

TREY SMITH - CURRICULUM VITAE

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Objective / Research Interests

I've done a wide variety of work, with the common thread of **making smart people more productive**. In the domain of planetary exploration (rovers, rover/astronaut teams, smart buoys), that has meant enabling the science team to gather more and better science through optimizing the system architecture and concept of operations, end-to-end. Along these lines, my most fundamental work has been in “adaptive science”, making robots that are aware of the science team's goals and able to intelligently react on the fly to their own scientific observations. But I've worked at all levels of these human-robot systems: on autonomous planning under uncertainty, robotic navigation, multi-robot coordination, human-robot interaction, and tools for mission planning, team situation awareness, and data analysis and visualization. I've also been able to apply many of the same methods to disaster response, astronaut Earth science photography, and my current project, which is developing a new zero-gee free-flying robotics research platform (Astrobee) that will operate inside the International Space Station, and open the ISS to new kinds of innovative guest science experiments. I seek future projects where I can do high-impact work with world-class colleagues from a variety of backgrounds and disciplines—ideally, building AI tools and techniques that make them dramatically more productive.

Education

2007 Ph.D., Robotics (School of Computer Science)

Carnegie Mellon University, Pittsburgh

Thesis Title: Probabilistic Planning for Robotic Exploration

Ph.D. Committee:

1. Reid Simmons (chair), CMU Robotics
2. Geoff Gordon, CMU Computer Science
3. Leslie Pack Kaelbling, MIT CSAIL
4. David Wettergreen, CMU Robotics

1999 B.S. / B.S. Computer Science / Math, with University Honors

Carnegie Mellon University, Pittsburgh

Certifications

2012 FEMA Urban Search and Rescue Technical Information Specialist
California Task Force 3, Menlo Park

Employment

2014- NASA Ames Research Center Research Computer Scientist AST

2007-2014	Carnegie Mellon Silicon Valley (NASA Ames Contractor)	Systems Scientist
2001-2007	Carnegie Mellon University	Ph.D. Candidate
Summer 2001	NASA Ames Research Center	Summer Internship
Summer 2000	Jet Propulsion Laboratory	Summer Internship
1999-2001	Carnegie Mellon University	Research Programmer
Summer 1998	NASA Ames Research Center	Summer Internship
1996-1997	Carnegie Mellon University	Undergrad. Research Assistant

SELECTED PROJECT ROLES

2014- Astrobee (HET2 Free Flyer) Systems Engineer

Leading an interdisciplinary team of 30+ engineers to design and develop a new class of free flying robots to operate inside the International Space Station with astronauts. The robots will serve as a zero-g research platform and a free flying camera to watch crew activities, as well as performing sensor surveys.

2015-2016 NEARdrop Asteroid Mission Concept Study Principal Investigator

Proposed a novel asteroid mission concept to a professional development course at NASA Ames. My proposal was the top ranked by senior management, and one of four selected to be matured during the eight-month concept incubator, during which I led a small inter-disciplinary team. The NEARdrop mission would be the first seismic investigation of any small body in the solar system. The NEARdrop hub spacecraft drops two types of CubeSat-class landers onto a near-Earth asteroid surface. One type carries an explosive charge and the other type carries a seismometer. We detonate the charges one by one and measure the seismic impulse-response. The hub spacecraft acts as a comm relay and carries its own sensors to study the explosion and the resulting crater before-and-after.

2013-2014 Planetary Lake Lander Engineering Lead

2011-2013 Planetary Lake Lander Software Lead

Co-I and engineering lead on field science campaign funded through NASA Astrobiology Science and Technology Exploration Program (ASTEP). Responsible for overall system reliability of PLL's autonomous probe buoy in a high-altitude lake in Chile. Lead developer for software system architecture, probe onboard software, science web site, and data visualization / analysis interfaces. Worked with science team to develop system requirements. Deployed to support field science in Chile.

2009-2016 Exploration Ground Data Systems Software Architect

Designed reusable software architecture for science-oriented ground data system web sites. Led software development for a variety of apps within the architecture, including a web-based shell for data analysis, live interactive tools for plotting and mapping time series data, a geospatial robot activity planner, and tools for robot and astronaut position tracking. Worked with science team and astronauts to develop system requirements. Deployed to support several planetary analog field tests.

