Lasers and Landing Sites: Preparing for *Curiosity*

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Space Grant Support

• 2006 Goddard NASA Academy
  (Michigan Space Grant)

• Space Grant Fellowship at Cornell
  (New York Space Grant)
ChemCam (Chemistry & Camera)

- Optical fiber
- Laser, telescope, camera
- Spectrometers (Inside)
LIBS yields atomic emission spectra:

Anderson et al., 2011
Our Dataset

- 195 rock slabs (+90 slab-derived powders)
- 30 powdered geostandards
- Analyzed under a Mars-like atmosphere (~7 Torr CO$_2$)
- Compare multivariate analysis techniques
  - Partial Least Squares (PLS) is generally better than neural networks
  - Improve accuracy by expanding the training set
Mars Global Topography

Gale Crater
Gale Crater

Anderson & Bell (2010)
Anderson & Bell (2010)
Inverted Channels in the Hummocky Plains Unit

Anderson & Bell (2010)
Marker Bed

Filled Channel

(No Vertical Exaggeration)
Possible Cross-Beds on the Upper Mound

Anderson & Bell (2010)
Conclusions

• ChemCam
  – Can rapidly analyze targets up to 7 meters away.
  – PLS is generally more accurate than ANN.
  – When in doubt, use a large training set.

• Gale Crater
  – Upper mound may be wind-deposited, but rover observations are needed to determine the origin of the lower mound.
  – Mound’s stratigraphy may capture important transition in Mars environment.
  – Curiosity will test many of our hypotheses!