SCOOP:
The Future of NDBC Real-Time Data Collection and Reporting

National Data Buoy Center

Stennis Space Center, MS

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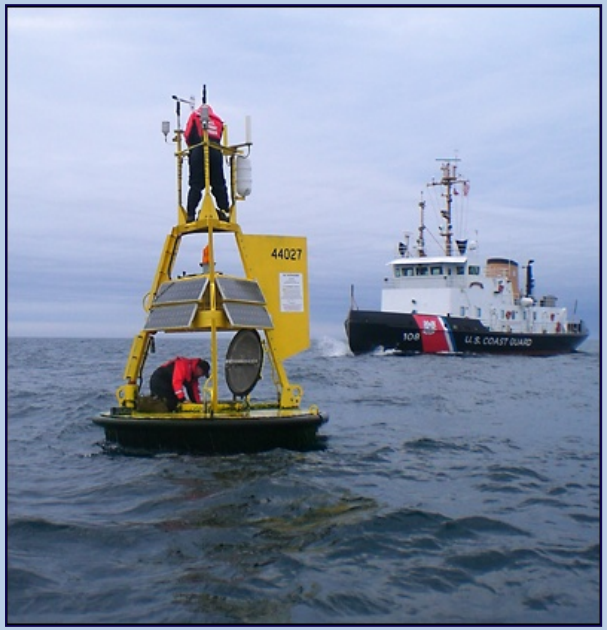
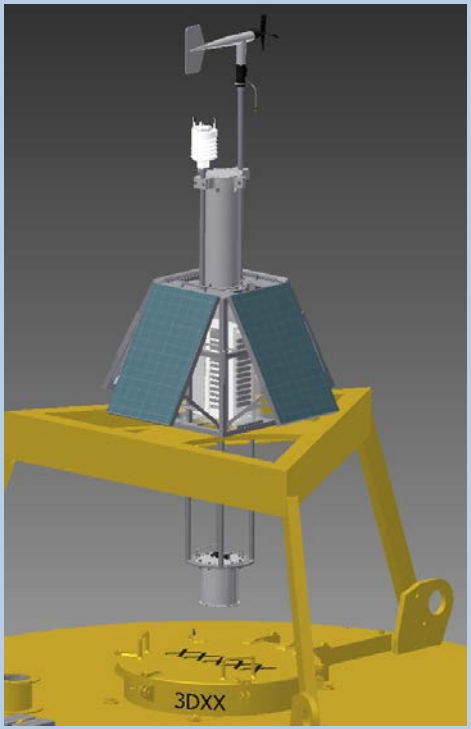
INMARTECH 2014, Corvallis Oregon

Self-Contained Ocean Observations Payload (SCOOP)

