



# Alaska Department of Transportation & Public Facilities

## DIGITAL ELEVATION MODEL (DEM)

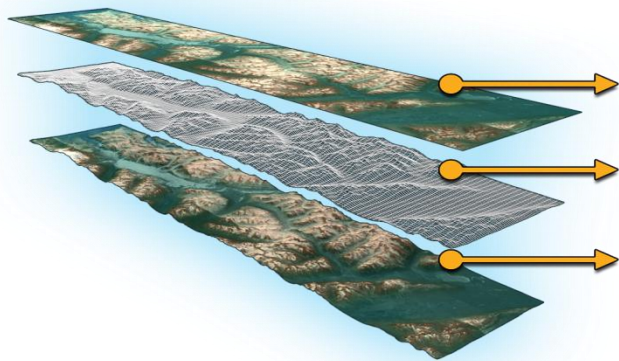
### Arctic Ports & Harbors

Nick Mastrodicasa

May 16, 2011



# ELEVATION IS FOUNDATIONAL



**Imagery**

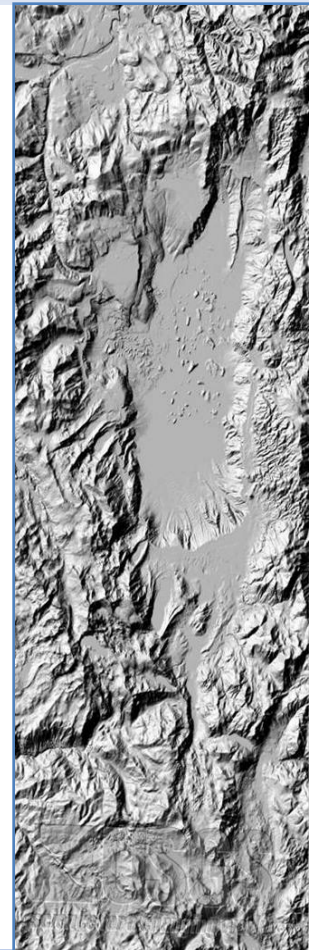
**+**

**DEM**

**=**

**Precision Geospatial  
Dataset**

- A DEM that is inaccurate or of poor resolution will pass those characteristics onto other data layers...

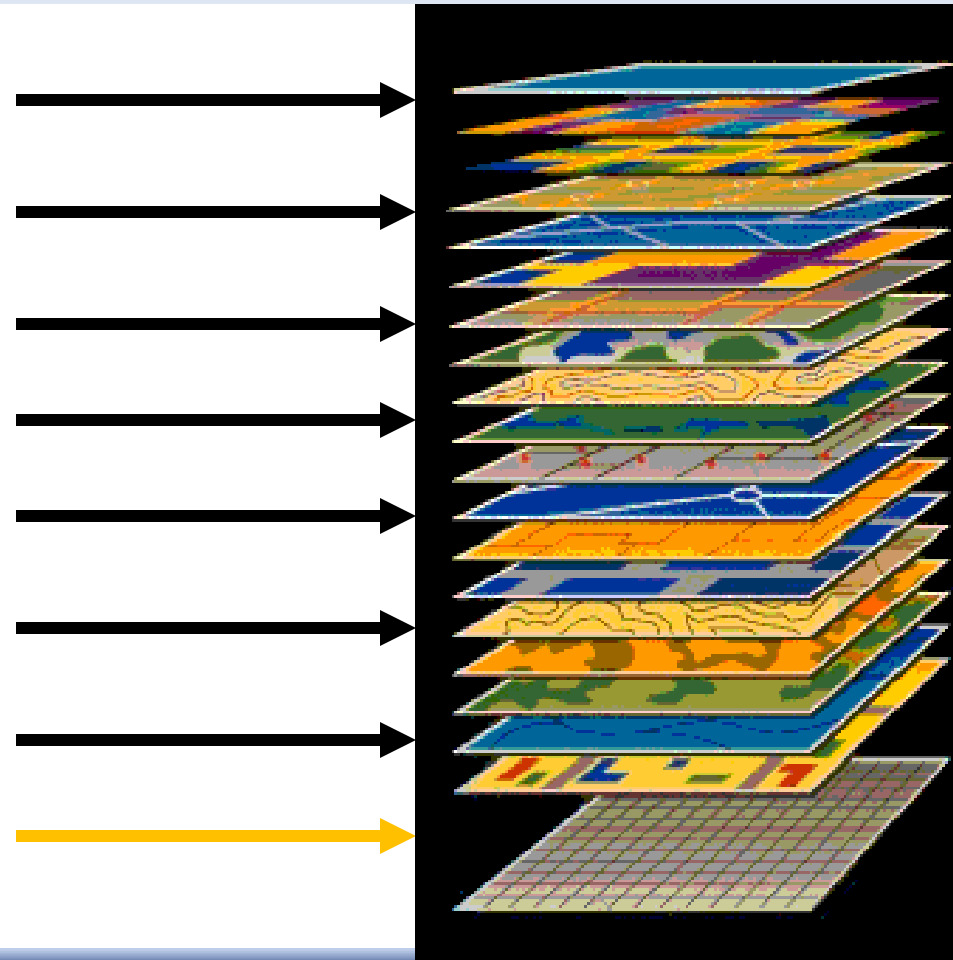




# THE DEM IS FOUNDATIONAL

TO ALL GIS (Geospatial Information System) LAYERS

- ETC.
- Utilities
- Buildings
- Vegetation
- **Infrastructure**
- Hydrographic
- Imagery
- **Base Layer-DEM**





