

Athul P. Girija

PH.D. CANDIDATE · ASTRODYNAMICS AND SPACE APPLICATIONS

School of Aeronautics and Astronautics, Purdue University, West Lafayette, IN 47907, USA

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Summary

Ph.D. candidate with expertise in spacecraft systems engineering, mission life cycle, aerocapture, Entry Descent and Landing (EDL) systems, mission formulation, and project management. Experienced in mechanical design and fabrication of hardware test equipment. Developer of the Aerocapture Mission Analysis Tool (AMAT).

Citizenship: India

Education

School of Aeronautics and Astronautics, Purdue University

West Lafayette, IN, USA

PH.D. CANDIDATE, ADVANCED ASTRODYNAMICS CONCEPTS (AAC) LAB

Aug. 2016 - present

- Dissertation: "An Systems Framework for Rapid Conceptual Design of Aerocapture Mission Concepts"
- Advisors: Dr. Sarag J. Saikia and Prof. James M. Longuski
- Major: Astrodynamics and Space Applications; Minor: Aerospace Systems
- GPA: **3.9/4.0**; Expected completion: July 2020

School of Aerospace Engineering, Indian Institute of Technology (IIT), Madras

Chennai, India

DUAL DEGREE (B.TECH.+M.TECH.) IN AEROSPACE ENGINEERING

Aug. 2011 - Jul. 2016

- Major: Aerospace Propulsion; Minor: Industrial Engineering
- GPA: **9.16/10.0**; Silver Medallist, Class of Aerospace Engineering, 2016

Research Projects

Outer Planet Aerocapture Studies

West Lafayette, IN, USA

FUNDED BY NASA JET PROPULSION LABORATORY (JPL)

Jan. 2018 - Sept. 2019

- Led the joint Purdue-JPL study which investigated aerocapture feasibility at Uranus and Neptune
- Coordinated project planning, execution, and delivery with Mission Design and Navigation Section at JPL
- Presented results to senior JPL program managers and scientists. Link to [Final Report](#) and [Presentation](#)

Systems Framework for Rapid Conceptual Design of Aerocapture Missions

West Lafayette, IN, USA

IN COLLABORATION WITH NASA JET PROPULSION LABORATORY

Jan. 2017 - Present

- Formulated an integrated systems analysis framework for aerocapture mission concept studies
- Created "aerocapture feasibility charts" unifying interplanetary trajectory and vehicle design for aerocapture

Purdue Single Wheel Test Rig for Ocean World Rovers

West Lafayette, IN, USA

FUNDED BY NASA SCIENCE MISSION DIRECTORATE, NASA H.Q.

Aug. 2017 - Present

- Led the mechanical design and commissioning of a state-of-the art planetary rover wheel test facility
- Unique facility designed to test mobility systems for Ocean Worlds surfaces. Link to [Factsheet](#), [Video](#)
- Managed a team of five graduate students and coordinated project collaboration with industrial partners at Thin Red Line Aerospace and Smithers Inc.

Venus Aerocapture Assessment

PURDUE UNIVERSITY

West Lafayette, IN, USA

Jan. 2017 - Dec. 2018

- Performed comprehensive feasibility assessment of aerocapture for future Venus missions
- Quantified the performance-benefit and applicability of aerocapture for ride-along SmallSat missions

Human Journey to Mars - Pioneering Mars Base Architecture

PURDUE UNIVERSITY

West Lafayette, IN, USA

Jan. 2017 - Apr. 2017

- Systems engineer in an interdisciplinary mission concept study for sustainable human Mars mission
- Developed the “Mars Surface Tunnel” concept to mitigate issues related to dust for manned surface missions

Atmospheric Sample Return from the Habitable Zone of Venus

PURDUE UNIVERSITY

West Lafayette, IN, USA

Jan. 2017 - Jun. 2017

- Analyzed the feasibility of collecting and returning a sample from the Venusian atmosphere
- Poster presented at the Planetary Science Vision (PSV) 2050 Workshop. Link to [poster](#) and [media coverage](#).

