

Shuttle Valve Design

Team #17

Date

October 22nd, 2013

Group Members

Ryan Laney – Team Leader

Billy Ernst – Team Webmaster

Samantha Zeidel – Team Treasurer

Instructor

Dr. Kamal Amin

Sponsor

Verdicorp Inc.
Robert Parsons



Faculty Advisor

Dr. A. Krothapalli

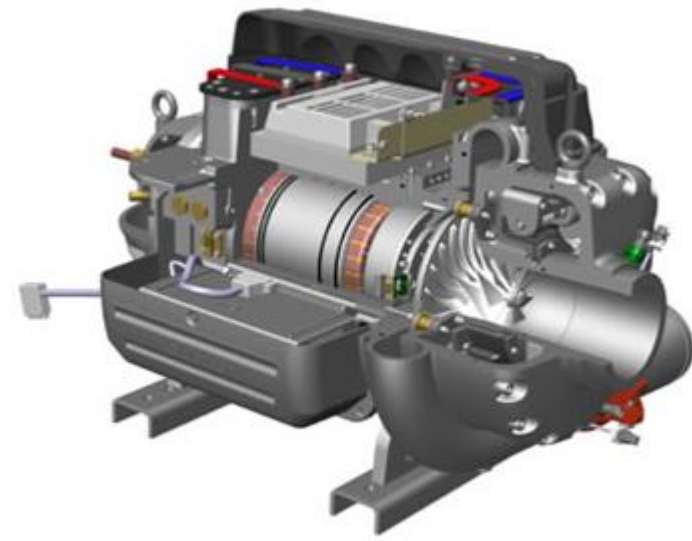


Problem Statement

- Verdicorp Environmental Technologies has developed a revolutionary Organic Rankine Cycle
- These systems are designed, built and manufactured here in Tallahassee, FL and distributed to clients worldwide
- The systems have somewhat low efficiency (~10-14%) due to the low grade heat that fuels them
- There is a special concern within the company to maximize this efficiency in any way possible
- Senior Design Team 17 has been tasked with increasing the efficiency of the system by eliminating parasitic losses within

