Lightning Imaging Sensor (LIS) for the International Space Station (ISS): Mission Description and Science Goals

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ABSTRACT: In recent years, the NASA Marshall Space Flight Center, the University of Alabama in Huntsville, and their partners have developed and demonstrated space-based lightning observations as an effective remote sensing tool for Earth science research and applications. The Lightning Imaging Sensor (LIS) on the Tropical Rainfall Measuring Mission (TRMM) continues to acquire global observations of total (i.e., intracloud and cloud-to-ground) lightning after 17 years on-orbit. However, TRMM is now low on fuel, so this mission will soon be completed. As a follow on to this mission, a space-qualified LIS built as the flight spare for TRMM has been selected for flight as a science mission on the International Space Station (ISS). The ISS LIS will be flown as a hosted payload on the Department of Defense Space Test Program (STP) H5 mission, which has a January 2016 baseline launch date aboard a SpaceX launch vehicle for a 2-4 year or longer mission. The LIS measures the amount, rate, and radiant energy of total lightning over the Earth. More specifically, it measures lightning during both day and night, with storm scale resolution (~4 km), millisecond timing, and high, uniform detection efficiency, without any land-ocean bias. Lightning is a direct and most impressive response to intense atmospheric convection. It has been found that lightning measured by LIS can be quantitatively related to thunderstorm and other geophysical processes. Therefore, the ISS LIS lightning observations will continue to provide important gap-filling inputs to pressing Earth system science issues across a broad range of disciplines, including weather, climate, atmospheric chemistry, and lightning physics. A unique contribution from the ISS platform will be the availability of real-time lightning data, especially valuable for operational applications over data sparse regions such as the oceans. The ISS platform will also uniquely enable LIS to provide simultaneous and complementary observations with other ISS payloads such as the European Space Agency's Atmosphere-Space Interaction Monitor (ASIM) that will be exploring the connection between thunderstorms and lightning with terrestrial gamma-ray flashes (TGFs) and the Japan Aerospace Exploration Agency's Global LIghtning and Sprites MeasurementS (GLIMS) with its focus on global lightning and sprite connections. Another important function of the ISS LIS will be to provide cross-sensor calibration/validation with a number of other payloads, including the TRMM LIS and the next generation geostationary lightning mappers such as the GOES-R Geostationary Lightning Mapper (GLM) and Meteosat Third Generation Lightning Imager (MTG LI), as well as with ground-based lightning detection systems. These inter-calibrations will improve the long term climate monitoring record provided by all these systems. Finally, the ISS LIS will extend the time-series climate record of LIS lightning observations and expand the latitudinal coverage of LIS lightning to the climate significant upper middle-latitudes.