National Data Buoy Center

To provide a **real-time**, end-to-end capability beginning with the **collection** of marine atmospheric and oceanographic data and ending with its transmission, **quality control and distribution**.

**DATA COLLECTION**
- NDBC & other NOAA observations
- IOOS Partners Platforms
- Tsunami Warning Centers
- NDBC Mission Control Center
- Oil & Gas Platforms
- HF Radars

**DATA DELIVERY**
- Weather Forecast Offices/River Forecast Centers
- MADIS
- NWS Global Telecommunication System (GTS)
- NWS/NCEP
- Emergency Managers
- NOAA NESDIS (NCDC, NODC, NGDC)
- Public
NDBC Organization

National Weather Service
Office of Operational Systems

NDBC Director

SRQA Office

Mission Control
- Mission Control Center
- Information Technology

Operations
- Field Operations
- Production Engineering

Engineering
- Technology Development
- Mission Support Engineering

Support Services
- Logistics and Facilities
- Business Services

40 Full-time Civilians (NWS)

U.S. Coast Guard Liaison Office – 1 Lt & 4 CWO Bos’ns

NDBC Technical Support Contract – 90 Contractors
Pacific Architects and Engineers (PAE)
NDBC is a cradle to grave operation - It begins with requirements and engineering design, then continues through purchasing, fabrication, integration, testing, logistics, deployment and maintenance, and then with observations ingest, processing, analysis, distribution in real time.
109 met/ocean WX buoys – added 30 buoys through 2009
51 C-MAN stations
39 DART Tsunami Monitoring stations – added in 2008
55 TAO Climate Monitoring buoys + 4 current profiler moorings – added in 2006
Tsunami Monitoring Network

Deep-ocean Assessment and Reporting of Tsunamis (DART) - 39 Stations ~230 ship days at sea on charter vessels, and NOAA vessels
Paul Whitmore, Director of West Coast/Alaska TWC:
"It [DART] gave us quick verification of a major tsunami, and provided data which could be assimilated into the models to calibrate forecasts."

Dr. Stuart Weinstein, Deputy Director Pacific TWC: "Because the closest coastal station was knocked out of commission by the quake, it was the DART 21418 that gave the TWC's the first indications of the tsunami."
ENSO & Climate Monitoring Network

Tropical Atmosphere Ocean (TAO) - 55 Stations; 4 Ocean Current Profilers

~250 Ship days at sea allocated on NOAA vessels

TAO – PART OF GLOBAL CLIMATE “BELT”

Change in Weekly SST Anoms (°C)
21NOV2012 minus 24OCT2012
“The loss of cutter hours to support NDBC weather buoy maintenance activities results in declining availability of wind, barometric pressure, ocean waves and temperature observations from buoys that are critical for the National Weather Service’s marine forecast and warning products. Buoy outages negatively impact the accuracy of the forecasts, and also cause a gap in the “nowcasts” that have an effect on decisions made to protect life and property.” (NCEP/OCWWS Dec 2013)
Cooperative Observing Partner Platforms

3 Million Web hits/day

Active Buoy / C-MAN Station Sponsors
U.S. Coast Guard
NASA Kennedy Space Center
Army Corps of Engineers
EPA Gulf of Mexico Program

NOS/NWLon and other NOAA Obs

90 Oil and Gas Platforms

50 Observing Partners – 500 Platforms
NERACOOS
Stevens Institute (NJ)
Texas General Land Office
Louisiana State University
University of Connecticut
Louisiana Universities Marine Consortium
University of North Carolina
Skidaway Institute of Oceanography
Caro-COOPS
 Scripps Institution of Oceanography
Forrest Oil
Chesapeake Bay Observing System
Shell Oil
Monterey Bay Aquarium Research Inst
Oregon State University
Petrobas
University of Southern Mississippi

NDBC website is a portal for real-time observations from NDBC-operated buoys and stations and those from observing “partners”
National Data Buoy Center (NDBC) Strategic New Direction

Mission Control Center, Unmanned Systems, and SCOOP
NDBC Mission Control Center

- Real-Time 24/7 Situational Awareness with Cameras and AIS
- Active Counter-Vandalism Program with NWS IA, USCG, U.S. State Dept.
- Operation and Monitoring of Buoy Networks and Robotic Gliders
- Inter-Agency Partnership with Navy for Public Data Dissemination
- Increase Partnership Activities with IOOS Regional Associations
- First WMO RMIC; Strong International Activities and Partnerships
BuoyCAM “Snap Shots” – Mid Morning on July 8, 2014
Flag) Purse Seine Fishing Vessel
Monitored in Real-Time Vandalizing a TAO Buoy
Working with NWS IA and U.S. State

