



Using Water Levels in Alaska

Hydrography, Shipping and Navigation

Alaska Water Levels Meeting
LT Bart Buesseler, NOAA
May 23, 2018



Office of Coast Survey
National Oceanic and Atmospheric Administration

Overview

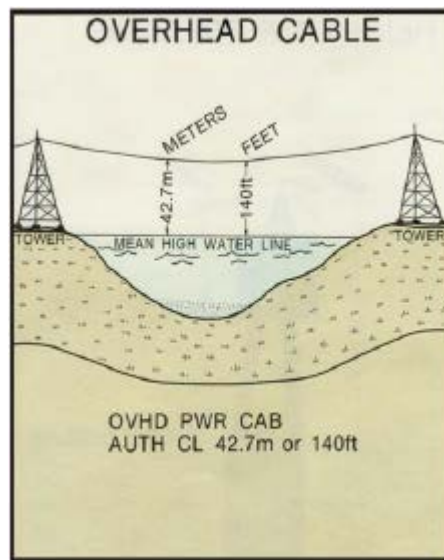
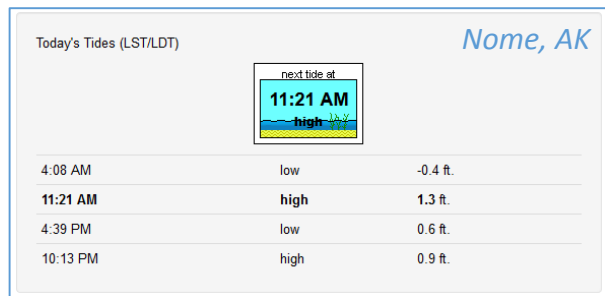
- What's used by the mariner on the chart?
- How is this addressed during hydrographic surveys?
- Summary & Questions



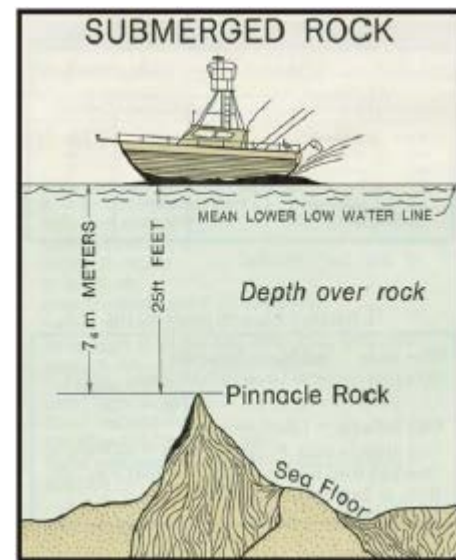
What's Used on the Chart?

- What does the mariner need to know?

- Will I fit *over* it?
- Will I fit *under* it?
- How much does it change?



HEIGHTS
Heights in feet above Mean High Water.



SOUNDINGS IN FATHOMS
(FATHOMS AND FEET TO ELEVEN FATHOMS)
AT MEAN LOWER LOW WATER

Mean Tidal Range (in feet) for Various Alaskan Cities

Juneau	Cordova	Valdez	Anchorage	Kodiak	Unalaska	Nome	Prudhoe Bay
13.7	10.2	9.7	26.2	6.8	2.4	0.5	1.0



Why does this matter?

