

Lightning Imaging Sensor (LIS) on the International Space Station (ISS): Launch, Installation, Activation and First Results

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Mission and Measurement

Mission

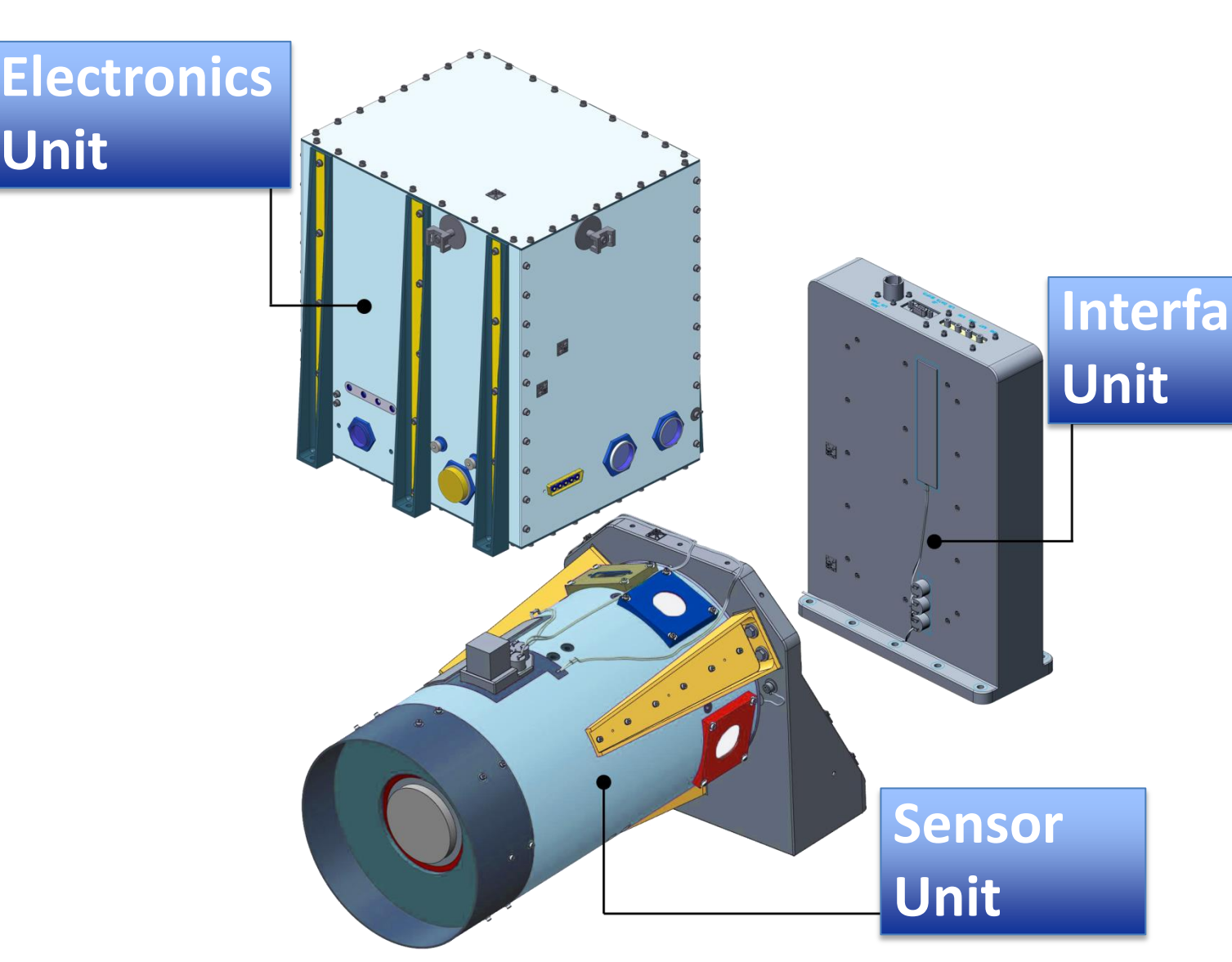
- Fly a flight-spare LIS on ISS to take advantage of unique capabilities provided by the ISS (e.g., high inclination, real time data).
- Integrate LIS as a hosted payload on the DoD Space Test Program-Houston 5 (STP-H5) mission and launch on a Space X rocket for a minimum 2 year mission.

Measurement

- NASA and its partners developed and demonstrated effectiveness and value of using space-based lightning observations as a remote sensing tool.
- LIS measures lightning (amount, rate, radiant energy) with storm scale resolution, millisecond timing, and high detection efficiency, with no land-ocean bias.

Benefit

- LIS on ISS will extend TRMM time series observations, expand latitudinal coverage, provide real time data to operational users, and enable cross-sensor calibration.



