Barone2 Sprint Report 5/17/21-5/29/21

Sprint 4 (Spring),

Prepared by George Hernandez

**Executive Summary of Progress:**

For this sprint, the primary goal was to perform the drone’s first flight test, verify power, and simulate more of the controls system in VREP, completing most of the verification that could be done before the end of the quarter. Due to PCB failure in the last sprint, a development board setup was adopted for the flight test. The flights failed due to manufacturing errors, however, power draw measurements of the electrical components show that meeting the minimum drone flight time is possible. Closed-Loop Remote Control was further developed, but Autonomous was not completed. The testing of controls in VREP was not completed due to issues setting up the Remote API to call the C files. Motor and servo responses were also set up and tested separately from the drone with Open Loop Remote Control to confirm their responses and communications protocols. In terms of this sprint as the major verification window, the goals were not met to prove the viability of the drone design. The time before the end of the quarter is limited, and tests for verification need to be prioritized and selected, since it may not be feasible to accomplish all tests before the end of the quarter.

**Progress made toward acceptance criteria:**

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

**Mechanical Design:**

| Order and pick up helium | Complete | Dylan, Jeremy | 3 | Helium was picked up from Praxair and delivered to a testing site in Delaware labs, while following proper safety procedures. |
| --- | --- | --- | --- | --- |
| Wire up minimum electronics to get drone flying | Complete | Leon, Jeremy, Dylan | 10 | Battery, kill switch, wire terminal, servos, ESCs, motors, and RC receiver were wired up to allow drone to hover |
| Wire up sensors to drone | Incomplete | Leon, Jeremy, Dylan | 6 | Didn’t get around to it because wiring drone took longer than expected; only battery, remote controller receiver, ESC, servos, and motors were wired up |
| Attach 3d printed parts to envelope | Complete | Dylan | 6 | 3D parts were successfully mounted onto the envelope. Additional bubble wrap was added in order to protect the lift bag. |
| Inflation test with 3d parts | Complete | Dylan, Isaac | 2 | Several inflation tests were conducted, the first of which resulted in a popped lift bag. After bubble wrap was added the inflation test was conducted successfully |
| Attach servo and motor shafts to bracket | Complete | Dylan, Leon, Jeremy | 4 | Servos and motors were successfully attached to the prototype using their intending mounting brackets. |
| Add ultrasonics to bracket | Incomplete | Dylan | 1 | Ultrasonic sensors were not added to the prototype since the autonomous controls system was not ready. |
| Inflation Test with all Electronics | Complete | Dylan, Jeremy | 2 | Prototype was inflated with the electronics necessary to fly, and the shape was found to remain the same. |
| Do initial RC test at Delaware | Complete | Dylan, Jeremy | 13 | First inflation popped while transporting to the testing site, second inflation had a leak and was unable to take off due to slack in the envelope not holding the propulsion systems outright. Additionally the start of the helium test was conducted, but was not completed due to lift bag popping. |

**Drone Simulation:**

| Implement closed loop remote control | Incomplete | Isaac | 25 | Communication network between V-rep and VS Code was established and basic remote API functions were able to run in the program as well. Control code was able to be communicated in the VS Code side, but VS Code had difficulty retrieving values in V-rep. We spent more than 50 hours on this assignment alone. |
| --- | --- | --- | --- | --- |
| Finish implementing autonomous control | Incomplete | Isaac | 20 | Autonomous control relied on closed loop control being completed. |

**Controls Design:**

| Update closed loop control with actual measurements | Complete | George | 4 | Control matrices were updated to respond to the actual dimensions and estimated physical properties of the drone ie buoyant moment |
| --- | --- | --- | --- | --- |
| Design feedback loop and with integral for autonomous controls | Incomplete | George | 4 | Matrices were defined but input to control via waypoints was not determined. |
| Tune closed loop control system to meet design requirements | Complete | George | 4 | Closed loop controls gain matrices were to tuned to meet specs in the system technical requirements |
| Simulate state response in matlab for closed loop system to confirm system response | Complete | George | 5 | All states remained within stable bounds in the matlab simulation |
| Tune autonomous control to meet system requirements | Incomplete | George | 7 | Autonomous not complete |
| Design control method for feeding control system next positional values | Incomplete | George | 6 | Autonomous not complete |
| Design estimator to determine drone position using accelerometer and GPS data | Incomplete | George | 5 | Autonomous task was required first due to priority |
| Integrate estimators with the control system for RC | Complete | George | 1 | Estimators integrated with the controls system by attaching the estimators to sensor inputs and the determined states to be imputed to the control system |
| Test state response for autonomous with estimators integrated | Incomplete | George | 2 | Not tested |
| Export closed loop RC to Vrep | Incomplete | George | 3 | C file created, but the simulation had communication issues that prevented testing |
| Adjust closed loop RC gains according to Vrep Response | Incomplete | George | 3 | Vrep not functional |

**Systems Programming:**

| Finish procedure to control servos/motors directly with remote controller | Complete | Leon | 15 | Remote controller was able to control a single servo and a single motor |
| --- | --- | --- | --- | --- |
| Implement system state machine for remote control functionality | Incomplete | Leon | 15 | Didn’t get around to it because wiring drone took longer than expected |
| Add sensor checking and sampling to system state machine | Incomplete | Leon | 15 | Didn’t get around to it because wiring drone took longer than expected |

