Ames Stereo Pipeline

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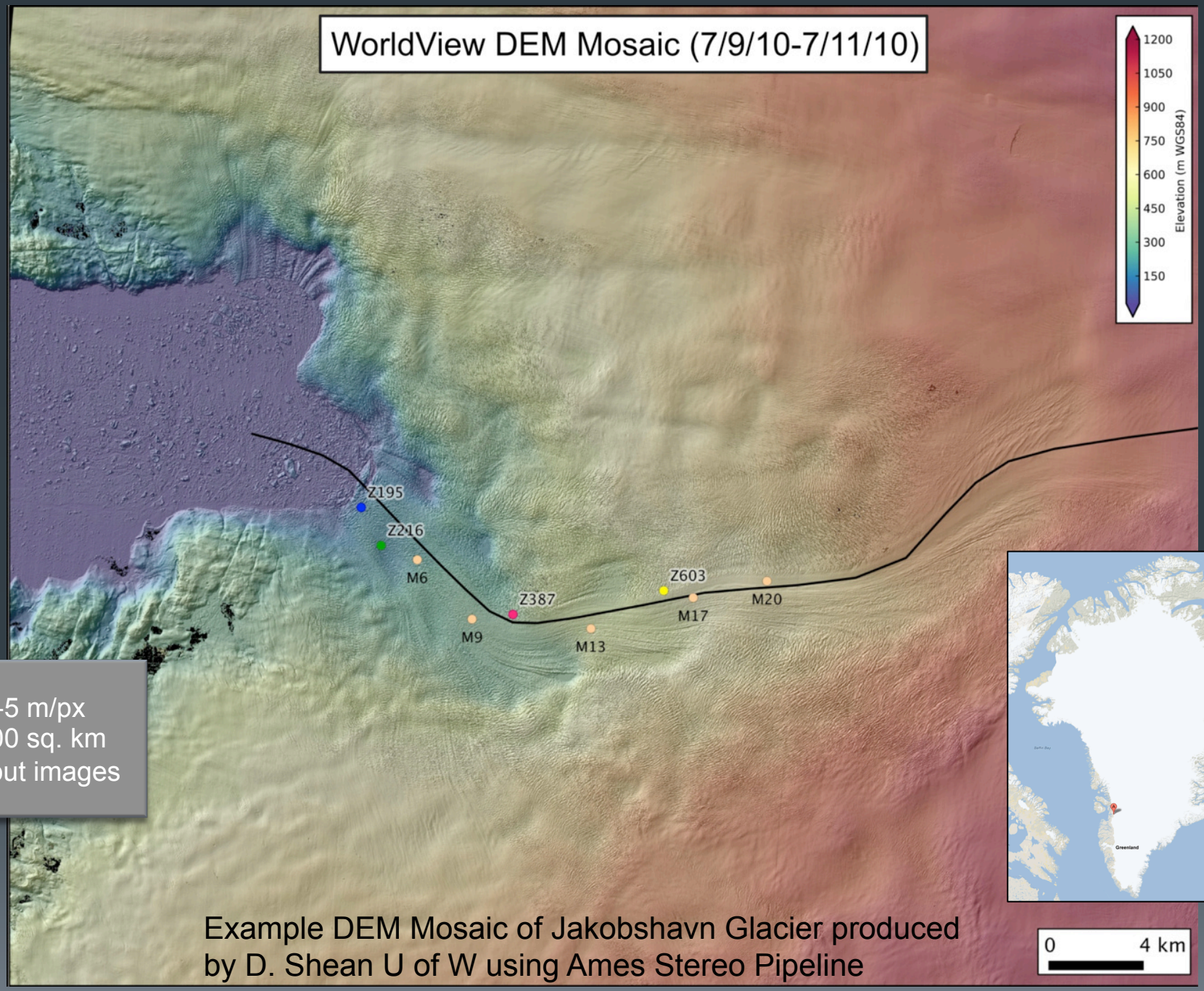
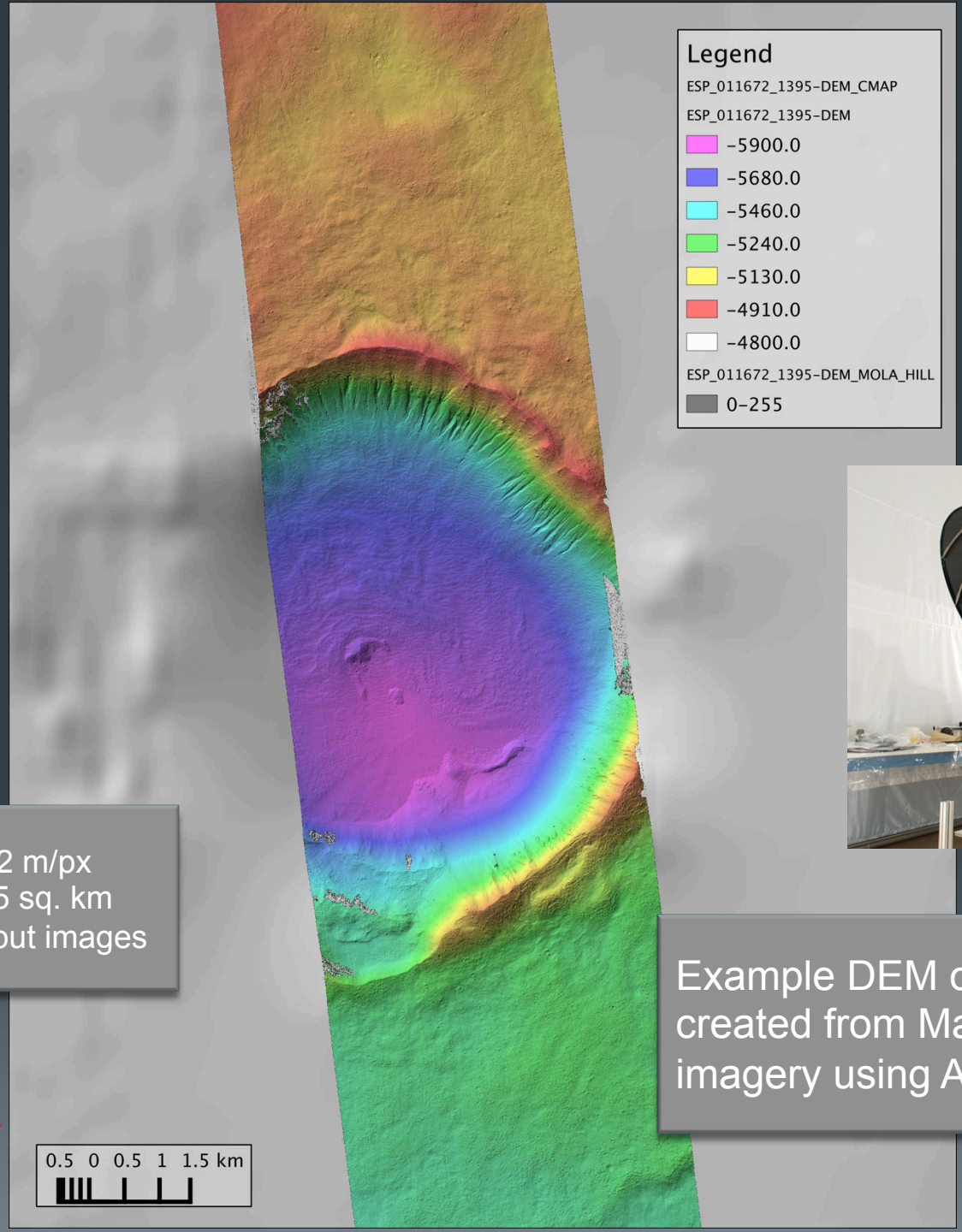
Ames Stereo Pipeline