Sensor Unit (legacy hardware)

- Optical Assembly
- 128 x 128 CCD Focal Plane
- Lightning and Background detection

Electronics Unit (legacy hardware)

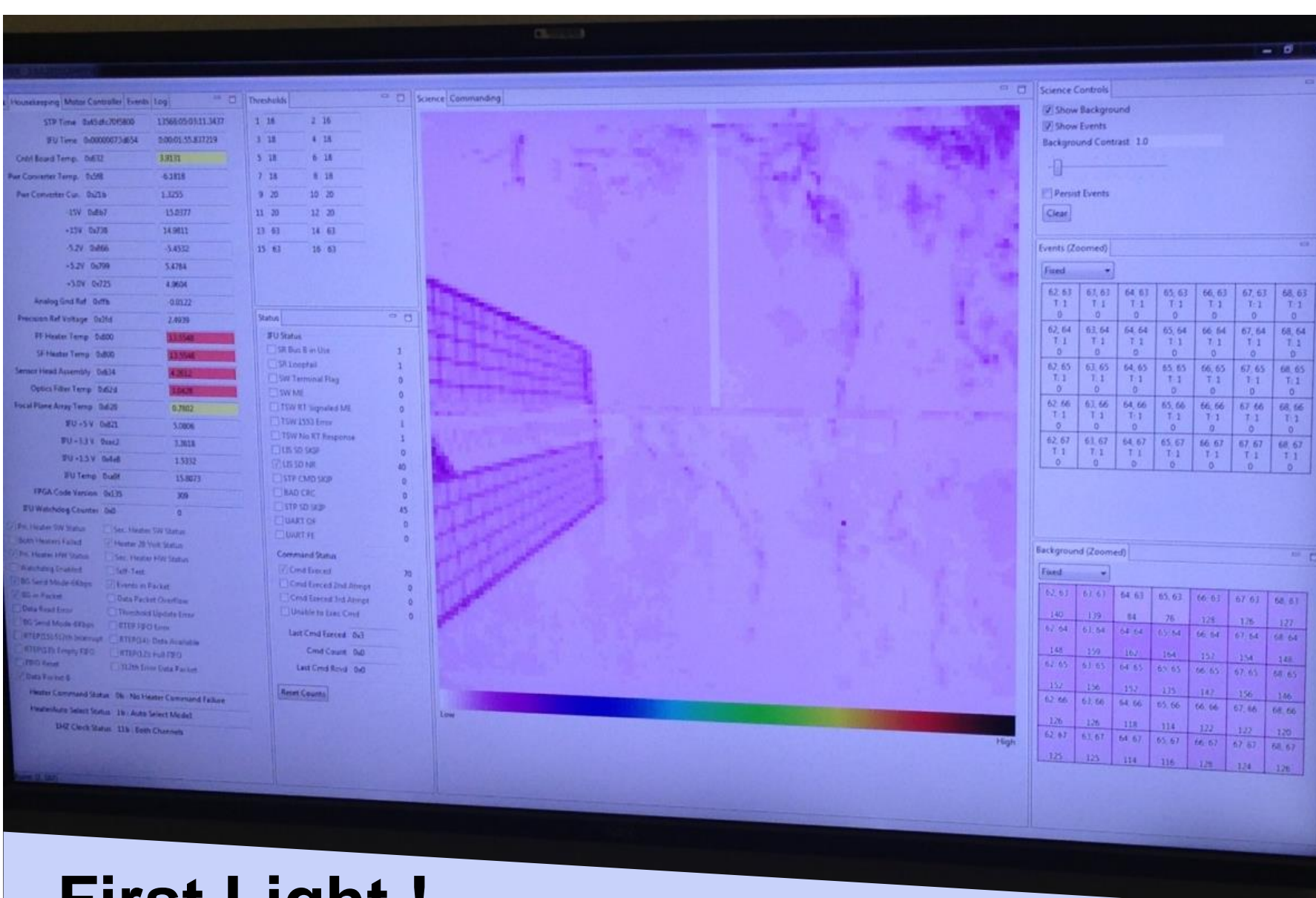
- Real Time Event Processor, Background removal, Data formatting
- Power conversion and control

Interface Unit (new hardware)

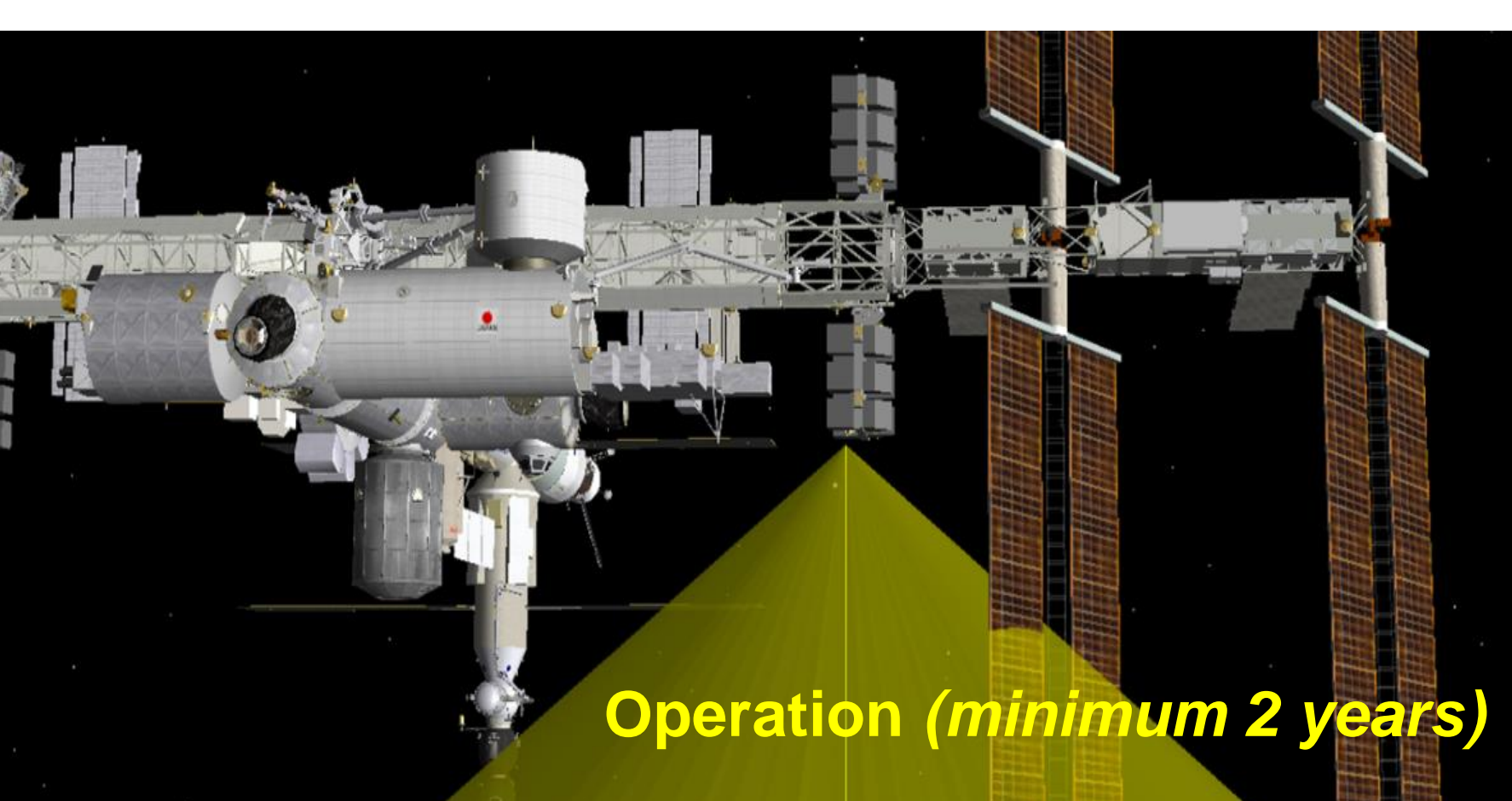
- Power conversion, timing, and control
- ISS interface



