

COASTAL INUNDATION PROJECT

Enhancing Coastal Community Resiliency

Northeast Region

Coastal Hazards Workshop

November 20, 2008

COASTAL INUNDATION PROJECT OVERVIEW

- **Why**
- **Goals**
- **Pilot Communities**
- **New/Enhanced Services and Products**
 - **Including visualization tools**
- **Vision**

WHY?

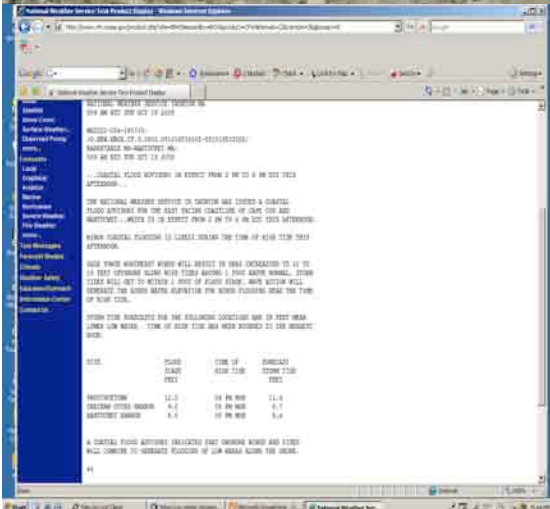
Evoked more effective response



October 1991 Perfect Storm



October 1991 Perfect Storm



Enhanced text with visualization maps



This image is also of Scituate, Ma. It shows historical still high-water points for the 1991 storm. The red hatched areas are warning polygons for an expected 15ft surge.

PROJECT OVERVIEW

PRIMARY GOALS

- **Improve forecasts of coastal inundation**
 - **Storm surge forecasts**
 - **Near shore wave forecasts**
 - **Wave run-up**
- **Provide coastal inundation visualization tools for decision-makers**
 - **Partner with NOAA's Coastal Service Center (CSC)**
 - **Communicate uncertainty**

PROJECT OVERVIEW

Other Applications

- Land use planning, especially in context of sea level rise
- Impact on habitats/benthic resources
- Predictive erosion/sediment transport capability



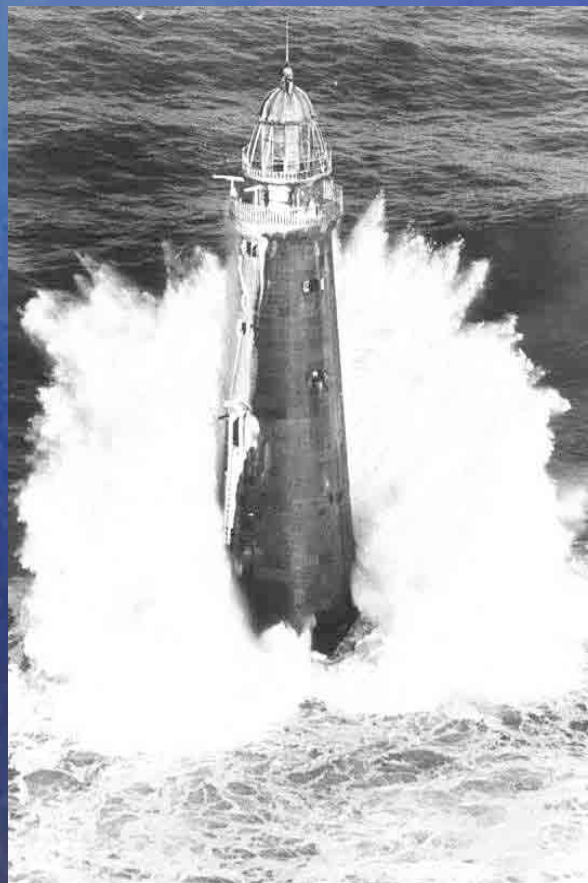
PILOT COMMUNITIES SCITUATE AND SACO

History provides a clue to the future



Sea ravaged homes along Pigeon Beach in Scituate.

