

**Ernest R. Bell, Jr.**  
Planetary Analog Geophysicist  
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## EDUCATION

### ***PhD, Geology, 2021***

University of Maryland, College Park, MD

Dissertation title: Geophysical Exploration of Terrestrial and Lunar Volcanic Fields

Thesis topic: Seismic studies of volcanic flows and subsurface magmatic features. Magnetic studies and modeling of lava tubes.

Examination of application of operational aspects of terrestrial geophysical fieldwork to lunar exploration and prospecting.

### ***Coursework, Earth and Planetary Science, 2012-2015***

University of Houston Clear Lake, Houston, Texas

### ***MAS, Space Studies & Aerospace Management, 2008***

Embry Riddle Aeronautical University, Houston, Texas

Graduate research project: Evaluation of the Benefits of Skills Based Training for Extravehicular Activity (spacewalks).

### ***MS, Mechanical Engineering, 2002***

Carnegie Mellon University, Pittsburgh, Pennsylvania

Graduate project work: Experimental work to determine the coefficient of thermal expansion of biological cryopreservation fluids.

### ***BS, Mechanical Engineering, 1996***

Pennsylvania State University, Erie, PA

- Pennsylvania State University Honors Certificate, 1994

## FIELDWORK AND GEOLOGIC FIELD TRAINING

- 2021, *Potrillo Volcanic Field, Kilbourne Hole, NM*; NASA Goddard Space Flight Center & University of Maryland: NASA SSERVI GEODES terrestrial lunar analog field studies of co-located geophysical data sets (seismic, GPR, magnetic, & sample analysis).
- 2019, *San Francisco Volcanic Field, Arizona*; University of Maryland: PSTAR-2015, Seismic array studies of volcanic cinder deposits and magnetic survey of lava tubes simulating geophysical exploration of analog lunar features.
- 2019, *Hawaii, HI*; NASA Planetary Volcanology Field Workshop: Immersive field study of volcanic features analogous to those on the Moon and Mars.
- 2017, *San Francisco Volcanic Field, Arizona*; University of Maryland: PSTAR-2015, Seismic and magnetic surveying of subsurface volcanic field features including potential fault following feeder dikes and sills.
- 2018, 2017, *Lava Beds National Monument, California*; University of Maryland: PSTAR-2015, TubeX; Investigated strategies for lava tube characterization and exploration using magnetometry, geophones, ground penetrating radar, and LiDAR.
- 2016, *San Francisco Volcanic Field, Arizona*; University of Maryland: PSTAR-2015, Analog Field Deployments of Seismic Arrays; Investigated volcanic field features and planetary exploration techniques using seismic, GPR, and magnetometry.
- 2011, 2010, 2009, *San Francisco Volcanic Field, Arizona*; NASA Johnson Space Center: NASA Desert Research and Technology Studies; Conducted planetary analog missions as mission operations support and mission operations lead.
- 2011, *Los Alamos, NM*; NASA Johnson Space Center Volcanology and Field Mapping Workshop: Volcanology and geologic mapping field course tailored for planning, training, and executing lunar exploration surface science missions.

## LICENSES, CERTIFICATIONS, AND ADDITIONAL EXPERIENCE

- Federal Aviation Administration (FAA) Private Pilot License
- PADI Open Water SCUBA certification
- Former member: United States Coast Guard Auxiliary - Air Observer rating (active 2004 – 2010)
- Performed ~50 hours Neutral Buoyancy Lab suited extravehicular activity (spacewalk) simulations
- Conducted zero-gravity experiments onboard 27 reduced gravity aircraft flights

## WORK EXPERIENCE

### **Post-doctoral Research Associate, NASA SSERVI GEODES, 2021 to present**

NASA Goddard Space Flight Center, University of Maryland, Department of Astronomy, CRESST II, Greenbelt, MD

