IPRO 308 Tsunami Relief - Final Report

Introduction:
This project was motivated and established through the desire of members of this team to investigate and promote the use of the capabilities of IIT's campus in the support and aid to disaster stricken areas of the world. This was to be the first semester of a multi-semester IPRO that would lead to an effective way of providing service learning opportunities for the faculty staff and students at IIT.

Table of Contents:

Project Background: 1
Purpose: 1
Research Methodology: 2
Assignments: 2
Barriers & Obstacles: 3
Findings: 3
Conclusion: 5
Recommended Next Steps: 5
Acknowledgements: 7

Project Background:

This IPRO was created through the initiative of a few IIT students the week of January 10.

One of the major challenges that the suffering nations have is that they are only receiving funding, and now need the people, supplies and actual assistance to make the changes to rebuild their lives.

Purpose:

The project will be a continuing multi-semester project. The first semester will be a period where the students and faculty decide which route to take, research the feasibility, research old or create new designs, structure a plan, and set up the contacts necessary to achieve one or more of the following: (1) Plan and design a clinic, (2) Plan and design a school, (3) Research problems and difficulties that current relief organizations have been encountering and develop viable solutions, (4) plan and design (and build?) cost-effective homes in collaboration with other universities (e.g. University of Houston).

The first semester will be researching and assessing the needs of the victims, the labor available, the supplies available, and costs in rebuilding various aspects of their lives: infrastructure, housing, medical, clinics, educational, public health etc. Students will then narrow the focus to a project and country that they would be motivated to focus on. As opposed to other projects where students work within the framework of a project, the team will be creating the framework. By mid-semester the team will have a plan, a list of contacts, and a specific project defined. By the end of semester the team should have made significant progress toward addressing the problem they have chosen. Work can begin by using old plans/models or designing new ones. Professors

from Civil Engineering, Psychology, Sociology, Humanities and Architecture have expressed serious interest in helping with contacts, connections, skills, expertise and other resources they may have available.

In semesters that follow, students will work to finish the structures or problems through new IPROs. For example, one team may be working on a physical structure, while one could work internally on public health care issues. By having the IPRO branch into different teams, the different faculty on campus can work to collaborate their efforts through their expertise. Funding can come from proposing the finished product to sponsors or the community. If the focus will be on building houses, students can propose the plan to NGOs or develop a cost for the home and fund-raise through the community.

Reaseach Methodology:

We first addressed exactly what the problem we faced was as an IPRO. Discussions led to what direction our team wanted to take, both practically and not, and we discussed what resources and talents we had among us. It was obvious that we needed help and input from students and faculty members throughout the IIT campus. After mass emails to the student body, both alumni and current, the team decided to contact National Government Agencies (NGO's) to possibly gain sponsorship or some sort of direct affiliation to start in aiding relief. While the team split up into contact information and brochure design, communication still progressed with companies, and was logged alphabetically on a database citing appropriate contact information. Upon completion, the brochure was sent out to dozens of NGO's in both PDF format and snail mail. Although there were many positive responses, immediate relief/action was tough to solidify. In the meantime, weekly discussions about possible project(s) the team can undertake for the rest of the semester kept happening. Possible considerations were: desalination of water, clay pot purification water system, lama homes, and the sun oven. All projects were brought up to the team via IIT faculty members. Further investigation eliminated the possibility of some projects, while demanded further research in others. As the semester progressed, the team's focus was directed towards still finding a NGO, but also finding a project(s) that interested the team as a whole for the rest of the semester or to continue to next year. Huge progress was made with Engineers without Borders, one organization that sent us a really positive reply.

While some projects were still pending an elimination status, and direct contact with EWB was progressing into a future student organization as well as an IPRO, interests in providing shelter and habitats for the affected people of the tsunami via cost effected housing sparked some more interest. Collaboration with Peter Beltimacchi, assistant Dean of Architecture, professors of architecture and engineering, and students' campus wide showed enough interest to propose another IPRO - The Design-Build of Site Specific Sustainable Building Systems.

