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E – FALCON (REUSABLE ELECTRIC ROCKET)

Christopher N[1], Dasam Venkata Manikantan[2], Dhanush B Gangatkar[3], Prof. Shilpa Chippalakatti[5]

[1,2,3]UG Scholars, Dept. of ECE, *Sambhram Institute of Technology, Bengaluru-97*

[5]Asst. Professor, Dept. of ECE, *Sambhram Institute of Technology, Bengaluru-97*

manikantandv@gmail.com

ABSTRACT

A reusable electric rocket made of drone parts is an effective way to develop a more affordable and environmentally friendly space launch system. By employing drone technical advancements like electric propulsion and lightweight materials, this type of rocket aims to provide a safer and more trustworthy alternative to conventional rocket systems. Utilizing electric propulsion provides several benefits, including reduced emissions and operating expenses, while combining drone components ensures better design and manufacturing flexibility. The development of a reusable electric rocket employing drone parts is a significant step towards developing a more sustainable and in expensive space launch capability for Cargo shipment to international space station.

I INTRODUCTION

The development of reusable electric rocket prototypes marks a new era in space exploration, promising to revolutionize the way we access and utilize space. Traditional rocket systems have been plagued by high costs, limited reusability, and negative environmental impacts, making space exploration and satellite deployment an expensive and unsustainable proposition. However, the advent of reusable electric rockets offers a more sustainable and cost-effective alternative to traditional rocket systems, leveraging electric propulsion technology and the ability to land and be reused for multiple missions.

Reusable electric rockets offer several advantages over traditional rockets. Firstly, the use of electric propulsion technology offers a more environmentally friendly alternative to traditional rockets, which rely on highly polluting fossil fuels. The electric propulsion system can significantly reduce emissions and the environmental impact associated with traditional rocket systems. Secondly, reusable electric rockets can drastically reduce the cost of space exploration and satellite deployment by allowing the same rocket to be used for multiple launches, resulting in significant cost savings for launch providers and their clients. Lastly, reusable electric rockets offer greater flexibility in design and operation, allowing engineers to optimize the rocket's propulsion, control, and landing systems for maximum efficiency and safety.

A crucial step in the development of the reusable electric rocket is the prototype stage. During this phase, engineers evaluate and improve the rocket's propulsion, landing, and design in order to guarantee its security, dependability, and affordability. The electric propulsion system, a crucial element of the rocket's design, can be tested for effectiveness during the prototype phase. The prototype's success will pave the way for the creation of bigger and more powerful reusable electric rockets, opening up access to space for a wider range of businesses, institutions, and

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people for scientific, commercial, and educational objectives.

Several companies and organizations have already started developing reusable electric rocket prototypes, such as SpaceX, Blue Origin, and Virgin Galactic. These companies are leveraging the latest advances in electric propulsion technology, including efficient battery systems and lightweight materials, to develop safe, reliable, and cost-effective rockets. The reusable electric rocket prototypes developed by these companies are designed to launch and land vertically, making them suitable for a range of applications, including satellite deployment, space tourism, and human spaceflight.

In conclusion, the development of reusable electric rocket prototypes marks a significant milestone in the history of space exploration and a promising step towards a more sustainable and accessible future in space. The success of the reusable electric rocket prototype will pave the way for a more cost-effective, reliable, and environmentally friendly space launch capability, enabling a broader range of organizations and individuals to access and utilize space for a variety of purposes.

II LITERATURE SURVEY

[1] Sheetz, Michael (25 February 2021). "Relativity Space unveils a reusable, 3D-printed rocket to compete with SpaceX's Falcon 9". CNBC. Archived from the original on 25 February 2021. Retrieved 31 July 2021.-

Five Two-Stage-To-Orbit Reusable Launch Vehicles (RLV) with stages propelled by rocket engines, turbojet engines, and Rocket Based Combined Cycle (RBCC) engines were the subject of this study. We also looked at direct versus lifting ascension trajectories and horizontal versus vertical takeoff launch.

[2] "Capabilities & Services" (PDF). SpaceX. 2022. Archived (PDF) from the original on March 2022. Retrieved 22 March 2022.

