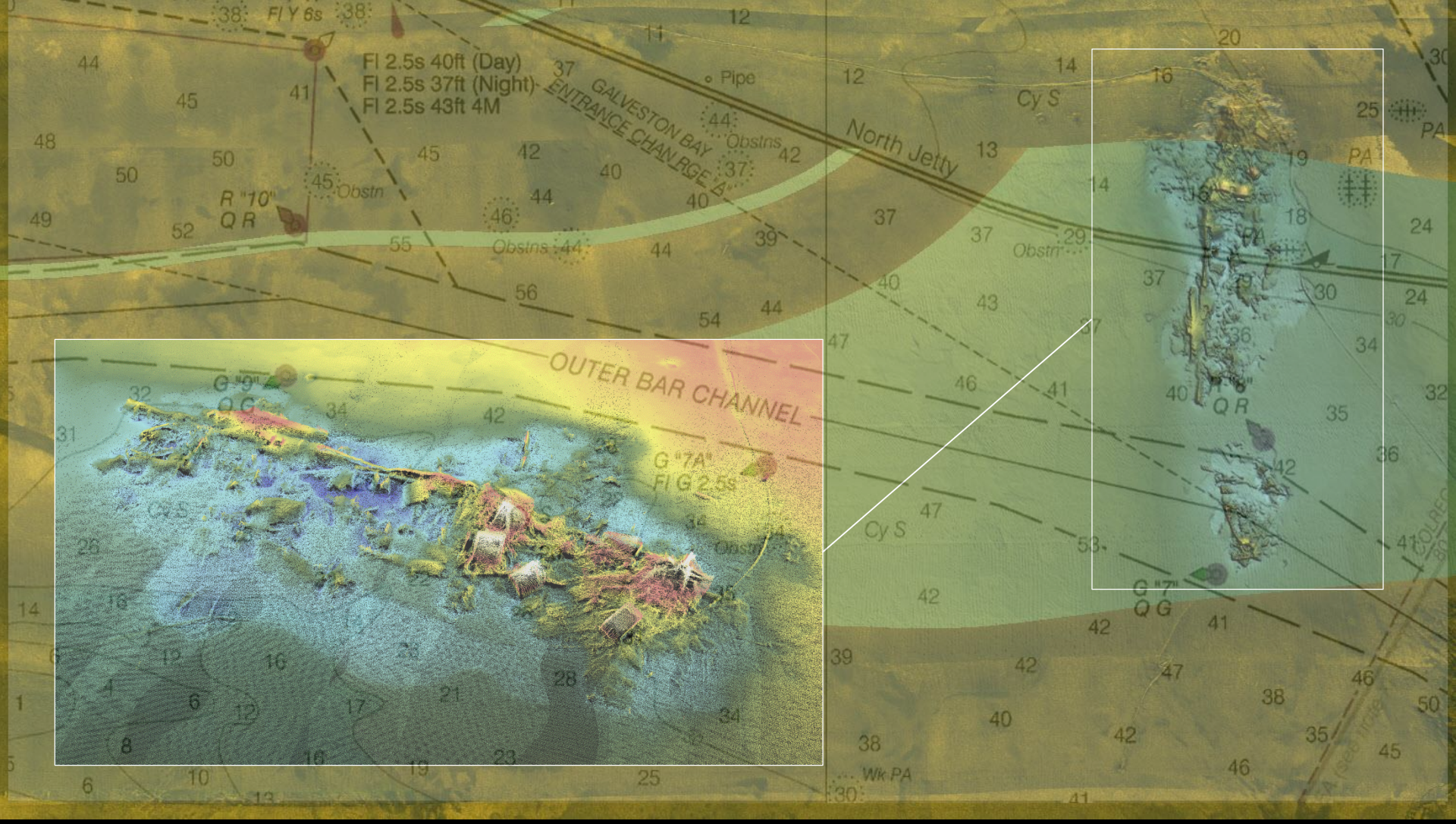


Sound Beginnings of a Hydrographic Scientist. Where They Come from and Why They Are Important!

