

Nicholas G. Rainville

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EDUCATION

University of Colorado, Boulder, Co, 2014-2019

PhD in Aerospace Engineering Sciences

Dissertation Topic: GPS Volcanic Ash Plume Detection Modeling and Instrumentation Development

Purdue, West Lafayette, In, August 2014

M.S. in Aeronautics and Astronautics

Thesis Topic: Development of a Real Time Bistatic Radar Receiver using Signals of Opportunity

Northeastern University, Boston, Ma, May 2006

B.S. in Electrical and Computer Engineering

Honors: Magna cum laude, University Honors Program, Dean's List

Teaching Experience

University of Colorado, Boulder, 2019-Present

Instructor

ASEN 3300 Aerospace Electronics and Communications, Spring 2020, Spring 2019. Course lecturer and lab instructor.

ASEN 5018/6028 Graduate Projects, Fall 2019-Present. Course coordinator and lecturer.

ASEN 4018/4028 Senior Projects Mentor. Electronics and Software support for senior project teams.

University of Colorado, Boulder, 2014-2018

Graduate Projects Mentor

Mentored CubeSat graduate projects teams. Spring 2016-Fall 2018.

Teaching Assistant

ASEN 3300 Aerospace Electronics and Communications, Spring 2014.

Purdue, West Lafayette, In, 2013

Teaching Assistant

AAE 301 Signals and Systems.

AAE 251 Introduction to Aerospace Design.

Undergraduate Research Mentor

Mentored students participating in the Summer Undergraduate Research Fellowship program.

Research Experience

Smead Aerospace Engineering Sciences, University of Colorado, Boulder, Co

Instructor, 2019-Present

Assisted development of PIC and ARM based cubesat software and electronics. Included bring-up of microcontroller based electrical power system, subsystem interface implementation for command and data handling system, and driver development for attitude determination and control system.

Temporary Researcher, Summer 2020

Development of a software defined radio based meteor radar receiver, including field testing and data collection.

PhD Research, 2014-2019

Research Advisor: Dr. Scott Palo

Designed and built the real time Volcanic Ash Plume Receiver (VAPR) sensor network. The system is based around low-cost commercial GNSS chips and a low power microcontroller. Installed system at Etna volcano in Sicily, which is currently providing real-time data of GNSS signal strength near the volcano. Characterization of system performance is underway and a forward model for signal attenuation due to volcanic ash is in development.

Independent Study Research, 2014-2017

Research Advisor: Dr. Scott Palo

Built and programmed an Attitude, Determination and Control System (ADCS) for the University of Colorado QB-50 Challenger CubeSat which was based around an ARM microprocessor. Responsible for the design and implementation of attitude instrumentation, attitude determination algorithms, as well as for overall final PCB designs. The CubeSat is currently in orbit and data has been successfully retrieved from ADCS sensors.

School of Aeronautics and Astronautics, Purdue University, West Lafayette, In

M.S. Research, 2013-2014

Research Advisor: Dr. James Garrison

Developed a real time bistatic radar system for remote sensing of ocean surface roughness. XM satellite radio signals were used as an illumination source and GNSS reflectometry methods were applied to the retrieved data. The processing algorithm was implemented on an FPGA which was installed in a NOAA WP-3D aircraft during an Arctic Testing campaign.

WORK EXPERIENCE

University of Colorado, Boulder, Co, 2019-present

Instructor in Aerospace Engineering Sciences

IBM, Westford, Ma, 2006-2012

Synthesis designer for 22nm processor

Responsible for closing two timing critical Large Block units

Responsible for fully routing Large Block units

VLSI Integrator for 32nm Xbox 360 GPU

Responsible for top level route of GPU

Assisted timing closure through floor-planning and signal buffering

Logic Designer for 45nm Wii U processor.

Scripted conversion of legacy RTL to synthesizable Verilog

Verified and debugged new logic through formal verification

Implemented new pervasive logic features

VLSI Integrator for 45nm Xbox 360 processor.

Responsible for top level integration of a memory unit

Re-floorplanned sub-units and dust logic to accommodate size requirements

Met goals on a compressed schedule compared to the 65nm shrink of the same design

Circuit Design Engineer for a PowerPC 460 series processor.

Modified design in Verilog to improve timing
Debugged issues found through formal verification
Provided library support, including timing characterization of custom dynamic circuits

IBM, Burlington, Vt and Waltham, Ma, 2004-2005

Hardware Verification Lab Co-Op

Assisted in bring up and verification of both single and dual core PowerPC 970 series processors.

Circuit Design Co-Op

Performed partition level integration tasks on a 65nm games processor

Sun Microsystems, Burlington, Ma 2003-2004

Circuit Design Co-Op

Provided schematic editing and verification support for the Ultrasparc5 processor

General Dynamics Armament and Technical Products, S. Burlington, Vt, 2002

Software Engineering Co-Op

Created and administered databases on risk mitigation and electrical interfaces

Publications and Presentations

Journal Articles

Rainville, N., S. Palo, K. Larson, and M. Mattia, 2019; "Design and Preliminary Testing of the Volcanic Ash Plume Receiver Network." *J. Atmos. Oceanic Technol.* doi:10.1175/JTECH-D-18-0177.1

PhD Thesis

Rainville, N., "GPS Volcanic Ash Plume Detection Modeling and Instrumentation Development", University of Colorado Boulder, 2019.

Master's Thesis

Rainville, N., "Development of a Real Time Bistatic Radar Receiver using Signals of Opportunity", Purdue, 2014.

Conference Posters

Rainville, N., Palo, S.E., Larson, K., Roesler, C., Mattia, M., Coltelli, M., Rossi, M., and Fee, D., "Detecting Volcanic Ash Plumes with GPS Signals", American Geophysical Union, Fall Meeting, San Francisco, 2016.

Rainville, N., Palo, S.E., Larson, K., and Naik, S. "Development of a GNSS Volcano Ash Plume Detector. AGU", American Geophysical Union, Fall Meeting, San Francisco, 2015.

Palo, S.E., N. Rainville, J. Stark, A. Dahir, N. Nell, C. Rouleau, A. Antunes de Sa and J. Fukushima, "One of 50: Challenger, the University of Colorado Boulder QB50 Constellation Satellite", American Geophysical Union, Fall Meeting, San Francisco, 2015.

Rainville, N., Vaudrin, C., and Palo, S. E. Multistatic Specular Meteor Radar. CEDAR, Summer Workshop, Seattle, 2014.

Conference Presentations

Rainville, N., Palo, S.E., Larson, K., Roesler, C., Mattia, M., Pulvirenti, M., Pellegrino, D., and Rossi, M., "V11E-07: Applying the GPS Volcanic Ash Plume Detection Technique to Consumer Navigation Receivers", American Geophysical Union, Fall Meeting, New Orleans, 2017.

Conference Papers

Aboaf, A.P., Harrod, E.S., Zola, M., Prakash, A., Palo, S. E., Marshall, R., Pilinski, M.D., Rainville, N. Dahir, A., Nataraja, V., Schwab, B. Gardell, A., Warshaw, L., "A Methodology for Successful University Graduate CubeSat Programs", 34th Annual AIAA/USU Conference on Small Satellites , 2020.

Grants and Awards Received

Collaborative Research: DASI T, PI: Scott Palo, CO-PI: Nicholas Rainville, National Science Foundation, 01/01/2020 – 12/31/2023, Project #1558451

Space Domain Awareness Orbit Research Partnership Graduate Project, PI: Nicholas Rainville, Aerospace Corporation, 09/01/2020-06/30/2021, AWD-20-08-0132