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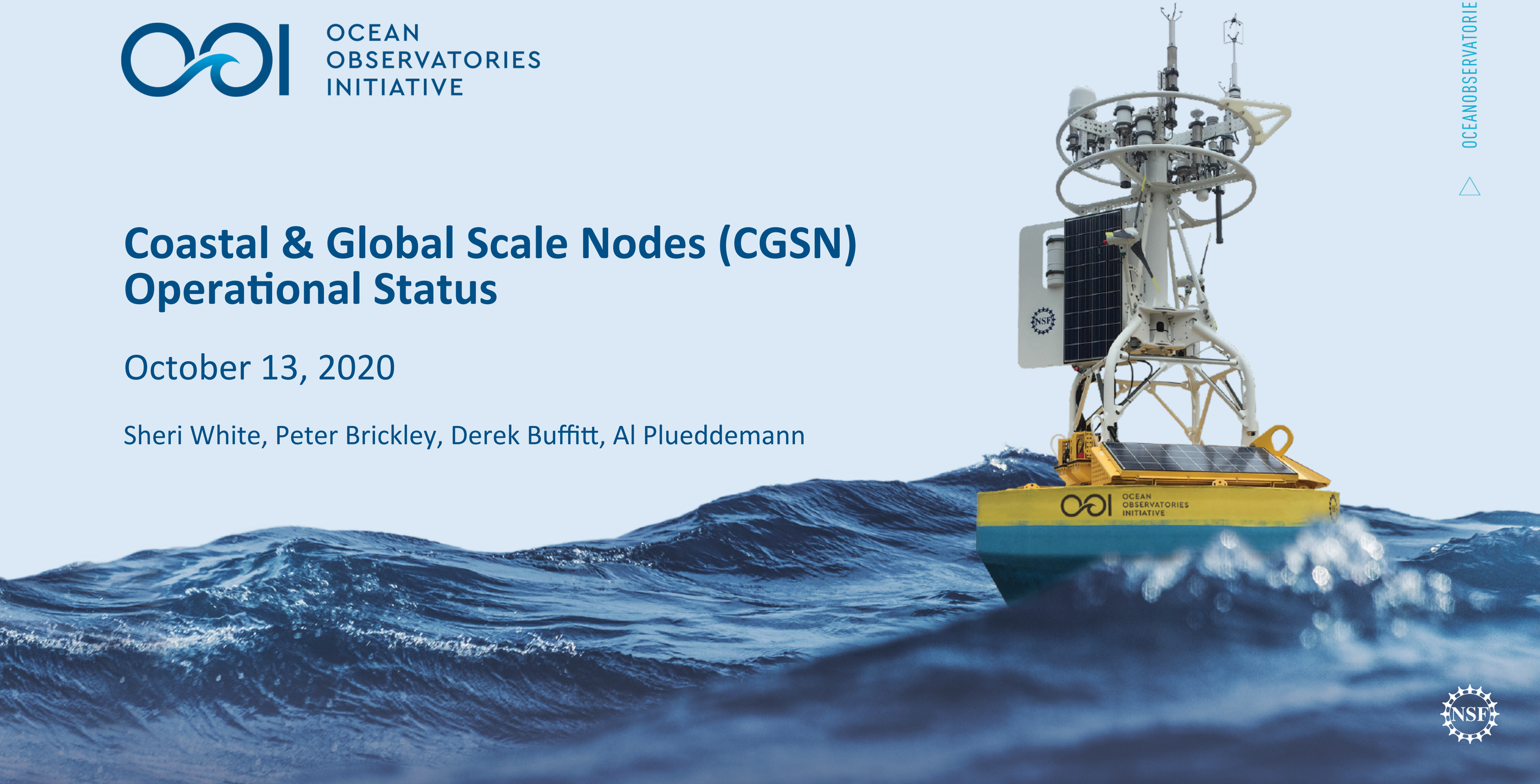
# Coastal & Global Scale Nodes (CGSN) Operational Status

October 13, 2020

Sheri White, Peter Brickley, Derek Buffitt, Al Plueddemann

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# CGSN Organizational Chart

Full-time LOE
Full-time Tasking
Part-time/As-needed

**Al Plueddemann** CGSN PI/PS

**Derek Buffitt** CGSN Program Manager

**Kim Sargent** Business Operations Lead

Global Chief Scientists:
**Sheri White**
**Kris Newhall**
**Alison MacDonald**
**Sebastien Bigorre**
Coastal Chief Scientists:
**Al Plueddemann**
**Sheri White**

**Kris Newhall** Refurbishment/ Procurement Overall Lead
- **Alex Franks** Integration & Test / Surface Mooring Lead
- **John Lund** Subsurface & Profiler Mooring Lead
  - **Dan Bogorff** **James Kuo**

Mooring Integration & Build Support:
**CRL Team**
**Jared Schwartz**
**Dave Wellwood**

**Don Peters** Mechanical Lead
- **Dan Duffany** **Christine Fournier** **Chris Lumping** **Megan Carroll**

**John Reine** Electrical Lead
- **Mike McCarthy** **Matthew Latvis** **Lucas Petersen**
- **Brian Kelly** **Marshall Swartz**

**Stephanie Petillo** Software Lead
- **TBD** Software
- WHOI IT: **Joe Futrelle** **Nick Symonds** **Mario Carloni**

**Jennifer Batryn** Instrument Refurbishment Lead
- **Allen Smith**
- **Irene Duran** **Leah Houghton**

**Sheri White** System Engineer/ QA&QC Lead
- **Andrew Reed** QA&QC Data
- **TBD** QA&QC Ops

CGSN Data Team:
**Sheri White**
**Rebecca Travis**
**Peter Brickley**
**Andrew Reed**
**Collin Dobson**
**Stephanie Petillo**
**Jennifer Batryn**
**Allen Smith**
**John Lund**
**James Kuo**
**Dan Bogorff**

