



JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY (JKUAT)

**SCHOOL OF ELECTRICAL, ELECTRONIC AND INFORMATION
ENGINEERING**

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

STUDENTS EXTERNAL ATTACHMENT LOG-BOOK

Duration: Minimum of 8 weeks



THE LOG BOOK

1. INTRODUCTION

This book is to assist the student to keep record of the training. It will show the departments and sections in which the student has worked and the periods of time spent in each.

2. DAILY REPORT

The daily work carried out during the periods of training is to be recorded clearly with sketches and diagrams where applicable.

3. WEEKLY REPORT

This is a summary of work done in a week and should cover theory/practical report on the work covered. Students are required to present the log-book weekly to the industry based supervisor for assessment of content and progress. The Supervisor can use any page for his comments where necessary.

4. CHANGE OF ATTACHMENT

A student is expected to start and finish his industrial attachment in one establishment. If it becomes absolutely necessary that he must change his place of attachment, the student should first secure permission in writing from the college. His application for change of place of attachment should indicate the name and the address (not just Post Office Box) of the company or industry to which he wishes to transfer. Any attachment not properly authorized will be cancelled.

5. UNIVERSITY SUPERVISOR'S VISIT

The training supervisor of the JKUAT will check the log-book. When he/she visits the project to ensure that the proper training is being received, and record his/her comment on the paper provided for this purpose, towards the end of the book.

6. SPECIAL REQUEST FOR THE INDUSTRY-BASED SUPERVISOR

Please assess the student as per assessment form provided.

7. REPORT WRITING

In addition to the daily and weekly record the student should submit a summary report of the work done during the attachment duration e.g. full coverage of the course, problems encountered. Suggest improvements to make the programme worthwhile. The report should contain a summary of activities of the organization, manufacturing/services processes the student was involved in. This includes the highlights of the project the student is involved in. The student is expected to point out the weak and strong points of the attachment.

8. REPORT SUBMISSION

The log-book and report must be submitted to the relevant departmental Attachment Co-ordinator at the end of the attachment.



S T U D E N T ' S P A R T I C U L A R S

Name of student: **PAUL ERICK MUTINDA**

Registration No. of the student:**ENE211-0025/2022**

Department: **DEPARTMENT OF ELECTRICAL & ELECTRONIC
ENGINEERING**

Course of study: **ELECTRICAL AND ELECTRONICS ENGINEERING**

Year of course: **3**

Name and Address of Company/Establishment Attached:

NAKUJA PROJECT

JAPAN INTERNATIONAL COOPERATION

AGENCY (JICA) JKUAT, JUJA CAMPUS

Name of Industry-based supervisor:

DR SHOHEI AOKI

Duration: From:**03/06/2025**

To:

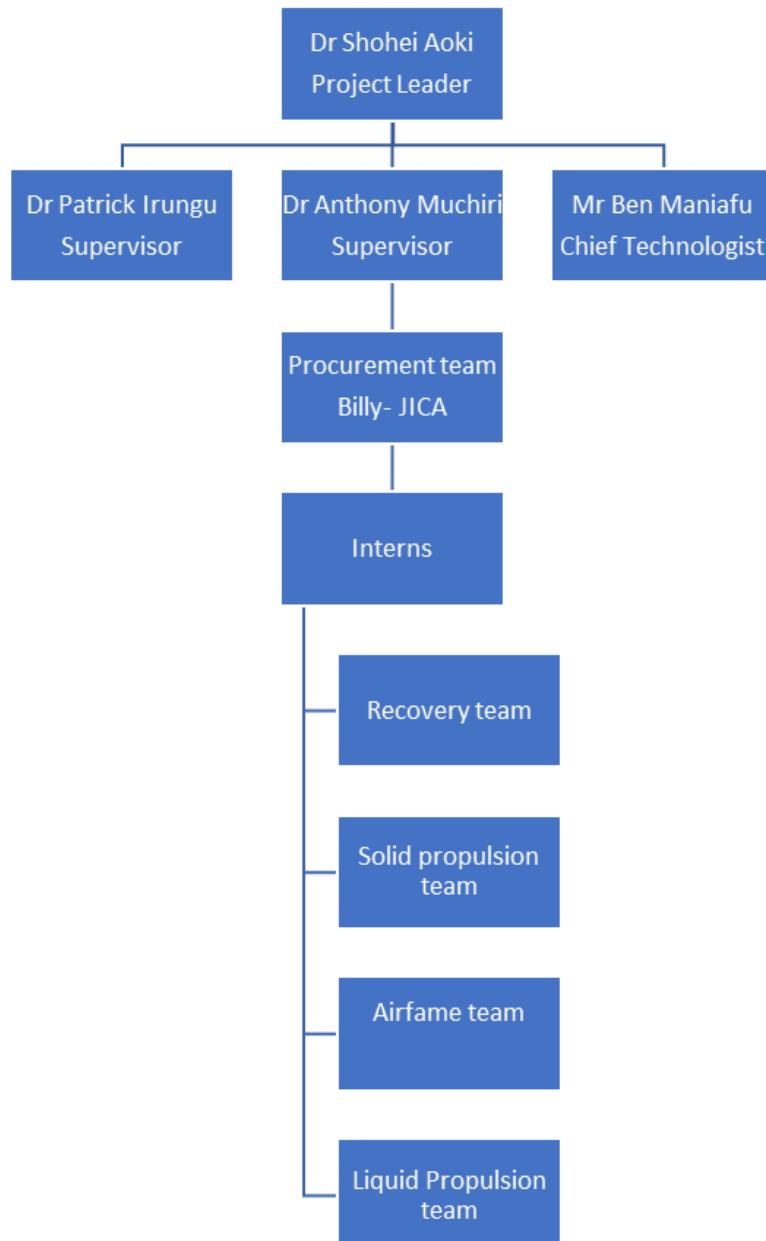
22/08/2025

The student could draw the Organization Chart of industry attached hereunder:



ATTACHMENT TIME-PLAN

(The student should draw a time-table indicating time to be sent on each task/section)



ATTACHMENT TIME-PLAN

(The student should draw a time-table indicating time to be sent on each task/section)

Internship Period: 03rd June 2025 - 22nd August 2025
Working Hours: 8:30 am - 4:30 pm, Mon - Fri
Team: Recovery Team



WEEKLY PROGRESS CHART**(WEEK ENDING 08/06/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Public holiday
TUES	1. Attended orientation session on available resources and the overall project structure. 2. Cloned the repositories for the Base Station (BS) and Flight Computer (FC) components.
WED	1. Studied the architecture and system components of the flight computer. 2. Reviewed previous project documentation and team progress reports to understand the current development status.
THUR	1. Assessed the previous team's progress and identified unfinished tasks. 2. Divided into three sub-teams and allocated responsibilities for remaining tasks. The teams are ; avionics, telemetry and parachute team
FRI	1. Completed the second round of functional tests on the Flight Computer (FC). 2. Analyzed existing programs for ignition and pop tests. 3. Visualized the design and operation of the parachute ejection mechanism
SAT	

TRAINEES WEEKLY REPORT

This week marked the official beginning of the internship and focused on establishing a strong foundation for the project's technical and organizational goals. The first part of the week involved an orientation session that introduced us to the overall structure of the project, available tools, and resources. This session helped clarify expectations and provided a roadmap for the internship period. We also gained access to the repositories for both the Flight Computer (FC) and Base Station (BS), ensuring that we had the necessary codebases to begin contributing meaningfully.

A significant portion of the week was dedicated to understanding the system architecture, especially the design and function of the flight computer. Reviewing documentation from previous teams helped us identify the current status of the project and areas that needed improvement or completion. This step was crucial in preparing for hands-on tasks and ensuring continuity between cohorts.

To streamline progress and improve task efficiency, we assessed the remaining work and reorganized ourselves into specialized sub-teams: avionics, telemetry, and parachute. Each team was assigned specific responsibilities based on project needs and individual strengths. This division enabled focused work and laid the groundwork for parallel development efforts.

Later in the week, we began technical testing and software analysis. We successfully completed a second round of functional tests on the flight computer and examined existing code related to the ignition and parachute deployment systems. Additionally, we explored the physical design and logic of the parachute ejection mechanism, which will be a critical component during flight recovery.



Overall, the week was productive and foundational. We transitioned from orientation into active contribution, established a collaborative team structure, and began detailed technical engagement with both hardware and software components. This set the stage for deeper engineering tasks in the coming weeks and gave valuable insight into real-world system integration and collaborative problem-solving.