- Plan and execute geophysical fieldwork, using various instrumentation, on volcanic features such as lava flows, lava tubes, volcanic ash, and magma bodies as analogs for lunar surface exploration.
  - Specific instrumentation used includes seismometers, magnetometers, ground penetrating radar, gravimeters, 3-D laser (LiDAR) scanners, GPS, time synchronizers, and as well as other methods.
  - Develop computer models and analyze terrestrial field data to characterize the sub-surfaces of these sites and extrapolate the results to lunar surface investigations.
- Investigate operational concepts and strategies for the efficient geologic exploration of the lunar surface by planning, conducting, and analyzing data from geophysical studies on terrestrial analogs.
  - Determine tactics for optimizing hardware and crew asset management tracking.
  - Use these studies to inform the requirements for hardware technologies and operational strategies needed for astronauts, enhanced mobility hardware, and robotic assets for lunar surface exploration.
  - Examine field data from these lunar analogs to provide recommendations for mission control science team approaches for providing timely and applicable direction for facilitating real-time mission operations.

### **Graduate Research Assistant, 2015 to 2021**

University of Maryland, Department of Geology, College Park, MD

- Performed collaborative near-surface geophysical research on terrestrial lunar analogs including volcanic fields and lava tubes.
- Conducted extensive fieldwork with multi-disciplinary teams of scientists and engineers.
  - Performed geophysical surveys on remote volcanic fields, lava flows, and lava tubes.
  - Operated applicable instrumentation; such as seismometers, magnetometers, ground penetrating radar, gravimeters, 3-D laser (LiDAR) scanners, GPS, and time synchronizers; to gather geophysical data sets at remote field sites.
- Developed and applied innovative computer codes and modeling techniques to study geologic features and processes.
  - Analyzed geophysical data sets including seismic and magnetic field measurements.
  - Used geophysical properties and principles to form models for understanding near-surface geologic features, geologic evolutionary processes, and geomorphology.
- Applied terrestrial geophysical studies to the exploration of similar locations on the Moon.
  - Examined the operational aspects of terrestrial field geophysical techniques for application to human lunar exploration and prospecting operations.

### **NASA Space Station & Space Shuttle Flight Control Officer & Astronaut Trainer, 2003 to 2015**

NASA Johnson Space Center (SGT, Inc. & United Space Alliance), Houston, TX

- MISSION OPERATION CERTIFICATIONS:
  - Certified EVA Flight Controller (2012)
  - Certified EVA Maintenance Flight Controller (2009)
  - Certified EVA Systems Flight Controller (2007)
  - Certified EVA Systems Instructor (2006)
- EXTRAVEHICULAR ACTIVITIES FLIGHT CONTROLLER & INSTRUCTOR DUTIES:
  - Flight Control Officer for spacewalk, spacesuit, and airlock operations.
  - Provided real-time technical expertise for EVA systems and tasks operations plus problem recognition, troubleshooting, and resolution, to the Mission Control Center Flight Director during the execution of EVAs and maintenance activities.
  - Support on-orbit EVA operations in the Mission Control Center Multi-Purpose Support Room.
  - Author and review flight notes, technical requests, anomaly reports, flight rules, and crew procedures.
  - Provided pre-mission cross-discipline planning and team coordination in preparation for on-orbit crew activities including the development of spacewalk procedures, generation of technical documentation, and advanced logistics planning.
  - Provide crew and flight controller training on spacesuits, airlocks, EVA hardware, and EVA tasks using various simulators and part-task trainers including ISS mockups, vacuum chambers, Virtual Reality Laboratory, and Neutral Buoyancy Laboratory, to certify them for mission operations.

