MOCI Science

Near-Real-Time Passive Terrain Mapping

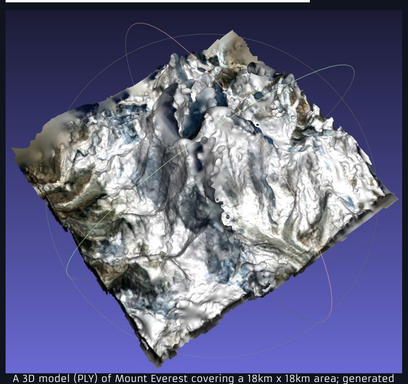
Science Goals

The Primary focus of the Mapping and Ocean Color Imager (MOCI) Satellite is to provide near real time terrain models from an orbital platform using structure from motion techniques.

In orbit, MOCI will be able to produce the following data products, any of which could be selected for downlink:

- DSM/DEM (Raster/PLY/GeoTiff/Tiff)
- Raw Surface (PLY/STL/OBJ)
- Dense Point Cloud (NVM)
- Feature Matching Sets

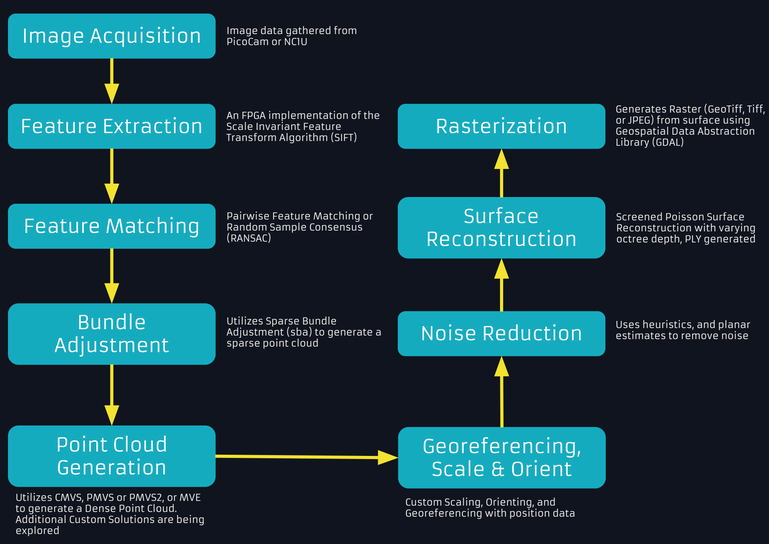
A Dense Point Cloud, generated from simulated data from a simulated payload, run through the MOCI SfM workflow. This shows a point cloud created from 2D images of Mount Everest.

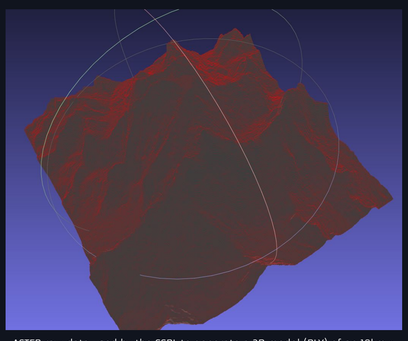


A 3D model (PLY) of Mount Everest covering a 18km x 18km area; generated from simulated image data, simulated payload, using the custom MOCI SfM workflow.

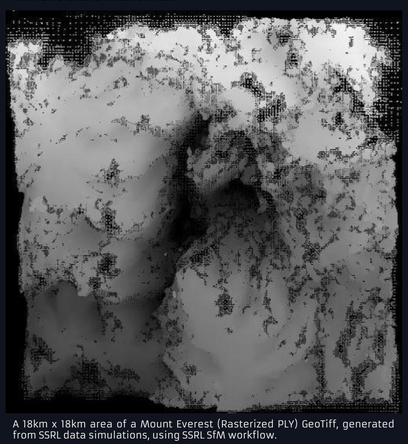
Structure from Motion

Structure from Motion (SfM) is a general term for a photogrammetric technique that utilizes Multiview Stereo to deduce 3D structure from sets of 2D images. SfM workflows vary greatly, an example of the current workflow for the MOCI satellite is as follows:

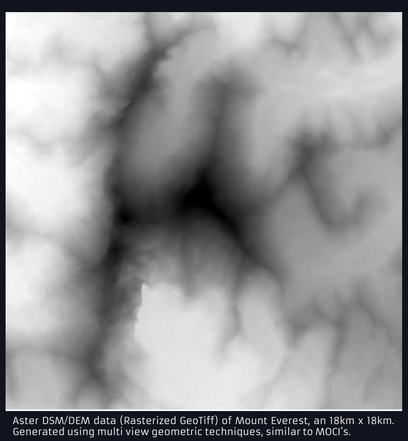




ASTER raw data used by the SSRL to generate a 3D model (PLY) of an 18km x 18km area around Mount Everest.



A 18km x 18km area of a Mount Everest (Rasterized PLY) GeoTiff, generated from SSRL data simulations, using SSRL SfM workflow.

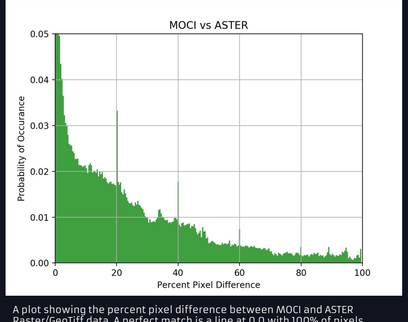


Aster DSM/DEM data (Rasterized GeoTiff) of Mount Everest, an 18km x 18km. Generated using multi view geometric techniques, similar to MOCI's.

DoD & AFRL Relevance

MOCI is capable of passively mapping highly variable, potentially hostile, terrains and producing DSM's/DEM's in near real time to increase tactical and situational awareness. MOCI aligns with the 2014 Quadrennial Defense Review goals to understand the impacts of climate change on future missions. Furthermore, MOCI aligns with the 2010-30 Air Force Science and Technology Horizon themes by helping to shift from:

- Platforms to Capabilities
- Control to Autonomy
- Permissive to Contested
- Sensor to Information



A plot showing the percent pixel difference between MOCI and ASTER Raster/GeoTiff data. A perfect match is a line at 0.0 with 100% of pixels having no height difference. A bell curve is expected, the goal is for MOCI data to place within 1.28 Sigma (80% accuracy) of existing DSM's/DEM's. This Initial test places MOCI within 65% accuracy. Percent Pixel difference is calculated by: Abs[(ASTER Pixel Height) - (MOCI Pixel Height)] / Bit Depth