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| CONTACT             | Robotics & Perception Lab<br>University of Colorado<br>ECCR 1B05B<br>Boulder CO, 803090430 USA  | <i>Voice:</i> +1 202 510 5040<br><i>Fax:</i> +1 303 492 2961<br><i>E-mail:</i> <a href="mailto:gsibley@colorado.edu">gsibley@colorado.edu</a><br><i>WWW:</i> <a href="http://arpg.colorado.edu">http://arpg.colorado.edu</a> |
| CITIZENSHIP         | United States   |  |
| RESEARCH INTERESTS  | Robotics<br>Computer Vision<br>Machine Learning<br>Artificial Intelligence<br>Cyber Physical Systems<br>Semantic Simultaneous Localization and Mapping<br>Environmental cleanup robots<br>Machine learning for long-term autonomy<br>Estimation theory  |  |
| EDUCATION           | <b>University of Southern California</b><br>Ph.D., Computer Science<br><ul style="list-style-type: none"> <li>• Dissertation: Long Range Stereo Data-fusion From Moving Platforms</li> <li>• Advisors: Gaurav S. Sukhatme and Larry H. Matthies</li> </ul>  | Los Angeles, California USA<br><i>May 2007</i>   |
|                     | <b>Emory University</b><br>B.S., Computer Science and Mathematics   | Atlanta, Georgia USA<br><i>May 2001</i>  |
| RESEARCH EXPERIENCE | <b>University of Colorado</b><br><i>Assistant Professor</i><br><ul style="list-style-type: none"> <li>• Robust perception, planning and control             <ul style="list-style-type: none"> <li>– MPC planning for agile ground vehicles</li> <li>– Long-term autonomy</li> <li>– Large-scale semantic SLAM for mobile devices</li> </ul> </li> </ul>              | Boulder CO, USA<br><i>August 2014—present</i>  |
|                     | <b>George Washington University</b><br><i>Assistant Professor</i><br><ul style="list-style-type: none"> <li>• Robot perception</li> </ul>   | Washington DC, USA<br><i>July 2011—August 2014</i>   |
|                     | <b>Somerville College, Oxford</b><br><i>Junior Research Fellow</i><br><ul style="list-style-type: none"> <li>• Lifelong learning for mobile autonomous robots             <ul style="list-style-type: none"> <li>– Appearance based loop-closure</li> <li>– Place recognition without discrete places</li> <li>– Unsupervised semantic mapping</li> </ul> </li> </ul> | Oxford, UK<br><i>April 2010—August 2011</i>  |
|                     | <b>University of Oxford</b><br><i>Post Doctoral Research Assistant</i><br><ul style="list-style-type: none"> <li>• Long-term Autonomy             <ul style="list-style-type: none"> <li>– Relative bundle adjustment and scalable topo-metric SLAM</li> </ul> </li> </ul>  | Oxford, UK<br><i>Aug 2007—July 2011</i>  |

- Learning over the long-term for improved mobile robot autonomy

**University of Southern California**  
*Graduate Research Assistant*

Los Angeles, California, USA  
*May 2001—May 2007*

- Estimation theory for robotic visual perception
  - Developed the novel constant time Sliding Window Filter SLAM algorithm
  - Derived a Second order bias-correction Gauss-Newton filter for long range stereo
  - Improved long range stereo with the novel Iterated Sigma Point Kalman Filter
- Wireless Robotic Sensor Networks
  - Team leader on the original Robomote sensor network project
  - Demonstrated autonomous sensor network deployment, route discovery, and fault repair (DDR) in the JPL Mars yard

**NASA-JPL Computer Vision Group**  
*Technical Staff*

Pasadena, California, USA  
*May 2002—Aug 2007*

- Novel algorithm development
  - Developed stereo based Simultaneous Localization and Mapping software for the DARPA mobile autonomous robot software (MARS) robotic vision 2020 program
  - Derived a constant time Sliding Window Filter SLAM algorithm
  - Developed long range stereo algorithms to improve hazard detection and path planning for the DARPA learning applied to ground robotics (LAGR) program
- Design and implementation of novel robotic research platforms
  - Stereo vision sensor integration for the Office of Naval Research (ONR) unmanned sea surface vehicle (USSV) program. The goal of this program is develop and demonstrate an initial capability for autonomous control of a USSV
  - Technical lead on the original Spiderbot Project. Demonstrated hexapod robots that can walk on flat surfaces, crawl on meshes, and assemble simple structures. Spiderbot traversed a mesh in micro-gravity on-board a Zero-G Boeing 727 (*aka* - the vomit comet)