Journal Publications

1. **A. P. Girija**, Y. Lu, and S. J. Saikia, “Feasibility and Mass-Benefit Analysis of Aerocapture for Missions to Venus”, *AIAA Journal of Spacecraft and Rockets*. Vol. 57, Number 1. January 2020. [DOI: 10.2514/1.A34529](#)
2. **A. P. Girija**, S. J. Saikia, J. M. Longuski, S. Bhaskaran, M. Smith, and J. A. Cutts, “Feasibility and Performance Analysis of Neptune Aerocapture Using Heritage Blunt-Body Aeroshells”, *AIAA Journal of Spacecraft and Rockets*. Accepted. April 2020. [Preprint](#)
3. S. Jarmak, E. Leonard, A. Akins, E. Dahl, D. R. Cremons, S. Cofield, A. Curtis, C. Dong, E. T. Dunham, B. Journaux, D. Murakami, W. Ng, M. Piquette, **A. P. Girija**, K. Rink, L. Schurmeier, N. Stein, N. Tallarida, M. Telus, L. Lowes, C. Budney, K. L. Mitchell, “QUEST: A New Frontiers Uranus Orbiter Mission Concept Study”, *Acta Astronautica*. January 2020. [DOI: 10.1016/j.actaastro.2020.01.030](#)
4. **A. P. Girija**, Y. Lu, A. Mudek, A. Arora, S. J. Saikia, J. M. Longuski, and J. A. Cutts, “Feasibility and Mass-Benefit of Aerocapture for Future Missions”. In preparation. Expected submission, May 2020.
5. **A. P. Girija**, Y. Lu, A. Arora, R. Agrawal, J. Prabha, M. de Jong, B. Aiken, M. Rajapakshe, M. Kent, S. J. Saikia, and J. M. Longuski, “Purdue Single Wheel Test Rig Facility for Ocean World Rovers”. In preparation.

Software

1. **A. P. Girija**, “Aerocapture Mission Analysis Tool (AMAT)”. [Project Documentation](#)

Conference Publications

1. **A. P. Girija**, S. J. Saikia, J. A. Cutts, and J. M. Longuski, “A Unified Framework for Aerocapture Systems Analysis”, AAS 19-811, AAS/AIAA Astrodynamics Specialist Conference, Portland, ME, August 2019. [engrXiv](#)
2. **A. P. Girija**, S. J. Saikia, J. M. Longuski, S. Bhaskaran, M. Smith, and J. A. Cutts, “Aerocapture Performance Analysis for a Neptune Mission using Blunt-Body Aeroshell”, AAS 19-815, AAS/AIAA Astrodynamics Specialist Conference, Portland, ME, August 11–15, 2019. [engrXiv](#)
3. **A. P. Girija**, S. J. Saikia, and M. de Jong, “Candidate Mechanisms and Fabric Layup Materials for the Mars Surface Tunnel Concept”, IEEE Aerospace Conf., Big Sky, MT, March, 2018. [DOI:10.1109/AERO.2018.8396720](#)