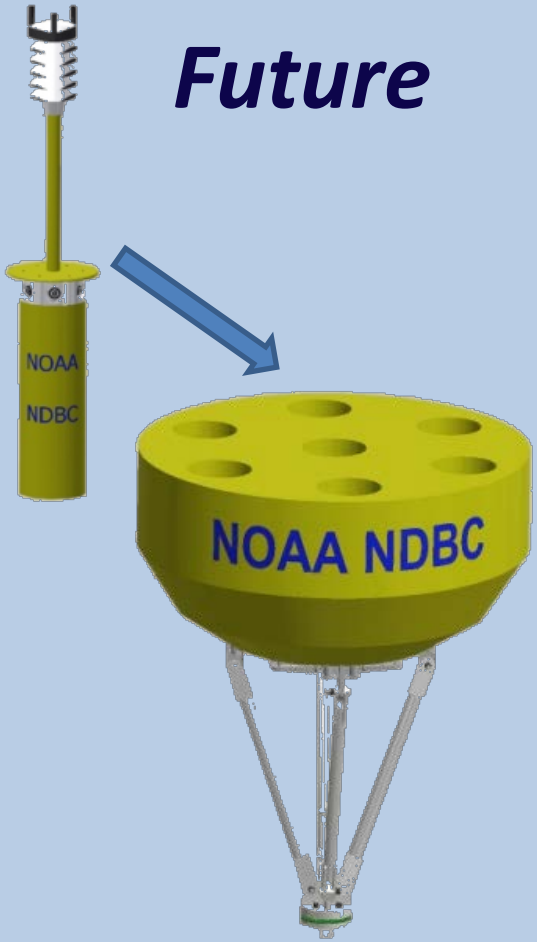
Past



Present

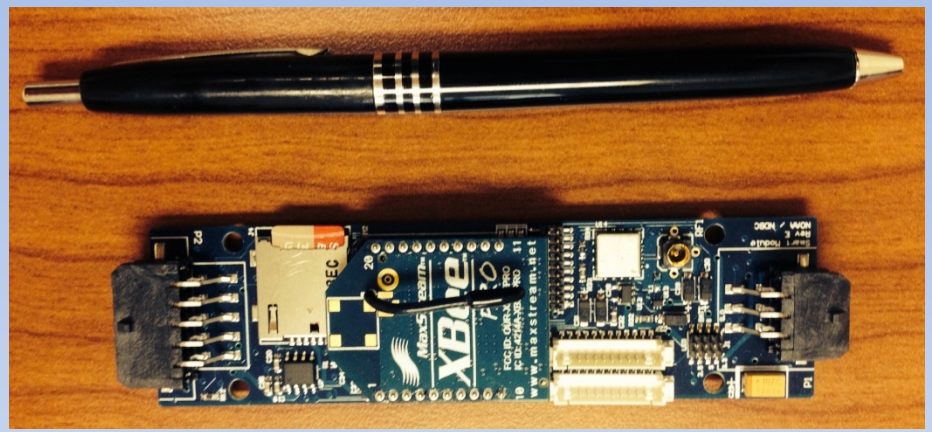


Future



Smart Module Board

*** Central building block of the electronics ****



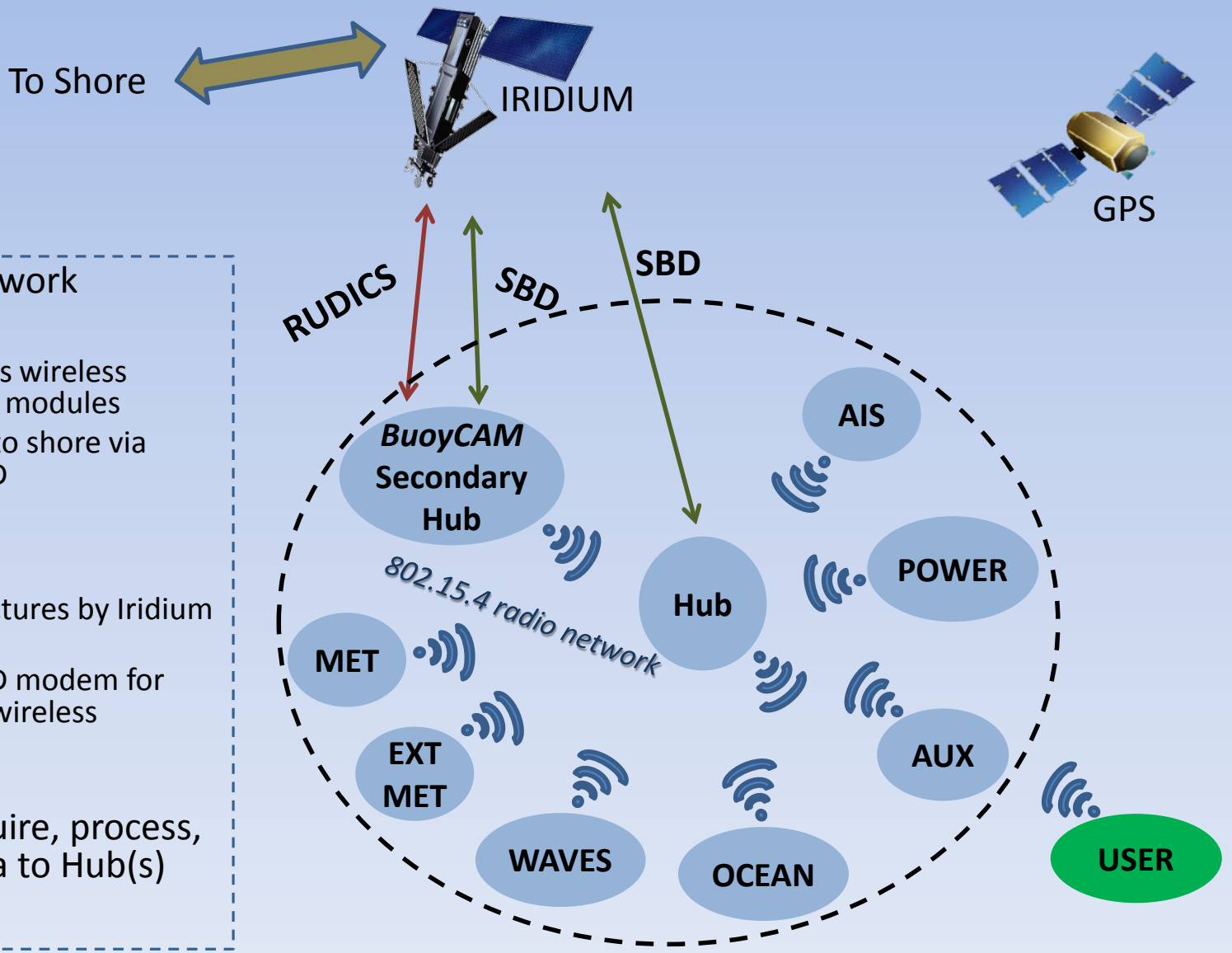
U.S. Patent Pending

Key Features

- GPS (time & position)
- Compass
- Iridium SBD modem
- 32GB storage
- IEEE 802.15.4 Radio (wireless network)
- Very low power (MSP430 processor)

**** Smart Modules interface sensor data to a central Hub (another Smart Module) to provide distributed processing and control of electronics ****

SCOOP Architecture



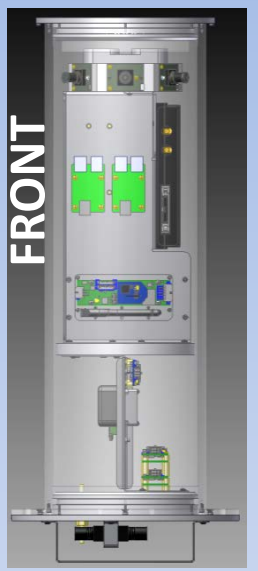
