Sreeja Nag

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Education

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, U.S.A.

PhD. Space Systems Engineering, Department of Aeronautics and Astronautics, June 2015

PhD. Thesis: Design and Evaluation of Distributed Spacecraft Missions for Multi-Angular Earth Observation

S.M. Aeronautics and Astronautics Engineering, June 2012

S.M. in Technology and Policy, Engineering Systems Division, June 2012

Dual S.M. Thesis: Collaborative Competition for Crowdsourcing Spaceflight Software and STEM Education using SPHERES Zero Robotics (a program that allows laymen to write spaceflight satellite code)

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR, India

M.S. in Exploration Geophysics, August 2009 (*Thesis in collaboration with University of California, Berkeley*)

B.S. in Exploration Geophysics with Minor Electives in Electrical Engineering, August 2009

Relevant Professional Experience

NASA AMES RESEARCH CENTER and BAER INSTITUTE, California, U.S.A.

- ***Position Title:*** Senior Research Scientist in the Mission Design Center - Engineering Directorate (June 2014-present)
  Research: Led orbital mechanics research for designing new NASA missions - a satellite constellation to perform atmospheric studies using solar occultation, a Cubesat mission for coral reef monitoring from space, multiple satellites in low Earth orbit for cloud and weather monitoring over Central Asia.
- ***Position Title:*** Senior Research Scientist in Aeronautics Systems Modeling & Optimization Branch (October 2014-)
  Research: Led a constellation mission design that simulated near continuous space-based coverage of remote airspaces using ADS-B signals from aircrafts. Developed an ADS-B model for surveillance of unmanned aerial vehicles (UAV). Co-lead NASA-FAA's Communication/Navigation group in the UAV Traffic Management Project.
- ***Position Title:*** Senior Research Scientist in the Earth Science Division (June 2014-present)
  Research: Designed formation flight solutions for Earth Observation based on Model-Based Systems Engineering. Developed a new algorithm for satellite pointing and schedule optimization for agile, responsive, Earth imaging.

NASA GODDARD SPACE FLIGHT CENTER, Maryland, and BAER INSTITUTE, California, U.S.A.

Position Title: Senior Research Engineer in the Software Engineering Division (August 2015-present)

Research: Leading the design trades for an open-source, open-access 'Tradespace Analysis Tool for Distributed Space Missions' that will allow multiple users to perform new space investigations with multiple spacecraft and optimize those designs with respect to a-priori Science goals. Programmed the Executive Driver that gathers requirements from the user interface and integrates the full system, and metric computation modules that uses the orbit propagation and coverage analysis to the generate multiple potential architectures and their associated performance characteristics.

NASA GODDARD SPACE FLIGHT CENTER and USRA, Maryland, U.S.A.

- ***Position Title:*** Research Associate in the Software Engineering Division (June 2013–January 2014)
  Research: Developed prototype software tools to analyze distributed space mission architecture trades and select optimal designs at minimum cost, as part of the Distributed Space Missions team at NASA.
- ***Position Title:*** Research Associate in the Climate Science and Radiation Lab (June 2012–May 2014)
  Research: Designed the architectural concept of a nano-satellite constellation for measuring angular variations of reflectance off Earth surface. The mission improves estimation of global bidirectional reflectance and dependent products. Programmed a physics-based model of the optical imager payload and verified dispersive elements (in sim).

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Massachusetts, U.S.A.

- ***Project Collaborator:*** Draper Laboratory, Massachusetts
  Position Title: Graduate Research Assistant (February 2014–May 2014)
  Research: Designed Cubesat radiometer constellations for more accurate estimation of global outgoing radiation.
- ***Project Collaborators:*** DARPA, NASA Headquarters, Aurora Flight Sciences
  Position Title: Program Lead of the SPHERES Zero Robotics Program (January 2011–February 2012)
  Research: Designed and developed software infrastructure for and conducted robotics programming tournaments on the International Space Station (ISS). The robots are SPHERES satellites and participants program strategies onto them using web-tools to play challenging space research games. Logged ~1800 users, ~180000 sims within 4 months.
- ***Project Collaborators:*** DARPA and Orbital Sciences Corporation Headquarters, Virginia
  Position Title: Graduate Research Fellow in the DARPA System F6 Program (February–May 2010)
  Research: Performed comparative benchmarking and optimization of fractionated spacecraft by value-centric design.

- **Project Collaborator:** MIT Lincoln Laboratory, Massachusetts
  Position Title: Graduate Research Fellow in Satellite Engineering (September–December 2009)
  Research: Modeled a laser communication downlink from the moon, developed to rapidly explore communication architectures for the Google Lunar X-Prize. Data rates more than 2 Mbps were proven possible with microwatt scale power and within Lincoln Lab's available capabilities, modulation schemes, aperture, gimbal and APD technologies.

EUROPEAN SPACE AGENCY (ESTEC), Noordwijk, The Netherlands
Position Title: International Research Fellow at ACT – Artificial Intelligence (June–August 2010)
Research: Demonstrated the scatter maneuver technique for satellite clusters using swarm intelligence and behavior-based path planning based on artificial potential fields. Feedback controls were added, technology enablers benchmarked. The algorithms were tested in the MIT SPHERES simulation and ground Laboratory.