Oral Presentations

1. **A. P. Girija**, S. J. Saikia, J. M. Longuski, S. Bhaskaran, M. Smith, and J. A. Cutts, “Ice Giant Aerocapture Using Low-L/D Aeroshells: Uncertainty Quantification and Risk Assessment”, 16th International Planetary Probe Workshop (IPPW), Oxford University, Oxford, United Kingdom, July 8–12, 2019. [Link](#)
2. **A. P. Girija**, Y. Lu, S. J. Saikia, J. M. Longuski, and J. A. Cutts, “Feasibility and Mass-Benefit Analysis of Aerocapture for SmallSat Missions to Venus”, 16th NASA Venus Exploration Group (VEXAG) Meeting, Johns Hopkins University Applied Physics Lab (APL), Laurel, MD, November 5–8, 2018. [Link](#)
3. **A. P. Girija**, A. Arora, S. J. Saikia and J. A. Cutts, “Hybrid Aerocapture using Low L/D Aeroshells for Ice Giant Missions”, 15th International Planetary Probe Workshop (IPPW), Boulder, CO, June 11–15, 2018. [Link](#)
4. Y. Lu, **A. P. Girija**, S. J. Saikia, and J. A. Cutts, “Venus Aerocapture Assessment”, 15th NASA Venus Exploration Group Meeting, Johns Hopkins University APL, Laurel, MD, November 14–16, 2017. [Link](#)
5. **A. P. Girija**, E. Shibata, Y. Lu, S. J. Saikia and J. A. Cutts, “Considerations for Atmospheric Sample Return from the Habitable Zone of Venus”, 14th International Planetary Probe Workshop (IPPW), The Hague, Netherlands June 12–17, 2017. [Link](#)

Poster Presentations

1. S. Jarmak, E. Leonard, A. Akins, E. Dahl, D. R. Cremons, S. Cofield, A. Curtis, C. Dong, E. T. Dunham, B. Journaux, D. Murakami, W. Ng, M. Piquette, **A. P. Girija**, K. Rink, L. Schurmeier, N. Stein, N. Tallarida, M. Telus, L. Lowes, C. Budney, K. L. Mitchell, “QUEST: A New Frontiers Uranus Orbiter Mission Concept Study”, 50th Lunar and Planetary Science Conference (LPSC), The Woodlands, TX, March 18–22, 2019. [Link](#)
2. Y. Lu, **A. P. Girija**, M. Rajapakshe, M. de Jong, J. M. Longuski, and S. J. Saikia, “A Single-Wheel Test Rig for Ocean Worlds”, NASA Outer Planets Assessment Group (OPAG) Meeting, Pasadena, CA, Sept. 11–12, 2018. [Link](#)
3. R. Agrawal, B. Aiken, M. de Jong, **A. P. Girija**, J. M. Longuski and S. J. Saikia, “A Surface Mobility System with Large Deployable and Conformal Tires for Ocean Worlds Exploration, 15th International Planetary Probe Workshop (IPPW), Boulder, CO, June 11–15, 2018. [Link](#)
4. **A. P. Girija**, R. Agrawal, Y. Lu, B. Aiken, M. de Jong, and S. J. Saikia, “A Novel Surface Mobility System for Ocean Worlds”, NASA Outer Planets Assessment Group (OPAG) Meeting, Hampton, VA, February 21–22, 2018. [Link](#)
5. Y. Lu, M. Rajapakshe, R. Agrawal, **A. P. Girija**, and S. J. Saikia, “A Single Wheel Test Rig for Ocean World Rover”, NASA Outer Planets Assessment Group (OPAG) Meeting, Hampton, VA, Feb. 21–22, 2018. [Link](#)
6. E. Shibata, Y. Lu, **A. P. Girija**, J. A. Cutts, and S. J. Saikia, “A Venus Atmospheric Sample Return Mission Concept: Feasibility and Technology Requirements”, Poster presented at Planetary Science Vision 2050 Workshop, NASA Headquarters, Washington D.C., February 27–28, 2017. [Link](#)

Scholastic Achievements

- **Mayan Prize** for best academic record in Aerospace Engineering, Class of 2016, IIT Madras.
- **Silver Medal** for academic excellence, Class of Aerospace Engineering (B.Tech + M.Tech), 2016, IIT Madras.
- **First Rank** in Infant Jesus High School, Indian School Certificate Examination (ICSE), 2009.
- **Top 1 percent** of students in the state of Kerala, India who took the Junior Astronomy Olympiad (2008).