TERRASOND
PRECISION GEOSPATIAL SOLUTIONS®

noaa
NOAA HYDROGRAPHIC SERVICES REVIEW PANEL

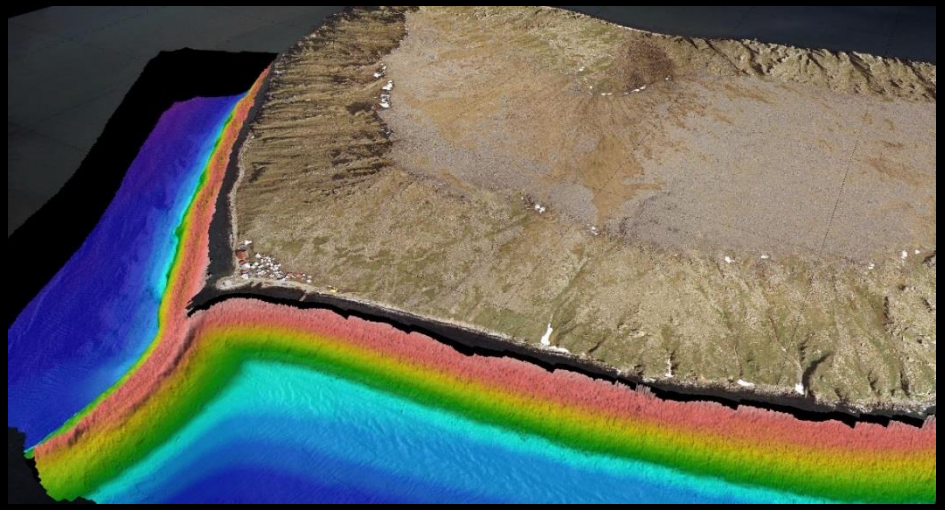
TEXAS A&M UNIVERSITY CORPUS CHRISTI

What is Hydrography?

Definition of Hydrography

"Hydrography is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defense, scientific research, and environmental protection."

– International Hydrographic Organization (IHO)



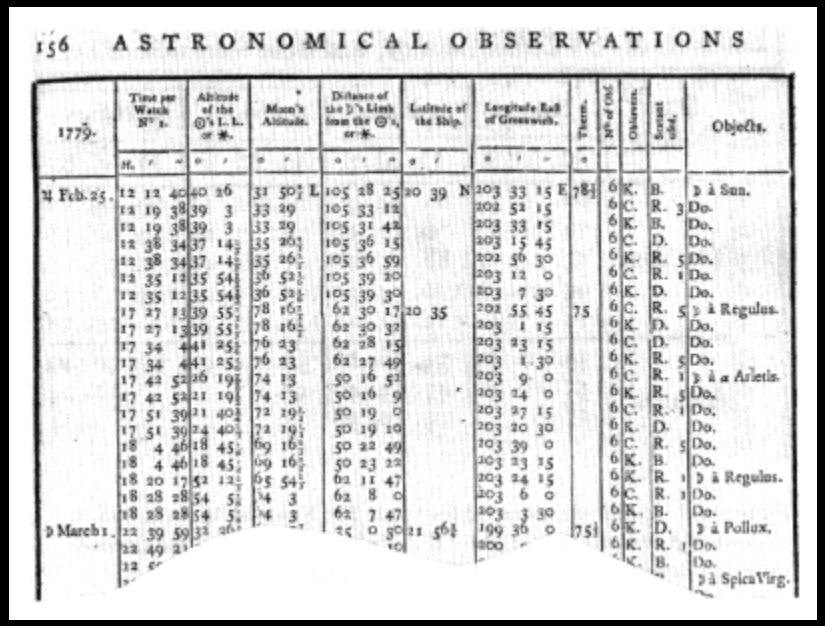
In the Beginning

- Only a Captain, Officer, or third party crew (scientist) would have the knowledge on how to take measurements.
- Measurements consisted of: lead lines; astronomical observations; cordage (speed through the water); and land sightings.
- Usually done from a moving wooden sailing vessel.

The Longitude Problem

- In 1567 King Phillip II of England offered a reward for anyone who cold find a way to accurate position longitude at sea.

- In 1714 the British established the Longitude Act which offered an equivalent of several million dollars in todays economy for any person or persons who could reliably and accurately position a line of longitude at sea.

