 2011; MS, Texas State University, 2012; MS, Air Force Institute of Technology, 2014; PhD, Air Force Institute of Technology, 2019. Capt Turner's research interests include combinatorial problems in statistics and discrete optimization with application towards data compression. The tools he uses for exploring combinatoric equivalence relations are discrete Fourier transform, integer programming, and heuristics. Tel. 937-255-3636 x7403, Email: [Jonathan.Turner@afit.edu](mailto:Jonathan.Turner@afit.edu)

### **UBER, RICHARD P., Capt**

Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2016 (AFIT/ENC); BGS, University of Nebraska Omaha, 2006; MS, Texas A&M University, 2010; PhD, Air Force Institute of Technology, 2016. Capt Uber's current research interests are electromagnetic wave scattering, partial differential equations, computational modeling, structural health monitoring, and machine translation. He has served as an Operations Research Analyst for Headquarters Air Education and Training Command, and as a Mandarin Language Instructor at the Defense Language Institute Foreign Language Center.

### **Other Significant Research Productivity**

Uber, R., "Modeling Acoustic Wave Scattering from Imperfections in Thin Plates." *Invited talk at Wayne State University, Department of Mathematics Colloquium*, Detroit, MI, Nov 2018.

### **WHITE, EDWARD D., III**

Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 1998 (AFIT/ENC); BS, University of Tampa, 1990; MAS, The Ohio State University, 1991; PhD, Texas A&M University, 1998. Dr. White's research interests include design of experiments, categorical data analysis, biostatistics, and model building. Tel. 937-255-3636 x4540, Email: [Edward.White@afit.edu](mailto:Edward.White@afit.edu)

### **Refereed Journal Publications**

O'Hanlon, G.B., Ritschel, J.D., White, E.D., and Brown, G.E., "Delineating Operating and Support Costs in Aircraft Platforms," *Defense Acquisition Research Journal*, Vol. 25, No. 3, pp. 264-286, Oct 2018.

Bunecke, K., White, E.D., Ritschel, J.D., and Bush, B.A., "Evaluating Annual Fixed Wing Maintenance Costs," *Defense Acquisition Research Journal*, Vol. 25, No. 3, pp. 244-262, Oct 2018.

Clayson, D., Thal, A., and White, E.D., "Cost Performance Index Stability: Insights from Environmental Remediation Projects," *Journal of Defense Analytics and Logistics*, Vol. 2, No. 2, pp. 94-109, Nov 2018.

Tvaryanas, A.P., Maupin, G.M., White, E.D., Schroeder, V.M., and Lysfjord, H.J., "Examination of the PC-PTSD in Previously Deployed Air Force Medical Service Personnel," *Military Psychology*, Vol. 30, No. 4, pp. 295-301, 2018.

Ritschel, J., Lucas, B., White, E.D., and Mrla, D., "The Impact of WSARA on the Cost of Air Force Weapon Systems," *Journal of Public Procurement*, Vol. 19, No. 1, pp. 2-14, Mar 2019.

Kim, D.B., White, E.D., Ritschel, J.D., and Millette, C.A., "Revisiting Reliability of Estimates at Completion for Department of Defense Contracts," *Journal of Public Procurement*, Vol. 19, No. 3, pp. 186-200, Sep 2019.

#### **Other Significant Research Productivity**

Markman M.R., Ritschel, J.D., White, E.D., and Valentine, S.M., "Statistical Analysis of Cost Factors in Department of Defense Programs," *87th MORS Symposium*, Colorado Springs, CO, Jun 2019.

Angell, E., White, E.D., Ritschel, J.D., and Thal, A.E., "Analysis of Military Construction Cost Growth in Major Defense Acquisition Programs," *87th MORS Symposium*, Colorado Springs, CO, Jun 2019.

Markman, M.R., Ritschel, J.D., White, E.D., and Valentine, S.M., "Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms," *16th Annual Acquisition Research Symposium*, Monterey, CA, May 2019.

#### **WOOD, AIHUA W.**

Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1994 (AFIT/ENC); BS, Peking University, 1984; MS, University of Connecticut, 1988; PhD, University of Connecticut, 1990. Dr. Wood's research interests include partial differential equations, electromagnetic wave propagation, and Boltzmann equations. Tel. 937-255-3636 x4272, Email: [Aihua.Wood@afit.edu](mailto:Aihua.Wood@afit.edu)

#### **Sponsor Funded Research Projects**

"Fast Methods for the Boltzmann Equation." Sponsor: AFOSR. Funding: \$101,643.

#### **Other Significant Research Productivity**

Wood, A.W., "Fast Methods for Kinetic Solutions of the Boltzmann Equation," *Mathematics Colloquium*, University of Greenwich, London, United Kingdom, Oct 2018.

Wood, A.W., "Through-Wall Radar Detection Analysis via Numerical Simulations," *Oxbridge PDE Conference*, University of Oxford, Oxford, United Kingdom, Mar 2019.

Wood, A.W., "Through-Wall Radar Detection Analysis via Numerical Simulations," *Mathematics Colloquium*, Ocean University of China, Qingdao, China, Apr 2019.

Wood, A.W., "Radar Detection Analysis through Walls," *International Symposium on Electromagnetic Theory*, San Diego, CA, May 2019.

## 5.5 DEPARTMENT OF OPERATIONAL SCIENCES

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### **5.5.1 DOCTORAL DISSERTATIONS**

BRADSHAW, CALVIN J., Using Manpower to Assess USAF Strategic Risk. AFIT-ENS-DS-19-J-021. Faculty Advisor: Dr. Alan B. Johnson. Sponsor: HQ AFMC/A9A. [COA]

CABALLERO, WILLIAM, Behavioral and Behaviorally Robust Models. AFIT-ENS-DS-19-J-022. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USSTRATCOM.

JENKINS, PHILLIP, Strategic Location and Dispatch Management of Assets in a Military Medical Evacuation Enterprise. AFIT-ENS-DS-19-J-037. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: MEPD.

KEITH, ANDREW J., Inferential, Sequential, and Adversarial Approaches. AFIT-ENS-DS-19-S-041. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: STRATCOM. [COA]

KLINE, ALEXANDER G., Real-Time Heuristics and Metaheuristics for Static and Dynamic Weapon Target Assignments. AFIT-ENS-DS-18-D-016. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: STRATCOM/JWAC. [COA]

## 5.5.2 MASTER'S THESES

- ALAJMI, ABDULAZIZ, RSAF C-130 Part Cancellation Process Analysis. AFIT-ENS-MS-19-S-032. Faculty Advisor: Dr. William A. Cunningham. Sponsor: NA.
- ALFORD, PARKER H., Strengths, Challenges, Opportunities, and Threats. AFIT-ENS-MS-19-M-098. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AMC/A4. [COA]
- ALZHRANI, MAJED, The Potential Socio-Economic Impacts of the New Public Transport System on the Saudi Economy (Jeddah Metro). AFIT-ENS-MS-19-S-033. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.
- BAKER, JADE, West Africa Logistics Networks. AFIT-ENS-MS-19-M-100. Faculty Advisor: Dr. Bruce A. Cox. Sponsor: US AFRICOM.
- BEVERIDGE, NATHANAEL, Social Network Threat Detection. AFIT-ENS-MS-19-M-101. Faculty Advisor: Lt Col Andrew J. Geyer. Sponsor: USSOCOM SOC/North Peterson AFB.
- BRAMBLETT, LAUREN M., Turbojet Range, Loiter, and Altitude Tradeoff Estimations in Efficient Modeling and Optimization Formulations. AFIT-ENS-MS-19-M-102. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: NASIC. [COA]
- BROWN, DOUGLAS, Applying Survival Analysis with Frailty to Aircraft Reliability. AFIT-ENS-MS-19-M-103. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: N/A.
- BUCK, JENNIFER, Pay-Setting Analysis of Laboratory Demonstration Workforce. AFIT-ENS-MS-19-M-104. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: 711th HPW.
- CHON, STEVEN H., Hyper-Parameter Optimization of a Convolutional Neural Network. AFIT-ENS-MS-19-M-105. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: AFRL/RV. [COA]
- CLEMENS, SAMUEL T., Maximizing a Cruise Missile Attack Using Variable Strategies and Salvo Firing. AFIT-ENS-MS-19-M-107. Faculty Advisor: Dr. John O. Miller. Sponsor: LM MFC. [COA]
- DARARUTANA, KANIT, Comparison of Novel Heuristic and Integer Programming Schedulers for the US Air Force Space Surveillance Network. AFIT-ENS-MS-19-M-108. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: AFSPC/A36Z. [CSRA]
- DAVIS, RANDALL, Network Modeling and Analysis of United States Africa Command West African Regional Logistics Network. AFIT-ENS-MS-19-M-109. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: US AFRICOM.
- GILL, ANDREW, Examining the Drivers of C-130J Maintenance Requirements. AFIT-ENS-MS-19-M-115. Faculty Advisor: Dr. William A. Cunningham. Sponsor: AFLCMC/LZ.
- GILTS, ERIKA, A Simulation Approach to Address MQ-9 Flying Training Unit Manning Shortfalls. AFIT-ENS-MS-19-M-116. Faculty Advisor: Maj Thomas P. Talafuse. Sponsor: ATKS.
- GOLD, SARAH, Effect of Using Probabilistic Contingency Tables to Modify Forecast Predictions. AFIT-ENS-MS-19-M-117. Faculty Advisor: Dr. Edward D. White. Sponsor: 45 WS.
- GREEN, NICHOLAS, Shipping Designs for the Post-Disaster Cargo Surge. AFIT-ENS-MS-19-M-118. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: FEMA.
- HARRIS, KAREN, A Comparative Analysis on UAS Operating Procedures within Military Airspace. AFIT-ENS-MS-19-M-120. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: AFRL/RQ.

HEBERT, TERRY R., The Impacts of Using Augmented Reality to Support Aircraft Maintenance. AFIT-ENS-MS-19-M-121. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AFRL/AFMC. [COA]

HORNBERGER, ZACHARY, Search and Rescue Operations Forecasting and Optimization. AFIT-ENS-MS-19-M-123. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: CG RDC.

HUGHES, MICHAEL S., A Port-Based Analysis of USTRANSCOM Shipping Network Vulnerability. AFIT-ENS-MS-19-M-124. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USTRANSCOM/JDPAC. [COA]

HYDER, DYLAN A., Liner Sustainment Workload Forecasting Using Exogenous Data. AFIT-ENS-MS-19-M-126. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USTRANSCOM/JDPAC. [COA]

JACKOVICH, PETAR, Solving the Traveling Salesman Problem Using Ordered-Lists. AFIT-ENS-MS-19-M-127. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: N/A.

KANE, ZACHARY J., An Imputation Approach to Developing Alternative Futures of Country Conflict. AFIT-ENS-MS-19-M-128. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: JCS J-7. [COA]

KEESLING, RICHARD B., Exploratory Analysis of the Potential Use of Augmented Reality in Aircraft Maintenance. AFIT-ENS-MS-19-M-129. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: AFRL. [COA]

KILGORE, TERRENCE R., Challenges and Opportunities. AFIT-ENS-MS-19-M-131. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

KOLANO, BRYAN, Multivariate Analysis of Diversity and Inclusion Data. AFIT-ENS-MS-19-M-132. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: 88th ABW.

LARKIN, MICHAEL T., A Stochastic Game Theoretical Model for Cyber Security. AFIT-ENS-MS-19-M-133. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: USD (R&E) DTEP. [COA]

LEDWITH, MATTHEW, An Application of Absorbing Markov Chains to the Assessment of Education Attainment Rates within Air Force Materiel Command Civilian Personnel. AFIT-ENS-MS-19-M-134. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: AFMC/A9A.

LUBIANO, HESTON JOHN D., A Qualitative Approach in Measuring Inclusion. AFIT-ENS-MS-19-M-135. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AFMC/A1. [COA]

MANGEN, MATTHEW, An Analysis of Changing the Federal Age Requirement for a Commercial Driver's License. AFIT-ENS-MS-19-J-038. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

MAUS, JOCELIN, Applying the Multiple Multidimensional Knapsack Assignment Problem to a Cargo Allocation and Transportation Problem with Stochastic Demand. AFIT-ENS-MS-19-M-137. Faculty Advisor: Maj Thomas P. Talafuse. Sponsor: N/A.

MCFADDEN, MICHAEL P., The Introduction of Open Source Initiatives in Supply Chain Management Software. AFIT-ENS-MS-19-M-138. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

MEYER, KEISHA A., Does Age, Gender, or Race Affect Undergraduate Pilot Training Attrition or Composite Scores? AFIT-ENS-MS-19-M-140. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: AETC/Det21. [COA]

MONTEIRO, LUCIANA M., Predicting Failures of the Brazilian Air Force Tucano Fleet Using Survival Analysis. AFIT-ENS-MS-19-M-139. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: ILA. [COA]

NELSON, CURTIS B., Fuzzy Inference Systems for Risk Appraisal in Military Operational Planning. AFIT-ENS-MS-19-M-141. Faculty Advisor: Dr. Richard F. Deckro. Sponsor: JWAC. [COA]

NOVITSKE, ZACHARY A., Measuring Human Systems Integration in Directed Energy Weapon Acquisition Programs. AFIT-ENS-MS-19-M-142. Faculty Advisor: LTC Christopher Smith. Sponsor: 711th HPW/HP. [COA]

PENDERGRASS, MICHAELA A., A Topological View of the Relationship between Women and Armed Conflict in West Africa. AFIT-ENS-MS-19-M-143. Faculty Advisor: LTC Christopher M. Smith. Sponsor: USAFRICOM. [COA]

POPE, TALON M., A Cost-Benefit Analysis of Pilot Training Next. AFIT-ENS-MS-19-M-144. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: N/A. [COA]

SANDS, BRENDON, Time Series Analysis of Stochastic Networks with Correlated Random Arcs. AFIT-ENS-MS-19-M-147. Faculty Advisor: Lt Col Andrew J. Geyer. Sponsor: N/A.

SCHLICHT, JOHN A., Operations Research Methods for Multi-Domain Campaign Phase Planning. AFIT-ENS-MS-19-M-148. Faculty Advisor: Dr. Richard F. Deckro. Sponsor: JWAC. [COA]

SPERANZA, DOMINICK, Lightning Prediction Using Recurrent Neural Networks. AFIT-ENS-MS-19-M-150. Faculty Advisor: Maj Andrew J. Geyer. Sponsor: 45th Weather Squadron.

ST PETER, TROY, Implementing an Autoregressive Distributed Lag Approach with Air Force Maintenance Data. AFIT-ENS-MS-19-M-151. Faculty Advisor: Dr. Raymond R. Hill. Sponsor: AFSC/LG.

WALTON, RYAN B., Simulating Maritime Chokepoint Disruption in the Global Food Supply. AFIT-ENS-MS-19-M-153. Faculty Advisor: Dr. John O. Miller. Sponsor: DIA/DRI-8. [COA]

WESTMAN, MARYDELL V., Using Simulation to Model Reserve Officer Training Corps Cadet Flow. AFIT-ENS-MS-19-M-155. Faculty Advisor: Dr. John O. Miller. Sponsor: USACC. [COA]

### 5.5.3 GRADUATE RESEARCH PAPERS

- COBURN, ZACHARY, A Qualitative Study of Air Mobility Command's Phoenix Horizon-Reach Program. AFIT-ENS-MS-19-J-024. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: USAF EC/EC.
- DIEMER, DANIEL P., Interagency Coordination between FEMA, USNORTHCOM, and USTRANSCOM during a Hurricane Response. AFIT-ENS-MS-19-J-025. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: 7000 Defense Pentagon. [COA]
- GILLILAND, SHARON, The First Step Towards an Interchangeable Aircraft Management Construct. AFIT-ENS-MS-19-J-030. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.
- GILMER, JARED, KC-46 Comparative Cargo Capability and What it Means to the MAF. AFIT-ENS-MS-19-J-031. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: 22 OG/CC.
- HAWKINS, STEVEN, Time Series Forecasting of Tanker Training Demand. AFIT-ENS-MS-19-J-033. Faculty Advisor: Dr. William A. Cunningham. Sponsor: USTC/J-3.
- HEMKEN, KATHERINE B., Forecasting Sustainment Cargo Requirements. AFIT-ENS-MS-19-J-035. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: N/A. [COA]
- MCCONVILLE, SEAN, Tailoring C-17 Training and Apportionment for the Evolving Mission Environment. AFIT-ENS-MS-19-J-040. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: AMC.
- MCDADE, GREGORY A., A Case Study in Requirements Prioritization. AFIT-ENS-MS-19-J-041. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: 86 AW/CC. [COA]
- PRIETO, LAUREN P., A Case Study of Air Force Implementation. AFIT-ENS-MS-19-J-055. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]
- RANKIN, DEREK R., The KC-10 Divestment, Personnel Movement Plan. AFIT-ENS-MS-19-J-043. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: 22nd Operations Group. [COA]
- RATCLIFFE, MATTHEW T., Identifying Operational and Fiscal Inefficiencies. AFIT-ENS-MS-19-J-044. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: AMC/IG. [COA]
- REYNOLDS, THOMAS, From the APOD to the Point of Need. AFIT-ENS-MS-19-J-045. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: N/A.
- RUPPEL, RENEE L., The Importance of Defining an Organization's Core Competencies. AFIT-ENS-MS-19-J-047. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]
- RUSSELL, KRISTIN M., An Evaluation of Total Force C-130 Fleet Utilization. AFIT-ENS-MS-19-J-048. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: DCoS USAF/A3. [COA]
- RUST, AUSTIN D., A Missing Link in AMC's Data Chain. AFIT-ENS-MS-19-J-049. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: 314 AW/CC. [COA]
- STEWART, JESSICA, Lessons Learned from Operation Inherent Resolve. AFIT-ENS-MS-19-J-051. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: 448 SCMW/DV.
- SUSTELLO, DAVID, An Analysis of the Inbound Aircraft Notification Process. AFIT-ENS-MS-19-J-052. Faculty Advisor: Dr. William A. Cunningham. Sponsor: 618AOC/CC.

WALKUSKY, MARK M., Optimizing the Forward Presence of PACAF's Expeditionary Communications. AFIT-ENS-MS-19-J-054. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A. [COA]

## 5.5.4 FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

### AHNER, DARRYL K.

Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2010 (AFIT/ENS); Director, Scientific Test and Analysis Techniques (STAT) for Test and Evaluation (T&E) Center of Excellence, Appointment Date: 2012; Director, Center for Operational Analysis, Appointment Date: 2018; BS, Mechanical Engineering, United States Military Academy, 1990; MS, Applied Mathematics, Rensselaer Polytechnic Institute, 1999; MS, Operations Research and Statistics, Rensselaer Polytechnic Institute, 1999; PhD, Systems Engineering, Boston University, 2005. Dr. Ahner's research interests include dynamic programming, optimization of stochastic models, test and evaluation, software testing, information theory, and military operations research applications. Dr. Ahner is a licensed Professional Engineer in the Commonwealth of Virginia. Dr. Ahner is a member of the Military Operations Research Society, Institute of Electrical and Electronics Engineers, and the Institute for Operations Research and the Management Sciences. Tel. 937-255-3636 x4708, Email: [Darryl.Ahner@afit.edu](mailto:Darryl.Ahner@afit.edu)

### Sponsor Funded Research Projects

“Advancements in Test and Evaluation of Autonomous Systems.” Sponsor: OSD. Funding: \$139,802.

“Advancements in Test and Evaluation of Autonomous Systems.” Sponsor: OSD. Funding: \$510,198.

“AFSIM Modular Development to Support the Solar Space Power Initiative (SSPI).” Sponsor: AFRL/RV. Funding: \$950,000. [COA]

“AFSIM Training Support.” Sponsor: SDPE. Funding: \$75,000.

“Analysis and Test Planning for Female Accommodation.” Sponsor: AFLCMC. Funding: \$65,000.

“COE-S 210/COE-R 210 Short courses.” Sponsor: NAVSEASYS CMD. Funding: \$36,000.

“COE-S 310/COE-S 410: Experimental Design and Analysis I & II.” Sponsor: PACOM/J81. Funding: \$35,000.

“Developmental Mission Assurance - Test & Evaluation of Manned-Unmanned Systems.” Sponsor: AFRL/RQ. Funding: \$40,000.

“Joint Live Fire T&E Analysis of Methodologies.” Sponsor: OSD. Funding: \$191,000.

“Scientific Test and Analysis Techniques for the Department of Homeland Security.” Sponsor: DHS. Funding: \$939,983.

“T-6 Subject Matter Expertise Engineering Support.” Sponsor: AFLCMC. Funding: \$325,000.

“Test & Evaluation Strategy Development for T-X Advanced Pilot Trainer.” Sponsor: AFLCMC. Funding: \$550,000 - Ahner 50%, Thorsen 50%.

“Test and Evaluation Center of Excellence.” Sponsor: OSD. Funding: \$360,520.

### Refereed Journal Publications

Shallcross, N., and Ahner, D., “Predictive Models of World Conflict: Accounting for Regional and Conflict-State Differences,” *Journal of Defense Modeling and Simulation*, Jul 2019. DOI: [10.1177/1548512919847532](https://doi.org/10.1177/1548512919847532)

Ahner, D., Thompson, J., and Justice, K., “Development of Composite Indices and a Regional Assessment Framework for Analyzing Nation-State Health,” *Journal of Defense Modeling and Simulation*, Vol. 6, No. 4, pp. 277-284, Jun 2019. DOI: [10.1177/1548512919850385](https://doi.org/10.1177/1548512919850385)

Kline, A., Ahner, D., and Lunday, B., “Real Time Heuristic Algorithms for the Static Weapon Target Assignment Problem,” *Journal of Heuristics*, Vol. 25, No. 3, pp. 377-397, May 2019.

Keith, A., Ahner, D., and Curtis, N., “Evaluation Theory and its Application to Military Assessments,” *Journal of Defense Modeling and Simulation*, March 2019. DOI: [10.1177/1548512919834670](https://doi.org/10.1177/1548512919834670)

Keith, A., Ahner, D., and Hill, R., “An Order-Based Method for Robust Queue Inference with Stochastic Arrival and Departure Times,” *Computers and Industrial Engineering*, Vol. 128, pp. 711-726, Jan 2019.

Kline, A., Ahner, D., and Hill, R., “The Weapon Target Assignment Problem,” *Computers and Operations Research*, Vol. 105, pp. 226-236, Jan 2019.

Ahner, D., and Brantley, L., “Finding the Fuel of the Arab Spring Fire: A Historical Data Analysis,” *Journal of Defense Analytics and Logistics*, Vol. 2, No. 2, pp. 58-68, Nov 2018.

Ahner, D., and McCarthy, A., “Response Surface Modeling of Precision Guided Fragmentation Munitions,” *Journal of Defense and Simulation*, Nov 2018. DOI: [10.1177/1548512918811138](https://doi.org/10.1177/1548512918811138)

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

James Wisnowski, James Simpson, and Darryl Ahner, “A Hitchhikers Guide to Automating Software Test,” *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Ethan Salgado, Darryl Ahner, and Matthew Robbins, “Can Drones Save Lives? Utilizing Heuristics Within a LSTD Algorithm to Solve a Military Inventory Routing Problem with Vehicle Loss,” *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Jennifer Thompson and Darryl Ahner, “Modeling Aircraft Maintenance, Loss, and Repairs for Wargaming,” *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Andrew Keith and Darryl Ahner, “A Game Theoretic Approach to Integrated Cyber and Air Defense,” *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Darryl Ahner, “Sequential Testing for Fast Jet Life Support Systems,” *Defense and Aerospace Test and Analysis (DATA) Workshop*, Alexandria, VA, 10-12 Apr 2019.

Darryl Ahner, “Test and Evaluation for Autonomy,” *Department of Defense Science and Technology Workshop on Environmental Security, AIAA SCITECH*, San Diego, CA, 7-11 Jan 2019.

Alexander Kline, Darryl Ahner, and Carl Parson, “Solving the Heterogeneous Multi-Stage Weapon Target Assignment Problem with Adaptive Dynamic Programming,” *Institute for Operations Research and the Management Sciences Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Andrew Keith and Darryl Ahner, “Operations Assessment Planning Using Robust Partially Observable Markov Decision Processes,” *Institute for Operations Research and the Management Sciences Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

### **Editorships in Professional Journals**

Editorial Board, *Military Operations Research Society*

### **Other Significant Research Productivity**

Darryl K. Ahner, “Executive Overview: The Scientific Test and Analysis Technique Process,” Naval Sea Systems Command, Washington, DC, May 2019.

**ANDERSON, JASON R., Lt Col**

Assistant Professor of Logistics and Supply Chain Management and Deputy Department Head, Chair, Department of Operational Sciences, AFIT Appointment Date: 2016 (AFIT/ENS); Program Manager of Advanced Study of Air Mobility (ASAM), 2016; BS, Operations Research, United States Air Force Academy, 2000; Masters of Science and Administration, Central Michigan University, 2007; Masters of Logistics and Supply Chain Management, Air Force Institute of Technology, 2013; PhD, Logistics and Supply Chain Management, Air Force Institute of Technology, 2016. Lt Col Anderson's research interests include transportation, logistics management, inventory, operations management, simulation, and sourcing. Lt Col Anderson is a member of the Airlift/Tanker Association, American Society of Transportation & Logistics, and the Council of Supply Chain Management Professionals. Tel. 937-255-3636 x4533, Email: [Jason.Anderson@afit.edu](mailto:Jason.Anderson@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Glover, Adam, and Anderson, Jason, "The Aviation Technical Track: A Cure to the Air Force Pilot Shortage?" Western Decision Sciences Institute, Los Angeles, CA, 3-5 Mar 2019.

**BREITBACH, TIMOTHY W., Maj**

Assistant Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2016 (AFIT/ENS); BA, University of Notre Dame, 2005; MS, Air Force Institute of Technology, 2012; PhD, Massachusetts Institute of Technology, 2017. Dr. Breitbach's research interests include supply chain finance and data analysis, humanitarian logistics and the role of supply chains in international development, supply chain resilience, and block chain. Maj Breitbach is a member of the Logistics Officer Association, Production and Operations Management Society, and the Council of Supply Chain Management Professionals. Tel. 937-255-3636 x4458, Email: [Timothy.Breitbach@afit.edu](mailto:Timothy.Breitbach@afit.edu)

**Sponsor Funded Research Projects**

"Strategic Network Design for Base Resilience." Sponsor: AFMC/A8/A9. Funding: \$33,020 - Breitbach 45%, Cox 45%, Ahner 10%.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Zachariah, Z., Breitbach, T., Hazen, B., and Mir, S., "Using Accelerators to Support and Integrate Supply Chain Innovations," *Council of Supply Chain Management Professionals Annual Conference*, Anaheim, CA, 17-20 Sep 2019.

Howard, K., Breitbach, T., "A Framework for the Strategic Alignment of Humanitarian Response and Recovery Effects," *Production and Operations Management Society Annual Conference*, Washington, DC, 2-6 May 2019.

Green, N., Breitbach, T., "An Analysis of San Juan Port Capacity and the Hurricane Maria Response," *Production and Operations Management Society Annual Conference*, Washington, DC, 2-6 May 2019.

Breitbach, T., Mir, S., Zachariah, Z., Hazen, B., "How Large Organizations Use Accelerator Programs to Support Supplier Innovation," *Production and Operations Management Society Annual Conference*, Washington, DC, 2-6 May 2019.

Zachariah, Z., Hazen, B., Mir, S., Breitbach, T., "Deriving Value from Customer-Driven Coopetition Projects," *Decision Sciences Institute Annual Conference*, Chicago, IL, 17-19 Nov 2018.

Howard, K., Joo, S., Breitbach, T., "A Meta-Analysis of Quality Management Practices and Logistics Firm Performance," *Council of Supply Chain Management Professionals Annual Conference*, Nashville, TN, 29 Sep – 2 Oct 2018.

Zachariah, Z., Breitbach, T., Hazen, B., Mir, S., "Coopetition and Supporting Innovation," *Council of Supply Chain Management Professionals Annual Conference*, Nashville, TN, 29 Sep – 2 Oct 2018.

Stanton, D.J., Hazen, B., Breitbach, T., “Blockchain for Supply Chain Management Simulation,” *Council of Supply Chain Management Professionals Annual Conference*, Nashville, TN, 29 Sep – 2 Oct 2018.

### **Other Significant Research Productivity**

Steenek, D., Breitbach, T., “Resilient Sustainment,” *The Exceptional Release*, Issue 147, Spring 2019.

Breitbach, T., “Blockchain for Supply Chain Management,” Tech Talks, United States Special Operations Command, Tampa, FL, Feb 2019.

### **CHAMPAGNE, LANCE E.**

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, Biomedical Engineering and Mathematics, Tulane University, 1991; MS, Operations Research, Air Force Institute of Technology, 1999; PhD, Operations Research, Air Force Institute of Technology, 2004. Dr. Champagne’s research interests include agent-based and discrete-event simulation, and applied and multivariate statistics. Dr. Champagne is a member of the Military Operations Research Society. Tel. 937-255-6565 x4646, Email: [Lance.Champagne@afit.edu](mailto:Lance.Champagne@afit.edu)

### **Sponsor Funded Research Projects**

“Education and Research Support for Modeling, Simulation, & Analysis.” Sponsor: SDPE. Funding: \$250,000 - Champagne 40%, Miller 30%, Lunday 30%. [COA]

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Bramblett, Lauren, and Champagne, Lance, “Turbojet Range, Loiter, and Altitude Tradeoff Estimations in Efficient Modeling and Optimization Formulation,” *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

### **CIARALLO, FRANK W.**

Associate Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2019 (AFIT/ENS); BS, Electrical Engineering, Engineering & Public Policy, Carnegie Mellon University, 1986; MS, Manufacturing and Operations Systems, Carnegie Mellon University, 1988; PhD, Industrial Administration, Carnegie Mellon University, 1993. Dr. Ciarallo’s research interests include strategies for centralization of stock in pharmaceutical distribution networks, study of aircraft component failures leading to lumpy spare part demands, Two-Echelon inventory systems with transshipment and quantity discounts, warehouse picking operations including picker congestion, evaluating airline boarding strategies for passenger aircraft, evaluating block chain capabilities to fulfill information needs of the healthcare system, modeling situation awareness of agents navigating on a network with imperfect information, and helper objectives in multiobjectivization for job shop scheduling. Tel. 937-255-3636 x4702, Email: [Frank.Ciarallo@afit.edu](mailto:Frank.Ciarallo@afit.edu)

### **COX, BRUCE A., Lt Col**

Assistant Professor and Division Chief of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, Worcester Polytechnic Institute, 1999; MS, Virginia Commonwealth University, 2006; PhD, Georgia Institute of Technology, 2011. Dr. Cox’s research interests include large scale linear and convex optimization, robust optimization, heuristics, and optimal control. Lt Col Cox is the Vice President of the Cincinnati-Dayton Chapter of the Institute of Operations Research and Management Sciences, and is a member of the Military Operations Research Society. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4510, Email: [Bruce.Cox@afit.edu](mailto:Bruce.Cox@afit.edu)

### **Sponsor Funded Research Projects**

“F-15 Modernization Schedule Optimization.” Sponsor: AFLCMC. Funding: \$250,000 - Cox 80%, Lunday 20%.

“West Africa Logistics Network (WALN).” Sponsor: USAFRICOM. Funding: \$43,600 - Cox 50%, Breitbach 50%.

**CUNNINGHAM, WILLIAM A.**

Professor of Logistics and Supply Chain Management, Department of Operational Sciences; Program Director, MS in Logistics & Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 1994 (AFIT/ENS); BS, Business Administration, Economics, Missouri Southern State College, 1976; MS, Economics, Oklahoma State University, 1979; PhD, Economics, University of Arkansas, 1986. Dr. Cunningham's research interests include strategic mobility, cost/benefit analysis, econometric modeling, costing, privatization and A-76 studies, modal choice, network analysis, location analysis, supply chain management, and RFID. Dr. Cunningham is a member of the Heavy Duty Trucking Advisory Board. AFIT research center affiliation(s): COA. Tel. 937-255-3636 x4283, Email: [William.Cunningham@afit.edu](mailto:William.Cunningham@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

William A. Cunningham, "Basic Supply Chain Management Concepts," *Logistics Officers Association Annual Conference*, Oklahoma City, OK, 8-10 Oct 2018. [COA]

**Editorships in Professional Journals**

Editorial Review Board, *Journal of Transportation Management* [COA]

**DECKRO, RICHARD F.**

Distinguished Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 1994 (AFIT/ENS); Joint Warfare Analysis Center (JWAC) Chair of Applied Operations Research, and Director, Future Operations Investigation Laboratory (FOIL); BS, Industrial Engineering, State University of New York at Buffalo, 1972; MBA & DBA, Decision Sciences, Kent State University, 1973/1976. Dr. Deckro's research, teaching, and consultation interests include the areas of information operations and information assurance, behavioral modeling including social network analysis, counter insurgency and irregular warfare, applied mathematical programming and optimization, scheduling, network models, project and program management, modeling and analysis, space applications, campaign modeling, reconstruction and stabilization, measures of effectiveness and assessment, technology selection and management, advanced manufacturing methods, multi-criteria decision making, and decision analysis. Dr. Deckro is a Fellow of the Military Operations Research Society and a USA Panel Member, NATO Science and Technology Organization System Analysis and Studies Panel. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x4325, Email: [Richard.Deckro@afit.edu](mailto:Richard.Deckro@afit.edu)

**Sponsor Funded Research Projects**

"JWAC AFIT Interaction." Sponsor: JWAC. Funding: \$78,180 - Deckro 40%, Lunday 6%, Ahner 6%, Meyer 43%, Cobb 5%. [COA]

**Refereed Journal Publications**

William N. Caballero, Brian J. Lunday, Richard F. Deckro, and Meir N. Pachter, "Informing National Security Policy by Modeling Adversarial Inducement and its Governance," *Socio-Economic Planning Sciences*, Apr, 2019.

**Other Significant Research Productivity**

William N. Caballero, Brian J. Lunday, and Richard F. Deckro, "Prospect and Regulated Prospect Games: Modeling Adversarial Inducement," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Richard F. Deckro, "Linking Human Behavior to Campaign Planning: A Discussion of Some Modeling Approaches," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Capt John A. Schlicht, Dr. Richard F. Deckro, and Dr. Matthew J. Robbins, "Major Blotto: A Staff Officer's Guide to Utilizing a Generalized Colonel Blotto Game in the Joint Planning Process," *87<sup>th</sup> Military Operations Research Society Annual Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

**DICKENS, JOHN M., Lt Col**

Assistant Professor and Division Chief of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, U.S. Military History, Air Force Academy, 2002; MS, Logistics and Supply Chain Management, Air Force Institute of Technology, 2011; Master of Military Operational Art & Science, Air University, 2014; PhD, Logistics Systems, University of North Texas, 2018. Lt Col Dicken's research interests include service-dominant logic, value and value creation, supply chain resilience, transaction cost economics, self-determination theory, resource-based view, experiments, survey, and simulation methodologies. Tel. 937-255-6565 x4319, Email: [John.Dickens@afit.edu](mailto:John.Dickens@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Hwang, S., Joo, J.S., Dickens, J., "Degree of Buyer Protectiveness and Supplier Absorptive Capacity in Buyer-Driven New Product Development," *European Decision Sciences Institute Conference*, Nottingham, UK, 1-5 Jun 2019.

**GALLAGHER, MARK A.**

Professor of Practice of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BS, Operations Research and Computer Science, United States Air Force Academy, 1983; MS, Operations Research, Air Force Institute of Technology, 1986; PhD, Operations Research, Air Force Institute of Technology, 1992. Dr. Gallagher's research interests include applied statistics, forecasting, decision analysis, and linear programming. Dr. Gallagher is a Fellow of the Military Operations Research Society, and a member of the Institute for Operations Research and Management Sciences, Military and Security Society, and the Air Force Association. Tel. 937-255-3636 x4703, Email: [Mark.Gallagher@afit.edu](mailto:Mark.Gallagher@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Gallagher, Mark A., and Saunders, Randy, "Designing the Bayesian Enterprise Analysis Model (BEAM)," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Gallagher, Mark A., Fullingim, Doug, and Quick, David, "Modeling Mission Effects Chains," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Gallagher, Mark A., and Fullingim, Doug, "Air Force Warfighting Integration Center (AFWIC) Analyses," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Gallagher, Mark A., Moss, Michael, and Fullingim, Doug, "Strategy-to-Task Hierarchy for a Strategy through System Requirements Framework," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Fenn, Daniel, Lepird, John, Hall, Shane A., and Gallagher, Mark A., "Comparison of Solution Methods in Evaluating a System of Risk Assessments," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

**Editorships in Professional Journals**

Associate Editor, *Military Operations Research*

Editorial Board, *Modeling and Simulation Journal*

## **HILL, RAYMOND R.**

Professor of Operations Research, Department of Operational Sciences; Program Chair, Operations Research Doctoral Program; Program Director, Graduate Test and Evaluation Certificate and Data Science Certificate; Director, Science of Test Research Laboratory, Department of Operational Sciences, AFIT Appointment Date:1997 (AFIT/ENS); BS, Mathematics, Eastern Connecticut State University, 1983; MS, Operations Research, Air Force Institute of Technology, 1988; PhD, Industrial and Systems Engineering, The Ohio State University, 1996. Dr. Hill's research interests include applied statistics and data analytics, in particular the application of design of experiments methodologies to test and evaluation, mathematical optimization, in particular the use of heuristic search methods for addressing particularly hard problems, and applied simulation modeling and analysis with particular interests in the areas of agent-based modeling and the validation of such models. Dr. Hill is a member of the Military Operations Research Society. Tel. 937-255-3636 x7469, Email: [Raymond.Hill@afit.edu](mailto:Raymond.Hill@afit.edu)

### **Sponsor Funded Research Projects**

"The Science of Test: Advanced Test and Evaluation in Support of the DOD Test and Evaluation Enterprise." Sponsor: OSD. Funding: \$393,766 - Hill 25%, Freels 25%, Hodson 25%, Talafuse 25%.

### **Refereed Journal Publications**

Kline, A.G., Ahner, D.K., and Hill, R.R., "The Weapon Target Assignment Problem," *Computers and Operations Research*, May, 2019.

