

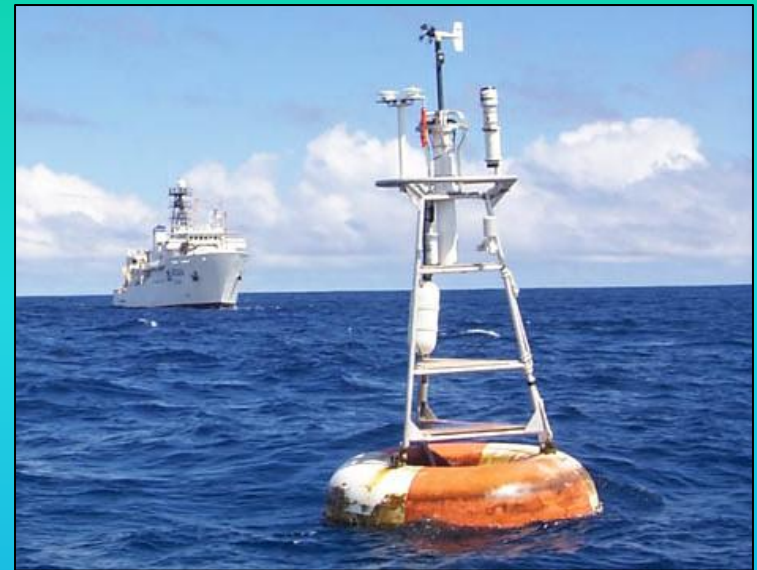
The background of the slide is a photograph of a large white research vessel with a red hull, identified as the 'SAGAR NIDHI' on its side. The vessel is positioned in the middle ground, facing right. In the foreground on the right, a moored buoy with a white frame and an orange float is visible. The sea is a deep blue with gentle waves, and the sky is a clear, light blue. The text is overlaid on this scene in a dark blue, sans-serif font.

Report of the
**Tropical Moored Buoy
Implementation Panel**
to the
**29th Session of the
Data Buoy Cooperation Panel**

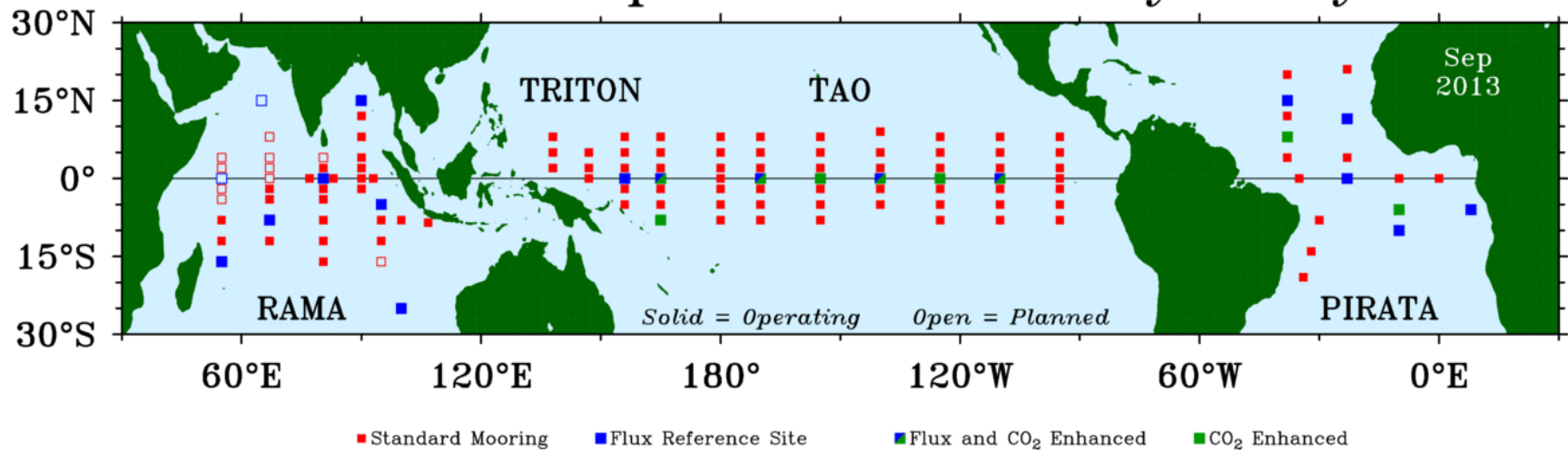
**September 23-27, 2013
Paris, France**

**Paul Freitag, Chris Meinig
NOAA/PMEL**

Global Tropical Moored Buoy Array:
A coordinated, sustained, multi-national effort to develop and implement moored buoy observing systems for climate research and forecasting throughout the global tropics



