Barone2 Report Week of 4/26/21

Sprint 2 (Spring),

Prepared by Leonid Shuster

**Executive Summary of Progress:**

In this sprint, the main goal was to finalize and order any remaining parts, and begin fabrication of the drone. We set our sprint to be a month long, and while we planned to complete more of the fabrication process, we fell behind due to delays in parts being ordered and shipped in time, as well as underestimation of tasks, technical difficulties with construction of the envelope and parts, and interfacing with the remote controller and definition of autonomous controls was inadequately designed. Ultimately, we started moving forward with the fabrication, but due to having too long of a sprint, some of us fell behind on our tasks and left several tasks undone. For the next sprint, we need to identify roadblocks early on in the sprint, and delegate more time and resources for them if possible, or identify that nothing can be done in the moment and focus on more important tasks.

On the mechanical side, we began 3D printing parts, and we cut and sewed the envelope for the lift bag and performed an inflation test of the lift bag filled with air inside the envelope. In drone simulation, implementing drag force was completed, and pseudo-random data can be produced from ideal sensors. In controls design, progress was made in closed-loop remote control, as well as the rederivation for linearized force equations, and the start of state estimation. For systems programming, servo and motor control was implemented, and remote control interfacing is in progress. In PCB design, the first PCB was ordered, and minor fixes have been made for the second version. Finally, for power management, the power budget was revised and updated, and a calculation check was done on the battery to ensure it met max performance of the system.

**Progress made toward acceptance criteria:**

| Task Deliverable/  Acceptance Criteria | Status | Responsible Party | Anticipated Hours | Details |
| --- | --- | --- | --- | --- |

**Mechanical Design:**

| Add updated parts to CAD | Complete | Dylan | 14 | All new parts added to CAD. Now at version 3.3 and ready for fabrication |
| --- | --- | --- | --- | --- |
| Set up sewing machine and 3D printers | Complete | Dylan | 2 | Sewing and 3D printer where setup and used. 3D printer took much longer then expected, closer to 15 hours spent on this task |
| Sew envelope | Complete | Dylan | 10 | Envelope was cut into gores and sewn realistically this task took close to 30 hours |
| 3D print parts | Incomplete, in progress | Dylan | 8 | Ultrasonic and motor mounts have been printed, as well as some back plates, gondola and servo brackets still need printing, more than 8 hours has been spent on this already with at least another 8 to go |
| Attach 3D printed parts to envelope | Incomplete | Dylan | 5 | Blocked by 3D parts being incomplete |
| Inflation test of lift bag inside envelope with air | Complete | Dylan | 5 | Envelope was inflated, to test if the balloon would take the shape of the envelope and if that shape was correct |
| Attach servo and motor shafts to brackets | Incomplete | Dylan | 4 | Blocked by 3D print and PCB |
| Add ultrasonics to bracket | Incomplete | Dylan | 1 | One was screwed on as test, rest of the task blocked by PCB |
| Add electronics to gondola | Incomplete | Dylan | 5 | Blocked by 3D print and PCB |
| Wire prototype | Incomplete | Dylan | 10 | Blocked by PCB |
| Second Inflation test of lift bag inside envelope with air | Incomplete | Dylan | 5 | Blocked by PCB |
| Help Fabricate Prototype | Complete | Isaac | 40 | Helped with the cutting and sewing of gores, as well as with 3D printing |

**Drone Simulation:**

| Implement Drag Force | Complete | Isaac | 30 | Drag forces were added to the simulation with both static and kinetic cases considered and implemented |
| --- | --- | --- | --- | --- |
| Implement Sensors to Read Pseudo Data from Vrep | Complete | Isaac | 22 | IMU, GPS, barometer, and ultrasonic sensors all read data and outputted to the simulation |
| Adding Noise to Sensors | Incomplete | Isaac | 12 | Gaussian function to implement noise has been added but standard deviations correlating to each sensor has not yet been added |
| Implement Closed Loop Remote Control | Incomplete | Isaac | 35 | Blocked by uncompleted closed loop remote control |
| Implement Autonomous Design | Incomplete | Isaac | 30 | Blocked by uncompleted closed loop remote control |
| Implement Sensors to Read Pseudo Data from Vrep | Complete | Dylan | 22 | Explained sensor functions and provided input to draw sensor data from |

**Controls Design:**

| Complete path following terrain tracking PID design | Incomplete | George | 10 | Incomplete. 50 hours spent. Current design approach is impractical to implement and needs a matrix and controls redefinition. This was a failure where I chose an abstraction approach when I shouldn’t used abstraction to start and build up from auxiliary functions. |
| --- | --- | --- | --- | --- |
| Simulate Path following terrain tracking in Matlab | Incomplete | George | 10 | Delayed since PID autonomous design not completed |
| Define plant for closed loop RC | Complete | George | 5 | Complete. Spent about 20 hours redefining matrices and analyzing approximations. Resulted in using a mix of polar and XYZ coordinates. Estimates are better defined and justified and much easier to work with.Also new definitions assisted in applying pole placement with integral implementations that we will be using for the rest of controls. |
| Pole placement and integral control added to RC design | Complete | George | 15 | Complete. Far superior approach that was built off of auxiliary functions. Will use the same method for the rest of controls. Spent approximately 15 hours. (Current design also includes height control) Current design works by calculating motor forces after the pith/roll/height regulator has already issued commands, so that the RC response does not interfere with stability of the drone. |
| Simulate RC response in Matlab | Complete | George | 5 | Complete. Response has been tested by analyzing physical response and motor commands based on user input. Appears to be ready to export to VREP simulation. Approximately 5 hours spent. |
| Design filters to obtain accurate state data | Incomplete  (7 hours complete. Complementary filter for pitch roll completed) | George | 25-30 | Task 1: Complementary filter for calculating pitch roll angles designed. Spent approximately 7 hours.  Task 2: Estimation of height was not completed, only high level design. Spent approximately 10 hours.  Task 3: Filter for ultrasonics for object avoidance not yet developed.  Task 4: GPS filter not yet designed |
| Simulate and test noisy sensor model | Incomplete (2 hours complete. Pitch and roll filter tested only. Other filters not designed) | George | 10 | Task 1: Filter for pitch and roll tested only, approximately 2 hours  Task 2: Rest of noisy sensors and filters not tested since not yet developed. |
| Auto landing function | Complete | George | 10 | Complete: Design is complete and ready to be exported into Vrep. |
| Auto take off function | Complete | George | 10 | Complete: Design is complete and ready to be exported into Vrep |
| Program C libraries for Linear algebra, integration, and other functions needed for controls | Incomplete | Jeremy, Ryan | 16 | Linear algebra functions were completed.  Integral function by Ryan incomplete due to tasks being focused on researching PCB design, e.g. trace width formula and shipment order tracking |
| Program C libraries RC response | Complete | Jeremy, Ryan | 16 | RC Response with the controls of the system was able to be completed |
| Program C Libraries for autonomous | Incomplete | Jeremy, Ryan | 16 | Autonomous design still being implemented and not ready for coding |
| Program C libraries automated landing and takeoff | Incomplete | Jeremy, Ryan | 16 | George found an easier, alternative way to handle automated landing and takeoff, meaning work did not have to be done in this area |

**Systems Programming:**

| Implement servo control | Complete | Leonid | 10 | Initial servos were not the right kind, and code was rewritten and retested on the right kind of servos once they arrived |
| --- | --- | --- | --- | --- |
| Implement ESC/motor control | Complete | Leonid | 10 | Code for motors was written and tested with ESC once battery arrived |
| Implement remote control communication with Raspberry Pi | Incomplete, in progress (7 hours complete) | Leonid | 10 | 7/10 hours completed: fell behind because of issues connecting with the remote controller receiver’s protocol. Raspberry Pi currently receives signal, needs to parse it for remote controller inputs |
| Implement servo control with remote controller | Incomplete, in progress (7 hours complete) | Leonid | 10 | 7/10 hours completed: PIC32 control of servos and motors completed, and communication between PIC32 and Raspberry Pi completed, but remote controller controlling servos not completed yet due to remote control communication with Raspberry Pi not being done yet |
| Implement ESC/motor control with remote controller | Incomplete, in progress (7 hours complete) | Leonid | 10 | 7/10 hours completed: PIC32 control of servos and motors completed, and communication between PIC32 and Raspberry Pi completed, but remote controller controlling motors not completed yet due to remote control communication with Raspberry Pi not being done yet |
| Implement autonomous control data processing between PIC32 and Raspberry Pi | Incomplete | Leonid | 30 | Autonomous control delayed because of problems with remote control implementation |
| Implement servo control with autonomous control | Incomplete | Leonid | 10 | Autonomous control delayed because of problems with remote control implementation |
| Implement ESC/motor control with autonomous control | Incomplete | Leonid | 10 | Autonomous control delayed because of problems with remote control implementation |
| Remove ECE 121 repo within Barone2 repo and re-upload ECE121 C programming code to Barone2 repo | Complete | Jeremy | 1 | Code from ECE121 uploaded for skeleton code for Leon to work from with C language with PIC32 microcontroller |
| Push ECE121 code to Github | Complete | Ryan | 1 | ECE121 initialization code is correctly updated and pushed to Barone2 Github |

