Project Plan
IPRO 357

Project Objectives:

Continuing the work of previous IPRO teams on this heat-driven refrigeration system, the goal of IPRO 357 for Fall 2004 is to finish the construction of the prototype and begin testing and optimizing it. Another objective is to begin developing a marketing strategy for this product. This will require research to identify possible markets and to understand the range of needs and requirement the system can meet.

Background:

This project began with an eye on developing nations and remote applications. It is true that many people around the world do not have access to refrigeration. The reason for this is either poverty or an unreliable source of electricity. This means that there often is no way to preserve food or medicine. Not being able to provide for these basic needs is a major hindrance to the development of other technologies.

There two main types of conventional refrigeration: Vapor-compression and absorption. Conventional vapor-compression refrigeration has the advantage of having a high coefficient of performance (COP) of nearly 3. The coefficient of performance is essentially a ratio of the units of cooling output obtained per unit of energy input. The problem is that this type of refrigeration uses a compressor that requires a large, constant electricity supply, which is often unavailable in developing nations or remote applications. Absorption refrigeration, on the other hand, does not require a large electricity supply. It uses waste heat, which could come from any number of sources, to provide refrigeration. The disadvantages are that the COP is usually less than one and it uses corrosive materials such as lithium-bromide or ammonia.

The solution proposed to these problems is the heat-driven refrigeration system we are working on: a Rankine power cycle used to drive a simple vapor-compression refrigeration cycle. The advantages of this are that any heat source can be used (i.e. wood, steam, biomass, etc.) and only a minimal amount of electricity is needed, which could be supplied by solar cells or batteries. The compression necessary for the refrigeration cycle is obtained from a dual piston “pressure exchanger” rather than an energy-consuming compressor and the expected COP of this device is calculated to be around 1.6. This device could be used not only in remote applications, but could also be competitive to absorption refrigeration currently used in many commercial applications.

Research Methodology:

In order to achieve the project goals as stated earlier, the team will take the following steps:

Technical Aspects

- Repair leaks present in boiler system
- Amplify thermocouple signals and feed them into computer controller
- Interface pressure exchanger with computer controller
- Devise and implement a way to fill and purge system of refrigerant
- Analyze system, devise and implement ways to optimize the system

Business Aspects

- Describe the problem that we are trying to solve, how we solve it, and the advantages and limitations of our solution
- Determine who the customer will be, what the barriers will be to introducing this product, and what the competition is for this product
- Determine the cost to start production and what the profit margins will be

Expected Results:

The two major results expected from this project are a working prototype and a business plan.

Project Budget:

Miscellaneous parts: $???

Schedule of Tasks and Milestone Events:

The following is a list of the assignments that must be completed and delivered during this semester:

Project Plan	September 10
Mid-Term Progress Report	October 22
Professional Style Exhibit	November 29
Project Abstract	November 29
Web Site	December 1
Final Oral Presentation	December 1
Final Report / Business Plan	December 3

Individual Team Member Assignments:

The IPRO team is divided into four groups to accomplish the technical tasks of getting the prototype working. The Heat Generation team is responsible for fixing the leaks associated with the boilers and testing the boilers to make sure they function properly. The Data Management team is responsible for integrating the pressure exchanger, pre-boiler, main boiler, and thermocouples into a single controllable program. The Refrigerant team's task is to determine how to fill and purge the system of refrigerant, implement that, and obtain refrigerant. The Analysis team is responsible for determining what data needs to be collected, how to collect it, and analyzing it in order to determine the COP of the device and other important statistics.

Technical Teams

- *Team Leader* — Tom Alworth
- *Heat Generation* — Alec Frost, Stefan Vogel, Alex Callow
- *Data Management* — Keon Kim, Donghoon Lee, Aron Ahmadia
- *Refrigerant* — Andrew Keen, Anel Medrano
- *Analysis* — Leo Nortes, Tanim Taher

The team is also divided into three groups for meeting the business plan objectives. The Product team is in charge of defining the problem that we are trying to solve with this device, describing how we solve it, and stating the advantages and limitations of our solution. The Marketing team is responsible for establishing who the customer will be, why they will buy it, how the product will be sold, and what the competition is for this product. The Finance team will determine how much it will cost to start production, how much the product will cost, and how much profit will be made.

Business Teams

- *Product* — Alec Frost, Stefan Vogel, Tom Alworth, Anel Medrano
- *Marketing* — Keon Kim, Donghoon Lee, Tanim Taher
- *Finance* — Andrew Keen, Alex Callow, Leo Nortes

Other tasks that have been assigned are as follows:

- *Secretary* — Leo Nortes
- *Web Page Design* — Aron Ahmadia

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