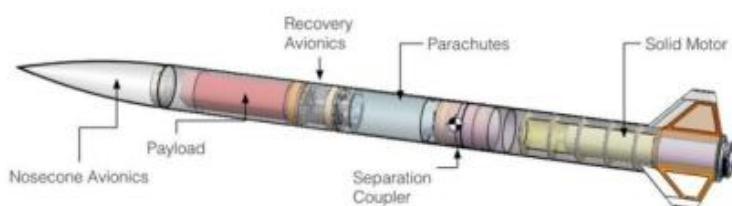
FOR SKETCHES, DIAGRAMS AND GRAPHS

DATE.....

(Additional drawings, may be attached where necessary)

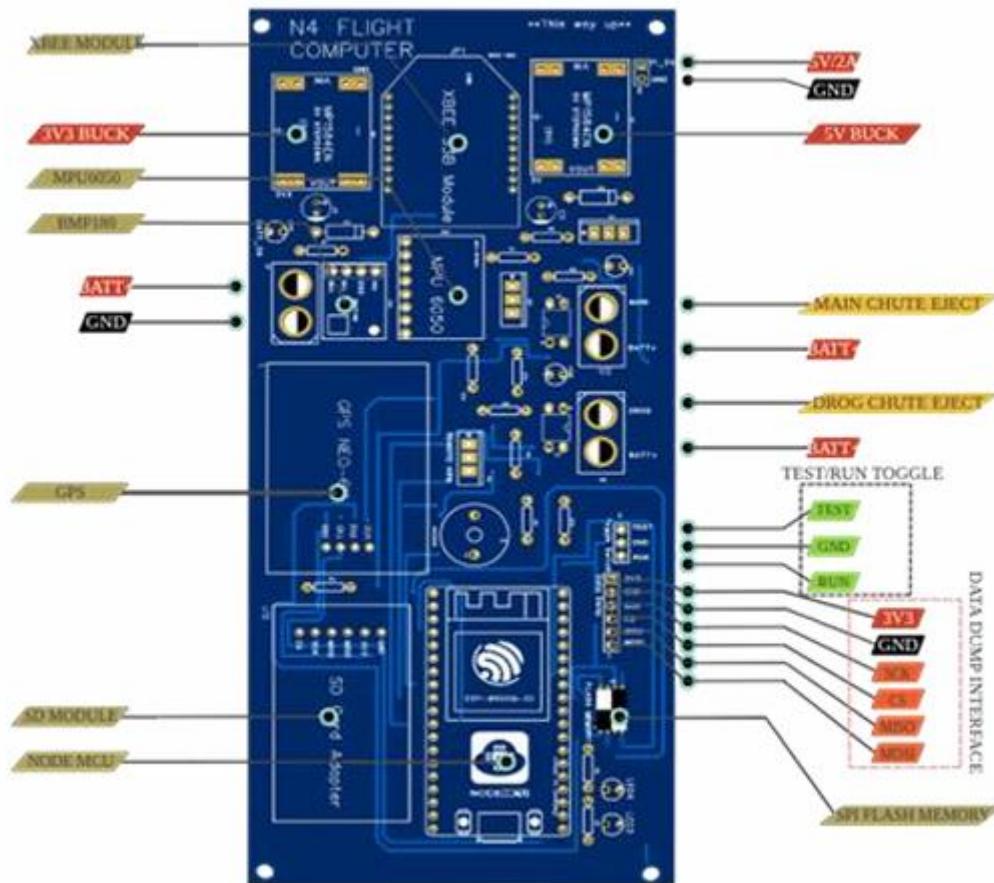
The student may also use this space for additional reports.

Breakdown of parts of a rocket



Flight computer





Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 15/06/2025**

DAY	DESCRIPTION OF WORK DONE
MON	1. Setting up the base station 2. Simulated MQTT telemetry stream using mock data to verify dashboard visualization functionality
TUES	1. Integrated display of FSM state, battery level, GPS coordinates, and altitude on the dashboard. 2. Validated live video streaming from Raspberry Pi
WED	We looked into the beacon documentation and code Watched reference videos that clarified more on the beacons. We did a test to see how the beacon works
THUR	Studied EasyEDA schematic designs to understand hardware component connections and layout
FRI	Captured video feed from the Raspberry Pi and recorded it locally. Team meeting
SAT	

TRINEES WEEKLY REPORT

This week involved deep engagement with both the hardware and software systems that support the Nakuja Base Station infrastructure. The focus was on system simulation, dashboard integration, and improvements to communication and deployment processes.

We began by simulating telemetry streams using mock data over MQTT, allowing us to verify that the dashboard was correctly visualizing real-time data inputs. This laid the foundation for integrating actual flight data later in the development cycle. Building on this, we successfully added visual indicators for the finite state machine (FSM), battery level, GPS coordinates, and altitude, enhancing the situational awareness capabilities of the dashboard.

Progress continued with the validation of live video streaming from the Raspberry Pi, confirming that video feeds could be both viewed in real time and recorded simultaneously to the SD card. This is a critical component for both in-flight monitoring and post-flight analysis.

The communication between the Flight Computer (FC) and the Base Station (BS) was then verified, ensuring reliable telemetry transmission. We also conducted an in-depth review of the beacon system's documentation and source code, which will later be essential for long-range recovery. Alongside this, we analyzed the EasyEDA schematics to understand the physical hardware layout and prepare for future modifications.

To streamline deployment and scalability, we containerized key components of the base station using Docker. This improved system efficiency, simplified setup, and ensured a consistent development environment. Finally, we successfully captured and logged video feeds locally from the Raspberry Pi,



completing the integration of the video subsystem with the rest of the platform.

This week significantly advanced the stability and integration of the Nakuja Base Station system. It combined software verification, hardware analysis, and infrastructure optimization, setting a strong technical foundation for upcoming flight tests and system expansions.

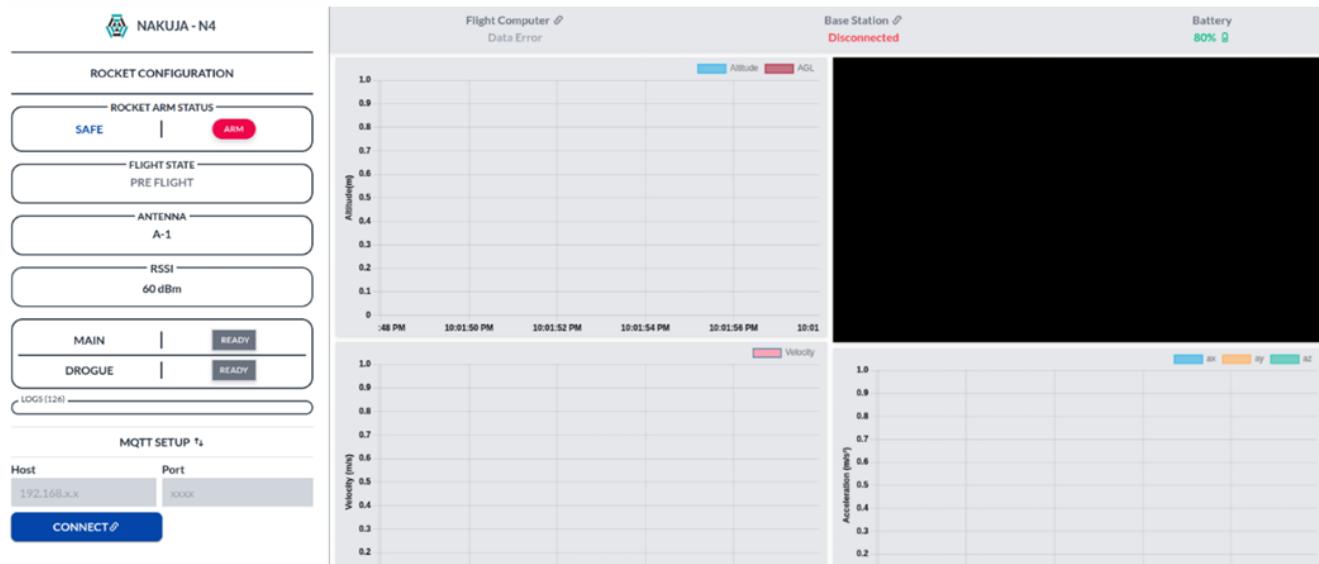
FOR SKETCHES, DIAGRAMS AND GRAPHS

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(Additional drawings, may be attached where necessary)