Assignments:

Team Leader: Derya Civelekoglu
Webmaster: David De La Vega

Contact NGO's: - Entire Team

Development Team:
IPRO - The Design-Build of Site Specific Sustainable Building Systems
Jon Murawski
Derya Civelekoglu
Anca Pitariu

Development Team:
IPRO - Engineers Without Borders Project Opportunities
Nathan Godfrey
Tim Winter
Mayuri Amarnath

Investigation Team:
Lama Homes
Jon Murawski
Anca Pitariu
Derya Civelekoglu

Investigation Team:
Humidification-Dehumidification
Mayuri Amarnath
David De La Vega

Obstacles & Barriers:

Possibly our biggest difficulty during the course of the project was finding direction within the enormous goals we had set for ourselves. Though we had great energy and started the project strong, we became a bit discouraged as we failed to get any good leads with the organizations we were contacting. We began to see that, because we gave a very open proposal without clear and concise direction to our offer, many of the aid organizations were unsure how to respond, especially while being flooded with people looking to help. Likewise, few if any of these groups knew how to handle the help we wanted to offer. Our breakthrough came with Engineers without Borders, and organization focused on using students, faculty, and area professionals to the benefit of needy communities.

Findings:

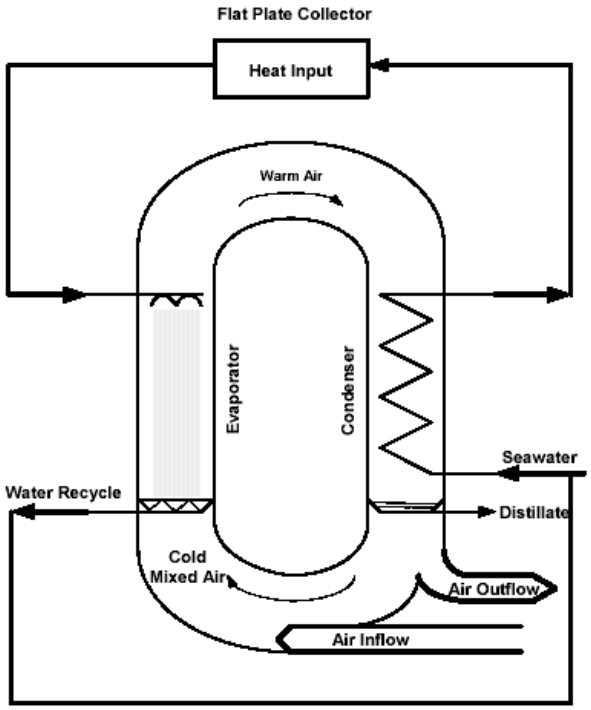
Solar Desalination of Water with Humidification-Dehumidification Technique:

Water is available in abundance on the earth; however there is a shortage of potable water in many countries in the world. In many countries the non-renewable energy is used to desalinate water from sea- water in multi-effect evaporators to overcome this problem. Major desalination processes consume a large amount of energy derived from oil and natural gas as heat and electricity. Solar desalination based on the humidification-dehumidification cycle presents a better alternative due to an overall high-energy efficiency.

The Desalination units average a daily production of 100 liters of fresh water out of 8.5 m^2 collector area (11.8 L/m2 d) of salted water without thermal storage. But if run continuously for 24 hours they can produce 1000L/ Day based on a 38 m^2 collector area. This technique is especially suited for seawater desalination when the
demand for water is decentralized. Several advantages of this technique could be presented which include flexibility in capacity, moderate installation and operating costs, simplicity, and possibility of using low-grade thermal energy (solar, geothermal, recovered energy or cogeneration).