- 2013-2014 GeoCam Space Principal Investigator
Led successful proposal for project to develop combined sensor package and ground software to improve geolocation of astronaut photographs taken with Digital SLR cameras aboard the International Space Station. The sensor package attaches to the camera and provides camera pointing information; ground software interprets sensor package telemetry, supports manual tie-pointing, and exports imagery as geospatial overlays. (Handed off project leadership to new staff member after successful proposal.)
- 2014 Google/NASA Crisis Mapping Technical Lead
Managed development of tools to provide improved map information to victims and responders after natural disasters. Initial focus was on flood inundation mapping from aerial and satellite visible, near infrared, and radar imagery, processing data using the Google Earth Engine platform for scalable geospatial analysis.
- 2008-2013 Google/NASA Disaster Response ("GeoCam") Technical Lead
Led software development to improve situation awareness in disaster response with geotagged imagery. Effort included some hardware integration of COTS devices. The project evolved from early use of GPS-enabled cameras and laser rangefinders in aerial and ground imaging, to phone apps for teams to collect geotagged imagery, to web apps for collecting and organizing heterogeneous map data from a variety of sources. Managed technical relationships with partners at Google, US Forest Service, CAL FIRE, FEMA, and others. Deployed to support response at several disasters.
- 2011 Exploration Precursor Robotic Program Study Researcher
Developed several software simulation models to support lunar surface rover feasibility study (sun and earth visibility from landing site, terrain navigability, etc). Led trade analysis for how to deploy rover after landing. Worked with partners at MSFC to understand subsystem interdependencies.
- 2008-2010 Robotic Reconnaissance and Followup Studies Researcher
Helped develop software architecture and operations workflow for lunar surface rover analog testing. Enabled high-tempo dynamic replanning using a geospatial plan editor and software for monitoring rover state and visualizing incoming science data. Worked with lunar scientists including Apollo veteran Harrison Schmitt. Deployed to support field test in High Arctic Canada.
- 2003-2005 Limits of Life in the Atacama Research Assistant
Developed software for astrobiology field campaign in the Atacama Desert with a Mars-analog surface rover. Led development of "science on the fly" fluorescence detection and autonomous followup. Helped develop multi-process onboard software architecture, science web site, and panorama stitcher.

PUBLICATIONS

Journal Articles

- 1. Automatic Boosted Flood Mapping from Satellite Data.**
Brian Coltin, Scott McMichael, Trey Smith, and Terry Fong. *Int. J. Remote Sens.*, 37(5):993–1015, 2016.
- 2. Simulated real-time lunar volatiles prospecting with a rover-borne neutron spectrometer.**
Richard C. Elphic, Jennifer L. Heldmann, Margarita M. Marinova, Anthony Colaprete, Erin L. Fritzler, Robert E. McMurray, Stephanie Morse, Ted L. Roush, Carol R. Stoker, Matthew C. Deans, and Trey Smith. *Adv. Space Res.*, pp. 2438–2450, 2015.
- 3. Planetary Lake Lander--A Robotic Sentinel to Monitor Remote Lakes.**
Liam Pedersen, Trey Smith, Susan Y. Lee, and Nathalie A. Cabrol. *J. Field Robotics*, 2014.
- 4. Reusable science tools for analog exploration missions: xGDS Web Tools, VERVE, and Gigapan Voyage.**
Susan Y. Lee, David Lees, Tamar Cohen, Mark Allan, Matthew Deans, Theodore Morse, Eric Park, and Trey Smith. *Acta Astronaut.*, 90(2):268–288, Oct. 2013.
- 5. Life in the Atacama: Science Autonomy for Improving Data Quality.**
Trey Smith, David R. Thompson, David S. Wettergreen, Nathalie A. Cabrol, Kimberley A. Warren-Rhodes, and Shmuel J. Weinstein. *J. Geophys. Res. Biogeosciences*, 2007.

Book Chapters

- 1. Coordination of Heterogeneous Robots for Large-Scale Assembly.**
David Hershberger, Reid G. Simmons, Sanjiv Singh, Josue Ramos, and Trey Smith. In Tucker R. Balch and Lynne E. Parker, editors, *Robot Teams: From Diversity to Polymorphism*, A K Peters, 2002.
- 2. A Layered Architecture for Coordination of Mobile Robots.**
Reid G. Simmons, Trey Smith, M. Bernardine Dias, Dani Goldberg, David Hershberger, Anthony Stentz, and Robert Zlot. In Alan C. Schultz and Lynne E. Parker, editors, *Multi-Robot Systems: From Swarms to Intelligent Automata*, Kluwer, 2002.

