



Artemis II Lunar Observations Support Software

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Introduction

The **Lunar Targeting Plan (LTP)** is a crew support tool used to guide the Artemis II crew through their lunar science observations during the lunar flyby period. The crew will observe the Moon through the Orion windows, capturing imagery with handheld Nikon D5 cameras, recording audio of their observations through the camera view finder and with their unaided eyes, and annotated notes on their handheld crew tablets.

The **Crew Lunar Observations (CLO)** Team, a subgroup of the Artemis II Lunar Science Team (A2LST), supports the science target selection process on the ground and, critically, produces and provides the Artemis II crew with the LTP.

In-Mission Operations Process

Target Determination

- CLO receives trajectory data.
- CLO utilizes Ansys System Tool Kit (STK) to generate **encounter** data. **Encounters** are areas of interest that will be visible and illuminated during the flyby period. **Encounter** data includes:
 - Start and end time the encounter is visible
 - Phase/incidence angles across flyby
 - Illumination across flyby
 - Anticipated ground sample distance from Orion
 - Simulated images and videos at varying fields of view across the flyby
- CLO delivers the **encounters** to the rest of the A2LST through an internal web-based tool known as the Live Encounters Guide [3].
- The Science Team utilizes the tool to:
 - Select and refine encounters based on potential science return
 - Write prompts for the Camera and Unaided Eye Actions in the LTP for selected encounters
 - Write prompts that detail the anticipated impact observations will have on lunar science
- The requested list of **targets** are worked on a timeline for crew shift schedules and accuracy. **Targets** are the **encounters** that were selected by the Science Team for the LTP.
- The Science Team delivers **targets** to CLO for LTP Generation.

LTP Generation & Delivery

- CLO receives the list of targets and their associated data, including:
 - Determined observation time, duration, and order
 - Scientific and observation prompts
 - Key features to label in the image
 - Time sensitivity
- CLO utilizes STK to produce simulated views of the targets using the field of view of the expected focal lengths at the requested target time.
- A2LST reviews and provides edits to the LTP.
- LTP is approved for delivery and gets uplinked to the crew tablets on Orion!

Lunar Targeting Plan (LTP)

The final LTP that is uplinked to the crew members includes an overview, timeline, geography review, and target pages with annotation capabilities. To produce realistic simulated imagery, CLO generates illumination-conditioned basemaps by computing surface reflectance and combining it with the albedo map from CGI Moon Kit [5]. All generated views are labeled with the "Big 15," key navigational areas on the lunar surface with high scientific value, and additional wayfinding features.

Target Overview / Home Page

- Shows targets (orange) and Big 15 (white)
- Highlights spatial relationship between targets and Big 15 across the flyby period
- Blue line across image shows Orion ground path
- Shift buttons enable Crew to toggle between each crew shift, showcasing only the targets related to their individual shifts
- Cue Card for observational talking points

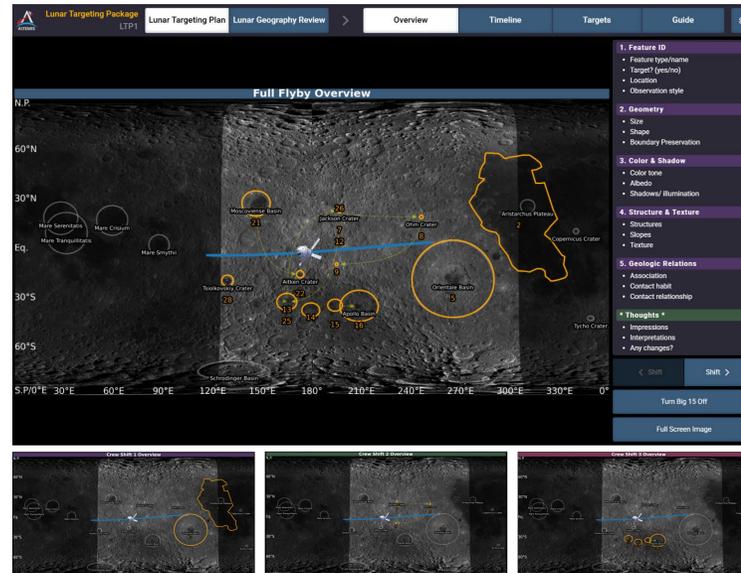


Fig. 1: Lunar Targeting Plan Overview (Home) page - The overview page houses a 2D map, shift and Big 15 toggles, full screen options, and the observation Cue Card. Overview maps for Shifts 1-3 span the bottom of the figure.

