**Team 509 Spring 2025 Project Plan**

## 1 - Introduction

The team will do extensive planning for the spring semester, which includes some things like doing the CDR, flight readiness review, and the post launch assessment. In addition to this there will be planning for senior design assignments for things like VDR, Senior design day April 1st, and other team assignments. These plans will be put into a work breakdown structure chart.

## 2 - Subscale Mass Simulant

The subscale flight will occur on December 14th and a payload mass simulant will be housed inside the rocket for testing. The mass simulant will be printed out of PLA and will be sized down 40 percent. The simulant will just consist of the capsule and will not house electronics. The reason for the simulant is to give the rocket team more data to test how they would fly when actual mass is added to the subscale. The launch will also give the payload team feedback on how the PLA holds upon landing and will let the team see if it can be an alternative to Nylon-12. The mass simulant will be printed by November 26th so the rocket and payload team can plan around any unexpected errors with the print or additional steps to take for the launch.

## 3 - Testing and Fabrication

Testing and fabrication have already begun as of the writing of this document and will continue into the spring semester. We have a 3D printed a prototype of the payload structure and all primary payload electronics components have been obtained. A subscale mass simulant will be printed by November 26th. This mass simulant will fly on the subscale launch on December 14th and will verify the payload's role in the rocket stability. In the Spring, an FEA will be conducted on to verify the strength of final design and then fabrication will begin. The final

version of the payload structure will be printed at the FSU Innovation Hub out of nylon 12. The aluminum mounting bracket and trays will be machined at the FAMU-FSU College of Engineering machine shop. The final version will be subjected to a fit test, drop test, and mounting test. The success of all these tests will allow the payload to be deemed safe to fly. The payload electronics will also be extensively tested in the spring. Transmission attenuation tests will be conducted to verify the theoretical predictions we have made. Range tests will also be conducted to determine the payloads transmission range. The accuracy of our sensors will also be tested early in the semester, allowing us to replace any components that are not working as expected/advertised. A power consumption test will be conducted to determine the size and quantity of lithium polymer batteries that the payload will fly with. A full system flight simulation test will be conducted to verify our flight software, data collection and transmission. A final assembly test will be conducted prior to competition to ensure that the payload can be constructed and armed within the time allotted in the competition.

**4 - Critical Design Review**

The Critical Design Review (CDR) is the final design of both the rocket and payload systems. In this presentation and report both the rocket and payload team must show all their efforts in the project such as full-scale fabrication, assembly, and integration. From the Payload team, we must be able to show that the design is complete and can be integrated into the rocket. This may be demonstrated through the report and presentation by explaining our design on a system level and how it interacts within the payload and with the rocket itself. We must also elaborate on the payload's electronics using schematics, block diagrams, and explaining how we are powering the payload. There is also an emphasis on the safety of the payload using switches and wattage indicators to make sure the payload is working fine the whole flight and is not a danger to itself or the rocket. We will then explain why we choose all the dimensions and

materials for our project and what makes our payload unique. We must submit all of this by January 8th, 2025, and we will have our teleconference presentation between January 15th, 2025 – February 6th, 2025.

**5 - NASA Student Launch Competition**

The NASA Student Launch Competition is an annual event held in Huntsville, Alabama. It is an event organized to allow colleges, universities, and other institutions from across the nation to design, build, launch, and fly a rocket and payload to assist NASA in their research of high-powered rockets. This is a 9-month process of being able to design, create, and fly a rocket and payload into the sky. As the payload team we can focus solely on the payload aspect of this project. Our objective is to build a payload that houses both sensors and STEMnauts, which are miniature astronauts, that will be able to transmit data, collected from the flight, over a certain radio frequency back to the NASA-owned data transceiver. We must also be able to protect our sensor and STEMnauts from any possible damage throughout the flight and ensure the safety and survivability of our STEMnauts. The rocket launch is set for the first weeks of April from Palm Bay Florida. This is because we will not be able to attend the Rocket launch in Huntsville, Alabama in early May due to graduation.

**6 - Senior Design Deliverables**

There will be three Virtual Design Reviews for our spring semester. Our group will conclude our project, and on April 1st we will present our final physical product along with also presenting our design on a poster board on Engineering Design Day. This day will allow our team to give an in-depth explanation of how our project was conducted from start to finish. On Engineering Design Day we'll be able showcase a fully operational rocket payload that was once an idea. Our team will be able to take individuals through the story of the highs and lows of creating a payload capsule. We'll be able to explain who we were able to work alongside a

separate rocket team and alongside teammates whose studies differed from one another at the FAMU-FSU College of Engineering.

Our team will have final exams May 1st to finish the spring semester for the courses we are enrolled in. We will display the knowledge we retained throughout the spring semester in the final exams we take. The success of those final exams and our overall grades at the end of the spring semester will dictate the next step which is graduation.

