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Standard Form 901 (11-18)
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Proposal Evaluation Form

Factor 1. Scientific/Technical Merit and Feasibility

Reviewer: 1

Strengths:

This is a strong proposal with well motivated claims and significant preliminary work. This proposed work fits the respective subtopic well. There is a strong comprehension of the problem, and potential of the proposed innovation. There is an appropriate appreciation of risk (for example the increased radiation and challenges associated with high speed flight as well as an awareness of power systems required to achieve 24/7 flight) and the method of approach to the technical problem will address potential risk through both physical prototyping and development of analogous models to optimize design computationally and gain knowledge of performance in applicable environment.

Weaknesses:

no weaknesses noted.

Reviewer: 2

Strengths:

The SP-Drone "Towed Platform" presents an interesting design which utilizes a thin plate cambered airfoil to achieve solar powered 24/7 flight. The airframe is intended to be scalable, increasing the scope of interest to many aerospace applications. The base case may achieve a speed of 280 mph with projected max speed of 560 mph. Application to the NASA mission includes area 18 (electric aircraft propulsion and zero emission technologies), areas 12 and 16 (launch and landing systems from self-sustaining airborne aircraft carriers above 120,000 ft including the usage of advanced fuels and chemicals) and area 20 (enhanced safety).

Weaknesses:

Several listed applications that focus on the contribution to the NASA mission fit more as secondary results. The core technical objective and deliverables are distant from the implied NASA contribution.

Factor 2. Experience, Qualifications and Facilities

Reviewer: 1

Strengths:

From the discussion of previous prototyping work and progress made with design in summer 2022 a reviewer can assume they have suitable facilities to continue to perform this work. This is a well form teamed with a diverse experience of knowledge that is suitable to the technical challenges including knowledge of aerospace, materials, and alternative energy.

Weaknesses:

No direct and explicit disucssion of facilities.

Reviewer: 2

Strengths:

The project principal investigator, Galen J. Suppes is a chemical engineering Ph. D with interest in advancing efficient aircraft designs using airfoil superstructures. He is the CEO of Homeland Technologies, LLC and also has experience as a chemical engineering professor. He is also supported by Adam Suppes, a chemical and biomolecular Ph. D with some experience using CFD. Homeland Technologies will have access to a metals and machining lab, electronics lab, wood/plastic fabrication lab, and 3D printing facilities to support the prototype fabrication.

Weaknesses:

Experience with aircraft design and general aerospace concepts seems limited. Both Galen J. Suppes and Adam Suppes are distinguished Ph. D researchers in chemical engineering with limited publications and work experience in CFD, aircraft design, and optimization. Computer hardware upgrades are necessary with product license to support CFD analysis, a second 3D printer purchase is requested.

Factor 3. Effectiveness of the Proposed Work Plan

Reviewer: 1

Strengths:

The work plan includes iterative design, and demonstration which will rapidly advance and enhance the development and potentially TRL. This is further strengthened by the coupling of prototyping and physical demonstration with computational modeling via digital twin development for calculations used to further understand and validate the performance of the design. The digital twin also being used for scale up will be beneficial.

Weaknesses:

no weaknesses noted in work plan.

Reviewer: 2

Strengths:

A comprehensive work plan with detailed labor distribution is presented to satisfy the listed deliverables. Usage of facilities and requested materials is detailed for prototype fabrication. Preliminary results discuss initial findings with cambered airfoils in 2D CFD.

Weaknesses:

A core deliverable, and expenditure, for this work plan relies on the successful implementation of CFD aided airframe design. Some concern exists with the proposed work plan regarding CFD implementation, validation, and design.

Results of SimFlow CFD are presented with limited simulation detail. Low quality images of 2D airfoils present pressure contour variations with increased camber. 3D effects are not addressed, stability and control analysis is not prioritized.

Energy consumption validation and absent propulsor simulation validation are to be performed between CFD model and tested aircraft. Experimental data collection and analysis might in the flight test field will make CFD validation challenging. Wind tunnel testing would provide a much better comparative test, eliminating environmental factors such as gusts and allowing for instrumentation for true lift and drag measurements.

Several questions regarding the methodology for design optimization, CAD model generation and modification, and manufacturing tolerance/accuracy exist as well.

Factor 4. Commercial Potential and Feasibility (Adjectival)

Reviewer: 1

Comments:

This proposed innovation has strong potential to be disruptive in crosscutting markets. 24/7 low energy consuming sustained flight is of significant interest for myriad applications and has synergy with many NASA CAS initiatives.

Reviewer: 2

Comments:

There is commercial potential and feasibility for the SP-Drone "Towed Platform". A unique design for a solar powered drone with 24/7 hour flight capability at moderate speeds may be of interest for several aerospace applications. The technology is a patented design by the principal investor, Galen J. Suppes. There is one prior award in 2015 through the National Science Foundation for SBIR Phase 1 convection.