Global Tropical Moored Buoy Array

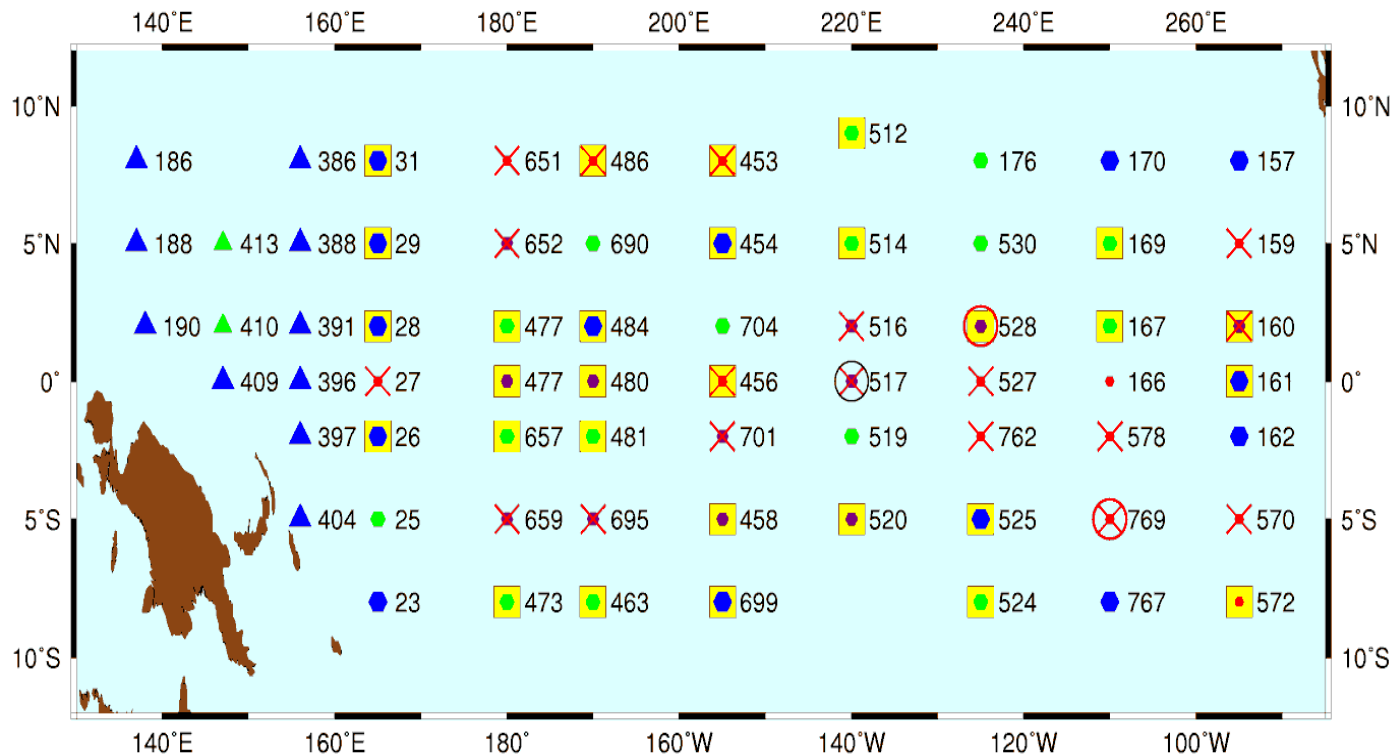


TAO Project Office, NOAA/PMEL

A contribution to GOOS, GCOS, and GEOSS

TAO/TRITON Status and Data Return

Updated Sep 11, 2013



(Click Mooring Symbol for Summary)

Mooring Type

- TAO/ATLAS (PMEL)
- TAO/Refresh (NDBC)
- ▲ TRITON (JAMSTEC)

Mooring Status

- ### Days Deployed
- Moved or Adrift
- Out of Position
- ✗ Not Transmitting

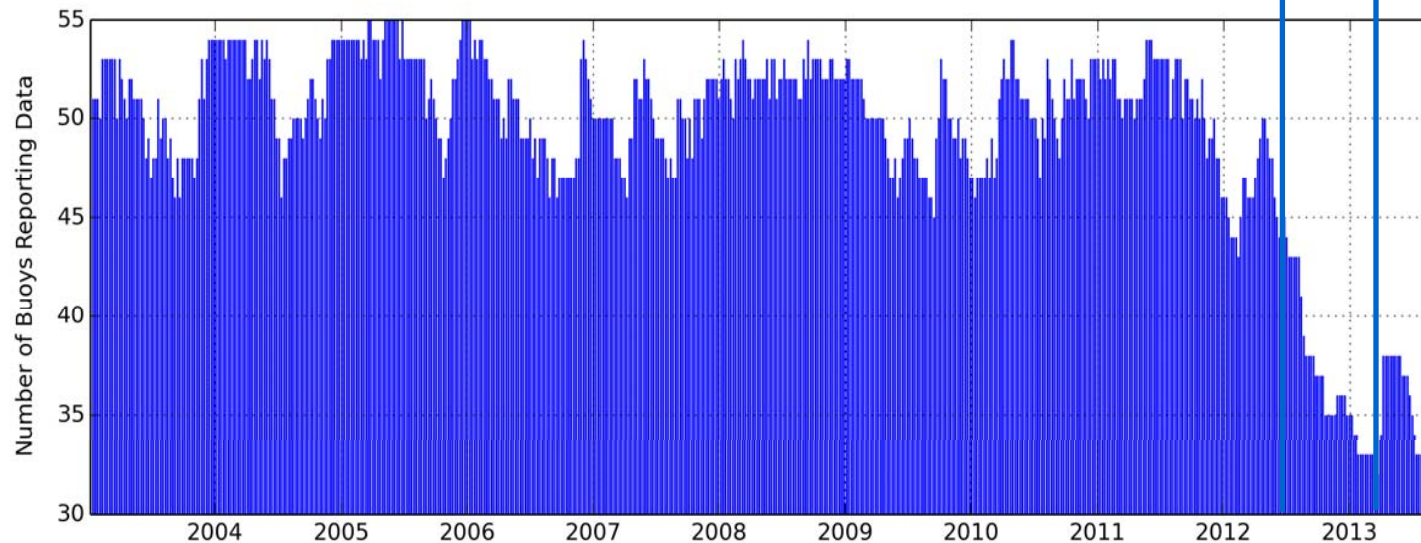
Data Return

- 0% - 50%
- 50% - 75%
- 75% - 90%
- 90% - 100%

- 38/55 TAO moorings deployed >1-year
- 9/12 TRITON moorings deployed >1 year
- 18 moorings not transmitting
- 48% TAO Realtime Data Return (September 2012 – August 2013)
- Lower data return due to reduced sea days and vandalism
- 29 of 55 TAO Surface Sites are ATLAS Refresh