Activation and Mission Operations



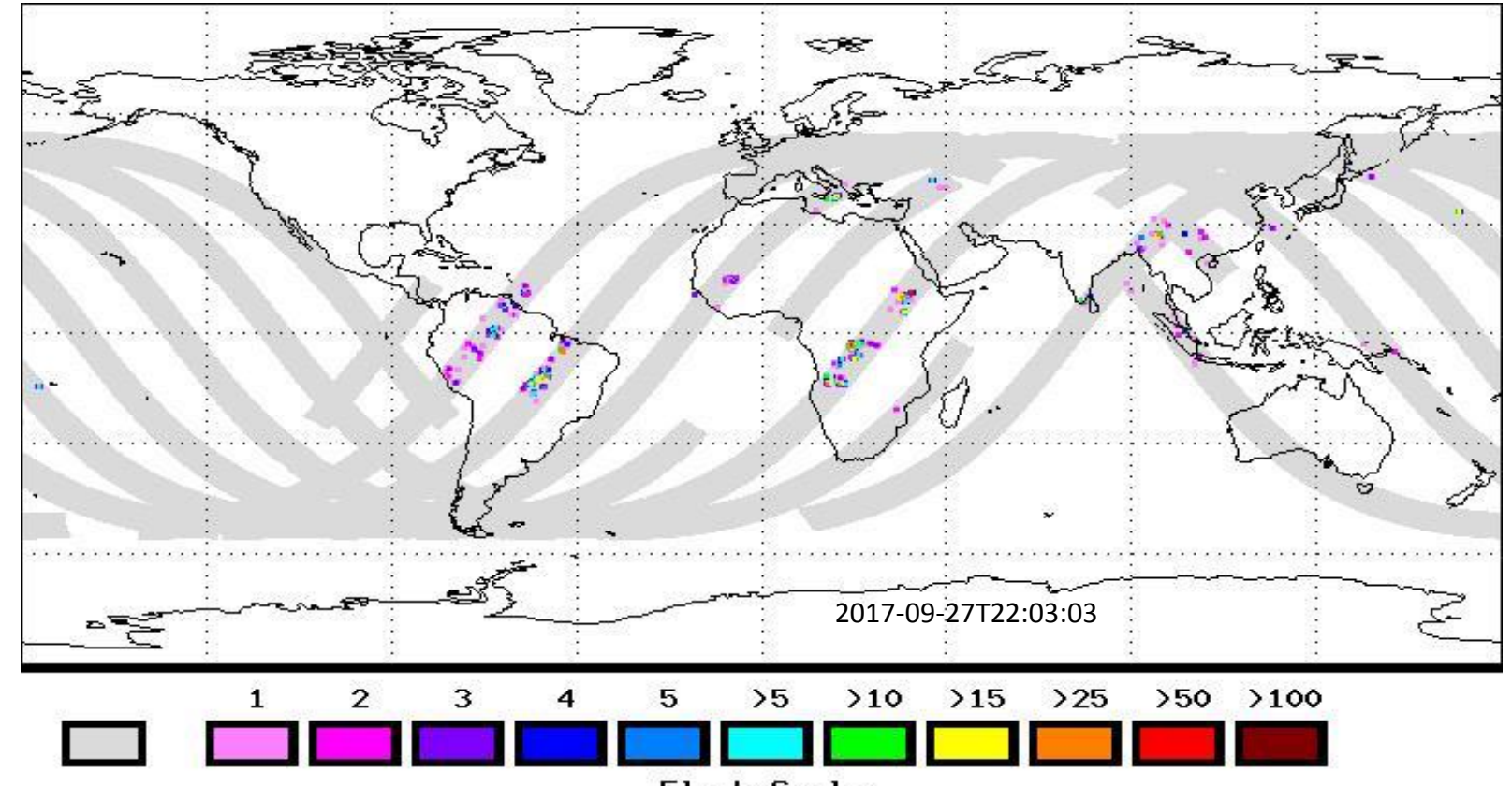
First Light!
As it appeared on the Real Time Display and Command window



