Team Meeting 3/2/20 - **1.5 Wks to CDR: Mar 11**

Meeting Agenda

- CDR Task updates
    - Reduce cost - $6000 budgeted, with many equipment/part costs still unaccounted for
    - Make drawings of machined parts
- Nick Gloria feedback on PDR slides
- McMaster order - Test stand hardware, tooling, etc.

CDR Task Updates

Main Injector (est. remaining cost: $500 - PTMC fittings, post-machining)

- **Progress**
    - Elements updated
        - Coaxial non-swirl
        - 0.03” fuel annulus width for better printability
    - Propellant inlets modified to make angle adjustment easier
    - Increased min wall thickness to 3mm from 2mm for improved FS
- **To Do**
    - Work with test stand & igniter to make sure prop inlets won’t interfere
    - Redo FEA to check increased FS
    - CFD (fuel & ox pressure drops)
    - Request printability analysis from Protolabs, maybe request prototype to see how well/poorly elements print?

Igniter (est. remaining cost: $300 - PTIC fittings, tooling)

- **To Do**
    - Heat transfer/FEA with 316 stainless
    - Change the CAD to make it less clocking sensitive, easier to machine, ~~possibly change the impinge angle~~ (read Huzel and Huang)
    - Drawings
    - Pressure transducer fittings
- Done: redo FEA with inconel 718

Controls & electronics (est. remaining cost: $150)

- Integrate BOM into main
- Done: Document assembly layout for control system
    - Mechanical layout of electronics & pneumatics

    - Electrical connections to be made

Nozzle (est. remaining cost: $0 - quotes received & added to BOM)

- Done: Integrate BOM into main
- Done: Quote for nozzle - $435.88 for 1
    - Done: Multiple identical - $595.68 for 3
    - ~~Alternative throat diameters (chamber pressures)~~
        - Done: Checked out mdots for different diameters. Could do 20mm if we need to reduce mdot slightly, but varied throat diameter is probably not worthwhile due to cost (Jeff)

Combustion Chamber (est. remaining cost: $750 (machining))

- **To Do**
    - Drawings & quotes for machine/waterjet parts
        - Make drawing template with title block info (Efaine)
        - O-ring groove in aluminum tube
        - Flange, nozzle retaining plate can probably be done with waterjet/CNC in PRL
- Done: Integrate BOM into main
    - Done: Explore cheaper options for raw materials
- Done: Switch O-ring gland from flange to chamber
- Bolt notch machining & test
    - Test on Monday (Alec)

Test Stand (est. remaining cost: $300)

- **To Do**
    - Done: Bolted test stand design
    - Drawings & quotes for machined/waterjet parts
    - Hydro test plug design & machining quote
- Done:: Switch welded joints to bolted?
- Find cart/stand to support engine at tank level?
- Not yet: Aluminum nozzle replacement plug for hydrostatic testing
- Done: Remove 1” back plate, redundant

Propellant Feed System (est. remaining cost: $1500 - regulator?)

- **To Do**
    - Propellant Quotes - Waiting on Praxair
    - Part drawings and machining quotes (Venturi)
    - Done: Full assembly CAD for fitting list verification
    - Relief valve quote - Efaine will call on Monday
        - Also ask about retrofitting HPRVA-250 with viton seals to PTFE
    - Ox cleaning supplies (ultrasonic cleaner)

- Done: Update full assembly CAD (make everything more compact, figure out elevation of chamber)
    - Move all tubing to tank end if possible, have fittings back to back into engine
- Look for new pressure reg. CAD model w/ 90 deg turn
- **Add burst disk for LOx run pressure relief - how much $$$?** Awaiting reply from Generant
    - **Can we run LOx tank at lower pressure (~500 psi?) to get margin with lower set relief valves?**
- Look into helium price & nitrogen solubility (Rishav)
    - Get quotes on Gox, nitrogen, helium - Awaiting reply from Praxair
    - Make sure ox dewar is low-pressure for low boiling temp - T~110 K expected for the LC-160 dewar
- Look for ultrasonic cleaner on campus
    - PRL? **YES** but not sure if we can use for cleaning purposes
        - https://snsf.stanford.edu/equipment/fab/fcr.html
    - Very cheap on Amazon for small parts
- Talk to Team AA about Tescom regulators from lab - can we use 1 of the 2? Yes, the one with ⅜" fitting
    - Requested quote from Swagelok for alternative regulator last month - $1300, lead time nonspecific
    - Requested quote for Tescom 44-1300 series (Cv 0.8 or 2) today, will see about price and lead time
    - Need to look into alternatives if they need both for some reason, or if we can't work with the ER3000 regulator controller
- Add branch to N2 line for low-pressure regulator for pneumatic control system (Alec)