Basically how this works is the air is heated and loaded with moisture as it passes upwards through the falling hot water in the evaporation chamber. After passing through a condenser

cooled with cold sea water, the partially dehumidified air leaves the unit, while the condensate (distillate) is collected. Water is recycled or re-circulated. Incoming cold air provides a cooling source for the circulating water
before it re-enters the condenser. This system with a closed salt water cycle ensures a high utilization of the salt water for fresh water production. In the closed water cycle, the salt water is evaporated continuously in the evaporation chamber.



MEH Unit with Open-Air/Closed-Water Cycle

Water Purification systems in developing countries:
In 2000, 1.1 billion people around the world lacked access to safe drinking water. Poor access to safe drinking water is a major cause of diarrhea disease and accounts for approximately one-fifth (19%) of child deaths annually. The consumption of safe water can reduce the risk of contracting diarrheic illnesses from 44% to 85%. Improved water supply and appropriate sanitation systems could probably contribute to a significant reduction of diarrhea mortalities and to improved health outcomes. Today in the wake of Tsunami the problems with safe drinking water are more profound and need immediate attention.

The proposed solution, called FILTRÓN, is a low cost household filter which treats contaminated water in order to render it safe to drink. FILTRÓN basically consists of a filtering element that can be made by local potters using local materials, with no need for electricity or advanced technology. It uses a technology that can be applied by members of the family and which generates job opportunities for local artisans.

FILTRÓN uses colloidal silver to remove turbidity and disinfect the water by deactivating any bacteria that pass through its tiny pores, thus it successfully purifies contaminated water. It guarantees secure storage of the treated water in the house. On passing through the filter, water deposits in a container equipped with a faucet so that no other object need be introduced to extract the water, thus assuring hygiene.

The Millennium Summit goal for 2015 is to "halve the proportion of people without sustainable access to safe drinking water" FILTRÓN is an innovatory system that can help attain this objective by ensuring low cost drinking water to poor families. In fact the set up costs for a filter workshop would be less than $5000. Personnel and equipment needed to setup such a workshop include a professional potter, 1-2 assistants, 15-20 ton hydraulic press, filter moulds, clay and sawdust mixer, hammer mill, Kiln with an area of 1 cubic meter and colloidal silver. Almost all these requirements are indigenously available hence once the workshop is setup each filter would cost a very affordable $6-$7. It has been tested to work continuously for 1 year without major maintenance.

This system also utilizes the Traditional Wisdom and Cultural Factors in its design and implementation; this would make it more acceptable for the native populations all across South East Asia. It has already been tested and demonstrated in Indonesia and Nicaragua with immensely encouraging results. As a simple, inexpensive intervention for Promoting Hygiene, Protecting and Preserving Human Health and the Environment the program utilizes the internal resources of the community and hence is ideal for the situation at hand.

Conclusion:

This semester we were able to work as a team to identify the available talents of the student body and faculty. We also identified different projects and ideas available on campus that with further development might be viable solutions to disaster relief situations. We also identified Engineers without Borders as an organization that would provide the necessary structure to bring international projects to our campus. A Chapter of Engineers without borders has been established and during the summer a project will be obtained so that the continuation of this IPRO can begin work on it at the start of the Fall semester.

Recommended Next Step:

IPRO - Engineers Without Borders Project Opportunities

Building on the good relationships that have been formed with Engineers Without Borders, we propose an IPRO that will partner with EWB-USA to develop an engineering solution and/or architectural design that will serve the region hit by the tsunami or another area in need. The goal of the team will be to work with the concurrently forming EWB-Chicago to successfully complete the design and implementation of the project received from the National Organization. The Project Plan will include the formation of a student chapter and proposal for a project in Phase I, design of a solution in Phase II, and implementation abroad in Phase III. The duration of the project from the beginning of the design could be 6 to 12 months, so the IPRO will likely continue over two semesters.