TAO Status and Data Return

TAO Array Data Return
January 2003 - September 2013



Data return at historical low level

FY 2013:
88 sea days
24 sites maintained

FY 2014 plans:
~68 sea days
26 sites
Additional days
subject to funding

TAO/TRITON Future

Tropical Pacific Observing System Workshop

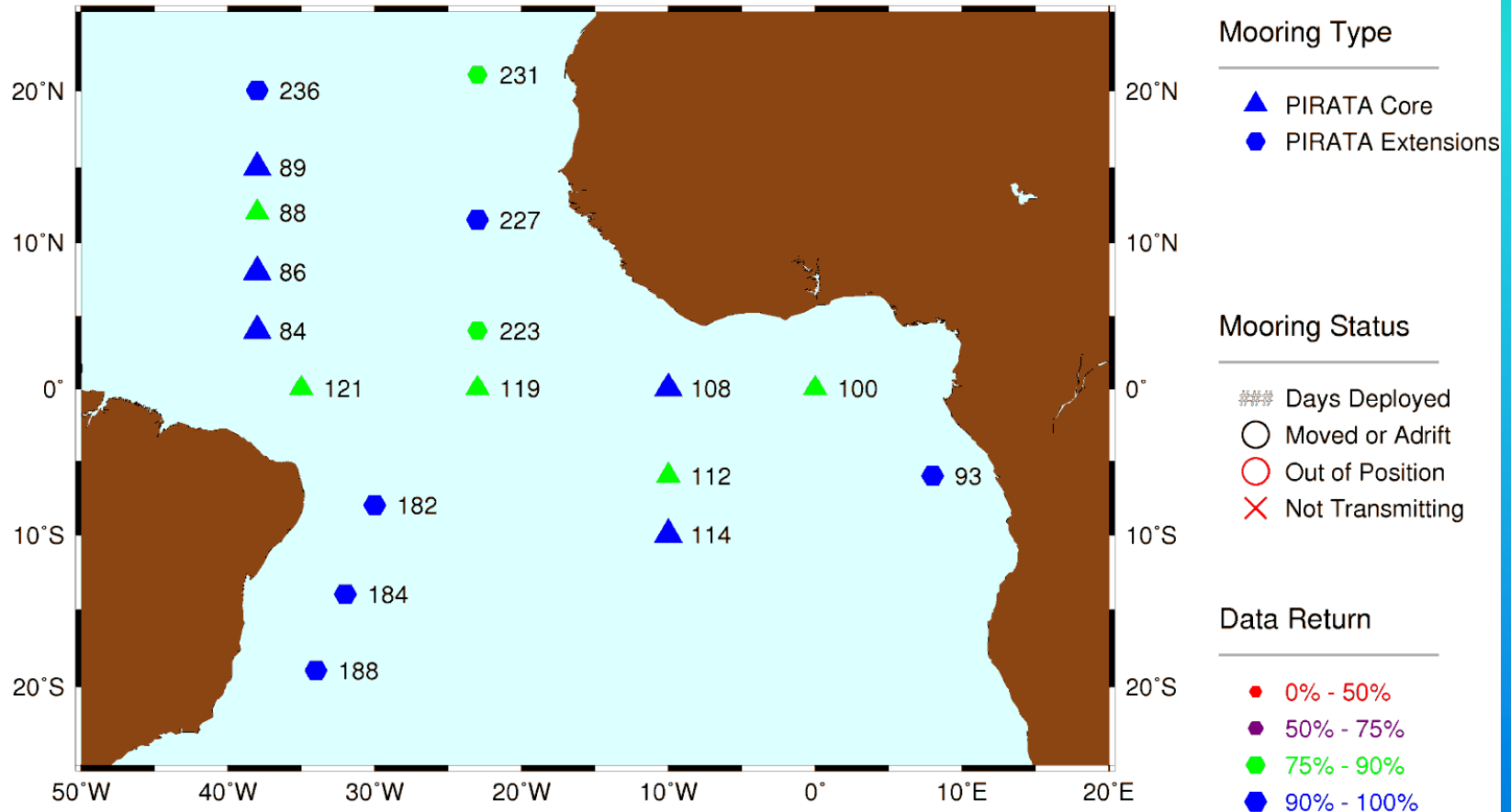
27-30 January 2014

La Jolla California

- Review of TAO/TRITON array to address concerns and abilities of current sponsors (US-NOAA and Japan-JAMSTEC) to sustain the array at historical levels
- Devise sustainable observing system for the tropical Pacific ocean
- Provide input leading to national commitments for a shared ocean observation system in the tropical Pacific