**PCB Design:**

| Complete wiring diagram for dev boards to sensors, servos, voltage regulator | Complete | Ryan | 5 | Wiring schematic was hand drawn and sent off to Leonid for wiring. Microcontroller, microprocessor, sensors, motors, esc, servos, and battery connected to switching regulators to power all of the above. |
| --- | --- | --- | --- | --- |
| Complete wiring diagram for V2.0 PCB | Incomplete | Ryan | 10 | Trace incomplete, V1.9 board incomplete and instead dev boards are used instead to control the drone. V2.0 linear voltage regulators have been switching to pinouts for switching regulators. Trace width from battery to ESC is set to 314mils for high current. |
| Prepare slides for PCB failure for design defense | Complete | Ryan | 10 | Verification methods for PCB power verification, 4 motor and 4 servo verification, and sensor array verification completed. |
| Order 3.3V and 5V switching regulators | Complete | Ryan | 2 | 3.3V and 5V switching voltage regulators were ordered and shipped to Leonid and implemented in current drone prototype |

**Power Management:**

| Buy wire terminal for battery distribution | Complete | Jeremy | 2 | Wire terminal ordered that fits in gondola and allows for multiple 11.1V outputs from battery |
| --- | --- | --- | --- | --- |
| Finish Servo Testing with motor load | Complete | Leon, Jeremy | 4 | Servos were found not to stall while at max throttle with the motors |
| Power Test with all parts | Incomplete | Jeremy, Leon | 5 | Testing for all individual parts was complete except for GPS, data transmitter, and internal pressure sensor |

**Other:**

| Group Meetings | Complete | All | 15 |  |
| --- | --- | --- | --- | --- |
| Hardware subteam meetings | Complete | Jeremy, Leon, Ryan | 5 |  |
| Software subteam meetings | Complete | Dylan, George, Isaac | 5 | Various meetings conducted mostly centered around debugging errors related to implementing Remote API for V-rep |
| Revise Power management chapter | Incomplete | Jeremy | 10 | Could not be done due to focusing on getting a test flight done at Delaware |
| Research legal/safety requirements | Incomplete | Jeremy | 6 | Could not be done due to focusing on getting a test flight done at Delaware |
| Finish legal/safety requirements chapter draft | Incomplete | Jeremy | 10 | Research for requirements was incomplete |
| First draft of simulation chapter | Incomplete | Isaac | 10 | Additional hours in the simulation section had taken up the hours set aside for this task. |
| Write considerations of buoyant drone draft | Incomplete | Dylan | 10 | Although some work was done on this chapter extra time was spent on physical tests and this chapter's draft was not finished. |
| Write drone lift bag and frame design draft | Incomplete | Dylan | 10 | Due to the extra time spent on the physical test, this chapter's draft was not finished. |
| Complete ch7 outline | Incomplete | George | 5 | Incomplete due to controls delay |
| Complete introduction outline | Incomplete | George | 4 | Redoing the intro to fix flow issues, but only partially complete |
| Finish PCB chapter draft | Incomplete | Ryan | 38 | Outline for Chapter 5 section 1 and 3 are completed. Ultrasonic sensor pinout to PIC32 for chapter 5, section 1 sensor array completed. Rest of sensor pinout explanation for section 1 and PCB Interface for section 3 are still in progress. |

**Calculate sprint velocities:**

| Team Member | Estimated hours of all tasks | Estimated hours of completed tasks | Actual hours worked | Sprint Velocity | Reasoning for members <1 |
| --- | --- | --- | --- | --- | --- |
| Dylan | 81 | 63 | 80 | 0.79 | Due to certain tasks taking more time then expected to be completed such as wiring work which involved driving back and forth to San Francisco, as well as onboarding at Delaware which was not accounted for. There was not enough time to do the writing based tasks. |
| Isaac | 82 | 27 | 90 | .30 | The level of difficulty anticipated for the tasks exceeded our expectations, but the hours provided to our tasks did not. |
| George | 111 | 72 | 100 | 0.72 | There were problems with software that took a lot of time to identify and delayed progress in other areas. |
| Leon | 85 | 49 | 53 | 0.92 | A lot of time was spent wiring up the drone, so there was not enough time to implement the system state machine, sensor checking into the state machine, and wiring up the sensors to the drone. |
| Ryan | 90 | 37 | 65 | 0.57 | Documentation references for PCB design choices took longer than expected. Meetings with TA resulted in a more thorough outline of Chapter 5 section 3 and more hours have been focused drafting the section. Experimental verifications on V1.9 PCB could not be done by me due to time constraints, V2.0 traces have not been complete as experimental verification of V1.9 PCB needs to be done to verify V2.0 component placement and then trace wiring. |
| Jeremy | 75 | 48 | 60 | 0.8 | Much of the writing required to be done this sprint was incomplete due to helping out with the physical testing of the prototype. |
| Total | 524 | 296 | 448 | 0.66 | The spring velocity of this sprint was relatively low due to many tasks that had been pushed to the very end of the quarter being assigned. Ultimately some of these tasks took much longer than expected causing them not to be completed and other tasks not to even be started. |

