

## Abstract:

The 50 Constellation Priority Sites – Noble, Joosten, French, Eppler, Gruener, Mendell, Plescia, Spudis, Wargo, Robinson, Lucey

The Constellation program (CxP) has developed a list of 50 sites of interest on the Moon which will be targeted by the LRO narrow angle camera. The list has also been provided to the M<sup>3</sup> team to supplement their targeting list. This list does not represent a “site selection” process; rather the goal was to find “representative” sites and terrains to understand the range of possible surface conditions for human lunar exploration to aid engineering design and operational planning. The list compilers leveraged heavily on past site selection work (e.g. Geoscience and a Lunar Base Workshop – 1988, Site Selection Strategy for a Lunar Outpost – 1990, Exploration Systems Architecture Study (ESAS) – 2005). Considerations included scientific, resource utilization, and operational merits, and a desire to span lunar terrain types.

The targets have been organized into two “tiers” of 25 sites each to provide a relative priority ranking in the event of mutual interference. A LEAG SAT (special action team) was established to validate and recommend modifications to the list. This SAT was chaired by Dr. Paul Lucey. They provided their final results to CxP in May. Dr. Wendell Mendell will organize an on-going analysis of the data as they come down to ensure data quality and determine if and when a site has sufficient data to be retired from the list. The list was compiled using the best available data, however, it is understood that with the flood of new lunar data, minor modifications or adjustments may be required.



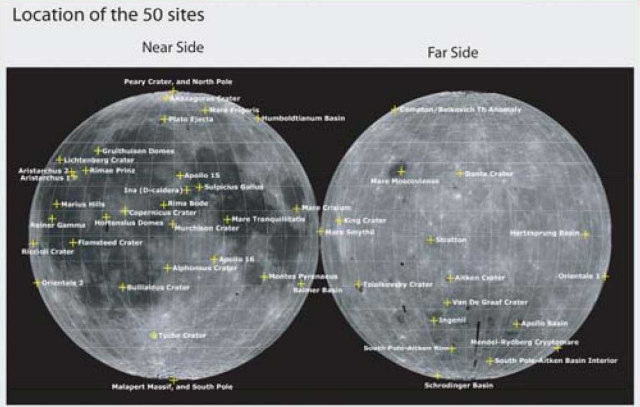
# The 50 Constellation Priority Sites

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The Constellation program (CxP) has developed a list of 50 sites of interest on the Moon which will be targeted by the LRO narrow angle camera. The list has also been provided to the M3 team to supplement their targeting list. This list does not represent a "site selection" process; rather the goal was to find "representative" sites and terrains to understand the range of possible surface conditions for human lunar exploration to aid engineering design and operational planning.

- The regions of interest were selected based on three criteria:
- Science rationale** - the 50 sites are of unique scientific interest or are scientifically complex requiring intensive field work with human interaction.
  - Resource potential** - as a whole, the 50 sites are representative of the type of natural resources available for development and exploitation.
  - Operational perspective** - as a whole, the 50 sites are representative of the different terrain types that the Altair lunar lander and the various lunar surface systems may encounter.



The list was compiled by a committee derived from both CxP and the science community (Eppler/Cx, French/LMMP, Gruener/Cx, Joosten/Cx, Mendell/Cx, Plescia/APL, Spudis/USRA, Wargo/ESMD). They leveraged heavily on past site selection work (e.g. Geoscience and a Lunar Base Workshop - 1988, Site Selection Strategy for a Lunar Outpost - 1990, Exploration Systems Architecture Study (ESAS) - 2005).

A LEAG special action team, chaired by Paul Lucey, was established to validate and recommend modifications to the list. They provided their final results to CxP in May.

The targets have been added as priority one to the LROC targeting database.

Wendell Mendell, Cx chief scientist, will organize an ongoing analysis of the data as they come down to ensure data quality and determine if and when a site has sufficient data to be retired from the list.

The targets have been organized into two "tiers" of 25 sites each to provide a relative priority ranking in the event of mutual interference. They are not prioritized within the tiers.

