

Conceptual design of a UAV for Mars

Hector Anadón* and Pol Fontanes*

First approach to Mars UAV conceptual design. Previous studies suggest that this kind of aerial machines could perform well on Mars. Background papers about this subject will be studied in order to present a UAV conceptual design.

Nomenclature

x	Variable value vector
F	Force, N
m	Mass, kg
Δx	Variable displacement vector
α	Acceleration, m/s ²
ρ	Density, kg/m ³
<i>Subscript</i>	
i	Variable number

I. Background

Significant technology advances have enabled planetary aircraft to be considered as viable science platforms. Such systems fill a unique planetary science measurement gap, that of regional-scale, near-surface observation, while providing a fresh perspective for potential discovery.¹

Different approach have been made and among those, the most interesting at the time of conceiving our own design where:

Plane lander ARES mission from NASA, aims to control a powered plane during its guided descent on Mars. Final design has been decided² and a half scale model test on high altitude Earth atmosphere.

Inflatable wings plane Similar to ARES missions have been conceived, to be more concrete, some researchers are trying to deploy inflatable wing structures in order to reduce weight and get more lift on the Mars atmosphere.³

Hybrid research drone From German Aerospace Centre (DLR), a concept and approaches for hybrid Mars exploration UAV is outlined.⁴

II. Proposal

Mars atmosphere is so much thinner than Earth's one and also its principal gas is CO_2 . These two facts compromise flying vehicles behaviour, that will require, new conceptual designs to operate as on Earth.

III. UAV specifications

*Aerospace engineering student, ESEIAAT.

References

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²SC C. Smith, M. D. MD Guynn, R. W. RW Parks, PA A. Gelhausen, M. A. Croom, SC C. Smith, R. W. RW Parks, and PA A. Gelhausen. Evolution of a Mars Airplane Concept for the ARES Mars Scout Mission. *Aiaa*, (September):1–16, 2004.

³Andrew D. Simpson, Osamah A. Rawashdeh, Suzanne W. Smith, Jamey D. Jacob, William T. Smith, and James E. Lumpp. BIG BLUE: High-altitude UAV demonstrator of mars airplane technology. *IEEE Aerospace Conference Proceedings*, 2005, 2005.

⁴Csaba Singer. Ultralight Solar Powered Hybrid Research Drone. *Concepts and Approaches for Mars Exploration*, 2:2, 2013.