

DAS-CUBES

Independent Emitter/Receiver Cubesat Configuration for Planetary Atmospheric Measurements

Cassandra Sands¹, Ed Wilson², Yupo Chan³, Adam Huang⁴

¹University of Arkansas, Center for Space and Planetary Sciences cmsands@uark.edu, ²Harding University, Searcy, AR ³University of Arkansas, Little Rock, ⁴University of Arkansas, Fayetteville

Spacecraft & Instrument Concept:

- A state of the art, low cost atmospheric detection platform, referred to as the Diurnal Atmospheric Surveyor CubeSats (DAS-Cubes)
- The DAS-Cubes system is a constellation of spacecraft, consisting of
 - DAS-E (emitter) with an light source of known intensity and spectrum
 - DAS-C (chaser) with receiving instrument & tracking capabilities
- Combined system is capable of achieving high quality measurements of atmospheric or other material in between the two spacecraft
- Spacecraft distance and vector separation can be dictated to control spatial and temporal resolution
- Components and capabilities of the system will be developed and tested as part of phased projects (ARKSAT-1 and ARKSAT-2)
- Project also includes development and in-orbit testing of novel CubeSat propulsion system and de-orbiting mechanism
- Satellite system will be tested and demonstrated in Low Earth Orbit, with applications throughout the solar system

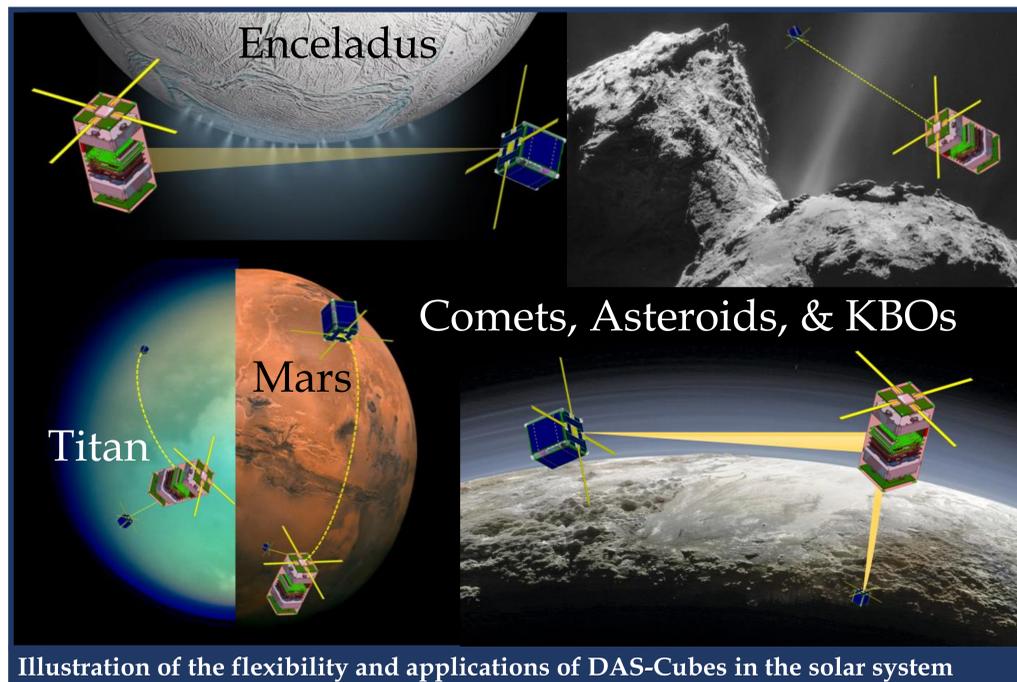
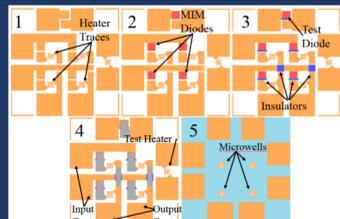
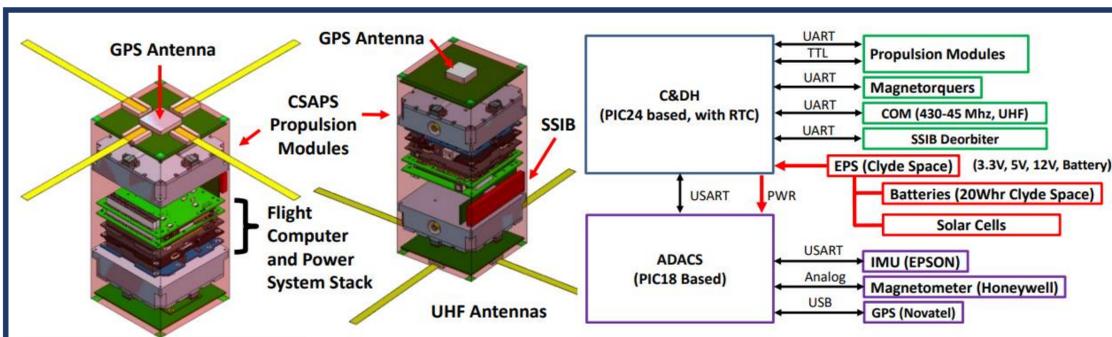