Refereed Conference Papers

- 1. Astrobees: A New Platform for Free-Flying Robotics Research on the International Space Station.** Trey Smith, Jonathan Barlow, Maria Bualat, Terrence Fong, Christopher Provencher, Hugo Sanchez, Ernest Smith, and The Astrobees Team. In *Proc. Int. Symp. on AI, Robotics, and Automation in Space (ISAIRAS)*, 2016.
- 2. Smooth Trajectory Generation on SE(3) for a Free Flying Space Robot.**
Michael Watterson, Trey Smith, and Vijay Kumar. In *Proc. IEEE Int. Conf. Rob. Sys. (IROS)*, 2016.
- 3. Astrobees: Developing a Free-Flying Robot for the International Space Station.**
Maria Bualat, Jonathan Barlow, Terrence Fong, Chris Provencher, and Trey Smith. In

Proc. AIAA Space Forum, 2015.

- 4. Developing a 3-DOF Compliant Perching Arm for a Free-Flying Robot on the International Space Station.**
In-Won Park, Trey Smith, Sze Wun Wong, Pedro Piacenza, and Matei Ciocarlie. In *Proc. IEEE Int. Conf. Robotics Automation (ICRA)*, 2015.
- 5. Avionics and perching systems of free-flying robots for the International Space Station.**
Jongwoon Yoo, In-Won Park, Vinh To, Jason QH Lum, and Trey Smith. In *IEEE Int. Symp. Systems Eng. (ISSE)*, pp. 198–201, 2015.
- 6. Planetary Lake Lander: Adaptive Science Initial Results.**
Trey Smith, Susan Y. Lee, Liam Pedersen, Hadayat Seddiqi, Nathalie A. Cabrol, Edmond A. Grin, Ralph Lorenz, Jeffrey Moersch, Eric MacLennan, Victor Parro, Eric Wartenweiler Smith, Pablo Sobron, Cristian Tambley, Cody Thompson, and David S. Wettergreen. In *Proc. Lunar and Planetary Sci. Conf. (LPSC)*, 2014.
- 7. Real-Time Science Decision Support Tools: Development and Field Testing.**
Matthew C. Deans, Trey Smith, David S. Lees, Edward B. Scharff, and Tamar E. Cohen. In *Proc. Lunar and Planetary Sci. Conf. (LPSC)*, 2013.
- 8. Deglaciation and the Evolution of Planetary Lake Habitability.**
Nathalie A Cabrol, Edmond A Grin, Christopher Haberle, Jeffrey Edward Moersch, Robert E Jacobsen, Ruben Sommaruga, Erich Fleming, Angela M Detweiler, Alex Echeverria, Victor Parro, Yolanda Blanco, Luis Rivas, Cecilia Demergasso, Leslie Bebout, Guillermo Chong, Kevin Rose, Trey Smith, Liam Pedersen, Susan Lee, Terry Fong, David Wettergreen, and Cristian Tambley. In *Proc. Amer. Geophys. Union (AGU)*, 2012.
- 9. Planetary Lake Lander: Using Technology Relevant to Titan's Exploration to Investigate the Impact of Deglaciation on Past and Present Planetary Lakes.**
N. A. Cabrol, E. A. Grin, C. Haberle, J. E. Moersch, R. E. Jacobsen, R. Sommaruga, E. D. Fleming, A. M. Detweiler, A. Echeverria, Y. Blanco, L. A. Rivas, L. Pedersen, T. Smith, D. S. Wettergreen, C. Demergasso, V. Parro, T. Fong, G. Chong, and L. Bebout. In *Proc. Lunar and Planetary Sci. Conf. (LPSC)*, 2012.
- 10. Planetary Lake Lander: A Robotic Sentinel to Monitor Remote Lakes.**
Liam Pedersen, Trey Smith, Susan Y. Lee, Nathalie Cabrol, and Kevin Rose. In *Proc. Int. Conf. on AI, Robotics, and Automation in Space (iSAIRAS)*, 2012.
- 11. Field Testing Next-Generation Ground Data Systems for Future Missions.**
Matthew Deans, David Lees, Trey Smith, Tamar Cohen, Ted Morse, and Terry Fong. In *Proc. Lunar and Planetary Sci. Conf. (LPSC)*, Houston, TX, 2011.
- 12. Lunar Albedo Reconstruction of the Apollo 15 and 16 Zone.**
Ara Nefian, Trey Smith, Zachary Moratto, Taemin Kim, Ross Beyer, Michael Lundy, and Terry Fong. In *Proc. NLSI Lunar Science Forum*, 2011.
- 13. Robotic Follow-up for Human Exploration.**
Terrence W Fong, Maria Bualat, Matthew Deans, Byron Adams, Mark Allan, Martha Altobelli, Xavier Bouyssounouse, Tamar Cohen, Lorenzo Fluckiger, Joshua Garber, Elizabeth Palmer, Essam Heggy, Mark Helper, Kip Hodges, Jose Hurtado, Frank Jurgens, Tim Kennedy, Linda Kobayashi, Rob Landis, Pascal Lee, Susan Y. Lee, David Lees, Jason Lum, Mike Lundy, Tim Shin, Tod Milam, Estrellina Pacis, Eric Park, Liam Pedersen, Debra Schreckenghost, Trey Smith, Vinh To, Hans Utz, Dawn

