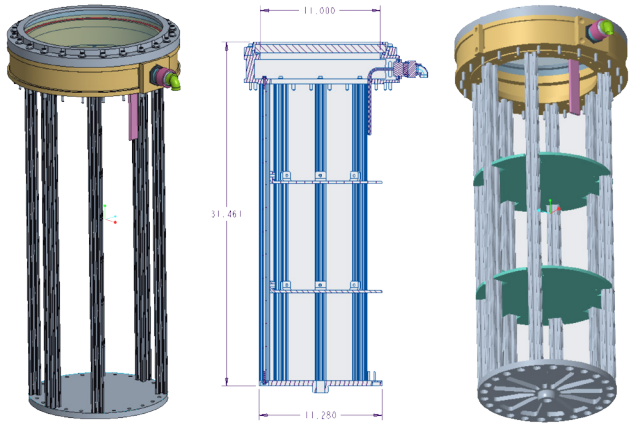
CapSIT Tube Inserts



- CapSIT Tubes are approximately 1 ft in diameter and 2.5 ft tall.
- Tubes can be flown pressurized, unpressurized, or partly pressurized.
- Tubes provide an instrument volume equal to ~53-U per tube or 106-U for a pair.
- The Tubes are designed to contain 17.5 kg of instrument mass and provide 20+ Watts of power.
- Tubes are designed with a standard interface for rapid interchangeability.
- The mechanical ICD will specify the CG location & frequency response.
- Tubes are intended to use this entire mass, adding weight if needed in order to maintain direct interchangeability with other tubes or a replacement dummy mass in order to not affect coupled loads.
- A single instrument can span 2 tubes by placing electronics in one tube and detectors/ optics/etc. in the other.
- Standard tubes can also be flown on other host spacecraft; simplifying interfaces, coupled loads, lead times, contracts, and cost.

"IF IT FITS, IT FLIES!"

Paper presented at The 20th & 21st Annual Small Payload Rideshare Symposium, 2018, 2019
"CapSat – An ESPA Class CubeSat Model" https://www.sprsa.org

Paper presented at the 2017 IEEE Aerospace Conference
"Capsulation Satellite or CapSat: A Low Cost Reliable Rapid Response Spacecraft Platform"

September 27, 2016: CapSat article makes top page of www.nasa.gov and www.nasa.gov/goddard

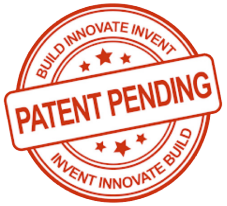
October 2016 CapSat inputs approved for next edition of NASA Technology Innovation Magazine
https://viewer.aemmobile.adobe.com/index.html#project/20151817-e5ce4721-aff0-65bc-38c9679b/view/ti.17.3/article/17.3.Space.for.Everyone

July 2016 CapSat article makes the cover of Cutting Edge

https://www.nasa.gov/sites/default/files/atoms/files/summer16current.pdf

https://www.nasa.gov/feature/goddard/2016/nasa-develops-satellite-concept-to-exploit-rideshare-opportunities

CapSat is currently in Patent pending status with the US Patent Office:



For more information
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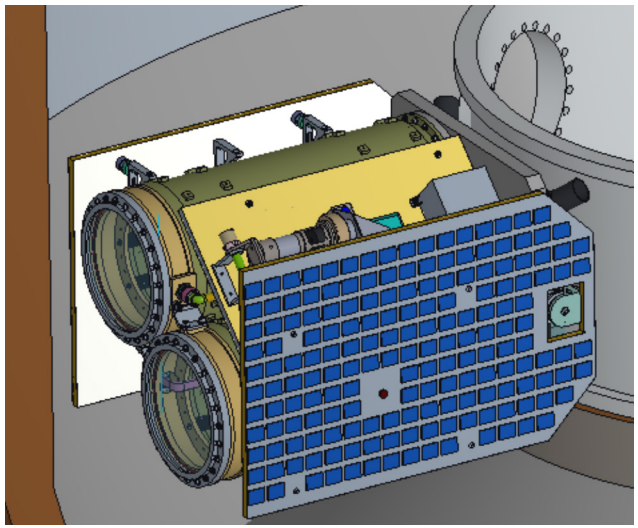
12102019

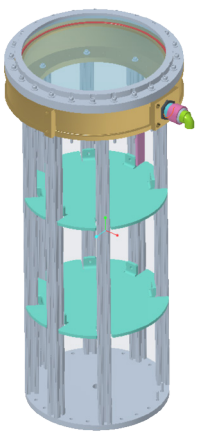
National Aeronautics and Space Administration

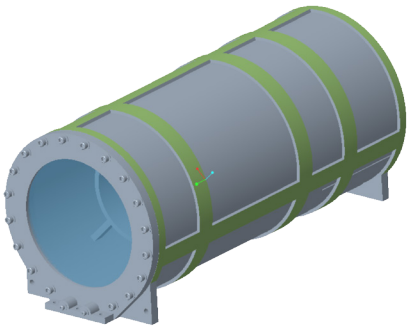
CapSat

Capsulation Satellite or CapSat is a low cost, 3 axis stabilized, modular, standardized spacecraft, based on a pressurized volume allowing ruggedized COTS hardware to be flown reliably in space at a cost per Kg 20 times cheaper than the average CubeSat.