095W TAO Pressure Sensor Shows “tugs” on Buoy

095W Camera captured events 5/24/13 & 5/26/13

2S95W Camera captured the same or nearly identical vessel 5/27/13 & 5/28/13

AIS positions ceased 5/19/13

AIS positions resumed during return to port 6/2/13

NDBC Counter-Vandalism Program Success!
NDBC Multi-Agency Counter Vandalism Program

From Start to Success in 36 Months

NDBC Establishes Counter-Vandalism & Buoy CAM Objectives

First Trail Cam “Catch”

Fishing License Suspension & Crew Education

First Trail Cams Deployed on TAO

The “Catch”

From Start to Success in 36 Months

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Aug 10</td>
</tr>
<tr>
<td>2012</td>
<td>Feb 16</td>
</tr>
<tr>
<td>2012</td>
<td>May 20</td>
</tr>
<tr>
<td>2012</td>
<td>May 20</td>
</tr>
<tr>
<td>2013</td>
<td>May 24</td>
</tr>
<tr>
<td>2014</td>
<td>Aug 6</td>
</tr>
</tbody>
</table>

Enforcement!
Wave Glider Test and Evaluation
Shell SeaGlider

Operated in Gulf of Mexico for Shell by NDBC MCC since Summer 2012

- NDBC procured its own Profiling Glider in Jan 2014
National Data Buoy Center (NDBC)
Strategic New Direction

SCOOP
NDBC’s “Game Changer” for Ocean Observations

Enabled by Hurricane Sandy Supplemental
Self-Contained Ocean Observations Payload (SCOOP)

Present

Future...
• 600 + hrs Labor to Construct
• Complex, Multiple Systems
• Weighs 3800 lbs
• Can’t Field a 100% Tech Refresh in a Realistic Timeframe
• Vulnerable Electronics Opened in Field for Maintenance
• Requires Large, Expensive Ships to Service (> 175 ft)
• Minimum 6-8 hrs per Service Visit – Mission Aborts
• Lots of Opportunities for Mistakes & Failures
The *OceanOBS* Buoy - Tomorrow

**SCOOP Payloads**

- MET-1
- Waves
- DART
- Aux Power
- Special

**Modular “Empty” Buoy**

- Basic Unit (NDBC MET-1) Includes MET, Cameras, AIS, and SATCOM

- ~ 40 hrs Labor to Construct
- Simple, Modular Sealed Systems
- Weight – One Person can Lift and Emplace on a Buoy
- Deploy Immediately on old & New Buoys – 100% Tech Refresh in a few Years
- Units Leave NDBC Sealed and Calibrated – Never Opened in Field
- With Smaller “Empty” Buoy Family – More Options for Deployment with Many Vessels
- Service Visit in Less than 30 min – Significant Reduction in Mission Aborts
- Lack of Opportunities for Mistakes & Failures – due to Sealed Units
- Same Unit goes Anywhere – on Legacy or New Buoys, C-MAN Towers, Ships, Land,…….
Legacy WX Buoy Electronics Payload vs SCOOP Prototype
Phase 1 – Pre-SCOOP Prototypes Already Built & Deployed

**GEN 1 BuoyCAM & Smart Weather Station**

**NOAA National Data Buoy Center**
**Observing Systems Branch**

**Technical Note**

**DART MET & Camera System**

June 2013

NDBC completed a prototype integration of its Smart Weather Station and buoy Camera onto a DART hull. This tech note provides a brief overview of the system and project.

Background
Previously the Smart Weather Station (SWS) was developed for quick easy installation of a basic meteorological observation system on buoys. The first generation (Gen I) Camera was developed to increase situational awareness of vandalism events in the TAO array. NDBC management reported that the

This same design has been deployed in the TAO array and has performed very well.

The Camera system acquires a composite image from the five individual cameras to form a panoramic image covering 300 degrees. The composite images are acquired at minutes 20, 40, and 60 of each hour that it’s enabled. The present design configuration is from 13 to 3 UTC or about 5:00 AM to 7:00 PM local Alaska Daylight time. At the top of each hour, a low resolution version of the last acquired image is transmitted to NDBC via Iridium satellite transmission (uses DOD RUDICS).

The Mission Control Center (MCC) can send a command via SBD to the camera system to acquire the high

Gen 1 **BuoyCAMs and Smart Wx Stations Deployed on Wx and DART Buoys in 2012/13**
Generation 1 BuoyCAM in Shipping Case

Generation 1 BuoyCAM and MET on DART Buoy

SCOOP Critical Design Review Mock-Up
MCC Operates 24/7/365

High Bay Fabrication

Wind Tunnel & Environmental Chambers

Machine Shops

National Data Buoy Center
Facilities at SSC, MS

Electronics Labs

Sensor Testing & Cal

Paint & Sandblasting

In-Water Testing
Thank you!

NOAA National Data Buoy Center