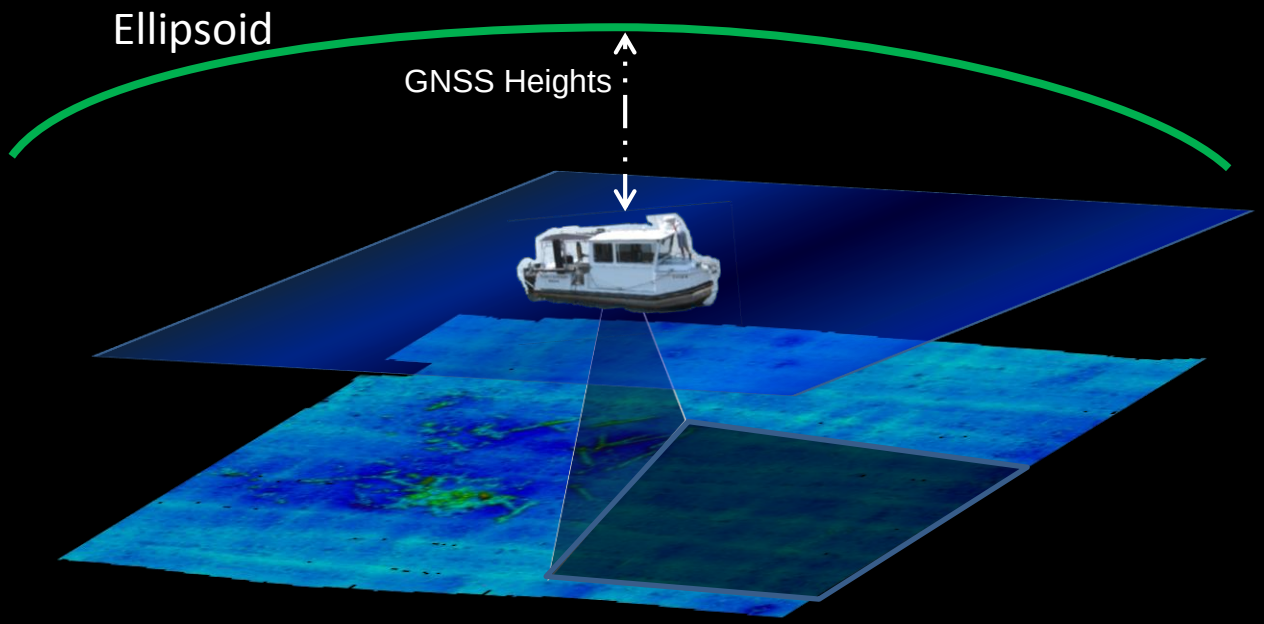


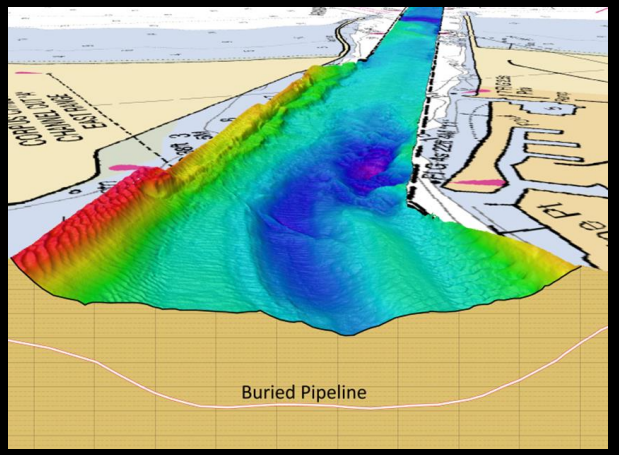
156 ASTRONOMICAL OBSERVATIONS

1779.	Time per Watch N° 1.	Altitude of the ☉'s L. L. or ✱.	Moon's Altitude.	Distance of the ☽'s Limb from the ☉, or ✱.	Latitude of the Ship.	Longitude Run of Greenwich.	Therm.	Nº of Obs.	Observers.	Sextant obs.	Objects.
	H. ′ ″	° ′	° ′	° ′ ″	° ′	° ′ ″	°				
M Feb. 25.	12 12 40	40 26	31 50½ L	105 28 25	20 39 N	203 33 15 E	78½	6	K.	B.	☽ à Sun.
	12 19 38	39 3	33 29	105 33 12		202 52 15		6	C.	R. 3	Do.
	12 19 38	39 3	33 29	105 31 42		203 33 15		6	K.	B.	Do.
	12 36 34	37 14½	35 26½	105 36 15		203 15 45		6	C.	D.	Do.
	12 38 34	37 14½	35 26½	105 36 59		202 56 30		6	K.	R. 5	Do.
	12 35 12	35 54½	36 52½	105 39 20		203 12 0		6	C.	R. 1	Do.
	12 35 12	35 54½	36 52½	105 39 30		203 7 30		6	K.	D.	Do.
	17 27 13	39 55½	78 16½	62 30 17	20 35	202 55 45	75	6	C.	R. 5	☽ à Regulus.
	17 27 13	39 55½	78 16½	62 30 32		203 1 15		6	K.	D.	Do.
	17 36 44	41 25½	76 23	62 28 15		203 23 15		6	C.	D.	Do.
	17 34 44	41 25½	76 23	62 27 49		203 1 30		6	K.	R. 5	Do.
	17 42 52	20 19½	74 13	50 16 51		203 9 0		6	C.	R. 1	☽ à α Arietis.
	17 42 52	21 19½	74 13	50 16 9		203 24 0		6	K.	R. 5	Do.
	17 51 39	21 40½	72 19½	50 19 0		203 27 15		6	C.	R. 1	Do.
	17 51 39	24 40½	72 19½	50 19 20		203 20 30		6	K.	D.	Do.
	18 4 46	18 45½	69 16½	50 22 49		203 39 0		6	C.	R. 5	Do.
	18 4 46	18 45½	69 16½	50 23 22		203 23 15		6	K.	B.	Do.
	18 20 17	52 12½	65 54½	62 11 47		203 24 15		6	K.	R. 1	☽ à Regulus.
	18 28 28	54 5½	64 3	62 8 0		203 6 0		6	C.	R. 1	Do.
	18 28 28	54 5½	64 3	62 7 47		203 3 30		6	K.	B.	Do.
☽ March 1.	22 39 59	32 26		25 0 36	21 56½	199 36 0	75½	6	K.	D.	☽ à Pollux.
	22 49 21			10		200		6	K.	R. 1	Do.
	22 [illegible]							[illegible]	[illegible]	B.	Do.
											☽ à Spica Virg.