Scope, Learning Objectives, and Considerations:

Because EWB-USA receives applications and project ideas from non-governmental organizations (NGOs), universities, and even remote villages, many different engineering topics could be

pursued, including: Water Supply (Drinking Water, Irrigation, etc.), Sanitation & Waste Treatment, Structures and Construction, Energy, Agriculture, Information & Communication Systems, and Microenterprise. Development of a solution of practical application in any of these areas requires much more than the know-how only a few people of one major. Instead, architects along with civil and environmental engineering students could be needed for a building project like bridge over a waterway, or chemical, mechanical, materials, and electrical engineers may be needed to address an energy or electrical power issue. The ability of the team to respond to the community in need will largely rely on its ability to successfully collaborate and self-manage while working with faculty and Chicago Professionals; good teamwork, project management, communication, and continued learning will be essential. Likewise, consideration of community's resources and their efficient, effective use will prove critical in the successful completion of the project in light of local customs and practices.

Student Development, Collaboration, Vision

For those proposing this project, two major components of a relationship with EWB-USA create an incredibly compelling reason to be involved. First, projects give student the opportunity to use the theories they have learned and skills they have developed in the classroom in a real world demonstration. Second, an incredible wealth of experience and enlightenment can be tapped when such knowledge and skills are applied to the service of others. The involvement of area professionals allows for the added advantage of creating networking opportunities for the students involved, possibly leading to future employment opportunities. We also believe that the EWB-USA/IPRO model could be used to help implement the developing Service Track in the IPRO Program. We are excited by the opportunity to help in the development of such an initiative that could have wide-sweeping impacts on the lives of individuals: both those being served, and the students who serve them. A project in association with Engineers Without Borders would provide an excellent starting point…

> "The mission of Engineers Without Borders™ - USA (EWB-USA) is to partner with disadvantaged communities to improve their quality of life through implementation of environmentally and economically sustainable engineering projects, while developing internationally responsible engineering students"

Future Consideration for IPRO: The Design/Build of Site Specific Building System

Considering the before and after affects of the tragic tsunami, it was clearly evident that there was a strong demand for housing. Upon further research, it was clear that many countries that were destroyed were previously populated quite densely. Housing was in a strong demand. Since many of these countries have non-traditional building techniques, the collaboration with local communities on site was be difficult. We would focus on a "natural building" approach. Natural building is any building system that places the highest value on social and environmental sustainability. Natural builders emphasize simple, easy-to-learn techniques based on locally available, renewable resources. These systems rely heavily on human labor and creativity instead of on capital, high technology and specialized skills. We also wanted to focus on sustainable buildings that resisted temporary designs and were primarily focused on lasted into the future. One viable solution was to focus on cost effective buildings that used the local communities and local labor as a catalyst throughout the construction. The team will strive to develop or improve a building system originating from the traditions of building and materials available in the selected village in Meulaboh, Indonesia. The extensive expertise involved in both the design and construction of any structure will allow many different professions to both improve and learn from this proposed IPRO. Since the structural quality of the building system will not be the only

major concern in this project, students from many engineering departments will find their work relevant to the proposed scheme. Mechanical systems, energy-efficiency, and material qualities are only some problems that we hope to undertake during the course of the semester.

Investigation of local customs is essential before engrossing in a plausible design or solution. Several sub-teams can be formed to focus on design, material, construction/engineering, energy efficiency, environmental and material investigation, and marketing/advertising. A design phase sub-team can be formed to head a preliminary to final design scheme for the unit– possibly proposing the idea to NGO's, Architecture Firms, or local companies. Communication amongst team members, other IPRO's, IIT faculty, and outside professionals will be extremely important to help enhance efficiency of work. Team and individual research is a must, both for design and construction purposes as well as to gain vast knowledge of local living customs/conditions. Since this is an economical problem worldwide, direct affiliation with NGO's is possible for sponsorship and will be contacted.

Acknowledgements:

Our team would also like to acknowledge and thank the support of many individuals who helped and supported this IPRO from the beginning:

Ray Deboth - General expert in all things IPRO
Gary Jones – President of Chicago Professional Chapter EWB
Tom Jacobius – Director of Inter-Professional Studies
EWB – USA
Faculty, Staff and Students of IIT