



ESM6 Thoughts

July 19, 2024

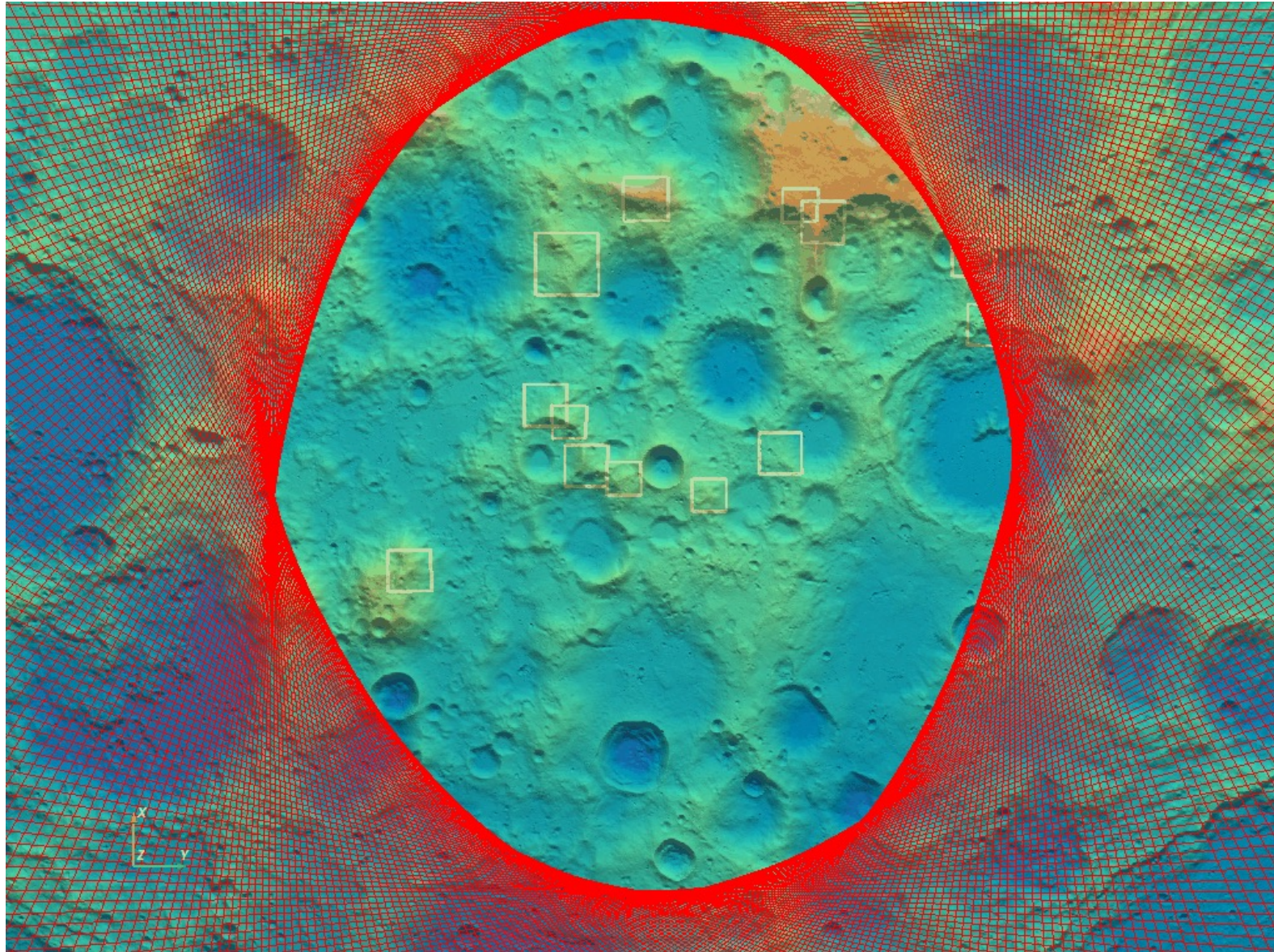


Notional Schedule - Thoughts

- Submission date of December 18th
 - Use of GSFC proposal support team for final PDF development
- Desire to minimize impact over end of year holidays (Thanksgiving)
- Ideally have no work from the teams after November 15th (week before Thanksgiving)
 - This means all main ESM6 science sections are "done" by this point
 - Would like 2 rounds of edits prior to that at ~2 weeks per round of edits, plus margin.
 - First drafts of sections mid-end of September
- Hybrid Team meeting in September in Northern VA/DC area
- August presentations on science topics
- Nobile Rim2 and Amundsen Rim though much of ESM6