Our team will conclude our senior design projects, and we will finish our spring semester. They will lead us to graduation on May 3rd with our bachelor's in mechanical engineering and electrical engineering.

**7 - Work Breakdown Structure**

Shown below is the work breakdown structure (WBS) for the team's spring semester. This document breaks down the tasks and timeline for all testing and fabrication tasks for the payload. This WBS will allow for the team to complete all necessary tasks while allowing for enough time to correct errors and iterate the final design.

Figure x: Work breakdown structure for the spring semester.

| T509: NASA Student Launch (Payload) | | | | | | |
|---|---|---|---|---|---|---|
| Spring Work Breakdown Structure | | | | | | |
| **Tier One Tasks** | **Tier Two Tasks** | **Tier Three Tasks** | **Asignee** | **Story Point (days)** | **Status** | **Due Date** |
| **1. Electronic Systems** | | | | | | |
| | **1.01 Radio Testing** | | | | IN PROGRESS | |
| | | 1.01.001 Obtain HAM Radio Liscense | Nathan & Neil | 2 | ☑ | |
| | | 1.01.002 Setup Reciver | Neil | 2 | ☐ | |
| | | 1.01.003 Attach Antena to radio module | Matthew | 1 | ☐ | |
| | | 1.01.004 Program Radio module to send simple transmossion | Nathan | 2 | ☐ | 12/6/2024 |
| | | 1.01.005 Test Simple Transmission | Donovan | 2 | ☐ | |
| | | 1.01.006 Program Radio module to send APRS Telemtry packets | Nathan | 2 | ☐ | |
| | | 1.01.007 Test APRS Telemetry packet transmission | Neil | 2 | ☐ | |
| | | 1.01.008 Test Long range Transmission | Kyle | 2 | ☐ | |
| | | 1.01.009 Test Obstructed Long Range Transmission | Nathan | 2 | ☐ | |
| | **1.02 IMU Testing** | | | | INCOMPLETE | |
| | | 1.02.001 Establish I2C communication bus between IMU and microcontroller | Neil | 2 | ☐ | 1/1/2025 |
| | | 1.02.002 Write software to sample, filter and log incoming IMU Data | Nathan | 3 | ☐ | |
| | | 1.02.003 Test IMU's Motion detection | Matthew | 2 | ☐ | |
| | **1.03 Altimeter Testing** | | | | INCOMPLETE | |
| | | 1.02.001 Establish I2C communication bus between Altimiter and microcontro | Neil | 2 | ☐ | |
| | | 1.03.002 Write software to sample, filter and log incoming Altimiter Data | Nathan | 3 | ☐ | 1/13/2025 |
| | | 1.03.003 Write Software to sample temperature Data | Neil | 2 | ☐ | |
| | | 1.03.004 Test Altimiter temperature and barometric readings | Matthew | 2 | ☐ | |
| | | 1.03.005 Test that altimiter is sufficently shielded form light in its position on t | Kyle | 1 | ☐ | |
| | **1.04 Finilze Code** | | | | INCOMPLETE | |
| | | 1.04.001 Write Payload payload OS that coordinates all sensors and program | Nathan | 5 | ☐ | |
| | | 1.04.002 Write flight software to regnize and react to flight milestones | Neil | 7 | ☐ | 2/3/2025 |
| | | 1.04.003 Write Transmission program | Nathan | 5 | ☐ | |
| | | 1.04.004 Test all code individually | Neil | 5 | ☐ | |
| | | 1.04.005 Test integrated code | Kyle | 4 | ☐ | |
| | **1.05 Tray one Assembly** | | | | INCOMPLETE | |
| | | 1.05.001 Design wiring harness | Neil | 2 | ☐ | 2/3/2025 |
| | | 1.05.002 Assembly wiring harness | Kyle | 2 | ☐ | |
| | | 1.05.003 Secure sensors | Donovan | 1 | ☐ | |
| | | 1.05.004 Test components | Nathan | 1 | ☐ | |
| | **1.06 Tray Two Assembly** | | | | INCOMPLETE | |
| | | 1.06.001 Design wiring harness | Nathan | 2 | ☐ | 2/3/2025 |
| | | 1.06.002 Assembly wiring harness | Matthew | 2 | ☐ | |
| | | 1.06.003 Secure sensors | Donovan | 1 | ☐ | |
| | | 1.06.004 Test components | Neil | 1 | ☐ | |
| | **1.07 STEMnaut Bay Assembly** | | | | INCOMPLETE | |
| | | 1.07.001 Design wiring harness | Nathan | 2 | ☐ | 2/10/2025 |
| | | 1.07.002 Assembly wiring harness | Neil | 2 | ☐ | |
| | | 1.07.003 Secure sensors | Donovan | 1 | ☐ | |
| | | 1.07.004 Test components | Nathan | 1 | ☐ | |
| **2. Structural and Mechanical Systems** | | | | | | |
| | **2.01 Prototype Assembly** | | | | IN PROGRESS | |
| | | 2.01.001 Print mounting bracket | Donovan | 1 | ☑ | |
| | | 2.01.002 Print capsule | Kyle | 1 | ☑ | |
| | | 2.01.003 Print divider | Matthew | 1 | ☑ | 12/3/2024 |
| | | 2.01.004 Print trays | Kyle | 1 | ☑ | |
| | | 2.01.005 Order fasteners | Kyle | 3 | ☐ | |
| | | 2.01.006 Assemble Structure | Matthew | 1 | ☐ | |

