Smart Module for Desalination

The need:

http://www.a-aqua.no/upload/produktbilde143.jpg

Throughout the world the access to clean water is a key challenge for many people in the developing and developed world. This project will utilize existing equipment to develop a membrane filtration system for cleaning of water that can be deployed rapidly to sites where contamination of the water may have occurred. In the developed world, this would be used in areas where a natural disaster had disrupted the water supply. In the developing world the need for clean water is a continuing issue and must be addressed at low cost and with a highly maintainable system.

This group must first research and understand water filtration. A system already exists as well as the basic parts required for developing a system. However, pressure relief and design review of the pumping system is needed in order to make a safe and effective reverse osmosis filter system. This platform must be made fully operational in order to design the smart module. The objective is to design a system that can be deployed for both humanitarian needs as well as used in locations where an immediate need exists for clean potable water.

In this project the primary deliverable is a pressure vessel designed with two taps for inclusion of ultrasonic sensors for fouling of the membrane surface. Fouling detection and the mitigation of the effects through flow control approaches allows both the yield and the effectiveness of the membrane filtration to be enhanced. The development of the smart module will reduce logistics cost for the

The key project design objective:

This is the design of a cost effective and safe composite pressure vessel. The introduction of the fittings for ultrasonic monitoring of the membrane filtration process is a non-trivial challenge since the pressure vessel needs to be design with the required fittings. Construction of the steel pressure vessel has been completed (https://sites.google.com/site/desalinationcapstone2014/) and should be used to understand the data from the system. While the existing pressure vessel demonstrates that the construction of the device is possible, a this project is focused on the composite pressure vessel. The prior year composite pressure vessel end cap design was inadequate which made the current composite design unusable (https://sites.google.com/site/desalination2014/). Filament winding hardware is available on campus, however this is an analysis intensive project where the system must be designed to print.

Who is the final customer for this device;

This system will be used by non-governmental agencies in areas of critical need for clean water in particularly after natural disasters. Desalination is also a critical technology during periods of displacement for civilian and military personnel.

Who will be supervising and evaluating the outcome of the project:

Professor Peterson will work with colleagues at Ben Gurion University of the Negev in Israel, University of Colorado and other academic and small business partners.

UMaine Mechanical Engineering technical contact point:

Professor Peterson will supervise the mechanics, materials and manufacturing issues related to the project and will serve as an interface with outside entities. Dr. Peterson is also an expert in ultrasonics and can lead the process for design. Outside technical support will be available for the evaluation of separation processes and the demands on the system for accuracy.

The core Mechanical Engineering classes required as background for the project:

Fluids
Controls
Lab classes
Circuits

Resources available:

This project is unique in that a wide range of people and equipment can be provided for the project.

End of year deliverables:

A complete design including solid model and drawings for all parts with tolerances for manufacturing will be completed as well as vended parts lists and assembly drawings. A prototype device must be built based on an optimized design approach which demonstrates the ability to meet pressure vessel codes as well as the effectiveness of the ultrasonic sensing device. Proof testing through and outside vendor will be required which will demonstrate the system meets the design goals.