Present Day

- Acoustic waves are used to image the seafloor with low uncertainty.
- Orbiting satellite constellations allow for a position almost anywhere in the world instantly more precisely and accurately than any method previous.





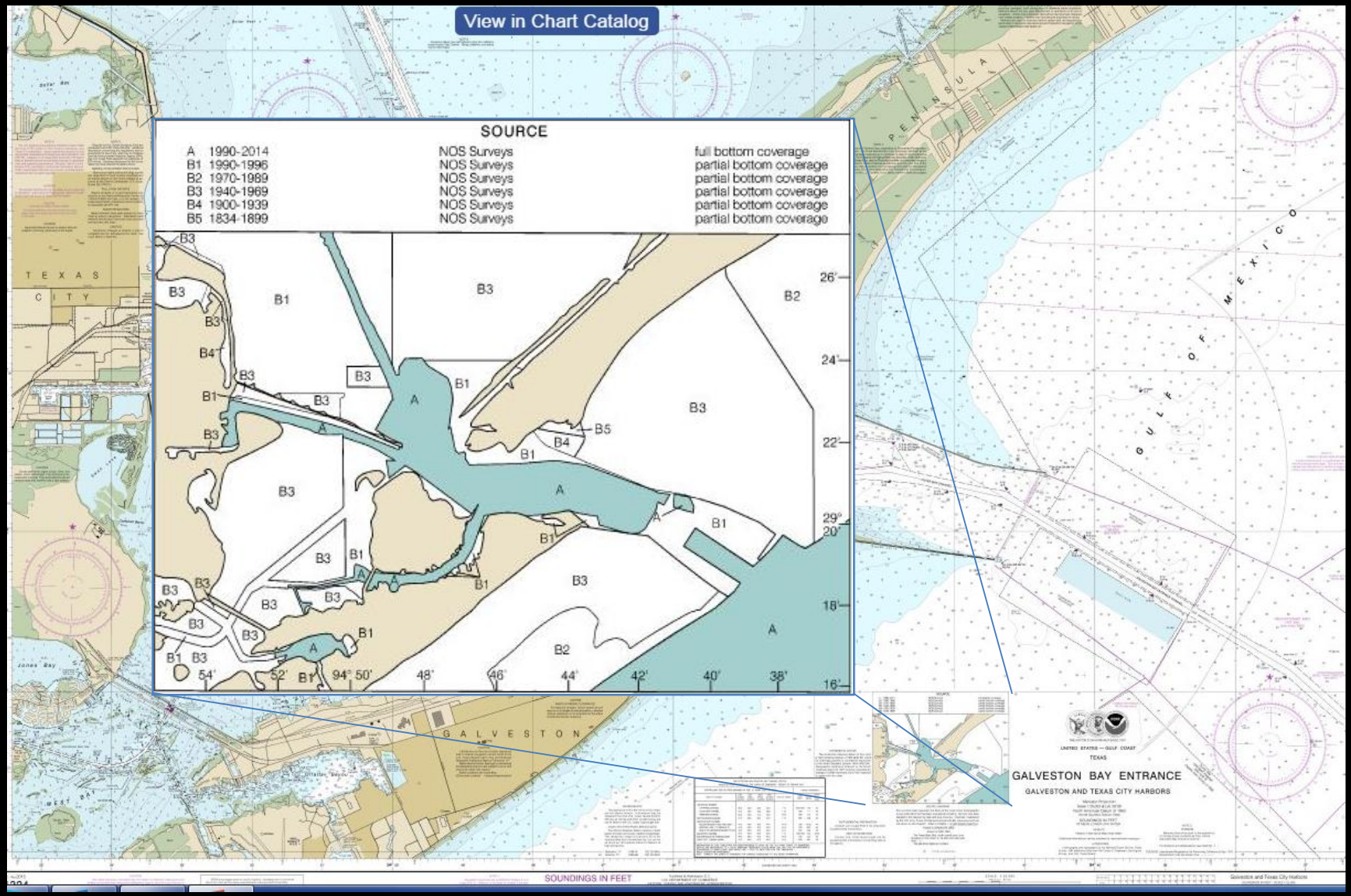
What Challenges do We Face Today?

