# 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 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 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

S. Noble<sup>1</sup>, K. Joosten<sup>2</sup>, R. French<sup>3</sup>, D. Eppler<sup>2</sup>, J. Gruener<sup>2</sup>, W. Mendell<sup>2</sup>, J. Plescia<sup>4</sup>, P. Spudis<sup>5</sup>, M. Wargo<sup>6</sup>, M. Robinson<sup>7</sup>, P. Lucey<sup>8</sup> <sup>1</sup>UAH/MSFC, <sup>2</sup>JSC, <sup>3</sup>MSFC, <sup>4</sup>APL, <sup>5</sup>LPI, <sup>6</sup>NASA HQ, <sup>7</sup>ASU, <sup>8</sup>UofHI ¹sarah.k.noble@nasa.gov



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:

Exploration Systems Architecture Study (ESAS) - 2005).

- Science rationale the 50 sites are of unique scientific interest or are scientifically complex requiring intensive field work with human interaction.
- 2. **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,

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.

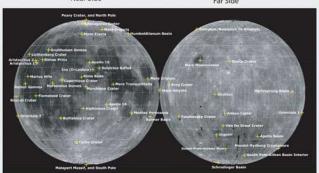
> The targets have been added as priority one to the LROC targeting database.

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.

#### Location of the 50 sites

Near Side

Far Side



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.

- No	Marchy	Timus Tipe	Longitude:	
Millar Cress	two prings - Basi	Ret .	177.48	-163
Alghimus	rollowies	Busin-cycla plains	1210	+12.9
Uniques:	per anothesia - comal poli-	highlands	-436	DESCRIPTION OF THE PERSON OF T
Apollo 15	Apomine - surface space weathering - LDEF	man	3.66	26.0
Aguilla Sé	surface own weathering-LDEF	bigliants	1547	ES ALV
Apollo Blasm	andmix	highlands	-153.72	-17.65
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NAME	complex highland coater with central peak	hiddenb	-22.56	-21.7
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Hetterpring	havin poolings - inner ning	man	-125.56	9.00
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Midgert Massif	fastis peology (SPA), partly view	highland moved	-297	45.9
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Suids Public	polar solitiles, extended satilight	bullanh	2619	57000
Orientale 1	racii short, mare pondo	may highland plains	-95.38	-36.3
Poes Cried	Polar volitiles	Inghiash	30.00	7343
Ezea Hide	treturus	prostence	-3.80	12.90
Sab his	Saur policy (SPA), Slockbarn crater	highlands	12036	243
525 Davin Interior	basin floor materials, impact milt	highland	-15994	40.9
Victor	Franch	Notifieds.	- NAME	2520
Sulpacies Gallers	produtes - resources	produce	8637	19.87
highs :	STRANG REGISTER STREET	organ Bay - wards	-0.30	42.0

Min	Opens	Zernie Type	\$30gmule	
Balmer Backs	arctot turn   basis	1081	66.82	THE
Compton Helkovitch	farside KREEP Th assemaly	highlands	94.25	86.11
Date	geneloses - ancient trest	highlands	37176	E2834
Flamined	Surveyor 1 site, young far as, resonance - No - To	man	-41.22	-24
Hartenna Donce	lew shoulds	mat	-2167	2.44
Hambridtonum Hasin	Name porkup	multiplicat.	77,14	3434
Sta ("Dreaders")	young utilized linkers - next six liv volation?	max	5.25	11.65
Inpeni	for side man, magnetic ascensh-bwork	man	164-42	-22.00
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May See Sei	mary ole, ground here Save	marr	85.33	-21
May Tranquines	moreover his -Ti hasalta	MAT	22.96	NAME OF TAXABLE PARTY.
Marios Hills	volume	man	-55.80	13.9
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Montes Promiseras	best policy - Natarii	man	40.83	-15.9
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## 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 place 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 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:

- 1 kull set of observations will include:
  1. Geometric stereo images
  2 observations one nadir, one at 20° off nadir (requires s/c slew)
  Solar incidence angle 50-68° off vertical if possible
  2. Photometric stereo images
  4 observations with different solar azimuths all nadir
  3. Hazards (craters and boulders)
  2. Photographics
  2. Photographics
  3. Photographics
  4. Photographics
  4. Photographics
  4. Photographics
  4. Photographics
  5. Photographics

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