TECHNICAL REPORT: Comparative Analysis of Launch Platforms

Module 4 Technical Report

Purpose

The purpose of this report is to conduct a comprehensive examination of a NASA mission supported by a specific launch platform, focusing on its objectives, scientific goals, stakeholders, and instrumentation. By analyzing the mission's characteristics and requirements, as well as its potential impact, students will gain a deeper understanding of the relationship between space missions and their launch platforms. Furthermore, this report engages students in critical thinking by challenging them to identify and evaluate an alternative launch platform for the chosen mission, considering both its advantages and limitations. Through this process, students will develop analytical skills and a thorough understanding of the variety of launch platforms supported by NASA Wallops Flight Facility.

Background

NASA's Wallops Flight Facility, located on the Eastern Shore of Virginia, stands as a cornerstone of America's space exploration efforts. Established in 1945, Wallops has evolved into a premier launch facility, specializing in a diverse array of missions spanning suborbital research, scientific exploration, and technology development. Operating under the guidance of NASA's Goddard Space Flight Center, Wallops boasts state-of-the-art facilities and a rich history of supporting groundbreaking missions that have contributed to our understanding of Earth, space, and the universe beyond.

At the heart of Wallops' mission is its commitment to advancing scientific discovery and technological innovation through the utilization of various launch platforms. From its expansive launch pads to its cutting-edge research facilities, Wallops offers a versatile and dynamic environment that can support a wide range of Earth and space exploration missions. Among the launch platforms supported by Wallops are sounding rockets, scientific balloons, airborne science platforms, and small satellites (small sats), each tailored to meet the unique requirements of specific missions.

Sounding rockets, a mainstay of Wallops' launch capabilities, provide researchers with access to the upper atmosphere and near-space environment, enabling them to conduct experiments and observations in regions beyond the reach of traditional aircraft. These suborbital missions, often lasting only minutes, yield invaluable data on phenomena ranging from atmospheric dynamics to cosmic radiation, contributing to our understanding of Earth's atmosphere and space beyond.

Scientific balloons represent another pillar of Wallops' launch infrastructure, offering scientists a cost-effective and flexible platform for conducting long-duration experiments at altitudes exceeding 100,000 feet. These balloons, equipped with sophisticated instrumentation, allow researchers to study a wide range of phenomena, including

atmospheric composition, cosmic rays, and celestial objects, with unparalleled precision and sensitivity.

In addition to sounding rockets and scientific balloons, Wallops supports airborne science platforms, such as research aircraft, which enable scientists to conduct observations and experiments within Earth's atmosphere. These platforms, equipped with advanced sensors and instrumentation, provide researchers with a unique vantage point from which to study atmospheric dynamics, climate change, and natural phenomena with high spatial and temporal resolution.

Furthermore, Wallops serves as a hub for the field of small satellite (small sat) technology, facilitating the rapid development and deployment of miniature spacecraft for a variety of scientific, commercial, and educational missions. Leveraging its expertise in launch operations and mission management, Wallops enables researchers to harness the capabilities of small sats to address pressing scientific questions and technological challenges in space exploration.

This technical report seeks to analyze NASA missions supported by Wallops' launch platforms and evaluate their potential for scientific and technological advancement.

Directions

Part I. Mission Selection. For this assignment, begin by selecting **one** of ten missions supported by NASA WFF below.

- NOTE: A single resource webpage is provided in the table below, however you will need to research and find additional credible resources to complete this assignment.
- IMPORTANT: You must choose a **different** mission than what was chosen for your Module 3 Technical Report.

Sounding Rocket Missions	
1	**Mission**: APEP **Objective**: To study the ionosphere during Solar Eclipses **Resource**: https://sites.wff.nasa.gov/code810/files/APEP_litho.pdf
2	**Mission**: RAISE **Objective**: To study radio waves that escape through the Earth's ionosphere **Resource**: https://sites.wff.nasa.gov/code810/news/story192.html
3	**Mission**: PolarNOx **Objective**: To measure the intensity of nitric oxide in the mesosphere and lower thermosphere in the polar region **Resource**: https://sites.wff.nasa.gov/code810/news/story202.html
Scientific Balloon Missions	
4	**Mission**: SuperBIT **Objective**: For the SuperBIT telescope to to map dark matter around galaxy clusters by measuring the way

