Juno Woods, PhD

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navigation & state estimation ∘ computer science ∘ mission design & analysis

Education

The University of Texas at Austin, Austin, Texas
Doctor of Philosophy, Cell & Molecular Biology (Bioinformatics) 2007–2013
- National Science Foundation Fellow (2009–2012)

Virginia Polytechnic Institute & State University, Blacksburg, Virginia
Bachelor of Science, Computer Science, magna cum laude 2002–2007
- Minors in Mathematics, Philosophy, and Russian

Professional Appointments

Metalunar, LLC, Boulder, Colorado
Translunar, LLC, Berkeley, California
Co-founder APR 2020–PRESENT
- GN&C systems, optical navigation, and interplanetary radios (LunaNet)
- Business models (system requirements, budget, timeline, market analysis)
- Proposal writing

Open Lunar Foundation, San Francisco, California
Senior Researcher MAR 2021–PRESENT
Director of Engineering Research & Strategy JUL 2020–MAR 2021
Guidance, Navigation, & Control OCT 2019–APR 2020
- Designs and analyses: EKF, BLS for orbit determination, sensors, trajectory
- Space policy: multilateral arms control treaties, export control policy, open source, electronic frontiers

Intuitive Machines, Houston, Texas
Senior Development Engineer JUN 2015–SEP 2019
- Trajectory design & optimization; lunar mission design & analysis (NOVA-C)
- Responsible for extended Kalman filter, models (Moon Express MX-1)
- ISS rendezvous/berthing plan, preliminary GN&C design (Axiom)
- State estimation (BLS, EKF, complementary) for drilling systems
- GPS-denied navigation and gravimetry (Doppler LIDAR)

Academic Appointments

Applied Space Exploration Laboratory, West Virginia University
Post-doctoral Fellow — Aerospace Engineer JAN 2014–JUN 2015
- LIDAR-based 6 DOF pose initialization strategy for non-cooperative rendezvous; derived/implemented dual inertial state EKF (satellite servicing)
- Open source OpenGL-based 3D sensor simulator, GLIDAR
- Remote sensing technologies for resource surveying and utilization
- Mentored and collaborated with grad students and an undergraduate

Center for Systems & Synthetic Biology, The University of Texas at Austin
National Science Foundation Fellow; Graduate Research Assistant 2007–2014
- Algorithms and data structures in Python, Perl, Ruby, and C/C++; pipelines and automation for large datasets
- Synthetic biology, HIV evolution, and evolutionary systems biology

Dept. of Chemistry & Biochemistry, The University of Texas at Austin
Graduate Teaching Assistant 2008, 2013
- Rewrote curriculum in Python (previously in Perl)

Patents

Marcotte, E.M.; McGary, K.; Wallingford, J.; Park, T.J.; **Woods, J.O.**; Cha, H.J. 12 August 2012. Orthologous phenotypes and non-obvious human disease models. *U.S. Patent Application Publication 2012/0215458 A1.*

Highlighted Articles

List of non-aerospace articles authored available upon request.

Woods, J.O.; Christian, J.A. 2016. LIDAR-based relative navigation with respect to non-cooperative objects. *Acta Astronautica 126*: pp. 298–311.

Woods, J.O.; Christian, J.A. 2016. GLIDAR: An OpenGL-based, real-time, and open source 3D sensor simulator for testing computer vision algorithms. *Journal of Imaging 2*(1).

Conference Proceedings

Woods, J.O.; Christian, J.A.; Evans, T. February 2015. A 6-DOF pose initialization strategy for LIDAR-based non-cooperative navigation. In *38th Annual Guidance & Control Conference*, Breckenridge, CO.

Sell, J.L.; Rhodes, A.; **Woods, J.O.**; Christian, J.A.; Evans, T. 2014. In *AIAA/AAS Astrodynamics Specialist Conference*, San Diego, CA.

Technical Reports

Some internal technical report titles have been changed for external clarity or to maintain client confidentiality.

Woods, J.O. 2021. An engineer's history of US and multilateral export controls. *OLF–ENG–2021–01*, Open Lunar Foundation, San Francisco, CA.