Operation (minimum 2 years)

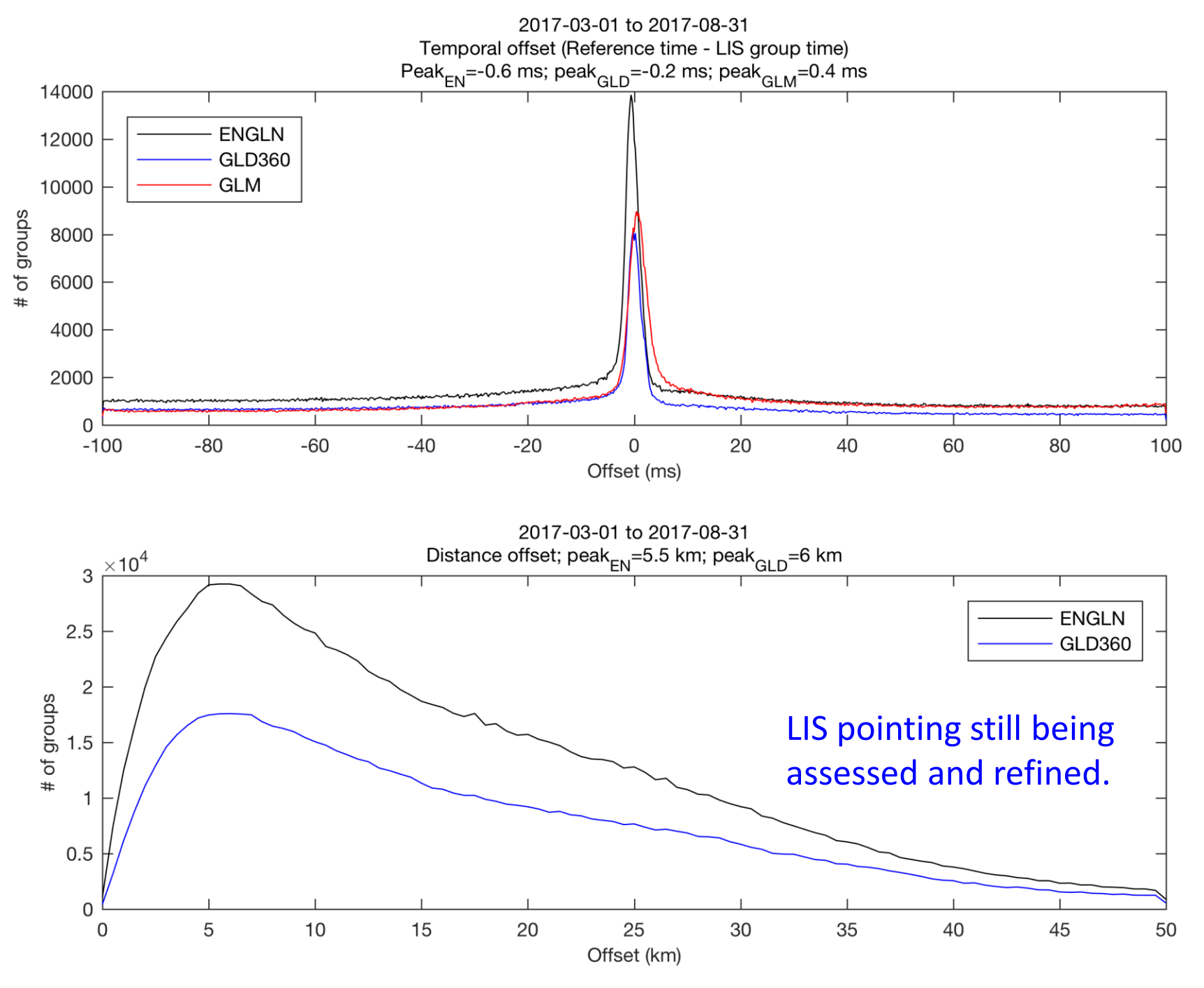


Real-time monitoring and commanding are managed from LIS Payload Operations Control Center (LIS POCC).



