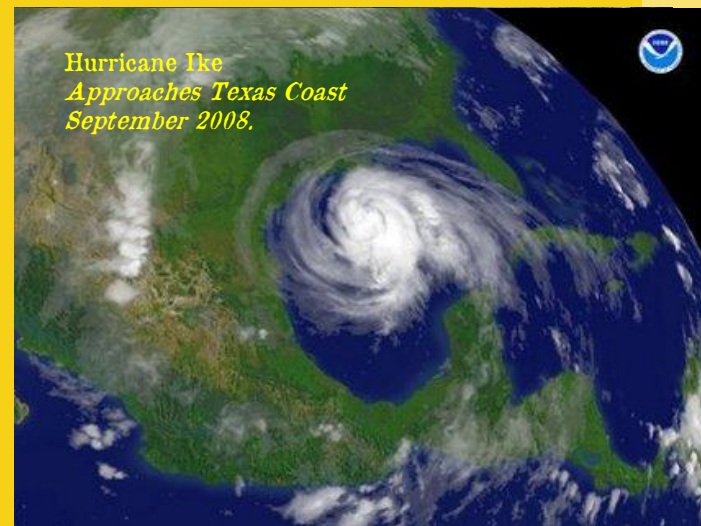




Meteorological and Oceanographic Observations for Hurricane Monitoring in the Gulf of Mexico

Summit 2011
State of the Gulf of Mexico

December 7, 2011



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Dick Crout, Chief Officer, Data Assembly Center, NOAA National Data Buoy Center (NDBC)

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Cautionary Note

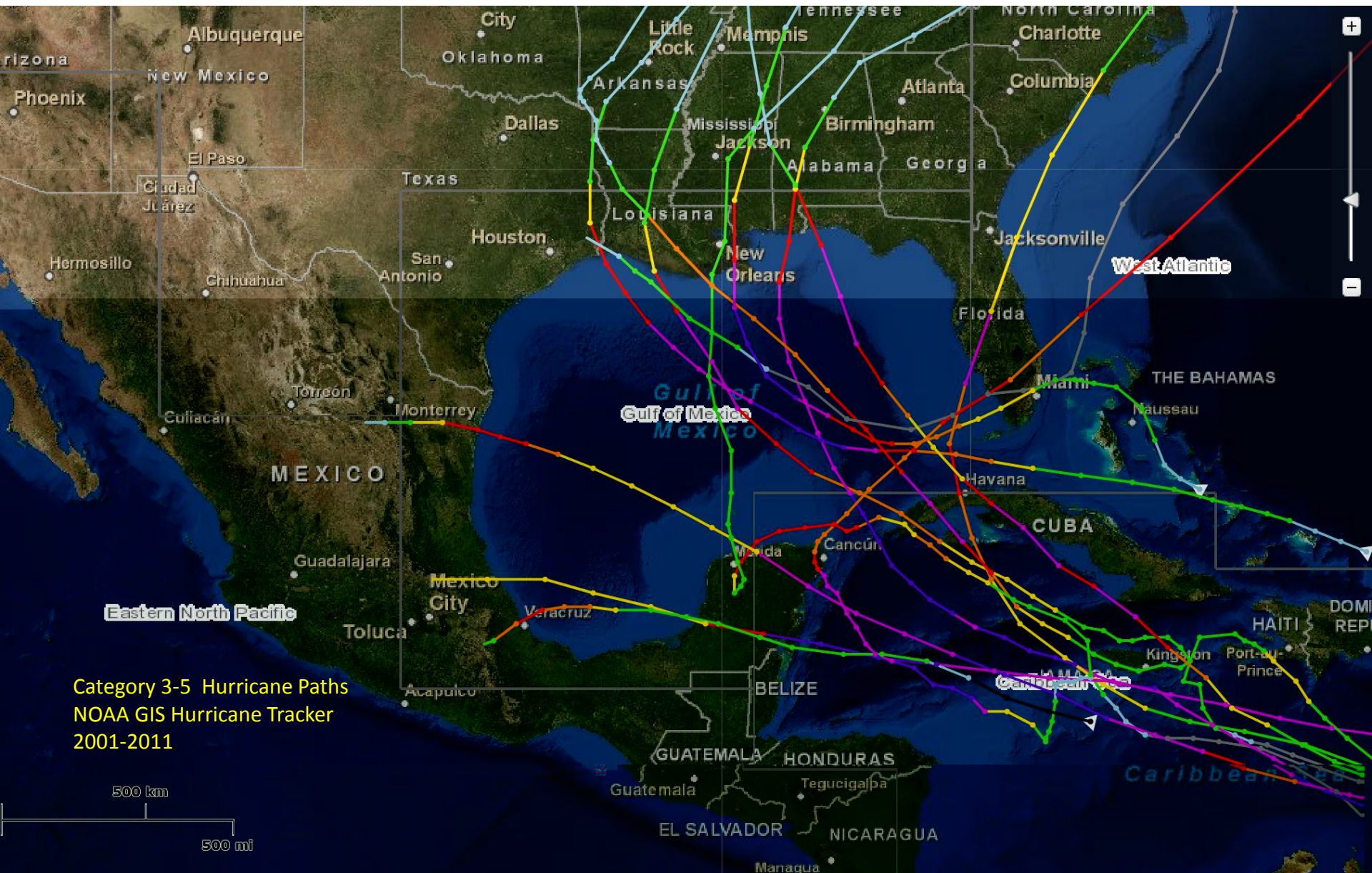
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Shell's Mars Platform
September, 2005