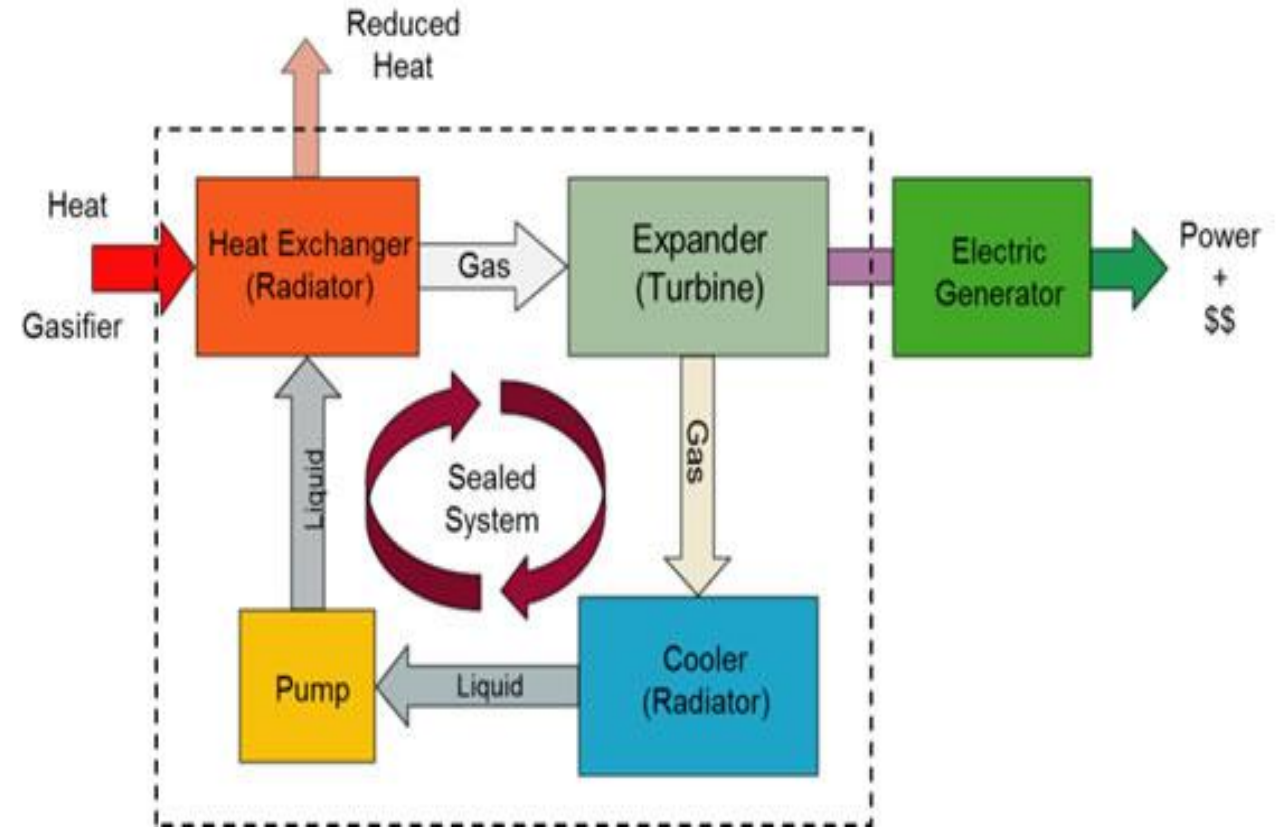
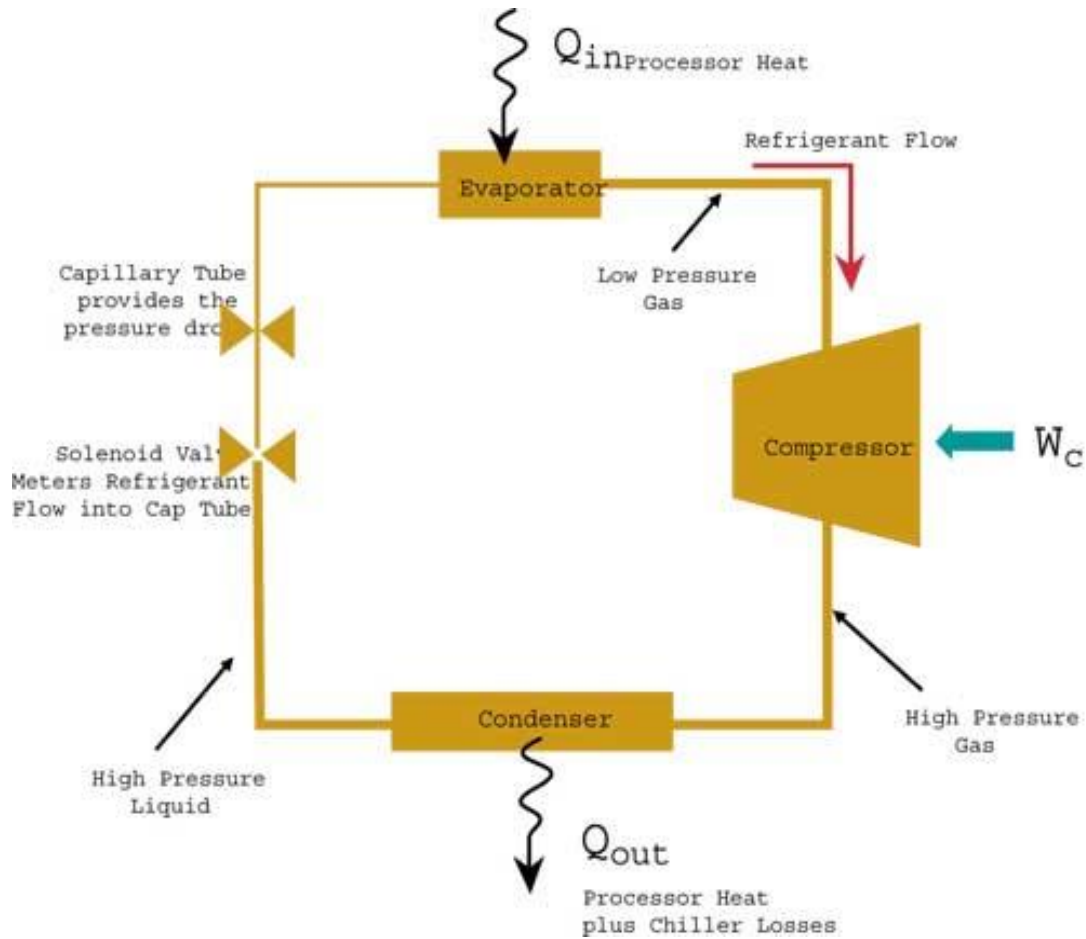
Project Scope

