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Respondent

11 Aakash Shah

15:28
Time to complete

1. Below please include a brief project summary and your requested changes. *

The Illinois Space Society is spearheading an innovative initiative focused on developing an environmentally sustainable, reusable rocket fitted with a state-of-the-art hybrid engine. Unlike traditional rocket engines that often utilize hazardous materials, our hybrid engine employs a unique and environmentally friendly combination of nitrous oxide and oxygen as the oxidizer and paraffin wax as the solid fuel. Our hybrid engine makes use of two propellants in different phases. The solid fuel, paraffin wax, is incredibly common and is used in most household candles. The liquid oxidizer is Nytrox, which is a mixture of oxygen and nitrous oxide, a gas used as an anesthetic for a variety of medical applications which is non-toxic as well. Hybrid rocket engines are also much safer for the students, not just the environment. Since the oxidizer and solid fuel are stored separately and cannot begin combustion without some form of ignition, the storage and use of hybrid engines is safer in comparison to a solid rocket motor that could ignite at any time.

Due to their nature, hybrid rocket engines are more reusable and sustainable than conventional solid rocket engines, as they can constantly be recycled for new use. In addition to that, solid rocket motors tend to include many harmful chemicals such as a Composite Propellant and Aluminum powder, which while not inherently harmful, pose a serious risk to the environment should a containment failure occur. This is not a risk with our design, as our engine is based upon paraffin wax, something we all know more commonly as candle wax. Overall, our project's goal is based on sustainability. Solid engines are harmful to the environment as they emit harmful byproducts and can only be used once; with a Hybrid engine, not only are we reusing the rocket after launch and recovery, but we are also using nontoxic fuel. In addition to its sustainability, the rocket is designed to be reusable, featuring a parachute system that ensures all components are safely returned to Earth, thereby minimizing waste and further reducing environmental impact.

Safety is another cornerstone of this project. The hybrid engine design stores the oxidizer and solid fuel separately, drastically reducing the risk of accidental ignition and providing a much-needed safety layer for both students and faculty involved. Beyond its technical and environmental merits, the project serves as an educational platform. This not only supplements their academic coursework but also provides them with invaluable hands-on experience, as they are actively involved in the design, assembly, and testing phases of the project. Importantly, our project is uniquely inclusive, as it is not restricted by International Traffic in Arms Regulations (ITAR), thereby enabling international students to participate—an opportunity often denied to them in other rocketry projects. Finally, the project's findings have been formally documented and published in an AIAA journal, contributing to the broader scientific community's understanding of sustainable rocket propulsion technologies.

2. Project Name: *

Illinois Space Society: Hybrid Rocket Engine

3. Date of Scope Change Submission *

10/13/2023

4. Type of Scope Change: *

- ○ Project Direction
- ◉ Budget
- ○ Timeline
- ○ Project Advisor/Financial contact
- ○ Project Lead

5. Please provide a detailed description of the requested budget change, increase, decrease or returned funds. *

While our initial budget was meticulously planned to account for all anticipated expenses, we encountered an unanticipated financial barrier related to insurance costs for testing the hybrid rocket engine. In order to test our engine at Willard Airport, they require us to purchase an expensive airport aviation liability insurance policy. This expense was not included in our previous budgets as we did not anticipate this requirement being imposed by Willard.

As a result, we are requesting an increase in funding for the following budget items:

Initial Total Budget: $10,000 (initial from 2018) + $5,000 (additional funding from 2021) + $6,000 (additional scope change)

Additional Requested Funds for Unforeseen Insurance Costs: $5,500

It's worth noting that despite this unforeseen hurdle, our commitment to sustainability and safety remains steadfast. Our hybrid engine, which uses an oxidizer combination of nitrous oxide and oxygen along with paraffin wax as fuel, is a greener and safer alternative to commonly used solid rocket motors. We believe that the added insurance costs are a necessary investment to ensure the safe and compliant development of this environmentally friendly technology. Insurance costs are a critical and non-negotiable component of any project that involves high-risk activities such as rocket testing. This is even more important in the context of a university setting, where the safety of the students, faculty, and facilities must be ensured. When we initially planned our budget, we overlooked the insurance requirements for hot fire testing the hybrid rocket engine. This oversight was an unanticipated financial barrier that we did not foresee at the project's inception.

The airport is required to comply with both university and industry standards when it comes to combustion testing on their grounds, ensuring that any potential liabilities are covered and that we operate within the legal and safety protocols. Without this insurance, we would be unable to proceed with the critical hot fire testing phase of our rocket engine, effectively halting the project's progress and nullifying the educational and practical experiences gained so far.

Therefore, we are seeking additional funding specifically to cover these unforeseen but essential insurance costs. These costs are not merely an administrative formality; they are a gateway that enables us to advance to the testing and eventual launching stages of the rocket. Meeting these insurance requirements will allow us to conduct tests in a manner that is both legally compliant and maximally safe for all involved.

Given these factors, we request a budget modification to include the additional funding needed for insurance. This will ensure that our project not only meets educational and scientific goals but also adheres to the highest safety and legal standards.

6. Please upload your updated Supplemental Budget and Timeline spreadsheet here
Fill out the detailed expenditures Excel sheet, and submit it below.

https://studentengagement.illinois.edu/student-sustainability/ssc/docs/SSC-Supplemental-Budget-Timeline.xlsx *

SSC-Supplemental-Budget-Timeline_Hybrid_Proje_Aakash Shah.xlsx

7. Additional comments (Optional) *

This is the home stretch of a multi-year project, aiming to complete it by the end of this academic year. Our team, which I've been a part of since my freshman year, is fully committed to the mission: of building a sustainable rocket propulsion system. This has been no easy task; it's a complex, high-stakes endeavor that has taught us so much about how to be better engineers.

The Illinois Space Society has always been about more than just rockets; it's about preparing the next generation of engineers to think critically and ethically. This project serves that mission by challenging us to design a propulsion system that is not just powerful, but also sustainable and safe for the environment, something most other collegiate rocketry clubs don't focus on.

We're proud of the progress we've made, but we also know we couldn't do it without SSC's support. We're hoping that with SSC's continued backing, we can finally see this project through to its conclusion and accomplish something that no other student group at UIUC has done before.