PIRATA Status and Data Return

Updated Sep 11, 2013

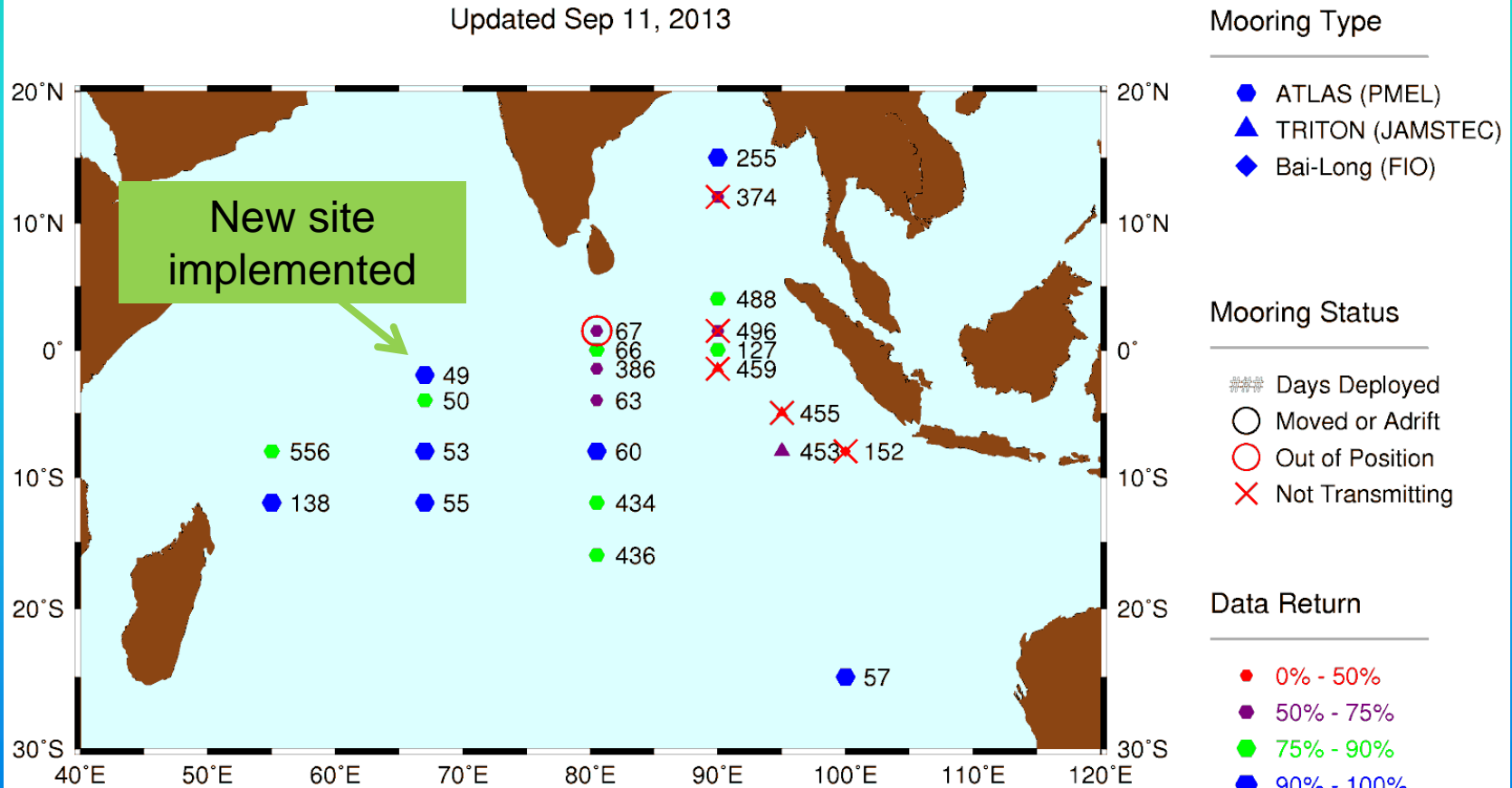


- 80% Real Time Data Return (September 2012 – August 2013)
- All sites serviced in past year and presently transmitting
- 143 sea days (including non-PIRATA work)
- 6°S 8°E site reoccupied after 6-year hiatus. Continuous maintenance planned.

RAMA Status and Data Return

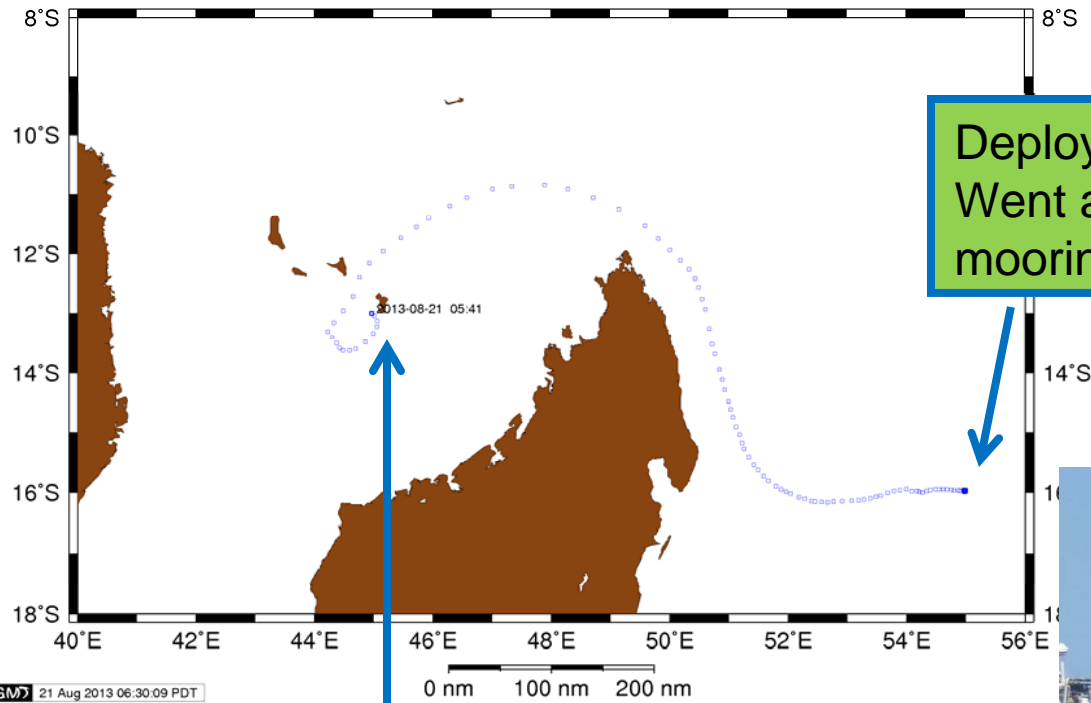
Status of Presently Deployed RAMA Moorings

Updated Sep 11, 2013



- Array implementation is 70% complete (32/46)
- 65% Realtime Data Return (September 2012 – August 2013)
- Vandalism continues to impact data return in some areas
- 7 sites not reporting or not occupied, including one on hold due to lack of sea days
- Extended deployments due to weather, security issues, postponed cruises