Wheeler, and Kelsey Young. In *Proc. AIAA Space 2010*.

14. Planning Lunar Surface Traverses for Robotic Scouting Followed By Crew.

Matthew C. Deans, Michael Broxton, Terry Fong, Mark Helper, Kip V. Hodges, Gerald G. Schaber, Harrison H. Schmitt, and Trey Smith. In *Proc. Amer. Assn. Petroleum Geol. (AAPG)*, 2009.

15. Robotic Scouting for Human Exploration.

Matthew C. Deans, Terrence Fong, Mark Allan, Xavier Bouyssounouse, Maria Bualat, Lorenzo Flueckiger, Linda Kobayashi, Susan Lee, David Lees, Eric Park, Estrellina Pacis, Liam Pedersen, Debbie Schreckenghost, Trey Smith, Vinh To, and Hans Utz. In *Proc. AIAA Space*, 2009.

16. Traverse Planning for Robotic Recon and Human Exploration of Hadley Rille.

Terrence Fong, Michael Broxton, Matthew C. Deans, Mark Helper, Kip V. Hodges, Gerald G. Schaber, Harrison H. Schmitt, and Trey Smith. In *Proc. Lunar and Planetary Sci. Conf. (LPSC)*, 2009.

17. Field Testing of Utility Robots for Lunar Surface Operations.

Terrence Fong, Maria Bualat, Matt Deans, Mark Allan, Xavier Bouyssounouse, Michael Broxton, Laurence Edwards, Rick Elphic, Lorenzo Flückiger, Jeremy Frank, Leslie Keely, Linda Kobayashi, Pascal Lee, Susan Y. Lee, David Lees, Estrellina Pacis, Eric Park, Liam Pedersen, Debra Schreckenghost, Trey Smith, Vinh To, and Hans Utz. In *Proc. AIAA Space 2008*, 2008.

18. A Preliminary Examination of Science Backroom Roles and Activities for Robotic Lunar Surface Science.

Terrence Fong, Matthew Deans, Trey Smith, Pascal Lee, Jennifer Heldmann, Estrellina Pacis, Debra Schreckenghost, Rob Landis, John Osborn, David Kring, Essam Heggy, Andrew Mishkin, Kelly Snook, and Carol Stoker. In *Proc. NLSI Lunar Sci. Conf.*, 2008.

19. Information-Optimal Selective Data Return for Autonomous Rover Traverse Science and Survey.

David R. Thompson, Trey Smith, and David Wettergreen. In *Proc. IEEE Int. Conf. on Robotics and Automation*, 2008.

20. Generating Exponentially Smaller POMDP Models Using Conditionally Irrelevant Variable Abstraction.

Trey Smith, David R. Thompson, and David S. Wettergreen. In *Proc. Int. Conf. on Applied Planning and Scheduling (ICAPS)*, 2007.

21. Focused Real-Time Dynamic Programming for MDPs: Squeezing More Out of a Heuristic.

Trey Smith and Reid G. Simmons. In *Proc. Nat. Conf. on Artificial Intelligence (AAAI)*, 2006.

22. Autonomous Rover Detection and Response Applied to the Search for Life Via Chlorophyll Fluorescence in the Atacama Desert.

Trey Smith, David R. Thompson, Shmuel J. Weinstein, and David S. Wettergreen. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, March 2006.

23. Autonomous Detection of Novel Biologic and Geologic Features in Atacama

Desert Rover Imagery.

