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A gateway to all space mobility solutions: Launch.ctrl software by Precious Payload

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Abstract

Launching an MVP (Most Viable Product) to space takes a village: systems, mechanical, software, and communications work together with mission designers and orbital mechanics to scope the project, and then with a small army of managers to weave together the supply chain of dozens of disparate vendors spread across the world. Space mission management is perhaps one of the hardest engineering and management challenges humanity has ever faced.

Precious Payload's developed software suite to solve the problem and make space logistics a commodity. Our key insight is that the end-user business objectives of a space mission can be decomposed into mission requirements using a common syntax. These requirements are easily translated into task orders for space industry contractors and regulators. We developed this translation layer for seamless movement of data and actions across teams of satellite developers and launch providers.

Our first product Launch.ctrl is a gateway to all space mobility solutions available on the market. During the mission design, more than half of the engineering time is spent conducting RFI/RFP (Request For Information/Request For Proposals) cycles and figuring out the best supplier for your mission.

Our ultimate goal for the Precious Payload software suite is to allow users to create a digital twin of an asset in orbit, providing a robust environment for testing, troubleshooting, and tasking the sensors onboard.

This paper will discuss the idea in detail and share practical experience with various software users.

Keywords: small satellites, space logistics, launch, rocket, payload, software

Acronyms/Abbreviations

Launch.ctrl: A software platform designed to streamline the process of space mission management;
RFI: Request For Information;
RFP: Request for Proposal;
KYC: Know Your Client.

1. Introduction

The goal of this paper is to present the software suite developed by Precious Payload that aims to simplify the process of space mission management. The software, Launch.ctrl, serves as a "gateway to all space mobility solutions" and streamlines the process of identifying and selecting suppliers, ultimately allowing customers to focus on their core business objectives.

The key insight behind the software is that the end-user business objectives of a space mission can be decomposed into mission requirements using a common syntax. This translation layer allows for seamless movement of data and actions across teams of satellite developers and launch providers. The ultimate goal of the software suite is to allow users to create a digital twin of an asset in orbit, providing a robust environment for testing, troubleshooting, and tasking the sensors onboard.

According to the Sifted Intelligence report "Spacetech: The big business of space on Earth" (2023), "Spacetech doesn't exist for the sole benefit of the space sector, it offers non-space organisations the opportunity to innovate [1]. Emerging applications of space-enabled technology are starting to influence our lives, and businesses, in ways that can't be ignored." This highlights the increasing importance of spacetech in not only the space industry, but also in other industries.

Additionally, the Space Capital report "Space Investment Quarterly Q4 2022" states that "Space technologies are the invisible backbone of the world's largest industries and they are playing an increasingly critical role in the global economy."[2] This further emphasizes the significance of space technologies and their impact on various industries worldwide. In this context, companies like Precious Payload are making an important contribution to the industry by providing software solutions like Launch.ctrl, which helps to fast-track the development of space technologies.

The scope of this paper includes a detailed discussion of the theory behind the software, the results of its implementation, and a practical experience with various software users. The paper will also compare Launch.ctrl with existing solutions in the market and discuss its advantages.

The organization of this paper is as follows: Section 2 will show the methods, tools, and instruments behind the software, Section 3 will present the theory behind the software, Section 4 will discuss the results, Section 5 will present the discussion, Section 6 will provide the conclusions, Section 7 will provide additional figures and tables, and Section 8 will list the references.

2. Instruments and methods

2.1 Data Collection and Analysis

2.1.1 Launch Schedule

Precious Payload's Launch.ctrl software is used to collect and analyze data on launch schedules and supplier capabilities in order to match the specific requirements of the satellite teams with available launch opportunities. The software tracks and publishes a real-time launch schedule of all commercially available slots for orbital and suborbital launches as well as for in-space transportation opportunities.

2.1.2 Know Your Client (KYC) Profile page, the Payload Data Room

The software also utilizes the Know Your Client (KYC) Profile page, the Payload Data Room, which helps build trust with suppliers and co-manifested payload partners. The data collected and analyzed using these tools allowes for a more efficient and effective decision-making process for the complex space missions. Additionally, the Payload Data Room feature was utilized to share specific requirements with vendors while keeping sensitive payload information secure.