- Organic Rankine Cycle uses waste heat from a low grade source and converts it to useful power
- Can be thought of as a refrigeration cycle in reverse
- Refrigerant 245fa is heated from waste heat and expanded in a turbo expander (turbine generator) to produce electricity
- Fluid is then condensed in a condenser and recirculated to the high temperature/pressure side via a pump
- The pump is a parasitic loss that lowers the overall efficiency of the system
- We must improve the efficiency of the Organic Rankine Cycle
- Decrease parasitic losses within the system (Pump ~ 10kW)



Presented by: Ryan Laney

Refrigeration Cycle vs. ORC



Application of an ORC

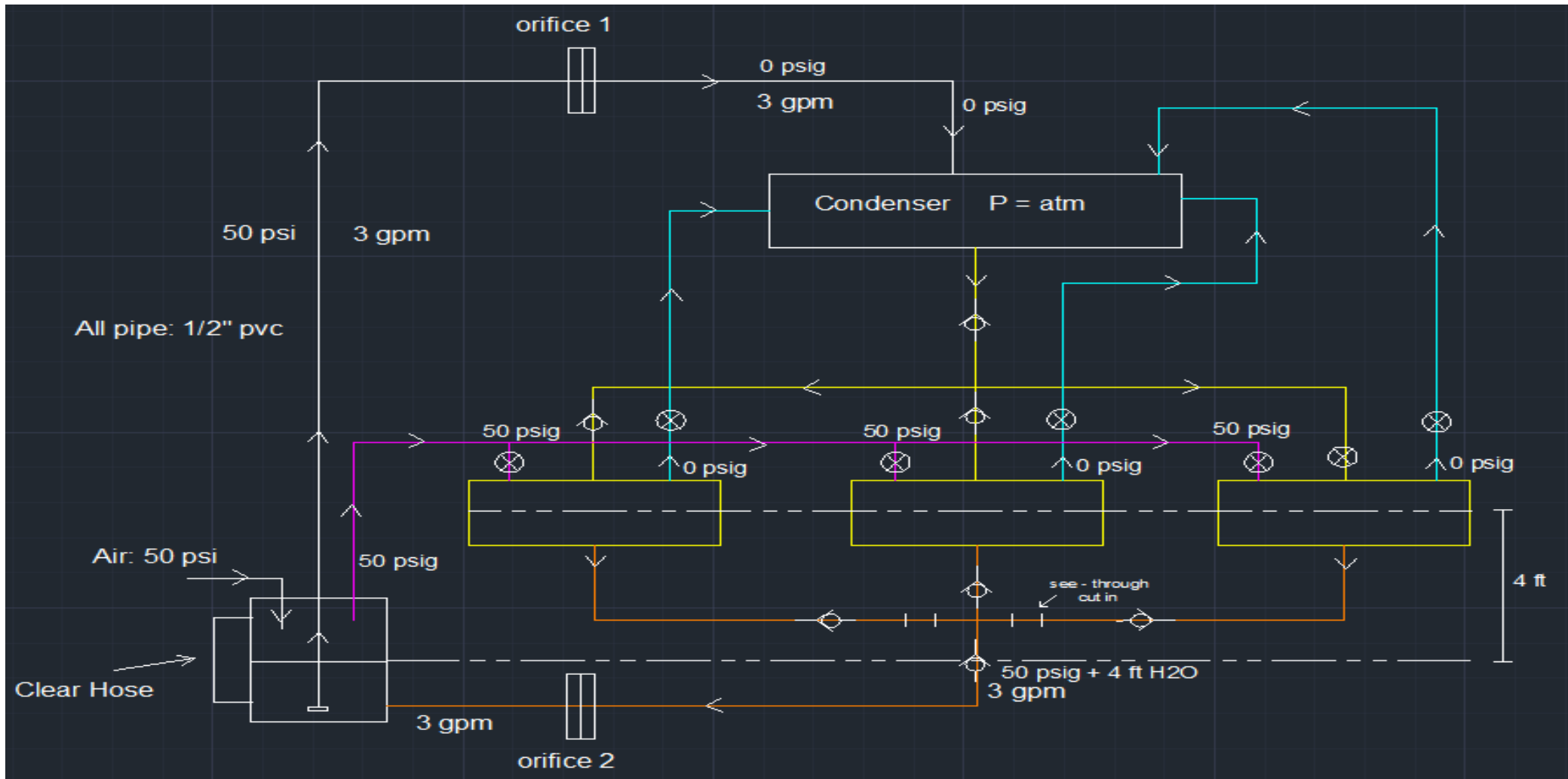


