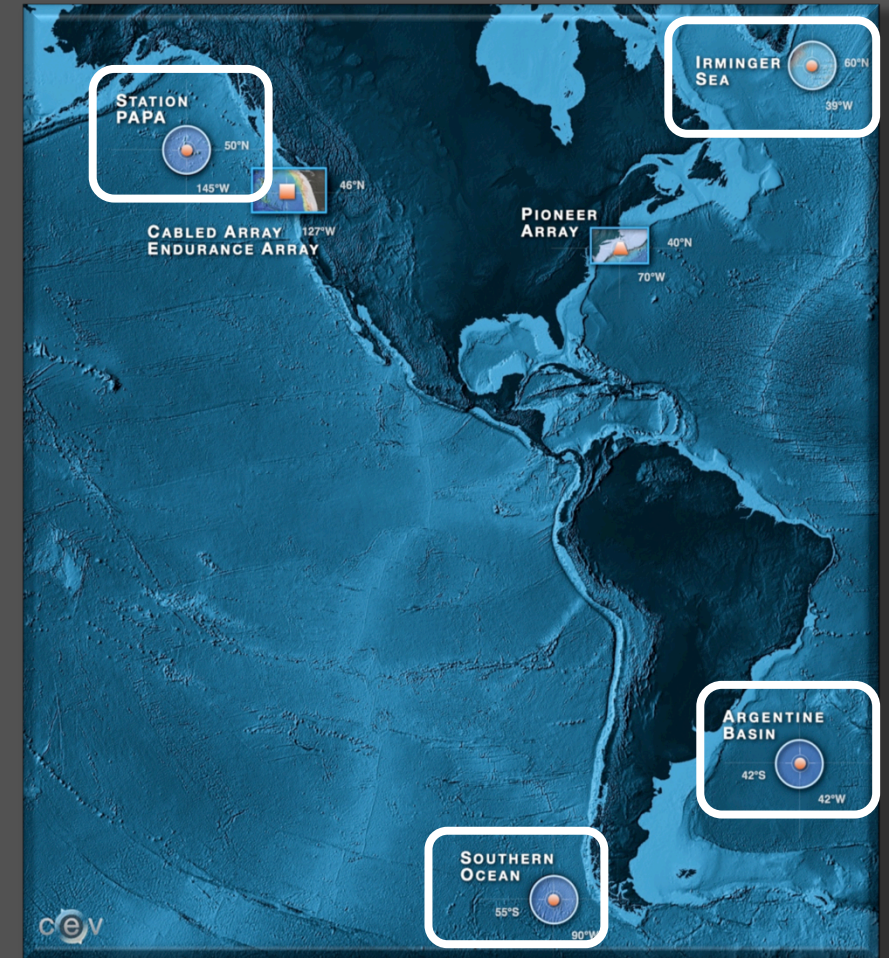


# OOI Instrument Overview



# OOI Instrument Status --Context

- Collectively, OOI has approx. 900 instruments deployed worldwide, on moorings, cabled sites, and mobile assets.
- As you've seen, not all of these instruments are working at any given time, which isn't surprising.
- On global arrays, in particular, it's impossible to evaluate sensor and instrument performance in real time (instruments are autonomous)
- Many of our sensors, instruments, and mobile assets were designed specifically for OOI, and are being deployed, operated, and evaluated for the first time.
- OOI is pushing (and redefining) the outer boundaries of extended operations in harsh environments, at great depths, etc.
- In many cases OOI is also ordering unprecedented quantities of some sensors and instruments, pushing vendors to "tool up" for large volume production and extensive long term refurbishment support, quality control and assurance, etc.
- Following extended evaluation OOI is beginning to develop an emerging sight picture of some sensors and instruments which are "problematic." We're actively engaged with vendors to correct shortfalls as able, and will engage with NSF as needed (through Engineering Change Requests) to replace and refresh our technology.

# OOI Core Science Instrument Issues

- CTD (Sea-Bird)
  - Issue with “interim” Druck pressure sensor [in progress]
- DOSTA (YSI/Aanderaa)
  - Incorrect 1-point calibration correction [resolved]
- NUTNR (Satlantic/Sea-Bird)
  - ISUS being discontinued, shift to SUNA [in progress]
- OPTAA (WET Labs)
  - Long lead times on refurb [working with vendor]
- PCO2W/PHSEN (Sunburst)
  - Quality/robustness issues [working with vendor and OL Quality Manager]
- ZPLSC (ASL Environmental)
  - Instruments at Offshore sites are too deep (~500 m) [consider moving or removing]

