SCOOP
New Ocean Observing System for NDBC

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## Self-Contained Ocean Observations Payload (SCOOP)

### Background - Typical NDBC Buoy Met Data

#### Continuous Winds

<table>
<thead>
<tr>
<th>TIME (HST)</th>
<th>WDIR</th>
<th>WSPD</th>
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<tbody>
<tr>
<td>8:30 am</td>
<td>ENE</td>
<td>20.2 kts</td>
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<tr>
<td>8:40 am</td>
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<td>20.0 kts</td>
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<tr>
<td>8:50 am</td>
<td>NE</td>
<td>19.8 kts</td>
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<td>9:00 am</td>
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#### Peak Gust during the measurement hour

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<tr>
<th>TIME (HST)</th>
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<tr>
<td>8:15 am</td>
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<td>25.3 kts</td>
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#### Previous observations

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<th>SwP</th>
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Self-Contained Ocean Observations Payload (SCOOP)

Future ...

Present
The Weather Buoy - Today

- 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
- Sub-Surface
- DART
- Special
- Aux Power

**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
SCOOP Architecture

- **Star type network**
- **Hub:**
  - Coordinates wireless network of modules
  - Interfaces to shore via Iridium SBD

- **BuoyCAM:**
  - Reports pictures by Iridium RUDICS
  - Iridium SBD modem for backup of wireless network

- Modules acquire, process, and send data to Hub(s)
Early Prototypes

*Generation 1 BuoyCAM in Shipping Case*

*Generation 1 BuoyCAM and MET on DART Buoy*

*One of First 15 SCOOP Units In Lab (Sept 2014)*
SCOOP Payload Mounted on a legacy 3m Weather Buoy Hull

SCOOP

Legacy

Need to add 1000 lbs ballast in hull to make Heavy enough

Weights > 4000 lbs & requires massive cranes
Prototype Deployments – Nov ‘15

Stern A-Frame Recovery

On-Deck Assembly
Prototype Deployments – Nov ‘15

Dockside Integrated Hulls

Port Crane Deployed
Prototype Deployments – Nov ‘15

SCOOPOP Retrofit

Stern A-Frame Redeployed
Eyes on the Ocean Environment

An Unanticipated Benefit of SCOOP

Ability to see images of waves, cloud cover, visibility, surface currents, ship traffic, fishing activities, and wildlife in the remote open ocean and coastlines promises to expand maritime domain awareness and environmental intelligence.

EXAMPLES

• Estimating Waves & Sea State from BuoyCAM Images
• Estimating Clouds & Visibility from BuoyCAM Images
• Estimating Surface Currents from BuoyCAM Images
Estimating Waves & Sea State from BuoyCAM Images

The Beaufort Scale & Guidelines for Visual Observations
BuoyCAM Images vs Instrumentation – Calm Seas

Significant Wave Height: 0.44 to 0.415 meters

Mostly swell wave

Picture taken halfway between the 13:00 and 14:00 UTC wave acquisition periods.
BuoyCAM Images vs Instrumentation – Rough Seas

Significant Wave Height: 2.864 to 2.462 meters

Large wind wave component, WSPD ~16.5 m/s

Picture taken halfway between the 17:00 and 18:00 UTC wave acquisition periods.
Estimating Clouds & Visibility from *BuoyCAM* Images

Variation of Ocean Color Vibrancy with small changes in Cloud Cover
Reducing Ocean Color to Gray Scale with Overcast Skies
Estimating Surface Currents from BuoyCAM Images

BuoyCAM Images of a Fairly Strong Surface Current “Wake”
Thank You..Questions ?