Cartographic Perspective on Precision Navigation

(NOAA/NOS/OCS/MCD)

Shachak Pe'eri, Elizabeth Kretovic, John Nyberg, Greg Seroka, Neil Weston, Craig Winn, Matthew Forney , Noel Dyerand Tara Wallace

Office of Coast Survey

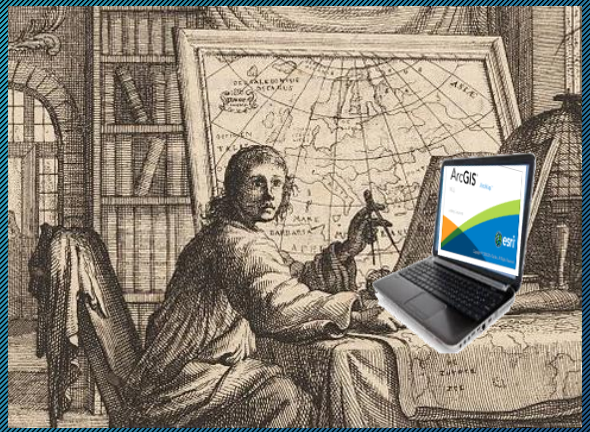
Contact info: Shachak.peeri@noaa.gov

Motivation – Keeping up with the times

1714 AD

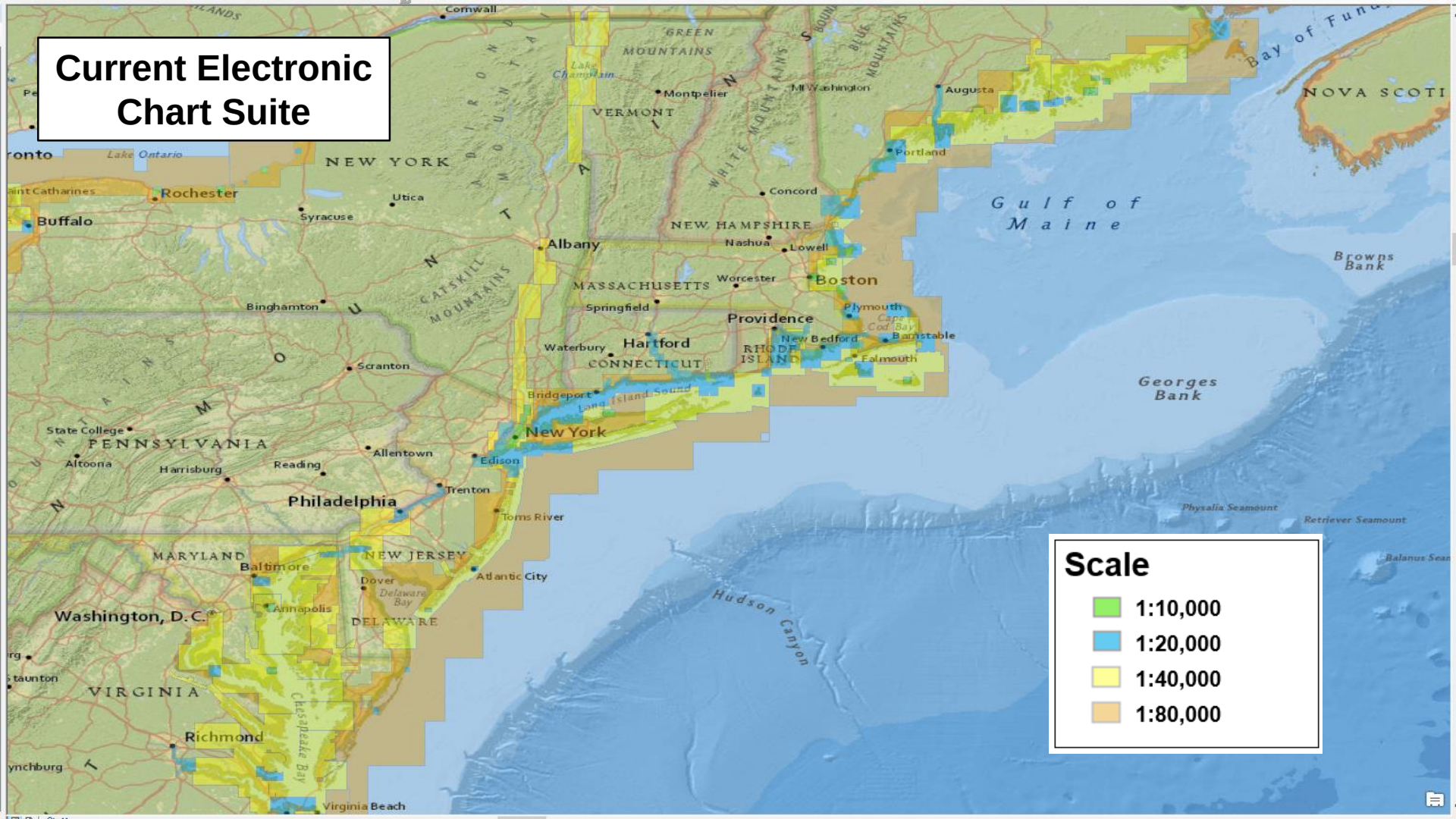
Gerardus Mercator

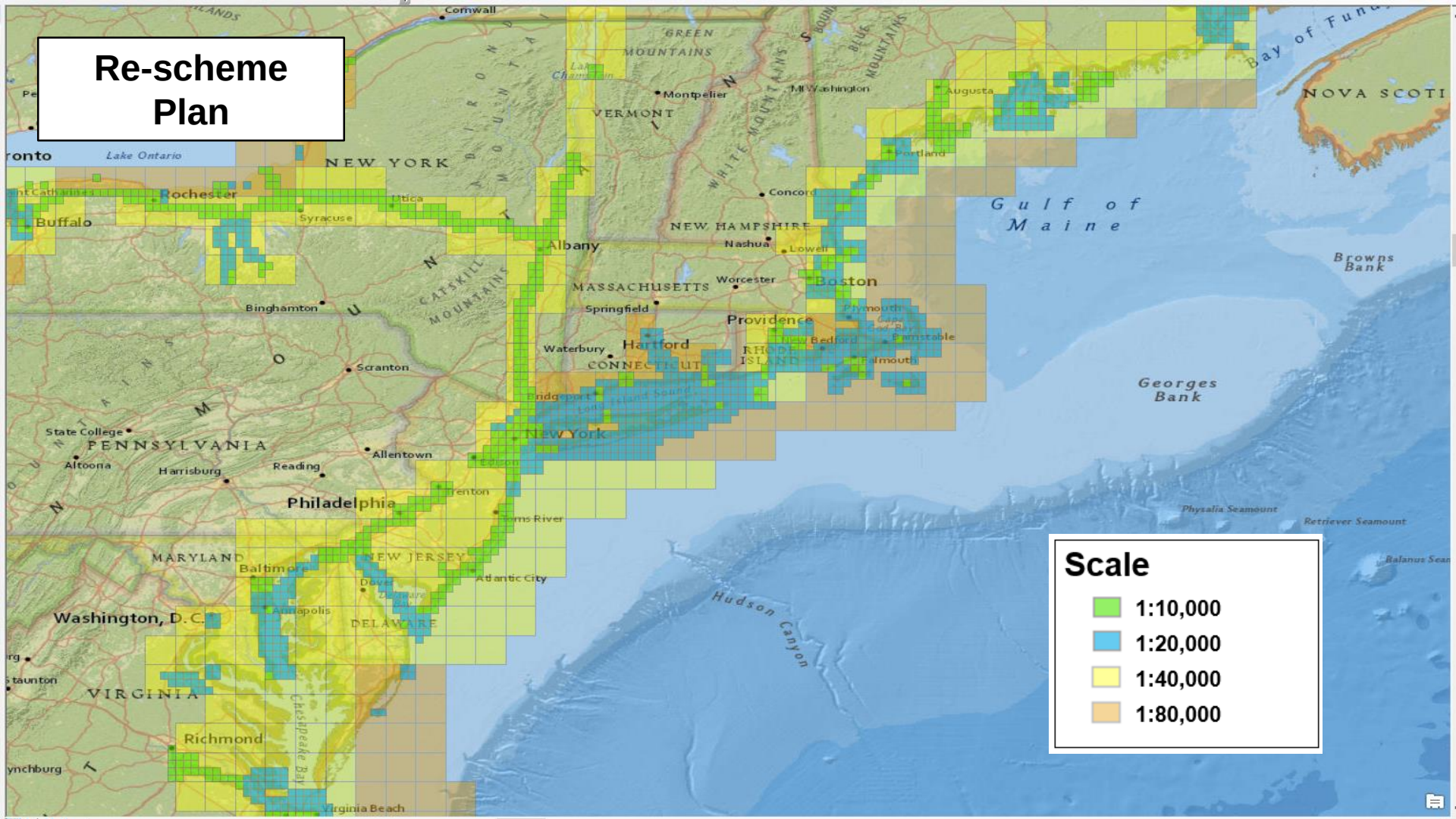
Henry Pelham



2018 AD

Current Electronic Chart Suite




Re-scheme Plan
Scale
1:10,000
1:20,000
1:40,000
1:80,000
Cornwall
Montpelier
Mt Washington
Augusta
Portland
Concord
Lake Ontario
Rochester
Syracuse
Utica
Buffalo
Albany
Nashua
Lowell
Worcester
Boston
Springfield
Providence
Binghamton
Waterbury
Hartford
Scranton
Bridgeport
New York
State College
Altoona
Harrisburg
Reading
Allentown
Trenton
Philadelphia
Toms River
Baltimore
Atlantic City
Annapolis
Washington, D.C.
Richmond
Virginia Beach
Gulf of Maine
Georges Bank
Hudson Canyon
Browns Bank
Physalia Seamount
Retriever Seamount
NEW YORK
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
PENNSYLVANIA
NEW JERSEY
MARYLAND
DELAWARE
VIRGINIA
GREEN MOUNTAINS
WHITE MOUNTAINS
BLUE MOUNTAINS
CATSKILL MOUNTAINS
Bay of Fundy
NOVA SCOTI

So much data,
so many wonderful products to create

