Introduction

The International Student Offshore Design Competition (ISODC), sponsored by the Society of Naval Architects and Marine Engineers (SNAME) as well as the American Society of Mechanical Engineers (ASME), is a perfect opportunity for MIT undergraduate Ocean Engineering students to gain additional deep-sea design experience and enhance their abilities to effectively work in teams and manage projects.

Specific Aims

There are two sets of goals that would be appropriately identified. First, SNAME and ASME have published their reasons for sponsoring the competition. The purposes they are trying to serve are ones that the Ocean Engineering department here at MIT should address as well. ISODC was designed for four primary reasons. First, these organizations hope to promote student interest in the offshore industry specifically and more generally, in the practice of naval architecture, marine, ocean and mechanical engineering. Secondly, they also hope to promote recognition by educators of the significance of naval architecture, marine, ocean, and mechanical engineering in the offshore industry. Their third purpose is to promote the participation of the offshore industry in the education of naval architects and ocean engineers. Finally, they hope to develop an appreciation for the design process and encourage interdisciplinary teamwork and collaborative effort, as well as to develop mentor relationships between the students and industry professionals. [www.sname.org]

Any academic department at any college shares, to some degree, those goals for their students. Additionally to those however, the OE department could also use another means for getting undergraduate students excited about the field, and the ISODC as an organized IAP event could serve to do just that. Refining team work skills and making contacts in the industry are very worthwhile goals, but even more so, MIT OE undergraduate students could use more design opportunities. Currently the extent of their detailed design work takes place in the senior design sequence. Undeniably, any engineering student can benefit from multiple, diverse design projects at an undergraduate level. A peripheral aim to the department's support of an ISODC team could be increased exposure of the MIT Ocean Engineering department as an excellent think tank for undergraduate OE students, who tend to be overlooked because of the large graduate program.

Background and Significance

The Society of Naval Architects and Marine Engineers is a professional society which has a large student membership. One of their primary aims with respect to this body of students is to encourage and expose them to the opportunities which exist in the various industries which constitute the field of ocean/marine engineering and naval architecture. One of these areas is the offshore industry.

The offshore industry encompasses those structures which are engineered specifically for the deeper ocean, as apposed to those marine structures, like boats, which are used in any body of water. The primary example of such a structure would be an oil rig. Because the environment for which you are designing can be so hostile, the constraints and safety measures which govern the design

Figure 1.1

are crucial. These structures are located in the mid Gulf of Mexico where dangerous hurricanes and rogue current eddies are a constant menace, and for the North Atlantic and Pacific where wave heights and sea states are so extreme that often the structure must be designed to operate autonomously because it is too dangerous to risk the personnel. The offshore industry, although challenging and often stressful, is a very exciting and cutting-edge field to be a part of.

Offshore drilling began over 50 years ago, and the challenges that engineers working in this area are presented with are extremely complex and difficult. Because of this, companies who exist in this sector of our economy, require highly skilled engineers and scientists. It is therefore in the best interests of these companies, mostly oil companies, to encourage young professionals and engineering students to get involved with offshore design. The ISODC is a means to achieve this goal. Through the contacts the students make with their professional advisors, a network of people in the industry will be created that could prove invaluable for the students when they begin to enter the job market.

Figure 1.2

The Competition itself is well organized. A more extensive set of the rules and regulations can be found at the SNAME web site (www.sname.org), but the basic set up is a team of up to 6 students and one student advisor prepare their design of an "offshore structure" (broad term which gives the teams freedom in their choice of system). They must register by the end of February, the design submission date is in the end of June, the top five designs are announced in the end of August, and the overall winner is announced in mid September. A first prize of $1500 is awarded, and 750$ and $500 are awarded the second and third place teams, respectively. Judging is based on utility and relevance to the industry, a demonstrated grasp of the key design issues, system integration, demonstrated teamwork, quality of work in the technical summaries, and creativity of design. The students must submit their design electronically and in English, and they must also provide an executive summary which is limited to 3 pages.

Proposed Project

The MIT students in Ocean Engineering have never before participated in any SNAME design competition as an organized team. Therefore, I am proposing that a team be organized for a structured series of design sessions over the Independent Activities Period (IAP) during the month of January. The team would consist of 6 students (the maximum allowed by the sponsoring organization) most probably from the Ocean Engineering department exclusively. With the aid of a faculty advisor, a faculty technical advisor, and a professional advisor, the team will use the structured IAP meetings to do the bulk of the design, and continue the design and preparation of the presentation through the spring term so that the competition submission deadline of early June can be met.

The students will meet 3 times a week over the four week IAP period. At least one of those meetings will include the faculty advisor. The meetings will most probably be officially 2 hour periods, however a larger time commitment is anticipated as there is a considerable amount of work to be completed over the IAP period. The initial goal will be to complete the design, at a somewhat technical level, by the end of the first week of Spring term, or Friday the 7th of February. During the remainder of the spring term, weekly 1-hour meetings will insure team member accountability and timely completion of the design. One student member of the team will be chosen to administer the project submission in June and maintain contact with the team members when necessary.