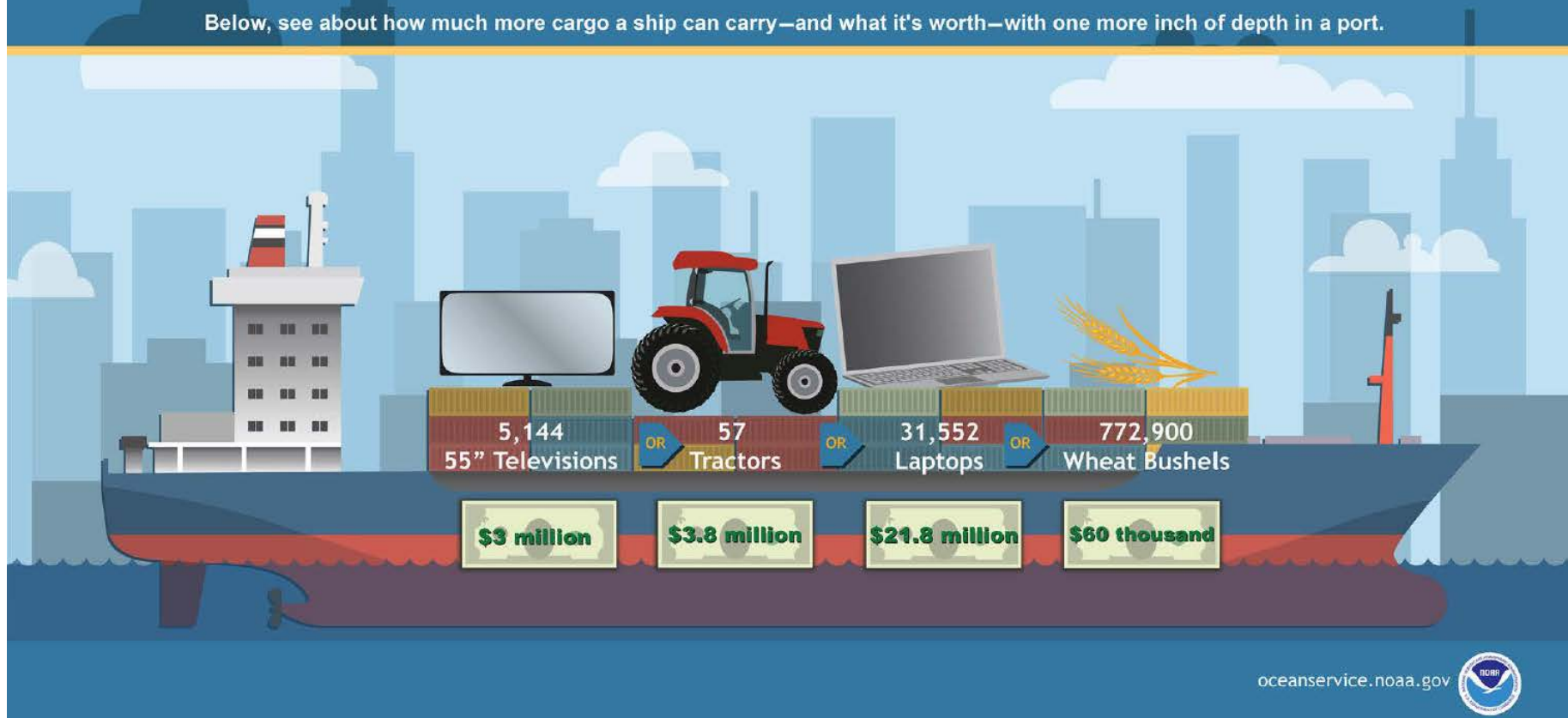
DEEPER PORTS, DEEPER POCKETS

One more inch of water in a port means larger ships can enter, bringing millions of dollars worth of additional cargo.

And, carrying more goods in one trip means fewer total trips to ship the same amount of stuff.

With one more inch of depth in a port, a cargo ship could carry about 50 more tractors, 5,000 televisions, 30,000 laptops, or 770,000 bushels of wheat.

Below, see about how much more cargo a ship can carry—and what it's worth—with one more inch of depth in a port.



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Why does this matter?

