LUNAR QUICKMAP: MEETING THE CHALLENGE OF POLAR EXPLORATION. E. Malaret[1], M.S. Robinson[2], C. Hash[1], P. Guasqui[1], C. Mauceri[1], A. Battisti[1], and V.A. Malaret[1]. [1]Applied Coherent Technology Corp. (112 Elden Street, Suite K, Herndon, VA 20170, malaret@actgate.com), [2]Arizona State University.

Introduction: Lighting conditions at the lunar poles present both challenges and opportunities. The opportunities are well known: areas with extended periods of illumination for solar power and cold trapped volatiles in some Permanently Shadowed Regions. Challenges include highly tangential illumination that results in a hodge-podge of deep shadows that, in some areas, change relatively rapidly. Some of the shadows originate from distant mountains resulting in sometimes counterintuitive shadowing. Such rapidly changing illumination trigger correspondingly rapid temperature variations.

Overview of Lunar QuickMap: ACT-REACT-QuickMap™ is a commercial product developed by Applied Coherent Technology Corporation (**ACT**). QuickMap provides an easy-to-use yet powerful web interface for cartographic products. Designed with the end-user in mind, QuickMap offers seamless access to numeric data layers without the tedium of handling file format details, data ingestion, and archive structures.

Mission Proven - QuickMap has directly supported NASA's MESSENGER, MRO/CRISM, and LRO missions providing the science community and public easy access to higher-level products.

Lunar QuickMap is a public-facing web tool developed in collaboration with the NASA LRO project, Arizona State University (ASU), and ACT. Lunar QuickMap has similarities to other web-based lunar data viewers, but it differs by exposing numerous advanced capabilities:

- Interactive visualization of numeric data layers
- Extraction of probes, data profiling, and sub-cubes
- Supports layer based algebraic expression
- Extraction of cartographic sub cube with all geophysical parameters of interest in the system
- Loading your own data: GeoTIFF/GeoJSON
- Supports both stack and grid view of layers
- Adv. search/display of LROC/NAC images
- Synthetic Lunar Image Modeling, based on QuickMap TerrainShadows
- Ability to implement mission specific decision support tool logic to assess landing or rover sites

All these features permit Lunar QuickMap to meet many of the challenges of polar exploration in terms of science analysis and mission planning.

Exploring Artemis 3 Candidate Regions: NASA recently announced 13 candidate regions for the Artemis III crewed landing. These sites are available as a new layer in Lunar QuickMap. In this presentation we will concentrate on demonstrating relevant recent capabilities such as:

- Access to a new layer class called terrain; a stack version of the DEMs such that the best resolution is in on top (NAC-DTMs.)
- Implementation and execution of Decision Support Tools (DST) for the assessment of candidate landing sites.
- Ability to achieve Rapid Environmental Assessment (REA) of past/future illumination conditions at a given location by: a) leveraging on new advance search tools that identify NAC images captured with similar subsolar LATLON conditions, b) Model illumination conditions using the new TerrainShadow tools, i.e.
    - Generate interactive 3D navigation over the terrain while simultaneously simulating lighting conditions at the poles. Illumination source can be either the Sun or Earth.
    - Evaluate illumination conditions over a traverse as a function of distance along the traverse and time of interest.
    - Evaluating line-of-sight communication between antenna and ground position
    - The interactive 3D model can be useful as a training tool for astronauts (and the scientific community) to build intuition on the illumination conditions.

We will present several example workflow scenarios leveraging Lunar QuickMap to achieve the challenge of polar exploration with emphasis on solar illumination and Earth visibility.

Future Plans: ACT plans to continue improving the capabilities in Lunar QuickMap for better support of polar exploration. Some recent suggestions include:

a) Refine it as training tool
b) Interfacing with autonomous landing software components that need simulated data
c) Adding new data layers.

Acknowledgments: Most of the data in the Lunar QuickMap can be accessed at the file level from the Planetary Data System (PDS).

References: [1] Malaret E., Robinson M., et al. (2022) LPSC abstract#2792 , Using Lunar QuickMap to Assess the VIPER Site Selection. [2] Malaret E., Robinson M. , et al. , PSIDA 2022 abstract, Using Lunar QuickMap For Synthetic Lunar Image Modeling (SLIM).