- Where are our hydrographers getting their educations?
- Who controls what they learn?
- Why is retention of good hydrographers such an issue?
- Are there enough resources dedicated to ensuring low uncertainty measurements are being taken at sea like the Longitude Board monitored in the 18th century?
- Who governors the quality of hydrographic surveys? Where is the incentive to be diligent?
- Are advancements in technology being utilized to improve hydrographic science?
- What has the definition of hydrographic science changed to in todays world.
- What does all this mean for the Texas Gulf Coast?

We Live in a Dynamic World

- NOAA's official shoreline length was measured by hand to be 95,471 miles in 1939-40.
- The coast is an ever changing place. Great job security for a hydrographer, but do people understand this?
- Do they know the limitations of our charts?

Class Experiment



- 15 students picked 15 US Nautical charts randomly.
- Each reported that the published data on the chart was from 2013-2015
- They were then showed were to look.
- They instantly become more curious and intrigued.

Date Range	Number of Areas
2010-2016	2
2000-2009	6
1980-1999	3
1960-1979	3
1901-1959	5 (all 1939-40)
1851-1900	4
1800-1850	2

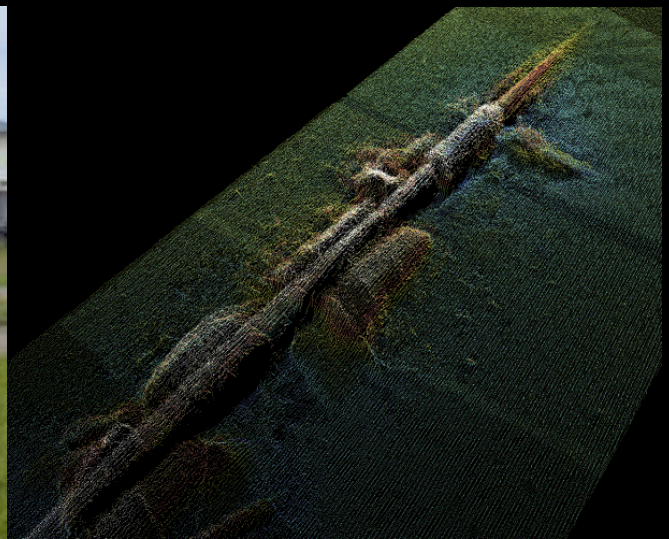
Education

- There are only three IHO recognized programs in the US as of 2011. Only two are IHO Cat. A certified:
    1. **University of Southern Mississippi's Master/Doctor of Hydrographic Science Degree and IHO/FIG Category A Certification.**
    2. **University of New Hampshire Master/Doctor of Ocean Engineering with Ocean Mapping Option/ IHO/FIG Category A Certificate.**
    3. Florida Institute of Technology Master of Ocean Engineering

- There are other degree programs that touch on hydrography and marine technology but, are focused on applied operation with little theory and are not recognized by the IHO. Such as Cape Fear Community College Marine Technology Degree and others like it.

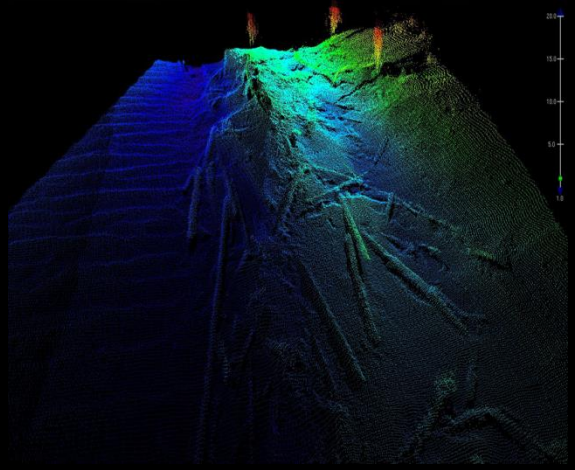
Private Industry

- Less than 25% of employees have any formal training in Hydrography
- Most are from a scientific/engineering background such as: geology; GIS; geomatics; geodesy; oceanography; etc.
- Don’t have all the theory or applied knowledge.
- Require in depth training and investment.



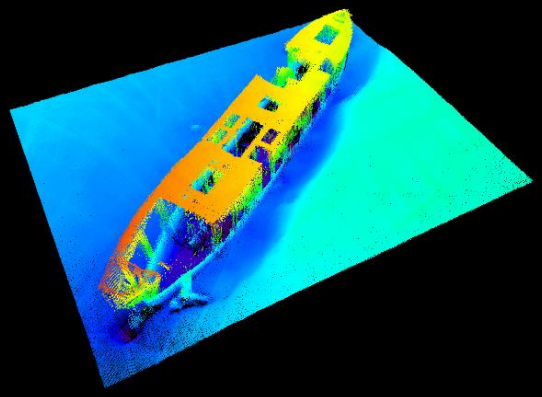
What is needed

- More dedicated degree programs meeting IHO specifications
- More hands on access to marine technology, such as sonars, TCOON, and Hydrographic Software Suites.
- Taught in depth theory along side of using technology.
- Focused internship opportunities with local and non-local agencies/companies.