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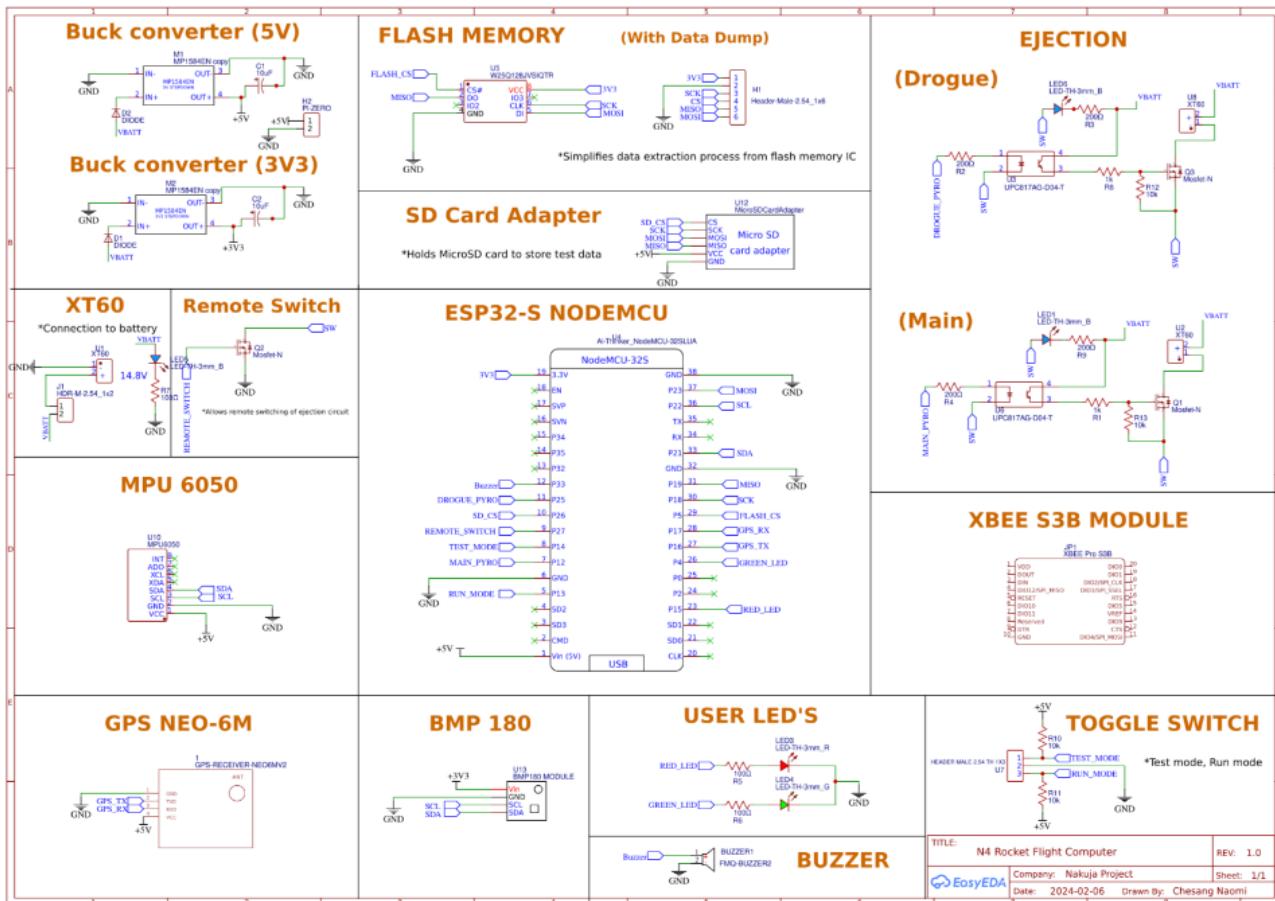
○ **TELEMETRY SUBSYSTEM – N4-Basestation**



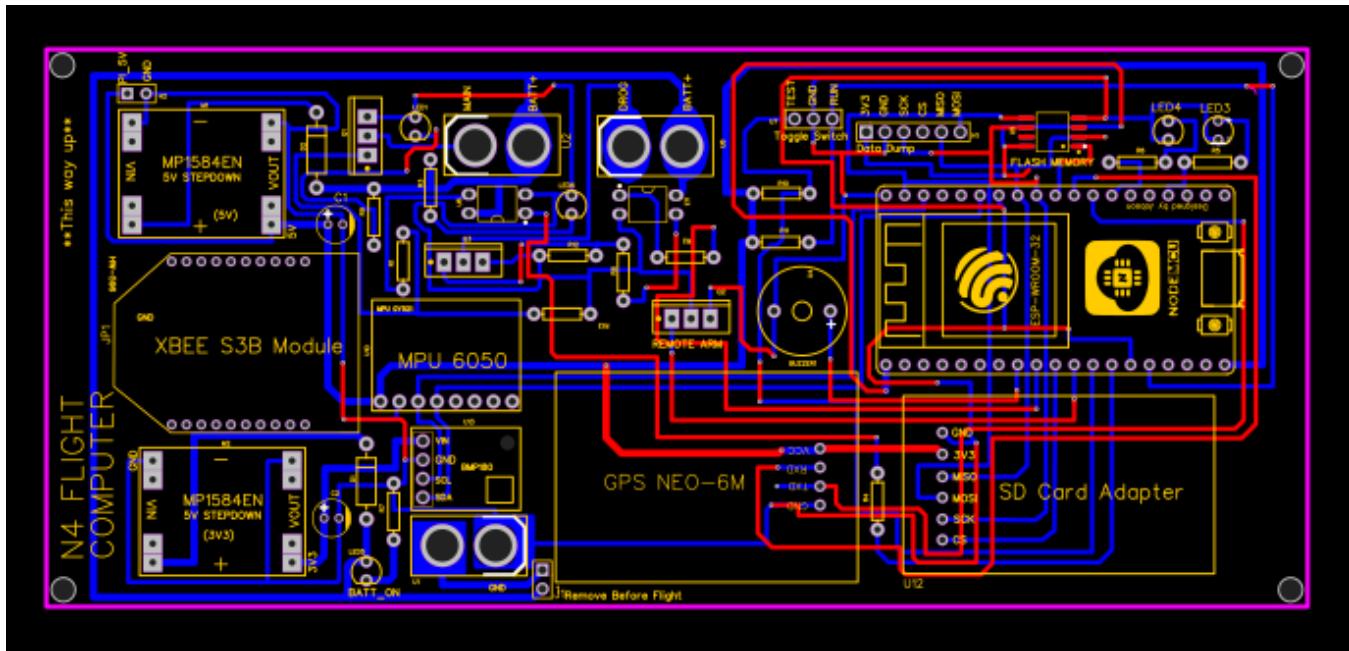
Base station



Schematic



Flight computer schematic



Flight computer design on easyeda

Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 22/06/2025**

DAY	DESCRIPTION OF WORK DONE
MON	1.Conducted telemetry data logging tests to SPI Flash and SD Card during simulated flight sessions. 2.Tested and verified Flight Computer 2 (FC-2) hardware and software, identifying and resolving functional errors
TUES	1.Performed unit tests and checked for continuity using a multimeter 2.Resoldered poorly connected parts.
WED	1. Implemented parachute ejection logic into the system firmware. 2. Replaced and tested the GPS module to ensure improved performance
THUR	1.Developed logic for switching communication between Wi-Fi and beacon protocols. 2.Analyzed the parachute deployment circuit and corresponding firmware implementation.
FRI	1.Streamed and logged video data from the Raspberry Pi to the base station. 2.Established and tested the connection between the Flight Computer and the base station
SAT	

TRAINEES WEEKLY REPORT

This week's focus was on validating and enhancing the performance of both flight hardware and data communication systems, with significant progress achieved across several core functionalities of the Nakuja platform.

The team began by conducting telemetry data logging tests during simulated flight sessions, ensuring that both SPI Flash and SD Card storage were functioning correctly. This verification step is vital for ensuring the reliability of data capture during actual flight missions. Alongside this, hardware and software for Flight Computer 2 (FC-2) were tested thoroughly. Functional errors were identified and resolved, leading to improved system stability and performance.

Attention was also given to mechanical integration, where the camera module dimensions were validated to guarantee a secure and accurate fit within the CFD-optimized housing. This ensures that onboard video systems are well-aligned for effective recording and streaming during flight.