- Automatic Stereo Correlation *(matching all pixels between two images)* for large satellite images.
- Camera models for NASA planetary rovers, NASA planetary satellites, DigitalGlobe Satellites, and generic RPC Models.
- Multithreaded and can be used across multiple machines. Works on high-end workstations to super computers.



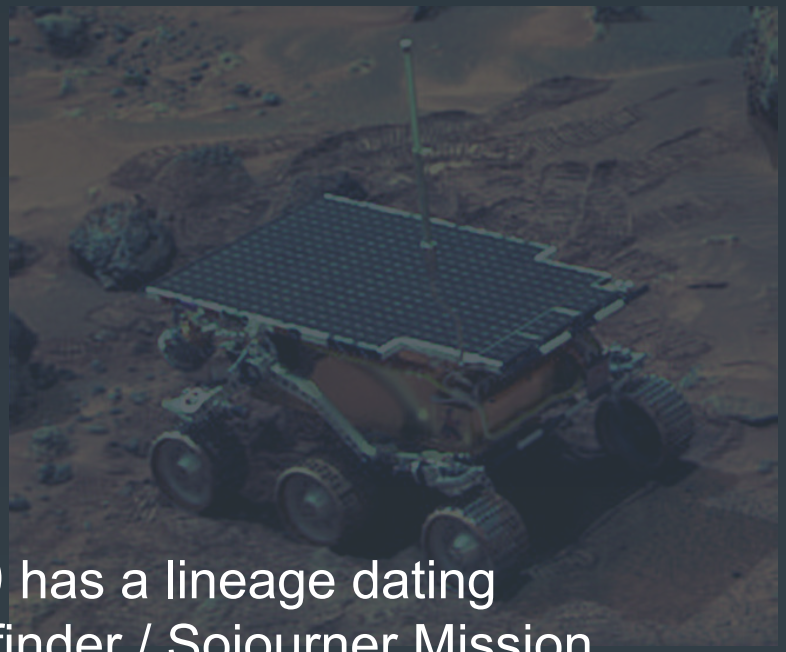
3-5 m/px
2500 sq. km
6 input images

Example DEM Mosaic of Jakobshavn Glacier produced by D. Shean U of W using Ames Stereo Pipeline



2 m/px
45 sq. km
2 input images

Example DEM of an unnamed crater created from Mars Reconnaissance Orbiter imagery using Ames Stereo Pipeline.

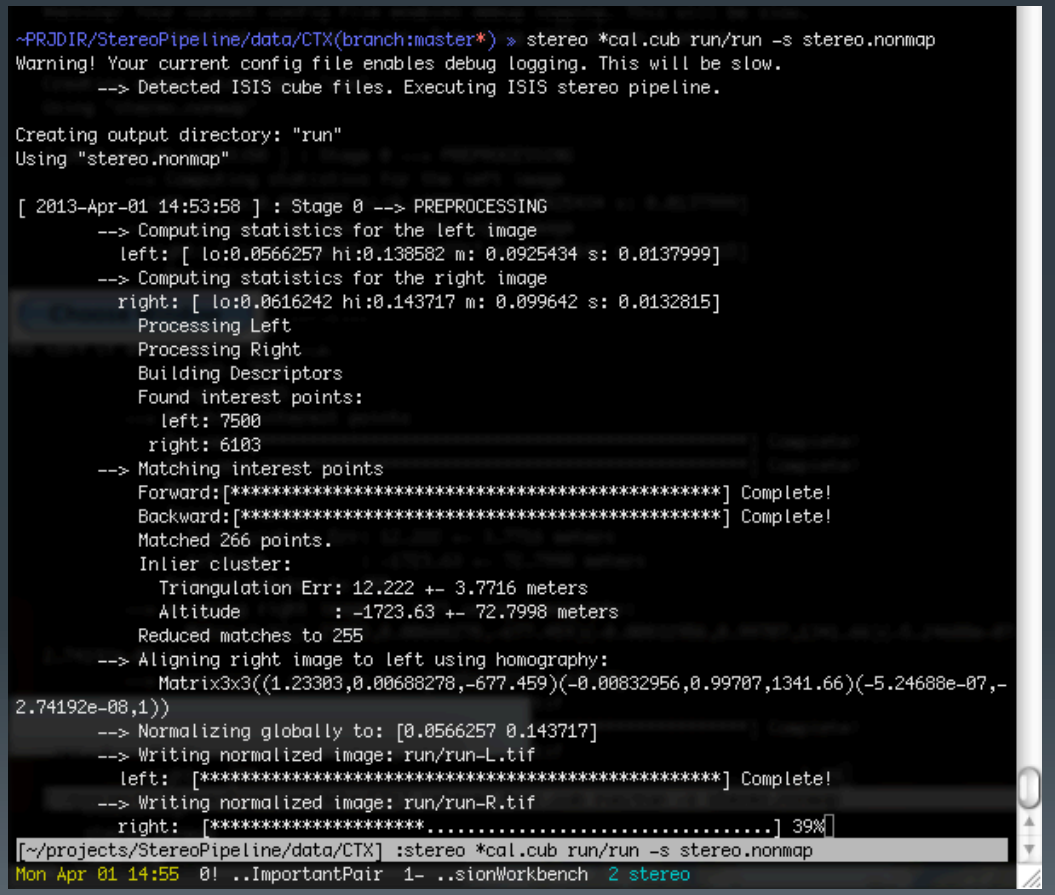


History

- Ames Stereo Pipeline *(ASP)* has a lineage dating back to the 1997 Mars Pathfinder / Sojourner Mission.
- October 2009 ASP v1 rewritten for satellite support and open-source released (NASA Open Source)
- June 2012 ASP v2 includes support for DigitalGlobe and open-source released (Apache 2 license)