Submerged Timber & Dock Pilings
(3D Point Cloud)

TCOON Water Monitoring Stations



Artificial Reef Shipwreck
(3D Point Cloud)

What's the Next Step?

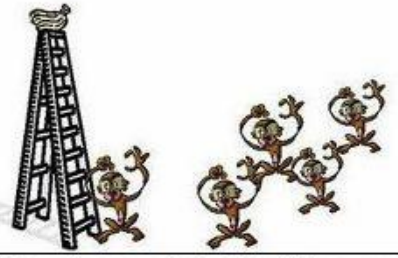
- The only professional certification offered in the US is the ACSM/THSOA Hydrographer Certification Program. As of 2012 there are only ~130.
- There is no professional registration or licensure for Hydrographers.
- Certifications can be taken away or threatened once they are achieved. Does this limit the integrity and of the surveys?
- Are hydrographers less diligent in their work?

Are We Keeping Up With Technology and Improved Methodology?

A group of scientists placed 5 monkeys in a cage and in the middle, a ladder with bananas on the top.

Every time a monkey went up the ladder, the scientists soaked the rest of the monkeys with cold water.

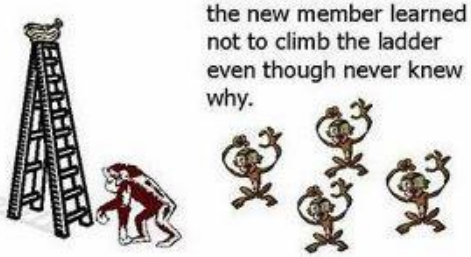
After a while, every time a monkey went up the ladder, the others beat up the one on the ladder.



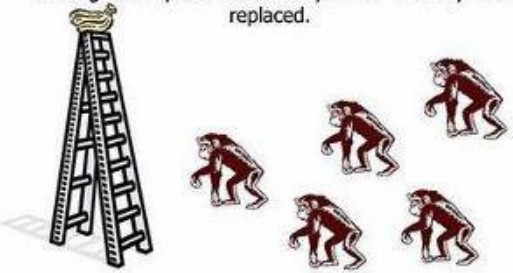
After some time, no monkey dare to go up the ladder regardless of the temptation.

Scientists then decided to substitute one of the monkeys. The 1st thing this new monkey did was to go up the ladder. Immediately the other monkeys beat him up.

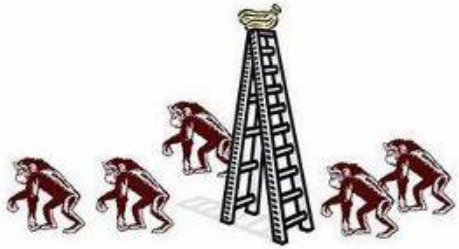
After several beatings, the new member learned not to climb the ladder even though never knew why.



A 2nd monkey was substituted and the same occurred. The 1st monkey participated on the beating for the 2nd monkey. A 3rd monkey was changed and the same was repeated (beating). The 4th was substituted and the beating was repeated and finally the 5th monkey was replaced.



What was left was a group of 5 monkeys that even though never received a cold shower, continued to beat up any monkey who attempted to climb the ladder.



If it was possible to ask the monkeys why they would beat up all those who attempted to go up the ladder.....
I bet you the answer would be....

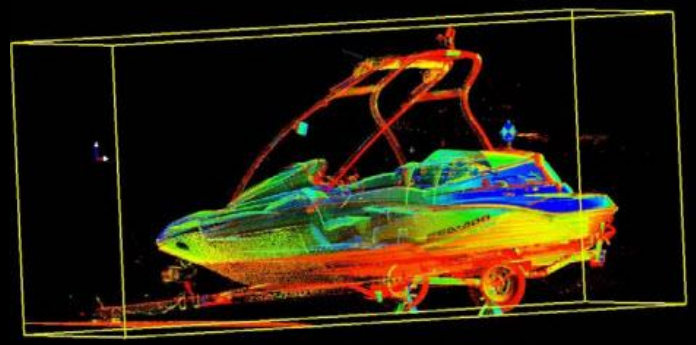
"I don't know – that's how things are done around here"

Does it sounds familiar?

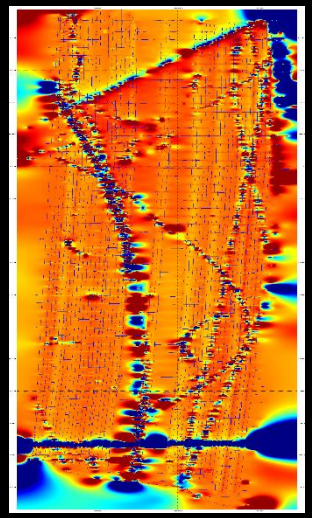
Don't miss the opportunity to share this with others as they might be asking themselves why we continue to do what we are doing if there is a different way out there.

