

# JUNO WOODS, PHD

703-801-2625  
juno@translunar.io

github:translunar  
linkedin:translunar

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aerospace engineering ○ evolutionary systems biology ○ research ○ design ○ empathy

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**Coding Proficiencies** C, C++, Ruby, Python, L<sup>A</sup>T<sub>E</sub>X, GNU Octave / Matlab

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

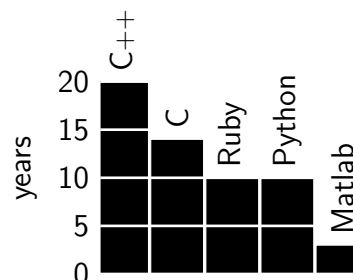
*Forgotten* Perl, Fortran 95, regular expressions

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

*Contributions* Spiceypy, Point Cloud Library, FLANN, NMatrix<sup>†</sup> (Ruby linear algebra library), Pyquat<sup>†</sup> (Python attitude library), GLIDAR<sup>†</sup> (3D LIDAR simulator)

<sup>†</sup> indicates primary authorship

*Software* Copernicus, Satellite Toolkit (STK), Git, GCC, Clang, GDB, Valgrind, CMake, Ubuntu, Mac OS X, GNU Radio



**Education** **The University of Texas at Austin**, Austin, Texas

*Doctor of Philosophy, Cell & Molecular Biology (Bioinformatics)* 2007–2013

- National Science Foundation Fellow (2009–2012), [Center for Systems & Synthetic Biology](#)

- Advisor: Dr. Edward M. Marcotte

**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** **Masten Space Systems**, Mojave, California

*GN&C engineer, 6-DOF (contractor)* JUL 2021–PRESENT

- Derived, designed, and prototyped extended Kalman filter for integrating sensor data into time series least squares model, including attitude

- Designed state machine for automating spacecraft behaviors

- Advised organization on diversity, equity, and inclusion as part of DE&I council

**Charismatic Metafauna by Majorelle Arts**, Oakland, California

*Sound Design Team Lead* 2021–PRESENT

- Wrote engineering requirements / system specifications for sound design for a large-scale interactive art project (\$30K budget, 20 volunteers)

- Coordinating activities of sound design team and interfacing with interactivity team to fulfill engineering requirements

**Numina Studios / Nocturne-X**, Oakland, California

*Electronics Assembly (contractor)* SEP–OCT 2021

- Soldering and electronics assembly for a large-budget interactive art experience at Gray Area in San Francisco for three months beginning October 2021

**Open Lunar Foundation**, San Francisco, California

*Senior Researcher* MAR–JUL 2021

*Director of Engineering Research & Strategy* JUL 2020–MAR 2021

*Guidance, Navigation, & Control* OCT 2019–APR 2020

- Engineering designs and analyses
- Space policy: multilateral arms control treaties, export control policy, open source, electronic frontiers
- Systems engineering: GN&C systems, optical navigation, and interplanetary radios (LunaNet)
- Created business plans, engineering schedules, and financial models for various for-profit and non-profit interventions

**Intuitive Machines**, Houston, Texas

*Senior Development Engineer* JUN 2015–SEP 2019

- Trajectory design & optimization; lunar mission design & analysis (NOVA-C)
- Documented and validated extended Kalman filter (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)
- Wrote engineering requirements for payloads, including for molecular biology in microgravity

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

- Pipelines and automation for large datasets
- Researched, designed, and wrote statistical software for searching for genes under various types of selection (positive, purifying, relaxed)
- Invalidated a hypothesis about HIV reservoirs using viral evolution simulation
- Designed scheme for re-engineering cellular metabolism in *E. coli*, and partially implemented it (wet lab)

- Some experience with mass spectrometry-based proteomics

**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 *List of non-aerospace articles authored available upon request.*  
Articles

**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).

**Woods, J.O.**; Tien, M.Z.; Marcotte, E.M. April 2015. Interrogating conserved  
elements of diseases using Boolean combinations of orthologous phenotypes.  
*BioRxiv*.

**Woods, J.O.**; Singh-Blom, U.M.; Laurent, J.M.; McGary, K.L.; Marcotte,  
E.M. January 2013. Prediction of gene–phenotype associations in humans,  
mice, and plants using phenologs. *BMC Bioinformatics 14*: p. 203.

Singh-Blom, U.M.; Natarajan, N.; Tewari, A.; **Woods, J.O.**; Dhillon, I.S.;  
Marcotte, E.M. January 2013. Prediction and validation of gene–disease  
associations using methods inspired by social network analyses. *PLoS One*  
8(5): e58977.

McGary, K.L.; Park, T.J.; **Woods, J.O.**; Cha, H.J.; Wallingford, J.B.; Mar-  
cotte, E.M. April 2010. Systematic discovery of nonobvious human disease  
models through orthologous phenotypes. *Proceedings of the National Academy*  
*of Sciences of the United States of America 107*(14): pp. 6544–9.

