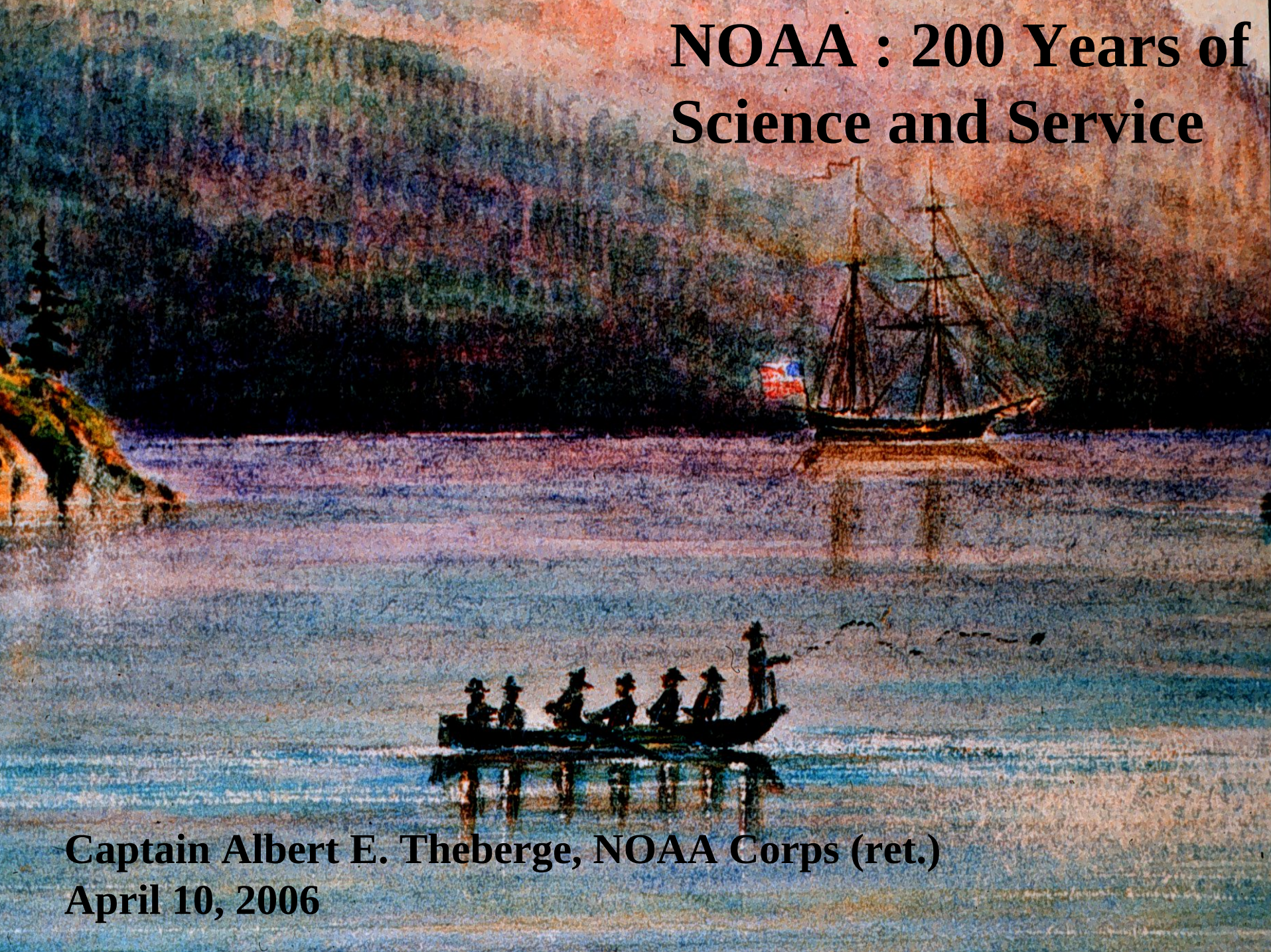
NOAA : 200 Years of Science and Service



Captain Albert E. Theberge, NOAA Corps (ret.)

April 10, 2006

The NOAA History Program

NOAA composed of three major ancestor agencies:

- **Coast and Geodetic Survey (1807)**
- **Weather Bureau (1870)**
- **Bureau of Commercial Fisheries (1871)**

Sporadic efforts to capture history or elements of it by all of the above organizations usually by in-house interested party

No official agency historians for any organization until late 1980's – short-lived NOAA historian's office

THE GOOD NEWS

NOAA Library is the largest open stack collection of historical earth science documents possibly on Earth and houses most NOAA Heritage published documents, a number of unpublished manuscripts, an extensive photo collection, and even 8 and 16 mm movie reels of early to mid-Twentieth Century operations

The National Archives, Library of Congress, and other organizations such as universities, historical organizations and archives, and other Government agencies contain extensive collections of NOAA Heritage materials

NOAA is becoming increasingly aware of its heritage because of approaching 200th Anniversary of Coast Survey, Preserve America Initiative, and development of major websites such as NOAA History at http://www.history.noaa.gov

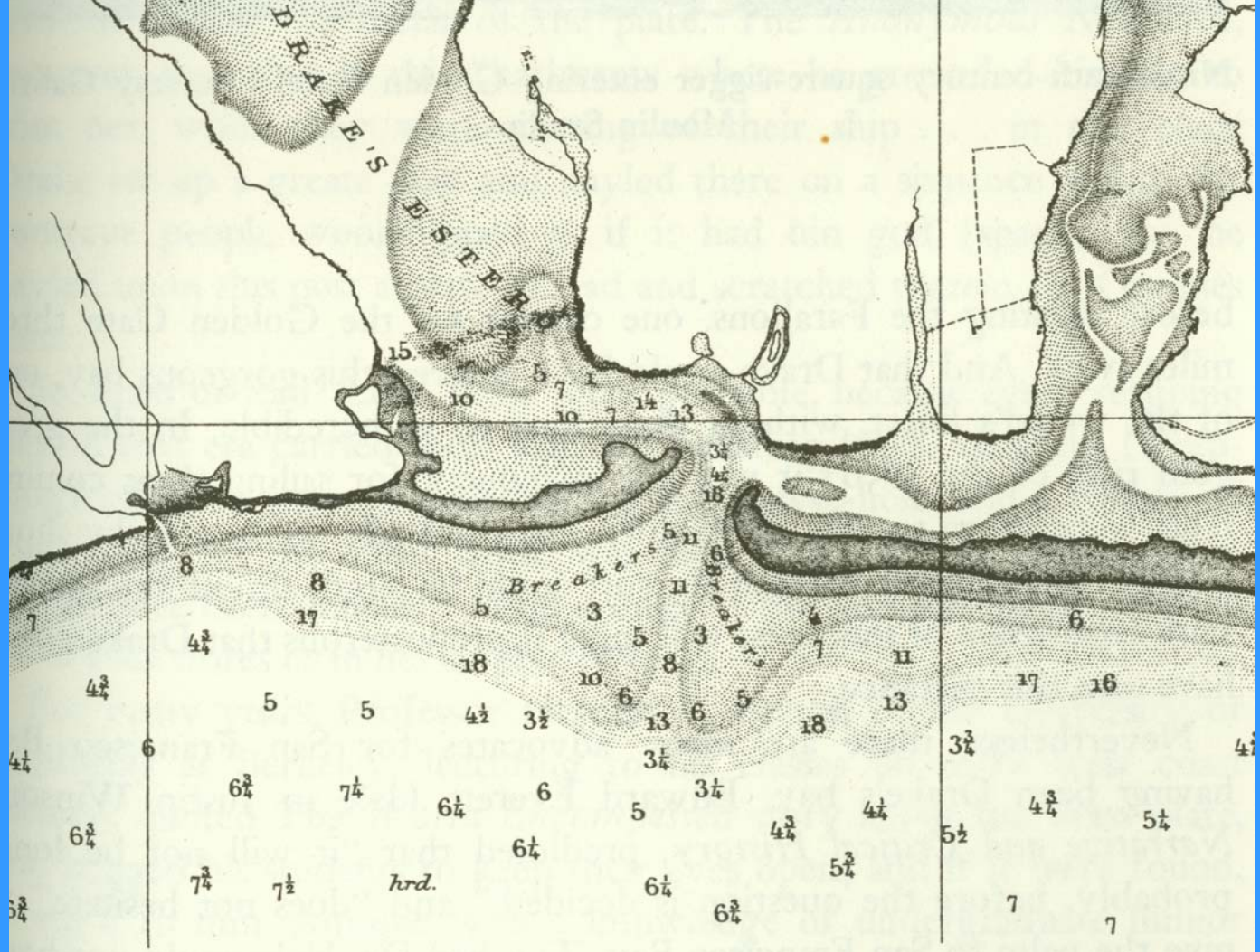
THE BAD NEWS

NOAA Heritage materials are geographically dispersed in many places

Even where concentrations of materials exist, there are non-existent, ranging to inadequate, finding aids

There is only a small community of historians who understand the policy and the science of NOAA and its ancestor agencies

There have been myths, legends, omissions and erroneous information perpetuated by misinformed and biased authors and historians.



Drake's Estero, Drake's Bay. From U. S. Coast Guard Chart of 1860.

Erroneously attributed chart source : NOAA Heritage work commonly attributed to Navy, Coast Guard, USGS, and academia.

WHY CARE ABOUT NOAA HERITAGE?

Virtually all American citizens and much of the world community are touched by NOAA products and services every day

NOAA ancestor agencies helped lay the foundation of much of the National science infrastructure as we know it today

NOAA ancestor agencies have served many commerce and defense needs of the Nation since inception

NOAA ancestor agencies were among the first conservation and environmental agencies of the Federal Government

WHY CARE ABOUT NOAA HERITAGE? II

NOAA ancestor agencies: particularly the Coast Survey, influenced the way Government is conducted; i.e., the merit system pioneer, first agency to hire women professionals, issues of military vs. civil science, contracting vs. inherently governmental, etc.

NOAA ancestor agencies: the Federal pioneer in Earth sciences including geodesy, cartography, oceanography, geomagnetism, gravity, geodynamics, marine geology, marine biology, fisheries science, meteorology, and climatology.

NOAA ancestor agencies intertwined with Smithsonian, National Academy of Sciences, Coast Guard, NIST, USGS, Navy, Army, etc.

A Survey of the Coast Authorized in 1807 under President Thomas Jefferson

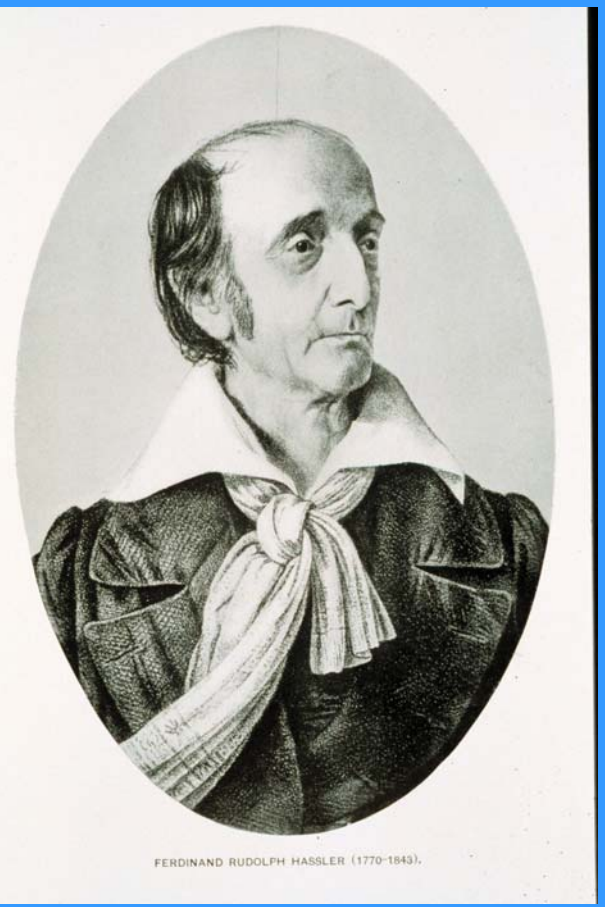
The first science agency in the United States Federal Government

Off to an anemic start but thriving by 1832

“ …a patient pursuit of facts, and cautious combination and comparison of them, is the drudgery to which man is subjected by his Maker, if he wishes to attain sure knowledge.”
Thomas Jefferson, 1785

The Coast Survey and all its descendants have been the patient pursuers of facts.

Ferdinand Rudolph Hassler (1770-1843)- The First Superintendent of the Coast Survey


FERDINAND RUDOLPH HASSLER (1770-1843).

Founded Coast Survey

Invented structure of a modern science agency and laid groundwork for modern scientific infrastructure

Imbued Survey, and by extension all present-day science agencies, with love of accuracy, precision, and scientific integrity

Pioneer in fighting against “spoils system” during administration of Andrew Jackson

Hassler's Vision

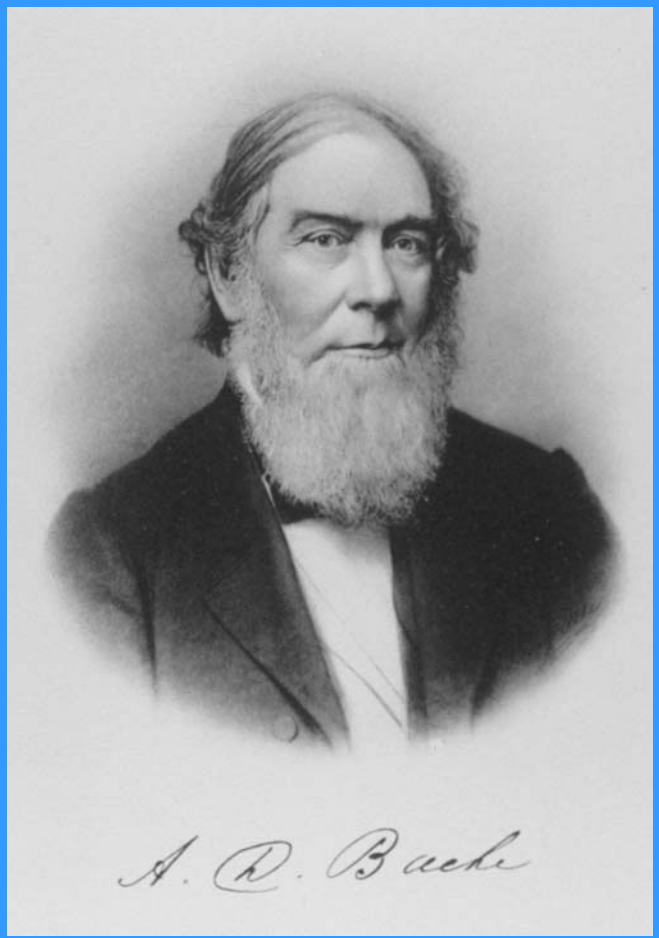
- **A Survey of the Nation based on geodetic principles**
- **Maps of the Nation and charts of its waterways tied into the geodetic survey framework**
- **National observatories to determine cardinal points of Latitude and Longitude to establish starting datum for the survey**
- **National standards of length, volume, and weight tied to physical principles**

What the Nation Got

- **The foundation of American Physical Science**
- **The Coast and Geodetic Survey and many components of NOAA**
- **Office of Weights and Measures which evolved into NIST**

Ferdinand Hassler directing the movement of the great theodolite during measurement of the Fire Island Baseline.

