

## Education

### University of Southern California - Viterbi School of Engineering

- Ph.D., Aerospace Engineering *August 2015*
    - Dissertation: “*High Temperature Latent Heat Thermal Energy Storage to Augment Solar Thermal Propulsion for Microsatellites*”
    - Recipient of the William F. Ballhaus, Jr. Prize for Excellence in Graduate Engineering Research
  - M.S., Aerospace Engineering – Combustion & Energy Systems Emphasis *December 2011*
  - B.S., Aerospace Engineering, *magna cum laude* *May 2010*
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## Academic Experience

### University of Southern California - Viterbi School of Engineering

*Department of Aerospace and Mechanical Engineering*

**Senior Lecturer** *August 2018 – Present*

**Full Time Lecturer** *August 2015 – July 2018*

- Courses Taught: AME 341a&b “Mechoptronics”, AME 441a&b “Senior Projects”, AME 490 “Directed Research”, AME 491 “Undergraduate Design Projects II”
- Faculty Advisor: USC Recumbent Vehicle Design Team, *2015-Present*  
USC Advanced Spacecraft Propulsion and Energy Laboratory, *2018-Present*

**Teaching Assistant** *August 2013 – May 2015*

- AME 341b, AME 441a

### USC Collaborative High Altitude Flow Facility, Los Angeles, CA

**Laboratory / Project Manager** *February 2010 – May 2018*

- Managed operation and maintenance of USC’s largest vacuum science facility and the USC Solar Furnace Facility
- Directed a team of 3-8 undergraduates completing AFRL and USC related research tasks
- Oversaw the construction and integration of a \$350k liquid nitrogen cryogenic system for primary 9’ x 18’ vacuum chamber
- Supervisor and sponsor for multiple AME 441 projects such as radiometric thrust measurements & CCD solar flux mapping

**Research Assistant** *January 2007 - January 2010*

- Constructed prototypes and collected experimental data supporting the AFRL “Advanced Concepts Group”
  - Responsible for the operation and construction of cooling systems, vacuum facilities, high power lasers and NI hardware
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## Professional Experience

### ERC Inc., Edwards AFB, CA

**Consultant, Advanced Spacecraft Propulsion** *August 2015 – March 2020*

- Developed a novel thrust stand system capable of simultaneous thrust ( $\mu\text{N}$ ) and mass loss ( $< \text{mg}$ ) measurements of Electrospays
- Responsible engineer on multiple hot-fire test programs for thrust measurement, data reduction and post testing analysis
- Designed  $\mu\text{N}$  scale thrust stands with electrostatic calibration up to 22 N systems incorporating electromechanical calibration

## Thrust Stand Engineer

January 2013 – August 2015

- Designed, built and verified a torsional thrust stand system for direct impulse measurements of monopropellant thrusters offering 2 N steady-state measurement capability while maintaining < 10 mNs I-bit resolution
- Automated data analysis and post processing for thousands of thruster firings across multiple test campaigns
- Frequent travel to industry partner facilities to install thrust stand hardware, oversee operations, establish data collection methods and troubleshoot thruster integration with the on-site team

## Co-Op

August 2010- August 2015

- Ph.D. Co-Op with the Air Force Research Laboratory (AFRL) “High Payoff Spacecraft Propulsion Technology Group”
- Designed and built the USC Solar Furnace Facility capable of 1 kW power delivery with concentration ratios exceeding 4000:1
- Performed >100 solar furnace tests to investigate asymmetrical freezing in molten silicon test articles
- Modeled the effects of geometry on thermal gradients and phase front location using MATLAB and SolidWorks Simulation
- Used STAR-CCM+ to study transient convective coupling under conditions relevant to solar thermal propulsion
- Presented data for the AFRL High Energy Advanced Thermal Storage program at domestic and international conferences

## AFRL Advanced Concepts Group Intern

May 2008 - August 2010

- Conducted and post-processed hundreds of pulsed plasma thruster firings establishing performance trends for energy utilization
- Developed fully automated thrust stand calibration system to characterize impulse delivery
- Demonstrated the ability of a piezoelectric hammer to expand torsional thrust stand diagnostic range
- Designed and built a 1 MW pulse forming network to drive a high efficiency capillary discharge type pulsed plasma thruster

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## Selected Publications & Presentations

- **Invited Speaker:** Gilpin, M.R. *Ultra-High Temperature Space Power Applications*. 1st International Workshop on Ultra-High Temperature Thermal Energy Storage, Transfer and Conversion. Madrid, Spain, November 14, 2019.
- Gilpin, M.R., M.R. Natisin, C. Marin, M.D. Eschen, and H.L. Zamora. *Dual-Axis Torsional Thrust Stand for Simultaneous Direct Measurement of Thrust and Mass Loss*. 36<sup>th</sup> International Electric Propulsion Conference, Vienna, Austria, September 15-20, 2019. IEPC-02019-139.
- Gilpin, M.R., D.B. Scharfe, M.P. Young, and R.N. Webb. *High Energy Advanced Thermal Storage (HEATS)*. In-House Final Report. Air Force Research Laboratory, Aerospace Systems Directorate, In-Space Propulsion Branch. AFRL-RQ-ED-TR-2018-0026. November 2018.
- Gilpin, M.R., D.B. Scharfe, M.P. Young. *Experimental Investigation of Latent Heat Thermal Energy Storage for Bi-Modal Solar Thermal Propulsion*. 12<sup>th</sup> International Energy Conversion Engineering Conference, Cleveland, OH, July 28-30, 2014. AIAA-2014-3832.
- D.B. Scharfe, M.P. Young, M.R. Gilpin, T. Rexius. *Augmentation of Solar Thermal Propulsion Systems via Phase Change Thermal Energy Storage and Thermal Electric Conversion*. Space Propulsion 2012, Bordeaux, France, May, 2012.
- Pancotti, A.P., M.R. Gilpin, M. Hilario. *Comparison of Electrostatic Fins with Piezoelectric Impact Hammer Techniques to Extend Impulse Calibration Range of a Torsional Thrust Stand*. Review of Scientific Instruments. Vol. 83. March 2012.
- Pancotti, A.P., M. Young, M.R. Gilpin. *Effect of Ignition Techniques on a Capillary Discharge Based Pulsed Plasma Thruster*. 45<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Denver, Colorado, Aug. 2-5, 2009. AIAA-2009-5280.