The Basics – Orbits from John Keller





Proposal and Estimated Allocation of Pages – Outline (40 Pages)

| | |
|--|---|
| • Executive Summary (Petro/Banks) | 1 |
| • Current Mission Status (Petro/Banks/MDs) | 1 |
| • LRO Accomplishments in ESM5 (Petro/Banks/Leads) | 4 |
| • ESM6 Objectives (Theme Leads) – 22 pages with two foldouts | |
| • Foldouts (x2) | 4 |
| • Volatiles | 4 |
| • Ring of Fire focus | |
| • Change over 16+ years? | |
| • Lunar Environment | 3 |
| • Lunar Ionosphere | |
| • Radiation environment | |
| • Regolith/Impacts | 5 |
| • Modern Craters | |
| • Interior Processes (Volcanism/Tectonism) | 4 |
| • Tectonic changes | |
| • Photometric studies | |
| • ESM6 Programmatic Objectives - Mission Support (Banks) | 7 |
| • ESM Operations Plan (MDs/SEs/Mesarch) | 2 |
| • Management Plan (Petro/Banks/Burns) | 1 |
| • Data Archiving Plan (Banks) | 1 |
| • Professional Development Plan (Petro/Banks) | 1 |
| • Cost stuff [Overguide/Descopes] (Burns/Petro) | 2 |



The Basics

- ESM 6: October 1, 2025 to September 30, 2028
- The guidelines for the proposal to reflect the ESM5 proposal
- No insight into budget guidelines
 - Science and Mission Support evaluation criteria
 - Volatiles
 - Space Environment
 - Internal Processes (volcanism and tectonism)
 - Regolith and Impacts
 - Mission Support (CLPS, HLS)
 - International Mission Support
 - Requirement for science questions that require new data
 - We will have to describe how we have extended the fuel life of the spacecraft, fortunately the ESM5 testing gives us a clear guide of how to implement the new mode in ESM6
 - New team members (encouraged but not required)
 - PDS history



Appendices

- A1. Acronym List (Project)
- A2. References (Project)
- A3. Publications (Project)
 - Team Publications. List of relevant journal publications where the primary author is or was on the team, with summary table listing total publication counts per year.
 - External Publications. List of relevant journal publications where the primary author is not or was not on the team, with summary table listing total publication counts per year.
 - Publications should include only peer-reviewed science journal articles. Conference proceedings, general-audience articles, and engineering papers should not be included.
 - Publications should include only those which are directly dependent upon mission data or results.
- A4. Science Team (All)
 - **Name, role, affiliation, and FTE of each science team member, with very brief descriptions of their science focus during the EM (e.g., “Martian atmospheric chemistry”). Proposals should identify team members at or above the level of postdoc. Individuals not yet identified may be listed generally (e.g. “1 postdoc - aeronomy”).**
 - FTEs should be listed in fractions of a work year. The FTE level for each team member should be listed as the effort directly funded by the EM, plus any effort funded at no cost to NASA by institutions or foreign partners (e.g., “0.5 + 0.25”). Individuals with total funded + unfunded effort < 0.03 FTE should not be listed.
- A5. Project Data Management Plan (PDMP). (Maria/PDS)



Review Criteria

- Primary Criteria
 - Intrinsic merit of the proposed science investigations to be undertaken during the EM.
 - Responsiveness of the proposal to goals described in the Decadal Survey Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032.
 - Missions may optionally also refer to goals in Vision and Voyages for Planetary Science in the Decade 2013-2022 (2011), and/or New Frontiers in the Solar System: An Integrated Exploration Strategy (2003), depending on when the mission was originally proposed. The proposal should make clear from which Decadal Survey each goal is taken.
 - Capability of the spacecraft to achieve proposed science.
 - Merit of any programmatic objectives
 - Scientific productivity of the mission team in the previous cycle.
 - Performance of the mission team in archiving data to the PDS in the previous cycle.



Review Criteria

- Secondary Criteria
 - Extent to which the science community beyond the mission science team utilizes data and conducts published research.
 - Intrinsic merit of science data to be acquired and archived.
 - Science value.
 - *The PMSR will not perform a detailed cost analysis of each proposal. However, the panels may assess in broad terms the science return of the mission relative to its overall cost. The panels may also assess the relative science return of descoped options presented at different budget levels.*
 - Demonstrated capabilities and expertise of key personnel.
 - Expected effectiveness of the proposed PDP in training future mission leaders.
 - Thoroughness and appropriateness of the PDMP, including any optional compliance with NASA's transition toward Open Science.