# An Accurate DEM is Required

to Understand and Prepare for the Impacts of:



- Sea Rise-Saltwater/Lowland Inundation
- Water Supply & Quality
- Climate Change

- Coastal Erosion
- Storm Surge Analysis
- Tsunami Inundation



# Village Relocation & Climate Change

- Site Selection for Villages in Peril;
- Safe Drinking Water;
  - Permafrost Thaw-Permeable;
  - Sewage lagoons;
  - New & Existing Water sources-groundwater & other;
  - Methane Poisoning???
  - Predictive Hydrological Models;
- Sea Rise—Coastal / Lowland Inundation;
- Climate Change Research, and
- Adaptation.





# COASTAL EROSION

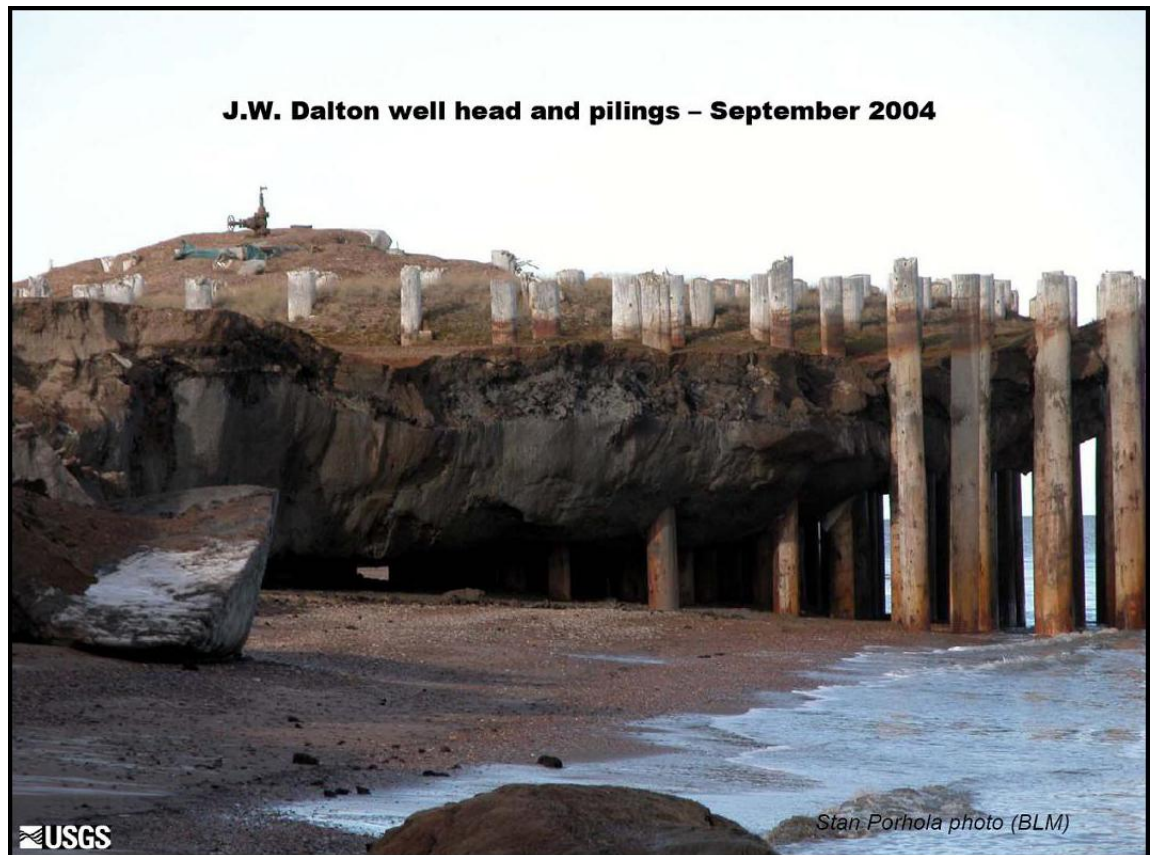
## 600' OF LAND LOSS

- Predictive Modeling;
- Sea Wall Construction;
- Adaptation & Mitigation efforts;
- Salt Water Inundation.

### JW Dalton Well

-- National  
Petroleum Reserve  
Alaska

Motivation for  
Good Mapping:  
Coastal Erosion





# Aviation Safety

- Synthetic Vision or In-Cockpit Moving Map:
  - Prevent CFIT;
  - Clear day view regardless of visual obscuration due to smoke or weather;
  - Improves Situational Awareness.
- CFIT is the number one reason for aviation fatalities in Alaska.
- An aviation Fatality occurs every two weeks in AK on average.





# INFRASTRUCTURE DEVELOPMENT

- **Roads to Resources;**
- **Resource Development:**
  - Mining, Oil & Gas—Gas Line Route, Permitting & Right of Way;
  - **Arctic Deep Water Port—Coast Guard Base;**
    - Local Jobs;
    - Northern Security and Emergency Services;
  - **Project Engineering / Site Selection;**
- **Arctic Civil Infrastructure Workshop (ACIW) Fairbanks 2010:**
  - 35 representatives of public (State & Federal) and private concluded the over-arching common need among all was:
    1. Streamlined Permitting of Projects, and
    2. An Accurate DEM (Digital Elevation Model).