**BlueSky Robotics, LLC**  
*Robotics Engineer, CEO and founder*

Los Angeles, California, USA  
*December 2003—October 2005*

- Wrote and won a DARPA small business innovative research grant to develop the Spinnerbot hexapod reconnaissance robot
- Contributed to the design and implementation of 22 degree of freedom humanoid torso

**University of Florida Machine Intelligence Laboratory**  
*Research Assistant*

Gainesville, Florida, USA  
*May 2000—September 2000*

- Designed, machined, programmed and demonstrated a complete rocker-bogie Mars rover under a National Science Foundation Research Experience for Undergraduates grant

**Emory University Mathematics and CS Department**  
*Graduate Research Assistant*

Atlanta, Georgia, USA  
*August 2000—May 2001*

- Developed software for Quality of Service monitoring and localization in Ricochet metropolitan area wireless networks
- Researched distributed collaboration software fault tolerance in mobile wireless networks

TEACHING AND  
MENTORING

### Teaching

- Computer Architecture I ( GWU 2164 )

- Introduction to Mobile Robotics ( GWU CS4526/6527 )
- Robot Games ( GWU CS3907/6907 )
- Mobile Manipulation ( GWU CS3907/6907 )
- Vector Calculus I (Oxford 2A1A )
- Vector Calculus II (Oxford 2A1B )
- Linear Algebra (Oxford 2A1C )

#### Teaching Assistant

- Operating Systems (Emory CS 451)
- Graduate Systems Programming (Emory CS 551)
- American Computer Experience Summer Camp Counselor

#### Student Mentoring

I take great pride in mentoring students of all ages. I have contributed at many levels, from discussion and clarification of ideas to joint project implementation. Two students have gone on to work at NASA, one is with Lockheed, one is doing a Masters at the University of Southern California, one is pursuing his Ph.D. at the University of Maryland, and one is pursuing his Ph.D. at the University of Southern California.

#### Leadership Experience

- Technical lead on the NASA-Explorer Team (NEXT) Spiderbot project
- Founder and CEO of BlueSky Robotics, LLC
- Principal Investigator for the DARPA Spinnerbot Small Business Innovative Research (SBIR) grant
- Principal Investigator for National Science Foundation Research Experience for Undergraduates (REU) RovIs rover project
- Team leader for the Scalable Coordination of Wireless Robots (SCOWR) Robomote project

#### PUBLICATIONS

##### JOURNAL ARTICLES

1. Jonathan Kelly, **Gabe Sibley**, Tim Barfoot, Paul Newman, “Taking the Long View: A Report on Two Recent Workshops on Long-Term Autonomy”, *IEEE Robot. Autom. Mag.*, vol. 19, no. 1, pp. 109-111, Mar 2012. (Impact factor: 2.484).
2. **Gabe Sibley**, Larry Matthies, Gaurav Sukhatme, “Sliding Window Filter with Application to Planetary Landing”, *Journal of Field Robotics*, Vol. 27, No. 5, pp. 587608, September/October 2010. (Impact factor: 2.152)
3. **Gabe Sibley**, Christopher Mei, Ian Reid, Paul Newman, “Vast Scale Outdoor Navigation Using Adaptive Relative Bundle Adjustment”, *International Journal of Robotics Research*, Vol. 29, No. 8, pp 958-980, July 2010. (Impact factor: 4.095)
4. Christopher Mei, **Gabe Sibley**, Mark Cummins, Paul Newman and Ian Reid “RSLAM: A System for Large-Scale Mapping in Constant-Time using Stereo”, *International Journal of Computer Vision*, Vol. 29 No. 8, pp. 958-980, June 2010. (Impact factor: 3.623)
5. Paul Newman, **Gabe Sibley**, Mark Cummins, Mike Smith, Alastair Harrison, Christopher Mei, Ingmar Posner, Robbie Shade, Derik Schroeter, Dave Cole, Ian Reid, “Navigating, recognizing and describing urban space”, *International Journal of Robotics Research*, Vol. 28, No. 11-12, pp. 1406-1433, November 2009. (Impact factor: 4.095)  
**Most cited IJRR paper in 2011.**

