

Team Meeting 1/13/20

Communication

- **Slack**
 - Have already requested workspace creation under Stanford domain
 - stanford-aa284.slack.com
- ~~Microsoft Teams~~
- ~~GroupMe~~

Document Control

- ~~OneDrive~~
- **Google Drive**
 - <https://drive.google.com/drive/u/1/folders/1JzycU-FSpI5V98R5BZjVGs4i7czcV3w>
- ~~Overleaf~~

CAD Data Management

- **SolidWorks + GrabCAD**
 - SolidWorks 3D CAD software, GrabCAD Workbench for PDM
 - Download Solidworks 19/20 here:
 - <https://library.stanford.edu/englib/using-terman/computers-equipment-software/solidworks>
 - Sign Up for GrabCAD Workbench here:
 - <https://workbench.grabcad.com/workbench/register>
 - Jeff will invite all to GrabCAD team
- ~~Fusion 360~~

Team Lead

- Jeff: I kind of want to, but not sure how good I'll be at it

Project Topic/Concept

- TVC by secondary flow injection (Rishav)
 - Pros:
 - most hardware/configuration can be taken from previous designs
 - maybe relatively simple?
 - Cons:
 - Thrust measurement is hard -> lots of test stand dev
- Liquid Biprop with throttling and/or restart (Jeff)
 - Restart and throttling can go together for liquid biprops

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- Pros:
 - Can build off of previous biprop project
 - Sounds like a good time
- Cons:
 - Combustion stability is a hard problem
 - Injection for throttling and restart
- Regen cooled hybrid nozzle for oxidizer heating (Rishav)
 - Add low O/F fuel concept (Delrin)?
 - Pros:
 - Improved thermo. Efficiency by pre-heating oxidizer or fuel
 - Cons:
 - Heat exchanger design is very hard - even harder in combustion flowpath
 - Working fluid selection would be hard - N2O vapor pressure is high
- Electric turbopump (Walker)
 - Could roll in throttling and/or restart
 - Take COTS turbocharger and build engine around it?
 - Are there small enough COTS turbos? Other similar COTS parts?
 - Ask Stealth Space about their work?
 - Pros:
 - Only Stealth and RocketLab have done it - no student groups
 - Cons:
 - Probably too expensive and complex for our timeline
 - Turbopump design & manufacturing to very tight tolerances is probably the key challenge. Do we have anyone with CFD experience on the team?
- (<https://arc.aiaa.org/doi/pdfplus/10.2514/6.2017-0300>)
- Cheapest possible engine (Alec)
 - Kind of already our goal
- ~~Area ratio correction via ablation (Alec)~~
 - Manufacturing would be hard
- Walker researched other university teams
 - Purdue is doing LOX/CH4 flight design
 - Purdue did 3-year turbopump design
 - USC did 3D printed Inconel thrust chamber (in-house capability)

Notes

- Efaine heard that other labs (BME?) at Stanford have 3D printed Inco capability

To-Do:

- Research Electric Turbopump, Regen cooled hybrid, Liquid Biprop throttling and restart
 - Ask Greg about these ideas after lecture