Category 3-5 Hurricane Paths
 NOAA GIS Hurricane Tracker
 2001-2011





Pointer 28°07'36.12" N 90°47'19.06" W

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Why a collaboration?

Benefits to Shell

- Combine Shell's offshore experience with NOAA's scientific expertise to deliver operational OOS that benefits all
- Safety and security
- Better forecasting
- Responsible, innovative operator in the Gulf of Mexico

Benefits to NOAA-NDBS U.S IOOS[®]

- Combine Shell's offshore experience with NOAA's scientific expertise to deliver operational OOS that benefits all
- New information from data-sparse areas
- Better forecasting
- NOAA-wide and U.S IOOS[®] involvement

Consultations to help determine focus of collaboration

- NOAA
 - HQ
 - National Data Buoy Center
 - National Hurricane Center
 - National Severe Storms Laboratory
 - U.S. IOOS Program
 - Former MMS
 - LSU Coastal Environmental Modeling Laboratory
 - Gulf of Mexico Coastal Ocean Observing System
- Priorities from Oil & Gas Workshop

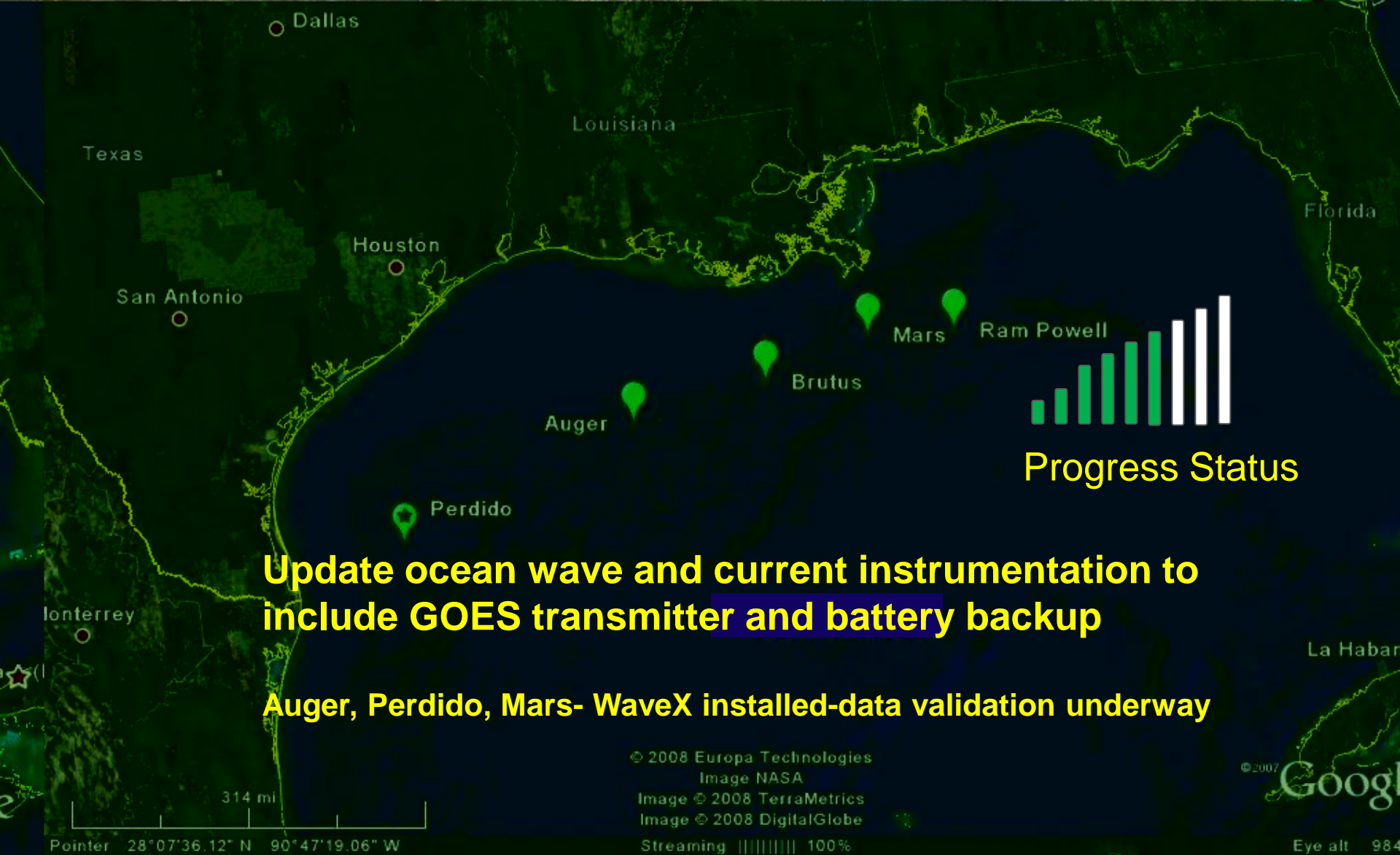
Projects Chosen to Pursue

- **Project 1:** Weather station upgrades on some Shell tension leg platforms to include GOES transmitter and battery back up
- **Project 2:** Ocean wave and current instrumentation on Auger to include GOES transmitter and battery back up
- **Project 3:** Collect and share meteorological observations from coastal Louisiana platforms with NDBC.
- **Project 4:** Collect and share measurement of “upper ocean heat content” from a tension leg platform.
- **Project 5:** Install high frequency radar bistatic antenna in Western Gulf of Mexico to expand Gulf Coast surface current network.



Weather station upgrades on Shell tension leg platforms; GOES transmitter and battery backup

Brutus, Mars, Ram-Powell complete; Perdido, Ursa in progress
Auger, Met data only.