Illustration of the flexibility and applications of DAS-Cubes in the solar system

[3] Left: Top-down mask views of the Generation 1 integrated SSGG: 1) Contacts and heaters. 2) MIM diodes. 3) Isolators. 4) Bridges. Also shown are device elements. 5) Microwells.



[3] Right: Solid State Inflation Balloon. Simple, reliable, low-cost small sat deorbiting mechanism.



[4] ARKSAT-2 schematic (left) & computing and power system diagram (right)

Planetary Science Applications:

The applications of the DAS-Cubes system throughout the solar system are numerous, and include measurements of: planetary atmospheres and transient surface processes, biosignatures indicative of extraterrestrial life, plumes on icy moons, ejecta, comet tails, and asteroid dusts. A paired dynamic emitter/receiver spacecraft system able to achieve high quality data would expand our horizons for low cost technology platforms, allow a deeper understanding of planetary atmospheric composition and dynamism, and aid in search for extraterrestrial life. Achieving global atmospheric measurements and spatial and temporal resolution of measurements will require much longer data acquisition times than has previously been accomplished via stellar and solar occultations and could be greatly augmented by the flexibility of an independent spacecraft with a light source of known intensity, spectrum, and source distance. The DAS-Cubes system is intended to investigate the applicability of this spacecraft concept to other bodies in the solar system, as well as ultimately demonstrate some of these capabilities in Low Earth Orbit.

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ARKSAT-1:

- 1U CubeSat
- Initial flight demonstration for UA CubeSat
- SSIB Deorbiter Module
- High-power LED for ground tracking
- Achieve LEO to surface atmospheric measurements

Selected for launch under NASA's 8th Cubesat Launch Initiative (CSLI-8)
Delivery April 2020

ARKSAT-2:

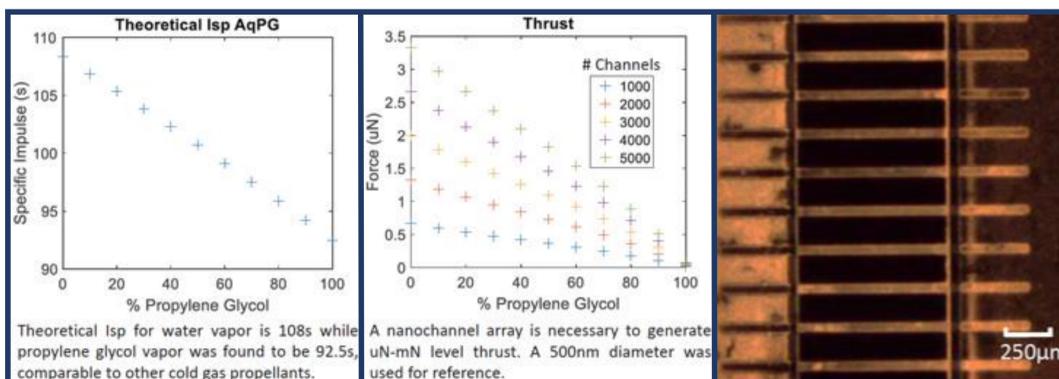
- 2U CubeSat, build on ARKSAT-1 technology
- Chasing/tracking demonstration
- Novel CubeSat Agile Propulsion System (CSAPS) used for attitude control

Launch via ISS Cygnus Resupply
Delivery July 2020

DAS-Cubes System:

- 1U & 2U CubeSat pair min. constellation size
- Combine tracking/chasing capabilities to achieve high-quality scientific measurements
- Able to control distance and vector between spacecraft

Orbit details and delivery date under investigation



[2] CSAPS-a biocompatible, unpressurized nanochannel propulsion system. Calculated ISP (left), thrust (center) and 50 μ m channels etched onto silicon (right)

References:

- [1] NASA/JHUAPL/SwRI. (2015) New Horizons Mission. [2] Lee, J., and Huang, A. (2017) AIAA Small Satellite Conference [3] Roddy, M., and Huang, A. et. al. (2016) ASME IMECE2016-67467 [4] Huang, P. (2016) NASA EPSCoR ISS Proposal