Presented by: Billy Ernst

Project Objectives

- Design a shuttle valve system to replace the pump within the ORC
- Maintain the continuous flow of liquid within the ORC
- Use solenoid valves with the aid of gravity to adjust the pressure inside the vessels
- Transfer the liquid in the system from the low pressure side to the high pressure side
- Minimize the parasitic losses in the system (electrical consumption)
- Confirm on a final design concept by late-October 2013
- Construct a prototype of the final design during Spring 2014

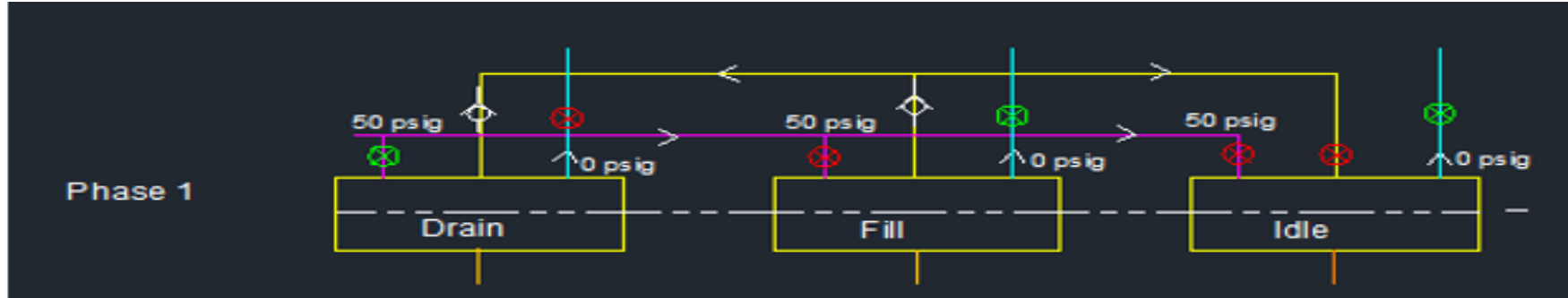
Design Concepts 1, 2, and 3 (Combined)



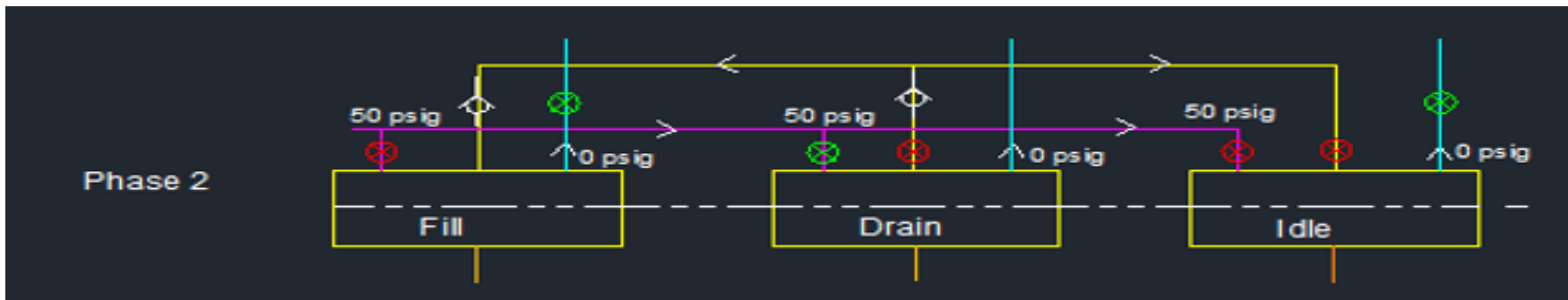
Presented by: Billy Ernst

Design Concepts 1, 2, and 3 (Combined)