Title

High Level Science Question(s)

- Point to Decadal/SCEM/Artemis SDT report

Investigation Science Question(s)

- What is/are the questions being answered

Key Figure(s)

Instrument Observations (and how much data is required)

- Instrument 1: Observation/data needed
- Instrument 2: Observation/data needed (if necessary)

Anticipated Outcome(s)



Additional Information

Additional details:

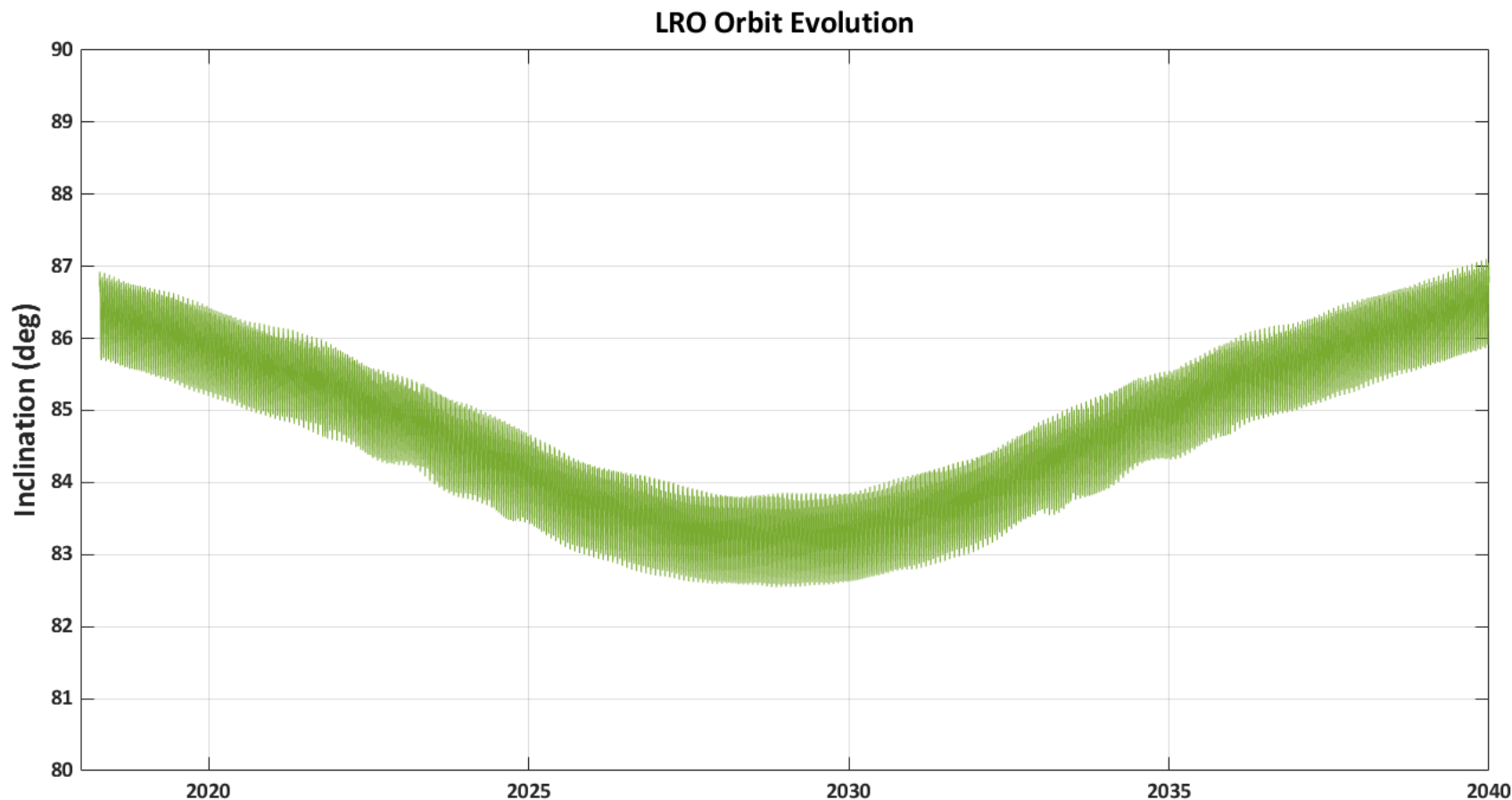
Additional figures:

Additional references:



LRO Orbit

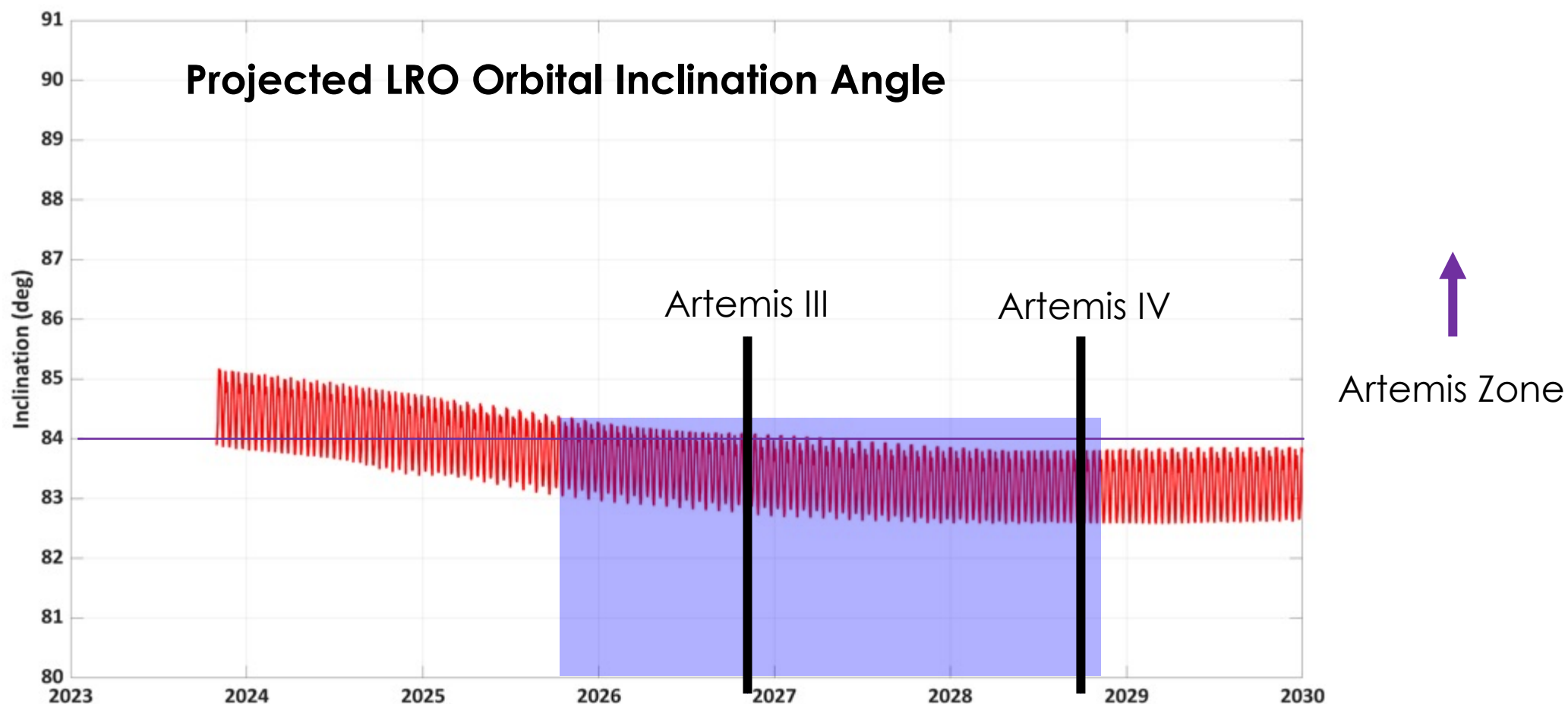
- During ESM6 LRO will essentially complete our inclination drift. Starts at $\sim -84.5^\circ$