Tier 1 Sites						Tier 2 Sites					
Site	Latitude	Longitude	Altitude	Area (km²)	Notes	Site	Latitude	Longitude	Altitude	Area (km²)	Notes
Adrian Crater	66°N	15°E	175.88	18.76	highland	Adrian Crater	66°N	15°E	175.88	18.76	highland
Alphonsus	10°N	10°E	2.18	12.76	highland	Alphonsus	10°N	10°E	2.18	12.76	highland
Amalthea	20°N	10°E	4.36	25.52	highland	Amalthea	20°N	10°E	4.36	25.52	highland
Artemis 1	10°N	10°E	2.18	12.76	highland	Artemis 1	10°N	10°E	2.18	12.76	highland
Artemis 2	10°N	10°E	2.18	12.76	highland	Artemis 2	10°N	10°E	2.18	12.76	highland
Artemis 3	10°N	10°E	2.18	12.76	highland	Artemis 3	10°N	10°E	2.18	12.76	highland
Artemis 4	10°N	10°E	2.18	12.76	highland	Artemis 4	10°N	10°E	2.18	12.76	highland
Artemis 5	10°N	10°E	2.18	12.76	highland	Artemis 5	10°N	10°E	2.18	12.76	highland
Artemis 6	10°N	10°E	2.18	12.76	highland	Artemis 6	10°N	10°E	2.18	12.76	highland
Artemis 7	10°N	10°E	2.18	12.76	highland	Artemis 7	10°N	10°E	2.18	12.76	highland
Artemis 8	10°N	10°E	2.18	12.76	highland	Artemis 8	10°N	10°E	2.18	12.76	highland
Artemis 9	10°N	10°E	2.18	12.76	highland	Artemis 9	10°N	10°E	2.18	12.76	highland
Artemis 10	10°N	10°E	2.18	12.76	highland	Artemis 10	10°N	10°E	2.18	12.76	highland
Artemis 11	10°N	10°E	2.18	12.76	highland	Artemis 11	10°N	10°E	2.18	12.76	highland
Artemis 12	10°N	10°E	2.18	12.76	highland	Artemis 12	10°N	10°E	2.18	12.76	highland
Artemis 13	10°N	10°E	2.18	12.76	highland	Artemis 13	10°N	10°E	2.18	12.76	highland
Artemis 14	10°N	10°E	2.18	12.76	highland	Artemis 14	10°N	10°E	2.18	12.76	highland
Artemis 15	10°N	10°E	2.18	12.76	highland	Artemis 15	10°N	10°E	2.18	12.76	highland
Artemis 16	10°N	10°E	2.18	12.76	highland	Artemis 16	10°N	10°E	2.18	12.76	highland
Artemis 17	10°N	10°E	2.18	12.76	highland	Artemis 17	10°N	10°E	2.18	12.76	highland
Artemis 18	10°N	10°E	2.18	12.76	highland	Artemis 18	10°N	10°E	2.18	12.76	highland
Artemis 19	10°N	10°E	2.18	12.76	highland	Artemis 19	10°N	10°E	2.18	12.76	highland
Artemis 20	10°N	10°E	2.18	12.76	highland	Artemis 20	10°N	10°E	2.18	12.76	highland
Artemis 21	10°N	10°E	2.18	12.76	highland	Artemis 21	10°N	10°E	2.18	12.76	highland
Artemis 22	10°N	10°E	2.18	12.76	highland	Artemis 22	10°N	10°E	2.18	12.76	highland
Artemis 23	10°N	10°E	2.18	12.76	highland	Artemis 23	10°N	10°E	2.18	12.76	highland
Artemis 24	10°N	10°E	2.18	12.76	highland	Artemis 24	10°N	10°E	2.18	12.76	highland
Artemis 25	10°N	10°E	2.18	12.76	highland	Artemis 25	10°N	10°E	2.18	12.76	highland

**Nested observations**

Because the Cx imaging requests exceed the LROC capabilities, at least during the ESMD mission phase, a nested approach has been employed where the highest priority is placed on achieving full observation sets for 10x10 km regions at all 50 sites and additional observations will be obtained with the priority listed below.

- Priority 1: All Targets with full observations 10x10 km
- Priority 2: Other LROC Level 1 measurement requirements
- Priority 3: All Targets "best effort" full observations 20x20 km
- Priority 4: All Targets "best effort" nadir mosaics 40x40 km

- A full set of observations will include:**
- Geometric stereo images
  - 2 observations - one nadir, one at 20° off nadir (requires s/c slew)  
Solar incidence angle 50-60° off vertical if possible
  - Photometric stereo images
  - 4 observations with different solar azimuths - all nadir
  - Hazards (craters and boulders)
  - 2 observations
- One at solar incidence angle of 66-72° off vertical, one near 80° off vertical
- The actual number of images will depend on specific orbit groundtracks, lighting, interference etc. and could be substantially more.

Through the Lunar Mapping and Modeling Project (LMMP), data for these 50 sites from the LROC narrow angle camera and other instruments will be compiled and made available to the Constellation Program, the science community, and any other interested parties. In addition to imagery, digital elevation maps will be created. Hazard assessment maps will be produced, including crater and boulder distributions and slope and surface roughness maps. Hyperspectral data from M3 and/or multispectral data from the LROC WAC will be provided where available.

- The Constellation Program will utilize this data for:
- planning tasks in the areas of landing site evaluation and selection
  - design and placement of landers and other stationary assets
  - design of rovers and other mobile assets
  - developing terrain-relative navigation (TRN) capabilities
  - assessment and planning of science traverses