Selected Awards and Achievements

- NASA Honor Award for Group Achievement, NASA Ames Research Center, June 2017
- Best Presentation Award, IAA Latin American Symposium on Small Satellites, Buenos Aires, Argentina March 2017
- NASA ESTO QRS Grant 2016 • NASA Advanced Information Systems Technology grants 2015-17, 2017-19
- NASA ARC Center Innovation Fund 2014-15 • Amelia Earhart Fellowship 2013
- Best Student Paper Award and winner of the Frank J. Redd Student Competition, Small Sat Conference, Utah 2014
- NASA Earth and Space Science Fellowship 2014-15 • NASA/GSFC John Mather Nobel Scholar Award 2012
- IAF Luigi G. Napolitano Award at the International Astronautical Congress, China 2013
- Best Student Paper Award, International Workshop for Satellite Constellations and Formation Flying, Portugal 2013

Relevant Leadership and Service

- *Panelist and Reviewer* for NASA Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), Heliophysics Technology and Instrument Development for Science (H-TIDeS), Space Technology Research Fellowships (NSTRF), Planetary Science Deep Space SmallSat Studies (PSDS3) programs, Flanders Research Foundation in Belgium to select commercial spaceflight funding in the European Union
- *NASA representative* for FCC/RTCA reviews to approve new satellite-based telecommunication networks.
- *Invited Expert in NASA Headquarters'* Weather Focus Workshop (April 2015) to participate in planning the strategic goals of NASA Earth Science - Weather Focus Area and *Workshop Organizer* (June 2016) for OSSE impact on Weather.
- *Session Co-Chair and Technical Committee Member* of the IEEE Aerospace Conference and ESA's 4S Symposium
- *Rapporteur* at the *Space Generation Congress, South Africa* (Sept. 2011) - Moderated a group of 35 international students to draft policy recommendations for the African Space Industry's outreach, presented at UN COPUOS meeting 2012.
- *Executive Editor 2008-09, Editor 2006-08, The Scholars'Avenue*, IIT Kharagpur's fortnightly campus newsletter delivered to >15,000 students, alumni and faculty. The website registered >3000/hits/day in peak seasons (e.g. elections)

Relevant Publications (selected from 50+ journal articles, conference proceedings, posters)

1. S. Nag, A.S. Li, J.H. Merrick, *"Scheduling Algorithms for Rapid Imaging using Agile Cubesat Constellations"*, in review for publication in COSPAR Advances in Space Research, June 2017.
2. S. Nag, J. Jung, K.S. Inamdar, *"Communicating with Unmanned Aerial Swarms using Automatic Dependent Surveillance Transponders"*, IEEE Sensors Conference (in press), November 2017
3. S. Nag, T. Hewagama, G. Georgiev, B. Pasquale, S. Aslam, C. K. Gatebe, *"Multispectral Snapshot Imagers onboard Small Satellite Formations for Multi-Angular Remote Sensing"*, IEEE Sensors Journal, 99, DOI: 10.1109/JSEN.2017.2717384.
4. S. Nag, S.P. Hughes, J.J. Le Moigne, "*Navigating the Design Tradespace of Earth Imaging Constellations using Open-Source Tools*", AIAA Space Conference, Long Beach California, September 2016
5. S. Nag, J. L. Rios, D. Gerhardt, C. Pham, "*CubeSat Constellation Design for Air Traffic Monitoring*", Acta Astronautica 128 (2016), 180-193 , DOI:10.1016/j.actaastro.2016.07.010.
6. S. Nag, C.K. Gatebe, D.W. Miller, O.L. de Weck, "*Effect of Satellite Formation Architectures and Imaging Modes on Albedo Estimation of major Biomes"*, Acta Astronautica 126 (2016), 77-97, DOI:10.1016/j.actaastro.2016.04.004
7. S. Nag, J.J. LeMoigne, O.L. de Weck "*Cost and Risk Analysis of Small Satellite Constellations for Earth Observation*", IEEE Aerospace Conference, Xplore DOI: 10.1109/AERO.2014.6836396, March 2014.
8. S. Nag, L. Summerer, "*Behavior-based, Autonomous and Distributed Scatter Manouevres for Satellite Swarms*", Acta Astronautica 82 (2013) 95-109, DOI: /10.1016/j.actaastro.2012.04.030.
9. S. Nag, I. Heffan, A. Saenz-Otero, M. Lydon, "*SPHERES Zero Robotics software development: Lessons on crowdsourcing and collaborative competition*", IEEE Aerospace Conference, Xplore DOI: 10.1109/AERO.2012.6187452, March 2012.
10. M.G. O'Neill, H.Yue, S. Nag, P.Grogan, O. de Weck, "*Comparing and Optimizing the DARPA System F6 Program Value-Centric Design Methodologies*", AIAA Space Conference, Anaheim, California 2010.

Computer Languages: Python, MATLAB, C, C++, Fortran 94-95, SQL, MS Connect for AGI STK
Hobbies: Reading, History, Culture and Travel, Journalism, the Performing arts, Hiking.