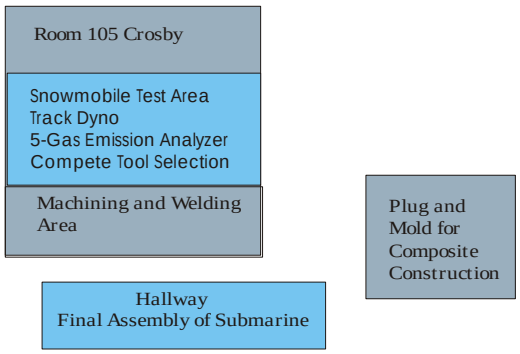
Capstone Design Studio and Workshop

The first physical realization of an engineering design is perhaps the most exciting in a design project. However, even in a world of computer design, the recognition of how much work remains after the first machine is built may be the most important lesson. The vision that underlies the capstone design class is that a computer is one of the design tools used for all of the projects. However, engineering principles are often best understood when a model becomes a system in metal, plastic or advanced composites. These systems are built from the engineering models using engineering principle s taught in thee first three years of the curriculum. The final system is then tested, critiqued and compared to the results of efforts by other students from the top engineering programs in North America.

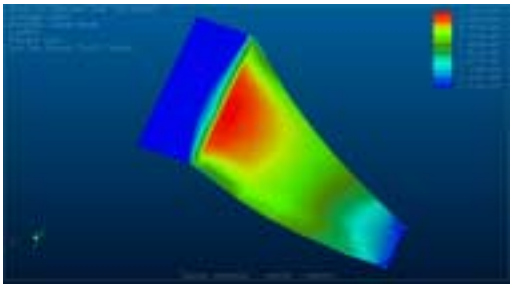
While the capstone design program has retained its traditional ties to Maine industry, growth in enrollment, changes in state industry and changes in student experience have required that the program adapt to a number of new realities. The new vision include the use of student intercollegiate competitions that fit the educational objectives of the department and which are well suited to Maine's growth opportunities.

The future direction of the program will include dedicated design and fabrication space. Currently Crosby Laboratory houses a unique set of undergraduate design laboratories, including a complete snowmobile test facility, a composite fabrication area, and the ability to produce molds and plugs for composite construction as well as more traditional metal fabrication for the projects including machining and welding. The latter is supplemented by the higher precision facilities in the Advanced Manufacturing Center. Currently support for the projects is solely from donations and departmental, university and college funding as available. However, increases in enrolment have not been accompanied by increases in the available budget. At the same time, continual upgrading of the physical facilities is needed to meet the changing demands of the program and safety regulations.



University of Maine Clean Snowmobile
Society of Automotive Engineers

The Society of Automotive Engineers Clean Snowmobile Challenge 2002 (SAE CSC 2002) is an engineering design competition organized by the Society of Automotive Engineers (SAE). The intent of the competition is to provide universities with an intercollegiate competition that allows them to re-design stock snowmobiles to reduce emissions and noise, while maintaining or improving the performance of the snowmobile. The emphasis is on low-cost modifications that are suitable for snowmobiles used as rentals in sensitive environmental areas. The modified snowmobiles are expected to be quiet, emit significantly less unburned hydrocarbons and carbon monoxide than conventional snowmobiles (without significantly increasing oxides of nitrogen emissions), and maintain or improve the performance characteristics of conventional snowmobiles. Teams compete both based on the technical content of their design as well as on the quality of their implementation.



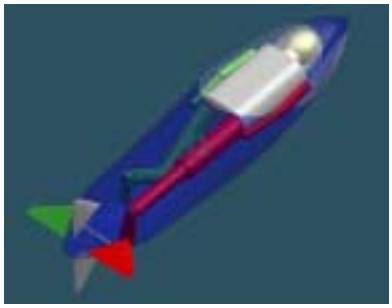
The University of Maine team has based their work in previous years on a 1994 470 CC 2-stroke SkiDoo. However, this year modifications will begin on a new 2003 Artic Cat 660cc 4-Stroke snowmobile. The modifications to the SkiDoo have included custom designed noise control system, air injection for hydrocarbon emission reduction and fuel injection. For the 4-stroke machine noise control will be accompanied by addition of a catalytic converter with additional performance enhancing options.

For both machines additional performance increases have been obtained by the use of custom composite components such as the carbon epoxy front leaf spring that was designed for the 1994 SkiDoo. Analysis is a key element of the project and an effort is underway to develop models of the snowmobile that will allow the competition performance to be predicted prior to testing.

Human Powered Submarine
American Society of Mechanical Engineers

University of Maine
Human Powered Submarine

Competing against the current winning teams in this competition means competing against the fastest submarines in the world. The Guinness Book of World Records has to separate categories for Human powered Submarine, propeller and non-propeller driven. The University of California San Diego and Ecole de Technologie Superieure currently hold the world record in the non-propeller and propeller categories respectively.



The competition is for wet submarines, which means that the operator will breathe using standard SCUBA equipment. This ensures the safety of the pilot and reduces the risk to the operator should there be a hull failure. The submarine is powered solely by the driver's efforts without any energy storage device. In the case of the University of Maine entry, this means that the operator uses a stepping motion to move the machine.

The University of Maine submarine has been developed over the past two years to optimize each of the subsystems of the submarine. These subsystems have comprised capstone design projects for 10 students over the past 2 years, which represents 10 credit hours per student or nearly 4500 hours of work by the design students. The submarine uses a composite sandwich hull that was designed and built by the first group of six students who worked on the projects. The following year two groups with two members each worked on optimization of the stability system and the control system. In addition, 4 other lower division students have worked in their own time on the project on training and system optimization. The efforts in the project over a number of years closely mimic the development of a high-risk endeavor in a technology driven company. T This communication between groups and across years with a clearly defined set of objectives is the cornerstone of our educational philosophy in this project.