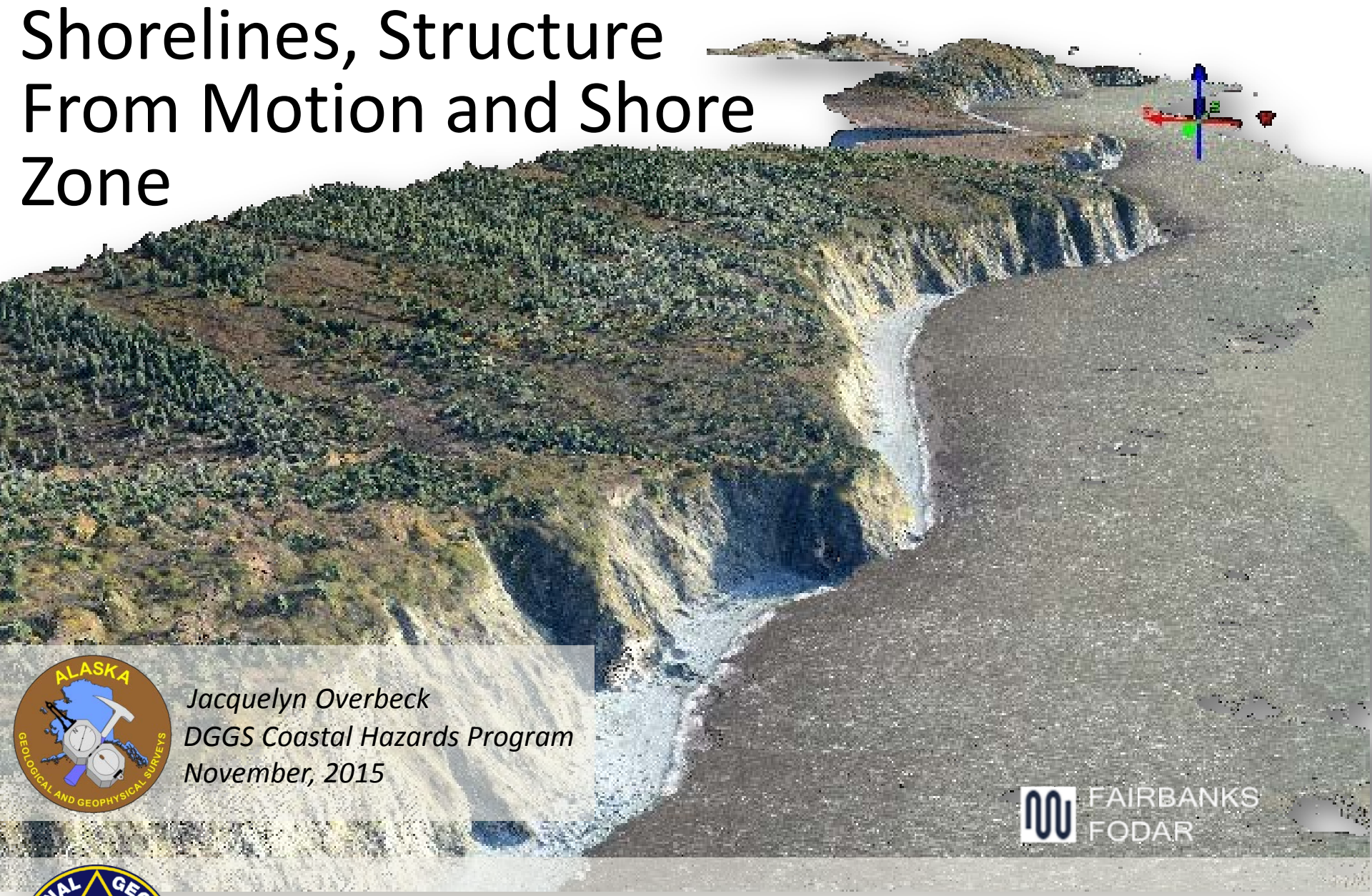
Shorelines, Structure From Motion and Shore Zone