- Star type network
- Hub:
  - Coordinates wireless network of modules
  - Interfaces to shore via Iridium SBD
- *BuoyCAM*:
  - Reports pictures by Iridium RUDICS
  - Iridium SBD modem for backup of wireless network
- Modules acquire, process, and send data to Hub(s)

MET-*BuoyCAM*-AIS

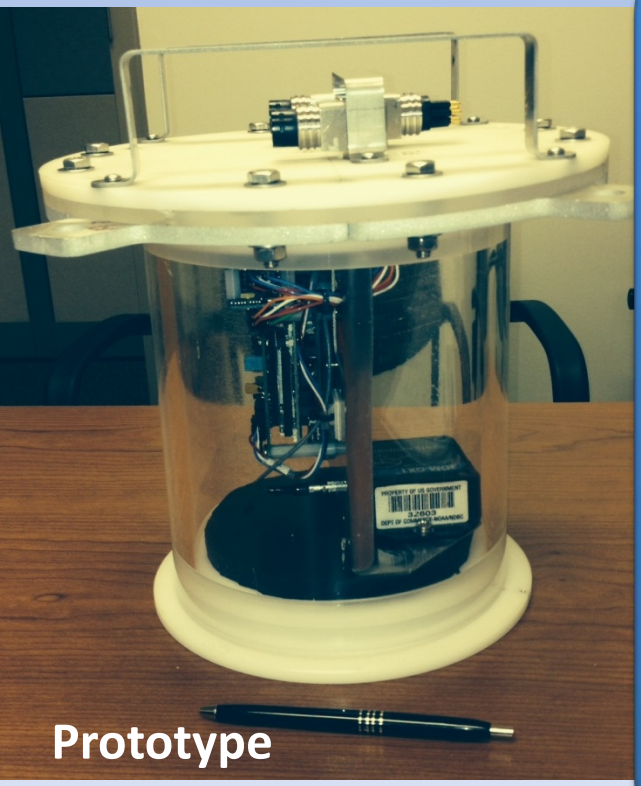
OBSERVATIONS:
- Winds, Pressure, Temperature, Humidity, AIS ship data, *BuoyCAM* - 360°
- RMY HD anemometer for high speed winds

ELECTRONICS:
- Iridium SIM-less (Observations)
- Iridium RUDICS (Pictures)
- 5, SMs provide distributed processing
- Linux computer for camera processing