Hydrography in Today's World

- Applied geophysics and remote sensing is becoming a bigger and bigger industry as methods become more advanced and reliable.
- These methods compliment traditional hydrography very well and the theory and instrumentation are very similar to traditional hydrographic tools.
- Hydrographers are the best suited/qualified people to be running these types of surveys.



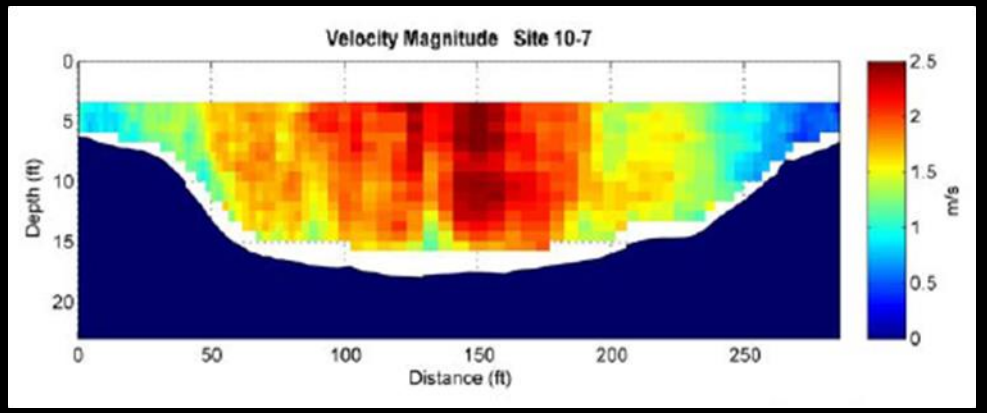
Laser Scanning
(3D Point Cloud)

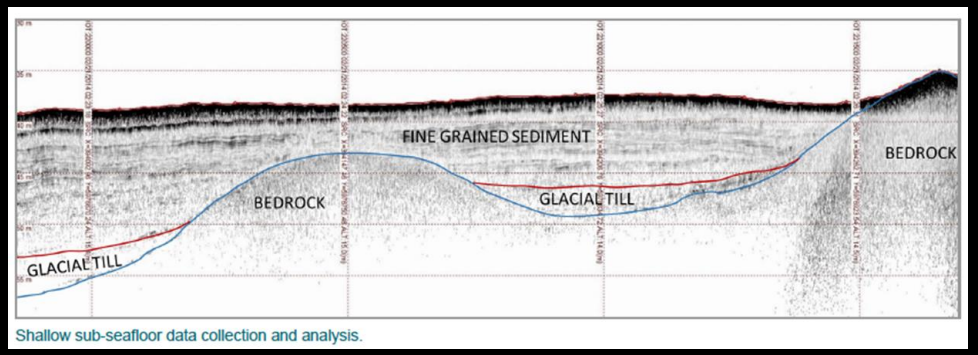


Magnetic Anomaly's of Pipelines
(Rendered Surface)

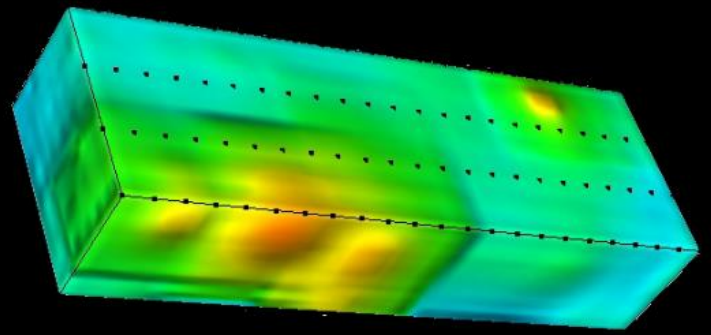
Exposed Pipelines
(Mosaicked Surface)

Examples





Shallow sub-seafloor data collection and analysis.