**PCB Design:**

| Finalize BOM PCB parts | Complete | Ryan | 2 | All parts are ordered, they are currently being shipped or are delivered |
| --- | --- | --- | --- | --- |
| Wiring data bus between sensors to microcontroller in board design | Complete | Ryan | 3 | I2C, SPI, and Input Capture pins are all connected between sensors and microcontrollers/microprocessor |
| Wiring voltage rails to all components | Complete | Ryan | 4 | All voltage rails are connected to respective sensors, microprocessors and microcontroller |
| Wiring microprocessor to microcontroller, receiver and pinouts for servos and ESC | Complete | Ryan | 3 | Pinouts are assigned for ESCs, data telemetry transmitter, and servos |
| Verify PCB with power management | Complete | Ryan | 4 | Trace width is corrected for each voltage rails |
| Send out PCB design to manufacturing | Complete | Ryan | 1 | PCB design is already delivered to Leonid. |
| Low-pass filter implementation | Complete | Jeremy | 5 | Low Pass filter implemented with a LC circuit will cause noise to be reduced to less than 1% of previous values with the switching voltage regulators |
| Finalized voltage divider for receiver | Complete | Jeremy | 4 | Voltage divider will allow the RC controller receiver to send an adjusted battery voltage to the controller, which will display the correct battery percentage |

**Power Management:**

| Verify PCB Design | Complete | Jeremy | 4 | PCB design was peer reviewed, catching some small connection errors before ordering the board itself, saving some debugging time |
| --- | --- | --- | --- | --- |
| Finalize Power Budget by double checking all parts and heat efficiencies | Complete | Jeremy | 10 | Power budget was went over again with peer review, fixing up some minor errors and making sure all components were included as accurately as possible before submitting to teaching staff a final time |
| Optimize Battery once power budget is finalized | Complete | Jeremy | 4 | Battery was tested on the max performance of the system, resulting in being just above the system technical requirement for minimum flight time |

**Other:**

| Group meetings | Complete | Leonid, Dylan, Jeremy, George, Ryan, Isaac | 25 | Twice a week 2-hour meetings |
| --- | --- | --- | --- | --- |
| Sub-team meetings | Incomplete  (5 hours complete) | Leonid, Jeremy, Ryan | 15 | Only around 5 hours worth of subteam meetings were achieved due to separate work areas amongst the team that could not have been done cooperatively |
| Sub-team meetings | Complete | Dylan, George, Isaac | 15 | Although the regularly scheduled meeting time was not often used Dyla, George, and Isaac often would have short meetings at various times to address topics of immediate concern |

**Calculate sprint velocities:**

| Team Member | Estimated hours of all tasks | Estimated hours of completed tasks | Estimate actual hours worked | Sprint Velocity | Reasoning for members <1 |
| --- | --- | --- | --- | --- | --- |
| Dylan | 126 | 93 | 130 | .73 | Certain tasks were far underestimated, mainly setting up the 3D printer and the fabrication of the envelope, which consumed almost all of the time during the sprint. The delays in PCB shipping also made some of the later tasks almost impossible to complete |
| Isaac | 152 | 92 | 136 | .61 | Incomplete hours due to delays in remote control were spent on fabricating the prototype instead. |
| George | 140 | 99 | 164 | .71 | Approach to autonomous controls was impractical and consumed a large amount of time. Reorganizing the controls approach was redefinition and reorganization of controls is helping to catch me back up. |
| Leon | 140 | 71 | 110 | .51 | Didn’t space out task time well enough and got hung up on specific task of connecting remote controller receiver to Raspberry Pi |
| Ryan | 106 | 90 | 90 | .84 | Didn’t fully understand integral function required and not enough research was done |
| Jeremy | 123 | 77 | 84 | .62 | Was not able to help out as much as expected with coding due to delays relating to the design of the controls and delivery of the needed parts to test actual power requirements |
| Total | 787 | 522 | 714 | .66 | The team had a low velocity this sprint due mainly to shipping delays, technical difficulties, and underestimation of tasks, which in a month-long sprint caused major bottlenecks for subsequent tasks which piled on as the sprint continued |

**Product Owner, Teaching Team, Client Feedback:**

| Functionality Demonstrated | Feedback | Team Response |
| --- | --- | --- |
| All new parts added to CAD. Now at version 3.3 and ready for fabrication | Although many parts where CAD to correct dimensions many alterations continually had to be made in order to assure that 3D printing was possible, 3D printing should have been kept in mind when designing many of these parts earlier on, so less work would have to be spent last minute | After several revision by other team members the CAD models where deemed ready for 3D printing and accepted |
| Envelope was cut into gores and sewn | The envelope although being completed has several issues. One the stitching is not of the highest quality as the fabricators had no experience sewing prior to the envelope. Secondly the length of fabric the stitching would take up was far underestimated resulting in a shorter circumference then wanted | After the first inflation test it was revealed that many of the stitches need to be redone in order to make the envelope stronger in areas where the stitching was weak as well as having its shape adjusted. |
| Envelope was inflated, to test if the balloon would take the shape of the envelope and if that shape was correct | The first inflation test showed that although the horizontal dimensions were close to being correct the vertical dimension where too large and needed to be stitched down. | The test itself went well and a lot was learned from it, such as data for how the envelope's shape needs to be adjusted. We also learned that a shop vac on reverse is much more efficient to inflate the lift bag then a tire pump. |
| Drag forces were added to the simulation with both static and kinetic cases considered and implemented. | The drag forces in the sim have worked as a confirmation that our requirements related to movement speed in headwinds should be attainable. | Drag forces correctly applied forces against the velocity of the drone as well as in the direction wind is applied, providing the simulation with a method to test in varying environmental conditions to accurately model closer to real life. |
| IMU, GPS, barometer, and ultrasonic sensors all read data and outputted to the simulation. | These values being in the sim are quite valuable especially when it will come to implementing the closed loop controls for RC and autonomous. The values could be scaled to look more like real readings from sensors rather than just values that serve the same function. | Sensor inputs will be read and eventually outputted with noise in order to provide the autonomous design with variables to use as the drone takes flight. |
| Large Pitch/Roll error response. Angle response and motor commands simulated in matlab | Thes error responses will be valuable in a real life flight situation. By stopping all other functions and focusing solely on correcting pitch and roll when they turn to a point of critical error. | Is well implemented in matlab with predictable and stable responses and ready to go into the simulation. |
| RC Response tested within matlab. Combines open loop RC commands with pitch/roll/height regulator. | The updated response for height control has been far improved, with minimal oscillation which should give for smooth control. | This should be ready to implement into the simulation. Matlab demonstration is abstract since it is mainly tracking motor responses so simulation should help with visualization and confirmation. |
| Auto Landing and takeoff functions work in matlab simulation by taking in a height command and working with pitch/roll regulators. | They will be useful to have as take off and leaning is often the most dangerous part of a flight. These functions must have little fluctuation | Controls act predictable in Matlab simulation and ready to be tested in Vrep |
| Wincher servos were shown to turn multiple rotations based on positional data. | The servos were able to be moved to specified angles based on positional data, however there does seem to be a smaller error that occurs when the servos make large angle rotations. | The team will have to see whether those servo inaccuracies are tolerable, and if not look for means to either fix those inaccuracies or work around them |
| The speed of the motors adjusted based on adjustable duty cycle feeding into ESC. | The motor speed being adjustable through the ESC is a great first step however the code for this cannot be finalized until the propellers arrive and are attached. | The ESC and motors will be tested once again with the propellers when they arrive |
| I2C, SPI, Input Capture, and Output Compare pins are all connected between sensors and microcontroller/ microprocessor | Reading data correctly and efficiently is essential to this project, this wiring is correctly reflected on the PCB | Communication protocols are tested in dev kits but not on PCB V1.9 yet. |
| All voltage rails are connected to respective sensors, microprocessors and microcontroller | Although everything is wired in the correct design the track thickness for many of the wires are chosen arbitrarily and will need to be redone. | Voltage rails are incorrectly implemented in PCB design. Trace widths are incorrect in V1.9 board. V2.0 will use switching regulators for 1.8V, 3.3V, and 5V voltage rails. |
| Pinouts are assigned for ESCs, data telemetry transmitter, and servos | Similar to the voltage rails some of the trace width will need to be redone in order to insure they can support viable current levels | Pinouts are implemented in PCB design. However, traces are not implemented yet in V2.0 due to V1.9 not being tested yet. |
| Trace width is corrected for each voltage rails | Now the new trace width will support the necessary current, the PCB should be in a much more usable shape. | Trace width is corrected in V2.0 between the 12V battery to ESC pinout |
| Low Pass filter implemented with a LC circuit will cause noise to be reduced to less than 1% of previous values with the switching voltage regulators | This is a good step in increasing the performance of the sensors that could be affected by noisy signals. | Performance of parts being powered by the voltage regulators will be steady and not affected by voltage ripple |
| Voltage divider will allow the RC controller receiver to send an adjusted battery voltage to the controller, which will display the correct battery percentage | The user being able to view the battery percentage is a requirement of the project. This will need to be tested thoroughly to ensure that it works without fail. | Since the completed form of the voltage divider will be included with the 2nd PCB iteration and not the first, it will need to be tested when the 2nd PCB is delivered |
| Power Budget has been completely finalized with all power values, which also shows the system will be able to achieve the system technical requirement of a 30 minute minimum flight time | Although the current power budget matches the current system iteration fully, there are still changes being made to the PCB so the Power Budget cannot be considered finalized until the PCB is also finalized | Parts will need to be tested individually in order to confirm the power budget estimates for each part and with the system as a whole |

