

## CURRICULUM VITAE

### **Nilton O. Renno**

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#### **EDUCATION**

1994-1995 **Caltech**, Pasadena, CA. Research Fellow in Planetary Sciences  
1993-1994 **LLNL**, Livermore, CA. Postdoctoral Scholar  
1992-1993 **MIT**, Cambridge, MA. Postdoctoral Associate  
1986-1992 **MIT**, Cambridge, MA. Ph.D. in Atmospheric Sciences  
1979-1983 **UNICAMP**, Campinas, Brazil. BS in Civil Engineering

#### **EMPLOYMENT**

2008-Present **Professor**, Climate and Space Sciences & Engineering (CLASP), U. Michigan  
(Also Applied Physics)  
2002-2008 **Associate Professor**, Atmospheric, Oceanic & Space Sciences, U. Michigan  
2006 **Visiting Scholar**, Department of Physics (AOPP), University of Oxford, UK  
2002-2005 **Adjunct Professor**, Department of Planetary Sciences, U. Arizona  
2001-2002 **Associate Professor**, Department of Planetary Sciences, U. Arizona  
2001-2002 **Associate Professor**, Department of Atmospheric Sciences, U. Arizona  
1995-2001 **Assistant Professor**, Department of Atmospheric Sciences, U. Arizona

#### **SERVICE**

2017-Present **Member**, NAS Committee on Strategy to Search for Life in the Universe  
2017-Present **Member**, Advisory Council, Space Physics Research Laboratory  
2017-Present **Member**, Safety Committee, College of Engineering, U. Michigan  
2017-Present **Member**, Department Chair Search Committee, CLASP, U. Michigan  
2017-Present **Member**, Promotion Committee, CLASP, U. Michigan  
2017 **Chair**, European Science Foundation's Europlanet Review Panel  
2017 **Member**, LPSC Europa Lander Executive Committee  
2017 **Member**, U. Michigan Space Institute Creation Committee  
2016-2017 **Member Org Committee**, Searching for Life Across Space and Time  
2016-Present **Chief Technology Officer**, Intelligent Vision Systems LLC  
2016-Present **Member**, CLASP Strategic Planning Committee  
2016-Present **Member**, CoE Space Center Planning Committee  
2016 **Member**, European Science Foundation's Europlanet Review Panel  
2015-Present **Co-Teaching** with Donald C. Winter former U.S. Secretary of the Navy  
2015-2016 **Mentor**, Atlanta University Center Dual Degree Engineering Program  
2015 **Briefed** US House of Representative Science Committee Staff  
2015 **Served** on the University of Michigan Faculty Grievance Hearing Board  
2015 **Briefed** COSPAR's Planetary Protection Panel on behalf of ESF/NRC  
2015 **Chaired** Oral Ph.D. Qualify Examination  
2015 **Technology Officer**, Premier Utility Services LLC  
2014-2017 **Member**, Northrop Grumman's VAMP Science Advisory Board  
2014-2016 **Member**, College of Engineering's Faculty Grievance Hearing Panel  
2014-2015 **Member**, ESF/NRC Mars Special Regions Review Committee

2014 **Chair**, AOSS Ph.D. Qualify Examination Committee  
 2014 **Member**, NASA Atmospheric Science Panel  
 2013-2015 **CEO**, Electric Field Solutions Inc.  
 2013-Present **Member**, AOSS Development Committee  
 2013-2015 **Member**, CoE Cross-Departmental Design Committee  
 2013-Present **Member**, Advisory Board, Fundação Imprensa  
 2013 **Co-Chair**, AOSS Ph.D. Qualify Examination Committee  
 2012-Present **Chair**, CLASP Masters Program  
 2012-Present **Director**, Master of Engineering Program in Space Engineering  
 2012 **Member**, NASA Discovery 2010 Transition Team  
 2012 **Member**, NASA Discovery 2010 Downselect Panel  
 2011-2015 **Chief Technology Officer**, Electric Field Solutions Inc.  
 2009-2011 **Member**, CoE International Programs in Engineering  
 2007-2011 **Member**, CoE Multidisciplinary Design Minor Steering Committee  
 2007-2008 **Member**, NASA Student Collaboration Program Definition Team  
 2001-2007 **Member**, NRC Research Associateship Review Committee  
 2001-2003 **Member**, Mars Exploration Rovers Atmospheric Sciences Advisory  
 Committee  
 2000-2002 **Associate Director**, Arizona Space Grant Consortium  
 2000-2002 **Chair**, University of Arizona Student Satellite Program Steering Committee  
 2001-2002 **Co-Chair**, NASA National Space Grant Student Satellite Program Steering  
 Committee

#### **MEMBERSHIPS (current and past)**

American Astronomical Society (**AAS**)  
 American Geophysical Union (**AGU**)  
 American Institute of Aeronautics and Astronautics (**AIAA**)  
 American Meteorological Society (**AMS**)  
 Institute of Physics, UK (**IOP**)  
 International Society for Optics and Photonics (**SPIE**)  
 American Meteorological Society (**AMS**)  
 Organisation Scientifique et Technique Internationale du vol a Voile (**OSTIV**)

#### **MISSION INVOLVEMENT**

**2011 NASA Mars Science Laboratory Mission**, Co-Investigator  
**Phoenix 2007 NASA Mars Scout Mission**, Co-Investigator and Lead of the  
 Atmospheric Science Theme Group  
**ExoMars EDM**, Co-Investigator  
**MetNet Mars Missions**, Co-Investigator

#### **INVENTIONS**

Ice-Crystals and Volcanic Ash Hazards Detection System, **Patent Pending**  
 Aircraft Icing Detector, **U.S. Patent No. 9,302,777 B2**  
 Ice and Supercooled Water Detection System, **U.S. Patent No. 9,297,755 B2**  
 Ice and Water Detection System, **U.S. Patent No. No. 9,304,081 B2**  
 Rotating Electric Field Sensor, **U.S. Patent No. 8,536,879**

Prandtl System for Atmospheric Static and Stagnation Pressure Measurements  
Picosatellite for Electric Field Measurements  
Balloon Deployment Systems  
Controller for Atmospheric Vortex Engine

**AWARDS (including to students)**

- 2017 University of Michigan Rackham Master's Mentor Award for "Impressive and Inspiring mentorship."
- 2017 NASA Honors Award "For exceptional technical innovations and execution of rover surface operations leading to numerous, profound new discoveries about the ancient climate and habitability of Mars" as part of the MSL Extended Mission-1 Science and Operations Team.
- 2016 Nominated by students to the Golden Apple Teaching Award "Very open and responsive to students and is always ready to give student concerns priority."
- 2015 Nominated by students to the Golden Apple Teaching Award "Outstanding mentor and takes his OWN initiative to motivate students to succeed."
- 2015 Nominated by TV Globo staff to Prêmio Faz Diferença.
- 2015 NASA Group Achievement Award as member of the MSL Prime Mission Science and Operations Team "For exceptional technical innovations in rover surface operations leading to significantly improved Mars Science Laboratory prime mission performance and science return."
- 2013 NASA Group Achievement Award as member of the Curiosity Rover "For exceptional achievement defining the REMS scientific goals and requirements, developing the instrument suite and investigation, and operating REMS successfully on Mars."
- 2013 The Space Foundation John L. "Jack" Swigert Jr. Award for Space Exploration as member of the Mars Science Laboratory Team "For its aggressive and technologically advanced exploration of another planet."
- 2013 The American Institute of Aeronautics and Astronautics (AIAA) Foundation's Award for Excellence as member of the Mars Science Laboratory Team "For significant accomplishment in space exploration, inspiring global fascination with space."
- 2013 The National Aeronautic Association 2012 Robert J. Collier Trophy as member of the Mars Science Laboratory Team "In recognition of the extraordinary achievements of successfully landing Curiosity on Mars, advancing the nation's technological and engineering capabilities, and significantly improving humanity's understanding of ancient Martian habitable environments."
- 2012 Time Tech's Best Invention of the Year as member of the Curiosity Mars Rover Team
- 2012 President's Postdoctoral Fellowship to Christine Hartzell
- 2012 National Academies Christine Mirzayan Science and Technology Policy Graduate Fellowship to Chase Estrin
- 2011 Named Ambassador of the "Município de São José dos Campos, SP, Brazil."

2010-2011 Monroe-Brown Foundation Research Excellence Award “For his many accomplishments as a multidisciplinary scientist that include being the leader of the Phoenix Mars Mission’s Atmospheric Science Theme Group that found liquid water on Mars; his work with dust devils that has led to his invention of miniature field sensors used in climate studies; and his outstanding work with both undergraduate and graduate students. Nilton’s Mars atmospheric research has brought him international recognition in both the theoretical and experimental communities.”