David R. Thompson, Trey Smith, and David S. Wettergreen. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, March 2006.

24. Searching for Life with Rovers: Exploration Methods and Science Results from the 2004 Field Campaign of the "Life in the Atacama" Project and Applications to Future Mars Missions.

Nathalie A. Cabrol, David S. Wettergreen, William L. Whittaker, Edmond A. Grin, Jeffrey E. Moersch, Guillermo Chong D., Charles S. Cockell, Peter Coppin, James M. Dohm, Gregory Fisher, Andrew N. Hock, Lucia Marinangeli, Edwin G. Minkley, Gabriele G. Ori, Jennifer L. Piatek, Alan Waggoner, Kimberley A. Warren-Rhodes, Shmuel J. Weinstein, Michael Wyatt, Francisco Calderón, Stuart Heys, Dominic Jonak, R. Allan Lüders, David Pane, Trey Smith, Kristen Stubbs, James P. Teza, Paul Tompkins, Daniel Villa, Christopher Williams, Michael D. Wagner, Geb Thomas, and Justin Glasgow. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, 2005.

25. Life in the Atacama Year 2: Geologic Reconnaissance Through Long-Range Roving and Implications on the Search for Life.

James M. Dohm, Nathalie A. Cabrol, Edmond A. Grin, Jeffrey E. Moersch, Guillermo Chong D., Charles S. Cockell, Peter Coppin, Gregory Fisher, Andrew N. Hock, Lucia Marinangeli, Edwin G. Minkley, Gabriele G. Ori, Jennifer L. Piatek, Kimberley A. Warren-Rhodes, Shmuel J. Weinstein, Michael Wyatt, Trey Smith, Michael D. Wagner, Kristen Stubbs, Geb Thomas, and Justin Glasgow. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, 2005.

26. Spectroscopic Results from the Life in the Atacama (LITA) Project 2004 Field Season.

Jennifer L. Piatek, Jeffrey E. Moersch, Michael Wyatt, Michael L. Rampey, Nathalie A. Cabrol, David S. Wettergreen, William L. Whittaker, Edmond A. Grin, Guillermo Chong D., Charles S. Cockell, Peter Coppin, James M. Dohm, Gregory Fisher, Andrew N. Hock, Lucia Marinangeli, Edwin G. Minkley, Gabriele G. Ori, Alan Waggoner, Kimberley A. Warren-Rhodes, Shmuel J. Weinstein, Dimitrios Apostolopoulos, Trey Smith, Michael D. Wagner, Kristen Stubbs, Geb Thomas, and Justin Glasgow. In *Proc. Lunar and Planetary Science Conf. (LPSC)*, 2005.

27. Point-Based POMDP Algorithms: Improved Analysis and Implementation.

Trey Smith and Reid G. Simmons. In *Proc. Int. Conf. on Uncertainty in Artificial Intelligence (UAI)*, 2005.

28. Concepts for Science Autonomy During Robotic Traverse and Survey.

Trey Smith, Scott Niekum, David R. Thompson, and David S. Wettergreen. In *Proc. IEEE Aerospace Conf.*, 2005.

29. Data Mining During Rover Traverse: From Images to Geologic Signatures.

David R. Thompson, Trey Smith, and David S. Wettergreen. In *Proc. Int. Symp. on Artificial Intelligence, Robotics and Automation in Space (iSAIRAS)*, September 2005.

30. Automatic Detection and Classification of Geological Features of Interest.

David R. Thompson, Scott Niekum, Trey Smith, and David S. Wettergreen. In *Proc. IEEE Aerospace Conf.*, March 2005.

31. Second Experiments in the Robotic Investigation of Life in the Atacama Desert of Chile.

David S. Wettergreen, Nathalie A. Cabrol, Vijayakumar Baskaran, Francisco Calderón, Stuart Heys, Dominic Jonak, R. Allan Lüders, David Pane, Trey Smith, James P. Teza, Paul D. Tompkins, Daniel Villa, Christopher Williams, and Michael D. Wagner. In *Proc. Int. Symp. on Artificial Intelligence, Robotics, and Automation in Space (iSAIRAS)*, 2005.

32. Heuristic Search Value Iteration for POMDPs.

Trey Smith and Reid G. Simmons. In *Proc. Int. Conf. on Uncertainty in Artificial Intelligence (UAI)*, 2004.

