

The Grand Challenge Initiative – CUSP and M/LT projects

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GCI CUSP

The Grand Challenge Initiative (GCI) - CUSP project was a major international rocket-based research project, with participation from NASA (six scientific projects), JAXA (1 scientific project) and UiO / ASP (1 scientific project). In addition, all three nations participated in a joint two-stage student rocket – RockSat-XN "G-CHASER", launched from Andøya as part of GCI CUSP in January 2019.

12 rockets are successfully launched from Andøya and Ny-Ålesund, Svalbard between 2018-2021 (around solar minimum), several times with both launch sites operated simultaneously. GCI CUSP is one of the largest scientific rocket projects NASA has ever participated in.

The project idea and ownership is Norwegian, conceived in 2012 by Professor Jøran Moen (UiO) and Kolbjørn Blix (ASP):

“Gathering scientists working on issues related to the gap in the Earth's magnetic field (CUSP) over Svalbard and for the first time ever launch sounding rockets from both Andøya and Ny-Ålesund in the same campaign”.

This way, Andøya Space launch NASA's largest sounding rockets – and fly them horizontally through the CUSP, high above Svalbard. While from Ny-Ålesund, we launch smaller rockets, straight up and into the CUSP.

Doing this at different heights and with different instruments is important when trying to understand the processes going on in and close to the CUSP. Coordinating already planned CUSP related projects and motivating the creation of new and complementary efforts was utterly important during the initial phase of the work with GCI CUSP. It was also important to ensure that necessary ground-based instruments and modelling communities were included in the team at an early stage.

Data Sharing

Another important goal from the Norwegian side was to ensure that all data from rockets and ground-based instruments is available from a common database, where all active participants have equal access. After all, data is the most important part of a scientific campaign, and these must be easily available for potential users after quality control and necessary quarantine time. The GCI data-sharing agreement was signed by SIOS (The Svalbard Integrated Earth Observing System), NASA, JAXA and UiO in Tokyo in 2017.

GCI M/LT

The next GCI project – M/LT (mesosphere / lower thermosphere) is already in operation. It includes US, Norway, Germany, Sweden, UK, Canada, Japan and Poland, but other nations are more than welcome to join. Due to working with lower altitude science than its CUSP cousin, GCI M/LT has a potential for even more activities. Rockets, measurements using aircrafts, satellites, balloon borne and ground-based instruments. Launching out of even more sites is also a possibility to be discussed, all based on the science topics raised during the planning phase. The first project to launch in M/LT was the XENON French balloon (European balloon infrastructure project HEMERA and CNES balloon campaign KLIMAT 2021) with their flight to 32.6 km altitude on the night 16-17 August 2021 from ESRANGE. The second project was the Sounding rocket project “PMWE” for investigation of polar mesosphere winter echoes by IAP in Germany. Two instrumented sounding rockets were launched on 13th and 18th of April under PMWE and non-PMWE conditions, respectively. The next sounding rocket project is NASA Lehmacher VortEx with 4 rockets from Andøya Space in March 2023.

Student Rockets

The people working with the GCI projects are highly devoted to including students, and also for the M/LT project a student sounding rocket mission will be provided by NASA and Andøya Space. The GHOST – “Grand cHallenge mesOsphere Student rocket” has a preliminary launch date set for

November 2024, but this may change to a later date depending on the process and other projects. It is important for us that the students get to experience the feeling of being part of a real GCI M /LT (or similar) rocket operation, and this can also mean that the launch time must be changed to adapt to this

GCI 3.0 CUSP Solar Max – new initiative (2026)

During AGU Fall Meeting 2022, a successful workshop on the proposed GCI CUSP follow-up project “GCI 3.0 CUSP Solar Max” was conducted, and the conclusion was that a solar max version of

the highly successful CUSP (solar min) project is both timely and scientifically justified with regards to new and remaining questions, ensure access to scientific infrastructure that could otherwise be made unavailable if there are no future projects that can make use of it, and lastly, new and upcoming ground-based/space based infrastructure will be available compared to the original CUSP project operational phase ended 2021.

The proposed timeline is first launch around 2026, but this is off course dependent on missions being funded in the time to come.