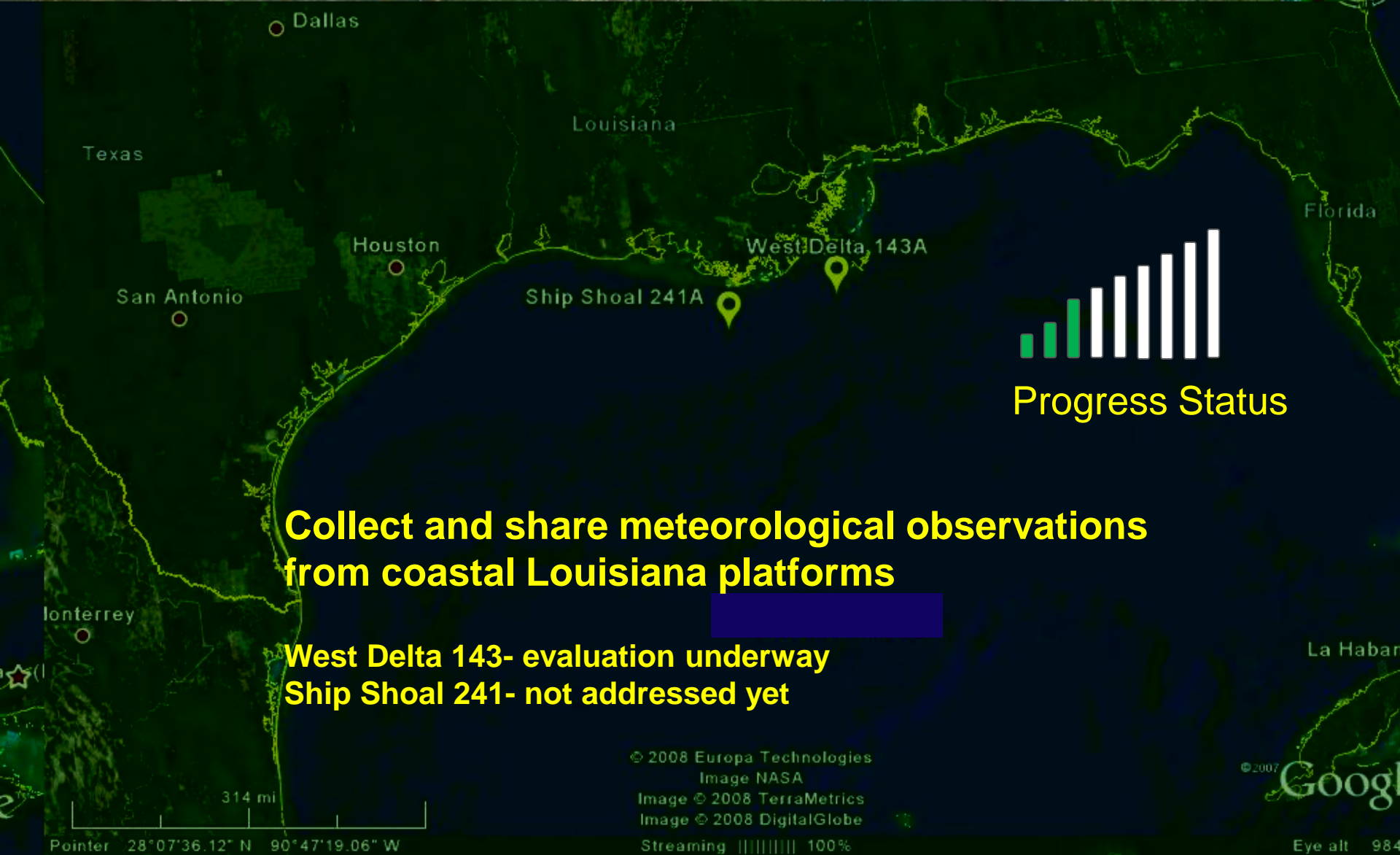
Update ocean wave and current instrumentation to include GOES transmitter and battery backup