CapSIT: Capsulation Satellite Science Instrument Tube



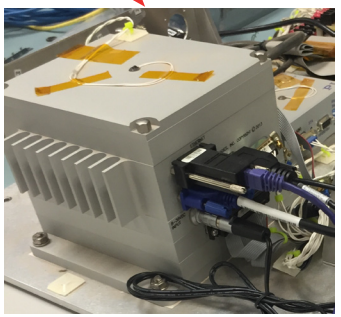


"IF IT FITS, IT FLIES!"

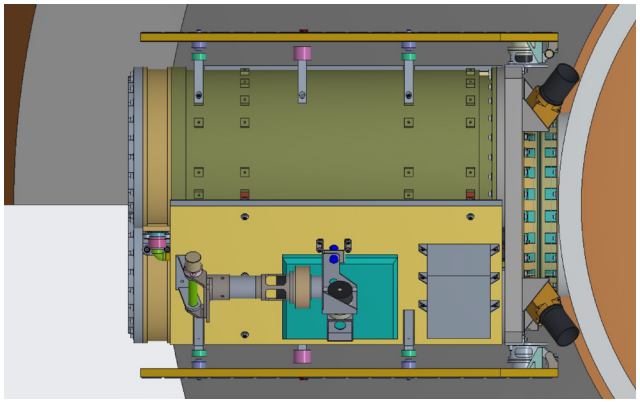
www.nasa.gov

CapSat builds on NASA's tradition of Hitchhicker Get Away Special-GAS Cans that flew on the shuttle. Hitchhiker flew over 200 missions over 2 decades managed out of Goddard Space Flight Center. CapSIT allows independent development of instruments and spacecraft decoupling funding, contracts and science. "If it fits, it flies!" and when its ready it can go. Interchangeable tubes allow slipping and leapfrogging of instruments and substitution to a dummy mass if needed to insure no impacts to the primary mission launch date.

CapSat Flight software uses NASA's open source core Flight Executive (cFE) developed with decades of Goddard heritage and now approved for Class A human rated use. A version of Microsoft Windows was successfully run on a CapSat C&DH within the cFS to demonstrate plug and play instrument software integration for a new type of Landsat Thermal Imaging Sensor instrument in 2016.



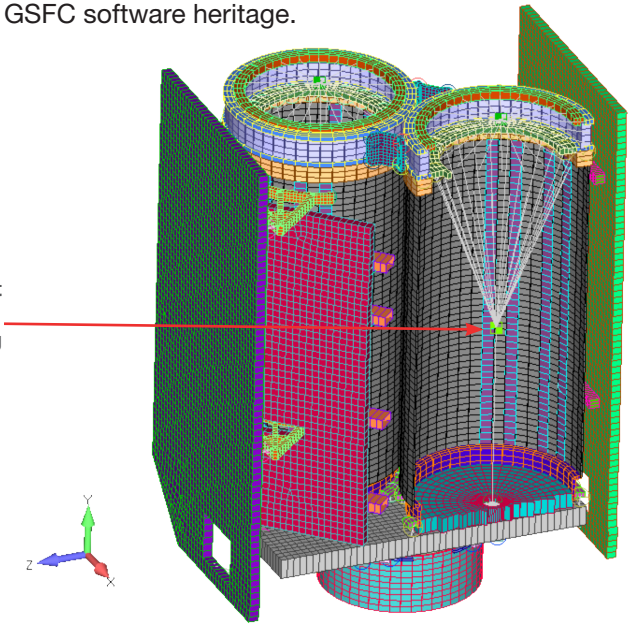
CapSat supports Motorized Lightband (MLB) attachment to a standard 6 port ESPA with 180 kg per port.



CapSat takes advantage of unused launch vehicle mass to orbit capabilities via the USAF Ride Share program; being specifically designed to mate to an ESPA Ring.

Almost all future NASA missions will be providing rideshare opportunities. This capacity typically goes unused largely due to cost. Typical CubeSat's are still nearly $1M/kg. A single CapSat can provide 180kg of on-orbit mass at a cost >20 times cheaper.

CapSat achieves this by leveraging proven SmallSat and CubeSat hardware combined with decades of GSFC software heritage.



Fully loaded CapSat Spacecraft, including 2 CapSIT tubes with instruments installed, has a 1st fundamental Frequency of 88hz. Coupled loads are being analyzed for 6 CapSats potentially flying with JPSS-2.

CapSat ground systems will use ITOS-Integrated Test & Operations System. Developed at Goddard in 1990 and available as a commercial product since 2000. ITOS has flown on missions like; Landsat , LRO, DSCOVR, Fermi (GLAST), LADEE, NuSTAR, upcoming ICESAT-2, ICON. ITOS supports instrument and spacecraft development as well as full observatory on orbit operations.