**Possible Sprint Improvements:**

* **Team Improvements**:
  + Sprint should have been shorter so goals could have been adjusted
  + Got better at working together within sub-groups
  + Task time was estimated very incorrectly
  + Better task delegation, for people whose work is blocked by the current status of shipping items.
* **Individual Improvements:** 
  + Dylan
    - Over confident (especially related to 3D printing
    - Need to stop assuming things will go as planned (leaving more room for error)
    - Will need more help going forward, much of fabrication is at least a 2 person job
  + George
    - Should be less stubborn with trying to make tasks work. PID autonomous severely delayed controls progress, should have changed approach earlier.
  + Isaac
    - Start work earlier in the day and manage my time more effectively
    - Ask for help outside of team meetings
    - Give more input during team meetings
  + Jeremy
    - Needs to ask other team members if they need help more often when tasks are getting stuck behind others
    - Clearly define tasks better or what needs to be worked on that are not exactly tasks
  + Ryan
    - Ask for help on C programming tasks when I don’t understand
    - Be proactive about asking other team members if they need help
  + Leon
    - Spent too much time on beginning of tasks and didn’t get around to future tasks
    - Need more optimized daily routine

**Next Sprint Goals:**

* Dylan
  + Finish 3D printing, related tasks
    - Print parts attach parts to envelope
  + Help out with other tasks for sensors coding and simulation while I wait for hardware to be ready to add to prototype
  + Test prototype once electronics and remote control are ready
  + Get helium
* George
  + Design autonomous Controls
  + Tuning for all systems
  + Design rest of sensor filters
  + Assist with manufacturing
* Isaac
  + Complete prototype fabrication
  + Add closed loop control to simulation
    - Find out how to convert C to Lua
    - Edit code to fit V-rep
* Jeremy
  + See how correct motor and servo estimations were with actual testing with Leon
  + Assist other team members with coding
* Ryan
  + Get started on V2.0 PCB and fix all issues with V1.9 board when its working
  + Ask to help other team members when I have time
* Leon
  + Finish up remote control implementation
  + Put together first PCB board with all parts and test hardware as fast as possible to find bugs
  + Start autonomous control implementation, at least create a structure to just plug in numbers for when autonomous control design is finished
* Team Goals
  + Report writing- First drafts of five chapters to be completed.
  + Put together complete drone
  + Attempt first drone flight

**Meeting Minutes for Sprint 6:**

Sprint 6 Start

Long Flight Time Buoyant Drone March 29, 2021 6:00 PM(PST)

horizontal lineATTENDEES

* Excused absences: N/A
* Unexcused absences: N/A
* Late: N/A

## AGENDA

* Administrative Stuff

6:01

* Updates
  + Leon: Looking at videos to power motors and servos
    - Also got servo shipping and motors should be coming soon

6:02

* + Jeremy: Updated motor power on the Power Budget, added camera
    - Flight time still is at least 30 minutes and can reach 1 hour

6:03

* + Isaac: Drag force implemented based on the velocity of the envelope
    - 30% complete to having drag fully implemented

6:05

* Dylan: Added RC transmitter to CAD, new voltage regulator as well
  + Helium vendor almost finalized, can either rent a large can or get a small can and refill it

6:11

* George: Mircea replied to funding email

6:15

* Ryan: Wiring Schematic finalized
  + Needs to work on BoM and PCB board before sending to Leon

6:17

* Gantt Chart Updates
  + CAD design still needs to add newest parts

6:22

* Add a presentation slide for all sensors working together
* Servos/Motors will need to be worked on, servos have arrived to test

6:25

* Path following should be done by 4/2, previously was 3/29

6:27

* Board Wiring and BoM should be finalized by tomorrow 3/30
* PCB design should be verified by power design on 3/31

6:40

* Leon is the SCRUM master for this sprint from 3/29/21 - 4/26/21
* Define Goals (General, see where we need dependencies etc)
  + Dylan - 6:46
    - Update CAD with newest parts (camera, receiver, voltage regulator) (4/2)
    - Fabricate Prototype (4/26)
  + Isaac - 6:50
    - Implement Drag Force (4/5)
    - Implement Sensors (4/13)
    - Implement Closed Loop Remote Control (4/19)
    - Implement Autonomous Design (4/26)
  + Leon - 6:52
    - Implement electronic actuators in software (ESC, motor, servos) (4/2)
    - Implement remote control in software (4/9)
    - Implement autonomous control in software (4/23)
  + George - 6:55
    - Closed Loop Remote Control designed and tested in Matlab (4/12)
    - Path following and terrain tracking ideal sensor model designed and tested in Matlab (LATE estimated completion on 4/3)
    - Path Following and Terrain Tracking-Noisy Sensor model designed and tested in Matlab (4/12)
    - Auxiliary Flight functions (4/26)
  + Ryan - 6:58
    - Finalize BOM PCB parts (3/30)
    - Wire up PCB (3/30)
    - Verify PCB with power management (3/31)
    - Send out PCB design to manufacturing (4/2)
  + Jeremy - 7:03
    - Finalize Power Budget when parts list is finalized (4/2)
    - Finalize/Optimize battery to fit within technical requirements of flight time (4/5)
* Define End Date 7:07
  + Sprint end: 4/26/21
* Tasks (Specific) List Requirement ID if available. Time estimate
  + Leon (140 hours) - 7:15
    - Implement servo control (10 hours)
    - Implement ESC/motor control (10 hours)
    - Implement remote control communication with Raspberry Pi (10 hours)
    - Implement servo control with remote controller (10 hours)
    - Implement ESC/motor control with remote controller (10 hours)
    - Implement autonomous control data processing between PIC32 and Raspberry Pi (30 hours)
    - Implement servo control with autonomous control (10 hours)
    - Implement ESC/motor control with autonomous control (10 hours)
    - Group meetings (25 hours)
    - Sub-team meetings (15 hours)
  + Jeremy (123 hours) - 7:22
    - Verify PCB Design (4 hours)
    - Finalize Power Budget by double checking all parts and heat efficiencies (10 hours)
    - Optimize Battery once power budget is finalized (4 hours)
    - Group meetings (25 hours)
    - Sub-team meetings (15 hours)
    - Push ECE121 code to Github(1 hour)
    - Program C libraries for Linear algebra, integration, and other functions needed for controls (16 hours)
    - Program C libraries RC response (16 hours)
    - Program C Libraries for autonomous (16 hours)
    - Program C libraries automated landing and takeoff (16 hours)
  + Isaac (152 hrs) - 7:31
    - Implement Drag Force **(30 hours)**
      * Calculate Balloon Speed (10 hours)
      * Create 3D Drag Force (10 hours)
      * Apply Logic to Drag Force Given Balloon Speed (10 hours)
    - Implement Sensors to Read Pseudo Data from Vrep **(22 hours)**
      * Research Sensors (6 hours)
      * Implement Ultrasonic Sensor (4 hours)
      * Implement IMU (4 hours)
      * Implement GPS (4 hours)
      * Implement Balloon Barometer (4 hours)
    - Implement Closed Loop Remote Control **(35 hours)**
      * Learn to Use Remote API to Apply C Code (15 hours)
      * Use Remote API or Rewrite C Code to Lua (10 hours)
      * Apply Outputs of Functions to Individual Parts (10 hours)
    - Implement Autonomous Design **(30 hours)**
      * Feed Sensor Input to Functions (10 hours)
      * Use Remote API or Rewrite C Code to Lua (10 hours)
      * Take Outputs and Apply Them to Individual Components   
        (10 hours)
    - Group meetings **(25 hours)**
    - Subteam meetings **(10 hours)**
  + Dylan (126 hours) - 7:39
    - Add updated parts to CAD (4/2) **(14 hours)**
      * Voltage Regulator (2 hours)
      * Camera and transmitter (4 hours)
      * Magaero housing (8 hours)
    - Fabricate Prototype (4/26) **(50 hours)**
      * Set up sewing machine and 3D printers (2 hours)
      * Sew envelope (10 hours)
      * 3D print parts **(8 hours)**
        + Servo brackets & plates (4 hours)
        + Ultrasonic mount & plate (1 hour)
        + Motor mounts (1 hour)
        + Gondola and plate (2 hours)
      * Attach 3D printed parts to envelope (5 hours)
      * Inflation test of lift bag inside envelope with air (5 hours)
      * Attach servo and motor shafts to brackets (4 hours)
      * Add ultrasonics to bracket (1 hour)
      * Add electronics to gondola (5 hours)
      * Wire prototype (10 hours)
      * Second Inflation test of lift bag inside envelope with air (5 hours)
    - Implement Sensors to Read Pseudo Data from Vrep **(22 hours)**
      * Research Sensors (6 hours)
      * Implement Ultrasonic Sensor (4 hours)
      * Implement IMU (4 hours)
      * Implement Gps (4 hours)
      * Implement Balloon Barometer (4 hours)
    - Group meetings (25 hours)
    - Subteam meetings (10 hours)
  + George (140 hours) - 7:48
    - Complete path following terrain tracking PID design (10 hours)
    - Simulate Path following terrain tracking in Matlab (10 hours)
    - Define plant for closed loop RC (5 hours)
    - Pole placement and integral control added to RC design (15 hours)
    - Simulate RC response in Matlab (5 hours)
    - Design filters to obtain accurate state data (25-30 hours) will be Broken down when filter design chosen after further research
    - Simulate and test noisy sensor model (10 hours)
    - Auto landing function (10 hours)
    - Auto take off function (10 hours)
    - Meetings (35 hours)
  + Ryan (122 hours) - 7:57
    - Finalize BOM PCB parts (2 hours)
    - Wiring data bus between sensors to microcontroller in board design (3 hours)
    - Wiring voltage rails to all components (4 hours)
    - Wiring microprocessor to microcontroller, receiver and pinouts for servos and ESC (3 hours)
    - Verify PCB with power management (4 hours)
    - Send out PCB design to manufacturing (1 hour)
    - Remove ECE 121 repo within Barone2 repo and re-upload ECE121 C programming code to Barone2 repo (1 hour)
    - Program C libraries for Linear algebra, integration, and other functions needed for controls (16 hours)
    - Program C libraries RC response (16 hours)
    - Program C Libraries for autonomous (16 hours)
    - Program C libraries automated landing and takeoff (16 hours)
    - Group meetings (25 hours)
    - Sub-team meetings (15 hours)
  + Members who finish their tasks early should help with sensors/controls/simulation coding depending on current progress in those areas.