## BOOK CHAPTERS

1. **Gabe Sibley**, Larry Matthies and Gaurav Sukhatme, “A Sliding Window Filter for Incremental SLAM”, in *Unifying Perspectives in Computational and Robot Vision*, Danica Kragic and Ville Kyrki (eds), Springer, pp. 103–112, 2008

REFEREED  
CONFERENCE AND  
WORKSHOP PAPERS

1. Ryan N. Smith, Christoffer Heckman, **Gabe Sibley** and Ani M. Hsieh, “A Representative Modeling Approach to Sampling Dynamic Ocean Structures”, Symposium on Marine Robotics - Broadening Horizons with Inter-Disciplinary Science & Engineering, 2015.
2. Nima Keivan and **Gabe Sibley**, “Constant-Time Monocular Self-Calibration”, IEEE International Conference on Robotics and Biomimetics, 2014.
3. Juan M. Falquez, Vincent Spinella-Mamo and **Gabe Sibley**. “Incremental and Adaptive Front End Fusion”. IEEE International Conference on Robotics and Biomimetics, 2014.
4. Jack Morrison, Dorian Galvez-Lopez and **Gabe Sibley**, “Scalable multi-device SLAM”, Robotics Science and Systems: workshop on Distributed Control and Estimation for Robotic Vehicle Networks, 2014.
5. Lu Ma, **Gabe Sibley**, “Unsupervised Dense Object Discovery, Detection, Tracking and Reconstruction”, European Conference on Computer Vision, 2014. (Acceptance rate: 24.4%)
6. Nima Keivan, Alonso Perez-Patron, **Gabe Sibley**, “Asynchronous Adaptive Conditioning for Visual-Inertial SLAM”, International Symposium on Experimental Robotics, 2014.
7. Jack Morrison, Dorian Galvez-Lopez, and **Gabe Sibley**, “MOARSLAM: Multiple Operator Augmented RSLAM”, International Symposium on Distributed Autonomous Robotic Systems (DARS), November 2014. (Acceptance rate: 43%).
8. Liz Murphy, **Gabe Sibley**, “Incremental Unsupervised Topological Place Discovery”, to appear In IEEE International Conference on Robotics and Automation, 2014. (Acceptance rate: 48%).
9. **Gabe Sibley**, Nima Keivan, Alonso Patron-Perez, Liz Murphy, Steven Lovegrove, Vincent Mamo, “Building Planet-scale 3D Maps with Crowd-sourcing”, International Symposium on Robotics Research, December 2013. (Acceptance rate: NA).
10. Nima Keivan, **Gabe Sibley**, “Real time Simulation-in-the-loop Control for Agile Ground Vehicles”, Towards Autonomous Robot Systems, August 2013. (Acceptance rate: NA). **Best Student Paper**.
11. Steven Lovegrove, Alonso Patron-Perez, **Gabe Sibley**, “Spline Fusion: A continuous-time representation for visual-inertial fusion with application to rolling shutter cameras”, British Machine Vision Conference, August 2013. (Acceptance rate: 30%).
12. Jonathan Kelly, Paul Timothy Furgale, Timothy Barfoot, **Gabe Sibley**, “Long-Term Autonomy: Navigation and Mapping for Real-World Applications,” In IEEE International Conference on Robotics and Automation Workshop, May 2013. (Acceptance rate: 39%).
13. Paul Furgale, Timothy Barfoot, **Gabe Sibley**, “Continuous Time Batch Estimation Using Temporal Basis Functions”, In IEEE International Conference on Robotics and Automation, May 2012. (Acceptance rate: 39%).
14. Christopher Mei, Eric Sommerlade, **Gabe Sibley**, Paul Newman and Ian Reid “Simplifying Video Surveillance Analysis using Real-Time Visual SLAM”, In IEEE International Conference on Robotics and Automation, May 2011. (Acceptance rate: 49%).