CONSTRUCTION:
- All three antennas protected inside tube
- Acrylic Tube with skin cutouts for cameras
- Delrin end caps with O-ring seals
- Stainless Steel internal rack
- Design allows for MET only packaging
- 54” long, 28.5 lbs or 24” long, 16 lbs without masts



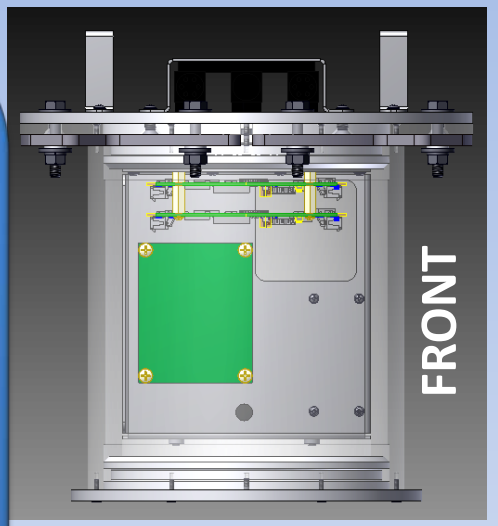
Wave & Ocean

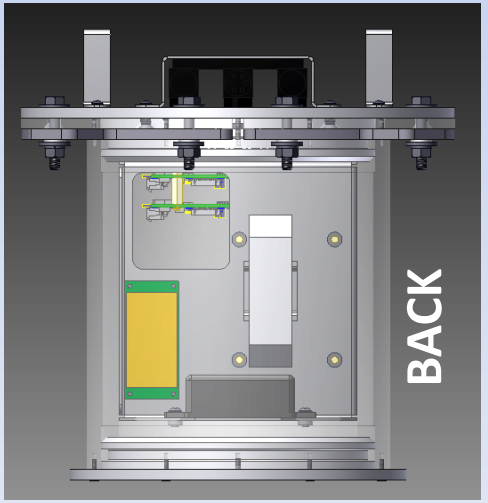


WAVES
- NDBC Directional Waves
- MEMS 9 axis motion sensor

OCEAN
- Sea Surface temperature
- 9 discrete depth observations
- BASIC: Thermistor array
- OPTION: Sea-Bird system

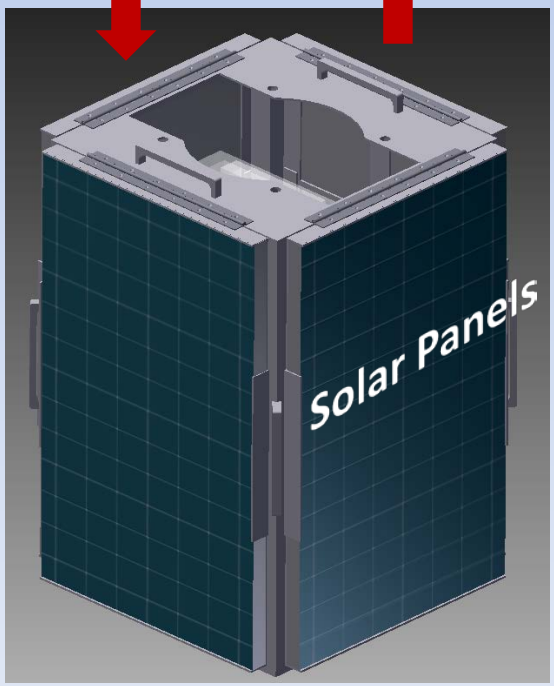
CONSTRUCTION:
- Same as ***BuoyCAM***-AIS-MET
- 10.5” long ; 9 lbs





Power System

Battery Pack

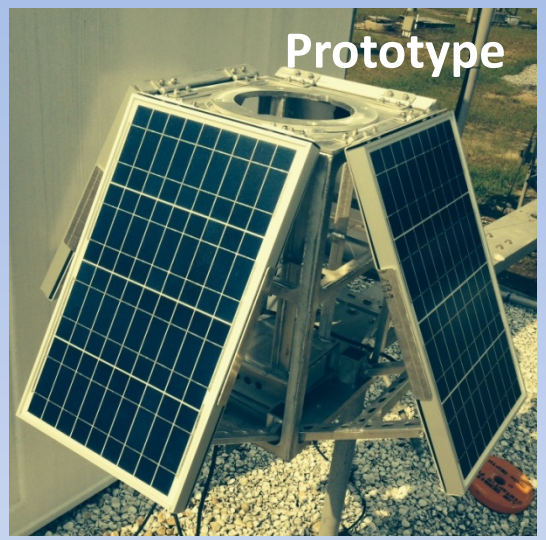


- Lithium Ion Rechargeable
- 10.9” x 9” x 4” battery pack
- 1339Wh capacity
- 10.8 Volts Nominal
- 4, 30 W solar panels
- Smart Controller for charging and system health