- Execution of Vessel 1

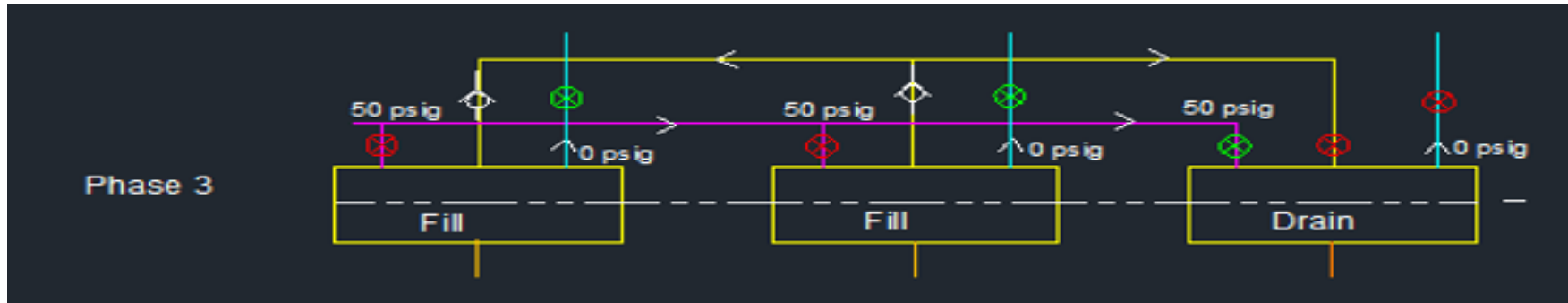


- Execution of Vessel 2

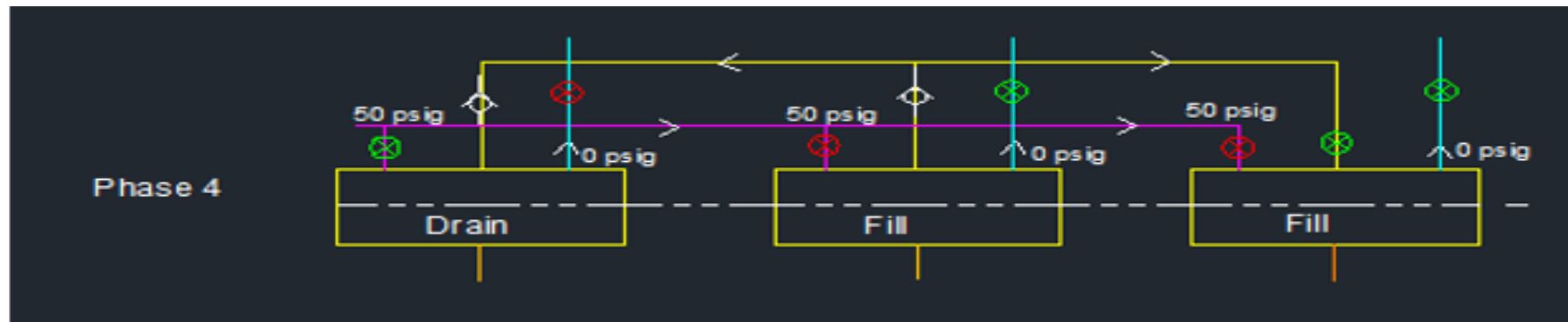


Design Concepts 1, 2, and 3 (Combined)