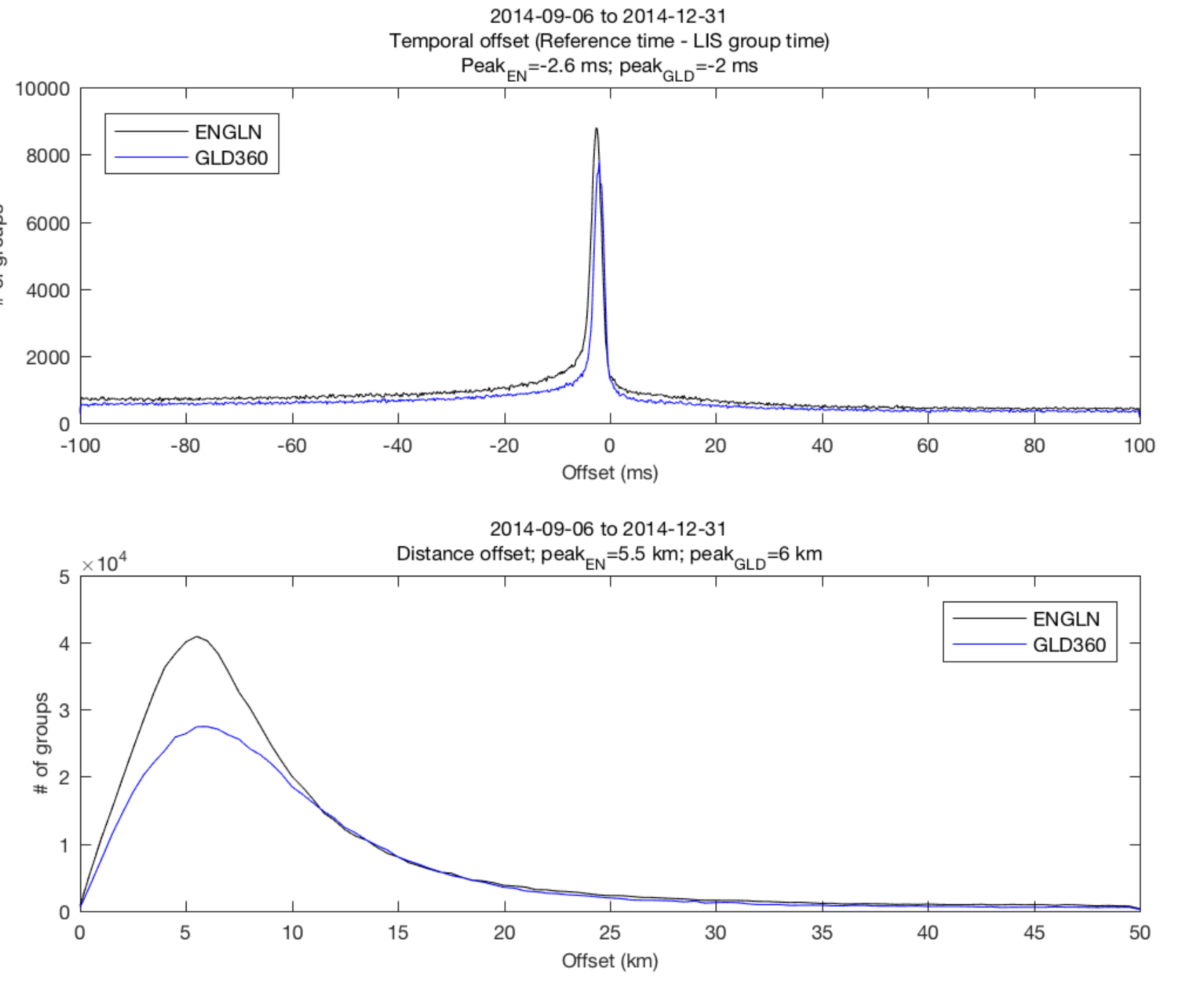
A 12 hour browse image is created in real time in 2 minute processing increments.

First Results

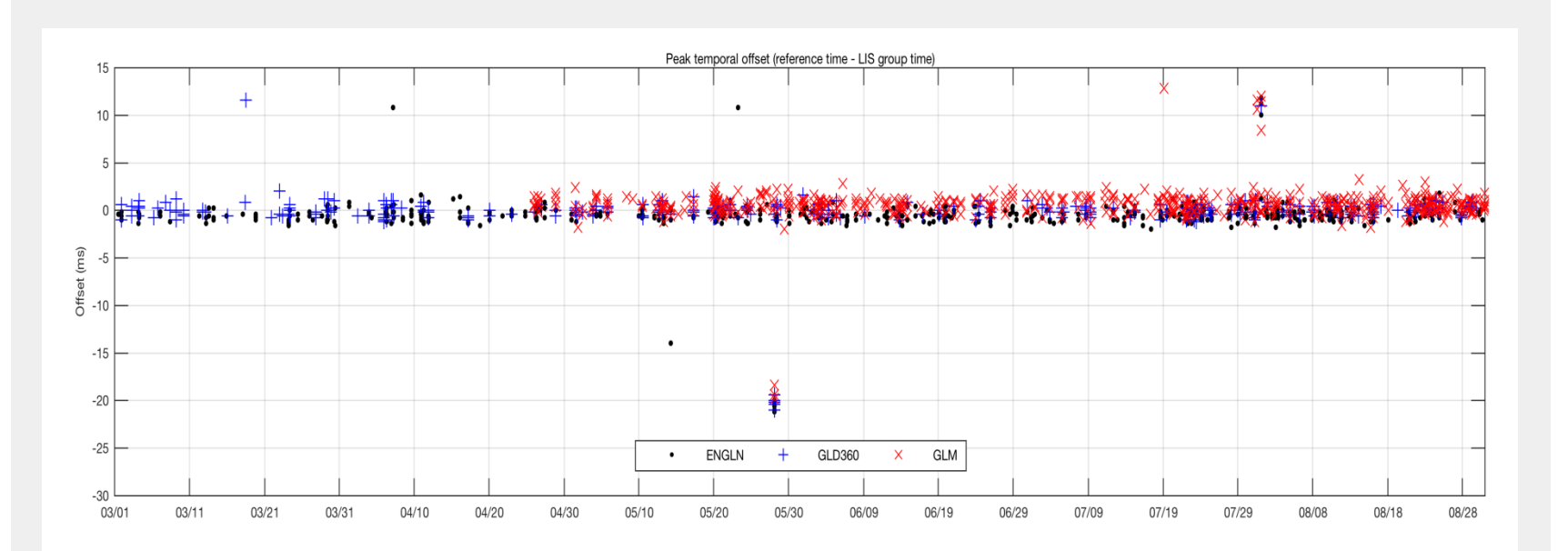


Time and distance offsets for LIS on ISS to three reference sources over first six months (Earth Networks, GLD360, Geostationary Lightning Mapper).