The Terran 1 is a next-generation launch vehicle created for constellation deployment and resupply in the future. Its ground-breaking, distinctive, and software-driven architecture can adapt to satellite clients' changing needs while also offering the most flexible and reasonably priced launch service available today. The most cutting-edge product to come out of the aerospace manufacturing sector since the beginning of the privatisation of space is Terran 1, which was designed and printed in the United States.A decade agoFive Two-Stage-To-Orbit Reusable Launch Vehicles (RLV) with stages propelled by rocket engines, turbojet engines, and Rocket Based Combined Cycle (RBCC) engines were the subject of this study. We also looked at direct versus lifting ascension trajectories and horizontal versus vertical takeoff launch.

[3] The small launch vehicle surveys a 2021 update (The rockets are flying) Author links open overlay panel by Carlos Version of Record 26 August 2022.

Finding current commercial (or explicitly stated commercial) initiatives in the area of tiny launch vehicles is the aim of this survey. We set forth a few criteria for inclusion on the list before we began the survey. This was required in order to define what a "active effort" was and to narrow the field. These conditions are merely intended to act as a filtering mechanism; they are neither scientifically rigorous nor comprehensive. the specifications, with a few small differences.To pinpoint the most important aspects of each system's architecture, information that was readily accessible was analysed. The launch vehicles are briefly described in this section, and then the next section focuses on important operational and commercial factors. Not all businesses will be included in all tables due to missing data.

[4] “A Review of Reusable Launch Vehicle (RLV) Technologies (2019)”, March 2019. - The many reusable launch

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vehicle concepts, including reusable electric rockets, that have been proposed or produced over the past few decades are thoroughly reviewed in this paper. The writers examine each technology's possible uses in space travel and exploration as well as its benefits and drawbacks.

III METHODOLOGY

A. Block diagram of Proposed System

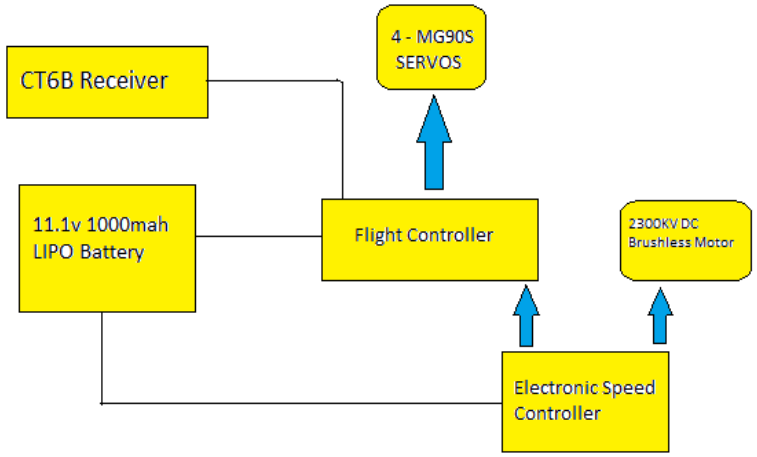

Fig.1 Block diagram of the proposed system

Fig.1 shows the Block diagram of the prototype, Its main component is a flight controller of any choice which has good stability, the one being used here is a KK2.1.5 flight controller, for a thrust of around 1Kg, a right propeller and a motor must be used of ratings of 2300kv or greater with high RPM, The propeller size must be of either 5 or 6 inches respectively, it's recommended to use a 3S lipo battery of 1000mah than 2000mah for less weight of around 80grams per battery, four servo motors are used for thrust vectoring control of the rocket prototype, servos are connected to Air vanes to tilt it based on the Gyroscope and accelerometer values. The servos used here are MG90S which is good for aircraft, a 30ampere electronic speed controller used for powering up the motor, and the flight controller and controlling the current supply to the motor, The PID values of the flight controller must be properly calibrated on a flat surface and a lot of testing must be done on its stability, CT6B receiver is used to control the Aileron, rudder, elevator of the prototype, CT6B transmitter is used for transmitting the signals to the receiver

The Components Used are -

1) KK 2.1.5 Flight Controller
2) MG90S Servo Motor
3) 30A Electronic Speed Controller
4) XT60 Connectors
5) ABS Filament for 3D printing
6) 1000mah 3S 11.1v Li-po battery
7) CT6B Transmitter and Receiver