A significant firmware milestone was the implementation of the parachute ejection logic, a critical safety feature. The GPS module was also replaced and tested, resulting in better signal acquisition and reliability. Communication protocols were optimized by developing a switching logic that allows seamless transition between Wi-Fi and beacon-based communication, enhancing system robustness in varied environments.

Further refinement was made to the parachute subsystem, where both the deployment circuit and its firmware were reviewed and analyzed for efficiency and effectiveness. On the data streaming side, successful video transmission from the Raspberry Pi to the base station was achieved. This was accompanied by the validation of a stable connection between the Flight Computer and the base station, ensuring end-to-end communication readiness.



FOR SKETCHES, DIAGRAMS AND GRAPHS

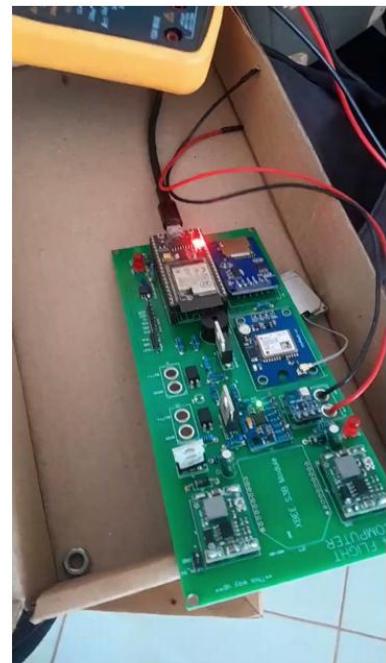
DATE.....

(Additional drawings, may be attached where necessary)

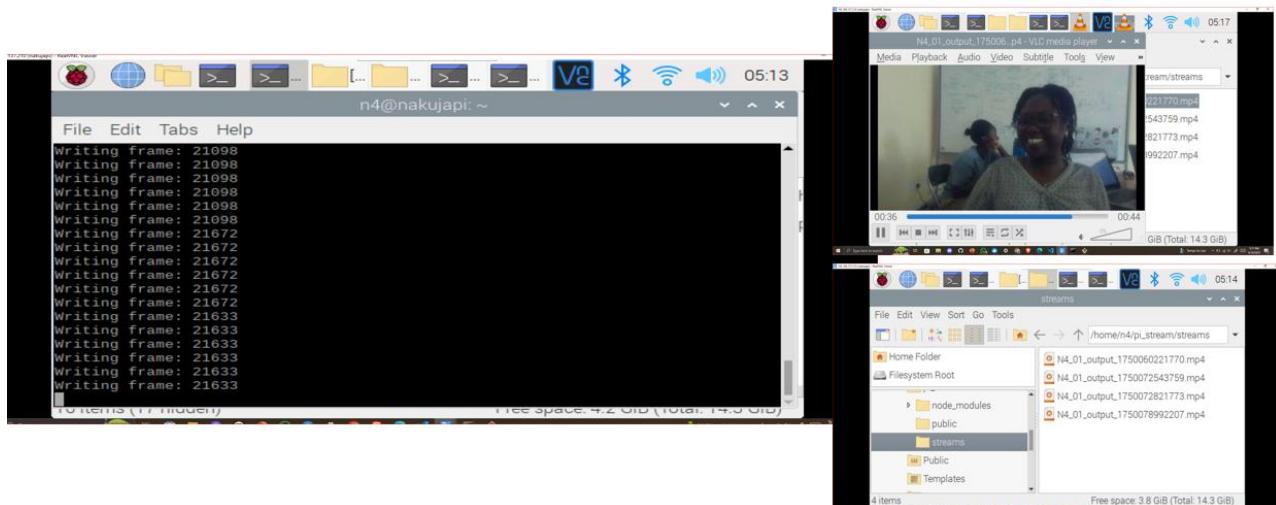
The student may also use this space for additional reports.

Flash memory testing

```
=====
===== INITIALIZING PERIPHERALS =====
=====
Log OK
[+]BMP init OK.
[+]MPU6050 init OK.
[+]GPS init OK!
flighttk_data.txt file does not exist. Creating file.
Failed to create file
Flash memory init state:1
MORE TEST
```

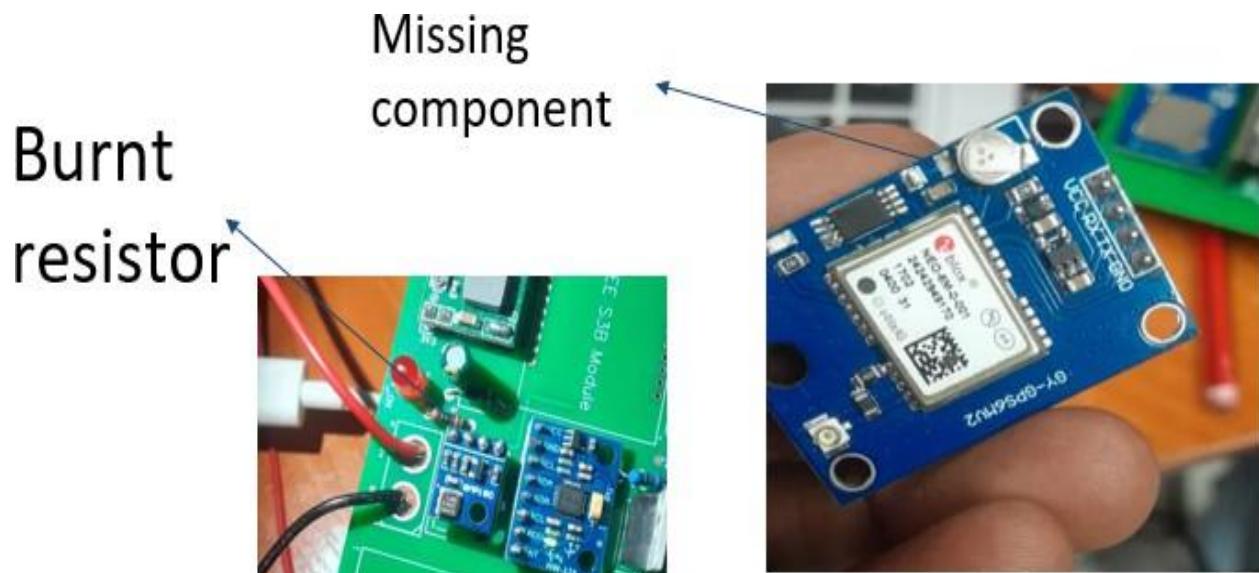


Stream and log video data from Raspberry Pi to base station



Basestation

The screenshot shows the N4 Telemetry Dashboard interface. On the left, there's a sidebar with 'ROCKET CONFIGURATION' sections for 'ROCKET ARM STATUS' (SAFE/ARM), 'FLIGHT STATE' (PRE FLIGHT), 'ANTENNA' (A-1), 'RSSI' (60 dBm), 'MAIN' (READY), and 'DROGUE' (READY). Below that is the 'MQTT SETUP' section with 'Host' (192.168.0.1) and 'Port' (30001), and a 'CONNECT' button. The main area has three tabs: 'Flight Computer' (Connected, showing Altitude and AOL graphs from 5:11:18 PM to 5:11:26 PM), 'Base Station' (Connected, showing Velocity and Acceleration graphs from 5:11:18 PM to 5:11:26 PM), and a video feed of a person in a room. A bottom map shows the launch site.



Fixing the flight computer hardware

Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:

WEEKLY PROGRESS CHART**(WEEK ENDING 29/06/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Validated SPI Flash logging functionality.
TUES	Inspected and tested the flash memory circuit for proper wiring and functionality
WED	Evaluated and adjusted camera positioning for optimal alignment with the payload structure and CFD housing. Tested the ejection firmware.
THUR	Revalidated SPI Flash logging accuracy under different test conditions. Improved the Kalman filter for better fusion of barometric and IMU sensor data, aiming to enhance altitude and velocity estimates.
FRI	Investigated alternative communication protocols for data transmission and redundancy, including: <ul style="list-style-type: none">• Beacons (transmitter configuration) with MQTT.• Beacon-to-beacon switching (transmitter and receiver modes).• ESP-NOW with beacon integration.• ESP-NOW protocol independently.
SAT	

TRAINEES WEEKLY REPORT

This week focused on advancing both data reliability and communication robustness across the avionics system. Key areas of concentration included memory validation, sensor integration, and experimentation with multiple communication protocols.