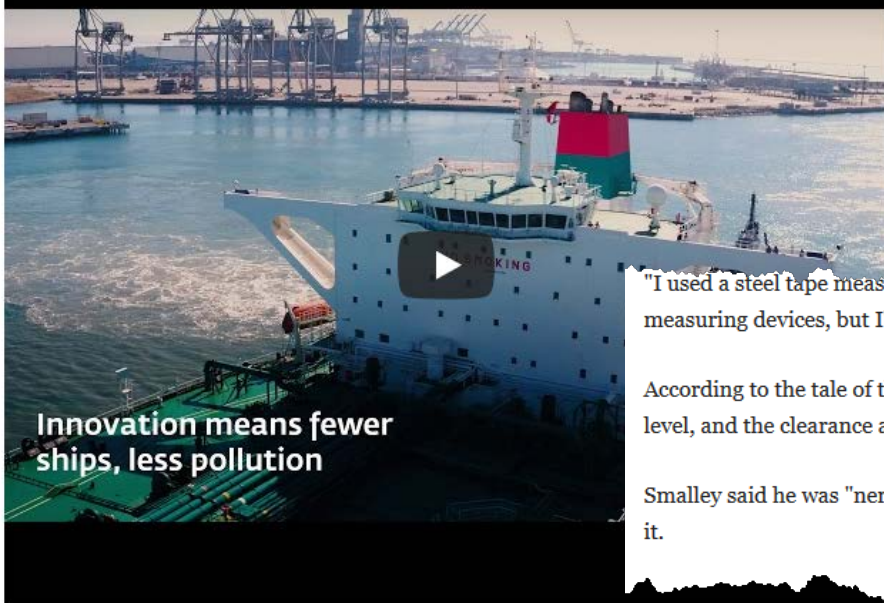
Andeavor TAQAH Oil Tanker Arrival at Port of Long Beach

in Recent Videos 19/02/2018



Earlier this month, the Port of Long Beach welcomed the oil tanker TAQAH to our Andeavor terminal on Pier T. Thanks to new technology, the TAQAH came into port safely with the deepest draft of any tanker in the U.S. Increasing the amount of oil in each tanker improves efficiency, with fewer ships meaning lower emissions.

Andeavor TAQAH Oil Tanker Arrival at Port of Long Beach



Innovation means fewer ships, less pollution

Squeaking Under the Span / World's largest cranes to slide under Golden Gate and Bay bridges this weekend by the closest of margins on their way to the Port of Oakland's new terminal

Steve Rubenstein, Chronicle Staff Writer Published 4:00 am, Friday, October 20, 2000



"I used a steel tape measure," said Smalley, supervising electrical-mechanical engineer for the port. "There are electronic measuring devices, but I'm an old-fashioned tape measure kind of guy."

According to the tale of the tape, the tops of the cranes -- with their booms lowered -- will sit precisely 223.75 feet above water level, and the clearance at low tide beneath the Bay Bridge is precisely 225.6 feet.

Smalley said he was "nervous" but expects all to go smoothly. Clearing the bridge by 22 inches, he said, still counts as clearing it.



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How is this addressed during surveys?

- Tidal data is a primary element of control required for hydrographic surveys
 - Lack of tidal datums can preclude an area from being surveyed
 - This can add significant lead time to survey requests if datums aren't available
- Accomplished by one of two methods
 - Concurrent Tidal Measurements
 - Applied via TCAR1 or Zoned Tide files to reduce data to MLLW based on timestamp
 - Ellipsoidally Referenced Separation Models
 - Applied via separation model (surface) to reduce data to MLLW based on position



Concurrent Tidal Measurements

- NWLON stations provide primary tidal data, with additional information / refinement by tertiary stations installed by survey crews
- Survey operations cannot start until tide station is operational
 - Gaps in tidal data can quickly result in unusable data