Meeting End: 8:10

**3/30/21 7:30 - 7:44pm**

* Leon: working on slides and scratchwork for servos and motors
  + Github work should help figure it out

7:32

* Jeremy: Working on double checking the power budget
  + PCB will be done tomorrow for verification

7:34

* Isaac: Vrep got balloon speed working with drag

7:35

* Dylan: Found screws and standoffs for voltage regulator
  + Made an account to order helium, helium should be available same day

7:36

* George: Running hole placement program with large matrix

7:37

* Working on wiring, error causing rewiring is source of delay, should be done by tomorrow

7:38

* Other stuff:
  + Reminder to review sprint planning doc for better planning on month-long sprint
  + Sprint meetings will be done at 7:00 in the future

7:44 END

**3/31/21 6 - 7:05pm**

* Leon: Slides are still in the works, although all sensors work together with interrupts
  + Working on running the servo code to get it operable

6:03

* Jeremy: Helping Ryan verify PCB design
  + Also still needs transmitters, camera, and rail power reviewed

6:04

* Isaac: Drag force vectors work as intended, need more time to make it work with velocity

6:05

* Dylan: Finished making an account for helium
  + Added Camera to CAD design, still need exact dimensions of the camera
  + Transmitter will be double taped on
  + WIll work on the MagAero Mounting for the drone

6:07

* George: Determinant finished running, result was unsatisfactory, is redoing it by hand

6:08

* Ryan: Finished for PCB and will have it reviewed with power management
  + Next step is to finalize BoM

6:09

* ETC
* Design review 1 slides made, as tasks are done, move slides onto there
* Rest of the meeting was designated to individual work

6:10-7:05

* Confirming PCB design is correct with all parts in the power budget and BoM
  + Parts were confirmed based on their voltage from 11.1,5,3.3, and 1.8V
  + Issues with ground plane not being auto done with all ground requirements
  + Double Checking Bom on Eagle Cad with BoM sheets
* PCB Board would be needed by 4/23/21

7:05 END

**4/1/21 7:05 - 7:20pm**

* Leon: Added slides to design review to demonstrate sensors, formatting needs review by the team
  + Comments: slides do not need to show exact process, only solution of the final product
  + Working on operating the servos with draft code

7:11

* Jeremy: PCB and wiring diagrams confirmed with designer
  + Power budget finalized and double checked with all parts

7:12

* Isaac: Needs to implement logic to the equations for drag force

7:13

* Dylan: Helium tank rentals will be free due to UCSC affiliation, helium itself would be around 250$
  + Finished camera mount in CAD design

7:15

* George: Working with new toolbox in matlab to finish determinant work

7:16

* Ryan: Only one linear voltage regulators needed for each voltage, ground pin also added
  + Ready for ordering by OSHA park
  + Should run it by TA in meeting tomorrow

7:20 END

**4/2/21 5:05 - 5:15pm**

* Sprint Updates

5:05

* Leon: servos are running, found out continuous servo motion is not sufficient for our project
  + Will either need to get new servos or find a way to find the position of the servos
  + ESC and motor came in, soldering may be needed for the motor
    - WIll also need connection between ESC and motors fixed

5:09

* Jeremy: Power budget done, will shift to helping George with C coding
  + Basic linear algebra functions will be sent later by controls
  + Power will also need to be changed if servos are replaced

5:10

* Isaac: All forces pumping out numbers, need to confirm with group before implementing

5:11

* Dylan: Helium needed is confirmed, 248$ total
  + CAD done for MagAero Holder, camera may need to be moved to make room

5:12

* George: Wrote hole placement methods

5:13

* Ryan: Needs to confirm SPI and other issues before ordering PCB board

5:14

* Milestone checking for each group member
  + About 1 day behind total on average
  + Keep checking due dates and try to hit them on track
* Split between personal work with servo discussion and PCB final checking
  + Also looking at simulation code

5:15 END

**4/3/21 7:00 - 7:10pm**

* Sprint Updates

7:00

* Leon: Motors cannot be connected without external bullet connectors to ESC
  + Scratch code written in the meantime to input numbers
  + Connecters ordered from amazon

7:02

* Jeremy: Servos added to Bom
  + Will help george with C coding

7:03

* Isaac: Direction and velocity affect magnitude of drag in simulation

7:04

* Dylan: Ordered New servos and screws for standoffs
  + RC controller and camera still need to be ordered
  + Nylon came in today, sewing of envelope is ready to begin
  + Will go over CAD design a final time

7:06

* George: Working on turning poles, trial and error method will taking time

7:08

* Ryan: PCB finished and ordered
  + Digikey parts ordered as well
  + Only things left to buy are battery, charger, ultrasonics, RC transmitter and receiver, and camera/receiver, telemetry transceiver, and helium

7:10 END

**4/4/21 7:00 - 7:11pm**

* Leon: Bullet connectors will be here tomorrow for connecting ESC and motor
  + Motor code tested on servos, code does work with it

7:02

* Jeremy: Helping george code linear algebra in C
  + Stuck on matrix multiplication

7:03

* Isaac: Finished with drag force, but has to code how it adds to normal force

7:05

* Dylan: Start of fabrication will start tomorrow, will email Mircea for assistance
  + Rachel Carson said it is not funding senior capstone projects

7:07

* Ryan: Had to backorder crystal oscillator, USB to UART
  + Is looking for other sellers to order them quickly
  + Battery should be ordered sometime this week
  + Wrong screws ordered, but they should still work with the standoffs for the voltage regulator
  + Weight allocation with new servos will have to be done

7:11 END

**4/5/21 6:00 - 6:35pm**

* Sprint Updates:
* Leon: WIll solder the bullet connecters after this meeting to the ESCs
  + Will test out motor code that was also used with servos

6:02

* Jeremy: Coding matrix functions in C
  + Matrix multiply, scalar multiply, add are complete
  + Next is determinant and inverse

6:03

* Isaac: Debugging Drag forces, some logic may be missing

6:04

* Dylan: Done with CADing

6:05

* George: Laptop broken, unable to continue work for the time being

6:06

* Ryan: Ordered remaining parts: transceivers and sensors
  + Found alternate oscillator that might not work with PCB already ordered
  + Also found USB to UART chip, will take longer to ship

6:07

* Need to keep emailing Mircea until he responds to get lab access
* Capstone Pitch Competition 10-11am this Sunday
  + Should participate to get funding for project
  + 200$ 1st place, 100$ 2nd place, 50$ 3rd place

6:12

* Software architecture workshop tomorrow
  + Leon should definitely go
  + Also Ryan and Jeremy should go as well

6:14

* Gantt Chart Updates
  + George: Path following should be done by tomorrow when he gets a new laptop
  + Dylan: CAD design completed
  + Leon: Actuators should be done by tomorrow since all parts have come in
  + Ryan: Board wiring and PCB are both complete
  + Jeremy: Power Source and Power budget are complete
  + Etc: All vendors have been finalized

6:22

* Need to order spools of wire to connect ESCs and motors together
* Longer and thicker wires may cause noise to interfere with electrical signals

6:26

* Presenters for Sunday’s pitch competition: Dylan, George, Jeremy, Leon

6:30

* Everyone needs to update trello because it is very out of date

6:35 END

**4/6/21 7:00 - 7:20pm**

* Sprint Updates:
* Leon: Soldered motors and ESCs with connectors
  + Issue because the current rating for the motors is too high for an adapter
  + Needs to get the battery to test the motors
  + After this, will work on the remote controller
  + Workshop today was not very helpful
    - Only going through an example project code and PCB

7:06

* Jeremy: Struggling with determinant code of a matrix, looking for examples online

7:09

* Isaac: finalizing drone design, choosing from 2 different designs within the simulation to see which performs better

7:10

* Dylan: Looking into the dimensioning of the ellipse to see how much fabric is needed for the drone’s envelope

7:13

* George: Got a new laptop, lost some data so will need to catch up
  + Porter college responded and sent the grant application

7:15

* Ryan: Ordered battery and charger
  + Everything on the BoM is now ordered
  + Just installed matlab, so can help out with matrix math for George

7:16

* Cannot fabricate in Mircea’s lab, will look into a separate source to fabricate
* Flowchart for microcontroller due next week
* Everyone needs to make slides for the tasks they have completed by friday’s meeting with the TA

End 7:20

**4/7/21 6:00 - 7:20pm**

* Sprint Updates:
* Leon: Remote controller being studied with manual and searching for other resources online

6:02

* Jeremy: Finished matrix math C code and pushed through GIT

6:03

* Isaac: finalized drag force in simulation
  + Starting on sensor research

6:04

* Dylan: Looking into the envelope sewing process and gores that will be needed
  + 6 gores per hemisphere, 12 total
  + Mircea said it may be possible to fabricate in the delaware lab

6:05

* George: Laptop fixed, finalizing grant application
  + Should go over it as a team before submission by tomorrow