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

| Functionality Demonstrated | Feedback | Team Response |
| --- | --- | --- |
| Order and pick up helium, brought to Westside Research Park and safely secured. | Although the helium was successfully picked up and brought to Westside Research Park, more preparation for following the proper protocols should be taken in order to save time in the future, i.e. bring the correct mounting equipment. | Proper mounting equipment, such as a chain and lock, have been purchased by the team for securing the helium in place for testing. The truck needed to be brought down from the bay area in order to safely transport the helium |
| Inflation test with 3d parts. Showed that the envelope could maintain its dimensions while holding the parts. | The brackets are all held taut when fully inflated. And the addition of bubble wrap was a clever last minute addition to protect the lift bag while adding little weight. It is concerning that the brackets will not be held taut if less than fully inflated. Extra support may need to be looked into in the future to maintain its outright angle even if less than fully inflated. | An entirely new envelope should be reconstructed to see further improvements in results. An internal frame could be added to further increase the support of the 3D mounted parts as well as improve the shape. However this will likely increase the weight of the system. |
| Attach servo and motor shafts to the bracket. This showed that the brackets could successfully hold the necessary parts. | Although the brackets successfully hold the parts, changes to the parts should be made in the future to be able to take the parts back out without damaging the part. | The brackets could be redone with slightly more room so that parts can more easily be put in or taken out. However doing this would need a more secure screwing method to securely hold in place the parts. |
| Wire up minimum electronics to get drones flying. This showed that the parts could be wired from the gondola and successfully take and receive signals. | This process was able to be done even without the PCB. However in the future the parts should be secured in place to insure no loose wires cause any malfunctions. | Electronics, more specifically the wiring, will be secured in place once more suitable replacements are found. |
| Inflation Test with all Electronics showed the best shape of envelope, as well as conducting the noise test which showed we did not meet our noise requirement. | This inflation test showed the best shape results of any of the tests, even if there is still room for improvement. This test should be reconducted outside to see if the noise level can be further reduced. | An outside noise test is planned for the future as soon as a safe operating procedure for outside testing is defined. |
| Do initial RC test at Delaware, showed that we were close to our required weight and would likely meet it if not for test malfunctions. Additionally it showed that we did not meet our helium loss requirement. We were not able to collect good flight time data from these tests. | These tests need to be redone in order to collect data on the flight time. Additionally a method of inflating the system without leaking needs to be found so that the lift bag will not rotate during inflation causing the leaking issue observed in this test. Lastly, find more ways of protecting the balloon from punctures since this was the cause of failure in both tests. | More lift bags have been ordered to perform further tests. Helium leakage while inflating the system will be fixed by ensuring the lift bag entrance is held in place when inflating. Inflating the drone will be done in the flight room the first time to avoid puncturing during transportation |
| Update closed loop control with actual measurements | This was able to successfully show that the closed loop controls could still be implemented even with current physical specifications implemented. however further tuning in V-rep needs to be done. | System state responses analyzed in matlab simulation. |
| Tune closed loop control system to meet design requirements | The tuning of the system has successfully shown in matlab simulation that our requirements should be met if this control system is implemented; however further tuning in V-rep needs to be done. | State response is within 0.1 radians of tilt angle and 0.15 m of height. Ready for VREP |
| Simulate state response in matlab for closed loop system to confirm system response | This simulation showed that all states remained stable with their bounds and should b tested in Vrep | With tech req bounds, ready for vrep. |
| Integrate estimators with the control system for RC | The estimator successfully is able to generate the state that can be used as an input to the control system but additional testing in vrep is required before hardware imp[lmnetnation. | The estimator is successfully integrated with the RC system, but IS NOT tested and needs vrep simulation to confirm. |
| Finish procedure to control servos/motors directly with remote controller | This procedure needs to be ripple checked, although it works 90% of the time occasionally winch servos will spin in unexpected ways, a problem that cannot happen during a test and needs to be debugged. | More debugging with the servos will be done to ensure they act reliably. |
| Complete wiring diagram for dev boards to sensors, servos, voltage regulator | This block diagram successfully shows how the system is expected to be wired with dev boards, but each of the parts needs to b e tested individually and integrated one at a time to be fully validated. | Wiring schematic for the entire system using development boards has been completed. 5V switching regulator has been tested with servos. |
| Finish Servo Testing with motor load | This test showed that the servos were successfully able to move the complete propulsion system load. Analysis should be done in order to find why the current was lower than expected. | Current was lower than expected because the stall current was not reached, further work was done and the torque calculated from the motor was less than torque of the servo, meaning servo will not stall |

**Possible Sprint Improvements:**

* **Team Improvements**:
  + Ensuring validation is properly presented. For Leon, he had shown the data that the sensors met or did not meet requirements, however, we failed to present it properly in the design review. For Ryan, after the PCB failed, he completed Dev Board design and verification so we could perform the power draw and flight tests, but we failed to show validation of his work as well. At this point these would mostly be solved in outline and design report review. We can hold a mini design defense for the last areas of validation as a team with Tanner present.
  + Assign work more evenly between members, and have members ask during sprints for more work if they have less work than others
* **Individual Improvements:** 
  + Dylan -
    - Be more proactive about planning to use facilities like WRP so that there isn't confusion at the last minute.
    - Be more proactive about verifying others work, ask for more demonstrations
  + George -
    - Take more short breaks from project work. Set an alarm to take a short break every couple of hours
  + Isaac -
    - Learn more about coding in C++
    - Ask for more help
  + Jeremy -
    - Be more thorough when explaining tests and their system block diagrams
  + Ryan -
    - Help out anyway possible with system verification method and writing.
  + Leon -
    - When presenting work from a task, explicitly show requirement and data taken and show whether it was met or not
* **Next Goals**:
  + Dylan-
    - Finish writing drafts for chapters 2&3
    - Revise until finalized for all chapters
    - Help with closed loop RC V-Rep sim
    - Final Flight test.
  + George-
    - Get RC simulated
    - Physically test Auto takeoff and landing functions
    - Write Chapter 7 and relevant portion of chapter 6
    - Review and give feedback on all chapters
  + Isaac-
    - Finish closed loop RC
    - Write up simulation chapter
  + Jeremy-
    - Focus on writing final report chapters since power tests are complete
    - Assist with any other team members’ work as necessary
  + Ryan-
    - Need to verify dev boards system requirement with Leon by printing sensor data via uC32’s USB port.
    - Verify SPI output from Raspberry Pi 3 B+ State Machine Estimation if possible
    - Verify power input over one flight time to Raspberry Pi 3 B+ and uC32.
  + Leon-
    - Verify all four servos and motors work off PIC32 from same signals
    - Have individual servos and motors move independently of each other from PIC32
    - Implement balloon pressure sensor and data telemetry transmitter into system
    - Implement state machine into system and add remote control functionality to state machine
* Team Goals -
  + - Complete Final Report
    - Ideahub Pitch
    - Sponsor Day Presentation
    - Poster
    - Final Flight Test