Data sets collected by NOAA (to name a few):

- Bathymetry
- Shoreline
- Tides
- Currents
- Gravity
- Sediment type
- Bottom vegetation
- Fish and other critter feeding grounds and migration patters
- Hydrothermal vents
- ….

Precision Navigation

Definition:

"Focuses on the ability of deep draft vessels to more safely and efficiently navigate and operate from the sea buoy to the berth, in close proximity to the seafloor, narrow channels, and other hazards, using integrated, interoperable NOAA (and allied agencies) observational, forecast, and geospatial information" (Kretovic, 2018)

What display and planning systems are used by the pilots?

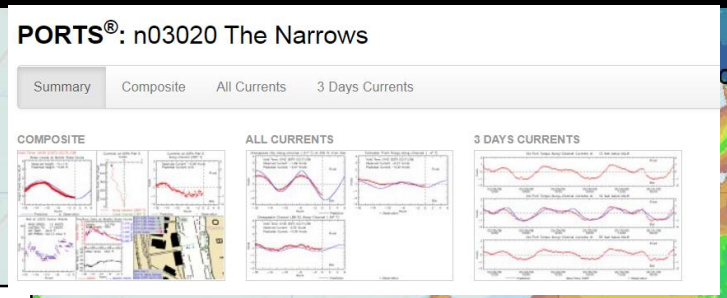
Common Portable Pilot Units (PPUs)

- Bowditch (Wheelhouse 2/3)
- NavSim (NavSim PPU)
- Portable Pilot (ORCA PILOT G2)
- QPS (Qastor)
- Raven Aerostar (Raven PPU)
- Rose Point (Coastal Explorer)
- SEAiq (Pilot)
- Transas (Pilot Pro)
- Trelleborg (Safe Pilot)

Providing products to PPUs

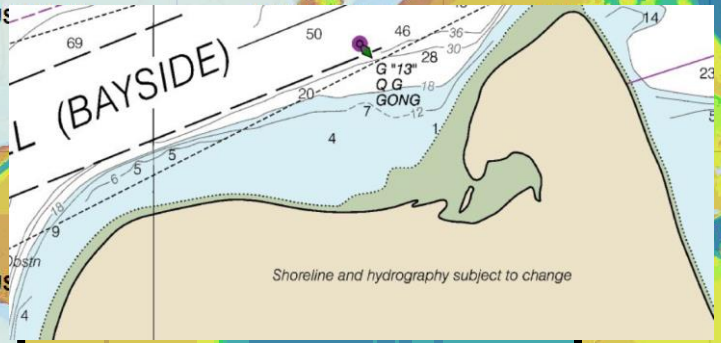
1. Product standards for Portable Pilot Units
2. Relevant layers (parameters to investigate)
3. Spatial resolution/Scales
4. Depth resolution for models (binning depth at a given interval)

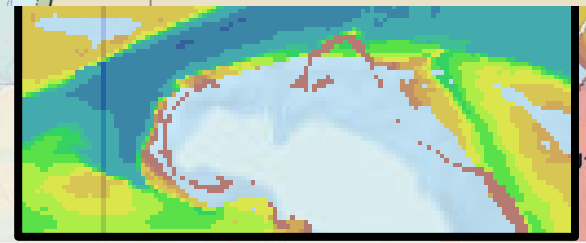
What can MCD bring to the Table? (i.e., working with F4)