6:06

* Ryan: Pressure sensor tubing needs another distributor because the other one will not ship little amount so far

6:07

* Work Meeting:
* Going over grant proposal: Overview of responses to the following prompts to get funding:
  + How does project facilitate porter students creative/innovative work
  + How do porter students contribute as innovators
  + How many students/how many porter students
  + How will this project benefit porter as whole

6:34

* Starting on work for the state machine with half on grant proposal and half on state machine due tomorrow

7:14

* Reconvening to finalize prompts for grant proposal
  + Making sure the prompts are not too technical for porter council and attention grabbing with regards to porter theme of art
  + Avoid using buzzwords in 1 paragraph
    - Spread them all around to envision passion with the project

7:50

* Grant Proposal Ready to submit
* Flowchart is also complete and ready to submit

**4/8/21 7:00 - 7:20pm**

* New servos had to be ordered because the wait time would be too long
* Sprint Updates:
  + Leon: Has a step-by-step diagram for the microcontroller flowchart, will get to finishing the final diagram
    - Implementing remote control with motors and servos being changed with inputs
    - Hardest part is figuring out how to interface with the remote controller

7:04

* + Jeremy: Working on slides to present for tomorrow
    - Will continue to assist george with C code

7:05

* Isaac: GPS and IMU are displaying in the simulation, ultrasonic would be next
  + Transferred into new model in code
  + Moment is off with new model due to larger speed, causing greater wobbling

7:06

* Dylan: Found new servo and ordered new servo couples
  + Will need to fix the dimensions of the servo in CAD
  + Also working on redimensioning the gores of the envelope
    - Concluded we have enough fabric and sewing/fabrication of the envelope will begin this weekend

7:09

* George: Working on turning controller and staying within the max of the motors
  + Will have Jeremy assist with coding more C libraries
  + Request max amount of funding possible, so we can get as much money as they can give us

7:11

* Ryan: Trying to find tubing to work with the system PCB

7:13

* Have slides ready for tomorrow to present to the TA for improvement for the next design review

7:15 END

**4/9/21 4:00 - 5:45pm**

* Meeting with TA Tanner
* Going over design review slides

4:10

* Jeremy: Be more specific with goals with flight time
  + Title should show goal oriented
  + Show how stretch goals is being attained
  + Specify power needed for throttle levels
  + Matrix slide is not needed, have that in the responsibilities
  + Include motor power redo

4:25

* Dylan: Have a refresher for the teaching team
  + Not every slide needs to be goal oriented
    - Each task must have a reason
  + MagAero needs to stand out more in the dimensions of the CAD
  + Good Slides overall

4:41

* Isaac: Needs to input what requirements are being met by the simulation
  + Input numbers on what is being tested, point out the changing variables in videos
  + Use videos showing wind and propeller separately
  + Specify what exactly is being proven by each video
  + Unrealistic to show wind up & down 20mph

4:53

* Ryan: Layouts may not be required for the design review, petersen may be able to read it however
  + Add goals/tasks to slides to be more goal oriented
  + Professors might not care where the parts were ordered from
  + Make some slides on some PCB board design considerations

5:04

* Leon: Flowchart showed to TA
  + Two state machine will be needed for the raspberry pi and microcontroller
  + State machine should describe low level processes such as interrupt priorities
  + Start with PIC state machine, use the flowchart made from last quarter to give an overview
  + Needs to specify how each state moves to another
  + Specify decisions vs readings in the flowchart to get a measure of the state machine

5:30

* Final words: STAY GOAL ORIENTED

5:35

* Sprint Meeting
* Leon: Working on state machine, TA helped understand how to separate it from a flowchart

5:37

* Jeremy: Working on C coding matrix functions for Controls

5:38

* Isaac: Putting in proximity sensor into simulation

5:39

* Dylan: Did a bunch of small changes in CAD
  + Moved ultrasonics, edited MagAero being fitted onto the bottom

5:40

* George: Tuning closed loop autonomous control

5:41

* Ryan: Had to clarify to some websites that he was not a chinese spy

5:42

* Pitch presentation is not specified if we are accepted, need to email back if we will be allowed
* Finish slides to submit either Monday or Tuesday
* Update and add new Trello Cards

5:45 END

**4/10/21 7:00 - 8:30pm**

* Sprint Updates

7:01

* Leon: Worked on state machine and trying to finish connecting the remote controller

7:02

* Jeremy: Finished coding matrix math for George

7:03

* Isaac: Looking at properties for proximity sensors for use in simulation

7:04

* Dylan: Will start cutting gores for envelope tomorrow and learn how to use the sewing machine

7:05

* Ryan: Adding slides for trace widths in PCB

7:06

* ETC: Slides can be reviewed one at a time by posting them on new channel on discord

7:10

* Working on Pitch day presentation slides and practicing for tomorrow

8:30 END

**4/11/21 7:00 - 7:20pm**

* Sprint Updates
* Won 1st place in pitch competition, 200$ for project funding

7:03

* Leon: Will have state machine done by tomorrow

7:04

* Jeremy: Will assist Leon since power management is out of work for right now
* Isaac: All the other sensors can work for functions, ultrasonic sensors are placed correctly in the simulation

7:05

* Dylan: Sewing machine used for getting width of the stitches

7:06

* George: Porter college grant wants to know more specifically how it will improve porter college specifically

7:12

* Ryan: Emailed OSH park about current specifications on the traces

7:15

* Crown Application for funding is also available, due in 2 days
  + Will submit tomorrow
* Tanner’s Office hours T-TH 12-1, we will be going to discuss design review on Friday
* Everyone also should update notebooks for submission before design review

7:20 END

**4/12/21 6:00 - 8:02pm**

* Archisha said faculty advisor must approve the money, then we will get a VISA gift card with the 200$ we won
* We need to wait for Mircea to approve before we can fabricate at Delaware, even though we have permission
* Sprint Updates:

6:03

* Leon: Drafted both state machine and flow chart for submission
  + Also wrote pseudocode for motors and servos with the remote control

6:04

* Jeremy: Crown grant request is done, needs review before submission

6:05

* Isaac: Added proximity sensors, still looking at how to code them

6:06

* Dylan: Cut the sheets of the gores into the sizes we needed, shapes themselves need to be cut after

6:07

* George: Working on matlab code with the aerospace toolbox
  + RC controls should come a lot faster

6:08

* Ryan: Tubing for pressure sensor is shipped

6:12

* Going over both crown and porter project funding applications before submitting them

6:21

* Gantt Chart Updates;
  + Simulation: 80% done with implementing proximity sensors, will be done tomorrow or the day after

6:23

* + Hardware Implementation: Implement controls in software should be done by April 14th
    - Autonomous control hasn’t been started yet

6:25

* + Controls: Path following is still in the works
    - Closed loop RC control needs ideal sensor model from simulation
    - May skip ideal sensor and move to noisy sensor model

6:27

* + PCB: Done and ordered
  + Fabrication: 15% done, moved to 4/26
    - Envelope started

6:29

* ETC: Ryan, Leon, and Jeremy will go to PCB workshop tomorrow
* Have slide done by tomorrow, milestones are the biggest part to focus on
* Isaac will be helping Dylan Fabricate

6:30

* State Machine Review
  + Needs an off button, else the drone will not know when not to turn the motors
  + Interrupt priorities are also specified
    - Needs to have sub priorities for sensors with the same priority

6:58

* Group split up so others can work on the diagram while Leon can work on the servos and motors with Ryan and Jeremy

7:07

* Leon will be working to coordinate the RC controller commands to be processed by the raspberry pi and have the Pic adjust the PWM of the servos and motors
  + Advanced controls, such as turning and moving at the same time, will be focused on later, due to complex moment mechanics needed

7:27

* Working on State machine

7:58

* Both diagrams finished
* Office hours tomorrow, Leon and George will go

8:02 END

**4/13/21 7:00 - 7:26pm**

* Sprint Updates:
* Went over final iteration of state machine and flow chart

7:11

* Sprint Report
* Leon: Finished working on state machine and flow chart
  + Also went to workshop and office hours today
  + Used an oscilloscope to translate controller outputs, should be able to connect them to any input

7:14

* Jeremy: Also went to workshop and worked on slides
  + Leon, George, and Isaac, can reach out if anyone needs help
  + Also received 300$ from crown for funding

7:18

* Isaac: Testing ultrasonic code, will be done by today

7:19

* Dylan: Has the 24 sheets, will start sketching the cuts of them by tomorrow

7:20

* George: Will try meeting with controls professor to help with tuning controls
  + Also will keep track of Porter’s funding application
  + Can also email to get funding from pitch competition

7:21

* Ryan: Added slides and went to workshop, showed Petersen PCB schematic

7:25

* Add milestones to first slides, will submit by 9pm today

7:26 END

**4/14/21 6:00 - 6:26pm**

* Meeting with TA Tanner:
* Traces are smaller than most manufacturers allow
  + Trace calculations may be wrong

6:07

* Actual Traces are much thicker than shown
  + However, still small compared to Amperage needed
  + Might fry the board since the copper width is too small

6:17

* Motor trace will probably be too big for the board
  + Will probably have to wire the motors outside the PCB

6:26 END

**4/14/21 6:00 - 6:47pm**

* Jeremy and Ryan are in a meeting with Tanner at the beginning of the meeting at Tanner’s request. George Dylan Issaac and Leon are in attendance. Will request an update message in discord for update and add to minutes when complete.