(Slide aerial photo by Bob Best)



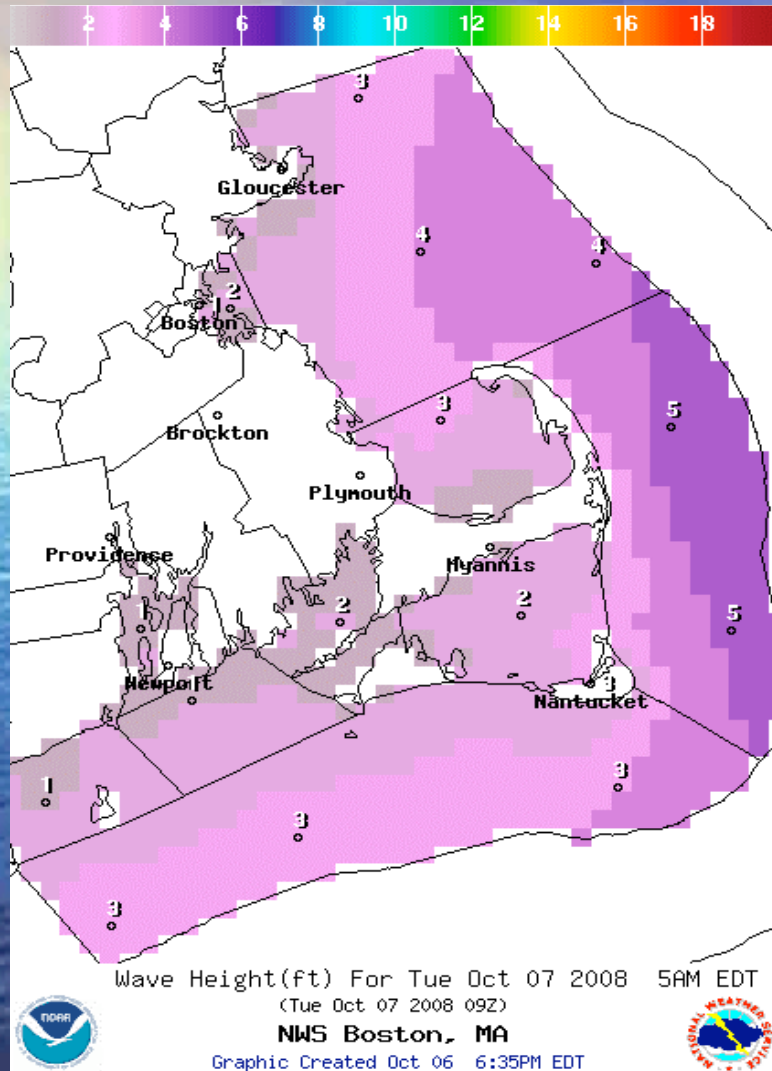
WHY SCITUATE AND SACO

- **Frequent flooders – larger sample size to work with**
- **Allows focus on extratropical storms (nor'asters)**
 - **Major problem for New England east coast**
 - **Fewer studies/tools than with hurricane issue**
- **Two pilot communities allow focus on entire coastal inundation forecast/visualization challenge**

ACCOMPLISHMENTS TO DATE

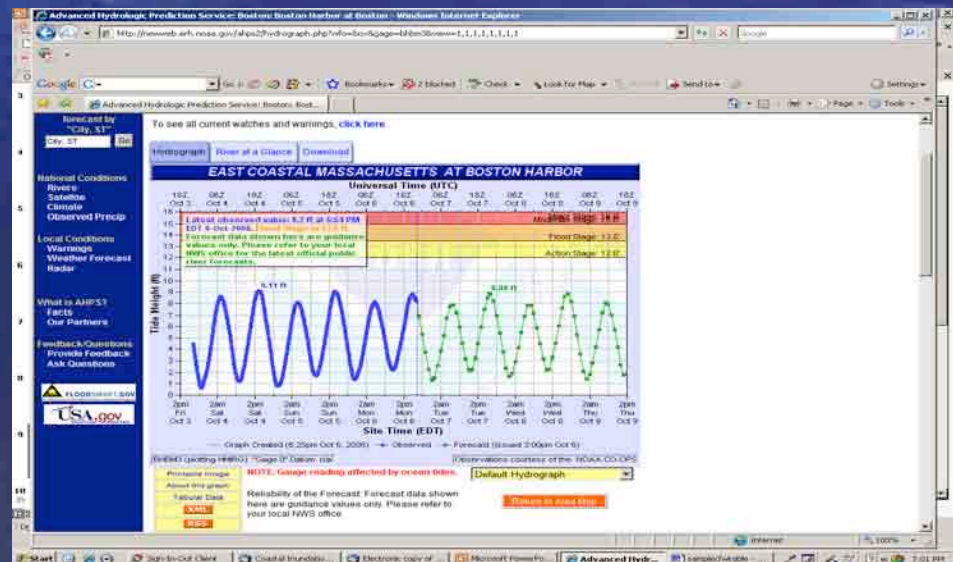
- **Forecast Process Improvements**
 - **SWAN Model implemented**
 - **Gridded storm surge output can be modified by forecasters**
 - **Total water level forecast**
 - **Gridded astro. tide + gridded storm surge**
- **Visualization of inundation**
 - **Reference maps from Coastal Services Center for pilot communities coming to web**

