



LappiSat-1: Geophysical Research Satellite from Lapland

J. Envall, A. Binios, J. Biström, M. Keskinen, S. Keskinen, S. Miettinen, M. Meskanen, E. Tanskanen, A. Karjalainen, L. Viikari

Finnish Satellite Workshop 18.-20.1.2023, Espoo, Finland

Sodankylä Geophysical Observatory

67.25°N

- The Sodankylä Geophysical Observatory has pioneered in the research of aurora borealis and the related fluctuations in the near-Earth magnetic environment for over a 100 years.
- Main research areas include magnetic disturbances, geomagnetic activity, ionospheric composition and disturbances, radio science, seismic activity, and cosmic rays.
- First sets of variometer measurements from 1880's.
- Continuous measurements since Jan 1, 1914.
- 27 locations, spanning from Svalbard (78°N) to Antarctica.

It has been a time-honored tradition at SGO to design, develop and construct the observatory's most critical measurement instruments in-house.



LappiSat Program

- The first Finnish satellites were launched in 2010's. As a byproduct the new wave of space engineers emerged.
- In 2020 SGO decided to bring some of that know-how to Lapland.
- LappiSat program will
 1. Establish a Space Technology Center in SGO's Tähtelä campus in Sodankylä.
 2. Build and operate satellites with scientific payloads.
 3. Provide education in the field of space technology and instrument building.
 4. LappiSat-1 will take the first step in expanding SGO's measurement network to space.

The first mission – LappiSat-1

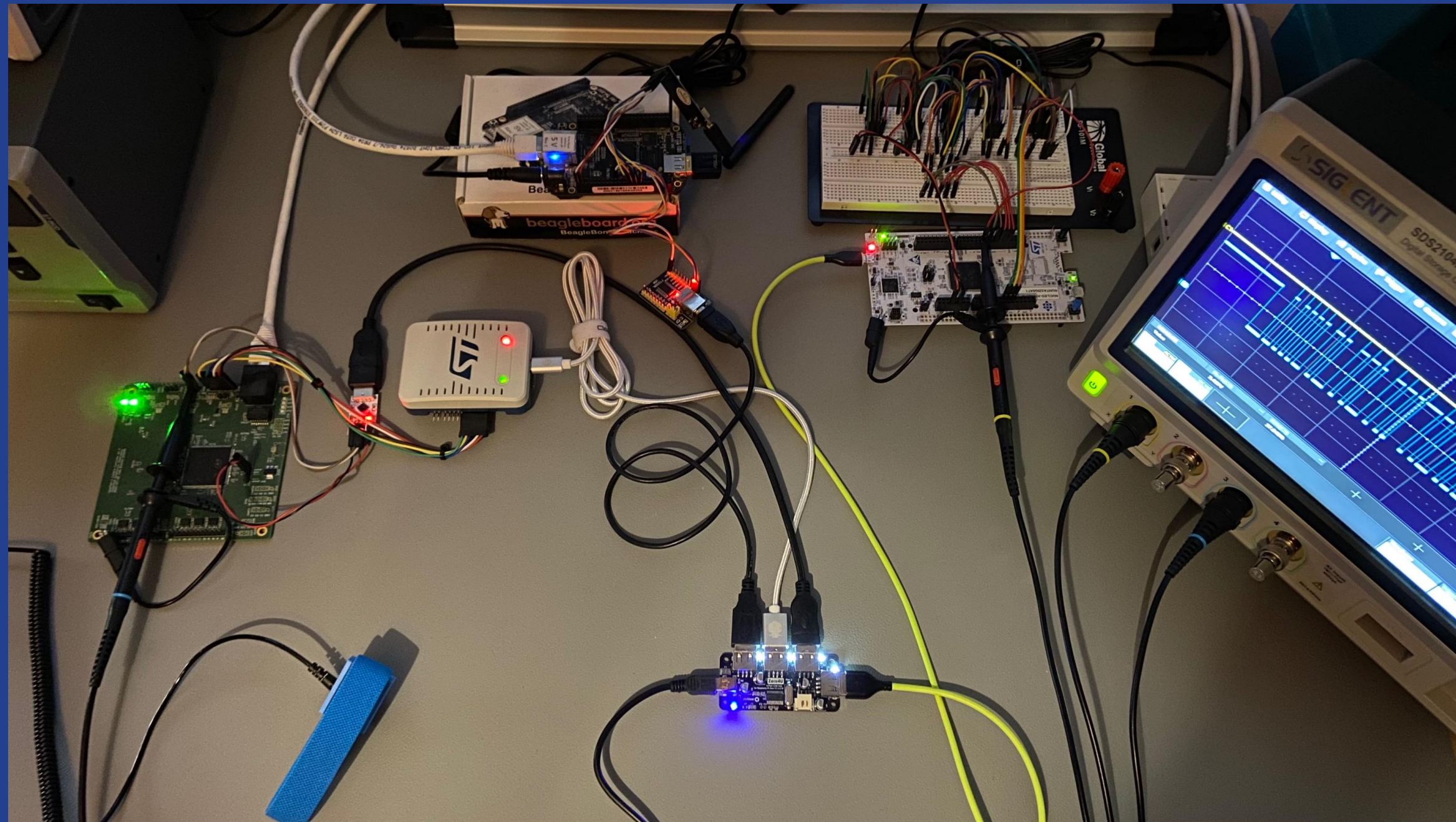
- 6U CubeSat, platform from NanoAvionics Corp.
- Sun synchronous polar LEO, altitudes 500 – 650 km in consideration.
- The scientific payload of the satellite will consist of instruments observing the aurorae and the related magnetic disturbances of the near-Earth space environment.
- The instruments will be designed and built mainly at SGO.
- The development of the satellite will be led and coordinated by SGO.
- Scientific instruments
 - Auroral imagers.
 - Auroral photometer.
 - Magnetometer.

