Laser Ranging (LR)-Lunar Reconnaissance Orbiter (LRO) Data Flow and Scheduling

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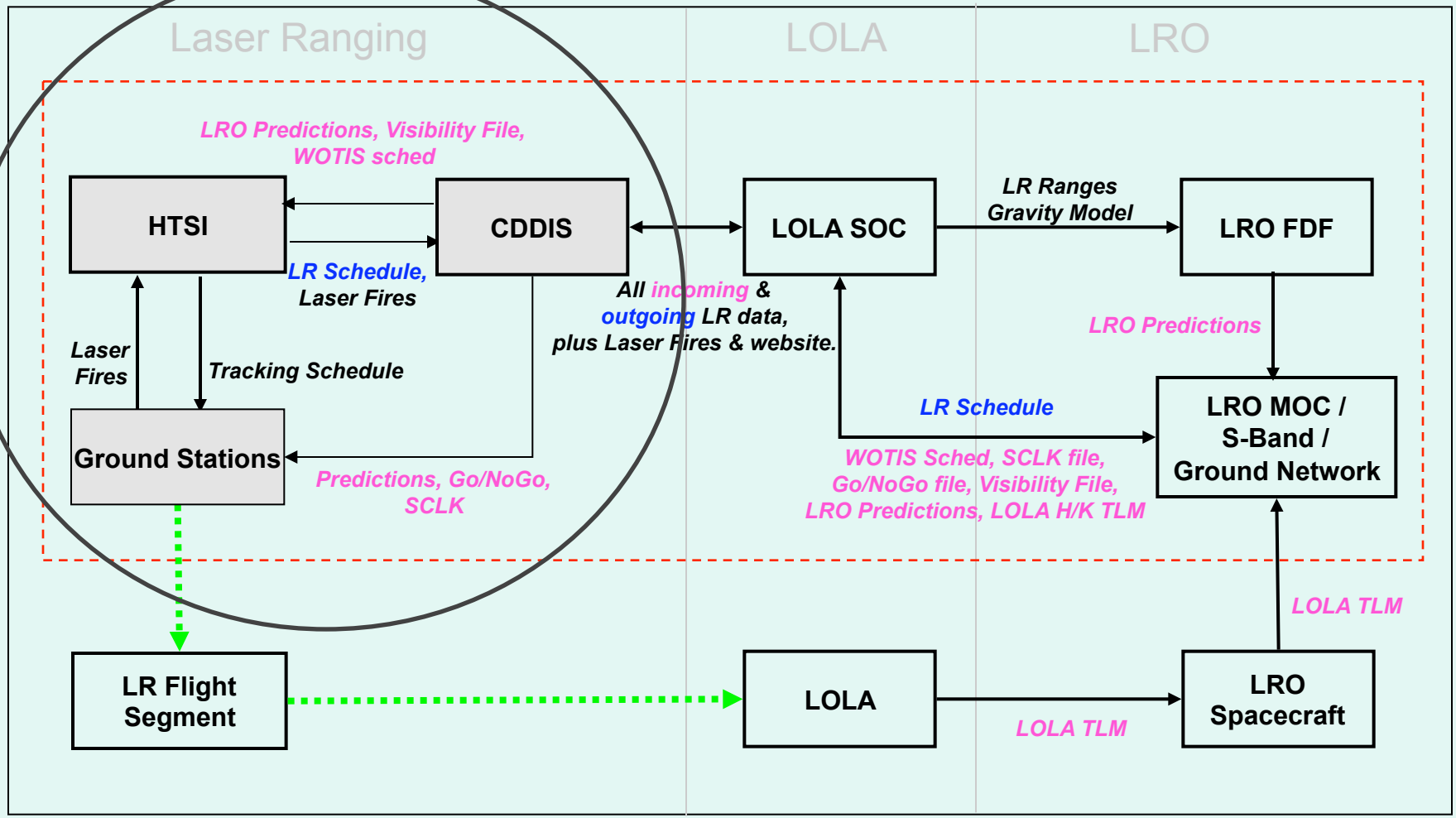
LR-LRO Data Flow and Scheduling

- After the launch of LRO in early 2009, NGSLR and all other approved ILRS stations will establish one-way ranging to the LRO-LOLA detector to meet intensive orbit determination requirements needed to develop a new lunar gravity field model.

- LRO will present new challenges for the ILRS and NASA SLR communities with new data and scheduling requirements that will help ensure the success of the LOLA payload experiment.
  - Data Format (New CRD format)
  - Data Flow
  - Scheduling for LRO Operations

- NASA SLR and HTSI have coordinated with the LRO mission and LOLA payload science team to develop new data and scheduling processes for LRO ranging.

Laser Ranging Network Block Diagram



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LR-LRO Data Products

- Predictions, in CPF format, will be generated by GSFC Flight Dynamics Facility (FDF):
  - Predictions will be generated once a week
  - Predictions will delivered to, and accessed on, a secure location on the CDDIS
  - Predictions will used to generate station visibilities, and station schedules
- Approved ILRS stations will establish one-way ranging to the LRO spacecraft and generate LR-LRO laser fire data in CRD format.
  - CRD format is required for added precision in the data product
  - Data filename will end in .frf (see CRD format v1.0, Ricklefs)
  - Data will be delivered to the ILRS Data Operations Centers (HTSI,EDC)
  - All LR-LRO fire data will be
    - compiled together once an hour
    - compressed and delivered to a secure location on the CDDIS
  - Data will then be available to the LOLA Science Team, which will
    - combine ground fires and corresponding spacecraft events
    - generate normal points in CRD format (.npt) and deliver to CDDIS (no public access)
    - develop lunar gravity field model

ILRS LR-LRO Schedules

- HTSI will generate the full tracking schedule for the NGSLR station, including LRO scheduled opportunities
  - HTSI will deliver NGSLR tracking schedule directly to station daily
  - NGSLR will be scheduled for every LR-LRO ranging opportunity
- Approved ILRS stations will be requested to range to specified LRO passes via a weekly combined LR-LRO schedule
  - HTSI will use LRO predictions to generate initial 20^{o} elevation station visibilities, then eliminating portions of the visibilities when LRO is on the far side of the moon
  - Schedules will then be produced based on:
    - System priority (NGSLR #1 priority during ranging opportunities)
    - High Gain Antenna schedule (WOTIS) - (systems will only be scheduled when antenna will be pointing at a “near by” S-Band stations)
  - LR-LRO ranging schedules will be generated every Friday, for the following Monday – Monday week
  - LR-LRO ranging schedule will be delivered to a secure location on the CDDIS

ILRS LR-LRO Schedules

- Weekly combined LR-LRO schedule
  - Approved ILRS stations will access the schedule on the CDDIS
  - LRO Mission Operations Center (MOC) will also access the combined LR-LRO ranging schedule for the required advanced notification of LR activity
  - Initially, LR-LRO ranging schedule will not overlap ranging opportunities for stations. This will most likely change later in the mission
  - LR-LRO ranging schedules will be suggested ranging opportunities for each selected station, however, each station must NOT range to LRO outside of these suggested opportunities
  - Currently in tests with approved ILRS stations

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Summary

- All ILRS stations approved to range to the LRO spacecraft will generate fire data (.frf) in CRD format
- All ILRS approved stations will send LR-LRO fire data to the ILRS Data Operations Centers (HTSI, EDC)
- HTSI will generate a combined LR-LRO schedule for all approved ILRS stations
- All LR-LRO products (predictions, fire data, normal points, and ILRS combined station schedules) will be hosted at a secure location on the CDDIS
- LRO Launch – April 24th, 2009
- Laser Ranging to LRO begins in June of 2009