Thomas Needham

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Education

Massachusetts Institute of Technology — **Cambridge, MA**
Candidate for S.B. in Mechanical Engineering — June 2017
Applicable courses: Statics, Dynamics, Product Design & Manufacturing, Mechanics of Materials, Thermal Fluids, Thermodynamics, Numerical Computation, Data Science (mechatronics focused)

Work & Experience

MIT CSAIL — **Cambridge, MA**
Prototyping and Mechanical UROP — December 2014 – Present

- Develop more appealing enclosure shapes, better production methods
- Design, 3D print, assemble, and test motorized system for mounting and rotating antennas precisely with feedback for experiments on alignment of 24GHz equipment
- Laser cut and thermoform enclosures for antenna arrays and RF equipment

Pi Charging, Inc. — **Cambridge, MA**
Enclosure and Test Consultant — June 2015 – August 2015

- Advised on thermal management of power electronics, industry standard connectors, materials, processes, and components for scaling up production of test units
- Designed, cut, machined, and calibrated RF coils inside metal-free portable test unit
- Optimized coil layout and design within unit; tested for peak coupling between MHz coils

Sloan Auto Lab — **Cambridge, MA**
Undergraduate Researcher, Engine Tech — June 2014 – March 2015

- Ran and processed data from test runs on 4 cyl. diesel engine used as reactor chamber
- Maintained engine: changed fluids, spark plugs (in test cyl, spark ignited mixture), cleaned cylinders and replaced gaskets, installed encoder aligned with TDC
- Augmented test electronics: new boards for signal processing, EMI shielding from sparks, diagnosing problems with DAQ, cleaning up signals from numerous sensors
- Results to be published in *The Canadian Journal of Chemical Engineering*

Skills

Rapid prototyping; CAD (EAGLE, SolidWorks, MasterCam); Arduino, MATLAB, and Python; CNC and manual machining; Soldering (incl. SMD); Project budgeting and ordering (BOMs); Industry-standard supplier familiarity (McMaster, Grainger, Digi-Key, Mouser, Online Metals)

Selected Projects

Rocketry: In high school, I designed and machined small liquid/gas and solid/hybrid rocket motors or test bench operation. Many motors had run times of several minutes, though thrust generation was poor. I made calculations for better-optimized chambers, but my ability to improve the design was limited by the inaccessibility of higher quality machinery and financial resources.

Room Lighting: I have designed and installed nine radio-controlled units with two 10w LEDs each (6000k and 3000k to reduce eye strain, blue light at night) to supplement insufficient single-light dormitory scheme. Each node contains a dozen sensors and metrics being reported back to the base station. Each has its own fail-safes and runs off a common 14VDC bus installed on and around my bespoke loft. The nodes operate on PCBs designed in EAGLE with SMD components, thermistors, error code LEDs, fans, a microcontroller, radio, and fit into machined mounts for connection to the power bus.

Robotic Arms: I created 3 systems for my high school's Science Olympiad team. Each saw increased levels of complexity and design considerations. One was a modification of existing arms, another from scratch (welded steel frame, aluminum and Plexiglas control panel, worm drive motors, electromagnet end effector, powered by car batteries and rolled on wood stand) and the third had two arms run by two operators for faster task completion.

Automation: I conceived, designed, and led a team in the creation of a small, self-contained oven/conveyor/refrigerator/computer to store, dispense, cook, and present foods on demand. The unit and all of its components were made by our team just for this project: the fridge was foam insulated and cooled by Peltier plates with water cooling on the heat rejection side; the dispensers were 3x3 stacks of electromagnetic levers that could be swapped out; the conveyor ran on a lead screw and operated in both the fridge and running oven; the computer accounted for cooking times, kept inventory, and monitored the system; the oven was double-insulated aluminum with Teflon interconnects and bearings, and was heated by Nichrome resistance wire. Upon completion, the entire system was no larger than the average microwave and baked its first item just before school started Senior year.