Auger, Perdido, Mars- WaveX installed-data validation underway

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Progress Status

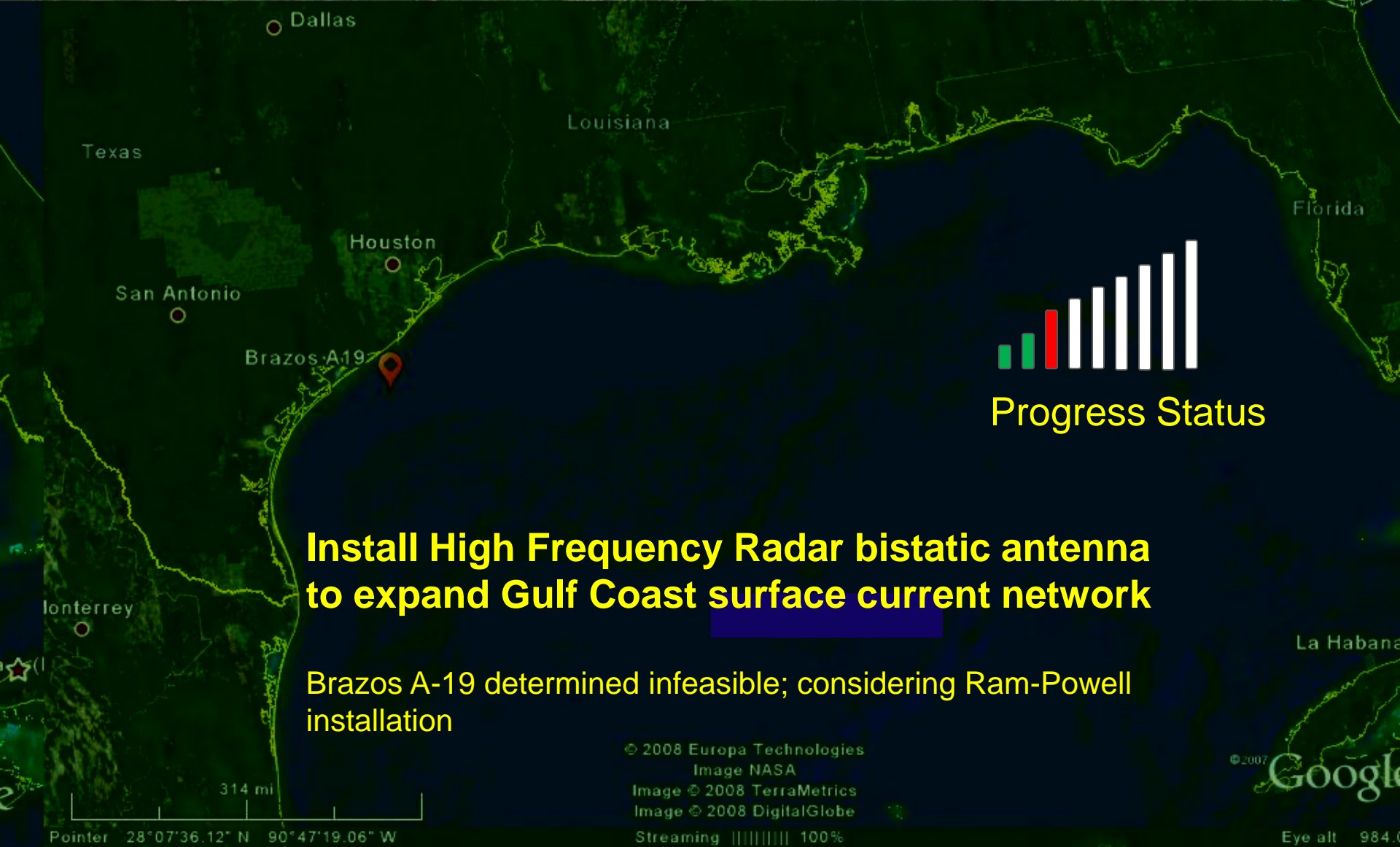
Collect and share meteorological observations from coastal Louisiana platforms