**Meeting Minutes for Spring Sprint 4:**

Sprint 8 Start

Long Flight Time Buoyant Drone May 17th, 2021 6:00 PM(PST)

horizontal lineATTENDEES

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

## AGENDA

* Administrative Stuff
* Sprint Reports

6:01

* + Leon
    - Working on startup procedures for drone flight
    - Wire terminal will also be needed to solder onto

6:05

* + Jeremy
    - Inputting values from servo and motor test
    - Will be doing a final servo test with a motor attached

6:08

* + Isaac
    - Helping Dylan with inflation test and working on final report

6:09

* + Dylan
    - Needs a pickup truck to carry the helium, will also need to buy a gauge
    - Pockets of the envelope cause more drag than expected

6:12

* + George
    - Using control points to optimize the correction

6:15

* + Ryan
    - Worked on chapter 5 of the final report

6:18

Etc:

* Got accepted for the first round of the pitch competition, need to follow up with them for practice pitch

6:23

* 8:30 thursday will be the pitch practice
* Define Goals (General, see where we need dependencies etc)

6:29

* + Hardware
    - Hook up minimum hardware to get drone to fly
      * 3D parts held taught by balloon
      * uC32, Raspberry Pi, ESC, servos, motors, wire terminals, remote controller receiver
    - TEST FLIGHT W/ Helium
    - Sensor array working with uC32
    - uC32 sensor data sending to Raspberry 3 B+
    - uC32 output 4x PWM signals to ESC (via OC pins)
    - uC32 output 4x PWM signals to servos (via digital I/O
    - Finish Servo Power test
  + Software
    - Finish procedure to control servos/motors directly with remote controller
    - Implement remote and autonomous control in VREP

6:41

* Define End Date
  + May 28th

6:42

* Tasks (Specific) List Requirement ID if available. Time estimate
  + Leon - (**85 hours**)
    - Finish servo testing with motor load with Jeremy **(4 hours)**
    - Finish procedure to control servos/motors directly with remote controller **(15 hours)**
      * Code procedure (10 hours)
      * Test procedure (5 hours)
    - Wire up minimum electronics to get drone flying (uC32, Raspberry Pi, ESC, servos, motors, wire terminals, remote controller receiver) **(10 hours)**
      * Wire electronics (5 hours)
      * Test drone with electronics (5 hours)
    - Implement system state machine for remote control functionality **(15 hours)**
      * Code state machine (5 hours)
      * Test state machine (10 hours)
    - Add sensor checking and sampling to system state machine **(15 hours)**
      * Code state machine (5 hours)
      * Test state machine (10 hours)
    - Wire up sensors to drone (IMU, ultrasonic, altimeter, GPS, and barometric) **(6 hours)**
      * Wire electronics (3 hours)
      * Test drone with electronics (3 hours)
    - Group meetings **(15 hours)**
    - Sub-team meetings **(5 hours)**
  + Jeremy (75 hours) -
    - Finish Testing Servos with motor load(4 hours)
    - Buy Wire terminal for battery distribution(2 hours)
    - Order helium and pick up helium (3 hours)
    - Revise Power Management chapter(10 hours)
    - Research legal/safety requirements(6 hours)
    - Finish draft of ch11 legal/safety(10 hours)
    - Wire prototype(10 hours)
    - Add electronics to gondola (5 hours)
    - Power test with all parts(5 hours)
    - Group Meetings(15 hours)
    - Subteam Meetings(5 hours)
  + Isaac - 82 hours
    - Finish implementing closed loop remote control (25 hours)
      * Import code to client program (10 hours)
      * Test and debug (15 hours)
    - Finish implementing autonomous control (20 hours)
      * Import code to client program (5 hours)
      * Test and debug (15 hours)
    - Help with fabrication testing(7 hours)
    - First draft of simulation chapter(10 hours)
    - Group meetings (15 hours)
    - Sub-team meetings (5 hours)
  + Dylan - **81 hours**
    - Attach 3D printed parts to envelope (6 hours)
      * Gondola (1)
      * Servo brackets(4)
      * Ultrasonic(1)
    - Inflation test with 3D parts (2 hours)
    - Attach servo and motor shafts to brackets (4 hours)
    - Add ultrasonics to bracket (1 hour)
    - Add electronics to gondola (10 hours)
    - Inflation test with all electronics (2 hours)
    - Order helium and pick up helium (3 hours)
    - Do initial RC test at Delaware (10 hours)
    - Start Helium loss test (3 hours)
    - Writing Considerations of a buoyant drone draft(10 hours)
      * General design overview outline (2)
      * Upgrading outline to draft (4)
      * Revisioning (4)
    - Writing Lift Bag and Drone Frame Design outline (10 hours)
      * Lift Bag Design (3)
      * Gondola Design (3)
      * Ultrasonic Mounting (1)
      * Servo Mounting (3)
    - Group meetings (15 hours)
    - Sub-team meetings (5 hours)
  + George (111 hours) - (Can contribute additional time since capstone is his only course)
    - Update Closed Loop Control System with actual measurements (4 hours)
    - Design feedback loop and with integral for autonomous controls (4 hours)
    - Tune Closed Loop Control System to meet design requirements (4 hours)
    - Simulate State Response in Matlab for the Closed Loop system to confirm system response (3 hours)
    - Tune autonomous system to meet design requirements (7 hours)
    - Design control method for feeding control system next positional values (6 hours)
    - Simulate State Response in Matlab for the Closed Loop system to confirm system response (5 hours)
    - Design estimator to determine drone position using accelerometer and GPS data (5 hours)
    - Integrate estimators with the control system (1 hour)
    - Test state response for closed loop RC with estimators integrated (2 hours)
    - Test state response for Autonomous with estimators integrated (2 hours)
    - Export Closed Loop RC to Vrep (3 hours)
    - Adjust Closed Loop RC gains according to Vrep Response (3 hours)
    - Export Autonomous to Vrep (3 hours)
    - Adjust Autonomous Gains according to Vrep Response (3 hours)
    - Complete Chapter 7 Outline (5 hours)
    - Complete Introduction Outline (4 hours)
    - Group Meetings (15 hours)
    - Subteam meetings (15 hours)
    - IdeaHub Pitch (10 hours)
  + Ryan (90 Hours) -
    - Complete wiring diagram for dev boards to sensors, servos, and voltage regulator (5 hours)
    - Complete wiring design for V2.0 PCB (10 hours)
    - Prepare slides on PCB failure in final design defense meeting and show how surface mount parts should be ordered in larger footprint for hand soldering (10 hours)
    - Order 3.3V, and 5V switching regulator for servo, sensors array, microcontroller, and microprocessor (2 hours)
    - Finish Section 1 Sensor array chapter
      * All sensors that require I2C protocol with microcontroller (5 hours)
      * GPS sensor requiring UART protocol with microcontroller (5 hours)
      * Microcontroller SPI communication with microprocessor (5 hours)
      * Data telemetry GPIO pin to microprocessor (5 hours)
      * RC receiver GPIO pin to microprocessor (5 hours)
    - Finish Section 2 State Machine Intro
      * Explain how sensor array data determines state machine (5 hours)
    - Finish Section 3 PCB Interface
      * Explain V1.9 design features and failures (5 hours)
      * Explain V2.0 design improvements on V1.9 with switching regulators, trace width improvements (6 hours)
      * Trace width calculation guideline explanation for V1.9 and V2.0 PCB (2 hour)
    - Group Meeting (15 hours)
    - Sub-team meetings (5 hours)