Woods, J.O. 2019. Navigation filter design towards a lunar lander. *OLF–GNC–2019–02*, Open Lunar Foundation, San Francisco, CA. *Work in progress, ceased and published early due to pandemic.* github.com/openlunar/navmemos/raw/master/filter/filter.pdf

Woods, J.O. 2019. Two-way range and range-rate observables in a sequential filter. *OLF–GNC–2019–01*, Open Lunar Foundation, San Francisco, CA. github.com/openlunar/navmemos/raw/master/radiometric/memo.pdf

Woods, J.O. 2018. Observability and sensitivity analyses for attitude estimation using a gimballed gyroscope. *IM–TM–2018–04.*

Woods, J.O. 2018. Position and velocity variance growth during dead reckoning of a drill. *IM–TM–2018–02*.

Woods, J.O. 2018. Derivation of the Doppler LIDAR measurement model in the inertial and topocentric frames. *IM–TM–2018–01*.

Crain, T.C.; **Woods, J.O.**; Baine, M.; Moore, J.; Getchius, J.; Ronalds, A.; Stewart, S. 2018. Cislunar navigation architecture study. *IMDM–9*.

Woods, J.O. 2017. A dual MARG complementary filter for attitude state estimation while drilling. *IM–TM–2017–04*.

Woods, J.O.; Christian, J.A. 2014. A real-time, software-based 3D sensor simulator. ASEL Technical Memorandum: *ASEL–14–005*.

Sell, J.; Rhodes, A.; **Woods, J.**; Christian, J.A. 2014. Theoretical foundations of pose estimation and covariance computation for non-cooperative relative navigation. ASEL Technical Memorandum: *ASEL–14–001*.

Selected Honors & Awards

White House Champion of Change	2014
National Science Foundation Graduate Research Fellowship	2009–2012
Initiate, Friar Society (University of Texas at Austin)	2010
Black Belt, Tae Kwon Do (Chung Do Kwan)	2006
National Merit Scholarship	2002

Community Contributions

Black Rock Rangers 2018–PRESENT
Green Dot 2019–PRESENT

Ruby Science Foundation (SciRuby)
Director & Co-Founder 2012–2018

Texas Gun Sense
Co-founder, Advisory Board Member 2013–PRESENT

Activities & Interests

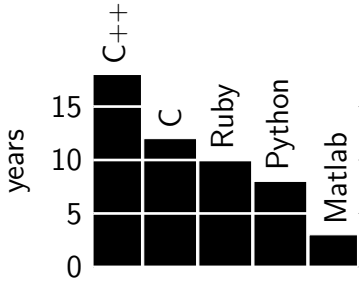
dance (lindy hop and ballet), roller skating, circus arts, space exploration, large-scale interactive art, immersive theatre

Foreign Languages

English (native tongue), Spanish (conversational), Russian (needs refreshing)

Coding Proficiencies

C, C++, Ruby, Python, LaTeX, GNU Octave / Matlab



Familiar Java, SQL, shell scripting, Agile, Julia, VHDL

Forgotten Perl, Fortran 95, regular expressions

Libraries Orekit, CSPICE (JPL NAIF), C++ STL and Boost, OpenGL, Trick simulator

Contributions Spiceypy, Point Cloud Library, FLANN, NMatrix† (Ruby linear algebra library), Pyquat† (Python attitude library), Glidar† (3D LIDAR simulator)

† indicates primary authorship

Software Copernicus, Git, GCC, Clang, GDB, Valgrind, CMake, Ubuntu, Mac OS X, GNU Radio

References

Chris Hadfield chris@chrishadfield.ca
Chair, Open Lunar Foundation; Commander, CSA and NASA

John Christian john.christian@mail.wvu.edu
Asst. Professor of Aerospace Engineering, Rensselaer Polytechnic Institute

Tim Crain tim@intuitivemachines.com
Vice President of Research and Development, Intuitive Machines

Amanda Acevedo amanda.acevedo@vedosystems.com
President, Vedo Systems; formerly Project Manager, Intuitive Machines

Ben Howard ben@openlunar.org
Chief Engineer, Open Lunar Foundation; Chief Spacecraft Architect, Planet