# BurstCube
## A CubeSat for Gravitational Wave Counterparts
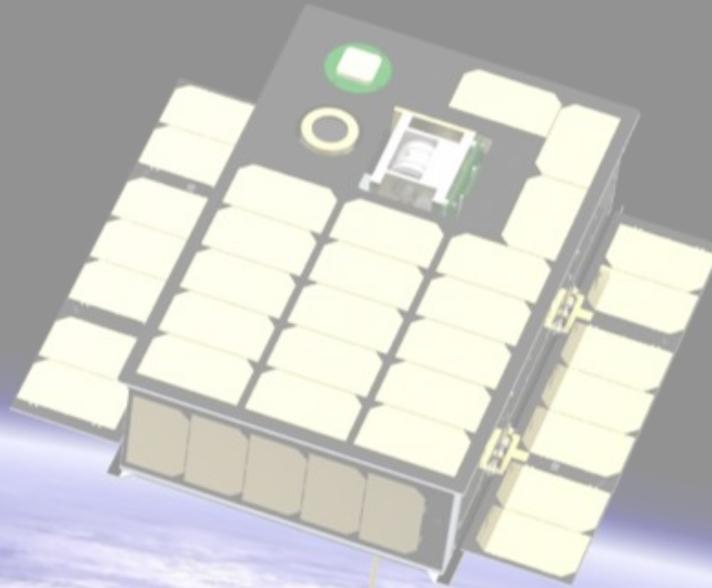
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See ICRC 2017 Proceedings for More Details: https://pos.sissa.it/301/760/
Website: https://asd.gsfc.nasa.gov/burstcube/

Mission Overview

- Observes the unocculted sky pointed. Records ɣ-ray photons. Triggers on rate fluctuations.
- 4 year development. 1 year operations.
- Baseline bus is *Dellingr*.
  - 6U CubeSat (PSC standard)
  - 3 axis pointing
  - UHF communication
  - Body mounted solar panels
  - Deployable solar panels
  - Star Tracker
  - Rapid comms (either globalstar or TDRS)
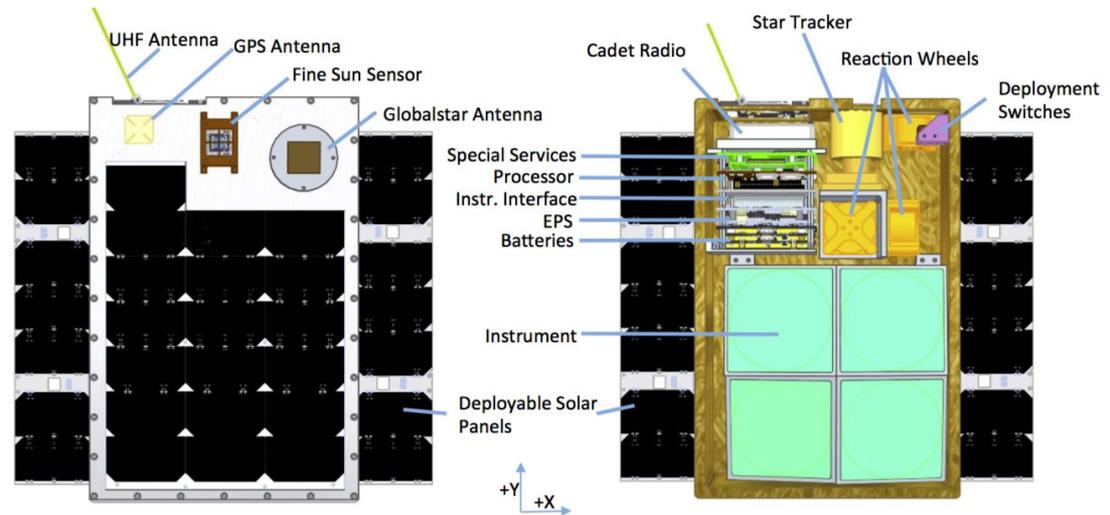
Use of Dellingr platform makes use of prior development and minimizes risk.

Grand Overview of BurstCube

- BurstCube: a **6U CubeSat** that will **detect and localize** Gamma-ray Bursts (GRBs):
  - Focus on **short GRBs** (sGRBs; binary neutron star mergers) that are the counterparts of gravitational wave (GW) sources.
- Will detect these with **four CsI** scintillators coupled with arrays of compact low-power **Silicon photomultipliers** (SiPMs).
- Spacecraft based on NASA/GSFCs Dellingr platform with many components sources commercially-off-the-shelf (COTS).
- Complement existing facilities (*Swift, Fermi)* and could be an **interim GRB instrument** before next generation missions fly.
- BurstCube **will fly in 2021**.
- The ultimate configuration of BurstCube would be **a set of ~5 CubeSats** providing all-sky coverage for a very low cost.

