Zachary Manchester

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Research Interests:

- Control Systems
- Nonlinear Dynamics
- Estimation and Filtering
- Spacecraft Orbital and Attitude Dynamics
- Small Spacecraft and Low-Cost Space Access
- Low-Power Radio Communication and Navigation

Education:

2015 ***Ph.D.*** ***Aerospace Engineering*** ***Cornell University***
- Cumulative GPA: 3.79

2010 ***M.Eng.*** ***Aerospace Engineering*** ***Cornell University***
- Cumulative GPA: 3.75

2009 ***B.S.*** ***Engineering Physics*** ***Cornell University***
- Cumulative GPA: 3.34

Research Experience:

2011-Present ***KickSat Project***
- Founded an effort to launch and deploy over 100 centimeter-scale spacecraft from a CubeSat in low Earth orbit
- Raised $74,586 through crowd-funding website Kickstarter
- Awarded launch through NASA's CubeSat Launch Initiative
- Developed long-range, low-power radio communication protocol
- Led a small team to design, build, test, and fly a 3U CubeSat

2012-2013 ***NASA Ames Research Center***
- Developed attitude determination and control algorithms for small satellites
- Performed integration and testing for CubeSats

2008-Present ***Cornell University***
- Conducted research on centimeter-scale spacecraft under Prof. Mason Peck
- Designed experiments for characterizing plasma and determining capacitance of charged objects in plasma

2009 ***Sandia National Laboratories***
- Worked on fabrication of satellite-on-chip devices at Sandia's Center for Integrated Nanotechnology
- Learned semiconductor fabrication processes

2006-2007 ***CU-24 Unmanned Arial Vehicle Team***
- Integrated onboard computer, autopilot, and communication systems for a UAV
- Developed a linux-based software stack for video and flight data communication

Teaching Experience:

Spring 2012 ***Lecturer – Spacecraft Engineering – Cornell University***

- Taught a junior-level undergraduate course (73 students) covering spacecraft orbital and attitude dynamics and space mission design

Fall 2010 ***Teaching Assistant – Feedback Control Lab – Cornell University***

- Ran the lab portion of a senior-level undergraduate course on feedback control systems where controllers were designed and implemented on electromechanical laboratory systems

Work Experience:

2010 ***Sentinel IC Technologies, Inc.***

- Developed high performance mixed-integer optimization code in C for semiconductor design applications

2007-2010 ***Analytical Graphics, Inc.***

- Developed an algorithm for calculating rhumb lines on oblate and prolate spheroids that is now part of the Systems Tool Kit (STK) software
- Worked on the astrodynamics back-end of a 3D visualization tool
- Developed an automated C# to Java source code translator

Academic Awards:

2010 ***Thomas J. and Joan T. Kelley Prize***

- Awarded for the top Master of Engineering project in Aerospace Engineering at Cornell

Journal Publications:

1. Z. Manchester and M. Peck. "Lyapunov-Based Control for Flat-Spin Recovery and Spin Inversion of Spin-Stabilized Spacecraft." (in preparation).
2. Z. Manchester and M. Peck. "The Sprite: A Printed Circuit Board Femtosatellite." (in preparation).
3. Z. Manchester and M. Peck. "Recursive Spacecraft Inertia Estimation with Semidefinite Programming." *AIAA Journal of Guidance, Control, and Dynamics* (in review).
4. Z. Manchester and M. Peck. "Quaternion Variational Integrators for Spacecraft Dynamics." *AIAA Journal of Guidance, Control, and Dynamics* (to appear).
5. Z. Manchester. "KickSat: Bringing Space to the Masses." *CQ VHF*. Vol. 17, no. 3, pp. 32-38, 2013.

Conference Publications:

1. Z. Manchester, M. Peck, and A. Filo. "KickSat: A Crowd-Funded Mission To Demonstrate The World's Smallest Spacecraft." AIAA/USU Conference on Small Satellites, Logan, Utah, August 12-16, 2013.
2. Z. Manchester and M. Peck. "Stochastic Space Exploration with Microscale Spacecraft." AIAA Guidance, Navigation, and Control Conference, Portland, OR, August 8-11, 2011.
3. J. Atchison, Z. Manchester, and M. Peck. "Microscale Atmospheric Reentry Sensors." 7th International Planetary Probe Workshop, Barcelona, Spain, June 14-18, 2010.

Invited Talks:

1. "CubeSat Constellations for Wildlife Tracking and Monitoring." National Science Foundation Workshop on Engineering and Biology at the Frontier of Environmental and Organismal Sensing, Washington, D.C., October 16, 2014.
2. "KickSat: The World's Smallest Spacecraft." Texas Instruments, Dallas, TX, May 30, 2014.
3. "KickSat: Crowd-Funding Space." Technology for Bootstrapped Entrepreneurship, Cornell University School of Hotel Administration, May 5, 2014.
4. "ChipSats: Centimeter-Scale Spacecraft and How They Will Change Atmospheric Science." NASA Ames Research Center, October 24, 2012.
5. "KickSat: Kick Starting the Personal Space Age." AIAA San Francisco Chapter Small Payloads Tech Talks, October 15, 2012.
6. "The Sprite Project: Satellite on a Chip." NASA Goddard Spaceflight Center, December 12, 2011.
7. "Demonstration of a Prototype 'Sprite' ChipSat." ChipSat Workshop, Brown University, Providence, RI, February 18, 2010.

Selected Popular Press Coverage:

1. BBC World News: Interviewed as part of a segment on low-cost space exploration, September 24, 2014.
2. The Science Channel, *Man vs. The Universe*. Episode 2, August 2014.
3. G. Fleishmann. "Nanosats are go!" *The Economist*. June 7, 2014.
4. R. Hollingham. "How to get to space on the cheap." *BBC Future*. April 16, 2012. http://www.bbc.com/future/story/20120412-how-to-get-to-space-on-the-cheap
5. C. Seidler. "SpaceX-Flug: Mein Haus, mein Auto, mein Mini-Satellit." *Der Spiegel*. April 14, 2014.
6. S. Clark. "Crowd-funded stowaway to deploy 104 tiny satellites." *Spaceflight Now*. April 13, 2014. http://spaceflightnow.com/falcon9/009/140413kicksat
7. N. Hurst. "Q&A: KickSat's Zac Manchester and Andy Filo." *Make Magazine*. April 11, 2014. http://makezine.com/2014/04/11/how-to-kick-a-sat/
8. Q. Hardy. "Space Chips for the Common Man." *The New York Times Bits Blog*. April 5, 2014. http://bits.blogs.nytimes.com/2014/04/05/space-chips-for-the-common-man
9. Z. Honig. "Crowd-funded KickSat to carry over 100 tiny satellites into space this Sunday." *Engadget*. March 13, 2014. http://www.engadget.com/2014/03/13/kicksat-launches-sunday/
10. BBC Radio 4: Interviewed about the KickSat project, October 13, 2011.
11. J. Biggs. "KickSat: Send Tiny DIY Satellites Into Space." *TechCrunch*. October 9, 2011. http://techcrunch.com/2011/10/09/kicksat-send-tiny-diy-satellites-into-space
12. Channel 9, Syracuse: Interviewed about a ChipSat experiment on ISS, May 15, 2011.

References:

Available upon request