Work began with the validation of the SPI Flash logging system. Functionality tests were performed to ensure data could be reliably written to and retrieved from memory under different operational conditions. In addition, the flash memory circuitry was thoroughly inspected and tested to confirm proper wiring and signal integrity. These steps were essential for ensuring stable onboard data storage, especially in environments where SD card logging alone might be insufficient.

Simultaneously, the positioning of the onboard camera was evaluated and adjusted to ensure optimal alignment with the payload structure and the aerodynamically optimized CFD housing. Proper orientation is critical for capturing usable footage during flight, particularly for post-recovery analysis. On the sensor fusion front, efforts were directed toward enhancing the Kalman filter responsible for integrating data from the barometer and IMU. Improvements to the filter's tuning have led to better accuracy in estimating altitude and velocity, both of which are essential for flight phase detection and control logic.

Another major area of focus was on strengthening data communication methods. A series of tests were conducted to evaluate alternative protocols for both real-time telemetry and redundancy. These included beacon transmitters combined with MQTT for long-range communication, beacon-to-beacon switching to enable bidirectional signaling, and ESP-NOW—both integrated with beacons and as a standalone protocol. Each configuration was analyzed for reliability, latency, and ease of integration within the current system design.



FOR SKETCHES, DIAGRAMS AND GRAPHS

DATE.....

(Additional drawings, may be attached where necessary)

The student may also use this space for additional reports.

SPI Flash firmware implementation

AI-Thinker Serial Tool V1.2.3.0 www.ai-thinker.com

Receive

```

ets Jul 29 2019 12:21:46
rst:0x1 (POWERON_RESET), boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00, q_drv:0x00, d_drv:0x00, cs0_drv:0x00, hd_drv:0x00, wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030, len:4660
load:0x40078000, len:15576
load:0x40080000, len:4
load:0x40080404, len:3152
entry 0x400805a0
File System Contents:
config.txt @ 0x010000 (18 bytes) data.bin @ 0x010012 (4 bytes)
message.txt @ 0x010016 (52 bytes) Next free: 0x01004A
message.txt (52 bytes): 0000: 4F 6E 65 20 73 6D 61 6C 6C 20 73 74 65
77 20 66 0010: 6F 72 20 48 75 6D 61 6E 69 74 79 20 61 20 67 69 0020:
61 6E 74 20 6C 65 61 70 20 66 6F 72 20 6D 61 6E 0030: 6B 69 6E 64
ASCII:
One small step f
or Humanity a gi
ant leap for man
kind

```

MultiText

HEX	Strings	Send
<input type="checkbox"/> AT+CSYSID	1	
<input type="checkbox"/> AT+GMR	2	
<input type="checkbox"/> AT+CWMODE=1	3	
<input type="checkbox"/> AT+CWLAP	4	
<input type="checkbox"/> AT+CWJAP_DEF="newifi_	5	
<input type="checkbox"/> AT+RST	6	
<input type="checkbox"/> AT+CLDUNBIND	7	
<input type="checkbox"/> AT+CIPSTA?	8	
<input type="checkbox"/> AT+LANSTART	9	
<input type="checkbox"/> AT+CLDSTART	10	
<input type="checkbox"/> AT+CLDSTOP	11	
<input type="checkbox"/> AT+RESTORE	12	
<input type="checkbox"/> AT+CSTOPDISCOVER	13	

Circle Send 500 ms

PortNum: COM5 **BaudRate**: 115200 **DataBits**: 8 **ParityBits**: None **StopBits**: One **HandShaking**: None

Add Time RecHex AutoNewLine
 SendCyclic ms SendNewLin SendHex FormatInput

Received: 788 Sent: 0 2025-07-02 12:03:43



This the data packet we are sending over mqtt

Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name: _____

Signature: Date:

WEEKLY PROGRESS CHART**(WEEK ENDING 06/07/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Conducted functionality tests on all three Flight Computers (FCs). Tested the GPS, BMP and MPU sensor modules Verified that FC1 and FC2 were operating correctly
TUES	Resolved the state machine issue, enabling successful deployment of both main and drogue parachutes. Fixed the flash memory on the second flight computer, resoldered the pins as they weren't well connected.
WED	Implemented firmware for SPI Flash memory. Verified the ability to store and retrieve data successfully.
THUR	Gained familiarity with multiplexer switching through LED testing. Successfully implemented multiplexer switching on wokwi to demonstrate how the esp will switch between the xbee and gps UART line
FRI	Conducted SD Card data logging to verify write/read functionality and integration with the flight system
SAT	

TRAINEES WEEKLY REPORT

This week's efforts were dedicated to validating the functionality of the core flight systems and improving modular communication within the avionics architecture. The work was structured to strengthen both firmware reliability and hardware integration.

The initial phase involved conducting comprehensive functionality tests on all three Flight Computers (FCs), during which FC1 and FC2 were confirmed to be fully operational. This step was critical to ensure redundancy and preparedness for flight simulation and actual deployment scenarios.

A significant milestone was the successful resolution of a state machine logic issue, which previously hindered parachute deployment. With this fix, the system was able to reliably execute both main and drogue parachute ejections—a key safety and recovery feature.

In parallel, firmware for the SPI Flash module was implemented and tested. Data was successfully written to and retrieved from memory, confirming the reliability of the onboard logging mechanism for critical flight data. This enhancement plays a vital role in post-flight analysis and debugging.

Further, foundational work was carried out to enable multiplexed communication using UART. Testing involved switching between X-BEE and GPS modules via LED-based simulations to confirm logic accuracy. This multiplexing approach is intended for integration in future hardware designs, allowing a single UART interface to manage multiple communication modules effectively.

The week concluded with tests on SD Card logging. These verified the card's read/write integrity when interfaced with the Flight Computer, ensuring compatibility and robustness in data storage under expected system loads.



FOR SKETCHES, DIAGRAMS AND GRAPHS

DATE.....

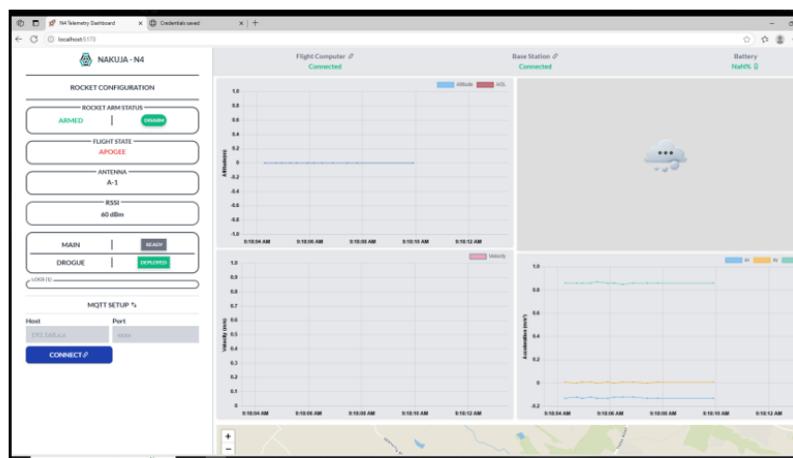
(Additional drawings, may be attached where necessary)
 The student may also use this space for additional reports.

Testing the arming logic

The arming logic was tested and is found to be working.