LRO Orbit

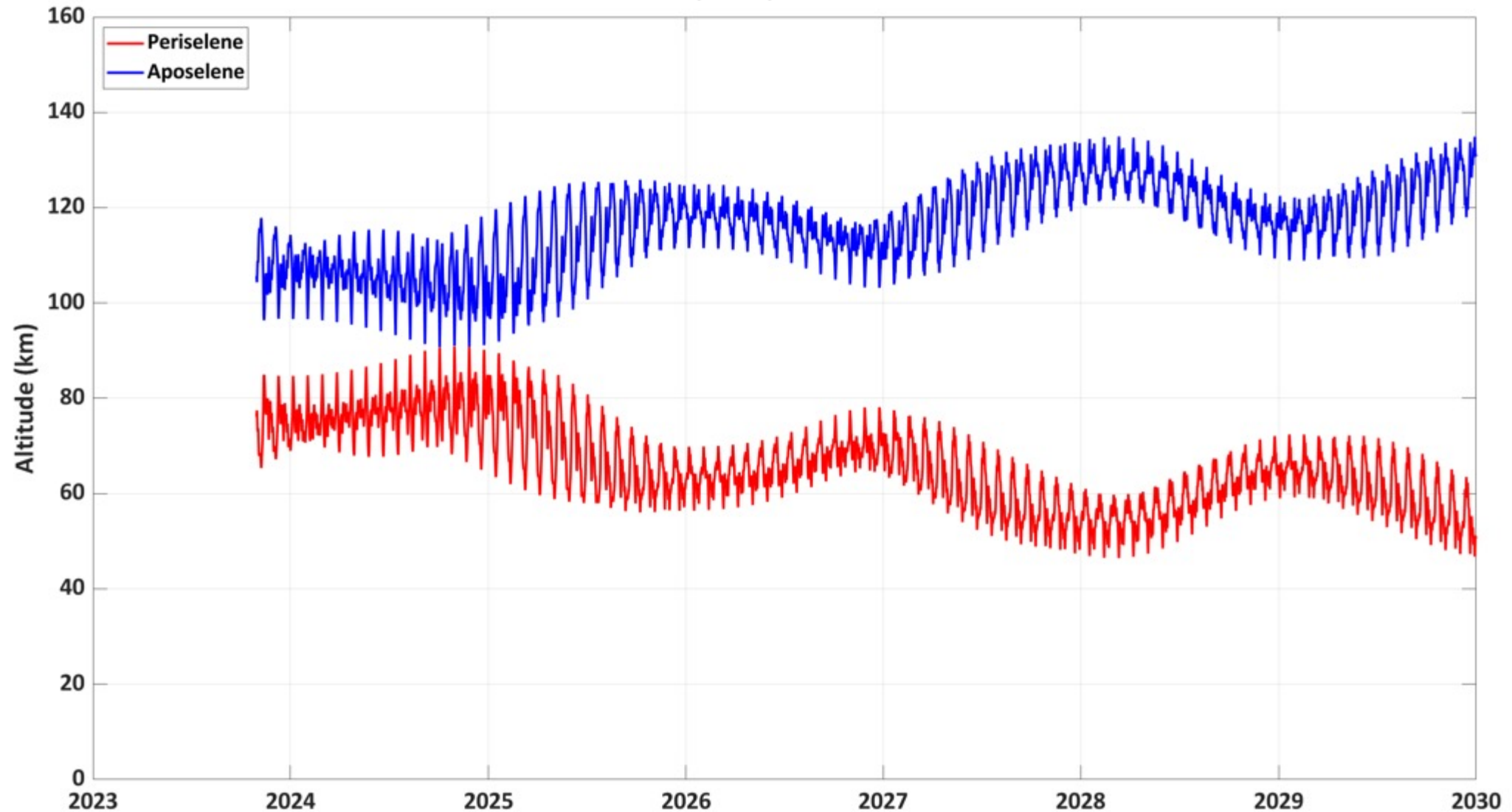
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Source: M. Mesarch, NASA GSFC Code 595