Summer Experience / Internships

Planetary Science Summer Seminar (PSSS), NASA Jet Propulsion Laboratory

Pasadena, CA

MISSION FORMULATION SECTION, TEAM X, JPL

May. 2013 - Jul. 2013

- Participant of the 30th NASA PSSS which formulated a New Frontiers mission concept to Uranus.
- Led the mission design and Uranus system tour design to achieve the science within the mission constraints
- Co-led the magnetosphere science team, and led the magnetometer instrument team.

Summer Intern, Indian Space Research Organization (ISRO)

Trivandrum, Kerala, India

AEROHEATING DIVISION, VIKRAM SARABHAI SPACE CENTER, ISRO

May. 2013 - Jul. 2013

- Studied modeling and simulation techniques for entry vehicle thermal protection systems (TPS) materials.
- Developed a MATLAB code to compute the temperature of TPS material during re-entry
- Supported the investigation of a temperature anomaly during the PSLV-C20 mission

Scholarships and Awards

- **IPPW Student Scholarship** to attend the International Planetary Probe Workshop (IPPW)
 - Awarded in 2019, 2018, and 2017
- **IPPW Student Poster Award** - 3rd place on co-authored poster, 15th IPPW, Boulder, CO.
- **Needs Based Scholarship** co-funded by the Purdue Graduate School and College of Engineering
 - Awarded in Fall 2018 and Spring 2019
- **NASA Planetary Science Summer Seminar Stipend** to attend the 30th annual NASA Planetary Science Summer Seminar (PSSS) at NASA Jet Propulsion Lab, Pasadena, California, August 6-10, 2018.
- **VEXAG Student Travel Grant** to attend the 16th NASA Venus Exploration Group (VEXAG) Meeting
 - Awarded in 2018 and 2017

Teaching Experience

Teaching Assistant (TA) for AAE450 (Spacecraft Design) - Purdue University

West Lafayette, IN, USA

INSTRUCTOR : PROF. JAMES LONGUSKI, SCHOOL OF AERONAUTICS AND ASTRONAUTICS.

Jan. 2020 - Present

- Capstone aerospace engineering course where students learn spacecraft systems engineering, conceptual design, technical communication, and project management. [Project Website](#)

Teaching Assistant (TA) for AAE301 (Signal Analysis) - Purdue University

West Lafayette, IN, USA

INSTRUCTOR : PROF. ARTHUR FRAZHO, SCHOOL OF AERONAUTICS AND ASTRONAUTICS.

Aug. 2019 - Dec. 2019

- Undergraduate level course where students learn basic signal processing and filtering techniques.

Teaching Assistant (TA) for AAE340 (Dynamics) - Purdue University

West Lafayette, IN, USA

INSTRUCTOR : PROF. CAROLINE FRUEH, SCHOOL OF AERONAUTICS AND ASTRONAUTICS.

Jan. 2018 - May. 2018

- AAE340 is an undergraduate dynamics course where students learn the basic principles of rigid body dynamics, vibrations, and orbital mechanics and is a prerequisite for many advanced courses in dynamics and control.

Teaching Assistant (TA) for AAE333L (Fluids Lab) - Purdue University

West Lafayette, IN, USA

INSTRUCTOR : PROF. SALLY BANE, SCHOOL OF AERONAUTICS AND ASTRONAUTICS.

Aug. 2016 - Dec. 2017

- AAE333L is an undergraduate fluid mechanics lab where students learn wind tunnel testing techniques.
- Received an overall rating of 4.7/5.0 from students in course evaluation.

Teaching Assistant (TA) for AS5210 (Senior Design) - IIT Madras

Chennai, Tamil Nadu, India

INSTRUCTOR : PROF. M. MATHUR, SCHOOL OF AEROSPACE ENGINEERING.

Jan. 2016 - Jun. 2016

- Capstone aircraft/spacecraft/space mission design course for students in aerospace engineering.

Teaching Assistant (TA) for AS5220 (Structural Design) - IIT Madras

Chennai, Tamil Nadu, India

INSTRUCTOR : PROF. H. S. N. MURTHY, SCHOOL OF AEROSPACE ENGINEERING.