	these massive objects warp the space around them **Resource**: https://blogs.nasa.gov/superpressureballoon/category/2023-campaign/superbit/
5	**Mission**: BARREL **Objective**: Study X-rays in Earth's atmosphere **Resource**: https://science.nasa.gov/mission/barrel
6	**Mission**: GUSTO **Objective**: Study all phases of the stellar life cycle **Resource**: https://science.nasa.gov/mission/gusto/
Airborne Science Missions	
7	**Mission**: IceBridge **Objective**: Image Earth's Polar Ice **Resource**: https://science.nasa.gov/mission/icebridge/
8	**Mission**: IMPACTS **Objective**: Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms **Resource**: https://espo.nasa.gov/impacts/content/IMPACTS
SmallSat Missions	
9	**Mission**: CeREs **Objective**: Study charged particle dynamics in Earth's radiation belts **Platform**: SmallSats **Resource**: https://science.nasa.gov/mission/compact-radiation-belt-explorer/
10	**Mission**: Firefly **Objective**: To study the relationship between lightning and Terrestrial Gamma-ray Flashes (TGFs) **Platform**: SmallSats **Resource**: https://smallsat.wff.nasa.gov/missions/firefly.php

Part II. Technical Paper Details. Once you have chosen a mission to focus on, do some research on the internet to gather information on the following:

Introduction

Your introduction should be engaging, contain a concise thesis statement, state the main ideas and subtopics clearly.

Body

In the body of the report, each component listed below should be a new paragraph. Therefore, there should be a minimum of four paragraphs for the body of the report. Within each paragraph provide details of the mission and justifications (where necessary) made in the design of this mission. ****See rubric for specifics***

1. **Mission Selection:**
    a. Choose one mission from the list provided.
    b. Clearly state the name of the mission, its objectives, science goals/research questions, and the purpose of the mission. Describe the science of the mission and why it is important.

    c. Is the mission Earth-based, Deep Space, Low Earth Orbit looking at the Earth, Low Earth Orbit looking at Deep Space, the Moon?
2. **Stakeholders and Impact:**
    a. Mission users/stakeholders: Who benefits from or uses the information produced by the mission?
    b. Who will benefit from and use the information? Who is the target audience? Who will be providing the funding for the Mission?
3. **Instrumentation:**
    a. Describe the instrument(s) used in the mission for data collection and analysis.
    b. Discuss their significance and contribution to achieving the mission's objectives.
4. **Secondary Platform Analysis:**
    a. Select one **alternative** launch platform from the following options: sounding rockets, scientific balloons, airborne science, or small satellites (small sats).
    b. Compare and describe a minimum of 2 potential advantages and 2 potential disadvantages of using the secondary platform for the mission, considering factors such as altitude,flight duration, scientific capabilities, instrumentation capabilities

Conclusion

- Wrap up your report by summarizing the main findings and insights you've discussed. Restate your thesis statement and briefly reflect on the significance of your analysis. Provide recommendations for further research or exploration.

Formatting

Your technical report should follow the below formatting guidelines. Please make sure to reference the *OWL Purdue APA Student Template for formatting assistance.*

- **Accepted APA Font Types**: 12-point Times New Roman; 11-point Calibri; 11-point Arial; 10-point Lucida Sans Unicode; 11-point Georgia; 10-point Computer Modern
- Your paper should include an introduction paragraph, at least 4 body paragraphs, and a conclusion paragraph
- **You should use in-text citations in your writing**
- Double-spaced
- Page numbers flush top right
- Title page containing appropriately formatted title, name, course, instructor and date
- Separate References page at the end - **YOU NEED A MINIMUM OF 3 REFERENCES**
- All references must follow APA format guidelines with hanging indent
- Correct spelling and grammar
- **Word Count**: Minimum 500 to maximum 1,200 words, **not including the title page and reference page**
- Follow APA in-text citation guidelines for quotes

Note: For a complete overview of APA, revisit our course APA presentation HERE or the OWL Purdue guidelines HERE.

Submission

Submit your assignment as a PDF to the assignment page. NOTE: It is your responsibility to review the PDF document *before* uploading it for grading. Sometimes formatting issues arise when converting a Word or Google Doc to a PDF, so please double check your paper before turning it in. Works submitted will be graded as is.

Grading

Scholars will be graded using the rubric attached to this assignment. Late submissions will be penalized according to the guidelines described in the rubric. Please read over the rubric before completing the assignment to achieve a successful score.