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## Professional Activities

**Manuscript Reviewer:** *Review of Scientific Instruments, Acta Astronautica, Sensors and Actuators A. Physical*

**Book Chapters:** “Ultra-High Temperature Space Power Applications” in *Ultra-High Temperature Energy Storage, Transfer and Conversion*, Elsevier, September 2020.

**Memberships:** AIAA, ASME

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## Honors and Awards

- William F. Ballhaus, Jr. Prize for Excellence in Graduate Engineering Research
- ARCS Foundation Scholar

May 2015  
August 2008 – May 2015

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## Student Development

### AME 490, Undergraduate Directed Research – Project Advisor

- 2016: Michelle Shadpour, “Thermal Energy Storage for the University of San Diego”

### AIAA Region VI Student Conference – Project Advisor

- 2021: 2<sup>nd</sup> Place “*A Novel Staged Warm Gas Thrust for CubeSats*”  
Spencer Powers, Connor Power, Michael Mastrangelo, Kamyar Zarkoub, Spencer Wing
- 2021: 3<sup>rd</sup> Place “*UAV Flight Disruption via Acoustic Forcing*”  
Miles Kay, Emma Roberson, Criss Edwards, Miranda Costigan
- 2020: 2<sup>nd</sup> Place “*Design and Construction Method of a Low-Voltage Bradbury-Nielsen Gate*”  
Brandon Dillon, Lorenzo Laxamana, Kevin Sampson, David Torre
- 2018: 1<sup>st</sup> Place “*Spray Cone Formation from Pintle-Type Injector Systems in Liquid Rocket Engines*”  
James Blakely, Johann Freeberg, Jacob Hogge
- 2017: 1<sup>st</sup> Place “*Design of a Paddle-Driven Wave Generator*”  
Henry Miskaryan, David Freeman, Andrew Lindo
- 2016: 1<sup>st</sup> Place “*Attenuation of Vortex Noise Generated by UAV Propellers at Low Reynolds Numbers*”  
Niko Intravartolo, Timothy Sorrells, Nazareth Ashkharian, Ryan Kim
- 2016: 2<sup>nd</sup> Place “*Design and Optimization of an Autonomous Projectile Trajectory Estimate and Interception System*”  
Martin Keyt, Harlan Raine, Henry Bard, Matthew Del Toro

### Additional Student Design Team Actives

- 2020-Present: USC NASA RASCAL Thermal Control System Sub-Group – Invited Design Reviewer
- 2017-Present: SC Racing – Invited Design Reviewer
- 2020-2021: FAA Smart Airport Student Competition Team – Advisor of Record
- 2019-2020: USC Solar Car – Invited Design Reviewer

### Outreach & Other Involvement

- 2017-Present: AME Sophomore Transition Event Panelist
- 2020-Present: Viterbi Admitted Students Faculty Roundtable Panelist
- 2015-Present: USC Explore Tour Guide
- 2018-2019: Organizer of the Annual AME Senior Project Expo
- 2017-Present: “Career Day” speaker at multiple local KIPP Elementary & Middle Schools

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## University Service

### School Level

- 2020-Present: AME Representative to the Engineering Curriculum Committee
- 2020-Present: Undergraduate Viterbi Awards Selection Committee

### Department Level

- 2015-Present: AME Undergraduate Awards Committee
- 2018-2019: AME NNT Merit Review Committee
- 2018: AME Full-Time Lecturer Search Committee (resulting in two full-time hires)

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## Research Support

Title: *Womersley Flowmeter Project Phase I & II*

PI: Matthew Gilpin & Niema Pahlevan

Agency: Air Force Research Laboratory

Period: 5/2019 – 11/2021

Amount Total: \$113,000

Major Objectives: Development and experimental validation of a novel transient flowmeter concept.

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## Research Interests

Novel Diagnostic Development, Latent Heat Thermal Energy Storage, Convective Coupling in High Temperature Heat Exchangers, Spacecraft Propulsion, Energy Systems

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## Media

- Viterbi News, *USC Student Team Places 4<sup>th</sup> at the Human Powered Vehicle Challenge*, April 2018 ([Link](#))
- Viterbi News, *Senior Mechanical Engineers Win 1<sup>st</sup> Place at AIAA Conference*, April 2018 ([Link](#))
- USC News, *A Fascination With Flight Leads USC Graduate Conor Cimo to the Space Industry*, May 2018 ([Link](#))
- Viterbi News, *Senior Design Projects Win Big at AIAA Conference*, April 2017 ([Link](#))
- Viterbi News, *Who Will Aid The Sick? Fight Air Pollution? Power Our Spacecraft?*, May 2016 ([Link](#))