Alexander Dallas Bache (1806-1867)
Second Superintendent of Coast Survey

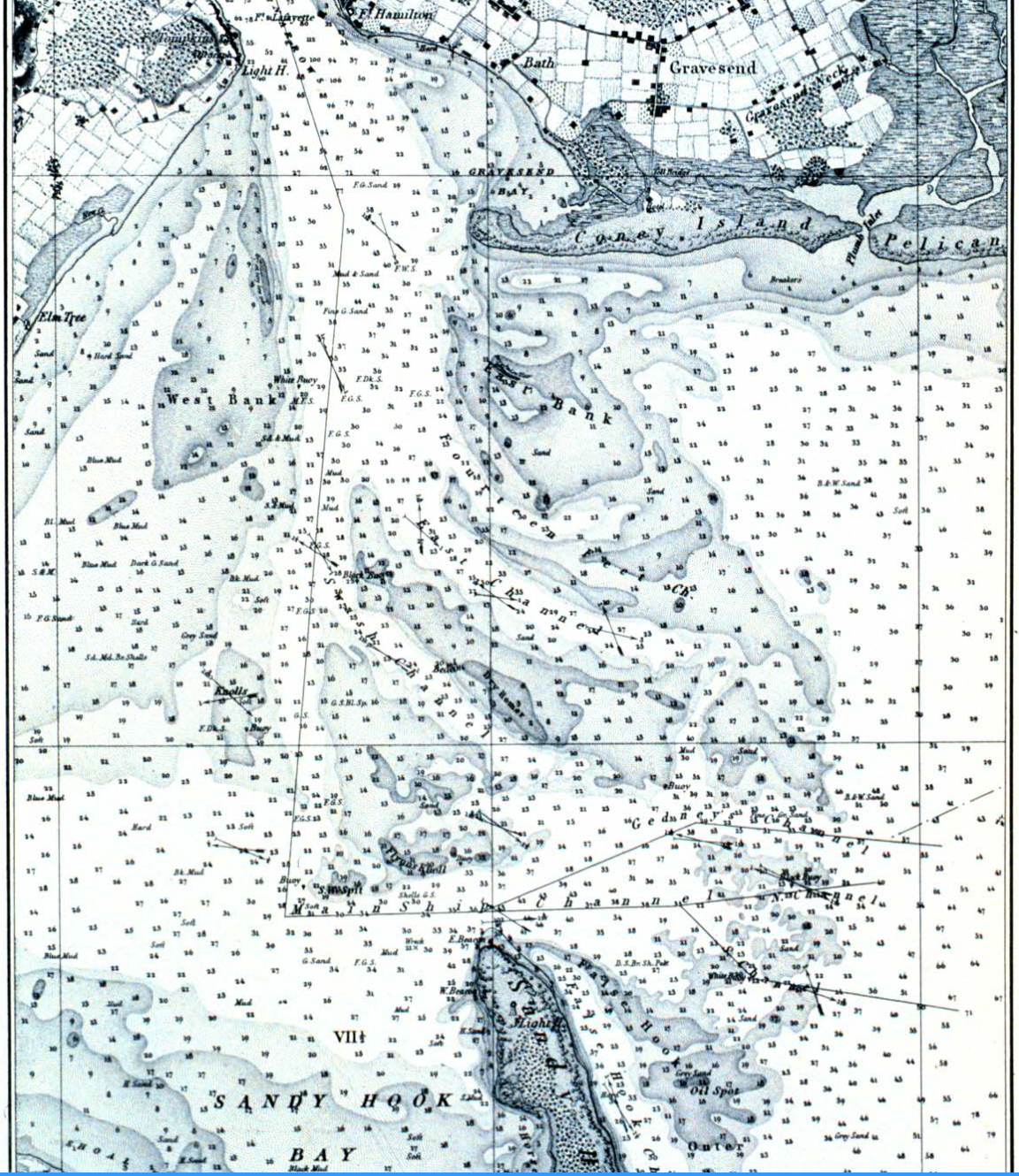


A great-grandson of Benjamin Franklin

Hassler laid the foundation, Bache built the house

Expanded operations throughout all coastal states and followed flag to Texas and West Coast –Quintupled budget

Began Geophysics and Oceanography operations in Coast Survey, first systematic efforts by Government



Section of 1845 New York Harbor Chart showing Gedney Channel – First Chart with distinctive Coast Survey style

Pioneering Oceanography

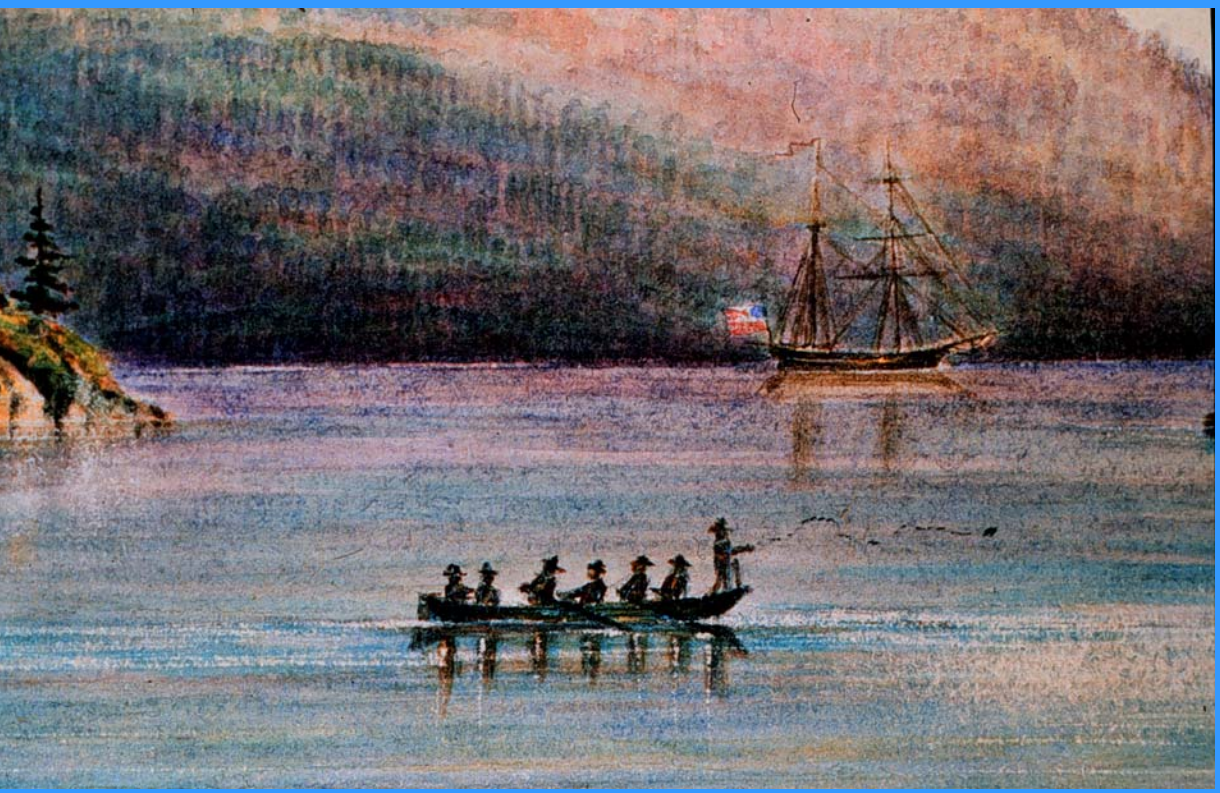
Under Alexander Dallas Bache, the Coast Survey begins Systematic Gulf Stream Observations in 1845. Bache instructed his captains to:

"(1) determine the temperature at the surface and at different depths; (2) the depth of water; (3) the character of the bottom; (4) the direction and velocity of the currents at the surface and at different depths; (5) as far as practicable notice the forms of vegetable and animal life."

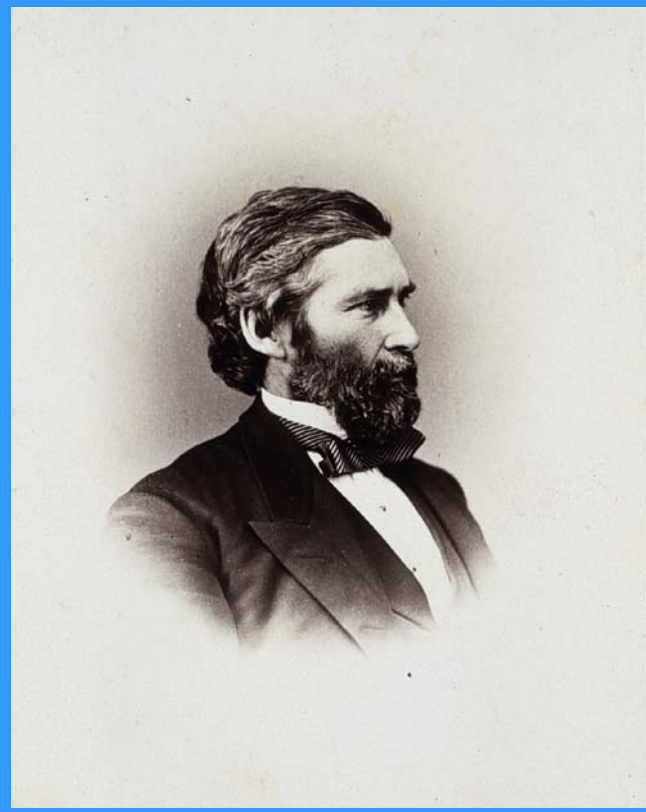
DISASTER TO THE COAST SURVEY BRIG "WASHINGTON."

Disaster strikes September 8, 1846. The WASHINGTON, while Conducting Gulf Stream Observations is caught in a hurricane. Eleven men are killed – Among the first martyrs to American science

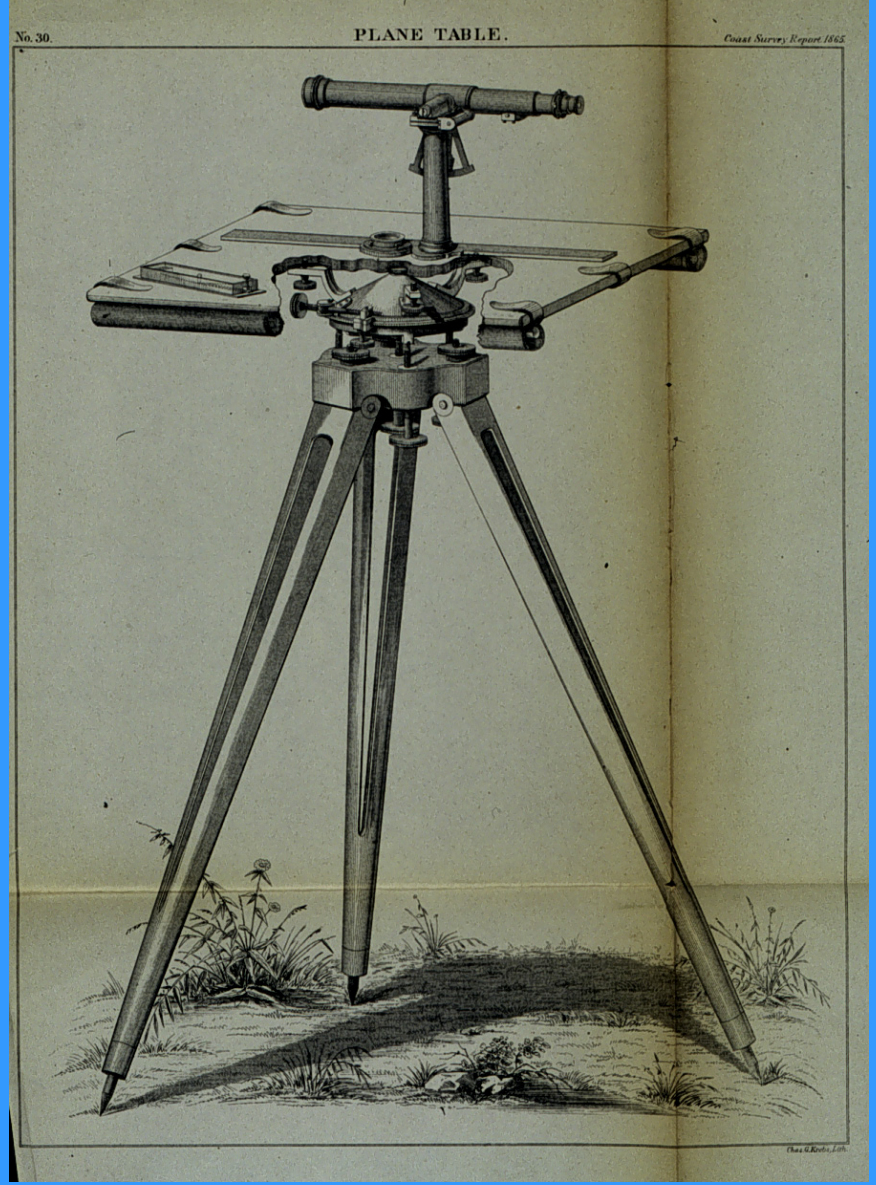
Following the Flag – Surveying the Frontier Coasts- Texas, Oregon, Washington, California