West Delta 143- evaluation underway
Ship Shoal 241- not addressed yet

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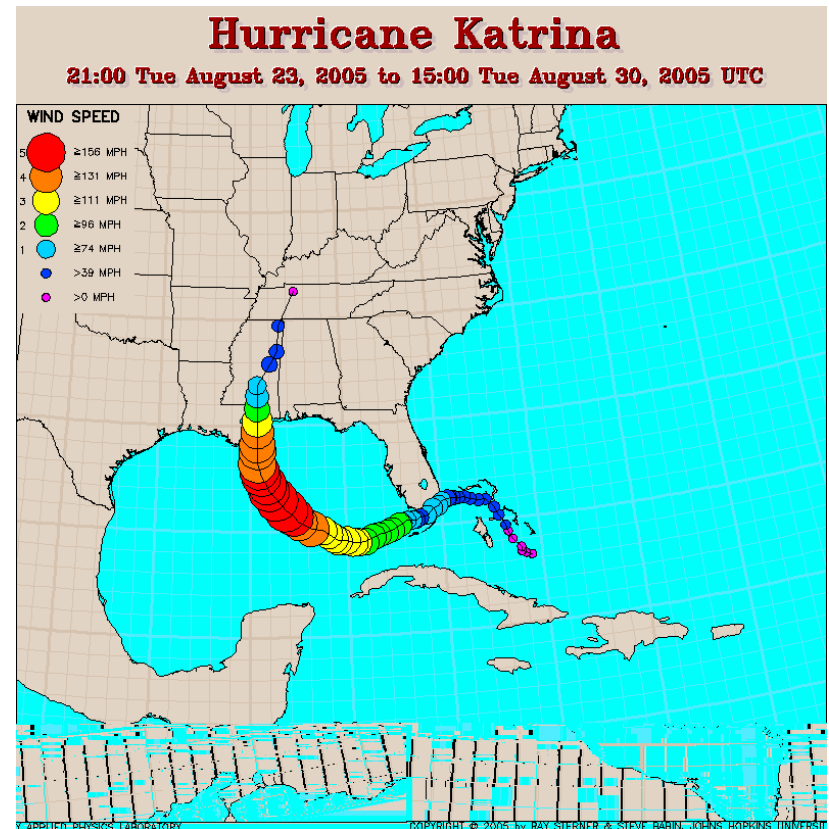
Install High Frequency Radar bistatic antenna to expand Gulf Coast surface current network