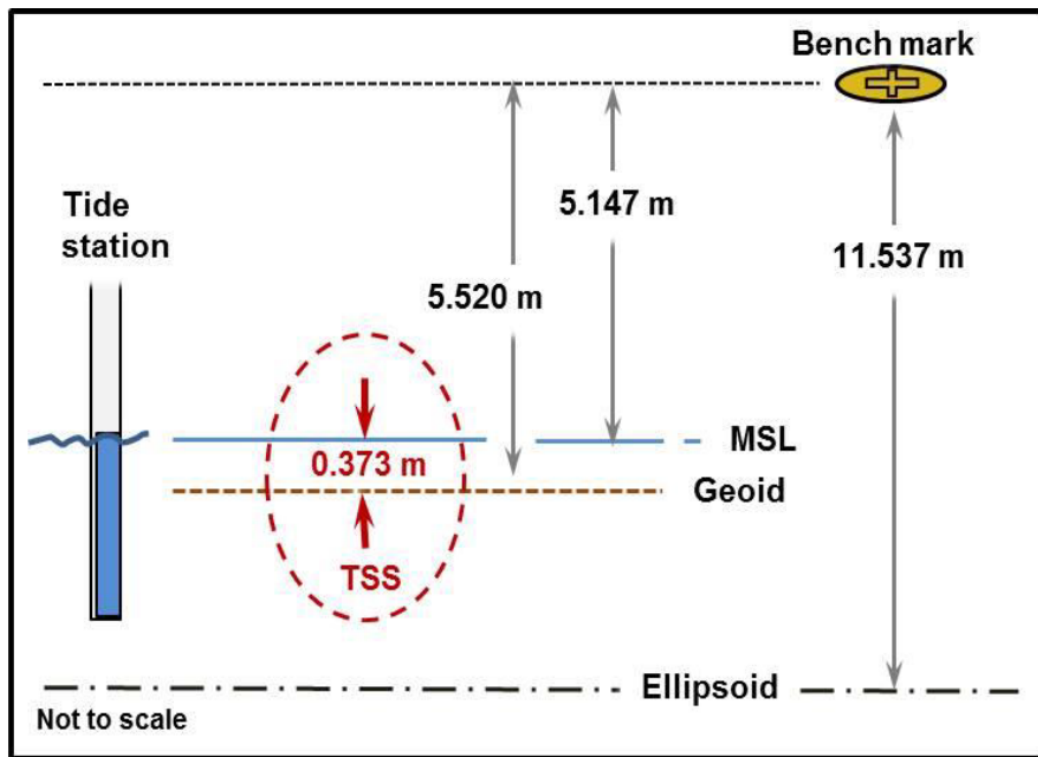
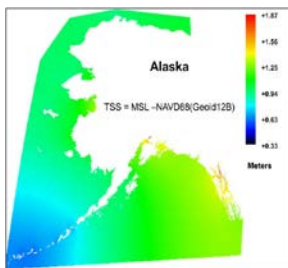
Ellipsoidally Referenced Separation Models

- Allows the establishment of tidal datums and survey operations to take place at different times
 - No dependence on operational tide gauge to start survey operations
- VDatum
 - Not available in Alaska
- Poor Man's VDatum (PMVD)
 - An AK alternative for VDatum, uses tidal benchmarks with geoid and ellipsoid heights to compute TSS, enabling use of ERS methods