Brennan, T.P.; **Woods, J.O.**; Sedaghat, A.R.; Siliciano, J.D.; Siliciano, R.F.;  
Wilke, C.O. September 2009. Analysis of human immunodeficiency virus type  
1 viremia and provirus in resting CD4<sup>+</sup> T cells reveals a novel source of residual  
viremia in patients on antiretroviral therapy. *Journal of Virology 83*(17): pp.  
8470–81.

Conference **Woods, J.O.**; Christian, J.A.; Evans, T. February 2015. A 6-DOF pose  
Proceedings 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. Pose performance of LIDAR-based navigation for satellite servicing. In *AIAA/AAS Astrodynamics Specialist Conference*, San Diego, CA.

## Posters

**Woods, J.O.**; Singh-Blom, U.M.; Laurent, J.; McGary, K.L.; Marcotte, E.M. 20–25 February 2012. In *Complex Traits: Genomics and Computational Approaches*, Keystone Symposia, Breckenridge, CO.

**Woods, J.O.**; Singh-Blom, U.M.; McGary, K.L.; Marcotte, E.M. 13–16 November 2010. In *From Functional Genomics to Systems Biology*, EMBL Heidelberg, Heidelberg, Germany.

## 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.** 2020. Concepts in lunar positioning, navigation, and timing. *OLF-GNC-2020-01*, 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](https://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](https://github.com/openlunar/navmemos/raw/master/radiometric/memo.pdf)

**Woods, J.O.** 2018. Observability and sensitivity analyses for attitude estimation using a gimbaled 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*.

Natarajan, N.; Singh-Blom, U.M.; Tewari, A.; **Woods, J.O.**; Dhillon, I.S.; Marcotte, E.M. 2011. Predicting gene–disease associations using multiple species data. UTCS Technical Report: *TR-11-37*.

Selected Honors & Awards	Burning Man Honorarium: <i>Charismatic Metafauna</i>	2022
	Masten Space Systems: Diversity, Equity, and Inclusion Council member	2022
	White House Champion of Change	2014
	National Science Foundation Graduate Research Fellowship	2009–2012
	“Best of Austin” Award: Best Activist ( <i>The Austin Chronicle</i> )	2011
	Scholar, Netroots Nation	2011
	Initiate, Friar Society (University of Texas at Austin)	2010
	Graduate School Recruitment Fellowship (University of Texas at Austin)	2007
	Black Belt, Tae Kwon Do (Chung Do Kwan)	2006
	Member, Hillcrest Honors Community (Virginia Tech)	2003–2007
	Inductee, YIIE (Virginia Tech)	2006
	Gilbert & Lucille Seay Scholarship (Virginia Tech)	2005
	National Merit Scholarship	2002
Community Contributions	<b>Lunar Surface Innovation Consortium</b>	2021–PRESENT
	<i>Communications Subgroup Lead</i>	2021–2022
	<b>Black Rock Rangers</b>	2018–PRESENT
	<i>Green Dot</i>	2019–PRESENT
	<b>Ruby Science Foundation (SciRuby)</b>	
	<i>Director &amp; Co-Founder</i>	2012–2018
Community Contributions	<b>Texas Gun Sense</b>	
	<i>Co-founder, Advisory Board Member</i>	2013–PRESENT
Activities & Interests	dance (lindy hop and ballet), music, roller skating, circus arts, space exploration, large-scale interactive art, immersive theatre	
Foreign Languages	English (native tongue), Spanish (conversational), Russian (needs refreshing)	
Other Skills	Metal fabrication and MIG welding, fiberglass/resin casting, FEMA ICS-100 certification	
References	Chris Hadfield	<a href="mailto:chris@chrishadfield.ca">chris@chrishadfield.ca</a>
	Chair, Open Lunar Foundation; Commander, CSA and NASA	
	John Christian	<a href="mailto:john.christian@mail.wvu.edu">john.christian@mail.wvu.edu</a>
	Asst. Professor of Aerospace Engineering, Rensselaer Polytechnic Institute	
	Tim Crain	<a href="mailto:tim@intuitivemachines.com">tim@intuitivemachines.com</a>
	Vice President of Research and Development, Intuitive Machines	

Amanda Acevedo [amanda.acevedo@vedosystems.com](mailto:amanda.acevedo@vedosystems.com)  
President, Vedo Systems; formerly Project Manager, Intuitive Machines

Ben Howard [ben@openlunar.org](mailto:ben@openlunar.org)  
Chief Engineer, Open Lunar Foundation; Chief Spacecraft Architect, Planet

Eva Pettinato [eva.pettinato@gmail.com](mailto:eva.pettinato@gmail.com)  
Lead Guidance, Navigation, and Control Engineer, Masten Space Systems

Edward Marcotte [marcotte@icmb.utexas.edu](mailto:marcotte@icmb.utexas.edu) 512-471-5435  
Professor of Chemistry & Biochemistry, The University of Texas at Austin