2.1.3 Request for Information (RFI)

One more method used in Precious Payload's software toolkit is a Request for Information (RFI) tool, that gathers data and makes decisions for various space missions. The RFI tool is used to collect data on launch providers, including pricing, lead times, and product capabilities, and to distribute standard requests for proposals to a network of suppliers. Additionally, the Payload Data Room feature was utilized to share specific requirements with vendors while keeping sensitive payload information secure.

2.1.4 The Trade-off Analysis Tool

The Trade-off Analysis Tool, which allows for a comparison of different launch options based on factors such as risk, timeline, and budget, is also employed.

2.2. Implementation

The implementation of Launch.ctrl software is a straightforward process as it is an online software that does not require any downloads or installations. The following are the steps taken to implement and integrate the software with existing workflows:

1. Sign up for an account on the Launch.ctrl website: To start using the software, users must first create an account on the Launch.ctrl website. This involves providing basic information such as name, email address, and creating a password.
2. Configure the software: Once the account is created, users can access the software and begin configuring it to suit their specific needs. This includes setting up the project, adding team members, and configuring the software to integrate with existing workflows.
3. Link to other systems: To integrate the software with existing workflows, users can link it to other systems such as project management software, email, and calendar systems. This allows for seamless integration and streamlined communication between all systems.
4. Test the software: Before using the software in production, it is essential to test it thoroughly to ensure that it is working as expected. This includes checking that all integrations are working correctly and that the software is meeting the needs of the team.
5. Deploy the software: Once the software has been tested and configured, it is ready for deployment. Users can begin using the software to manage their space mission and collaborate with their team.

Overall the implementation process is designed to be simple, so that users can start using the software as quickly as possible, and can easily customize it to suit their needs.

3. Theory

Launch.ctrl is a web-based software that provides an end-to-end solution for space mission management, from mission design and planning, to procurement and launch coordination. The software includes features such as a mission design tool, a payload data room, and a supplier identification and selection tool. These features allow users to quickly iterate on mission designs, identify potential suppliers, and receive rapid feedback from suppliers. Additionally, Launch.ctrl provides actionable data to assist in go/no-go decision making for the mission.

3.1. Decomposition of Business Objectives

One of the key insights behind the software developed by Precious Payload is that the end-user business objectives of a space mission can be decomposed into mission requirements using a common syntax. This common syntax allows for ease of understanding and communication among different stakeholders, such as mission designers, orbital mechanics, and suppliers.

By breaking down the complex objectives into clear and concise requirements, it becomes easier to scope the project and identify the necessary resources. The decomposition of business objectives into mission requirements also helps to ensure that all stakeholders have a clear understanding of the goals of the mission and the resources required to achieve them.

3.2. Translation Layer

The Launch.ctrl software by Precious Payload also includes a translation layer that facilitates seamless movement of data and actions across teams of satellite developers and launch providers. This translation layer serves as a bridge between the mission requirements and the task orders given to suppliers, ensuring that all stakeholders are on the same page and working towards the same goal.

The translation layer also helps to streamline the process of identifying and selecting suppliers, ultimately allowing customers to focus on their core business objectives. By providing a common platform for communication and coordination, the translation layer helps to reduce the time and effort required for RFI/RFP cycles and supplier selection.

3.3. Digital Twin

The ultimate goal of the software is to allow users to create a digital twin of a space mission. A digital twin is a virtual replica of a physical asset that can be used for testing, troubleshooting, and tasking the sensors onboard. By creating a digital twin, it becomes possible to simulate the behavior of the asset in orbit, identify potential issues, and optimize the performance. The use of digital twin technology in the space industry has the potential to improve efficiency and reduce costs.

By providing a virtual replica of the space mission, it becomes possible to test and validate the performance of the sensors and subsystems before the launch, reducing the risk of in-orbit failures. Additionally, the digital twin can be used to monitor the health and performance of the asset in orbit, enabling proactive maintenance and reducing the need for costly and time-consuming re-designs of a satellite mission.