2010 Finalist to the University of Michigan Provost’s Teaching Innovation Prize

2009 NASA Group Achievement Award as member of the Phoenix Project Science Development Team “For outstanding performance in the planning for the execution of the science for the Phoenix mission”

2009 NASA Group Achievement Award as member of the Phoenix Development and Mission Team “For outstanding achievement in the development and operation of the Phoenix spacecraft leading to the first landing in the Martian arctic”

2009 Ph.D. Student Jasper Kok was selected to be the University of Michigan’s Single Nominee for the National “Council for Graduate Schools/University Microfilms International (UMI) Distinguished Dissertation Award” in Mathematics, Physical Sciences, and Engineering

2009 Ph.D. Student Jasper Kok received the University of Michigan Rackham Graduate School Distinguished Dissertation Award (8 Ph.D. dissertations out of about 800 receives this honor)

1<sup>st</sup> Place on the AFRL OSU-UM 2009 Challenge as Mentor to the Eng 450 Team

2009 John L. "Jack" Swigert, Jr., Award for Space Exploration as member of the Phoenix Mars Mission Team

2008 Popular Mechanics Magazine Breakthrough Award for Innovation as member of the Phoenix Mars Mission Team

2008 Popular Science Magazine's 2008 "Best of What's New" Grand Award in the aviation and space category as member of the Phoenix Mars Mission Team

2008 National Space Club Astronautics Engineer Award as member of the Phoenix Mars Mission Team

2008 Civil Space Award from the California Space Authority as member of the Phoenix Mars Mission Team

2008 Rackham Predoctoral Fellowship (to Jasper Kok)

2007 and 2008 Arizona Governor's Innovator of the Year Award as member of the Phoenix Mars Mission Team

2007 AGU Fall Meeting, Outstanding Student Paper Award as mentor to Jasper Kok

1<sup>st</sup> Place on NASA RASC-AL 2007 as Mentor to the Eng 450 Mars Balloon Team

2006 UM/MGU, 1<sup>st</sup> place as mentor to Jasper Kok

2<sup>nd</sup> Place on NASA RASC-AL 2006 as Mentor to the Eng 450 Mars Balloon Team

NASA Institute of Advanced Concepts 2005 as mentor to Aimee Covert

2<sup>nd</sup> Place on NASA RASC-AL 2005 as Mentor to the UM Mars Rover Team

2005 UM/MGU, 1<sup>st</sup> place on oral presentation as mentor to Jasper Kok

2005 UM/MGU, 1<sup>st</sup> place on poster presentation as mentor to Jacquelin Koch

## **GRADUATE STUDENTS**

### **Ph.D. Students**

1. Dr. Enio P. Souza (Professor, UFPb, Brazil)
2. Dr. David K. Adams (Professor, Universidad Nacional Autónoma de México, México City, Mexico)
3. Dr. Nadia Vinogradova (Artist)
4. Dr. Jacquelin Koch (Lecturer, Hope College, MI)
5. Rapporteur for Dr. Pierre-Yves Meslin (Assistant Professor, Université Paul Sabatier, Toulouse, France)
6. Dr. Jasper Kok (Assistant Professor, UCLA)
7. Dr. Manish Mehta (NASA MSFC)
8. Shintaro Taniguchi (U. Hawaii)
9. Dr. Douglas Halleaux (US Army)
10. J. Michael Newman (NASA GRC)
11. Rapporteur for Dr. Alvaro de Vicente-Retortillo (University Complutense)
12. Rapporteur for Dr. Gregoire Deprez (University of Paris VI)
13. Harvey Elliott (Current)
14. Erik Fischer (Current)
15. David Sweeney (Current)

### **Master Students**

1. Mentored more than a 100 Master of Engineering in Space Engineering students since January 2012
2. Matthew Burkett (High School Teacher, Phoenix, AZ)
3. Ronald A. Mastaler (Research Associate, U. Arizona)
4. Daniel Rovey (Raytheon)
5. Charles Yana (CNES)
6. Brian Russell (California Environmental Protection Agency)
7. Kevin Rogers (Lockheed Martin)
8. Rachael McKay (Lockheed Martin)
9. Bruno Scarpelli (Private Industry in Brazil)
10. Shintaro Taniguchi (U. Hawaii)
11. Josh Adamson (Northrop Grumman)
12. Fernando Saca (UM)
13. Harvey Elliott (UM)
14. Chase Estrin (Orbital ATK)
15. Neeti Banerjee (UM)
16. Erik Fischer (UM)
17. Max Riekeles (TU Berlin)
18. Wayne Lester (UM)

### **Undergraduate Students**

Dozens of UROP and REU Students

## GRADUATE AND POSTDOCTORAL ADVISORS

Kerry A. Emanuel and Peter H. Stone, MIT  
Andrew Ingersoll, Caltech

## JOURNAL PUBLICATIONS

1. Borlina, Caue S., and **Nilton O. Rennó**, 2017. The Impact of a Severe Drought on Dust Lifting in California's Owens Lake Area. *Nature Reports*, doi: 10.1038/s41598-017-01829-7.
2. Vicente-Retortillo, Á., G.M. Martínez, **N.O. Renno**, M.T. Lemmon and M. Torre-Juárez, 2017. Determination of dust aerosol particle size at Gale Crater using REMS UVS and Mastcam measurements. *Geophys. Res. Lett.*, doi: 10.1002/2017GL072589.
3. Martínez, G.M., A. De-Vicente-Retortillo, A.G. Fairén, E. Fischer, S. D. Guzewich, R. M. Haberle, Henrik Kahanpää, O. Kemppinen, M. Lemmon, C. Newman, **N. Renno**, M. Richardson, M.D. Smith, M. Torre-Juárez and A. Vasavada, 2017. Characterization of the Martian Climate: A review of in-situ data from Viking to Curiosity. *Space Science Review*, doi: 10.1007/s11214-017-0360-x.
4. Esposito, F., S. Debei, C. Bettanini, C. Molfese, I. Arruego Rodríguez, G. Colombatti, A-M. Harri, F. Montmessin, C. Wilson, A. Aboudan, P. Schipani, L. Marty, F.J. Álvarez, V. Apestigue, G. Bellucci, J-J. Berthelier, J. R. Brucato, S. B. Calcutt, S. Chiodini, F. Cortecchia, F. Cozzolino, F. Cucciarrè, N. Deniskina, G. Déprez, G. Di Achille, F. Ferri, F. Forget, G. Franzese, E. Friso, M. Genzer, R. Hassen-Kodja, H. Haukka, M. Hieta, J. J. Jiménez, J-L. Josset, H. Kahanpää, O. Karatekin, G. Landis, L. Lapauw, R. Lorenz, J. Martinez-Oter, V. Mennella, D. Möhlmann, D. Moirin, R. Molinaro, T. Nikkanen, E. Palomba, M.R. Patel, J-P. Pommereau, C.I. Popa, S. Rafkin, P. Rannou, **N.O. Renno**, J. Rivas, W. Schmidt, E. Segato, S. Silvestro, A. Spiga, D. Toledo, R. Trautner, F. Valero, L. Vázquez, F. Vivat, O. Witasse, M. Yela, R. Mugnuolo, E. Marchetti, S. Pirrotta, 2017. The DREAMS experiment onboard the Schiaparelli Module of the ExoMars 2016 mission: Design, performances and expected results. *Space Science Review*, Submitted.
5. Fischer, E., G. M. Martínez, **N. O. Rennó**, 2016. Formation and persistence of liquid brine in the Martian polar region: Experimental analysis throughout the diurnal cycle at the Phoenix landing site. *Astrobiology*, 16, doi: 10.1089/ast.2016.1525.
6. Rettberg, Petra, Alexandre Anesio, Victor Baker, John Baross, Sherry Caddy, Emmanouil Detsis, Christine Foreman, Ernst Hauber, Gian Gabrielle Ori, David Pearce, **Nilton Renno**, Gary Ruvkun, Birgit Sattler, Mark Sauders, David Smith Dirk Wagner, Frances Westall, 2016. Planetary Protection and Mars Special Regions –A Suggestion for Updating the Definition. *Astrobiology Magazine*, 16, doi: 10.1089/ast.2016.1472.
7. Harrison, R.G., E. Barth, F. Esposito, J. Merrison, F. Montmessin, K.L. Aplin, C. Borlina, J.J. Berthelier, G. Déprez, W.M. Farrell, I.M.P. Houghton, **N.O. Renno**, K.A. Nicoll, S.N. Tripathi, M. Zimmerman, 2016. Applications of

- electrified dust and dust devil electrodynamics to Martian atmospheric electricity. *Space Science Review*, 203, doi:10.1007/s11214-016-0241-8.
8. Kurgansky, M.V., R.D. Lorenz, **N. O. Renno**, T. Takemi, Z. Gu, W. Wei, **2016**. Dust Devil Steady-State Structure from a Fluid Dynamics Perspective. *Space Science Review*, 203, doi: 10.1007/s11214-016-0281-0.
  9. Martínez, G. M., E. Fischer, **N. O. Rennó**, E. Sebastián, O. Kempainen, N. Bridges, C. S. Borlina, P-Y. Meslin, M. Genzer, A-H. Harri, A. Vicente-Retortillo, M. Ramos, M. de la Torre Juárez, F. Gómez, J. Gómez-Elvira, **2016**. Likely frost events at Gale crater: Analysis from MSL/REMS measurements. *Icarus*, doi:10.1016/j.icarus.2015.12.004.
  10. Francisco Martín-Torres, María-Paz Zorzano, Patricia Valentín-Serrano, Ari-Matti Harri, Maria Genzer, Osku Kempainen, Edgard G. Rivera-Valentin, Insoo Jun, James Wray, Morten Bo Madsen, Walter Goetz, Alfred S. McEwen, Craig Hardgrove, **Nilton Renno**, Vincent F. Chevrier, Michael Mischna, Rafael Navarro-González, Jesús Martínez-Frías, Pamela Conrad, Tim McConnochie, Charles Cockell, Gilles Berger, Ashwin R. Vasavada, Dawn Sumner, and David Vaniman, **2015**. Transient liquid water and water activity at Gale crater on Mars. *Nature Geoscience*, **8**, 357-361, doi:10.1038/ngeo2412.
  11. John E. Moores, Mark T. Lemmon, Henrik Kahanpää, Scot C. R. Rafkin, Raymond Francis, University of Western Ontario, Jorge Pla-Garcia, Keri Bean, Robert Haberle, Claire Newman, Michael Mischna, Ashwin R. Vasavada, Manuel de la Torre Juárez, **Nilton Rennó**, Jim Bell, Fred Calef, Bruce Cantor, Timothy H. Mcconnochie, Ari-Matti Harri, Maria Genzer, Michael Wong, Michael D. Smith, F. Javier Martín-Torres, María-Paz Zorzano, Osku Kempainen, Emily McCullough, **2015**. Observational evidence of a suppressed planetary boundary layer in northern Gale Crater, Mars as seen by the Navcam instrument onboard the Mars Science Laboratory rover, *Icarus*, 249, 129-142, doi:10.1016/j.icarus.2014.09.020.
  12. Harri, A.-M, M. Genzer, O. Kempainen, J. Gomez-Elvira, R. Haberle, J. Polkko, H. Savijarvi, **N. Renno**, J. A. Rodriguez-Manfredi, W. Schmidt, M. Richardson, T. Siili, M. Paton, M. De La Torre-Juarez, T. Makinen, C. Newman, S. Rafkin, M. Mischna, S. Merikallio, H. Haukka, J. Martin-Torres, M. Komu, M.-P. Zorzano, V. Peinado, L. Vazquez. and R. Urqui, **2014**. Mars Science Laboratory Relative Humidity Observations: Initial Results, *J. Geophys. Res.*, doi: 10.1002/2013JE004514.
  13. Fischer, E., G.M. Martinez, H.M. Elliott, **N.O. Renno**, **2014**. Experimental Evidence for Deliquescence on Mars. *Geophys. Res. Lett.*, 41, doi:10.1002/2014GL060302.
  14. Halleaux, D. and **N. O. Renno**, **2014**. Aerosols–climate interactions at the Owens “Dry” Lake, California. *Aeolian Res.*, 15, 91-100, doi:10.1016/j.aeolia.2014.08.004.
  15. R. E. Arvidson, P. Bellutta, F. Calef, A. A. Fraeman, J. B. Garvin, O. Gasnault, J. A. Grant, J. P. Grotzinger, V. E. Hamilton, M. Heverly, K. A. Iagnemma, J. R. Johnson, N. Lanza, S. Le Mouélic, N. Mangold, D. W. Ming, M. Mehta, R. V. Morris, H. E. Newsom, **N. Rennó**, D. Rubin, J. Schieber, R.