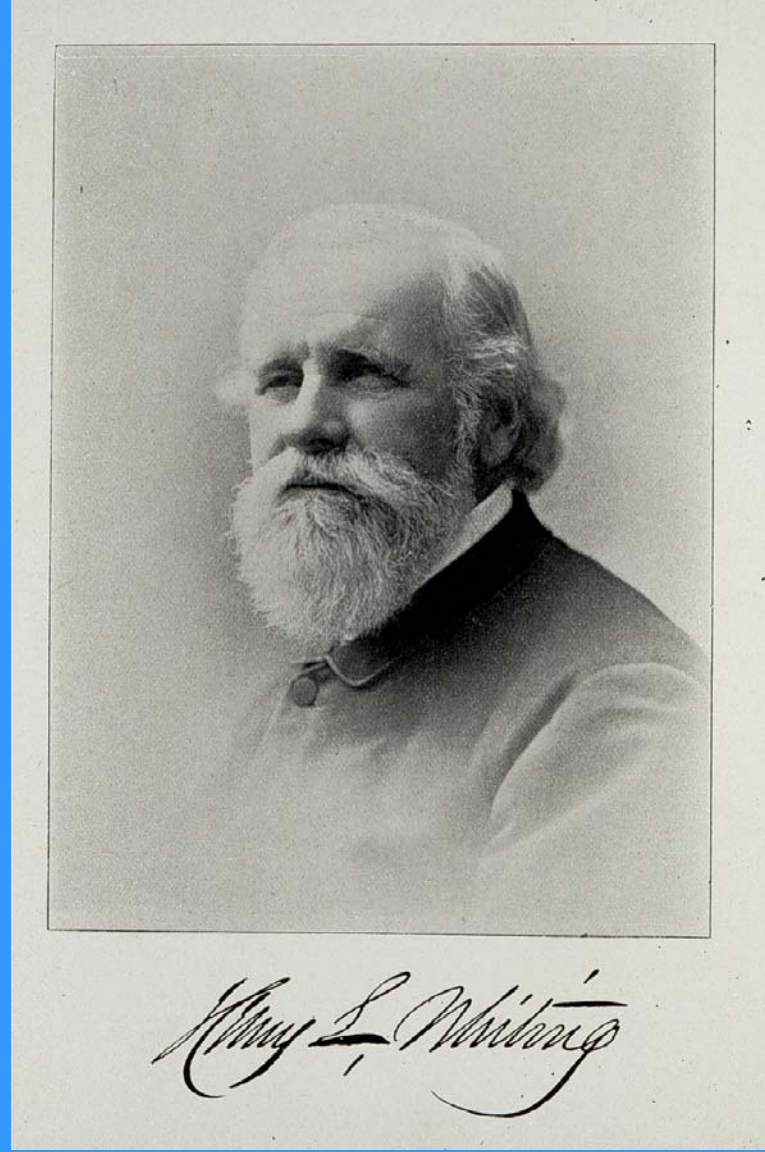
Sounding at Strawberry Harbor
Washington Territory



George Davidson –
Pioneer Surveyor

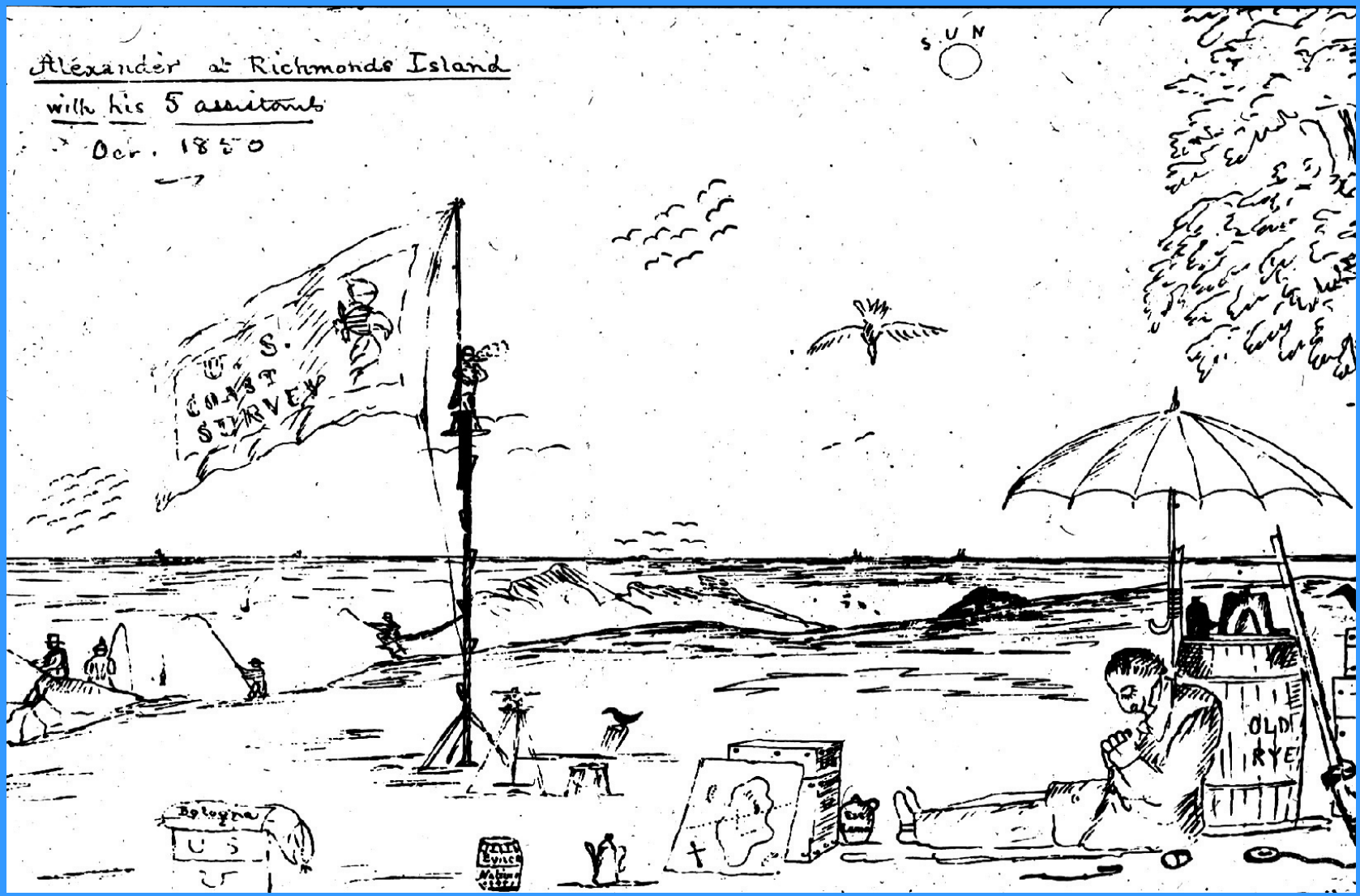


Topographic Mapping – Plane Table introduced by Hassler to United States



Henry Laurens Whiting – Dean of Coast Survey Topographers

Incredibly detailed topographic survey of Cape Ann area
By Henry Laurens Whiting



Perhaps it wasn't all serious – Alexander Wadsworth Longfellow At Richmond Island, 1850

Geodesy - Measuring the Epping Plains Baseline, Downeast Maine 1857

Charles Schott
Chief Mathematician
And
Geodesist

Bache Continued

Organized American science – presided over three of the first six Meetings of the American Association for the Advancement of Science

Made strong alliances with Joseph Henry of Smithsonian, Benjamin Peirce and Louis Agassiz of Harvard, and other luminaries of the times to direct the course of American science and rid it of the specter of “Charlatanism”

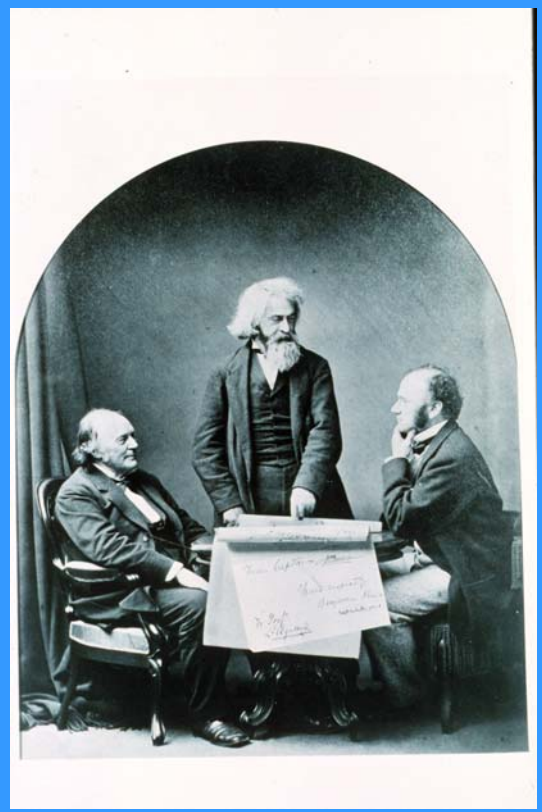
First to recognize the multi-disciplinary nature of scientific investigation and call for a synergistic team approach of physicists, mathematicians, and other specialists to attack and solve problems such as prediction of tides

MARIA MITCHELL

(Painted by H. Dassel in 1851)

Maria Mitchell hired by the Coast Survey for astronomic Observations in 1847 – First woman professional hired by Federal Government

Louis Agassiz
Benjamin Peirce
Carlile Patterson



Joseph Henry – Staunch ally and friend of Bache – Worked together to rid American science of charlatanism

Bache Continued II

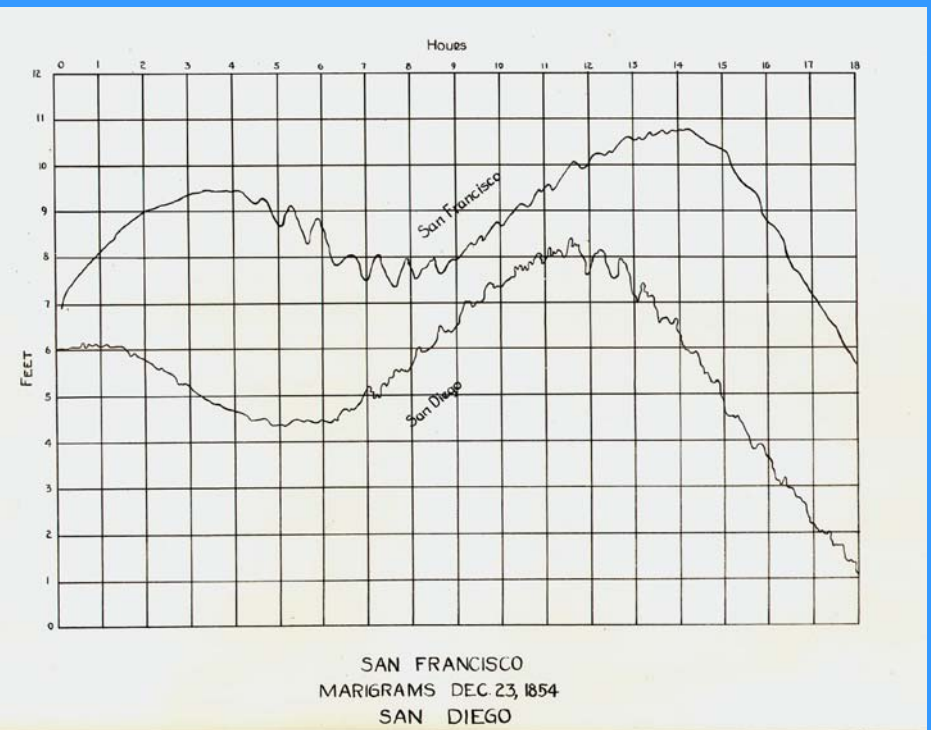
Established cooperative support system for university research in the physical sciences

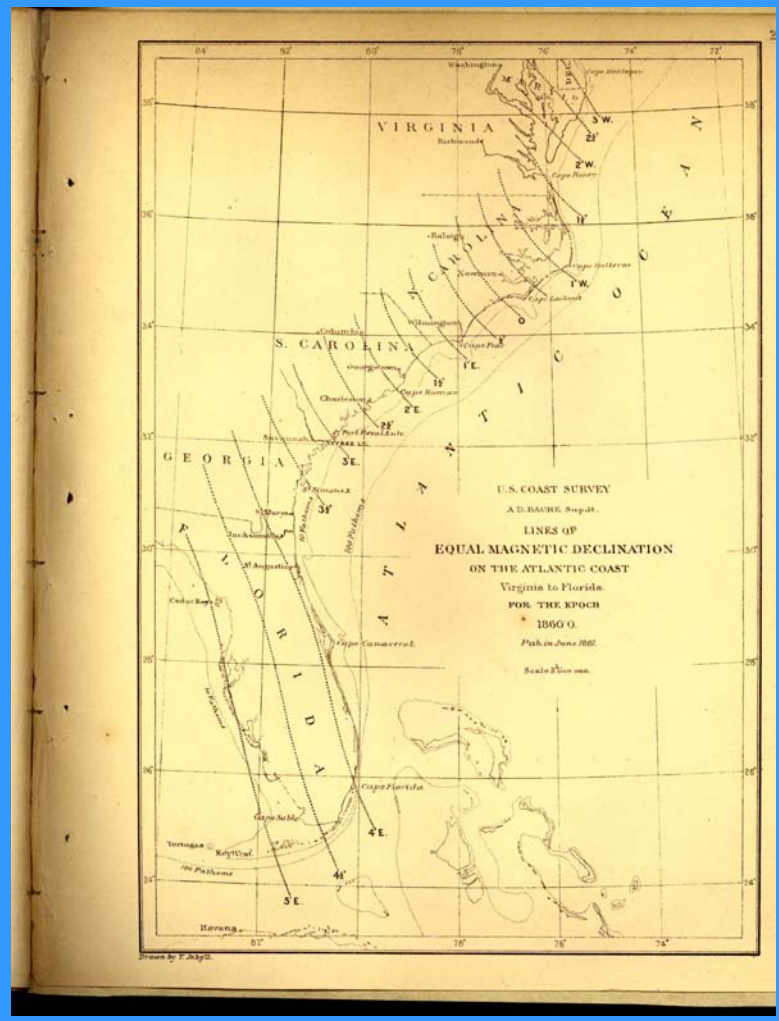
First to suggest, founder, and first President of the National Academy of Sciences – left $40,000 endowment to support research

Instrumental in having Joseph Henry appointed first Secretary of Smithsonian Institution in 1846 and was the most influential regent

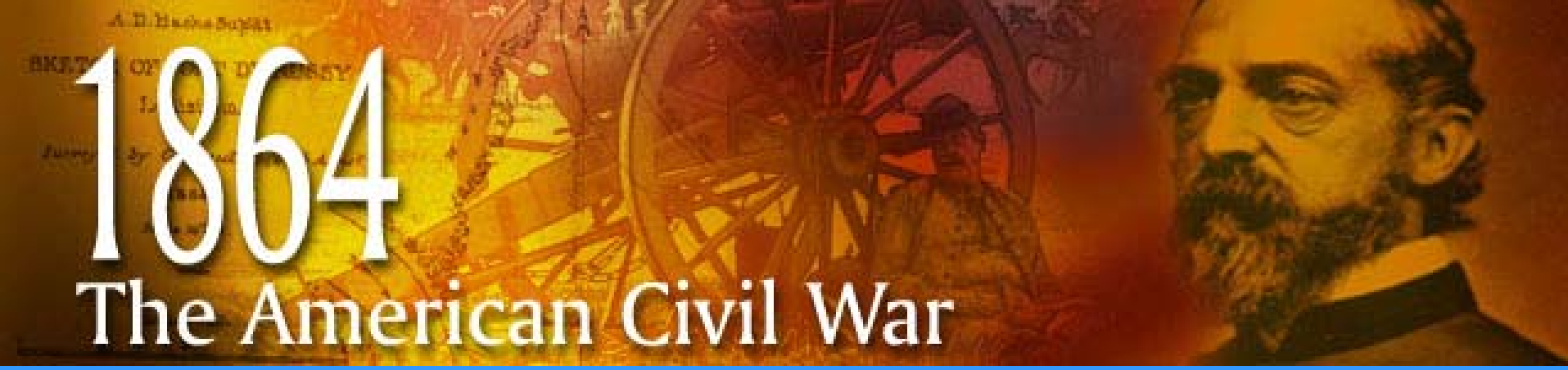
Influential in the Lighthouse Board established in 1851 – Coast Survey selected locations and conducted initial surveys for many lighthouse sites and was instrumental in establishing “red right return” system of buoyage

Served on Harbor Commissions for most major harbors with Army Chief of Engineers and a naval officer





Charts, Tides, Geophysics, and Tsunamis - The First Earth Science Agency



- **Coast Survey intelligence (data acquired before and during war) helped formulate strategy of the Union Blockade**
- **Coast Survey maps, charts, and other data contributed to day-to-day tactical operations of Union forces – Coast Survey quadrupled map output during war**

Notes on the Coast – Instrumental In Planning Blockade

8

(No 36.)