# DISASTER MITIGATION & RECOVERY

- Wildfire Modeling & Fire Line Propagation;
- Safe Evacuation Routes;
- Mitigation, Preparedness & Desktop Training, Simulations and Drills;
- Emergency Response (Situational Awareness);
- Search & Rescue/Recovery;
- Environmental Disaster Response & Recovery



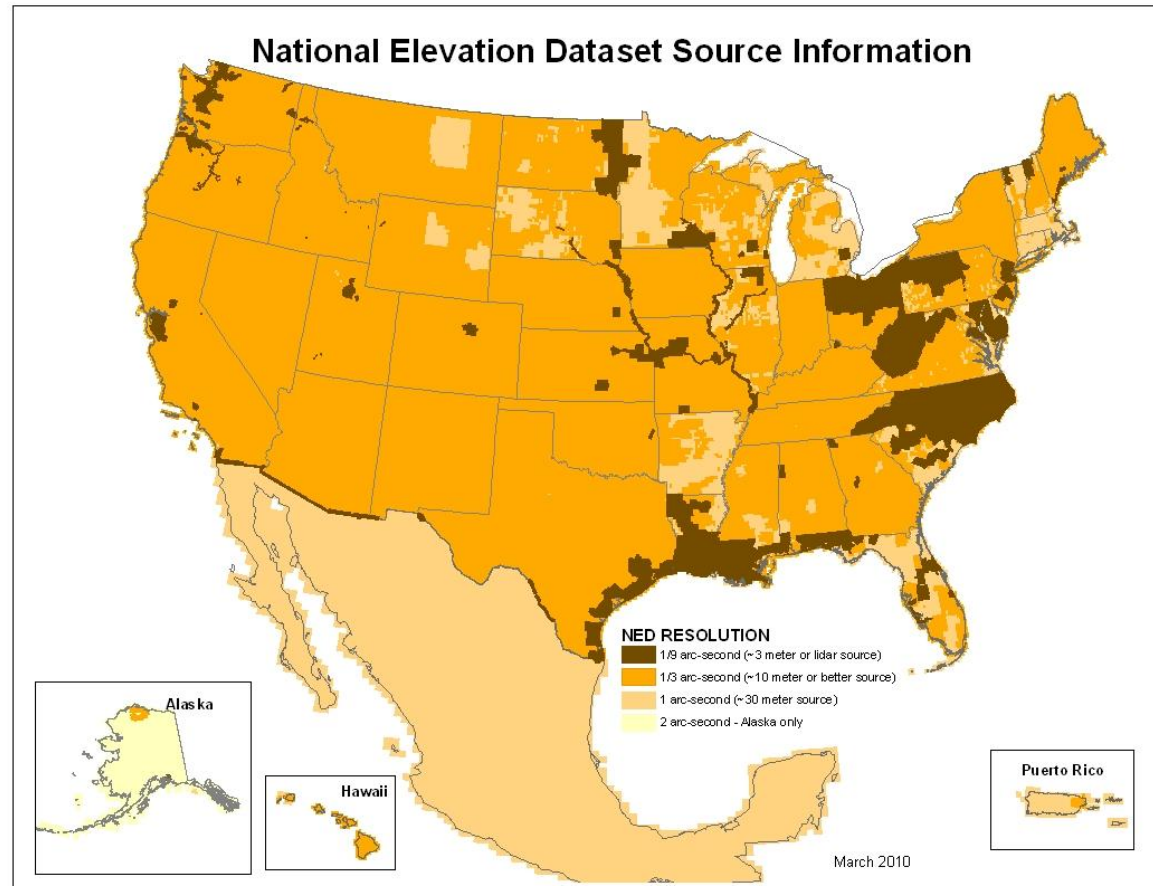
***Of the 20 biggest earthquakes in the U.S. 13 were located in Alaska. The top three happened in AK and one resulted in a massive tsunami.***