The Narrows, NY n3020

Sandy Hook, NJ 8531680



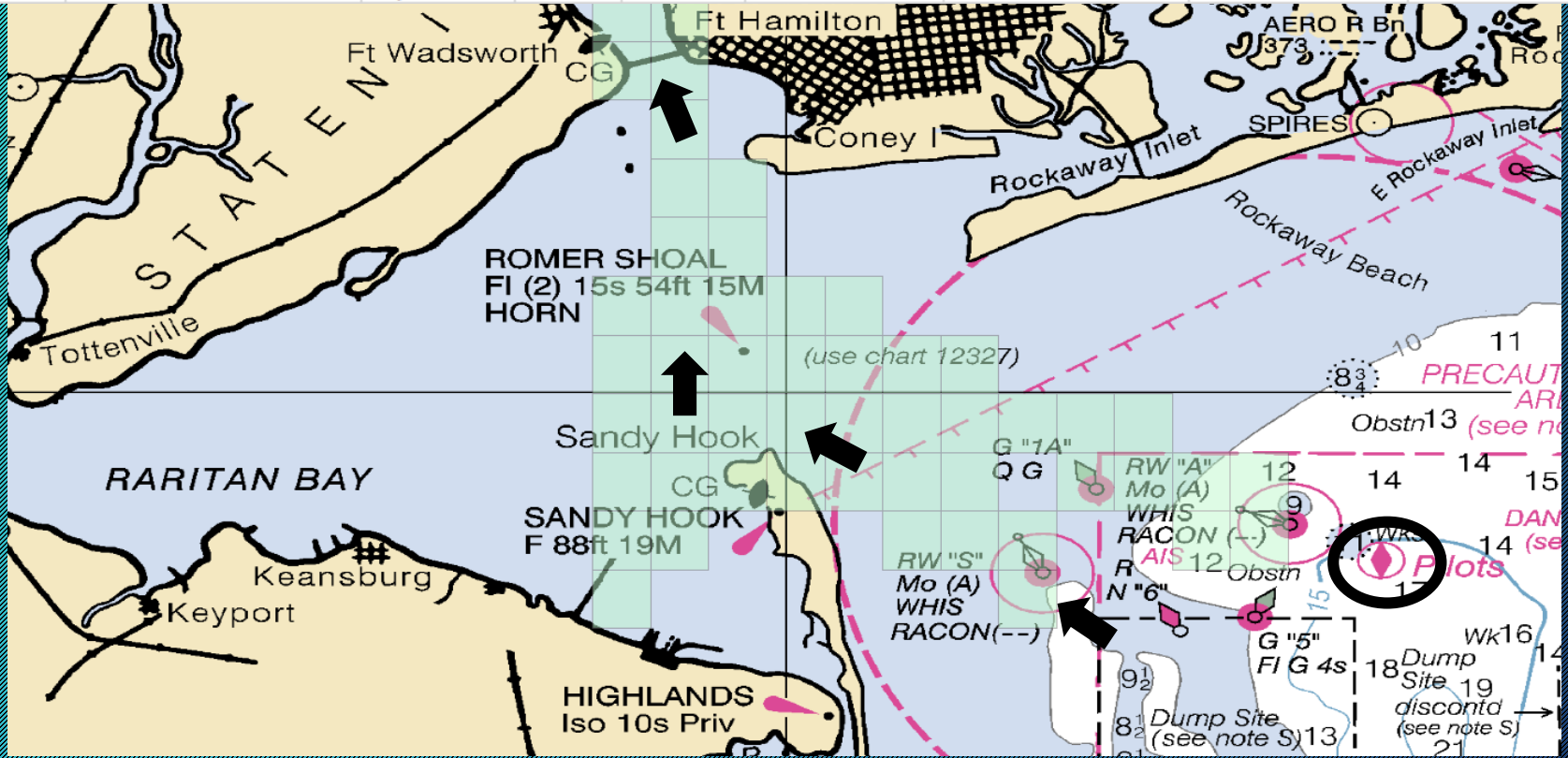


Depth (m)

- 0 - 2.1
- 2.1 - 3.1
- 3.1 - 4.1
- 4.1 - 5.1
- 5.1 - 6.1
- 6.1 - 7.1
- 7.1 - 8.1
- 8.1 - 9.1
- 9.1 - 10.1
- 10.1 - 15.1
- 15.1 - 20.1
- 20.1 - 30.5

US5NYCCC
US5NY1BF
US5NYCBG
US5NYCBH
US5NYCBI
US5NYCAG
US5NYCAH
US5NYCAI
US5NJ1UN
US5NJ1UO
US5NJ1UP

FEATURE_ID	FEATURE_NAME	FEATURE_CL	STATE_A	STATE_NU	COUNTY_NAME	COUNTY_NUMERIC	PRIM_LAT_DEC	PRIM_LONG_DEC
207080	Fishers Island Sound	Bay	CT	9	New London	11	41.3075991	-71.9625725
878764	Newark Bay	Bay	NJ	34	Essex	13	40.6659362	-74.1387543
879614	Raritan Bay	Bay	NY	36	Richmond	85	40.5216174	-74.092474
881377	Upper Bay	Bay	NJ	34	Hudson	17	40.6695476	-74.0448628
942132	Acabonack Harbor	Bay	NY	36	Suffolk	103	41.0281558	-72.1411883