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8) 2300kv FPV drone motor

B. Model Design

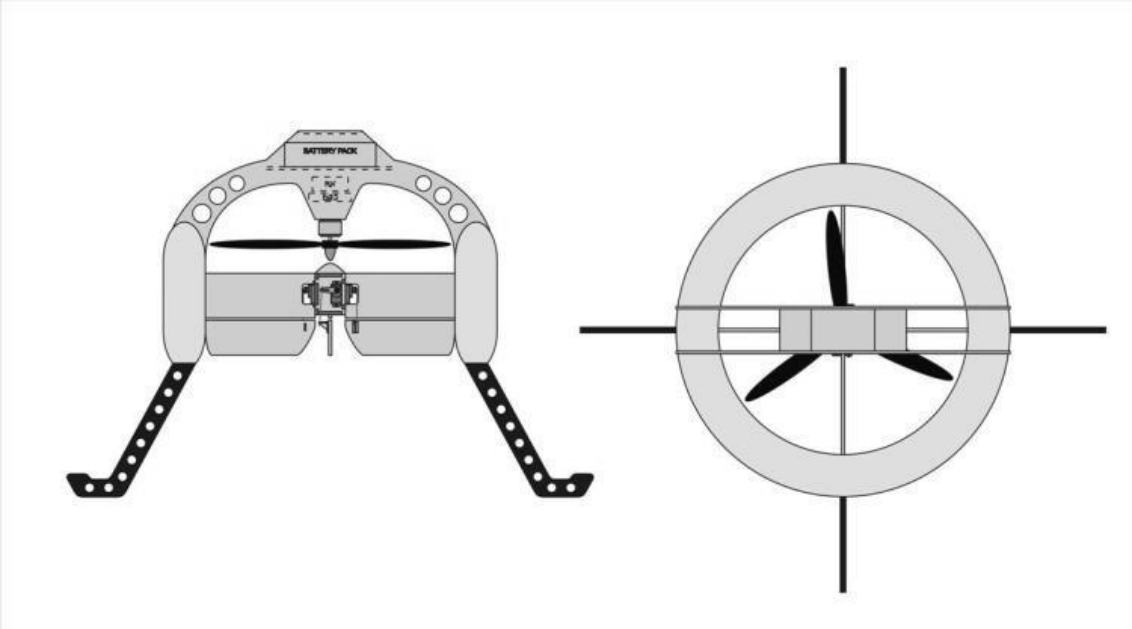

Fig.2 Model Design of the proposed system

From Fig.2 is an reference model design, which is to be modified and the exact dimensions are 3d printed using ABS or PETG filament for better Durability and Flexibility, the 2300kv motor provides the necessary thrust of 1KG to lift the rocket to some meters of height, the four air vanes control the moment of the model and base support is used for its landing, for the payload part another 3D model which looks like a dome must be printed and designed on Autodesk Fusion 360, For stability lot of calibration has to be done on the rudder, aileron, and elevator, Centre of mass must be perfectly known so that the prototype is stable.

C. Software

1) **Autodesk Fusion 360** - Fusion 360 is a software application created by Autodesk for use in commercial computer-aided design, computer-aided manufacturing, computer-aided engineering, and printed circuit board design. It is accessible for both macOS and Windows, while streamlined applications are offered for iOS and Android smartphones. In many different areas, including product design, engineering, and architecture, Autodesk Fusion 360 is a potent 3D modelling and design tool. It is a complete piece of software that provides a wide range of features and tools for making intricate 3D models..

2) **JLCPCB Designer-** is a high-tech manufacturer that specialises in rapid PCB sample and small-batch PCB manufacturing. It is the largest PCB prototype company in China.

IV CONCLUSION

In conclusion, the development of reusable electric rocket prototypes is an exciting and promising area of research in the space industry. The use of electric propulsion technology and reusable designs can significantly reduce the cost

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and environmental impact of space exploration. The literature survey shows that there is ongoing research and development of reusable electric rocket prototypes for various applications, including small satellite deployment, lunar missions, and commercial space tourism. The use of drone components, onboard energy storage, and modular designs are some of the innovative approaches being explored in the development of these prototypes. As the technology continues to advance, reusable electric rockets have the potential to enable greater access to space and support a wide range of scientific and commercial applications.

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