- Intercomparison of LIS with specially processed GLM shows good correlation.
- However, the geolocation for both LIS and GLM datasets continue to be refined and improved.
- Some of the issues will be discussed by Virts et al. in oral presentation AE41A.

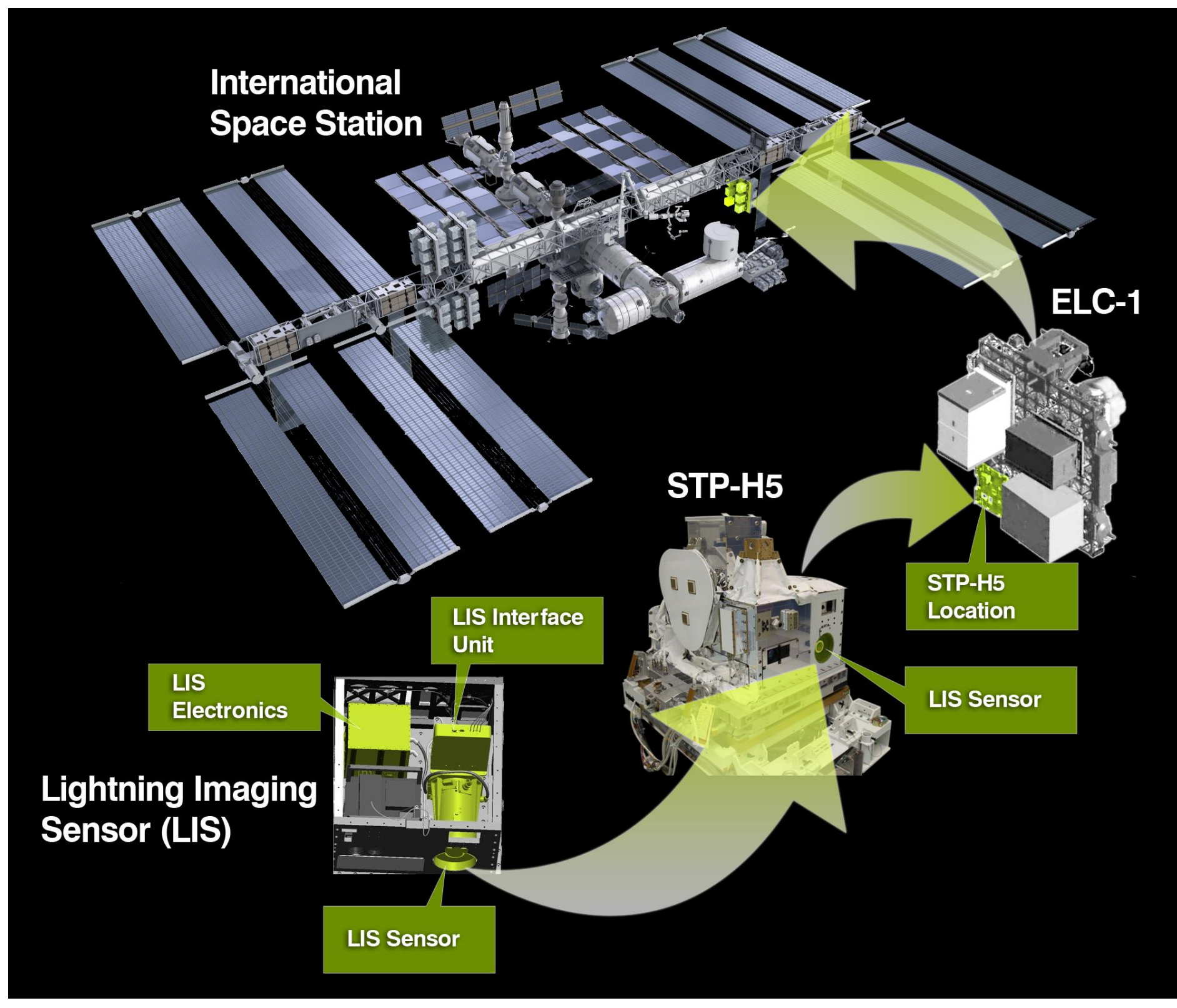


Similar time and distance offsets exist for TRMM LIS as shown here (the -2 ms temporal offset in TRMM LIS is known and previously characterized in the literature).