Jacquelyn Overbeck
DGGS Coastal Hazards Program
November, 2015

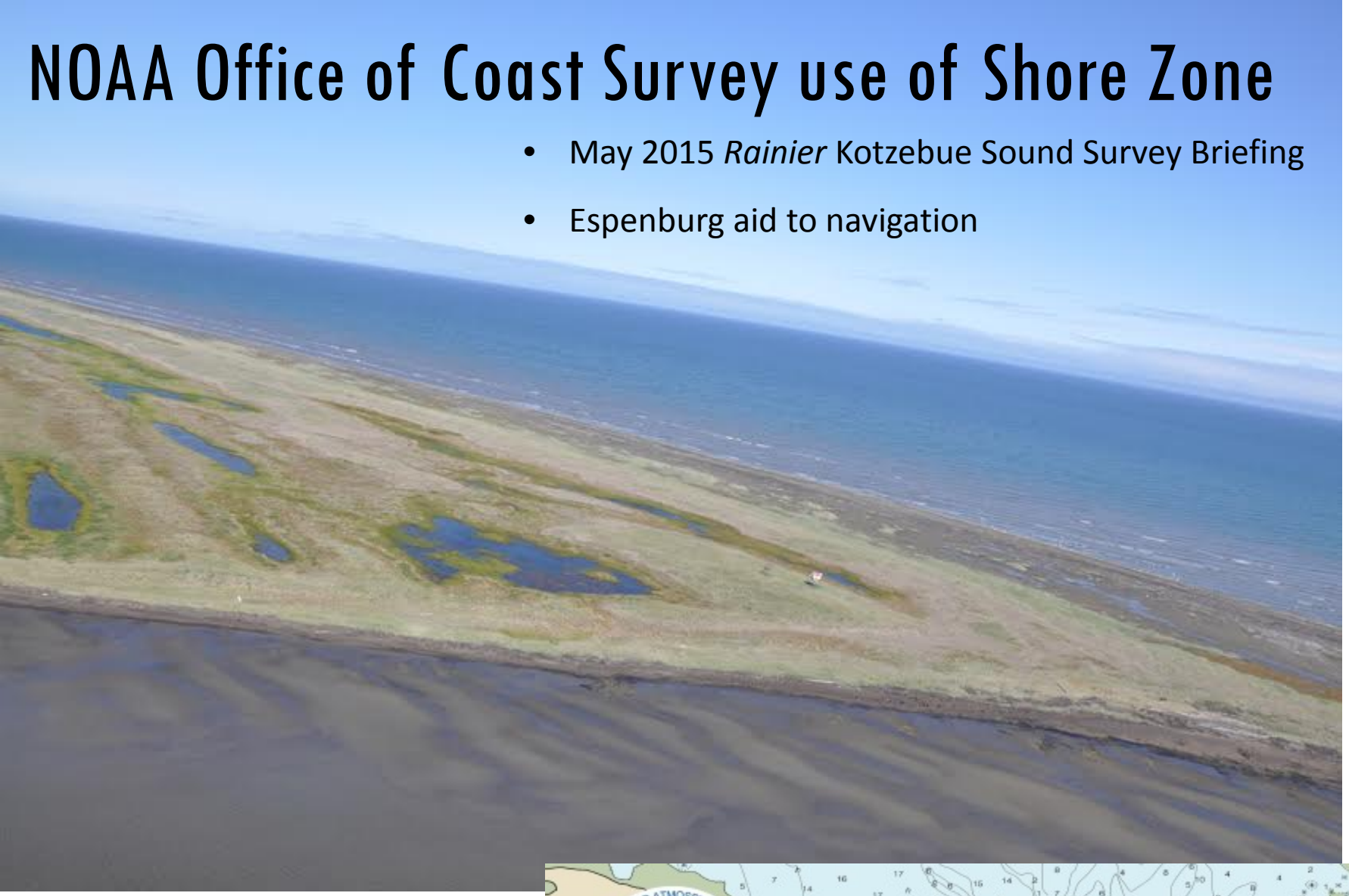
Nicole Kinsman
Coastal and Geodetic Advisor
NOAA National Geodetic Survey

Partner Presentation

October 14, 2015

NOAA Office of Coast Survey use of Shore Zone

- May 2015 *Rainier* Kotzebue Sound Survey Briefing
- Espenburg aid to navigation



Contact:

Lt. Tim Smith

Timothy.m.smith@noaa.gov

Office of Coast Survey

The Nation's Chartmaker

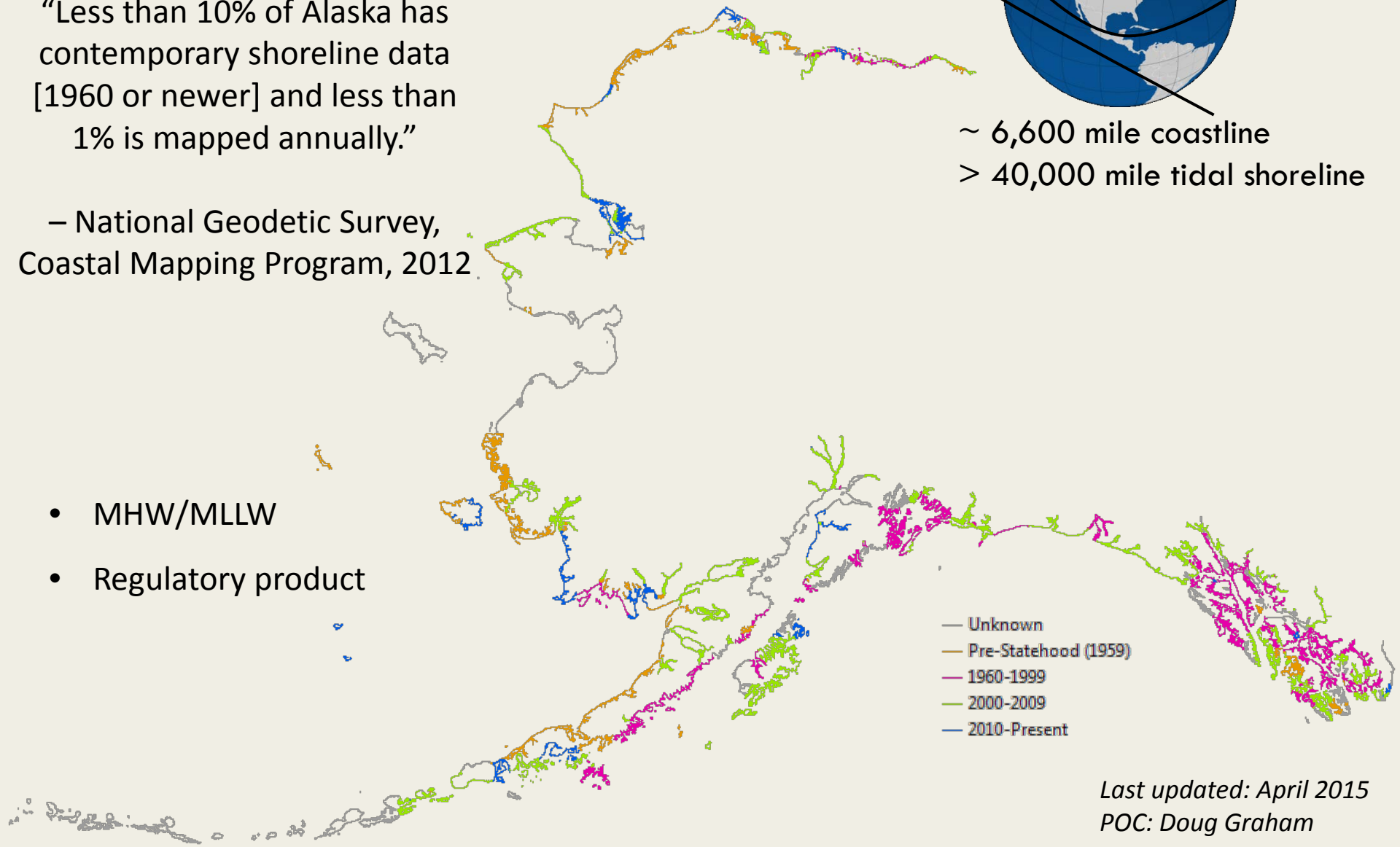
Status of NOAA's 'National Shoreline'