7:07

* Gantt Chart Updates

Meeting End: 7:19

**5/18/21 7:00 - 7:07pm**

* Leon: Unable to do much due to other class assignments
  + Will be ready to test motor and servo code when fabricating tomorrow
  + WIll keep the drone to put in wire terminal and new ESC

7:01

* Jeremy: Will be doing final tests for motor and servo power tonight

7:02

* Isaac/Dylan: Inflation test, all parts were screwed onto the gondola
  + Both balloons popped, ordered 2 more

7:03

* George: Sick, could not work

7:04

* Ryan: Did wiring diagram to fabricate drone tomorrow

7:07 END

**5/19/21 6:00 - 7:40pm**

* Sprint Reports:
* Leon/Jeremy/Dylan: Planning to wire, but issues with motor and ESC delayed it
  + New ESC already arrived, 6 new motors were ordered just in case
  + Old motor data is useless because new motors had to be gotten due to very long wait times on new motors

6:05

* Isaac: Working on Vs code and having trouble with including C code

6:06

* Dylan: Put hot glue on the envelope parts to soften sharp ends to prevent more popping
  + Gondola left at Leon’s house after most parts were tested to fit together

6:08

* George: Working on autonomous, also got an email confirming zoom for pitch meeting

6:09

* Ryan: Working on final report chapter

6:11

* 2 things today: Practice pitch and start design defense slides

6:15

* New info: Only one person can present the pitch for practice
* Dylan and George will be presenting the pitch

6:17

* Working on pitch slides

6:36

* Practice pitch run

6:43

* Adjusting pitch slides based on pitch run

6:54

* Working on Design defense slide outline
  + Slides based on system technical requirements
  + Use one slide for each subsystem requirement

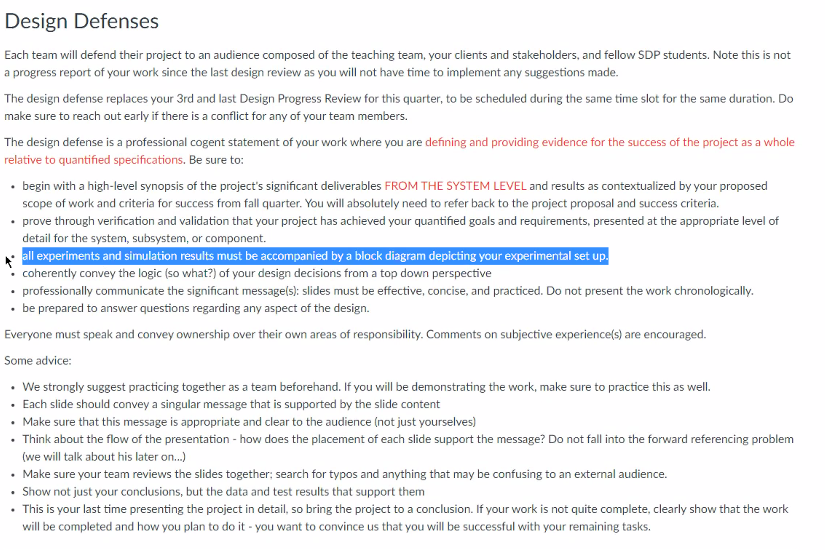
7:20

* Dylan and George practicing pitch run more while others work on design defense slides

