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

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Introduction and Overview
LIS Hardware (Heritage and New)
Science and Applications from LIS Lightning

Mission
- Fly a space-qualified, flight-spare LIS on ISS to take advantage of unique capabilities provided by the ISS (e.g., high inclination, real time data).
- Integrate LIS as hosted payload on DoO Space Test Program Houston 5 (STP-H5) mission and launch on SpaceX IoT (Super Storm Sandy October 28, 2012)
- LIS Flight Heritage

LIS Integration as Hosted Payload on STP-H5
- Launch on a SpaceX rocket with Dragon cargo vehicle Feb. 2016
- Robotically installed on an external truss (ELC-1) in position shown
- Operated for 2 years, but will seek mission extension from NASA

LIS Performance Parameters
- LIS is one of thirteen instruments on the STP-HS payload manifest
- LIS will be installed on ISS in an Earth viewing (nadir) position
- Payload built to allow robotic installation on ISS

Science and Applications from LIS Lightning
- Weather: Total lightning is strongly coupled in a quantitative way to thunderstorm processes and responds to updraft velocity and cloud particles (concentration, phase, type, and flux).
  - LIS acts like a radar in space; it reveals the heart of the cloud.
  - Lightning can improve convective precipitation estimates.
  - Lightning is strongly coupled to severe weather hazards (winds, floods, tornadoes, hail, wild fires) and can improve forecast models.
- Climate: Lightning is an excellent variable for climate monitoring because it is sensitive to small changes in temperature and atmospheric forcing. ISS LIS will:
  - Extend 16 year time series of TRMM LIS, expand to higher latitudes.
  - Monitor the occurrence and changes in extreme storms.
  - Provide much desired cross-sensor calibrations between platforms.

Chemistry: ISS LIS will help improve estimates of lightning produced NO, for climate and air quality studies
- Lightning NOx also impacts ozone, an important greenhouse gas.
- Climate most sensitive to ozone in upper troposphere, exactly where lightning is the most important source of NO.

Other: Complementary ISS LIS observations will help unravel the unique science contributions from ISS platform
- Lightning coverage at higher latitude missed by TRMM
  - TRMM LIS misses up to 30% lightning in Northern Hemisphere
- Enhance regional and global weather, climate, and chemistry studies
  - Provide CONUS coverage needed for National Climate Assessment
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- Climate most sensitive to ozone in upper troposphere, exactly where lightning is the most important source of NO.

Unique Science Contributions from ISS Platform
- Lightning coverage at higher latitude missed by TRMM
- Real time lightning using ISS for operational applications
- Enable simultaneous / complementary observations with other ISS payloads
- Support cross-sensor calibration and validation activities
- Support cross-sensor calibration and validation activities

Summary
- There exist several core science applications of ISS lightning observations, that range from weather and climate to atmospheric chemistry and lightning physics due to strong quantitative connections that can be made between lightning and other geophysical processes of interest.
- The space-basal vantage point, such as provided by ISS LIS, still remains an ideal location to obtain total lightning observations on a global basis.