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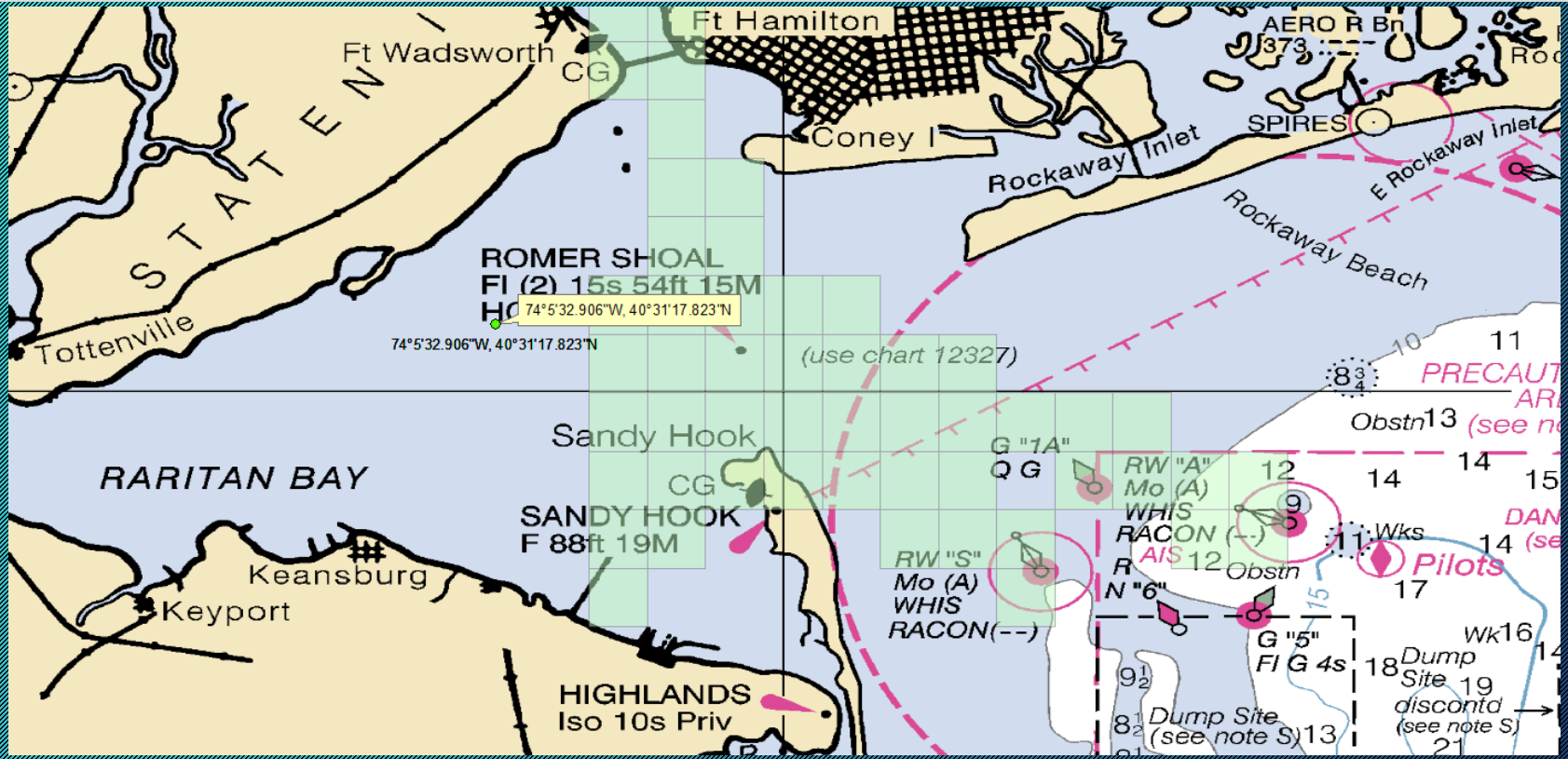
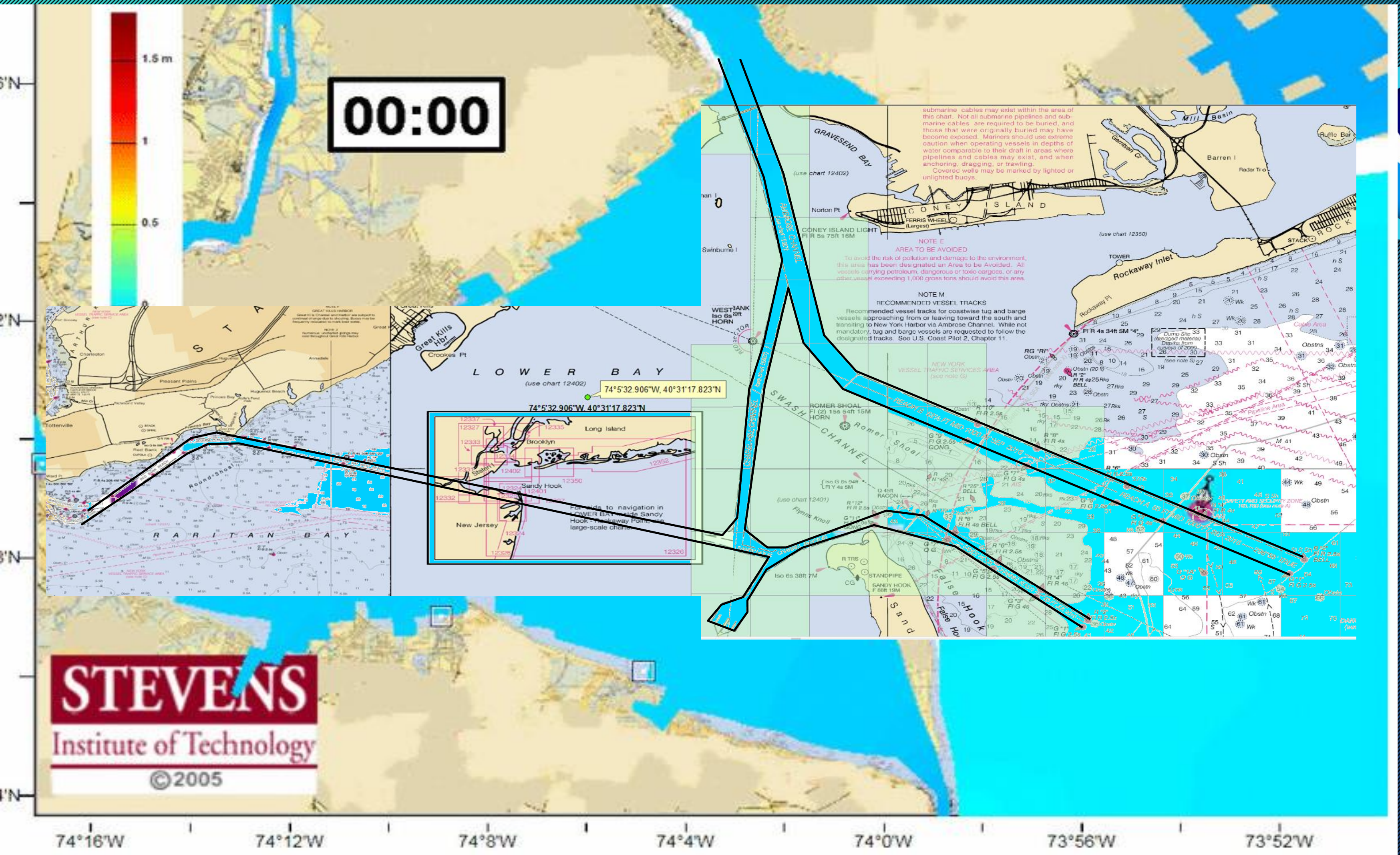
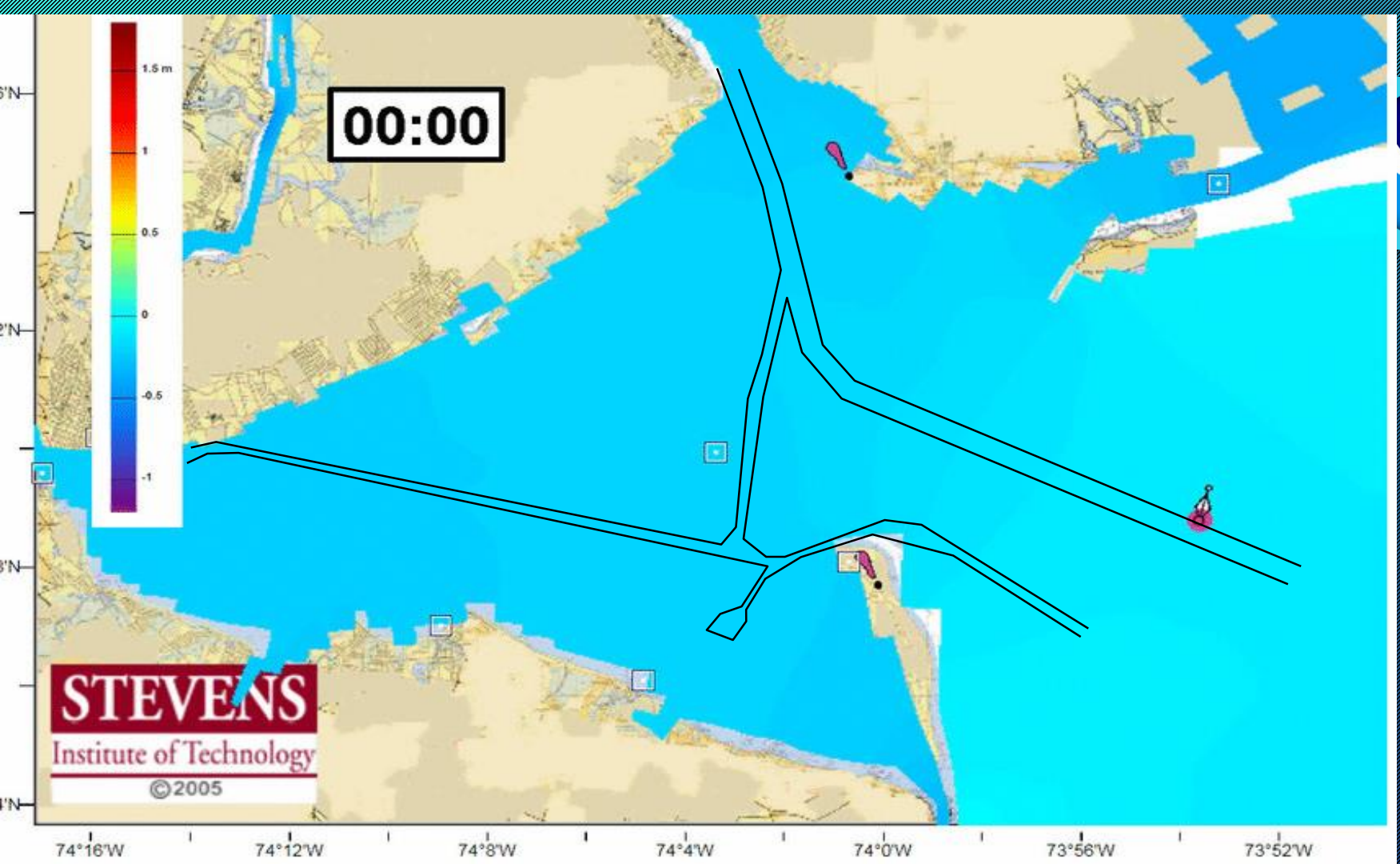



ABAND LIGHTHOUSE
Ft Wadsworth
VERRAZANO - NARROWS BRIDGE
SUSPENSION BRIDGE
VERT CL 198 FT
(FOR MIDDLE 2000 FT)
VERT CL 183 FT AT PIERS
VERT CL 215 FT AT CENTER
(see note E)