15. Christopher Mei, **Gabe Sibley** and Paul Newman, "Closing Loops Without Places", In IEEE International Conference on Intelligent Robots and Systems, October 2010.
16. Ashley Napier, **Gabe Sibley** and Paul Newman, "Real-Time Bounded-Error Pose Estimation for Road Vehicles Using Vision", In IEEE Intelligent Transport Systems, pp. 1141-1146, 2010.
17. **Gabe Sibley**, Christopher Mei, Ian Reid and Paul Newman, "Planes, Trains and Automobiles – Autonomy for the Modern Robot," In IEEE International Conference on Robotics and Automation, May 2009.
18. Christopher Mei, **Gabe Sibley**, Ian Reid and Paul Newman, "A Constant Time Efficient Stereo SLAM System", British Machine Vision Conference, September 2009.
19. **Gabe Sibley**, Christopher Mei, Ian Reid and Paul Newman, "Adaptive Relative Bundle Adjustment," Robotics Science and Systems, August 2009.
20. Steven Holmes, **Gabe Sibley**, Georg Klein and David Murray, "A Relative Frame Representation for Fixed-Time Bundle Adjustment in SFM," In IEEE International Conference on Robotics and Automation, May 2009.
21. **Gabe Sibley**, Gaurav S. Sukhatme and Larry Matthies, "Constant Time Sliding Window Filter SLAM as a Basis for Metric Visual Perception," In IEEE International Conference on Robotics and Automation *Workshop*, April 2007.
22. **Gabe Sibley**, Gaurav S. Sukhatme and Larry Matthies, "The Iterated Sigma Point Kalman Filter with Applications to Long Range Stereo," Robotics Science and Systems, August 2006. pp. – **Nominated for Best Student Paper**
23. Anelia Angelova, Larry Matthies, Daniel Helmick, **Gabe Sibley** and Pietro Perona, "Learning to Predict Slip for Ground Robots," In IEEE International Conference on Robotics and Automation, May 2006, pp. 3324-3331.
24. **Gabe Sibley**, Larry Matthies, and Gaurav S. Sukhatme, "Bias Reduction and Filter Convergence for Long Range Stereo", 12th International Symposium of Robotics Research, October 2005. pp. –
25. **Gabe Sibley**, Mohammad H. Rahimi and Gaurav S. Sukhatme, "Robomote: A Tiny Mobile Robot Platform for Large-Scale Sensor Networks," In IEEE International Conference on Robotics and Automation, pp. 1143-1148, May 2002.
26. James S. Pascoe, Vaidy S. Sunderam and Rodger J. Loder, **Gabe Sibley**, "Facilitating Adaptation to Trouble-spots in Metropolitan Area Wireless Networks," In 7th IEEE Symposium on Computers and Communication, pp. 415, July 2002.
27. **Gabe Sibley** and Vaidy S. Sunderam. "Tools for collaboration in metropolitan Wireless Networks," In IEEE International Conference Computational Sciences, pp. 395-403, May 2001.
28. James S. Pascoe, Vaidy S. Sunderam and Rodger J. Loder, **Gabe Sibley**, "Mobile Wide Area Wireless Fault-Tolerance," In IEEE International Conference Computational Sciences, pp. 385-394, May 2001.

TECHNICAL  
REPORTS

1. **Gabe Sibley**, "Relative Bundle Adjustment," University of Oxford, Technical Report No. 2307/09, Jan 27, 2009.
2. **Gabe Sibley**, "Sliding Window Filters for SLAM," University of Southern California, Report No. CRES-06-004, Aug 2006.

INVITED TALKS &  
PANELS

1. NSF RI Panel, 2013
2. NSF RI Panel, 2013
3. “Perception for Mobile Robot Long-term Autonomy”, University Maryland, November 2013
4. “Relative Bundle Adjustment”, Virginia Tech, USA, May 2013
5. University of Pennsylvania GRASP lab invited seminar, Philadelphia, PA, November 2012
6. Robotics Distinguished Lecture, IEEE Robotics & Automation Society, MITRE, VA USA, October 2012
7. Keynote presentation at Howard Hughes Medical Institutes Janelia Farm Research Campus Conference on Insect Navigation and the Central Complex April 15-18th, 2012
8. Invited Colloquium at Georgia Tech. April 22nd, 2012
9. NSF NRI Panel, 2012
10. NSF NRI Panel, 2012
11. Invited talk at iRobot Corporation, Aug 8th, 2011
12. Invited talk at Toyota, Aug 21st, 2011
13. Invited Colloquium at GMU Oct. 5th, 2011
14. Honorarium at Naval Research Laboratory, Oct 24th, 2011
15. “Scalable Perception”, Carnegie Mellon University, Pittsburgh, February 2011
16. “Long-term Autonomy”, University of Utah, Salt Lake City, Utah, March 2011
17. “Scalable Perception”, EPFL, Lausanne, Switzerland, March 2011
18. “Robotic Sensor Networks”, Hughes Research Laboratory, Malibu, California, USA, November 2002
19. “Robomote: Towards Autonomous Dynamic Topology”, Center for Embedded Networked Sensing, UCLA, USA, September 2001
20. “RovIs: cost effective all-terrain research rovers”, Machine Intelligence Laboratory, UF, Florida, USA, August 2000