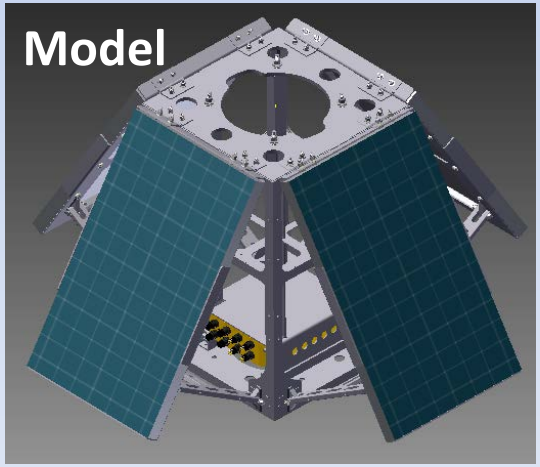
CONSTRUCTION:

- Aluminum frame
- 27” long x 20” Sq at 75 lbs
- Panels Collapse for shipping

Prototype



Model



System Changes with SCOOP

- Distributed architecture using NDBC's Smart Module technology
- XML data message format
  - Easier to read, well accepted industry standard
- Smaller compact sealed modular design
  - Easier to ship and handle
  - Allows at-sea service to exchange entire payload, not pieces/parts
  - No exposed antennas
  - Increased reliability
- All Iridium, no GOES – allows for transmit retries and backchannel access

Data Changes with SCOOP

- **Hub**
  - Coordinates processed data transfer from end devices
  - Handles Iridium Short Burst Data (SBD) transmissions of processed data
  - Provides time and position synchronization to end devices
  - Provides system configuration metadata
  - Handles backchannel access to end devices through Iridium
- **MET / Extended MET**
  - Data collected, processed and reported every ten (10) minutes to shore instead of hourly
    - Decreased data latency
    - Allows for minimal impact from dropped transmissions
  - COTS All-In-One MET sensor
    - Allows field evaluation of All-In-One sensors versus individual legacy sensors
  - Heavy Duty/High Speed RM Young Anemometer
    - Higher reliability and increased range