"Less than 10% of Alaska has contemporary shoreline data [1960 or newer] and less than 1% is mapped annually."

– National Geodetic Survey, Coastal Mapping Program, 2012

~ 6,600 mile coastline
> 40,000 mile tidal shoreline

- MHW/MLLW
- Regulatory product

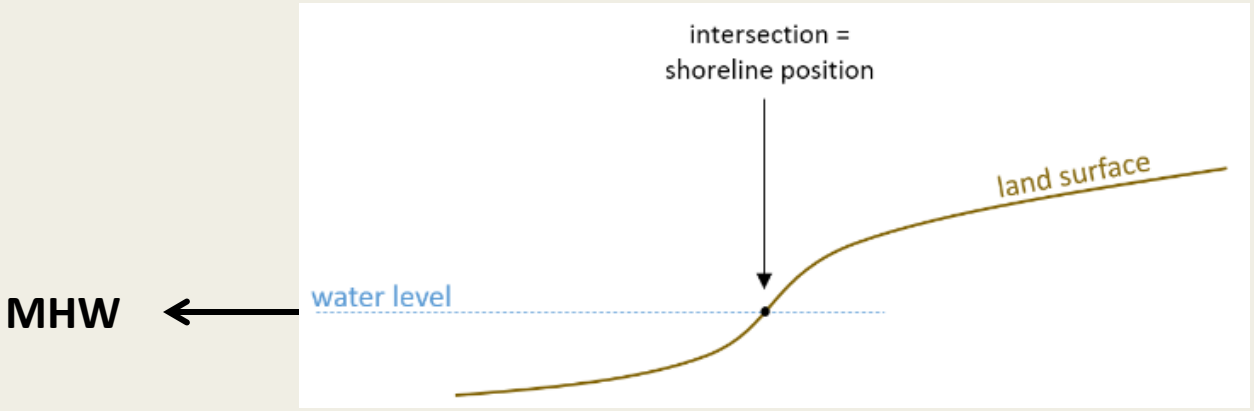


Last updated: April 2015
POC: Doug Graham

Future improvement of NOAA Shoreline Vectors

"Joint effort among NOAA, USGS and the State of Alaska to coordinate on satellite imagery analysis and other technologies for shoreline and near-shoreline coastal mapping, critical for safe navigation and to observe climate change in action."

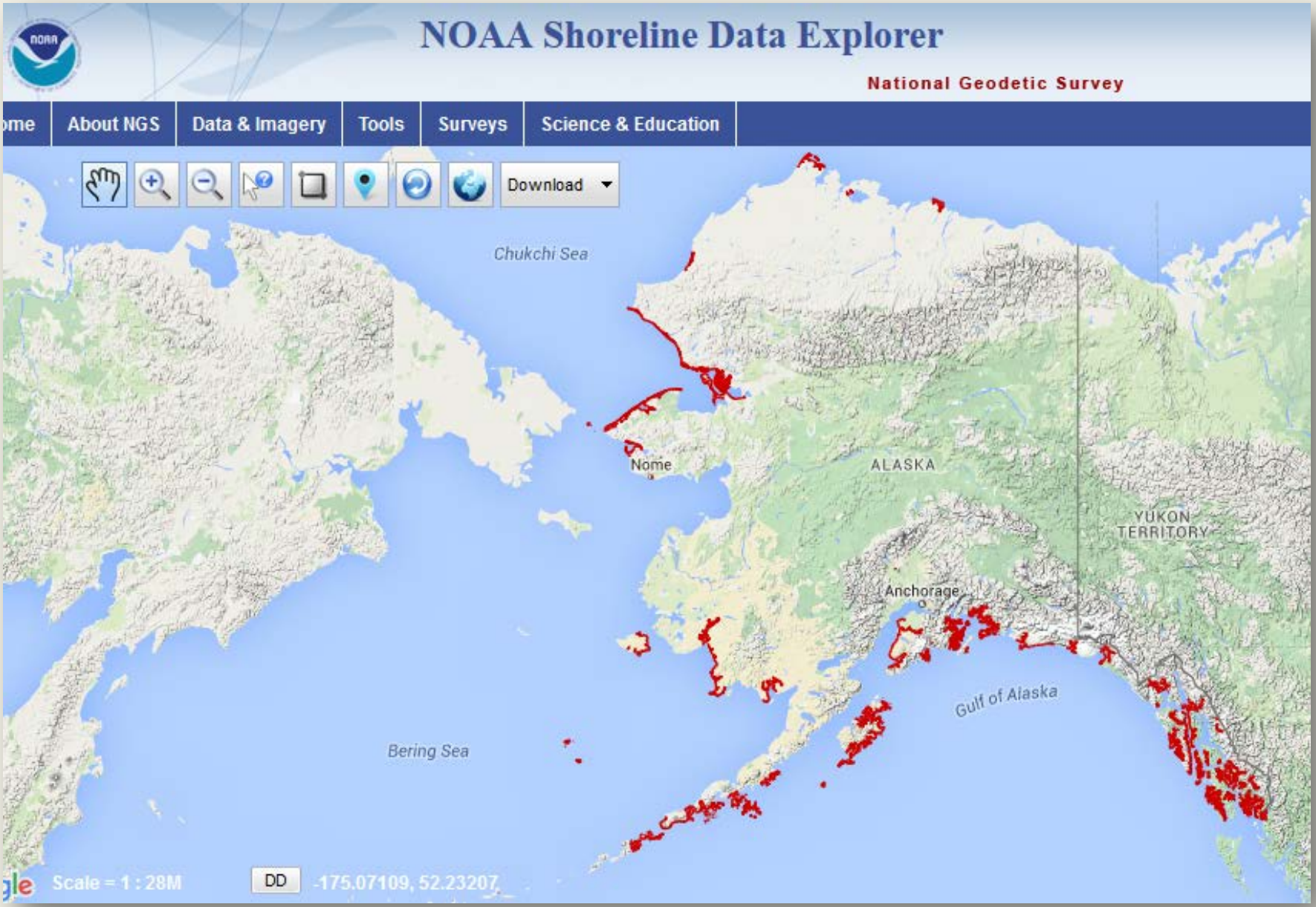
– National Ocean Service, 2016 GLACIER Commitment