# DOES ALASKA MEASURE UP?

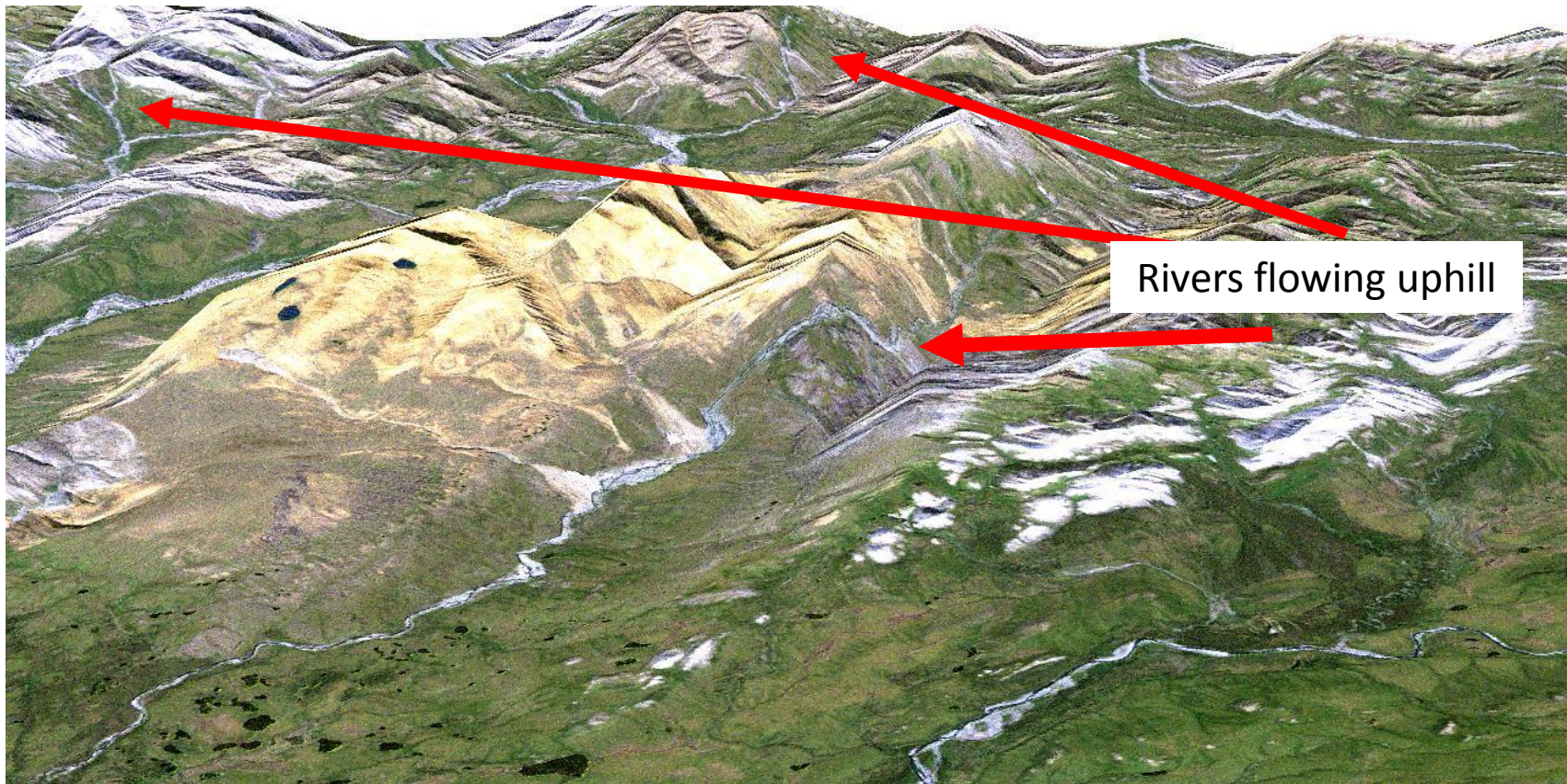
## ALASKA'S MAPS:

- USGS Topo maps created around statehood;
- The Alaska map never met National Map Accuracy Standards when created;
- No statewide digital maps;
- USGS Topos widely considered grossly inaccurate and incapable of supporting modern management practices.





# RIVERS DO NOT FLOW UPHILL

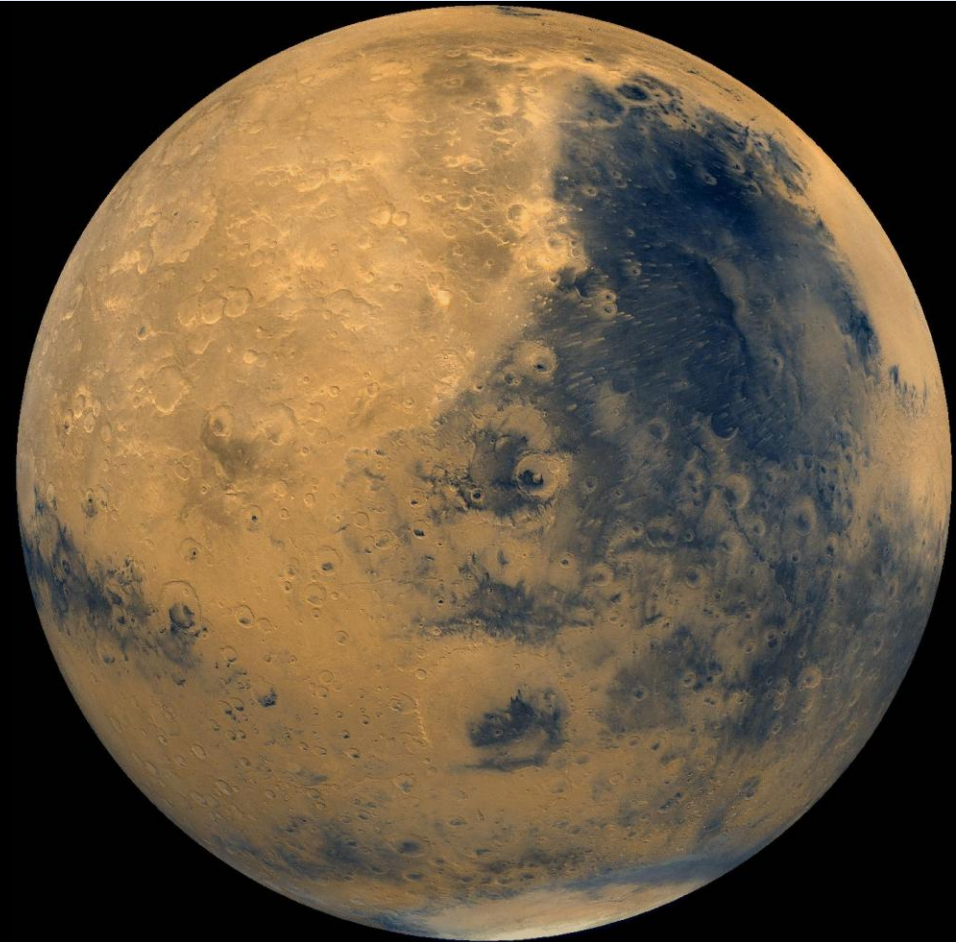




# HOW DOES ALASKA MEASURE UP?

## MARS:

- More Accurately, More Extensively, and More Recently Mapped than Alaska.
- 20 m/pixel Resolution
- NASA Viking Missions