Timeline Page

- Lists targets and activities in requested temporal order
- Each target's timeline shows the times targets are visible from Orion
- Target coloration indicates which crew member is assigned the target
- Icons convey target importance and actions
- Triangles indicate when Loss of Signal occurs
- Green line tracks along the timeline as time progresses

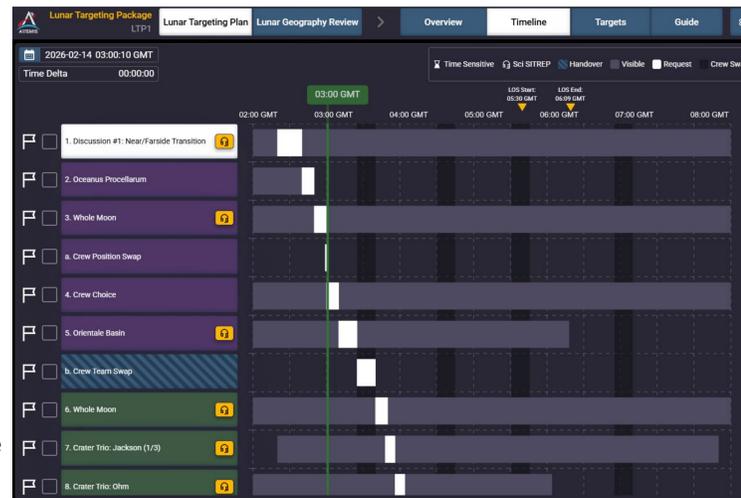


Fig. 2: The Timeline page lists the targets of interest at the requested observation time per crew shift and includes time for handovers, reflections, and swaps.

Target Details Page

- Pocket Timeline view
- Target / activity details and information
- Actions to perform by crew member with and without camera
- Impact observations will have on science
- Simulated views of the surface at the specified time from Orion without camera & common focal lengths (135, 200, 400 mm)
- Labels, full screen, and rotation toggles
- OneNote button to open OneNote for annotations
- Cue Card and toggle

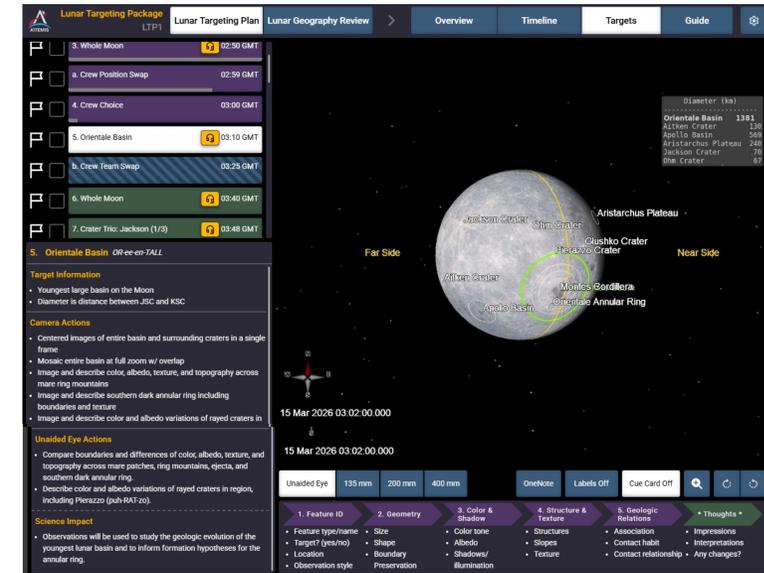


Fig. 3: The Targets page shows details relevant to capturing science-specific observations, along with simulated views of each target to aid with identifying the target area.

OneNote Annotations

- Link in Targets Page to Target / Activity in OneNote
- OneNote targets in same order as LTP
- Each page hosts unlabeled simulated imagery from the LTP
- Additional pages for notes during conferences and handovers and reference data
- Enables note taking and drawing on the provided images

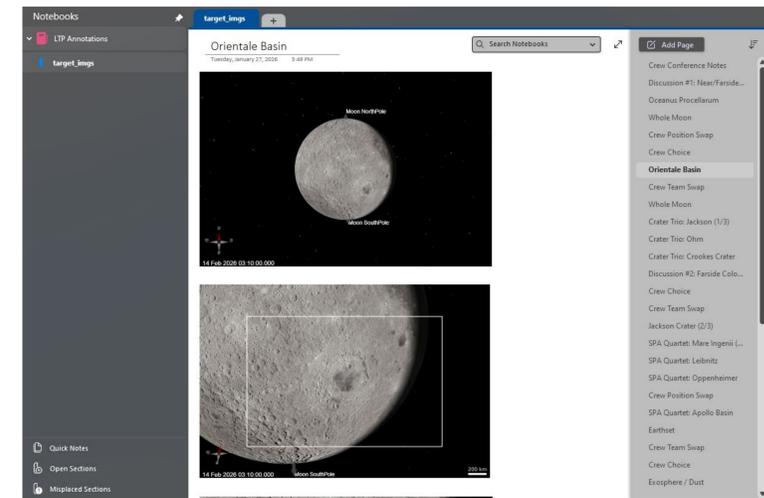


Fig. 4: OneNote application loaded with unlabeled simulated views from the LTP Target Page.

Conclusion

The Crew Lunar Observations (CLO) Team developed the Lunar Targeting Plan (LTP) to **support** and **empower** the **Artemis II crew** in capturing scientifically valuable observations of the lunar surface. The LTP integrates mission planning, target selection, simulated views, observation prompts, and in-flight tools to streamline crew operations and **maximize science return**. The software development processes, crew training and feedback, documentation, and live-mission support occurring during Artemis II lays the foundation for future lunar missions, reinforcing the role of human-led observations in planetary exploration.

References

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