Notes on the Coast of the United States

by A.D. Bache, Sup'dt: U.S.C. Survey.

Section V. Coast of South Carolina.

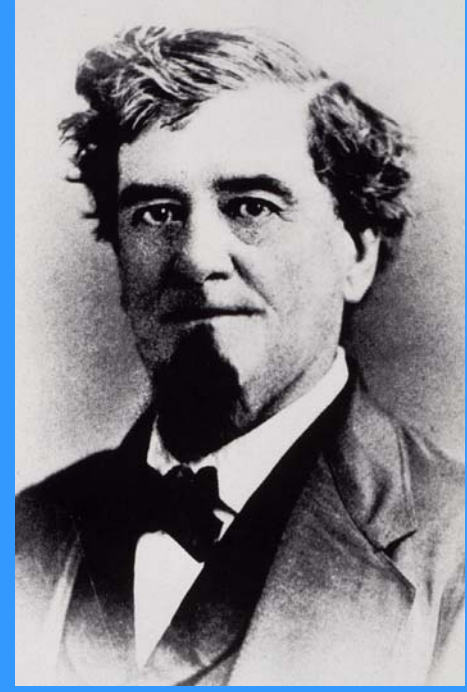
(With 8 Maps)

June. 1861.

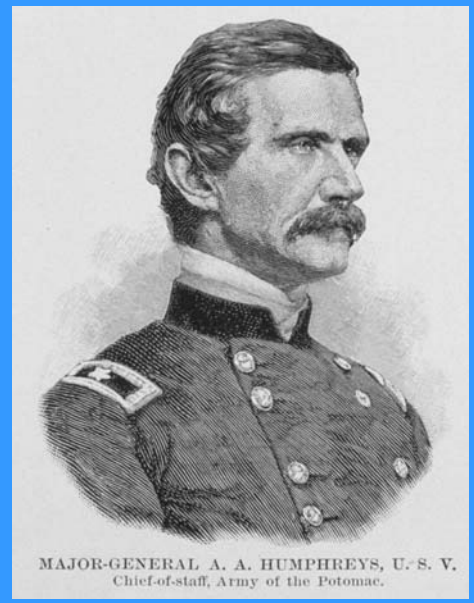
Note. This Memoir was prepared by C.O. Boutelle Esq. Assistant U.S.C. Survey, and revised by Prof. A.D. Bache, Sup'dt, assisted by Capt: C.P. Patterson, Hydrog. Inspector, and Prof. W.P. Trowbridge, Assist: U.S.C. Survey

City Map of Richmond – From Coast Survey map of 1858

- **Served with Union Armies and Navies during Civil War as topographers, hydrographers, scouts, and aides-de-camp – involved in most major land battles and many naval battles**
- **Over 800 Naval Officers served with the Coast Survey during the Nineteenth Century – A great training ground for brown-water navy operations – about 100 future admirals served on Coast Survey field parties, many for 2 or 3 tours**
- **Approximately 60 Army officers including many famous Civil War generals served on Coast Survey prior to Civil War**

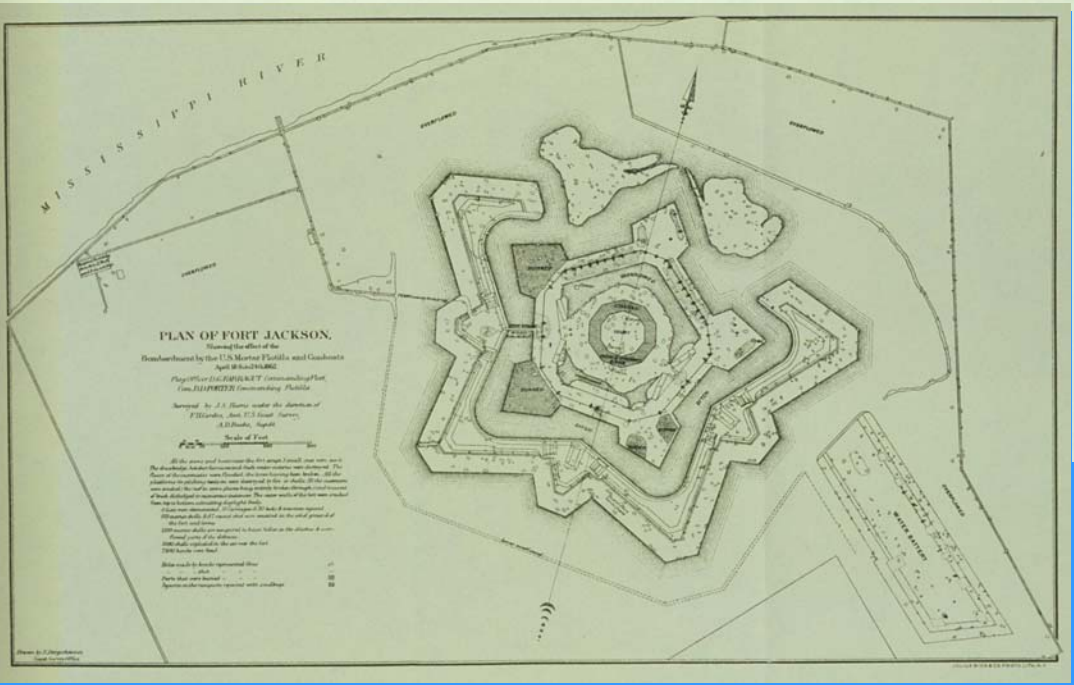


RADM Charles H. Davis
In charge April 1865 - Aug. 1866



MAJOR-GENERAL A. A. HUMPHREYS, U. S. V.
Chief-of-staff, Army of the Potomac.

UNITED STATES MORTAR SCHOONER No. 7.

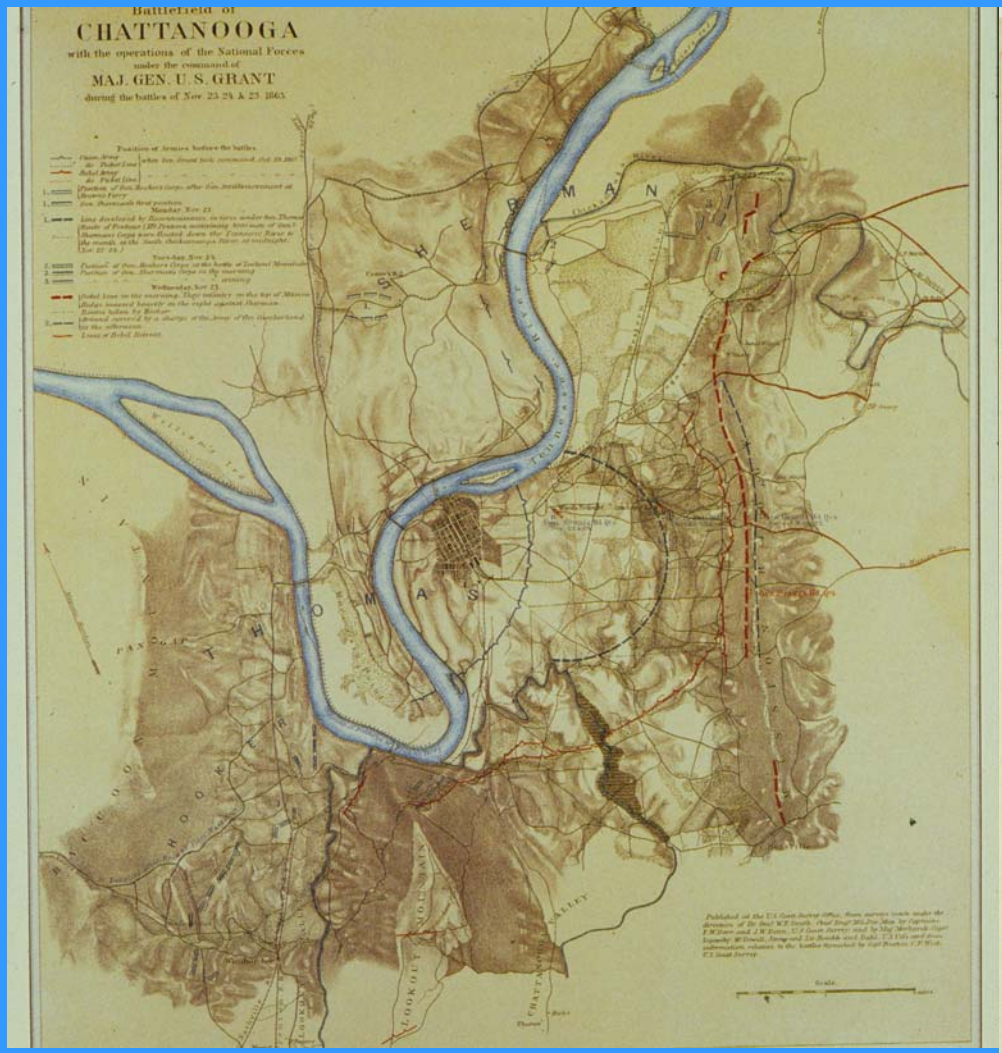


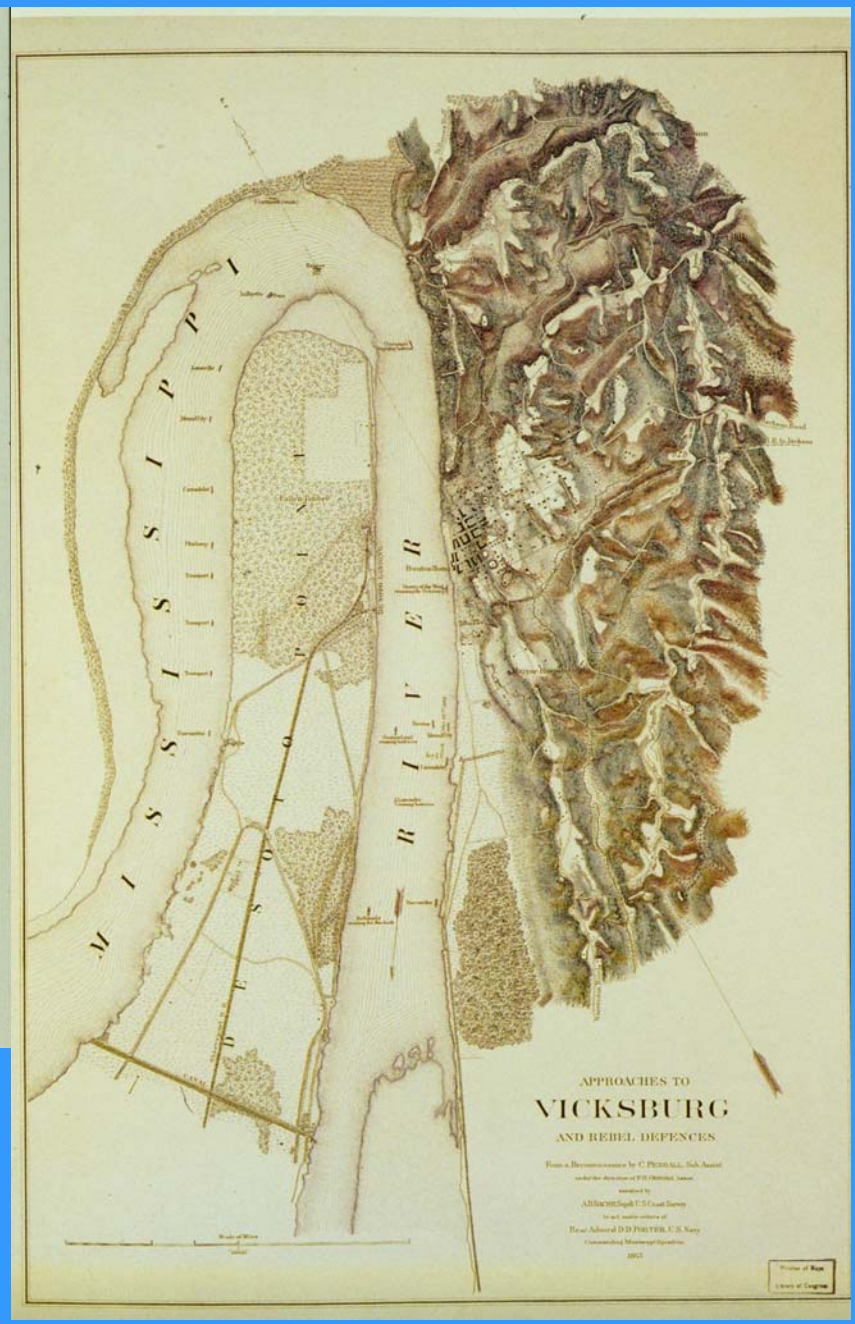
THE OPENING OF THE LOWER MISSISSIPPI.

MORTAR-SCHOONERS ENGAGED AGAINST FORT JACKSON.