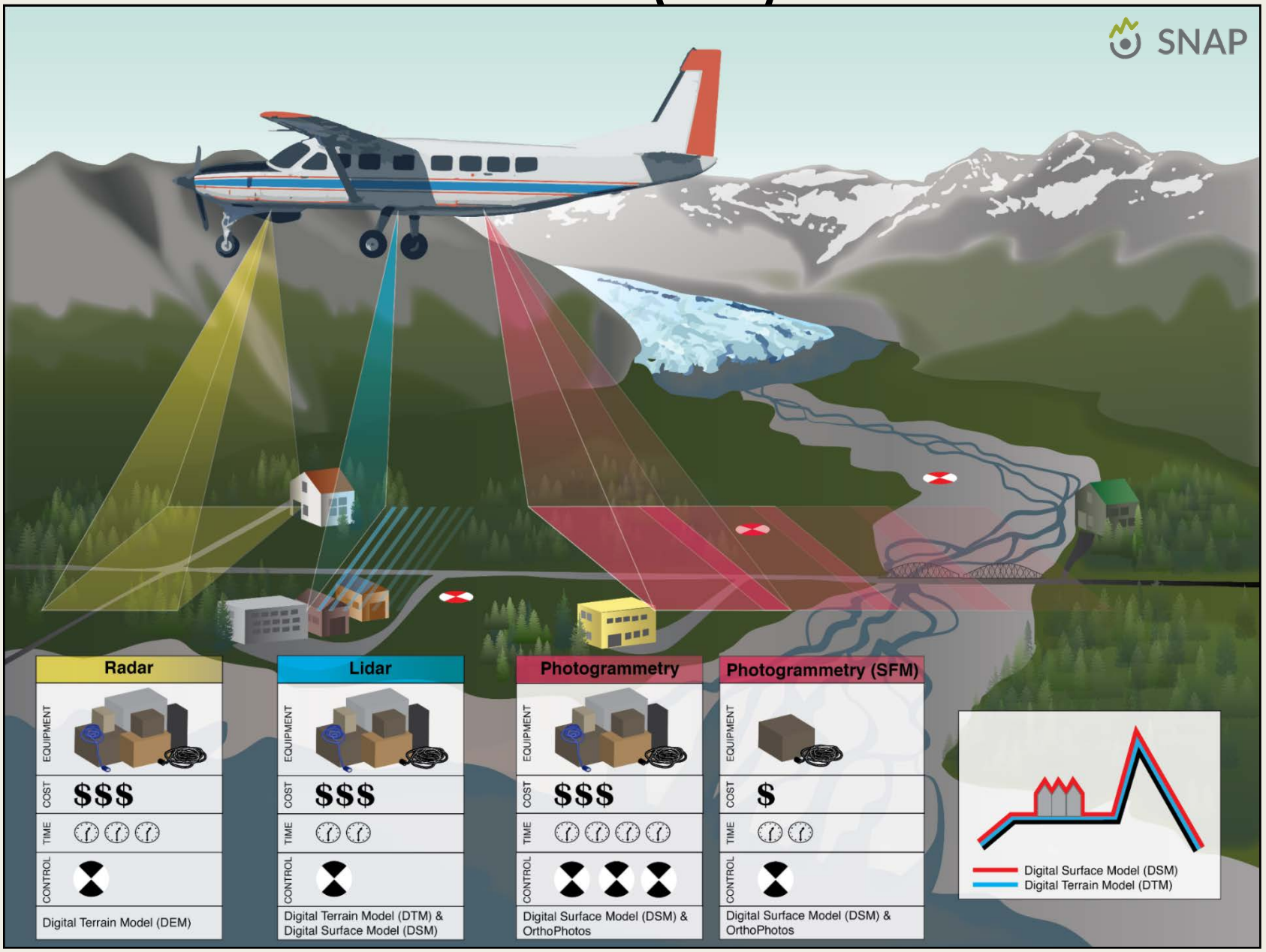
Continually Updated Shoreline Product (CUSP)

- Most current shoreline representation
- A more frequently updated continuous shoreline to meet needs of many 'consumers'
- Employs/incorporates state-of-the-art-technology for development and validation
- Includes both NOAA and non-NOAA source data