Freels, J., Timme, D.A., Pignatiello, J.J., Warr, R.L., and Hill, R.R., "Maximum Likelihood Estimation for the Poly-Weibull Distribution," *Quality Engineering*, May, 2019.

Little, Z.C., Weir, J.D., Hill, R.R., Stone, B.B., and Freels, J.K., "Batch Sequential NOAB Designs by Way of Simultaneous Construction and Augmentation," *International Journal of Experimental Design and Process Optimisation*, Vol. 6, No. 2, pp. 127-145, Mar 2019.

Lessin, A.M., Lunday, B.J., and Hill, R.R., "A Multi-Objective Bi-Level Sensor Relocation Problem for Border Security," *Institute for Industrial and System Engineering – Transactions*, Vol. 51, No. 10, pp. 1091-1109, Feb 2019.

Keith, A., Ahner, D., and Hill, R.R., "An Order-Based Method for Robust Queue Inference with Stochastic Arrival and Departure Times," *Computers and Operations Industrial Engineering*, Vol. 128, pp. 711-726, Jan 2019.

Hazen, B., Skipper, J.B., Boone, C.A., and Hill, R.R., "Back in Business: The Value of Operations Research in Support of Big Data Analytics for Operations and Supply Chain Management," *Annals of Operations Research*, Vol. 270, Issue 1-2, pp. 201-211, Nov 2018.

Storm, S.M., Hill, R.R., Pignatiello, J.J., White, E.A., and Vining, G.G., "Point-Wise Model Validation over Experimental Regions Using Regression Tolerance Intervals with Bayesian Relaxations," *Simulation: Transactions of the Society for Modeling and Simulation International*, Oct 2018.

Deehr, J. Smith, C., and Hill, R.R., "Improving Admissions Processes through Value Focused Thinking," *Journal of Applied Operational Research*, Vol. 10, No. 1, pp. 53-65, Oct 2018.

Hill, R.R., Rupp, C.C., Jones, K.M., and Atkinson, A.D., "A Case Study in Engineering Model Validation Using New Wavelet-Based Methods," *Quality and Reliability Engineering International*, Vol. 35, No. 3, pp. 815-823, Oct 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Yost, K.J., Robbins, B.A., Perdikakis, W., Kitzmiller, C., Jones, K., and Hill, R.R., "Quantifying Parameter Variability on a Population of Aerospace Synchronous Generators," *Proceedings of the IEEE International Electric Machines and Drives Conference*, San Diego, CA, 11-15, May 2019.

Hill, R.R., Tolk, A., Hodson, D.D., and Millar, J.R., "Open Challenges in Building Combat Simulation Systems to Support Test, Analysis and Training," *Proceedings of the Winter Simulation Conference*, Piscataway, NJ, 9-12 Dec 2018.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Lessin, A.M., Lunday, B.J., and Hill, R.R., "A Trilevel Optimization Model for Integrated Air Defense System Penetration," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

#### **Editorships in Professional Journals**

Editor, *Journal of Defense Analytics and Logistics*

Editor, *Military Operations Research*

Associate Editor, *Journal of Defense Modeling and Simulation*

Associate Editor, *Journal of Simulation*

Associate Editor, *International Journal of Mathematics in Operational Research*

Associate Editor, *Naval Research Logistics*

Associate Editor, *Quality Engineering*

#### **HOLZMANN, TIMOTHY W., Lt Col**

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BA, Mathematics, Cedarville University, 2004; MS, Operations Research, Air Force Institute of Technology, 2009; PhD, Industrial Engineering, Clemson University, 2019. Maj Holzmann's research interests include combinatorial optimization, optimization under uncertainty, multiobjective optimization, decision support, and stochastic modeling. Maj Holzmann is a member of the Institute for Operations Research and the Management Sciences, and the Military Operations Research Society. Tel. 937-255-3636 x4337, Email: [Timothy.Holzmann@afit.edu](mailto:Timothy.Holzmann@afit.edu)

#### **Refereed Journal Publications**

Holzmann, T., and Smith, J.C., "The Shortest Path Interdiction Problem with Arc Improvement Recourse: A Multiobjective Approach," *Naval Research Letters*, Vol. 66, No. 3, pp. 230-252, Apr 2019.

Holzmann, T., and Smith, J.C., "Solving Discrete Multi-Objective Optimization Problems Using Modified Augmented Weighted Tchebychev Scalarizations," *European Journal of Operations Research*, Vol. 271, No. 2, pp. 436-449, Dec 2018.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Holzmann, T., and Smith J.C., "Modeling the Shortest Path Interdiction Problem with Randomized Strategies," *Proceedings of the IISE Annual Conference*, Orlando, FL, 18-21 May 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Holzmann, T., and Smith, J.C., "Optimizing Random Interdiction Strategies in Shortest Path Interdiction Problems," *IISE Annual Conference*, Orlando, FL, 18-21 May 2019.

Holzmann, T., and Smith, J.C., "A Shortest Path Interdiction Problem with Improvement," *INFORMS Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

### **JENKINS, PHILLIP R., Capt**

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BS, Mathematics, Ohio University, 2012; MS, Operations Research, Air Force Institute of Technology, 2017; PhD, Operations Research, Air Force Institute of Technology, 2019. Capt Jenkin's research interests include dynamic programming, approximate dynamic programming, Markov decision processes, stochastic programming, applied statistics, machine learning, and multiobjective optimization. Capt Jenkins is a member of the Institute for Operations Research and the Management Sciences, and the Military Operations Research Society.  
Tel. 937-255-3636 x6100, Email: [Phillip.Jenkins@afit.edu](mailto:Phillip.Jenkins@afit.edu)

### **Refereed Journal Publications**

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," *Omega*, Jul 2019. DOI: 10.1016/j.omega.2019-07.004

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *Omega*, Dec 2018. DOI: 10.1016/j.omega.2018-12-009

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Examining Military Medical Evacuation Dispatching Policies Utilizing a Markov Decision Process Model of a Controlled Queueing System," *Annals of Operations Research*, Vol. 271, No. 2, pp. 641-678, Dec 2018.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Jenkins, P.R., "Utilizing Operations Research Techniques to Solve Military Medical Evacuation Problems," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Cincinnati-Dayton Chapter Fall Technical Symposium*, Dayton, OH, 19 Oct 2018.

### **JOO, SEONG-JONG**

Professor of Logistics & Supply Chain Management, Department of Operational Sciences; Co-Director, Distance Learning Program; MS, Logistics & Supply Chain Management; Program Chair, Logistics Doctoral Program, Department of Operational Sciences, AFIT Appointment Date: 2016 (AFIT/ENS); BS, Korea Air Force Academy (Seoul, Korea), 1982; MBA, Saint Louis University, 1992; PhD, Saint Louis University, 1995. Dr. Joo's research interests include sourcing, inventory management, transportation, and performance measurement and benchmarking. Dr. Joo is a member of the Academy of Management, American Production and Inventory Control Society, Decision Sciences Institute, Institute for Supply Management, and Production and Operations Management Society. AFIT research center affiliation(s): COA.  
Tel. 937-255-3636 x4761, Email: [Seong-Jong.Joo@afit.edu](mailto:Seong-Jong.Joo@afit.edu)

### **Sponsor Funded Research Projects**

"Logistics Distance Learning Program." Sponsor: HAF/A4. Funding: \$25,000.

"Research, Analysis and Transition Support to the Directorate of Logistics and Sustainment/AFMC." Sponsor: AFMC/A4. Funding: \$350,000 - Joo 40%, Steeneck 25%, Boehmke 20%, Breitbart 5% . [COA]

“Research, Analysis and Transition Support to the Directorate of Logistics and Sustainment/AFMC.” Sponsor: AFMC/A4. Funding: \$90,000 - Joo 40%, Steeneck 25%, Boehmke 20%, Breitbach 5%. [COA]

### **Refereed Journal Publications**

Anderson, J., Cunningham, W., and Joo, S., “Examining the Impact of the Increased Fuel Efficiency Standards on State Gas-Tax Revenues,” *Journal of Accounting and Finance*, Vol. 18, No. 6, pp. 10-23, Oct 2018.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Hwang, S., Joo, S., and Dickens, J., “Degree of Buyer Protectiveness and Supplier Absorptive Capacity in Buyer-Driven New Product Development,” *Annual European Decision Sciences Institute Conference*, Nottingham, UK, 2-5 Jun 2019.

Zunker, C., Howard, K., and Joo, S., “A Statistical Study of the Factors Affecting Variable Shipment Costs,” *Annual POMS Conference*, Washington, DC, 2-6 May 2019.

Monteiro, L., and Joo, S., “Predicting Failures of Military Aircraft Using Survival Analysis,” *Spring Korea Industrial Engineering Society Consolidated Conference*, Gwangju, South Korea, 10-13 Apr 2019.

Hebert, T., Joo, S., and Keesling, R., “Measuring the Productivity of Aircraft Maintenance Operations Using Data Envelopment Analysis,” *Annual Meeting of the Decision Sciences Institute*, Chicago, IL, 17-19 Nov 2018.

Lee, C., and Joo, S., “Impacts of Group Purchasing Organizations and Distributors on Hospital Efficiency,” *Annual Meeting of the Decision Sciences Institute*, Chicago, IL, 17-19 Nov 2018.

### **LACASSE, PHILLIP M., Lt Col**

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019 (AFIT/ENS); BS, Mathematics, United States Military Academy, 2000; MS, Industrial Engineering, University of Wisconsin, 2010; PhD, Industrial Engineering, University of Wisconsin, 2019. Lt Col LaCasse’s research interests include data science, probability and statistics, operations research, and sports analytics. Tel. 937-255-3636 x4318, Email: [Phillip.LaCasse@afit.edu](mailto:Phillip.LaCasse@afit.edu)

### **Refereed Journal Publications**

P. M. LaCasse, W. Otieno, and F. Maturana, “A Survey of Feature Set Reduction Approaches for Predictive Analytics Models in the Connected Manufacturing Enterprise,” *Journal of Applied Science*, Vol. 9, No. 5, p. 843, Apr 2019.

P.M. LaCasse, W. Otieno, and F.P. Maturana, “A Hierarchical, Fuzzy Inference Approach to Data Filtration and Feature Prioritization in the Connected Manufacturing Enterprise,” *Journal of Big Data*, Vol. 5, No. 1, p. 45, Dec 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

LaCasse, P., Otieno, W., Vance, G., Maturana, F., and Cvijetinovic, M., “A Defect Prediction Case Study for Printed Circuit Board Assemblies Containing Ball Grid Array Package Types,” *Surface Mount Technology Association (SMTA) International Conference Proc*, Rosemont, IL, 22-26 Sep 2019.

LaCasse, P., Otieno, W., and Maturana, F., “Operationalization of Defect Prediction Case Study in a Holonic Manufacturing System,” *International Conference on Industrial Applications of Holonic and Multi-Agent Systems (HoloMAS)*, Linz, Austria, 26-28 Aug 2019.

Otieno, W., Garantiva, J., and LaCasse, P., “Optimal One-Dimensional Free-Replacement Warranty Period for AGM Batteries,” *Proceedings of the IEEE-Explore, Annual Reliability and Maintainability Symposium*, Las Vegas, NV, 6-8 Jan 2019.

## **LUNDAY, BRIAN J.**

Associate Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2016 (AFIT/ENS); BS, Mechanical Engineering, United States Military Academy, West Point, 1992; MS, Industrial Engineering, University of Arizona, 2001; PhD, Industrial and Systems Engineering, Virginia Polytechnic Institute and State University, 2010. Dr. Lunday's theoretical research interests include math programming, game theoretic models, and algorithmic design for global optimization, whereas his application research interests include network design, network interdiction, network restoration, facility location, and resource allocation/assignment. Dr. Lunday is a member of the Institute for Operations Research and Management Sciences, Military Operations Research Society, and the Air Force Association. Tel. 937-255-3636 x4624, Email: [Brian.Lunday@afit.edu](mailto:Brian.Lunday@afit.edu)

### **Sponsor Funded Research Projects**

"Personnel Recovery Asset Basing in the USAFRICOM AOR." Sponsor: USAFRICOM. Funding: \$8,820.

"Transportation and Distribution Research." Sponsor: USTRANSCOM. Funding: \$125,000.

### **Refereed Journal Publications**

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," *Omega*, Jul 2019. DOI: 10.1016/j.omega.2019.07.004

Kline, A.G., Ahner, D.K., and Lunday, B.J., "Real-Time Heuristic Algorithms for the Static Weapon Target Assignment Problem," *Journal of Heuristics*, Vol. 25, No. 3, pp. 377-397, Jun 2019.

Lessin, A.M., Lunday, B.J., and Hill, R.R., "A Multi-Objective Bi-Level Sensor Relocation Problem for Border Security," *Institute for Industrial and System Engineering: Transactions*, Vol. 51, No. 10, pp. 1091-1109, May 2019.

Lunday, B.J., and Robbins, M.J., "Collaboratively-Developed Vaccine Pricing and Stable Profit Sharing Mechanisms," *Omega*, Vol. 84, pp. 102-113, Apr 2019.

Caballero, W.N., Lunday, B.J., Deckro, R.F., and Pachter, M., "Prospect Games and Regulated Prospect Games: Modeling Adversarial Inducement and Its Governance," *Socio-Economic Planning Sciences*, Apr 2019. DOI: [10.1016/j.seps.2019.04.006](https://doi.org/10.1016/j.seps.2019.04.006)

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *Omega*, Dec 2018. DOI: 10.1016/j.omega.2018.12.009

Hanks, R.W., Lunday, B.J., and Weir, J.D., "Robust Goal Programming for the Multi-Objective Optimization of Data-Driven Problems: A Use Case for the United States Transportation Command's Liner Rate Setting Problem," *Omega*, Nov 2018. DOI: 10.1016/j.omega.2018.10.013

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Bastian, W.N., Lunday, B.J., Fisher, C.B., and Hall, A.O., "Stochastic Goal Programming to Optimize Army Cyber Branch Readiness and Manning Under Uncertainty," *INFORMS Conference on Business Analytics*, Austin, TX, 14-16 Apr 2019.

Caballero, W.N., Lunday, B.J., and Deckro, R.F., "Leveraging Behavioral Game Theory for the Study of International Relations," *NATO Studies & Systems (SAS) Panel Symposium on Deterrence and Assurance within an Alliance Framework*, London, UK, 17-18 Jan 2019.

Lessin, A.M., and Lunday, B.J., "A Multi-Objective Bi-Level Optimization Model for the Relocation of Integrated Air Defense System Assets," *Annual Meeting of the Decision Sciences Institute*, Chicago, IL, 17-19 Nov 2018.

Caballero, W.N., and Lunday, B.J., "Influence Modeling: Mathematical Programming Representations of Persuasion under Either Risk or Uncertainty," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Bastian, N.D., Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Using Multiple Level Aggregation," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Military Medical Evacuation Dispatching Policies," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Lessin, A.M., Lunday, B.J., and Hill, R.R., "A Multi-Objective Trilevel Optimization Model for Integrated Air Defense System Penetration," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Military Medical Evacuation Dispatch Policies," *Fall Technical Symposium, Cincinnati-Dayton INFORMS Society*, 19 Oct 2018.

Caballero, W.N., and Lunday, B.J., "Influence Modeling: Mathematical Programming Representations of Persuasion under Either Risk or Uncertainty," *Fall Technical Symposium, Cincinnati-Dayton INFORMS Society*, 19 Oct 2018.

### **Editorships in Professional Journals**

Associate Editor, *Military Operations Research*

### **MILLER, JOHN O.**

Associate Professor of Operations Research, Department of Operational Sciences; Program Chair, Operations Research Division, AFIT Appointment Date: 2002 (AFIT/ENS); Director, Combat Modeling Laboratory; BS, Biology, United States Air Force Academy, 1980; MBA, University of Missouri at Columbia, 1983; MS, Operations Research, Air Force Institute of Technology, 1987; PhD, Industrial Engineering, The Ohio State University, 1997. Dr. Miller's research interests include computer simulation, ranking and selection, agent based modeling, combat modeling, network centric warfare, high performance computing, applied statistics, and nonparametric statistics. AFIT research center affiliation(s): COA. Tel. 937-255-3636 x4326, Email: [John.Miller@afit.edu](mailto:John.Miller@afit.edu)

### **Sponsor Funded Research Projects**

"Operational Analysis of Blue Weapons with Focus on Autonomy." Sponsor: Lockheed Martin. Funding: \$50,000 - Miller 75%, Champagne 25%. [COA]

"SIMIO Simulation Training for AFLCMC." Sponsor: AFLCMC. Funding: \$6,000 - Miller 50%, Hodson 50%. [COA]

### **Refereed Journal Publications**

Troya, A., Mailloux, L., Miller, J.O., FitzHarris, R., and Mueller, M., "Modeling and Studying the Air Force Airworthiness Process with Considerations for Reusable Launch Vehicles," *Journal of DOD Research and Engineering*, Vol. 1, No. 3, pp. 5-21, Dec 2018. [COA]

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Troya, A., Mailloux, L., Miller J.O., FitzHarris, R., and Mueller, M., "A Study of Cross-Domain Process Adaptation Applied to Reusable Launch Vehicle Re-Qualification," *IEEE International Systems Engineering Symposium*, Rome, Italy, 1-3 Oct 2018. [COA]

### **Editorships in Professional Journals**

Associate Editor, *International Journal of Operations Research* [COA]

**PIGNATIELLO, JOSEPH J., Jr.**

Professor of Operations Research and Head, Department of Operational Sciences; AFIT Appointment Date: 2010 (AFIT/ENV); 2011 (AFIT/ENS); BS, Mathematics, University of Massachusetts, 1976; MS, Industrial and Systems Engineering, The Ohio State University, 1979; PhD, Industrial and Systems Engineering, The Ohio State University, 1982. Dr. Pignatiello's research interests include statistical process monitoring, change-point models, design and analysis of experiments, reliability, statistical data analysis, robust design, and Six Sigma methods. Dr. Pignatiello is a Fellow of both the American Society for Quality, and the Institute of Industrial and Systems Engineers. Tel. 937-255-3636 x4311, Email: [Joseph.Pignatiello@afit.edu](mailto:Joseph.Pignatiello@afit.edu)

**Refereed Journal Publications**

Vanli, O. Arda, Giroux, Rupert, Erman Ozguven, Eren, and Pignatiello, Joseph J., Jr., "Monitoring of Count Data Time Series: Cumulative Sum Change Detection in Poisson Integer Valued GARCH Models," *Quality Engineering*, Vol. 31, No. 3, pp. 439-452, 2019.

Freels, Jason K., Timme, D. A., Pignatiello, Joseph J., Jr., Warr, Richard L., and Hill, Raymond R., "Maximum Likelihood Estimation for the Poly-Weibull Distribution," *Quality Engineering*, May 2019. DOI: 10.1080/08982112.2018.1557685

Storm, Scott M., Hill, Raymond R., Pignatiello, Joseph J., Jr., White, Edward A., and Vining, Geoffrey G., "Point-Wise Model Validation Over Experimental Regions Using Regression Tolerance Intervals with Bayesian Relaxations," *Simulation: Transactions of the Society for Modeling and Simulation International*, Apr 2019. doi: 10.1177/0037549719844193

**Editorships in Professional Journals**

Editorial Board, *Quality Engineering*

Editorial Board, *IIE Transactions*

Editorial Advisory Board, *International Journal of Lean Six Sigma*

**REIMAN, ADAM D., Col**

Associate Dean of the Graduate School of Engineering and Management, and Assistant Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2014 (AFIT/ENS); BS, Astronautical Engineering, United States Air Force Academy, 1995; MBA, Military Management, Touro University International, 2006; MS, Logistics Management, Air Force Institute of Technology, 2009; PhD, Logistics, Air Force Institute of Technology, 2014. Col Reiman's research interests include airlift metrics, routing, scheduling, fuel efficiency, energy efficiency, supply and demand, value-focused thinking, and heuristic search algorithms. Tel. 937-255-3636 x4689, Email: [Adam.Reiman@afit.edu](mailto:Adam.Reiman@afit.edu)

**ROBBINS, MATTHEW J.**

Associate Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BS, Computer Systems Engineering, University of Arkansas, 1999; MS, Operations Research, Air Force Institute of Technology, 2005; PhD, Industrial Engineering, University of Illinois, 2010. Dr. Robbins' research interests include applied statistics, approximate dynamic programming, stochastic processes, game theory, Markov decision processes, machine learning, and simulation. Dr. Robbins is a member of the Institute for Operations Research and the Management Sciences, Military and Security Society, Optimization Society (Optimization under Uncertainty), and Military Operations Research Society. Tel. 937-255-3636 x4606, Email: [Matthew.Robbins@adit.edu](mailto:Matthew.Robbins@adit.edu)

**Refereed Journal Publications**

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," *Omega*, Jul 2019. DOI: 10.1016/j.omega.2019.07.004

Lunday, B.J., and Robbins, M.J., “Collaboratively-Developed Vaccine Pricing and Stable Profit Sharing Mechanisms,” *Omega*, Vol. 84, pp. 102-113, Apr 2019.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., “Examining Military Medical Evacuation Dispatching Policies Utilizing Markov Decision Process Model of a Controlled Queueing System,” *Annals of Operations Research*, Vol. 271, No. 2, pp. 641-678, Dec 2018.

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., “Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation,” *Omega*, Dec 2018. DOI: 10.1016/j.omega.2018-12-009

### **Editorships in Professional Journals**

Associate Editor, *Military Operations Research*

### **Other Significant Research Productivity**

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., “Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation,” *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., “Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies,” *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., “Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies,” *INFORMS Cincinnati-Dayton Chapter Fall Technical Meeting*, Dayton, OH, 19 Oct 2018.

### **TALAFUSE, THOMAS P., Maj**

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2017 (AFIT/ENS); BS, Operations Research and Mathematics, United States Air Force Academy, 2007; MS, Operations Research, Air Force Institute of Technology, 2011; PhD, Industrial Engineering, University of Arkansas, 2016. Maj Talafuse’s research interests include reliability, reliability growth, optimization, stochastic processes, design of experiments, applied statistics, and risk analysis. He is a member of the Institute for Operations Research and the Management Sciences, and the Institute for Industrial and Systems Engineers. Tel. 937-255-3636 x4740, Email: [Thomas.Talafuse@afit.edu](mailto:Thomas.Talafuse@afit.edu)

### **Refereed Journal Publications**

Ledwith, M.C., Jackson, R.A., Reboulet, A.M., and Talafuse, T.P., “Ethics and Education: A Markov Chain Assessment of Civilian Education in Air Force Materiel Command,” *International Journal of Responsible Leadership and Ethical Decision-Making*, Vol. 1, No. 1, pp. 25-37, 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Talafuse, T.P., and Gilts, E.E., “A Simulation Approach to Address MQ-9 Flying Training Unit Manning Shortfalls,” *Military Operations Research Society Annual Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

**WEIR, JEFFERY D.**

Professor of Operations Research and Associate Department Head, Department of Operational Sciences; AFIT Appointment Date: 2002 (AFIT/ENS); BS, Electrical Engineering, Georgia Institute of Technology, 1988; MBA, Embry Riddle-Aeronautical University, 1992; MS, Operations Research, Air Force Institute of Technology, 1995; PhD, Industrial & Systems Engineering, Georgia Institute of Technology, 2002. Dr. Weir's research interests include decision analysis, deterministic optimization, and applied statistics. Dr. Weir is a member of the Institute of Industrial Engineers, and the Decision Sciences Institute. AFIT research center affiliation(s): COA. Tel. 937-255-3636 x4523, Email: [Jeffery.Weir@afit.edu](mailto:Jeffery.Weir@afit.edu)

**Sponsor Funded Research Projects**

"Cost Capability Analysis AFIT Support to Acquisition Intelligence Requirements Task Force (AIR-TF) and Headquarters Air Force A2 (HAF/A2)." Sponsor: OSD. Funding: \$450,000. [COA]

**Refereed Journal Publications**

Little, Z. C., Weir, J. D., Hill, R. R., Stone, B. B., and Freels, J. K., "Batch Sequential NOAB Designs by way of Simultaneous Construction and Augmentation," *International Journal of Experimental Design and Process Optimisation*, Vol. 6, No. 2, pp. 127-146, Aug 2019. [COA]

Su, C., Weir, J.D., Zhang, F., Yan, H., and Wu, T., "ENTRNA: A Framework to Predict RNA Foldability," *BMC Bioinformatics*, Vol. 20, No. 373, Jul 2019. [COA]

Gehret, G.H., Weir, J.D., Johnson, A.W., and Jacques, D.R., "Advancing Stock Policy on Repairable, Intermittently Demanded Service Parts," *Journal of the Operational Research Society*, May 2019. DOI: 10.1080/01605682.2019.1610206 [COA]

Hanks, R., Lunday, B., and Weir, J., "Robust Goal Programming for Multi-Objective Optimization of Data-Driven Problems: A Use Case for the United States Transportation Command's Liner Rate Setting Problem," *Omega*, Nov 2018. DOI: 10.1016/j.omega.2018.10.013 [COA]

Little, Z. C., Weir, J. D., Hill, R. R., Stone, B. B., and Freels, J. K., "Second-Order Extensions to Nearly Orthogonal-and-Balanced (NOAB) Mixed-Factor Experimental Design," *Journal of Simulation*, Vol. 13, No. 3, pp. 226-237, Oct 2018. [COA]

**Editorships in Professional Journals**

Associate Editor, *Military Operations Research Journal* [COA]

Associate Editor, *IIE Transactions on Healthcare Systems Engineering* [COA]

**ZAWADZKI, MARCELO, Lt Col**

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, Aeronautical Sciences, Brazilian Air Force Academy, 1999; MS, Operations Research, Technological Institute of Aeronautics, 2009; MBA, Public Management, Universidade Federal Fluminense, 2011; PhD, Operations Research, Technological Institute of Aeronautics/London School of Economics and Political Science, 2014. Lt Col Zawadzki's research interests include resource allocations against emerging threats, and multiobjective analysis. Tel. 937-255-3636 x4521, Email: [Marcelo.Zawadzki.BR@afit.edu](mailto:Marcelo.Zawadzki.BR@afit.edu)

## **5.6 DEPARTMENT OF SYSTEMS ENGINEERING AND MANAGEMENT**

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<b>5.6.1</b>	<b><u>DOCTORAL DISSERTATIONS (N/A)</u></b>	<b>170</b>
<b>5.6.2</b>	<b><u>MASTER'S THESES</u></b>	<b>170</b>
<b>5.6.3</b>	<b><u>FACULTY BIOGRAPHIES &amp; RESEARCH OUTPUT</u></b>	<b>173</b>

### 5.6.1 DOCTORAL DISSERTATIONS

NA.

### 5.6.2 MASTER'S THESES

ALQAHTANI, AHMED, Saudi Arabia Progression Towards Renewable Energy According to its Vision 2030. AFIT-ENV-MS-19-S-050. Faculty Advisor: Dr. William A. Cunningham. Sponsor: N/A.

ALSHAMMARI, DHAHER M., Trust and Suspicion as a Function of Cyber Security in Human Machine Team (HMT) of Unmanned Systems. AFIT-ENV-MS-19-S-051. Faculty Advisor: Dr. John J. Elshaw. Sponsor: N/A. [CCR]

ANGELL, EMILY, Analysis of Military Construction Cost Growth in Major Defense Acquisition Programs. AFIT-ENV-MS-19-M-159. Faculty Advisor: Dr. Edward D. White. Sponsor: AFCAA.

BAKER, JERRY, An Analysis of Profit Margin in Relation to the Better Buying Power Initiative. AFIT-ENV-MS-19-M-160. Faculty Advisor: Lt Col Scott T. Drylie. Sponsor: OSD/CAPE.

BEEEMER, CODY, An Analysis of Built Environment Factors in Residences and the Associated Effects on Mental Health Symptoms of United States Veterans. AFIT-ENV-MS-19-M-161. Faculty Advisor: Lt Col Andrew J. Hoisington. Sponsor: MIRECC.

BERNER, WILLIAM, Estimating Total Cost of Ownership for United States Air Force Chiller Assets. AFIT-ENV-MS-19-M-162. Faculty Advisor: Maj Steven J. Schuldt. Sponsor: AFIMC.

BONENFANT, BENJAMIN, An Analysis of Estimate Variance in Program Office Estimates. AFIT-ENV-MS-19-M-163. Faculty Advisor: Lt Col Clay M. Koschnick. Sponsor: AFLCM/FM.

BOWERS, BRETT, A Study of Onboarding and Turnover Mediating Variables in US Air Force Officers. AFIT-ENV-MS-19-S-053. Faculty Advisor: Dr. Alfred E. Thal. Sponsor: USAF HQ/A4.

BRADLEY, LOYD, Investigating Schedule Length of Space and Missile Systems Center Contracts. AFIT-ENV-MS-19-M-164. Faculty Advisor: Dr. Edward D. White. Sponsor: SMC/PI.

CANZONETTA, DAVID, Assessing Artificial-Agent Response Time Effects on Human-Agent Teams in Variable Inter-Arrival Time Environments. AFIT-ENV-MS-19-M-166. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFOSR.

CHESTER, DAVID, A Life Cycle Analysis of DOD Expeditionary Waste Management Strategies in SimaPro. AFIT-ENV-MS-19-M-167. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CX.

COMBS, COREY A., DT&E of an Autonomous UAS Swarming Algorithm. AFIT-ENV-MS-19-M-168. Faculty Advisor: Dr. John M. Colombi. Sponsor: AFRL/RV. [ANT]

COWEN, LUKAS, Municipal Wastewater to Algal Biomass: A Techno-Economic Analysis. AFIT-ENV-MS-19-M-169. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CX.

DELONG, BRANDEN, Quantifying Resiliency Risk Metrics through Facility Dispersion. AFIT-ENV-MS-19-M-170. Faculty Advisor: Maj Steven J. Schuldt. Sponsor: N/A.

ELLIS, ASHLEE, Interactions between Bacteriophage MS2, Kaolinite, and Fiberglass. AFIT-ENV-MS-19-M-171. Faculty Advisor: Dr. Willie F. Harper. Sponsor: US EPA.

ELWORTH, CHRISTOPHER, Comparing Estimated-to-Actual Development Budgets for Air Force Space Programs. AFIT-ENV-MS-19-M-172. Faculty Advisor: Dr. Edward D. White. Sponsor: SMC/RFM.

ENOS, TREVOR, A Case Study of EPA Clauses as they Apply to Fixed Price Contracts. AFIT-ENV-MS-19-M-173. Faculty Advisor: Dr. Jonathan Ritschel. Sponsor: AFLCMC/FZ.

GEISER, PHILICIA, Evaluation of Guar Gum as a Novel Adsorbent. AFIT-ENV-MS-19-M-174. Faculty Advisor: Lt Col John E. Stubbs. Sponsor: US EPA.

GLASS, JOSHUA, Toxicological Life Cycle Impact Analysis of Short and Long Chain Perfluorinated Compounds Compared to Impacts of Treatment Techniques. AFIT-ENV-MS-19-M-176. Faculty Advisor: Dr. Eric G. Mbonimpa. Sponsor: AFCEC/CZ.

HAYES, AUSTIN, The Evaluation of High-Molecular-Weight Methacrylate as a Treatment Option for Shrinkage Cracks in Airfield Pavement. AFIT-ENV-MS-19-M-177. Faculty Advisor: Dr. Alfred E. Thal. Sponsor: AFCEC.

HERTWIG, FRED D., Search-Based vs Task-Based Space Surveillance for Ground-Based Telescopes. AFIT-ENV-MS-19-M-178. Faculty Advisor: Dr. John Colombi. Sponsor: N/A. [CSRA ANT]

HINES, PARKER, Analyzing the Efficiency of Horizontal Photovoltaic Cells at Air Force Installations in Various Climate Regions. AFIT-ENV-MS-19-M-179. Faculty Advisor: Lt Col Torrey J. Wagner. Sponsor: N/A.

JESTICE, CHRISTINE, A Human Capital Perspective. AFIT-ENV-MS-19-M-180. Faculty Advisor: Dr. John J. Elshaw. Sponsor: AFLCMC/CV.

JORDAN, RAMOANE, Fate and Transport Modeling of Perfluoroalkyl Substances (PFAS) in Groundwater from Aqueous Film Forming Foam (AFFF) Impacted Sites. AFIT-ENV-MS-19-M-181. Faculty Advisor: Dr. Eric Mbonimpa. Sponsor: AFCEC/CZOM.

KELLY, PATRICK J., Methodology for Including Base Infrastructure in Conceptual System Analysis. AFIT-ENV-MS-19-M-182. Faculty Advisor: Dr. John M. Colombi. Sponsor: AFLCMC/XZ [ANT]

KLINE, SETH, Text Analysis of Air Force References in Twitter. AFIT-ENV-MS-19-M-183. Faculty Advisor: Dr. Jonathan Ritschel. Sponsor: AFCAA.

LABEDZ, THEODORE, Quantifying Permafrost Extent, Condition, and Degradation at Eielson Air Force Base. AFIT-ENV-MS-19-M-184. Faculty Advisor: Maj Steven J. Schuldt. Sponsor: N/A.

LEVALLEY, ANDREW S., A Mixed Integer Programming Framework for the Fuel Optimal Guidance of Complex Spacecraft Rendezvous and Proximity Operation Missions. AFIT-ENV-MS-19-M-185. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFSPC/A2/3/6TW [CSRA]

MACGREGOR, KATIE, Analysis of Cross-Cultural Training Efforts, Competencies, and Implications, and How Cross-Cultural Competency Affects the Success of Construction Projects on Air Force Installations Overseas. AFIT-ENV-MS-19-M-186. Faculty Advisor: Dr. John J. Elshaw. Sponsor: N/A.

MARKMAN, MATTHEW, Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms. AFIT-ENV-MS-19-M-187. Faculty Advisor: Dr. Jonathan Ritschel. Sponsor: AFLCMC/FZ.

MARTINEZ SANCHEZ, JOSE, Electrochemical Modification of Granular-Activated Carbon and Carbon Nanofibers to Determine Effect on Adsorption. AFIT-ENV-MS-19-M-188. Faculty Advisor: Lt Col John E. Stubbs. Sponsor: US EPA.

MCWHIRTER, TRAVIS, Ground Vehicle Physics-Based Energy Modeling and Series Hybrid System Optimization. AFIT-ENV-MS-19-M-189. Faculty Advisor: Lt Col Torrey Wagner. Sponsor: TARDEC.

O'CONNOR, SARA, An Analysis of Defense Contractor Profit Margins. AFIT-ENV-MS-19-M-191. Faculty Advisor: Maj Scott Drylie. Sponsor: OSD/CAPE.

PASION, CHRISTIL, Modeling Power Output of Horizontal Solar Panels Using Multivariate Linear Regression and Random Forest Machine Learning. AFIT-ENV-MS-19-M-192. Faculty Advisor: Lt Col Torrey Wagner. Sponsor: CESS.

PLOURDE, TIMOTHY, Analysis of the Effect of Corrosion on the Surface Chemistry of Mild Steel Exposed to Biofuel. AFIT-ENV-MS-19-M-193. Faculty Advisor: Dr. Jeremy Slagley. Sponsor: AFRL/RX.

POOLE, JONATHAN D., Product Development Process for Small Unmanned Aerial Systems. AFIT-ENV-MS-19-M-194. Faculty Advisor: Lt Col Amy Cox. Sponsor: AFRL/RQ [ANT]

RASK, THEODORE A., Commercialization Analysis of SBIR-Funded Technologies. AFIT-ENV-MS-19-M-195. Faculty Advisor: Lt Col Amy Cox. Sponsor: AFRL/SB [ANT]

SHULER, ROBERT, Selecting a Construction Contract Acquisition Strategy to Support Foreign Military Sales Facility Construction. AFIT-ENV-MS-19-M-196. Faculty Advisor: Dr. Alfred E. Thal. Sponsor: AFSAC.

SIGALA, ALBERTO, A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities. AFIT-ENV-MS-19-M-197. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFOSR.

SPRANGER, ZACHARY, Analysis and Design of Modular Overhead Protection System Utilizing Readily Available Materials. AFIT-ENV-MS-19-M-198. Faculty Advisor: Dr. Alfred Thal. Sponsor: AFCEC.

TYHURST, JAMES, Non-Intrusive Occupancy Detection Methods and Models. AFIT-ENV-MS-19-M-200. Faculty Advisor: Lt Col Andrew J. Hoisington. Sponsor: N/A.

TYSON, ROBERT, An Assessment of the Air Force's Return on Investment for Product Support Business Case Analysis Processes. AFIT-ENV-MS-19-M-201. Faculty Advisor: Dr. R. David Fass Sponsor: AFLCMC.

### 5.6.3 FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliation is listed in [ ] if applicable.

#### **BADIRU, ADEDEJI B.**

Dean, Graduate School of Engineering and Management, AFIT Appointment Date: 2013 (AFIT/EN); BS, Tennessee Technological University, 1979; MS, Tennessee Technological University, 1981; PhD, Industrial Engineering, University of Central Florida, 1984. Dr. Badiru's research interests include Project Modeling, Analysis, Management and Control, Mathematical Modeling, Computer Simulation, Information Systems, and Economic Analysis. He is the author of several books and technical journals. Tel. 937-255-3636 x4799, Email: [Adedeji.Badiru@afit.edu](mailto:Adedeji.Badiru@afit.edu)

#### **Refereed Journal Publications**

Badiru, Adedeji B., "Quality Insights: Umbrella Theory for Innovation: A Systems Framework for Quality Engineering and Technology," *International Journal of Quality Engineering and Technology*, Vol. 7, No. 4, pp. 331-345, 2019.

Badiru, Adedeji B., "Quality Insights: Artificial Neural Network and Taxonomical Analysis of Activity Networks in Quality Engineering," *International Journal of Quality Engineering and Technology*, Vol. 7, No. 2, pp. 320-329, Jan 2019.