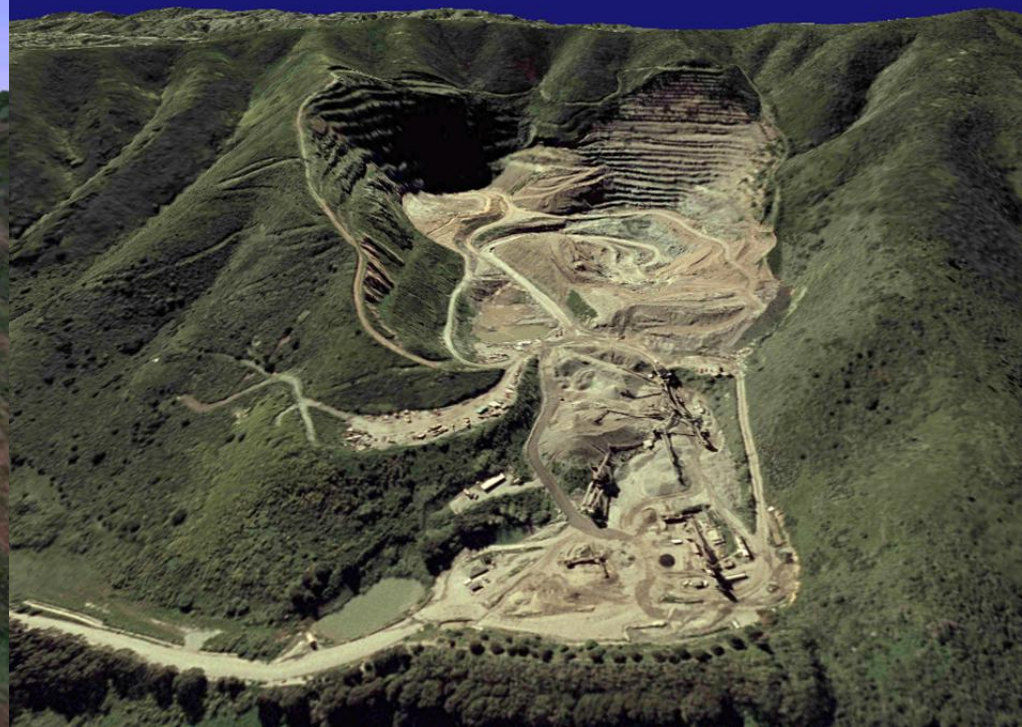




# ACCURACY MATTERS

6" Aerial Photo  
30 m USGS NED

6" Aerial Photo  
5 m NEXMap DTM



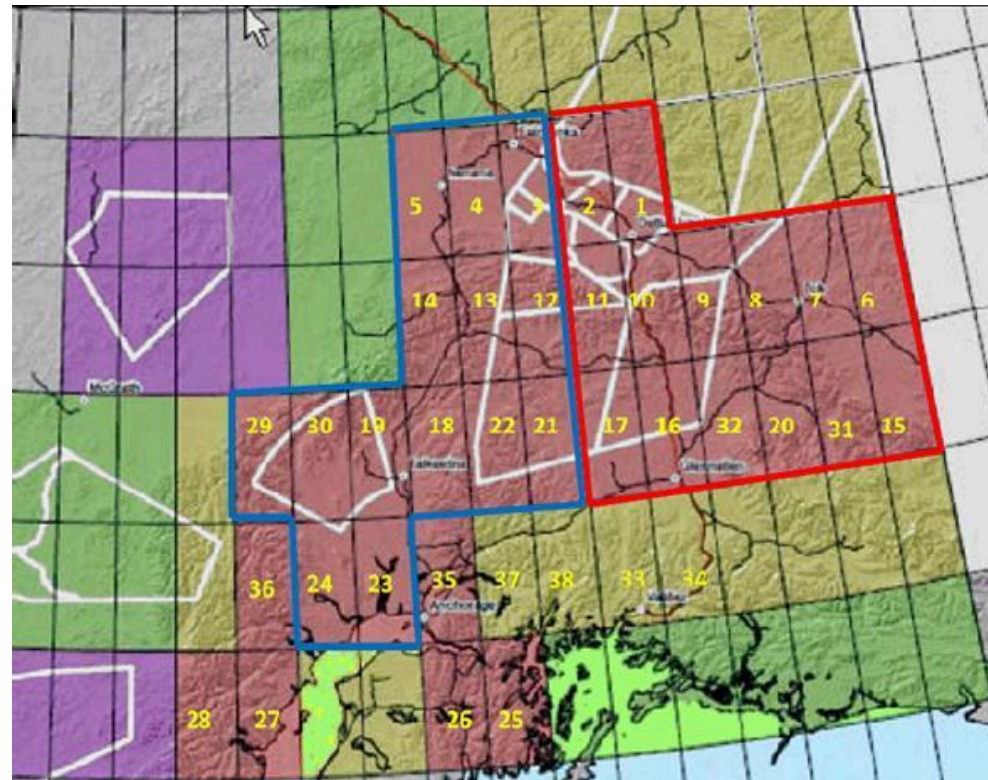


# 2010 DEM COLLECT

## COST SHARING PARTNERS:

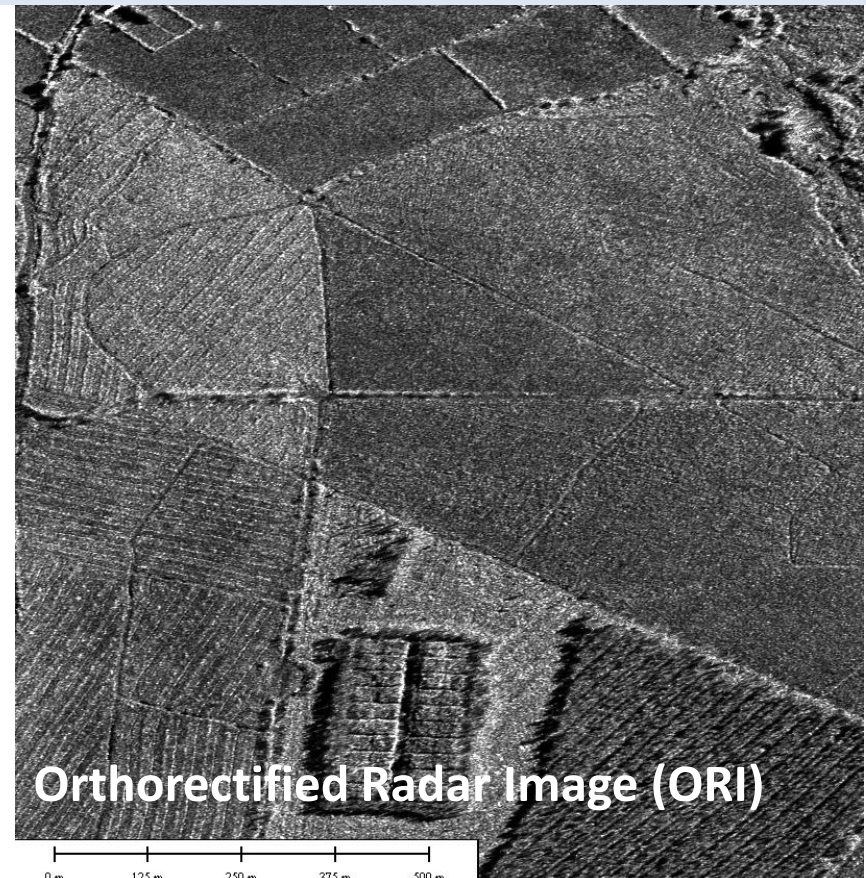