Mission Concept

- For a **small fraction** of the cost of an explorer mission, BurstCube will
  - **Detect, Roughly Localize**, and **Characterize** GRBs
- This approach is **complementary** to existing or upcoming facilities (e.g. Swift, Fermi, SVOM)
  - Especially if there is a gap between GRB missions operating at the peak of the GW observatory operations.
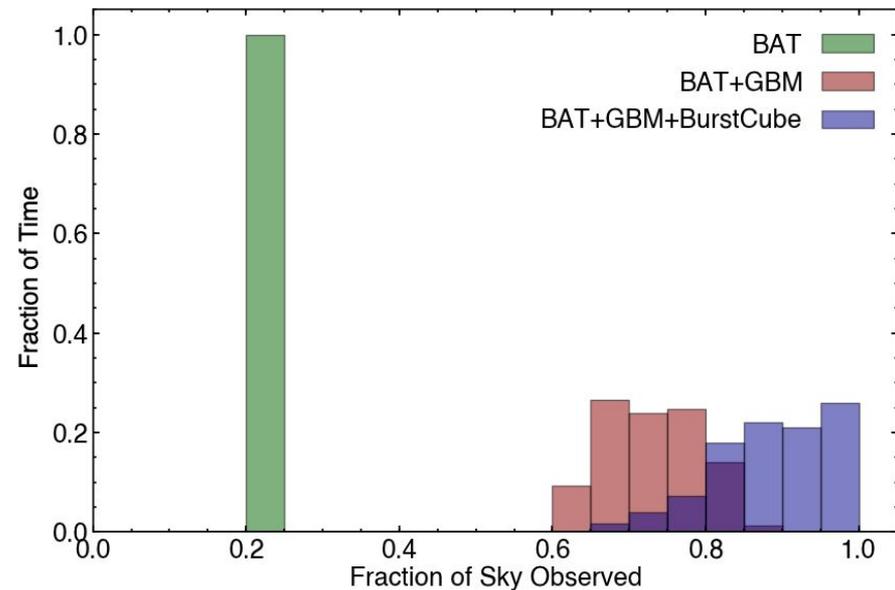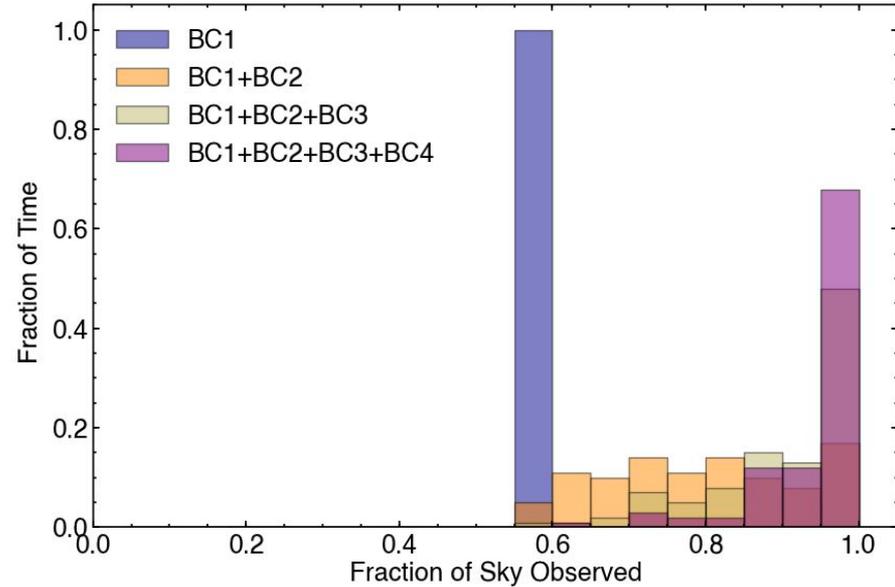
Mission Implementation

