

## SS-520-3 Sounding Rocket Experiment Targeting the Ion Outflow in the Polar Cusp / Aurora

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In order to achieve collective understanding of the microphysics and its role (scale coupling) in the global scale to mesoscale phenomena in the polar ionosphere, Japan-Norway sounding rocket experiment program is now in progress. Although Japanese sounding rocket SS-520-3 was planned to be launched from Ny-Ålesund, Svalbard in Spitsbergen in December 2017, the launch was postponed due to mal-function of the timer equipment that was found during the final stage of the integration test. Since the timer equipment problem has already been completely fixed, SS-520-3 Payload Instrument team desires the earliest possible launch of the sounding rocket.

The main objective of this sounding rocket is to understand the particle acceleration processes that cause the ion outflow by making in-situ observation of the wave-particle interaction in the cusp region. SS-520-3 sounding rocket experiment aims to resolve the wave-particle interaction by making in-situ measurements in the polar cusp with newly developed instruments for the satellite mission. Since these wave-particle interactions are predicted to be effective above 800km altitude, a two-stage sounding rocket SS-520 whose apex can be higher than 750km is necessary. The rocket range where SS-520 can be launched targeting the cusp region is only Ny-Ålesund in Svalbard. Since simultaneous ground based optical observation of the cusp aurora is necessary to decide the launch timing, the best launch period is determined from the conditions of both the sunlight and the moonlight. From the sunlight condition, the best launch period is in the winter polar night that is around the winter solstice. On the other hand, two weeks before/after the new moon is the best launch period from the condition of the moonlight. Launch window for each day is 0700UT-1130UT (0800LT-1230LT: 1000MLT-1430MLT) when the cusp is possibly on the same magnetic field line as the trajectory of SS-520-3. SS-520-3 sounding rocket experiment is a part of the comprehensive observation campaign including ground-based radar and optical observations. SS-520-3 sounding rocket experiment is also one of the projects participating in “A Grand Challenge Initiative (GCI) Cusp program” that is a large-scale international collaboration for targeting advancement in the common understanding of cusp region space physics.

Although SS-520-3 Payload Instrument team desires the earliest possible launch of the sounding rocket, the severe budgetary situation at ISAS in 2018 prevented the launch of SS-520-3 in winter 2018-2019. Approaching the solar minimum in this solar cycle, that will be in 2020, the opportunities that satisfy the launch condition will decrease since the latitude of cusp tends to be higher comparing the apex latitude of SS-520-3. In order to overcome this situation, SS-520-3 Payload Instrument team is considering to add possible ion outflow over morning side polar cap aurora or nightside auroral arc as alternative targets of SS-520-3 sounding rocket experiment.

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