U.S. Navy Recovery of Drifting RAMA Mooring



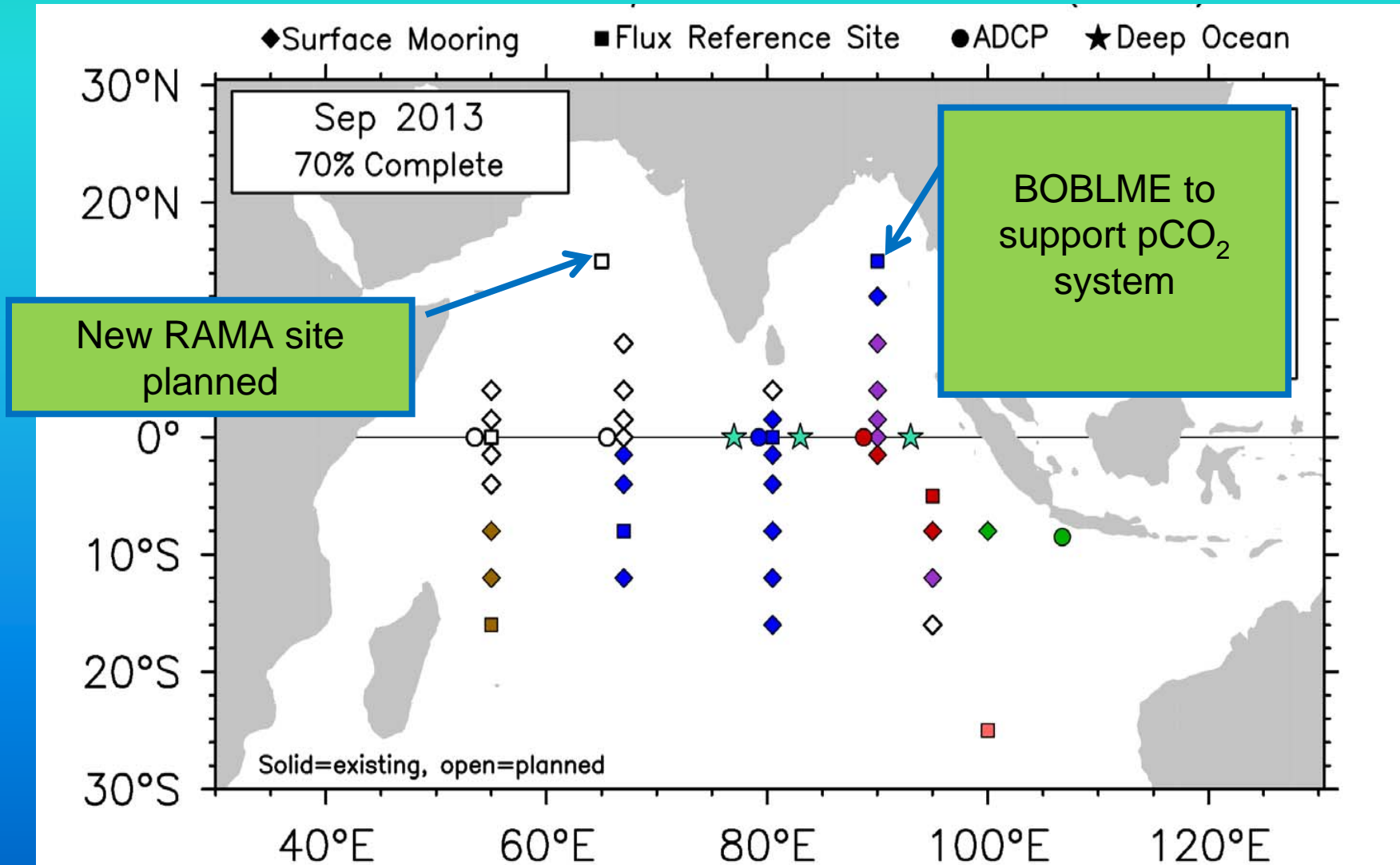
Deployed 16°S, 55°E April 2013.
Went adrift June 2013 with
mooring line attached

Entered Mozambique Channel and
stopped near Mayotte reef August
2013. Recovered intact by U.S. Navy.



Photo courtesy of French Navy

2013-2014 RAMA Plans



Formal Agreements, Capacity Building, Information Exchange

Formal Agreements:

- NOAA/Indonesia Implementing Arrangement renewal begun 2013.
- NOAA/MoES Implementing Arrangement to be renewed 2014

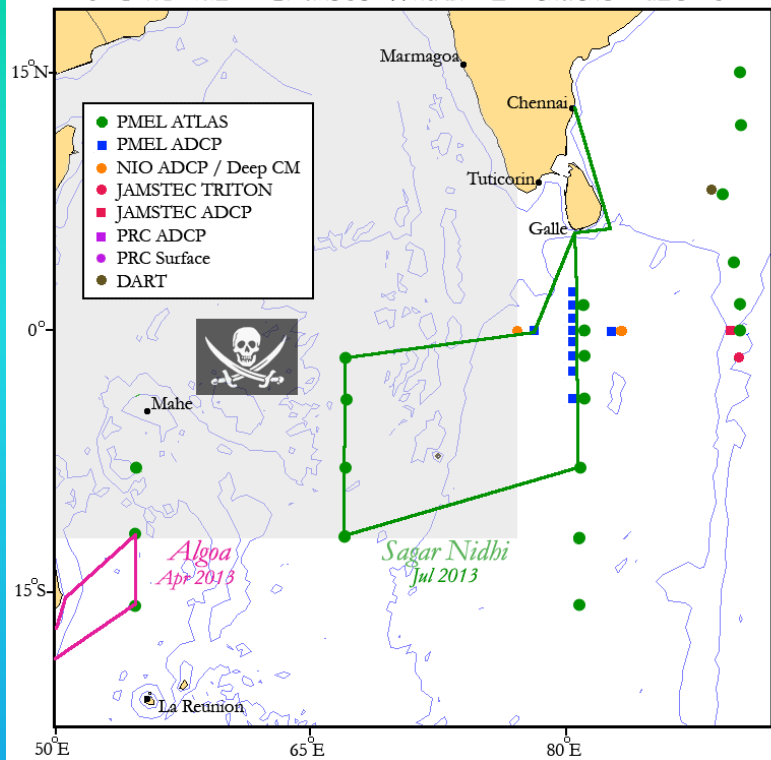
PMEL Visitations:

- Iwao Ueki from JAMSTEC April 2012 to March 2013
- Huiwu Wang from FIO October to December 2012
- Presad Punna, Kesavakumar Balakrishnan and Vengatesan Gopalakrishnasmi from NIOT August 5-9, 2013. Will lead installation of BOBLME pCO₂ system

Meetings and Workshops:

- CLIVAR/GOOS Indian Ocean Panel 9th Session October 2012, Capetown, SA
- TIP Workshop, October 2012, Jakarta, Indonesia.
- 8th Annual "Indonesia-U.S. Ocean Climate Observations Partnership" Workshop, October 2012, Bogor, Indonesia
- CLIVAR/GOOS Indian Ocean Panel 10th Session 8-12 July, 2013, Lijiang, China
- PIRATA-18/TAV 22-25 October 2013, Venice, Italy
- Tropical Pacific Observing System Review, January 2014