Aug. 2015 - Dec. 2016

- Design, build, test and fly course for graduate students in aerospace engineering

Research Experience

Research Assistant (RA) - Purdue-JPL Aerocapture Studies

West Lafayette, IN, USA

SUPERVISORS : PROF. SARAG SAIKIA AND PROF. JAMES LONGUSKI

Jan. 2018 - Dec. 2018

- Assessment of aerocapture for outer planet missions, guidance, navigation and control (GNC) algorithms

Research Assistant (RA) - NASA COLDTech Program

West Lafayette, IN, USA

SUPERVISORS : PROF. SARAG SAIKIA AND PROF. JAMES LONGUSKI

Jun. 2018 - Aug. 2019

- Design, fabrication, assembly, and validation of planetary rover wheel test rig for Ocean World surfaces
- Design of test methods and selection of simulants or planetary surfaces

Skills

- **Programming Languages:** Python (Advanced), MATLAB, Mathematica, Shell scripting
- **Operating Systems:** Linux, Windows
- **Presentation Software:** Microsoft Office, Libre Office, LaTeX, Adobe InDesign, Adobe Illustrator
- **Astrodynamics Software and Packages:** GMAT, AstroPy, jplephem, spicpy
- **CAD and Visualization Software:** Blender, Autodesk Inventor, SolidWorks, matplotlib

Course Projects

Impact of Anthropogenic Aerosols on Climate

West Lafayette, IN, USA

ATMOSPHERIC PHYSICS (EAPS 531): PROF. D. T. DAWSON

Jun. 2019

- Studied the effect of anthropogenic aerosols on Earth's radiative transfer budget and climate change.

Agent based modeling for optimization of missile defense systems

West Lafayette, IN, USA

SYSTEM-OF-SYSTEMS ANALYSIS (AAE 560): PROF. D. DELAURENTIS

Jun. 2018

- Optimized the selection and deployment of missile defense systems in a hypothetical battlefield. [Report](#)
- Used Monte Carlo simulations to quantify missile defense system-of-system performance.

Goddard problem of optimal rocket ascent with dynamic pressure constraint

West Lafayette, IN, USA

TRAJECTORY OPTIMIZATION (AAE508): PROF J. M. LONGUSKI

Dec. 2017

- Solved the optimal control problem using OpenGoddard, an open-source pseudospectral library. [Report](#)

Trajectory design for the Voyager 2 spacecraft

West Lafayette, IN, USA

ORBITAL MECHANICS (AAE532): PROF K. C. HOWELL

Dec. 2016

- Developed a Python code to reproduce the 'Grand Tour' trajectory using patched conic method.

- Analyzed the spin motion of Galileo spacecraft and the ship *Endurance* in the movie *Interstellar*. [Report](#)

Service

Aerospace Engineering Association (AEA), IIT Madras

Chennai, Tamil Nadu, India

SECRETARY

Jun. 2015 - Jul. 2016

- Led a seven member team which organized various technical and non-technical, sporting, and cultural events at the Department of Aerospace Engineering, IIT Madras. [Website](#)

Extras

- **Languages:**
 - English
 - Hindi
 - Malayalam (native proficiency)
 - Chinese (basic proficiency)
 - Russian (elementary proficiency)

References

1. **Dr. Sarag J. Saikia**
Research Assistant Professor, School of Aeronautics and Astronautics, Purdue University
E-mail: ssaikia@purdue.edu, Phone: 765-203-1236
2. **Dr. James M. Longuski**
Professor, School of Aeronautics and Astronautics, Purdue University
E-mail: longuski@purdue.edu, Phone: 765-494-5139
3. **Dr. James A. Cutts**
Program Manager, Solar System Exploration Directorate, NASA Jet Propulsion Laboratory
E-mail: james.a.cutts@jpl.nasa.gov, Phone: 818-354-4120