The circuit is also working okay , it is able to arm the rocket so as to deploy the parachutes

The base station however has an update delay, the state update does not follow the simulated data



This shows that the arming is working fine, the drogue is shown to have been deployed

sketch.ino

```

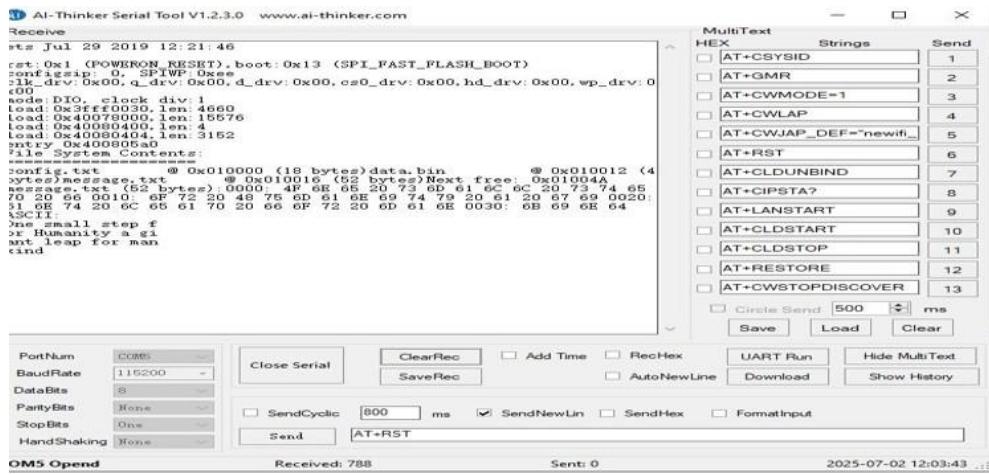
4 #define SIG 17
5 #define GPS_LED 2
6 #define XBEE_LED 15
7
8 void setup() {
9   pinMode(S0, OUTPUT);
10  pinMode(S1, OUTPUT);
11  pinMode(SIG, OUTPUT);
12  pinMode(GPS_LED, OUTPUT);
13  pinMode(XBEE_LED, OUTPUT);
14
15  Serial.begin(9600);
16  Serial.println("== MUX VERIFICATION TEST ==");
17  Serial.println("Watch the serial output AND LED behavior");
18 }
19
20 void loop() {
21   // Test all 4 possible channel combinations
22   testChannel(0, 0, 0, "Channel 0 (GPS)");
23   testChannel(1, 0, 1, "Channel 1 (XBee)");
24   testChannel(0, 1, 2, "Channel 2 (Unused)");
25   testChannel(1, 1, 3, "Channel 3 (Unused)");
26
27   Serial.println("== Test Complete ==\n");
28   delay(2000);
29 }
30
31 void testChannel(int s0_val, int s1_val, int channel_num, String name) {
32   Serial.print("Testing ");
  
```

Simulation

== MUX VERIFICATION TEST ==
 Watch the serial output AND LED behavior
 Testing Channel 0 (GPS) - S0=0, S1=0
 → GPS LED should be ON, XBee LED OFF
 Testing Channel 1 (XBee) - S0=1, S1=0
 → XBee LED should be ON, GPS LED OFF
 Testing Channel 2 (Unused) - S0=0, S1=1



SPI Flash data logging : Logging of flight data into the flash memory,



Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 13/07/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Researched on a new camera casing plan to accommodate a downward-facing camera orientation
TUES	Conducted unit tests for SD card data logging. Successfully logged simulated sensor data to the SD card during test runs
WED	Verified flash memory functionality by successfully storing and retrieving data.
THUR	Worked on board design modifications to enable the Raspberry Pi and amplifier to be powered directly from the main Flight Computer (FC) board.
FRI	Tested a combined module integrating both BMP and MPU sensors to reduce component count on the board. Successfully tested the onboard BMP sensor functionality. Evaluated a smaller GPS module as an alternative solution. Planned to simulate a GPS warm fix by storing fix data in flash memory and injecting it into the GPS module during initialization.
SAT	

TRAINEES WEEKLY REPORT

This week focused on enhancing hardware integration and optimizing sensor configurations to streamline the avionics system design. The team undertook a series of targeted activities aimed at improving component layout, data logging functionality, and sensor interfacing.

Early in the week, research was conducted to redesign the camera casing, specifically to support a downward-facing camera orientation. This modification is crucial for aerial imaging and trajectory analysis during rocket flight.

Subsequently, unit tests were carried out to evaluate the SD card data logging system. Simulated sensor data was successfully written to the SD card, verifying the reliability of the logging process and ensuring that the system is capable of capturing and preserving critical flight data during test and live operations.

Flash memory functionality was also tested and confirmed. Data was successfully stored and retrieved from the memory, validating its use as a secondary storage option for mission-critical parameters and telemetry logs.

In parallel, modifications were made to the hardware board layout to enable the Raspberry Pi and the signal amplifier to receive power directly from the main Flight Computer (FC) board. This integration aims to simplify power distribution and reduce wiring complexity within the avionics bay.

Toward the end of the week, sensor consolidation efforts were undertaken by testing a combined module integrating both BMP (barometric pressure) and MPU (IMU) sensors. The onboard BMP sensor was successfully verified, marking a significant step toward minimizing board footprint and reducing potential points of failure. Additionally, a smaller GPS module was evaluated as a space-efficient alternative. Plans were also made to simulate a GPS warm fix by preloading fix data into flash memory and injecting it into the GPS module during initialization, with the goal of reducing time-to-first-fix during launch.



FOR SKETCHES, DIAGRAMS AND GRAPHS

DATE.....

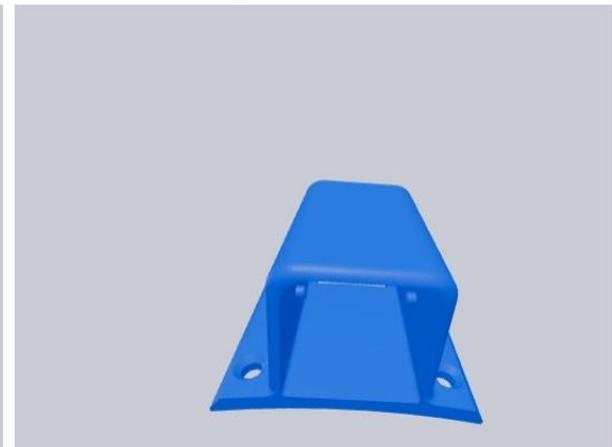
(Additional drawings, may be attached where necessary)

The student may also use this space for additional reports.

New camera casing plan

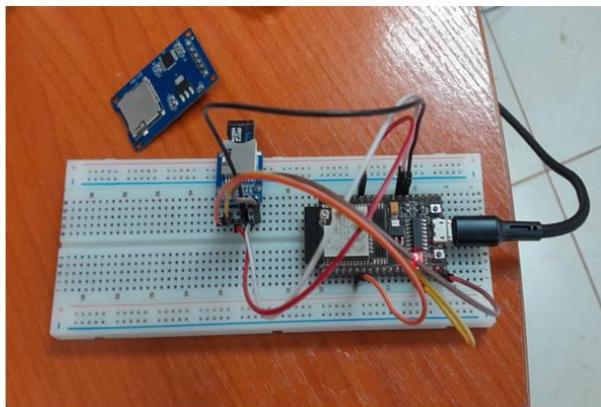
Downward-facing camera position with
fastening

The final design will be curved



SD Card data logging test

Unit test



Simulated sensor data is successfully logged to the SD card

```

1 //Node-RED
2 //Node.js
3
4 // File Logging (based on your SDIO-S NodeRED schematic) ---
5
6 //File SD.js
7 // This file will be used to log sensor data to an SD card
8 // Activate SD card 10 // Master in Slave Out
9 // Activate SD card 11 // Clock
10
11 // --- File Name for logging ---
12 const name="log1.txt"; //Name + "Logging.txt"
13
14 //--- Data logging variables ---
15 const logInterval = 5000; // Log every 5 seconds
16 const unsigned long logInterval = 5000; // Log every 5 seconds
17 int logCounter = 0;
18
19 void setup() {
20   Serial.begin(9600);
21 }

```

Output: Serial Monitor #1

```

Message from node message to Node-RED on COM0
Data Logged:
110001,228,16,43,49,43,43
Data Logged:
110017,229,23,35,73,26,43
Data Logged:
111003,230,25,08,47,25,24
Data Logged:
110017,231,26,77,03,79,4
Data Logged:
110017,231,15,32,32,75,30

```

FLASH MEMORY-data can be stored and retrieved successfully

Erasing sector ensures optimal storage utilization
The **green** checkmark indicates successful completion of erasing
Flash memory init state :1 confirms memory is ready for data logging

The system here is reading data from the flash memory and it can handle multiple data streams simultaneously

This ensures easy retrieval of data

```

[createErasable] Erasing sector @ 0x04B000
[createErasable] Erasing sector @ 0x04C000
[createErasable] Erasing sector @ 0x04D000
[createErasable] Erasing sector @ 0x04E000
[createErasable] Erasing sector @ 0x04F000
[createErasable] ✓ File created and sectors erased.
Created flight_data.txt file. Ready for data logging!
Flash memory init state:1
MODE:TEST
Log OK

=====
===== INITIALIZING DATA LOGGING SYSTEM =====
=====
Log OK