Sprint Report

* Leon 6:01 -
  + tested servos and ran with previously used code and servos were controllable. Takes position data and able to make multiple revolutions as need
  + Can only use one servo at a time for testing due to current draw
    - Needs update from Ryan on battery
* Dylan/Issaac 6:03
  + cut out the first half of the first gore, took a few hours but progress is being made. Might need to dedicate a few extra hours. Isaac and Dylan have been working together.
  + Need to follow up with Mircea again
* George 6:07
  + Am stopping by office hours for pointers on the control design
  + Generating matrices for the closed loop RC control to do work in the meantime
  + Could use noisy sensor model in Vrep
    - Isaac will check it out
    - Use data sheet for numbers
* Motor updates 6:15
  + Current draw is limiting testing but appears to be working so far
  + May try testing with no load to limit current on brushless motors
* Meeting schedules for 7pm 4/15 to have practice run of presentation. Expect Long meeting
* Meeting End at 6:28PM, hopped back on for Jeremy and Ryan

6:34

* Ryan and Jeremy finished with Tanner so we hopped back on
* Ryan Update
  + Need to adjust voltage at board due to lack of enough width for copper
  + Can do the 12V off the board
  + Will not reorder yet, gonna test the board to see if there are any other problems
  + Need to remove a couple pin outs in the next design of the board

6:35

* Jeremy
  + Worked on coding the height tracker for use in the controls
  + Needs to push but ready to be checked
* Battery Update given for Leon
  + Shipped on April 12th
  + Battery order got “cancelled by sender”, but we didn’t cancel. Not sure what happened, so we need to contact the seller immediately
  + Need to get a barrel Plug for testing due to the delay while we figure this out

6:47 Meeting End

**4/15/21 7:00 - 8:47pm**

* Sprint Updates:
* Leon:

7:03

* Jeremy: Went over slides a final time

7:04

* Isaac: Not sure where to find datasheets for sensors
  + Should find them on the BoM

7:05

* Dylan: Tela has given feedback for slides, will work on that today

7:06

* George: Working on slides
  + Also been working on remote control and Complementary filter

7:07

* Ryan: Updated current for each rail and rearranging PCB designs

7:10

* Need to put all milestones in the first 2 slides

7:15

* Fixing Slides based on TA notes

8:02

* Practice Design review and fixing slides
* Common Issues:
  + Change wording of milestone slides and titles

10:30 END

**4/17/21 7:00 - 7:10pm**

* Sprint Reports
* Tanner was invited to the discord
* Leon: Working with the remote controller

7:01

* Jeremy: Sent in power budget for review, also sent receipts for crown funding

7:02

* Isaac/Dylan: Cutting out gores for the envelope, will be halfway done by the end of the day
* Isaac also has the equation for the standard deviations for the noisy sensors

7:05

* George: Building the pitch/roll system should be done quicker than the closed loop remote control

7:06

* Ryan: Contacted Digikey for reviewing second order, delivery for rest of electronics will be delayed until the end of next week

7:08

* Speaker notes will be on the design review slides for follow ups

7:10 END

**4/18/21 7:00 - 7:15pm**

* Sprint Reports
* Leon: Working on coding between the Raspberry pi and Pic32 from getting the RC controller inputs

7:03

* Jeremy: Getting sources for battery draining and fixing the voltage divider

7:05

* Isaac: Testing out code for standard Gaussian distribution of noise

7:06

* Dylan: Cut out the gores last night, will be finished by tomorrow

7:07

* George: 2 degree of freedom system will be done by tomorrow
  + Also working on how good the functionality of exporting the system to C works and how it works to test reliability

7:08

* Ryan: Added wires into PCB design for the 12V rail, which is an underneath wire

7:10

* Fill out peer eval forms for meeting on Monday

7:12

* George will be presenting slides to catch the team up in the controls part of the project
* We should start planning on how to start writing the report

7:15 END

Peer Review meeting

Long Flight Time Buoyant Drone 4/19/2021 6:00 PM -(PST)

horizontal lineATTENDEES

* Excused absences:
* Unexcused absences:
* Tardy:Ryan

## AGENDA

* **Check in:**
  + Leon 6:06
    - Got signal to propagate from RC controller to motors and servos
    - Ready to start working on the 4 basic turns, left, right, up/down,forward/backwards
    - Didn’t use the battery on the motors yet
  + Jeremy 6:10
    - Working with Ryan to fix voltage divider for PCB
    - Also seeing power losses from switching regulators compared to linear
  + Isaac 6:13
    - Been cutting out gores with Dylan
  + Dylan 6:14
    - Cutting out gores with Isaac, should be done today
  + George 6:15
    - Working on Error cases for large angle approximation
    - Added new folder to google drive for final report drafting by chapter
  + Ryan 6:16
    - Contacting Digikey to see status of shipments
    - Also rearranging power components, regulators in PCB
* **Gantt Chart 6:17**
  + Changes: 6:25
    - PCB milestone added to update PCB design
      * Also needs fabrication for the 2nd PCB delivery
    - Power management changed task to testing motor power
      * Also added milestone to finalize decision to use switching or linear regulators
* **Feedback:** Each person will receive feedback from each of the team members and themselves pros and cons, this should be the same feedback you gave on the evals. **BE HONEST**
  + Dylan 6:36
    - Has been noticing he has been feeling burnt out lately
    - Can still work on conflict resolution
    - Has been doing a good job keeping himself and others on track with the project
    - Has improved on holding people accountable for their work
    - Can still work on delegating tasks more evenly among the team
    - Pivotal member of the team, does well in discussing work during the design reviews
  + George 6:43
    - Has been behind in his work due to lack of experience with what he has been working with
    - Has been good recently at delegating and asking team members for help
    - Will be presenting to the team about controls stuff more often
    - Been putting in the most time of the team
    - Maybe is burnt out from the hard material he is dealing with
    - Can still work on communicating and delegating his work with the rest of the team
  + Isaac 6:54
    - Caught up with his work that was lagging behind, also asking more questions during meetings
    - Has also been putting in more time and quality of work
    - Can work on showing the team his finished tasks and what it means for the rest of the team
    - Work can be a fallback if the fabrication does not work
  + Jeremy 7:02
    - Always willing to help out and work with other people
    - Should reach out more to team members if they need help with anything
    - Struggles with presenting slides and showing them in slides
    - Also should work on providing better documentation, can work on the final report early if nothing else to do
    - Has been doing well in the tasks that other team members needed help with
  + Ryan 7:12
    - Has improved on slides and working on milestones
    - Has been struggling with the meeting times
    - Working more with Leon and Jeremy in sub-team meetings more
    - One of the last ones to work on slides
    - Has also been rushing some aspects of his work without team checking, reviewing with other people can help catch any mistakes
  + Leon 7:22
    - Has been focusing more on his work due to lack of other hard classes
    - Can work on slides more and practice presenting to get better at design reviews
    - Work on understanding and commenting on code
    - Ask for help more often since others have experience with coding he is working on
    - Work will decide how well the drone will perform and team’s final accomplishments
* **Group discussion:** How we can improve as a team, what changes should we make to the team, what should our workflow look like going forward. 7:32
  + Slides have gotten better
  + Peer reviews have been the biggest issue, sub-teams should work together more
  + Have been following Gantt Chart more and using it to hold us accountable
  + Documentation and Trello has been lagging behind
  + Prototyping needs to be done as soon as possible to fix bugs for the second design phase
* **Individual Improvement:** Everyone says one or two things that they are going to improve on before the next design review. 7:42
  + Dylan 7:43
    - Work on checking in with everyone to get a better understanding of their work
    - Delegate high level team tasks so that work flow become more efficient especially related to the final paper
  + George 7:44
    - Delegate tasks to other team members, particularly ones with coding or tuning, to free up time on the design side of controls.
    - Start generating lots of graphs and images to help the team follow my work better, as well as use in the final report.
  + Isaac 7:45
    - Review other people's work more in depth and be able to provide technical feedback
    - Work on tasks throughout the week instead of working near the end of a sprint week
  + Jeremy 7:46
    - Get better at showing documentation and reasoning behind design decisions
    - Take initiative and ask team members specifically if they need help with anything
  + Ryan 7:47
    - Work more with Leon and Jeremy in sub-team meetings
    - Prepare slides in days advance before design reviews
    - Ask team members to review PCB design before sending it to board house
    - Work more closely with TA whenever making critical changes to design
    - Whenever there are no tasks, work on the final design review presentation and paper
  + Leon 7:48
    - Have better documentation on any piece of code written
    - Understand every single line of code and be ready to explain what it does
    - Allocate more work to teammates

Meeting End: 7:50 PM

**4/20/21 7:00 - 7:10pm**

* Sprint Updates:
* Leon: Working on PIC32 code on 4 basic directions for RC controller
  + Charging the battery, will be used later tonight

7:01

* Jeremy: Worked on Voltage divider for receiver and coding height algorithm for George

7:02

* Dylan/Isaac: Finished cutting gores, sewing gores will come next but is harder

7:03

* George: Unable to work on project today due to other reasons

7:04

* Ryan: Talked with Tanner about soldering iron
  + Added Voltage divider to PCB
  + Digikey should be shipping everything by the end of the week

7:08

* Presentation tomorrow for controls

7:10 END

**4/21/21 6:00 - 8:10pm**

* Sprint Updates:
* Leon: Hooked up the battery to the ESC and got a single motor working
  + Next step is to write procedure for all controller inputs

6:07

* Jeremy: Power budget had been given feedback by instructors, will be looked at as soon as possible

6:08

* Isaac: Looking at datasheets for 4 sensors, all had noise components
  + Only sensor that noise can’t be found is the ultrasonic