Status of CUSP in Alaska



STRUCTURE FROM MOTION (SfM) PHOTOGRAMMETRY



SOME PROS

- Lidar-comparable elevation product for investigations that:
  - require frequent re-measurement
  - cover large areas
  - are geographically remote
- Relatively low-cost, rapid
- Inherently co-registered imagery
- Any angle of overlapping imagery may be used (inc. Shore Zone)

. . . AND CONS

- Still an emerging approach
- Limited to subaerial portions of coastal environments
- Challenging to algorithmically remove vegetation and other non-surface features from DSM
- Ground control remains an issue for absolute positioning (relative positional accuracy of products is high)

SEPTEMBER 2014: DGGS PILOT PROJECT EXTENT

1000 photos w/ a DSLR camera time-linked to a GPS receiver

~ 12 x 2 km area

Processed with AgiSoft Photoscan

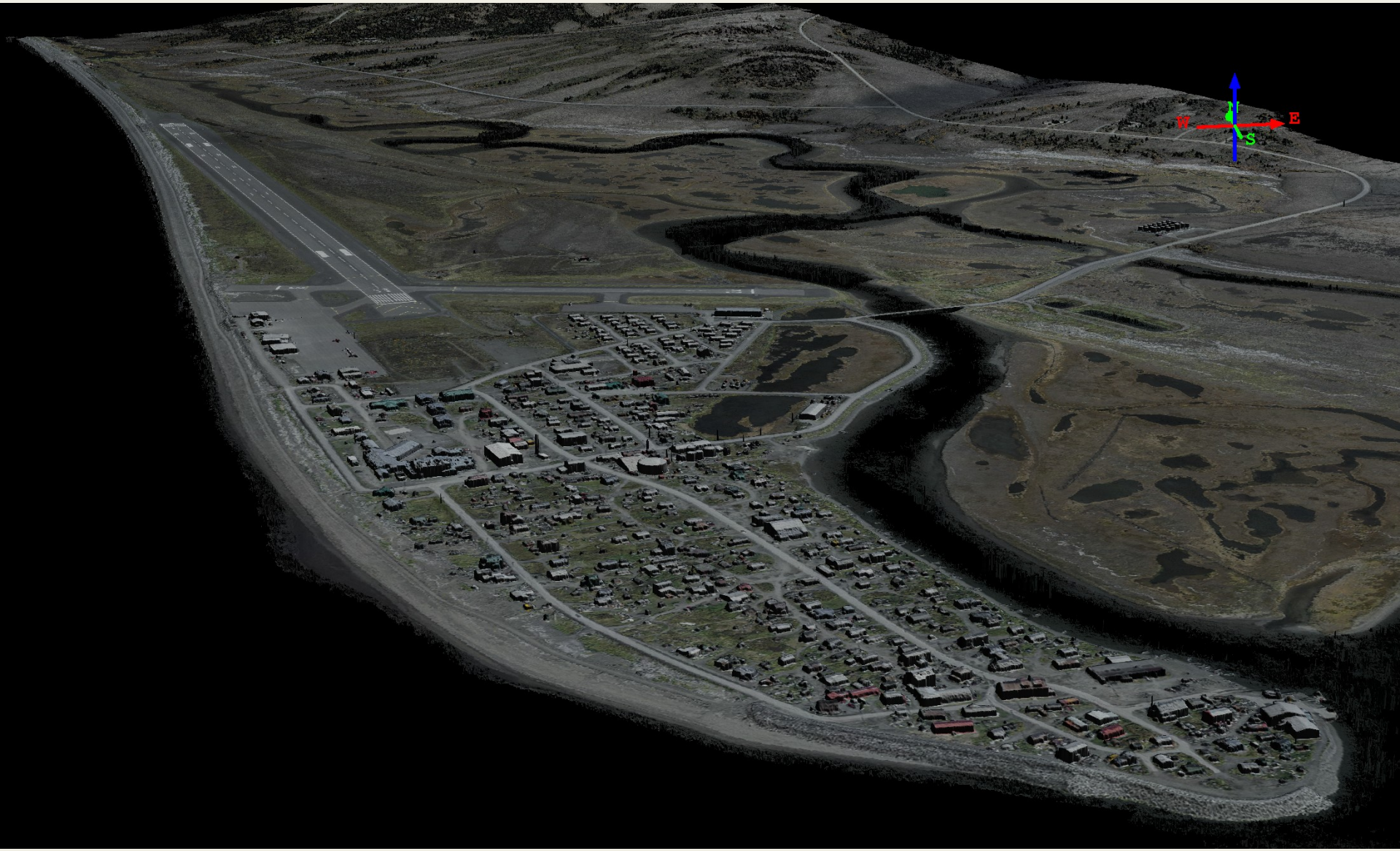
Used archived, 2011 photo-identifiable ground control

