The Rex-Cut team, which took first place, designed and built a fully-automated machine for boring very precise center holes in abrasive disks. The task had formerly been accomplished manually by an operator standing at a drill press. This machine takes a blank disk off a stack using a pick-and-place robotic arm, bores the hole with a diamond ream, and moves the finished disk to a hopper. It also counts the disks, processing them in batches of 25 units. This machine will improve both quantity and quality of the finished product -- and will relieve the operator of a boring task!
The Protonex team, which took second place, designed and demonstrated a fuel delivery approach for a small, portable fuel cell system used by, among others, the military. Originally, the fuel was delivered to the system from pressurized cans that are similar to spray paint cans. As the fuel was used, the pressure decreased, changing the rate of delivery and changing system performance. The team designed a new delivery system that inverted the fuel cans, delivering the fuel as a liquid instead of a gas. Fuel management and delivery was significantly stabilized, allowing the fuel cell to operate more efficiently and in a wider range of temperature environments.
The MBTA team, which took third place, designed a manually operated wheelchair ramp to be retrofitted into the Massachusetts Bay Transportation Authority’s 96 Green Line cars in Boston. The existing wheelchair ramp retracts under the subway car and is often jammed by stones, sand, road grit, ice, and snow. This new design folds up and is stored inside the passenger compartment, away from damaging debris. The prototype was welded from aluminum stock and other materials, functions as designed, meets all design criteria, and meets demanding ADA, MBTA, and structural requirements.
The Aquapoint team redesigned a very large wastewater treatment structure, constructed primarily of fiberglass, and built a working quarter-scale demonstration model. The current design is fabricated as a monolithic system, and is completed at the factory in ready-to-use mode. This means that it is very large and requires special and very expensive shipping arrangements. Moreover, it may take many months to reach a distant customer. The new design is built in sections so it can be assembled on location. This significantly reduces both shipping costs and shipping time. The new design was fully analyzed using computer modeling to confirm that it would withstand all pressures and forces that would be expected in normal installations.
The Hayward team designed a cost-effective water jet display system to be used with home swimming pools. The sponsor, Hayward Industries, wanted a price competitive system to be offered as an option to owners of its swimming pool. The technical approach included sophisticated computer modeling and subsequent 3D-printing of the nozzle designs. The nozzles and valve designs met all performance expectations, and the system logged almost a million successful water jet cycles in laboratory testing.
The Micro Magnetics team designed and built a high temperature oven for processing 6” diameter semiconductor in a high temperature, low-pressure, inert gas environment with very strong magnetic fields using a combination of convective and radiative heating. Their design was significantly influenced by extensive computer modeling and was constrained by restrictions imposed by the strong magnetic field.
The Philips-Lightolier team (now Philips Lighting) designed a work station where employees assemble a sophisticated lighting fixture. The goal of this project was to improve throughput, reduce WIP (work in process), reduce errors, reduce defects, reduce scrap, reduce cost, improve quality, increase safety by designing a more ergonomic work environment, and improve product quality and uniformity. A significant accomplishment by this team was using a computer simulation to model the manufacturing process, allowing them to establish design guidelines quickly. Their design was deemed successful by their sponsor and has been adopted.
The Raytheon team designed and built a portable drop-test fixture for evaluating and measuring the impact functions of electronic devices (such as circuit boards and hard drives) dropped on specified surfaces, including concrete, wood, and carpet floors. The apparatus allows the user to select various drop heights and adjust the angle of impact. The accelerometer is affixed to the device under test and connected to a laptop computer, which acquires and analyzes the impact. This apparatus was designed to function without requiring external power.
School for Marine Science & Technology
Wave Energy Conversion

Left to right:
Kyle Smythe
Jacob Andrews
Matthew Masterson (Team Leader)
Ryan Hansen
Will Conroy

The Wave Energy team designed and built a prototype wave energy conversion apparatus to demonstrate the feasibility of magnetically coupling the external float with the internal mechanism, which includes an alternator. In this design, the internal mechanism is completely sealed, so that sea water cannot contaminate the moving and electronic parts. The project was sponsored by UMass Dartmouth’s School for Marine Science & Technology (SMAST).
The United Technologies team designed a new approach to using an all-water cooling loop (instead of the standard ammonia-water double loop) for cooling a spacecraft. In this type of system, water is circulated to the external radiator, where it could freeze, disabling the cooling system and seriously endangering the spacecraft. The team built a working laboratory model of their design and successfully demonstrated that the water loop would be protected from freezing when the radiator was exposed to a -196°F environment while in a vacuum comparable to deep space.