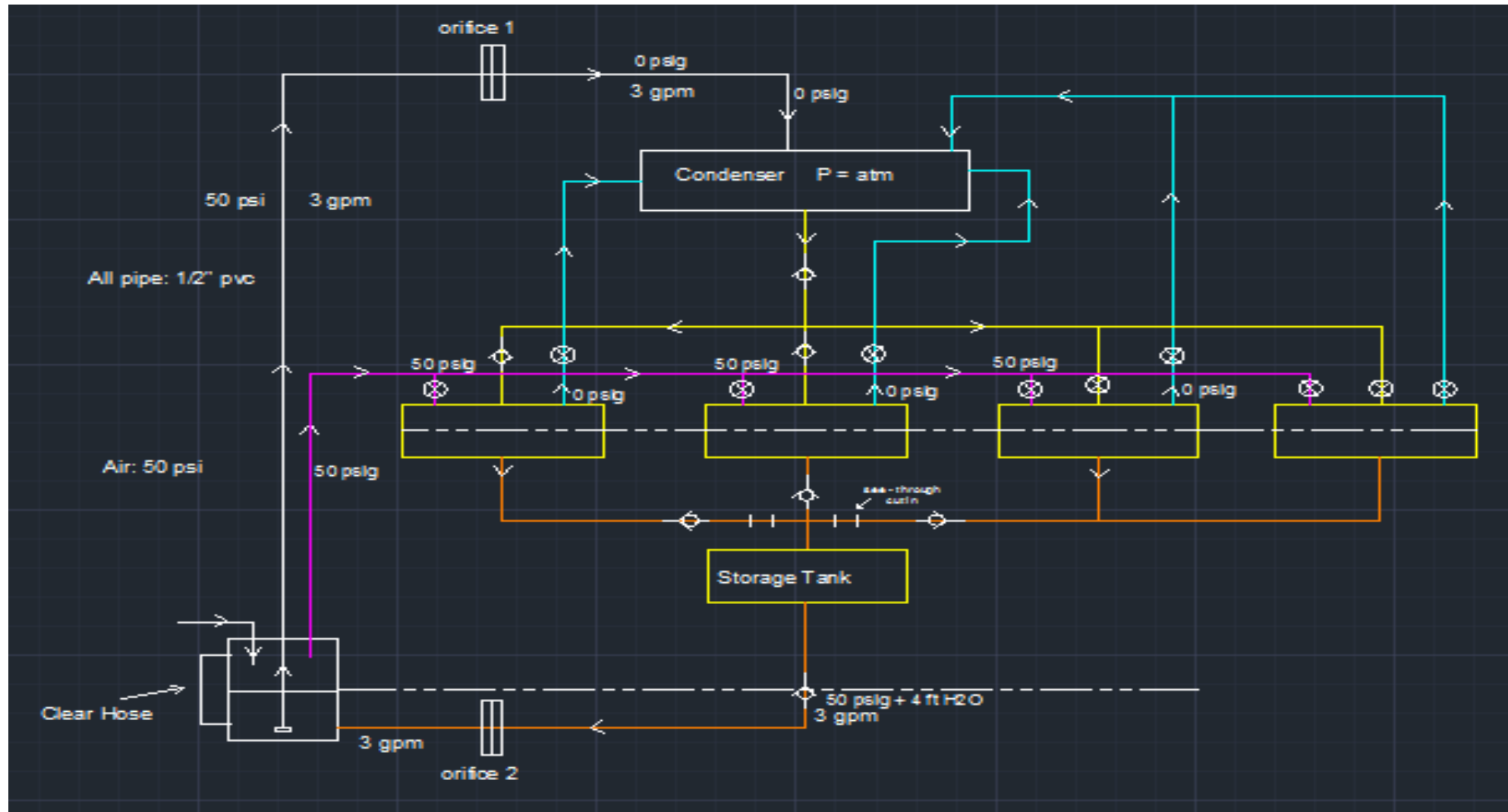
- Reservoir Vessel Execution



- Reservoir Vessel Recovery



Design Concept 4



Presented by: Ryan Laney

Evaluation of Concepts

- Design concepts 1, 2, and 3 (Combined):
 - Three very similar designs with small variations (sensor selection) generated individually by each team member
 - Combination of these designs into one design concept
 - Ideal design concept agreed upon by the team
 - Upon analysis, good chance to be final design selection
- Design concept 4:
 - Different overall design compared to the other three
 - Use of a storage tank to collect the liquid from the vessels
 - Exclusion of an emergency vessel and use of 4 continuous usage vessels
 - Extra materials and components to accomplish same goal as the other combined concept
 - Upon analysis, likely to be discarded

Potential Problems

- Challenges:
 - Creating an entirely closed system
 - Finding a transparent material that can withstand pressure of 50 psi
 - Preventing reverse flow within the system
 - Selecting an appropriate air compressor to maintain the system
 - Selecting appropriate control valves: pneumatic, solenoid, mechanical
 - Damping the noise of the air compressor
- Risks:
 - High pressure risks (50 psi)
 - Refrigerant 245fa (actual system)
 - Explosion of pressurized vessels