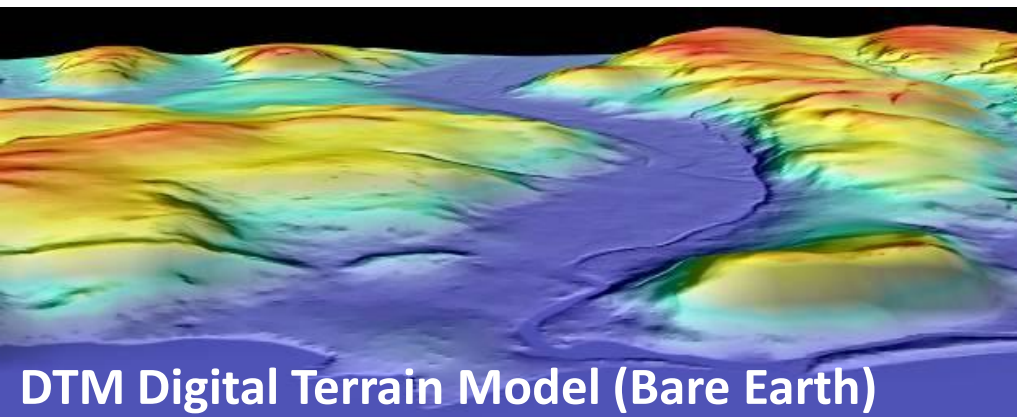
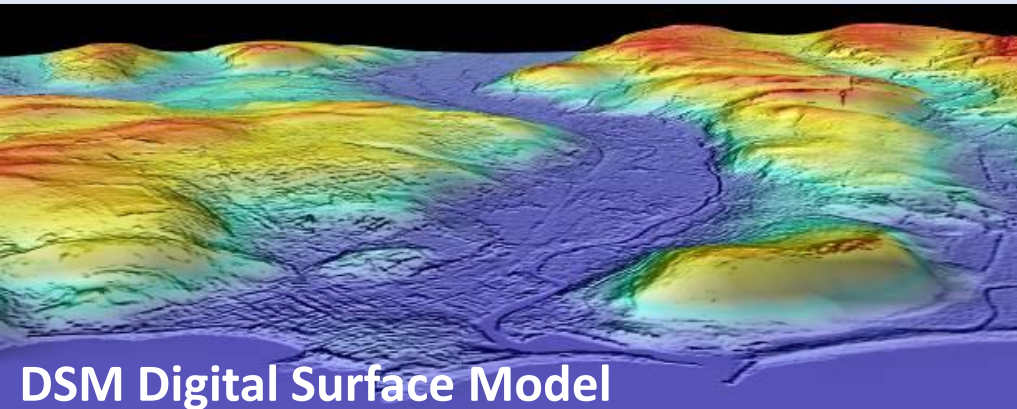
NGA	\$2.4M	
USGS	\$1.0M	
BLM	\$200k	
NPS	\$100k	
NRCS	<u>\$100k</u>	
<b>FED</b>	<b>\$3.8M</b>	<b>66%</b>
<b>STATE</b>	<b><u>\$2.0M</u></b>	<b>34%</b>
TTL	\$5.8M	