#### **Books and Chapters in Books**

Badiru, A. B. (2019), *Project Management: Systems, Principles, and Applications*, Second Edition, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B. (2019), *Systems Engineering Models: Theory, Methods, and Applications*, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B., Oye Ibidapo-Obe, and Babs J. Ayeni (2019), *Manufacturing and Enterprise: An Integrated Systems Approach*, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B., S. Abi Badiru, and I. Ade Badiru, (2019), *Mechanics of Project Management: Nuts and Bolts of Project Execution*, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B. (2019), *The Story of Industrial Engineering: The Rise from Shop-Floor Management to Modern Digital Engineering*, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B., and Cassie B. Barlow, editors (2019), *Defense Innovation Handbook: Guidelines, Strategies, and Techniques*, Taylor & Francis/CRC Press, Boca Raton, FL.

#### **CHINI, CHRISTOPHER M.**

Assistant Professor of Engineering Management, Department of Systems Engineering and Management; AFIT Appointment Date: 2019 (AFIT/ENV); BS, Civil Engineering, Texas A&M University, 2011; MS, Civil Engineering, University of Illinois at Urbana-Champaign, 2015; PhD, Civil Engineering, University of Illinois at Urbana-Champaign, 2018. Dr. Chini's research interests include resource management, installation resilience, life cycle analysis, energy-water nexus, asset management, and water resources planning and management. Dr. Chini is also interested in data management and visualization, as well as geospatial information systems and scientific communication. Tel. 937-255-3636 x4568, Email: [Christopher.Chini@afit.edu](mailto:Christopher.Chini@afit.edu)

#### **Refereed Journal Publications**

Chini, C.M. and Stillwell, A.S. "The metabolism of U.S. cities 2.0," *Journal of Industrial Ecology*, 23(6), 1353-1362. DOI: 10.1111/jec.12923

**COLOMBI, JOHN M.**

Associate Professor and Program Chair of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2008 (AFIT/ENV); AFIT Military Appointment Date: 2003 (AFIT/ENG); BSEE, University of Lowell, 1982; MSEE, Air Force Institute of Technology, 1992; PhD, Electrical Engineering, Air Force Institute of Technology, 1996. Dr. Colombi's research interests, within the broad discipline of Systems Engineering, include systems architecture and model-based systems engineering techniques, multi-vehicle unmanned/autonomous design, acquisition process modeling, optimal space constellation design, systems of systems analysis, complex adaptive systems and human systems integration. AFIT research center affiliation(s): CSRA. Tel. 937-255-3636 x3347, Email: [John.Colombi@afit.edu](mailto:John.Colombi@afit.edu)

**Sponsor Funded Research Projects**

"Development of AFLCMC MBSE Models, Training and Competency." Sponsor: AFLCMC. Funding: \$150,000.

"Model-based Systems Engineering for WNS Acq Workforce." Sponsor: AFLCMC. Funding: \$92,934.

**Refereed Journal Publications**

Felten, M.S., Colombi, J.M., Cobb, R.G., and Meyer, D.W., "Multi-Objective Optimization Using Parallel Simulation for Space Situational Awareness," *Journal of Defense Modeling and Simulation Applications, Methodology, Technology*, pp 1-33, Oct 2018. DOI: 10.1177/1548512918803212 [CSRA]

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Hertwig, Fred D., Colombi, John M., Cobb, Richard G., and David W. Meyer, "Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, 17 – 19 September, 2019. [CSRA]

**COOPER, CASEY W., Maj**

Assistant Professor of Industrial Hygiene, Department of Systems Engineering and Management; AFIT Appointment Date: 2019 (AFIT/ENV); BS, Environmental Engineering, United States Air Force Academy, 2004; MBA, Tennessee Technological University, 2010; MS Environmental Engineering and Science, Air Force Institute of Technology, 2010; PhD, Occupational and Environmental Health, University of Oklahoma Health Science Center, 2019. Dr. Cooper's research interests include bioterrorism, bioaerosols, aerosol science, industrial hygiene, CBRN countermeasures, health physics, radiation, and healthcare acquired infections. Tel. 937-255-3636 x4511, Email: [casey.cooper@afit.edu](mailto:casey.cooper@afit.edu)

**Refereed Journal Publications**

Cooper, C., Aithinne, K., Floyd, E., Stevenson, B., Johnson, D., "A Comparison of Air Sampling Methods for Clostridium Difficile Endospore Aerosol," *Aerobiologia*, 35(3): 411-420 2019.

Aithinne, K., Cooper C., Lynch, R., Johnson, D., "Toilet Plume Aerosol Generation Rate and Environmental Contamination Following Bowl Water Inoculation with Clostridium difficile Spore," *American Journal of Infection Control*, 47(5), 515-520, 2018.

**COX, AMY M., Lt Col**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, Mechanical Engineering, University of Cincinnati, 1997; MS, Space Operations, Air Force Institute of Technology, 1999; AA French, Presidio of Monterey, 2005; Brevet, Flight Test Engineering, École du Personnel Navigant d'Essais et de Réception, 2006; PhD, Systems Engineering, George Washington University, 2017. Lt Col Cox's research interests include flexible design, system architecture, user innovation, and open innovation. Tel. 937-255-3636 x4352, Email: [Amy.Cox@afit.edu](mailto:Amy.Cox@afit.edu)

### **Sponsor Funded Research Projects**

“F-15 Modernization Schedule Optimization.” Sponsor: AFLCMC. Funding: \$250,000 - Cox 80%, Lunday 20%.

“West Africa Logistics Network (WALN).” Sponsor: USAFRICOM. Funding: \$43,600 - Cox 50%, Breitbach 50%.

### **DELORIT, JUSTIN D., Maj**

Assistant Professor of Engineering Management, Department of Systems Engineering and Management; AFIT Appointment Date: 2019 (AFIT/ENV); BS, Civil Engineering, Michigan Technological University, 2005; MS, Air Force Institute of Technology, 2012; PhD, Civil and Environmental Engineering, University of Wisconsin-Madison, 2018. Maj Delorit’s research interests include installation resilience, decision-making under risk and uncertainty, applied forecasting, engineering economics, and water resources planning and management.

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### **ELSHAW, JOHN J.**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management; AFIT Appointment Date: 2013 (AFIT/ENV); BS, Accounting, University of Akron, 1991; MBA, Regis University, 1996; PhD, Krannert School of Management, Purdue University, 2010. Dr. Elshaw’s research interests include organizational behavior, trust, leadership, human resource management, organizational causes of high-consequence errors, technology impact on individual and group behavior, social network analysis, cognition and emotions, organizational climate and culture, psychological influences on foreign audiences, cross-cultural leadership and communication, and hierarchical linear modeling. Tel. 937-255-3636 x4650, Email: [John.Elshaw@afit.edu](mailto:John.Elshaw@afit.edu)

### **Sponsor Funded Research Projects**

“A New Learning Curve For DoD Acquisition Programs: How To Account For The “Flattening Effect.” Sponsor: NPS. Funding: \$57,780 - Elshaw 60%, Koschnick 30%, Ritschel 10%.

“Measuring Human-Machine Trust Relationships.” Sponsor: AFOSR. Funding: \$24,975. [ANT]

### **Refereed Journal Publications**

Elshaw, John J., Fass, Robert D., and Mauntel, Brian R., “Cognitive Mentorship: Protégé Behavior as a Mediator to Performance,” *Mentoring & Tutoring: Partnership in Learning*, 26:4, 358-376, Oct 2018.

Guinn, V., Langhals, B. and Elshaw, J., “Evaluating Smartphones for Infrastructure Work Order Management,” *International Association of Online Engineering*, Retrieved 24 June 24, 2019. <https://www.learntechlib.org/p/207202/>.

Gay, C., Horowitz, B., Elshaw, J. J., Bobko, P., and Kim, I., “Operator Suspicion and Human-Machine Team Performance Under Mission Scenarios of Unmanned Ground Vehicle Operation,” *IEEE Access*, PP(99):1-1, 25 Feb 19.

### **Other Significant Research Productivity**

Baker, J., Ritschel, J. D., Elshaw, J. J., and Koschnick, C., Panel Discussion: Decision Support Panel Discussion, *International Cost Estimation & Analysis Association (ICEAA)*, Dayton Chapter, March 2019.

### **ENINGER, ROBERT M., Col**

Assistant Professor of Industrial Hygiene, AFIT Appointment Date: 2015 (AFIT/ENV); BS, Civil and Environmental Engineering, United States Air Force Academy, 1995; MS, Civil Engineering, University of Texas-San Antonio, 2000; MS, Health Science, Purdue University, 2002; PhD, Environmental Health, University of Cincinnati, 2008. Lt Col Eninger’s research interests include aerosol science, exposure assessment, and respiratory protective devices.

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### Sponsor Funded Research Projects

"CBRN Decon Effectiveness for EMEDS (Decon Capabilities for Far Forward Med Team)." Sponsor: 711 HPW. Funding: \$276,600 - Slagley 50%, Eninger 50%.

### Refereed Journal Publications

Titus, E., Lemmer, G., Slagley, J.M., and Eninger, R., "A Review of CBRN Topics Related to Military and Civilian Patient Exposure and Decontamination," *American Journal of Disaster Medicine*, 14(2), 137-149, Spring 2019, DOI:10.5055/ajdm.2019.0324

Trawick, J., Slagley, J.M., and Eninger, R., "Occupational Noise Dose Reduction via Behavior Modification Using In-Ear Dosimetry among United States Air Force Personnel Exposed to Continuous and Impulse Noise," *Open Journal of Safety Science and Technology*, 9:2, 61-81, June 2019. DOI: [10.4236/ojsst.2019.92005](https://doi.org/10.4236/ojsst.2019.92005)

### FASS, ROBERT D.

Assistant Professor of Systems Integration and Cost Analysis, Department of Systems Engineering and Management, AFIT Appointment Date: 2015 (AFIT/ENV); BA Economics, University of New Mexico, 1989; MBA, University of New Mexico, 1993; PhD, Business Administration and Management, New Mexico State University, 2008. Dr. Fass' research interests include cost analysis, decision analysis, risk analysis, operations research, behavioral economics, organizational behavior, organizational change, and government acquisition policy. Tel. 937-255-3636 x4388, Email: [Robert.Fass@afit.edu](mailto:Robert.Fass@afit.edu)

### Refereed Journal Publications

Elshaw, John J., Fass, Robert D., and Mauntel, Brian R., "Cognitive Mentorship: Protégé Behavior as a Mediator to Performance," *Mentoring & Tutoring: Partnership in Learning*, 26:4, 358-376, Oct 2018.

Rosson, J.P., Rice, M., Lopez Jr., J., Fass, R.D., "Incentivizing Cyber Security Investment in the Power Sector Using An Extended Cyber Insurance Framework," *Homeland Security Affairs*, 15, Article 2, May 2019. <https://www.hsaj.org/articles/15082>

McGowin, A.L., Ritschel, J.D., Fass, R.D., and Boehmke, B., "A Text Mining Analysis of Acquisition Reforms and Expert Views," *Defense Acquisition Research Journal*, 25(3): 288-323, October 2018. <https://doi.org/10.22594/dau.18-802.25.03>

### Other Significant Research Productivity

O'Connor, Sara K., Drylie, Scott T., Fass, R. David, White, Edward D., Koschnick, Clay M., "An Analysis of Contractor Profit Margin Percentages," AFIT Thesis Presentations: *International Cost Estimation & Analysis Association (ICEAA) Dayton Chapter*, 19 March 2019.

Tyson Jr., Robert E., Fass, R. David, Ritschel, Jonathan D., White, Edward D., Shanske, Craig R., "An Assessment of the Air Force's Return on Investment for Product Support Business Case Analysis Processes," AFIT Thesis Presentations: *International Cost Estimation & Analysis Association (ICEAA) Dayton Chapter*, 19 March 2019.

### FELKER, DANIEL L.

Chemist GS-11, Department of Systems Engineering and Management, Appointment Date: 2006 (AFIT/ENV); PhD, Analytical Chemistry, Kansas State University, 2005; United States Army Service, Dec 1986–Aug 1997. Current research interests include: x-ray photoelectron spectroscopy of thin film surfaces with a focus on the surface absorption organophosphates, modeling the absorbent properties of nano-particles for remediation of toxic compounds, the mechanism of thermo deactivation of Bacillus Anthracis Spores, electrochemical biosensors for the detection of organophosphates, and environmental chemistry of wetlands. Tel. 937-255-3636 x7410, Email: [Daniel.Felker@afit.edu](mailto:Daniel.Felker@afit.edu)

**FORD, THOMAS C.**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management (through Integrity Applications, Inc.), AFIT Appointment Date: 2014 (AFIT/ENV); BS, Electrical Engineering, Brigham Young University, 1994; BA, Chinese, Brigham Young University, 1994; MS, Engineering, Wright State University, 1998; PhD, Systems Engineering, Air Force Institute of Technology, 2008. Dr. Ford's research interests include interoperability, resiliency, and system architecting. Tel. 937-255-3636 x4747, Email: [Thomas.Ford@afit.edu](mailto:Thomas.Ford@afit.edu)

**FREELS, JASON K., Maj**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2013 (AFIT/ENV); BS, Auburn University, 2000; MS, Air Force Institute of Technology, 2006; PhD, Systems Engineering, Air Force Institute of Technology, 2013. Maj Freels' research interests include reliability growth testing, accelerated life testing, accelerated degradation testing, and competing risk analysis. Tel. 937-255-3636 x4676, Email: [Jason.Freels@afit.edu](mailto:Jason.Freels@afit.edu)

**GRIMAILA, MICHAEL R.**

Professor and Head, Department of Systems Engineering and Management, AFIT Appointment Date: 2004 (AFIT/ENV); BS, Texas A&M University, 1993; MS, Texas A&M University, 1995; PhD, Computer Engineering, Texas A&M University, 1999. Dr. Grimaila's research interests include modeling and simulation, network management and security, quantum cryptography, quantum networking, and systems engineering. He is a member of the ACM, a Senior Member of the IEEE, and a Fellow of the ISSA. AFIT research center affiliation(s): CCR. Tel. 937-255-3636 x4800, Email: [Michael.Grimaila@afit.edu](mailto:Michael.Grimaila@afit.edu)

**Refereed Journal Publications**

Okolica, J.S., Peterson, G., Mills, R.F., and Grimaila, M.R., "Sequence Pattern Mining with Variables," *IEEE Transactions on Knowledge and Data Engineering*, pp. 1-20, 19 November 2018. DOI: 10.1109/TKDE.2018.2881675

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Beach, P.M., Langhals, B.T., Grimaila, M.R., Hodson, D., and Engle, R.D.L., "Developing a Methodology for the Identification of Alternative NoSQL Data Models via Observation of Relational Database Usage," *Proceedings of the 18th International Conference on Information and Knowledge Engineering*, Las Vegas, NV, 29 July–1 August 2019.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Sigala, A., Langhals, B.T., Grimaila, M.R., and Hodson, D., "USAF Applications of Unmanned Aerial Systems (UAS): A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities," *Proceedings of the 44th Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, 5 March 2019.

**Editorships in Professional Journals**

Editorial Board of *Information System Security Association (ISSA) Journal*. [CCR]

Assistant Editor, *The Defense Cyber Review*, Army Cyber Institute, West Point. [CCR]

**HARPER, WILLIE F.**

Professor of Engineering and Environmental Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2012 (AFIT/ENV); BS, Civil Engineering, University of California, Los Angeles, 1992; MENG, Civil and Environmental Engineering, Cornell University, 1993; PhD, Civil and Environmental Engineering, University of California, Berkeley, 2002. Dr. Harper's research interests include water quality with a focus on environmental biotechnology, advanced oxidation, and sensing. Tel. 937-255-3636 x4528, Email: [Willie.Harper@afit.edu](mailto:Willie.Harper@afit.edu)

### Sponsor Funded Research Projects

“Sequencing Batch Reactors (SBR) for Fate of Bacillus Spores in Wastewater: An Addendum Describing Follow-on Investigations.” Sponsor: EPA. Funding: \$70,000.

### Refereed Journal Publications

Yun Xing, Ashlee Ellis, Matthew Magnuson, and Willie F. Harper Jr., “Adsorption of Bacteriophage MS2 to Colloids: Kinetics and Particle Interactions,” *Colloids and Surfaces A: Physicochemical and Engineering Aspects*. Accepted (COLSUA-D-19-02383R1).

Sudarshan Kurwadkar, Timothy V. Hoang, Kailas Malwade, Sushil Kanel, Willie F. Harper Jr., and Garrett Struckhoff, “Application of Carbon Nanotubes for Removal of Emerging Contaminants of Concern in Engineered Water and Wastewater Treatment Systems,” *Nanotechnology for Environmental Engineering*, 4(1), 12-27 Apr 2019.

Mbonimpa, E.G., Blatchley, E., Applegate, B., and Harper, W.F., “Ultraviolet A and B Wavelength-Dependent Inactivation of Viruses and Bacteria in the Water,” *Journal of Water and Health*, Vol. 16 (5), 796-806, Oct 2018.

### HOISINGTON, ANDREW J., Lt Col

Assistant Professor and Curriculum Chair of Engineering Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, Civil Engineering, University of Michigan, 2001; MS, Environmental Engineering, University of Texas, Austin, 2007; PhD, Environmental Engineering, University of Texas, Austin, 2013. Lt Col Hoisington’s research interests include air quality in the built environment, microbiome of the built environment, and air quality or microbiome factors that influence mental health.

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### Sponsor Funded Research Projects

“Detection and Quantification of Immunomodulatory Bacterial Species Important to Health and Performance.” Sponsor: 711 HPW. Funding: \$23,544.

“Preventative vs. Breakpoint Maintenance for Facility Sustainment Modeling.” Sponsor: AFIMSC. Funding: \$12,000.

### Refereed Journal Publications

Hoisington, A.J., Stearns-Yoder, K.A., Schuldt, S.J., Beemer, C.J., Kinney, K.A., Postolache, T.T., Lowry, C.A., and Brenner, L.A., “Ten Questions Concerning the Built Environment and Mental Health,” *Building and Environment*, 155, 58-69, 15 May 2019. <https://doi.org/10.1016/j.buildenv.2019.03.036>

Corona, C.C., Zhang, M., Wadhawan, A., Daue, M.L., Groer, M.W., Dagdag, A., Lowry, C.A., Hoisington, A.J., Ryan, K.A., Stiller, J.W., Fuchs, D., Mitchell, B.D., and Postolache, T.T., “Toxoplasma gondii IgG Associations with Sleep-Wake Problems, Sleep Duration and Timing,” *Pteridines*, 30(1), 1-9 Feb 2019. <https://doi.org/10.1515/pteridines-2019-0001>

Sharma, A., Richardson, M., Crall, L., Stamper, C., Maestre, J.P., Stearns-Yoder, K.A., Bates, K., Kinney, K., Brenner, L., Lowry, C., Gilbert, J., and Hoisington, A.J., “Longitudinal Assessment of the Influence of Lifestyle Homogenization on the Microbiome in a Cohort of United States Air Force Cadets,” *Microbiome*, 7(70), 1-17, 2018. <https://doi.org/10.1186/s40168-019-0686-6>

Brenner, L.A., Hoisington, A.J., Stearns, K.E., Stamper, C., Heinz, J, Postolache, T.T., Hoffmire, C., Stanislawski, M., and Lowry, C.A., “Military-Related Exposures, Normal Physiology, Dysbiosis, and Disease: the United States-Veteran Microbiome Project (US-VMP),” *Frontiers in Cellular and Infection Microbiology*, 8, 400, Nov 2018. <https://doi.org/10.3389/fcimb.2018.00400>

### Refereed Conference Papers Accepted on the Basis of Full Paper Review

Spranger, Z., Ellis, A., Beemer, C., Plourde, T., Jordan, R., and Hoisington, A.J., “Lessons Learned in Development of Model to Reduce Lifecycle Costs for Infrastructure Assets,” *World Congress on Resilience, Reliability, and Asset Management*, Singapore, Jul 27–Aug 1 2019.

Moore, B., Schuldt, S.J., and Hoisington, A.J., “Transportation Infrastructure Performance: A Systematic Review of Transportation Performance Assessments,” *World Congress on Resilience, Reliability, and Asset Management*, Singapore, 27 Jul–1 Aug 2019.

### Refereed Conference Papers Accepted on the Basis of Abstract Review

Brenner, L.A., Stearns-Yoder, K.A., Forster, J.E., Hoisington, A.J., Stamper, C.E., Postolache, T.T., and Lowry, C.A., “Biological Signature of an Immunomodulatory Probiotic Intervention for Veterans with Mild TBI and PTSD,” Presentation: *Tri-Services Microbiome Consortium Symposium*, Dayton, OH, 22-24 Oct 2019.

Sharma, A., Stamper, C.E., Maestre, J.P., Stearns-Yoder, K.A., Bates, K.L., Postolache, T.T., Kinney, K.A., Brenner, L.A., Lowry, C.A., Gilbert, J.A., and Hoisington, A.J., “The Microbiome of the Built Environment, an Overview of What We Know and What We Hope to Learn From It,” Presentation: *Tri-Services Microbiome Consortium Symposium*, Dayton, OH, 22-24 Oct 2019.

Leonard, D. and Hoisington, A.J., “Detection and Quantification of Immunomodulatory Bacterial Species Important to Health and Performance,” Presentation: *Military Health System Research Symposium*, Kissimmee FL, 19-22 August 2019.

Sharma, A., Stamper, C.E., Maestre, J.P., Stearns-Yoder, K.A., Bates, K.L., Postolache, T.T., Kinney, K.A., Brenner, L.A., Lowry, C.A., Gilbert, J.A., and Hoisington, A.J., “The Microbiome of Occupant’s and the Built Environment at the United States Air Force Academy,” Presentation: *Military Health System Research Symposium*, Kissimmee FL, 19-22 August 2019.

Taylor, W. and Hoisington, A.J., “The Connection Between Indoor Air Quality and Mental Health Outcomes,” Presentation: *ISES ISIAQ*, Kaunas Lithuania, 18-22 August 2019.

Kohl, N.T. and Hoisington, A.J., “How the Built Environment Can Influence an Individual’s Mental Health,” Presentation: *ISES ISIAQ*, Kaunas Lithuania, 18-22 August 2019.

Hernandez, N. and Hoisington, A.J., “Modification of the Air Force Base’s Plant Replacement Value Due to Hurricane Intensities,” Presentation: *Enterprise and Infrastructure Resilience Workshop*, Cincinnati, OH, 12-13 Aug 2019.

Spencer, R. and Hoisington, A.J., “Integration of Risk Assessment Techniques Within Business Continuity Management of Civil Infrastructure,” Presentation: *Enterprise and Infrastructure Resilience Workshop*, Cincinnati, OH, 12-13 Aug 2019.

Moore, B., Schuldt, S.J., and Hoisington, A.J., “Transportation Infrastructure Performance: A Systematic Review of Transportation Performance Assessments,” Presentation: *World Congress on Resilience, Reliability, and Asset Management*, Singapore, 27 Jul–1 Aug 2019.

Sharma, A., Richardson, M., Crall, L., Stamper, C., Maestre, J.P., Stearns-Yoder, K.A., Bates, K., Kinney, K., Brenner, L., Lowry, C., Gilbert, J., and Hoisington, A.J., “Longitudinal Assessment of the Influence of Lifestyle Homogenization on the Microbiome in a Cohort of United States Air Force Cadets,” Presentation: *FEMS 2019*, Glasgow, Scotland, 7-11 July 2019.

Yip, A. and Hoisington, A.J., “Efficiently Altering a Base Community to Improve Physical Health in the Air Force,” Presentation: *Air Force Civil Engineering Community Planning Symposium*, San Antonio, TX, 24-26 Jun 2019.

Postolache, T.T., Corona, C.C., Zhang, M., Wadhawan, A., Daue, M.L., Groer, M.W., Dagdag, A., Lowry, C.A., Hoisington, A.J., Brenner, L.A., Ryan, K., Stiller, J.W., Fuchs, D., and Mitchell, B.M., “Sleep Duration and Timing in Relationship to *Toxoplasma gondii* IgG Seropositivity and Serointensity.” Presentation: *38th International Winter-Workshop on Clinical, Chemical and Biochemical Aspects of Pteridines and Related Topics*, Vienna, Austria, 26 Feb–1 Mar 2019. <https://doi.org/10.1093/sleep/zsz067.060>

Hoisington, A.J., Lowry, C.A., Stearns-Yoder, K.A., Brenner, L., and Postolache, T.T., “Biological Signature of an Immunomodulatory Probiotic Intervention for Veterans with Mild TBI & PTSD,” *Archives of Physical Medicine and Rehabilitation*, 99 (11), e130, Nov 2018. <https://doi.org/10.1016/j.apmr.2018.08.008>

Hoisington, A.J., Lowry, C.A., Stamper, C., Henize, J., Stearns-Yoder, K.A., and Brenner, L.A., “Veteran Microbiome and the Application for Those with TBI and Co-occurring Mental Health Conditions,” *Archives of Physical Medicine and Rehabilitation*, 99 (11), e152, Nov 2018. <https://doi.org/10.1016/j.apmr.2018.08.074>

### **Other Significant Research Productivity**

Hoisington, A.J., “Altering the Microbiome for Improved Mental Health Outcomes—Exploring the Premise, the Progress, and the Problems,” Presentation: University of Leeds, Leeds, England, 16, Jul 2019.

Hoisington, A.J., “Altering the Microbiome for Improved Mental Health Outcomes—Exploring the Premise, the Progress, and the Problems,” Presentation: St. Elizabeth Hospital and University of Maryland Baltimore, Washington DC, 22 Jan 2019.

Hoisington, A.J., “Understanding Microbiome Papers Through Data Analysis and Figure Interpretation,” Presentation: St. Elizabeth Hospital and University of Maryland Baltimore, Washington DC, 22 Jan 2019.

Hoisington, A.J., “Altering the Microbiome for Improved Mental Health Outcomes—Exploring the Premise, the Progress, and the Problems,” Presentation: The Ohio State University Graduate School of Public Health, Columbus, OH, 22 Oct 2018.

### **JACQUES, DAVID R.**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT  
Appointment Date: 2017 (AFIT/ENV); BS, Mechanical Engineering, Lehigh University, 1983; MS, Aeronautical Engineering, AFIT, 1989; PhD, Aeronautical Engineering, AFIT, 1995. Dr. Jacques’ research interests include development planning, architecture-based evaluation, multi-objective or constrained optimal design, and cooperative behavior and control of autonomous vehicles. AFIT research center affiliation(s): ANT and CSRA.  
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### **Sponsor Funded Research Projects**

“Cooperative Search and Surveillance with Unmanned Agents.” Sponsor: AFRL/RV. Funding: \$30,000 - Jacques 80%, Colombi 80%. [ANT]

“Human-Machine Team Performance for Cyberattack Resilient Systems: Experimental Protocol.” Sponsor: OSD. Funding: \$15,000.

### **KOSCHNICK, CLAY M., Lt Col**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT  
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### **Refereed Journal Publications**

Clay M. Koschnick and Joseph C. Hartman, “Using Performance-Based Warranties to Influence Consumer Purchase Decisions,” *The Engineering Economist*, August 2019. DOI: 10.1080/0013791X.2019.1642430.

Hines, P.A., Wagner, T.J., Koschnick, C.M., and Schuldt, S.J., “Analyzing the Efficiency of Horizontal Photovoltaic Cells in Various Climate Regions,” *Journal of Energy and Natural Resources*, Vol. 8, Issue 1-2, 77-86, June 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Kelly, Patrick, Colombi John M., Koschnick Clay, M., and Freels, Jason, “Methodology for Including Base Infrastructure in Conceptual Systems Analysis,” *87th Military Operations Research Society Symposium*, USAFA US Air Force Academy, CO, Presentation ID: 43324, 17-20 June 2019.

#### **Other Significant Research Productivity**

O’Connor, Sara K., Drylie, Scott T., Fass, R. David, White, Edward, D., and Koschnick, Clay M., “An Analysis of Contractor Profit Margin Percentages,” *International Cost Estimation & Analysis Association (ICEAA)*, Dayton Chapter, AFIT Thesis Presentations: 19 March 2019.

#### **KRISTBAUM, JOSEPH P., Maj**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2019 (AFIT/ENV); BS, Marquette University, 2007; MS, Oklahoma State University, 2013; PhD, Wright State University, 2019. Maj Kristbaum’s research interests include organizational behavior, optimization, and judgement and decision making.

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#### **LANGHALS, BRENT T.**

Assistant Professor of Information Resource Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, United States Air Force Academy, 1995; MS, Air Force Institute of Technology, 2001; PhD, University of Arizona, 2011. Dr. Langhals’ research interests include data analytics, big data, human-computer interfaces, systems engineering, vigilance, and psychophysiological cue detection.

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#### **Sponsor Funded Research Projects**

“Modernizing Database Architectures in Support of Dynamic Data Driven Application Systems.” Sponsor: AFOSR. Funding: \$58,514 - Langhals 40%, Hodson 40%, Grimaila 20%.

#### **Refereed Journal Publications**

Beach, P.M., Mailloux, L.O., Langhals, B.T, and Mills, R.F., “Analysis of Systems Security Engineering Design Principles for the Development of Secure and Resilient Systems,” *IEEE Access*, Vol. 7, Issue 1, August 2019.

Guinn, V.L., Langhals, B.T., and Elshaw, J.J., “Evaluating Smartphones for Infrastructure Work Order Management,” *International Journal of Interactive Mobile Technologies*, Vol. 12, Issue 8, December 2018.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Beach, P.M., Langhals, B.T., Grimaila, M.R., Hodson, D., and Engle, R.D.L., “Developing a Methodology for the Identification of Alternative NoSQL Data Models via Observation of Relational Database Usage,” *Proceedings of the 18th International Conference on Information and Knowledge Engineering*, Las Vegas, NV, 29 July–1 August 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Sigala, A., Langhals, B.T., Grimaila, M.R., and Hodsen, D., “USAF Applications of Unmanned Aerial Systems (UAS): A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities,” *Proceedings of the 44th Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, 5 March 2019.

## Other Significant Research Productivity

Langhals, B.T., “Modernizing Database Architectures in Support of Dynamic Data Driven Application Systems,”  
*AFOSR Grant 18RT0095, PI Report*, Jan 2019.

### **LONG, DAVID S.**

Assistant Professor of Systems Engineering (through SRISY), Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, Industrial Engineering and Management, North Dakota State University, 1988; MS, Engineering, California State University Northridge, 1997; PhD, Engineering Systems, Massachusetts Institute of Technology, 2012. Dr. Long’s research interests include systems of systems, open systems architecture, model-based systems engineering, wicked problems, human machine interfaces, automation, and autonomy.

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### **LUCAS, BRANDON M., Lt Col**

Assistant Professor of Cost Analysis, Department of Systems Engineering and Management, AFIT Appointment Date: 2015 (AFIT/ENV); BA, University of Texas at Austin, 1998; ME and MA, University of Oklahoma, 2002; MS, Air Force Institute of Technology, 2004; PhD, Economics, George Mason University, 2011. Lt Col Lucas’ research interests include incentive structures, profit motives, coordination issues, and the economics of public choice and the law. Email: [Brandon.Lucas@afit.edu](mailto:Brandon.Lucas@afit.edu)

### **MAILLOUX, LOGAN O., Lt Col**

Associate Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2015 (AFIT/ENV); BS, Computer Engineering, Lawrence Technological University, 2002; MS, Systems Engineering, Air Force Institute of Technology, 2008; PhD, Systems Engineering, Air Force Institute of Technology, 2015. Lt Col Mailloux serves as a computer developmental engineer and is a Certified Information System Security Professional (CISSP), Certified Systems Engineering Professional (CSEP). Lt Col Mailloux holds DOD certifications in cyberspace operations, systems engineering science and technology management, test and evaluation, and program management. He is a member of IEEE, ACM, INCOSE, and ITEA professional societies, as well as HKN and TBP honor societies. Lt Col Mailloux has served the USAF as a cyberspace operations expert responsible for planning and executing network defense exercises, documenting and training computer security best practices, performing test and evaluation of enterprise resource planning solutions, and maintaining distributed simulation infrastructure. His research interests include system security engineering, complex information systems, and quantum key distribution. AFIT research center affiliation(s): CCR.

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### **MBONIMPA, ERIC G.**

Assistant Professor of Engineering and Environmental Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2014 (AFIT/ENV); BS, Civil Engineering, Kigali Institute of Science and Technology, 2004; MS, Environmental Engineering, University of Missouri-Columbia, 2007; PhD, Environmental Engineering, Purdue University, 2010. Dr. Mbonimpa’s research interests include environmental sustainability, life cycle assessment, and fate and transport of contaminants and water quality.

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## Refereed Journal Publications

Mbonimpa, E.G., E. Blatchley, B. Applegate, and W.F. Harper, “Ultraviolet A and B Wavelength-Dependent Inactivation of Viruses and Bacteria in the Water,” *Journal of Water and Health*, 16, No. 5, pp. 796-806, October 2018.

## Refereed Conference Papers Accepted on the Basis of Abstract Review

Jordan, R. and E.G. Mbonimpa, “Fate and Transport Modeling of Perfluoroalkyl Substances (PFAS) in Groundwater from Aqueous Film Forming Foam (AFFF) Impacted Sites,” SAME- Society of American Military Engineers, WPAFB, OH, 14 February 2019

Glass, J. and E.G. Mbonimpa, "Toxicity Impact Assessment of PFOS and PFOA," *Water Management Association of Ohio (WMAO) conference*, Cincinnati, OH, 31 Oct 2018.

Jordan, R. and E.G. Mbonimpa, "PFAS Fate and Transport Modeling Using Numeric and Analytic Models," *Water Management Association of Ohio (WMAO) conference*, Cincinnati, OH, 31 Oct 2018.

#### **MCGUIRL, JOHN M.**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT  
Appointment Date: 2018 (AFIT/ENV); B.S. Electrical Engineering, University of Massachusetts, 1990; M.S.,  
Industrial and Systems Engineering, The Ohio State University, 2002; PhD, Industrial and Systems Engineering, The  
Ohio State University, 2008. Dr. McGuirl's research interests include human-machine interaction, complex cognitive  
systems, decision-support systems, and team decision-making under stress.

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#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Schneider, M.F., Miller, M.E., and McGuirl, J.M., "Towards a Meta-Model to Specify and Design Human-Agent  
Teams," *International Symposium on Aviation Psychology*, Dayton, OH, May 2019.

#### **MILLER, MICHAEL E.**

Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date:  
2010 (AFIT/ENV); BS, Ohio University, 1987; MS, Ohio University, 1989; PhD, Industrial and Systems Engineering,  
Virginia Tech., 1993. Dr. Miller's research interests include Human Systems Integration, Human-Automated Agent  
Interaction, and Application of Human Vision to Display, and Lighting Design. AFIT research center affiliation(s):  
ANT. Tel. 937-255-3636 x4651, Email: [Michael.Miller@afit.edu](mailto:Michael.Miller@afit.edu)

#### **Refereed Journal Publications**

Satava, S.J., Parr, J.C., and Miller, M.E., "A Method for Developing Side Impact Upper Neck Injury Criteria, which  
Compensates for Biomechanical Differences between ATDs and Humans," *IIEE Transactions on Occupational  
Ergonomics and Human Factors*, 6(2), 51-63, Dec 2018. DOI: 10.1080/24725838.2018.1482242.

Bindewald, J.M., Miller, M.E., and Peterson, G.L., "Creating Effective Automation to Maintain Explicit User  
Engagement," *International Journal of Human-Computer Interaction*, July 2019. DOI:  
10.1080/10447318.2019.1642618

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Canzonetta, D.J. and Miller, M.E., "Adaptive Artificial Agent Response Time Impact on Human-Agent Team  
Performance," *Industrial and Systems Research Conference*, Orlando, FL, May 2019. [ANT]

Geiselman, E.E. and Miller, M.E., "The Development and Evaluation of a Spatially Constrained Text Access Method  
for Information Visualization," *The IMAGE Conference*, Dayton, OH, October 2019.

Gerhardt, J., Miller, M.E., Yood, H., and Akhavend, T., "Estimating OLED Display Device Lifetime from Pixel and  
Screen Brightness and its Application," *27th Color Imaging Conference*, Paris, France, October 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Schneider, M.F., Miller, M.E., and McGuirl, J.M., "Towards a Meta-Model to Specify and Design Human-Agent  
Teams," *International Symposium on Aviation Psychology*, Dayton, OH, May 2019. [ANT]

Canzonetta, D.J., and Miller, M.E., "Identifying a Possible Function for Artificial Agent Adaptation in Variable Task  
Rate Environments," *International Symposium on Aviation Psychology*, Dayton, OH, May 2019. [ANT]

Reis, G.A., Geiselman, E.E., and Miller, M.E., "Effects of Visual Perceptual Asymmetries on Performance While Using and Aircraft Attitude Symbology," *International Symposium on Aviation Psychology*, Dayton, OH, May 2019. [ANT]

### **Books and Chapters in Books**

Miller, M.E., *Color in Electronic Display Systems: Multi-Primary Display Advantages*, First Edition, Springer Nature, Switzerland AG, pp. 237, January 2019.

### **Patent Applications**

Canzonetta, D.J., Schneider, M.F., Miller, M.E., Interactive Artificial Intelligence System with Adaptive Timing, Provisional Patent Application, 16 May 2019.

### **Other Significant Research Productivity**

Miller, M.E., "Investigating Lighting-Display Configurations for Improved Intelligence, Surveillance and Reconnaissance," AFRL-SA-WP-TR-2019-0012, Final Report Aug 2016-Nov 2018, pp. 50.

### **REITH, MARK G.**

Assistant Professor of Cyber Systems, Department of Systems Engineering and Management, AFIT Appointment Date: 2019 (AFIT/ENV); BS, Computer Science, University of Portland, 1999; MS, Computer Science, Air Force Institute of Technology, 2003; PhD, Computer Science, University of Texas at San Antonio, 2009. Research interests include cyber education, multi-domain operations, dynamic mission mapping, Agile software engineering and model-based systems engineering. Tel: 937-255-3636 x4603, Email: [Mark.Reith@afit.edu](mailto:Mark.Reith@afit.edu)

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Park, Y., Reith, M.G., and Mullins, B., "Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal, July 2019.

Newlin, M., Reith, M.G., and DeYoung, M., "Synthetic Data Generation with Machine Learning for Network Intrusion Detection Systems," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal, July 2019.