2013 RAMA Cruises Within Exclusion Zone



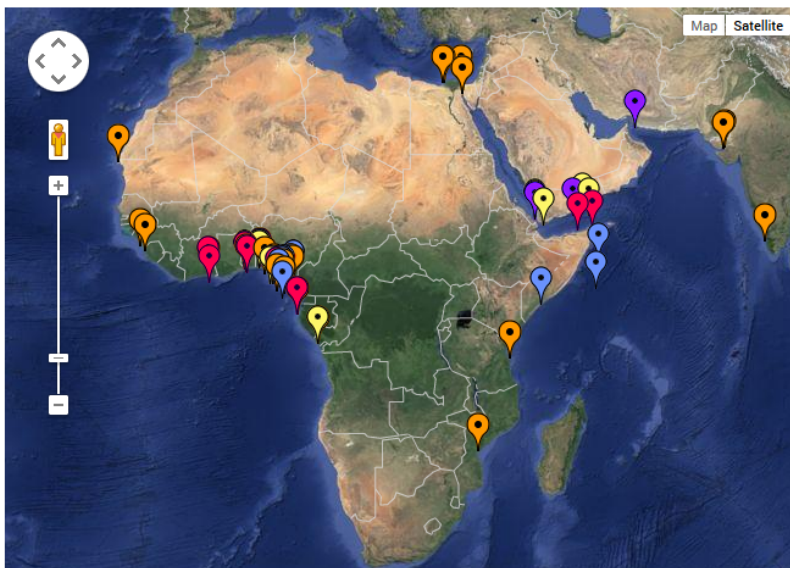
PIRACY

- Sagar Nidhi cruise in 2013 entered Lloyds of London Exclusion Zone with security team provided by INCOIS
- Algoa not permitted to enter zone. 8°S 55°E mooring not serviced
- IO pirate activity continues to ebb. Confined to Somali coast
- Lloyds has not revised size of Exclusion Zone to reflect decrease in risk
- Piracy in Gulf of Guinea has not affected PIRATA to date but is a concern.

Indian Ocean	2013	2012	2011	2010
Vessels Hijacked	0	7	27	51
Boarding	0	1	17	16
Vessels Fired Upon/ Attempted Boarding	4	24	122	119

Gulf of Guinea	2013	2012	2011	2010
Vessels Hijacked	9	14	19	1
Boarding	15	31	41	26
Vessels Fired Upon/ Attempted Boarding	30	30	26	12
Kidnapping	15	14	18	17

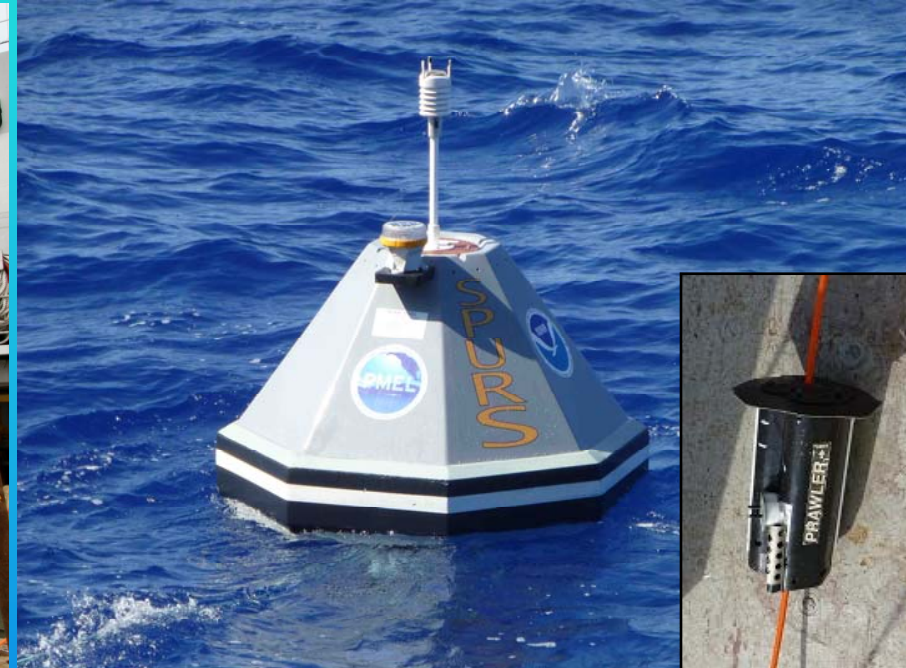
📍 = Attempted Attack
 📍 = Boarded
 📍 = Fired upon
 📍 = Hijacked
 📍 = Suspicious vessel



Next Generations Field Testing



Present: T-Flex



Near Future: PICO-PRAWLER

T-Flex Field Testing

Completed:

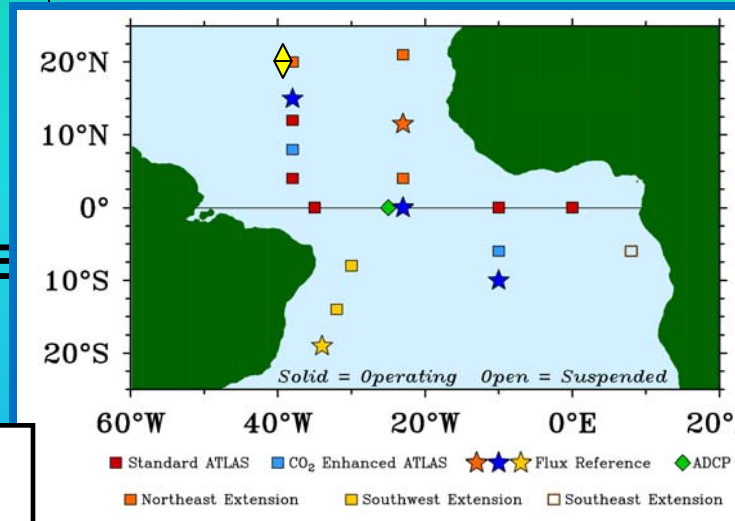
- March 2011 to April 2012, 12°S, 93°E
- July 2011 to January 2013, 20°N, 38°W


Underway:

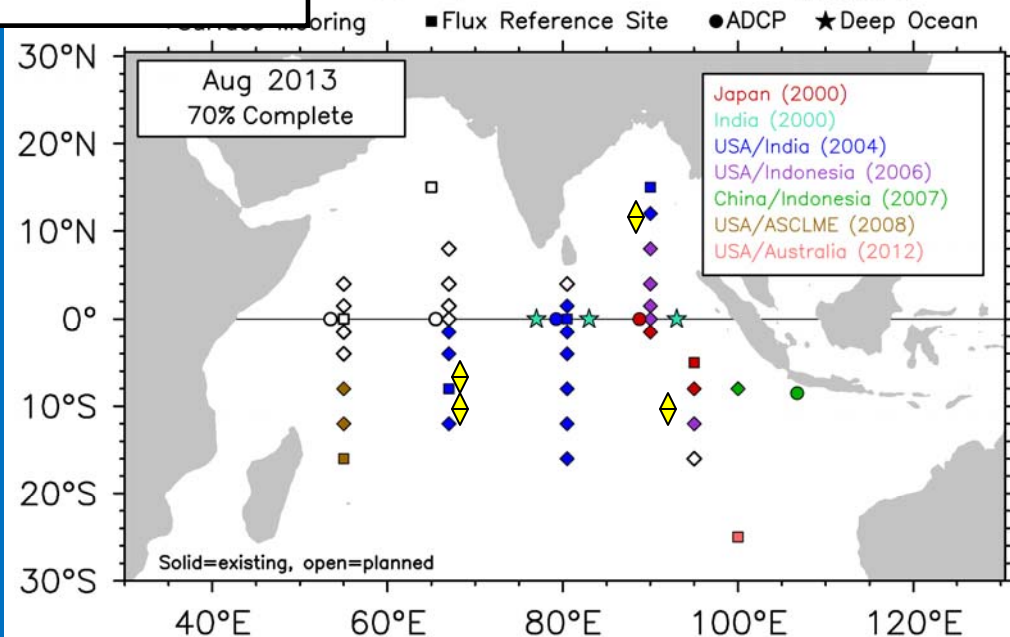
- December 2012 – November 2013, 12°N, 90°E
- January 2013 – November 2013, 20°N, 38°E
- July 2013 – Summer 2014, 8°S, 67°E
- July 2013 – Summer 2014, 12°S, 90°E

Planned:

- November 2013, 20°N, 38°E



 T-Flex Test Sites



T-Flex Field Testing



Evaluation:

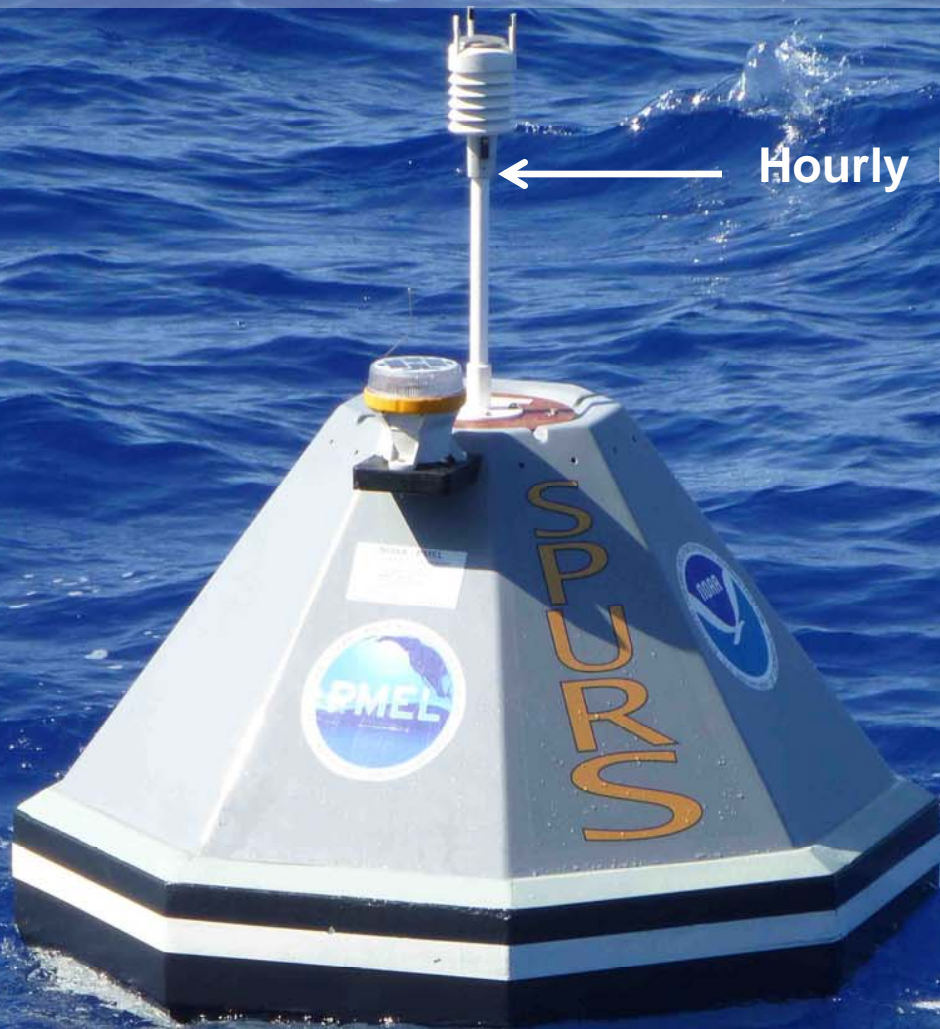
- Systems have generally worked well, providing long time series. Two recovered systems telemetered data until recovery, 402 and 540 days.
- ATLAS/T-Flex produce comparable data.

Issues:

- Wind direction error found in 1st system has been fixed.
- System presently deployed at 12°N, 90°E stopped transmitting after 158 days. Cause TBD. Vandalism has slowed field testing.

Standalone Implementation to begin in 2014.