9 cm imagery & 20 cm DSM; 16 cm vertical RMSE

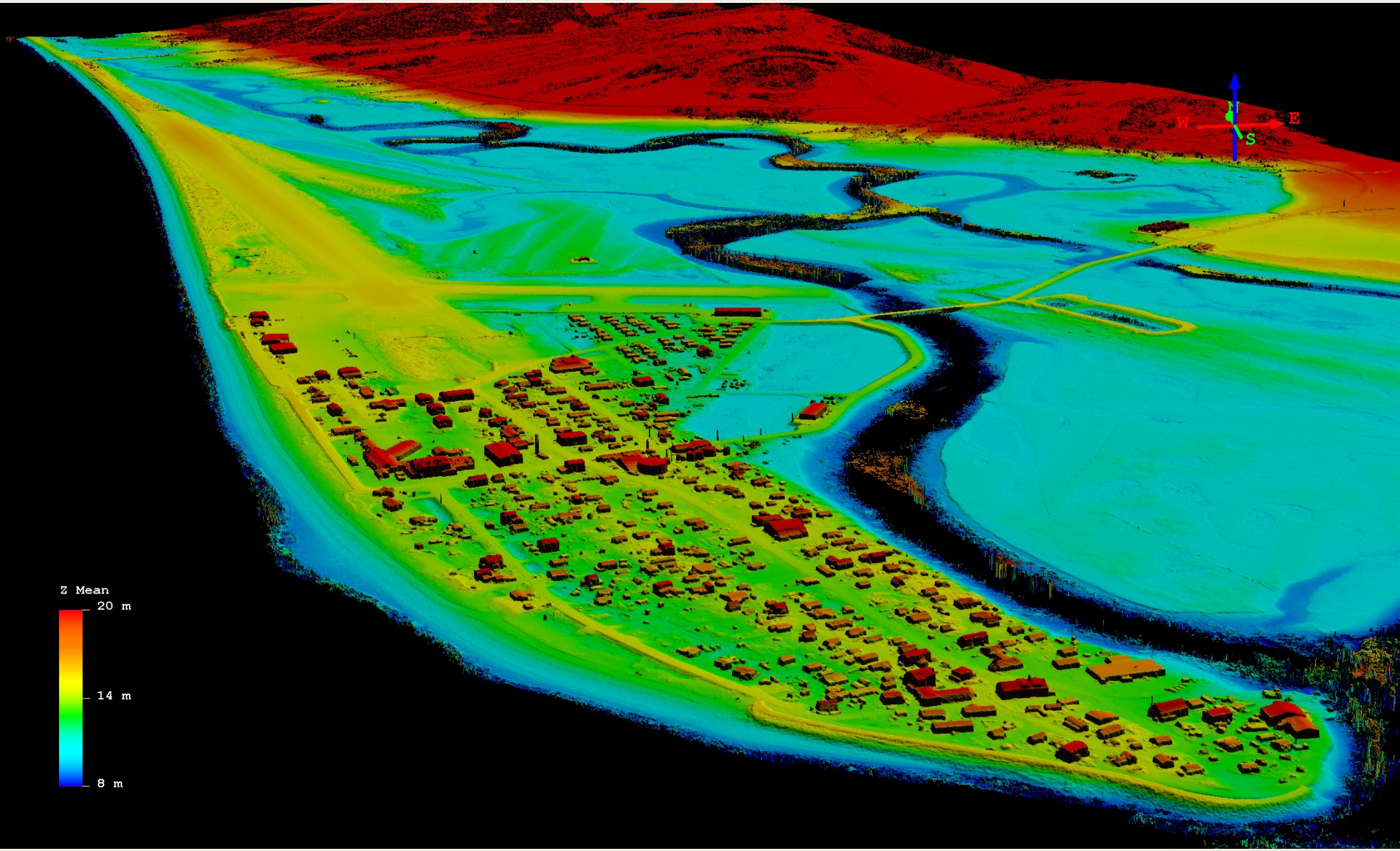
FAIRBANKS
FODAR
If your topography is changing,
we can measure it.