Dukarm, C., Dill, M., and Reith, M.G., "Improving Phishing Awareness in the United States Department of Defense," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal, July 2019.

Flack, N. and Reith, M.G., "Self-Directed Learning Tools in USAF Multi-Domain Operations Education," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal, July 2019.

Tomcho, L., Reith, M.G., Long, D., Coggins, M., and Lin, A., "Applying Game Elements to Cyber eLearning," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa, Feb 2019.

Martin, S. and Reith, M.G., "Rethinking USAF Cyber Education and Training," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa Feb 2019.

Pendleton, A. and Reith, M.G., "Quantifying Cyber Vulnerability Risk in Acquisitions," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa, Feb 2019.

Dillon, P. and Reith, M.G., "Building Irrefutable Trust throughout Computer Networks Using Blockchains," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa, Feb 2019.

## **RITSCHEL, JONATHAN D.**

Assistant Professor of Cost Analysis, Department of Systems Engineering and Management, AFIT Appointment Date: 2011 (AFIT/ENV); BBA, Accountancy, University of Notre Dame, 1997; MS, Cost Analysis, Air Force Institute of Technology, Wright-Patterson AFB, OH, 2003; PhD, Economics, George Mason University, VA, 2011. Dr. Ritschel's research interests include public choice, the effects of acquisition reforms on cost growth in DOD weapon systems, research and development cost estimation, and economic institutional analysis.  
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### **Sponsor Funded Research Projects**

"Developing Standard Cost Factors Through an Analysis of Major Defense Acquisition Programs." Sponsor: NPS.  
Funding: \$25,997 - Ritschel 70%, White 30%.

### **Refereed Journal Publications**

Kim, D.B., White, E.D., Ritschel, J.D., and Millette, C.A., "Reliability of Estimates at Completion for Department of Defense Contracts," *Journal of Public Procurement*, 19(3): 186-200, July 2019. <https://doi.org/10.1108/JOPP-02-2018-0006>

Ritschel, J.D., Ritschel, T.L., and York, N. (2019). "Providing a Piece of the Puzzle: Insights into the Aircraft Availability Conundrum," *Journal of Defense Analytics and Logistics*, 3(1): 29-40, Feb 2019.  
<https://doi.org/10.1108/JDAL-09-2018-0015>

Ritschel, J.D., Lucas, B.M., White, E.D., and Mrla, D., "The Impact of WSARA on the Cost of Air Force Weapon Systems," *Journal of Public Procurement*, 19(1): 2-14, March 2019. <https://doi.org/10.1108/JOPP-03-2019-022>

O'Hanlon, G.B., Ritschel, J.D., White, E.D., and Brown, G.E., "Delineating Operating and Support Costs in Aircraft Platforms," *Defense Acquisition Research Journal*, 25(3): 264-287, October 2018. <https://doi.org/10.22594/dau.18-801.25.03>

McGowin, A.L., Ritschel, J.D., Fass, R.D., and Boehmke, B., "A Text Mining Analysis of Acquisition Reforms and Expert Views," *Defense Acquisition Research Journal*, 25(3): 288-323, October 2018.  
<https://doi.org/10.22594/dau.18-802.25.03>

Bunecke, K., White, E.D., Ritschel, J.D., and Bush, B.A., "Evaluating Annual Fixed Wing Maintenance Costs," *Defense Acquisition Research Journal*, 25(3): 244-263, October 2018. <https://doi.org/10.22594/dau.18-797.25.03>

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Markman, M.R., Ritschel, J.D., White, E.D., and Valentine, S.M., "Statistical Analysis of Cost Factors in Department of Defense Programs," *87th MORS Symposium*, Colorado Springs, CO, 17-20 June 2019.

Angell, E., White, E.D., Ritschel, J.D., and Thal, A.E., "Analysis of Military Construction Cost Growth in Major Defense Acquisition Programs," *87th MORS Symposium*, Colorado Springs, CO, 17-20 June 2019.

Markman, M.R., Ritschel, J.D., White, E.D., and Valentine, S.M., "Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms," *16th Annual Acquisition Research Symposium*, Monterey, CA, 8-9 May 2019.

Ritschel, T.L., Ritschel, J.D., and York, N. "Insights into the Aircraft Availability Conundrum," *2018 Fall Technical Symposium Cincinnati-Dayton Chapter of INFORMS*, Dayton, OH, 19 October 2018.

## Other Significant Research Productivity

Markman, M.R., Ritschel, J.D., White, E.D., and Valentine, S.M., “Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms,” *International Cost Estimation & Analysis (ICEAA) Dayton Chapter*, Thesis Presentation: 19 March 2019.

Tyson, R.E., Fass, R.D., Ritschel, J.D. and White, E.D. (2019). “An Assessment of the Air Force’s Return on Investment for Product Support Business Case Analysis Processes,” *International Cost Estimation & Analysis (ICEAA) Dayton Chapter*, Thesis Presentation: 19 March 2019.

Enos, T.A, Ritschel, J.D., White, E.D. and Drylie, S.T. (2019). “A Case Study of EPA Clauses as They Apply to Fixed Price Contracts,” *International Cost Estimation & Analysis (ICEAA) Dayton Chapter*, Thesis Presentation: 19 March 2019.

## SCHULDT, STEVEN J., Maj

Assistant Professor of Engineering Management and Director, Graduate Engineering Management Program, Department of Systems Engineering and Management, AFIT. Appointment Date: 2018 (AFIT/ENV); BS, Civil Engineering, University of Illinois at Urbana-Champaign, 2006; MS, Environmental Engineering and Science, Air Force Institute of Technology, 2012; PhD, Civil Engineering, University of Illinois at Urbana-Champaign, 2017. Maj Schuldt’s research interests include installation resilience, project/construction management, optimal resource/asset utilization, and sustainability. Tel. 937-255-3636 x4645, Email: [Steven.Schuldt@afit.edu](mailto:Steven.Schuldt@afit.edu)

## Sponsor Funded Research Projects

“20M AFIT GEM Civil Engineer Research.” Sponsor: AFCEC. Funding: \$198,247 - Schuldt 50%, Hoisington 50%.

“20M AFIT GEM Civil Engineer Research.” Sponsor: AFCEC. Funding: \$26,753 - Schuldt 50%, Hoisington 50%.

“Air National Guard Civil Engineer Research.” Sponsor: NGB. Funding: \$100,200.

## Refereed Journal Publications

Hines, P.A., Wagner, T., Koschnick, C.M., and Schuldt, S.J., “Analyzing the Efficiency of Horizontal Photovoltaic Cells in Various Climate Regions,” *Journal of Energy and Natural Resources*, Vol. 8, No. 2, Jan 2019. DOI: <https://doi.org/10.11648/j.jenr.20190802.15>

Hoisington, A.J., Stearns-Yoder, K.A., Schuldt, S.J., Beemer, C., Maestre, J.P., Kinney, K., Postolache, T.T., Lowry, C.A., and Brenner, L., “Ten questions Concerning the Built Environment and Mental Health,” *Building and Environment*, 155, 58–69, March 2019. DOI: <https://doi.org/10.1016/j.buildenv.2019.03.036>

Thomsen, N., Wagner, T., Hoisington, A.J., and Schuldt, S.J., “A Sustainable Prototype for Renewable Energy: Optimized Prime-Power Generator Solar Array Replacement,” *International Journal of Energy Production and Management*, 4(1), 28-39, March 2019. DOI: <https://doi.org/10.2495/EQ-V4-N1-28-39>

## Refereed Conference Papers Accepted on the Basis of Full Paper Review

Jagoda, J., Case, M., Diggs-McGee, B., Kreiger, E., Kreiger, M., and Schuldt, S.J., “The Benefits and Challenges of On-Site 3D-Printed Construction: A Case Study,” *3<sup>rd</sup> International Conference on Engineering Technology and Innovation*, Belgrade, Serbia, 17-21 Apr 2019.

Paquette, R., and Schuldt, S.J., “Defense of Military Installations from Ballistic Missile Attack: Doctrine, History, Challenges, and Future Research,” *7<sup>th</sup> International Conference on Military Technologies*, Brno, Czech Republic, 30-31 May 2019.

Thomsen, N., Wagner T., Hoisington, A.J., and Schuldt, S.J., “A Sustainable Prototype for Renewable Energy: Optimized Prime-Power Generator Solar Array Replacement,” *8<sup>th</sup> International Conference on Energy and Sustainability*, Coimbra, Portugal, 3-5 July 2019.

Moore, B., Schuldt, S.J., and Hoisington, A.J., "Systematic Review of Transportation Performance Assessments: A Comparison of the ASCE Infrastructure Report Card Model," *2019 World Congress on Resilience, Reliability and Asset Management*, Singapore, 28-31 July 2019.

Filer, J. and Schuldt, S.J., "Quantifying the Environmental and Economic Performance of Remote Communities," *7<sup>th</sup> International Conference on Sustainable Development*, Rome, Italy, 4-5 Sep 2019.

Schuldt, S.J., El-Rayes, K., Soylemezoglu, A., and Garfinkle, N., "Quantifying Physical and Psychological Impacts of Explosive Attacks on Building Occupants," *6th International Conference on Disaster Management and Human Health Risk*, Ancona, Italy, 25-27 Sep 2019.

### **SITU, JOHN X., Maj**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT  
Appointment Date: 2018 (AFIT/ENV); MS, Operations Research, Air Force Institute of Technology, 2012; PhD, Systems Engineering and Operations Research, George Mason University, 2018. Maj Situ received his commission from the University of Texas at Austin in 2006, and began his operations research analyst career at Edwards Air Force Base, California, where he served as an operational flight test analyst and electronic warfare analyst. Maj Situ also served as personnel analyst, Chief of Force Development Analysis and Chief, Analysis Branch at the Air Force Personnel Center, Randolph Air Force Base, Texas. In 2015, he was selected for the Air Force Institute of Technology Faculty Training Program. Maj Situ's research interests include stochastic optimization, meta-heuristics, modeling and simulation, and dynamic programming. [John.Situ@afit.edu](mailto:John.Situ@afit.edu)

### **SLAGLEY, JEREMY M.**

Assistant Professor of Industrial Hygiene and Environmental Science, Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, United States Military Academy, 1993; MS, University of Iowa, 2000; PhD, West Virginia University, 2006. Dr. Slagley's research interests include occupational stressor assessment and control, specifically for hazardous noise, aerosols, and exposure assessment. He also models deployed waste-to-energy systems for sustainability.  
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### **Sponsor Funded Research Projects**

"CBRN Decon Effectiveness for EMEDS (Decon Capabilities for Far Forward Med Team)." Sponsor: 711 HPW.  
Funding: \$276,600 - Slagley 50%, Eninger 50%.

### **Refereed Journal Publications**

Titus, E., Lemmer, G., Slagley, J.M., and Eninger, R., "A Review of CBRN Topics Related to Military and Civilian Patient Exposure and Decontamination," *American Journal of Disaster Medicine*, 14(2), 137-149, Spring 2019, DOI:10.5055/ajdm.2019.0324

Trawick, J., Slagley, J.M., and Eninger, R., "Occupational Noise Dose Reduction via Behavior Modification Using In-Ear Dosimetry among United States Air Force Personnel Exposed to Continuous and Impulse Noise," *Open Journal of Safety Science and Technology*, 9:2, 61-81, June 2019. DOI: [10.4236/ojsst.2019.92005](https://doi.org/10.4236/ojsst.2019.92005)

Richburg, C., Slagley, J.M., "Noise Concerns of Residents Living in Close Proximity to Hydraulic Fracturing Sites in Southwestern Pennsylvania" *Public Health Nursing*, 00:1-8, Jan 2019. DOI: 10.1111/phn.12540.

### **Books and Chapters in Books**

Winn, G.L., Slagley, J.M., Slagley, M.L., and Winn, L., "Teaching Safety, Health, and Environment in Engineering Programs for Millennials: Ethics Is the Basis," *Industry Integrated Engineering and Computing Education* (pp. 119-133). Springer, Cham, 2019.

**STUBBS, JOHN E., Lt Col**

Deputy Department Head and Assistant Professor of Environmental Engineering and Science, Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, North Carolina State University, 1998; MS, Air Force Institute of Technology, 2010; PhD, Air Force Institute of Technology, 2017. Lt Col Stubbs' research interests include physical and chemical water treatment processes and environmental sustainability. Tel. 937-255-3636 x4329, Email: [john.stubbs@afit.edu](mailto:john.stubbs@afit.edu)

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

T. McWhirter, T. Wagner, and J. Stubbs, "Ground Vehicle Energy Requirement Modeling and System Optimization," *Society of Automotive Engineers World Conference*, Detroit, MI, April 2019.

**Other Significant Research Productivity**

"Advanced Treatment of Secondary Wastewater Effluents with Ultraviolet Light-Emitting Diodes," *Ohio Water Development Authority*, Co-P.I. Jan 2020 – Dec 2020, \$63,333 total awarded to AFIT.

**THAL, ALFRED E., Jr.**

Assistant Professor of Engineering Management, Department of Systems Engineering and Management, AFIT Appointment Date: 1998 (AFIT/ENV); BS, Civil Engineering, Texas Tech University, 1981; MS, Engineering Management, AFIT, 1985; PhD, Environmental Engineering, University of Oklahoma, 1999. Dr. Thal's research interests include engineering and environmental management, groundwater flow and remediation technologies, facility and infrastructure management, product development, sustainability, and project management. Tel. 937-255-3636 x7401, Email: [Al.Thal@afit.edu](mailto:Al.Thal@afit.edu)

**Refereed Journal Publications**

P. Ramsey, D. Prigge, T. Wagner, and A.E. Thal, "Statistical Viability Analysis of United States Air Force Estimating Cost Factor for Sustainable Construction," *Journal of Advances in Civil Engineering*, Vol. 5, No. 2, 2019.

**WAGNER, TORREY J., Lt Col**

Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, Electrical Engineering, University of Minnesota, 2000; MS, Aerospace Systems Engineering, Loughborough University, 2004; PhD, Electro-Optics, Air Force Institute of Technology, 2010. Lt Col Wagner's primary interest is DOD-focused energy systems engineering, including the research topics of air vehicle, ground vehicle, fixed installation and contingency base energy systems. Tel. 937-255-3636 x4611, Email: [Torrey.Wagner@afit.edu](mailto:Torrey.Wagner@afit.edu)

**Sponsor Funded Research Projects**

"Identification & Mitigation of Biodiesel Microbial Biodeterioration." Sponsor: AFRL/RQ. Funding: \$20,000.

"UAV Hybrid Energy System Modeling." Sponsor: AFRL/RQ. Funding: \$35,000.

**Refereed Journal Publications**

J. Poole, T. Wagner, and D. Dudis, "8x Raven Small UAS Endurance with an Optimized Hybrid Solid Oxide Fuel Cell & Battery Energy System," *Journal of Defense Research & Engineering*, Vol. 1, No. 2, May 2019.

D. Chester, T. Wagner, and D. Dudis, "36% Reduction in Fuel Resupply Using a Hybrid Generator & Battery System for an Austere Location," *Marine Corps Gazette—The Professional Journal of the United States Marine Corps*, Vol. 103, No. 3, March 2019.

P. Ramsey, D. Prigge, T. Wagner, and A.E. Thal, "Statistical Viability Analysis of United States Air Force Estimating Cost Factor for Sustainable Construction," *Journal of Advances in Civil Engineering*, Vol. 5, No. 2, 2019.

P.A. Hines, T. Wagner, C.M. Koschnick, and S.J. Schuldt, "Analyzing the Efficiency of Horizontal Photovoltaic Cells in Various Climate Regions," *Journal of Energy and Natural Resources*, Vol. 8, No. 2, June 2019.

N. Thomsen, T. Wagner, A.J. Hoisington, and S.J. Schuldt, "A Sustainable Prototype for Renewable Energy: Optimized Prime-Power Generator Solar Array Replacement," *International Journal of Energy Production and Management*, Vol. 4, No. 1, March 2019.

K. Meyer, T. Wagner, and J. Williams, "Using Wind and Hydro Power to Sustain the Off-Grid Power Supply for a 50' Cruising Sailboat," *Journal of Fundamentals of Renewable Energy and Applications*, Vol. 9, No. 1, May 2019.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

J. Kramer and T. Wagner, "Developmental Test and Requirements Best Practices of Successful Information Systems Efforts Using Agile Methods," *Defense Acquisition University Symposium*, Fort Belvoir, VA, April 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

N. Thomsen, T. Wagner, A.J. Hoisington, and S.J. Schuldt, "A Sustainable Prototype for Renewable Energy: Optimized Prime-Power Generator Solar Array Replacement," *8th International Conference on Energy and Sustainability*, Portugal, Jul 2019.

T. McWhirter and T. Wagner, "Ground Vehicle Energy Requirement Modeling and System Optimization," *Society of Automotive Engineers World Conference*, Detroit, MI, April 2019.

N. Thomsen, T. Wagner, A.J. Hoisington, R. Salavani, and S.J. Schuldt, "A Sustainable Prototype for Renewable Energy," *Dayton Area Engineering Sciences Symposium*, Dayton, OH, Oct 2019.

J. Pearson, T. Wagner, and S.J. Schuldt, "Insulation Sensitivity Analysis for an Optimized Fabric Shelter Off-Grid Hybrid Energy System," *Dayton Area Engineering Sciences Symposium*, Dayton, OH, Oct 2019.

#### **Other Significant Research Productivity**

Created New Course: *SENG 582A Aviation Energy Systems Engineering* with co-instructors from the Air Force Research Laboratory Aerospace Systems Directorate.

J. Williams and T. Wagner, "Northern Hemisphere Horizontal Photovoltaic Power Output Data for 12 Sites," Mendeley Data, July 2019. <http://dx.doi.org/10.17632/hfhwmn8w24.5>

T. Wagner, "Optimization of Airspeeds and Altitudes for F-15E and KC-135 Coronet Missions," Presentation: Deputy Assistant Secretary of the Air Force for Operational Energy, Washington D.C., 10 Jun 2019.

T. Wagner, "Optimization of Airspeeds and Altitudes for Coronet Missions," Presentation: Air Force Research Laboratory Aerospace Vehicles Directorate, Dayton, OH, 18 Jun 2019.

## **6. RESEARCH CENTER PUBLICATIONS AND FUNDING INFORMATION**

The contents of this section are duplicated data, grouped by center. The information is previously listed within each project's specific academic department.

## 6.1 AUTONOMY AND NAVIGATION TECHNOLOGY CENTER

### Autonomy and Navigation Technology (ANT) Center

Director (937) 255-3636 x4755

Executive Administrator (937) 255-3636 x4583

Laboratory Manager (937) 255-3636 x4911

Homepage: <http://www.afit.edu/ANT>

### 6.1.1 DOCTORAL DISSERTATIONS

JURADO, JUAN D., Autonomous and Resilient Management of All-Source Sensors for Navigation Assurance. AFIT-ENG-DS-19-S-006. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: N/A.

### 6.1.2 MASTER'S THESES

ARAGON, ANGELITO E., Evaluating Machine Learning Techniques for Smart Home Device Classification. AFIT-ENG-MS-19-M-006. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS.

BARBER, TAYLOR S., Performance Analysis of Angle of Arrival Algorithms Applied to Radiofrequency Direction Finding. AFIT-ENG-MS-19-M-008. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: AFRL/RW.

BEARGIE, DAVID W., Assessment of Camera Pose Estimation Using Geo-Located Images from Simultaneous Localization and Mapping. AFIT-ENG-MS-19-M-009. Faculty Advisor: Capt Aaron J. Canciani. Sponsor: N/A.

BERHOLD, JEDEDIAH M., Convolutional Neural Network Architecture Study for Aerial Visual Localization. AFIT-ENG-MS-19-M-010. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RV.

BRAUN, ANDREW D., High Fidelity Satellite Navigation Receiver Front-End for Advanced Signal Quality Monitoring and Authentication. AFIT-ENG-MS-19-M-013. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: N/A.

COMBS, COREY A., DT&E of an Autonomous UAS Swarming Algorithm. AFIT-ENV-MS-19-M-168. Faculty Advisor: Dr. John M. Colombi. Sponsor: AFRL/RV.

DALLMANN, WILLIAM E., Infrared and Electro-Optical Stereo Vision For Automated Aerial Refueling. AFIT-ENG-MS-19-M-022. Faculty Advisor: Scott L. Nykl. Sponsor: AFRL/RQ.

HERTWIG, FRED D., Search-Based vs Task-Based Space Surveillance for Ground-Based Telescopes. AFIT-ENV-MS-19-M-178. Faculty Advisor: Dr. John Colombi. Sponsor: N/A.

KELLY, PATRICK J., Methodology for Including Base Infrastructure in Conceptual System Analysis. AFIT-ENV-MS-19-M-182. Faculty Advisor: Dr. John M. Colombi.

KIM, KYUNG M., Monocular Visual Odometry For Fixed-Wing, Small Unmanned Aircraft Systems. AFIT-ENG-MS-19-M-036. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RV.

LEE, TAYLOR N., Aerial Simultaneous Localization and Mapping Using Earth's Magnetic Anomaly Field. AFIT-ENG-MS-19-M-039. Faculty Advisor: Capt Aaron J. Canciani. Sponsor: N/A.

MONTGOMERY, MADISON J., Active Control Of a Morphing Wing Aircraft and Failure Analysis For System Reliability. AFIT-ENG-MS-19-M-045. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RQ.

MORA, EDWIN A., A Multi-Vehicle Cooperative Localization Approach For an Autonomy Framework. AFIT-ENG-MS-19-M-046. Faculty Advisor: Dr. Robert C. Leishman.

NELSON, KALEB J., Event-Based Visual-Inertial Odometry on a Fixed-Wing Unmanned Aerial Vehicle. AFIT-ENG-MS-19-M-048. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RV.

POOLE, JONATHAN D., Product Development Process for Small Unmanned Aerial Systems. AFIT-ENV-MS-19-M-194. Faculty Advisor: Lt Col Amy Cox.

RASK, THEODORE A., Commercialization Analysis of SBIR-Funded Technologies. AFIT-ENV-MS-19-M-195. Faculty Advisor: Lt Col Amy Cox.

RIVERA, JUAN A., Design and Flight Test of a Path Planning Algorithm Utilizing Graph Theory for Real-Time Applications. AFIT-ENV-MS-19-M-241. Faculty Advisor: Dr. David R. Jacques. Sponsor: AFRL/RQ.

WALLACE, SCOUT T., Extended Kalman Filtering for Missile Live-Fire Data Analysis. AFIT-ENG-MS-18-D-004. Faculty Advisor: Lt Col Scott J. Pierce. Sponsor: AFRL/RV.

WASZ, PATRICK J., Two-On-One Pursuit with a Non-Zero Capture Radius. AFIT-ENG-MS-19-M-066. Faculty Advisor: Dr. Meir Pachter. Sponsor: AFRL/RV.

### **6.1.3 FACULTY RESEARCH OUTPUT**

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### **BETANCES, JOAN A., Maj, Department of Electrical and Computer Engineering**

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

B. Burfeind, R.F. Mills, S.L. Nykl, J.A. Betances, and C. Sielski, "Confidential ADS-B," *IEEE Aerospace Conference*, Big Sky, MT, Mar 2019, pp. 1-11.

#### **BORGHETTI, BRETT J., Department of Electrical and Computer Engineering**

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Curro, Joseph A., Raquet, John F., Borghetti, Brett J., "Navigation Using VLF Signals with Artificial Neural Networks" *Navigation*, 5 Dec 2018, pp. 1-13. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/navi.2664>

Villarreal, Micah N., Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," *Human Factors and Ergonomics Society (HFES) Annual Conference*, Seattle, WA, 28 Oct-1 Nov 2019.

Skouson, Mark B., Borghetti, Brett J., Leishman, Robert C., "Ursa: A Neural Network for Unordered Point Clouds Using Constellations," *Computer Vision Conference (CVC) 2019*, Las Vegas, NV, 25-26 Apr 2019.

##### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Berhold, J., Mark, Leishman, Robert C., Borghetti, Brett J., and Venable, Donald T., "Hyperparameter Comparison on Convolutional Neural Network for Visual Aerial Localization," *Institute of Navigation (ION) Pacific Position Navigation Timing (PNT) conference*, Honolulu, HI, 8-11 April 2019.

**CANCIANI, AARON J., Maj, Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

“High Resolution Magnetic Mapping over Naval Test Range.” Sponsor: NGA. Funding: \$250,000.

“Navigation for A2AD, Long Range, Over Water Ingress.” Sponsor: AFRL/RV. Funding: \$550,796 - Canciani 60%, Leishman 30%, Raquet 10%.

**CASEY, DANIEL J., Maj, Department of Electrical and Computer Engineering**

**COBB, RICHARD G., Department of Aeronautics and Astronautics**

**Sponsor Funded Research Projects**

“Timely Path Optimization for Enhanced Autonomy.” Sponsor: AFRL/RQ. Funding: \$25,000.

“Developing Artificial Intelligence Opponents for Contested Space Simulations.” Sponsor: AFRL/RV. Funding: \$100,000 - Cobb 25%, Hess 25%, Johnson 25%, Curro 25%.

**COLLINS, PETER J., Department of Electrical and Computer Engineering**

**COLOMBI, JOHN M., Department of Systems Engineering and Management**

**CORBELL, PHILLIP M., Lt Col, Department of Electrical and Computer Engineering**

**COX, AMY M., Lt Col, Department of Systems Engineering and Management**

**GUNAWARDENA, SANJEEV, Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RV. Funding: \$759,917.

**Refereed Journal Publications**

Gunawardena, S., Raquet, J., and Carroll, M., Correlator Beamforming for Multipath Mitigation in High Fidelity GNSS Monitoring Applications,” *NAVIGATION: Journal of the Institute of Navigation*, Vol. 66, No. 1, Spring 2019, pp. 169-183. <https://doi.org/10.1002/navi.2886>

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Gunawardena, S., Rügamer, A., Hameed, M.S., Arizabaleta, M., Pany, T., and Arribas, J., ION Software-Defined Radio Metadata Standard Final Report, Proceedings of the 32nd International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2019), Miami, Florida, September 2019, pp. 3785-3800. <https://doi.org/10.33012/2019.170227>

Raquet, N., Gunawardena, S., Patel, P., and Hinks, E.J., Phase Optimized Constant Envelope Transmission-Induced Pseudorange Biases and Mitigation, Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation, Long Beach, CA, July 2019.

Braun, A., and Gunawardena, S., High Fidelity Satellite Navigation Front-End for Signal Quality Monitoring and Advanced Authentication, Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation, Long Beach, CA, July 2019.

**HODSON, DOUGLAS D., Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

“AFSIM Maturation and Capability Improvements.” Sponsor: AFRL/RQ. Funding: \$35,948 - Hodson 50%, Peterson 50%.

**HOPKINSON, KENNETH M., Department of Electrical and Computer Engineering**

**Refereed Journal Publications**

Compton, A.J., Pecarina, J.M., Hopkinson, K.M., and Lin, A.C., “Peer Appear: A Self-Organizing Distributed Geospatial Index Supporting Collaborative World Model Construction and Maintenance,” *Elsevier Future Generation Computer Systems*, Vol. 95, June 2019, pp. 802-815.

**JACQUES, DAVID R., Department of Systems Engineering and Management**

**Sponsor Funded Research Projects**

“Cooperative Search and Surveillance with Unmanned Agents.” Sponsor: AFRL/RQ. Funding: \$30,000 - Jacques 80%, Colombi 80%.

**LEISHMAN, ROBERT C., Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

“ENG18-001 PNT Focused Distance Learning Electrical Engineering Master’s Degree.” Sponsor: 746 TS. Funding: \$80,000 - Leishman 34%, Canciani 33%, Gunawardena 33%.

“ENG18-004 PNT Focused Distance Learning Electrical Engineering Master’s Degree.” Sponsor: USA CERDEC. Funding: \$80,000 - Leishman 34%, Canciani 33%, Gunawardena 33%.

“Morphing and Shape Adaptable Aircraft Control, Integration, and Flight Test.” Sponsor: AFRL/RQ. Funding: \$24,940 - Leishman 80%, Jacques 20%.

“Morphing and Shape Adaptable Aircraft Control, Integration, and Flight Test.” Sponsor: AFRL/RQ. Funding: \$39,127 - Leishman 80%, Jacques 20%.

“Morphing and Shape Adaptable Aircraft Control, Integration, and Flight Test.” Sponsor: AFRL/RQ. Funding: \$85,933 - Leishman 80%, Jacques 20%.

“Real-Time Path Planning in Constrained, Uncertain Environments.” Sponsor: AFRL/RQ. Funding: \$150,000.

“Scorpion Suite Development and Support.” Sponsor: USA/ISR. Funding: \$225,000 - Leishman 50%, Taylor 50%.

“Scorpion Support for AgilePod Flight Test.” Sponsor: AFRL/RQ. Funding: \$200,000.

**LIEVSAY, JAMES R., Maj, Department of Electrical and Computer Engineering**

**MARTIN, RICHARD K., Department of Electrical and Computer Engineering**

**MERKLE, LAURENCE D., Department of Electrical and Computer Engineering**

**MILLER, MICHAEL E., Department of Systems Engineering and Management**

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Canzonetta, D.J. and Miller, M.E., “Adaptive Artificial Agent Response Time Impact on Human-Agent Team Performance,” *Industrial and Systems Research Conference*, Orlando, FL, May 2019.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Schneider, M.F., Miller, M.E., and McGuirl, J.M., “Towards a Meta-Model to Specify and Design Human-Agent Teams,” *International Symposium on Aviation Psychology*, Dayton, OH, May 2019.

Canzonetta, D.J., and Miller, M.E., “Identifying a Possible Function for Artificial Agent Adaptation in Variable Task Rate Environments,” *International Symposium on Aviation Psychology*, Dayton, OH, May 2019.

Reis, G.A., Geiselman, E.E., and Miller, M.E., “Effects of Visual Perceptual Asymmetries on Performance While Using and Aircraft Attitude Symbology,” *International Symposium on Aviation Psychology*, Dayton, OH, May 2019.

**NYKL, SCOTT L., Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

“Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3.” Sponsor: AFRL/RQ. Funding: \$100,000.

“Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3.” Sponsor: AFRL/RQ. Funding: \$50,000.

**Refereed Journal Publications**

J. Roeber, S.L. Nykl, and S.R. Graham, “Assessment of Structure from Motion for Reconnaissance Augmentation and Bandwidth Usage Reduction,” *Journal of Defense Modeling and Simulation*, Vol. 1, No.1, pp. 1–13, Apr 2019. <https://doi.org/10.1177/1548512919844021>

C. Parsons, Z. Paulson, S.L. Nykl, W. Dallman, B.G. Woolley, and J. Pecarina, “Analysis of Simulated Imagery for Real-Time Vision-Based Automated Aerial Refueling,” *AIAA: Journal of Aerospace Information Systems*, Vol. 16, No. 3, pp. 77–93, Jan 2019. <https://doi.org/10.2514/1.1010658>

Z. Paulson, S.L. Nykl, J. Pecarina, and B. Woolley, “Mitigating the Effects of Boom Occlusion on Automated Aerial Refueling Through Shadow Volumes,” *The Journal of Defense Modeling and Simulation*, Vol. 16, No. 2, pp. 175–189, 018. <https://doi.org/10.1177/1548512918808408>

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

J.A. Vagedes, D.D. Hodson, S.L. Nykl, and J.R. Millar, “ECS Architecture for Modern Military Simulators,” *Proceedings of the International Conference on Scientific Computing (CSC)*. The Steering Committee of the World Congress in Computer Science, 2019, pp. 118–122.

B. Burfeind, R.F. Mills, S.L. Nykl, J. Betances, and C. Sielski, “Confidential ADS-B: A Lightweight, Interoperable Approach,” *IEEE Aerospace Conference*, Big Sky, Montana, 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Lee and S.L. Nykl, "Biologically Inspired Machine Learning to Improve Automated Aerial Refueling Algorithms," *Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC)*, ser. ION JNC '19. Long Beach, CA, USA: Institute of Navigation, July 2019.

B. French, and S.L. Nykl, "Determining Virtually Simulated Aerial Refueling Fidelity Using Physically Collected Stereo Vision Images and DGPS-based Truth Data," *Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC)*, ser. ION JNC '19. Long Beach, CA, USA: Institute of Navigation, July 2019.

M. Crowl, and S.L. Nykl, "Use of LIDAR in Automated Aerial Refueling (AAR): An Improvement over the Existing Stereo Vision System," *Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC)*, ser. ION JNC '19. Long Beach, CA, USA: Institute of Navigation, July 2019.

### **Patent Applications**

S.L. Nykl, B. Woolley, and J. Pecarina, "Stereo Vision Relative Navigation of Airborne Vehicles," U.S. Patent Pending 62/886,550, August, 2019.

### **OXLEY, MARK E., Department of Mathematics and Statistics**

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Oxley, M.E. and Schubert Kabban, C.M., "Fusion within a Detection System Family," *Proceedings of FUSION 2019*, Paper No. 1570537583, Jul 2019.

### **PACHTER, MEIR, Department of Electrical and Computer Engineering**

#### **Sponsor Funded Research Projects**

"Cooperative Control." Sponsor: AFRL/RQ. Funding: \$40,000.

#### **Refereed Journal Publications**

M. Pachter, E. Garcia, and D. Casbeer, "Toward a Solution of the Active Target Defense Differential Game," *Dynamic Games and Applications*, Vol. 9, No. 1, pp. 165-2016, February 2019.

E. Garcia, D. Casbeer, and M. Pachter, "Design and Analysis of State Feedback Optimal Strategies for the Differential Game of Active Defense," *IEEE Trans. on Automatic Control*, Vol. 64, No. 2, pp. 553-568, February 2019.

M. Pachter, and S. Coats, "The Classical Homicidal Chauffeur Differential Game," DOI 10.10007/s13235-018-0264-8, *Dynamic Games and Applications*, March 2019.

M. Pachter, A. Von Moll, E. Garcia, and D. Casbeer, "Two-on-One Pursuit," *AIAA Journal of Guidance*, Vol. 42, No. 7, July 2019.

M. Pacher, and P. Wasz, "On a Two Cutters and Fugitive Ship Differential Game," *IEEE Control Systems Society Letters*, Vol. 3, No. 4, October 2019.

Von Moll, A., D. Casbeer, E. Garcia, D. Milutinovic, and M. Pachter, "The Multi-Pursuer, Single-Evader Game-A Geometric Approach," *Journal of Intelligent & Robotic Systems*, 1 March 2019.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Eloy Garcia, David Casbeer, and Meir Pachter, "Cooperative Two-Pursuer One-Evader Blocking Differential Game," *American Control Conference*, pp.2702-2709, Philadelphia, PA, 10-12 July 2019.

Patrick Wasz, Meir Pachter, and Khanh Pham, "Two-On-One Pursuit with a Non-Zero Capture Radius," *Mediterranean Control Conference*, Akko, Israel, 1-4 July, 2019.

Meir Pachter, Eloy Garcia, Roger Anderson, and David Casbeer, "Maximizing the Target's Longevity in the Active Target Defense Differential Game," *European Control Conference*, Naples, Italy, 24-28, 2019.

Meir Pachter, Alexander Von Moll, Eloy Garcia, David Casbeer, and Dejan Milutinovic, "Singular Trajectories in the Two Pursuers One Evader Differential Game," *ICUAS*, pp. 1153-1160, Atlanta, GA, 11-14 June, 2019.

Meir Pachter, Eloy Garcia, and David Casbeer, "Linear-Quadratic Formulation of the Target Defense Differential Game," *ICUAS*, pp.1069-1075, Atlanta, GA, 11-14 June, 2019.

R. Anderson, M. Pachter, and R. Murphey, "Defender Assisted Evasion Maneuvers," *Proceedings of the 59th Israel Annual Conference on Aerospace Sciences*, Tel Aviv and Haifa, 6-7 March 2019.

S. Jackson, A. Palazotto, M. Pachter, and N. Niedbalski, "Control of Vapor Compression Cycles Under Transient Thermal Loads," *AIAA SciTech Forum*, 7-11 January 2019, San Diego, CA.

E. Garcia, D. Casbeer, and M. Pachter, "The Capture-the-Flag Differential Game," *Conference on Decision and Control*, Miami Beach, FL, pp. 4167-4172, 17-19 December, 2018, pp. 4167-4172.

**PETERSON, GILBERT L., Department of Electrical and Computer Engineering**

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

King, D.W., and Peterson, G.L., "A Macro-Level Order Metric for Self-Organizing Adaptive Systems," *IEE 12th International Conference on Self-Adaptive and Self-Organizing Systems*, 2018, pp. 60-69.  
DOI: 10.1109/SASO.2018.00017

King, D.W., L. Esterle, and Peterson, G.L., "Entropy-Based Team Self-Organization with Signal Suppression," *Proceedings of the Artificial Life Conference 2019*. 2019, DOI: 10.1162/isal\_a\_00154

**Other Significant Research Productivity**

King, D.W., and Peterson, G.L., "A Macro-Level Order Metric for Self-Organizing Adaptive Systems," *12th IEEE International Conference on Self-Adaptive and Self-Organizing Systems*, Trento, Italy, September 2018.

**PIERCE, SCOTT J., Lt Col, Department of Electrical and Computer Engineering**

**RAQUET, JOHN F., Department of Electrical and Computer Engineering**

**Sponsor Funded Research Project**

"Alternative Sensors for Non-GPS Navigation." Sponsor: Draper Laboratory. Funding: \$20,000.

"ANT Center and Laboratory Support per MOA between AFIT and AFRL." Sponsor: AFRL/R.Y. Funding: \$200,000 - Raquet 50%, Pierce 50%.

"Multi-Sensor Navigation Demonstration." Sponsor: USA CERDEC. Funding: \$300,000.

"PNT-Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: AFRL/R.Y. Funding: \$100,000 - Raquet 25%, Canciani 25%, Leishman 25%, Gunawardena 25%.

“PNT-Focused Distance Learning Electrical Engineering Master's Degree.” Sponsor: AFRL/R.Y. Funding: \$86,618 - Raquet 25%, Canciani 25%, Leishman 25%, Gunawardena 25%.

“Scorpion Suite Development and Support.” Sponsor: USA CERDEC. Funding: \$225,000 - Leishman 50%, Taylor 50%.