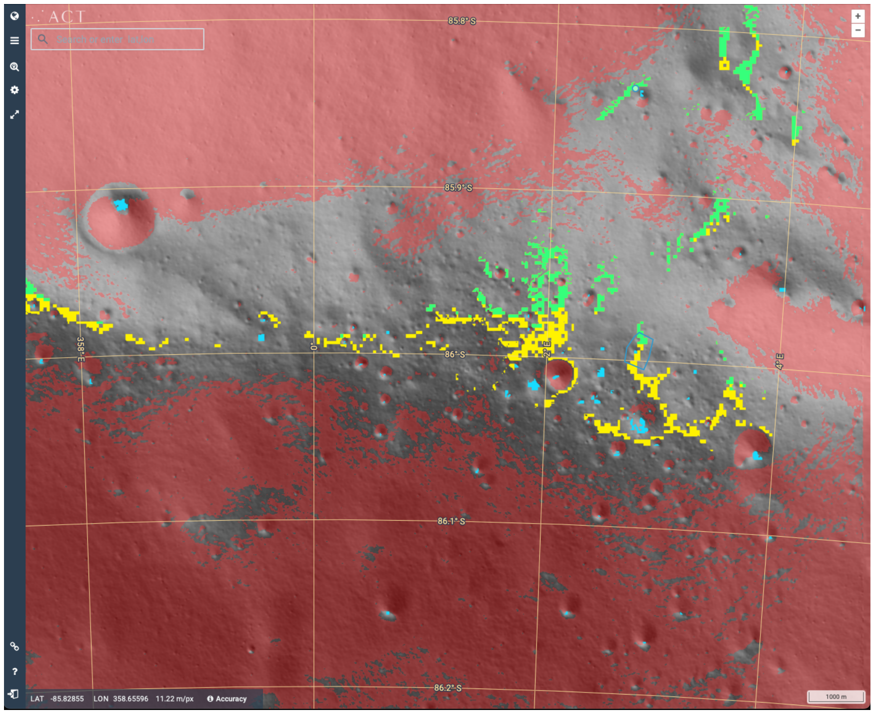

Fig. 1. Polar stereographic view over the Malapert Massif region. Color coding is computed on the fly by QuickMap's DST workflow. depicting different criteria zones, e.g. Green = Rover Safe Zone, Red = Rover to Avoid, Blue = potential water zone, Yellow = Recommended as a rover transit zone.

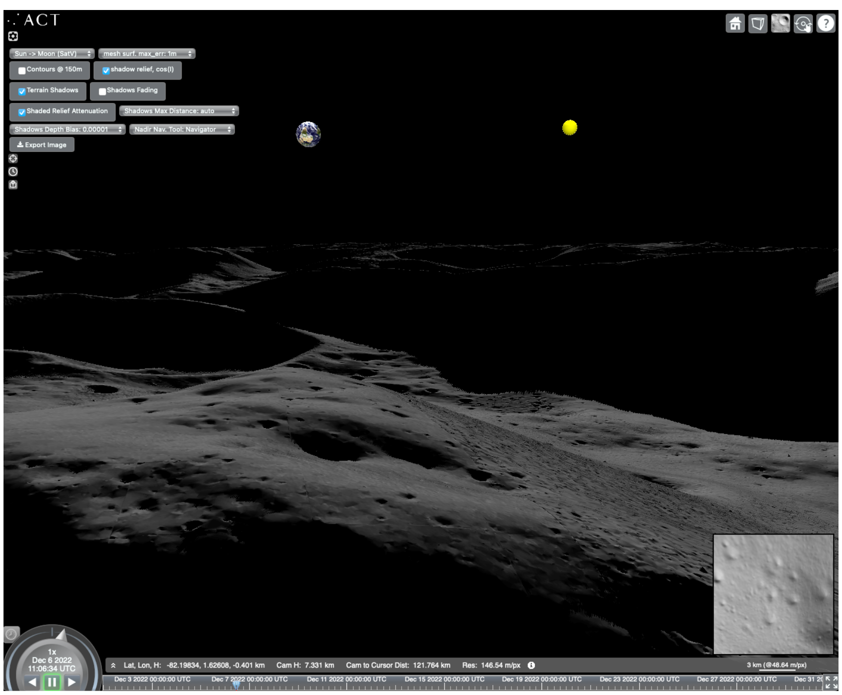

Fig. 2. QTS-3D simulation of lander approaching Malapert Massif (one of the A3 candidate regions). On the horizon both Earth and Sun are visible [https://tinyurl.com/3rpufxhc]. On the lower right, a nadir looking camera is activated with detail TerrainHillshade information under the observer position.