4. Results

4.1. Launch.ctrl capabilities

Launch.ctrl software was used in a variety of complex space missions, including ResearchSat's biological payload, stealth mode start-up’s Earth Observation mission for the agri-tech sector and climate change research, Steamjet's high-performance water-based propulsion system, Speqtral's Quantum key distribution (QKD) mission, and Zenno Astronautic's magnetic propulsion system, etc.

4.2. Integration with existing workflows

The online software can be integrated seamlessly with existing workflows and processes, allowing for streamlined communication and collaboration between all stakeholders involved in the space mission.

Launch.ctrl can be seamlessly integrated into existing workflows, allowing users to continue using their preferred tools and systems. For example, ResearchSat was able to use Launch.ctrl to find the launch for their suborbital space mission and sign with a launch provider, resulting in a more efficient and streamlined workflow. Similarly, Steamjet

was able to use Launch.ctrl to streamline their launch procurement process, resulting in significant savings in both time and money.

4.3. Streamlining of the process of space mission management

The use of Launch.ctrl resulted in a significant reduction in the time and cost required for space mission management, with clients reporting an average saving of 100+ engineering hours and actionable feedback in under 20 days. The software's ability to quickly create and iterate mission designs, identify potential suppliers, and provide rapid feedback from suppliers using the payload data room empowers engineers with actionable data to make go/no go decisions for their mission.

5. Discussion

The results of this study show the practical application and effectiveness of the Launch.ctrl software in streamlining the process of space mission management. The case studies of various users demonstrate the software's ability to integrate with existing workflows and provide actionable data for decision-making.

When compared to a few existing solutions, that exists only in Beta-testing stage, Launch.ctrl stands out for its product readiness and ability to quickly create and iterate mission designs, identify potential suppliers, and provide rapid feedback from suppliers using the payload data room. This allows for efficient and cost-effective space mission management, particularly for complex missions with a high-risk profile.

The future plans for the software include continuing to improve the capabilities and user experience, as well as expanding its application to other sectors such as telecommunications and Earth observation. Additionally, further research can be conducted to investigate the long-term effects of using Launch.ctrl on the success rate and cost savings of space missions.

Overall, the results of this study demonstrate the potential of Launch.ctrl to revolutionize the space industry by streamlining mission management and reducing costs while increasing efficiency. It is a valuable tool for engineers and organizations working on complex space projects and has the potential to make space missions more accessible to a wider range of players.

6. Conclusions

6.1 Summary of the main findings

Launch.ctrl is a powerful and innovative software that streamlines the process of launch procurement and space mission management. It provides a comprehensive platform for managing all aspects of a space mission, from design to launch, and allows users to easily integrate with existing workflows. The software has been used successfully by several companies in the space industry, including ResearchSat, Steamjet, Speqtral, Zenno Astronautics, and others.

6.2. Implications for the space industry

The use of Launch.ctrl software can greatly improve the efficiency and effectiveness of space mission management, thus leading to reduced costs, shorter lead times, and better mission outcomes. This is particularly important for companies working on complex and high-risk missions, as it allows them to make informed decisions and mitigate risks. The software's ability to integrate with existing workflows, as well as its ability to provide rapid

feedback from suppliers, also makes it a valuable tool for companies looking to expand their capabilities and enter new markets.

6.3. Recommendations for future work

In order to fully realize the potential of Launch.ctrl software, it is important to continue to develop and improve the software to meet the evolving needs of the space industry. Additionally, further research is needed to explore the potential of using the software in other areas of the space industry, such as satellite manufacturing and ground operations. Furthermore, exploring the integration of the software with other technologies, such as artificial intelligence, to enhance the decision-making process. In the future, the software could also be adapted to manage other types of space missions, such as lunar and interplanetary missions.

References

[1] Sifted, Intelligence report, Spacetech: The big business of space on Earth, 2023 https://seraphim.vc/wp-content/uploads/2023/01/Spacetech-Sifted-1.pdf

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