“Support for PNT Modeling and Simulation.” Sponsor: USA CERDEC. Funding: \$100,000.

**TEMPLE, MICHAEL A., Department of Electrical and Computer Engineering**

## 6.2 CENTER FOR CYBERSPACE RESEARCH

### Center for Cyberspace Research (CCR)

Director (937) 255-6565 x4690

Executive Program Coordinator (937) 255-3636 x4602

Homepage: <http://www.afit.edu/CCR>

### 6.2.1 DOCTORAL DISSERTATIONS

HAMILTON, NICOLAS S., Adaptive-Hybrid Redundancy for Radiation Hardening. AFIT-ENG-DS-19-S-005.

Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A.

KING, DAVID W., Emergent Behavior Development and Control in Multi-Agent Systems. AFIT-ENG-DS-19-S-007.

Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AF Pentagon, Studies, Analyses and Assessments.

STONE, BRENT J., Enabling Auditing and Intrusion Detection for Proprietary Controller Area Networks. AFIT-

ENG-DS-18-D-003. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A.

### 6.2.2 MASTER'S THESES

ADDERLEY, NIKOLAI A., Graph-Based Temporal Analysis in Digital Forensics. AFIT-ENG-MS-19-M-005.

Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: DC3/DC.

ALSHAMMARI, DHAHER M., Trust and Suspicion as a Function of Cyber Security in Human Machine Team

(HMT) of Unmanned Systems. AFIT-ENV-MS-19-S-051. Faculty Advisor: Dr. John J. Elshaw. Sponsor: N/A.

ARAGON, ANGELITO E., Evaluating Machine Learning Techniques for Smart Home Device Classification. AFIT-

ENG-MS-19-M-006. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS.

BOGGS, BRANDON N., RF-DNA Fingerprinting Ping 2020i ADS-B UAT Devices Using a Low-Cost SDR. AFIT-

ENG-MS-19-M-011. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL/RV.

BRAMLETTE, CLINT M., Cyber-Attack Drone Payload Development and Geolocation Via Directional Antennae.

AFIT-ENG-MS-19-M-012. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: N/A.

BRAUN, ANDREW D., High Fidelity Satellite Navigation Receiver Front-End for Advanced Signal Quality

Monitoring and Authentication. AFIT-ENG-MS-19-M-013. Faculty Advisor: Dr. Sanjeev Gunawardena. Sponsor: N/A.

CHIARATTI, NICHOLAS S., Software Defined Radio (SDR) Device Discrimination Using Chip Shape-Distinct

Native Attribute (CS-DNA) Features. AFIT-ENG-MS-19-M-018. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL AFMC.

CINTRON, LUIS A., Modeling a Consortium-Based Distributed Ledger Network with Applications for Intelligent

Transportation Infrastructure. AFIT-ENG-MS-18-M-019. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/RV.

CRUZ, FRANKIE A., Near Real-Time RF-DNA Fingerprinting for ZigBee Devices Using Software Defined Radios.

AFIT-ENG-MS-19-M-021. Faculty Advisor: Maj Joan A. Betances Jorge. Sponsor: AFRL/RV.

DONTIGNEY, TROY B., Space Surveillance Network Design. AFIT-ENG-MS-19-J-003. Faculty Advisor: Dr.

Laurence D. Merkle. Sponsor: AFRL/RV.

GANITANO, GRAIG S., Confidence Inference In Defensive Cyber Operator Decision Making. AFIT-ENG-MS-19-M-028. Faculty Advisor: Dr. Brett J. Borghett. Sponsor: 711HPW/CL.

GRIMM, MATTHEW A., Imitating Human Responses Via a Dual-Process Model Approach. AFIT-ENG-MS-19-M-030. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/R.Y.

HACKER, KENNETH L., Preserving Privacy In Automotive Tire Pressure Monitoring Systems. AFIT-ENG-MS-19-M-031. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A.

JAMES, KENNETH , Testing the Fault Tolerance of a Wide Area Backup Protection System using SPIN. AFIT-ENG-MS-19-M-034. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A.

LASSITER, RAHN M., Physical Layer Discrimination Of Electronic Control Units Using Wired Signal Distinct Native Attribute (WS-DNA) Fingerprints. AFIT-ENG-MS-19-M-038. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/R.Y.

MARTIN, SETH A., Unguided Cyber Education Techniques Of the Non-Expert. AFIT-ENG-MS-19-M-041. Faculty Advisor: Mark A.Reith. Sponsor: N/A.

MOSBY, JOSHUA K., A Blockchain-Based Anomalous Detection System For Internet Of Things' Devices. AFIT-ENG-MS-19-M-047. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS.

SCHMITT, DARYL W., A Framework for Cyber Vulnerability Assessments of InfiniBand Networks. AFIT-ENG-MS-19-M-054. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL/R.Y.

STAFIRA, LUKAS A., Examining Effectiveness of Web-Based Internet of Things' Honeypots. AFIT-ENG-MS-19-M-057. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS.

TOMCHO, LANDON G.M., Experimentation and Analysis Using Modern Gamification Techniques. AFIT-ENG-MS-19-M-061. Faculty Advisor: Dr. Mark A. Reith. Sponsor: N/A.

### **6.2.3 FACULTY RESEARCH OUTPUT**

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### **BETANCES, JOAN A., Maj, Department of Electrical and Computer Engineering**

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Rondeau, Temple, and Betances, "DRA for CB-DNA Fingerprinting to Improve Industrial IoT Wireless Security," *Proc of the 52nd Hawaii Int'l Conf on System Sciences*, pp. 7126-7135, Jan 2019.

B. Burfeind, R.F. Mills, S.L. Nykl, J.A. Betances, and C. Sielski, "Confidential ADS-B," *IEEE Aerospace Conference*, Big Sky, MT, Mar 2019, pp. 1-11.

Matsui, Yousuke, and Betances, Addison, "Detecting Wireless Intrusion with RF Watermarks," *IEEE National Aerospace & Electronics Conference*, Dayton, OH, Jul 2019.

##### **Patent Applications**

Rondeau, Temple, Lopez, Betances, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," AFD-1967P, SN 62/856,784, 4 Jun: 2019.

**BORGHETTI, BRETT J., Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

“Modeling Decision Confidence to Improve Cyber Mission Effectiveness.” Sponsor: 711 HPW. Funding: \$12,375.

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Villarreal, Micah N., Kamrud, Alexander J., Borghetti, Brett J., “Confirmation Bias Estimation from Electroencephalography with Machine Learning,” *Human Factors and Ergonomics Society (HFES) Annual Conference*, Seattle, WA, 28 Oct-1 Nov 2019.

**COLLINS, PETER J., Department of Electrical and Computer Engineering**

**GRAHAM, SCOTT R., Department of Electrical and Computer Engineering**

**Sponsor Funded Research Projects**

“Reconnaissance Improvement via Change Detection, Data Compression, & Comm Resilience Using Jetson TX1s & TX2s.” Sponsor: Undisclosed. Funding: \$30,780 - Graham 50%, Nykl 50%.

**Refereed Journal Publications**

Badenhop, C.W., Graham, S.R., Mullins, B.E., and Mailloux, L.O., “Looking Under the Hood of Z-Wave: Volatile Memory Introspection for the ZW0301 Transceiver,” *ACM Transactions on Cyber-Physical Systems*, Vol. 3 Issue 2, Dec 2018.

Beyer, S.M., Mullins, B.E., Graham, S.R., and Bindewald, J.M., “Pattern-of-Life Modeling in Smart Homes,” *IEEE Internet of Things Journal*, Vol. 5, Issue 6, Dec 2018.

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Cintron, L.A., Graham, S.R., and Hodson, D.D., “Modeling Liability Data Collection Systems for Intelligent Transportation Infrastructure Using Hyperledger Fabric,” *13th International Conference on Critical Infrastructure Protection*, Mar 2019.

Hacker, K.L., Graham, S.R., and Dunlap, S.J., “Vehicle Identification and Route Reconstruction via TPMS Data Leakage,” *13th International Conference on Critical Infrastructure Protection*, Mar 2019.

Lassiter, R. M., Graham, S.R., Carbino, T.J., and Dunlap, S.J., “Electronic Control Unit Discrimination Using Wired Signal Distinct Native Attributes (WS-DNA),” *13th International Conference on Critical Infrastructure Protection*, Mar 2019.

Schmitt, D.J., Graham, S.R., Sweeney, P.J., Mills, R.F., “A Cyber Vulnerability Assessment of Infiniband Networking,” *13th International Conference on Critical Infrastructure Protection*, Mar 2019.

Cintron, L.A., Graham, S.R., Hodson, D.D., and Mullins, B.E., “Distributed-Ledger Based Event Attestation for Intelligent Transportation Systems,” *14th International Conference on Cyber Warfare and Security (ICCWS 2019)*, Mar 2019.

Hacker, K.L., and Graham, S.R., “Preserving Privacy and Integrity in Automotive Tire Sensors,” *14th International Conference on Cyber Warfare and Security (ICCWS 2019)*, Mar 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Hamilton, N.S., Graham, S.R., Carbino, T.J., Petrosky, J.C., and Betances, J.A., “Adaptive-Hybrid Redundancy for Rad-Hardening,” *Proceedings of the IEEE 2019 National Aerospace and Electronics Conference (NAECON)*, 15-19 Jul 2019.

### **Books and Chapters in Books**

Celebucki, D.J., Graham, S.R., and Gunawardena, S., “Reversing a Lattice ECP3 FPGA for Bitstream Protection,” *Critical Infrastructure Protection XII*, Springer, 2018.

Bentjen, K.C., Graham, S.R., Nykl, S.L., “Introducing Persistent Human Control into a Reservation-Based Autonomous Intersection Protocol,” *Critical Infrastructure Protection XII*, Springer, 2018.

Wolfe, C.L., Graham, S.R., Mills, R.F., Nykl, S.L., and Simon, P.E., “Securing Data-in-Transit for Power-Limited Sensor Networks Using Two-Channel Communication,” *Critical Infrastructure Protection XII*, Springer, 2018.

### **Editorships in Professional Journals**

Guest Editor, *ACM Digital Threats: Research and Practice*, Special Issue on the Digital Threats of Hardware Security.

### **Patent Applications**

Reber, P.E., Graham, S.R., Sweeney, P.J., and Stephensen, M.M., “Active Attestation of Embedded Systems,” Filed 14 Jan 2019 via AFMC (Based on Provisional patent 62/635204 titled “Runtime Attestation of Embedded Systems,” filed previously on 26 Feb 2018).

### **GRMAILA, MICHAEL R., Department of Systems Engineering and Management**

#### **Editorships in Professional Journals**

Editorial Board of *Information System Security Association (ISSA) Journal*.

Assistant Editor, *The Defense Cyber Review*, Army Cyber Institute, West Point.

### **GUNAWARDENA, SANJEEV, Department of Electrical and Computer Engineering**

### **HODSON, DOUGLAS D., Department of Electrical and Computer Engineering**

#### **Sponsor Funded Research Projects**

“Developing Artificial Intelligence Opponents for Contested Space Simulations.” Sponsor: AFMC/A9. Funding: \$211,047 - Hodson 30%, Gallagher 20%, Peterson 25%, Grmaila 25%.

“AFSIM Maturation and Capability Improvements.” Sponsor: AFRL/RQ. Funding: \$35,948 - Hodson 50%, Peterson 50%.

### **HOPKINSON, KENNETH M., Department of Electrical and Computer Engineering**

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

James, K., and Hopkinson, K.M., “Testing the Fault-Tolerance of a Backup Protection System Using SPIN,” *Proceedings of the 14th International Conference on Cyber Warfare and Security (ICWS)*, 28 February–1 March 2019, Stellenbosch University, South Africa, pp. 133-141.

### **Other Significant Research Productivity**

Hamman, S., and Hopkinson, K.M., “Adversarial Thinking,” NSA Featured Curriculum Module, *National Security Agency's National Cybersecurity Curriculum Program*, 29 November 2018.  
<https://www.clark.center/details/shamman/Adversarial%20Thinking>

**MAGNUS, AMY L., Department of Mathematics and Statistics**

#### **Sponsor Funded Research Projects**

“Distributed Intelligence and the Nature of Mature Work.” Sponsor: AFOSR. Funding: \$149,917 - Magnus 90%, Oxley 10%.

**MARTIN, RICHARD K., Department of Electrical and Computer Engineering**

**MERKLE, LAURENCE D., Department of Electrical and Computer Engineering**

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

L.A. Hsia, L.D. Merkle, G. Vernizzi, M.Y. Lanzerotti, and D. Langley, “Hardware Verification and Security for Quantum Computing Systems,” *Government Microcircuit Applications & Critical Technology Conference*, 2019.

**MILLS, ROBERT F., Department of Electrical and Computer Engineering**

#### **Sponsor Funded Research Projects**

“RF-EW Systems Support.” Sponsor: AFRL/Ry. Funding: \$40,000.

#### **Refereed Journal Publications**

Span, M., Mailloux, L.O., Mills, R.F., and Young, W., “Conceptual Systems Security Requirements Analysis: Aerial Refueling Case Study,” *IEEE Access*, pp 1-15. DOI: [10.1109/ACCESS.2018.2865736](https://doi.org/10.1109/ACCESS.2018.2865736)

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Burfeind, B., Mills, R.F., Nykl, S.L., Betances, J.A., and Sielski, C., “Confidential ADS-B: A Lightweight, Interoperable Approach,” *IEEE Aerospace Conference*, March 2019.

#### **Books and Chapters in Books**

Wolfe, C.L., Graham, S.R., Mills, R.F., Nykl, S.L., and Simon, P., “Securing Data in Power-Limited Sensor Networks Using Two-Channel Communications.” In: Staggs, J., and Sheno, S., (eds) *Critical Infrastructure Protection XII*, IFIP Advances in Information and Communication Technology, Vol. 542, Springer, Cham, pp 81-90, Dec 2018.

**MULLINS, BARRY E., Department of Electrical and Computer Engineering**

#### **Refereed Journal Publications**

S.M. Beyer, B.E. Mullins, S.R. Graham, and J.M. Bindewald, “Pattern-of-Life Modeling in Smart Homes,” *IEEE Internet of Things Journal*, Vol. 5, No. 6, December 2018, DOI: [10.1109/JIOT.2018.2840451](https://doi.org/10.1109/JIOT.2018.2840451), pp. 5317-5325.

C.W. Badenhop, S.R. Graham, B.E. Mullins, and L.O. Mailloux, “Looking Under the Hood of Z-Wave: Volatile Memory Introspection for the ZW0301 Transceiver,” *ACM Transactions on Cyber-Physical Systems*, Vol. 3, No. 2, December 2018, Article 20 (pp. 20:1-20:24).

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

- Y. Park, R. Dill, and B.E. Mullins, "IoTAMU: Protecting Smart Home Networks via Obfuscation and Encryption," *SECURWARE 2019 The Thirteenth International Conference on Emerging Security Information, Systems and Technologies*, 27-31 October 2019, Nice, France, pp. 101-106.
- Y. Park, M.G. Reith, and B.E. Mullins, "Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities," *18th European Conference on Cyber Warfare and Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal, pp. 346-353.
- L.A. Cintron, S.R. Graham, D.D. Hodson, and B.E. Mullins, "Distributed-Ledger Based Event Attestation for Intelligent Transportation Systems," *14th International Conference on Cyber Warfare and Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, South Africa, pp. 565-573.

### **Books and Chapters in Books**

- L. Bradford, B.E. Mullins, S.J. Dunlap, and T. Lacey, "Variable Speed Simulation for Accelerated Industrial Control System Cyber Training," *Critical Infrastructure Protection XII*, J. Staggs and S. Sheno, eds., Springer, New York, NY, December 2018, pp. 283-306.

### **Patents Awarded**

- B.W. Ramsey and B.E. Mullins, "Wireless Intrusion Detection and Device Fingerprinting through Preamble Manipulation," Issued 23 October 2018. US Patent No. 10,111,094.

### **Other Significant Research Productivity**

- B.C. Stone, S.R. Graham, B.E. Mullins, and C.M. Schubert Kabban, "Reverse Engineering 17+ Cars in Less Than 10 Minutes," *DEFCON 27*, Las Vegas NV, 10 Aug 19.

### **NYKL, SCOTT L., Department of Electrical and Computer Engineering**

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

- B. Burfeind, R.F. Mills, S.L. Nykl, J. Betances, and C. Sielski, "Confidential ADS-B: A Lightweight, Interoperable Approach," *IEEE Aerospace Conference*, Big Sky, Montana, 2019.

#### **Books and Chapters in Books**

- K. Bentjen, S.R. Graham, S.L. Nykl, and P. Simon, "Introducing Persistent Human Control into a Reservation-Based Autonomous Intersection Protocol," *Critical Infrastructure Protection XII*, J. Staggs and S. Sheno, Eds. New York City: Springer, Feb 2019. ISBN: 978-3-030-04537-1
- C.L. Wolfe, S.R. Graham, R.F. Mills, and S.L. Nykl, "Securing Data-in-Transit for Power-Limited Sensor Networks Using Two-Channel Communication," *Critical Infrastructure Protection XII*, J. Staggs and S. Sheno, Eds. New York City: Springer, Feb 2019. ISBN: 978-3-030-04537-1

### **PACHTER, MEIR, Department of Electrical and Computer Engineering**

#### **Refereed Journal Publications**

- M. Pachter, E. Garcia, and D. Casbeer, "Toward a Solution of the Active Target Defense Differential Game," *Dynamic Games and Applications*, Vol. 9, No. 1, pp. 165-2016, February 2019.
- E. Garcia, D. Casbeer, and M. Pachter, "Design and Analysis of State Feedback Optimal Strategies for the Differential Game of Active Defense," *IEEE Trans. on Automatic Control*, Vol. 64, No. 2, pp. 553-568, February 2019.

M. Pachter, and S. Coats, "The Classical Homicidal Chauffeur Differential Game," DOI 10.10007/s13235-018-0264-8, *Dynamic Games and Applications*, March 2019.

M. Pachter, A. Von Moll, E. Garcia, and D. Casbeer, "Two-on-One Pursuit," *AIAA Journal of Guidance*, Vol. 42, No. 7, July 2019.

M. Pachter, and P. Wasz, "On a Two Cutters and Fugitive Ship Differential Game," *IEEE Control Systems Society Letters*, Vol. 3, No. 4, October 2019.

Von Moll, A., D. Casbeer, E. Garcia, D. Milutinovic, and M. Pachter, "The Multi-Pursuer, Single-Evader Game-A Geometric Approach," *Journal of Intelligent & Robotic Systems*, 1 March 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Eloy Garcia, David Casbeer, and Meir Pachter, "Cooperative Two-Pursuer One-Evader Blocking Differential Game," *American Control Conference*, pp.2702-2709, Philadelphia, PA, 10-12 July 2019.

Patrick Wasz, Meir Pachter, and Khanh Pham, "Two-On-One Pursuit with a Non-Zero Capture Radius," *Mediterranean Control Conference*, Akko, Israel, 1-4 July, 2019.

Meir Pachter, Eloy Garcia, Roger Anderson, and David Casbeer, "Maximizing the Target's Longevity in the Active Target Defense Differential Game," *European Control Conference*, Naples, Italy, 24-28, 2019.

Meir Pachter, Alexander Von Moll, Eloy Garcia, David Casbeer, and Dejan Milutinovic, "Singular Trajectories in the Two Pursuers One Evader Differential Game," *ICUAS*, pp. 1153-1160, Atlanta, GA, 11-14 June, 2019.

Meir Pachter, Eloy Garcia, and David Casbeer, "Linear-Quadratic Formulation of the Target Defense Differential Game," *ICUAS*, pp.1069-1075, Atlanta, GA, 11-14 June, 2019.

R. Anderson, M. Pachter, and R. Murphey, "Defender Assisted Evasion Maneuvers," *Proceedings of the 59th Israel Annual Conference on Aerospace Sciences*, Tel Aviv and Haifa, 6-7 March 2019.

E. Garcia, D. Casbeer, and M. Pachter, "The Capture-the-Flag Differential Game," *Conference on Decision and Control*, Miami Beach, FL, pp. 4167-4172, 17-19 December, 2018, pp. 4167-4172.

### **PETERSON, GILBERT L., Department of Electrical and Computer Engineering**

#### **Sponsor Funded Research Projects**

"Autonomy Capability Design and Development." Sponsor: 711 HPW. Funding: \$250,000.

"SensorRE - Analytic Provenance System for Software Reverse Engineering." Sponsor: AFRL/RI. Funding: \$25,000.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

King, D.W., and Peterson, G.L., "A Macro-Level Order Metric for Self-Organizing Adaptive Systems," *IEE 12th International Conference on Self-Adaptive and Self-Organizing Systems*, 2018, pp. 60-69. DOI: 10.1109/SASO.2018.00017

King, D.W., L. Esterle, and Peterson, G.L., "Entropy-Based Team Self-Organization with Signal Suppression," *Proceedings of the Artificial Life Conference 2019*. 2019, DOI: 10.1162/isal\_a\_00154

## **Books and Chapters in Books**

G. Peterson, and S. Sheno (Eds.) *Advances in Digital Forensics XV*, Springer, Nature Switzerland AG, 2019.

## **Editorships in Professional Journals**

Associate Editor, *International Journal of Critical Infrastructure Protection*.

## **Invention Disclosures**

Vambrace, Software License for Digital Forensics Abstraction Interface, October 2019.

## **REITH, MARK G., Department of Systems Engineering and Management**

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Park, Y., Reith, M. and Mullins, B. "Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities", *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal, pp. 346-353.

Newlin, M., Reith, M. and DeYoung, M. "Synthetic Data Generation with Machine Learning for Network Intrusion Detection Systems", *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal.

Dukarm, C., Dill, M. and Reith, M. "Improving Phishing Awareness in the United States Department of Defense", *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal.

Flack, N. and Reith. "Self-Directed Learning Tools in USAF Multi-Domain Operations Education", *18th European Conference on Cyber Warfare & Security ECCWS*, 4-5 July 2019, University of Coimbra, Coimbra, Portugal.

Tomcho, L., Reith, M., Long, D., Coggins, M. and Lin, A. "Applying Game Elements to Cyber eLearning", *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa.

Martin, S. and Reith, M. "Rethinking USAF Cyber Education and Training", *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa.

Pendleton, A. and Reith, M. "Quantifying Cyber Vulnerability Risk in Acquisitions", *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa.

Dillon, P. and Reith M. "Building Irrefutable Trust throughout Computer Networks using Blockchains", *14th International Conference on Cyber Warfare & Security ICCWS*, 28 February-1 March 2019, Stellenbosch University, Stellenbosch, South Africa.

## **SWEENEY, PATRICK J., Lt Col, Department of Electrical and Computer Engineering**

### **Sponsor Funded Research Projects**

"Research Supporting Weapon System Cyber Resiliency." Sponsor: AFRL/R.Y. Funding: \$24,975 - Sweeney 50%, Graham 50%.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Schmitt, D.J., Graham, S.R., Sweeney, P.J., Mills, R.F., “A Cyber Vulnerability Assessment of Infiniband Networking,” *13th International Conference on Critical Infrastructure Protection*, Mar 2019.

### **Patent Applications**

Reber, P.E., Graham, S.R., Sweeney, P.J., and Stephensen, M.M., “Active Attestation of Embedded Systems,” Filed 14 Jan 2019 via AFMC (Based on Provisional patent 62/635204 titled “Runtime Attestation of Embedded Systems,” filed previously on 26 Feb 2018).

### **TEMPLE, MICHAEL A., Department of Electrical and Computer Engineering**

#### **Sponsor Funded Research Projects**

“RF-EW Systems Support.” Sponsor: AFRL/RV. Funding: \$35,000.

#### **Refereed Journal Publications**

T.J. Bihl, T.J. Paciencia, K.W. Bauer, and M.A. Temple, “Cyber-Physical Security with RF Fingerprint Classification Through Distance Measure Extensions of Generalized Relevance Learning Vector Quantization,” *Jour of Security and Communication Networks*, Wiley, Sep 2019.

B.J. Voetberg, M.A. Temple, T.J. Carbino, P.R. Buskohl, N.R. Glavis, and J.R. Deneault, “Using Active DNA Fingerprinting to Discriminate AJP Conductive Ink Elements Embedded in Integrated Circuits,” *Jour of DOD Rsrch & Engr*, Vol. No. 2, Special Edition, pp. 2-12, Aug 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

C.M. Rondeau, M.A. Temple, and C.K Schubert-Kabban, “TD-DNA Feature Selection for Discriminating WirelessHART IIoT Devices,” Proc of the 52nd Hawaii Int’l Conf on System Sciences, pp. 6387-6396, Jan 2019.

### **Patent Applications**

C.M. Rondeau, M.A. Temple, J. Lopez, J.A. Betances, “Passive Physical Layer Distinct Native Attribute Cyber Security Monitor,” AFD-1967P, SN 62/856,784, 4 Jun: 2019.

## 6.3 CENTER FOR DIRECTED ENERGY

### Center for Directed Energy (CDE)

Director (937) 255-3636 x4506

Executive Administrator (937) 255-3636 x4551

Homepage: <http://www.afit.edu/CDE>

### 6.3.1 DOCTORAL DISSERTATIONS

LLOYD, ROBERT L., Numerical Simulation of Unstable Laser Resonators with a High-Gain Medium. AFIT-ENP-DS-19-S-024. Faculty Advisor: Dr. David E. Weeks. Sponsor: N/A.

THOMAS, GRANT M., Daytime Satellite Detection for Persistent Ground-Based Custody. AFIT-ENY-DS-19-S-083. Faculty Advisor: Dr. Richard G. Cobb.

THORNTON, DOUGLAS E., Digital Holography Efficiency Experiments for Tactical Applications. AFIT-ENP-DS-19-S-029. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD.

VAN WOERKOM, TODD A., On the Pulsed Ablation of Metals and Semiconductors. AFIT-ENP-DS-19-S-030. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD.

WALLERSTEIN, AUSTIN J., Kinetics of Higher Lying Potassium States After Excitation of the D2 Transition in the Presence of Helium. AFIT-ENP-DS-18-D-009. Faculty Advisor: Dr. Glen P. Perram. Sponsor: DEJTO.

### 6.3.2 MASTERS THESES

BROWNLEE, LAUREN E., Battle Damage Assessment with Optical Cross Section Measurements. AFIT-ENP-MS-19-S-018. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: Raytheon SAS.

ETHRIDGE, JAMES A., Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials. AFIT-ENP-MS-19-M-077. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFOSR/RT.

MAO, DAVIN, Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System. AFIT-ENP-MS-19-M-084. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD.

WOLFMAYER, SCOTT S., Coupled Atmospheric Surface Observations with Surface Aerosol Particle Counts for Daytime Sky Radiance Quantification. AFIT-ENP-MS-19-M-095. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO.

### 6.3.3 FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### AKERS, BENJAMIN F., Department of Mathematics and Statistics

##### Sponsor Funded Research Projects

“Applications of Radial Basis Functions.” Sponsor: AFOSR. Funding: \$34,763 - Akers 50%, Reeger 50%.

##### Refereed Journal Publications

Gustafsson, J., Akers, B.F., Reeger, J.A., and Sritharan, S.S., “Atmospheric Propagation of High Energy Lasers,” *Engineering Mathematics Letters*, Vol. 7, pp. 1-14, 2019.

Akers, B.F., and Reeger, J.A., "Numerical Simulation of Thermal Blooming with Laser-Induced Convection, *Journal of Electromagnetic Waves and Applications*, Vol. 33, No. 1, pp. 96-106, 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Morrill, D., and Akers, B., "High Energy Laser Propagation: Modelling Scintillation Effects," *Imaging and Applied Optics*, PW1D.4, 2019.

#### **Other Significant Research Productivity**

Akers, B., "Wave Optics Modeling and Simulation for HEL Propagation," UCF/TISTEF, Merritt Island, FL, Dec 2018.

Akers, B., "Wave Optics Modeling and Simulation for HEL Propagation," *ONR/DRDO Program Review*, Chitradurga, India, Jun 2019.

#### **BOSE-PILLAI, SANTASRI R., Department of Engineering Physics**

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Steven Fiorino, Santasri R. Bose-Pillai, and Kevin J. Keefer, "In-situ Field Profiling of Optical Turbulence Using 3D Sonic Anemometers," Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), OSA Imaging and Applied Optics Congress, Munich, Germany, June 2019.

Santasri R. Bose-Pillai, Jack E. McCrae, Aaron J. Archibald, Christopher A. Rice, and Steven T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE 11001, Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019.

Steven T. Fiorino, Santasri R. Bose-Pillai, Jaclyn E. Schmidt, Brannon J. Elmore, and Kevin J. Keefer, "Implications of 4D Weather Cubes for Improved Cloud Free Line of Sight Assessments of Free Space Optical Communications Link Performance," *Proc. SPIE 10981, Laser Technology for Defense and Security XV*, 109810S, 13 May 2019.

Santasri R. Bose-Pillai, Jack E. McCrae, Michael A. Rucci, Eric M. Kwasniewski, and Steven T. Fiorino, "Estimation of Fried's Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Jack E. McCrae, Santasri R. Bose-Pillai, Christopher A. Rice, and Steven T. Fiorino, "Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Steven T. Fiorino, Santasri R. Bose-Pillai, Josiah E. Bills, Jaclyn E. Schmidt, Brannon J. Elmore, and Kevin J. Keefer, "Assessing Free Space Optical Communications Through 4D Weather Cubes," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J. Meoak, B.J. Elmore, T.P. Kesler, C.A. Rice, and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "First Look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating Diffractive Effects in Tilt-Based Turbulence Estimation Through Simulation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

### **Patent Applications**

Milo W. Hyde, and Santasri R. Bose-Pillai, "Generation of Vector Partially Coherent Optical Sources Using Phase-Only Spatial Light Modulators," non-provisional application filed in Oct 2018.

### **Invention Disclosures**

Santasri R. Bose-Pillai, Jack E. McCrae, Christopher A. Rice, and Steven T. Fiorino, "Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-lapse Imagery," provisional application filed in June 2019.

### **BURGI, KENNETH W., Lt Col, Department of Engineering Physics**

#### **Sponsor Funded Research Projects**

"Dynamic Data Driven Phase Optimization for Controlling Light Scattered by a Rough Surface." Sponsor: AFOSR. FundPhaseg: \$37,290 - Burgi 75%, Marciniak 15%, Oxley 10%.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Nagamine, E.K., Burgi, K.W., Butler, S.D., and Marciniak, M.A., "Non-Mechanical Beam-Steering in Reflective Inverse Diffusion," *Laser Beam Shaping XIX*, Vol. 11107, Page. 1110706). *International Society for Optics and Photonics*, Sep 2019.

### **BUTLER, SAMUEL D., Lt Col, Department of Engineering Physics**

#### **Refereed Journal Publications**

Ewing, B.E., Butler, S.D., and Marciniak, M.A., "Improved Grazing Angle Bidirectional Reflectance Distribution Function Model Using Rayleigh–Rice Polarization Factor and Adaptive Microfacet Distribution Function," *Opt. Eng.* 57, 1, 2018.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

E.K. Nagamine, K.W. Burgi, S.D. Butler, and M.A. Marciniak, "Nonmechanical Beam-Steering in Reflective Inverse Diffusion," *Proc. SPIE*, 1110706, 2019.

S.D. Butler, and M.A. Marciniak, "Analysis of Modified Microfacet BRDF Models for IR Remote Sensing Applications," *Presentation: SPIE Optics and Photonics*, 12 Aug 2019

A.M. Lanari, S.D. Butler, M.A. Marciniak, and B.E. Ewing, "Polarimetric Evaluation of Oblique and Grazing Angle Microfacet BRDF Model Modification Using Experimental Data," *Presentation: SPIE Optics and Photonics*, Oct 2018.

### **COBB, RICHARD G., Department of Aeronautics and Astronautics**

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Dontigney, T., Merkle, L., Cobb, R., Colombi, J., and Lamont, G., "Methodology for Comparison of Algorithms for Real-World Multi-Objective Optimization Problems: Space Surveillance Network Design," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

Hertwig, F., Colombi, J., Cobb, R., and Meyer, D., "Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

Thomas, G., and Cobb, R., "Ground-Based, Daytime Modeling and Observations in SWIR for Satellite Custody," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

### **FERDINANDUS, MANUEL R., Department of Engineering Physics**

#### **Sponsor Funded Research Projects**

"Airy and Non-Gaussian Beam Testbed." Sponsor: AFRL/RV. Funding: \$63,024 - Ferdinandus 90%, Perram 10%.

### **FIORINO, STEVEN T., Department of Engineering Physics**

#### **Sponsor Funded Research Projects**

"2019 AFIT Center for Directed Energy Summer Intern (DESI) Program." Sponsor: DEJTO. Funding: \$125,000.

"2019 AFIT Center for Directed Energy DoD HPCMP HPC Internship Program (HIP)." Sponsor: HPCMP. Funding: \$25,000.

"AFIT Research in Support of ONR's US-India OSD-DRDO Collaborations." Sponsor: ONR. Funding: \$21,727.

"Airborne Aero-Optics Laboratory-Beam Control." Sponsor: DEJTO. Funding: \$120,000.

"Atmospheric Effects Inputs for HEL JWS and JLaSE." Sponsor: OSD. Funding: \$110,000.

"CY2019 DE JTO AP TAWG Research and Analysis." Sponsor: DEJTO. Funding: \$400,000.

"CY2019 DE JTO M&S TAWG Research and Analysis." Sponsor: DEJTO. Funding: \$400,000.

"Extended-Range Comprehensive Atmospheric Optics Sensing (ERCAOS) Experimental Campaign." Sponsor: DARPA. Funding: \$150,000.

"Probabilistic and Predictive HEL Performance Analyses for SDPE." Sponsor: AFLCMC. Funding: \$100,000.

"Sensor Weather Effects Modeling." Sponsor: AFRL/RV. Funding: \$125,000.

#### **Refereed Journal Publications**

Van Zandt, N.R., M.F. Spencer, and S.T. Fiorino, "Speckle Mitigation for Wavefront Sensing in the Presence of Weak Turbulence," *Appl. Opt.* 58, 2300-2310. [CDE]

Burley, J.L., S.T. Fiorino, B.J. Elmore, and J.E. Schmidt, "A Remote Sensing and Atmospheric Correction Method for Assessing Multispectral Radiative Transfer Through Realistic Atmospheres and Clouds," *J. Atmos. Oceanic Technol.*, 36, 203–216, DOI.org/10.1175/JTECH-D-18-0078.1. [CDE]

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Fiorino, S.T., S.R. Bose-Pillai, and K.J. Keefer, "In-situ Field Profiling of Optical Turbulence Using 3D Sonic Anemometers," *Propagation Through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), OSA Imaging and Applied Optics Congress*, Munich, Germany, June 2019.

Fiorino, S.T., S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, "Implications of 4D Weather Cubes for Improved Cloud Free Line of Sight Assessments of Free Space Optical Communications Link Performance," *Proc. SPIE* 10981, *Laser Technology for Defense and Security XV*, 109810S, 13 May 2019.

Wolfmeyer, S.G. Thomas, S.T. Fiorino, "Coupled Atmospheric Surface Observations with Surface Aerosol Particle Counts for Daytime Sky Radiance Quantification," *Proc. SPIE* 10986, *Algorithms, Technologies, and Applications for Multispectral and Hyperspectral Imagery XXV*, 1098618, 14 May 2019.

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE* 11001, *Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019.

Fiorino, S.T., S.R. Bose-Pillai, J.E. Bills, J.E. Schmidt, B.J. Elmore, and K.J. Keefer, "Assessing Free Space Optical Communications through 4D Weather Cubes," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, "Estimation of Fried's Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Thomas, G.M., R.G. Cobb, S.T. Fiorino, and M.R. Hawks, "SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites in the SWIR," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Fiorino, S.T., J.E. Schmidt, and K.J. Keefer, "Multi-Spectral Transmission and Extinction Quantification for HEL Test and Evaluation," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

Fiorino, S.T., J.E. Schmidt, B. J. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for EHEL PA Using Weather Cubes," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J. Meoak, B.J. Elmore, T. Kesler, C.A. Rice and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

Fiorino, S.T., K.J. Keefer, J.E. Schmidt, and B.J. Elmore, "The Apparent Coupling of Surface Layer Turbulence and PM2.5 Aerosol Concentrations and Effects on HEL Propagation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, J.L. Burley, and B.J. Elmore, "Global Cloud Free Line of Sight (CFLOS) Characterizations using Numerical Weather Prediction Data," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, K.J. Keefer, A.J. Archibald, and B.J. Elmore, "HEL Performance Forecasting for Field Experiments using Weather Cubes," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "First Look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating Diffractive Effects in Tilt-Based Turbulence Estimation Through Simulation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, S. Peckham, and K.J. Keefer, "Evaluation of Aerosol Characterizations in Numerical Weather Modeling for Emerging DOD Technologies and Climate Change Studies," 23<sup>rd</sup> Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), *99th Annual American Meteorological Society Meeting*, Phoenix, AZ, Jan 2019.  
<https://ams.confex.com/ams/2019Annual/meetingapp.cgi/Paper/356249>.

### **Editorships in Professional Journals**

Guest Editor, Atmospheric Propagation Special Section of *Optical Engineering*, Vol. 59, Issue 8.

### **Patent Applications**

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-lapse Imagery," provisional application, filed Jun 2019.

**GROSS, KEVIN C., Department of Engineering Physics**

**HAWKS, MICHAEL R., Department of Engineering Physics**

**MARCINIAK, MICHAEL A., Department of Engineering Physics**

### **Sponsor Funded Research Projects**

"2D Photonic Crystals from Birefringent Nanorod Thin-Films for Nanophotonic Component Applications." Sponsor: AFOSR. Funding: \$39,142.

### **Refereed Journal Publications**

P.J. Plummer, K.J. Barnard, and M.A. Marciniak, "Investigation of Speckle Imagery Spectral Estimation Challenges for Modulation Transfer Function Measurements," *Optical Engineering*, 58(7), 077106 (1-10), Jul 2019.