# Surface Mooring Instrument Data Summary

CAMDS	Digital still camera	Frequent hardware failures, slow vendor service so often not deployed, software incomplete, requires a lot of OOI labor
PCO2W	Aqueous partial pressure carbon dioxide	Frequent hardware failures, finicky instrument, inconsistent manufacturing quality, delicate, requires a lot of OOI labor. OOI addressing issues with vendor. Data quality verified by non-OOI field measurements.
PHSEN	pH	Frequent hardware failures, finicky instrument, inconsistent manufacturing quality, delicate, requires a lot of OOI labor. OOI addressing issues with vendor. Data quality verified by non-OOI field measurements.
OPTAA	Optical attenuation and absorption	Slow vendor service so often not deployed, significant biofouling, requires a lot of OOI labor. Vendor is improving robustness and service speed
NUTNR	Dissolved nitrate	Frequent instrument hardware failures, slow vendor service, significant biofouling, requires a lot of OOI labor. Being replaced with better model (ISUS to SUNA)
ZPLSC/G	Zooplankton sonar	Occasional hardware or configuration failure, field calibration being researched. OOI working with vendors and external scientists.
FDCHP	Air-sea Flux direct covariance	Occassional hardware failures—being addressed. Slow service in past—improved recently.
VEL3D	High-frequency 3D point velocity	Mooring-to-instrument driver not working as planned—being addressed internally and with instrument vendor
PCO2A	Air and sea partial pressure carbon dioxide	Significant fouling on buoys--mitigated
ADCPT/S	Acoustic Doppler current profiler	Occasional instrument hardware failure or mooring miscommunication--being addressed
VELPT	Mean 3D point velocity	Occasional instrument hardware failure or mooring miscommunication--being addressed
CTDBP	Conductivity, temperature, pressure	Occasional mooring miscommunication and some biofouling--being addressed
DOSTA	Dissolved Oxygen, stable (vs. fast DOFAST)	Significant biofouling in upper water column--may need new mitigation
SPKIR	Spectral irradiance	Delicate antifouling mitigation--vendor addressing
METBK	Bulk meteorology (short & long wave radiation, air pressure, temperature, relative humidity, wind, rain)	Occasional instrument hardware failures--being addressed. Essentially robust.
FLORT	Florescence (chlorophyll-a, optical backscatter, CDOM)	No problems
WAVSS	Wave spectra	No problems in buoy or on ISSM MFN
PRESF	Bottom pressure	No problems

*NOTE: Statistics on performance of each instrument not yet available*



# Ocean Gliders

- OOI operates a (nominal) fleet of 64 Slocum Gliders
  - 24 Coastal Gliders, 40 Open Ocean Gliders (new Glider variant, designed specifically for OOI)
- Since 2014 15 Gliders have been lost (2 Coastal, 13 Open Ocean)
- More Gliders WILL be lost in the future
- With Gliders, in particular, OOI is pushing (and redefining) the outer boundaries of extended operations in harsh environments. We're deploying Gliders longer and doing more with them (acoustic data mules) than any other operational science program.
- During initial design reviews and analysis of alternatives, as far back as 2011, risk of Glider loss was understood, and documented (projected loss rates of up to 20%).
- OOI PMO and WHOI (Glider lead) have been conducting a comprehensive investigation of the Glider program since Aug 2016. Our final report has been submitted to NSF for (ongoing) review.
- In coming months we'll be coordinating closely with NSF to determine whether any changes are required in our current CONOPS for Glider operations.



# CGSN Core Science Instruments

Instrument	Instrument Class	Vendor	Model
Conductivity, Temperature, Depth (CTD)	CTDBP	SeaBird	SBE 16plusV2
	CTDMO	SeaBird	SBE 37-IM
	CTDPF	SeaBird	SBE 49, SBE 52MP
	CTDGV, CTDAV	SeaBird	SBE GP
Seafloor pressure	PRESF	SeaBird	SBE 26plus
Dissolved Oxygen	DOFST	SeaBird	SBE 43F
	DOSTA	Aanderaa	AADI optode 4831, 4330
Acoustic Doppler Current Velocity (ADCP)	ADCPA	Teledyne RDI	Explorer 600 DVL, Navigator 600
	ADCPS, ADCPT	Teledyne RDI	WorkHorse, LongRanger
Single Point Velocity	VELPT	Nortek	Aquadop
Surface Wave Spectra	WAVSS	Axys Technologies	TRIAXYS
Direct Covariance Flux	FDCHP	WHOI	DCFS
Bulk Meteorology	METBK	Star Engineering	ASIMET

# CGSN Core Science Instruments, cont.

26 instrument Classes in CGSN, 512 instruments deployed

Instrument	Instrument Class	Vendor	Model
Multi-Channel Fluorometer	FLORD	WET Labs	ECO Puck FLBB
	FLORT	WET Labs	ECO Triplet, ECO Puck FLBB CD, ECO Puck BB3
Optical Attenuation and Absorption	OPTAA	WET Labs	AC-S
Photosynthetically Available Radiation (PAR)	PARAD	Biospherical	QSP
Spectral Irradiance	SPKIR	Satlantic	OCR507
Nitrate	NUTNR	Satlantic	ISUS, SUNA
Partial Pressure of CO2 in Air & Water	PCO2A	Pro-Oceanus	pCO2-PRO with ATM
Partial Pressure of CO2 in Water	PCO2W	Sunburst Sensors	SAMI-CO2
pH	PHSEN	Sunburst Sensors	SAMI-pH
Bio-Acoustic Sonar	ZPLSC	ASL Environmental	AZFP (38/125/200/455 kHz)
	ZPLSG	ASL Environmental	AZFP (38/70/125/200 kHz)