PICO-PRAWLER



← Hourly MET

Profiling CTD
Depth: 3-500m

↑
0.5m
↓



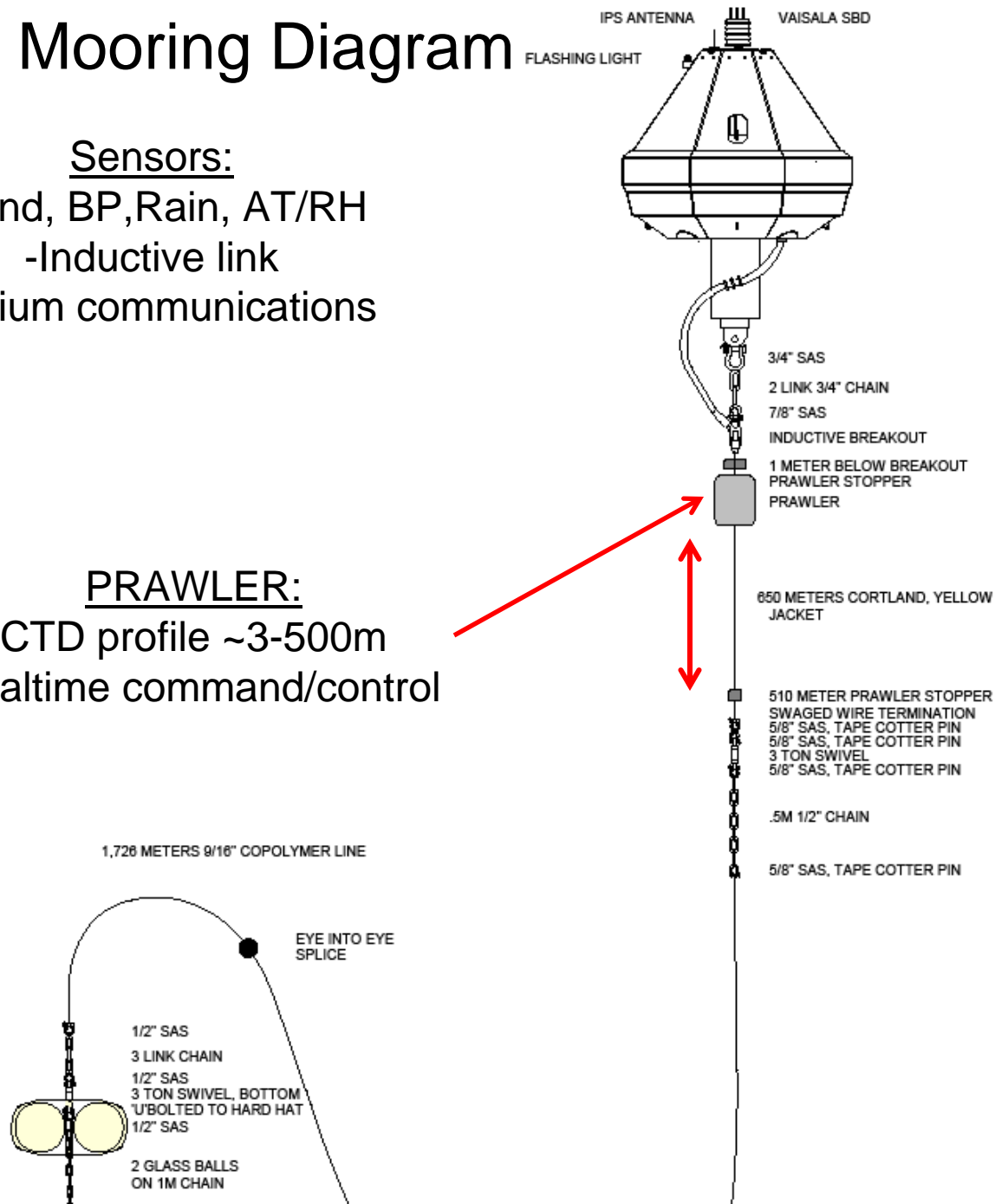
PICO Mooring Diagram

Sensors:

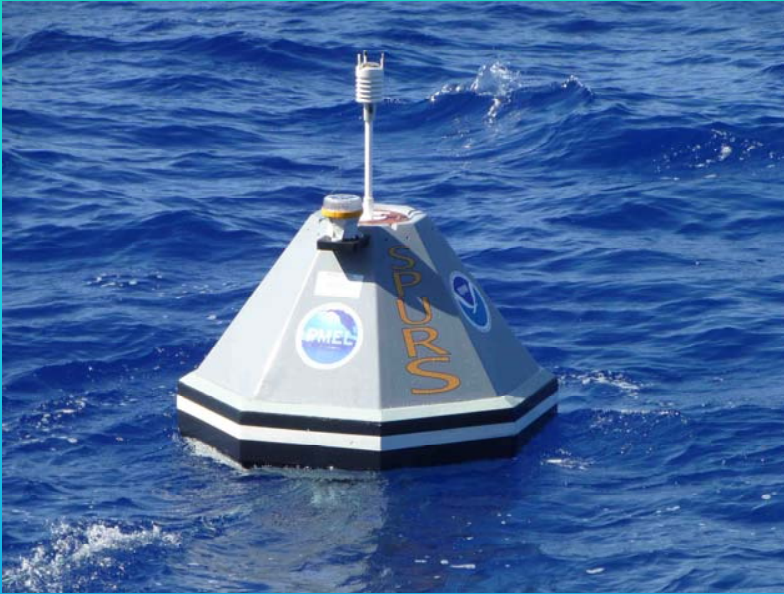
- Wind, BP,Rain, AT/RH
- Inductive link
- Iridium communications

PRAWLER:

CTD profile ~3-500m
Realtime command/control



PICO-PRAWLER Field Testing



Evaluation:

- **Systems have generally worked well, providing ~1 year time series with some gaps in CTD profiles, wind, ATRH, BP, rain (WTX-520).**
- **MET & CTD will be compared to WHOI buoy in '14 & ship CTDs.**

Issues:

- **PRAWLER CTD Endurance only proven to 6 months**
- **Unexplained mooring breaks**

Pacific test within TAO scheduled for '13/'14

Summary

- **TAO data at historical lows because of ship support**
- **PIRATA & RAMA are stable & expanding, w/challenges**
- **Next-gen developments are underway and testing to proceed via GCOS principles**