

SIMPL (Satlet Initial Mission Proofs and Lessons) Mission Abstract

NovaWurks has been investigating the cellularization of satellite technology as a way to dramatically decrease the cost of new space assets, while also enabling these assets to be incrementally upgradeable and easily repairable. Basically, a small number of nanosat-scale satellites (satlets) serve as building-blocks for assembling a fully-functional satellite, analogous to how the human body is made up of a fairly limited number of basic cell types. NovaWurks has developed a hyper-integrated satlet, named HISat, which provides complete satellite functionality in a nanosat scale package.

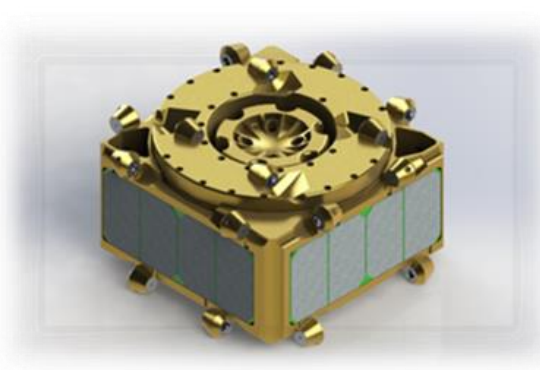


Figure 1. HISat Prototype 4

Mission Description

As a way to buy-down risk during NovaWurks HISat technology development program, NovaWurks is planning to demonstrate an on-orbit assembly and LEO deployment of the NovaWurks Hyper-Integrated Satlet (HISat) system. The proposed research utilizes a cargo vehicle flight to the ISS with six HISats, and an amateur transponder providing service as an OSCAR (Orbiting Satellite Carrying Amateur Radio). To achieve packaging efficiency in the pressurized area of the ISS cargo vehicle the HISats will be packaged individually and installed by astronauts available on the space station. As an added benefit the disassembled cargo vehicle configuration enables a demonstration of the ease of on-orbit HISat assembly into packages, also known as PACs (Package of aggregated cells).

The research goals require exposure to the space environment. HISat space exposure is satisfied by transfer from the cargo vehicle's pressurized area into the ISS for eventual transfer to the ISS exterior (i.e. through the JEM airlock). The HISats will remain in an inactive state upon transfer into the ISS and be stored until an astronaut activity time can be scheduled to assemble the HISats into their flight PAC. HISats are designed to be attached together utilizing their unique edge connector design. This portion of the research seeks to demonstrate and characterize the assembly of HISats into an aggregated system capable of sharing resources and improving selected performance metrics. Figure 2 shows a rendition of the flight PAC.

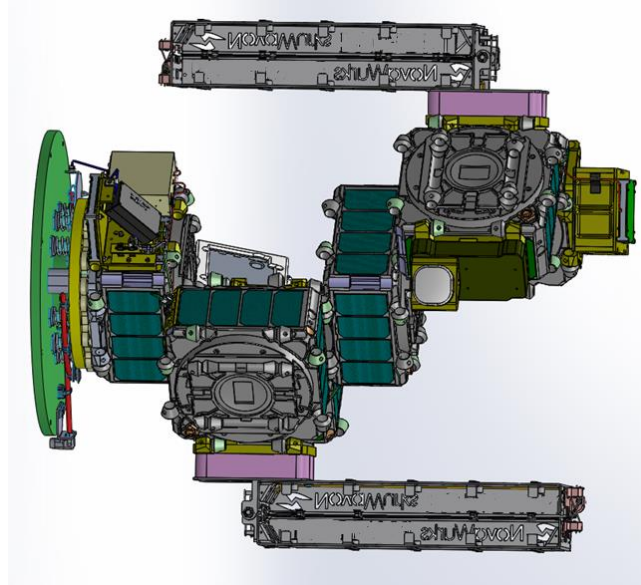


Figure 2. ISS Flight PAC – Assembled

After assembly, the PAC will be mounted on the JAXA Multi-Purpose Experiment Platform (MPEP), and placed on the JEM airlock slide table for transfer outside the ISS. Once exterior to the ISS, the PAC is activated and undergoes checkout.

The final step of the plan is the deployment of the PAC from the ISS for free flying operations. An approach similar to prior cubesat deployments will be utilized where a crewmember operates the JEM Remote Manipulating System (JRMS) – to grapple and position the PAC for deployment. As a free flyer, the PAC will operate as an OSCAR for at least two weeks. This research will advance understanding of the cellular satellite technologies that NovaWurks has embodied in its HISat design.

[PAC Radio Frequency Usage](#)

SIMPL features a unique design which utilizes inter-system links that are mandatory to the functionality of the spacecraft as a whole. These inter-system links operate in Bluetooth and Wi-Fi allocated ISM bands and are not meant for any space to ground communications. Bluetooth operation on SIMPL is 2400-2483.5 MHz Spread Spectrum and WIFI operation is 5150-5250 MHz and operate on a non-interference basis.

The spacecraft is fully autonomous and does not require any commanding or uplink requirements to function.

The main payload is to support an amateur transponder service (APRS) as an OSCAR. It contains an automatic beacon on the terrestrial APRS frequency to alert terrestrial users when the space transponder is in view. The beacon will be on VHF 144.390 MHz over North America only, and on 144.825 MHz over Europe, and off at all other times. This beacon will alert terrestrial amateur users out of range of the terrestrial APRS network to switch to the space frequency and engage the transponder without having to maintain a live tracking program while in the field.