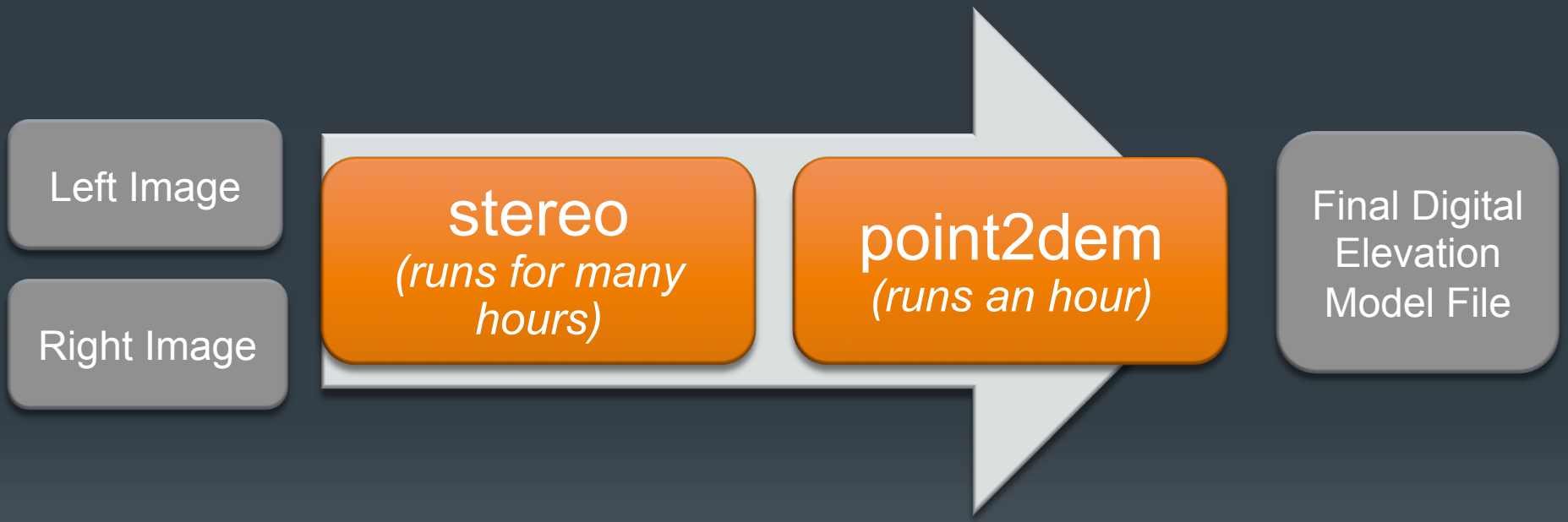
How it works

- Ames Stereo Pipeline is a set of command line tools.
- Designed for computing clusters and super computers.
- UNIX derived platforms (Linux, Mac OSX, etc)



