

Justin Poh (he/him)

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EDUCATION

Massachusetts Institute of Technology

Cambridge, MA

Candidate for Ph.D. in Aeronautics and Astronautics

Expected December 2024

Provisional Thesis Title: A Systems-Theoretic Framework for Safety-Driven Development of System Architectures

(Advisor: Prof. Nancy Leveson)

Master of Science in Aeronautics and Astronautics

February 2022

Thesis: A Top-Down, Safety-Driven Approach to Architecture Development for Complex System

(Advisor: Prof. Nancy Leveson)

Franklin W. Olin College of Engineering

Needham, MA

Bachelor of Science in Mechanical Engineering

May 2016

INDUSTRY EXPERIENCE

Aptiv and Motional (Hyundai-Aptiv Joint Venture)

Boston, MA

Engineer III, Vehicle Systems Engineering

January 2018 – July 2020

- Led a team consisting of 2 other systems engineers to work with the product management team to define product-level requirements for a subsystem on the company's next generation of autonomous vehicle.
- Generated subsystem-level requirements and developed logical subsystem architecture based on the product-level requirements with inputs from safety and cybersecurity teams.
- Collaborated with software development teams to develop hardware and software requirements and the physical system architecture for the sensor suites and computational hardware on the vehicle. These requirements informed development conversations with potential component suppliers.
- Worked with cybersecurity team to define software and component requirements needed to enable secure on-vehicle communications and secure software updates for components
- Contributed to integration efforts with an OEM vehicle, working with engineers at the vehicle OEM to identify suitable hardware and software interfaces for use by the autonomous driving software
- Developed hardware and software requirements for a vehicle power management device that resulted in an issued patent
- Led a team of 3 other engineers to develop a diagnostic and vehicle commissioning tool for internal use. The tool included a Python-based local client and a PostgreSQL database.

nuTonomy (Acquired by Aptiv in 2017)

Boston, MA

Autonomous Vehicle Engineer, Vehicle Engineering

August 2016 – December 2017

- Performed on-vehicle testing and debugging of the autonomous driving software
- Contributed to the development of processes for evaluating software bugs or behavioral problems identified during on-road testing to assist software development teams in identifying potential fixes
- Developed several improvements to the on-vehicle health monitoring software to provide better feedback to safety operators who monitor the vehicle's behavior during operation.

RESEARCH EXPERIENCE

Massachusetts Institute of Technology

Cambridge, MA

Graduate Researcher – Air Traffic Management Architecture Development

January 2022 – Present

- Developed the Safety-Driven Architecture Development Framework (SDADF), an extension of the initial systems-theoretic approach created in Masters thesis. Framework provides a process for using STPA to systematically explore the design space to identify preferred system architecture(s) based on safety and other considerations.
- Applied SDADF iteratively to develop and refine an air traffic management system architecture for enabling urban air mobility (UAM). Over two design iterations, an adaptive collision avoidance architecture was developed that allows ground-based air traffic management to work with pilots to collectively prevent collisions.
- Presented research results at project brief-out meetings that included NASA and FAA attendees. Early results were also presented in a conference paper at ICRAT 2024.

Graduate Researcher – Advanced Rotorcraft Architecture Development

September 2020 – January 2022

- Developed an initial systems-theoretic approach to architecture development to define how to use STPA results to inform architecture development (approach described in Masters thesis).
- Applied this initial approach to develop the pilot-automation architecture for an advanced rotorcraft intended to be flown in degraded visual environments (DVEs) (e.g. heavy rain/snow, fog, haze, brownout conditions).
- Demonstrated how system safety, human factors engineering and algorithm design considerations can be accounted for in an integrated manner during both system analysis and design of the rotorcraft architecture.
- Developed and compared 3 pilot-automation architecture options representing different levels of flight autonomy to demonstrate how this approach can help systems designer decide on appropriate responsibilities for the pilots and automation in the system.
- Conference paper summarizing human factors contributions of this research is currently in review at the 2025 International Symposium on Aviation Psychology.

Franklin W. Olin College of Engineering

Needham, MA

Research Assistant – Development of Autonomous System for a Ground Vehicle

September 2015 – May 2016

- Led a team of 3 researchers to modernize an old John Deere utility vehicle that was previously used as a robotics test bed. This included hardware upgrades to improve vehicle safety and add computational resources.
- Implemented drive-by-wire capability in ROS (written in Python) and performed field testing of new hardware and software added to the vehicle.
- Integrated LiDAR and camera images to create a depth-registered image of the scene in front of the vehicle for use in future obstacle and terrain detection algorithms.

TEACHING EXPERIENCE

Massachusetts Institute of Technology

Cambridge, MA

Graduate Teaching Assistant – System Safety Concepts

September 2022 – December 2022

- Teaching assistant for introductory graduate-level course on system safety. Course introduces students to accident analysis and system analyses including both traditional techniques and STAMP-based techniques (i.e. CAST for accident analysis and STPA for system analysis).
- Held weekly office hours to help students with STPA and CAST class projects and answer student questions about class material.
- Reviewed student submissions (both CAST and STPA) and provided feedback to students.

PUBLICATIONS

J. Poh, N.G. Leveson, N.A. Neogi, “A Safety-Driven Approach to Exploring and Comparing Air Traffic Management Concepts for Enabling Urban Air Mobility”, Proceedings of the International Conference on Research in Air Transportation (ICRAT), July 2024.

WORKS IN PROGRESS

J. Poh, N.G. Leveson, R.R. Copeland, “Designing Safe Highly Automated Human-Machine Systems Using an STPA-Based Approach: A Case Study”, International Symposium on Aviation Psychology 2025, *In Review*.

PATENTS

US Patent US-11513488-B2, “Controlling Power of Electronic Devices on a Vehicle,” Nov 29, 2022.

SELECTED GRADUATE COURSE PROJECTS

Massachusetts Institute of Technology

Cambridge, MA

Sustainable Deployment of Constellations – Multidisciplinary Design Optimization Class Project

February – May 2023

- Worked with a team of 4 other students to develop a simulation to optimize mission parameters for the deployment of a hypothetical satellite constellation while accounting for cost, schedule, environmental impact, and mechanical and thermal system constraints.

Pick and Place Robot – Principles of Autonomy and Decision Making Class Project

November – December 2022

- Developed a simple activity planner, motion planner and trajectory optimizer to enable a simulated pick and place robot to navigate a kitchen environment to retrieve and place items in required positions.