33. First Results in the Coordination of Heterogeneous Robots for Large-Scale Assembly.

Reid G. Simmons, Sanjiv Singh, David Hershberger, Josue Ramos, and Trey Smith. In *Proc. Int. Symp. on Experimental Robotics (ISER)*, 2000.

34. Recent Progress in Local and Global Traversability for Planetary Rovers.

Sanjiv Singh, Reid G. Simmons, Trey Smith, Anthony Stentz, Vandt Verma, Alexander Yahja, and Kurt Schwehr. In *Proc. IEEE Int. Conf. on Robotics and Automation (ICRA)*, 2000.

35. Autonomous Rovers for Mars Exploration.

Richard Washington, Keith Golden, John Bresina, David E. Smith, Corin Anderson, and Trey Smith. In *Proc. IEEE Aerospace Conf.*, 1999.

Refereed Workshop Papers

1. Exploring Planetary Lakes.

Nathalie A. Cabrol, Edmond A. Grin, Jeffrey E. Moersch, Robert E. Jacobsen, Ruben Sommaruga, Angela M. Detweiler, Alex Echeverria, Victor Parro, Angeles Aguilera, Luis Rivas, Cecilia Demergasso, Leslie Bebout, Kevin Rose, M Smith, Trey Smith, Eric Smith, Liam Pedersen, Susan Lee, Terry Fong, David S. Wettergreen, Zuki Tanaka, Ellen Stofan, and Cristian Tambley. In *Proc. NASA Ames Astrobiology Symp.*, 2013.

2. Science Autonomy in the Atacama.

Trey Smith. In *Proc. Int. Conf. on Machine Learning (ICML) Workshop on Machine Learning Technologies for Autonomous Space Applications*, 2003.

3. A Distributed Layered Architecture for Mobile Robot Coordination: Application to Space Exploration.

Dani Goldberg, Vincent Cicirello, M. Bernardine Dias, Reid G. Simmons, Stephen Smith, Trey Smith, and Anthony Stentz. In *Proc. Int. NASA Workshop on Planning and Scheduling for Space*, 2002.

4. Constructing and Clearing Combinatorial Auctions Using Preference Elicitation.

Trey Smith, Tuomas Sandholm, and Reid G. Simmons. In *Proc. Nat. Conf on Artificial Intelligence (AAAI) Workshop on Preferences in AI and CP*, 2002.

Technical Reports and Theses

1. Probabilistic Planning for Robotic Exploration.

Trey Smith. Ph.D. Thesis, The Robotics Institute, Carnegie Mellon University, Pittsburgh, PA, CMU-RI-TR-07-26, 2007.

2. Rover Science Autonomy: Probabilistic Planning for Science-Aware Exploration.

Trey Smith. 2004. Ph.D. thesis proposal, The Robotics Institute, Carnegie Mellon University.

3. Technology for Autonomous Space Systems.

Ashley Stroupe, Sanjiv Singh, Reid G. Simmons, Paul D. Tompkins, Vandii Verma, Regina Vitti-Lyons, and Michael D. Wagner. Technical Report CMU-RI-TR-00-02, The Robotics Institute, Carnegie Mellon University, 2001.

Other Publications

1. Future Directions in Multi-Robot Autonomy and Planetary Surface Construction.

Trey Smith, Reid G. Simmons, Sanjiv Singh, and David Hershberger. In *Proc. Space Studies Inst. Conf. (SSI)*, 2001.

OTHER PROFESSIONAL ACTIVITIES

Invited Talks and Panels

1. "GeoCam: Sharing Maps with Mobile Devices", Disaster Management Initiative Workshop, CMU Silicon Valley, May 2011.
2. "The GeoCam Disaster Response Project", FEMA Conference on GIS for Urban Search and Rescue, Boston, June 2010.
3. Invited panelist, Citizen Response and Social Networking Panel, Disaster Management Initiative Workshop, CMU Silicon Valley, March 2010.
4. "Disaster Response at NASA", Random Hacks of Kindness #0, Mountain View, CA, November 2009.
5. "Improving the Operating Picture During Natural Disasters", Tactical Fire Remote Sensing Advisory Committee Meeting, Boise, ID, November 2009.
6. "Using Google Earth for Exploration, Planetary Science, and Disaster Response", Scientific Applications with Google Earth Conference, Ann Arbor, MI, October 2008.
7. "The Google NASA Disaster Response Project", Google Geo Tech Talk, Mountain View, CA, April 2008.