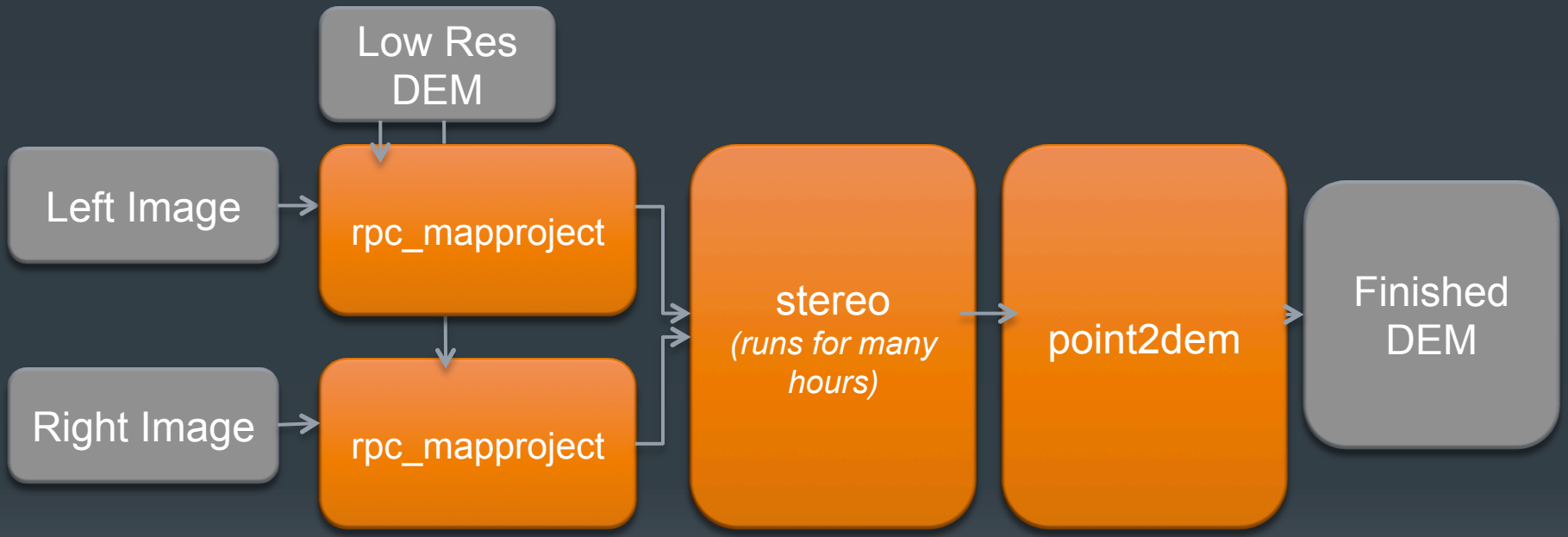
Typical output on the terminal when using Ames Stereo Pipeline.

Typical User Operation



- In the simplest operation, the user only runs two commands from ASP.
- The stereo command creates a point cloud.
- The point2dem command converts the point cloud to DEM of your chosen projection.

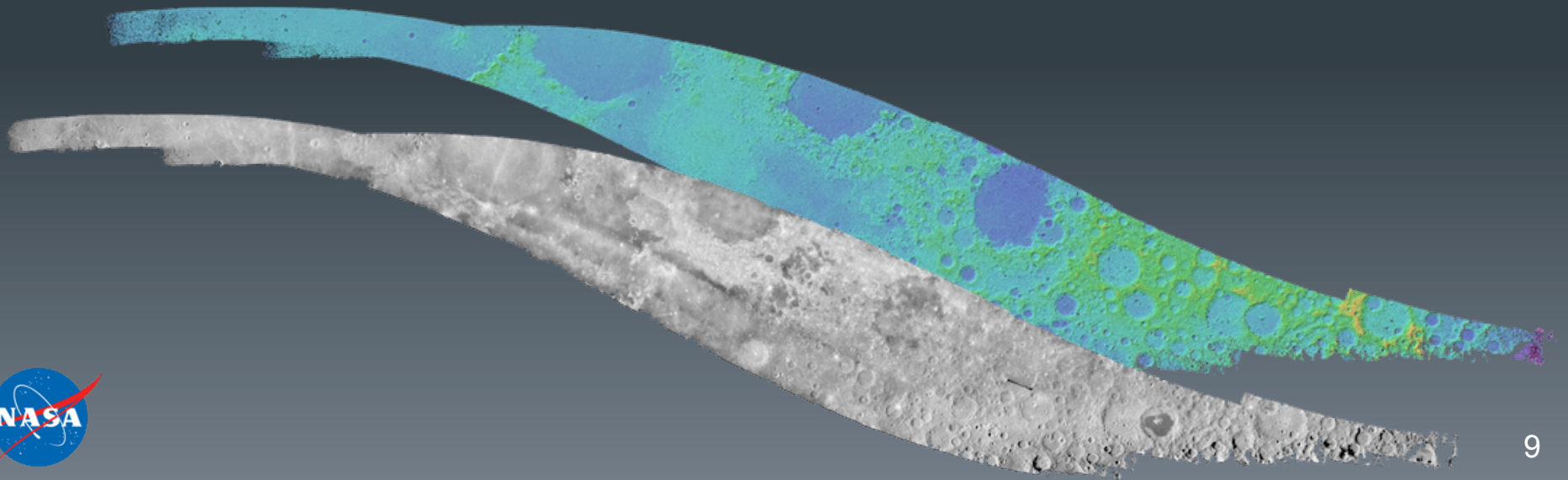
Advanced Operation



- Ames Stereo Pipeline can use existing DEMs to speed up its work.
- This operation is achieved by “map projecting” the input images prior to stereo correlation.

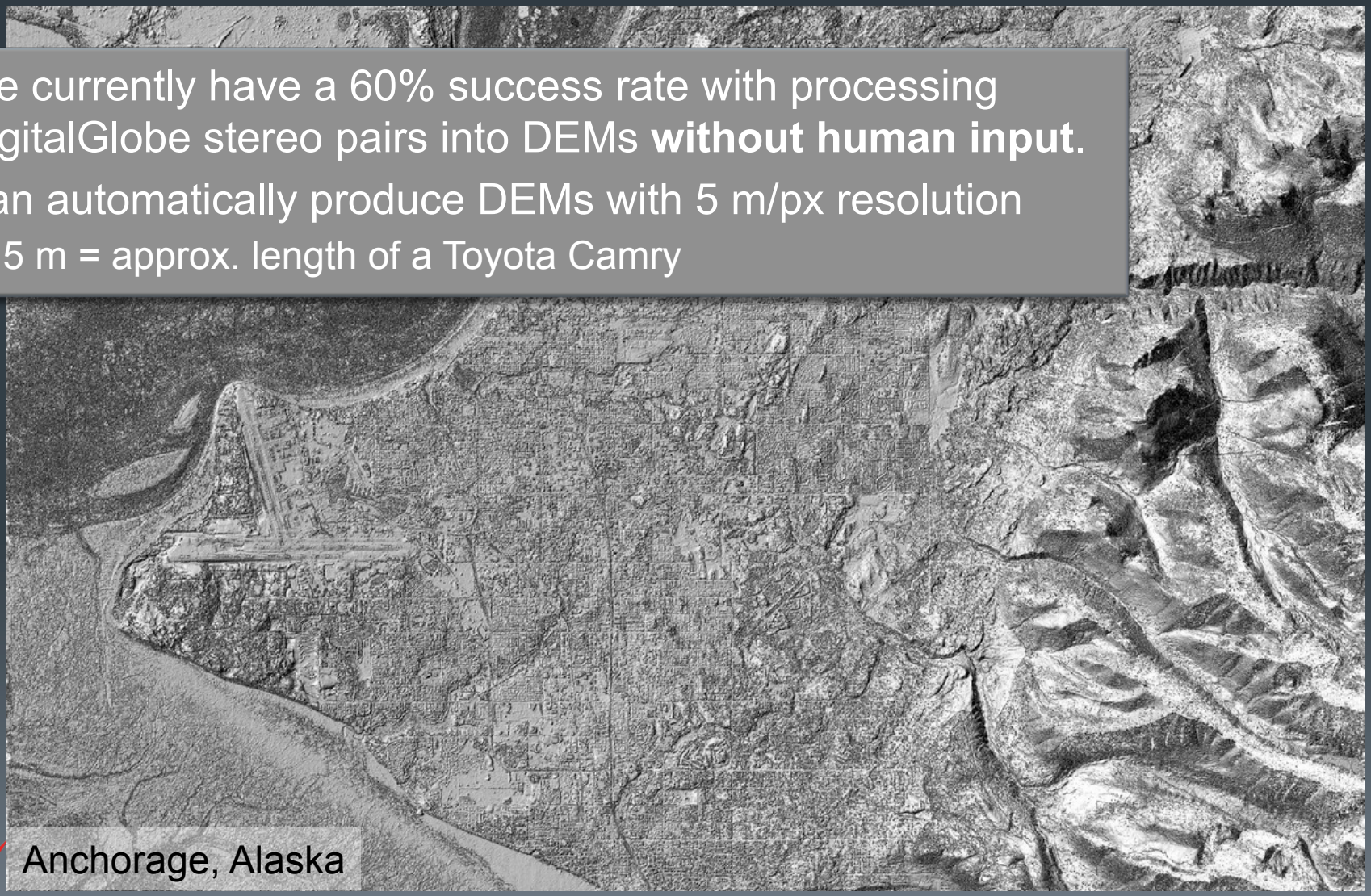
Our Past Applications

- We've used ASP to create 40 m/px DEMs from 3000 stereo pairs of the Moon (captured by Apollo 15, 16, and 17).
  - 40 m = approx. the length of 3 school buses end-to-end
  - The final mosaic covered 20% of the Moon
- These were all processed in a single week using the NASA Ames Pleiades Supercomputer



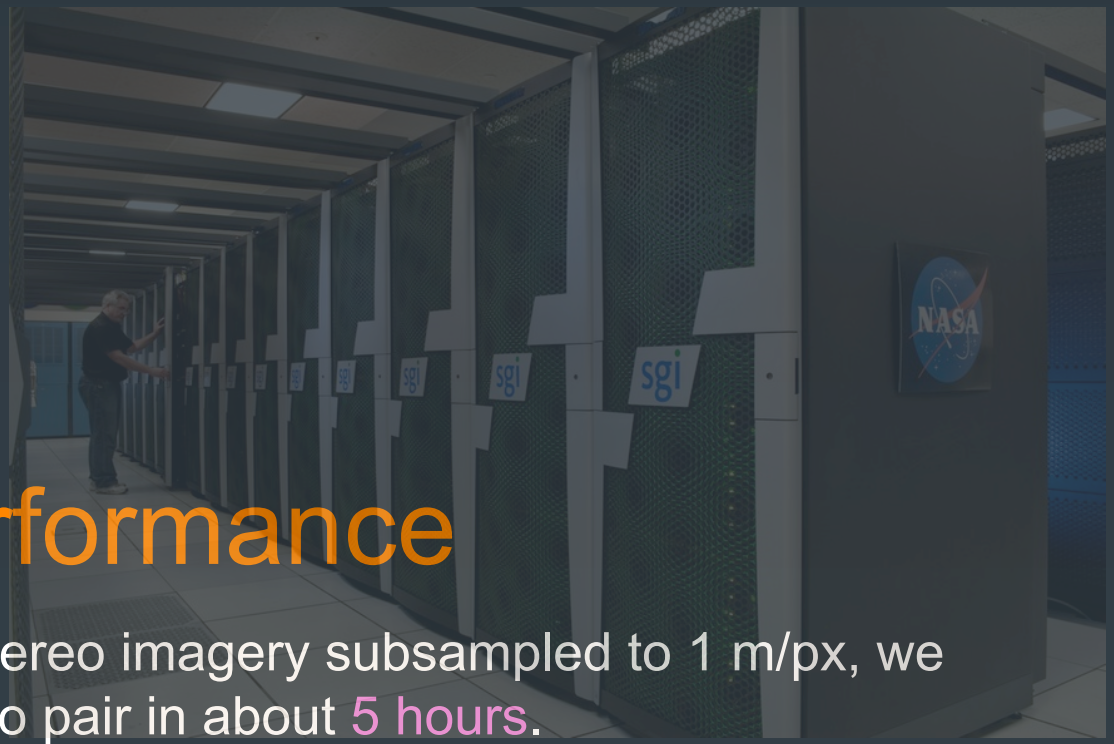
Autonomous Processing Earth Imagery

- We currently have a 60% success rate with processing DigitalGlobe stereo pairs into DEMs **without human input**.
- Can automatically produce DEMs with 5 m/px resolution
  - 5 m = approx. length of a Toyota Camry



Anchorage, Alaska

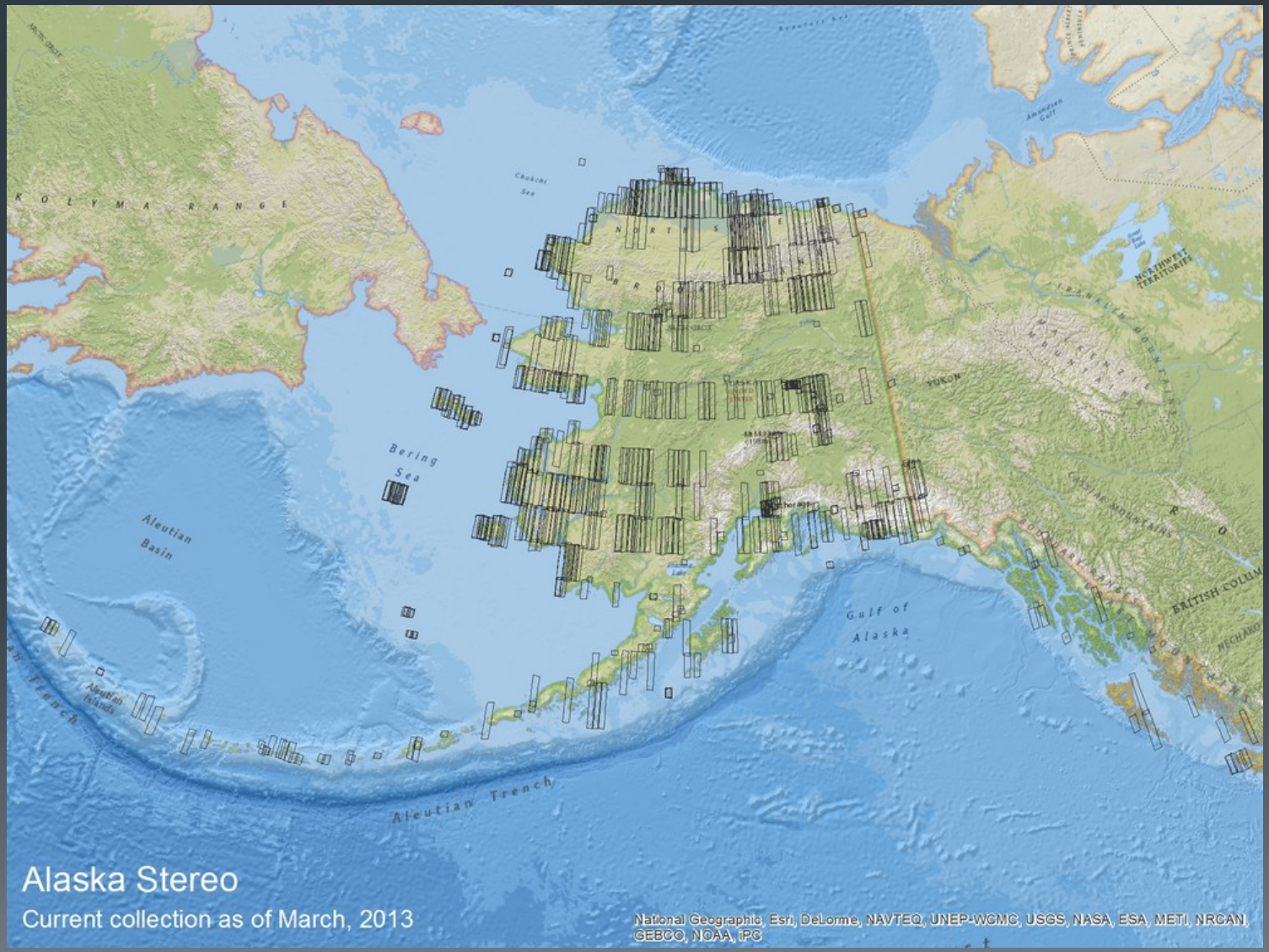

Noise
Barrow, Alaska



Typical Performance

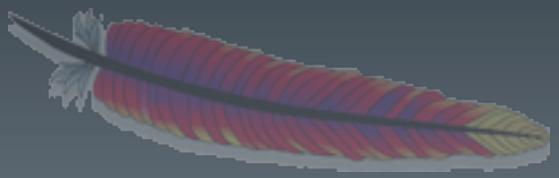
- With DigitalGlobe stereo imagery subsampled to 1 m/px, we can process a stereo pair in about 5 hours.
- Performance changes with the amount of parallax in the imagery.
- Processing cost is 5 minutes of CPU time / square km. (on NASA Pleiades supercomputer, 3 GHz Xeon processors)

Stereo is Available



Software License

- Ames Stereo Pipeline v2 is available as open-source
  - Worldwide release (no country restrictions)
  - Can be freely reproduced and distributed, with or without modifications
- Apache 2 license
  - http://www.apache.org/licenses/LICENSE-2.0.html



Source Code

- Our C++ code repository is hosted on Github.
- Ames Stereo Pipeline is part of the NASA "Neo Geography Toolkit"
- Available to download, copy, modify, collaborate, …

github.com/NeoGeographyToolkit/StereoPipeline

Prebuilt Binaries

irg.arc.nasa.gov/ngt/stereo

- Most Linux Distributions
  - 32 and 64-bit versions, RHEL 5+, SuSE, Debian
- Mac OSX 10.6+
- We do not support Windows

Additional images & technical

Lunokhod.org

- For more information:
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