```

```

clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div1
load:0xfffff0030, len:4660
load:0x40078000, len:15576
load:0x40080400, len:4
load:0x40080404, len:3152
entry:0x40080500

█ Reading file: data_01.txt from SPI Flash...
[initFilesystem] Reading file table...
[initFilesystem] ✓ Initialized. Next free address: 0x050000
✓ Flash initialized
█ Reading file: data_01.txt (262144 bytes)
1,0,0,-0.04,0.05,1.05,-2.69,2.55,-11.80,-16.04,4.85,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1068,0.4743,1.0493
2,0,0,-0.05,0.04,1.06,-3.00,2.45,-11.59,-15.64,5.43,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1319,0.5268,1.0493
3,0,0,-0.05,0.05,1.06,-2.24,2.79,-11.71,-15.00,5.64,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1319,0.5268,1.0493
4,0,0,-0.04,0.04,1.06,-3.28,2.10,-11.49,-15.34,5.34,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1319,0.5268,1.0493
5,0,0,-0.04,0.05,1.05,-2.58,2.10,-11.92,-14.76,5.34,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1595,0.5788,1.0400
6,0,0,-0.05,0.04,1.04,-2.49,2.44,-10.99,-14.82,5.64,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1597,0.6310,1.0435
7,0,0,-0.04,0.04,1.06,-2.35,2.41,-11.34,-14.85,5.30,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1597,0.6310,1.0435
8,0,0,-0.04,0.05,1.06,-2.58,2.49,-11.80,-15.30,5.67,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.2226,0.6837,1.0582
9,0,0,-0.03,0.05,1.05,-2.32,2.63,-11.43,-15.61,4.94,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.119,0.40,20.95,-0.30,-0.1743,0.4796,1.0012
10,0,0,-0.04,0.04,1.05,-2.65,2.71,-12.07,-15.52,4.66,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1490,0.5319,1.0454
11,0,0,-0.05,0.04,1.04,-2.04,2.05,-11.25,-15.73,5.49,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1490,0.5319,1.0454
15,0,0,-0.05,0.05,1.04,-3.16,2.32,-11.49,-15.82,5.70,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.1211,0.5541,1.0435
16,0,0,-0.05,0.04,1.05,-3.47,2.01,-11.74,-15.49,5.49,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.13,0.0317,0.7239,1.0522
17,0,0,-0.04,0.05,1.05,-2.44,2.28,-10.98,-15.43,5.76,0.0000,0.0000,-0.00,0.00,0.00,0.00,0.00,0.13,0.0362,0.7762,1.0488

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Board design to power the raspberry Pi and the amplifier from the main FC board

Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 20/07/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Fabricated the Raspberry Pi PCB and Base Station PCB
TUES	Performed soldering and testing of SD card modules to verify data logging functionality.
WED	Etched and assembled both the base station PCB and Raspberry Pi interface PCB.
THUR	Implemented and tested data logging for both SD card and flash memory modules simultaneously We had to include a resistor on the chip select pin for simultaneous logging
FRI	Prepared for upcoming drone test, including hardware readiness and preliminary integration. Documented all components and materials required for the drone test procedure.
SAT	

TRAINEES WEEKLY REPORT

This week's activities focused on hardware fabrication, memory module testing, and preparing for upcoming drone tests. The primary objective was to complete the physical construction and validation of key system components, ensuring readiness for deployment and data acquisition during flight trials. The fabrication of the Raspberry Pi interface PCB and the Base Station PCB was successfully completed. This included the full cycle of designing, etching, and assembling the boards. Careful attention was paid to layout optimization and port alignment to ensure compatibility with the Raspberry Pi and other peripheral devices.

Following fabrication, extensive soldering and testing of SD card modules were conducted. The goal was to validate the integrity of the connections and confirm that data logging systems functioned as intended. Successful data writes to the SD card during test runs confirmed that the module was operating reliably.

Further work involved simultaneous data logging to both SD card and flash memory modules. This dual-logging system was tested and confirmed to function correctly, offering redundancy and reliability in capturing critical telemetry and sensor data during operations.

In preparation for the upcoming drone test, the team initiated hardware integration protocols. Components were tested for readiness, and any compatibility or performance issues were addressed early. This proactive approach ensures smoother testing sessions and minimizes downtime during live trials.

Finally, detailed documentation was compiled outlining all components and materials required for the drone test procedure. This list will streamline logistics and ensure that all necessary elements are in place during deployment.

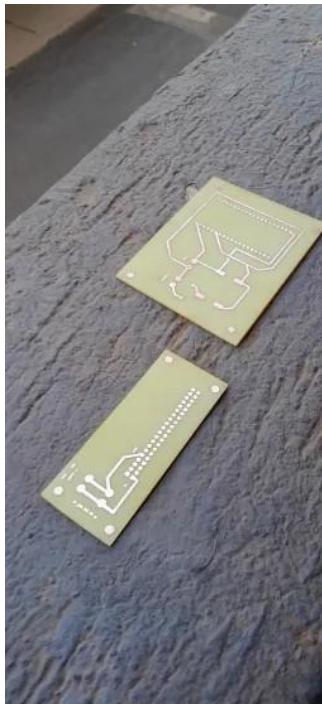


FOR SKETCHES, DIAGRAMS AND GRAPHS

DATE.....

(Additional drawings, may be attached where necessary)
The student may also use this space for additional reports.

Etched PCBs: Raspberry Pi power PCB and Base Station PCB



Student's Signature:

Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 27/07/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Assembled the avionics bay in preparation for full system integration. Researched on necessary xbee peripherals and created a purchase request Tested newly etched boards and fixed the apparent issues
TUES	Tested the parachute ejection logic using nichrome wire and verified successful deployment behavior
WED	Performed a vehicle test Continued etching of pcbs
THUR	Performed a range test. Soldered the newly purchased SD cards. Tested the Ubiquiti PowerBeam for compatibility with beacons. Finalized the drone test procedures.
FRI	Weekly meeting
SAT	



TRINEES WEEKLY REPORT

The week began with a briefing session with the supervisors to review current progress and agree on upcoming priorities. Work then focused on assembling the avionics bay, creating a well-organized platform to house and integrate the flight electronics. In parallel, research was carried out on suitable XBee accessories — including antennas, adapters, and breakout modules — to strengthen wireless communication capabilities. A purchase requisition was prepared to secure these peripherals promptly. At the same time, the latest etched PCBs were inspected and tested, and minor defects identified during the process were successfully corrected.

Development of safety mechanisms advanced through testing of the parachute ejection system using nichrome wire. Because of its high resistance, nichrome generates heat quickly, making it ideal for igniting charges or cutting tethers for parachute deployment. The firing logic was reviewed and tuned to enhance dependability during flight. Updates were also made to the Raspberry Pi and base station circuit designs, after which new versions of the boards were etched for further trials.

A vehicle trial was conducted to evaluate the ejection setup, while 3D printing was utilized to produce a protective camera housing to secure the onboard video payload. Repeated tests of the ejection circuit with nichrome wire continued until consistent and reliable results were achieved.

Later in the week, a communication range assessment was performed to confirm telemetry stability over extended distances. Recently acquired SD card modules were soldered and verified to support flight data recording. Experiments with a Ubiquiti PowerBeam followed, examining its suitability for high-bandwidth beacon links. The week concluded with refining drone test protocols, ensuring they are ready to simulate real flight conditions ahead of a full-scale launch.

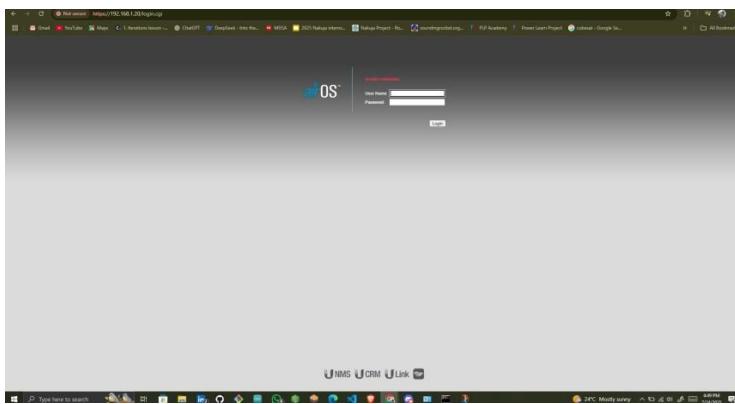


FOR SKETCHES, DIAGRAMS AND GRAPHS
DATE.....

Additional drawings, may be attached where necessary) The student may also use this space for additional reports.

Configuration of the Ubiquiti PowerBeam

The Ubiquiti PowerBeam is a directional Wi-Fi antenna integrated with a built-in radio. It is designed for long-range point-to-point or point-to-multipoint links, capable of transmitting and receiving data across distances ranging from a few kilometers to several tens of kilometers, depending on environmental conditions and line-of-sight



Vehicle test preparations



Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 03/08/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Set up and calibrated the 3D printer, then designed, fabricated, and tested a prototype jig to support upcoming experiments.
TUES	Soldered components on the Base Station PCB and the Raspberry Pi PCB, and fabricated a test jig for use in wind tunnel trials.
WED	Conducted a wind tunnel test to evaluate system performance and prepared documentation detailing requirements, tools, and procedures for the planned drone tests and range tests
THUR	Tested the newly fabricated PCBs to verify correct operation, stability, and readiness for integration into the system.
FRI	Participated in the weekly progress meeting to present updates, discuss challenges, and outline next steps.
SAT	

TRAINEES WEEKLY REPORT