- Sletten, N. T. Stein, F. Thuillier, A. R. Vasavada, J. Vizcaino and R. C. Wiens, **2014**. Terrain Physical Properties Derived From Orbital Data and the First 360 Sols of Mars Science Laboratory Curiosity Rover Observations in Gale Crater. *J. Geophys. Res.*, doi:10.1002/2013JE004605.
16. N. T. Bridges, F. J. Calef, B. Hallet, K. E. Herkenhoff, N. L. Lanza, S. Le Mouélic, C. E. Newman, D. L. Blaney, M. A. de Pablo, G. A. Kocurek, Y. Langevin, K. W. Lewis, N. Mangold, S. Maurice, P.-Y. Meslin, P. Pinet, **N. O. Renno**, M. S. Rice, M. E. Richardson, V. Sautter, R. S. Sletten, R. C. Wiens and R. A. Yingst, **2014**. The rock abrasion record at Gale Crater: MSL results from Bradbury Landing to Rocknest *J. Geophys. Res.*, doi: 10.1002/2013JE004579.
17. A.-M. Harri, M. Genzer, O. Kempainen, H. Kahanpää, J. Gomez-Elvira, J. A. Rodriguez-Manfredi, R. Haberle, J. Polkko, W. Schmidt, H. Savijärvi, J. Kauhanen, E. Atlaskin, M. Richardson, T. Siili, M. Paton, M. de la Torre Juarez, C. Newman, S. Rafkin, M. T. Lemmon, M. Mischna, S. Merikallio, H. Haukka, J. Martin-Torres, M.-P. Zorzano, V. Peinado, R. Urqui, A. Lapinette, A. Scodary, T. Mäkinen, L. Vazquez, N. Rennó and the REMS/MSL Science Team, **2014**. Pressure observations by the Curiosity rover: Initial results, *J. Geophys. Res.*, doi: 10.1002/2013JE004423.
18. R. M. Haberle, J. Gómez-Elvira, M. de la Torre Juárez, A.-M. Harri, J. L. Hollingsworth, H. Kahanpää, M. A. Kahre, M. Lemmon, F. J. Martín-Torres, M. Mischna, J. E. Moores, C. Newman, S. C. R. Rafkin, **N. Rennó**, M. I. Richardson, J. A. Rodríguez-Manfredi, A. R. Vasavada, M.-P. Zorzano-Mier and REMS/MSL Science Teams, **2014**. Preliminary interpretation of the REMS pressure data from the first 100 sols of the MSL mission, *J. Geophys. Res.*, doi: 10.1002/2013JE004488.
19. Martínez, G.M., **N. Rennó**, E. Fischer, C. S. Borlina, B. Hallet, M. de la Torre Juárez, A. R. Vasavada, M. Ramos, V. Hamilton, J. Gomez-Elvira and R. M. Haberle, **2014**. Surface energy budget and thermal inertia at Gale Crater: Calculations from ground-based measurements, *J. Geophys. Res.*, doi:10.1002/2014JE004618.
20. Javier Gómez-Elvira, Carlos Armiens, Isaiás Carrasco, Maria Genzer, Felipe Gómez, Robert Haberle, Victoria E. Hamilton, Ari-Matti Harri, Henrik Kahanpää, Osku Kempainen, Alain Lepinette, Javier Martín Soler, Javier Martín-Torres, Jesús Martínez-Frías, Michael Mischna, Luis Mora, Sara Navarro, Claire Newman, Miguel A. de Pablo, Verónica Peinado, Jouni Polkko, Scot C. R. Rafkin, Miguel Ramos, **Nilton O. Rennó**, Mark Richardson, José A. Rodríguez-Manfredi, Julio J. Romeral Planelló, Eduardo Sebastián, Manuel de la Torre Juárez, Josefina Torres, Roser Urquí, Ashwin R. Vasavada, José Verdasca and María-Paz Zorzano, **2014**. Curiosity's rover environmental monitoring station: Overview of the first 100 sols, *J. Geophys. Res.*, doi: 10.1002/2013JE004576.
21. Meslin, P.-Y., O. Gasnault, O. Forni, S. Schröder, S. Clegg, G. Berger, J. Lasue, A. Cousin, S. Le Mouélic, S. Maurice, N. Mangold, C. Fabre, R. Wiens, B. Ehlmann, P. Pinet, N. Lanza, R. Anderson, D. Archer, D. Bish, D. Blake, D. Blaney, N. Bridges, B. Clark, G. Dromart, M.D. Dyar, M. Fisk, W.



- Goetz, K. Herkenhoff, J.-L. Lacour, Y. Langevin, L. Leshin, E. Lewin, M. Madsen, H. Newsom, A. Ollila, E. Rampe, **N. Rennó**, V. Sautter, J.-B. Sirven, L. d’Uston, D. Vaniman, and the MSL Science Team, **2013**. Soil diversity and hydration as observed by ChemCam at Gale crater –Mars, *Science*, 341, doi: 10.1126/science.1238670.
- 22. Halleaux, D.** and **N. O. Renno**, **2013**. The Michigan Prandtl System: An instrument for accurate pressure measurements in convective vortices. *J. Atmos. Ocean. Tech.*, 30, 2426-2433.
- 23. Mehta, M.**, A. Sengupta, **N.O. Renno**, J.W. Van Norman, P.G. Huseman, D.S. Gulick, M. Pokora, **2013**. Thruster Plume Surface Interactions: Applications for Spacecraft Landings on Planetary Bodies. *AIAA Journal*, in press, doi: 10.2514/1.J052408.
- 24. Seran, E.**, M. Godefroy, **N. Renno**, and **E. Elliott**, **2013**. Variations of electric field and electric resistivity of air caused by dust motion, *J. Geophys. Res.*, **118**, 5358–5368, doi:10.1002/jgra.50478.
- 25. Haberle, R.M.**, J. Gomez-Elvira, E. Atlaskin, J.R. Barnes, M. De La Torre Juarez, J.L. Hollingsworth, M.A. Kahre, J. Kauhanen, J. Martin-Torres, M. Mischna, C. Newman, M. Paz Zorzano, S.C.R. Rafkin, **N. Renno**, M.I. Richardson, H. Savijärvi, J. Schaeffer, D. Tyler, A.R. Vasavada, and the REMS Team, **2013**. Meteorological Predictions for the REMS Experiment on MSL. *Space Sci. Rev.*, in press.
- 26. Rennó, N. O.**, E. Williams, D. Rosenfeld, D. G. Fischer, J. Fischer, T. Kremic, A. Agrawal, M. O. Andreae, R. Bierbaum, R. Blakeslee, A. Boerner, N. Bowles, H. Christian, J. Dunion, A. Horvath, X. Huang, A. Khain, S. Kinne, M. C. Lemos, J. E. Penner, U. Pöschl, J. Quaas, E. Seran, B. Stevens, T. Walati, T. Wagner, **2013**. CHASER: An Innovative Satellite Mission Concept to Measure the Effects of Aerosols on Clouds and Climate. *Bull. Amer. Meteor. Soc.*, 94, 685-694.
- 27. Martinez, G.** and **N. O. Rennó**, **2013**. Water and Brines on Mars: Current Evidence and Implications for MSL. *Space Sci. Rev.* (Invited), DOI 10.1007/s11214-012-9956-3.
- 28. Rennó, N. O.**, C. Ruf, **2012**. Comments on the search for electrostatics on Mars. *ApJ*, 716, doi:10.1088/0004-637X/761/2/88.
- 29. Balme, M. R.**, Pathare, A. V., Metzger, S. M., Towner, M. C., Lewis, S. R., Spiga, A., Fenton, L., **Renno, N. O.**, Elliot, H. M., Saca, F. A., Michaels, T., Russell, P., and Verdasca, J. A., **2012**. Field measurements of horizontal forward motion velocities of terrestrial dust devils: Towards a proxy for ambient winds on Mars and Earth, *Icarus*, 221, 632–645.
- 30. Gomez-Elvira, J.**, C. Armiens, L. Castaner, M. Dominguez, M. Genzer, F. Gomez, R. Haberle, A-M. Harri, V. Jimenez, H. Kahanpaa, L. Kowalski, A. Lepinette, J. Martinez-Frias, J. Martin, I. McEwan, L. Mora, J. Moreno, S. Navarro, M.A. de Pablo, V. Peinado, A. Pena, J. Polkko, M. Ramos, **N. O. Renno**, J. Ricart, M. Richardson, J. Rodriguez-Manfredi, J. Romeral, E. Sebastian, J. Serrano, M. de la Torre Juarez, J. Torres, F. Torrero, R. Urqui, T. Velasco, J. Verdasca, M.-P. Zorzano, F. J. Martin-Torres, **2012**. REMS: an

- Environmental Sensor Suite for the Mars Science Laboratory. *Space Sci. Rev.*, In Press.
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143. Williams, E., and N. Renno, 1991. The Role of Ice in the Conditional Instability of the Tropical Atmosphere. MIT Center for Global Change. Report No. 9, November 1991.
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#### **CURRENT & RECENT RESEARCH PROJECTS**

##### **1. Aircraft Icing Detection System**

*Principal Investigator:* Nilton Renno

*Co-Is:* None

*Sponsor:* NSF/AIR-TT

*Funding Period:* August 1, 2017 to February 30, 2019

*Total funding:* \$200,000

##### **2. Aerosols-Climate Interactions: Characterization of the Effects of a Severe Drought on Dust Lifting**

*Principal Investigator:* Nilton Renno

*Co-Is:* None

*Sponsor:* NSF/AGS

*Funding Period:* August 15, 2015 to August 14, 2018

*Total funding:* \$671,958

##### **3. MAHRS: A Simple Instrument Suite to Characterize the Weathering and Habitability of the Shallow Martian Subsurface**

*Principal Investigator:* Nilton Renno

*Co-Is:* Michael J. Krasowski, George E. Ponchak, Norman F. Prokop, Joseph M. Flatico, and Brent J. Bos

*Sponsor:* NASA/MATISSE

*Funding Period:* September 1, 2013 to August 30, 2016

*Total funding:* \$2,300,000 (including cost-share)

4. **A Miniature Sensor for Measuring Soil Wetness and Searching for Brines on Mars and Beyond**  
*Principal Investigator:* Nilton Renno  
*Co-Is:* Bruce P. Block, Michael Krasowski and George Ponchak  
*Sponsor:* NASA/ASTID  
*Funding Period:* July 30, 2012 to September 30, 2017  
*Total funding:* \$859,510
  
5. **Mars Science Laboratory Phase E**  
*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* NASA  
*Funding Period:* November 1<sup>st</sup>, 2011 to December 24<sup>th</sup>, 2017  
*Total funding:* \$900,000 (approximately)
  
6. **The brines of the Phoenix landing site, the potential for life to adapt to them, and the implications for life elsewhere**  
*Principal Investigator:* Nilton Renno  
*Co-I:* Bruce P. Block  
*Sponsor:* NASA/Exobiology  
*Funding Period:* January 1<sup>st</sup>, 2011 to December 31<sup>st</sup>, 2016  
*Total funding:* \$1,050,000
  
7. **Synergistic Use Telecommunications Systems to Conduct Bistatic Radar Observations for Planetary Science**  
*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* JPL  
*Funding Period:* November 1<sup>st</sup>, 2011 to September 25, 2016  
*Total funding:* \$150,000 (approximately)
  
8. **Icing Detection System**  
*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* NSF/IIP  
*Funding Period:* November 1<sup>st</sup>, 2015 to October 05, 2016  
*Total funding:* \$50,000
  
9. **Validation of the Bistatic radar and Radiometry Investigation of the NEAR Subsurface (BRINES) Instrument**  
*Principal Investigator:* Nilton Renno  
*Co-Is:* Sami Asmar, Chris Ruf, Todd Gaier, Leslie Tamppari  
*Sponsor:* NASA/ASTID  
*Funding Period:* September 1, 2013 to August 30, 2014  
*Total funding:* \$25,000

**10. The Charge Tracker**

*Principal Investigator:* Nilton Renno

*Co-I:* None

*Sponsor:* NSF/Innovation-Corps (to assess the readiness of emerging technology concepts for transitioning into valuable new products)

*Funding Period:* July 1<sup>st</sup>, 2012 to December 31<sup>st</sup>, 2013

*Total funding:* \$50,000

**11. Aerosols-Climate Interactions: Characterization of Saltation, Dust Lifting, and Dust Electrification in Important Dust Source Regions**

*Principal Investigator:* Nilton Renno

*Co-I:* None

*Sponsor:* NSF

*Funding Period:* July 1<sup>st</sup>, 2011 to June 30<sup>th</sup>, 2014

*Total funding:* \$851,481

**12. DREAMS: Dust characterization, Risk assessment and Environment Analyser on the Martian Surface)**

*Principal Investigator:* Nilton Renno (**Italian PI:** Dr. Francesca Esposito)

*Sponsor:* ESA/NASA

*Funding Period:* November 1<sup>st</sup>, 2011 to December 31<sup>st</sup>, 2017

*Total funding:* 0

**13. Experiment on a Long-duration Stratospheric Balloon**

*Principal Investigator:* Nilton Renno

*Co-I:* None

*Sponsor:* NASA/PIDDP

*Funding Period:* September 1<sup>st</sup>, 2010 to August 31<sup>st</sup>, 2011

*Total funding:* \$145,000

**14. A Prototype System for Electrical and Meteorological Measurements in Convective Vortices**

*Principal Investigator:* Nilton Renno

*Co-I:* None.

*Sponsor:* NSF/EAGER

*Funding Period:* September 1<sup>st</sup>, 2009 to August 31<sup>st</sup>, 2010

*Total funding:* \$85,000

**15. An Electric Field Sensor for Dusty Environments**

*Principal Investigator:* Nilton Renno

*Co-I:* Harold Kirkham (JPL)

*Sponsor:* NASA/PIDDP

*Funding Period:* June 1<sup>st</sup>, 2007 to May 31<sup>st</sup>, 2010

*Total funding:* \$681,167

**16. Monitoring Microdischarges from Martian Dust Storms During DSN Downlinks**

*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* JPL  
*Funding Period:* August 1<sup>st</sup>, 2009 to July 31<sup>st</sup>, 2010  
*Total funding:* \$46,000

**17. Threshold Electric Field Detector**

*Principal Investigator:* Nilton Renno  
*Co-I:* Steven Rogacki  
*Sponsor:* State of Michigan (MUCI)  
*Funding Period:* September 1<sup>st</sup>, 2008 to August 31<sup>st</sup>, 2009  
*Total funding:* \$38,000

**18. In-Situ Studies of Terrestrial Dust Devils and Ambient Meteorology:  
Applications to Mars Climate**

*Principal Investigator:* Nilton Renno  
*Sponsor:* NASA/MFRP  
*Funding Period:* April 1<sup>st</sup>, 2008 to March 31<sup>st</sup>, 2011  
*Total funding:* \$110,000

**19. MSL MLE Site-Alteration and Dust Lifting Test Program**

*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* JPL  
*Funding Period:* August 1<sup>st</sup>, 2008 to July 31<sup>st</sup>, 2009  
*Total funding:* \$35,000

**20. Multidisciplinary System Engineering: Development of a Balloon Payload  
for Electric Field Measurements in the Stratosphere**

*Principal Investigator:* Nilton Renno  
*Co-I:* Jeffrey L Hall (JPL)  
*Sponsor:* JPL  
*Funding Period:* September 1<sup>st</sup>, 2008 to August 31<sup>st</sup>, 2009  
*Total funding:* \$25,000

**21. A Miniature Sensor for Electrical Field Measurements in Dusty  
Environments**

*Principal Investigator:* Nilton Renno  
*Co-I:* Harold Kirkham (JPL)  
*Sponsor:* JPL  
*Funding Period:* September 1<sup>st</sup>, 2007 to August 31<sup>st</sup>, 2008  
*Total funding:* \$25,000

**22. Multidisciplinary System Engineering: The Development of Parametric  
Models and Laboratory Testbeds for Space Exploration**

*Principal Investigator:* Robert Easter (JPL)

*Co-I:* Nilton Renno  
*Sponsor:* JPL  
*Funding Period:* January 1<sup>st</sup>, 2007 to December 31<sup>st</sup>, 2007  
*Total funding:* \$50,000  
*UM funding:* \$25,000

**23. Plume-Ground Soil Interaction Study due to Pulse-Modulated Descent Engines at Low Ambient Pressure**

*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* Lockheed Martin Corporation  
*Funding Period:* January 1<sup>st</sup>, 2007 to December 31<sup>st</sup>, 2007  
*Total funding:* \$50,000

**24. Practicum in a Multi-Disciplinary World: A Proposal for an Interdisciplinary Practicum Concentration Initiative**

*Principal Investigator:* Brian Gilchrist  
*Co-I:* Nilton Renno (Lead of the Space Exploration Concentration)  
*Sponsor:* UM Provost  
*Funding Period:* January 1<sup>st</sup>, 2007 to December 31<sup>st</sup>, 2008  
*Total funding:* \$500,000

**25. Aerosol-Climate Interactions: Development and Tests of a Dust Lifting Model**

*Principal Investigator:* Nilton Renno  
*Co-I:* None.  
*Sponsor:* NSF  
*Funding Period:* December 1<sup>st</sup>, 2006 to November 30<sup>th</sup>, 2009  
*Total funding:* \$434,580

**26. Plume-Ground Soil Interactions Study Due to Pulse-Modulated Descent Engines at Low Ambient Pressure**

*Principal Investigator:* Nilton Renno  
*Co-I:* None.  
*Sponsor:* NASA/GSRP  
*Funding Period:* September 12<sup>th</sup>, 2006 to September 11<sup>th</sup>, 2007 (1<sup>st</sup> year)  
*Total funding:* \$125,700

**27. Concept Development Toolkit**

*Principal Investigator:* Robert Easter  
*Co-I:* Nilton Renno  
*Sponsor:* JPL  
*Funding Period:* December 1<sup>st</sup>, 2005 to September 30<sup>th</sup>, 2006  
*Total funding:* \$8,500