- BurstCube is a **6U CubeSat** that includes
  - Deployable Solar Panels
  - Full ACS System
- Instrument Package
  - **4 CsI scintillator** crystals coupled to arrays of **low-power** Silicon Photomultipliers (SiPMs) with custom electronics
  - **Localizes GRBs** based on relative intensities in each detector.
- BurstCube will observe the **full un-occulted sky** by zenith pointing, recording gamma-ray photons, and triggering on significant rate fluctuations.
- BurstCube will relay data to the ground every **2-12 hours**.
- Trigger data will be **immediately transferred** to the ground via the GlobalStar network or TDRS (TBD).
- The instrument hardware and flight and ground software design r**elies heavily upon heritage** from Fermi-GBM.
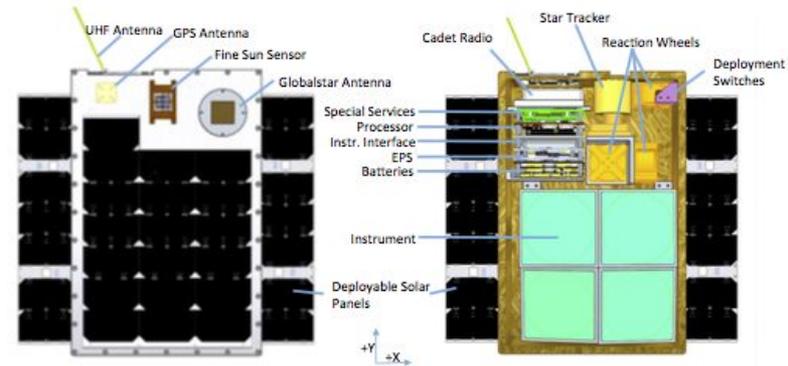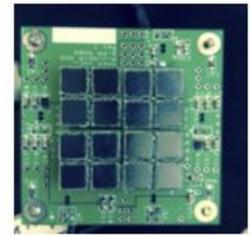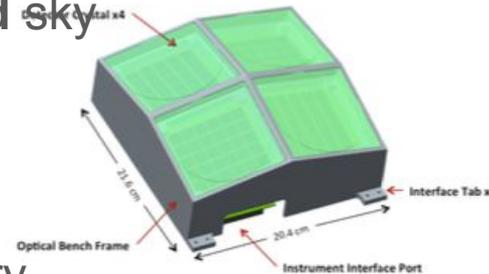
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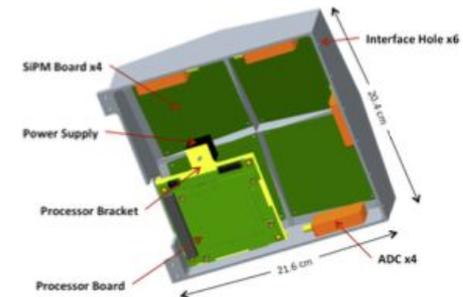
Mission Performance

- Continuous Science Operations
- Detect **~24 sGRBs/year**
  - Including **~1 coincident** sGRB-GW/yr
  - Large increase from not having BurstCube
- Detect **> 100 long GRBs/yr** in addition to other gamma-ray transients (solar flares, SGRs, etc.)
  - Will result in a significant increase in statistics.
- BurstCube has competitive performance with *Fermi*-GBM
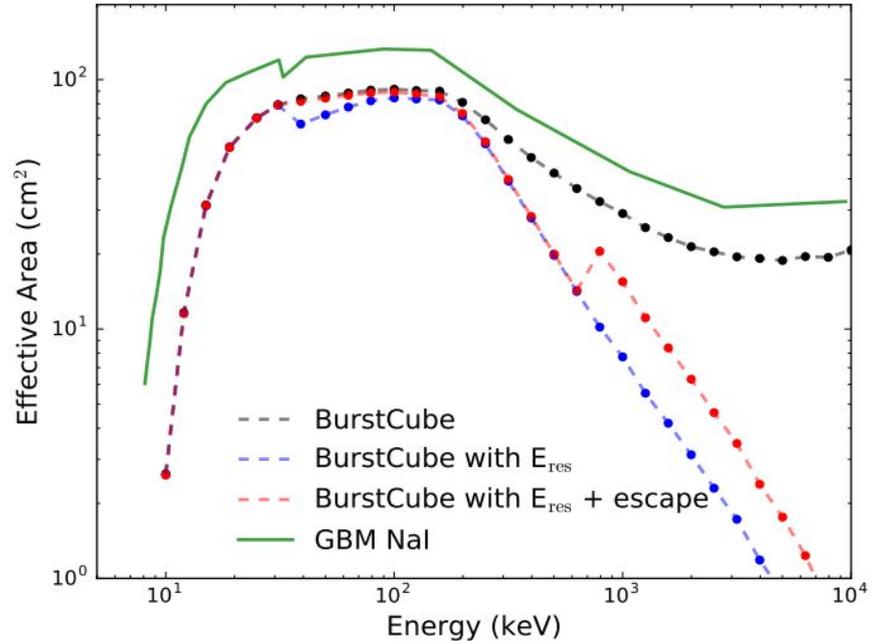
Effective area is 67% that of the larger GBM NaI detectors at 100 keV and 15 degree incidence (MEGAlib based sims)

Updates:
Instrument Design

- Received funding to begin a slow ramp up of the project
- Preliminary Design is underway for the instrument
  - Mechanical
  - Electrical
- Testing current SiPM array designs
- Protoflight detectors and electronics will be on hand by the end of the year.