The week started with setting up and calibrating the 3D printer to ensure accurate performance. Once configured, a prototype jig was designed, fabricated, and tested to confirm its suitability for supporting hardware during upcoming experiments.

Attention then shifted to the electronics, where soldering work was completed on the Base Station PCB and the Raspberry Pi PCB. Alongside this, a dedicated test jig was built to aid in precise measurements and airflow experiments inside the wind tunnel.

Midweek activities centered on a wind tunnel assessment aimed at understanding how the system responds to controlled airflow conditions. During this phase, documentation was also prepared to outline the requirements, tools, and step-by-step procedures needed for both drone testing and range testing. Later in the week, the newly fabricated PCBs underwent functional testing to verify signal integrity, stability, and readiness for integration with the rest of the system.

The week concluded with a progress meeting, where the team shared updates, discussed technical challenges, and planned the upcoming tasks. The weekend was kept free for rest and light review of notes, ensuring readiness for the following week's activities.,



FOR SKETCHES, DIAGRAMS AND GRAPHS
DATE.....

(Additional drawings, may be attached where necessary)
The student may also use this space for additional reports.

Running tests on the third-generation etched PCBs



Camera casing design print and positioning on the airframe



Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature: Date:



WEEKLY PROGRESS CHART**(WEEK ENDING 10/08/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Completed 3D printing of shear pins and diagnosed a short circuit that had occurred on the circuit.
TUES	Prepared for the upcoming dry run and assembled the parachutes into the avionics bay.
WED	Performed an additional range test to verify communication stability.
THUR	Tested the circuits and organized all components in readiness for the rocket launch dry run.
FRI	Carried out the first dry run to validate launch procedures and system functionality.
SAT	

TRAINEES WEEKLY REPORT

Work began with the 3D printing of shear pins — small sacrificial components designed to hold sections of the rocket together until the ejection charges activate. Their strength and reliability were carefully verified, as they must endure flight stresses while breaking cleanly during parachute deployment. During this phase, a short circuit detected on one of the boards was diagnosed and corrected to prevent faults during later integration.

As preparations advanced, attention turned to readiness for a full systems rehearsal. Parachutes were assembled into the avionics bay, with careful packing and secure attachment to the ejection mechanism. Each step was carried out with precision to ensure smooth deployment without tangling once triggered by the ejection charges.

To validate communication performance, a range test was conducted, confirming stable links between the flight computer and base station over distance. This step provided confidence that telemetry and command signals would remain reliable during flight.

Subsequently, the circuits were tested to confirm proper functionality across all subsystems, and the complete setup was organized for the upcoming rocket launch dry run — the culmination of the team's efforts in fabrication, testing, and integration.

A dry run in rocketry is a full rehearsal of the launch sequence without actually igniting the motor. It involves assembling the rocket, powering all electronics, and stepping through every stage of the flight profile. Systems such as the flight computer, sensors, ejection circuits, parachute deployment, telemetry, and base station communication are evaluated together to ensure they work correctly in combination. This process helps uncover last-minute issues — like wiring faults, weak solder joints, communication dropouts, or parachute-packing errors — so that the actual launch proceeds smoothly and safely.



FOR SKETCHES, DIAGRAMS AND GRAPHS
DATE.....

(Additional drawings, may be attached where necessary)
The student may also use this space for additional reports.

Preparation for dry run





Range test

Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature:

Date.....



WEEKLY PROGRESS CHART**(WEEK ENDING****17/08/2025.....)**

DAY	DESCRIPTION OF WORK DONE
MON	Purchased ESP32 boards without onboard antennas and researched how to attach external antennas.
TUES	Installed antennas on the new microcontrollers and carried out a mock range test to assess their performance; results were promising.
WED	Tested Flight Computer 2 and confirmed it was ready for the pop test. Prepared incident reports documenting previous short circuits.
THUR	Prepared crimson powder for use as ejection charges in the parachute deployment system.
FRI	Performed an improved dry run, refining procedures and verifying system readiness.
SAT	

TRAINEES WEEKLY REPORT

At the start of the period, new ESP32 microcontrollers without onboard antennas were procured. Research was undertaken to determine the best method of attaching external antennas to these boards, ensuring they could provide reliable wireless communication during operations. Once the approach was finalized, antennas were installed on the new microcontrollers, and a mock range test was carried out to evaluate their performance. The results were encouraging, indicating that the modified boards would perform well in an actual range test environment. Attention then shifted to avionics readiness. Flight Computer 2 was thoroughly tested and confirmed to be ready for the upcoming pop test. During this phase, incident reports were also created to document short circuits encountered earlier, providing clear records for troubleshooting and process improvement. Later, work focused on preparing the ejection charges. Crimson powder was carefully mixed and prepared to ensure it would ignite effectively and generate the force needed to deploy the parachutes. By the end of the period, another dry run was performed. This rehearsal showed significant improvement compared to previous attempts, demonstrating steady progress toward a fully operational launch system. The weekend provided time for rest and reflection before resuming development tasks.



FOR SKETCHES, DIAGRAMS AND GRAPHS

DATE.....

External antenna attached to the circuit



Crimson powder preparation



Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature..... Date.....



WEEKLY PROGRESS CHART**(WEEK ENDING 24/08/2025**

DAY	DESCRIPTION OF WORK DONE
MON	Reprinted shear pins on the 3D printer after discovering during the dry run that the earlier ones were too weak.
TUES	Designed a new test jig in SolidWorks, incorporating feedback from supervisors on improvements to the previous design.
WED	Began fabricating new couplers to correct issues found in earlier pieces, including inconsistent thickness, incorrect weight, and insufficient space for parachute packing.
THUR	Prepared an additional batch of crimson powder to provide enough ejection charges for upcoming pop tests
FRI	Participated in the general progress meeting to review work and plan next steps
SAT	

TRAIINEES WEEKLY REPORT

Work opened with the reprinting of shear pins on the 3D printer after the previous batch was found to be too weak during the dry run. The new pieces were produced with tighter tolerances to ensure they could withstand flight loads while still breaking cleanly during parachute deployment.

Attention then turned to improvements in testing hardware. A new jig was designed in SolidWorks, integrating feedback from supervisors on how to enhance the functionality and strength of the earlier design. This update aimed to make testing procedures more efficient and accurate.

Midweek efforts focused on fabricating new couplers. The earlier versions had shown several problems, including uneven thickness, weight discrepancies, and insufficient room for proper parachute packing. The new parts were machined carefully to meet both strength and packaging requirements.

Later, an additional batch of crimson powder was prepared to ensure a reliable supply of ejection charges for upcoming pop tests. Handling and mixing were performed cautiously to maintain safety and consistency in performance.

The activities concluded with a general progress meeting, where the team reviewed current achievements, discussed outstanding challenges, and outlined the next set of tasks to support rocket readiness.



FOR SKETCHES, DIAGRAMS AND GRAPHS
DATE.....

(Additional drawings, may be attached where necessary)
The student may also use this space for additional reports.

Crimson powder



Newly fabricated shear pins



New wind tunnel test jig fabrication



Student's Signature: Date.....

Comments by Lecturer/Supervisor:

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Name:

Signature..... Date.....



FOR THE USE OF THE UNIVERSITY SUPERVISOR ONLY

General comments on first/second/third (delete as appropriate) Visit.

Name of the Supervisor:

Signature of the Supervisor:

Date:

