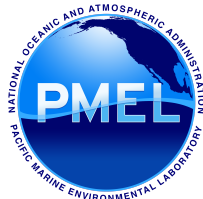


Engineering

To be given as handouts

Final
v. 8/22/2014

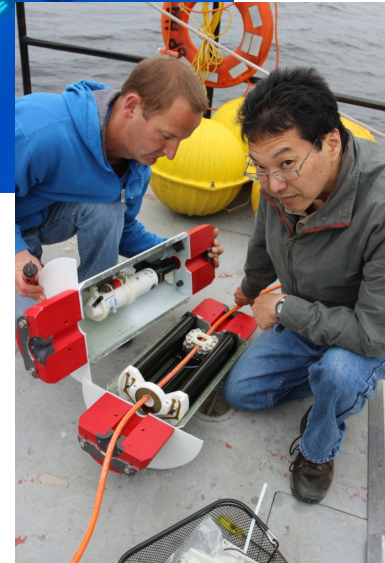
Christian Meinig



Engineering Background

Our mission is to push the limits of ocean observing platforms and sensors to advance NOAA research

- ⊕ Committed service group of ~18:
(Avg. PMEL tenure ~12 years)
- ⊕ Cross-trained in mechanics, electronics, software, manufacturing, science, sensors, leadership & mission management
- ⊕ Involved in >90% of the Lab's fieldwork
- ⊕ Customers: Ocean & Atmospheric Researchers, Program Managers, NOAA operations, Industry Partners



Background

Technology Innovators of the Tropical Moored Buoy Array, DART Array & Emerging Carbon Observatory

Opportunity?

- ⊕ Science drivers, mission requirements, fund raising
- ⊕ Technology Vision to meet Science Goals
- ⊕ Partnerships: Fostering productive relationships

Build

- ⊕ Engineering innovation & design
- ⊕ Prototypes
- ⊕ Field testing –local & full ocean depths
- ⊕ Transition Evaluation

Launch

- ⊕ Scientific evaluation & feedback
- ⊕ Fabrication, integration, deployment
- ⊕ Science & Engineering publications



Quality

Partnerships: Working together to build solutions

CRADAs:

- Battelle: pco2 system development (2012)
- Paros Scientific: ultra-low powered sensors (2012)
- Liquid Robotics: wave gliders for ocean science (2013)
- Saildrone: unmanned surface vessels/sensors (2014)

Patent Filings:

- “Mooring Cable for Transmitting Ocean Data” (2013)
-Jointly with Cortland Cable Inc.

Patent License:

SAIC DART & DART-ETD systems ('08-'14)

Special Studies Agreements:

DART-ETD technical transfer (2010)

DART-4G technical transfer (2014)

MOU's:

- US Intelligence Agency : Arctic Concept of Ops (2009)
- Australia BOM: Easy-to-Deploy Moorings (2010)
- UW-Regional Scales Nodes: Sub-sea volcano systems (2011)
- CSIRO: Buoy system development (2012)
- CSIR: Carbon Wave Glider transfer (2012)
- US Army Yakima Training Center: UAS Flight Operations (2010-2014)
- TE Subcom & Subpartners: Dual-use telecom repeaters(2014)

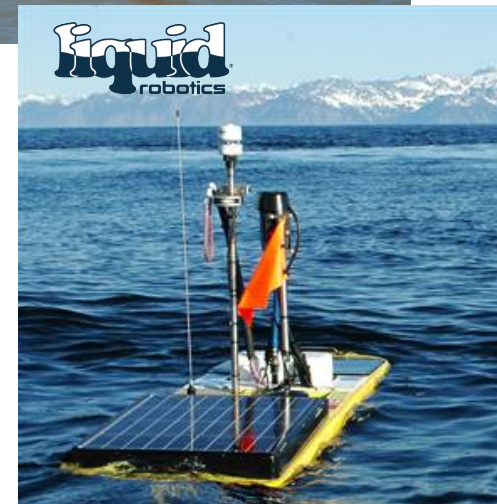
NOAA Tech Transfer Awards:

DART Tsunami Technology (2008)

pCO2 measurements (2011)



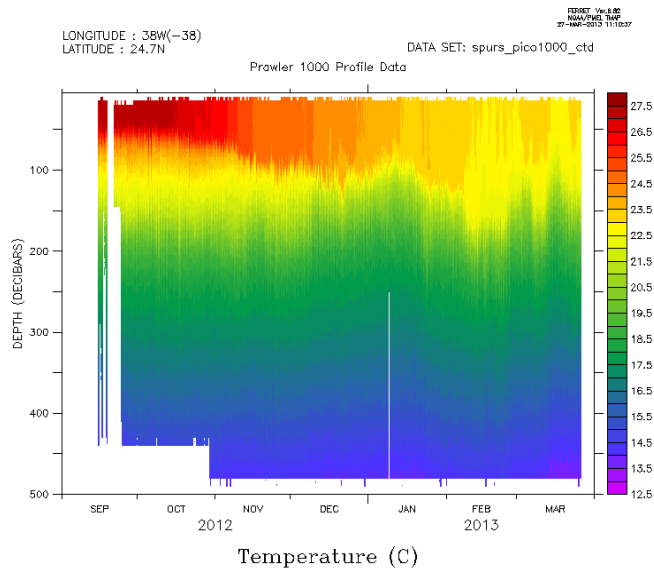
SAILDRONE



Quality: *Right tool for the right job*

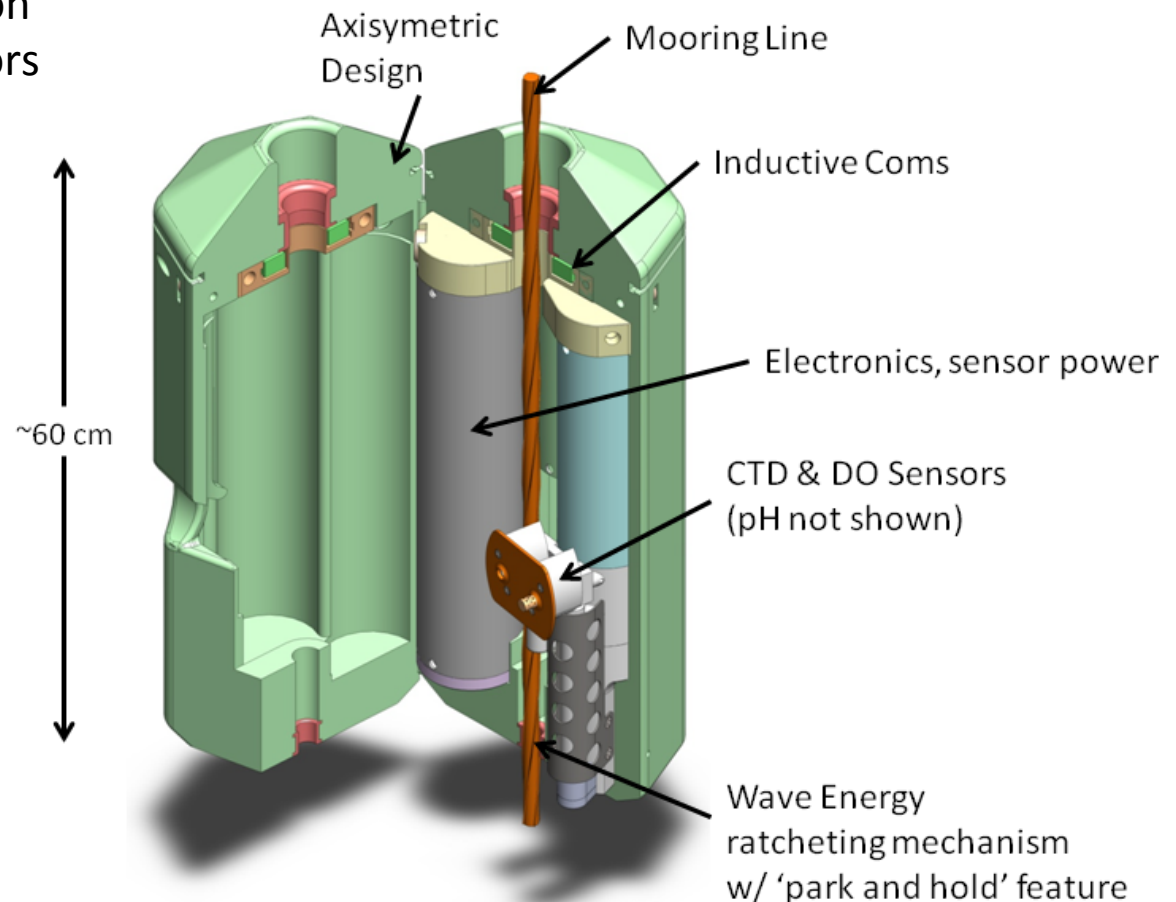
“PRAWLER”(Profiler+Crawler): Profiles on Mooring Lines

- Uses wave energy for locomotion
- CTD(proven), DO (testing) sensors
- Realtime communications
- 600m depth rating



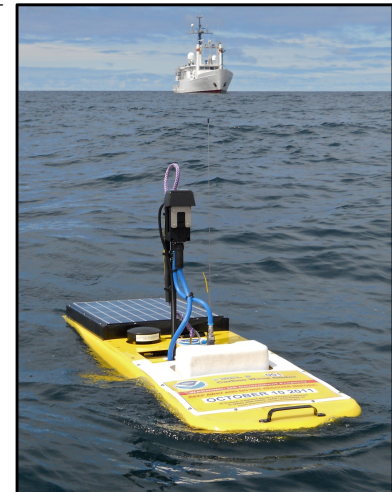
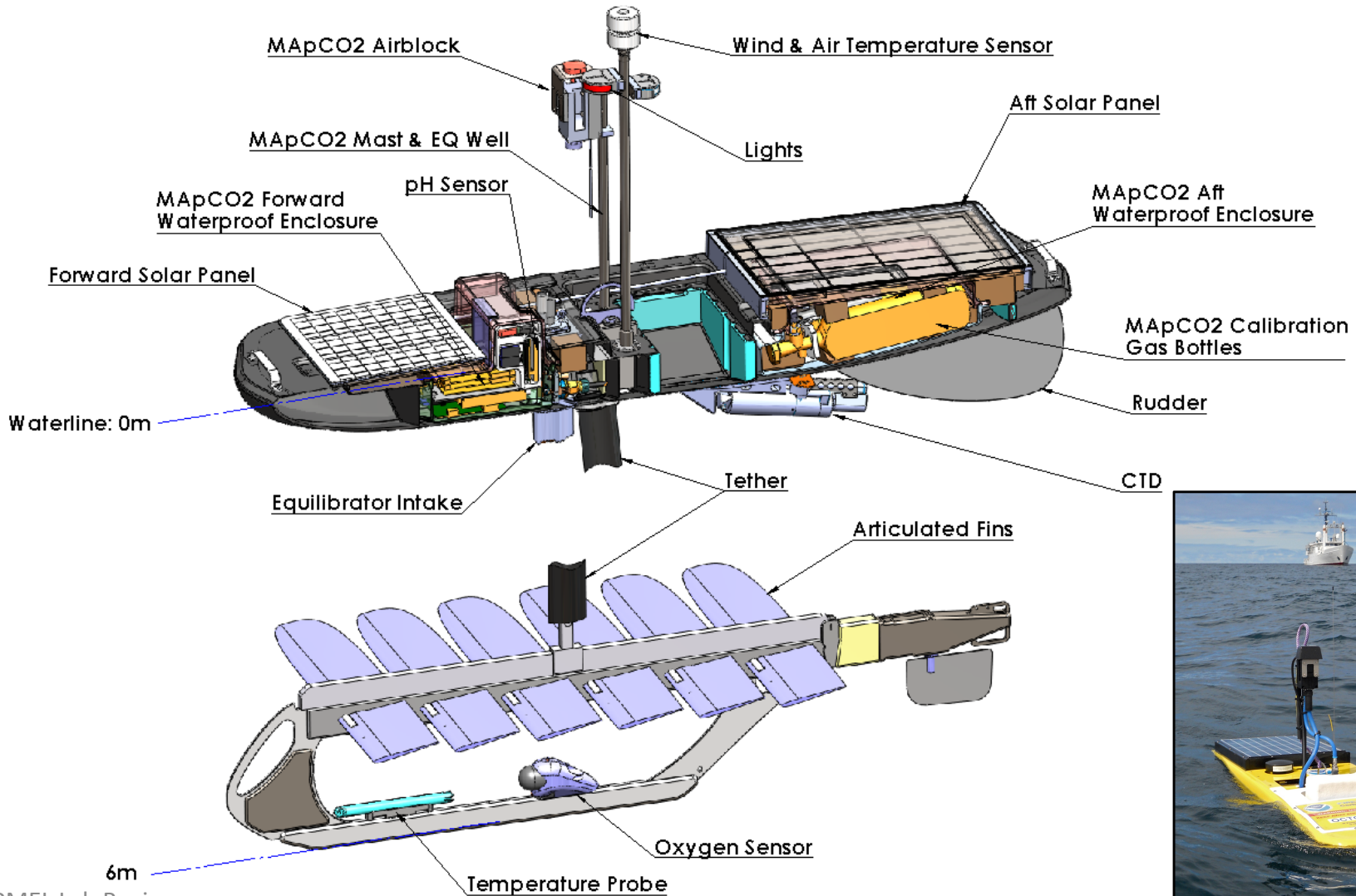
1500 profiles in 6 months

Carbon PRAWLER



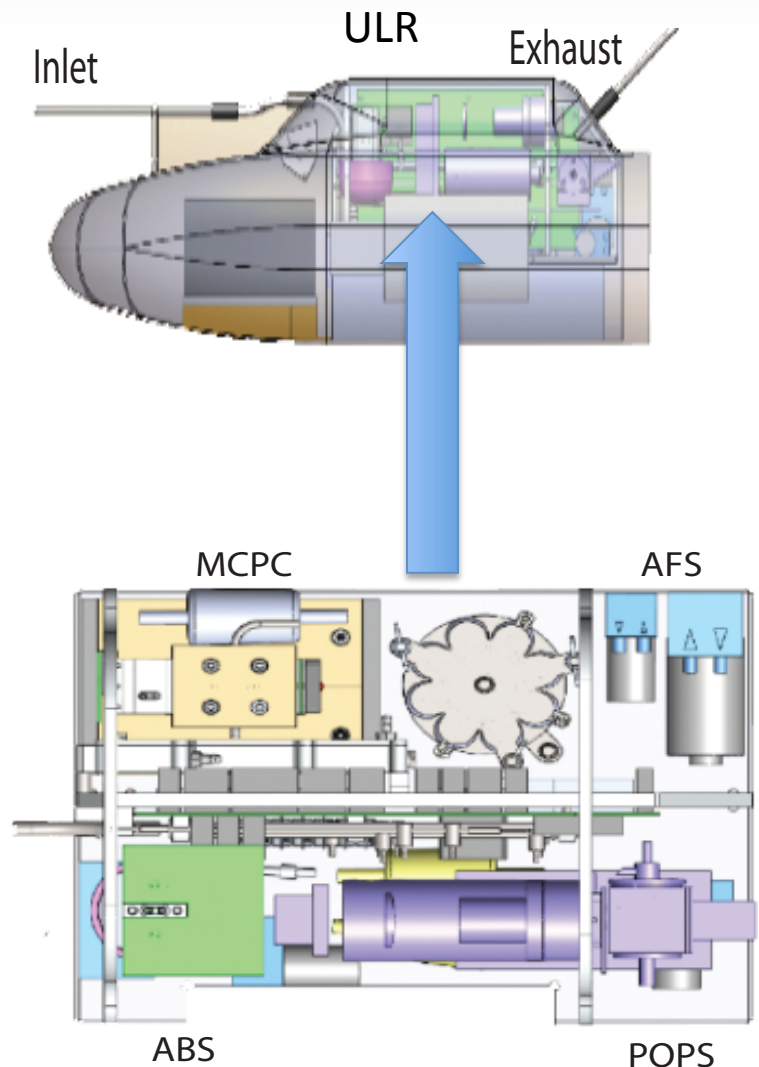
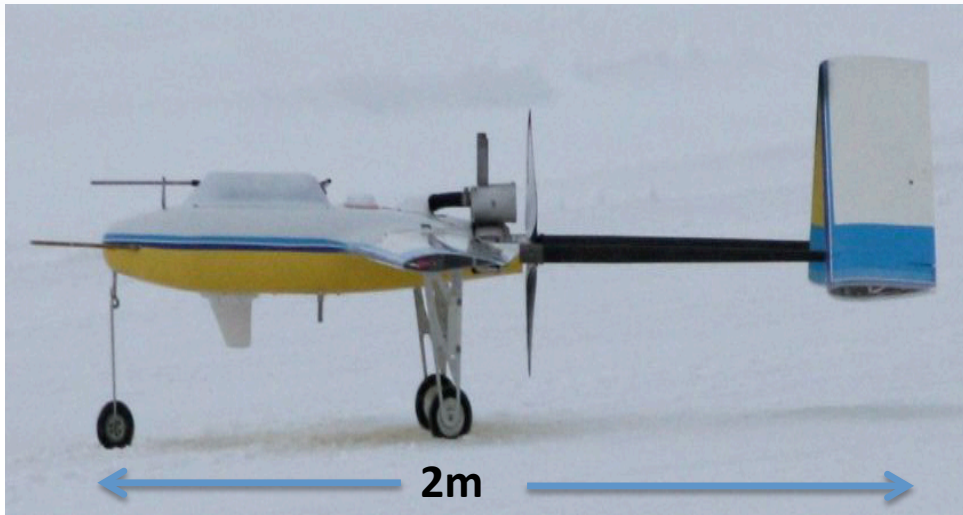
Quality: *Right tool for the right job*

Carbon Wave Glider: Unmanned Surface Vehicle



Quality: *Right tool for the right job*

MANTA UAS: NOAA/PMEL-ESRL/CSD Aerosol Sampler

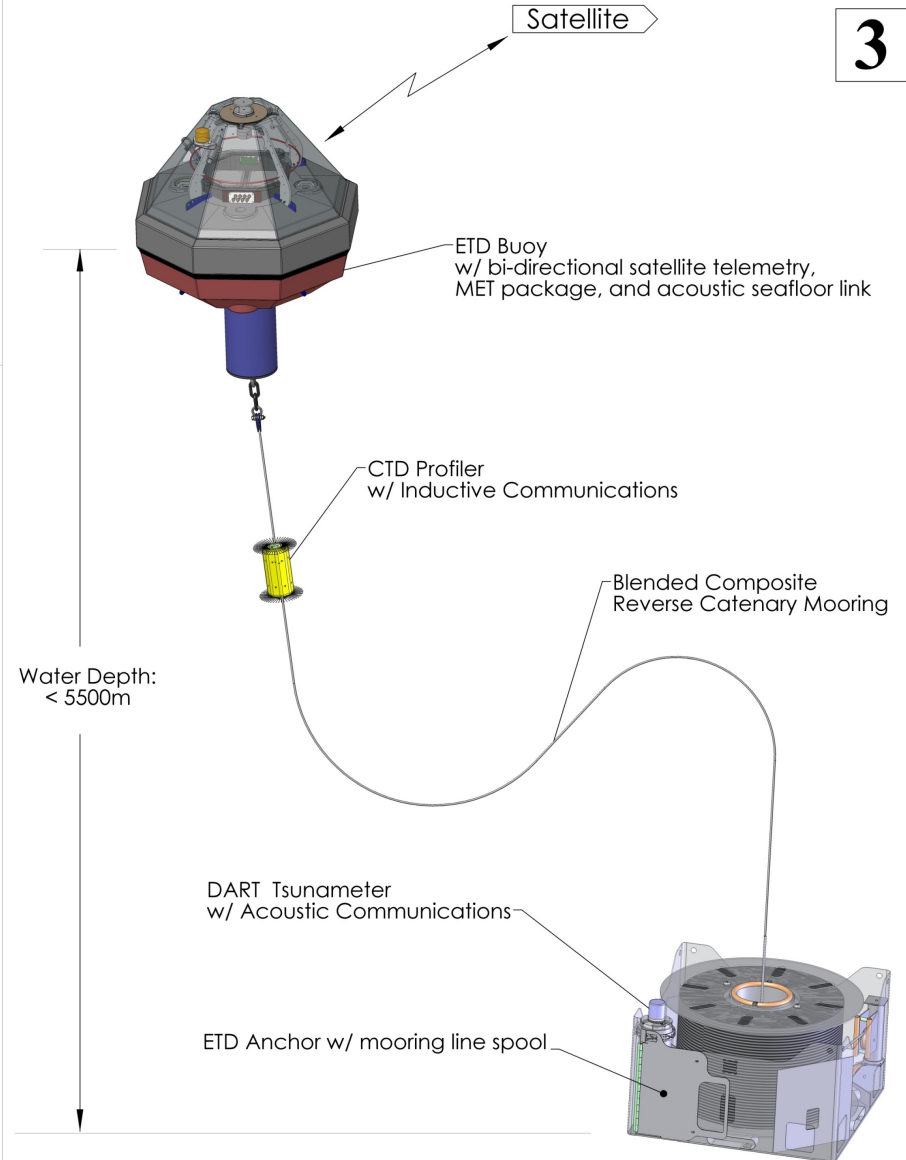
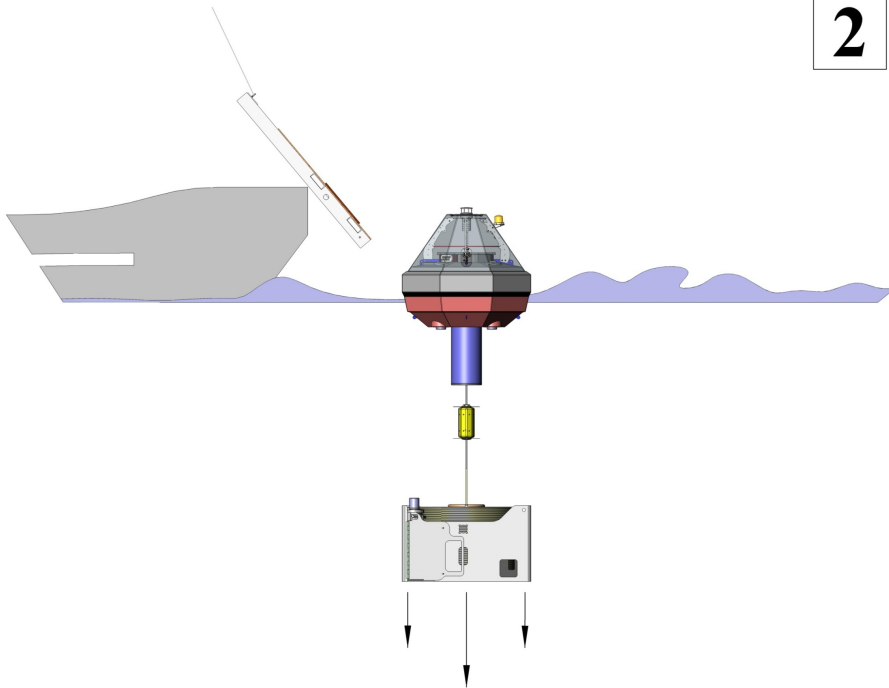
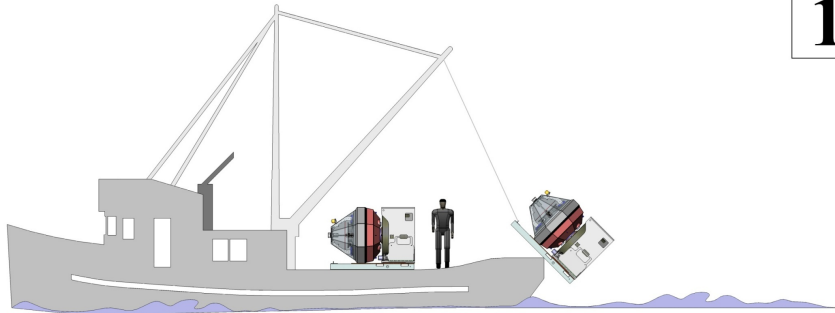


Partnering with Industry, Government & Academia:

1. Mixing Condensation Particle Counter (MCPC) -PMEL
2. Aerosol Absorption Spectrometer (ABS) -PMEL
3. Aerosol Filter Sampler (AFS) -PMEL
4. Printed Optical Particle Spectrometer (POPS) GAO-ESRL/CSD
5. Upward Looking Radiometer (ULR) Murphy –ESRL/CSD

Performance

Innovation coupled with global mooring array experience



Performance

Buoy Operations Cost Savings



- A typical 40' container has space for only 1-2 conventional moorings but can hold <20 ETD systems
- Simplified operations with smaller/cheaper vessels of opportunity

Performance

NOAA-PMEL Patent Licensed to Industry



**SAIC DART Total Sales >
\$30M '08-'13**

Future

Cost Effective & Innovative Platforms and Sensors to Provide Data for Important Science and Societal Needs

Engineering Trends:

- Organizational flexibility: Required to respond to needs & opportunities
- New Sensors: Ultra-low cost chip level sensors for ocean research
- Moorings are still important: Improvement endurance & reduce costs
- Increased automation: Realtime command & control; autonomous decision making
- ‘Robots Deploying Robots’



Bosch BME280
Temp, Pressure and RH
2.5mm x 2.5mm
3.6 μ A @1Hz

Observing Systems:

- Enhanced Arctic Observing System (< 5yrs)
 - Extremely challenging environment, shiptime expensive
 - Several vehicle developments underway
 - New low-cost moorings for large spatial coverage

