IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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CONCEPTUAL RESEARCH ON A MARS UNMANNED AERIAL VEHICLE BASED ON SUPER LARGE ROTORS

Abstract

Mars is one of the most important destinations for human deep space exploration, however, the rugged and complex environment of Mars make it difficult for Mars rovers and other probes to move and explore on the surface of Mars. Highly mobile Mars drones can effectively overcome this difficulty and improve the efficiency of Mars surface exploration. However, there are significant differences in the atmospheric environment between Mars and Earth. The extremely low atmospheric density on the surface of Mars poses a great challenge to the design of Mars unmanned aerial vehicle.The payload capacity and flight implementation of Mars drones are severely limited. Therefore, this article proposes a new concept based on the super large rotor Mars drone, which can not only be used as a probe independently, but also replace the existing "sky crane maneuver" to help Mars rovers land. The super large rotor uses inflatable wings to achieve efficient folding inside the rocket, while utilizing the centrifugal force generated by wing rotation and distributed power to unload the load at the wing roots, thereby generating sufficient lift with an ultra lightweight structure. On the basis of this new concept, this article conducts research on its conceptual design, uses computational fluid dynamics methods to optimize its aerodynamic shape design, and analyzes its aerodynamic efficiency; Analyzed the mechanical loads on its wings and developed an overall design plan for the aircraft. The calculation results indicate that this Mars unmanned aerial vehicle can generate 70N lift per kW of power during hovering, and its payload capacity can reach over 500kg.