00:00
1.5 m
1
0.5
0
74°5'32.906"W, 40°31'17.823"N
L O W E R B A Y
(use chart 12402)
R A R I T A N B A Y
GRAVESEND BAY
C O N E Y I S L A N D
CONEY ISLAND LIGHT
Rockaway Inlet
Barren I
Norton Pt
Swinburne I
Great Kills Hbr
Crookes Pt
Tottenville
NOTE E
AREA TO BE AVOIDED
NOTE M
RECOMMENDED VESSEL TRACKS
S W A S H C H A N N E L
ROMER SHOAL
Romer Shoal
Flynns Knoll
SANDY HOOK
False Hook
Long Island
Brooklyn
Staten I
Sandy Hook
New Jersey
STEVENS
Institute of Technology
©2005
74°16'W
74°12'W
74°8'W
74°4'W
74°0'W
73°56'W
73°52'W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1.5 m
1
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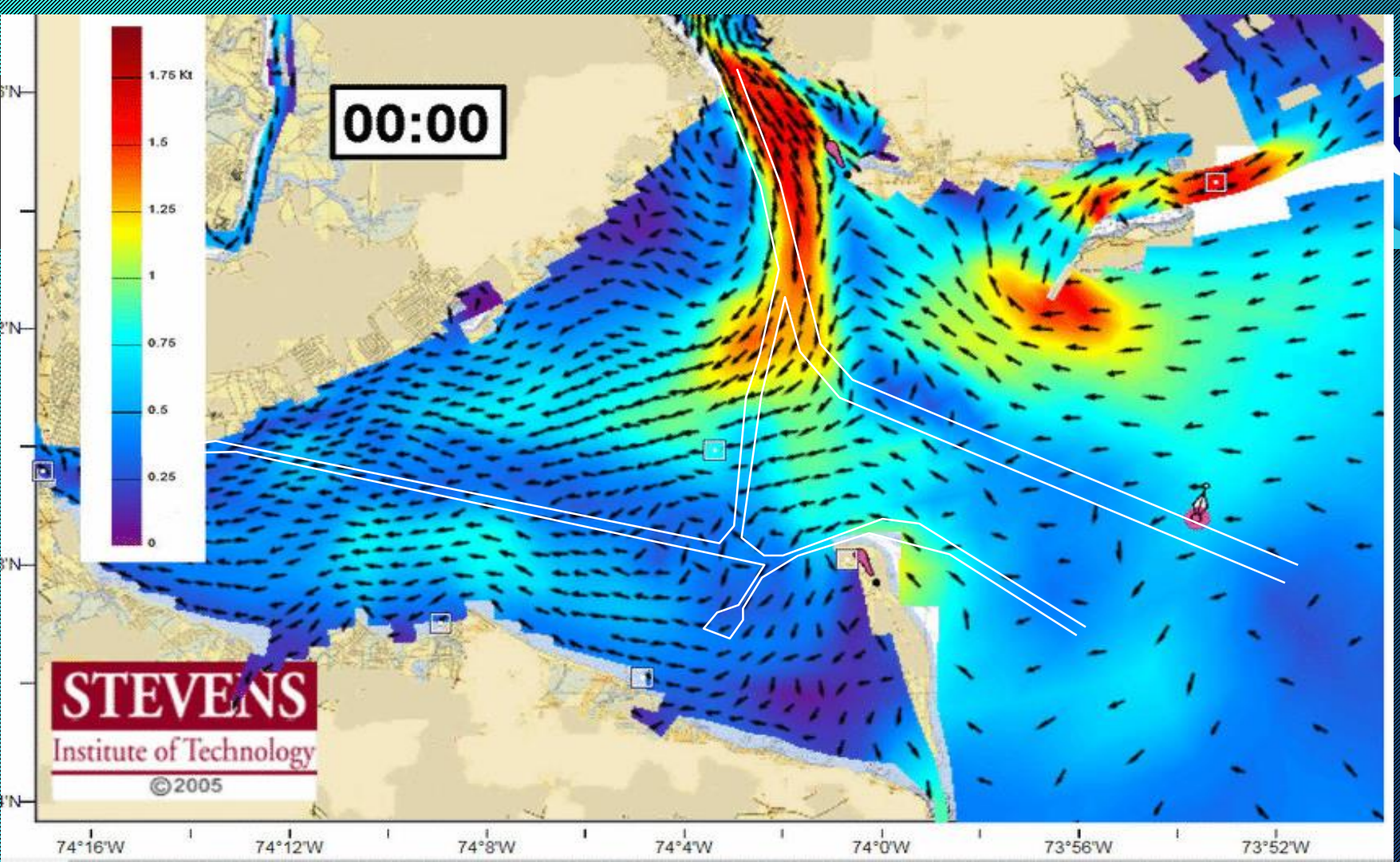