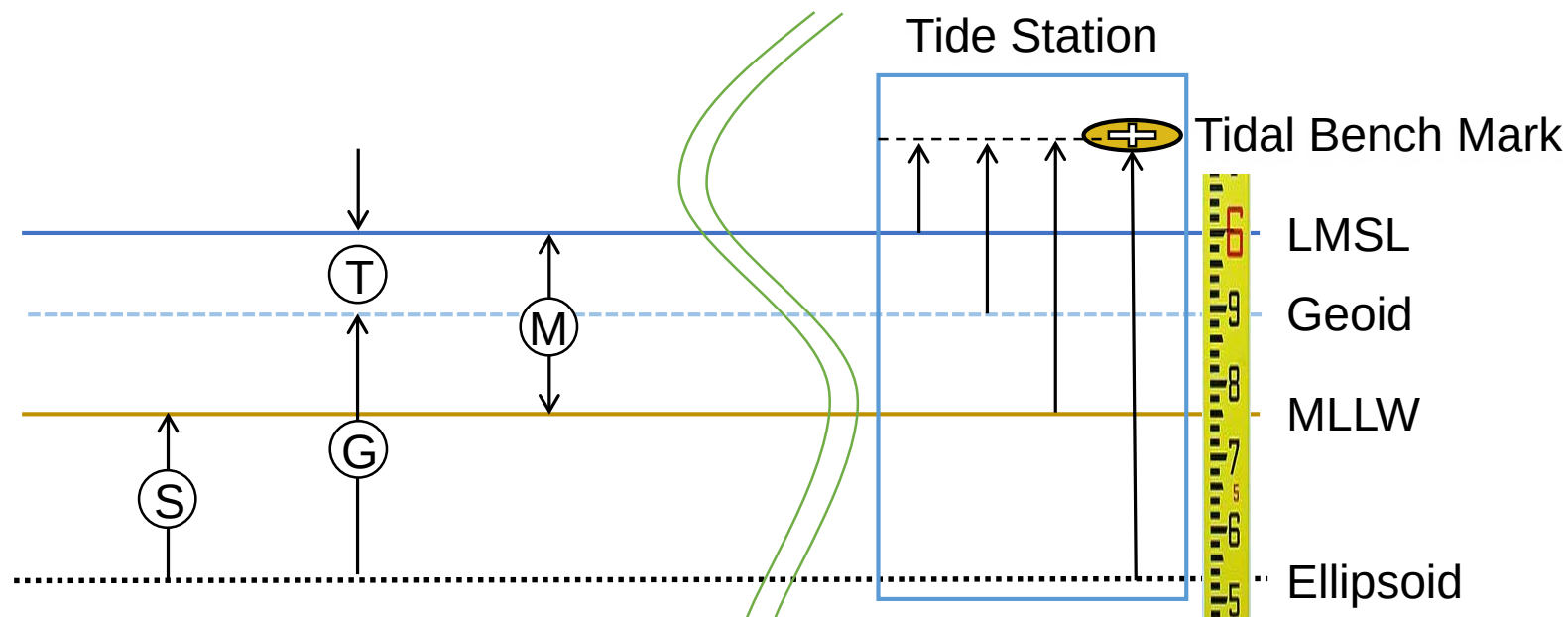


How do we get the TSS?

- By calculating the difference between where the water should be (via the geoid) and where it is (via the tide gauge), the Topography of the Sea Surface (TSS) is determined
 - By doing this at tide stations across the state, a state wide TSS model can be created

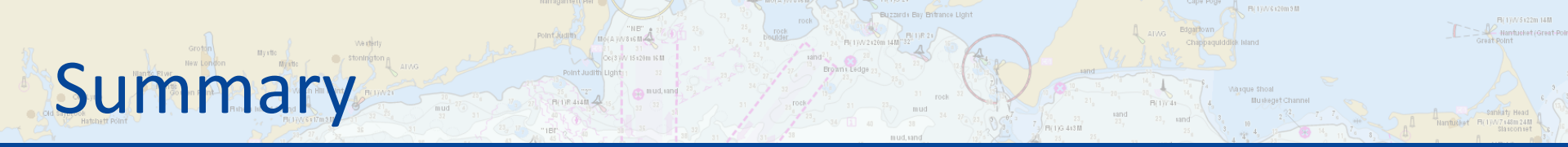


How do we use tidal data for PMVD?



- Ⓢ SEP: $V_{\text{Datum}} = \textcircled{G} + \textcircled{T} - \textcircled{M}$
- ⓖ Geoid
- Ⓣ Topography of the Sea Surface (TSS)
- Ⓜ Tidal Marine Grid (Chart Datum Offset)