Brazos A-19 determined infeasible; considering Ram-Powell installation



Hurricane Intensity – Upper ocean heat content

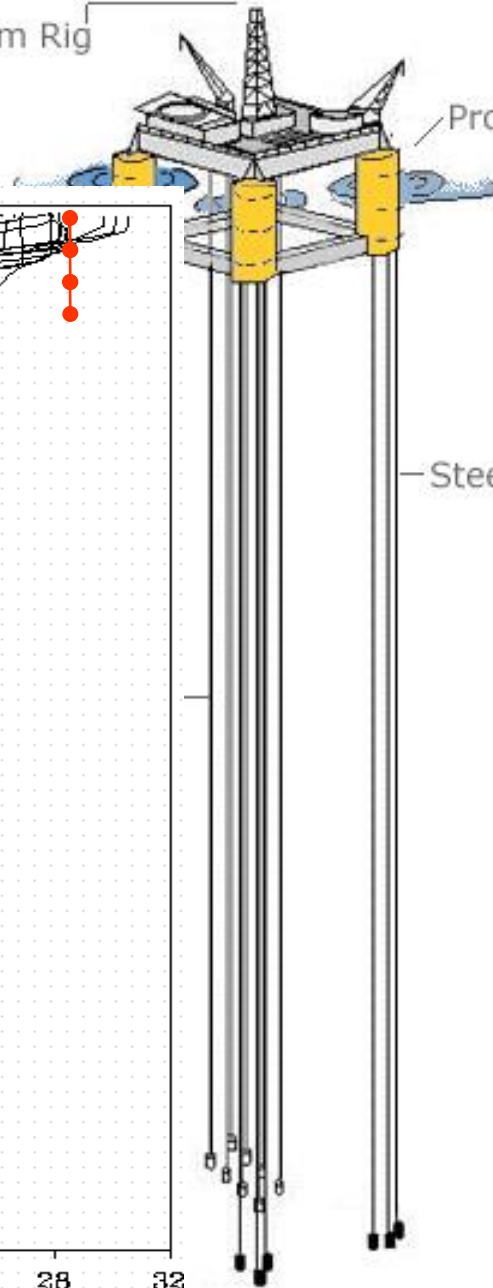
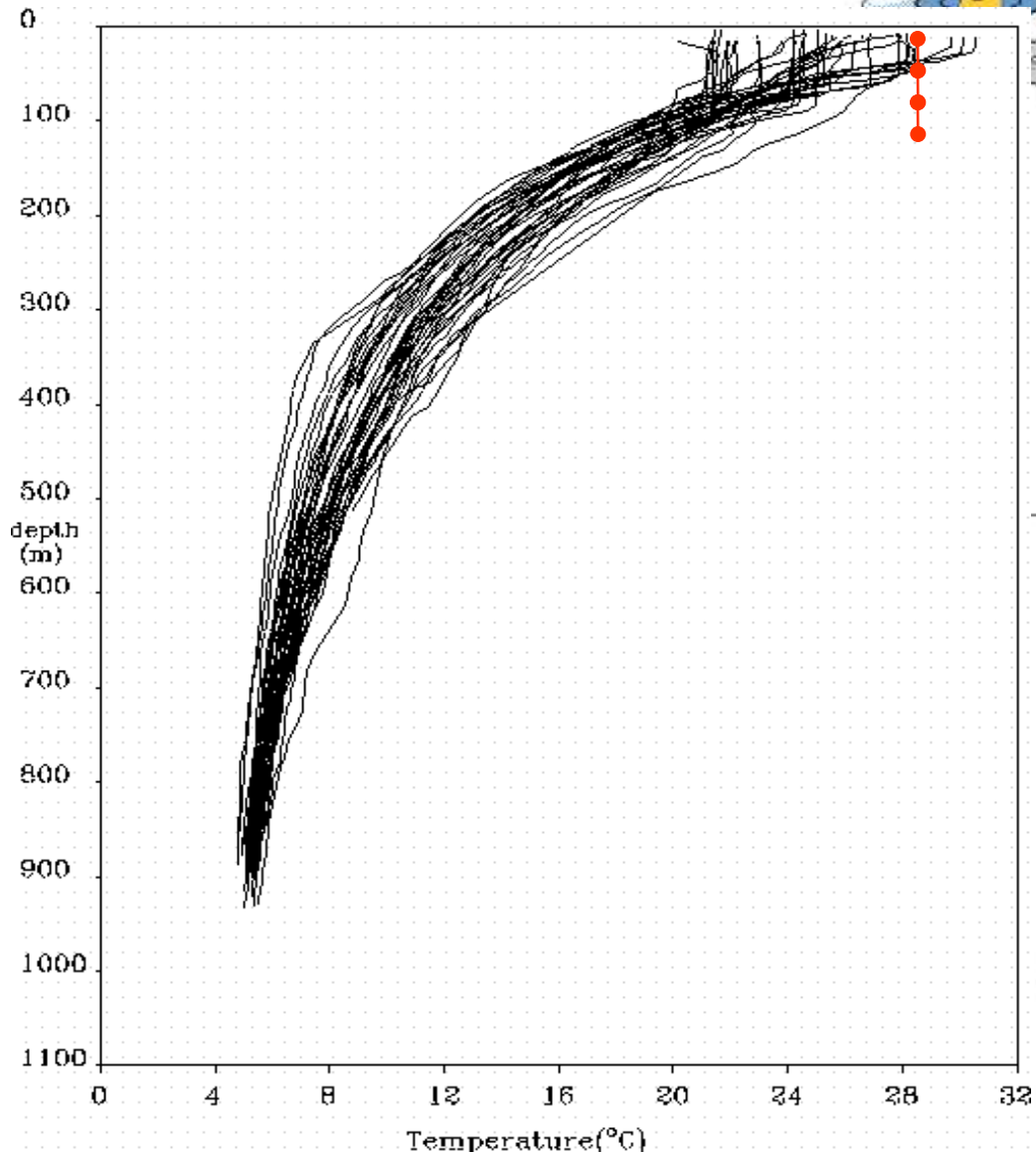
- Hurricanes acquire some of their energy from the upper ocean
- The Loop Current and Loop Eddies provide a deep source of heat for hurricanes
- After intensifying over the Loop Current, Hurricane Katrina weakened as it approached Louisiana, was it due to leaving that deep source of heat?