7:40 END

**5/21/21 4:00 - 5:34pm**

* Meeting with TA Tanner
  + Slides:
    - Should be system level overview
    - For each system requirement, say if it will be done/successful by the end of the quarter
      * Focus on client-set deliverables
    - For each Requirement, sub slides would be good to show how it was
    - For goals not met, explain why
    - Introduce autonomous and remote control requirements first, then talk about sensors and microcontroller, servos and motors
    - Move cost slide to the end
    - Drone Safety slide: switching regulators for heat doesn’t belong there?
    - Helium Leakage slide: can do one day test of helium loss and estimate for a week
    - FAA Compliance slide before cost slide
    - Make sure to add verification to prove specs



* Slides are good, mostly need results due to delayed testing
* Sensors need to be specified whether or not they work and meet the requirements

5:02

* Burnt out motor required replacing all the motors
  + Be honest about why, also say if requirements were not met due to this but would have been met otherwise
* Everyone must talk about their own area of responsibility
* Work that was not correct should not be talked about, focus on the completed work

5:25 end of TA meeting

* Sprint Reports:
* Leon: Getting ready to test the motors tomorrow, soldering and fixed the servo/motor code

5:27

* Jeremy: Working on slides, will be testing new motors tomorrow with Leon

5:28

* Isaac: Keeps getting include errors in C code to Vrep/Vs

5:30

* Dylan: Finished the pitch presentation, new schedule for next week will come out soon

5:31

* George: Needs to figure out how to avoid overshoot with waypoint

5:32

* Ryan: Trying to write section 2, state machine and the PCB

5:33

* ETC: Everyone work on slides over the weekend
* Sprint report will also be done over the weekend

5:34 END

**5/23/21 7:00 - 7:14pm**

* Sprint Reports
* Leon/Jeremy: Got better thrust and power values while testing both motos

7:03

* Isaac: Having trouble compiling, working on C++ with new code trying to compile

7:04

* Dylan: Ordered new ESCs to be delivered to Leon
  + Will be going tomorrow to pick up helium with Jeremy and to meet with Gordon

7:07

* George: Helping Isaac figure out how to fix compiling error

7:08

* Ryan: Fixing traces for V2.0 PCB

7:10

* Keep working on design defense slides

7:13 END

**5/24/21 6:00 - 8:00pm**

* Sprint Reports
* Leon: Waiting for ESCs, will be testing with Jeremy after the meetings
  + Also working on design defense slides

6:02

* Dylan/Jeremy: Got helium and nozzle, also chain and lock to keep the tank at 2300 Delaware
  + New issue with not being able to fill drone with helium without proper procedures, sent an email to see

6:06

* Isaac/George; Testing more compiler issues, stuck with C++ code not compiling in Vrep

6:07

* Ryan: Met with power budget to redo the voltages required for sensor boards
  + Another Switching regulator ordered for other 5V parts other than servos

6:08

* Everyone needs to fill descriptions for sprint report

6:10

* Dylan and George will email to get form to sign up for next pitch slides

6:12

* Working on sprint report feedback and tasks

6:22

* Working on design defense slides

8:00 END

**5/25/21 2:00 - 4:00pm**

* Meeting with TA Tanner
  + Focus slides on if goals/requirements/deliverables were met and how they were verified
  + Really looking for verification on how engineering specifications were met
  + Power draw test
  + Semi-verified can be used with block diagram of power tests
  + If something was not met, explain if it could have been met or could be met in the future
  + If we have not tested it, say how we will test it

4:00 END

**5/25/21 7:00 - 7:15pm**

* Leon/Jeremy: Tested motor power and servo power
  + Servos will not stall with max thrust on motors, verified power
  + Motor power is verified as it was before
  + 4 in 1 esc is more efficient than the single ESCs
  + Verified that kill-switch work

7:10

* Isaac: Met with Alexey today to help fix Vrep simulation work

7:12

* Dylan: Did some work on chapter 2 outline
  + Redid inflation test and balloon didn’t pop after smoothening edges

7:13

* George: Made changes to pitch slides that will be presented on Thursday
  + Also still helping Leon on closed loop control in Vrep

7:15

* Ryan: Working on slides and chapter 5 outline for PCB
  + Finishing Eagle CAD for V2.0 PCB

7:16

* Design defense should focus on meeting requirements and how it was verified

7:20 END

**5/26/21 6:00 - 8:00pm**

* Leon/Jeremy/Dylan: Were able to get motors working on the drone, servos too but the servos had some glitches
  + Dylan will be meeting with Gordon tomorrow to fly with helium

6:03

* Isaac/George: Trying to integrate simulation code together, got stuck on a bug and couldn’t move on

6:04

* Ryan: Working on block diagrams and PCB verification slide

6:05

* Finishing spring sprint 3 report

6:30

* Dylan is back, going over feedback from slides and working individually

8:00 END

**5/27/21 7:00 - 7:20pm**

* Sprint Stand up
* Leon: Doing concrete results with sensors and video of servos and motors
  + Power tests were not done yet, will be done later today

7:02

* Dylan/Jeremy
  + Inflation test, 4.44kg uninflated, after adding air and helium it was 1.2kg
  + After it popped before flight testing, another inflation test happened but we didn’t have enough helium, final weighing 750g
  + Flight test was not done since balloon could not be fully inflated with helium because the motors were hitting the envelope
    - Balloon popped while trying to fill it up with more air
  + Helium test: after half an hour, got 100g heavier

7:08

* Isaac: Making progress with simulation with George and Leon’s help
  + Position, linear and angular velocity, and orientation is integrated
  + Still need remote control functions into the simulations
  + Goal is to finish by tonight