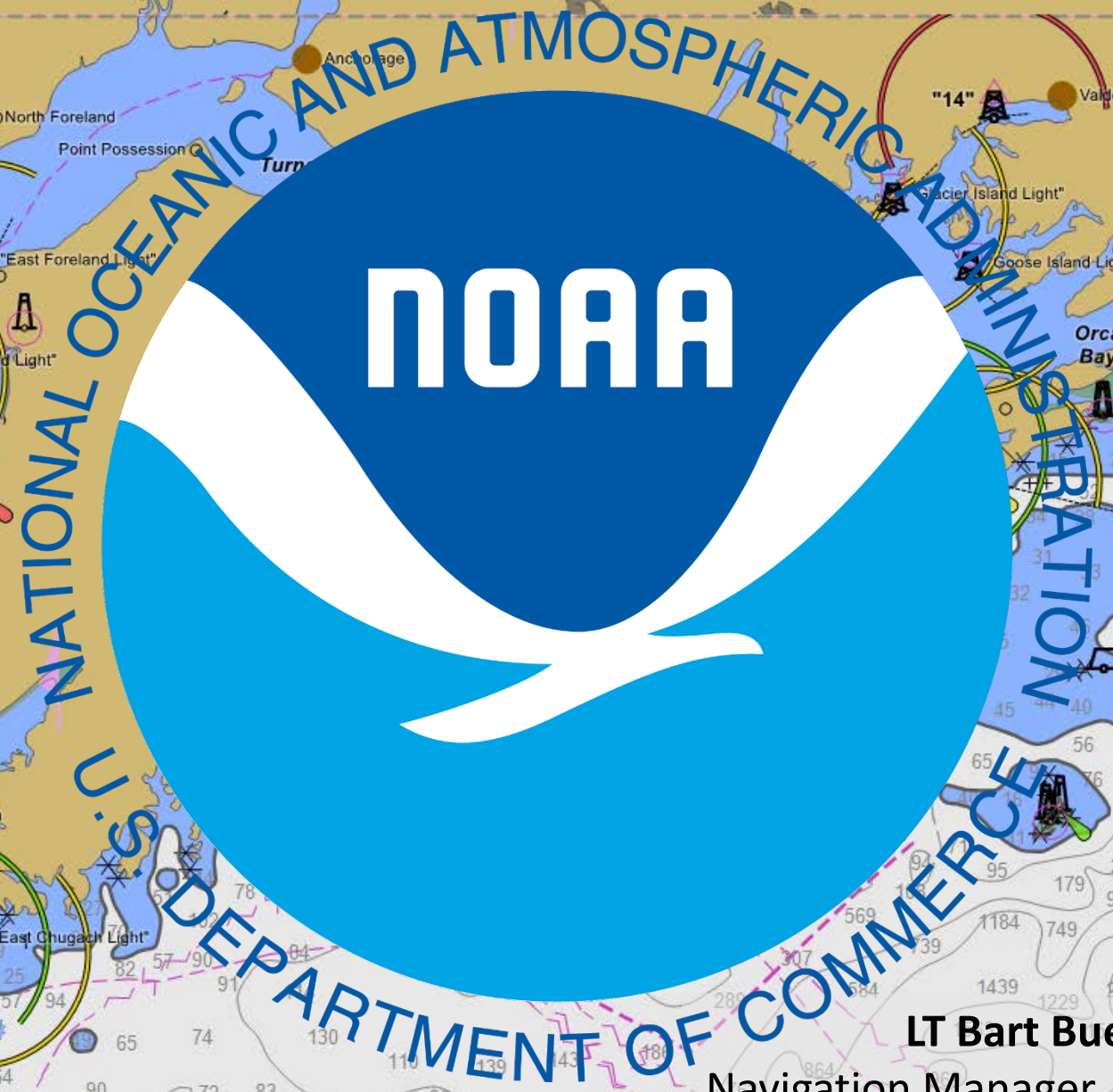
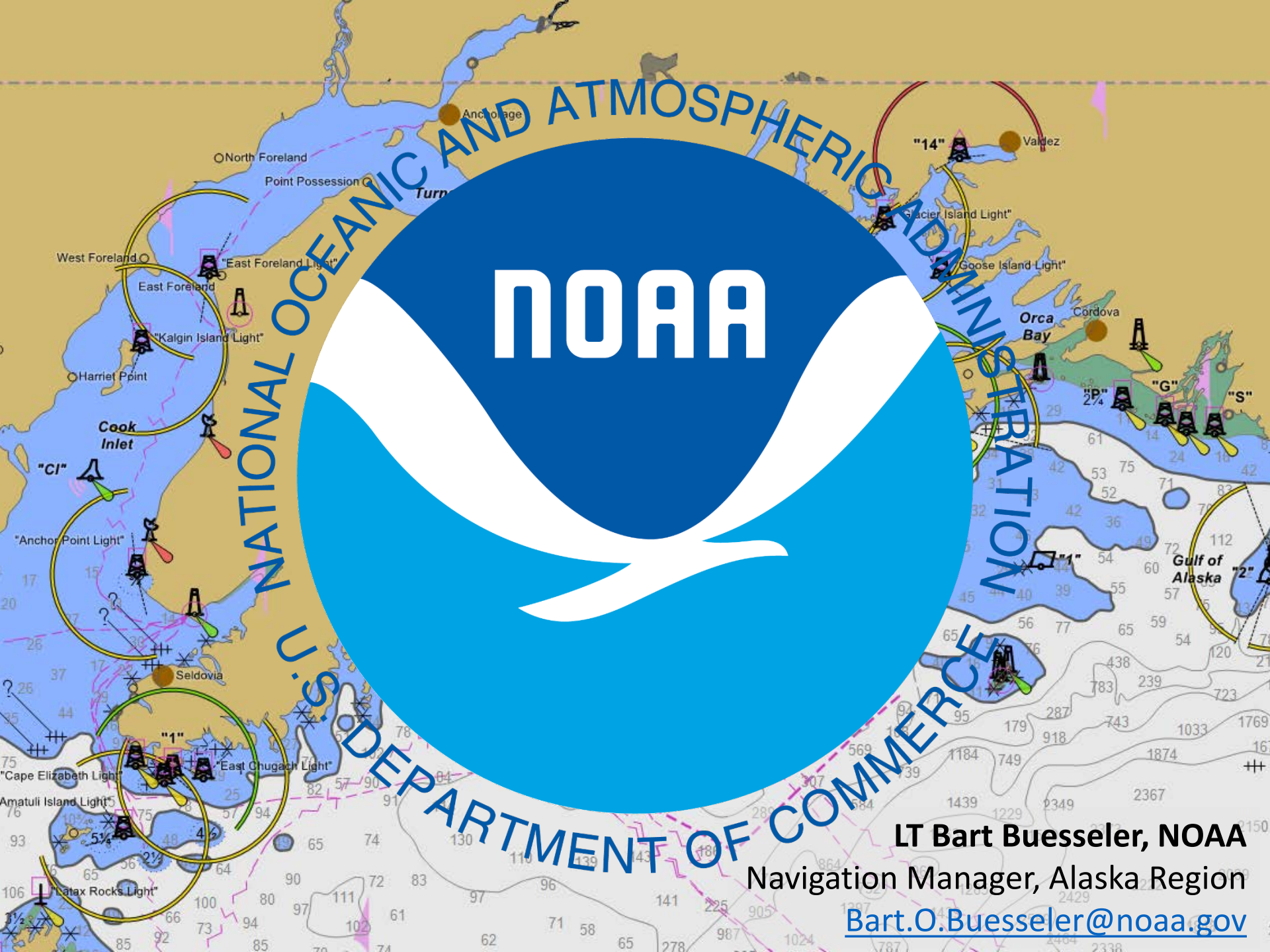
Disclaimer:
PMVD SEP models are **not** as accurate as VDatum products and must be compared to Tidal / ERZT products before use!



Summary

- Mariners need to know how deep the water is and how much clearance they have from overhead structures
 - Poor tidal datums increase risk to mariner and environment
- Hydrographic surveyors need to have accurate tidal data in order to produce quality data
 - No tidal datums = no survey operations
 - Accurate tidal datums allow for additional products such as PMVD
- **Tidal datums are the infrastructure on which the maritime community operates**





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