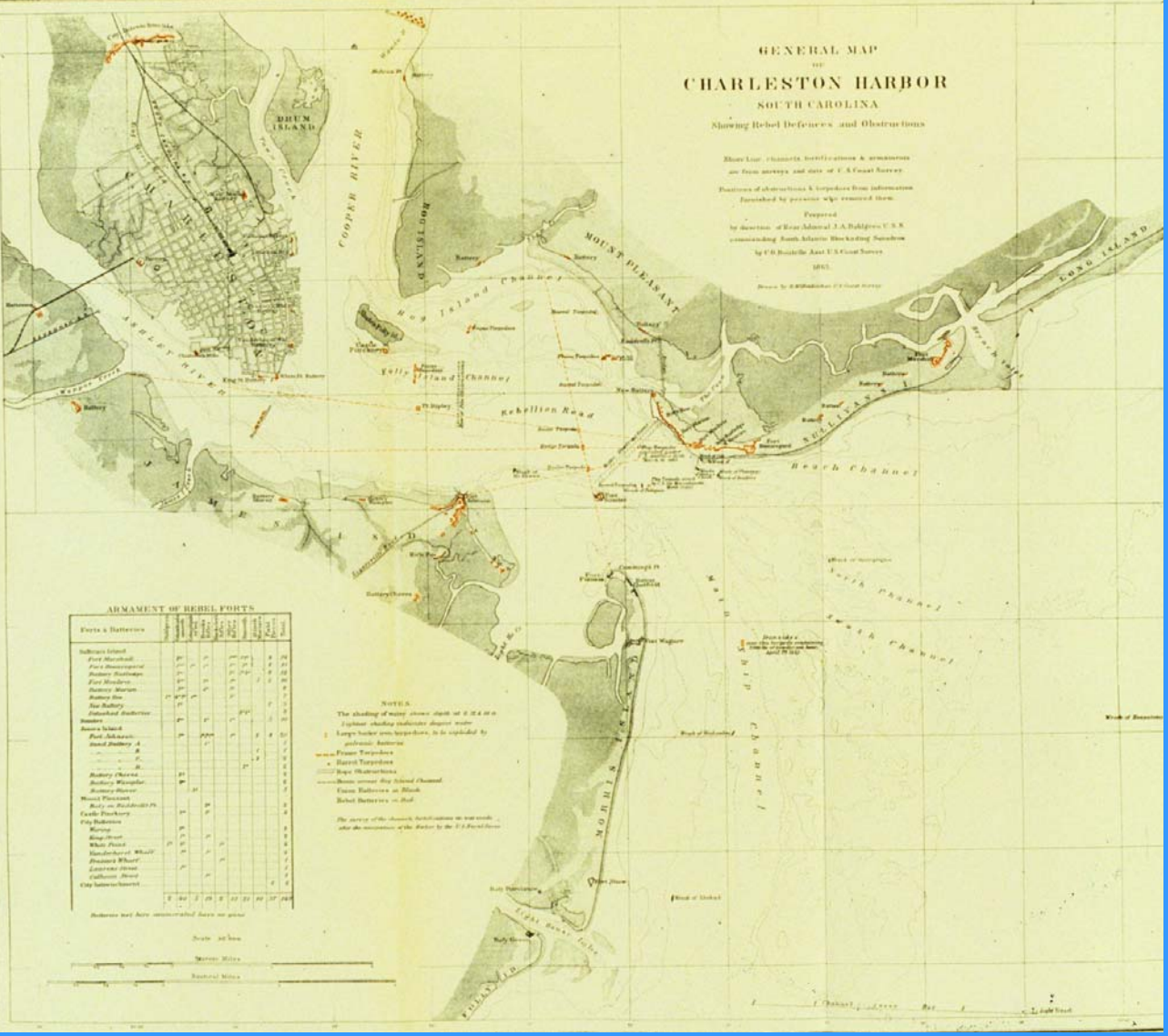
Distance of leading schooner from the fort, 2850 yards. Duration of fire, six days. Total numbe of shells fired, 16,800.

Service on the Mississippi - The Mortar Boats on the Lower Mississippi – First Indirect Artillery Fire

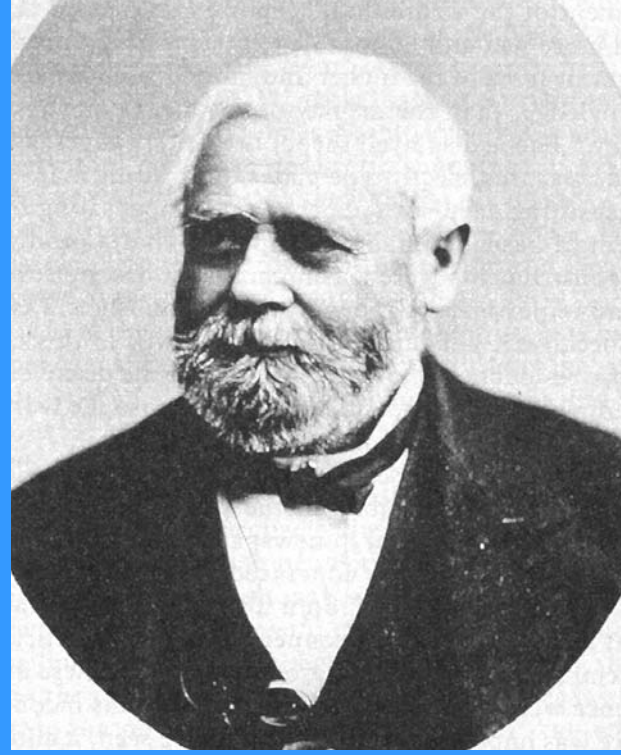




Service in the Interior during the Civil War – Chattanooga and Vicksburg



Service on the Coast - Charleston Harbor and the South Atlantic Blockading Squadron



Charles Boutelle – Chief Hydrographer and confidant of Admirals Du Pont and Dahlgren

Charleston Harbor as painted by Confederate Engineer John Ross Key, formerly of the Drawing Division of the Coast Survey. August 1863

At the request of Brigadier-General Albert J. Myer, Chief Signal-Officer of the Army, Mr. Schott assisted during several days in August in organizing the system by which observations of the weather generally, and reports on storms since that time, have been made public for the benefit of commerce. Coast Survey Annual Report for 1870, p. 28.

At the request of Prof. Spencer F. Baird, the commissioner authorized by Congress to institute investigations in regard to the habits of fish that frequent the coast of the Atlantic States, quarters for two special observers, Messrs. Smith and Hager, were provided on the steamer by Commander Howell. Dredgings made in the vicinity of Halifax, Nova Scotia, to which point the vessel was driven by stress of weather, and others about Cultivator Shoal and George's Bank, were conducted by the special observers. Coast Survey Annual Report for 1872, p. 15.

Following Bache

USCS heads scientific party to Alaska in 1867 influencing decision to purchase Seward's Icebox

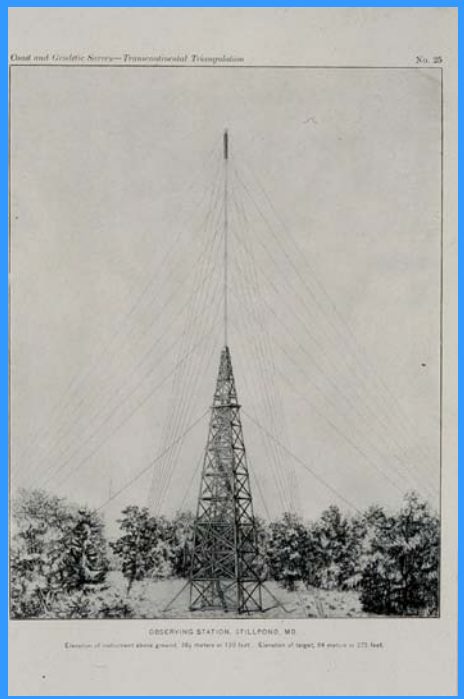
Coast Survey moves geodetic operations into interior of country – Renamed Coast and Geodetic Survey in 1878

Influences oceanographic community through innovations on C&GS Steamer BLAKE with first use of steel cable for dredging, invention of Sigsbee Sounding Machine, first deep ocean anchoring, and classic Gulf Stream studies

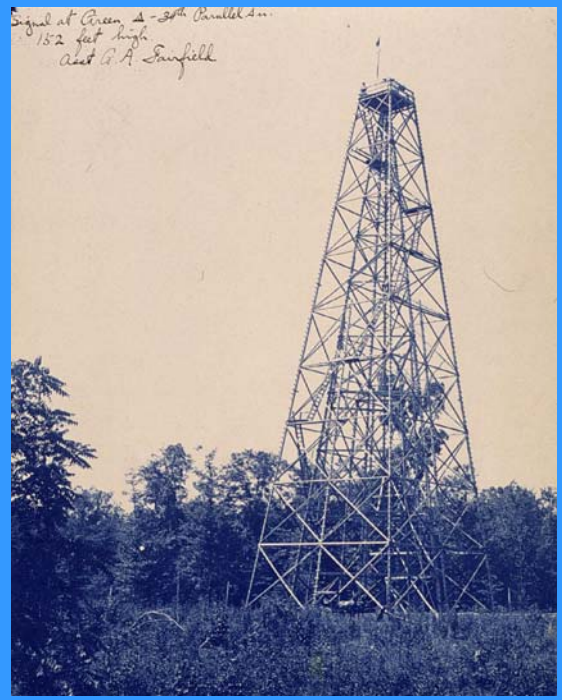
Mathematical modeling -- Tide predictions brought within reach of computation – William Ferrel lays groundwork for field of geophysical fluid dynamics – Charles Schott develops mathematical techniques for geodesy, geomagnetism, and climatology.

Alaska – Following the Flag

The 39th Parallel Survey – Beginning the Survey of a Nation

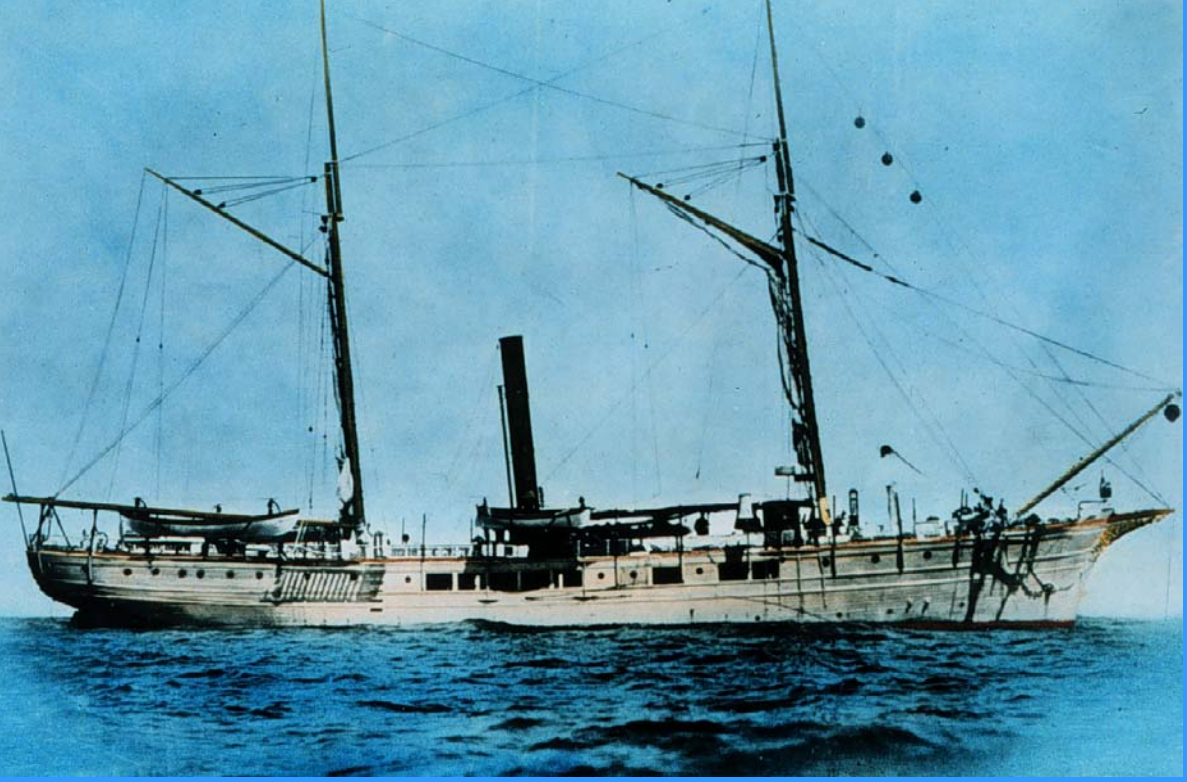


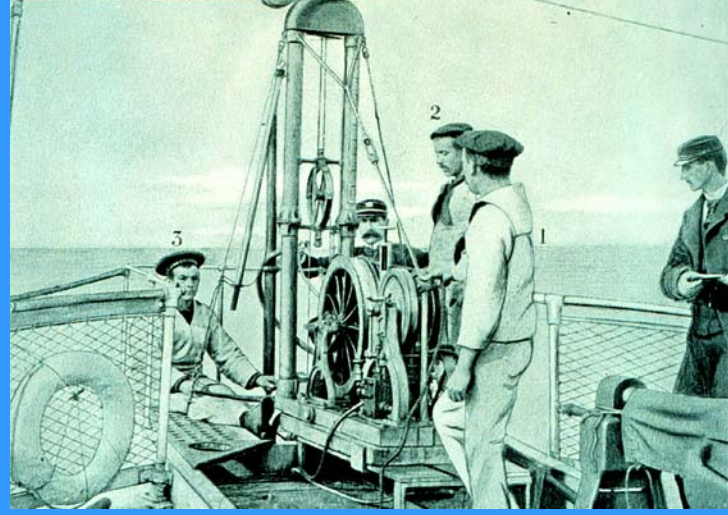
Maryland



Indiana

California -Sierra Nevada





Oceanography – The Coast Survey Steamer BLAKE


PLATE 30.

U. S. COAST SURVEY. DEEP-SEA SOUNDING AND DREDGING.

VIEW OF THE "BLAKE'S" DECK LOOKING FORWARD FROM THE BOW OF THE STARBOARD QUARTER-BOAT READY FOR PAYING OUT THE DREDGE.

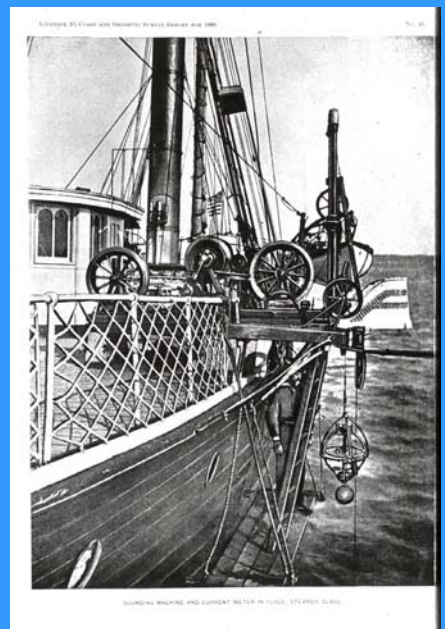
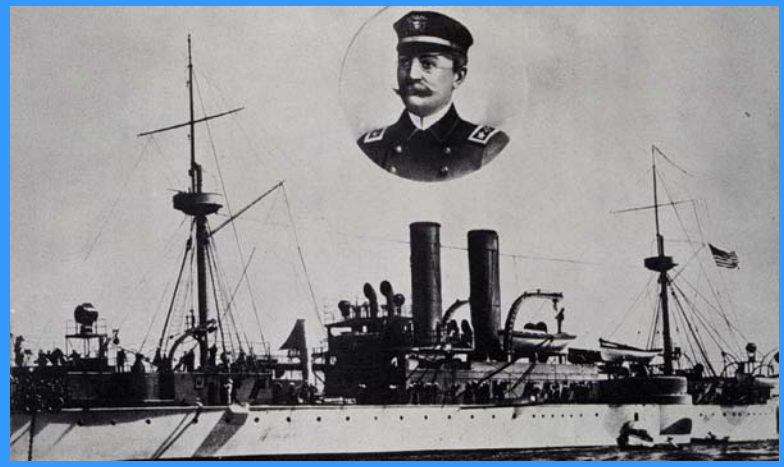


Fig. 55. — Model of part of the Western North Atlantic.

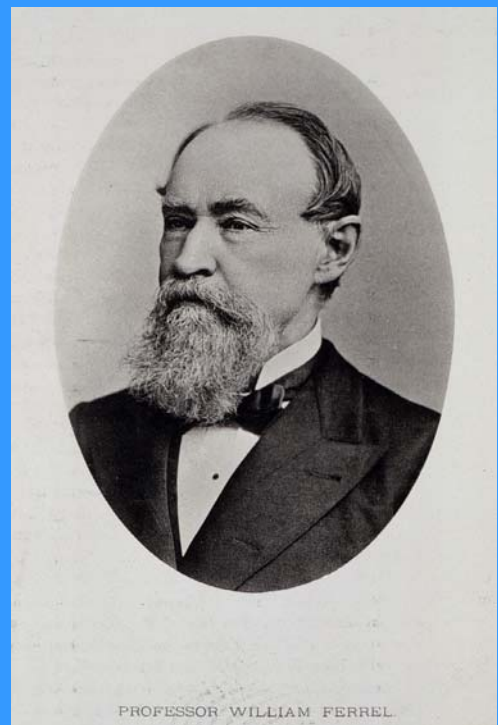
SOME LATE NINETEENTH CENTURY PERSONALITIES

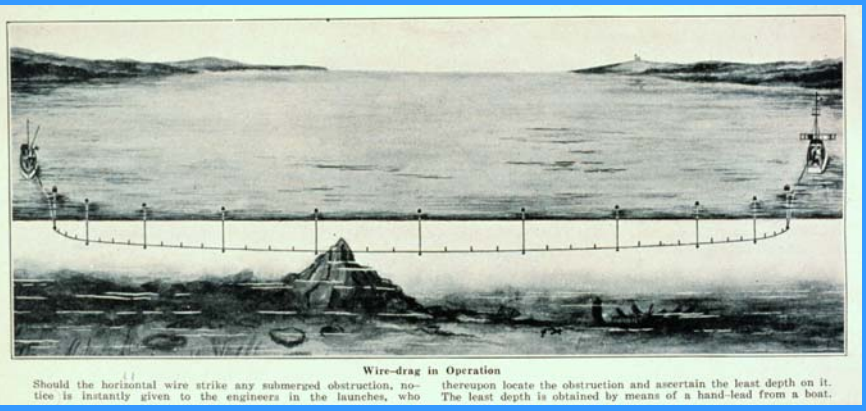
Charles Sigsbee - Remember the Maine!



William Ferrel – With LaPlace a Founder of Geophysical Fluid Dynamics

Charles Sanders Peirce – Scientist and Philosopher – Considered to be among greatest of American thinkers

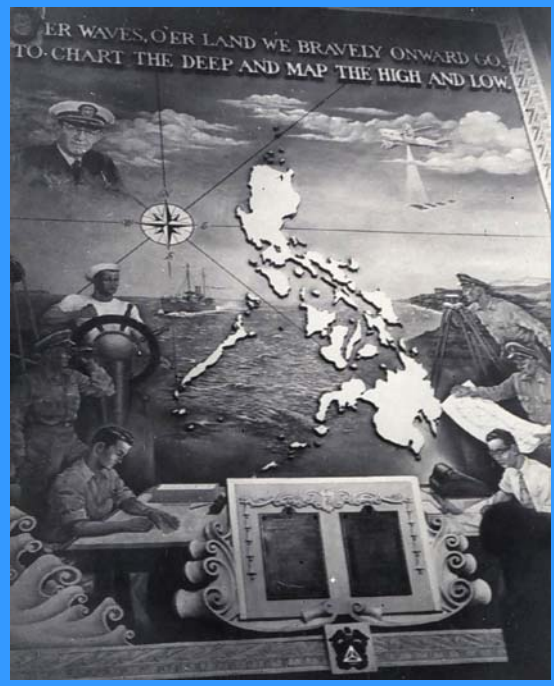




Wire-drag in Operation

Should the horizontal wire strike any submerged obstruction, notice is instantly given to the engineers in the launches, who thereupon locate the obstruction and ascertain the least depth on it. The least depth is obtained by means of a hand-lead from a boat.

Wiredrag to find obstructions

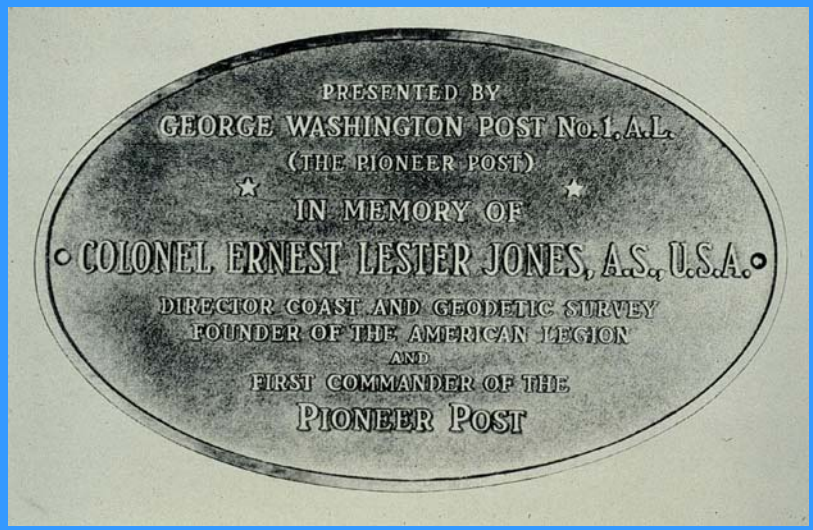


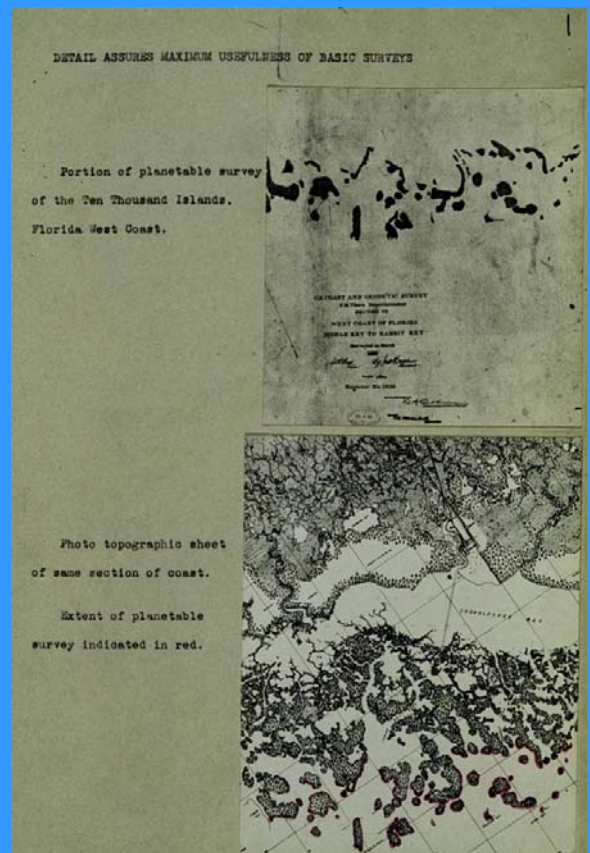
Spanish-American War – Philippines and Puerto Rico

Automobile revolutionizes transportation –Horses still needed

Coast and Geodetic Survey and World War I

First World War – Law enacted making field force of Coast Survey commissioned officers and able to be transferred into armed services – ½ transferred to Army, Navy, Marines serving as hydrographers, navigators, artillery surveyors, mine sweeping officers, researchers, etc.





World War I Legacy – Photogrammetry, Electronics, Radio-Acoustic Ranging

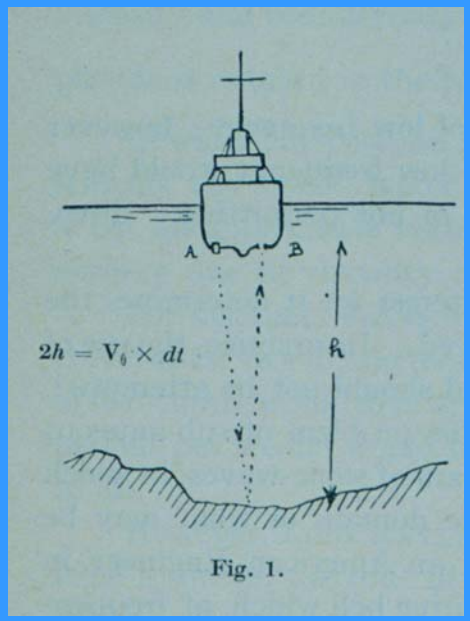
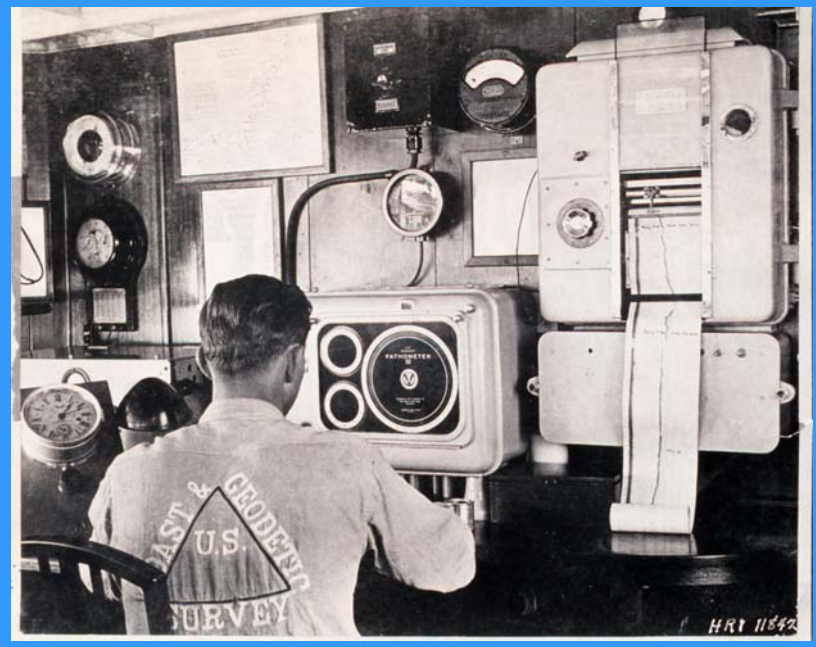
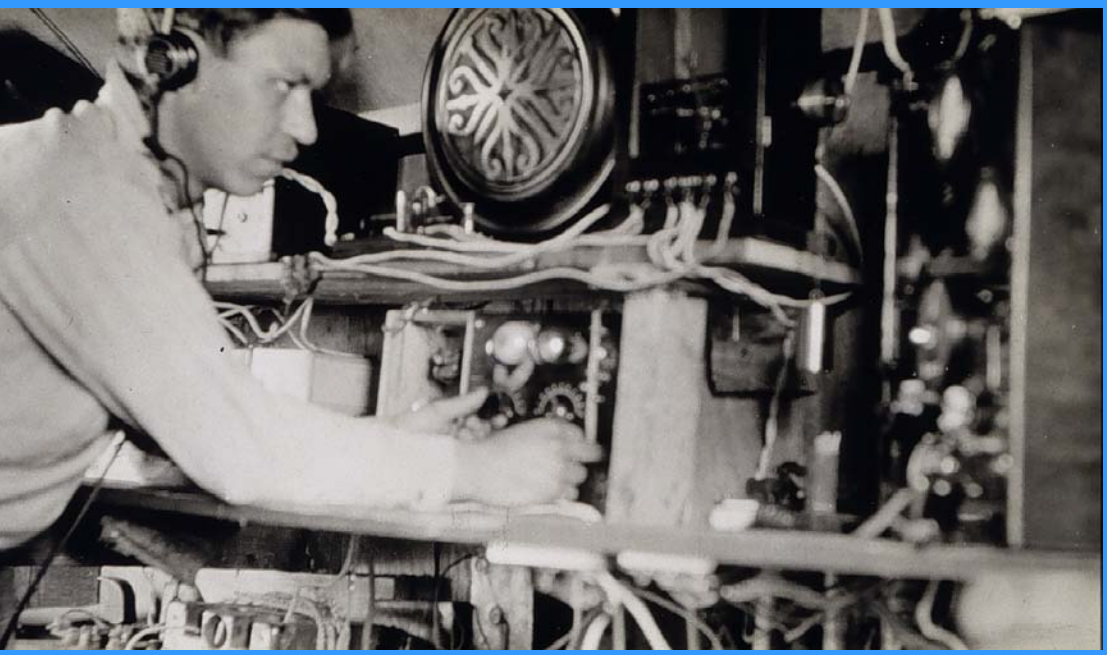
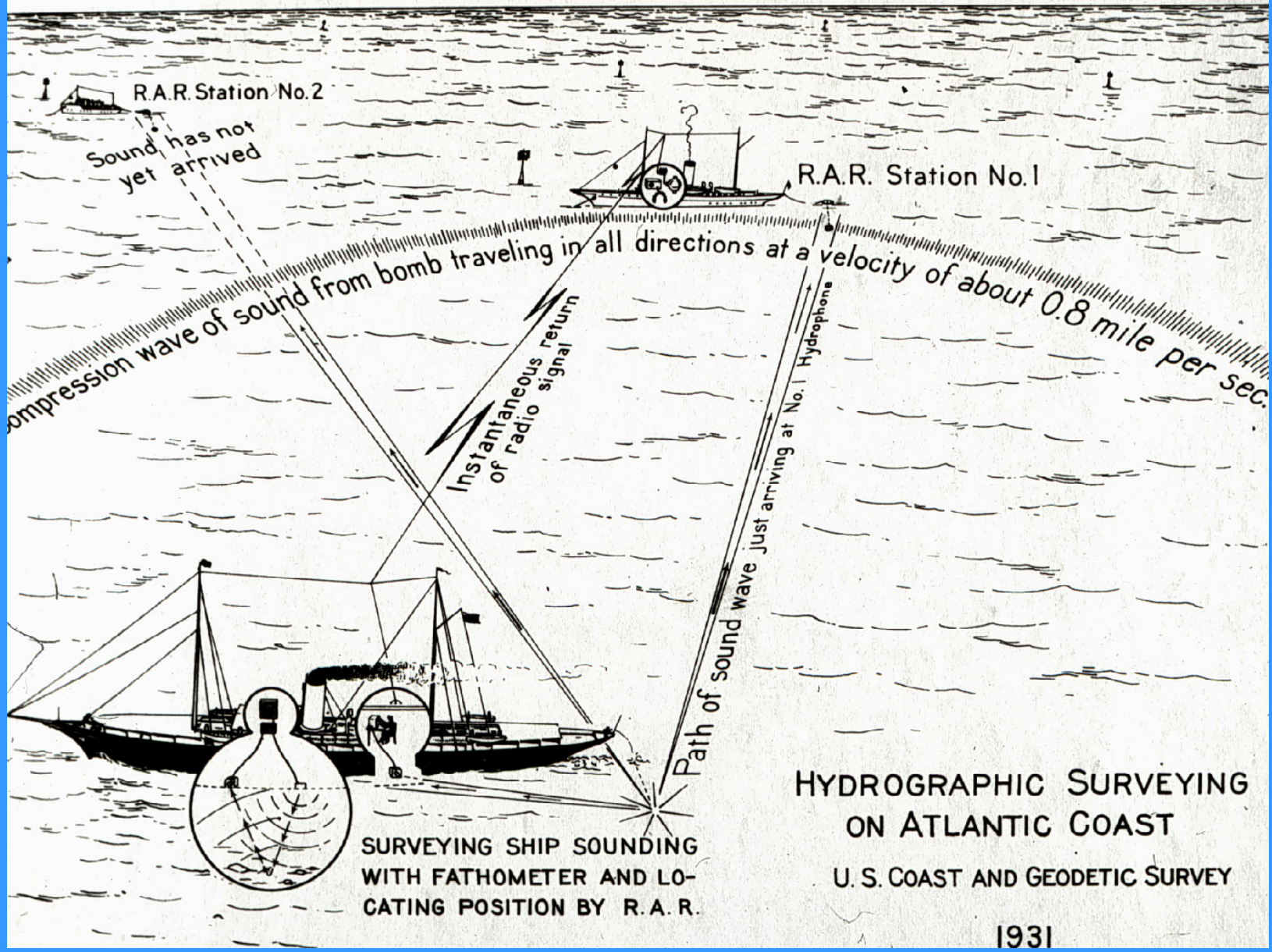


Fig. 1.