B. Adomanis, D.B. Burckel, and M. Marciniak, "3D Plasmonic Design Approach for Efficient Transmissive Huygens Metasurfaces," *Optics Express* 27(15), 20928-20937, Jul 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

J.A. Ethridge, M.A. Marciniak, and A.M. Sarangan, "Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials," *Proc. SPIE* 11089, 110890T (1-14), 2019.

E.K. Nagamine, K.W. Burgi, S.D. Butler, and M.A. Marciniak, "Non-Mechanical Beam-Steering in Reflective Inverse Diffusion," *Proc. SPIE* 11107, 1110706, (1-7), 2019.

C.D. Diaz, A.L. Franz, and M.A. Marciniak, "Frequency Analysis and Optimization of a Spectral Intermediate Image Diffractive Plenoptic Camera," *Proc. SPIE* 10986, 10986-51, 2019.

P. Plummer, K.J. Barnard, and M.A. Marciniak, "Parameter Exploration for Spectral Estimation of Speckle Imagery in Modulation Transfer Function Measurements," *Proc. SPIE* 11001, 11001-26, 2019.

## **MCCRAE, JACK E., Jr., Department of Engineering Physics**

### **Sponsor Funded Research Projects**

“Novel Characterization Measurements and Meteorological-Driven Modeling of Turbulence and Refraction in the Lower Atmosphere for Directed Energy Applications.” Sponsor: DEJTO. Funding: \$280,000 - McCrae 80%, Fiorino 20%.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE 11001, Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019.

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, “Estimation of Fried’s Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, “Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J., Meoak, B.J. Elmore, T. Kesler, C.A. Rice, and S.T. Fiorino, “Initial Results for Turbulence Measurement Experiment on 149 km Path,” *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, “Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling,” *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

Bose-Pillai, S.R., J.E. McCrae, A.J. Archibald, C.A. Rice, and S.T. Fiorino, “First Look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras,” *21st Annual DEPS S+T Symposium*, Destin, FL, 8–12 Apr, 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Investigating Diffractive Effects in Tilt-Based Turbulence Estimation through Simulation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8–12 Apr, 2019.

### **Patent Applications**

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, “Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-Lapse Imagery,” provisional application filed in Jun 2019.

## **MORRILL, DANA F., Maj, Department of Mathematics and Statistics**

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Morrill, D. and Akers, B., “High Energy Laser Propagation: Modelling Scintillation Effects,” *Imaging and Applied Optics*, PW1D.4, 2019.

## **PERRAM, GLEN P., Department of Engineering Physics**

### **Sponsor Funded Research Projects**

“Diode Pumped Alkali Laser Kinetics: Rb-He System.” Sponsor: MDA. Funding: \$250,000 - Perram 50%, Rice 50%.

“High Energy Laser Analysis Tool: Advanced Kinetics.” Sponsor: Creare. Funding: \$128,520.

“Hollow Core Raman Fiber Laser for Mid-IR Applications.” Sponsor: Lidomika, LLC. Funding: \$45,015 - Perram 50%, Rice 50%.

“In-Process Monitoring of Additive Manufacturing: Phase IIX, Inconel Spectra and Imagery.” Sponsor: NASA/UTC. Funding: \$25,600.

“Melt Pool Monitoring for Metal Additive Manufacturing.” Sponsor: ATS LLC. Funding: \$5,000.

“Wave Front Sensing for Laser Weapon Applications.” Sponsor: AFRL/RD. Funding: \$75,181 - Perram 80%, Rice 20%.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

D.E. Thornton, M.F. Spencer, C.A. Rice, G.P. Perram, “Digital Holography Efficiency Measurements with Excess Noise,” *Appl. Opt.*, Vol. 58, No. 34, p. G19, 2019.

Rice, C.A., Lapp, K., Rapp, A., Miller, W.S., and Perram, G.P., “Rubidium D1 and D2 Far Wing Line Shapes Induced by Rare Gases,” *Journal of Quantitative Spectroscopy and Radiative Transfer*, 224, 550–555.  
<https://doi.org/10.1016/J.JQSRT.2018.12.014>

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

D. Mao, D.E. Thornton, C.A. Rice, M.F. Spencer, and G.P. Perram, “Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System,” *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 14, 2019.

D.E. Thornton, M.F. Spencer, C.A. Rice, and G.P. Perram, “Laser Line Width Measurements Using Digital Holography,” *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 15.

**PHILLIPS, GRADY T., Department of Engineering Physics**

**RICE, CHRISTOPHER A., Department of Engineering Physics**

### **Sponsor Funded Research Projects**

“The Enhanced Navy Simulation of the Extended MBL Environment (ENSEMBLE) Toolkit – Phase II Support to Spectral Sciences, Inc.” Sponsor: Spectral Sciences. Funding: \$150,000.

### **Refereed Journal Publications**

D.E. Thornton, M.F. Spencer, C.A. Rice, G.P. Perram, “Digital Holography Efficiency Measurements with Excess Noise,” *Appl. Opt.*, Vol. 58, No. 34, p. G19, 2019.

Rice, C.A., Lapp, K., Rapp, A., Miller, W.S., and Perram, G.P., “Rubidium D1 and D2 Far Wing Line Shapes Induced by Rare Gases,” *Journal of Quantitative Spectroscopy and Radiative Transfer*, 224, 550–555.  
<https://doi.org/10.1016/J.JQSRT.2018.12.014>

AJ Wallerstein, Glen P. Perram, and Christopher A. Rice, “Excitation of Higher Lying States in a Potassium Diode Pumped Alkali Laser,” *Appl Phys B*, 124, 145, July 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Santasri R. Bose-Pillai, Jack E. McCrae, Aaron J. Archibald, Christopher A. Rice, and Steven T. Fiorino, "Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *Proc. SPIE 11001, Infrared Imaging Systems: Design, Analysis, Modeling and Testing XXX*, 1100112, 14 May 2019.

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, "Estimation of Fried's Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Jack E. McCrae, Santasri R. Bose-Pillai, Christopher A. Rice, and Steven T. Fiorino, "Investigating the Outer Scale of Atmospheric Turbulence with a Hartmann Sensor," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

D. Mao, D.E. Thornton, C.A. Rice, M.F. Spencer, and G.P. Perram, "Effects of Sinusoidal Phase Modulation on the Signal-To-Noise Ratio in a Digital Holography System," in *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing 2019*, 2019, Vol. 11135, p. 14.

D.E. Thornton, M.F. Spencer, C.A. Rice, and G.P. Perram, "Laser Linewidth Measurements Using Digital Holography," *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 15, 2019.

McCrae, J.E., S.R. Bose-Pillai, A.J. Archibald, J. Meoak, B. Elmore, T. Kesler, C.A. Rice, and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, and S.T. Fiorino, "Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram, "Heterodyne Mixing Efficiency of a Digital Holography System," *Imaging and Applied Optics Congress*, Optical Society of America, Munich, Germany, June 2019.

Tim True, Christopher A. Rice, and Glen P. Perram, "Excited State Cesium Line Shapes with High Pressure Rare Gases," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019.

Santasri R. Bose-Pillai, Jack E. McCrae, Aaron J. Archibald, Christopher A. Rice, and Steven T. Fiorino, "First look at Profiling Atmospheric Turbulence Using Time-Lapse Imagery from Two Cameras," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019.

Jack E. McCrae, Santasri R. Bose-Pillai, Christopher A. Rice, and Steven T. Fiorino, "Investigating Diffractive Effects in Tilt-Based Turbulence Estimation through Simulation," *21st Annual DEPS S+T Symposium*, Destin, FL, 8-12 Apr, 2019.

### **Patent Applications**

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters Using Differential Motion of Extended Features in Time-Lapse Imagery," provisional application filed Jun 2019.

**SRITHARAN, SIVAGURU S., Department of Mathematics and Statistics**

**TERZUOLI, ANDREW J., Jr., Department of Electrical and Computer Engineering**

**WEEKS, DAVID E., Department of Engineering Physics**

## 6.4 CENTER FOR OPERATIONAL ANALYSIS

### Center for Operational Analysis (COA)

Director (937) 255-3636 x4251

Deputy Director (937) 255-3636 x4523

Homepage: <http://www.afit.edu/COA>

### 6.4.1 DOCTORAL DISSERTATIONS

BRADSHAW, CALVIN J., Using Manpower to Assess USAF Strategic Risk. AFIT-ENS-DS-19-J-021. Faculty Advisor: Dr. Alan B. Johnson. Sponsor: HQ AFMC/A9A.

KEITH, ANDREW J., Inferential, Sequential, and Adversarial Approaches. AFIT-ENS-DS-19-S-041. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: STRATCOM.

KLINE, ALEXANDER G., Real-Time Heuristics and Metaheuristics for Static and Dynamic Weapon Target Assignments. AFIT-ENS-DS-18-D-016. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: STRATCOM/JWAC.

### 6.4.2 MASTER'S THESES

ALFORD, PARKER H., Strengths, Challenges, Opportunities, and Threats. AFIT-ENS-MS-19-M-098. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AMC/A4.

BRAMBLETT, LAUREN M., Turbojet Range, Loiter, and Altitude Tradeoff Estimations in Efficient Modeling and Optimization Formulations. AFIT-ENS-MS-19-M-102. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: NASIC.

CHON, STEVEN H., Hyper-Parameter Optimization of a Convolutional Neural Network. AFIT-ENS-MS-19-M-105. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: AFRL/RV.

CLEMENS, SAMUEL T., Maximizing a Cruise Missile Attack Using Variable Strategies and Salvo Firing. AFIT-ENS-MS-19-M-107. Faculty Advisor: Dr. John O. Miller. Sponsor: LM MFC.

HEBERT, TERRY R., The Impacts of Using Augmented Reality to Support Aircraft Maintenance. AFIT-ENS-MS-19-M-121. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: AFRL/AFMC.

HUGHES, MICHAEL S., A Port-Based Analysis of USTRANSCOM Shipping Network Vulnerability. AFIT-ENS-MS-19-M-124. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USTRANSCOM/JDPAC.

HYDER, DYLAN A., Liner Sustainment Workload Forecasting Using Exogenous Data. AFIT-ENS-MS-19-M-126. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: USTRANSCOM/JDPAC.

KANE, ZACHARY J., An Imputation Approach to Developing Alternative Futures of Country Conflict. AFIT-ENS-MS-19-M-128. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: JCS J-7.

KEESLING, RICHARD B., Exploratory Analysis of the Potential Use of Augmented Reality in Aircraft Maintenance. AFIT-ENS-MS-19-M-129. Faculty Advisor: Maj Timothy W. Breitbach. Sponsor: AFRL.

KILGORE, TERRENCE R., Challenges and Opportunities. AFIT-ENS-MS-19-M-131. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A.

LARKIN, MICHAEL T., A Stochastic Game Theoretical Model for Cyber Security. AFIT-ENS-MS-19-M-133. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: N/A.

- LUBIANO, HESTON JOHN D., A Qualitative Approach in Measuring Inclusion. AFIT-ENS-MS-19-M-135. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A.
- MCFADDEN, MICHAEL P., The Introduction of Open Source Initiatives in Supply Chain Management Software. AFIT-ENS-MS-19-M-138. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A.
- MEYER, KEISHA A., Does Age, Gender, or Race Affect Undergraduate Pilot Training Attrition or Composite Scores? AFIT-ENS-MS-19-M-140. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: AETC/Det21.
- MONTEIRO, LUCIANA M., Predicting Failures of the Brazilian Air Force Tucano Fleet Using Survival Analysis. AFIT-ENS-MS-19-M-139. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: ILA.
- NELSON, CURTIS B., Fuzzy Inference Systems for Risk Appraisal in Military Operational Planning. AFIT-ENS-MS-19-M-141. Faculty Advisor: Dr. Richard F. Deckro. Sponsor: JWAC.
- NOVITSKE, ZACHARY A., Measuring Human Systems Integration in Directed Energy Weapon Acquisition Programs. AFIT-ENS-MS-19-M-142. Faculty Advisor: LTC Christopher Smith. Sponsor: 711th HPW/HP.
- PENDERGRASS, MICHAELA A., A Topological View of the Relationship between Women and Armed Conflict in West Africa. AFIT-ENS-MS-19-M-143. Faculty Advisor: LTC Christopher M. Smith. Sponsor: USAFRICOM.
- POPE, TALON M., A Cost-Benefit Analysis of Pilot Training Next. AFIT-ENS-MS-19-M-144. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: N/A.
- SCHLICHT, JOHN A., Operations Research Methods for Multi-Domain Campaign Phase Planning. AFIT-ENS-MS-19-M-148. Faculty Advisor: Dr. Richard F. Deckro. Sponsor: JWAC.
- WALTON, RYAN B., Simulating Maritime Chokepoint Disruption in the Global Food Supply. AFIT-ENS-MS-19-M-153. Faculty Advisor: Dr. John O. Miller. Sponsor: DIA/DRI-8.
- WESTMAN, MARYDELL V., Using Simulation to Model Reserve Officer Training Corps Cadet Flow. AFIT-ENS-MS-19-M-155. Faculty Advisor: Dr. John O. Miller. Sponsor: USACC.

### **6.4.3 GRADUATE RESEARCH PAPERS**

- DIEMER, DANIEL P., Interagency Coordination between FEMA, USNORTHCOM, and USTRANSCOM during a Hurricane Response. AFIT-ENS-MS-19-J-025. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: 7000 Defense Pentagon.
- HEMKEN, KATHERINE B., Forecasting Sustainment Cargo Requirements. AFIT-ENS-MS-19-J-035. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: N/A.
- MCDADE, GREGORY A., A Case Study in Requirements Prioritization. AFIT-ENS-MS-19-J-041. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: 86 AW/CC.
- PRIETO, LAUREN P., A Case Study of Air Force Implementation. AFIT-ENS-MS-19-J-055. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A.
- RANKIN, DEREK R., The KC-10 Divestment, Personnel Movement Plan. AFIT-ENS-MS-19-J-043. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: 22nd Operations Group.
- RATCLIFFE, MATTHEW T., Identifying Operational and Fiscal Inefficiencies. AFIT-ENS-MS-19-J-044. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: AMC/IG.

RUPPEL, RENEE L., The Importance of Defining an Organization's Core Competencies. AFIT-ENS-MS-19-J-047. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A.

RUSSELL, KRISTIN M., An Evaluation of Total Force C-130 Fleet Utilization. AFIT-ENS-MS-19-J-048. Faculty Advisor: Dr. Daniel W. Steeneck. Sponsor: DCoS USAF/A3.

RUST, AUSTIN D., A Missing Link in AMC's Data Chain. AFIT-ENS-MS-19-J-049. Faculty Advisor: Lt Col Jason R. Anderson. Sponsor: 314 AW/CC.

WALKUSKY, MARK M., Optimizing the Forward Presence of PACAF's Expeditionary Communications. AFIT-ENS-MS-19-J-054. Faculty Advisor: Maj Benjamin T. Hazen. Sponsor: N/A.

#### **6.4.4 FACULTY RESEARCH OUTPUT**

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### **AHNER, DARRYL K., Department of Operational Sciences**

##### **Sponsor Funded Research Projects**

“AFSIM Modular Development to Support the Solar Space Power Initiative (SSPI).” Sponsor: AFRL/RV. Funding: \$950,000.

##### **Refereed Journal Publications**

Ahner, D., and Brantley, L., “Finding the Fuel of the Arab Spring Fire: A Historical Data Analysis,” *Journal of Defense Analytics and Logistics*, Vol. 2, No. 2, pp. 58-68, Nov 2018.

Ahner, D., and McCarthy, A., “Response Surface Modeling of Precision Guided Fragmentation Munitions,” *Journal of Defense and Simulation*, Nov 2018. doi: [10.1177/1548512918811138](https://doi.org/10.1177/1548512918811138)

Ahner, D., Thompson, J., and Justice, K., “Development of Composite Indices and a Regional Assessment Framework for Analyzing Nation-State Health,” *Journal of Defense Modeling and Simulation*, Vol. 6, No. 4, pp. 277-284, Jun 2019.

Keith, A., Ahner, D., and Hill, R., “An Order-Based Method for Robust Queue Inference with Stochastic Arrival and Departure Times,” *Computers and Industrial Engineering*, Vol. 128, pp. 711-726, Jan 2019.

Kline, A., Ahner, D., and Lunday, B., “Real Time Heuristic Algorithms for the Static Weapon Target Assignment Problem,” *Journal of Heuristics*, Vol. 25, No. 3, pp. 377-397, May 2019.

Kline, A., Ahner, D., and Hill, R., “The Weapon Target Assignment Problem,” *Computers and Operations Research*, Vol. 105, pp. 226-236, Jan 2019.

Keith, A., Ahner, D., and Curtis, N., “Evaluation Theory and its Application to Military Assessments,” *Journal of Defense Modeling and Simulation*, March 2019. doi: [10.1177/1548512919834670](https://doi.org/10.1177/1548512919834670)

Keith, A., and Ahner, D., "A Survey of Decision Making and Optimization under Uncertainty." *Annals of Operations Research*, 1-35, 2019. <https://doi.org/10.1007/s10479-019-03431-8>

Shallcross, N. and Ahner, D., “Predictive Models of World Conflict: Accounting for Regional and Conflict-State Differences,” *Journal of Defense Modeling and Simulation*, <https://doi.org/10.1177/1548512919847532>.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

James Wisnowski, James Simpson, and Darryl Ahner, "A Hitchhikers Guide to Automating Software Test," *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Ethan Salgado, Darryl Ahner, and Matthew Robbins, "Can Drones Save Lives? Utilizing Heuristics Within a LSTD Algorithm to Solve a Military Inventory Routing Problem with Vehicle Loss," *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Jennifer Thompson and Darryl Ahner, "Modeling Aircraft Maintenance, Loss, and Repairs for Wargaming," *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Andrew Keith and Darryl Ahner, "A Game Theoretic Approach to Integrated Cyber and Air Defense," *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

Darryl Ahner, "Sequential Testing for Fast Jet Life Support Systems," *Defense and Aerospace Test and Analysis (DATA) Workshop*, Alexandria, VA, 10-12 Apr 2019.

Darryl Ahner, "Test and Evaluation for Autonomy," *Department of Defense Science and Technology Workshop on Environmental Security, AIAA SCITECH*, San Diego, CA, 7-11 Jan 2019.

Alexander Kline, Darryl Ahner, and Carl Parson, "Solving the Heterogeneous Multi-Stage Weapon Target Assignment Problem with Adaptive Dynamic Programming," *Institute for Operations Research and the Management Sciences Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Andrew Keith and Darryl Ahner, "Operations Assessment Planning Using Robust Partially Observable Markov Decision Processes," *Institute for Operations Research and the Management Sciences Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

### **Editorships in Professional Journals**

Editorial Board, *Military Operations Research Society*

### **Other Significant Research Productivity**

Darryl K. Ahner, "*Executive Overview: The Scientific Test and Analysis Technique Process*," Naval Sea Systems Command, Washington, DC, May 2019.

**ANDERSON, JASON R., Lt Col, Department of Operational Sciences**

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Glover, Adam, and Anderson, Jason, "*The Aviation Technical Track: A Cure to the Air Force Pilot Shortage?*" Western Decision Sciences Institute, Los Angeles, CA, 3-5 Mar 2019.

**BORGHETTI, BRETT J., Department of Electrical and Computer Engineering**

### **Refereed Journal Publications**

Dickey, Joshua T., Borghetti, Brett J., and Juneke, William, "Improving Regional and Teleseismic Detection for Single-Trace Waveforms Using a Deep Temporal Convolutional Neural Network Trained with an Array-Beam Catalog," *Sensors (MDPI)*, Vol. 19, Issue 3, pp. 597-618, 31 Jan 2019. doi: 10.3390/s19030597

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, Vol. 11, Issue 6, pp. 1866-1886, 9 Aug 2019. doi: 10.3390/rs11161866

**BREITBACH, TIMOTHY W., Maj, Department of Operational Sciences**

**Sponsor Funded Research Projects**

“Strategic Network Design for Base Resilience.” Sponsor: AFMC/A8/A9. Funding: \$33,020 - Breitbach 45%, Cox 45%, Ahner 10%.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Howard, K., Breitbach, T., “A Framework for the Strategic Alignment of Humanitarian Response and Recovery Effects,” *Production and Operations Management Society Annual Conference*, Washington, DC, 2-6 May 2019.

Green, N., Breitbach, T., “An Analysis of San Juan Port Capacity and the Hurricane Maria Response,” *Production and Operations Management Society Annual Conference*, Washington, DC, 2-6 May 2019.

Breitbach, T., Mir, S., Zachariah, Z., Hazen, B., “How Large Organizations Use Accelerator Programs to Support Supplier Innovation,” *Production and Operations Management Society Annual Conference*, Washington, DC, 2-6 May 2019.

Zachariah, Z., Hazen, B., Mir, S., Breitbach, T., “Deriving Value from Customer-Driven Coopetition Projects,” *Decision Sciences Institute Annual Conference*, Chicago, IL, 17-19 Nov 2018.

Howard, K., Joo, S., Breitbach, T., “A Meta-Analysis of Quality Management Practices and Logistics Firm Performance,” *Council of Supply Chain Management Professionals Annual Conference*, Nashville, TN, 29 Sep – 2 Oct 2018.

Zachariah, Z., Breitbach, T., Hazen, B., Mir, S., “Coopetition and Supporting Innovation,” *Council of Supply Chain Management Professionals Annual Conference*, Nashville, TN, 29 Sep – 2 Oct 2018.

Stanton, D.J., Hazen, B., Breitbach, T., “Blockchain for Supply Chain Management Simulation,” *Council of Supply Chain Management Professionals Annual Conference*, Nashville, TN, 29 Sep – 2 Oct 2018.

**Other Significant Research Productivity**

Steenek, D., Breitbach, T., “Resilient Sustainment,” *The Exceptional Release*, Issue 147, Spring 2019.

Breitbach, T., “Blockchain for Supply Chain Management,” *Tech Talks, United States Special Operations Command*, Tampa, FL, Feb 2019.

**CHAMPAGNE, LANCE E. Department of Operational Sciences**

**Sponsor Funded Research Projects**

“Education and Research Support for Modeling, Simulation, & Analysis.” Sponsor: SDPE. Funding: \$250,000 - Champagne 40%, Miller 30%, Lunday 30%.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Bramblett, Lauren, and Champagne, Lance, “Turbojet Range, Loiter, and Altitude Tradeoff Estimations in Efficient Modeling and Optimization Formulation,” *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

**CIARALLO, FRANK W., Department of Operational Sciences**

**COX, BRUCE A., Lt Col, Department of Operational Sciences**

**Sponsor Funded Research Projects**

“F-15 Modernization Schedule Optimization.” Sponsor: AFLCMC. Funding: \$250,000 - Cox 80%, Lunday 20%.

“West Africa Logistics Network (WALN).” Sponsor: USAFRICOM. Funding: \$43,600 - Cox 50%, Breitbart 50%

**DECKRO, RICHARD F., Department of Operational Sciences**

**Sponsor Funded Research Projects**

“JWAC AFIT Interaction.” Sponsor: JWAC. Funding: \$78,180 - Deckro 40%, Lunday 6%, Ahner 6%, Meyer 43%, Cobb 5%.

**Refereed Journal Publications**

William N. Caballero, Brian J. Lunday, Richard F. Deckro, and Meir N. Pachter, “Informing National Security Policy by Modeling Adversarial Inducement and its Governance,” *Socio-Economic Planning Sciences*, Apr, 2019.

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Caballero, W.N., Lunday, B.J., and Deckro, R.F., “Leveraging Behavioral Game Theory for the Study of International Relations,” NATO Studies & Systems (SAS) Panel Symposium on Deterrence and Assurance within an Alliance Framework, London, UK, 17-18 Jan 2019.

**Other Significant Research Productivity**

William N. Caballero, Brian J. Lunday, and Richard F. Deckro, “Prospect and Regulated Prospect Games: Modeling Adversarial Inducement,” *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Richard F. Deckro, “Linking Human Behavior to Campaign Planning: A Discussion of Some Modeling Approaches,” *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Capt John A. Schlicht, Dr. Richard F. Deckro, and Dr. Matthew J. Robbins, “Major Blotto: A Staff Officer’s Guide to Utilizing a Generalized Colonel Blotto Game in the Joint Planning Process,” *87<sup>th</sup> Military Operations Research Society Annual Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

**DICKENS, JOHN M., Lt Col, Department of Operational Sciences**

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Hwang, S., Joo, J.S., Dickens, J., “Degree of Buyer Protectiveness and Supplier Absorptive Capacity in Buyer-Driven New Product Development,” *European Decision Sciences Institute Conference*, Nottingham, UK, 1-5 Jun 2019.

**GALLAGHER, MARK A., Department of Operational Sciences**

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

Gallagher, Mark A., and Saunders, Randy, “Designing the Bayesian Enterprise Analysis Model (BEAM),” *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Gallagher, Mark A., Fullingim, Doug, and Quick, David, “Modeling Mission Effects Chains,” *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Gallagher, Mark A., and Fullingim, Doug, "Air Force Warfighting Integration Center (AFWIC) Analyses," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Gallagher, Mark A., Moss, Michael, and Fullingim, Doug, "Strategy-to-Task Hierarchy for a Strategy through System Requirements Framework," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

Fenn, Daniel, Lepird, John, Hall, Shane A., and Gallagher, Mark A., "Comparison of Solution Methods in Evaluating a System of Risk Assessments," *Institute for Operations Research and Management Sciences Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

### **Editorships in Professional Journals**

Associate Editor, *Military Operations Research*

Editorial Board, *Modeling and Simulation Journal*

**HOLZMANN, TIMOTHY W., Lt Col, Department of Operational Sciences**

### **Refereed Journal Publications**

Holzmann, T., and Smith, J.C., "The Shortest Path Interdiction Problem with Arc Improvement Recourse: A Multiobjective Approach," *Naval Research Letters*, Vol. 66, No. 3, pp. 230-252, Apr 2019.

Holzmann, T., and Smith, J.C., "Solving Discrete Multi-Objective Optimization Problems Using Modified Augmented Weighted Tchebychev Scalarizations," *European Journal of Operations Research*, Vol. 271, No. 2, pp. 436-449, Dec 2018.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Holzmann, T., and Smith J.C., "Modeling the Shortest Path Interdiction Problem with Randomized Strategies," *Proceedings of the IISE Annual Conference*, Orlando, FL, 18-21 May 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Holzmann, T., and Smith, J.C., "Optimizing Random Interdiction Strategies in Shortest Path Interdiction Problems," *IISE Annual Conference*, Orlando, FL, 18-21 May 2019.

Holzmann, T., and Smith, J.C., "A Shortest Path Interdiction Problem with Improvement," *INFORMS Annual Conference*, Phoenix, AZ, 4-7 Nov 2018.

**JENKINS, PHILLIP R., Capt, Department of Operational Sciences**

### **Refereed Journal Publications**

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," *Omega*, Jul 2019. DOI: 10.1016/j.omega.2019-07.004

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *Omega*, Dec 2018. DOI: 10.1016/j.omega.2018-12-009

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Examining Military Medical Evacuation Dispatching Policies Utilizing a Markov Decision Process Model of a Controlled Queueing System," *Annals of Operations Research*, Vol. 271, No. 2, pp. 641-678, Dec 2018.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Jenkins, P.R., "Utilizing Operations Research Techniques to Solve Military Medical Evacuation Problems," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Cincinnati-Dayton Chapter Fall Technical Symposium*, Dayton, OH, 19 Oct 2018.

### **LACASSE, PHILLIP M., Lt Col, Department of Operational Sciences**

#### **Refereed Journal Publications**

P. M. LaCasse, W. Otieno, and F. Maturana, "A Survey of Feature Set Reduction Approaches for Predictive Analytics Models in the Connected Manufacturing Enterprise," *Journal of Applied Science*, Vol. 9, No. 5, p. 843, Apr 2019.

P.M. LaCasse, W. Otieno, and F.P. Maturana, "A Hierarchical, Fuzzy Inference Approach to Data Filtration and Feature Prioritization in the Connected Manufacturing Enterprise," *Journal of Big Data*, Vol. 5, No. 1, p. 45, Dec 2018.

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

LaCasse, P., Otieno, W., Vance, G., Maturana, F., and Cvijetinovic, M., "A Defect Prediction Case Study for Printed Circuit Board Assemblies Containing Ball Grid Array Package Types," *Surface Mount Technology Association (SMTA) International Conference Proc*, Rosemont, IL, 22-26 Sep 2019.

LaCasse, P., Otieno, W., and Maturana, F., "Operationalization of Defect Prediction Case Study in a Holonic Manufacturing System," *International Conference on Industrial Applications of Holonic and Multi-Agent Systems (HoloMAS)*, Linz, Austria, 26-28 Aug 2019.

Otieno, W., Garantiva, J., and LaCasse, P., "Optimal One-Dimensional Free-Replacement Warranty Period for AGM Batteries," *Proceedings of the IEEE-Explore, Annual Reliability and Maintainability Symposium*, Las Vegas, NV, 6-8 Jan 2019.

### **LUNDAY, BRIAN J., Department of Operational Sciences**

#### **Sponsor Funded Research Projects**

"Personnel Recovery Asset Basing in the USAFRICOM AOR." Sponsor: USAFRICOM. Funding: \$8,820.

"Transportation and Distribution Research." Sponsor: USTRANSCOM. Funding: \$125,000.

#### **Refereed Journal Publications**

William N. Caballero, Brian J. Lunday, Richard F. Deckro, and Meir N. Pachter, "Informing National Security Policy by Modeling Adversarial Inducement and its Governance," *Socio-Economic Planning Sciences*, Apr, 2019.

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *Omega*, Dec 2018. DOI: 10.1016/j.omega.2018-12-009

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," *Omega*, Jul 2019. doi: 10.1016/j.omega.2019.07.004

Kline, A.G., Ahner, D.K., and Lunday, B.J., "Real-Time Heuristic Algorithms for the Static Weapon Target Assignment Problem," *Journal of Heuristics*, Vol. 25, No. 3, pp. 377-397, Jun 2019.

Lessin, A.M., Lunday, B.J., and Hill, R.R., "A Multi-Objective Bi-Level Sensor Relocation Problem for Border Security," *Institute for Industrial and System Engineering: Transactions*, Vol. 51, No. 10, pp. 1091-1109, May 2019.

Lunday, B.J., and Robbins, M.J., "Collaboratively-Developed Vaccine Pricing and Stable Profit Sharing Mechanisms," *Omega*, Vol. 84, pp. 102-113, Apr 2019.

Caballero, W.N., Lunday, B.J., Deckro, R.F., and Pachter, M., "Prospect Games and Regulated Prospect Games: Modeling Adversarial Inducement and Its Governance," *Socio-Economic Planning Sciences*, Apr 2019. DOI: [10.1016/j.seps.2019.04.006](https://doi.org/10.1016/j.seps.2019.04.006)

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *Omega*, Dec 2018. doi: 10.1016/j.omega.2018.12.009

Hanks, R.W., Lunday, B.J., and Weir, J.D., "Robust Goal Programming for the Multi-Objective Optimization of Data-Driven Problems: A Use Case for the United States Transportation Command's Liner Rate Setting Problem," *Omega*, Nov 2018. doi: 10.1016/j.omega.2018.10.013

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Cincinnati-Dayton Chapter Fall Technical Symposium*, Dayton, OH, 19 Oct 2018

Bastian, W.N., Lunday, B.J., Fisher, C.B., and Hall, A.O., "Stochastic Goal Programming to Optimize Army Cyber Branch Readiness and Manning Under Uncertainty," *INFORMS Conference on Business Analytics*, Austin, TX, 14-16 Apr 2019.

Caballero, W.N., Lunday, B.J., and Deckro, R.F., "Leveraging Behavioral Game Theory for the Study of International Relations," *NATO Studies & Systems (SAS) Panel Symposium on Deterrence and Assurance within an Alliance Framework*, London, UK, 17-18 Jan 2019.

Lessin, A.M., and Lunday, B.J., "A Multi-Objective Bi-Level Optimization Model for the Relocation of Integrated Air Defense System Assets," *Annual Meeting of the Decision Sciences Institute*, Chicago, IL, 17-19 Nov 2018.

Caballero, W.N., and Lunday, B.J., "Influence Modeling: Mathematical Programming Representations of Persuasion under Either Risk or Uncertainty," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Bastian, N.D., Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Using Multiple Level Aggregation," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Military Medical Evacuation Dispatching Policies," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Lessin, A.M., Lunday, B.J., and Hill, R.R., "A Multi-Objective Trilevel Optimization Model for Integrated Air Defense System Penetration," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Military Medical Evacuation Dispatch Policies," *Fall Technical Symposium, Cincinnati-Dayton INFORMS Society*, 19 Oct 2018.

Caballero, W.N., and Lunday, B.J., "Influence Modeling: Mathematical Programming Representations of Persuasion under Either Risk or Uncertainty," *Fall Technical Symposium, Cincinnati-Dayton INFORMS Society*, 19 Oct 2018.

### **Editorships in Professional Journals**

Associate Editor, *Military Operations Research*

**MILLER, JOHN O., Department of Operational Sciences**

### **Sponsor Funded Research Projects**

"Operational Analysis of Blue Weapons with Focus on Autonomy." Sponsor: Lockheed Martin. Funding: \$50,000 - Miller 75%, Champagne 25%.

"SIMIO Simulation Training for AFLCMC." Sponsor: AFLCMC. Funding: \$6,000 - Miller 50%, Hodson 50%.

### **Refereed Journal Publications**

C.W. Weimer, J.O. Miller, R.R. Hill, and D.D. Hodson, "Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models," *Journal of Artificial Societies and Social Simulation (JASSS)*, Vol. 22, No. 4, 2019.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Troya, A., Mailloux, L., Miller J.O., FitzHarris, R., and Mueller, M., "A Study of Cross-Domain Process Adaptation Applied to Reusable Launch Vehicle Re-Qualification," *IEEE International Systems Engineering Symposium*, Rome, Italy, 1-3 Oct 2018.

### **Editorships in Professional Journals**

Associate Editor, *International Journal of Operations Research*

**PIGNATIELLO, JOSEPH J., Jr., Department of Operational Sciences**

### **Refereed Journal Publications**

Vanli, O. Arda, Giroux, Rupert, Erman Ozguven, Eren, and Pignatiello, Joseph J., Jr., "Monitoring of Count Data Time Series: Cumulative Sum Change Detection in Poisson Integer Valued GARCH Models," *Quality Engineering*, Vol. 31, No. 3, pp. 439-452, 2019.

Freels, Jason K., Timme, D. A., Pignatiello, Joseph J., Jr., Warr, Richard L., and Hill, Raymond R., "Maximum Likelihood Estimation for the Poly-Weibull Distribution," *Quality Engineering*, May 2019.  
doi: 10.1080/08982112.2018.1557685

Storm, Scott M., Hill, Raymond R., Pignatiello, Joseph J., Jr., White, Edward A., and Vining, Geoffrey G., "Point-Wise Model Validation Over Experimental Regions Using Regression Tolerance Intervals with Bayesian Relaxations," *Simulation: Transactions of the Society for Modeling and Simulation International*, Apr 2019. doi: 10.1177/ 0037549719844193

### **Editorships in Professional Journals**

Editorial Board, *Quality Engineering*

Editorial Board, *IIE Transactions*

Editorial Advisory Board, *International Journal of Lean Six Sigma*

**REIMAN, ADAM D., Col, Department of Operational Sciences**

**ROBBINS, MATTHEW J., Department of Operational Sciences**

### **Refereed Journal Publications**

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," INFORMS Annual Meeting, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," *Omega*, Jul 2019. DOI: 10.1016/j.omega.2019.07.004

Lunday, B.J., and Robbins, M.J., "Collaboratively-Developed Vaccine Pricing and Stable Profit Sharing Mechanisms," *Omega*, Vol. 84, pp. 102-113, Apr 2019.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Examining Military Medical Evacuation Dispatching Policies Utilizing Markov Decision Process Model of a Controlled Queueing System," *Annals of Operations Research*, Vol. 271, No. 2, pp. 641-678, Dec 2018.

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *Omega*, Dec 2018. doi: 10.1016/j.omega.2018-12-009

Ethan Salgado, Darryl Ahner, and Matthew Robbins, "Can Drones Save Lives? Utilizing Heuristics Within a LSTD Algorithm to Solve a Military Inventory Routing Problem with Vehicle Loss," *Military Operations Research Society Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," INFORMS Annual Meeting, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," INFORMS Cincinnati-Dayton Chapter Fall Technical Symposium, Dayton, OH, 19 Oct 2018

### **Editorships in Professional Journals**

Associate Editor, *Military Operations Research*

### **Other Significant Research Productivity**

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Annual Meeting*, Phoenix, AZ, 4-7 Nov 2018.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," *INFORMS Cincinnati-Dayton Chapter Fall Technical Meeting*, Dayton, OH, 19 Oct 2018.

Capt John A. Schlicht, Dr. Richard F. Deckro, and Dr. Matthew J. Robbins, "Major Blotto: A Staff Officer's Guide to Utilizing a Generalized Colonel Blotto Game in the Joint Planning Process," 87th Military Operations Research Society Annual Symposium, Colorado Springs, CO, 17-20 Jun 2019.

### **STEENECK, DANIEL W., Department of Operational Sciences**

#### **Other Significant Research Productivity**

Steenek, D., Breitbach, T., "Resilient Sustainment," *The Exceptional Release*, Issue 147, spring 2019.

### **SMITH, CHRISTOPHER M., Lt Col, Department of Operational Sciences**

### **TALAFUSE, THOMAS P., Maj, Department of Operational Sciences**

#### **Refereed Journal Publications**

Ledwith, M.C., Jackson, R.A., Reboulet, A.M., and Talafuse, T.P., "Ethics and Education: A Markov Chain Assessment of Civilian Education in Air Force Materiel Command," *International Journal of Responsible Leadership and Ethical Decision-Making*, Vol. 1, No. 1, pp. 25-37, 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Talafuse, T.P., and Gilts, E.E., "A Simulation Approach to Address MQ-9 Flying Training Unit Manning Shortfalls," *Military Operations Research Society Annual Symposium*, Colorado Springs, CO, 17-20 Jun 2019.