-1
STEVENS
Institute of Technology
©2005
74°16'W
74°12'W
74°8'W
74°4'W
74°0'W
73°56'W
73°52'W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1.75 Kt
1.5
1.25
1
0.75
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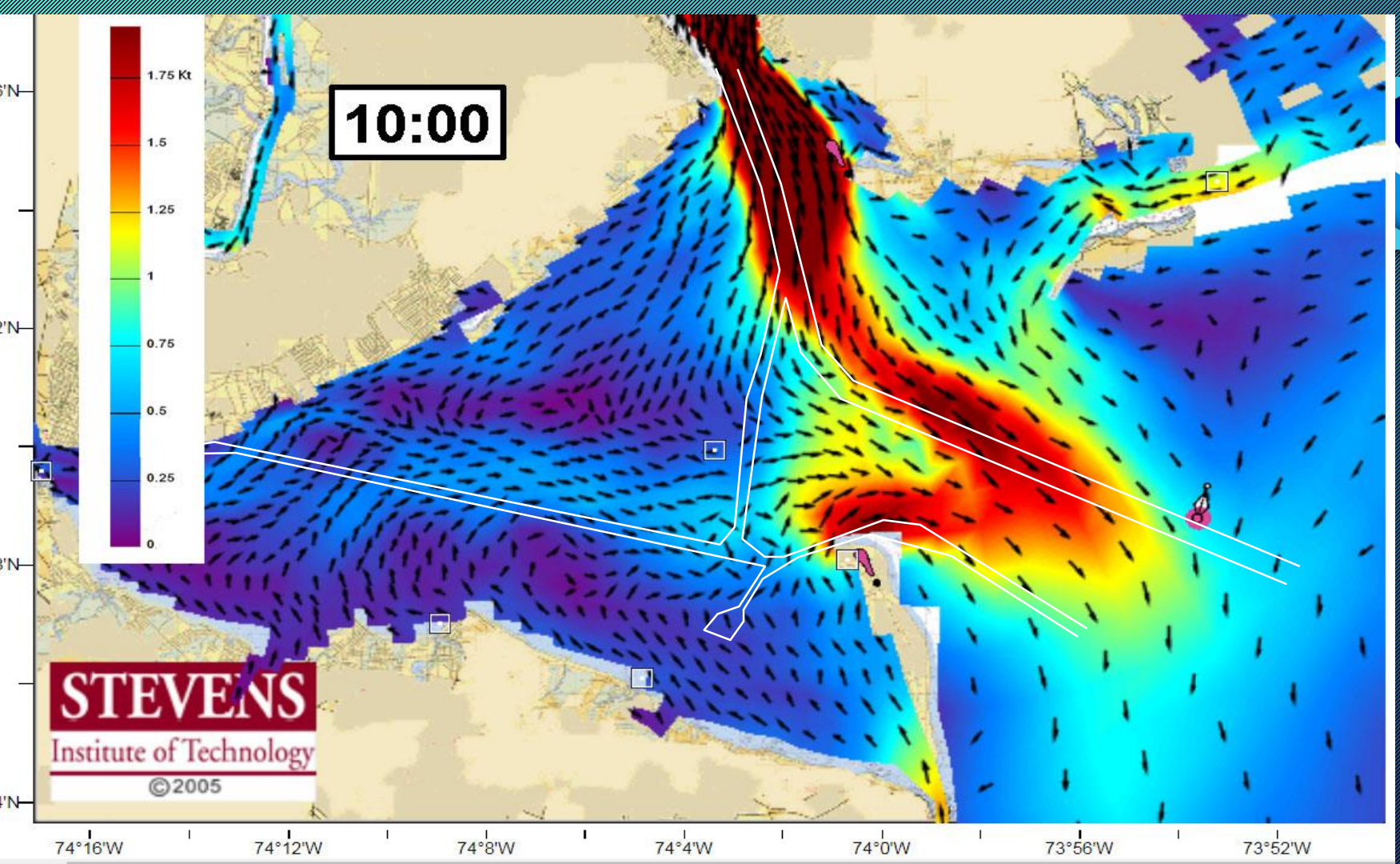
0.25
0
STEVENS
Institute of Technology
©2005
74°16'W
74°12'W
74°8'W
74°4'W
74°0'W
73°56'W
73°52'W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STEVENS
Institute of Technology
©2005
74°16'W
74°12'W
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74°4'W
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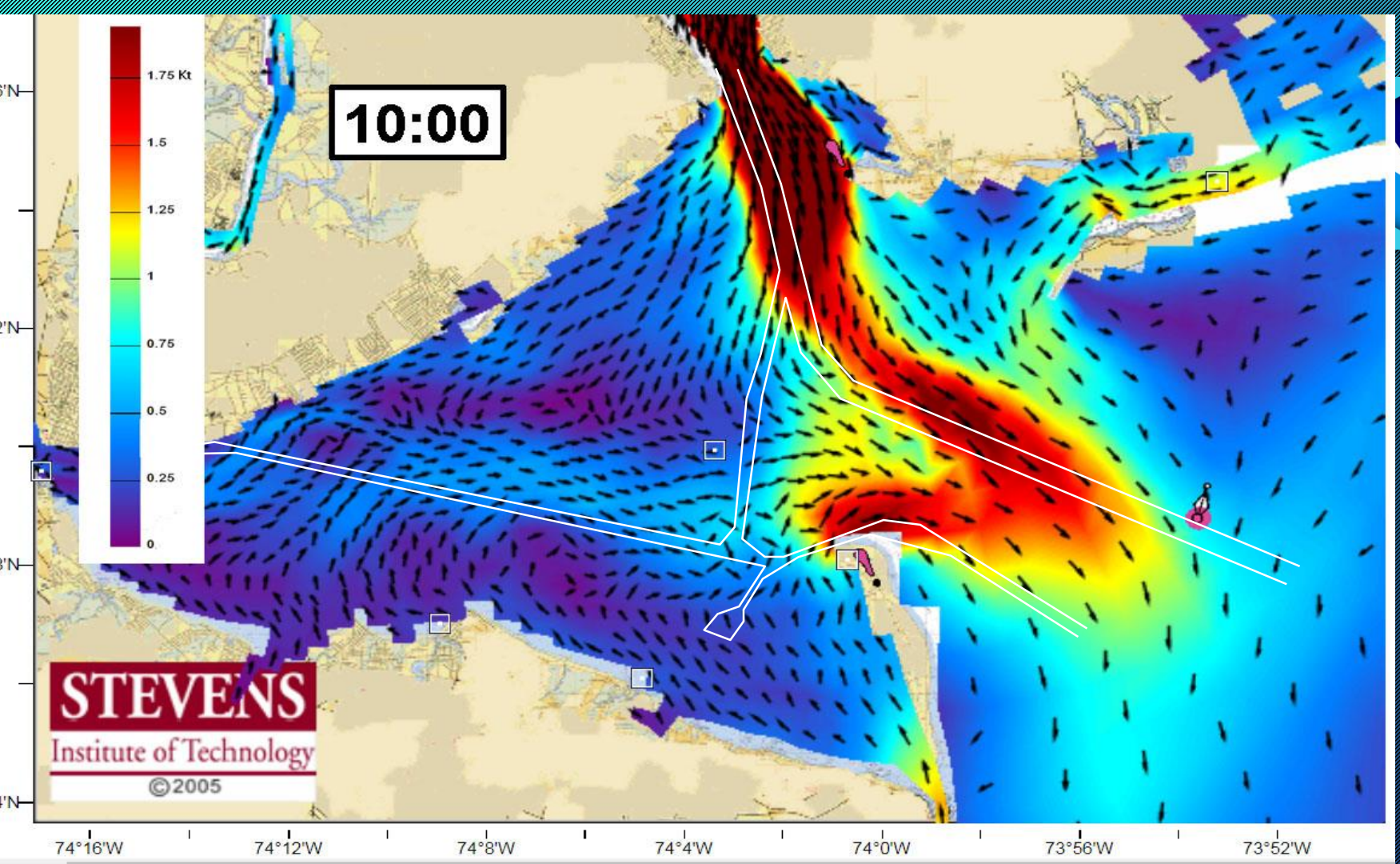
73°52'W