- 28. University Nanosat Program: Teather System Assessment Through Teaming (TSATT)**  
*Principal Investigator:* Brian Gilchrist  
*Co-I:* Peter D. Washabaugh and Nilton Renno  
*Sponsor:* DOD –Air Force  
*Funding Period:* October 1<sup>st</sup>, 2005 to September 30<sup>th</sup>, 2007  
*Total funding:* \$200,000
- 29. A Mars Whole Atmospheric Climate Model: Development and Applications**  
*Principal Investigator:* Stephen Bougher  
*Co-I:* Nilton Renno  
*Sponsor:* NSF  
*Funding Period:* October 1<sup>st</sup>, 2005 to September 31<sup>st</sup>, 2010  
*Total funding:* \$573,078
- 30. Aerosol-Climate Interactions: The Relationship between Desert Dust and Atmospheric Convection**  
*Principal Investigator:* Nilton Renno  
*Co-I:* Vincent Abreu  
*Sponsor:* NSF  
*Funding Period:* August 1<sup>st</sup>, 2004 to July 31<sup>st</sup>, 2007  
*Total funding:* \$466,731
- 31. Atmospheric Studies in Support of the Phoenix Mission**  
*Principal Investigator:* Nilton Renno (Phoenix Mission Co-Investigator)  
*Co-Is:* None  
*Sponsor:* NASA  
*Funding Period:* September 2003 – September 2009  
*Total funding:* \$700,000
- 32. Rover Environmental Monitoring Station (REMS)**  
*Sponsor:* Spanish Ministry of Science and Technology and NASA  
*Principal Investigator:* Luis V. Martínez, CAB, Madrid, Spain  
*Co-Is:* A.-M. Harri (Finish Meteorological Institute, Finland), R. Haberle (NASA/Ames), J. Martinez-Friaz (Centro de Astrobiologia, Spain), N. Renno (UM), M. Richardson (Caltech), F. Valero (Universidad Complutense, Spain)  
*Sponsor:* NASA/Spanish Minister of Science and Technology  
*Funding Period:* October 1<sup>st</sup>, 2005 to December 31<sup>st</sup>, 2011  
*Total funding:* \$20,000,000 (Contribution from the Spanish Government)  
*Renno budget:* 60,000/year (negotiable on a year by year basis)
- 33. Bridging the Gap between Robotic and Human Exploration of Mars**  
*Principal Investigator:* Nilton Renno  
*Co-I:* None  
*Sponsor:* NASA/JPL

*Funding Period:* January 1<sup>st</sup>, 2004 to December 31<sup>st</sup>, 2005  
*Total funding:* \$155,000

**34. Aerosols-Climate Interactions: The Relationship Between Desertification, Aerosols and Climate in the Caucasus**

*Principal Investigator:* Gocha Didebulidze (Georgian Academy of Sciences)  
*Co-Is:* Vincent Abreu and Nilton Renno  
*Sponsor:* ISTC (State Department)  
*Funding Period:* January 1<sup>st</sup>, 2005 to December 1<sup>st</sup>, 2005  
*Total funding:* \$200,000.  
*UM funding:* \$68,000

**35. A Student Get-Away Special Space Shuttle Experiment to Demonstrate Cold-Cathode Field Emitter Technology in Space (FEGI)**

*Principal Investigator:* Brian Gilchrist  
*Co-Is:* Nilton Renno and Peter D. Washabaugh  
*Sponsor:* DOD –Air Force  
*Funding Period:* January 2003 to February 2005  
*Total funding:* \$99,991

**36. University of Michigan Meteorology Instrument for the Phoenix Mars Mission**

*Principal Investigator:* Nilton Renno  
*Co-Is:* None  
*Sponsor:* NASA  
*Funding Period:* December 2002 to May 2003  
*Total funding:* \$30,000 from NASA, \$20,000 in matching funds

**37. Simultaneous Observations of Martian Dust Events with the Very Large Array (VLA) and Mars Global Surveyor (MGS) Instruments.**

*Principal Investigator:* Nilton Renno  
*Co-I:* S. Atreya, A.-S. Wong, I. dePater, G. Delory, R.J. Sault, B. Cantor,  
*Sponsor:* NRAO  
*Funding Period:* Oct. 1<sup>st</sup>, 2005 to Dec. 31<sup>st</sup>, 2005  
*Total funding:* N/A –48 hours of observation time with the VLA

**38. Educational Program –Gifts & discretionary funds to support my educational activities**

*Sponsors:* Northrop Grumman (NG), General Motors (GM), College of Engineering  
*Funding Period:* Unlimited (Donation)  
*Total funding:* \$50,000 from NG, \$20,000 from GM, and \$20,000 from CoE, \$150,000 from Ford, \$20,000 from Aerospace Corp.

**39. Campaign Methodologies for Exploration-Driven System-of-Systems Architectures**



*Principal Investigator:* M. Marshall, Aerospace Corporation, El Segundo, CA  
*Sponsor:* NASA  
*Funding Period:* May 14, 2005 to May 14, 2007  
*Total funding:* \$3,798,269  
*Renno budget:* \$449,286 (The NASA program was cancelled)

## **RECENT AND UPCOMING TALKS**

### **Presentations at National and International Conferences**

The UM Road Condition Monitoring Technology, “Tus Star—Tus International” Intelligent and Connected Vehicle Incubation Accelerator Program & The Opening Ceremony of Intelligent Connected Vehicle Incubator. Beijing, PRC, November 6, 2017.

Space Robots –Panel Member, AIAA Intelligent Systems Workshop, Ann Arbor, MI, July 26-27, 2017.

Experimental Confirmation of Liquid Brines on Mars, AGU Fall Meeting, December 15, 2015. San Francisco, CA (Presented by Erik Fischer).

Aviation, Space Exploration, and Icing Detection. NBAA Conference, November 18, 2015. Las Vegas, NV.

Review of the MEPAG Report on Mars Special Regions. COSPAR Panel on Planetary Protection Colloquium, September 22, 2015, Bern, Switzerland.

“The Phoenix discoveries and its astrobiological implications” Keynote talk at the Sao Paulo Advanced School of Astrobiology, Sao Paulo, Brazil, December 16, 2011.

“Evidence for deliquescence and liquid water on Mars” Invited presentation at the Sixth Annual Conference on the Physics, Chemistry and Biology of Water, West Dover, VT, October 21, 2011.

“Spectral Evidence for Liquid Water on Mars” EGU 2011, Vienna, Austria, April 6, 2011.

“Spectral Evidence for Liquid Water on Mars” LPSC 2011, Woodland, Texas, March 10, 2011.

“The Discovery of Liquid Water on Mars and Its Implications” Prague, Czech Republic, September 29, 2010.

“Following the Water and Finding Liquid Brines on Mars” Prague, Czech Republic, September 29, 2010.

“Electrical Activity and Dust Lifting on Earth, Mars and Beyond” Keynote Speaker at the 32<sup>nd</sup> Annual International EOS/ESD Symposium and Exhibits, Reno, NV, October 5<sup>th</sup>, 2010.

“Deliquescence, Liquid Water, and the Search for Sources and Sinks of Methane on Mars” SPIE Conference on Instruments, Methods, and Missions for Astrobiology XIII, San Diego, CA, August 4<sup>th</sup>, 2010.

“Deliquescence and Liquid Water on Mars” El Escorial Summer School, Madrid, Spain, July 15, 2010.

“Do Brines Make The Viking 2 Landing Site Habitable?” Astrobiology Science Conference, League City, TX, April 26-29, 2010.

“To Search For Life on Mars: Follow the Brines” Astrobiology Science Conference, League City, TX, April 26-29, 2010.

“A Portable Instrument for Atmospheric Measurements” 41<sup>st</sup> Lunar and Planetary Science Conference, Woodlands, TX, March 1-5, 2010.

“A Generalization of Bernoulli's Equation to Convective Vortices” 41<sup>st</sup> Lunar and Planetary Science Conference, Woodlands, TX, March 1-5, 2010.

“The Discovery of Liquid Water on Mars and its Implications for Astrobiology.” Keynote Speaker at the International Electric Propulsion Conference (IEPC), Ann Arbor, Michigan, September 23, 2009.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” American Chemical Society, National Meeting, Washington, DC, August 16, 2009.

“The Discovery of Liquid Water on Mars and its implications for Astrobiology.” SPIE Conference on Instruments, Methods, and Missions for Astrobiology XII, San Diego, CA, August 5<sup>th</sup>, 2009.

“Independent Physical and Thermodynamical Evidence for Liquid Water on Mars.” Third International Workshop on the Mars Atmosphere: Modeling and Observations, Williamsburg, November 11, 2008.

“Detecting Thermals Remotely.” OSTIV Congress, Berlin, Germany, August 12, 2008.

“Electrostatics and Dust Lifting on Earth, Mars, and Beyond.” Keynote speaker at the Electrostatics Society of America Annual Meeting, Minneapolis, June 17-19, 2008.

“Evidence for deliquescence and liquid water on Mars” AGU Fall Meeting, December 15, 2008.

“Brines on Mars” Phoenix Science Team Meeting #16, December 13, 2008.

“Evidence for deliquescence and liquid water on Mars: Reply to Mike Hecht’s Critique” Phoenix Eng of Sol Meeting, November 20, 2008.

“Evidence for deliquescence and liquid water on Mars” Center for Astrobiology, Madrid, Spain, November 17, 2008.

“Salts in Mars Meteorites and Antarctica” Phoenix End of Sol Meeting, November 12, 2008.

“Evidence for deliquescence and liquid water on Mars” AOSS Department Seminar, Ann Arbor, MI October 23, 2008.

“The Evidence for Liquid Water on Mars” Michigan Space Grant Consortium Annual Meeting, Ann Arbor, MI, October 18, 2008.

“Evidence for Deliquescence and Liquid Water on Mars” EAPS/MIT Department Seminar, Cambridge, MA, September 10, 2008.