INFORMATION DISSEMINATION



SCITUATE

TOTAL TIDE FT	DAY-TIME	ASTRO TIDE FT	SURGE FT	WAVES FT	IMPACT
8.8	25:02 AM	8.9	-0.1	2	NONE
12.9	25:02 PM	11.1	1.8	5.6	MINOR
11.7	26:03 AM	9.2	2.5	9-11	MINOR
13.4	26:03 PM	10.2	3.2	18	MODERATE
12.3	27:04 AM	9.6	2.7	14-15	MINOR
11.2	27:04 PM	10.2	1.0	8	NONE



Sample of internal product used to construct tables in Coastal Flood Warning Product

File Edit Options Version Tools Scripts Products Help

AFOS Browser Load History WMO Search Enter Editor Accum Update Obs Clear

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TOTAL COASTAL WATER LEVEL FORECAST
NATIONAL WEATHER SERVICE TAUNTON MA
235 PM EDT WED OCT 22 2008

ALL TIDE HEIGHTS ARE REFERENCED TO MEAN LOWER LOW WATER.
TIME OF HIGH TOTAL TIDE IS APPROXIMATE TO NEAREST HOUR.

NEWBURYPORT

TOTAL TIDE /FT/	DAY/TIME	ASTRO TIDE /FT/	SURGE /FT/	WAVES /FT/	FLOOD CATEGORY
9.1	22/06 PM	8.7	0.4	8	NONE
10.5	23/07 AM	9.8	0.7	6-7	NONE
9.1	23/07 PM	8.9	0.2	4	NONE
9.3	24/08 AM	9.7	-0.4	2-4	NONE
8.8	25/08 PM	9.2	-0.4	1	NONE
9.4	25/09 AM	9.7	-0.3	1	NONE

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GLOUCESTER HARBOR

TOTAL TIDE /FT/	DAY/TIME	ASTRO TIDE /FT/	SURGE /FT/	WAVES /FT/	FLOOD CATEGORY
9.1	22/06 PM	8.7	0.4	10	NONE
10.5	23/07 AM	9.7	0.8	7-9	NONE
9.0	23/07 PM	8.8	0.2	5	NONE
9.2	24/08 AM	9.6	-0.4	3-5	NONE
8.7	25/08 PM	9.1	-0.4	2	NONE
9.3	25/09 AM	9.6	-0.3	1	NONE

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BOSTON HARBOR

TOTAL TIDE /FT/	DAY/TIME	ASTRO TIDE /FT/	SURGE /FT/	WAVES /FT/	FLOOD CATEGORY
9.4	22/06 PM	8.9	0.5	2	NONE
10.8	23/07 AM	10.0	0.8	1-2	NONE
9.3	23/07 PM	9.1	0.2	1	NONE
9.5	24/08 AM	9.9	-0.4	1	NONE
9.0	25/08 PM	9.4	-0.4	1	NONE
9.5	25/09 AM	9.8	-0.3	1	NONE

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SANDWICH HARBOR

TOTAL TIDE	DAY/TIME	ASTRO TIDE	SURGE	WAVES	FLOOD

CAUTION:

Flood categories are first guess only, based on collective experience of several staff. Staff encouraged to modify as necessary.

