Meeting 1/26/2023

Goals:

* Discuss individual established research goals and overall project goals
* Develop a plan of action for completing each goal, we have drafted one
* ~~SURG funding status~~
* ~~Impulse hammer amplifier status, ordered~~
* Meeting of the minds information and guidelines, info online isn’t up to date
* Is our ‘thesis’ paper really only a one page executive summary?

Notes from meeting:

* What are the reliability and safety metrics, enumerate all ideas for design,
* Cite the sources that show what the big rockets do, can use videos to cite research for hobby space
* How to use test rig once assembled and we can get data? Sweep angle and look at relationship between angle output and force components recorded. We are trying to figure out the pounds force/degree angle, want to verify our model. Assume angle of gimbal is correct.
* Use impulse hammer to tap rocket while in motion and see what the response is given a known impulse. Does the impulse from the hammer ran in sim match what we saw in our experiment? This is to make the sim as close to our rocket controller as possible.
* Then optimize controller with sim
* Could we use two rockets, one with tvc one without?
* Fix PCB design, worth it
* Reply to surg email for status
* Estimate drag of potential prop design
* Email Bedillion discussion before meeting

To do: assemble test rig, look at design for parachute deployment, think about timeline now for this

Meeting 2/2/2023

Goals

* trying the impulse hammer out
* status of rig assembly, problems we had along the way with assembly and our solutions for now. Friction has been a struggle with the design and we may need to reduce that or incorporate that into our simulation
* ideas for parachute deployment mechanism, analysis of feasibility of propeller
* order of events for the project from now until the end, is there a guideline for what we should include in our meeting of the minds presentation?

Notes

* Need bearings in outer ring for rig, redesign and order bearings
* Need to test the maple seed idea in a better sim to see what is necessary for success
* Could talk to bergbreiter about spring mechanism, singh about cfd
* Apogee detection based on imu?
* Meeting of the mind guidelines are basically present your research for 20 mins

To do:

* Elijah:
  + design new outer ring for rig with bearings
  + Order the bearings
  + get that ring printed
  + Possibly test rig with a launch with current rocket
* Ian:
  + Research maple leaf aerodynamics
  + Create better sim for maple leaf drag, see how plausible the idea is
  + Develop a preliminary design to review for the mechanism
  + Work on making the full CAD of rocket to better design parachute mechanism, we haven’t made that yet

Meeting 2/9/2023

Goals

* Rig encoder issues
* Design review of spring loaded parachute deployment built into electronics bay capsule
* Review the concept of maple leaf in the context of rocket recovery, not low mass enough for us. Couldn’t find a good way to simulate due to the complexity of objects in free fall.
* We need about a 40” parachute
* Research on rocket engines that don’t have an explosive charge
* Look at how to use impulse hammer, upon testing the amplifier appears to work but not sure how to interpret the response

Notes

* Oscilloscope
  + Change slope to both high and low
  + Can get data from USB
  + Get voltage vs time, get force from voltage via data sheet where voltage corresponds to force.
  + Change volt/division vertically or trigger level to increase sensitivity to taps
* Try and store data locally then write after some time for encoders
* Spring mechanism good because it’s highly reusable
* Metric to measure launch velocity of parachute
* Order stuff

To do

* Ian
  + Decide between spring and wings for parachute mechanism, or maybe make both? The wings could be promising if our rocket is lighter weight and longer
  + Order materials to begin testing, probably need a new parachute, tube(s), and sturdy cardboard at a minimum. Maybe get springs or find those in techspark
  + Begin prototyping if possible, or calculate drag of wings to understand scale better
  + http://www.aircommandrockets.com/recovery\_guide.htm#\_49
* Elijah
  + Work on developing code for writing data to flash easier
  + Figure out how to get data from oscilloscope and make a system for interpreting the mV vs. time into force vs. time
  + Figure out if we take an oscilloscope home or we borrow one, could borrow from ideate lending library

Meeting 2/16/2023

Goals:

-Full design review of spring loaded parachute deployment mechanism, parts are ready to be ordered. Plan is to make it next week

- Progress with the testing rig

- Filtering the rig data and processing to frequency domain

Notes:

* Change design of lever to interface flat with the collar of the push rod
* Steel rod should be re-evaluated and changed to pipe at least
* Parachute could be tested via drop
* fft(out)/fft(in) = transfer function
* Fft -> frequency cutoffs -> butterworth filter is what prof. Bedillion suggests
* Could use putty to read serial data

To Do:

* Finish parachute deployment design and order parts from mcmaster carr
* Assemble prototype of design to test
* Finish data filtering and start figuring out interpretation of data from test rig

Meeting 2/23/2023

Goals:

* Look at parachute prototype construction thus far
* Talk about plan for beginning testing
* Review testing rig code to prepare for first tests

Notes:

To Do:



Meeting 3/16/2023

Goals:

* Matching up the oscilloscope data to the sensor data, mismatched sampling rates
* Dealing with 2 transfer functions
* Proper filtering of encoder and hammer data using filfit, only using nyquist frequency right now
* Parachute mechanism isn’t strong enough to eject the parachute
  + The parachute seems to dampen the impact enough from the plunger that the nose cone can’t come off
  + We tried adding a cup to the plunger without much success
  + Stronger springs could be tried
* Parachute mechanism needs to be further back this time, means the CG will be further back which is bad
* Thinking of creating a nose cone that splits apart instead? Could also try the air brake method maybe, I think using stronger springs could get too heavy

Notes:

* Springs might need to be powered through the whole stroke of the plunger so it can extend with power past the exit of the tube
* Springs can run in parallel maybe
* Custom 3D printed cup is a good idea, parachute can be pulled out of the cup with the nose cone
* We could test one d.o.f at a time by twisting the rocket 90\* and doing two tests if we have way too much friction in one ring
* We should try to align the gimbal axis to the test rig axis
* Meeting 3-4pm on 3/21

To Do:

* Ian:
* Elijah:

Meeting 3/21/2023

Goals:

* Review parachute mechanism
* Review progress with rig matlab

Notes:

* Can reduce interface between nose cone and rocket
* Could use manual trigger for tvc?

To Do

Ian

* Create trigger algorithm and test by throwing rocket up in the air
* 3D print the ebay?
* Line over bridge? Fishing line

Meeting 3/30/2023

Notes:

* For file naming use if exist, move to next number and do that until it doesn’t exist
* COM is ok to be a little off
* Code to make the servo command increment constant and known
  + Tstart = millis()
  + [command code]
  + delay( Ts - (millis() - tstart) ) where Ts is the sampling interval we want, this is for a variable delay
* If com is off by a few degrees it won’t matter because angle is too small, small angle theorem
* Align data by start of encoder moving
* M = I\*alpha and M -> servo tick pos.

Meeting 4/11/2023

Notes:

* Angle measurement works if accurate within +- a degree of servo angle measurement
* We can add angle noise into simulink function to make sure that with error in that measurement we can still handle rocket stabilization
* Use two different PID functions for each axis of the rocket
* Record power on time than don’t record data/move servos for a certain delay. Dump data to an array and store before dynamic mem runs out
* Change servo sample to 80 Hz

Meeting 4/20/2023

* Want 2 axis so we can see how our 2 axis pid controller performs in the rig
* How good does the data need to be?
* Cherry pick data that looks most accurate
* Only need one section of the sweep
* Repeating tests would show repeatability of test rig, but may not help compute the result
* Maybe just use P
* Try various values of PID and show their response on a graph
* Order more engines
* Gopro for response time of rocket? sure
* Fan over rocket maybe
* What is our metric to improve PID
* Only benefit of the impulse hammer is to know what input tap we gave it
* Transfer functions can have different units in/out
* Can’t just look at thrust along rocket to get the total vertical component on load cell, need the normal component to rocket as well
* We are trusting thrust spec and protractor readings from commanded servo position values
* See how thrust force calculated agrees with thrust force on the spec sheet
* Alternatively could calc the actual servo angle from the spec thrust force curve
* Protractor prob accurate to .5\*
* Mark told us to use phi because originally we didn’t have good force data
* Could use time after it hits 1g (free fall) or monitor until it hits a constant
* Can constantly compute delta height and when it goes negative then we have reached apogee

Meeting 5/5/23

* Block to allow gimbal to launch freely
* No I or D, start with only P controller