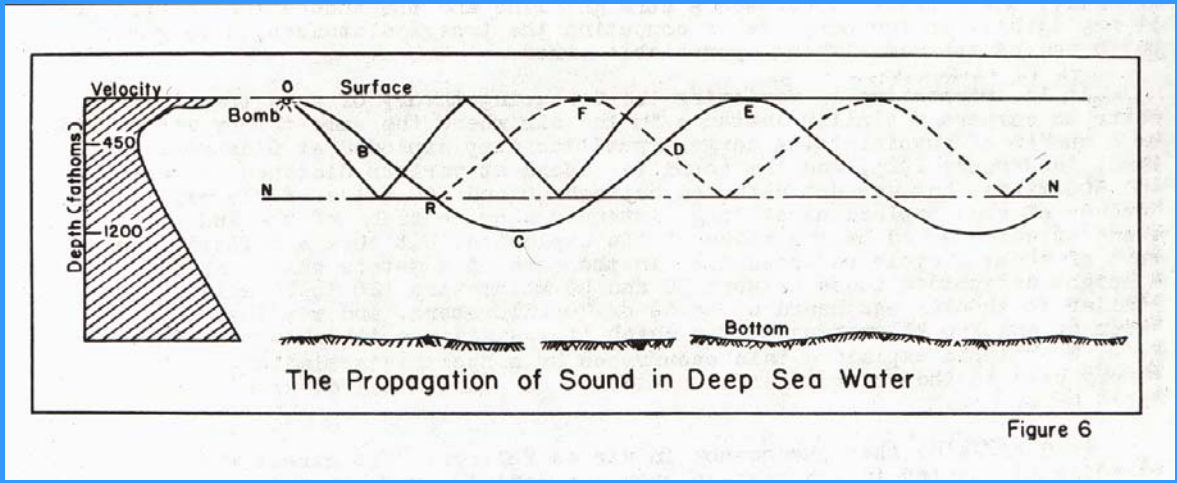


Electronics Revolutionizes Hydrography and Oceanography 1923-1941

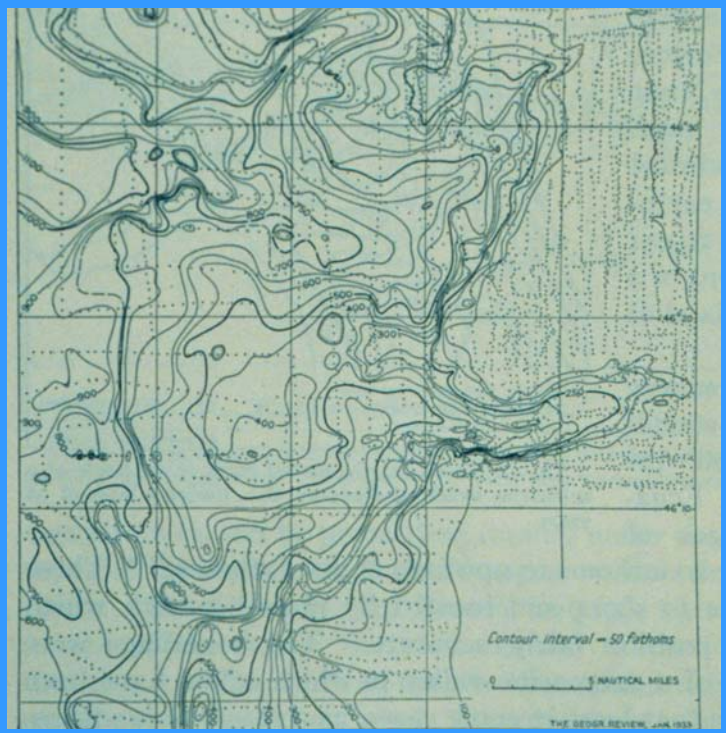


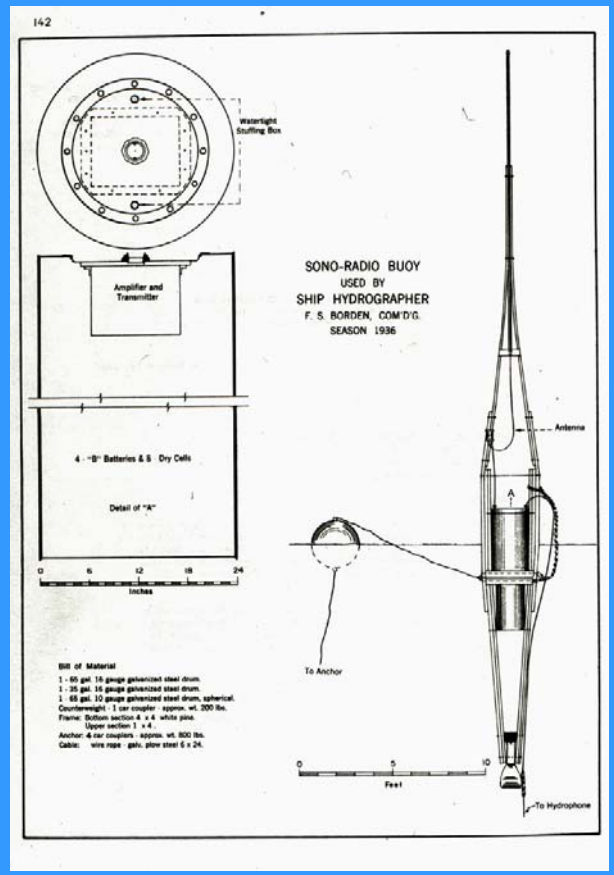
Radio Acoustic Ranging

TIMING THE FUSE INTERVAL



Deep Sound Channel -SOFAR

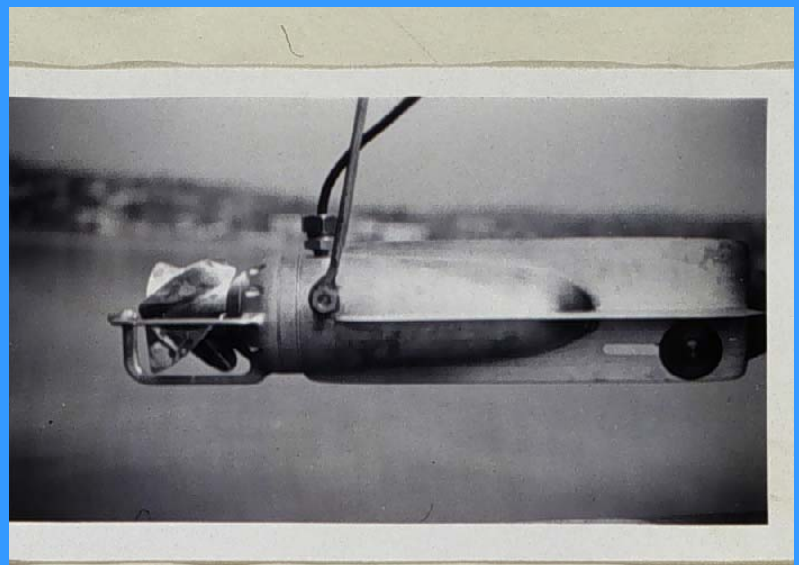




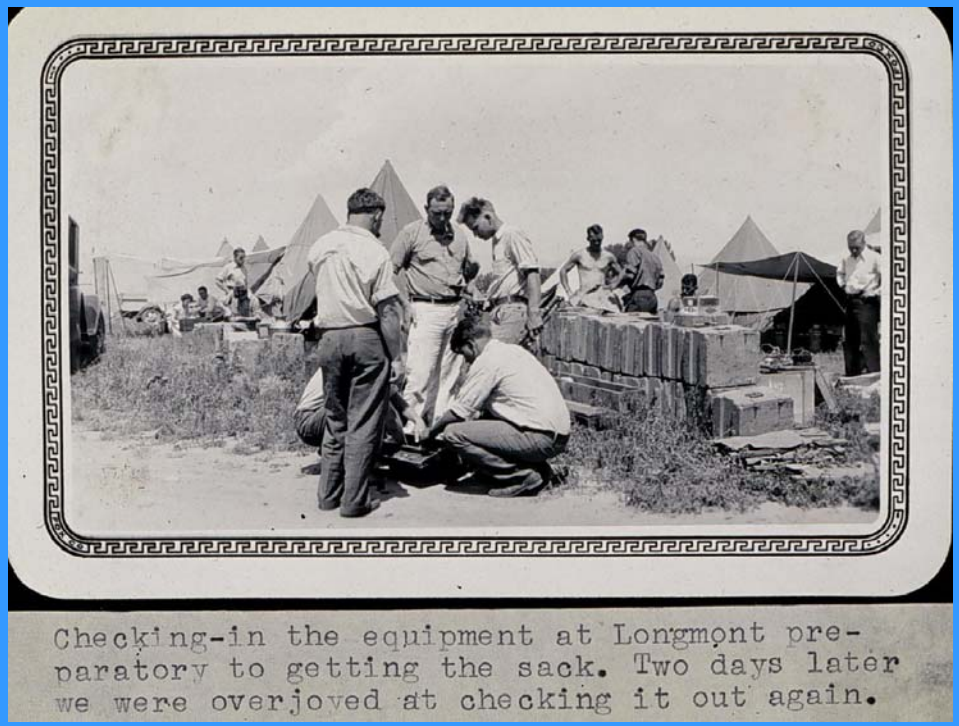
Radio Sono-buoy

Astoria Canyon by Francis Shepard 1933

1942 Roberts Radio Current Meter



The 1930's Coast and Geodetic Survey – Employer of thousands during the Great Depression - Survey Gypsies an integral part of the American landscape



Checking-in the equipment at Longmont preparatory to getting the sack. Two days later we were overjoyed at checking it out again.

The Coast Survey's Finest Hour - WWII

½ of commissioned officers transferred to Army, Navy, Marines, And Army Air Forces – 1100 civilians join armed services

Officer corps serve as artillery surveyors at Corps level in Europe, combat Hydrographers throughout the Pacific, regimental navigators and hydrographers for Army amphibious Engineering units in New Guinea and Philippines, as Marine artillery surveyors and intelligence officers

Civilian volunteers and draftees served in virtually all capacities – Senior personnel served in survey or engineering organizations

Three major ships go to Navy as hydrographic survey vessels

WW II Continued

PATHFINDER, OCEANOGRAPHER, and HYDROGRAPHER serve throughout the Pacific

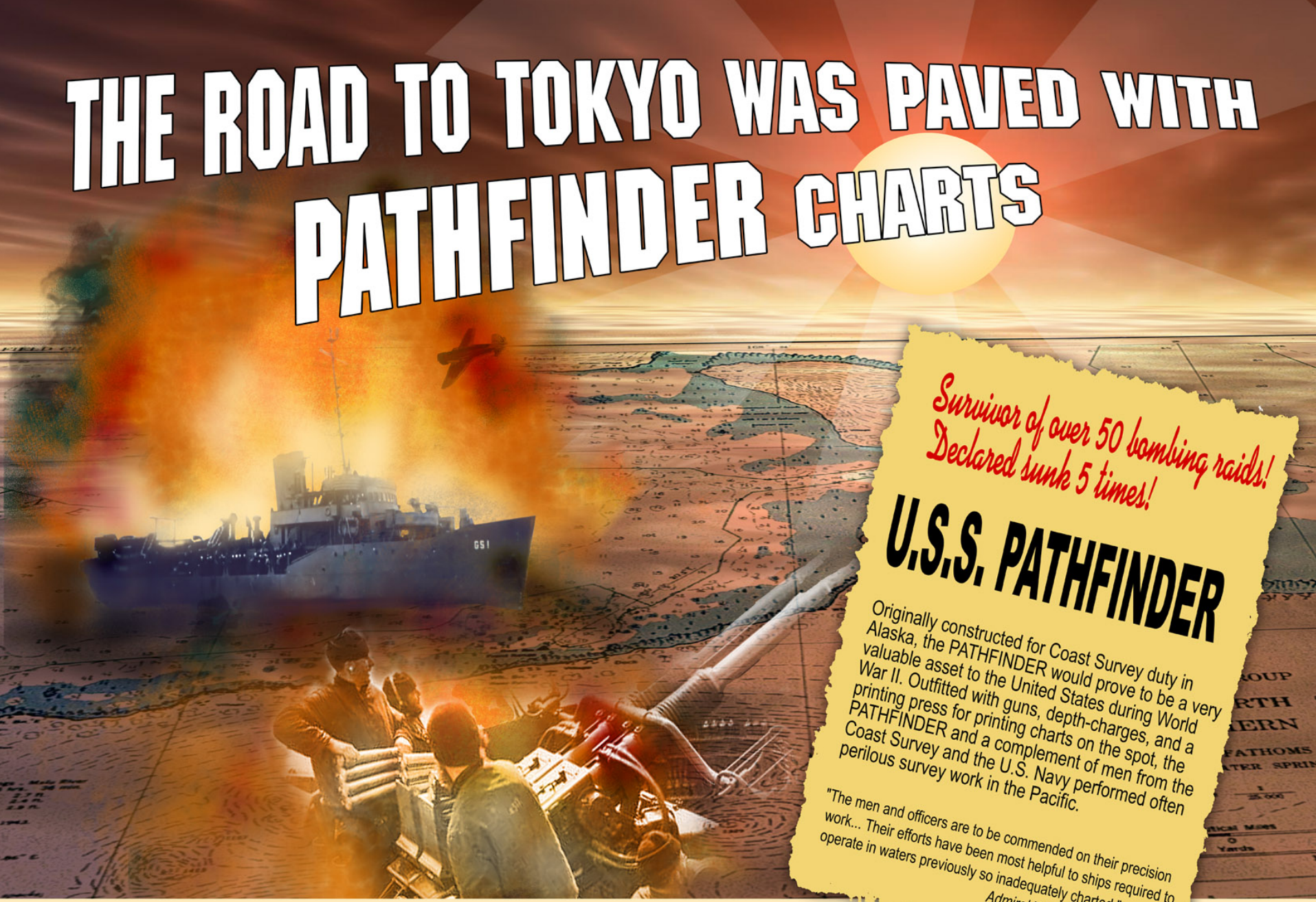
Artillery surveyors in Europe first cog in artillery machine that devastates German artillery – one shot volleys by Germans

80M maps and charts made for Allied forces by C&GS- Another 14M at St. Louis Chart Plant under command of C&GS officer transferred to Army and 25 M in Italy

World aeronautical chart system designed by C&GS – carried over to Civil Aviation after war

C&GS officers conduct surveys to clear harbors

THE ROAD TO TOKYO WAS PAVED WITH PATHFINDER CHARTS



Survivor of over 50 bombing raids!
Declared sunk 5 times!