7:11

* George: Added synopsis slide at beginning saying if project was successful or not
  + Other feedback gotten from Tanner’s TA meeting
  + Also helping Isaac getting the sim working

7:13

* Ryan: Added diagram and slides for design defense
  + Verification for power supply to each sensor within the PCB and power tests needed

7:20 END

Sprint 8 Conclusion Meeting

Long Flight Time Buoyant Drone 5/29/2021 7:00-7:51 TIME(PST)

horizontal lineATTENDEES

* Excused absences:
* Unexcused absences:

## AGENDA

* **Review of Progress**: 7:00
  + Leon(49/85 hours completed, spent 53 hours) - 7:10
    - Finish servo testing with motor load with Jeremy **(4 hours)**
      * Complete
      * Spent 8 hours on it
    - Finish procedure to control servos/motors directly with remote controller **(15 hours)**
      * Code procedure (10 hours)
        + Complete
      * Test procedure (5 hours)
        + Complete
    - Wire up minimum electronics to get drone flying (uC32, Raspberry Pi, ESC, servos, motors, wire terminals, remote controller receiver) **(10 hours)**
      * Wire electronics (5 hours)
        + Complete
        + Wiring took longer than actually testing, also didn’t need uC32 and Raspberry Pi
      * Test drone with electronics (5 hours)
        + Complete
    - Implement system state machine for remote control functionality **(15 hours)**
      * Code state machine (5 hours)
        + Incomplete
        + Didn’t get around to it because wiring drone took longer than expected
      * Test state machine (10 hours)
        + Incomplete
        + Didn’t get around to it because wiring drone took longer than expected
    - Add sensor checking and sampling to system state machine **(15 hours)**
      * Code state machine (5 hours)
        + Incomplete
        + Didn’t get around to it because wiring drone took longer than expected
      * Test state machine (10 hours)
        + Incomplete
        + Didn’t get around to it because wiring drone took longer than expected
    - Wire up sensors to drone (IMU, ultrasonic, altimeter, GPS, and barometric) **(6 hours)**
      * Wire electronics (3 hours)
        + Incomplete
        + Didn’t get around to it because wiring drone took longer than expected
      * Test drone with electronics (3 hours)
        + Incomplete
        + Didn’t get around to it because wiring drone took longer than expected
    - Group meetings **(15 hours)**
      * Complete
    - Sub-team meetings **(5 hours)**
      * Complete
  + Jeremy (75 hours), (48/75 done + 10) - 7:12
    - Finish Testing Servos with motor load(4 hours)
      * Complete
    - Buy Wire terminal for battery distribution(2 hours)
      * Complete
    - Order helium and pick up helium (3 hours)
      * Complete
    - Revise Power Management chapter(10 hours)
      * Incomplete
    - Research legal/safety requirements(6 hours)
      * Incomplete
    - Finish draft of ch11 legal/safety(10 hours)
      * Incomplete
    - Wire prototype(10 hours)
      * Complete
    - Add electronics to gondola (5 hours)
      * Complete
    - Power test with all parts(5 hours)
      * Incomplete, 4 hours done although not all parts tested
    - Group Meetings(15 hours)
      * Complete
    - Subteam Meetings(5 hours)
      * Complete
    - Spent 10 hours at Delaware testing prototype
  + Isaac, 82 hours - 7:14
    - Finish implementing closed loop remote control (25 hours)
      * Import code to client program (10 hours)
      * Test and debug (15 hours)
      * **Incomplete** spent 50+ hours
    - Finish implementing autonomous control (20 hours)
      * Import code to client program (5 hours)
      * Test and debug (15 hours)
      * **Incomplete**
    - Help with fabrication testing(7 hours) **Complete** 10 hours spent
    - First draft of simulation chapter(10 hours) **Incomplete**
    - Group meetings (15 hours) **Complete**
    - Sub-team meetings (5 hours) **Complete**
  + Dylan, 63/81 hours - 7:16
    - Attach 3D printed parts to envelope (6 hours)
      * Gondola (1)
      * Servo brackets(4)
      * Ultrasonic(1)
      * **All Completed**
    - Inflation test with 3D parts (2 hours)
      * **completed**
    - Attach servo and motor shafts to brackets (4 hours)
      * **Completed**
    - Add ultrasonics to bracket (1 hour)
      * **Incomplete ultrasonics not ready**
    - Add electronics to gondola (10 hours)
      * **Completed**
    - Inflation test with all electronics (2 hours)
      * **Completed**
    - Order helium and pick up helium (3 hours)
      * **Completed**
    - Do initial RC test at Delaware (10 hours)
      * **Completed**
    - Start Helium loss test (3 hours)
      * **Completed**
    - Writing Considerations of a buoyant drone draft(10 hours)
      * General design overview outline (2)
        + Completed
      * Upgrading outline to draft (4)
      * Revisioning (4)
      * **Draft was not taken beyond the outline Pase**
    - Writing Lift Bag and Drone Frame Design outline (10 hours)
      * Lift Bag Design (3)
      * Gondola Design (3)
      * Ultrasonic Mounting (1)
      * Servo Mounting (3)
      * **Incomplete not worked on**
    - Group meetings (15 hours)
      * **Completed**
    - Sub-team meetings (5 hours)
      * **Completed**
  + George, (111 hours), 57/111 completed (Can contribute additional time since capstone is his only course) - 7:16
    - Update Closed Loop Control System with actual measurements (4 hours)
      * Complete
    - Design feedback loop and with integral for autonomous controls (4 hours)
      * Not Complete
    - Tune Closed Loop Control System to meet design requirements (4 hours)
      * Complete
    - Simulate State Response in Matlab for the Closed Loop system to confirm system response (3 hours)
      * Complete