Data Changes with SCOOP

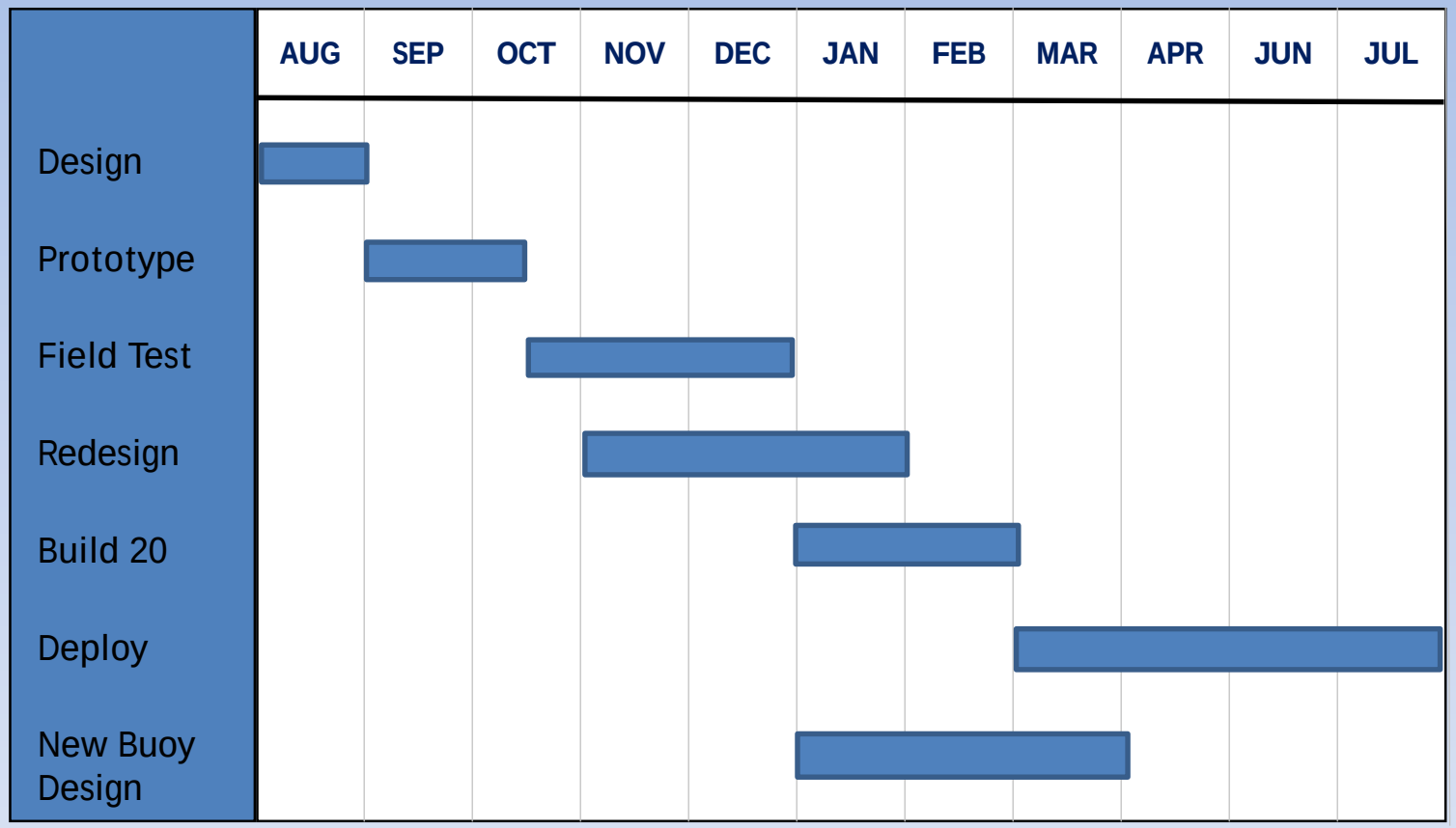
- **Waves**
  - Wireless network data transfer of current wave processor and sensor (initial deployments)
  - Linux processor with (lower cost/power) MEMS sensor(ongoing development)

- **Ocean**
  - MET sea surface temperature using serial Seabird sensor in bridle – Sampled and reported every 10 minutes
  - Digital Thermistor Array (Option #1) – Nine (9) nodes from 5m to 150 m depths – Sampled every ten minutes – Reported hourly – (Base Option)
  - Seabird Sensor Array (Option #2) – New to Weather Buoy fleet – Up to nine (9) sensors of configurable type (T, CT, TD, CTD) – Sampled every ten (10) minutes – Reported hourly

Data Changes with SCOOP

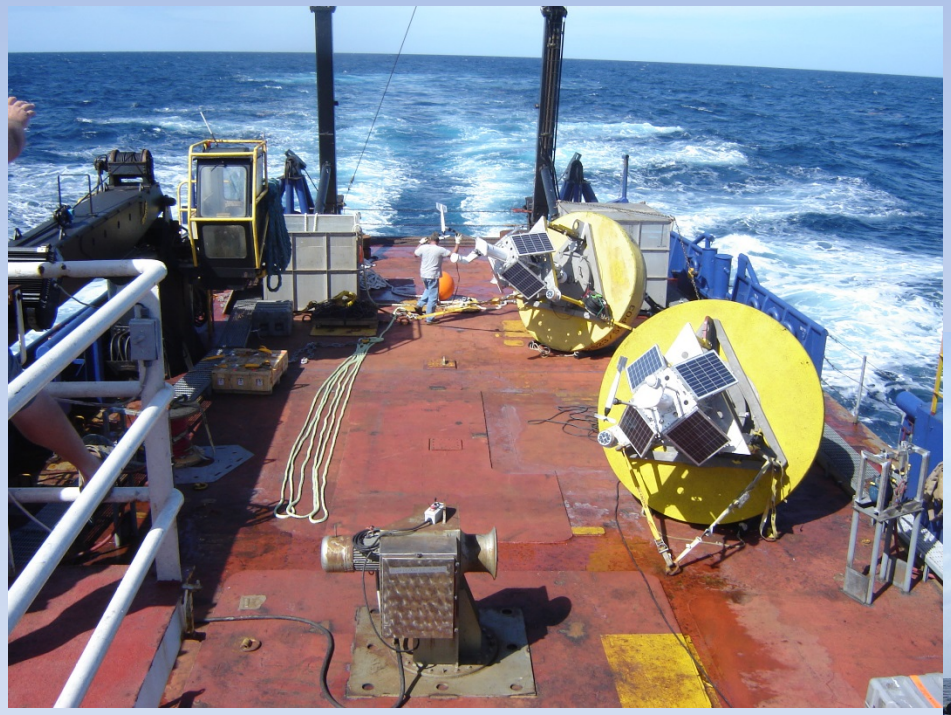
- **BuoyCAM**
  - 360° view (currently 300°) – Pictures every 5 minutes – One transmitted per hour
  - Serves as secondary transmitter
- **Automatic Identification System (AIS)**
  - Store and report first unique vessel/message type pairs over two (2) minutes every thirty (30) minutes
- **Auxiliary**
  - General module with RS-232 and analog interfaces
  - Used to interface 3rd party sensors and equipment
  - Return data through wireless network with minimal impact to NDBC systems
- **Power System**
  - Lithium-Ion Smart Battery/Charging System
  - Retrieve (via Smart Battery Bus (SMBus)) battery status (i.e. voltage, current, temperature) every ten (10) seconds and report statistics once per hour and an expanded statistics daily
  - Allows for better system health monitoring and remote power management

Project Timeline

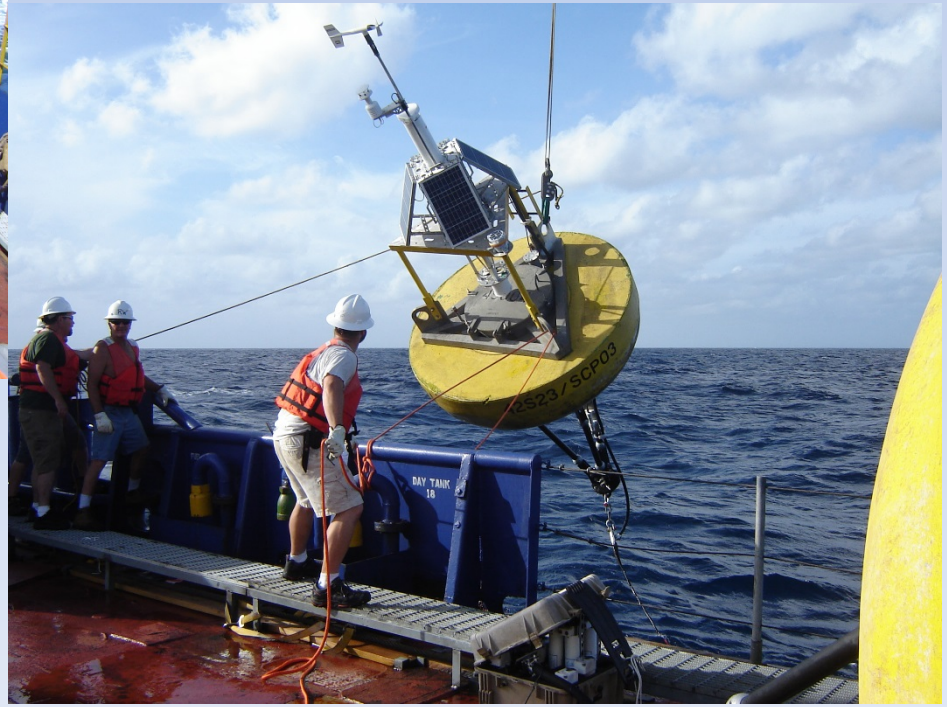


Prototype Deployments

Dockside Integrated Hulls



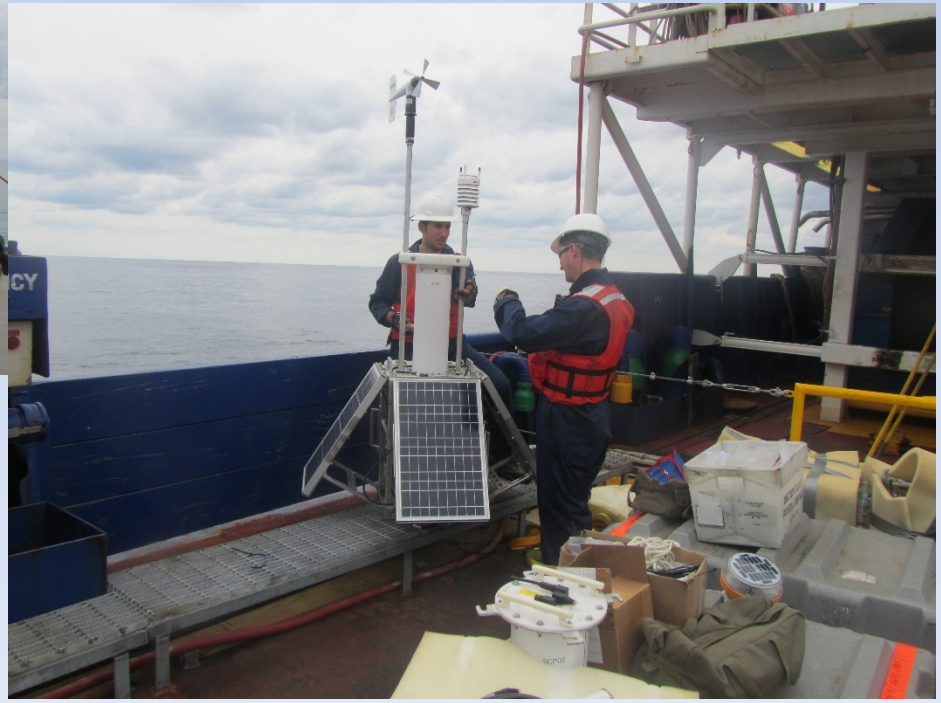
Port Crane Deployed



Prototype Deployments

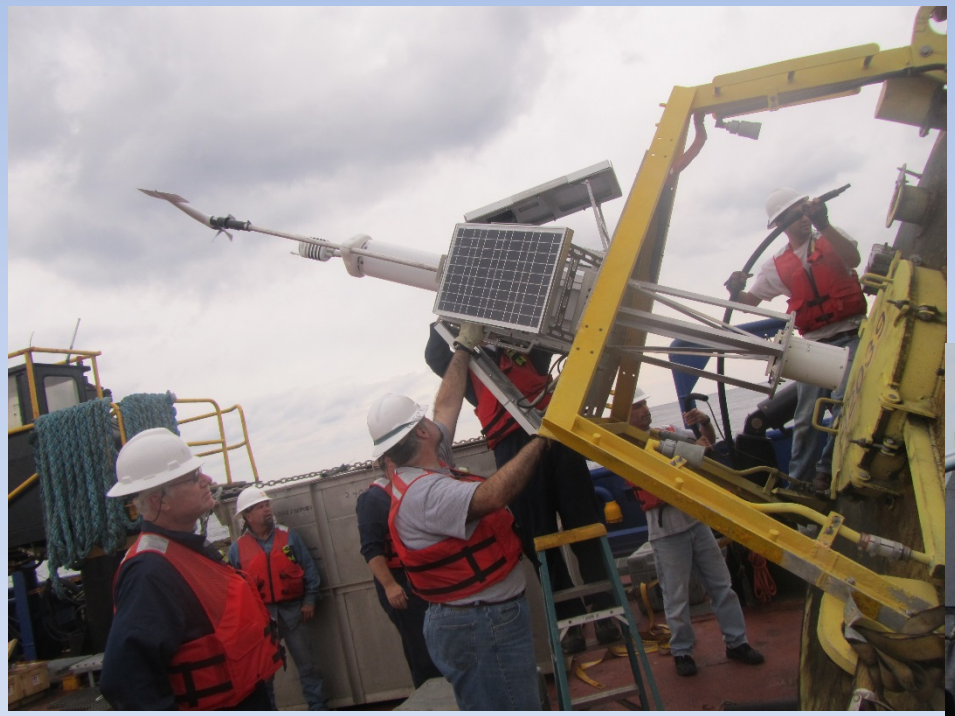
Stern A-Frame Recovery

On-Deck Assembly



Prototype Deployments

SCOOP Retrofit



Stern A-Frame Redeployed

Future Deployments

- *Install on all hurricane array buoys*
- *Install on selected weather buoy & C-MAN stations around coastal U.S.*
- *Continue collaboration with other organizations (WHOI, MBARI, Scripps)*

Thank You!

Questions?