### **WEIR, JEFFERY D., Department of Operational Sciences**

#### **Sponsor Funded Research Projects**

"Cost Capability Analysis AFIT Support to Acquisition Intelligence Requirements Task Force (AIR-TF) and Headquarters Air Force A2 (HAF/A2)." Sponsor: OSD. Funding: \$450,000.

#### **Refereed Journal Publications**

Little, Z. C., Weir, J. D., Hill, R. R., Stone, B. B., and Freels, J. K., "Batch Sequential NOAB Designs by way of Simultaneous Construction and Augmentation," *International Journal of Experimental Design and Process Optimisation*, Vol. 6, No. 2, pp. 127-146, Aug 2019.

Su, C., Weir, J.D., Zhang, F., Yan, H., and Wu, T., "ENTRNA: A Framework to Predict RNA Foldability," *BMC Bioinformatics*, Vol. 20, No. 373, Jul 2019.

Gehret, G.H., Weir, J.D., Johnson, A.W., and Jacques, D.R., "Advancing Stock Policy on Repairable, Intermittently-Demanded Service Parts," *Journal of the Operational Research Society*, May 2019. doi: 10.1080/01605682.2019.1610206

Hanks, R., Lunday, B., and Weir, J., "Robust Goal Programming for Multi-Objective Optimization of Data-Driven Problems: A Use Case for the United States Transportation Command's Liner Rate Setting Problem," *Omega*, Nov 2018. doi: 10.1016/j.omega.2018.10.013

Little, Z. C., Weir, J. D., Hill, R. R., Stone, B. B., and Freels, J. K., "Second-Order Extensions to Nearly Orthogonal-and-Balanced (NOAB) Mixed-Factor Experimental Design," *Journal of Simulation*, Vol. 13, No. 3, pp. 226-237, Oct 2018.

### **Editorships in Professional Journals**

Associate Editor, *Military Operations Research Journal*

Associate Editor, *IIE Transactions on Healthcare Systems Engineering*

**ZAWADZKI, MARCELO, Lt Col, Department of Operational Sciences**

## 6.5 CENTER FOR SPACE RESEARCH AND ASSURANCE

### Center for Space Research and Assurance (CSRA)

Director (937) 255-3636 x4679  
Deputy Director (937) 255-3636 x4285  
Associate Director (937) 255-3636 x4559  
Homepage: <http://www.afit.edu/CSRA>

### 6.5.1 DOCTORAL DISSERTATIONS

KEMNITZ, RYAN A., Mechanical Behavior and the Effects of the Space Environment. AFIT-ENY-DS-18-D-036.  
Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

THOMAS, GRANT M., Daytime Satellite Detection for Persistent Ground-Based Custody. AFIT-ENY-DS-19-S-083.  
Faculty Advisor: Dr. Richard G. Cobb. Sponsor: SatAC

### 6.5.2 MASTER THESES

BADUI, JAIME M., Geosynchronous Satellite Systems' Delta V Allocation for Collision Avoidance Maneuvers.  
AFIT-ENY-MS-19-M-203. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: NASIC.

BITTEL, THOMAS P., Modeling and Design Optimization of a Water Electrolysis Thruster. AFIT-ENY-MS-19-J-069. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

CHAVEZ, CHRISTIAN M., Optimal Natural Motion Circumnavigation Orbit Transfer Trajectories for Satellite Proximity Operations. AFIT-ENY-MS-19-M-208. Faculty Advisor: Maj Joshua A. Hess. Sponsor: AFRL/RV.

COLE, TIFFANY D., Satellite On-Orbit Characterization Based on Inspection Relative Orbit Parameters. AFIT-ENY-MS-18-D-033. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: N/A.

CROUCH, SAMUEL T., Modeling Electrical Conductivity of Chemical Rocket Exhaust Plumes. AFIT-ENY-MS-19-M-210. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: 45 WS.

DARARUTANA, KANIT , Comparison of Novel Heuristic and Integer Programming Schedulers for the US Air Force Space Surveillance Network. AFIT-ENS-MS-19-M-108. Faculty Advisor: Lt Col Bruce A. Cox. Sponsor: AFSPC/A36Z.

EVERETT, NICHOLAS D., Instantaneous Bandwidth Expansion Using Software Defined Radios. AFIT-ENG-MS-19-M-024. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A.

GARLISI, CHARLES J., Performance Characterization of an Accion Systems TILE Colloid Thruster Using a Force Balance Test Stand. AFIT-ENY-MS-19-M-214. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

GEORGE, BRANDON C., Optimal and Robust Neural Network Controllers for Proximal Spacecraft Maneuvers. AFIT-ENY-MS-19-M-215. Faculty Advisor: Maj Joshua A. Hess. Sponsor: AFRL/RV.

GOOCH, JOSHUA Y., Global Ionosonde and GPS Radio Occultation Sporadic-E Intensity and Height Comparison. AFIT-ENP-MS-19-M-079. Faculty Advisor: Maj Daniel J. Emmons. Sponsor: AFRL/RV.

HERTWIG, FRED D., Search-Based vs Task-Based Space Surveillance for Ground-Based Telescopes. AFIT-ENV-MS-19-M-178. Faculty Advisor: Dr. John Colombi. Sponsor: N/A.

HOHNBAUM, CHARLES C., Fracture Toughness and Fatigue Crack Growth Rate Characterization of Inconel 718 Formed by Laser Powder Bed Fusion. AFIT-ENY-MS-19-M-220. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: AFIT/ENY

KROTT, MATTHEW J., CubeSat Payload Thermal Management Optimization. AFIT-ENY-MS-19-M-225. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A.

LEONARD, AVERY W., Sheet Velocity Measurements Using Laser Absorption Spectroscopy in a Xenon Hall Effect Thruster Plume. AFIT-ENY-MS-19-M-227. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: AFOSR.

LEVALLEY, ANDREW S., A Mixed Integer Programming Framework for the Fuel Optimal Guidance of Complex Spacecraft Rendezvous and Proximity Operation Missions. AFIT-ENY-MS-19-M-185. Faculty Advisor: Dr. Richard G. Cobb.

MACCHIA, MICHAEL, Application of Metamaterials for Multifunctional Satellite Bus Enabled Via Additive Manufacturing. AFIT-ENY-MS-19-M-230. Faculty Advisor: Maj Ryan O'Hara. Sponsor: N/A.

MAIKELL, MEGAN, Characterization and Anomalous Diffusion Analysis of a 100W Low Power Annular Hall Effect Thruster. AFIT-ENY-MS-19-M-231. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

MERCIER, MARK R., Optimal Inspection of a Satellite with Dynamic Zone Constraints. AFIT-ENY-MS-19-M-234. Faculty Advisor: Lt Col Kirk W. AFSPC

O'KEEFE, JAMES C., Mechanical and Vibration Damping Characterization of Hybrid Carbon Nanotube Laminates. AFIT-ENY-MS-19-M-235. Faculty Advisor: Maj Ryan P. O'Hara. Sponsor: N/A.

OSTMAN, JOSHUA A., Cislunar Trajectory Generation with Sun-Exclusion Zone Constraints Using a Genetic Algorithm and Direct Method Hybridization. AFIT-ENY-MS-19-S-081. Faculty Advisor: Maj Joshua A. Hess. Sponsor: N/A.

PALMER, BRIAN O., Thermal Management of Satellite Electronics Via Gallium Phase Change Heat Sink Devices. AFIT-ENY-MS-18-D-038. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

RAMOS, JENNIFER N., Uranium Dioxide Actinide Detection Device Support Design For Space Applications. AFIT-ENG-MS-19-M-050. Faculty Advisor: Maj Tod Laurvick. Sponsor: N/A.

ROUND, JOSEPH F., Variations of Heavy Ion Abundances Relative to Proton Abundances In Large Solar Energetic Particle Events. AFIT-ENP-MS-19-M-090. Faculty Advisor: Dr. Robert D. Loper. Sponsor: AFRL/RV.

RUNCO, JOHN J., Computational Aerothermodynamic Analysis of Satellite Trans-Atmospheric Skip Entry Survivability. AFIT-ENY-MS-19-M-243. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A.

SCHMIDT, KYRA L., Analytical Models and Control Design Approaches for a 6 DOF Motion Test Apparatus. AFIT-ENY-MS-19-M-245. Faculty Advisor: Dr. Richard Cobb. Sponsor: AFRL/RW.

SINN, YONG U., Unresolved Object Detection Using Synthetic Data Generation and Artificial Neural Networks. AFIT-ENG-MS-19-M-055. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A.

TOWNLEY, TALON A., Limited-Duty-Cycle Satellite Formation Control Via Differential Drag. AFIT-ENY-MS-19-M-249. Faculty Advisor: Lt Col Kirk W. Johnson. Sponsor: SPAWAR SSC Pacific SIS Division.

WEBB, JEREMIAH M., Comprehensive Study of Optimal Synergetic Skip Entries with Dynamic Thrust Vectoring Control. AFIT-ENY-MS-19-M-251. Faculty Advisor: Maj Robert A. Bettinger. Sponsor: N/A.

WILLBURN, ZANE A., Manufacture of Fused Deposition Modeling Joints Using ULTEM 9085. AFIT-ENY-MS-19-M-252. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

### **6.5.3 FACULTY RESEARCH OUTPUT**

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### **ALBRECHT, TIMOTHY W., Col, Department of Operational Sciences**

##### **Sponsor Funded Research Projects**

“CubeSat-Optimized Software-Defined Flight Radio.” Sponsor: Undisclosed. Funding: \$100,000 - Albrecht 25%, Gunawardena 25%, Johnson 25%, Cobb 25%.

#### **AYRES, BRADLEY J., Department of Aeronautics and Astronautics**

#### **BETANCES, JOAN A., Maj, Department of Electrical and Computer Engineering**

#### **BETTINGER, ROBERT A., Maj, Department of Aeronautics and Astronautics**

##### **Sponsor Funded Research Projects**

“Attitude Determination using Terrestrial Illumination Matching.” Sponsor: AFRL/RV. Funding: \$40,000.

“Launch Site Optimization Study for Launch-On-Demand System.” Sponsor: SDPE. Funding: \$20,002.

“Spacecraft Survivability, Reliability, and Rendezvous (S2R2) Short Course.” Sponsor: NASIC. Funding: \$7,500 - Bettinger 50%, Hess 50%.

“Jetson TX2 PC104 Board.” Sponsor: Undisclosed. FundBoardg: \$90,556 - Bettinger 40%, Hartsfield 30%, Cobb 30%.

“Policy and Geopolitical Implications of Launch-on-Demand Capabilities.” Sponsor: Air University. Funding: \$2,453.

##### **Refereed Journal Publications**

Bettinger, R.A., “Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low Earth Orbits, *Journal of Spacecraft and Rockets*, Vol. 56, No. 5, pp. 1300-1311, September-October 2019.

Schmitt, S., and Bettinger, R.A., “The Potentiality of Space Enterprise Force Reconstitution: Nationalizing Civilian Satellites during Kinetic Conflicts,” *Air & Space Power Journal*, Vol. 33, No. 2, pp. 61-72, Summer 2019.

##### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Shockley, L.M. and Bettinger R.A., “Policy Implications of Launch-on-Demand Employment,” *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

Tatman, L.A., Bettinger R. A., Hess, J.A., Lingenfelter, A.J., “Orbital Debris Propagation in Solwind Anti-Satellite Event,” 2019 AIAA Science and Technology Forum and Exposition, San Diego, CA, January 2019.

Hess, J.A., Bettinger, R.A., Lingenfelter, A.J., “Spacecraft Survivability in a Catastrophic Formation Mishap, 2019 AIAA Science and Technology Forum and Exposition, San Diego, CA, January 2019.

##### **Patent Applications**

Bettinger, R.A., “Early Warning Reentry System Comprising High Efficiency Module for Determining Spacecraft Reentry Time,” U.S. Provisional Patent No. 16/352,936, March 2019.

## **Other Significant Research Productivity**

Bettinger, R.A., "Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low Earth Orbits," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

Bettinger, R.A., "Atmospheric Reentry Hemisphere Prediction for Prograde Orbits Using Logical Disjunction," *44<sup>th</sup> AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

Krott, M.J., and Bettinger, R.A., "CubeSat Payload Thermal Management Optimization," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

Lomanno, C P., and Bettinger, R.A., "Utility of Modular Attitude Determination and Control Subsystems for Small Satellites," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

Runco, J.J., and Bettinger, R.A., "Computational Aerothermodynamic Analysis of Satellite Trans-Atmospheric Skip Entry Survivability," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

Webb, J.M., and Bettinger, R.A., "Comprehensive Study of Optimal Synergetic Skip Entries with Dynamic Thrust Vectoring Control," *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

Krott, M.J., and Bettinger, R.A., "CubeSat Payload Thermal Management Optimization," *14th Dayton Engineering Sciences Symposium (DESS)*, Dayton, OH, October 2018.

## **COBB, RICHARD G., Department of Aeronautics and Astronautics**

### **Sponsor Funded Research Projects**

"AFIT Support for Operations in Contested Space." Sponsor: SSDP. Funding: \$140,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%.

"AFIT Support for Operations in Contested Space." Sponsor: SSDP. Funding: \$160,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%.

"Developing Artificial Intelligence Opponents for Contested Space Simulations." Sponsor: AFRL/RV. Funding: \$100,000 - Cobb 25%, Hess 25%, Johnson 25%, Curro 25%.

"Multi-slew Constrained Dynamic Optimization." Sponsor: Undisclosed. Funding: \$40,000.

"Satellite Attitude Control Testbed Upgrades." Sponsor: Undisclosed. Funding: \$38,000 - Cobb 34%, Johnson 33%, Zagaris 33%.

"Space Domain Modeling & Simulation via High Performance Computing." Sponsor: Undisclosed. Funding: \$212,500 - Cobb 50%, Meyer 50%.

### **Refereed Journal Publications**

Prince, E.P., Hess, J.A., Cobb, R.G., and Carr, R.W., "Elliptical Orbit Proximity Operations Differential Games." Published Online: *Journal of Guidance, Control, and Dynamics*, 19 Mar 2019, <https://doi.org/10.2514/1.G004031>

Curtis, D. and Cobb, R., "Satellite Articulation Tracking Using Computer Vision," Published Online: *AIAA Journal of Spacecraft and Rockets*, 0, 0:0, 1-14, 16 Jun 2019, <https://doi.org/10.2514/1.A34343>

Felten, M.S., Colombi, J.M., Cobb, R.G., and Meyer D.W., "Multi-Objective Optimization Using Parallel Simulation for Space Situational Awareness," *Journal of Defense Modeling and Simulation*, 16(2):145-57, Apr 2019.

Denton, J.C., Hodson, D.D., Cobb, R.G., Mailloux, L.O., Grimaila, M.R., and Baumgartner, G., "A Model to Estimate Performance of Space-Based Quantum Communication Protocols including Quantum Key Distribution Systems," *Journal of Defense Modeling and Simulation*, 16(1):5-13, Jan 2019.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Dontigney, T., Merkle, L., Cobb, R., Colombi, J., and Lamont, G., "Methodology for Comparison of Algorithms for Real-World Multi-Objective Optimization Problems: Space Surveillance Network Design," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

Hertwig, F., Colombi, J., Cobb, R., and Meyer, D., "Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

Thomas, G., and Cobb, R., "Ground-Based, Daytime Modeling and Observations in SWIR for Satellite Custody," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, September 2019.

George, C., Hess, J., and Cobb, R., "Evolutionary Neurocontrol for Spacecraft Proximity Operations," *29th AAS/AIAA Space Flight Mechanics Meeting*, Kaanapali, HI, January 2019.

Thomas, G.M., R.G. Cobb, S.T. Fiorino, and M.R. Hawks, "SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites in the SWIR," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Spendel, D.F., Hess, J.A., Johnson, K.W., and Cobb, R.G., "Parameter Study of an Orbital Debris Defender Using Two Team, Three Player Differential Game Theory," *42nd Annual AAS Guidance, Navigation, and Control Conference*, Breckenridge, CO, 31 January – 6 February 2019.

#### **COLLINS, PETER J., Department of Electrical and Computer Engineering**

##### **Refereed Journal Publications**

Alex Paul, Collins, P.J., and Temple, M., "Nondestructive Evaluation of Radio Frequency Connector Continuity Using Stimulated Emissions," *ASME Jour of Nondestructive Evaluation*, Vol. 2, No. 1, Dec 2018.

Alex Paul, Collins, P.J., and Temple, M., "Enhancing Microwave System Health Assessment Using Artificial Neural Networks," *IEEE Antennas and Wireless Propagation Letters*, Vol. 18, No. 11, Nov 2019.

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Nicholas Everett and Collins, P.J., "Instantaneous Bandwidth Expansion Using Software Defined Radios," *International Radar Conference*, Toulon, France, 23-27 September 2019.

#### **COLOMBI, JOHN M., Department of Systems Engineering and Management**

##### **Refereed Journal Publications**

Felten, M. S., Colombi, J.M., Cobb, R.G., and Meyer, D.W., "Multi-Objective Optimization Using Parallel Simulation for Space Situational Awareness," *Journal of Defense Modeling and Simulation Applications, Methodology, Technology*, pp 1-33, Oct 2018. DOI: 10.1177/1548512918803212

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Hertwig, Fred D., Colombi, John M., Cobb, Richard G., and David W. Meyer, "Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes," *Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS)*, Maui, HI, 17 – 19 September, 2019.

**CORBELL, PHILLIP M., Lt Col, Department of Electrical and Computer Engineering**

**COX, BRUCE A., Lt Col, Department of Operational Sciences**

**DECKRO, RICHARD F., Department of Operational Sciences**

**EMMONS, DANIEL J., Maj, Department of Engineering Physics**

**Sponsor Funded Research Projects**

“GPS Radio Occultation Data.” Sponsor: AFRL/RV. Funding: \$16,100.

**Other Significant Research Productivity**

Nava, O.A., Emmons, D.J., and Loper, R., “Modulation of Lightning Occurrence by the Solar Wind,” *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

**FERDINANDUS, MANUEL R., Department of Engineering Physics**

**FIORINO, STEVEN T., Department of Engineering Physics**

**Refereed Journal Publications**

Burley, J.L., S.T. Fiorino, B.J. Elmore, and J.E. Schmidt, “A Remote Sensing and Atmospheric Correction Method for Assessing Multispectral Radiative Transfer Through Realistic Atmospheres and Clouds,” *J. Atmos. Oceanic Technol.*, 36, 203–216, DOI.org/10.1175/JTECH-D-18-0078.1.

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Fiorino, S.T., S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, “Implications of 4D Weather Cubes for Improved Cloud Free Line of Sight Assessments of Free Space Optical Communications Link Performance,” *Proc. SPIE 10981, Laser Technology for Defense and Security XV*, 109810S, 13 May 2019.

Fiorino, S.T., S.R. Bose-Pillai, J.E. Bills, J.E. Schmidt, B.J. Elmore, and K.J. Keefer, “Assessing Free Space Optical Communications through 4D Weather Cubes,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Bose-Pillai, S.R., J.E. McCrae, M.A. Rucci, E.M. Kwasniewski, and S.T. Fiorino, “Estimation of Fried’s Coherence Diameter from Differential Motion of Features in Time-Lapse Imagery,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

Thomas, G.M., R.G. Cobb, S.T. Fiorino, and M.R. Hawks, “SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites in the SWIR,” *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

**GRIMAILA, MICHAEL R., Department of Systems Engineering and Management**

**GROSS, KEVIN C., Department of Engineering Physics**

**GUNAWARDENA, SANJEEV, Department of Electrical and Computer Engineering**

**HARTSFIELD, CARL R., Department of Aeronautics and Astronautics**

**Sponsor Funded Research Projects**

“Evaluation of Process Impacts on Carbon Nanotube Properties.” Sponsor: Undisclosed. Funding: \$97,750 - Hartsfield 50%, O’Hara 50%.

“Satellite Structures Built in Space.” Sponsor: Undisclosed. Funding: \$96,250.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Shelton, T., Hartsfield, C., and Cobb, G., “Additive Manufacturing Designing to Withstand Space Launch,” *57<sup>th</sup> AIAA Aerospace Sciences Meeting*, 7 Jan 2019.

Anderson, W., Heister, S., and Hartsfield, C., “Experimental Study of a Hypergolically Ignited Liquid Bipropellant Rotating Detonation Rocket Engine,” *57<sup>th</sup> Aerospace Sciences Meeting*, 6 Jan 2019.

Winter, M., Koch, H., Green, R., and Hartsfield, C., “Direct Inertial Electrostatic Confinement Propulsion at Low Power Levels”, 36<sup>th</sup> International Electric Propulsion Conference, 15 Sep 2019.

#### **Other Significant Research Productivity**

Leonard, A., and Hartsfield, C., “Sheet Velocity Measurements using Laser Absorption Spectroscopy in the Plume of a Hall Effect Thruster,” Presentation; *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

Willburn, Z., and Hartsfield, C., “Manufacture of Fused Deposition Modeling Joints using Ultem 9085,” Presentation: *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

Maikell, M., and Hartsfield, C., “Characterization and Anomalous Diffusion Analysis of a 100W Hall Effect Thruster,” *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

Garlisi, C., and Hartsfield, C., “Colloid Thruster Performance Characterization Using a Force balance Test Stand,” *44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium*, Dayton, OH, March 2019. [CSRA]

#### **HAWKS, MICHAEL R., Department of Engineering Physics**

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

G. Thomas, R. Cobb, S.T. Fiorino, and M.R. Hawks, “SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites the SWIR,” *2019 IEEE Aerospace Conference*, 2019, DOI: 10.1109/AERO.2019.8742185.

#### **HESS, JOSHUAH, A., Maj, Department of Aeronautics and Astronautics**

##### **Sponsor Funded Research Projects**

“Satellite Pursuit-Evasion Differential Games.” Sponsor: AFRL/RV. Funding: \$20,000.

##### **Refereed Journal Publications**

Nesmith, A., Lingenfelter, A., Hess, J.A., and Liu, D., “Applications of Second-Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity,” *Journal of Aircraft Survivability*, Fall 2019.

Newell, D.J., O'Hara R., Cobb, G.R., Palazotto, A.N., Kirka, M.M., Burggraf, L.W., and Hess, J.A., "Mitigation of Scan Strategy Effects and Material Anisotropy through Supersolvus Annealing in LPBF IN718," *Materials Science and Engineering: A*, DOI 10.1016/j.msea.2019.138230.

Prince, E., Hess, J.A., Carr, R., and Cobb, R.G., “Elliptical Orbit Proximity Operations Differential Games,” *Journal of Guidance, Control, and Dynamics*. DOI 10.2514/1.G004031.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Scarcella, P.C., Johnson, K.W., Hess, J.A., "Consider Filtering Applied to Maneuver Detection for Relative Orbit Determination," 2019 AAS/AIAA Astrodynamics Specialist Conference, August 2019, AAS 19-872.

George, B.C., Hess, J.A., and Cobb, R.G., "Evolutionary Neurocontrol for Spacecraft Proximity Operations," 29<sup>th</sup> AAS/AIAA Space Flight Mechanics Meeting, Kaanapali, Maui, HI, 13-17 January 2019.

Spendel, D.F., Hess, J.A., Johnson, K.W., and Cobb, R.G., "Parameter Study of an Orbital Debris Defender Using Two Team, Three Player Differential Game Theory," 42nd Annual AAS Guidance, Navigation, and Control Conference, Breckenridge, CO, 31 January – 6 February 2019.

Bettinger, R.A., Hess, J.A., Lingenfelter, A.J., and Tatman, L., "Spacecraft Survivability in a Catastrophic Formation Mishap," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

Hudson, K., Lingenfelter, A.J., and Hess, J.A., "Dynamic Mass Balancing of a Spacecraft Test Platform," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

Tatman, L., Bettinger, R., Hess, J.A., and Lingenfelter, A.J., "Orbital Debris Propagation in Solwind Anti-Satellite Event," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

Nesmith, A.D., Lingenfelter, A.J., Hess, J.A., and Liu, D., "Applications of Second Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

### **Other Significant Research Productivity**

George, B.C., Hess, J.A., and Cobb, R.G., "Open-and Closed-Loop Neural Network Control for Spacecraft Proximal Spacecraft Maneuvers," 44<sup>th</sup> Annual Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 2019.

**HODSON, DOUGLAS D., Department of Electrical and Computer Engineering**

**HOGSED, MICHAEL R., Lt Col, Department of Engineering Physics**

**HOPKINSON, KENNETH M., Department of Electrical and Computer Engineering**

### **Sponsor Funded Research Projects**

"AI-based Strategy for Space Ops." Sponsor: AFRL/RV. Funding: \$40,000 - Hopkins 50%, Betances 50%.

"Autonomous Systems Software." Sponsor: AFRL/RV. Funding: \$40,000 - Hopkins 50%, Betances 50%.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Y.U., Hopkinson, K.M., Borghetti, B.J., and Steward, B.J., "IR Small Target Detection and Prediction with ANNs Trained Using ASSET," *IEEE Aerospace Conference*, 2-9 March 2019, Big Sky, Montana, USA, pp. 1-10.

**JACQUES, DAVID R., Department of Systems Engineering and Management**

**JOHNSON, KIRK W., Lt Col, Department of Aeronautics and Astronautics**

### **Sponsor Funded Research Projects**

"Image Processing and OD for SSA." Sponsor: AFRL/RV. Funding: \$16,000.

"Localization of Gnd/Space RF Trans." Sponsor: AFRL/RV. Funding: \$16,000.

“Noise Radar CubeSat 6U CubeSat Flight Model - Phase 1.” Sponsor: Undisclosed. Funding: \$779,916 - Johnson 35%, Collins 35%, Hartsfield 10%, Albrecht 10%, Cobb 10%.

“Orbit-Dynamics Visual Servoing.” Sponsor: AFRL/RV. Funding: \$16,000.

“Rapid CubeSat Build and Test.” Sponsor: AFRL/RV. Funding: \$50,000.

“Rapid CubeSat Design, Fabrication, and Test.” Sponsor: Undisclosed. Funding: \$90,041 - Johnson 25%, Albrecht 25%, Cobb 25%, Hartsfield 25%.

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$140,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%.

“AFIT Support for Operations in Contested Space.” Sponsor: SSDP. Funding: \$160,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%.

“Developing Artificial Intelligence Opponents for Contested Space Simulations.” Sponsor: AFRL/RV. Funding: \$100,000 - Cobb 25%, Hess 25%, Johnson 25%, Curro 25%.

“Satellite Attitude Control Testbed Upgrades.” Sponsor: Undisclosed. Funding: \$38,000 - Cobb 34%, Johnson 33%, Zagaris 33%.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Scarcella, P., Johnson, K.W., and Hess, J.A., “Consider Filtering Applied to Maneuver Detection for Relative Orbit Determination,” *Astrodynamics Specialist Conference*, Portland, ME, 11-15 Aug 2019.

Mercier, M., and Johnson, K.W., “Optimal Inspection Trajectories with Enforcement of Chief and Inspector-Centered Dynamic Zone Constraints,” *Astrodynamics Specialist Conference*, Portland, ME, 11-15 Aug 2019.

Spendel, D.F., Hess, J.A., Johnson, K.W., and Cobb, R.G., “Parameter Study of an Orbital Debris Defender Using Two-Team, Three-Player Differential Game Theory,” *42nd Annual AAS Guidance, Navigation, and Control Conference*, Breckenridge, CO, 31 January–6 February 2019.

Mercier, M., and Johnson, K.W., “Optimal Inspection of a Nadir-Pointing Satellite with Dynamic Angle Constraints,” *29<sup>th</sup> AAS/AIAA Space Flight Mechanics Meeting*, Kaanapali, Maui, HI, 13-17 January 2019.

#### **Other Significant Research Productivity**

Mercier, M., and Johnson, K. W., “6-DOF Constrained Optimal Satellite Inspection Trajectories,” *44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS)*, Dayton, OH, March 2019.

#### **KOMIVES, JEFFREY R., Lt Col, Department of Aeronautics and Astronautics**

##### **Sponsor Funded Research Projects**

“Signature Codes for Hypersonic Modeling.” Sponsor: AFRL/RV. Funding: \$46,000 - Komives 60%, Emmons 40%.

#### **LAURVICK, TOD V., Maj, Department of Electrical and Computer Engineering**

#### **LINGENFELTER, ANDREW J., Maj, Department of Aeronautics and Astronautics**

##### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Bettinger, R.A., Hess, J.A., Lingenfelter, A.J., and Tatman, L., “Spacecraft Survivability in a Catastrophic Formation Mishap,” *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

Hudson, K., Lingenfelter, A. J., and Hess, J.A., "Dynamic Mass Balancing of a Spacecraft Test Platform," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

Tatman, L., Bettinger, R., Hess, J.A., Lingenfelter, A.J., "Orbital Debris Propagation in Solwind Anti-Satellite Event," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

Nesmith, A.D., Lingenfelter, A.J., Hess, J.A., and Liu, D., "Applications of Second Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity," *AIAA Scitech Forum*, San Diego, CA, 7-11 Jan 2019.

**LOPER, ROBERT D., Department of Engineering Physics**

**Refereed Journal Publications:**

Loper, Robert D. (2019), "Carrington-type Events as a Great Filter for Electronic Civilizations in the Drake Equation," *Pub. Astron. Soc. Pacific*. 131, 044202; doi:10.1088/1538-3873/ab028e

**Refereed Conference Papers Accepted on the Basis of Full Paper Review:**

Round, J. F., R. D. Loper, O. A. Nava, and S. W. Kahler, "Variations of H-Normalized Heavy Ion Abundances in Large Solar Energetic Particle Events," 36th International Cosmic Ray Conference, 2019  
<https://pos.sissa.it/358/1090/pdf>

**Refereed Conference Papers Accepted on the Basis of Abstract Review:**

Loper, Robert D., "Plasma Structure of the Deep Solar Interior," *Dynamics of the Sun & Stars: Honoring the Life & Work of Michael Thompson*, 2019.

Loper, Robert, "Reconnection Signatures in Solar Magnetograms During the Solar Storms of 4-10 September 2017," *Japan Geoscience Union Meeting*, 2019.

Loper, Robert, "Carrington-type Events as a Great Filter for Electronic Civilizations in the Drake Equation," *2019 Space Weather Workshop*, 2019.

**Other Significant Research Productivity**

Nava, O.A., Emmons, D.J., and Loper, R.D., "Modulation of Lightning Occurrence by the Solar Wind," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

**MAGNUS, AMY L., Department of Mathematics and Statistics**

**MAILLOUX, LOGAN O., Lt Col, Department of Systems Engineering and Management**

**MARCINIAK, MICHAEL A., Department of Engineering Physics**

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

C.D. Diaz, A.L. Franz, and M.A. Marciniak, "Frequency Analysis and Optimization of a Spectral Intermediate Image Diffractive Plenoptic Camera," *Proc. SPIE* 10986, 10986-51, 2019.

**MCCLORY, JOHN W., Department of Engineering Physics**

**MERKLE, LAURENCE D., Department of Electrical and Computer Engineering**

**Refereed Conference Papers Accepted on the Basis of Abstract Review**

T.B. Dontigney, and L.D. Merkle, "Comparison of Multi-Objective Optimization Algorithms for GEO Space Surveillance Network Architecture Design," *20th Annual Advanced Maui Optical and Space Surveillance Technologies Conference*, 2019.

**NAVA, OMAR A., Maj, Department of Engineering Physics**

**Sponsor Funded Research Projects**

"Correlating Lightning Obs w/ HF Noise." Sponsor: AFRL/RV. Funding: \$16,100.

**Other Significant Research Productivity**

Nava, O.A., Emmons, D.J., and Loper, R.D., "Modulation of Lightning Occurrence by the Solar Wind," *Japan Geoscience Union Meeting*, Tokyo, Japan, May 2019.

**PETROSKY, JAMES C., Department of Engineering Physics**

**RUTLEDGE, JAMES L., Lt Col, Department of Aeronautics and Astronautics**

**STEWART, BRYAN J., Department of Engineering Physics**

**Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Yong U., Hopkinson, Kenneth M., Borghetti, Brett J., Stewart, Bryan J., "IR Small Target Detection and Prediction with ANNs Trained Using ASSET," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

**TEMPLE, MICHAEL A., Department of Electrical and Computer Engineering**

**TERZUOLI, ANDREW J., Jr., Department of Electrical and Computer Engineering**

**WIESEL, WILLIAM E., Jr., Department of Aeronautics and Astronautics**

**Sponsor Funded Research Projects**

"Onboard SmallSat Navigation and Mission Planning." Sponsor: AFRL/RV. Funding: \$40,000.

**Refereed Journal Publications**

Craft, C. and Wiesel, W., "Impulsive Control of Earth Satellites on Low-Eccentricity Kolmogorov–Arnold–Moser Tori," *Journal of Guidance, Control, and Dynamics*, Vol. 42, pp. 2297-2304, 2019.

## 6.6 CENTER FOR TECHNICAL INTELLIGENCE STUDIES AND RESEARCH

### Center for Technical Intelligence Studies and Research (CTISR)

Director (937) 255-3636 x4742

Associate Director (937) 255-3636 x4565

Homepage: <http://www.afit.edu/CTISR>

### 6.6.1 DOCTORAL DISSERTATIONS

THOMAS, GRANT M., Daytime Satellite Detection for Persistent Ground-Based Custody. AFIT-ENY-DS-19-S-083. Faculty Advisor: Dr. Richard G. Cobb.

THORNTON, DOUGLAS E., Digital Holography Efficiency Experiments for Tactical Applications. AFIT-ENP-DS-19-S-029. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD.

### 6.6.2 MASTER'S THESES

ETHRIDGE, JAMES A., Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials. AFIT-ENP-MS-19-M-077. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFOSR/RT.

FERNANDEZ, FERNANDO D., A Focal Plane Array and Electronics Model for CMOS and CCD Sensors In the AFIT Sensor and Scene Emulation Tool (ASSET). AFIT-ENG-MS-19-M-026. Faculty Advisor: Dr. Bryan J. Steward. Sponsor: SMC/RS.

MAO, DAVIN , Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System. AFIT-ENP-MS-19-M-084. Faculty Advisor: Dr. Glen P. Perram. Sponsor: AFRL/RD.

MCREYNOLDS, BRIAN J., A Comprehensive Test Methodology and Physics-Based Camera Model for Characterizing Neuromorphic Imagers. AFIT-ENP-MS-19-M-085. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: N/A.

SINN, YONG U., Unresolved Object Detection Using Synthetic Data Generation and Artificial Neural Networks. AFIT-ENG-MS-19-M-055. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A.

### 6.6.3 FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### **BORGHETTI, BRETT J., Department of Electrical and Computer Engineering**

##### **Refereed Journal Publications**

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach", *Remote Sensing (MDPI)*, 9 Aug 2019, Vol 11, issue 6, pp. 1866-1886, DOI: 10.3390/rs11161866. <https://www.mdpi.com/2072-4292/11/16/1866/htm>.

##### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Yong U., Hopkinson, Kenneth M., Borghetti, Brett J., Steward, Bryan J., "IR Small Target Detection And Prediction With ANNs Trained Using ASSET", *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Westing, Nicholas M., Borghetti, Brett J., Gross, Kevin C., "Analysis of Long-Wave Infrared Hyperspectral Classification Performance Across Changing Scene Illumination", *SPIE Defense and Commercial Sensing* Baltimore, MD, 14-18 April, 2019.

Anthony, Keith D., Borghetti, Brett J., Steward, Bryan J., "Initial Investigation into the Effect of Image Degradation on the Performance of a 3-Category Classifier Using Transfer Learning and Data Augmentation", *SPIE Defense and Commercial Sensing* Baltimore, MD, 14-18 April, 2019.

**BUTLER, SAMUEL D., Lt Col, Department of Engineering Physics**

**CAYLOR, MICHAEL J., Department of Engineering Physics**

**COBB, RICHARD G., Department of Aeronautics and Astronautics**

**DEXTER, MICHAEL L., Lt Col, Department of Engineering Physics**

**FRANZ, ANTHONY L., Lt Col, Department of Engineering Physics**

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Carlos D. Diaz, Anthony L. Franz, Michael A. Marciniak, "Frequency Analysis and Optimization of the Diffractive Plenoptic Camera," *Presentation: Proc. SPIE 10986, Algorithms, Technologies, and Applications for Multispectral, Hyperspectral, and Ultraspectral Imagery XXV*, 109861G, 14 May 2019.

**GROSS, KEVIN C., Department of Engineering Physics**

### **Sponsor Funded Research Project**

"Algorithm Development for WFOV Mission Data Processing (Phase 2 SBIR)." Sponsor: AFRL/RV. Funding: \$140,000 - Gross 20%, Steward 40%, Hawks 40%.

"Performance Analysis and Sensor Toolkit for ASSET (PASTA)." Sponsor: Undisclosed. Funding: \$79,000 - Gross 10%, Steward 10%, Hawks 50%, Oxley 30%.

"Spectro-polarimetric Imaging of Disturbed Earth - Phase III." Sponsor: USA ERDC. Funding: \$176,250 - Gross 50%, Hawks 50%.

"Open Skies IR Target Study." Sponsor: NASIC. Funding: \$250,000 - Gross 5%, Hawks 75%, Marciniak 10%, Franz 10%.

### **Refereed Journal Publications**

Westing, N., Borghetti, B., Gross, K.C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension-Reduction Approach," *Remote Sens.* 2019, *11*, 1866. <https://doi.org/10.3390/rs111618666>

W.L. Harrell, J.C. Petrosky, M.E. Oxley, and K.C. Gross, "Identification Algorithm Development for a Data-Fused Optical Nuclear Detonation Monitoring System," *Journal of Radiation Effects Research and Engineering*, Vol. 37, No. 1, April, 2019

Mason Paulec, Michael Marciniak, Kevin Gross, Benjamin Akers, and David Azevedo, "Tomographic Reconstruction of a Jet Engine Exhaust Plume Using an Infrared Hyperspectral Imager," *Optical Engineering*, 57(10), 103103, 16 October 2018. <https://doi.org/10.1117/1.OE.57.10.103103>

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Fernando D. Fernandez, Bryan J. Steward, Kevin C. Gross, Michael Hawks, "Implementation of a Non-Linear CMOS and CCD Focal Plane Array Model in ASSET," *Proc. SPIE*, 110010C, 2019.