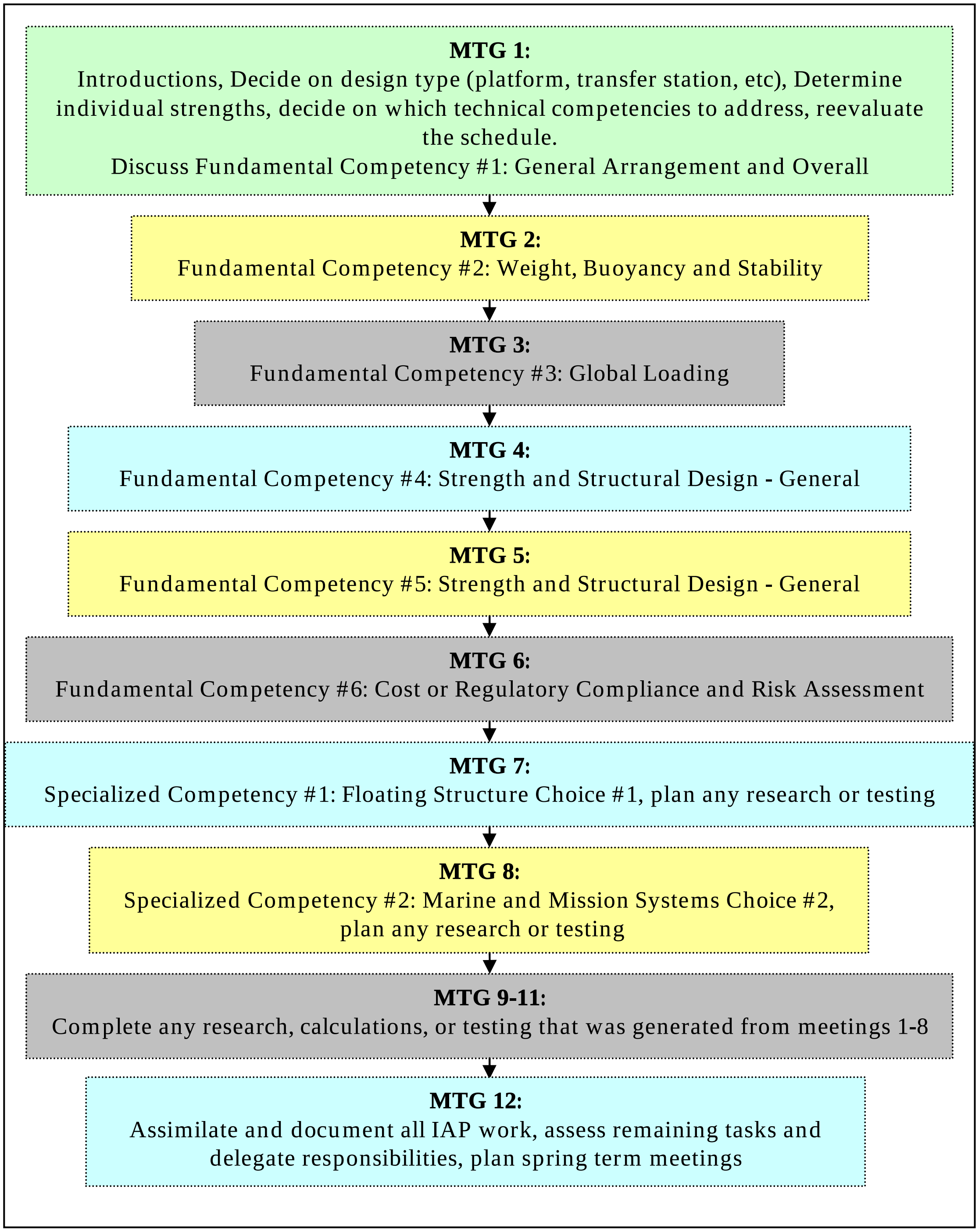

Figure 2.1 : Schedule of IAP Meetings

One of the goals of establishing this ISODC team this IAP is to establish a sufficient infrastructure for the continuation of this "program". The idea being that each IAP, a faculty advisor helps a team of students organize themselves around this same competition, or at the very least one of the Naval Architectural or Ocean Engineering competitions that SNAME sponsors each year. Because this year will be the inaugural, sufficient higher level organization will have to be executed and well documented to facilitate the future year's teams. Higher level is meant to mean, broad organizational guidelines that can be used to organize a team of OE students around an arbitrary design contest with the help of a faculty advisor.

On a more technical level, the team of students will be required to address at least 8 of the following areas of competency. Five or more should come from the fundamental competencies, and the remainder from the more specialized competencies.