Matrices for Flood Category First Guess

- **Collective experience**
- **A couple of studies on moderate coastal flood events**
- **Forecasters encouraged to adjust**
- **New guidance**
 - **GOMOOS “Splashover Nomogram” (available now)**
 - **Regression analysis (collaborate project this winter with Wheaton College)**

COASTAL FLOODING IMPACT MATRICES
October 22, 2008

Newburyport

Storm Tide	Wave Height					
	10	15	20	25	30	35
9.0	-	-	-	-	-	Minor
9.5	-	-	-	-	Minor	Moderate
10.0	-	-	-	Minor	Moderate	Moderate
10.5	-	Minor	Minor	Moderate	Moderate	Moderate
11.0	Minor	Minor	Moderate	Moderate	Moderate	Major
11.5	Minor	Minor	Moderate	Moderate	Major	Major
12.0	Minor	Moderate	Moderate	Major	Major	Major
12.5	Moderate	Moderate	Major	Major	Major	Major
13.0	Moderate	Moderate	Major	Major	Major	Major
13.5	Moderate	Major	Major	Major	Major	Major
14.0	Major	Major	Major	Major	Major	Major

Gloucester

Storm Tide	Wave Height					
	10	15	20	25	30	35
9.5	-	-	-	-	Minor	Minor
10.0	-	-	Minor	Minor	Minor	Moderate
10.5	-	Minor	Minor	Minor	Moderate	Moderate
11.0	Minor	Minor	Moderate	Moderate	Moderate	Major
11.5	Minor	Minor	Moderate	Moderate	Major	Major
12.0	Minor	Minor	Moderate	Moderate	Major	Major
12.5	Minor	Moderate	Moderate	Major	Major	Major
13.0	Moderate	Moderate	Major	Major	Major	Major

HEADLINE CRITERIA

- **Minor – Coastal Flood Advisory**
- **Moderate or Major = Coastal Flood Warning**



Minor



Moderate



Major



VISUALIZATION

- **Opportunity to focus on locations that are threatened**
- **Reference maps for various water levels soon to be available for pilot communities**



This image, created in ArcMap shows Scituate, MA. The blue areas represent different depths from a simulated 15ft storm tide

Another view of a simulated tide of 18ft for Scituate, MA displayed in Google Earth. The red areas are surge warning zones and the points are historical still high-water marks for the 1991 storm.





This image shows a theoretical 18ft **tide** to Scituate, Ma displayed in Google Earth format. It also shows historical still high-water mark areas for the 1991 storm.



This image also shows a theoretical flood of 15ft near Saco, Maine with 3-D structures. This view is more aerial and can be panned in any direction in Google Earth.

Another 15 ft tide simulation for Saco, Maine looking North and from above.