Nicholas M. Westing, Brett J. Borghetti, Kevin C. Gross, Jacob A. Martin, "Analysis of Long-Wave Infrared Hyperspectral Classification Performance Across Changing Scene Illumination," *Proc. SPIE*, 109860V, 2019.

F.D. Fernandez, B.J. Steward, A.S. Kondrath, J.N. Patel, and K.C. Gross, "AFIT Sensor and Scene Emulation Tool (ASSET): FPA and Electronics Sub-Model Improvements," *MSS Parallel Conference*, Orlando, FL, 25-28 Feb 2019.

### **HAWKS, MICHAEL R., Department of Engineering Physics**

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

G. Thomas, R. Cobb, S.T. Fiorino, and M.R. Hawks, "SNR Modeling for Ground-Based Daytime Imaging of GEO-Satellites the SWIR," *2019 IEEE Aerospace Conference*, 2019, DOI: 10.1109/AERO.2019.8742185.

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

F.D. Fernandez, B.J. Steward, K.C. Gross, and M.R. Hawks, "Implementation of a Non-Linear CMOS and CCD Focal Plane Array Model in ASSET," *Proceedings of the SPIE*, Vol. 11001, 2019, DOI: 10.1117/12.25189072019.

### **HOPKINSON, KENNETH M., Department of Electrical and Computer Engineering**

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Y.U., Hopkinson, K.M., Borghetti, B.J., and Steward, B.J., "IR Small Target Detection and Prediction with ANNs Trained Using ASSET," *IEEE Aerospace Conference*, 2-9 March 2019, Big Sky, Montana, USA, pp. 1-10.

#### **Other Significant Research Productivity**

Hamman, S., and Hopkinson, K.M., "Adversarial Thinking," NSA Featured Curriculum Module, *National Security Agency's National Cybersecurity Curriculum Program*, 29 November 2018.  
<https://www.clark.center/details/shamman/Adversarial%20Thinking>

### **JACKSON, JULIE A., Department of Electrical and Computer Engineering**

### **KOMIVES, JEFFREY R., Lt Col, Department of Aeronautics and Astronautics**

#### **Sponsor Funded Research Projects**

"Turbulence Modeling in Hypersonic Flows." Sponsor: USAFA. Funding: \$73,925 - Komives 34%, Reeder 33%, Gross 33%.

### **LIEVSAY, JAMES R., Maj, Department of Electrical and Computer Engineering**

### **MARCINIAK, MICHAEL A., Department of Engineering Physics**

#### **Sponsor Funded Research Projects**

"Meta-Optic Microlenses for Severe-Axial-Chromatic-Aberration Imaging Systems Phase 1: Metamaterial Development." Sponsor: Undisclosed. Funding: \$65,067 - Marciniak 75%, Franz 25%.

### **Refereed Journal Publications**

P.J. Plummer, K.J. Barnard, and M.A. Marciniak, "Investigation of Speckle Imagery Spectral Estimation Challenges for Modulation Transfer Function Measurements," *Optical Engineering*, 58(7), 077106 (1-10), Jul 2019.

B. Adomanis, D.B. Burckel, and M. Marciniak, "3D Plasmonic Design Approach for Efficient Transmissive Huygens Metasurfaces," *Optics Express* 27(15), 20928-20937, Jul 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

J.A. Ethridge, M.A. Marciniak, and A.M. Sarangan, "Computational and Experimental Development of 2D Anisotropic Photonic Crystal Metamaterials," *Proc. SPIE* 11089, 110890T (1-14), 2019.

C.D. Diaz, A.L. Franz, and M.A. Marciniak, "Frequency Analysis and Optimization of a Spectral Intermediate Image Diffractive Plenoptic Camera," *Proc. SPIE* 10986, 10986-51, 2019.

P. Plummer, K.J. Barnard, and M.A. Marciniak, "Parameter Exploration for Spectral Estimation of Speckle Imagery in Modulation Transfer Function Measurements," *Proc. SPIE* 11001, 11001-26, 2019.

**MCCLORY, JOHN W., Department of Engineering Physics**

**OXLEY, MARK E., Department of Mathematics and Statistics**

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Oxley, M.E. and Schubert Kabban, C.M., "Fusion within a Detection System Family," *Proceedings of FUSION 2019*, Paper No. 1570537583, Jul 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Oxley, M.E., and Schubert Kabban, C.M., "Sequential and Parallel Fusion of Detection and Classification Systems," *Proceedings of SPIE* 11018, *Signal Processing, Sensor/Information Fusion, and Target Recognition XXVIII*, 110180G, May 2019.

### **Other Significant Research Productivity**

Oxley, M.E. and Schubert Kabban, C.M., "Detection System Fusion Based on the Predictive Value Curve and its Variations," *Dayton-Cincinnati AIAA Aerospace Science Symposium*, Sinclair Conference Center, Dayton, OH, Mar 2019.

**PERRAM, GLEN P., Department of Engineering Physics**

### **Sponsor Funded Research Projects**

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: \$72,811 - Perram 50%, Rice 50%.

"Digital Holography: Recording Geometry." Sponsor: Undisclosed. Funding: \$37,914 - Perram 50%, Rice 50%.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

D.E. Thornton, M.F. Spencer, C.A. Rice, G.P. Perram, "Digital Holography Efficiency Measurements with Excess Noise," *Appl. Opt.*, Vol. 58, No. 34, p. G19, 2019.

Rice, C.A., Lapp, K., Rapp, A., Miller, W.S., and Perram, G.P., "Rubidium D1 and D2 Far Wing Line Shapes Induced by Rare Gases," *Journal of Quantitative Spectroscopy and Radiative Transfer*, 224, 550-555.  
<https://doi.org/10.1016/J.JQSRT.2018.12.014>

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

D. Mao, D.E. Thornton, C.A. Rice, M.F. Spencer, and G.P. Perram, "Effects of Sinusoidal Phase Modulation on the Signal-to-Noise Ratio in a Digital Holography System," *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 14, 2019.

D.E. Thornton, M.F. Spencer, C.A. Rice, and G.P. Perram, "Laser Line Width Measurements Using Digital Holography," *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 15.

**RICE, CHRISTOPHER A., Department of Engineering Physics**

### **Refereed Journal Publications**

D.E. Thornton, M.F. Spencer, C.A. Rice, G.P. Perram, "Digital Holography Efficiency Measurements with Excess Noise," *Appl. Opt.*, Vol. 58, No. 34, p. G19, 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

D. Mao, D.E. Thornton, C.A. Rice, M.F. Spencer, and G.P. Perram, "Effects of Sinusoidal Phase Modulation on the Signal-To-Noise Ratio in a Digital Holography System," in *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing* 2019, 2019, Vol. 11135, p. 14.

D.E. Thornton, M.F. Spencer, C.A. Rice, and G.P. Perram, "Laser Linewidth Measurements Using Digital Holography," *Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing*, Vol. 11135, p. 15, 2019.

**STEWART, BRYAN J., Department of Engineering Physics**

### **Sponsor Funded Research Projects**

"Persistent Infrared Scientific and Analytical Support." Sponsor: NASIC. Funding: \$180,000 - Steward 60%, Gross 10%, Hawks 30%.

"Support to TAP Lab Effort (STAPLES)." Sponsor: SMC. Funding: \$248,255 - Steward 95%, Hodson 5%.

"Support to TAP Lab Effort (STAPLES)." Sponsor: SMC. Funding: \$663,000 - Steward 90%, Gross 10%.

### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Sinn, Yong U., Hopkinson, Kenneth M., Borghetti, Brett J., Steward, Bryan J., "IR Small Target Detection and Prediction with ANNs Trained Using ASSET," *IEEE Aerospace Conference*, Big Sky, MT, 2-9 Mar 2019.

### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

F.D. Fernandez, B.J. Steward, M.R. Hawks, and K.C. Gross, "Implementation of a Non-Linear CMOS and CCD Focal Plane Array Model in ASSET," *SPIE Defense + Commercial Sensing*, Baltimore, MD, 14-18 Apr 2019.

K D. Anthony, B.J. Borghetti, and B.J. Steward, "Initial Investigation into the Effect of Image Degradation on the Performance of a 3-Category Classifier Using Transfer Learning and Data Augmentation," *SPIE Defense + Commercial Sensing*, Baltimore, MD, 14-18 Apr 2019.

F.D. Fernandez, B.J. Steward, A. Kondrath, J.N. Patel, and K.C. Gross, "AFIT Sensor and Scene Emulation Tool (ASSET): FPA and Electronics Sub-Model Improvements," *MSS Parallel Conference*, Orlando, FL, 25-28 Feb 2019.

### **Other Significant Research Productivity**

M.J. Rensing, A.J. Niklas, and B.J. Steward, "Algorithm Development for WFOV Mission Data Processing," Air Force Research Laboratory, Space Vehicles Directorate, Kirtland AFB, NM, August 2019.

## 6.7 NUCLEAR EXPERTISE FOR ADVANCING TECHNOLOGIES (NEAT)

### Nuclear Expertise for Advancing Technologies (NEAT)

Director 255-3636 x4562

Deputy Director/Publications Chair 255-3636 x4609

Administrator/Education Chair 255-3636 x4735

Research Chair 255-3636 x4767

Homepage: <https://www.afit.edu/NEATCSR/>

### 6.7.1 DOCTORAL DISSERTATIONS

N/A.

### 6.7.2 MASTER'S THESES

N/A.

### 6.7.3 FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

#### BEVINS, JAMES E., Department of Engineering Physics

##### Sponsor Funded Research Projects

“Nuclear Survivability Experimentation, Modeling, and Data Verification.” Sponsor: NNSA. Funding: \$175,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%.

“AFTAC Endowed Chairs.” Sponsor: Air Force Technical Applications Center. Funding: \$100,000.

##### Refereed Journal Publications

M. C. Recker, E. J. Cazalas, J. W. McClory, and J. E. Bevins, “Comparison of SiPM and PMT Performance Using a Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC) Scintillator with Two Optical Windows,” *IEEE Transactions on Nuclear Science*, vol. 66, no. 8, pp. 1959–1965, 2019.

J. E. Bevins, Z. Sweger, N. Munshi, and B. L. Goldblum, “Performance Evaluation of an Energy Tuning Assembly for Neutron Spectral Shaping,” *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* Vol. 923 pp. 79-87, 2019.

##### Refereed Conference Papers Accepted on the Basis of Full Review

Robert J. Olesen, D. E. Holland, Erik Brubaker, James Cole, and James E. Bevins, “Advanced Radiation Imaging Algorithms with Rotating Scatter Masks,” *International Nuclear Materials Management Conference*, Palm Desert, CA, 18 July, 2019.

B. V. Egner, D. E. Holland, L. W. Burggraf, J. E. Bevins, and V. M. Martin, “Development of a Dual-Particle Directional Detection System Using a Rotating Scatter Mask,” *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, April 11th, 2019.

W. D. Johnston, M. L. Dexter, J. W. McClory, and J. E. Bevins, “Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations,” *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 10 April, 2019.

N. J. Quartemont, R. Slaybaugh, L. Bernstein, and J. E. Bevins, "Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments at the National Ignition Facility," *Hardened Electronics and Radiation Technology Conference*, San Diego, CA, 11 April, 2019.

N. J. Quartemont, R. Slaybaugh, L. Bernstein, and J.E. Bevins, "Development of a Novel National Ignition Facility Platform for Simulating Nuclear Relevant Neutron Environments," *IEEE Nuclear Science Symposium and Medical Imaging Conference*, Sydney, Australia, 14 Nov, 2018.

#### **Patents**

Holland, D., Olesen, R., Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask De-sign Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,816,435, filed March 11, 2019. Patent Pending.

Olesen, R., Egner, B., Holland, D., Martin, V., Bevins, J. 2019. "An Efficient, Dual-particle Directional Detection System using a Rotating Scatter Mask." U.S. Patent Application 62,816,451, filed March 11, 2019. Patent Pending.

**BICKLEY, ABIGAIL A., Department of Engineering Physics**

**DEXTER, MICHAEL L., Department of Engineering Physics**

#### **Refereed Conference Papers Accepted on the Basis of Full Review**

Will D. Johnston, Michael L. Dexter, John W. McClory, and James E. Bevins, "Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations," *Hardened Electronics and Radiation Technology Conference*, JREERE April 2019, San Diego, California.

**HOBBS, EDWARD L., Department of Engineering Physics**

**HOLLAND, DARREN E., Department of Engineering Physics**

#### **Refereed Conference Papers Accepted on the Basis of Abstract Review**

Olesen, R., Holland, D., Brubaker, E., Cole, J., and Bevins, J., "Advanced Radiation Imaging Algorithms with Rotating Scatter Masks," *INMM 60th Annual Meeting*, 2019.

#### **Patents**

Holland, D., Olesen, R., Burggraf, L., O'Day, B., and Bevins, J., "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging," *U.S. Patent Application 62,816,435*, filed 11 March, 2019. Patent Pending.

Egner, B., Olesen, R., Holland, D., Martin, V., O'Day, B., Burggraf, B., Bevins, J., "An Efficient, Dual-Particle Directional Detection System using a Rotating Scatter Mask," *U.S. Patent Application 62,816,451*, 11 March, 2019. Patent Pending.

**MCCLORY, JOHN W., Department of Engineering Physics**

#### **Sponsor Funded Research Projects**

"AFIT/ENP Research Support of Defense Threat Reduction Agency Nuclear Technologies." Sponsor: DTRA. Funding: \$110,000 – McClory 30%, Bevins 40%, Clinton 30%.

"Support for the US Nuclear Detonation Detection System." Sponsor: NNSA. Funding: \$50,000 – McClory 50%, Bickley 50%.

## Refereed Journal Publications

- M. C. Recker, E. J. Cazalas, J. W. McClory, and J. E. Bevins, "Comparison of SiPM and PMT Performance Using a CLYC Scintillator with Two Optical Windows," *IEEE Transactions on Nuclear Science*, Vol. 66, No. 8, pp. 1959-1965, August, 2019. <http://dx.doi.org/10.1109/TNS.2019.2926246>.
- W.J. Erwin, E. Cazalas, A. Cahill, J.A. Clinton, J.W. McClory, and A.W. Decker, "The Gamma Emission Spectrum from the Fast Burst Reactor," *Journal of Radiation Effects, Research and Engineering*, Vol. 37, No. 1, pp. 50-56, April 2019.
- Michael A. Ford, Buckley E. O'Day, John W. McClory, Manish K. Sharma, and Areg Danagoulian, "Evaluation of Eu:LiCAF for Neutron Detection Utilizing SiPMs and Portable Electronics," *Nuclear Instruments and Methods in Physics Research A*, Vol. 908, pp. 110-116, November 2018. <https://doi.org/10.1016/j.nima.2018.08.016>.
- Michael A. Ford, Buckley E. O'Day, John W. McClory, and Areg Danagoulian, "Development of a Neutron Spectrometer Utilizing Rubberized Eu:LiCAF Wafers," *Nuclear Instruments and Methods in Physics Research*, Published on-line, November 2018. <https://doi.org/10.1016/j.nima.2018.11.144>.
- M.C. Recker, E. Cazalas, and J.W. McClory, "Pulse Shape Discrimination with a Low-Cost Digitizer Using Commercial Off-the-Shelf Components," *Nuclear Instruments and Methods in Physics Research A*, Published on-line October 2018. <https://doi.org/10.1016/j.nima.2018.10.157>.

## Refereed Conference Papers Accepted on the Basis of Abstract Review

- W. D. Johnston, M. L. Dexter, J. W. McClory, and J. E. Bevins, "Validation of the Impact of Reflected Shock on Surface Interacting Nuclear Detonations," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019.
- M.E. Mace, J.W. McClory, J.C. Petrosky, E. Heller, and G. Vizkelethy, "Targeted Ion Radiation of AlGaIn/GaN HEMTs," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019.
- M. C. Recker, and J. W. McClory, "Comparison of Clustering Algorithms for Analysis of Pulse Shape Data from Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC)," Presentation: *Hardened Electronics and Radiation Technology Conference*, April 2019.
- Melanie Mace, John McClory, and Eric Heller, "Targeted Ion Radiation of AlGaIn/GaN High Electron Mobility Transistors," Presentation: *44th Dayton-Cincinnati Aerospace Sciences Symposium*, February 2019.
- M. C. Recker, E. J. Cazalas, J. W. McClory, and J. E. Bevins, "Comparison of SiPM and PMT Performance Using Cs<sub>2</sub>LiYCl<sub>6</sub>:Ce<sup>3+</sup> (CLYC) Scintillator with Two Optical Windows," Presentation: *IEEE Nuclear Science Symposium*, November 2018.

**MCGIFFIN, CURTIS D., Associate Dean, AFIT School of Strategic Force Studies**

**NARASAKI, CRAIG T. Dean, AFIT School of Strategic Force Studies**

**PETERSON, G., Department of Engineering Physics**

**PETOSKY JAMES, C., Department of Engineering Physics**

## Sponsor Funded Research Projects

"Support Activities to Homeland Security." Sponsor: DHS. Funding: \$200,000.

### **Refereed Journal Publications**

W.L. Harrell, J.C. Petrosky, M.E. Oxley, and K.C. Gross, "Identification Algorithm Development for a Data-Fused Optical Nuclear Detonation Monitoring System," *Journal of Radiation Effects Research and Engineering*, Vol. 37, No. 1, April 2019.

### **Other Significant Research Productivity**

Established the NEAT on 1 May 2019.

### **VARSHNEY, GAIVEN, Department of Engineering Physics**

#### **Refereed Journal Publications**

G. Varshney, J.R. Cezeaux, and J.C. Petrosky, "Investigation of Fissile Materials Collected from a Non-Critical Nuclear Explosion Site Using Non-destructive Analytical Techniques," *Journal of Radioanalytical and Nuclear Chemistry*, 318 (1) 505-513, Nov 2019.

#### **Other Significant Research Productivity**

G. Varshney, "Detection, Morphological Characterization and Classification of Actinide Bearing Particles Formed by a Non-Critical Weapon Test," Presentation: *Joint Defense Threat Reduction Agency (DTRA) and the Department of Homeland Security Countering Weapons of Mass Destruction Office (CWMD) Nuclear Program Technical Review (NPTR)*, SAIC Crown Conference Center, Lorton, Virginia, 23-27 September, 2019.

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J. R. Cezeaux, G. Varshney, A. Bickley, and J. C. Petrosky, "Morphological Classification and Analysis of Fuel Bearing Debris from a Non-Critical Event," Presentation: *Hardened Electronics and Radiation Technology (HEART) Conference*, April 2019.

### **WANG, BUGUO, Department of Engineering Physics**

## **7. TECHNOLOGY TRANSFER**

## 7.1 COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS

“Alternative Sensors for Non-GPS Navigation,” USAF CRADA No. 18-AFIT-08, Collaborator: Charles Stark Draper Laboratory, Inc., Faculty Investigator: Dr. John Raquet. Effective Date: 4 October 2018, Term: 33 months.

“NDA - KubOS Flight Software and Major Tom Mission Control Software (FY19),” USAF CRADA No. 19-AFIT-01, Collaborator: Kubos Corporation, Faculty Investigator: Col Timothy Albrecht. Effective Date: 29 November 2018, Term: 12 months.

“Hollow Core Raman Fiber Laser for Mid-IR Applications,” USAF CRADA No. 19-AFIT-02, Collaborator: Lidomika LLC, Faculty Investigator: Dr. Glen Perram. Effective Date: 11 December 2018, Term: 12 months.

“High Energy Laser Analysis Tool: Advanced Kinetics,” USAF CRADA No. 19-AFIT-03, Collaborator: Creare LLC, Faculty Investigator: Dr. Glen Perram. Effective Date: 26 December 2018, Term: 30 months.

“IEC Electric Propulsion Research,” USAF CRADA No. 19-AFIT-04, Collaborator: University of Kentucky, Faculty Investigator: Dr. Carl Hartsfield. Effective Date: 7 June 2019, Term: 24 months.

“NDA - Data Analytic Collaborative Research Project,” USAF CRADA No. 19-AFIT-05, Collaborator: Walt Disney Parks and Resorts U.S., Inc. (Disney), Faculty Investigator: Dr. Ray Hill. Effective Date: 26 June 2019, Term: 12 months.

“Human-Machine Shared Awareness Cooperative Research,” USAF CRADA No. 19-AFIT-06, Collaborator: NextGen Federal Systems LLC, Faculty Investigator: Dr. Michael Miller. Effective Date: 3 August 2019, Term: 12 months.

## 7.2 PATENTS

### Invention Disclosures

Steven Fiorino, James Campbell (not AFIT), David Flagg (not AFIT), Paul Frederickson (not AFIT), Neil Gordon (not AFIT), Tracy Haack (not AFIT), Eric Hallenborg (not AFIT), Stephen Hammel (not AFIT), Teddy Holt (not AFIT), Katherine Horgan (not AFIT), Kevin McBryde (not AFIT), Lee Rogers (not AFIT), Shouping Wang (not AFIT), and Victor Wiss (not AFIT), “Method for Characterizing Atmospheric Full-Electromagnetic Spectrum Propagation,” October 2018.

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C.J. Tait, P.J. Akbari, M.D. Polanka, and B.C. Sell

Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low-Earth Orbits  
AFD-1925; Application No. 16,352,936  
Maj Robert Bettinger

Vacuum Lift Apparatus  
AFD-2003P; Application No. 62/883,595  
Ruben Adorno-Rodriquez

Diode Pumped Alkali Laser Extended to Novel Wavelengths via Two-Photon Pumping  
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Nathan Haluska, Christopher Rice, and Glen Perram

Energy Separation Turbine Cooling Method  
AFD-1952P; 62/867,277  
Carol Bryant, James Rutledge, and Matthew Fuqua

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AFD-1926P; Application No. 62/804,996  
J. L. Rutledge, M.N. Fuqua, and C. E. Bryant

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AFD-1894; Application No. 62/803,630  
Hengky Chandralalim and Michael T. Dela Cruz

Statistically-Designed Liquid Crystalline Molecular Cell Sensors  
AFD-1984P; Application No. 62/803,630  
Hengky Chandralalim and Michael T. Dela Cruz

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Christopher Rondeau, Michael Temple, Juan Lopez, Maj Joan Betances

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P.E. Reber, S.R. Graham, P.J. Sweeney, and M.M. Stephensen

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S.L. Nykl, B. Woolley, and J. Pecarina

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D.E. Holland, R.J. Olesen, L.W. Burggraf, B.E. O'Day, and J.E. Bevens

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R. J. Olesen, B.V. Egner, V.M. Martin, and J.E.

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Milo W. Hyde, and Santasri R. Bose-Pillai

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Maj Robert Bettinger

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Santasri R. Bose-Pillai, Jack E. McCrae, Christopher A. Rice, and Steven T. Fiorino

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United States Patent 10,111,094

## APPENDICES

### **APPENDIX A: POST-DOCTORAL AND OTHER RESEARCH ASSOCIATES' CREDENTIALS**

#### **ARCHIBALD, AARON J.**

Research Engineer, Department of Engineering Physics, AFIT Center for Directed Energy. AFIT Appointment Date: 2016 (AFIT/ENP); BS, Engineering Physics, Wright State University, 2010; MS, Nanotechnology, Chuang Yuen Christian University, 2012. Mr. Archibald's research supports the efforts of the Airborne Aero-Optics Laboratory through design, fabrication, and operation of the experimental laser tracking system.

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**BURDSALL, ADAM C.**, Oak Ridge Institute for Science and Education Post-Doctoral Fellow, AFIT Appointment Date: 2018 (AFIT/ENV); BS, Geology, Wittenberg University (Springfield, Ohio), 2011; MS, Earth and Environmental Sciences, Wright State University (Dayton, Ohio), 2013; PhD, Environmental Science, Wright State University (Dayton, Ohio), 2018. Dr. Burdsall's work has focused on the fate of chlorinated and nitroaromatic groundwater pollutants and the use of nanoparticle minerals in their remediation, sedimentology, and surface and subsurface hydrology. Current work is focused on using advanced oxidation methods to degrade nitroaromatic groundwater pollutants and bioaerosol release mechanisms and monitoring.

**CHANDRANI, MUKHERJEE, PhD** is a post-doctoral research assistant in the Environmental Thrust area. She is an ORISE contractor studying waste-to-energy processes, and recently published an article in *Renewable and Sustainable Energy Reviews* titled, "A review on municipal solid waste-to-energy trends in the USA."

#### **ELMORE, BRANNON J.**

##### **Refereed Journal Publications**

Burley, J.L., S.T. Fiorino, B.J. Elmore, and J.E. Schmidt, "A Remote Sensing and Atmospheric Correction Method for Assessing Multispectral Radiative Transfer Through Realistic Atmospheres and Clouds," *J. Atmos. Oceanic Technol.*, 36, 203–216, DOI.org/10.1175/JTECH-D-18-0078.1. [CDE]

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Fiorino, S.T., J.E. Schmidt, B. J. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for EHEL PA Using Weather Cubes," *UK/US Directed Energy Workshop*, Swindon, UK, 25 July 2019.

Schmidt, J.E., S.T. Fiorino, J.L. Burley, and B.J. Elmore, "Global Cloud Free Line of Sight (CFLOS) Characterizations using Numerical Weather Prediction Data," *21st Annual DEPS S+T Symposium*, Destin, FL, 8 – 12 Apr, 2019.

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#### **EVERT, DAVID N.**

Software Engineer, Department of Engineering Physics, and AFIT Center for Directed Energy. Appointment Date: 2019 (AFIT/ENP); BS, Aerospace Engineering, The Ohio State University, 2019. Mr. Evert's research includes development and validation of C++ LEEDER software to measure atmospheric effects on directed energy applications. Email: [david.evert.ctr@afit.edu](mailto:david.evert.ctr@afit.edu)

#### **HONG, JINSUNG**

Senior Researcher under ESEP (Engineer and Scientist Exchange Program), working in the Department of Systems Engineering at AFIT. Mr. Hong received a B.S. degree in aerospace engineering in 2005 from Inha University, South Korea. He also received both a M.S. and a Ph.D. degree in aerospace engineering in 2007 and 2018 from KAIST, Korea Advanced Institute of Technology, South Korea. He has been a senior researcher since 2008 at ADD, Agency for Defense Development, South Korea. His current research effort is aimed at designing UAV control laws based on the Vector Field and Cuker-Smale model, and expanding it for multiple UAV cooperation. Email: [Jinsung.Song@afit.edu](mailto:Jinsung.Song@afit.edu)

#### **KEEFER, KEVIN J.**

Research Physicist, Department of Engineering Physics, AFIT Appointment Date: 2012 (AFIT/ENP); BS, Atmospheric Physics, United States Air Force Academy, 1981; MS, Systems Management, University of Southern California, 1983; MS Engineering Physics, Air Force Institute of Technology, 1985; PhD, Solid State Physics, Air Force Institute of Technology, 1990; Measurement and Signature Intelligence Certificate, Air Force Institute of Technology, 2004. Dr. Keefer's research interests include: atmospheric sciences with special emphasis on microphysical processes and radiative transfer effects associated with atmospheric molecular and aerosol constituents, as well as solar radiative flux, micrometeorological, molecular, aerosol, and optical turbulence instrumentation for remote sensing and directed energy research and experimentation, and military/geo-political history and its implications for development of current and future national security strategy.

Tel. 937-3636 x4344 Email: [Kevin.Keefer@afit.edu](mailto:Kevin.Keefer@afit.edu)

#### **Refereed Conference Papers Accepted on the Basis of Full Paper Review**

Steven Fiorino, Santasri R. Bose-Pillai, and Kevin J. Keefer, "In-situ Field Profiling of Optical Turbulence Using 3D Sonic Anemometers," Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), OSA Imaging and Applied Optics Congress, Munich, Germany, June 2019.

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<https://ams.confex.com/ams/2019Annual/meetingapp.cgi/Paper/356249>

### LEMMER, GEORGE P.

Education: BS Biological Sciences Wright State University, 2010; currently pursuing MS of Industrial Hygiene from AFIT. Mr. Lemmer's Research efforts include literature review of CBRNe decontamination on patients, titled, "A Review of CBRN Topics Related to Military and Civilian Patient Exposure and Decontamination," published in the *American Journal of Disaster Medicine*. Mr. Lemmer also presented current and future research at the AIHCE2019 conference. His current research includes efforts to characterize and model aerosol exposure chamber with computational fluid dynamics (CFD). Future research will include characterizing the air flow around a patient on a litter using particle shadow image velocimetry and CFD as it relates to the environment within a C-130H Hercules during aeromedical evacuation transport. Email: [George.Lemmer@afit.edu](mailto:George.Lemmer@afit.edu)

### MUKHERJEE, CHANDRANI

Post-Doctoral Research Assistant in the area of Environmental Thrust. Ms. Mukherjee is an ORISE contractor studying waste-to-energy processes. She recently published a review on municipal solid waste-to-energy trends in *USA in Renewable and Sustainable Energy Reviews*.

### PETERSON, GEORGE G.

ORISE Participant, AFIT Appointment Date: 2018 (AFIT/ENP); PhD, Materials Engineering, University of Nebraska – Lincoln, 2017; BSME, Mechanical Engineering, University of Nebraska Lincoln, 2012; BA, Political Science, Augustana University, 1998. Dr. Peterson's work is focused on the correlation of material properties and changes to electrical response of semiconductors with an emphasis on radiation interaction. The related mission spaces are electronics survivability, stockpile to target delivery, nuclear forensics, and radiation detection, comprised of both modeling and experimental testing. AFIT research center affiliation(s): NEAT.  
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### Refereed Journal Publications

M. Nastasi, George Peterson, Q. Su, Y. Wang, N. J. Ianno, N. Benker, E. Echeverría, A. Yost, J. A. Kelber, B. Dong, and P. A. Dowben, "Electrical and Structural Characterization of Neutron Irradiated Amorphous Boron Carbide/silicon p-n Heterojunctions," *Nuclear Instruments and Methods in Physics Research Section B: 44*, 48-54, Oct 2018. DOI: 10.1016/j.nimb.2018.07.006

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#### **RAUT, YOGENDRA Y.**

Research Scientist; Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); PhD, Environmental Science, The Ohio State University, 2017; MS, Ecological Modeling, The University of New England, New South Wales Australia, 1997; BS (Hons) from Tribhuvan University (Nepal), 1984. Dr. Raut's work is focused on soil, water, and air quality. The fate of stormwater management, carbon fractionation, nanoparticles, and laboratory equipment are some of the other areas of his expertise. Dr. Raut has authored/co-authored four books, including one textbook. Tel. 937-255-3636 x4241; Email: [Yogendra.Raut.ctr@aft.edu](mailto:Yogendra.Raut.ctr@aft.edu)

#### **SCHMIDT, JACLYN E.**

Research Meteorologist, LEEDR POC, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Meteorology, University of South Alabama, 2010. Ms. Schmidt's research involves atmospheric characterization and radiative transfer modeling and simulation, and the enhancement of 4D Weather Cubes and its applications to high energy laser system performance binning and forecasting. Email: [Jaclyn.Schmidt@afit.edu](mailto:Jaclyn.Schmidt@afit.edu)

#### **Refereed Journal Publications**

Burley, J.L., S.T. Fiorino, B.J. Elmore, and J.E. Schmidt, "A Remote Sensing and Atmospheric Correction Method for Assessing Multispectral Radiative Transfer Through Realistic Atmospheres and Clouds," *J. Atmos. Oceanic Technol.*, 36, 203–216. DOI.org/10.1175/JTECH-D-18-0078.1

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<https://ams.confex.com/ams/2019Annual/meetingapp.cgi/Paper/356249>

**TITUS, EMILY**

Research Associate and graduate student working on a Masters of Industrial Hygiene at AFIT. Ms. Titus' current research efforts support a project aimed at understanding the gaps in CBRN (Chemical, Biological, Radiological, and Nuclear) decontamination. Her past work includes a literature review and gap analysis of this topic, which was published recently in the *American Journal of Disaster Medicine*. Preliminary results were presented in poster sessions at the EPA International Decontamination Conference and the Chemical and Biological Defense Science and Technology Conference. Ms. Titus' current research is aimed at developing a full-body method for quantifying the extent of contamination using a UV fluorescent tracer and image analysis. This will be used to quantify the extent of contamination both before and after decontamination efforts. Specifically she is interested in backing the statistic that any decontamination method results in a 90% reduction in contamination with data. Email: [Emily.Titus@afit.edu](mailto:Emily.Titus@afit.edu)

**WANG, BUGUO**

Part-time Research Scientist (research faculty), Department of Engineering Physics, AFIT Appointment Date: 2014 (AFIT/ENP); BSc, MSc, Physical Chemistry, Soochow University (Suzhou, China), 1990; PhD, Materials Science and Engineering, Chinese Academy of Sciences (Shanghai, China), 1997. Dr. Wang's work is focused on the structural, optical, and electrical properties of novel semiconductor materials and devices, in correlation with their growth conditions as well as radiation effects. AFIT research center affiliation (s): NEAT Email: [buguo.wang.ctr@afit.edu](mailto:buguo.wang.ctr@afit.edu)

**Refereed Journal Publications**

Buguo Wang, T.R. Harris, M.R. Hogsed, Y.K. Yeo, Mee-Yi Ryu, and J. Kouvetakis, "Comparison Study of Temperature Dependent Direct/Indirect Bandgap Emissions of  $\text{Ge}_{1-x-y}\text{Si}_x\text{Sn}_y$  and  $\text{Ge}_{1-y}\text{Sn}_y$  Grown on Ge Buffered Si, Thin Solid Films," 673, 63–71, March 2019.

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**VIKUTYTE, JURATE, DR.**

(ORISE POST DOC). Project: Environment Remediation. Sponsor: DERA

**XING, YUN**

Education: PhD in Bioengineering, Georgia Institute of Technology, 2005, currently an AFIT onsite contactor affiliated with KBR. Dr Xing's past research efforts include cancer nanotechnology, biomedical imaging, and biodefense. She has published 21 peer-reviewed journal articles with more than 3,000 citations, six invited book chapters and a book (editor). Her current research efforts include studying the behavior of biocontaminants and their surrogates in wastewater and other types of water matrices. Email: [Yun.Xing@afit.edu](mailto:Yun.Xing@afit.edu)

## APPENDIX B: SELECTED ACRONYM LIST

There are a number of abbreviations for organizations that are used in this report. This alphabetical listing includes only selected organizations.

711 HPW/RH	711 Human Performance Wing Human Effectiveness Directorate
ACC	Air Combat Command
AETC	Air Education and Training Command
AFCAA	Air Force Cost Analysis Agency
AFCEC	Air Force Civil Engineering Center
AFGSC	Air Force Global Strike Command
AFIA	Air Force Inspection Agency
AFIMSC	Air Force Installation and Mission Support Center
AFIT	Air Force Institute of Technology
AFIT ANT	AFIT Center for Autonomy and Navigation Technology
AFIT CCR	AFIT Center for Cyberspace Research
AFIT CDE	AFIT Center for Directed Energy
AFIT COA	AFIT Center for Operational Analysis
AFIT CSRA	AFIT Center for Space Research and Assurance
AFIT CTISR	AFIT Center for Technical Intelligence Studies and Research
AFIT/ENC	AFIT Department of Mathematics & Statistics
AFIT/ENG	AFIT Department of Electrical & Computer Engineering
AFIT/ENP	AFIT Department of Engineering Physics
AFIT/ENR	AFIT Office of Research and Sponsored Programs
AFIT/ENS	AFIT Department of Operational Sciences
AFIT/ENV	AFIT Department of Systems Engineering & Management
AFIT/ENY	AFIT Department of Aeronautics and Astronautics
AFIT STAT COE	AFIT Center of Excellence for Scientific Test & Analysis Techniques
AFLCMC	Air Force Life Cycle Management Center
AFMC	Air Force Materiel Command
AFMOA	Air Force Medical Operations Agency
AFNWC	Air Force Nuclear Weapons Center
AFRL	Air Force Research Laboratory
AFRL/AFOSR	AFRL/Air Force Office of Scientific Research
AFRL/RD	AFRL/Directed Energy Directorate
AFRL/RI	AFRL/Information Directorate
AFRL/RQ	AFRL/Aerospace Systems Directorate
AFRL/RV	AFRL/Space Vehicles Directorate
AFRL/RW	AFRL/Munitions Directorate
AFRL/RX	AFRL/Materials and Manufacturing Directorate
AFRL/RY	AFRL/Sensors Directorate
AFSC	Air Force Sustainment Center
AFSPC	Air Force Space Command
AFTAC	Air Force Technical Applications Center
AFTPS	Air Force Test Pilot School
AIAA	American Institute of Aeronautics and Astronautics
AMC	Air Mobility Command
ASEE	American Society for Engineering Education
DAGSI	Dayton Area Graduate Studies Institute
DARPA	Defense Advanced Research Projects Agency
DEJTO	Directed Energy Joint Technology Office
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
DTRA	Defense Threat Reduction Agency
EPA	Environment Protection Agency

ERDC	Engineer Research and Development Center
EUCOM	United States European Command
IEEE	Institute of Electrical and Electronics Engineers
INCOSE	International Council on Systems Engineering
JASPO	Joint Aircraft Survivability Program Office
JTWC	Joint Typhoon Warning Center
JWAC	Joint Warfare Analysis Center
MIT	Los Alamos National Laboratory
LTS	Laboratory for Telecommunications Sciences
MDA	Missile Defense Agency
MIT	Massachusetts Institute of Technology
MORS	Military Operations Research Society
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NAVAIR	Naval Air Systems Command
NGA	National Geospatial-Intelligence Agency
NNSA	National Nuclear Security Administration
NPS	Naval Postgraduate School
NSA	National Security Agency
NSF	National Science Foundation
OSD	Office of the Secretary of Defense
SAF	Office of the Secretary of the Air Force
SCOW	635 Supply Chain Operations Wing
SMC	Space and Missile Systems Center
SOCHE	Southwestern Ohio Council for Higher Education
SPIE	The International Society for Optical Engineering
TuAF	Turkish Air Force
USAF	United States Air Force
USAFA	United States Air Force Academy
USSOCOM	United States Special Operations Command
USTRANSCOM	United States Transportation Command
WPAFB	Wright-Patterson Air Force Base

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