    - Tune autonomous system to meet design requirements (7 hours)
      * Incomplete
    - Design control method for feeding control system next positional values (6 hours)
      * Incomplete
    - Simulate State Response in Matlab for the Closed Loop system to confirm system response (5 hours)
      * Complete
    - Design estimator to determine drone position using accelerometer and GPS data (5 hours)
      * Incomplete
    - Integrate estimators with the control system for RC (1 hour)
      * Complete
    - Test state response for closed loop RC with estimators integrated (2 hours)
      * Incomplete
    - Test state response for Autonomous with estimators integrated (2 hours)
      * Incomplete
    - Export Closed Loop RC to Vrep (3 hours)
      * Incomplete
    - Adjust Closed Loop RC gains according to Vrep Response (3 hours)
      * Incomplete
    - Export Autonomous to Vrep (3 hours)
      * Incomplete
    - Adjust Autonomous Gains according to Vrep Response (3 hours)
      * Incomplete
    - Complete Chapter 7 Outline (5 hours)
      * Incomplete
    - Complete Introduction Outline (4 hours)
      * Incomplete
    - Group Meetings (15 hours)
      * Complete
    - Subteam meetings (15 hours)
      * Complete
    - IdeaHub Pitch (10 hours)
      * Complete
  + Ryan, (90 Hours) - 7:19
    - Complete wiring diagram for dev boards to sensors, servos, and voltage regulator (5 hours)
      * Complete
    - Complete wiring design for V2.0 PCB (10 hours)
      * Incomplete, V2.0PCB will not be finished
    - Prepare slides on PCB failure in final design defense meeting and show how surface mount parts should be ordered in larger footprint for hand soldering (10 hours)
      * Complete
    - Order 3.3V, and 5V switching regulator for servo, sensors array, microcontroller, and microprocessor (2 hours)
      * Complete
    - Finish Section 1 Sensor array chapter
      * All sensors that require I2C protocol with microcontroller (5 hours)
      * GPS sensor requiring UART protocol with microcontroller (5 hours)
      * Microcontroller SPI communication with microprocessor (5 hours)
      * Data telemetry GPIO pin to microprocessor (5 hours)
      * RC receiver GPIO pin to microprocessor (5 hours)
      * Incomplete, in progress, outline complete
    - Finish Section 2 State Machine Intro
      * Explain how sensor array data determines state machine (5 hours)
      * Incomplete, George will complete Section 2 of Chapter 5
    - Finish Section 3 PCB Interface
      * Explain V1.9 design features and failures (5 hours)
      * Explain V2.0 design improvements on V1.9 with switching regulators, trace width improvements (6 hours)
      * Trace width calculation guideline explanation for V1.9 and V2.0 PCB (2 hour)
      * Incomplete, in progress, outline complete
    - Group Meeting (15 hours)
    - Sub-team meetings (5 hours)
* **Team Improvements**: 7:20
  + Ensuring validation is properly presented. For Leon, he had shown the data that the sensors met or did not meet requirements, however, we failed to present it properly in the design review. For Ryan, after the PCB failed, he completed Dev Board design and verification so we could perform the power draw and flight tests, but we failed to show validation of his work as well. At this point these would mostly be solved in outline and design report review. We can hold a mini design defense for the last areas of validation as a team with Tanner present.
  + Assign work more evenly between members, and have members ask during sprints for more work if they have less work than others
* **Individual Improvements: 7:28**
  + Dylan - 7:33
    - Be more proactive about planning to use facilities like WRP so that there isn't confusion at the last minute.
    - Be more proactive about verifying others work, ask for more demonstrations
  + George - 7:34
    - Take more short breaks from project work. Set an alarm to take a short break every couple of hours
  + Isaac - 7:35
    - Learn more about coding in C++
    - Ask for more help
  + Jeremy - 7:36
    - Be more thorough when explaining tests and their system block diagrams
  + Ryan - 7:37
    - Help out anyway possible with system verification method and writing.
  + Leon - 7:38
    - When presenting work from a task, explicitly show requirement and data taken and show whether it was met or not
* **Next Goals**: 7:39
  + Dylan- 7:39
    - Finish writing drafts for chapters 2&3
    - Revise until finalized for all chapters
    - Help with closed loop RC V-Rep sim
    - Final Flight test.
  + George- 7:40
    - Get RC simulated
    - Physically test Auto takeoff and landing functions
    - Write Chapter 7 and relevant portion of chapter 6
    - Review and give feedback on all chapters
  + Isaac- 7:41
    - Finish closed loop RC
    - Write up simulation chapter
  + Jeremy- 7:42
    - Focus on writing final report chapters since power tests are complete
    - Assist with any other team members’ work as necessary
  + Ryan- 7:43
    - Need to verify dev boards system requirement with Leon by printing sensor data via uC32’s USB port.
    - Verify SPI output from Raspberry Pi 3 B+ State Machine Estimation if possible
    - Verify power input over one flight time to Raspberry Pi 3 B+ and uC32.
  + Leon- 7:44
    - Verify all four servos and motors work off PIC32 from same signals
    - Have individual servos and motors move independently of each other from PIC32
    - Implement balloon pressure sensor and data telemetry transmitter into system
    - Implement state machine into system and add remote control functionality to state machine
* Team Goals - 7:45
  + - Complete Final Report
    - Ideahub Pitch
    - Sponsor Day Presentation
    - Poster
    - Final Flight Test
* **Other Business** -
  + Porter funding

Meeting End: 7:51