Auroral Imagers

- Science Camera
 - Optimized for scientific observations of the auroral oval.
 - Final optical specifications TBC.
 - E.g. spectrally filtered images, or integration over the entire spectrum (B/W).
- Outreach Camera
 - Optimized for ordinary orbital photography.
 - Aesthetically pleasing color images of aurorae.
 - Used for public outreach, education etc.

Auroral Imagers (2)

- Current status: electronics and software development at a mature phase. Optical properties to be determined during spring.



Credit S. Keskinen

Auroral Photometer

- Device taking measurements of the intensity of auroae at several narrow wavelength bands, centered at e.g. 427.8, 557.7, and 630.0 nanometers.

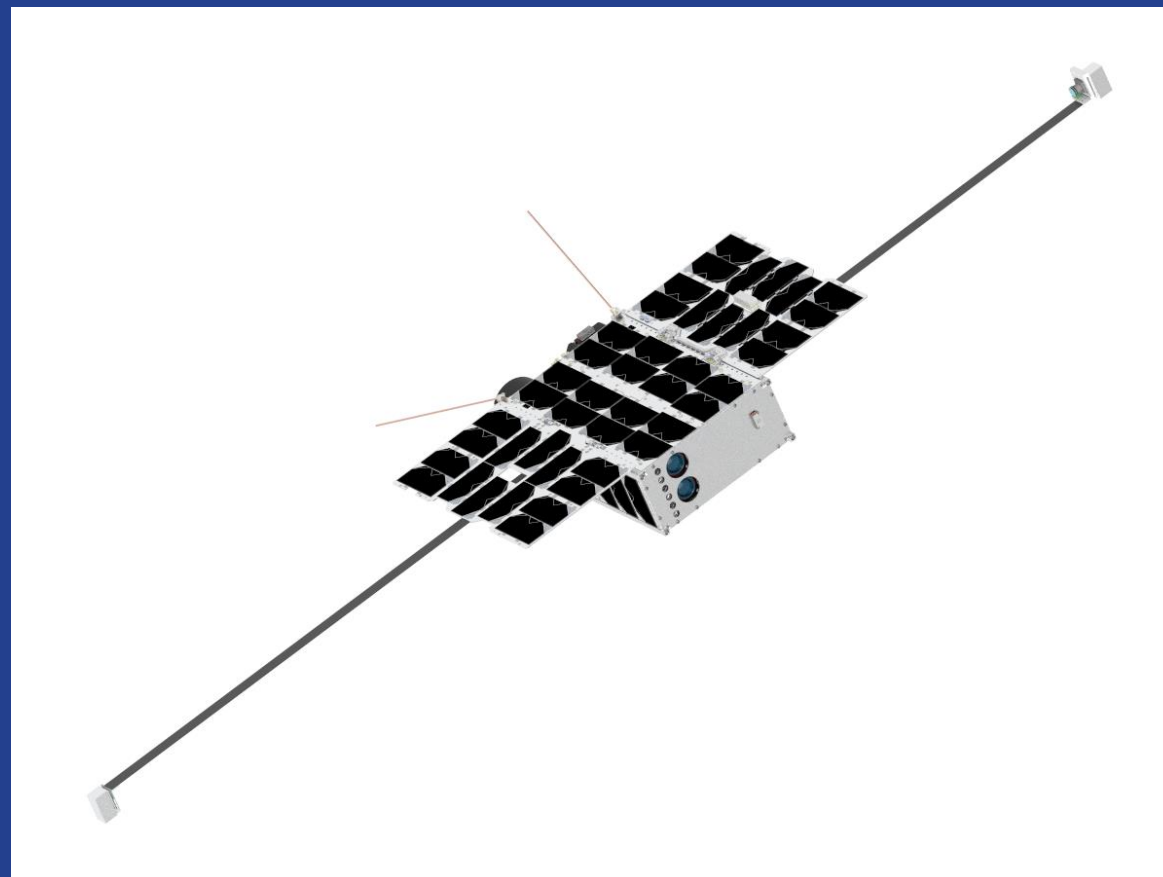


Credit S. Miettinen

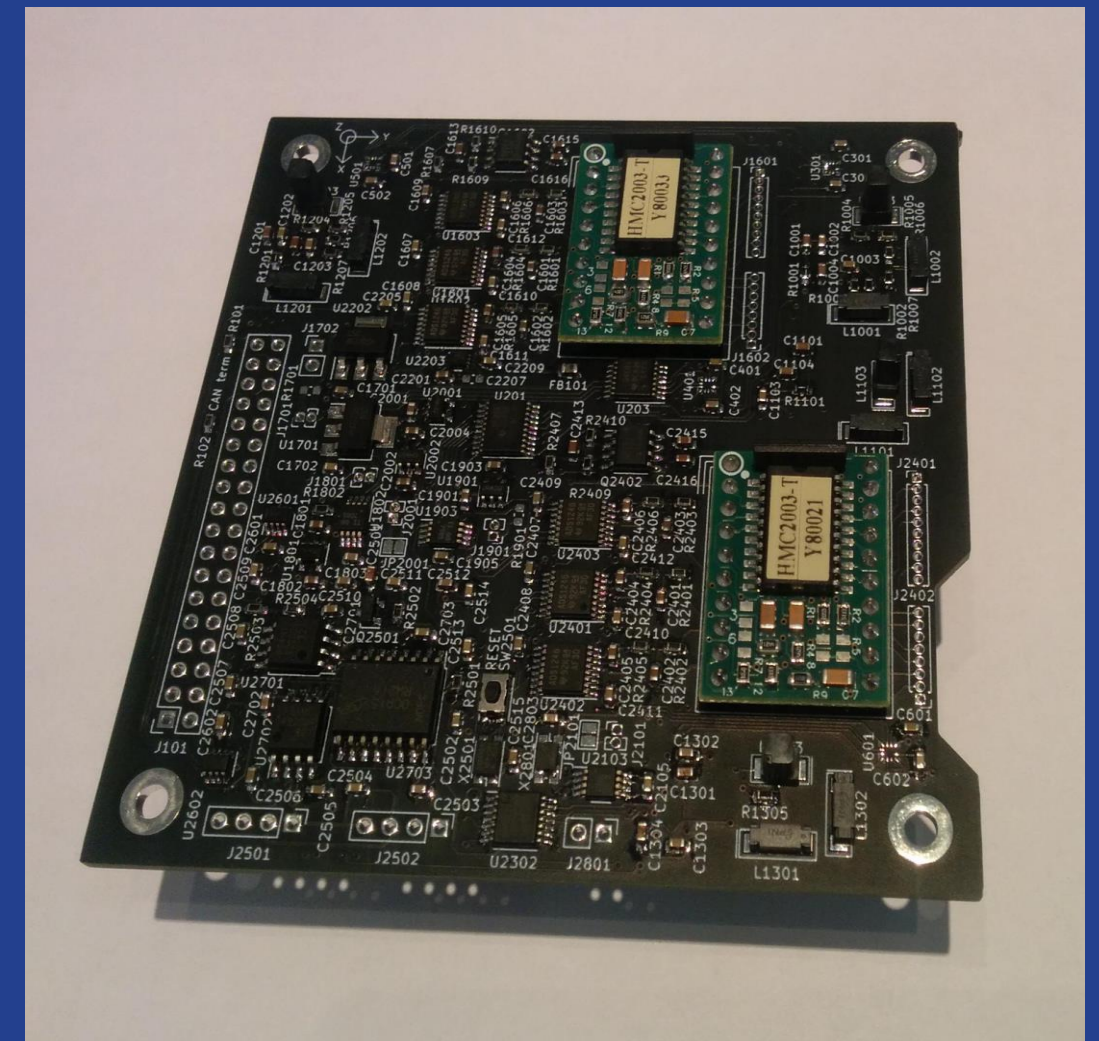


CubeMAG

- A miniaturized magnetometer for small satellites.
- Several types of sensors within the satellite frame and at the tip of a boom.
- Target resolution of the instrument is 1 nT.



Credit M. Meskanen



Credit J. Biström



Cleanroom Facility in Tähtelä

- To be finished by April 2023.



Credit M. Meskanen



Ground Station

- Old weather radar station, to be converted for satellite operation duties during 2023.
- Remains: location, antenna rotator, radome, infrastructure.
- Renewed: radio equipment and supporting instruments.





Thank You



LAPIN LIITTO