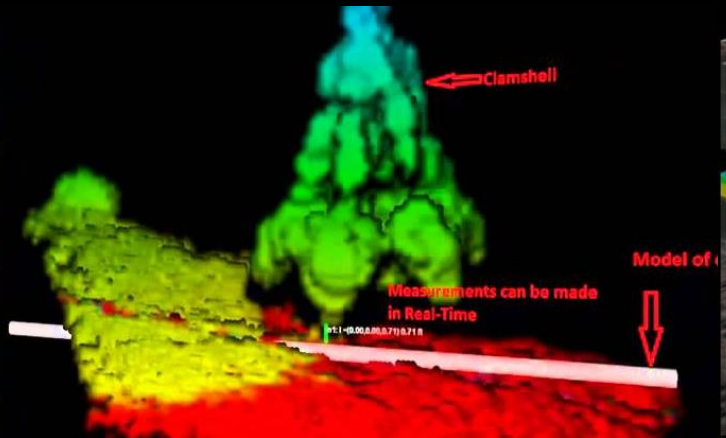


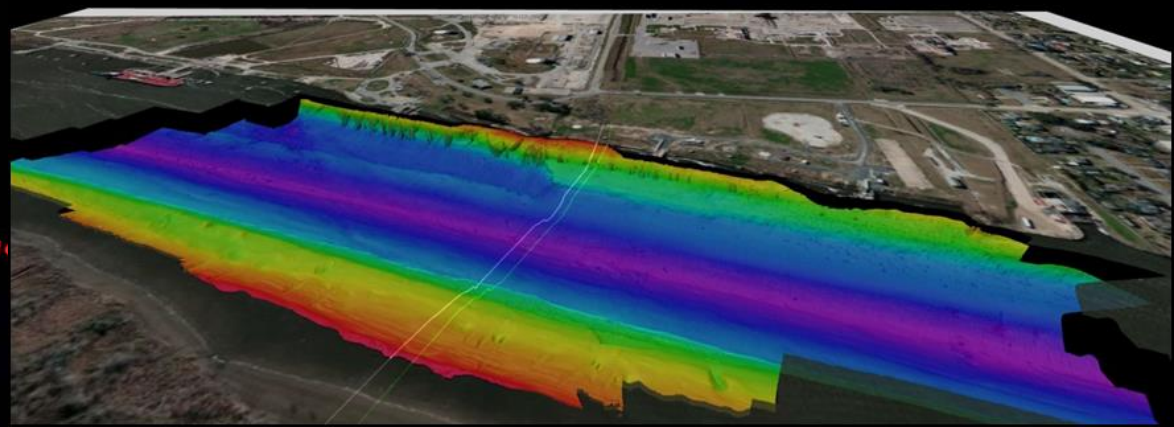
Typical Services Offered by Hydrographic Companies?

- 3D Asset Modeling
- 3D Laser Scanning
- 4D Aerial Rectified Surveys
- Airborne LiDAR Bathymetry
- Beach Erosion Surveys
- Boundary Surveys
- Breakwater Surveys
- Bridge and Dam Scour Surveys
- Burial Assessment Surveys
- Control Surveys
- Current Measurements and Analysis
- Dimensional Control Surveys
- Diver Tracking
- Dredge Positioning Support
- Dredge Volume Computations
- Electronic Navigation Chart (ENC) Generation
- Emergency Call-out Surveys
- Expert Witness
- Fisheries Habitat Mapping
- Floodplain Mapping
- Gas Hydrate Investigations
- Geodetic Consulting
- Geophysical Near Surface Surveys
- Geotechnical Surveys
- GIS
- Hazard Site Assessment Surveys
- Heritage Preservation Surveys
- Ice Scour Surveys
- Landing Site Surveys
- Levee Condition Surveys
- Locks and Dam Surveys
- Marine Archeological Surveys
- Nautical Charting
- Offshore Cable Route Surveys
- Offshore Navigation
- Permit and Lease Support Services
- Pipeline Surveys
- Port and Channel Condition Surveys
- Pre / Post Excavation / Dredge Surveys
- Real-time Asset Positioning
- River Discharge Measurements
- River Flow Monitoring
- Seafloor Mapping
- Search & Recovery Survey/Positioning Support
- Sediment and Seabed Sampling / Coring
- Sediment Transport Studies
- Seismic Surveys
- Shallow Hazard Surveys
- Site Clearance Surveys
- Tidal and Wave Studies
- Tideland Surveys
- Topographic LiDAR
- Topographic Surveying and Mapping
- True Nautical Bottom Surveys
- Unexploded Ordinance (UXO) Detection

Why Good Hydrographers are Needed in Texas?

- The Gulf Coast and the water ways that empty into it are one of the most important resources that we have in Texas.
- The shipping and production of hazardous materials is very prevalent in Texas. Most of this is done in/through/around the marine environment.
- Assisting in post hurricane surveys to open ship channels and waterways.
- Artificial Reef monitoring.
- Dredge Surveys
- Clearance Surveys for Ships and Rigs.
- Pipe line locating





What are we doing about it?

- Texas A&M University Corpus Christi is again offering an elective 400 level Hydrographic Science course in their Geographic Information Science & Geospatial Surveying Engineering Program.

- TerraSond Limited has partnered up with TAMUCC to give the students a hand on approach supported with the theory behind it. Which they will need to make Sound decisions and to understand the dynamics of Texas' coastal ecosystem.

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