

Background

The Fastener-less Flange project is an undergraduate design project set to redesign the flange. Bolted Flanges are the current go-to method for temporary pipe connections. These flanges rely on bulky, threaded bolts to secure the two pipe ends together. Additionally, the mated ends must be of a certain machined finish and have a gasket inserted between them to achieve a reliable seal. This leads to a large increase in weight and assembly time for any piping systems.

Goals

- Create fastener-less flange **But What is a Fastener-less Flange?**
- The intent is to create a fully integrated connection system with respect to the pipe network of the rocket
- No separate pieces required for connection
- It would be simpler than a bolted flange in terms of manufacturing and installation
- Contributes to the greater goal of a fully 3D-printed rocket

Objectives

Main Objectives

- Design a fully 3D printable design
- Reduced in weight compared to a traditional flange
- Able to withstand pressures and leak rates according to ASME B16.5 Class 150 standards

Secondary Objectives

- Have an equally distributed load
- Eliminate extra machining
- Minimize the amount of additional parts needed
- Allow for easy installation and disassembly





- pre-loading
- Pressure Seal utilizes internal pressure to its advantage

Week 2

Introduction began formulating a requirements document.

Fastener-less Flange

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Preliminary Design

Pressure Seal, Snap Fit Idea

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Zip Tie Idea

- Snap Fit reduces part count and creates
- Reciprocating Zip Tie Mechanism for Tightening
- Standard Flange Face and Gasket Sealing Method

Project Timeline Fall 2021 Hand Calculations Analysis Prototyping We calculated the theoretical forces We plan on using FEA to analyze the We will begin to create prototypes for our designs would endure and looked strength of our designs, as well as its our final design and adjust it as we at their feasibility. fatigue life. see fit. Week 9 Week 6 Week 7 Week 8 Week 10 **Next Quarter** Down Selection Rapid Prototyping **Design Selection** After reviewing our different designs After reviewing our down selection We 3D printed quick iterations of our table, we eliminated designs based on designs to get a better idea of what and their feasibility, we will choose a



Relatirity

Test of "Pull Apart" Forces on Locking Mechanism (Resisting 300 psi)



final design to move forward with.

Radial snap fit test of pressure on the inside of the pipe