10:00
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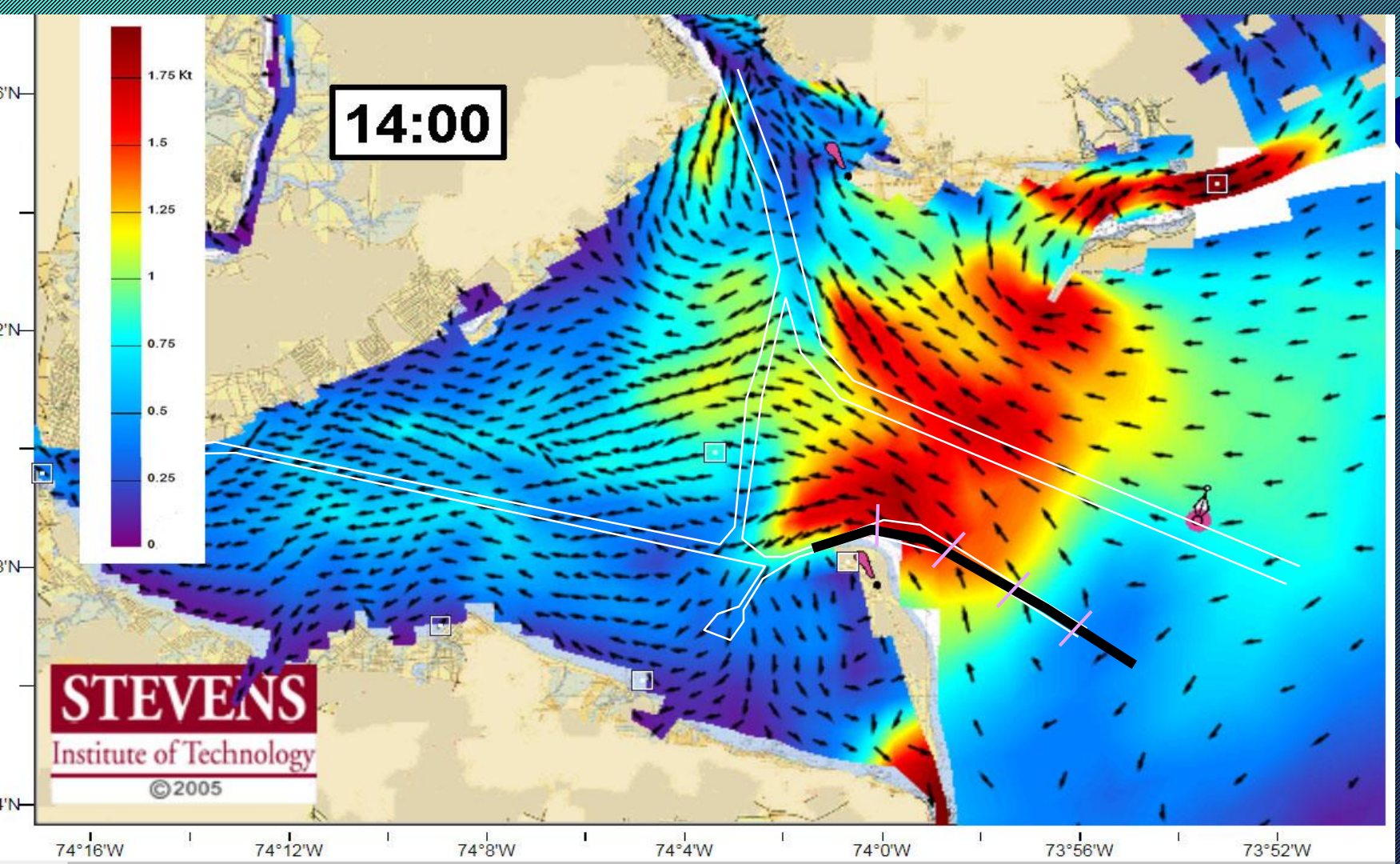
STEVENS
Institute of Technology
©2005
74°16'W
74°12'W
74°8'W
74°4'W
74°0'W
73°56'W
73°52'W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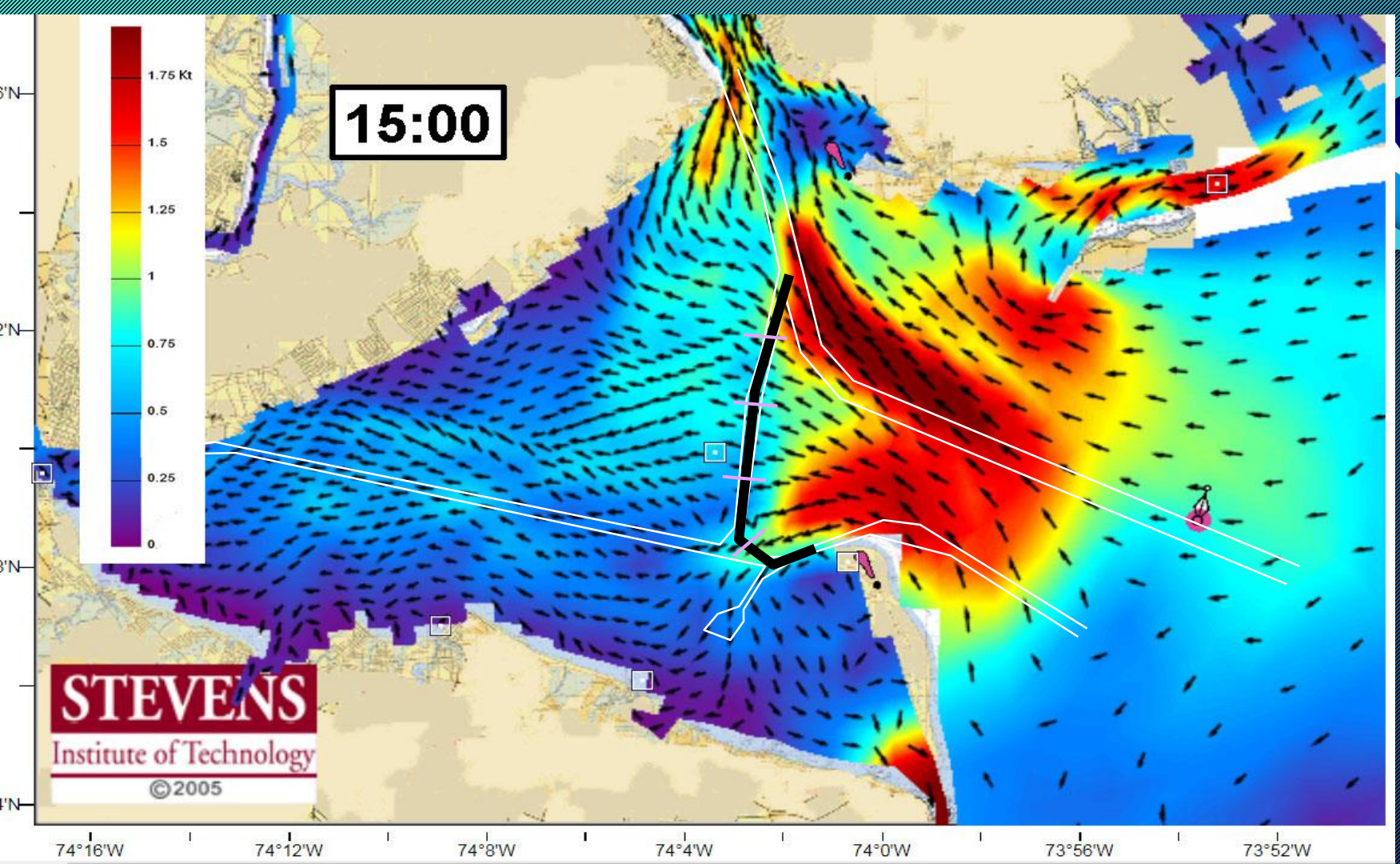
73°52'W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Institute of Technology
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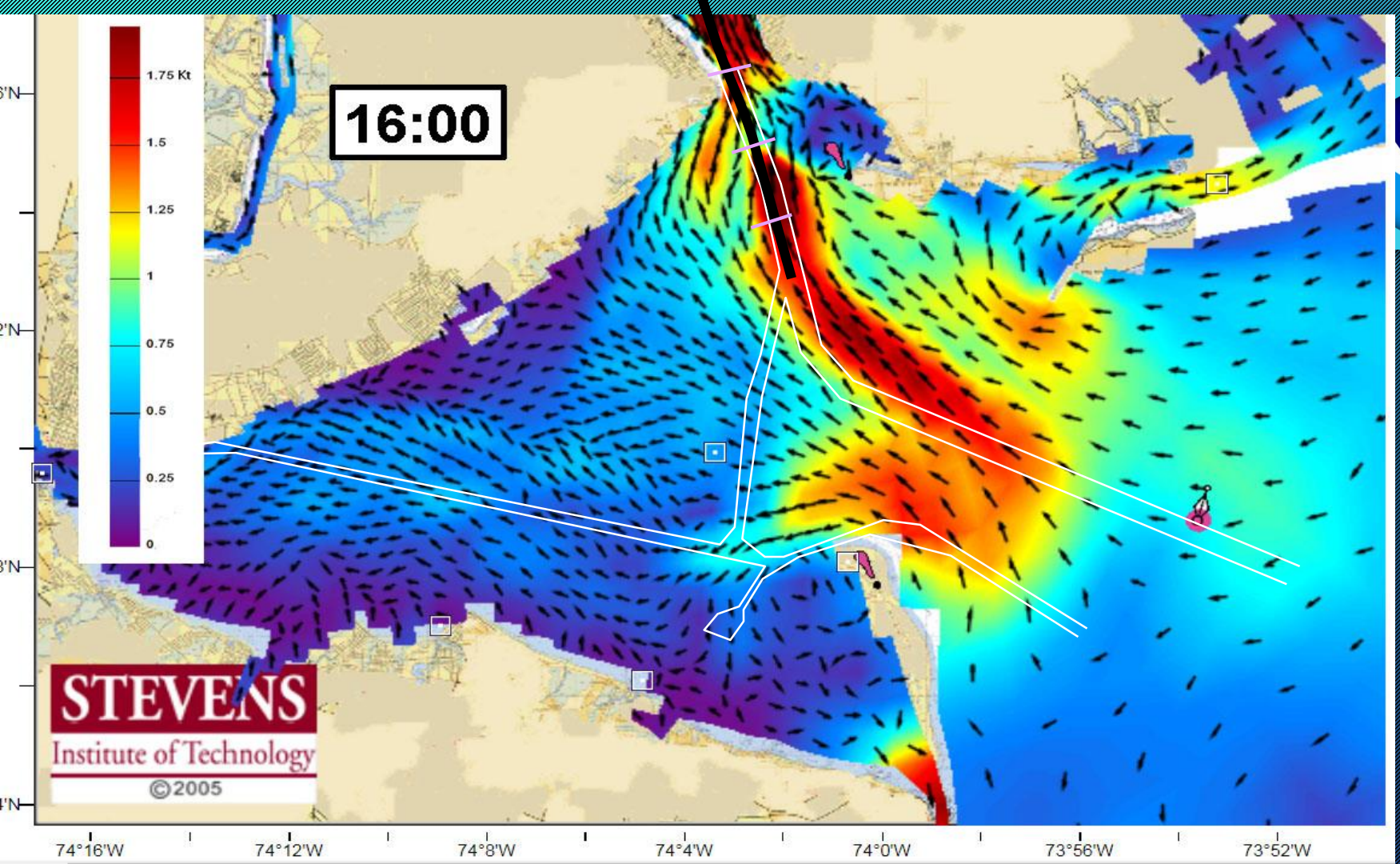
73°56'W
73°52'W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1.75 Kt
1.5
1.25
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0.5
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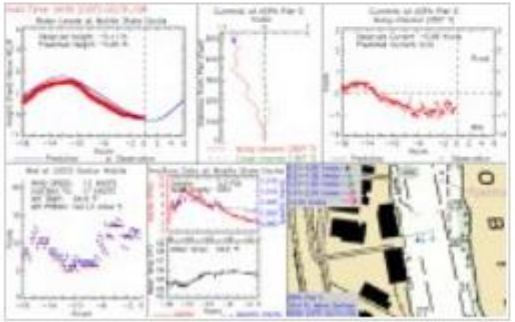
STEVENS
Institute of Technology
©2005
74°16'W
74°12'W
74°8'W
74°4'W
74°0'W
73°56'W
73°52'W