“Physical and Thermodynamical Evidence for Deliquescence and Liquid Water on Mars” Department Seminar, University of Paris VI, Paris, France, August 19, 2008.

“Physical and Thermodynamical Evidence for Deliquescence and Liquid Water on Mars” Department Seminar, University of Oxford, Oxford, UK, August 5, 2008.

“Evidence de Agua Liquida em Marte” Ipuá, Brazil, July 26, 2008.

“Deliquescent Salts at the Phoenix Landing Site –A Testable Hypothesis” Phoenix End of Sol Meeting #49, Tucson, AZ, 2008.

“Should we Test the Hypothesis that the Ice Has Been Melting” Phoenix End of Sol Meeting #34, Tucson, AZ, 2008.

“Understanding Dodo’s Ice” Phoenix End of Sol Meeting, Tucson, AZ, 2008.  
“Do We Have Evidence of Ice that Melted” Phoenix End of Sol Meeting #26, Tucson, AZ, 2008.

“How Can we Maximize the Probability of (Mission) Success” Phoenix End of Sol Meeting #26, Tucson, AZ, 2008.

“Scaling in Comparative Planetary Sciences.” Symposium in honor of Professor Peter H. Stone. MIT, Cambridge, MA, December 7, 2007.

**Presentations at Special Events**

“Discussion on Technology and Education as guest of Embraer’s Project Vivencias.” Embraer, São Jose dos Campos, SP, Brazil, June 21, 2016.

“Black Ice Detector” at Embraer’s Division of Technology and Development. São Jose dos Campos, SP, Brazil, June 21, 2016.

“Black Ice Detector” at Event for Business Leaders for Michigan hosted by UM President Mark Schlissel –Ann Arbor Entrepreneurial Eco-System BLM Member Tour. Ann Arbor, MI, April 26, 2016.

“Mars Exploration” Post-Film Discussion at the Michigan Theater, following Science on the Screen show of “The Martian.” Ann Arbor, MI, April 20, 2016.

“Opportunities and Rewards in Space Exploration” Keynote speaker at Yuri’s Night, University of Michigan Department of Aerospace Engineering Leadership Award Ceremony. Ann Arbor, MI, April 12, 2016.

“Exploração Espacial: Motivações, Riscos e Recompensas.” Seminário Embraer de Tecnologia e Inovação. Keynote speaker at the opening of the event. São Jose dos Campos, SP, Brazil, June 3, 2014.

“Explorando a Geoquímica de Marte com o Robô ‘Curiosity’” Keynote Speaker – XIV Congresso Brasileiro de Geoquímica, Diamantina, Brazil, October 16, 2013.

“Explorando Marte com o Robô ‘Curiosity’” Instituto Tecnológico de Aeronáutica, São Jose dos Campos, SP, Brazil, August 6, 2013.

“Encontro com o Cientista Nilton Rennó” Programa Decolar da Rede Municipal de Ensino, São Jose dos Campos, SP, Brazil, August 5, 2013.

“The Mars Science Laboratory Curiosity Rover” Saturday Morning Physics, University of Michigan, Ann Arbor, MI, March 16, 2013.

“Explorando Marte com o Robô ‘Curiosity’” Associação Aeroespacial Brasileira, São Jose dos Campos, Brazil, March 7, 2013.

“Explorando Marte com o Robô ‘Curiosity’” ETAPA, São Paulo, Brazil, March 5, 2013.

“Space Exploration: Mars and Beyond” Knight-Wallace Fellows at Michigan, Wallace House, The University of Michigan, Ann Arbor, MI, February 7, 2013.

“The Mars Science Laboratory Curiosity Rover” Immortal ConFusion, Dearborn, MI, January 20, 2013.

“The Mars Science Laboratory Curiosity Rover” U–M Retirees Association, Ann Arbor, MI, January 10, 2013.

“The Mars Science Laboratory Curiosity Rover” Michigan Theater –Science on Screen Series, Ann Arbor, MI, January 9, 2013.

“The Mars Science Laboratory Curiosity Rover” University Lowbrow Astronomers, Ann Arbor, MI, September 28, 2012.

“Exploração Espacial e a Missão Phoenix” Prefeitura Municipal, São Jose dos Campos, SP, Brazil, June 19, 2012.

“The Phoenix discoveries and its astrobiological implications” University Lowbrow Astronomers, Ann Arbor, MI, March 16, 2012.

“The Phoenix discoveries and its astrobiological implications” CATP Virtual Seminar, Canadian Astrobiology Group, February 8, 2012.

“The brines of Mars and its astrobiological implications” Invited Presentation, LSA Honors Lunch, Ann Arbor, MI, November 7, 2011.

“Water and Life – On Mars and Beyond” Science Café, Conor O’Neill’s Traditional Irish Pub, Ann Arbor, MI, November 16, 2011.

“How does finding water on Mars help us solve problems on Earth” University of Michigan –College of Engineering Bay Area Event, San Francisco, CA, October 14, 2011.

“Deliquescence and Liquid Water on Mars” Saturday Morning Physics, University of Michigan, Ann Arbor, MI, February 19, 2011.

“Deliquescence and Liquid Water on Mars” Greenhills School, Ann Arbor, MI, February 11, 2011.

“Deliquescence and Liquid Water on Mars” Milan High School, Milan, MI, December 9, 2010.

“Electric Activity and Dust Lifting on Earth, Mars and Beyond” Feira do Joven Empreendedor, Sao Jose dos Campos, SP, Brazil, October 21, 2010.

“A Descoberta de Agua Liquida em Marte” Feira do Joven Empreendedor, Sao Jose dos Campos, SP, Brazil, October 21, 2010.

A Descoberta de Água Líquida em Marte, EMFE Vera Babo, São Jose dos Campos, Brazil, October 22, 2010.

“Exploração Espacial: A Descoberta de Água em Marte” Seniors, Colégio Engenheiro Juarez de Siqueira Britto Wanderley, Eugenio de Melo, Brazil, August 16, 2010.

“Exploração Espacial: A Descoberta de Água em Marte” Juniors, Colégio Engenheiro Juarez de Siqueira Britto Wanderley, Eugenio de Melo, Brazil, August 13, 2010.

“Exploração Espacial: A Descoberta de Água em Marte” Instituto Pandavas, Monteiro Lobato, Brazil, August 12, 2010.

“Exploração Espacial: A Descoberta de Água em Marte” Colégio Poliedro, São José dos Campos, Brazil, August 6, 2010.

“Exploração Espacial: A Descoberta de Água em Marte” TV Vanguarda, São José dos Campos, Brazil, July 28, 2010.

“Exploração Espacial: A Descoberta de Água em Marte” CEDEMP Centro de Educação Empreendedora, São José dos Campos, Brazil, July 28, 2010.

“Finding Liquid Water on Mars.” Keynote Speaker, Ann Arbor Flyers Annual Meeting. Ann Arbor, March 10, 2010.

“The Truth is Out There: Finding Water on Mars.” The University of Michigan MLibrary Spotlight Series, Ann Arbor, March 8, 2010.

“The Science and Engineering of Space Exploration.” The University of Michigan, College of Engineering, Tech Day. November 2009.

“Light in the Cosmos.” Presentation and Panel Discussion at the Art College Berlin-Weißensee, Berlin Germany, October 22, 2009.

“Evidence for Deliquescence and Liquid Water on Mars.” Life in the Cosmos Panel, SPIE Conference on Instruments, Methods, and Missions for Astrobiology XII, San Diego, CA, August 4, 2009.

“Phoenix and the Discovery of Evidence for Liquid Water on Mars.” Lecture at El Escorial Summer School, San Lorenzo de El Escorial, Spain, June 13-17, 2009.

“A Descoberta de Agua Líquida em Marte.” University Seminar, Universidade do Estado do Amazonas, Manaus, Brazil, July 6, 2009.

“Engenharia e Ciencia: Um Exemplo de Carreira Multidisciplinar.” Colegio Engenheiro Juarez de Siqueira Britto Wanderley, Sao Jose dos Campos, Brazil, June 22, 2009.

“Engenharia e Ciencia para Exploracao Espacial.” Colegio Engenheiro Juarez de Siqueira Britto Wanderley, Sao Jose dos Campos, Brazil, June 22, 2009.

“The Science and Engineering of Space Exploration” Speaker at the College of Engineering Tech Day, November 8, 2008.

“Evidence for Liquid Water on Mars” Keynote speaker at the Thirteenth Annual Michigan Space Grant Conference, October 18, 2008.

Panelist on “Education and Space Exploration” at the SPRL at 60 Celebration. University of Michigan, October 17, 2008.

“Evidence for Liquid Water on Mars” Keynote speaker at the CVV-CTA dinner in Ipuã, Brazil, June 26, 2008.

“Exploring the atmosphere of the earth and other planets” Keynote speaker at the celebration of 50<sup>th</sup> Anniversary of the CVV-CTA and the 25<sup>th</sup> Anniversary of Ipuã, Brazil, August 18<sup>th</sup>, 2007.

### **Department Seminars and Colloquia**

“Exploring Mars with the Curiosity Rover” Colloquium and Public Event, Osservatorio Astronomico Capodimonte, Naples, Italy, May 12, 2015.

“Exploring Mars with the Curiosity Rover” Colloquium, Observatório Nacional, Rio de Janeiro, RJ, Brazil, August 7, 2013.

“Exploring Mars with the Curiosity Rover” Physics Colloquium, University of Michigan, Ann Arbor, MI, October 17, 2012.

“Dust lifting and the effects of aerosols on clouds and climate” Applied Physics, University of Michigan, January 18, 2012.

“Dust lifting and the effects of aerosols on clouds and climate” Earth and Environmental Science, University of Maryland at Baltimore County, December 9, 2012.

“Deliquescence and Liquid Water on Mars” Astro-AOSS-GeoSci Symposium, University of Michigan, April 20, 2011.

“Electric Activity and Dust Lifting on Earth, Mars and Beyond” NASA Glenn Research Center, Cleveland, OH, January 11, 2011.