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|---|---|---|---|---|---|---|
| | **2.02 Structual Testing** | | | | INCOMPLETE | |
| | | 2.02.001 Prototype fit-check | Kyle | 1 | ☐ | 1/6/2025 |
| | | 2.02.002 Prototype drop test | Donovan | 2 | ☐ | |
| | | 2.02.003 Record test results | Donovan | 1 | ☐ | |
| | | 2.02.004 SolidWorks FEA | Matthew | 1 | ☐ | |
| | **2.03 Manufacturing Request** | | | | INCOMPLETE | |
| | | 2.03.001 Order raw material | Kyle | 5 | ☐ | |
| | | 2.03.002 Machine mounting bracket | Kyle | 1 | ☐ | |
| | | 2.03.003 Machine divider | Kyle | 1 | ☐ | 1/25/2025 |
| | | 2.03.004 Print capsule | Matthew | 1 | ☐ | |
| | | 2.03.005 Receive mounting bracket | Kyle | 5 | ☐ | |
| | | 2.03.006 Receive divider | Kyle | 5 | ☐ | |
| | | 2.03.007 Receive capsule | Matthew | 2 | ☐ | |
| | **2.04 Quality Check** | | | | INCOMPLETE | |
| | | 2.04.001 Inspect mounting bracket | Kyle | 1 | ☐ | 1/27/2025 |
| | | 2.04.002 Inspect divider | Donovan | 1 | ☐ | |
| | | 2.04.003 Inspect capsule | Matthew | 1 | ☐ | |
| | | 2.04.004 Draft report | Donovan | 1 | ☐ | |
| | **2.05 Assemble Structure** | | | | INCOMPLETE | |
| | | 2.05.001 Assemble chamber one | Nathan | 1 | ☐ | 2/3/2025 |
| | | 2.05.002 Assemble chamber two | Neil | 1 | ☐ | |
| | | 2.05.003 Assemble chamber three | Nathan | 1 | ☐ | |
| **3. Senior Design** | | | | | | |
| | **3.01 VDR 4** | | | | INCOMPLETE | |
| | | 3.01.001 Create slide deck | Kyle | 5 | ☐ | TBD |
| | | 3.01.002 Edit slide deck | Matthew | 2 | ☐ | |
| | | 3.01.003 Schedule practice presentations | Nathan | 1 | ☐ | |
| | | 3.01.004 Submit slide deck | Donovan | 1 | ☐ | |
| | **3.02 VDR 5** | | | | INCOMPLETE | |
| | | 3.02.001 Create slide deck | Matthew | 5 | ☐ | TBD |
| | | 3.02.002 Edit slide deck | Nathan | 2 | ☐ | |
| | | 3.02.003 Schedule practice presentation | Donovan | 1 | ☐ | |
| | | 3.02.004 Submit slide deck | Neil | 1 | ☐ | |
| | **3.03 VDR 6** | | | | INCOMPLETE | |
| | | 3.01.001 Create poster | Nathan | 5 | ☐ | TBD |
| | | 3.01.002 Edit poster | Donovan | 2 | ☐ | |
| | | 3.01.003 Schedule practice presentations | Neil | 1 | ☐ | |
| | | 3.01.004 Submit presentation | Kyle | 1 | ☐ | |
| | **3.04 Final Report** | | | | INCOMPLETE | |
| | | 3.04.001 Edit chapter one | Donovan | 3 | ☐ | TBD |
| | | 3.04.002 Edit chapter two | Neil | 2 | ☐ | |
| | | 3.04.003 Abstract | Kyle | 1 | ☐ | |
| | | 3.04.004 Format | Matthew | 2 | ☐ | |
| | | 3.04.005 Complete edit | Nathan | 2 | ☐ | |
| | | 3.04.006 Submit report | Donovan | 1 | ☐ | |
| | **3.05 Engineering Design Day** | | | | INCOMPLETE | |
| | | 3.05.001 Create poster | Neil | 5 | ☐ | 4/1/2025 |
| | | 3.05.002 Edit poster | Kyle | 2 | ☐ | |
| | | 3.05.003 Table Set-up | Matthew | 1 | ☐ | |
| | | 3.05.004 Present | Nathan | 1 | ☐ | |