### **NASA Space Station & Space Shuttle Flight Control Officer & Astronaut Trainer (continued)**

- **MISSION ASSIGNMENTS:**
  - U.S. EVA 22, Radiator Grapple Bar Lead (2013)
    - Led EVA team in the coordination with program offices and mission operations for the EVA task planning and crew training for the International Space Station (ISS) Radiator Grapple Bar U.S. EVA.
    - Provided realtime coordination, within Mission Control, to the Flight Director during execution of the EVA.
  - International Space Station Expedition 28 EVA Lead (2011)
  - Space Shuttle Mission STS-133 EVA backup (2009-2011)
  - International Space Station Expedition 19 EVA Systems Lead (2008-2009)
  - Space Shuttle Mission STS-123 EVA Systems Lead (2007-2008)
  - Space Shuttle Mission STS-117 Lead EVA simulations instructor (2006-2007)
  - Space Shuttle Mission STS-116 EVA Systems Backup (2006)
  - International Space Station Expedition 12 EVA Systems Trainee (2004-2006)
- **ADDITIONAL ASSIGNMENTS:**
  - NASA Desert Research and Technologies Studies (Desert RATS) (2009 to 2012)
    - Mission Operations Lead (2010 and 2011)
    - Coordinated Mission Operations team architecture, procedures, flight rules, and protocol inputs with multiple organizations to develop test scenarios for field test campaigns simulating human space exploration missions, to the Moon and asteroids, to demonstrate techniques, mission architecture, and conceptual vehicles.
    - Deployed to the San Francisco Volcanic Field, AZ in 2009, 2010, and 2011 to support lunar analog field testing of space exploration mission scenarios and conceptual vehicles and hardware.
  - Flight controller part-task simulators
    - EVA Branch technical liaison for development and currency of flight controller trainer lesson plans.
    - Provide technical expertise to incorporate EVA training into various part task flight controller simulations.
  - ISS Testbed for Analog Research (ISTAR)
    - EVA Branch technical liaison for testing delayed communications operations concepts for future space exploration.

### **Space Station Systems Integration Engineer, 2003**

NASA Johnson Space Center (United Space Alliance), Houston, TX

- Member of Vehicle Integration, Performance, Environments, & Resources (VIPER) group in the Space Station Program Office.
- Performed technical assignments to categorize impacts to Space Station systems.

### **Test Facilities Operations Engineer, 1998 to 2001**

NASA Glenn Research Center (QSS Group, Dynacs Engineering Company, & NYMA), Cleveland, OH

- Cryogenic rocket propellant vacuum research facility test operations engineer
  - Directed and assisted with modifications, maintenance, and operation of the facility and the installation of test articles.
  - Conducted design, buildup, and operation of experiment hardware, including authoring test procedures.
- Microgravity test engineer: Designed research hardware and conducted experiments onboard NASA reduced gravity aircraft.

### **Design and Development Engineer, 1997 to 1998**

Oceaneering Space Systems, Houston, TX

- Developed and tested hardware and procedures to evaluate zero gravity methods for space station research hardware use.
- Coordinated scientific requirements and test results between the customer and development team.

### **Engineering Intern, summers of 1994 to 1996**

Delphi Packard Electric Division, Warren, OH

- Assignments in Departments of Industrial Engineering, Process Engineering, & Product Design.

## TEACHING EXPERIENCE

### **Teaching Assistant, Department of Geology** – University of Maryland, 2016

- Conduct geology labs in fundamentals of geology, geophysics, and geomorphology.

### **NASA Extravehicular Activities Trainer** – NASA Johnson Space Center, 2003 to 2015

- Conduct astronaut and flight controller training on spacesuits, airlock systems, and techniques for conducting spacewalks.
- Operate space station and space shuttle systems simulators to train, evaluate, and mentor new instructors and flight controllers.
- Create, review, and update lesson plans.

### **NASA Reduced Gravity Education Program Mentor** – NASA Johnson Space Center, 2008 to 2015

- Evaluated flight experiment proposals, and provided expertise to university teams in the design of experiment hardware.
- Assist in the execution of experiments onboard reduced gravity aircraft flights.

### **Teaching Assistant, Mechanical Engineering** – Carnegie Mellon University, 2001-2002

- Organized and conducted class recitations, labs, and design projects for heat transfer and fundamentals of engineering.