SEPTEMBER 2014: DGGS ORTHOIMAGE

SEPTEMBER 2014: DGGS DSM



SEPTEMBER 2014: DGGS DSM



http://maps.dggs.alaska.gov/elevationdata

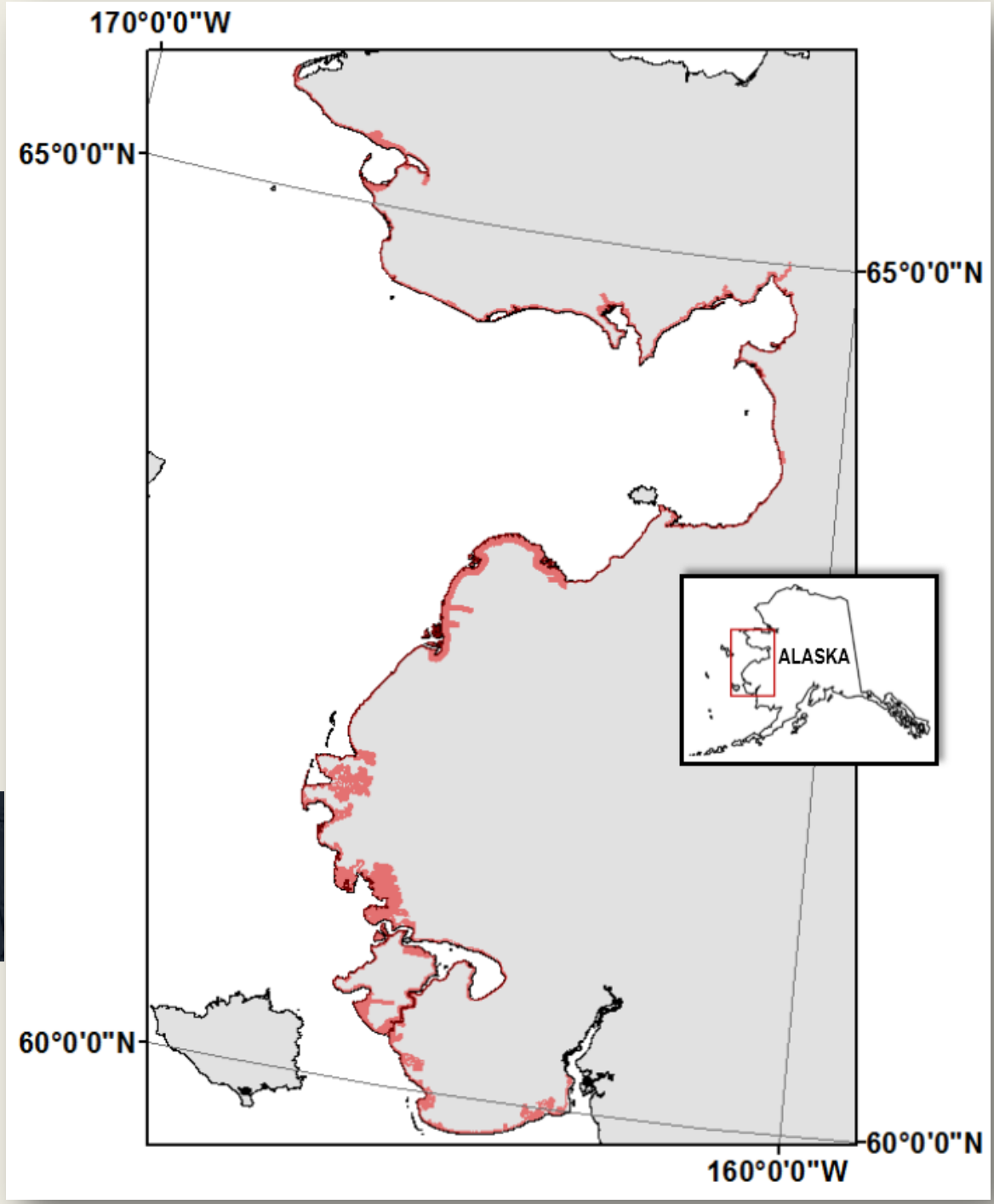
DGGS 2015

- Approximately 3,500 km collection
- 1.5 – 5 km swath
- Tide-coordinated
- Independent ground control
- Open-source data products

FAIRBANKS FODAR
If your topography is changing, we can measure it.

ALASKA GEOLOGICAL AND GEOPHYSICAL SURVEYS

RECON



UNK Data Collection Experiments: Cell Phone Cameras

- Data need:

  Shape and size of an object/feature

  For example:

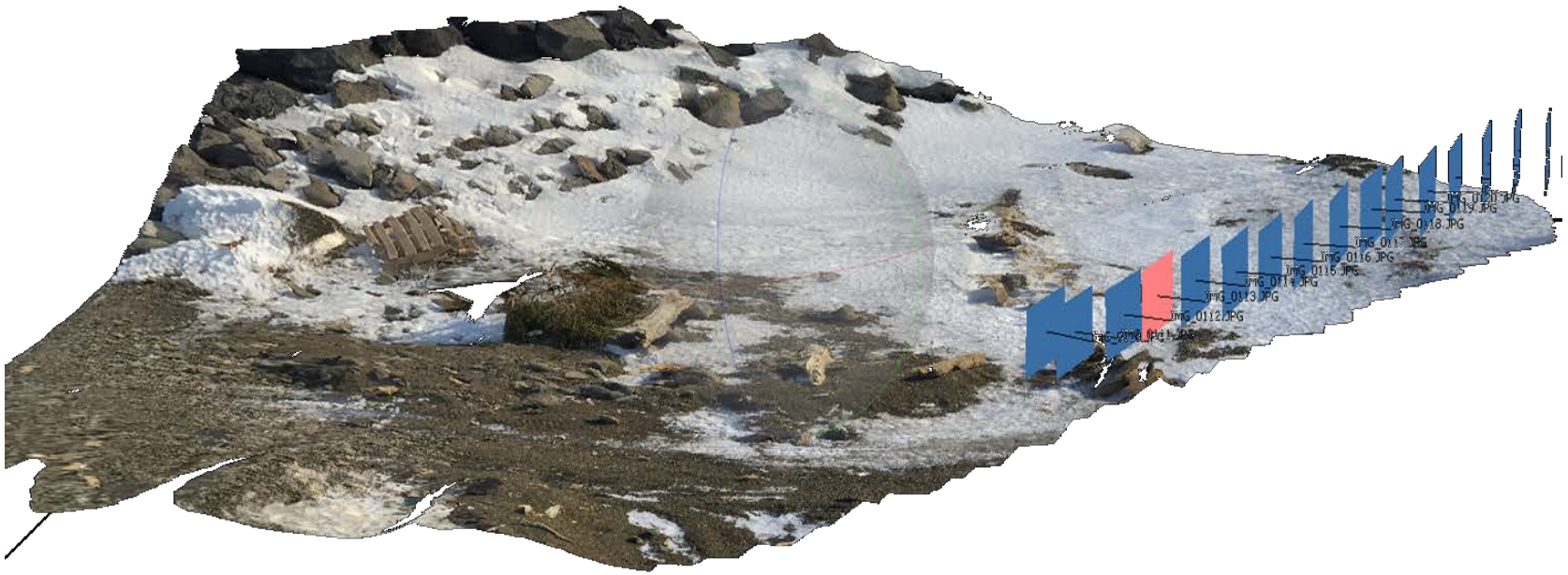
  - Erosion areas or damaged revetments/seawalls
  - Biological monitoring (whales, seals, plant life)
  - Glacial monitoring
  - Sea level trends
  - Permafrost degradation

- The method:
  - Lots of pictures from slightly different angles are taken of the area/object of interest
  - An object with a known size (box, for example) is placed in the images for scale
  - Computer software at DGGS (AgiSoft PhotoScan) is used to build a 3-D model that can be emailed