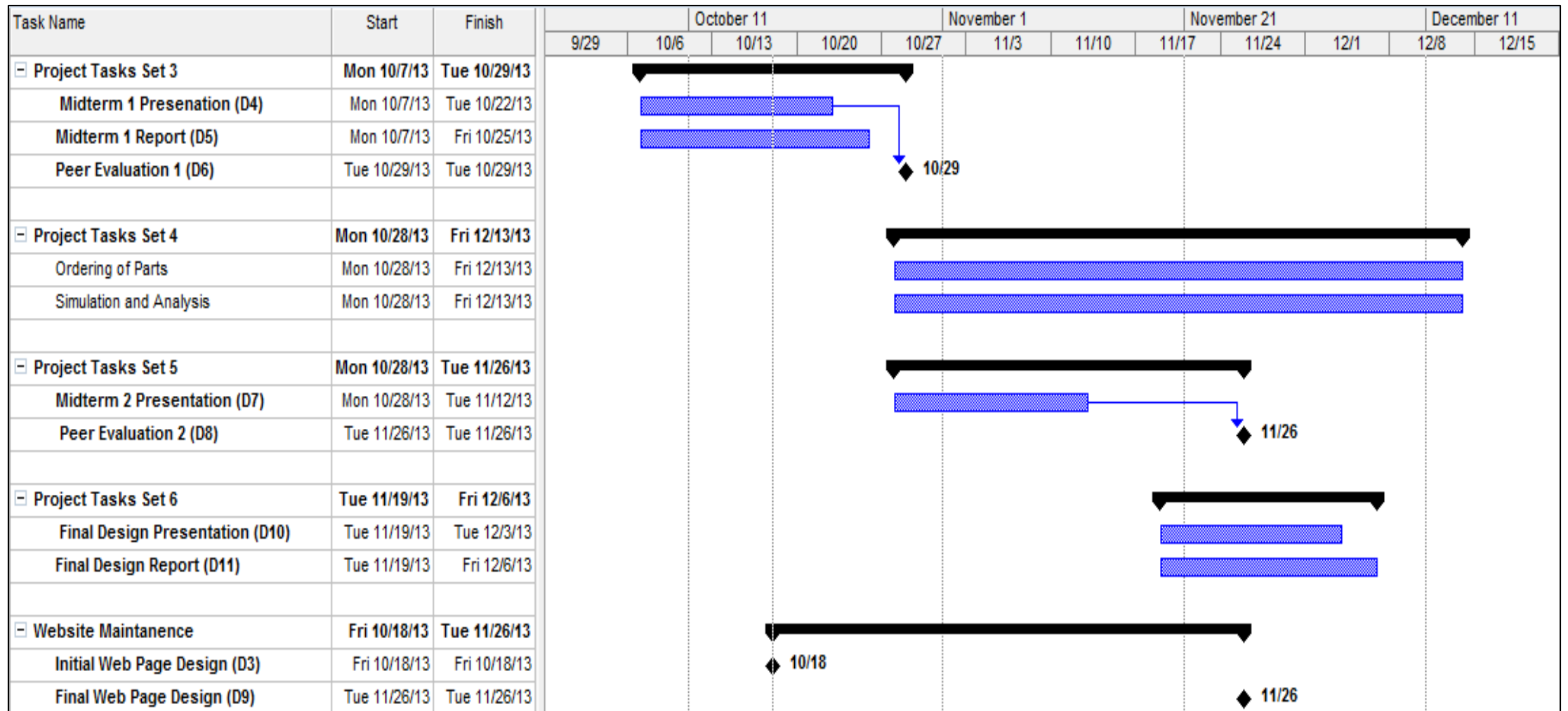


Presented by: Samantha Zeidel

Project Plans

- Simulation and analysis of final selected design
 - Calculations
 - Physical testing
 - Computational testing (PIPE-FLO, AutoCAD)
- Ordering of parts/components
 - All purchasing will be done through Verdicorp Inc.
 - AutoCAD breakdown of all components of the design
 - Obtaining the materials we will need to build our prototype
- Midterm 2 Presentations
 - Preparation – project progress update and improvement of presentation skills
- Website Maintenance
 - Making our website aesthetically pleasing
 - Updating information

Gantt Chart



Project Summary

- Analysis of the design concepts
 - Design Concepts 1, 2, and 3 (Combined): Currently the favored design
 - Design Concept 4: Currently the flawed design
- Project Progress: Great, On-schedule, Moving-forward
- Any Questions??



Presented by: Samantha Zeidel