“Deliquescence and Liquid Water on Mars”, Seminário na Divisão de Astrofísica do INPE, São Jose dos Campos, October 19, 2010.

“Deliquescence and Liquid Water on Mars” Cursos de Verano de la Universidad Complutense de Madrid, San Lorenzo de El Escorial, Spain, July 15, 2010.

“Evidence for Liquid Saline Water on Mars” ESTEC/ESA (European Space Agency), Noordwijk, Netherlands, July 9, 2010.

“Deliquescence and Liquid Saline Water on Mars.” Adlershofer Planetenseminar, DLR Institut für Planetenforschung, Berlin, Germany, October 26, 2009.

“Deliquescence and Liquid Saline Water on Mars.” Applied Physics Seminar, University of Michigan, Ann Arbor, MI, September 30, 2009.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Southwest Research Institute, Boulder, CO, May 5, 2009.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Science Lecture Series, NASA Headquarters, Washington DC, April 22, 2009.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Alumni/Shell Oil Company Distinguished Lecture Series, Department of Geological Sciences, Michigan State University, April 2, 2009.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Centro de Astrobiology, Madrid, Spain, November 17, 2008.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, October 23, 2008.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Department of Atmospheric, Oceanic and Planetary Sciences, MIT, September 10, 2008.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Institut Pierre Simon Laplace, Université Paris 6, France, August 19, 2008.

“Physical and Thermodynamical Evidence for Liquid Water on Mars.” Subdepartment of Atmospheric, Oceanic and Planetary Physics, University of Oxford, UK, August 5, 2008.

“Exploring the Martian Atmosphere.” Department of Physics, University of Michigan, Ann Arbor, MI, November 12, 2007.



“Atmospheric Vortices: Theory, Dust Transport and Electrification.” Division of Planetary Sciences, Caltech, Pasadena, CA, February 27, 2007.

“Atmospheric Vortices: Theory, Dust Transport and Electrification.” Department of Physics and Astronomy, Open University, UK, December 14, 2006.

“Atmospheric Heat Engines.” Subdepartment of Atmospheric, Oceanic and Planetary Physics, University of Oxford, UK, November 9, 2006.

“Atmospheric Vortices: Theory, Dust Transport, and Electrification.” Mars Simulation Laboratory, University of Aarhus, Denmark, October 30, 2006.

“Multiple Equilibria and the Runaway Greenhouse in Moist Atmospheres.” Non-Linear GFD Seminar, University of Oxford, October 24, 2006.

“Atmospheric Vortices: Theory, Dust Transport, and Electrification.” Department of Meteorology, University of Reading, UK, October 9, 2006.

“Atmospheric Sciences and Engineering Design: A Few Highlights.” Annual Retreat, Subdepartment of Atmospheric, Oceanic and Planetary Physics, University of Oxford, UK, September 29, 2006.

#### **Presentations at Workshops and Project Meetings**

The UM Road Monitoring Technology, Presentation to Murata Manufacturing Co., Ltd., Tokyo, May 7, 2018.

The UM Aircraft Icing Detection Technology, Presentation to Honeywell, Ann Arbor, MI, March 5, 2018.

The UM Road Monitoring Technology, Presentation at GM’s Technical Center, Warren, MI, April 3, 2018

The UM Aircraft Icing Detection Technology, Presentation to United Technologies Corp Aerospace Systems, Ann Arbor, MI, March 21, 2018.

The UM Icing Detection Technology, Presentation to Murata Manufacturing Co., Ltd., Ann Arbor, MI, March 9, 2017.

The UM Icing Detection Technology, Ford Motor Company, Dearborn, MI, March 2, 2017.

The UM Icing Detection Technology, Ford Motor Company, Dearborn, MI, January 27, 2017.

The UM Electric Field Sensor, Consolidated Edison, Manhattan, NY, January 7, 2016.

The UM Electric Field Sensor, RG&E, Binghamton, NY, December 15, 2015.

The UM Electric Field Sensor, BG&E, Baltimore, MD, December 8, 2015.

“Dust Lifting and Aerosols in the Owens Lake Salty Playa”  
DREAMS Project Meeting, Naples, Italy, May 13, 2015.

“Phase Diagram for Water”  
Mars Special Regions review workshop, Irvine, CA, February 12-13, 2015.

“Deliquescence ”  
Mars Special Regions review workshop, Irvine, CA, February 12-13, 2015.

“Atmospheric Composition and Pressure”  
Mars Special Regions review workshop, Potsdam, Germany, December 16-17, 2014.

“Recurring Slope Lineae (RSL), Gullies and Craters”  
Mars Special Regions review workshop, Potsdam, Germany, December 16-17, 2014.

“Significance of Deliquescence in the Martian Natural Environment”  
Mars Special Regions review workshop, Potsdam, Germany, December 16-17, 2014.

“Contemporary Snow Deposition”  
Mars Special Regions review workshop, Potsdam, Germany, December 16-17, 2014.

Is Yellowknife Bay a Net Source of Water?  
MSL Science Meeting, March 5, 2013.

Aqueous Processes at Gale?  
MSL Science Meeting, February 28, 2013.

“Clouds, Hazards, and Aerosols Survey for Earth Researchers (CHASER).”  
Project Team Meeting. DLR, Bremen, February 24, 2012.

“Clouds, Hazards, and Aerosols Survey for Earth Researchers (CHASER).”  
Project Team Meeting. Free University of Berlin, Berlin, February 23, 2012.

“Studying Aerosols with MAGI-L.” Earth Venture-1 Proposal Workshop.  
Aerospace Corp, El Segundo, CA, October 13, 2011.

“Clouds, Hazards, and Aerosols Survey for Earth Researchers (CHASER).” Red Team Proposal Review. NASA/GRC, Cleveland, August 12, 2011.

“Clouds, Hazards, and Aerosols Survey for Earth Researchers (CHASER).” Compass Mission Design. NASA/GRC, Cleveland, June 20, 2011.

“Clouds, Hazards, and Aerosols Survey for Earth Researchers (CHASER).” CoE Proposal Review Workshop. University of Michigan, Ann Arbor, June 3, 2011.

“Clouds, Hazards, and Aerosols Survey for Earth Researchers (CHASER).” Proposal Review Workshop. NASA/GRC, Cleveland, May 23, 2011.

“Climate, Hurricanes and Aerosols Survey for Earth Researchers (CHASER).” Earth Venture-2 Proposal Workshop. NASA/GRC, Cleveland, March 4, 2011.

“Trace Gas Microwave Radiometer (TGMR).” Proposal Review at CoE. Ann Arbor, April 9, 2010.

“Trace Gas Microwave Radiometer (TGMR).” Proposal Review at CoE. Ann Arbor, April 9, 2010.

“Trace Gas Microwave Radiometer (TGMR).” Proposal Review at JPL. Pasadena, March 11, 2010.

“The University of Michigan Electric Field Sensor and Balloon Payload” Lunar dust, plasma and atmosphere: The next steps" January 29, 2010, Boulder, CO.

“Dust, Salts, Clouds and Water: Some Results from Phoenix and Implications for MSL” REMS Science Team Meeting, Madrid, Spain, November 18, 2008.

“Deliquescent Salts at the Phoenix Landing Site? -A Testable Hypothesis” Phoenix End-of-Sol Presentation, Tucson, August 26, 2008.

“Should we Test the Hypothesis that Ice has been Melting at the Landing Site?” Phoenix End-of-Sol Presentation, Tucson, June 29, 2008.

“Do We Have Evidence of Ice That Melted?” Phoenix End-of-Sol Presentation, Tucson, June 21, 2008.

“How Can We Maximize The Probability of (Mission) Success?” Phoenix End-of-Sol Presentation, Tucson, June 20, 2008.

“ASTG Request for Sol 21” Phoenix End-of-Sol Presentation, Tucson, June 13, 2008.

“ASTG’s Campaigns” Phoenix End-of-Sol Presentation, Tucson, June 11, 2008.

“Is Martian Saltation Giant?” Phoenix End-of-Sol Presentation, Tucson, June 9, 2008.

“More on Cratering & Splashing During Landing (Phoenix)” Phoenix End-of-Sol Presentation, Tucson, June 8, 2008.

“Cratering & Splashing During Landing (Phoenix)” Phoenix End-of-Sol Presentation, Tucson, June 7, 2008.

“Dust lifting on Mars, Earth and beyond” Workshop on *Mars’ Planetary Boundary Layer* organized by the International Space Science Institute (ISSI). Bern, Switzerland, 13-18 May, 2008.

“Atmospheric Science Campaigns for REMS” REMS Science Team Meeting, Madrid, April 2008.

“Electrostatics and Thermal Effects on the Lunar Surface” UCLA-JPL Lunar Science Workshop, February 25, 2008.

“Electric activity and dust lifting on earth and beyond” Workshop on *Planetary Atmospheric Electricity* jointly organized by the Europlanet Network and the International Space Science Institute (ISSI). Bern, Switzerland, 23-27 July 2007.

“A miniature sensor for electrical field measurements in dusty planetary atmospheres.” Electrostatics 2007, Oxford, UK, March 25-29, 2007.

“TECP Calibration.” Phoenix 10<sup>th</sup> Science Team Meeting. Tucson, AZ, October 16-17, 2006. Sample Delivery Experiments. Phoenix 10<sup>th</sup> Science Team Meeting. Tucson, AZ, October 16-17, 2006.

“Mars Balloon Mission: Science Goals and Requirements.” Lockheed Martin Corporation, Waterton, CO, October 19, 2006.

“Wind and temperature measurements at the surface of Mars: Primary science objectives.” REMS 3<sup>rd</sup> Science Team Meeting, CAB, Madrid, November 28-29, 2006.