## GRANTS

Funded (\$2.7 million); 75% NSF success-rate:

1. PI on NSF SMA grant (recommended for funding) Computer Science meets Anthropology: A novel approach for reconstructing locomotion from fossil human footprints – \$202K
2. Co-PI on NSF MRI grant 35118/2/IXXS20968N: Dense Scene Capture – \$500K
3. PI on NSF grant 34083/1/CCLS20795F: EAGER: Prototype Dense Motion Capture for Large-Scale Deformable-Scene Tracking – \$73K
4. PI on CIA grant 33998/1/CCNS21068F: Focused Dense Tracking and Mapping – \$239K
5. PI on Toyota grant 33643/1/ECNS20952N: Robust Perception – \$121K
6. PI on Motorola grant 34525/1/EENS20681N: Mobile Perception – \$1.1M
7. PI on NASA grant 33661/1/CCNS21039F: Uncertainty in Multi-frame Pose Adjustment – \$47K
8. PI on Toyota grant 33643/1/ECNS20952N: Accurate visual-inertial map estimation – \$337K

9. PI on MITRE grant: (funded,pending) Multi-Sensor Monocular Dense 3D Reconstruction – \$118K

In preparation (\$2.6 million):

1. PI on NSF grant: NRI: Collaborative: Environmental Cleanup Robot Co-workers–\$2.3M
2. DARPA-YFA grant: Parkour Cars: Agile Perception for Fast Ground Vehicles – \$297K

Wrote or contributed substantially to the technical content of the following successful grant proposals:

1. JPL grant 1277958: Improving Stereo Range Resolution via Filtering
2. DARPA grant 5-39509-A: Mobile Autonomous Robot Software (MARS 2020)
3. NSF grant CNS-0520305: Mobility-assisted Network Deployment and Maintenance
4. NSF grant CNS-0540420: A Generic Multi-scale Modeling Framework for Reactive Observing Systems

Principal Investigator on the following successful grant proposals:

1. DARPA Small Business Innovative Research (SBIR) grant: A Small, Capable Reconnaissance Tool - The Spinnerbot
2. NSF Research Experience for Undergraduate (REU) grant: RovIs Mars Rover Research Platform

#### HONORS AND AWARDS

- GWU SEAS Faculty Recognition Young Researcher Award. October 2013
- National Science Foundation REU Grant. May 2000—August 2000
- Dorot Travel Grant and Stipend. May 1998—August 1998
- Georgia Hope Scholar. 1997—2001
- Emory University Courtesy Scholar. 1996—2001
- United States Junior Olympic Alpine Skiing Medalist in 1990, 1992, 1994, and 1995. International competitor (FIS). 1992—1996

#### PROFESSIONAL MEMBERSHIPS

- Institute of Electrical and Electronics Engineers (IEEE)
- IEEE Robotics and Automation Society
- Association for Computing Machinery (ACM)

#### REVIEWING

##### Journals

- Autonomous Robots
- IEEE Transactions on Automation
- IEEE Transactions on Aerospace and Electronic Systems
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Robotics
- International Journal of Computer Vision
- International Journal of Control
- International Journal of Robotics Research
- Journal of Field Robotics
- Robotics and Autonomous Systems

##### Conferences

- European Conference on Computer Vision
- IEEE Conference on Computer Vision and Pattern Recognition
- IEEE International Conference on Robotics and Automation
- IEEE International Conference on Computer Vision

- IEEE/RSJ International Conference on Robots and Systems
- IEEE Workshop on Embedded Network Sensors
- Robotics: Science and Systems
- Workshop on the Algorithmic Foundations of Robotics

## REFERENCES

**Prof. Paul Newman**

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