6:09

* Dylan: Focusing on 3d parts the rest of the day while sewing the gores together

6:10

* George: worked on presentation for the team to review controls
  + Also working on simplifying some systems since they will not need to be perfect

6:11

* Ryan: Digikey says they will ship tonight or tomorrow
  + Also started to look into trapezoidal integral for controls programming

6:12

* Controls Presentation by George:
  + High level overview of use of controls
    - Moving from current state to desired state
* PID Controls and how they interact with a tunable system
* Different Matrices used as inputs to get outputs

7:10

* Get slides for the TA meeting if you have completed tasks
* Sprint end on Monday
* Working on the final paper will be planned and implemented as part of the hours of future sprints

7:15 END

**4/22/21 7:00 - 7:15pm**

* Sprint Report
* Leon: Worked on the PIC32 code, is finished
  + Now working on the raspberry pi code, had to install a bunch of libraries, looking at other code online to see how to read protocol

7:05

* Jeremy: Sent responding comments to Tela with the power budget
  + Worked on using switching regulators instead

7:07

* Dylan: Worked on more sewing last night, will work more with Isaac tonight
  + Might need to redo some of the sewing, also might run out of string so will order more just in case
  + Haven’t started 3d printing yet, focusing on sewing

7:08

* George: Controls need to be tuned since it gets steady within 6 seconds

7:09

* Ryan: Digikey cannot guarantee but they said they will ship tomorrow, 2-day shipping everything else is finalized

7:10

* Isaac: Looking at datasheets for noise specifications
  + Will be helping Dylan with sewing tonight

7:12

* Next sprint will be focused on testing and writing the final report
  + 80% testing 20% writing
* Next sprint will be 50% testing, 50% writing
* Last sprint will be 100% writing

7:15

* Follow up with Mircea for lab access

7:17

* Follow up with funding from crown, porter, and the pitch competition

**4/23/21 4:00 - 5:32pm**

* Meeting with TA Tanner

4:06

* Flowchart needed an interrupt service routine and interrupt vector table
  + Sub flow chart for those interrupts
  + Add specific reading number quantified to progress in the flow chart

4:12

* Get started as early as you can on writing the final report

4:14

* Making slides on fabrication can be shown with the verifications that it was fabricated correctly

4:20

* PCB and fabrication should be finished and tested by the next design review

4:22

* Mircea has been unresponsive to give an orientation to delaware labs even though we technically have access to the building already

4:26

* Our project has a complicated PCB board, it will most likely require much more fixing before it is complete and with minimal errors

4:30

* Gore design would have taken a lot longer if we didn’t have 2 people in-person working on it

4:36

* Overview of PCB:
  + Switching regulator breakout boards can be used instead of linear regulators in the PCB to save power efficiency
  + Keep the analog and digital signals separate from each other so they don’t interfere with each other

5:13

* Going over final report outline and folders in our google drive

5:19

* Questions about the appendix:
  + Github, CAD drawings will be put in the appendix
  + Don’t be rigid with the chapter breakdown because it can change

5:24

* Sprint Updates:
* Leon: Working on Raspberry Pi code, couldn’t do too much due to getting vaccine

5:28

* Jeremy: Working with reducing noise from the switching regulator

5:29

* Dylan/Isaac: Finished sewing the gores, had to redo some of them
  + Will do some 3d printing this weekend

5:30

* George: Simplified pitch-and-roll response even more
  + Figured out how to convert simulink into C Code, still needs verification
  + Working on implementing open-loop control RC in conjunction with closed loop of the height control and pitch & roll

5:31

* Ryan: Working on PCB 2nd design and integral function for controls

5:32 END

**4/24/21 7:00 - 7:15pm**

* Leon: Found example code interacting with special protocol on receiver

7:02

* Jeremy: Will need to ask Tanner about a circuit to average an AC voltage

7:03

* Isaac/Dylan: Doing more sewing last night and today
  + Dylan is also working on 3d printing, had some trouble getting it working initially
  + Will try to print all parts by Monday

7:05

* George: Making changes to A and B matrices, trying to simplify them as much as possible with different types of coordinates

7:09

* Ryan: Absent due to doctor’s appointment

7:10

* ETC: Sewing should be done this weekend as well

**4/25/21 7:00 - 7:15pm**

* Leon: Found example code interacting with special protocol on receiver
  + Trouble converting C++ code state machine

7:01

* Jeremy: Troubleshooting using a switching regulator with a low pass filter to reduce noise

7:05

* Isaac/Dylan: Still sewing the envelope gores, sewing needle broke but had a replacement
  + 3d printing was very wrong, created a clump, resulted in delay

7:08

* George: Layout of the response was redone, resulted in dampening much faster
  + Hovering capability being added now, closed loop RC should be done by the end of the sprint

7:09

* Ryan: Writing documentation for GPS module and antenna
  + Also correcting trace widths for PCB

7:12 END

Sprint 6 Conclusion Meeting

Long Flight Time Buoyant Drone 4/26/2021 6:00 - 7:35 (PST)

horizontal lineATTENDEES

* Excused absences:
* Unexcused absences:

## AGENDA

* **Sprint progress:** 6:00
  + Leon: Struggling with code and compiling issues
    - Might try to write code instead of using libraries

6:03

* Jeremy: Figured out low pass filter for switching regulators
  + Should some power compared to linear regulators

6:04

* Dylan/Isaac: Almost finished with envelope, more string coming tomorrow and will be finished the same day
  + Printed ultrasonic mount, caused a jam in the printer
  + Getting it unjammed right now
  + Updated servo mounts with new dimensions Leon sent

6:05

* George: Height control added to the system, adjusts properly
  + Added remote control system that works with the pitch/roll/height regulator by combining them with the RC inputs

6:06

* Ryan: Digikey realized something is not right with shipment, contacted warehouse
  + Also working with the switching regulators and filters onto the PCB

6:08

* **Gantt Chart Updates:**
* Isaac: Sensor Simulation due 29th

6:10

* Leon: Electronic actuators implemented, marked as done
  + RC control almost done, raspberry pi needed to interact with receiver, will be done by 4/30

6:12

* George: Closed loop RC in matlab requires saturation numbers from the motors, 99% done, code generated by 4/27
  + Auxiliary autopilots functions designed, needs to code it into simulation

6:15

* Ryan: Fixing V1.9 PCB pushed to 5/4 due to shipping parts
  + Implementing switching regulators due 4/28

6:18

* Jeremy: Regulator choice has been finalized
  + Test power draw of motors and servos is waiting for the motor propellers and first PCB design

6:22

* Dylan: 3d printing fabrication is pushed back a couple of days due to printer issues
  + Also envelope sewing will be done by tomorrow
* **Review of Progress**: 6:30
  + Leon (110/140 hours) - 6:31
    - Implement servo control (10 hours)
      * Complete
      * Spent 20 hours due to change in servos
    - Implement ESC/motor control (10 hours)
      * Complete
      * Spent 10 hours
    - Implement remote control communication with Raspberry Pi (10 hours)
      * Incomplete, in progress
      * Had issues connecting to the receiver using receiver’s protocol
      * Spent 30 hours
      * Expected 4/30
    - Implement servo control with remote controller (10 hours)
      * Incomplete, in progress
      * PIC32 control of servos and motors completed, and communication between PIC32 and Raspberry Pi completed, but remote controller controlling servos not completed yet due to remote control communication with Raspberry Pi not being done yet
      * Spent 10 hours
      * Expected 4/30
    - Implement ESC/motor control with remote controller (10 hours)
      * Incomplete, in progress
      * PIC32 control of servos and motors completed, and communication between PIC32 and Raspberry Pi completed, but remote controller controlling motors not completed yet due to remote control communication with Raspberry Pi not being done yet
      * Spent 10 hours
      * Expected 4/30
    - Implement autonomous control data processing between PIC32 and Raspberry Pi (30 hours)
      * Incomplete, haven’t started yet due to not being done with remote control implementation
    - Implement servo control with autonomous control (10 hours)
      * Incomplete, haven’t started yet due to not being done with remote control implementation
    - Implement ESC/motor control with autonomous control (10 hours)
      * Incomplete, haven’t started yet due to not being done with remote control implementation
    - Group meetings (25 hours)
      * Complete
    - Sub-team meetings (15 hours)
      * Incomplete
      * Only 5 hours of meeting
  + Jeremy (123 hours) - 6:43 **(77/123 hours worked) + 9 hours on other tasks**
    - Verify PCB Design (4 hours)
      * Complete
    - Finalize Power Budget by double checking all parts and heat efficiencies (10 hours)
      * Complete
    - Optimize Battery once power budget is finalized (4 hours)
      * Complete
    - Group meetings (25 hours)
      * Complete
    - Sub-team meetings (15 hours)
      * Incomplete
      * Only 5 hours of meetings
    - Push ECE121 code to Github(1 hour)
      * Complete
    - Program C libraries for Linear algebra, integration, and other functions needed for controls (16 hours)
      * Incomplete:
      * 12 hours done on linear algebra
    - Program C libraries RC response (16 hours)
      * Complete
    - Program C Libraries for autonomous (16 hours)
      * Incomplete, in progress by George
    - Program C libraries automated landing and takeoff (16 hours)
      * Incomplete, found an alternative way for landing and takeoff
    - Other Tasks:
      * Low-pass filter implementation(5 hours)
      * Finalized voltage divider for receiver(4 hours)
  + Isaac (est. 152 hrs /**act. 129 hrs**) - 6:55
    - Implement Drag Force **(30 hours) - Complete**
      * Calculate Balloon Speed (10 hours)
      * Create 3D Drag Force (10 hours)
      * Apply Logic to Drag Force Given Balloon Speed (10 hours)
    - Implement Sensors to Read Pseudo Data from Vrep **(22 hours) - Complete**
      * Research Sensors (6 hours)
      * Implement Ultrasonic Sensor (4 hours)
      * Implement IMU (4 hours)
      * Implement GPS (4 hours)
      * Implement Balloon Barometer (4 hours)
    - Help Fabricate Prototype with Dylan **(30 hours) - Complete**
      * Sewing Envelope (20 hours)
      * 3D printing parts (10 hours)
    - Adding Noise to Sensors **(12 hours) - Incomplete/ In Progress**
    - Group meetings **(25 hours)**
    - Subteam meetings **(10 hours)**