## HONORS, AWARDS, AND PROFESSIONAL ACTIVITIES

- NASA Review Panel, 2022
- NASA Lunar Surface Science Workshop, Science Enabled by Mobility, Session Assistant, 2020
- American Geophysical Union Fall Meeting, Analog Environments Session, Co-chair, 2020
- University of Maryland Ann G. Wylie Dissertation Fellowship, 2019
- Geologic Society of America, Travel Grant to present at Cordilleran Section Meeting, 2018
- Lunar and Planetary Institute Career Development Award, 2016
- NASA Review Board, Executive Secretary, 2016
- NASA Agency Team Award for Research into Autonomous Crew Mission Operations, 2013
- United Space Alliance, Quest for Excellence Award for Technical Achievement, 2013
- Alumni Guest Speaker, Jamestown Area High School Graduation, 2012
- NASA 'Go the Extra Mile (GEM)' Award, 2011
- Space Shuttle STS-123 Mission Plaque hanging - EVA team, 2008
- NASA Glenn Research Center, Facilities and Test Engineering Division Award, 2001
- Dynacs Company Performance Award, 2000
- Pennsylvania State University, Behrend College, Mechanical Engineering Senior Design Award, 1996
- Boy Scouts of America, Eagle Scout Award, 1988

## INVITED TALKS

University of Maryland, Information Studies 154 course, College Park, MD.

Title: Mission Control & EVA from LEO to Lunar, October 2020, March 2021, October 2021.

D.C. Regional Volcanology Workshop, sponsored by NASA Goddard Space Flight Center, Solar System Exploration Division, Planetary Dynamics Lab, Greenbelt, MD, Title: "Geophysical Characterization of Near Surface Volcanic Structure, An Analog to Lunar Exploration", February, 2018.

NASA Goddard Space Flight Center, Solar System Exploration Division, Planetary Dynamics Lab, Greenbelt, MD.

Title: "From Mission Control and the Space Station to Lunar Exploration on Earth", May, 2017.

University of Maryland, Geology 100 course, College Park, MD.

Title: "Space Exploration, From the Consoles of Mission Control to Planetary Analogs in the Desert", November 2016, April 2017.

## PEER REVIEWED PUBLICATIONS

**Bell E.**, Schmerr, N., Young, K., Esmaili, S., Garry, W.B., Jazayeri, S., Kruse, S., Richardson, J., Whelley, P. Field Mapping and Modeling of Terrestrial Lava Tube Magnetic Anomalies as an Analog for Lunar Lava Tube Exploration and Prospecting. *Journal of Geophysical Research: Planets, Special Issue: Exploring Planetary Caves as Windows into Subsurface Geology, Habitability, and Astrobiology*. In review 2022.

Esmaili S., Kruse S., Jazayeri S., Whelley P., **Bell E.**, Richardson J., Garry W.B., Young K. Resolution of Lava Tubes with ground penetrating radar: The TubeX project. *Journal of Geophysical Research: Planets*. 2020.

**Bell, E.** et al., Mission Control Team Structure & Operational Lessons Learned From the 2009 & 2010 NASA Desert RATS Simulated Lunar Exploration Field Tests. *Acta Astronautica. NASA Desert RATS Special Issue*, 2013.

Horz, F. **Bell, E.** et al., The Traverse Planning Process for Desert RATS 2010. *Acta Astronautica. NASA Desert RATS Special Issue*, 2013.

## ABSTRACTS

**Bell, E.**, Schmerr, N., Richardson, J., Wike, L., Braccia, C., Huang, H., Whelley, P., West, J., Rees, S., *Volcanic Maar Crater Co-Located Geophysical Survey Provides an Analog for Lunar Surface Science Operations*, NASA Exploration Science Forum, Boulder, CO, 2022.

Schmerr, N., Richardson, J., Young, K., Whelley, P., Wasser, M., Barry, C., **Bell, E.**, Braccia, C., Wike, L., Huang, H., Rees, S., West, J., Hurtado, J., Sweeney, T., Valenzuela, N., NASA Exploration Science Forum, Boulder, CO, 2022.