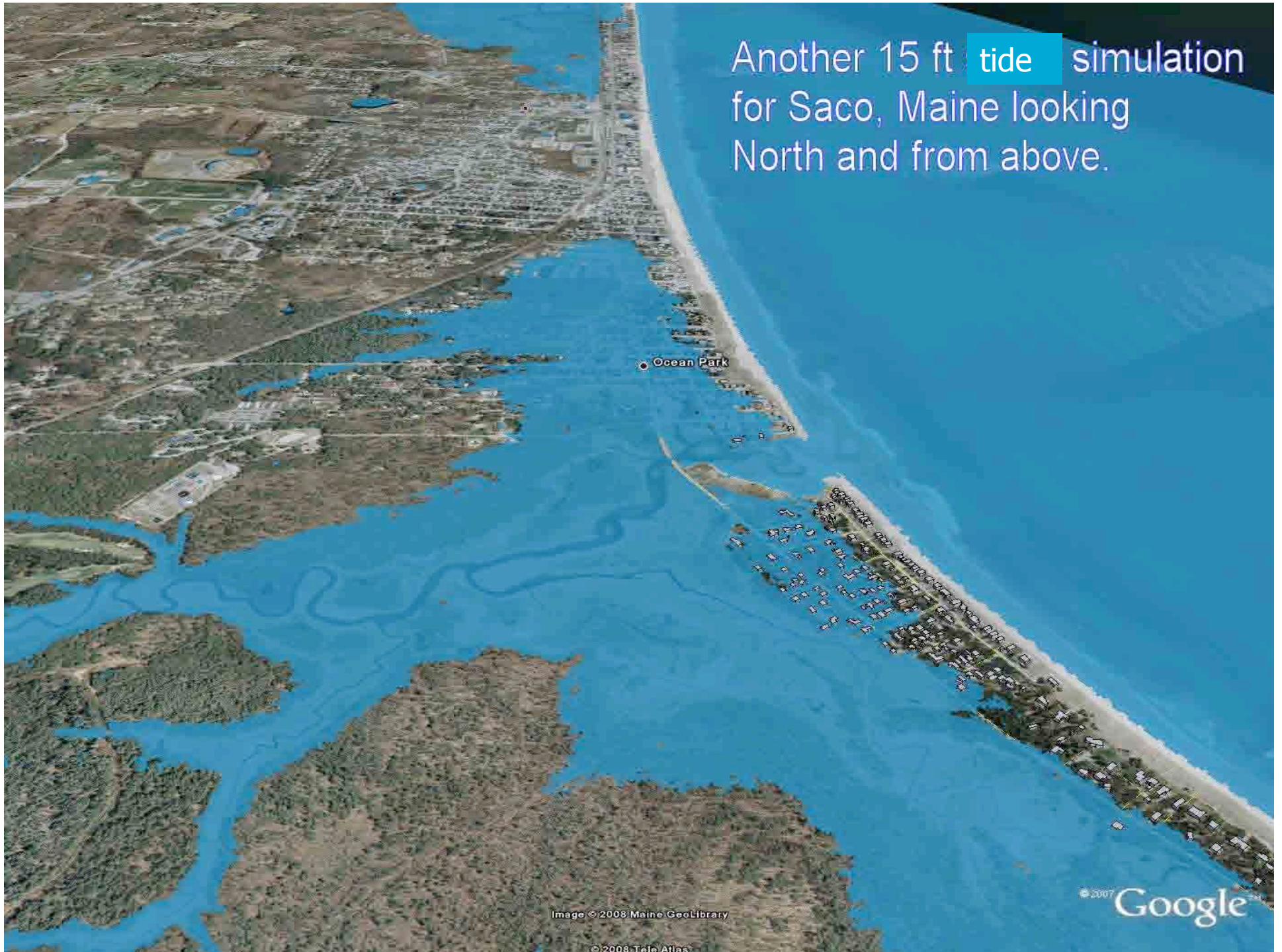


Image © 2008 Maine GeoLibrary

© 2008 TeleAtlas

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FUTURE

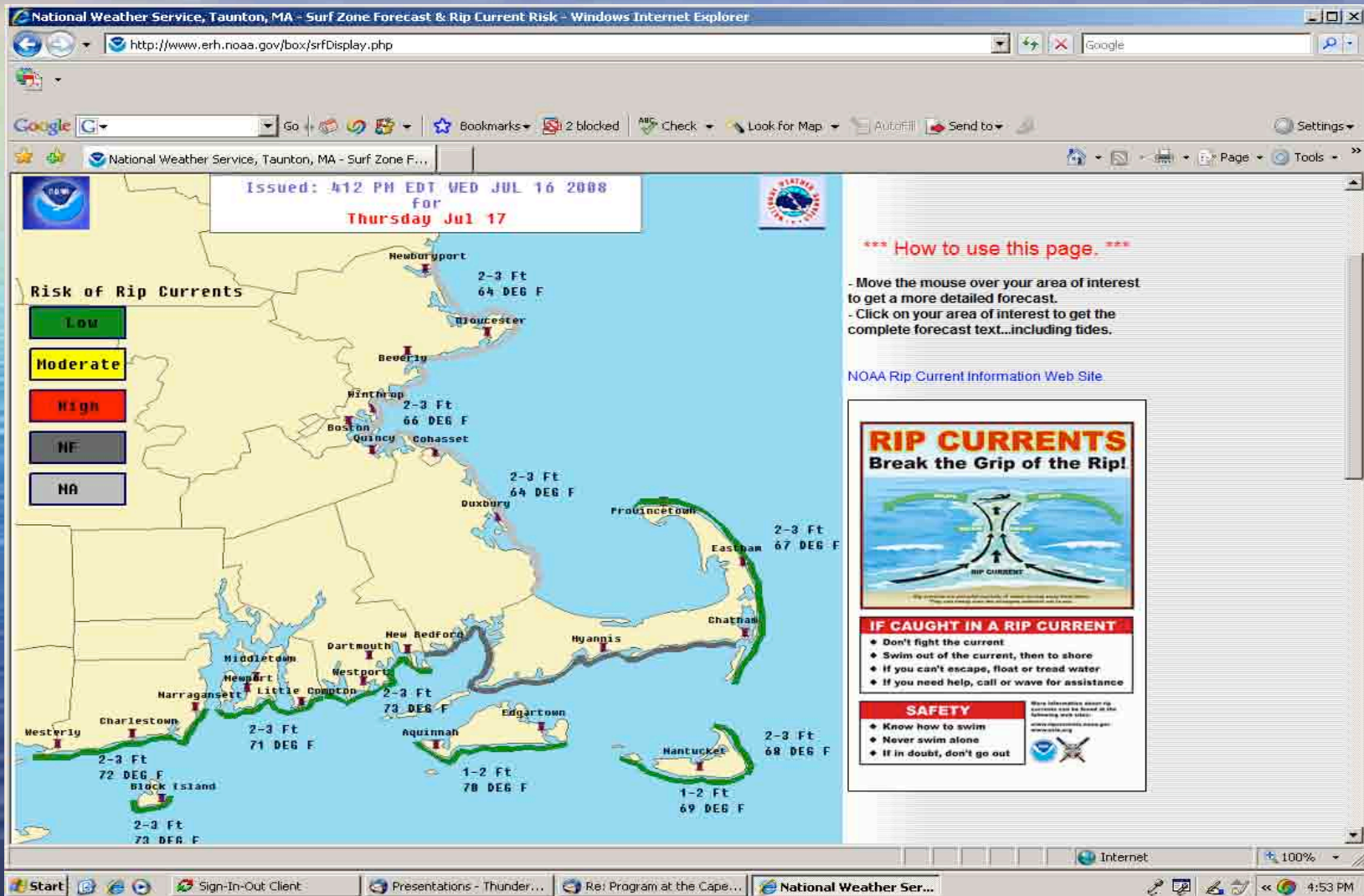
Short Term

- **Investigate wave run-up in collaboration with Coastal Services Center (CSC)**
- **Evaluate UMASS FVCOM Model**
- **Develop Model Output Statistics guidance**
 - Predict impact based on screened predictors (wind, waves, storm tide...)
 - In cooperation with Wheaton College
- **Event assessment**
 - Tide gage installation in Scituate
 - Rapid Response Team in Scituate
 - Expansion of Skywarn amateur radio net to provide detailed coastal flood impact feedback from other communities
- **Visualization mapping to other locations**
- **Refine visualization maps to depict velocity zones for various wave heights**
- **Help pilot communities become *StormReady***

MEDIUM TERM

Produce Interface Map

Like Surf Zone Forecast Map



FUTURE

Longer Term

- **Produce real-time forecast visualization maps based on forecast surge and waves**
 - **Factor in uncertainty**
- **Look at erosion**
 - **Can potential erosion be predicted?**
- **Consider impact of sea level rise scenarios**
- **Look at Benthic impacts**

PARTNERS

- **NOAA's North Atlantic Regional Team**
- National Ocean Service (NOS)
 - Coastal Services Center (Doug Marcy & Matt Pendleton)
 - Stellwagen Bank Sanctuary Office
 - Betsy Nicholson
- Jeremiah Pyle (Student Intern)
- MA Coastal Zone Management
- Communities of Scituate and Saco
- USGS
- NERACOOS/GOMOOS
- Southern New England Amateur Radio Skywarn Coordinators
- National Weather Service (Gray and Taunton)

QUESTIONS?