- 28 CELLS ACQUIRED
- 157,434 k<sup>2</sup> COLLECT
- \$34.73/ k<sup>2</sup>





# DELIVERABLES DSM / DTM / ORI



The USGS National Elevation Dataset (NED) seeks Digital Terrain Models (DTM) which the low resolution DEM does not provide

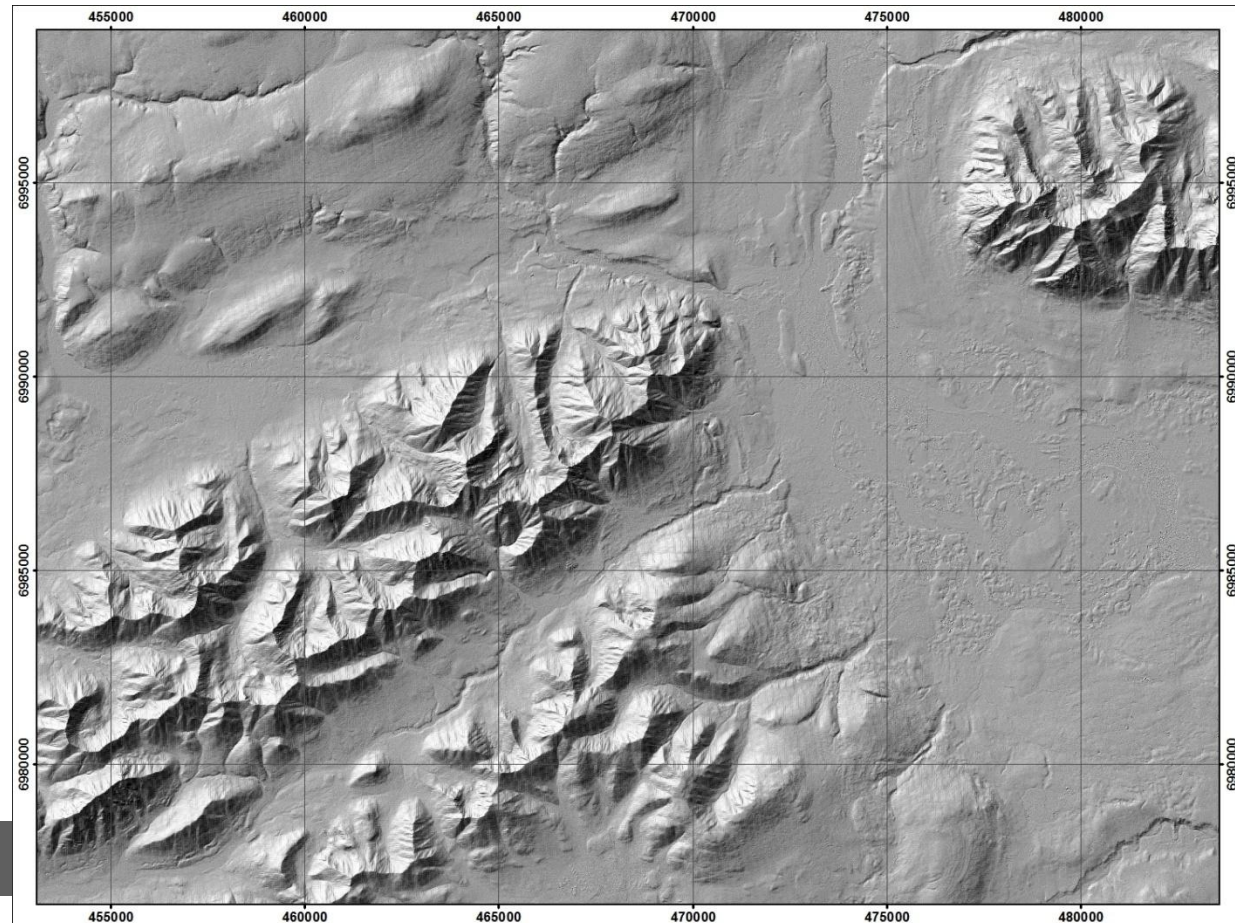
Radar images may be the only imagery available in areas of perpetual cloud cover



# IFSAR ALREADY USED

## F-22 Raptor Crash 11/2010:

- Slope analysis to determine avalanche danger to recovery crews.
- Unscheduled Emergency Delivery of IFSAR Data:
  - Raw Data
  - No QA/QC
  - High praise for product



Hillshade from 5m IFSAR DEM





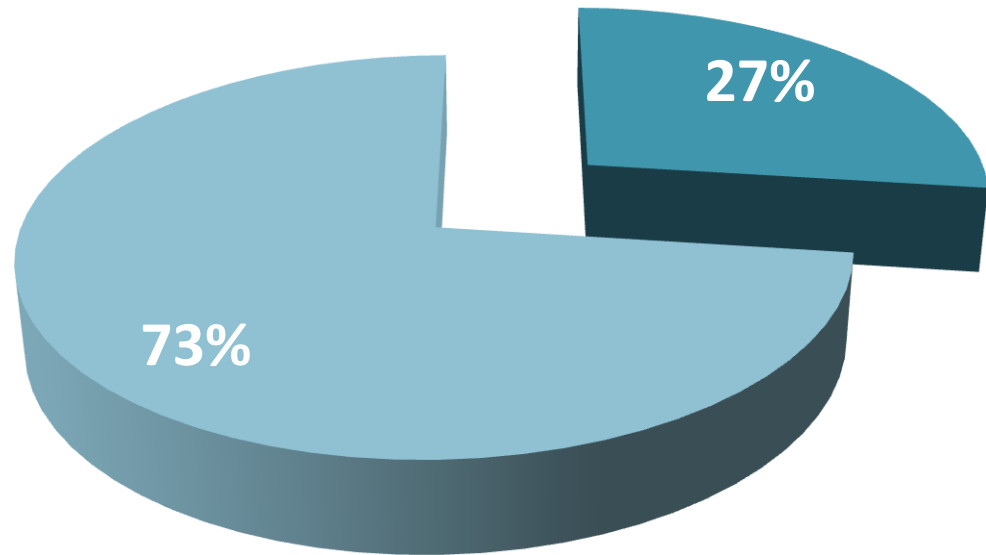
# DEM FUNDING STRATEGY

\$48M DEM Project Cost

■ State ■ Federal

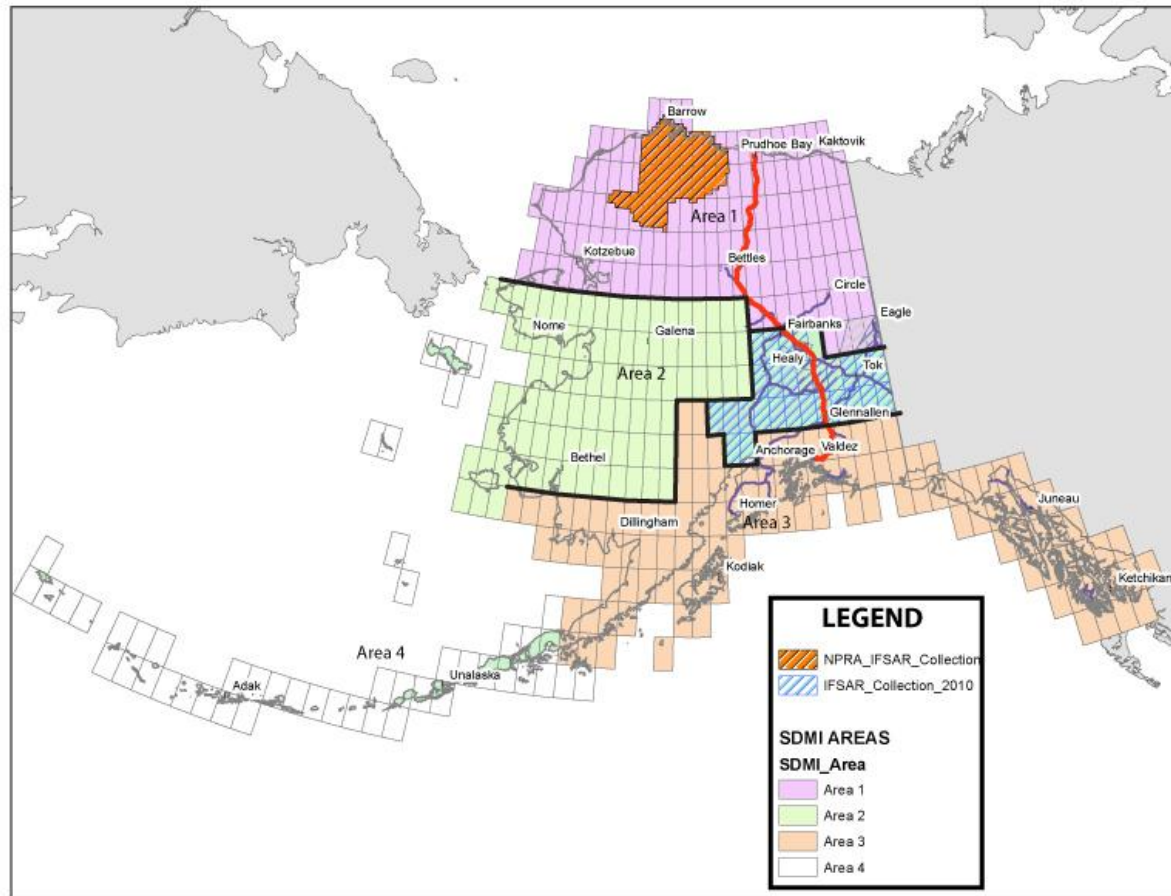
State Cost  
\$12.96M

Federal Cost  
\$35.04M





# FORWARD LOOKING





# John Wesley Powell, 2<sup>nd</sup> Director of USGS



Testimony to Congress on  
December 5, 1884

*“A Government cannot do any scientific work of more value to the people at large, than by causing the construction of proper topographic maps of the country”*

**This statement remains true today in Alaska where public safety, resource management and development are critical.**