Skiddable Platform Rig

Production Facilities

Steel Pipe Tendons

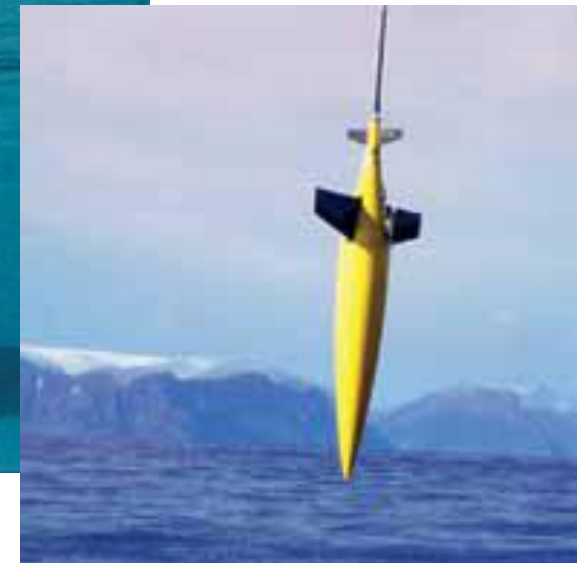
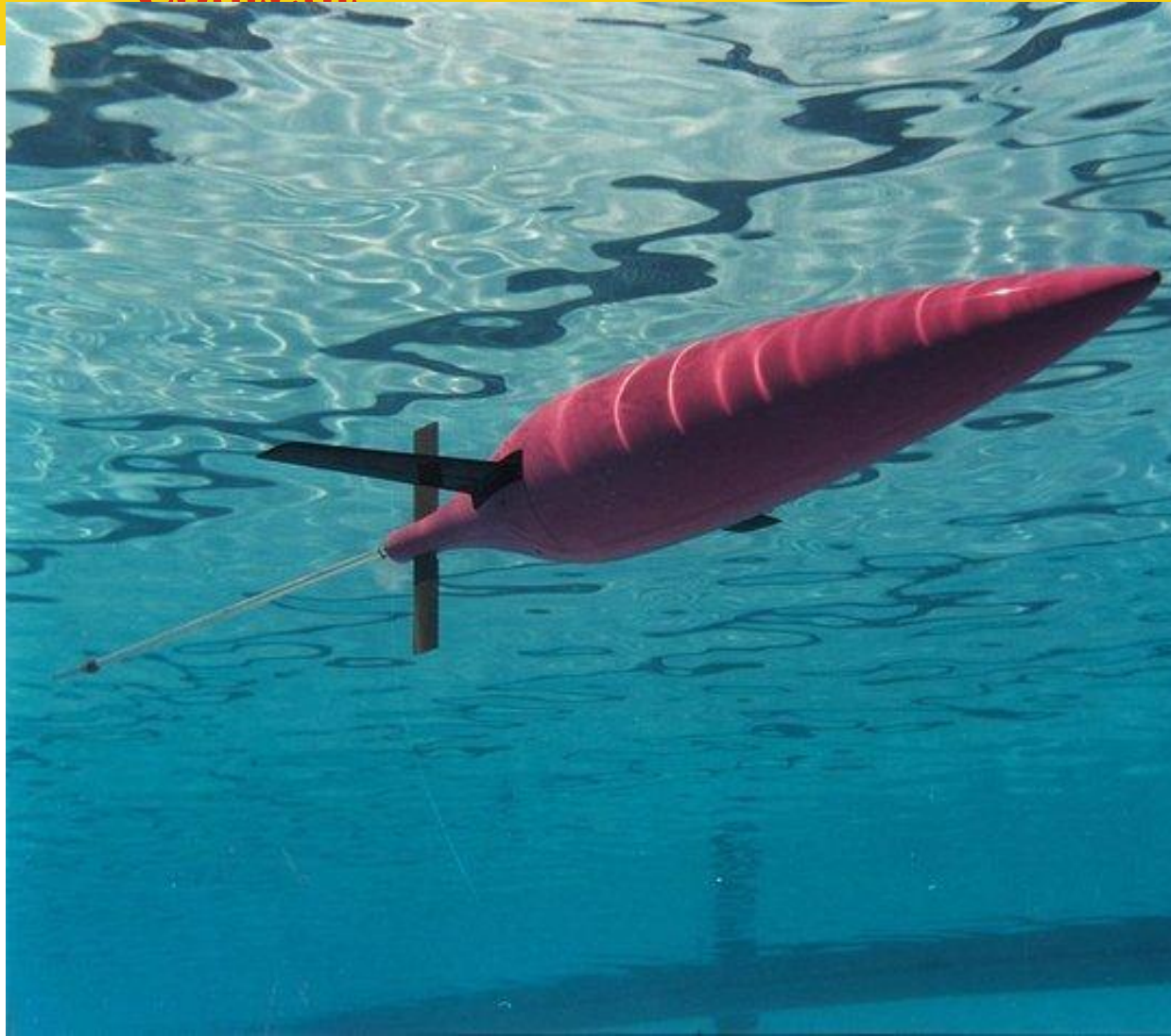




Collect and Share Measurement of “Upper Ocean Heat Content” from a tension leg platform

Auger and Brutus infeasible; Evaluated on new installation Mars B; Pursuing alternative technology

Using SeaGlider Technology-Upper Ocean Heat Content



Using SeaGlider Technology-Upper Ocean Heat Content

- iRobot IKA Seaglider System
 - Conductivity and Temperature Sensors
 - Colored Dissolved Organic Matter
 - Chlorophyll A
 - Dispersed Oil
 - Dissolved Oxygen
- Capable of diving 20 to 1000 meters
- NOAA scientists will pilot. Shell will own and maintain. Research missions will be developed collaboratively.



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