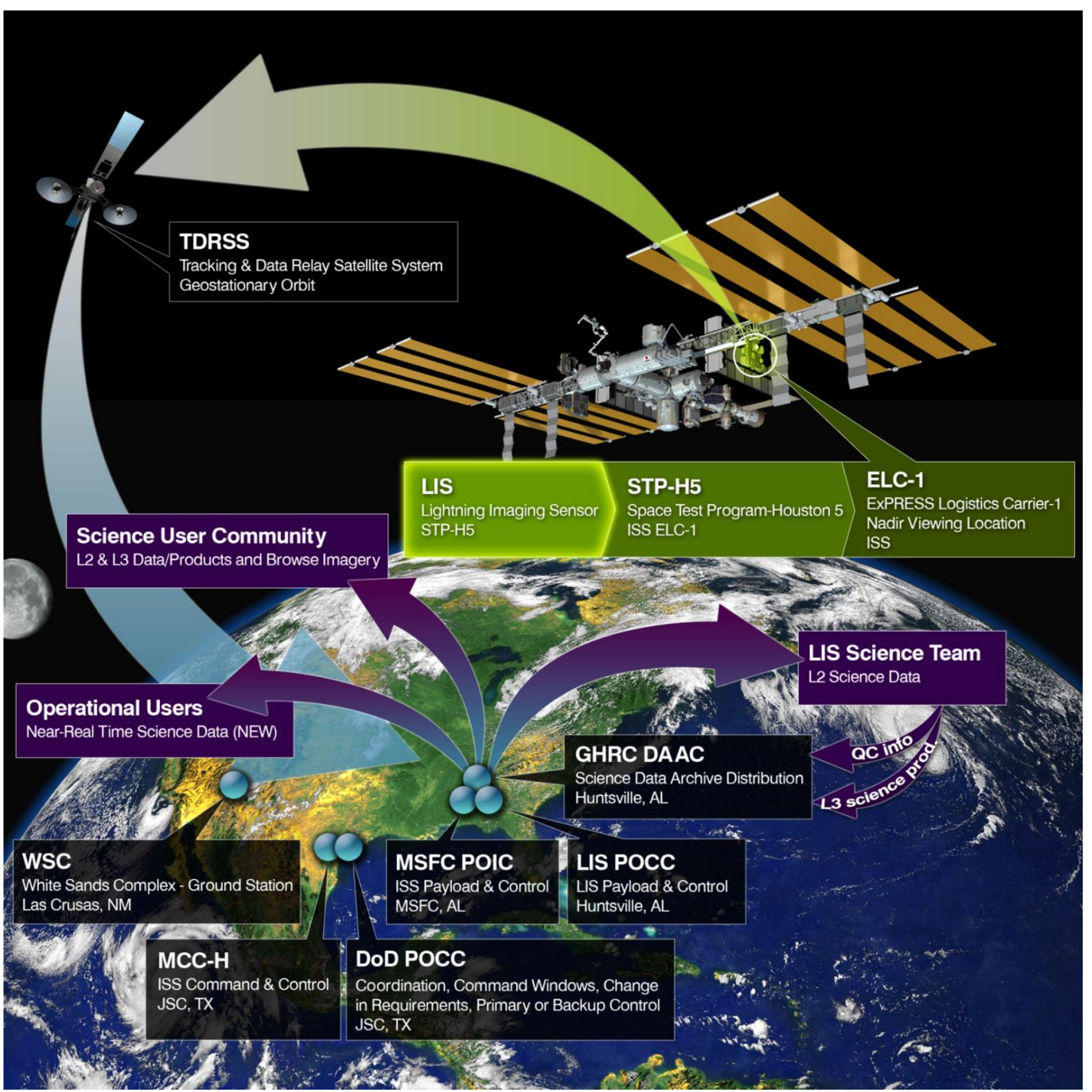
Peak time offset of LIS to reference data in 30 second bins over first 6 months demonstrates good time stability.

