

[illegible]

- Responsible for the development of computational tools for the analysis of rocket and missile systems. Developed software to accurately model the aerodynamic forces and effects on rocket systems through all phases of flight. Accurate modeling of the aerodynamics allows for improved simulation accuracy and performance predictions.
- Developed software to accurately interface operational sensor systems. Implemented an extensive MATLAB/ Python library to simulate and analyze missile systems and sensors.

*Lead Test Engineer, Guidance, Navigation, & Control Group*  
*Air Force Research Laboratory (AFRL/RVSVC)*

Aug 2011-Sep 2014

- Directed a 6 member team in developing orbit determination software and designing an observation campaign for the ANGELS flight experiment. An Unscented Kalman Filter (UKF) was developed to verify and validate the performance of a GPS receiver in geostationary orbit. Additionally, a ground based collection strategy, incorporating AFSSN sensors, was developed and tested on operational satellites. The AFRL ANGELS vehicle launched in 2014 to advance autonomous rendezvous and proximity operation control algorithms. The UKF and ground based observation campaign was critical for accurate navigation and allowed for more aggressive maneuvers.
- Designed custom astrodynamics force model for the ANGLES flight experiment. Incorporated the effects of solar radiation pressure, attitude control actuators and sensors, Earth gravitational models, and thruster uncertainties to predict the expected performance of the spacecraft. Analysis predicted a coupling between rotational and translational motion during angular momentum desaturation burns. A orientation profile was developed which minimized the accumulation of undesired angular momentum and allowed for extended quiescent periods in support of orbit determination activities.
- Led \$5M lab development program to develop an in situ attitude dynamics and control simulator. Responsible for procurement, design, and integration of the largest spherical air-bearing platform in the world. Developed software to interface with inertial measurement units, motion capture systems, and control hardware to allow for hardware in the loop system testing. The facility is currently being used to validate future flight attitude control actuators and algorithms.
- Developed a method for space based geolocation via time difference of arrival signals. Implemented geometric techniques to develop a closed form analytical solution to locate a noncooperative electromagnetic signal based on the time of arrival to a formation of satellites.
- Led the development of a satellite relative motion simulator using embedded ground based robotic systems. Designed the software to allow for accurate scaling and simulation of spacecraft motion. Directly implemented a motion capture system on embedded hardware to allow for accurate positioning and control.

*Deputy Space Vehicles Lead, Responsive Space Squadron*  
*Space Development and Test Directorate (SDTD/SDDR)*

May 2009-Aug 2011

- Responsible for development, integration, test, & launch of ORS-1 (Operationally Responsive Space) satellite ORS-1 was the first operational satellite developed under the ORS office and supports US Central Command Battlespace Awareness. An accelerated development cycle allowed for the integration and launch in under 2 years.
- Extensive experience with technical management of diverse contractor/government teams leading to successful ORS-1 launch and orbit operation. Managed a team of 5 to ensure the correct integration and testing of the space vehicle. Ensured mission requirements were being met during the integration period.
- Resolved a \$600K satellite flight sensor failure. Directly managed the repair analysis team to prevent launch delays and ensure the system capability. Monitored the hardware repair process and verified they were completed correctly.
- Firsthand experience monitoring 100+ days of integration and testing of ORS-1. Sole space vehicles lead during launch site operations at Wallops Island, VA. Ensured correct

	<p>procedures and standards leading to on-time launch on 29 June 2011</p> <ul style="list-style-type: none"> <li>Assessed and served as on-site government inspector of 200+ satellite test plans. Verified technical analysis and testing procedures on all flight hardware of ORS-1. Test plans were critical in ensuring correct performance of both ground and space hardware and critical to mission success.</li> </ul>	
CONFERENCE PRESENTATIONS	<ul style="list-style-type: none"> <li>Shankar Kulumani. Space based TDOA Geo-Location. In <i>2013 Space Control Conference, MIT/Lincoln Laboratories</i>, May 2013</li> </ul>	
PROFESSIONAL MEMBERSHIPS	<p>American Astronautical Society (AAS), Member</p> <p>American Institute of Aeronautics and Astronautics (AIAA), Member</p> <p>Sigma Gamma Tau, Member</p>	<p>2015-present</p> <p>2012-present</p> <p>2008-present</p>
AWARDS	<p>George Washington University</p> <ul style="list-style-type: none"> <li>Most Innovative/Creative Project Award, 5th Annual Student Competition Society of Satellite Professionals International (SSPI) Systematic design of optimal low-thrust orbital transfers in the three-body problem</li> <li>Graduate Research Fellowship, George Washington University</li> </ul> <p>Responsive Space Squadron</p> <ul style="list-style-type: none"> <li>Rotary National Award for Space Achievement Foundation Stellar Award nomination for successful ORS-1 mission accomplishments</li> <li>ORS-1 named by C4ISR Journal as one of the top 25 most important intelligence, surveillance and reconnaissance concepts of the year</li> </ul> <p>United States Air Force Academy</p> <ul style="list-style-type: none"> <li>Commandant/Dean pin for high military/academic performance</li> <li>Top Academic Performer - Astrodynamics 321</li> </ul>	<p>2015</p> <p>2014</p> <p></p> <p>2011</p> <p>2011</p> <p>2005-2009</p> <p>2007</p>
SECURITY CLEARANCE	<p>Cleared for Top Secret information and granted access to sensitive compartmented information based on a single scope background investigation completed on 21 June 2010. Please contact SSO AF Reserve Command for additional clearance information.</p>	