Titan Organic Explorer : a one kg UAV for Organic Compounds Search

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Context: Together with Earth, Titan is probably the only place in the Solar System where the use of UAVs is favoured (Mars atmosphere is too tenuous). The combination of a thick atmosphere with low gravity makes it extremely tempting to use UAVs as reconnaissance vectors around any Titan Lander. Several papers have considered this possibility [1,2]. Based on an in-house design of UAV, we therefore propose a similar approach, but we will perform the imaging at local scale of the Lander surroundings, with a focus on the search of organic compounds. The overall mass of such a vector (<1 kg) would make it compatible with payload mass allocated to Titan missions ([4]).

Fig 1: Space X-Microcamera [5]

Payload and Scientific Objectives: Due to the strong mass constraints, we have to limit the payload to the necessary extend. The payload will be therefore limited to a small NIR "webcam" (approx 150 g), based on a Rosetta-like design [5] with die-stacking technology, to augment the descent cameras and look for organic compounds in the micrometer range (The Titan low temperature allowing the focal plane operating without any cooling) Final IR operating window will result from a trade-off between focal place complexity and scientific return. A pressure sensor, used for control, will also provide information on the atmospheric boundary layer.

Mission Concept The mission concept will ultimately depend on the UAV carrier. Two options shall be considered: deployment from a Mongolfiere or more likely deployment from a Titan Lander (possibly a lake lander). After landing, the UAV batteries will be charged and heated to the maximum extend, and the UAV will take off to make its pre-programmed reconnaissance flight. A 30 min flight seems yet to be a good compromise between scientific return, thermal and energy constraints.

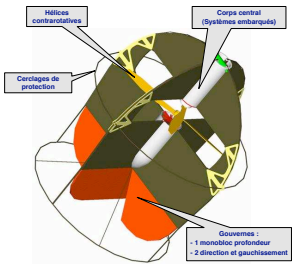

Fig 2 : Vision'Air UAV

Technical Challenges and Preliminary sizing: Preliminary lift sizing has been done yet on stationary flight (sizing case). The overall performance will eventually result from the thermal control performance of the battery package cocoon. Foreseen critical technology demonstrations include brushless motor at very low temperature and battery cocoon performances. The baseplate remaining on the lander, which encloses the DC/DC, the battery charging electronics, the communication payload (UHF TBC) and the Lander bus interface shall have its mass strongly minimized.

References

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[4] Titan Saturn System Mission Joint Titan Saturn System Mission Science Definition Team Summary report NASA/ ESA January 16, 2009
[5] http://www.microcameras.ch/files/products.htm