**Bell, E.**, Schmerr, N., Bleacher, J., Porter, R., Young, K., *Active Source Seismic Investigation of the San Francisco Volcanic Field Along Simulated Lunar Traverses*, Lunar and Planetary Science Conference, Houston, TX, 2022.

**Bell E.**, Schmerr, N., Feist, B., Richardson, J., Whelley, P., Young, K., *Recommendations for Real-Time Coordination for Artemis Lunar Surface Geophysical Science Investigations*, Lunar Surface Science Workshop, Structuring Real-Time Science Support of Artemis Crewed Operations, 2021.

Young, K., Bleacher, J., Graff, T., Glotch, T., Rogers, A., McAdam, A., Whelley, P., Richardson, J., Achilles, C., Knudson, C., Garry, W.B., Feist, B., Scheidt, S., Honniball, C., Morse, A., Nais, A., Coan, D., Rampe, E., Evans, C., **Bell, E.**, Schmerr, N., *The Importance of Incorporating Field Portable Instrumentation in Lunar Surface Exploration – And the Implications of Doing So*, Lunar Surface Science Workshop, Tools and Instruments for Surface Science, 2020.

Richardson, J., **Bell, E.**, Schmerr, N., Espley, J., Sheppard, D., Connor C., Whelley, P., Strauss, B., Young, K., *Magnetic Surveys to Probe the Lunar Subsurface*, Lunar Surface Science Workshop, Geophysics, 2020.

Eppler, D., Barker, D., **Bell, E.**, Bleacher, J., Evans, C., Graff, T., Head, J., Helper, M., Hodges, K., Hurtado, J., Klaus, K., Neal, C., Schmitt, H., Skinner, J., Tewksbury, B., Young, K., *Framework for Executing Lunar Scientific Exploration*, Lunar Surface Science Workshop, Lunar Surface Operations, 2020.

Richardson, J., Esmaili, S., Baker, D., Shoemaker, E., Kruse, S., Jazayeri, S., Whelley, P., Garry, W.B., **Bell, E.**, Young, K., Carter, L., Schmerr, N., *Prospecting Buried Resources with Ground Penetrating Radar*, Lunar Surface Science Workshop, Lunar Surface Operations, 2020.

**Bell, E.**, Schmerr, N., Garry, W.B., Porter, R., Richardson, J., Whelley, P., Young, K., *Terrestrial Seismic and Magnetic Field Studies of Volcanic Fields as an Analog to Lunar Surface Prospecting*, American Geophysical Union Fall Meeting, 2020.

**Bell, E.**, Schmerr, N., Young, K., Bleacher, J., Esmaili, S., Garry, W.B., Jazayeri, S., Kruse, S., Porter, R., Richardson, J., Whelley, P., *Magnetic Signatures of Terrestrial Lava Tubes as Analogs for Lunar Prospecting of Subsurface Features*, Lunar and Planetary Science Conference, Houston, TX, 2020.

Esmaili, S., Jazayeri, S., Kruse, S., Young, K., Garry, W. B., Whelley, P., & **Bell, E.**, Richardson, J., Grady-Weil, K., Alfred, S., (2019, December). Optimizing ground penetrating radar (GPR) Imaging of Lava Tubes: TubeX results on modeling and exploration strategies. In AGU Fall Meeting Abstracts.

**Bell, E.**, Schmerr, N., Bleacher, J., Young, K., Porter, R., Whelley, P., Garry, W.B., Kruse, S., Esmaili, S., Jazayeri, S., Richardson, J., West, J., Pettit, D., Rees, S., *Using Terrestrial Volcanic Fields as an Analog for the Geophysical Characterization of Potential Lunar Resources*, Lunar In-Situ Resource Utilization Workshop, Columbia, MD, 2019.

**Bell, E.**, Schmerr, N., Bleacher, J., Porter, R., Young, K., Richardson, J., West, J., Pettit, D., Rees, S., *Geophysical Characterization of a Volcanic Cinder Cone Field, An Analog to Lunar Exploration*, Lunar and Planetary Science Conference, Houston, TX, 2019.