Awards

1. NASA Honor Group Achievement Award for Mojave Volatiles Prospector Team, 2015.
2. NASA Ames Honor Group Achievement Award for Exploration Ground Data Systems Development Team, 2015.
3. NASA Ames Technology Transfer Software Release Award for the Crisis Mapping Toolkit v1, 2014.
4. NASA Honor Group Achievement Award for Planetary Lake Lander Team, 2014.
5. NASA Ames Honor Group Achievement Award for Pavilion Lake Research Project, 2014.
6. NASA Ames Honor Award for Exploration Ground Data Systems Project, 2013.
7. Led winning team, Google Hack for Change 2013, for the *Eat Healthy for Less* meal planning app to help people save money shopping and reach their nutritional goals.
8. NASA Ames Research Center Contractor Council Award for Planetary Lake Lander Project, 2013.
9. NASA Ames Research Center Ames Honor Award for Tech Transfer/Commercialization to the GeoCam Project team, 2010.
10. Random Hacks of Kindness First Prize to the *I'm OK!* team for prototype software to notify friends and family of your status after a natural disaster, 2009.
11. NASA Group Achievement Award to the Human-Robot Site Survey team, 2008.
12. NASA Graduate Student Research Program Fellowship (Ames Research Center), 2003-2005.
13. Carnegie Mellon University Honors in Computer Science and Mathematics, 1999.
14. Carnegie Mellon University Andrew Carnegie Scholarship, 1995-1999.

Conference Support

1. Program Committee, Int. Conf. on Applied Planning and Scheduling (ICAPS), 2008.
2. Program Committee, Int. Conf. on Machine Learning (ICML), 2008.
3. Co-Chair, Workshop on Advancements in POMDP Solvers, Nat. Conf. on Artificial Intelligence (AAAI), 2008.

NASA Field Tests Supported

1. Planetary Lake Lander, study of global warming impact on high-altitude lakes and planetary analog lake probe operations, deployed to Laguna Negra, Chile, 2011-2013.

2. In Situ Resource Utilization, lunar analog science rover operations at Pu'u Haiwahine, Mauna Kea, Hawaii, June 2012.
3. Desert Research and Technology Studies (D-RATS), inter-center study of NEO operations with astronauts and surface vehicles, supported ground control team in Houston, September 2011.
4. Pavilion Lake Research Project, NASA/CSA international study using submersibles and divers to investigate microbialites, deployed to Kelly Lake, BC, Canada, August 2011.
5. Haughton Mars Project, planetary analog robotic followup human precursor operations study, helped experiment design and software development, July 2011.
6. Haughton Mars Project, planetary analog robotic followup operations study, deployed to Devon Island, NT, Canada, August 2010.
7. Human Robot Systems Black Point Lava Flow Test, planetary analog robotic reconnaissance operations study, supported ground control team at Ames, September 2009.
8. Human Robot Systems Moses Lake Test, planetary analog robotic reconnaissance operations study, supported ground control team in Houston, June 2008.
9. Life in the Atacama Field Tests, robotic astrobiology study, deployed to Atacama Desert, Chile three times, 2003-2005.

Disaster Response Incidents Supported

1. Japan Tohoku Earthquake, March 2011. Provided mapping support to USA-1 and USA-2 Urban Search and Rescue teams deployed by USAID.
2. Chile Earthquake, February 2010. Provided *I'm OK!* software to World Bank staff in Chile.
3. Haiti Earthquake, January 2010. Sent phones to support mapping conditions on the ground by U.S. Military Southern Command.
4. Loma Fire, Santa Cruz County, California, Summer 2009. Deployed to provide phones, training, and mapping support for CAL FIRE response.
5. Guiberson Fire, Ventura County, California, Summer 2009. Deployed to provide phones, training, and mapping support for CAL FIRE response.
6. CAL FIRE Sonoma Air Attack Base, California, Summer 2009. Provided phones with GeoCam software over a month-long period to support transmitting live geotagged photos from initial air attack plane to the Emergency Command Center in St. Helena.
7. Basin Fire, Big Sur, California, 2008. Deployed to collect and map geotagged photos in support of the U.S. Forest Service response.

Teaching Assistantships

1. CMU 16-731 Introduction to Artificial Intelligence, instr. Andrew Moore, Spring 2003.
2. CMU 16-862 Introduction to Mobile Robot Programming, instr. Illah Nourbakhsh, Fall 1998.