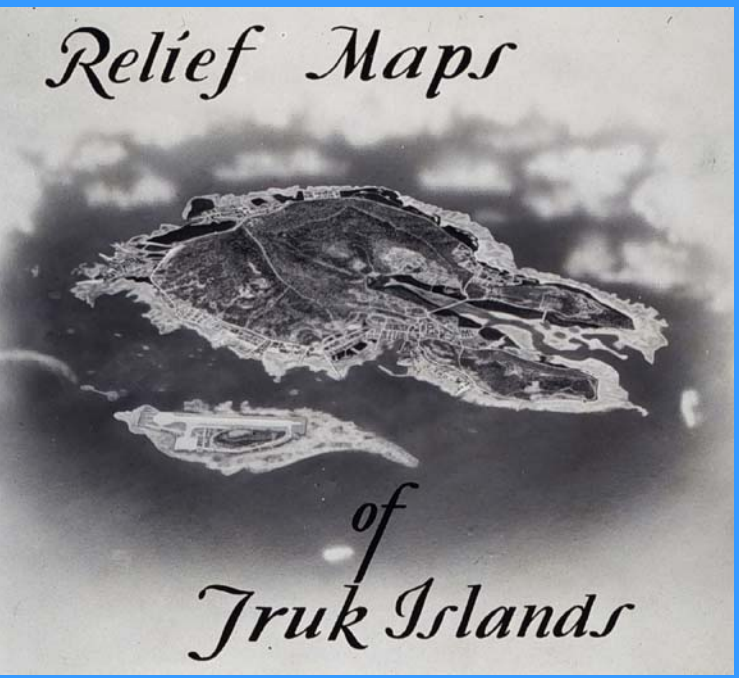
U.S.S. PATHFINDER

Originally constructed for Coast Survey duty in Alaska, the PATHFINDER would prove to be a very valuable asset to the United States during World War II. Outfitted with guns, depth-charges, and a printing press for printing charts on the spot, the PATHFINDER and a complement of men from the Coast Survey and the U.S. Navy performed often perilous survey work in the Pacific.

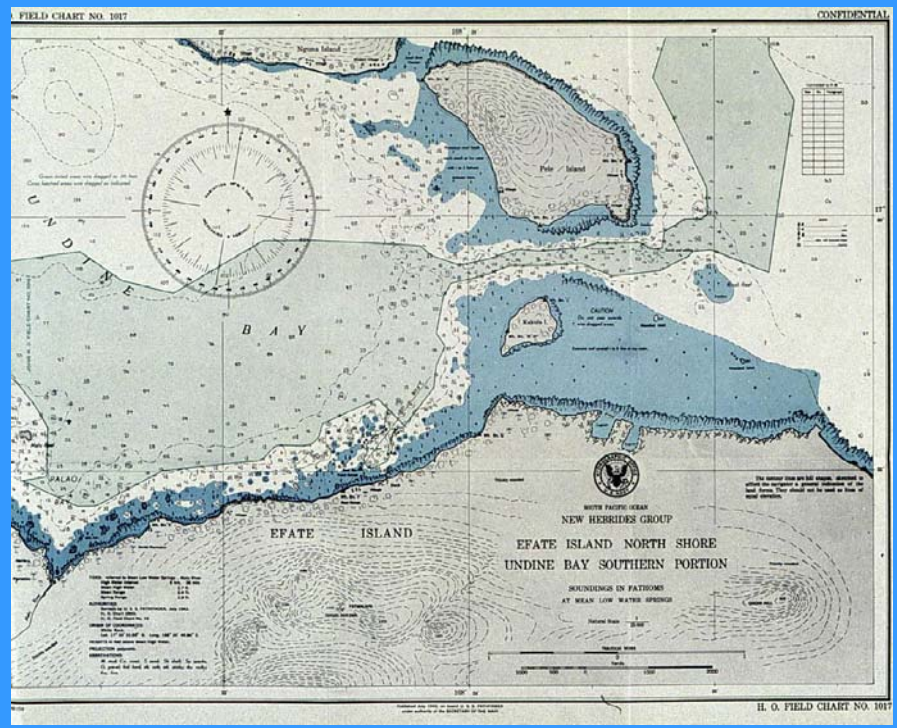
"The men and officers are to be commended on their precision work... Their efforts have been most helpful to ships required to operate in waters previously so inadequately charted."
Admiral William F. "Bull" Halsey

Celebrating 200 Years of America's Science & Service - NOAA Legacy 1807 - 2007

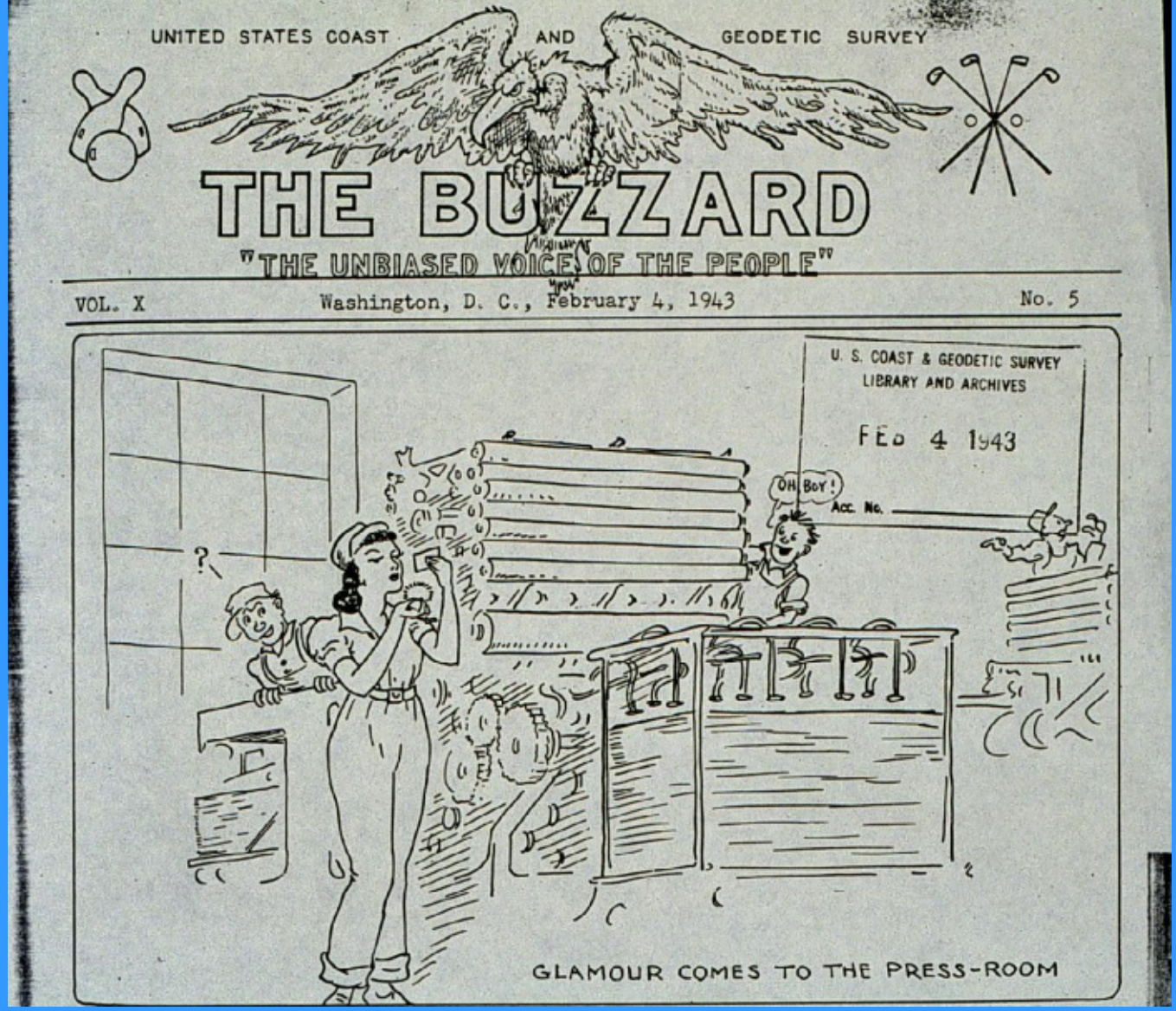
Army and Marine Artillery Surveyors – Responsible for destruction Of 1000's of enemy Artillery pieces



Marine Intelligence Officers



Navy Hydrographers – Chart produced on PATHFINDER



As in other parts of society, WWII opened up numerous opportunities for women in the C&GS that had been previously closed.

President Dwight David Eisenhower 1957 at the 150th Anniversary of the C&GS

"So, when a whole group - the Coast and Geodetic Survey, can look back over 150 years and have this feeling - and the conviction: we have done our duty, I submit to you there are no words that anyone can bring to you - the most brilliant adjectives ever invented by man - that can say to you more. We shall feel, as I am sure America feels - and as I know I do - that *the Coast and Geodetic Survey has done its duty for 150 years to the United States of America.*"


1907 - 1957
SEAL OF THE PRESIDENT OF THE UNITED STATES

Coast and Geodetic Survey Legacy

Imbued both the philosophy and conduct of American Science with a tradition of instrumental observation followed by mathematical analysis and error analysis and mitigation

Helped organize American Science by heavily influencing the early years of the Smithsonian Institution, National Academy of Sciences, American Geophysical Union, American Society of Photogrammetry and Remote Sensing, etc., etc.

The Coast and Geodetic Survey Legacy

Over 1000 Nautical Charts that guide billions of tons of cargo per year through United States Ports

Over 1,000,000 geodetic control points for defense, governmental, and commercial needs –established both horizontal and vertical datums for the United States

Tide and Current Observations extending back over 150 years

Aeronautical Charting System for United States that has now passed to FAA

Establishment of national standards of measure that have now passed to NIST

Legacy Continued

Through tidal observations ascertained sea level rising

First detailed mapping of continental shelves and slopes as result of acoustic sounding and radio acoustic ranging

First systematic oceanography with Gulf Stream studies beginning In 1845

Development of both civil and military survey grid systems during and following WWI

First geophysical agency - began magnetic and gravity studies in Nineteenth Century followed by seismology in early Twentieth Century

Developed Tsunami Warning System following 1946 Hilo tsunami

1970

A New Agency

NOAA Today

Coast and Geodetic Survey Descendants

NOS – Office of Coast Survey, National Geodetic Survey, Center for Operational Oceanographic Products

NOAA Corps

Much of OAR wet side including Office of Ocean Exploration, Tsunami Studies, physical oceanography studies

NWS Tsunami Warning System

Virtually any part of NOAA involved in instrumental observation followed by mathematical analysis is following path first followed by the Coast Survey in the United States

The End. THANK YOU!!!

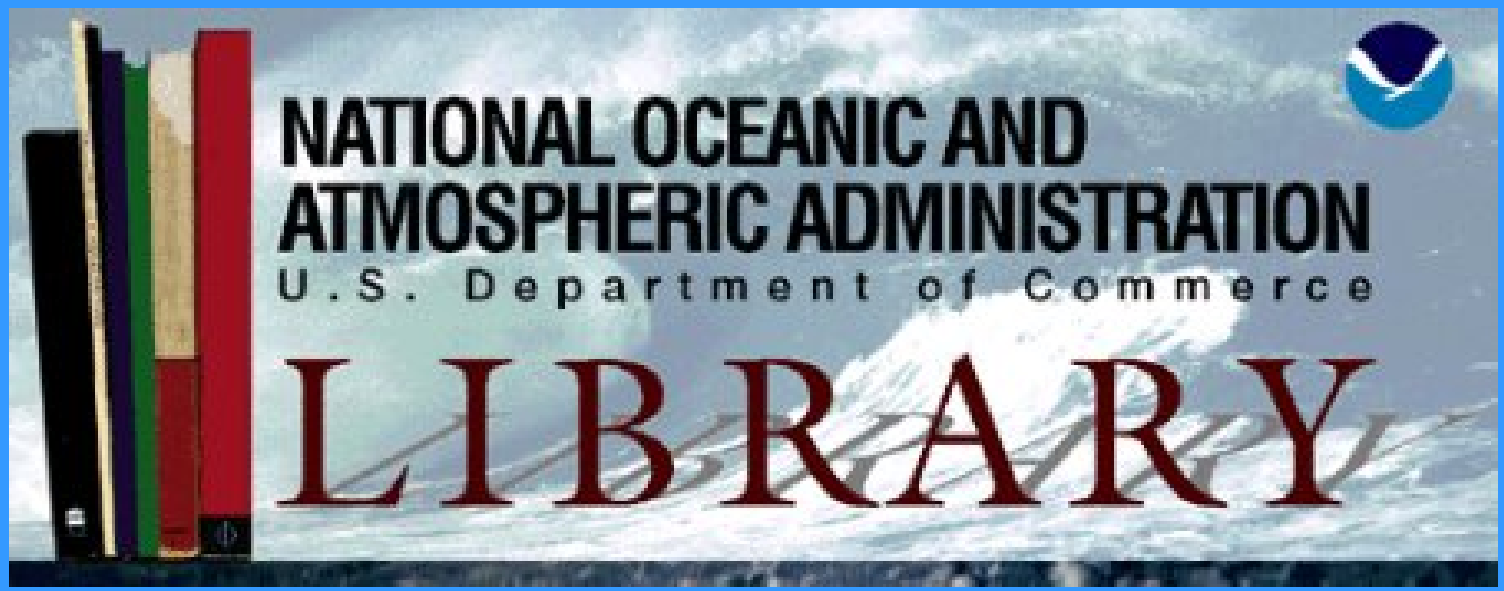
NOAA History Resources

http://www.history.noaa.gov/

http://www.photolib.noaa.gov/

http://oceanexplorer.noaa.gov/history/history.html

NOAA Central Library



http://www.lib.noaa.gov

Help Celebrate
the 200th Anniversary of the
Coast Survey 1807-2007