## ABSTRACTS (continued)

**Bell, E.**, Schmerr, N., Bleacher, J., Porter, R., Young, K., Richardson, J., West, J., Rees, S., Pettit, D., *Using Earth Analogs of the Moon to Study Volcanic Fields and Prepare for Human Lunar Geophysical Exploration*, American Geophysical Union Fall Meeting, Washington D.C., 2018.

Eppler, D., Young, K., Bleacher, J., Klaus, K., Barker, D., Evans, D., Tewksbury, B., Schmitt, H., Helper, M., Hurtado, J., Deans, M., Yingst, A., Spudis, P., **Bell, E.**, Skinner, J., Cohen, B., Head, J., *Returning to the Moon: Building the Systems Engineering Base for Successful Science Missions*, New Views of the Moon 2 – Asia, 2018.

**Bell, E.**, Schmerr, N., Bleacher, J., Porter, R., Young, K., Richardson, J., Rees, S., Pettit, D., *Geophysical Examination of Volcanic Features and Processes with Lunar Science Operations Implications*, Geologic Society of America, Cordilleran Section 114<sup>th</sup> Meeting, Flagstaff, AZ, 2018.

**Bell, E.**, Schmerr, N., Young, K., Whelley, P., Garry, W., Kruse, S., Esmaeili, S., and Jazayeri S., *Characterization of Lava Tubes with Magnetometry*, Lunar and Planetary Science Conference, Houston, TX, 2018.

Young, K., Whelley, P., Kruse, S., Esmaeili, S., Jazayeri S., **Bell, E.**, Garry, W., Bleacher, J., and Schmerr, N., *Using GPR, LiDAR, Magnetometry, and In-Situ Geochemistry to Develop a Strategy for the Exploration and Characterization of Lava Tubes*, Lunar and Planetary Science Conference, Houston, TX, 2018.

Eppler, D., Bleacher, J., Bell, E., et al., *A Framework for Lunar Surface Science Exploration*, New Views of the Moon 2 Workshop, Munster, Germany, 2017.

**Bell, E.**, Schmerr, N., Bleacher, J., Porter, R., Young, K., Pettit, D., *Planetary Traverse Based Geophysical Field Analysis of San Francisco Volcanic Field Study Region*, GSA Cordilleran Section 113<sup>th</sup> Meeting, Honolulu, HI, 2017.

**Bell, E.**, Schmerr, N., Bleacher, J., Porter, R., Young, K., Pettit, D., *Planetary Analog Studies of Geophysical Field Techniques*, Lunar and Planetary Science Conference, Houston, TX, 2017.

Miller, M., Lim, D., Brady, A., Cardman, Z., **Bell, E.**, Garry, W., Reid, D., Chappell, S., Abercromby, A., *PLRP-3: Operational perspectives conducting science-driven extravehicular activity with communications latency*, IEEE Aerospace Conference, Big Sky MT, 2016.

**Bell, E.**, Schmerr, N., Plescia, J., *Numerical Simulations of Seismic Wave Propagation Within Asteroids*, Lunar and Planetary Science Conference, Houston, TX, 2016.

**Bell, E.**, Coan, D., *A Review of the Approach to ISS Increment Crew EVA Training*, AIAA Space 2007 Conference, Long Beach, CA, September 2007.

**Bell, E.**, Coan, D., Oswald, D., *A Discussion on the Making of an EVA: What it Really Takes to Walk in Space*, AIAA SpaceOps 2006 Conference, Rome, Italy, June 2006.

Coan, D., **Bell, E.**, *Essential Commonality for Effective Future Extravehicular Activity Operations*, AIAA SpaceOps 2006 Conference, Rome, Italy, June 2006.

**Bell, E.**, Oswald, D., *Past and Present Extravehicular Mobility Unit (EMU) Operational Requirements Comparison for Future Space Exploration*, AIAA Space 2005 Conference, Long Beach, CA, August 2005.