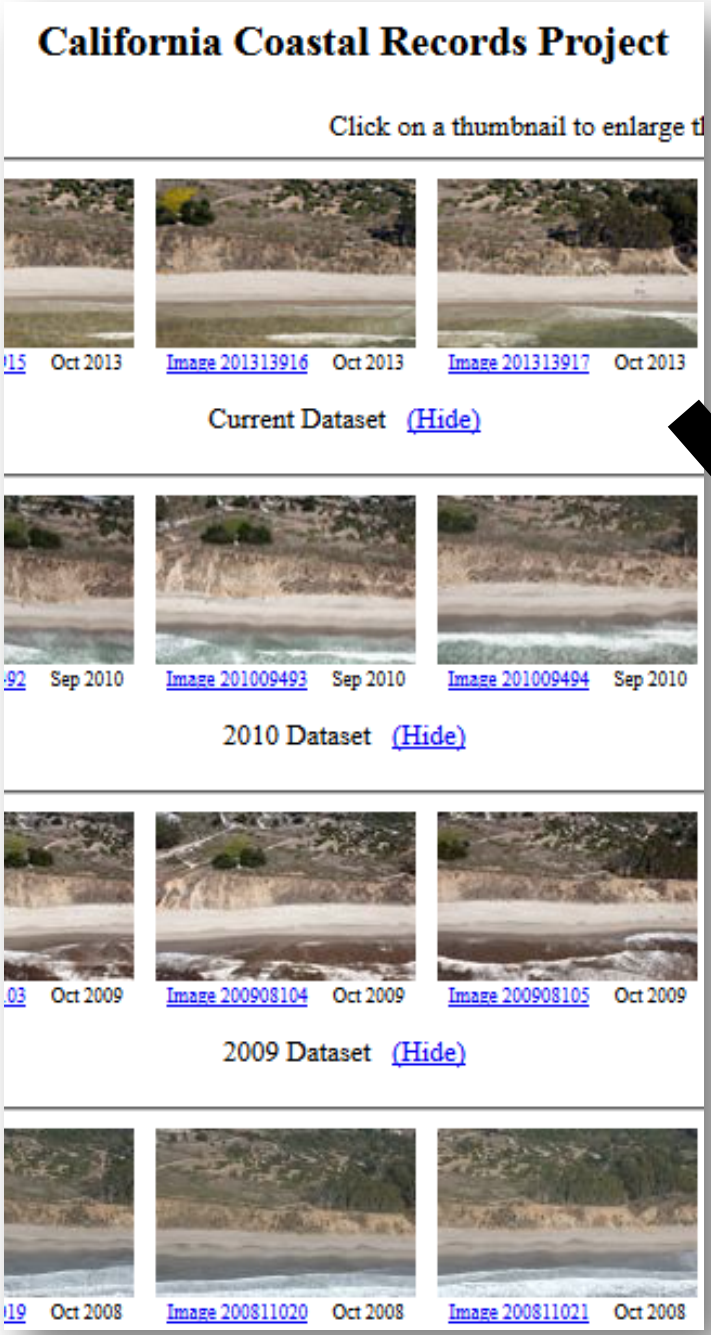
DGGS intern scientist: Lauren Southerland

Community Partner: John Henry Jr, IGAP Coordinator, Native Village of Unalakleet

UNK Data Collection Experiments: 3-D “Snap Shots”



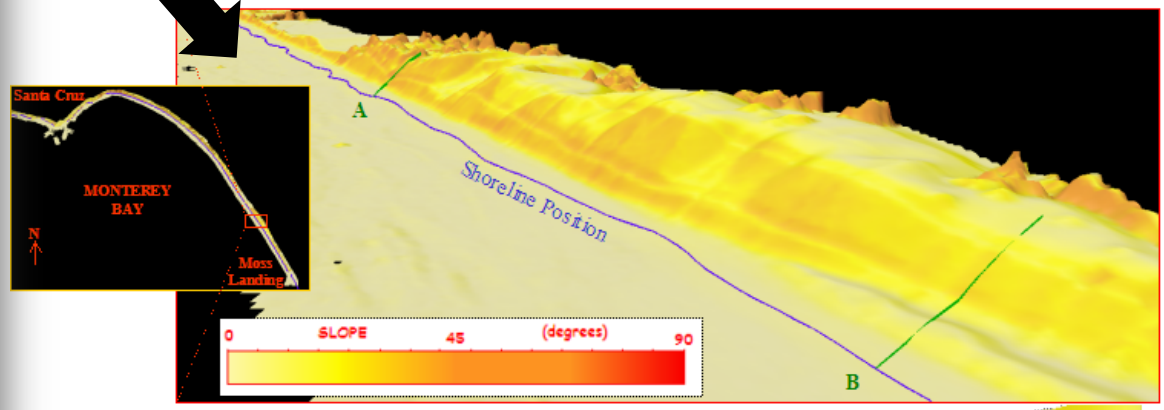
- Ongoing experiments to test best photo distance, spacing, etc.
- Lots of possible applications
- Can calculate volume change with repeat imaging

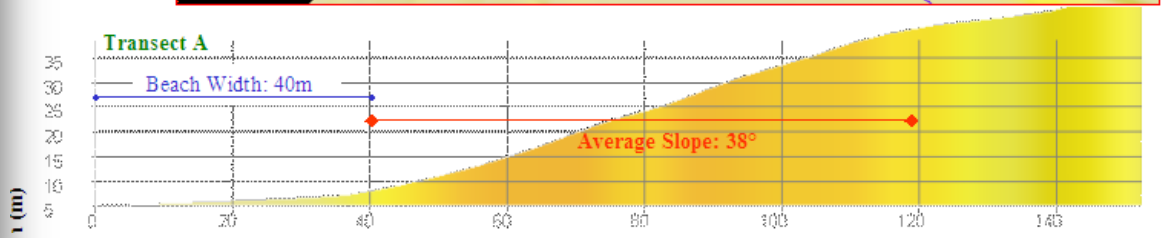


Repeat Obliques in CA

- 1972, 1979, 1987, 2002, 2004, 2005, 2006, 2008, 2009, 2010, 2013
- Structure From Motion DEM extraction for change detection (USGS, in progress)
- POC: Jon Warrick

USGS science for a changing world
Pacific Coastal and Marine Science Center





THANK YOU!

Types of Shoreline Vectors