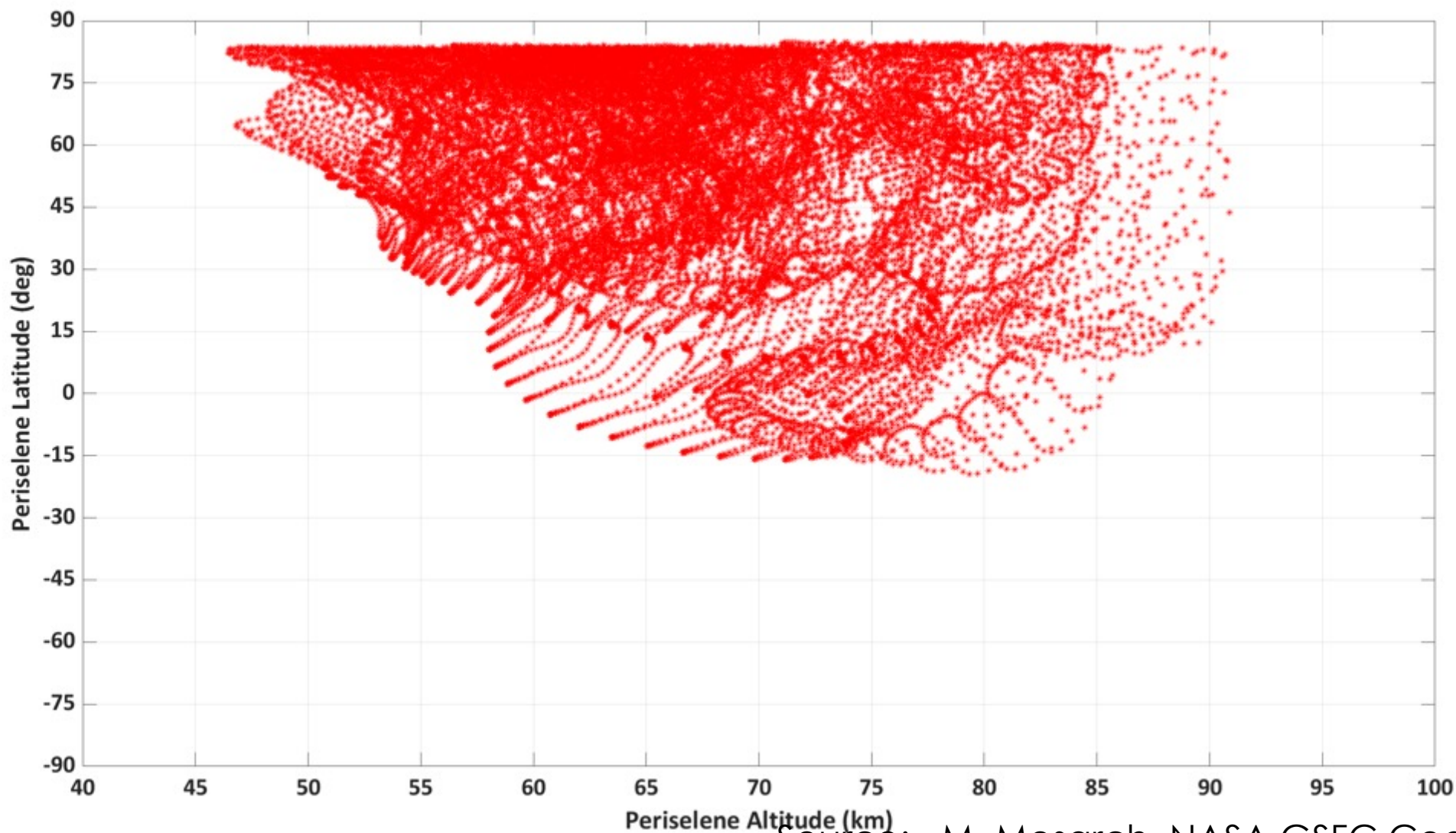
LRO Orbit



Source: M. Mesarch, NASA GSFC Code 595



LRO Orbit - ESM 6



Source: M. Mesarch, NASA GSFC Code 595



LRO Planned North Polar Orbital Coverage: “Ring of Fire”

