LEAG REVIEW OF CONSTELLATION PROGRAM REGIONS OF INTEREST FOR HUMAN EXPLORATION OF THE MOON P. G. Lucey[1], J.T. Gillis-Davis[1], B.R. Hawke[1], L.A. Taylor[2], M. B. Duke[3], T. Brady[4] and T. Mosher[5]; [1]University of Hawaii, Institute for Geophysics and Planetology, 1680 East-West Road, Honolulu Hawaii, 96822, lucey@higp.hawaii.edu, [2]Dept. of Geological Sciences, Planetary Geosciences Institute, 402 GS Building, University of Tennessee, [3] Colorado School of Mines, 1500 Illinois St., Golden, CO 80401.Knoxville, TN 37996-1410, [4]Draper Laboratory 555 Technology Square, MS27 Cambridge, MA 01239, [5]Sierra Nevada Corporation Space Systems 8130 Shaffer Parkway Littleton, CO 80127

Introduction: The National Aeronautics and Space Administration (NASA) Constellation Program Office (CxPO) requested the Lunar Exploration Analysis Group (LEAG) to form a special action team to review and comment on targets and regions of interest identified by CxPO for imaging by the Lunar Reconnaissance Orbiter Narrow Angle Camera. These are intended to be representative of regions of future human lunar exploration activities and are meant to provide valuable scientific, operational and resource information.

Background: The Lunar Reconnaissance Orbiter Camera (LROC) will begin imaging the lunar surface in 2009. Two narrow angle cameras (NACs) will image the Moon at 0.5 m/pixel. Each individual NAC image frame represents a 2.5 x 25 km surface area, with the NAC pair resulting in a 5 x 25 km area of coverage. In the course of the first year of mapping, this will result in only 8-10% of the Moon's surface being imaged at high resolution. Thus, it is important to make sure priority regions of interest are identified and placed into the NAC targeting plan. The Constellation Program Office (CxPO) is responsible for the planning of future human missions to the Moon, including long duration missions to a lunar outpost, and shorter duration human-sortie missions to locations other than the outpost location. CxPO has identified 50 high priority regions of interest for human exploration of the Moon, based on three past NASA reports[1,2,3].

The 50 regions of interest have been divided into two tiers to aid planners in the case of LROC operational conflicts, each with 25 locations. Tier 1 regions of interest have a higher priority than Tier 2 regions of interest; there is no prioritization within each tier.

The regions of interest were selected based on three criteria:

1. 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.
3. 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 images acquired by the LROC NAC will be used by NASA to create image mosaics, topographic maps and digital elevation models, and surface hazard assessments. These data will be used in the design process for the Altair lunar lander (e.g., approach and landing, hazard avoidance), and lunar surface systems such as habitation, surface mobility, power, communications, and navigation.

CxPO has been working with the Lunar Reconnaissance Orbiter (LRO) Project Office and the LROC principal investigator (PI) to develop a plan for imaging the 50 regions of interest identified by Constellation, including the area of coverage for a given location that is allowed by orbit parameters and mission constraints.

For each region of interest, there is a series of nested squares, or a 'box within a box', that represent three areas of coverage. The 10 x 10 km 'box' represents an area as described by the LRO Project requirements. This area has a Priority 1 in the LROC prioritization scheme, and a full set of observations will be made for an image mosaic, stereo imaging (geometric and photometric), and hazard identification. The 20 x 20 km 'box' has a Priority 3, and represents a 'best effort' by the LROC PI to acquire a full set of observations. The 40 x 40 km 'box' has a Priority 4, and represents a 'best effort' by the LROC PI to acquire a monochromatic mosaic only.

Request to LEAG by Constellation: The review and comment on the 50 regions of interest identified by Constellation will include:

1. Reprioritization between Tiers 1 and 2, if deemed appropriate.
2. Adjustment of the target coordinates if deemed appropriate.
3. Additional suggested targets and regions of interest that could replace those identified by CxPO.
4. Suggested additional regions of interest for a lower priority ranking (i.e., “Tier 3”).

Rationale will accompany all comments and suggestions, based on Constellation's criteria of scientific rationale, resource potential, and operational perspective.

TIER ONE TARGETS		
Feature Name	Lat	Long
Alphonsus Crater	-2.16	-12.56
Aristarchus 1	-48.95	24.56
Orientale 1	-95.38	-26.2
Apollo 15	3.66	26.08
Aristarchus 2	-52.9	25.68
Ingenii	164.42	-35.48
Ina ('D-caldera')	5.29	18.65
Flamsteed Crater	-43.22	-2.45
Reiner Gamma	-58.56	7.53
Copernicus Crater	-20.01	9.85
Tycho Crater	-11.2	-42.99
Orientale 2	-87.91	-18.04
South Pole	-130	-89.3
North Pole	76.19	89.6
Van De Graaf Crater	172.08	-26.92
Malapert Massif	-2.93	-85.99
Gruithuisen Domes	-40.14	36.03
Mare Tranquillitatis	22.06	6.93
Rima Bode	-3.8	12.9
Marius Hills	-55.8	13.58
South Pole-Aitken Basin Interior	-159.94	-50.76
Tsiolkovsky Crater	128.51	-19.35
Mare Smythii	85.33	2.15
Montes Pyrenaeus	40.81	-15.91
Dante Crater	177.7	26.14

TIER TWO TARGETS		
Feature Name	Lat	Long
Aitken Crater	173.48	-16.76
Anaxagoras Crater	-9.3	73.48
Apollo 16	16.47	-9
Apollo Basin	-153.72	-37.05
Balmer Basin	69.82	-18.69
Bullialdus Crater	-22.5	-20.7
Compton/Belkovich Th Anomaly	99.45	61.11
Hertzsprung	-125.56	0.09
Hortensius Domes	-27.67	7.48
Humboldtianum Basin	77.14	54.54
King Crater	119.91	6.39
Lichtenberg Crater	-67.23	31.65
Mare Crisium	58.84	10.68
Mare Frigoris	40.74	55.45
Mare Moscoviense	150.47	26.19
Mendel-Rydberg Cryptomare	-93.07	-51.14
Murchison Crater	-0.42	4.74
Mutus Crater	30.85	-63.77
Plato Ejecta	-5.21	53.37
Riccioli Crater	-74.28	-3.04
Rimae Prinz	-41.72	27.41
Schickard	-53.96	-44.05
Schrödinger	138.77	-75.4
Stratton	166.88	-2.08
Sulpicius Gallus	10.37	19.87

References: 1. Exploration Systems Architecture Study (ESAS), 2005. 2. A Site Selection Strategy for a Lunar Outpost, Science and Operational Parameters, 1990. 3. Geoscience and a Lunar Base, A Comprehensive Plan for Lunar Exploration, NASA CP 3070, 1990.