## **TEACHING (at University of Michigan only)**

### **Teaching Evaluation**

Q1 = Course value

Q2 = Instructor value

Maximum score = 5.0

### **Fall 2015**

- AERO 582, Spacecraft Technology, 24 students, 4 credits

Teacher Evaluation: *Q1*: 4.63, *Q2*: 4.33

- AERO 590, Space Systems Project, 1 student, 4 credits  
Teacher Evaluation: *Q1*: 4.0, *Q2*: 5.0

#### **Winter 2015**

- AERO 583, Spacecraft Management, 32 students, 4 credits  
Teacher Evaluation: *Q1*: 4.0, *Q2*: 4.3
- AERO 590, Space Systems Project, 5 students, 4 credits  
Teacher Evaluation: *Q1*: NA, *Q2*: NA

#### **Fall 2014**

- AERO 582, Spacecraft Technology, 30 students, 4 credits  
Teacher Evaluation: *Q1*: 3.5, *Q2*: 3.8
- AERO 590, Space Systems Project, 10 students, 4 credits  
Teacher Evaluation: *Q1*: 4.0, *Q2*: 5.0

#### **Winter 2014**

- AERO 583, Spacecraft Management, 23 students, 4 credits  
Teacher Evaluation: *Q1*: 4.0, *Q2*: 3.83
- AERO 590, Space Systems Project, 5 students, 4 credits  
Teacher Evaluation: *Q1*: NA, *Q2*: NA

#### **Fall 2013**

- AERO 582, Spacecraft Technology, 28 students, 4 credits  
Teacher Evaluation: *Q1*: 3.67, *Q2*: 3.80
- AERO 590, Space Systems Project, 5 students, 4 credits  
Teacher Evaluation: *Q1*: NA, *Q2*: NA

#### **Winter 2013**

- AERO 583, Spacecraft Management, 22 students, 4 credits  
Teacher Evaluation: *Q1*: 3.25, *Q2*: 3.00
- AOSS 499, Directed Study, 2 students, 1-16 credits  
Teacher Evaluation: NA
- AOSS 590, Space Systems Projects, 2 students, 4 credits  
Teacher Evaluation: NA

#### **Winter 2012**

- AOSS 350, Atmospheric Thermodynamics, 12 students, 4 credits  
Teacher Evaluation: *Q1*: 4.83, *Q2*: 4.93
- ENG 450, Multidisciplinary Design, 5 students, 4 credits  
Teacher Evaluation: NA
- AOSS 701, Special Problems, 3 students, 1-16 credits  
Teacher Evaluation: NA

#### **Fall 2011**

- ENG 450, Multidisciplinary Design, 3 students, 4 credits

- Teacher Evaluation: *NA*
- ENG 455, Multidisciplinary Design II, 1 student, 4 credits  
Teacher Evaluation: *NA*
- ENG 456, Mentorship Leadership, 1 student, 1-3 credits  
Teacher Evaluation: *NA*
- ENG 499, Independent Study, 1 student, 1-16 credits  
Teacher Evaluation: *NA*

#### **Winter 2011**

- ENG 450, Multidisciplinary Design, 36 students, 4 credits  
Teacher Evaluation: *Q1: 4.50, Q2: 4.50*
- ENG 455, Multidisciplinary Design II, 2 students, 4 credits  
Teacher Evaluation: *NA*
- ENG 456, Mentorship Leadership, 1 students, 4 credits  
Teacher Evaluation: *NA*
- AOSS 701, Special Problems, 2 students, 4 credits  
Teacher Evaluation: *NA*

#### **Fall 2010**

- ENG 450, Multidisciplinary Design, 18 students, 4 credits  
Teacher Evaluation: *Q1: 4.17, Q2: 4.50*
- ENG 455, Multidisciplinary Design, 2 students, 4 credits  
Teacher Evaluation: *NA*

#### **Winter 2010**

- ENG 450, Multidisciplinary Design, 26 students, 4 credits  
Teacher Evaluation: *Q1: 4.75, Q2: 4.75*
- ENG 455, Multidisciplinary Design, 4 students, 4 credits  
Teacher Evaluation: *Q1: 4.50, Q2: 4.50*

#### **Fall 2009**

- ENG 450, Multidisciplinary Design, 16 students, 4 credits  
Teacher Evaluation: *Q1: 4.75, Q2: 4.75*

#### **Winter 2009**

- ENG 450, Multidisciplinary Design, 21 students, 4 credits  
Teacher Evaluation: *Q1: 4.00, Q2: 4.00*
- AOSS 749, A&S Seminar, 8 students, 1 credit  
Teacher Evaluation: *Q1: 4.33, Q2: 4.50*
- AOSS 499, Directed Study, 1 student  
Teacher Evaluation: *NA*

#### **Fall 2008**

- AOSS 749, A&S Seminar, 14 students, 1 credit  
Teacher Evaluation: *Q1: 4.63, Q2: 4.75*
- ENG 390, Multidisciplinary Design, 9 students, 4 credits

- Teacher Evaluation: *Q1*: NA, *Q2*: NA
- AOSS 499, Directed Study, 1 student

### Winter 2008

- ENG 450, Multidisciplinary Design, 21 students, 4 credits  
Teacher Evaluation: *Q1*: 4.71, *Q2*: 4.58
- AOSS 749, A&S Seminar, 23 students, 1 credit  
Teacher Evaluation: *Q1*: 3.80, *Q2*: 3.67
- AOSS 499, Directed Study, 3 students, 3 credits
- AOSS 701, Special Problems, 3 students, 3 credits  
Teacher Evaluation: *Q1*: NA, *Q2*: NA

### Fall 2007

- AOSS 411, Clouds and Precipitation, 13 students, 3 credits  
Teacher Evaluation: *Q1*: 3.60, *Q2*: 3.75
- ENG 390, Special Topics: Multidisciplinary Design, 10 students, 3 credits  
Teacher Evaluation: *Q1*: NA, *Q2*: NA
- AOSS 749, A&S Seminar, 27 students, 1 credit  
Teacher Evaluation: *Q1*: 3.95, *Q2*: 3.93
- AOSS 499, Directed Study, 1 student
- AOSS 995, Dissertation Candidate, 1 student
- APPPHYS 995, Dissertation Candidate, 1 student

### Winter 2007

- ENG 450, Multidisciplinary Design, 21 students, 4 credits  
Teacher Evaluation: *Q1*: 4.95, *Q2*: 4.75
- AOSS 499, Directed Study, 2 students
- AOSS 990, Dissertation Pre-Candidate, 1 student
- APPPHYS 995, Dissertation Candidate, 1 student

### Fall 2006 (Sabbatical)

- AOSS 701, Special Problems, 1 student
- APPPHYS 995, Dissertation Candidate, 1 student
- AOSS 499, Directed Study, 4 students

### Winter 2006

- ENG 450, Multidisciplinary Design, 19 students, 4 credits  
Teacher Evaluation: *Q1*: 4.69, *Q2*: 4.69
- APPPHYS 995, Dissertation Candidate, 1 student
- AOSS 990, Dissertation Pre-Candidate, 1 student
- AOSS 499, Directed Study, 4 students

### Fall 2005

- AOSS 414, Weather Systems, 9 students, 4 credits  
Teacher Evaluation: *Q1*: 4.25, *Q2*: 4.17
- AOSS 499, Directed Study, 8 students

- AOSS 499, Direct Study, 1 student

#### **Winter 2005**

- ENG 450, Multidisciplinary Design, 26 students, 4 credits  
Teacher Evaluation: *Q1*: 4.54, *Q2*: 4.40
- AOSS 701, Special Problems, 3 students
- AOSS 321, Earth Systems Dynamics, 25 students, 4 credits  
Teacher Evaluation: *Q1*: 3.38, *Q2*: 4.00

#### **Fall 2004**

- AOSS 414, Weather Systems, 11 students, 4 credits  
Teacher Evaluation: *Q1*: 4.70, *Q2*: 4.93

#### **Winter 2004**

- ENG 450, Multidisciplinary Design, 18 students, 4 credits  
Teacher Evaluation: *Q1*: 4.79, *Q2*: 4.30
- AOSS 411, Cloud and Precipitation, 12 students, 4 credits  
Teacher Evaluation: *Q1*: 4.25, *Q2*: 4.40
- AOSS 499, Directed Study, 1 student
- EECS 599, Directed Study, 1 student
- AOSS 990, Dissertation Pre-Candidate, 2 students

#### **Fall 2003**

- AOSS 414, Weather Systems, 7 students, 4 credits (check)  
Teacher Evaluation: *Q1*: 4.25, *Q2*: 4.50
- AOSS 605, Current Topics, 4 students, 4 credits (check)  
Teacher Evaluation: *Q1*: 4.50, *Q2*: 5.00
- EECS 599, Directed Study, 1 student  
AOSS 990, Dissertation Pre-Candidate, 2 students

#### **Winter 2003**

- AOSS 701, Special Problems, 3 students  
AOSS 990, Dissertation Pre-Candidate, 2 students

#### **Fall 2002**

- AOSS 414, Weather Systems, 15 students, 4 credits  
Teacher Evaluation: *Q1*: 3.94, *Q2*: 4.69

#### **Fall 1995 to Summer 2002**

- I thought a variety of undergraduate and graduate courses at the University of Arizona. Student feedbacks were similar to the ones I have been getting at the University of Michigan.

#### **SAMPLE STUDENT COMMENTS (on teacher evaluation forms)**

- “It’s the best class.”



- “Best teacher that I had at the University of Michigan.”
- “Excellent teacher. Gave clear explanations, was always willing to meet outside of class, and was very, very helpful. In all honesty one of the best teachers I ever had!!”
- “Seemed to have great knowledge of the subject matter.”
- “The instructor was very approachable with questions and very thorough with explanations.”
- “The professor was well prepared for every class. Made sure we understood everything before moving on. He had office hours and would meet at any other time to help with assignments and answer questions, very helpful.”
- “Prof. Renno got me to like dynamics... if that isn't a miracle, I don't know what it is. He is very patient and understanding, clear, and extremely accessible...”
- “Willing to take the time to make things clear and be helpful.”