on LOLA Topography

ESM #6: Time Span: 3 years: Oct 1, 2025 to Oct 1, 2028

Ephemeris: LRO_FO_20231030.bsp

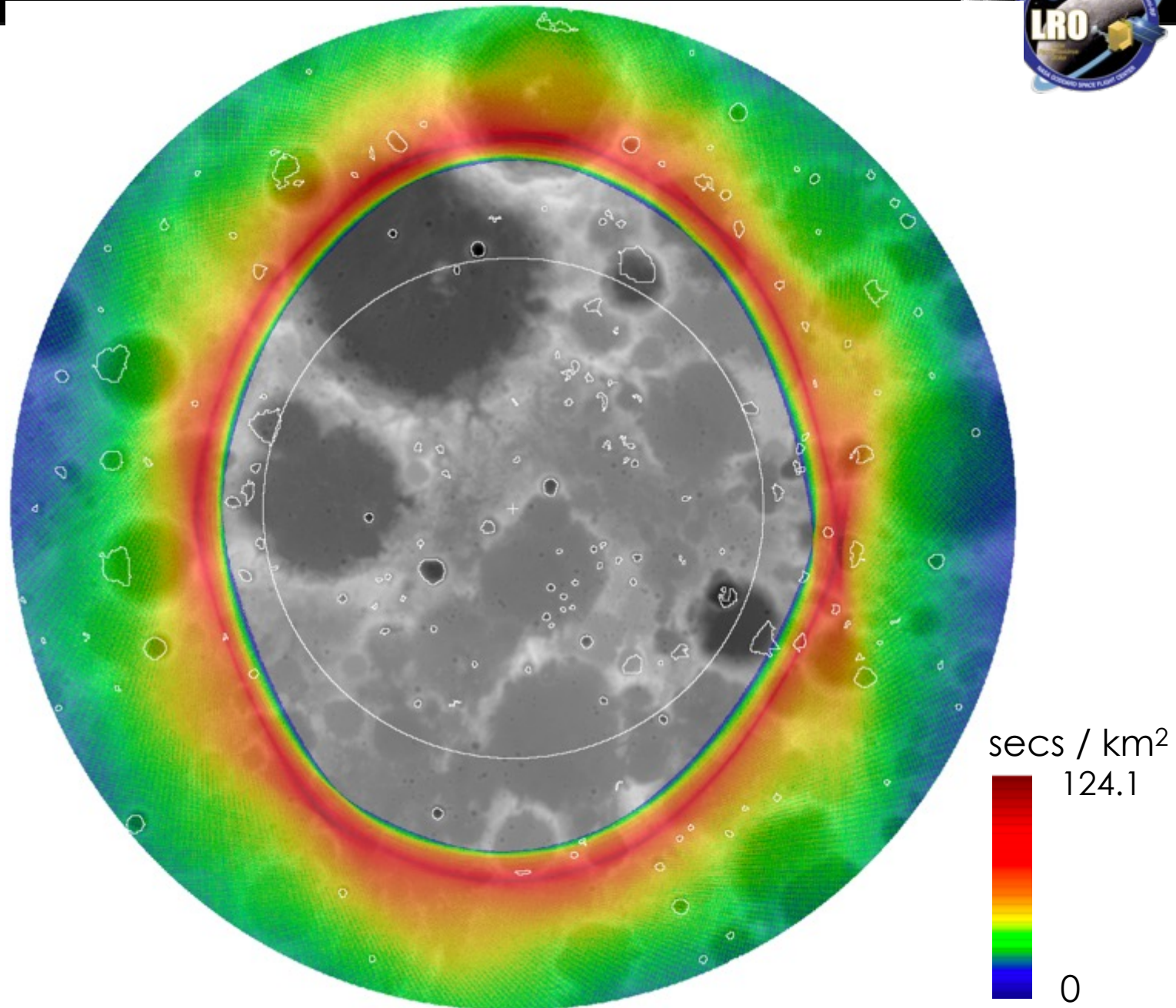
Assumes all coverage is nadir-pointing

Units = secs / km²

No duty cycle or slews factored.

Map is LOG10(Secs)

Colored areas have positive coverage Time. Grey areas (LOLA topo) = 0 secs coverage. White rims show large permanently shadowed regions with at least 5 km² area.





LRO Planned South Polar Orbital Coverage: “Ring of Fire”