Fundamental Competencies

- General Arrangement and Overall Hull/System Design
- Weight, Buoyancy and Stability
- Global Loading
- Strength and Structural Design- General
- Cost
- Regulatory Compliance and Risk Assessment

Specialized Competencies – Floating Structures

- Hydrodynamics of Motions and Loading
- Wind and Current Loading
- Mooring/Station Keeping (or propulsion, tendon design)
- Structural Design: Local Strength design with attention to fabrication
- Structural Analysis: Global strength
- Fatigue Strength
- Specialized floating vessel design (operations support or construction vessels, drilling and production vessels, etc)

Specialized Competencies – Marine and Mission Systems

- Marine Engineering: Choice, arrangements, and sizing of marine systems and equipment
- Power Generation, Distribution, and Electric Load Analysis
- Electronics and Instrumentation

- Definition, Development, and mechanical design of specialized mission systems (petroleum production or exploration, offshore construction, risers, subsea, etc)

Specialized Competencies – Miscellaneous

- Geotechnical (soils engineering): design of foundations, piles, and anchoring.
- Construction, fabrication, and Installation

Personnel

The four primary personnel categories are as follows:

1. 1 Faculty Advisor: meets with team weekly over the IAP period, aids with the organizational and technical aspects of the duration of the competition, helps to procure adequate resources for any technical testing to be conducted, helps the students to find and access multimedia presentation design hardware and software, and in general overseas and advises the progress of the design.
2. 1 Faculty Technical Advisor: this is a less obligated member of the faculty who has significant experience in offshore design. The students will be able to consult this advisor at random points in the design process as purely a technical resource. He or she will also help to refine the final project at the end of the spring term, checking for technical inaccuracies and adequate design thoroughness.
3. At least 1 Professional Advisor: For this particular years team, we already have an offer from Dr. Steve Leverette a structural engineer at Atlantia, an engineering firm based in Houston which has done extensive design work on the Tension Leg Platform (TLP) type vessels used by Exxon and Shell oil in the Gulf of Mexico.

The professional advisor, or advisors as the students are encouraged to contact engineers at any of the participating firms, will play a role similar to the faculty technical advisor, in that he or she will be consulted on an as needed basis, and have little to no responsibility to the team or the finished product.

4. 1 Group of 6 students: This year, the team will probably consist exclusively of Ocean Engineering Undergraduate students. However, in future years, multiple teams with representation from other departments, i.e. mechanical engineering, might be possible. The only obstacle to overcome with multiple teams is getting multiple faculty advisors to commit to overseeing the process.

Resources and Budget

More than money, there are a few resources which will be necessary for this team to be able to adequately create and present a feasible design. On a more basic level, a room to meet in will be necessary for the 12 design sessions over IAP. Ideally the room would be located in either buildings 1, 5, or 7. Additionally, should the team decide to organize some actual model testing, they will need access to one of the Ocean Engineering departments tank facilities; the Tow Tank would probably be the best suited. From the quality of the presentations given by the winning teams in last year's competition, the team could also benefit from access to some more advanced multi-media software.

Financially speaking, there are 3 possibly sources of expense. Starting with the largest potential expenditure, if the team is to place in the top five finalists of the competition, they will be invited to present the design at the SNAME annual meeting which will be in San Diego next year. There is obviously a considerable cost associated with sending 6 students and one faculty advisor to California from Massachusetts. SNAME is (supposedly) establishing a travel subsidy for exactly this purpose, but assuming roughly $500 per person to travel and stay in San Diego for 3 days, there is potential for a $3000 expense. Additionally, money may be required to purchase materials for the presentation or whatever models or tests are generated. Assuming the use of all software can be acquired for free, the most that should reasonably be required for materials is certainly less than $500. Finally, providing dinners for one of the weekly meetings would enhance the experience, and this could cost up to $100 over the IAP period.

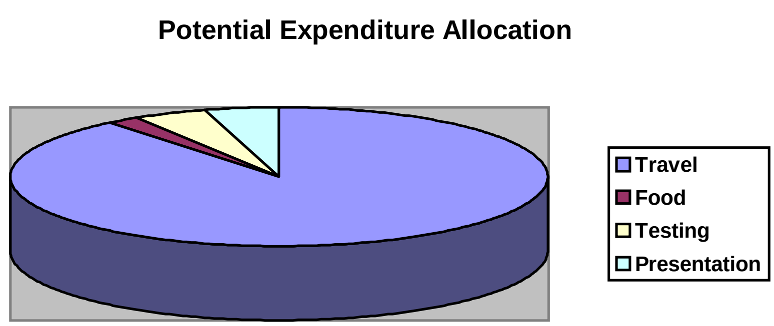

Figure 2.2

Conclusion

The MIT Ocean Engineering Department can do nothing less than benefit from supporting, in every way possible, an ISODC team. Financial cost to the department is miniscule with respect to the potential benefits to the students and the program. This proposal is doing little more than requesting Ocean Engineering at MIT to further ameliorate an already superb undergraduate education.