Launch and Installation

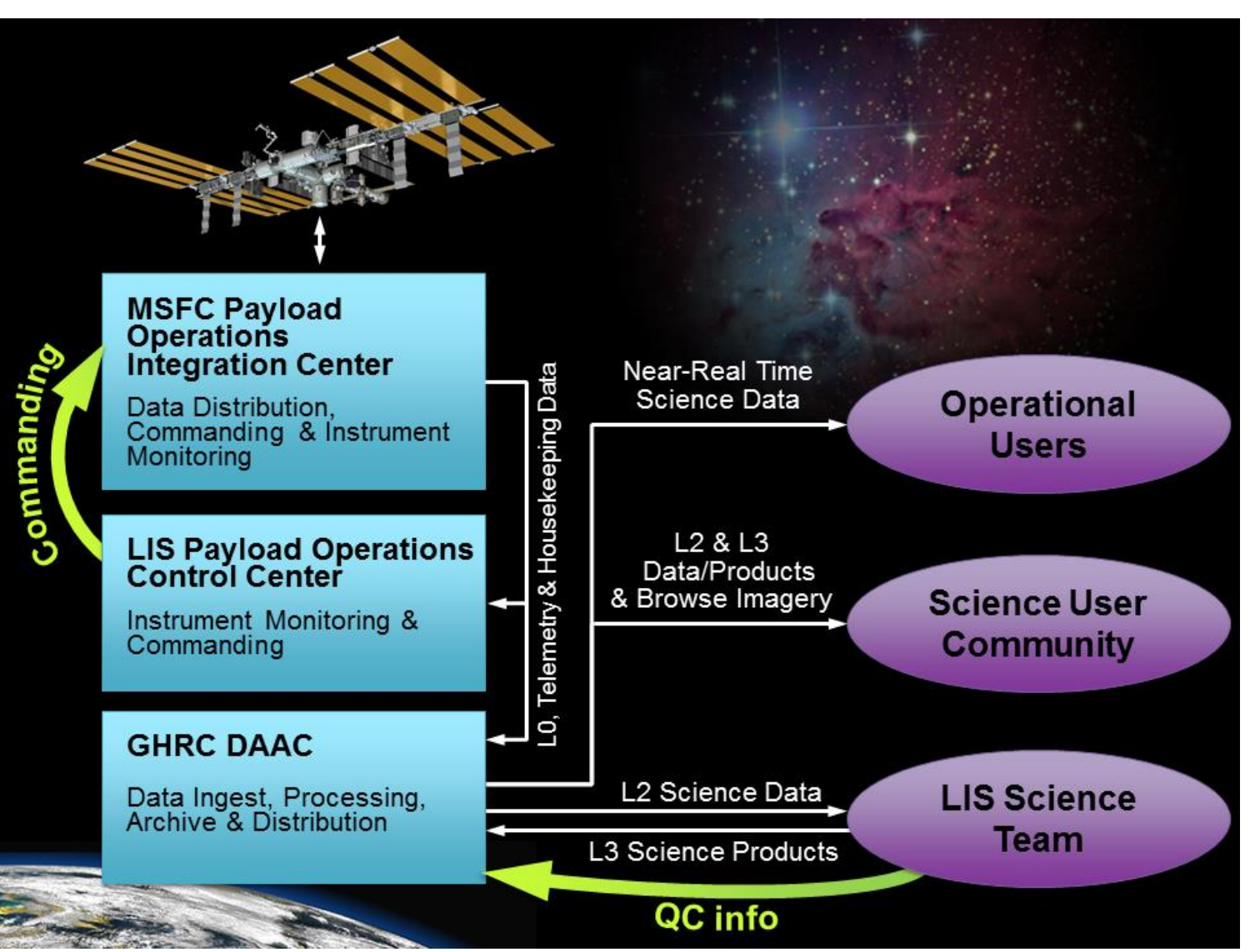


- LIS launched aboard Space X Cargo Resupply Service-10 (CRS-10) mission on 19 February 2017.
- STP-H5 payload robotically installed with LIS in an Earth viewing (nadir) position.
- LIS powered-up on 27 February 2017.
- Continuous operation has been maintained since LIS power-up.

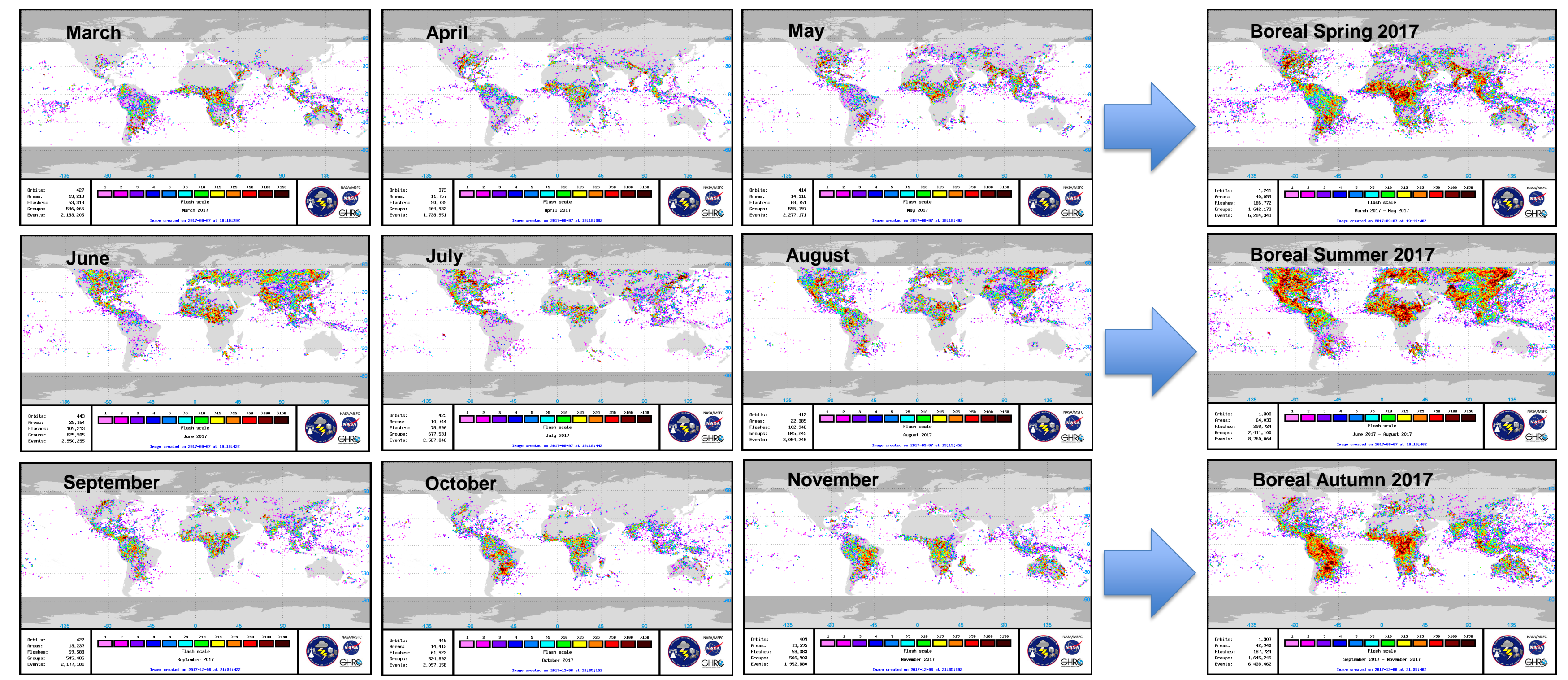
Data Handling (Processing, Archival, and Distribution)



Data handling involves a close partnership between the LIS science team and the Global Hydrology Resource Center (GHRC) Distributive Active Archive Center (DAAC).



- The well-established and robust data handling infrastructure used for LIS on the Tropical Rainfall Measuring Mission (TRMM) was adapted for the ISS mission to assure that lightning observations from LIS on ISS can be quickly delivered to science and applications users.
- Both legacy TRMM LIS format (HDF4) and a new netCDF-4/CF data are being produced for LIS on ISS.
- Provisional data will be publicly released by the GHRC mid to late December 2017.



Global lightning detections from LIS on ISS over first 9 months (no view time corrections applied) is similar to what was observed with the Optical Transient Detector (OTD) and TRMM LIS.

Summary

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