on LOLA Topography

ESM #6: Time Span: 3 years: Oct 1, 2025
to Oct 1, 2028

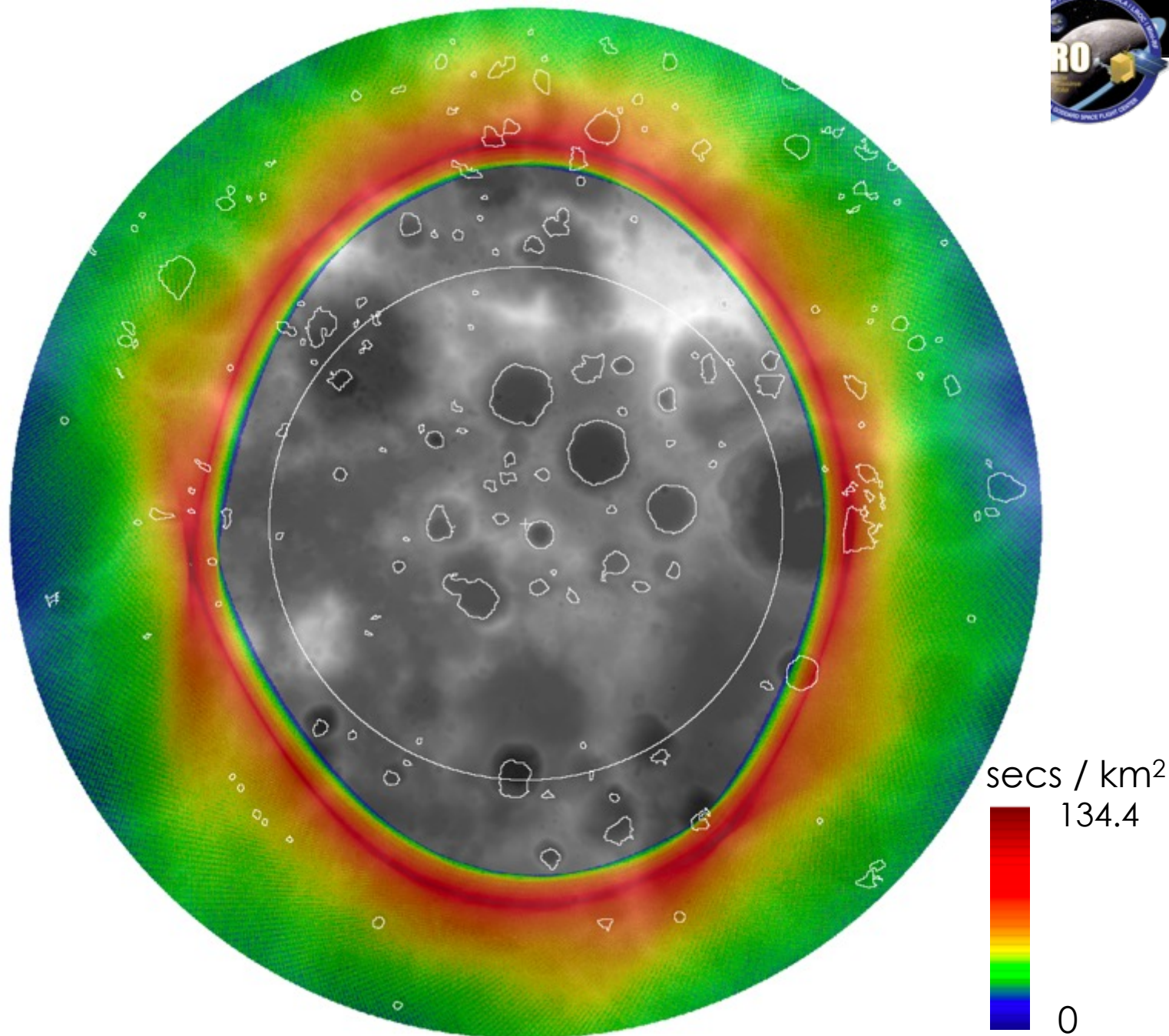
Ephemeris: LRO_FO_20231030.bsp

Assumes all coverage is nadir-pointing

Units = secs / km²

Map is LOG10(Secs)

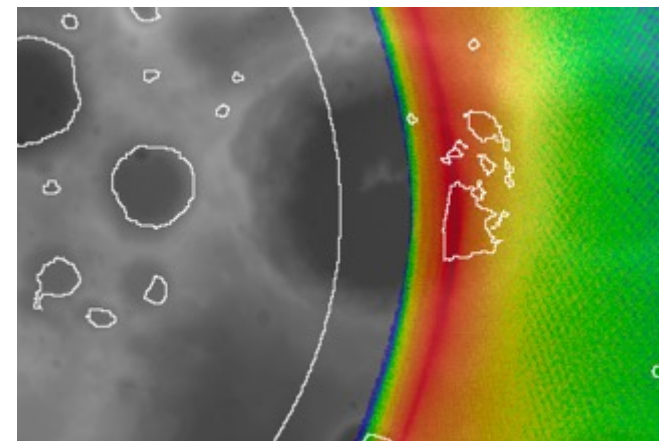
Colored areas have positive coverage
Time. Grey areas (LOLA topo) = 0 secs
coverage. White rims show large
permanently shadowed regions with
at least 5 km² area.





LRO Opportunities

- Science thoughts:
 - Orbit density coverage over Amundsen PSR, are there comparable PSR's in the North Pole?
 - Solar Activity – implications during this solar cycle
 - Change detection
 - Additional multi-instrument photometric observations
 - Lander disturbance to the surface/exosphere
- Mission Support
 - CLPS mission landing sites
 - PRSIM opportunities
 - Artemis and demo mission support





Proposal - Outline

1. Executive Summary (Petro/Banks) – 1 Page
2. Current Mission Status (Petro/Banks/MDs) – 1 page
3. LRO Accomplishments (Petro/Banks/Leads) – 4 pages
4. ESM6 Objectives (Theme Leads) – 22 pages with two foldouts
5. ESM6 Programmatic Support (Banks) – 7 pages
6. Technical Plan to Meet Objectives (MDs/SEs/Mesarch) – 2 pages
 1. Including instrument status sentences
7. Management Plan (Petro/Banks/Burns) – 1 page
8. Data Archiving Plan (Banks) – 1 page
9. Professional Development Plan (Petro/Banks) – 1 page
10. Cost stuff (Burns/Petro)
11. Appendices (PS's)
 1. Publications (LRO/Non-LRO)
 2. Science Team – Work for each member
 3. Data Management Plan
 4. Biographical Sketches of new team members



Additional Information

CRaTER:

Sunspot cycle is 11 years, but solar cycle is technically 22 years. So we will be comparing the next approach to sunspot minimum with the one that happened 11 years ago, but we will also be observing the yet unwitnessed end of the 22-year solar cycle that we've only partly observed.

LROC:

LROC can still image the pole with a roll slew (45 to 65 degrees depending on orbit).