Delayed due to Remote Control Sub-team Delays

* + - Implement Closed Loop Remote Control **(35 hours) - Incomplete**
      * Learn to Use Remote API to Apply C Code (15 hours)
      * Use Remote API or Rewrite C Code to Lua (10 hours)
      * Apply Outputs of Functions to Individual Parts (10 hours)
    - Implement Autonomous Design **(30 hours) - Incomplete**
      * Feed Sensor Input to Functions (10 hours)
      * Use Remote API or Rewrite C Code to Lua (10 hours)
      * Take Outputs and Apply Them to Individual Components   
        (10 hours)
  + Dylan (126 hours) - 6:59
    - Add updated parts to CAD (4/2) **(14 hours)**
      * Voltage Regulator (2 hours)
      * Camera and transmitter (4 hours)
      * Magaero housing (8 hours)
      * **All completed**
    - Fabricate Prototype (4/26) **(50 hours)**
      * Set up sewing machine and 3D printers (2 hours)
        + It took far more than 2 hours to complete closer to 10 hours.
      * Sew envelope (10 hours)
        + 90% complete waiting on more string to arrive tomorrow
        + Almost 30 hours spent on sewing and cutting (far underestimated time) should have probably been split into 3 10 hours tasks 2 of which are complete.for cutting sheets, cutting gore shapes, and an incomplete for sewing.
      * 3D print parts **(8 hours)**
        + **Issues with 3d printers caused delays in starting the printing process**
        + Servo brackets & plates (4 hours)
        + Ultrasonic mount & plate (1 hour)

**complete**

* + - * + Motor mounts (1 hour)
        + Gondola and plate (2 hours)
      * **All other tasks blocked by 3d printing and PCB not being ready**
      * Attach 3D printed parts to envelope (5 hours)
      * Inflation test of lift bag inside envelope with air (5 hours)
      * Attach servo and motor shafts to brackets (4 hours)
      * Add ultrasonics to bracket (1 hour)
      * Add electronics to gondola (5 hours)
      * Wire prototype (10 hours)
      * Second Inflation test of lift bag inside envelope with air (5 hours)
    - Implement Sensors to Read Pseudo Data from Vrep **(22 hours)**
      * Research Sensors (6 hours)
      * Implement Ultrasonic Sensor (4 hours)
      * Implement IMU (4 hours)
      * Implement Gps (4 hours)
      * Implement Balloon Barometer (4 hours)
      * **All complete**
    - Group meetings (25 hours)
    - Subteam meetings (10 hours)
  + George (140 hours) - 7:02. Spent 164
    - Complete path following terrain tracking PID design (10 hours)
      * Incomplete. 50 hours spent. Current design approach is impractical to implement and needs a matrix and controls redefinition. This was a failure where I chose an abstraction approach when i shouldnt used abstraction to start and build up from auxiliary functions.
      * Also decided Closed Loop RC is more important for testing and should be completed first.
      * Currently scrapping the current design since the new approach, that has been used to define closed loop and auxiliary functions, is far faster and allows me more control in the design.
    - Simulate Path following terrain tracking in Matlab (10 hours)
      * Delayed since PID autonomous design not completed
    - Define plant for closed loop RC (5 hours)
      * Complete. Spent about 20 hours redefining matrices and analyzing approximations. Resulted in using a mix of polar and XYZ coordinates. Estimations are better defined and justified and much easier to work with.
      * Also new definitions assisted in applying pole placement with integral implementations that we will be using for the rest of controls.
    - Pole placement and integral control added to RC design (15 hours)
      * Complete. Far superior approach that was built off of auxiliary functions. Will use the same method for the rest of controls. Spent approximately 15 hours. (Current design also includes height control) Current design works by calculating motor forces after the pith/roll/height regulator has already issued commands, so that the RC response does not interfere with stability of the drone.
    - Simulate RC response in Matlab (5 hours)
      * Complete. Response has been tested by analyzing physical response and motor commands based on user input. Appears to be ready to export to VREP simulation. Approximately 5 hours spent.
    - Design filters to obtain accurate state data (25-30 hours) will be Broken down when filter design chosen after further research
      * Task 1: Complementary filter for calculating pitch roll angles designed. Spent approximately 7 hours.
      * Task 2: Estimation of height was not completed, only high level design. Spent approximately 10 hours.
      * Task 3: Filter for ultrasonics for object avoidance not yet developed.
      * Task 4: GPS filter not yet designed
    - Simulate and test noisy sensor model (10 hours)
      * Task 1: Filter for pitch and roll tested only, approximately 2 hours.
      * Task 2: Rest of noisy sensors and filters not tested since not yet developed.
    - Auto landing function (10 hours)
      * Complete: Design is complete and ready to be exported into Vrep.
      * Spent approximately 10 hours
    - Auto take off function (10 hours)
      * Complete: Design is complete and ready to be exported into Vrep.
      * Essentially the same function as auto landing. No time spent.
    - Meetings (35 hours)
      * Spent more than 35 hours with a few smaller meetings for other functions. Approximately 40 hours.
  + Ryan (122 hours) - 7:07
    - Finalize BOM PCB parts (2 hours)
      * Complete
    - Wiring data bus between sensors to microcontroller in board design (3 hours)
      * Complete
    - Wiring voltage rails to all components (4 hours)
      * Complete
    - Wiring microprocessor to microcontroller, receiver and pinouts for servos and ESC (3 hours)
      * Complete
    - Verify PCB with power management (4 hours)
      * Complete
    - Send out PCB design to manufacturing (1 hour)
      * Complete
    - Remove ECE 121 repo within Barone2 repo and re-upload ECE121 C programming code to Barone2 repo (1 hour)
      * Complete
    - Program C libraries for Linear algebra, integration, and other functions needed for controls (16 hours)
      * Incomplete, working on fixing voltage rails, rearranging sensors and microcontroller away from voltage rails.
    - Program C libraries RC response (16 hours)
      * Complete
    - Program C Libraries for autonomous (16 hours)
      * Incomplete, in progress by George
    - Program C libraries automated landing and takeoff (16 hours)
      * Incomplete, found an alternative way for landing and takeoff
    - Group meetings (25 hours)
    - Sub-team meetings (15 hours)
      * Incomplete
      * Only 5 hours of meetings
* **Team Improvements**: 7:12
  + Sprint should have been shorter so goals could have been adjusted
  + Got better at working together within sub-groups
  + Task time was estimated very incorrectly
* **Individual Improvements: 7:16**
  + Dylan- 7:16
    - Over confident (especially related to 3D printing
    - Need to stop assuming things will go as planned (leaving more room for error)
    - Will need more help going forward, much of fabrication is at least a 2 person job
  + George- 7:18
    - Should be less stubborn with trying to make tasks work. PID autonomous severely delayed controls progress, should have changed approach earlier.
  + Isaac- 7:19
    - Start work earlier in the day and manage my time more effectively
    - Ask for help outside of team meetings
    - Give more input during team meetings
  + Jeremy- 7:20
    - Needs to ask other team members if they need help more often when tasks are getting stuck behind others
    - Clearly define tasks better or what needs to be worked on that are not exactly tasks
  + Ryan- 7:21
    - Ask for help on C programming tasks when I don’t understand
    - Be proactive about asking other team members if they need help
  + Leon- 7:22
    - Spent too much time on beginning of tasks and didn’t get around to future tasks
    - Need more optimized daily routine
* **Next Goals**: 7:23
  + Dylan- 7:24
    - Finish 3D printing, related tasks
      * Print parts attach parts to envelope
    - Help out with other tasks for sensors coding and simulation while I wait for hardware to be ready to add to prototype
    - Test prototype once electronics and remote control are ready
    - Get helium
  + George- 7:25
    - Design autonomous Controls
    - Tuning for all systems
    - Design rest of sensor filters
    - Assist with manufacturing
  + Isaac- 7:26
    - Complete prototype fabrication
    - Add closed loop control to simulation
      * Find out how to convert C to Lua
      * Edit code to fit V-rep
  + Jeremy- 7:27
    - See how correct motor and servo estimations were with actual testing with Leon
    - Assist other team members with coding
  + Ryan- 7:28
    - Get started on V2.0 PCB and fix all issues with V1.9 board when its working
    - Ask to help other team members when I have time
  + Leon- 7:29
    - Finish up remote control implementation
    - Put together first PCB board with all parts and test hardware as fast as possible to find bugs
    - Start autonomous control implementation, at least create a structure to just plug in numbers for when autonomous control design is finished
  + Team Goals
    - Report writing-
    - Put together complete drone
    - Attempt first drone flight
* **Other Business**- 7:30
  + Final report should be started by each team member over the course of this week
  + Sprint report should be started by Wednesday, and submit it by Friday
  + Next sprint will be started sometime this week

Meeting End: 7:35