Planning accordingly with all resources available

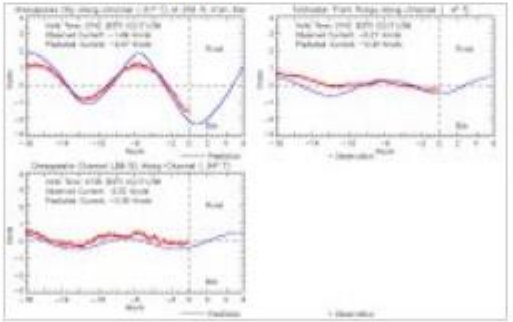
PORTS®: n03020 The Narrows

Summary | Composite | All Currents | 3 Days Currents

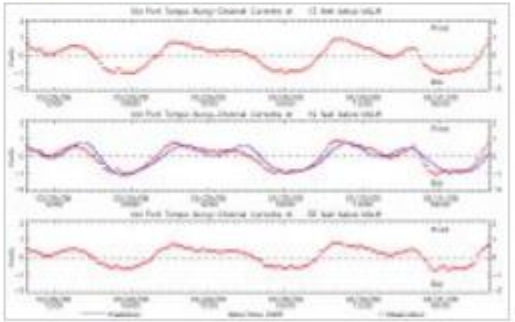
COMPOSITE



ALL CURRENTS



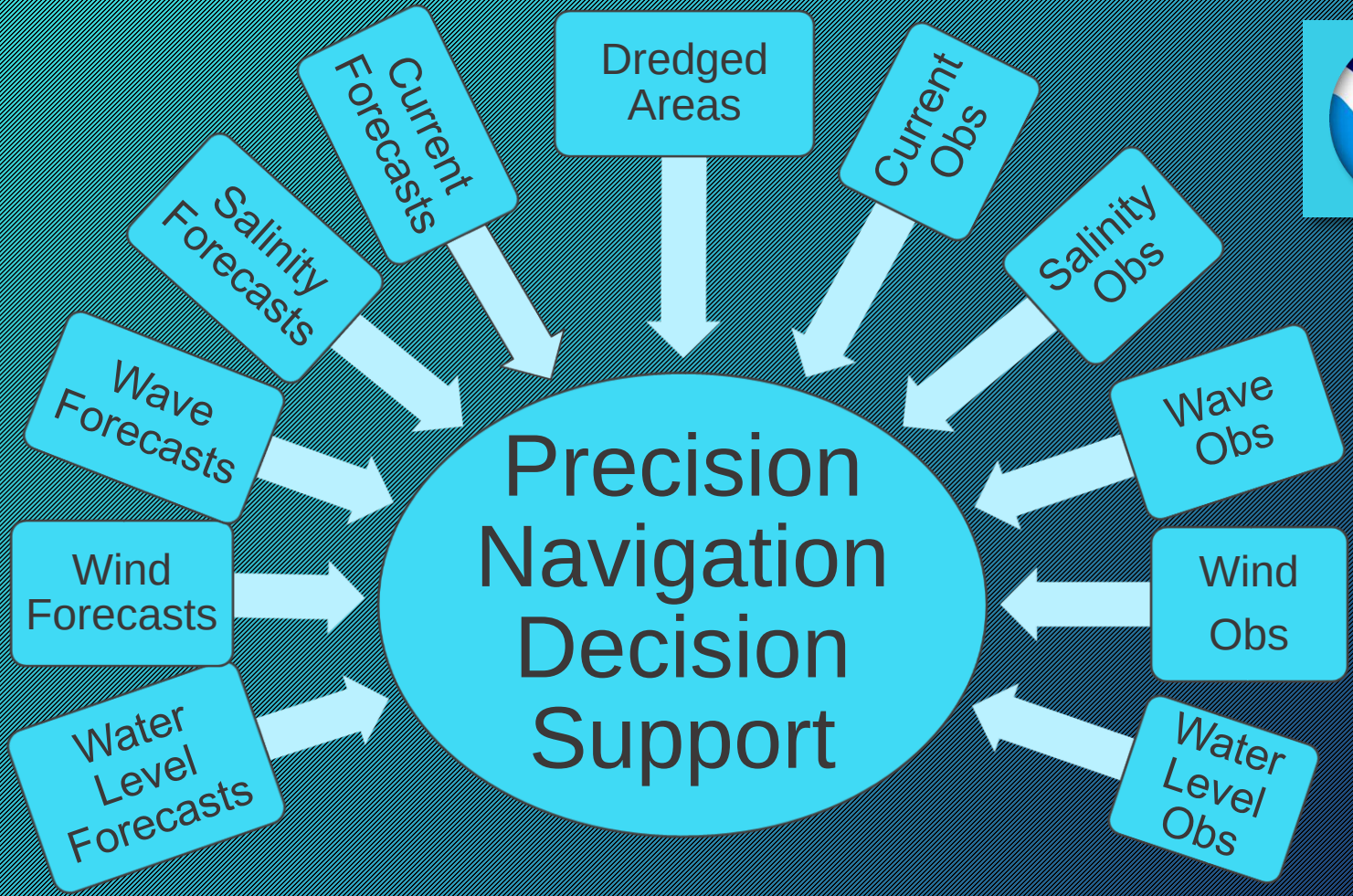
3 DAYS CURRENTS



Is that all the consideration?

What about…

- Changing sand waves?
- Vessel traffic?
- Cruise line industry traffic?
- Military activity?
- Recreational activities?
- Migration and presence of protected species?


Current Forecasts
Dredged Areas
Current Obs
Salinity Forecasts
Salinity Obs
Wave Forecasts
Wave Obs
Precision Navigation Decision Support
Wind Forecasts
Wind Obs
Water Level Forecasts
Water Level Obs

Discussion points

1. Presenting a planned path every 6 minutes rather than 1 hour?
2. Relevant layers (parameters to investigate)?
3. Spatial resolution - 5 to 10 m?
4. Depth resolution for models – 5 m ?
5. Product standards for Portable Pilot Units?

Note: The cartographic goal for precision navigation is to keep the current formats and scales of incoming sources.

Next steps

Decision support for precision navigation

Integrated for place, time, and vessel

- Charts
- High resolution bathymetry
- Safety contours
- Tides & water levels
- Currents
- Winds
- Wave heights
- Weather
- Regulatory restrictions

In the Works…

New York/New Jersey

Lower Mississippi River


Thanks
Questions?
Comments?
Compliments?
Lake Okeechobee
Florida Gap
Florida Keys
Freeport
Freeport City
Northwest Providence
Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors