California Site Pre-Launch Experiment Plan

Yi Chao

Remote Sensing Solutions – RSS

June 29, 2018

Ocean In-Situ Cal/Val Experiment Objectives & Approach

Geodetic Objectives

- To validate the SSH error wavenumber spectrum

Approach

- To measure SSH directly

Oceanographic Objectives

- To validate the SSH representativeness of upper ocean dynamic height

Approach

- To measure hydrography (i.e., profiles of density or temperature and salinity)

Questions to be addressed by CA Site Pre-Launch Experiment

Geodetic Question

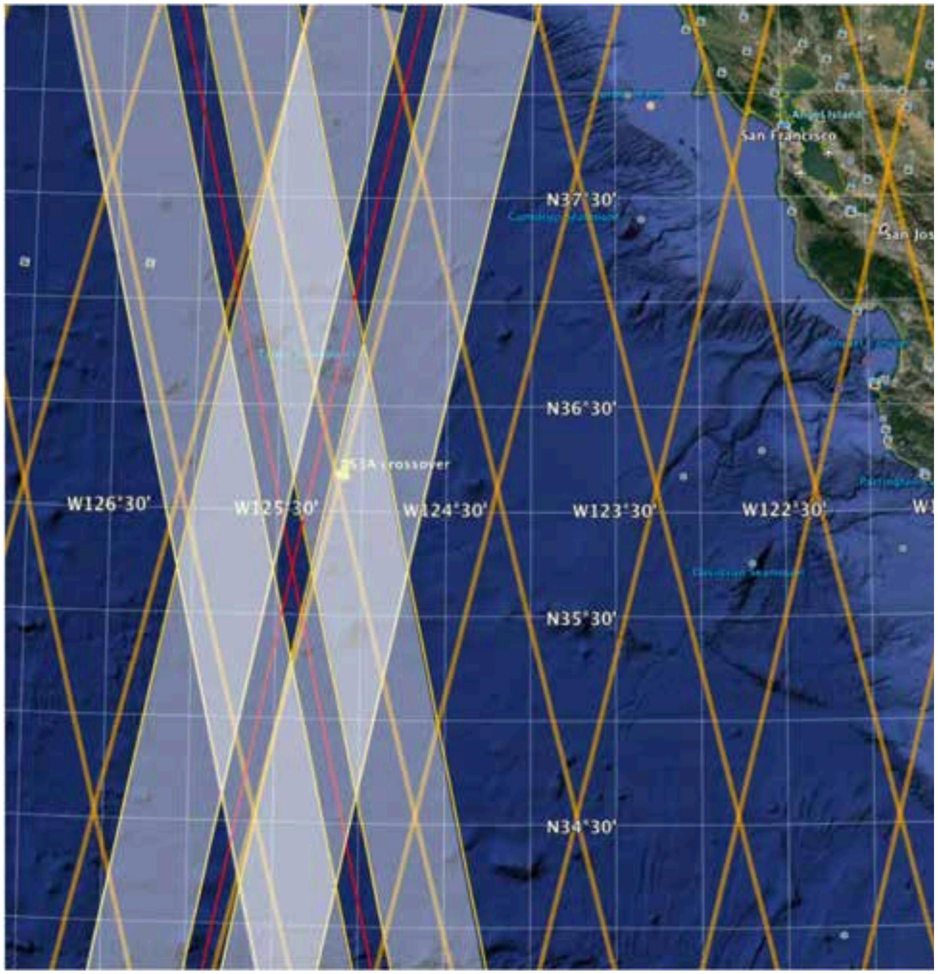
- Can we quantify the GPS SSH data accuracy when compared to BPR and DH at the CA cal/val site (more flat bottom)?

Oceanographic Questions

- How deep should the glider profile in order to represent the full-depth DH?
- Can the glider keep station?

CA Site Pre-Launch Experiment Jan-March 2019

SWOT & S3A tracks



- **Objectives**
  - How deep should be the profile of T/S in order to represent the full-depth DH?
    - One full-depth CTD mooring
  - Can the glider keep station?
    - Two Slocum hybrid gliders
  - Can we quantify the GPS SSH data accuracy when compared to BPR and DH at the CA cal/val site (more flat bottom)?
    - One GPS at the surface
    - One BPR at the bottom

Considerations for the Proposed Options

- Near real-time data
- Fixed time period (e.g., Jan-March 2019)
- Cost cap
- Cost sharing and leveraging

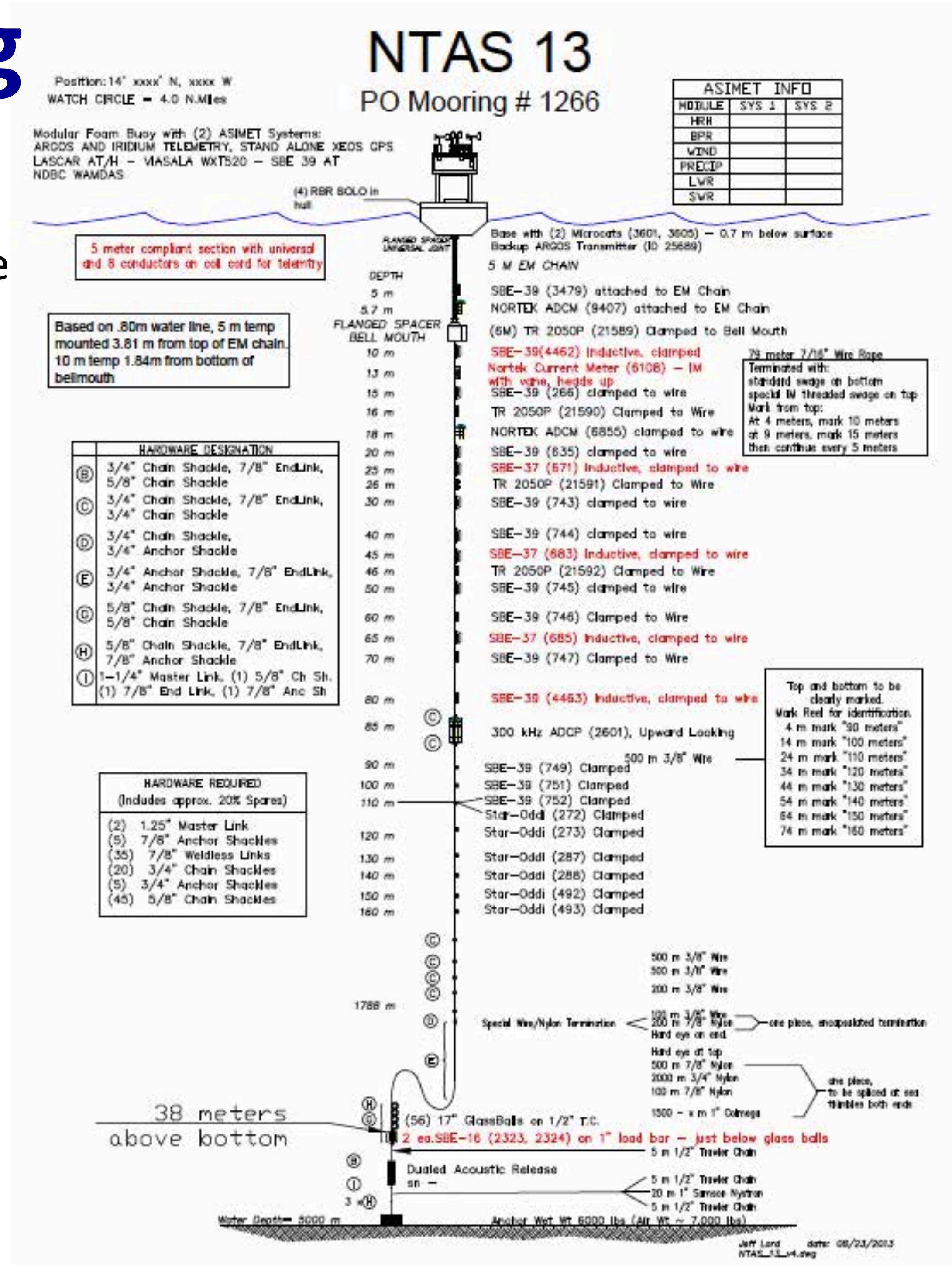
Proposed Instrument Choices

Objectives	Instrument	Data	Lead PI (Institution) Estimated Cost
How deep should the glider profile?	Full-depth CTD surface mooring (1)[1]	Continuous profiles of T/S from surface to 1700 m	Tom Farrar (WHOI) $275,000[2]
Can the glider keep station?	Hybrid Slocum glider (2)	Profiles of T/S from surface to 1000 m every 2 hours	Oscar Schofield (Rutgers) $125,000
How accurate is the GPS measured SSH when compared to BPR & DH?	GPS surface mooring (1) BPR (1) subsurface with real-time communication	SSH Bottom pressure	Chris Meinig (NOAA PMEL) $210,000[3]

[1]Alternative: A subsurface mooring with glider comm. from SIO/UCSD
[2]Leveraging from NASA SPURS funded hardware
[3]In-kind contribution ($95,000) from NOAA PMEL

Surface Mooring

- To be provided by Dr. Tom Farrar at WHOI with significant leverage from NASA SPURS.
- 30 CTDs above 1700 m with limited real-time telemetry (top 5 CTDs).
- Real-time telemetry for the five CTDs near the surface ($25k).
- Adding real-time telemetry for each additional CTD costs $5K, so there will be no real-time telemetry for the 25 CTDs below the near surface depths.
- The deployment and recovery of this surface mooring each require 8 hours of ship time.



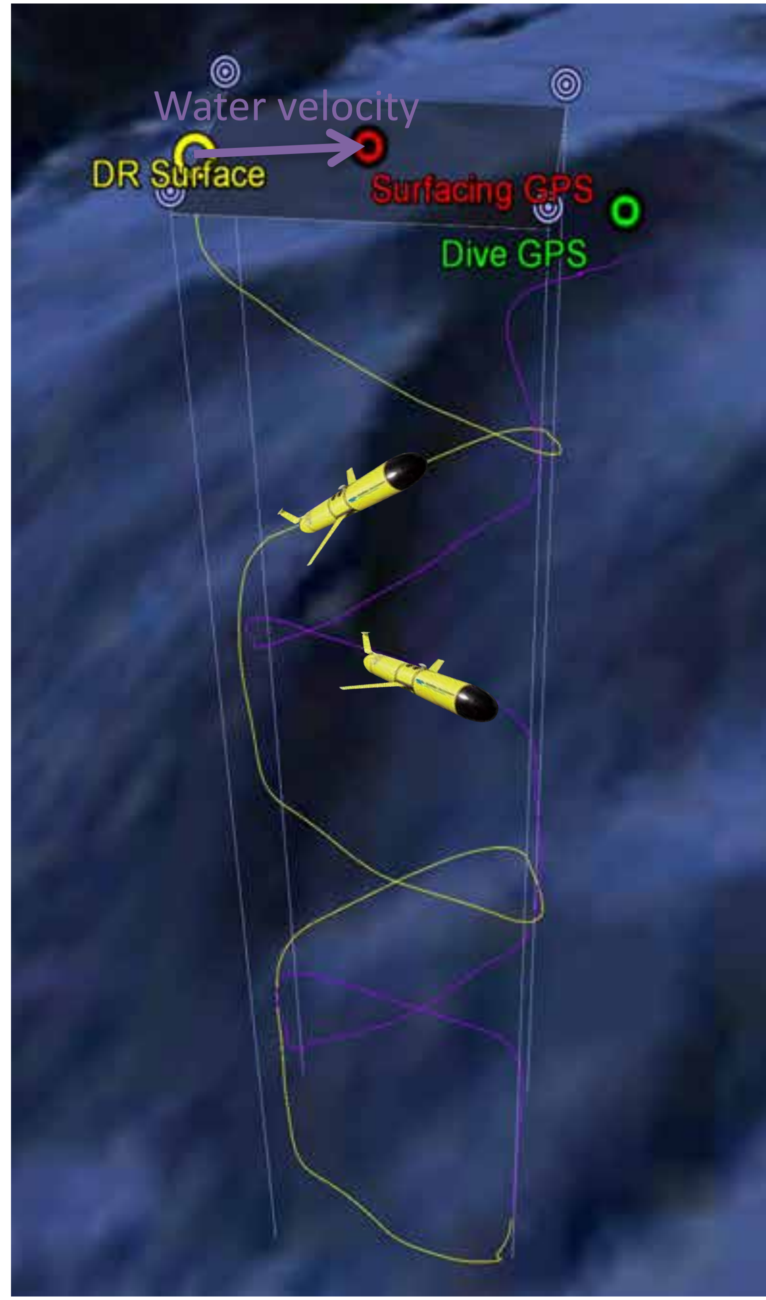
Slocum Hybrid Gliders

Successfully tested in Monterey Bay

Hybrid operation will be tested to increase speed and assess endurance

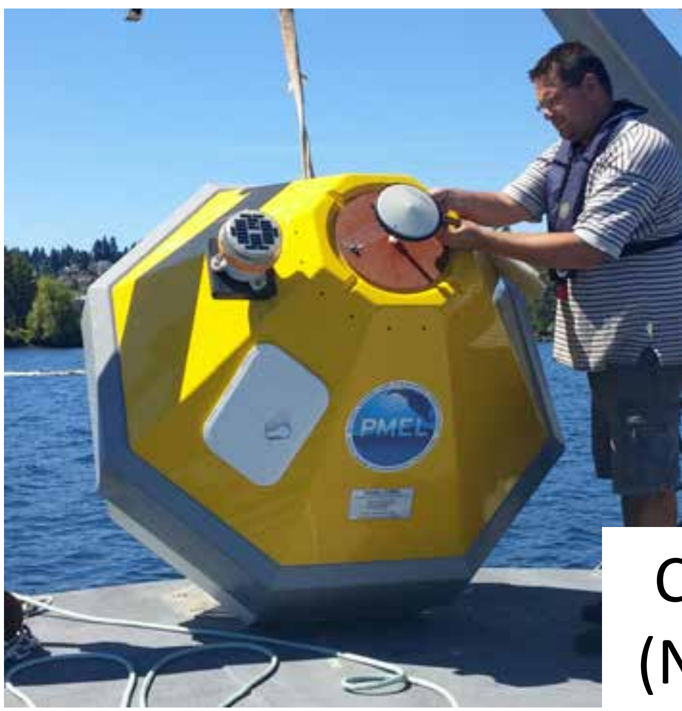
(Oscar Schofield, Rutgers)

Station-Keeping Operation

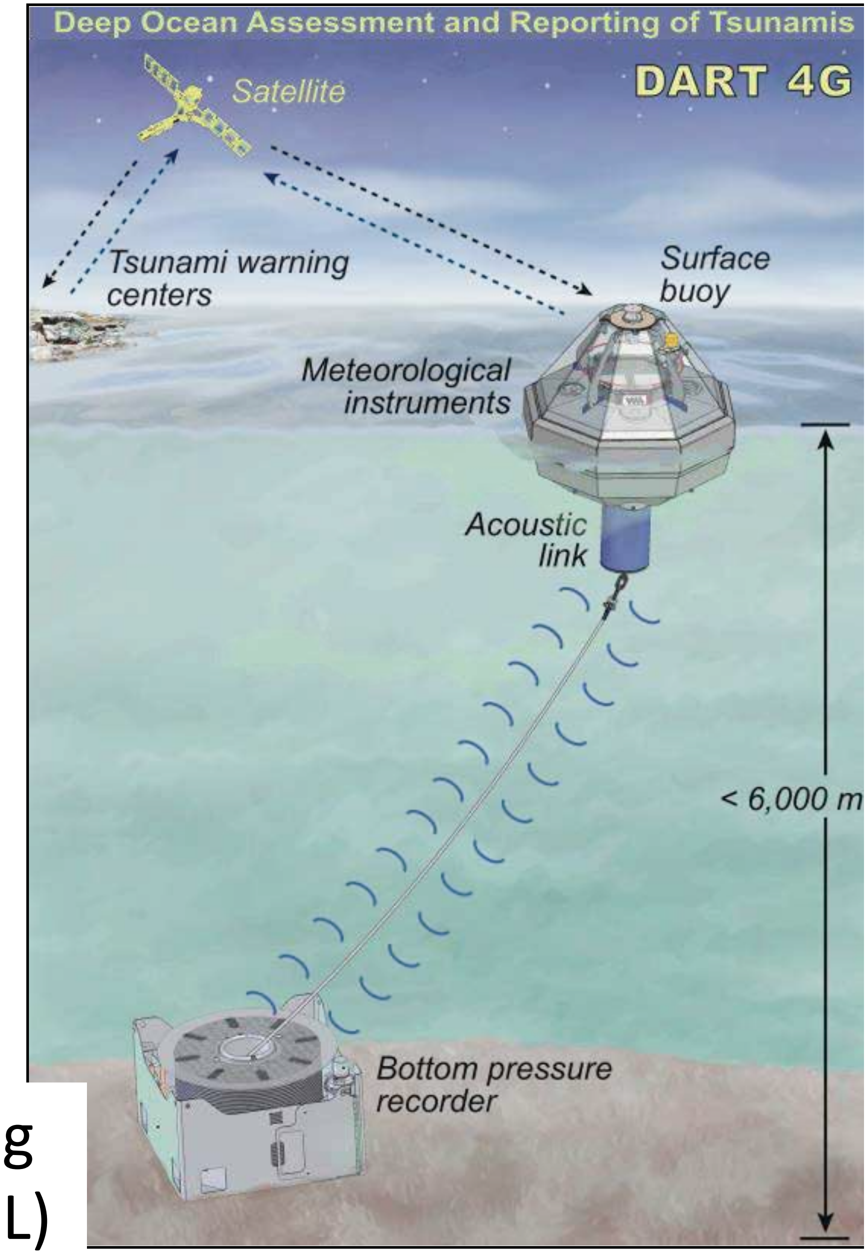


GPS Surface Mooring & Subsurface BPR

Surface GPS mooring
Successfully tested in Monterey Bay
Co-located BPR



Chris Meinig
(NOAA PMEL)



Potential Risks for the Glider Option

- What if the Slocum hybrid glider cannot keep station?
- How can one reduce the profiling time?

Ship Options
(early Jan deployment, late March recovery)

R/V Sproul (UNOLS, operated by SIO/UCSD, $18K/day)

M/V Danny C (77', operated by Castagnola Tug Service Inc. from Santa Barbara, $9k/day)

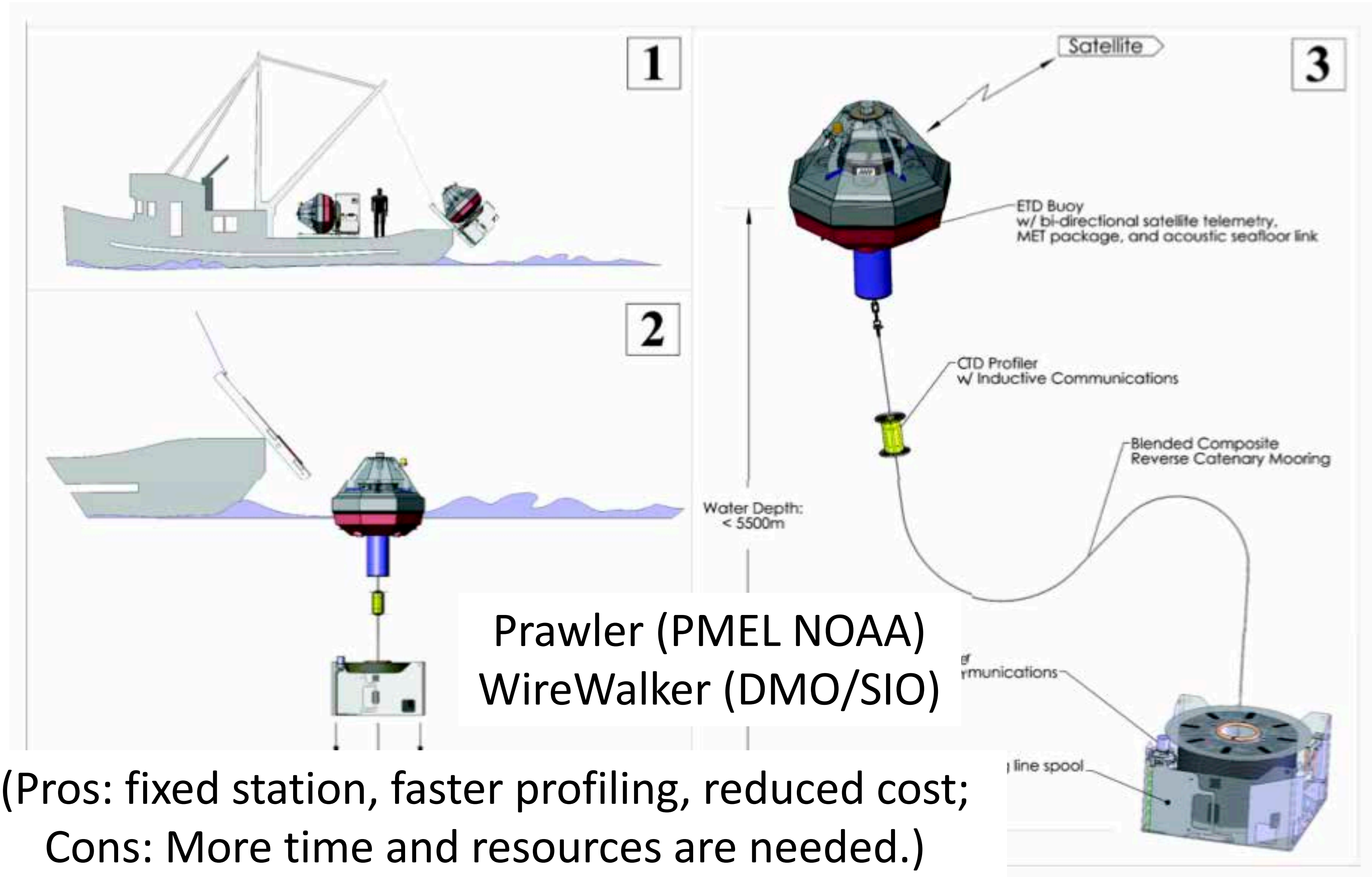
DSV Clean Ocean (155', operated by Aqueos Corporation from Long Beach, $12K/day)

Tasks and Schedule

June'18 | Sept'18 | Jan'19 | Mar'19 | June'19

- SWOT Science Team meeting
  - Peer review
    - Contract with JPL established
      - Ship schedule confirmed with signed contract
      - Subcontracts with participating institutions
        - Field experiment readiness review
          - Deployment cruise early January
            - Recovery cruise late March
              - Preliminary report
                - Final report

Glider Risk Mitigation Strategy: A profiling CTD on GPS/BPR mooring



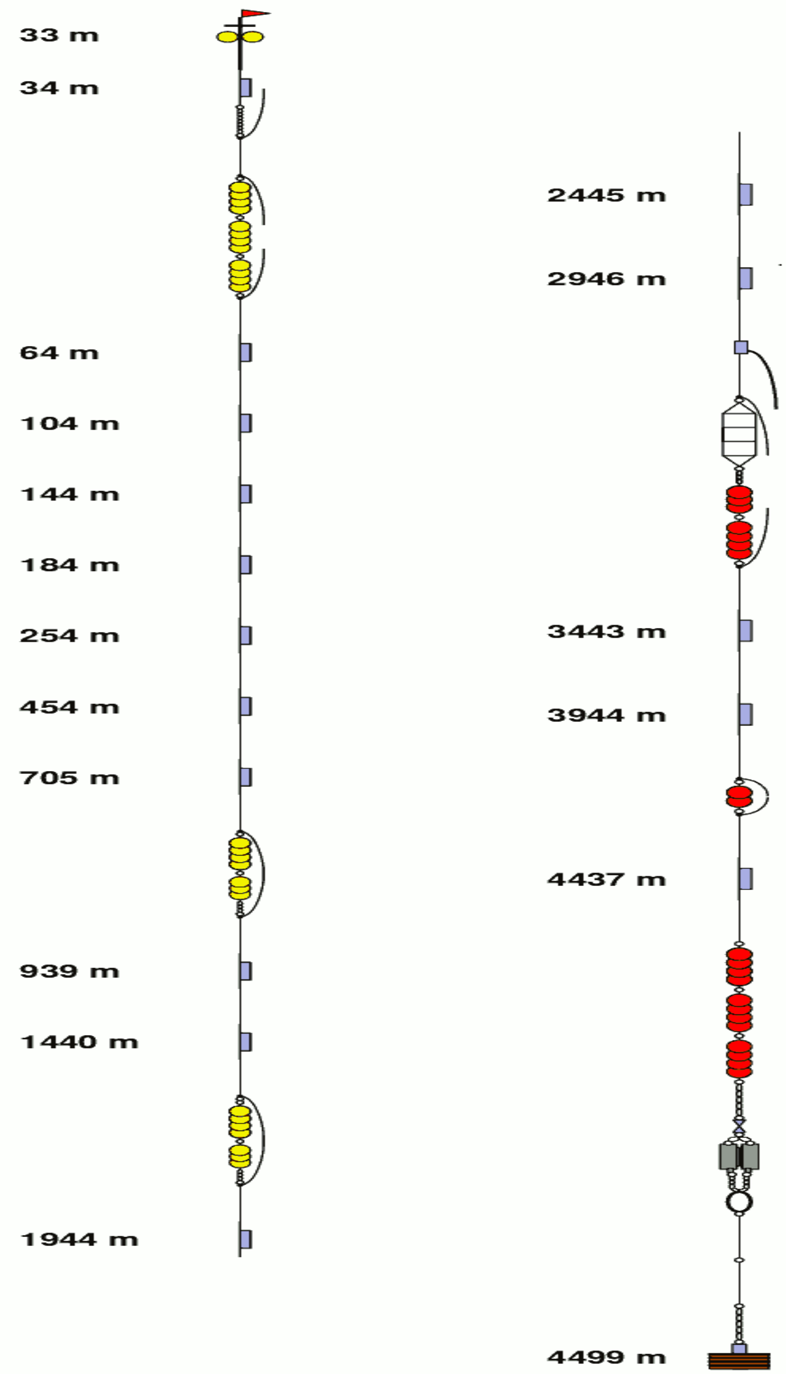
Prawler (PMEL NOAA)
WireWalker (DMO/SIO)

(Pros: fixed station, faster profiling, reduced cost;
Cons: More time and resources are needed.)

Backup Slides

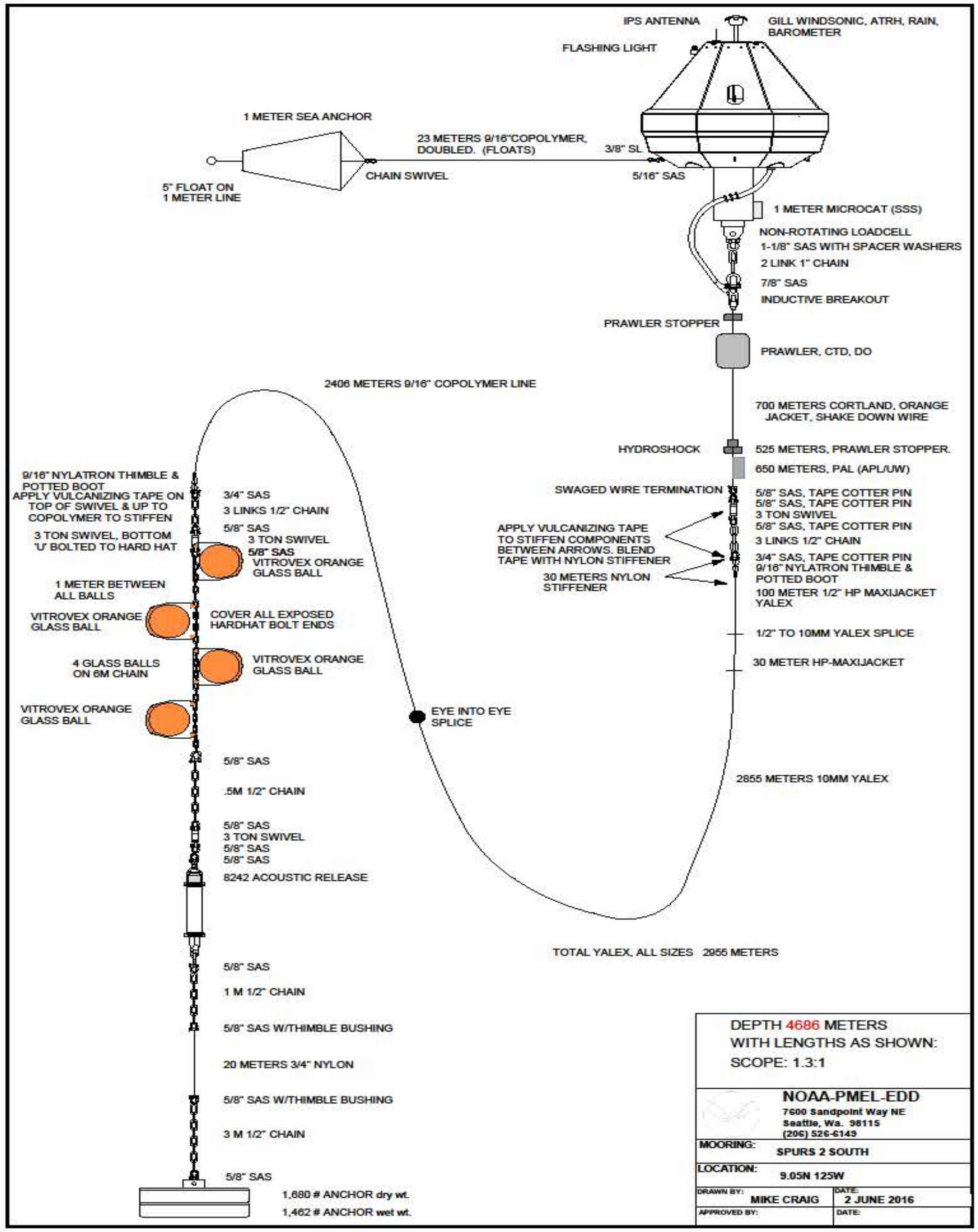
Subsurface Mooring

- To be provided by Prof. Uwe Send at SIO/UCSD, leveraging NSF funding.
- 16 CTD instruments placed at the following depths of 34, 63, 103, 143, 183, 253, 454, 704, 938, 1439, 1947, 2448, 2949, 3443, 3944, 4437.
- Estimated cost $410,000, purchase the mooring (at a cost of $300,000), BPR ($20,000) and a Spray glider for data communication ($90,000)
- Additional $50K to add five additional CTD sensors (each CTD costs $10,000) with three placed between 1000 and 1500 meters and two between 1500 and 2000 meters.



Prawler

- PRAWLER (PRofiling crAWLER) to be provided by NOAA PMEL, leveraging test results from SPURS.
- One single custom designed Seabird CTD climbing up and down the mooring line powered by wave energy.
- Estimated cost $308,675: of hardware cost ($102,940), budget for one scientist (3 months), one data manager (1.5 month) and one lead engineer (2.5 months), one software engineer (1 month) and one electronic technician for fabrication/assembly (3 months), two travels for engineers to deploy and recover the buoy, and one travel for the PI to attend SWOT Science Team meeting.



*A commercial product will be available from McLane Labs (http://mclanelabs.com/) around 2019 through a licensing agreement.

WireWalker

- Wirewalker will be provided by Rob Pinkel and Drew Lucas at Del Mar Oceanographic, LLC through exclusive license from SIO/UCSD.
- One single RBR CTD climbing up and down the mooring line powered by wave energy.
- Estimated cost $148,000: for (1) 1000m WW system (profiler, foam ballast, 1000 m profiling wire, surface buoy); and (2) 2000m RBR CTD (w/ Iridium telemetry), mooring system, mobilization and deployment costs, data analysis and report preparation costs including quality control and processing of Wirewalker data, products include dynamic height relative to 1000 dbar.