**Rebecca Travis** Documentation & Configuration Management Lead

**Peter Brickley** Observatory Operations / Mobile Assets Lead
- **Collin Dobson** **Diana Wickman**
- **Jared Schwartz** **Jessica Kozik**

**Dee Emrich** Field Operations & Logistics Lead
- **John Kemp** Mooring Operations Director

Cruise Support:
**Chris Basque**
**Meghan Donohue**
**Jim Dunn**
**Leah Houghton**
**Nicos Llanos**
**Jeff Pietro**
**Ellen Roosen**
**Jim Ryder**
**Jared Schwartz**
**Tina Thomas**
**Dave Wellwood**

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# CGSN Operations

- **Refurbishment/Mechanical:** Kris Newhall
- **Electrical:** John Reine
- **Software:** Stephanie Petillo
- **Instruments:** Jennifer Batryn
- **System Engineering & Data Team Lead:** Sheri White
- **Data QA/QC:** Andrew Reed
- **Documentation/Config. Management:** Rebecca Travis
- **Platform Operations:** Peter Brickley
- **Logistics:** Dee Emrich

# CGSN Status: Pioneer

## Operations

- Pioneer 14 was a profiler only cruise. All profiler moorings were turned. Vendor firmware was updated and continues to operate successfully. Next firmware update, allowing further remote intervention, in test on PMUI. PMUO has halted telemetering of data, attempt to turn mooring will be made during Pioneer 15.

No change in surface moorings since last update:

- ISSM: MFN power conservation due to wind turbine damage.
- OSSM: MFN shutdown following electrical short in riser.
- CNSM: Initial MFN shutdown due to power controller (PSC) issues, now resolved as MFN functional.

Up to date on ingestion of available telemetered & recovered data.

## Mobile Assets

- 4 of 5 planned gliders in the field
- Glider 340, 376, 379, 583 healthy and on track
- AUV cruises on hold due to COVID-19.
- Delays in cruises and refurb operations could decrease glider deployments and create data gaps

## Refurbishment

- All moorings completed refurbishment for Pioneer 15.
- Surface & Profiler Moorings in burn-in

## Cruise

- Planning for limited Pioneer 15 cruise 28 Oct. – 11 Nov., 2021
- Ongoing risk assessment and cruise planning activities.
- Focus on Surface & Winter Profiler Moorings only. PMUO will be turned as weather and schedule allows. Minimizes shore-side and at-sea personnel risk. Prioritizes moorings requiring refurbishment and limited data delivery.

| Platform | Infrastructure % | Instruments % | Delivered XMIT % | Data Collected % |
|---|---|---|---|---|
| CP01CNSM | 83% | 76% | 48% | 84% |
| CP03ISSM | 74% | 65% | 43% | 70% |
| CP04OSSM | 74% | 73% | 9% | 73% |
| CP02PMCI | 100% | 86% | 86% | 86% |
| CP02PMCO | 100% | 100% | 100% | 100% |
| CP02PMUI | 100% | 86% | 86% | 86% |
| CP02PMUO | 29% | 86% | 0% | 86% |
| CP04OSPM | 100% | 100% | 100% | 100% |

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*COVID Risks shown in Red*

# CGSN Status: Irminger Sea



## Operations

- Turn of Irminger moorings successful; Irminger Surface Mooring operational, PCO2 instruments inoperational at deployment.
- HYPM, FLMA, FLMB fully operational.

Up to date on ingestion of available telemetered and recovered data

## Mobile Assets

- 2 of 3 planned gliders in the field
- Glider 535 (profiling glider), and 365 (open ocean glider)
- Both gliders have modified optode configuration (that resulted from success of BCP and subsequent ECR)
- Delays in cruises and refurb operations could decrease glider deployments and create data gaps

## Refurbishment

- Recovered Irminger mooring in disassembly.
- Integration planned start: May 28, 2021.
- Burn-in planned start: June 28, 2021.

## Cruise

- Planning for Irminger 8 cruise, Sept 7 - 27, 2021.
- Ports are Galway - Reykjavik
- Assuming pre-cruise isolation locally and decreased science team

| Platform | Infrastructure % | Instruments % | Delivered XMIT % | Data Collected % |
|---|---|---|---|---|
| GI01SUMO | 100% | 91% | 91% | 93% |

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*COVID Risks shown in Red*

# CGSN Status: Station Papa

## Operations

No change at Papa since last update, Papa 7 cruise cancelled due to COVID-19:

- All subsurface moorings in operation based on last glider update
- Upper WFP on HYPM failed to inductive comms failed; data will be recovered next turn.
- Up to date on ingestion of available telemetered and recovered data
- Expect data gaps starting Sept/Oct 2020 from HYPM, and in mid to late 2021 from FLMs due to power limitations

## Mobile Assets

- 1 of 3 planned gliders in the field
- Glider 537, 575 recovered successfully using third party vessel
- Glider 566 in transit to Papa after deployment from 3rd party vessel in October
- Delays in cruises and refurb operations could decrease glider deployments and create data gaps

## Refurbishment

- Recovered Irminger mooring pending disassembly.
- Integration planned start: April 1, 2021.
- Burn-in planned start: May 10, 2021.

## Cruise

- Planning for Papa 8 cruise, July 18 – August 1, 2021.
- Ports are Seward - Seward
- Assuming pre-cruise isolation locally and decreased science team
- Recommendation on conducting the cruise pending ongoing risk assessment.

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*COVID Risks shown in Red*

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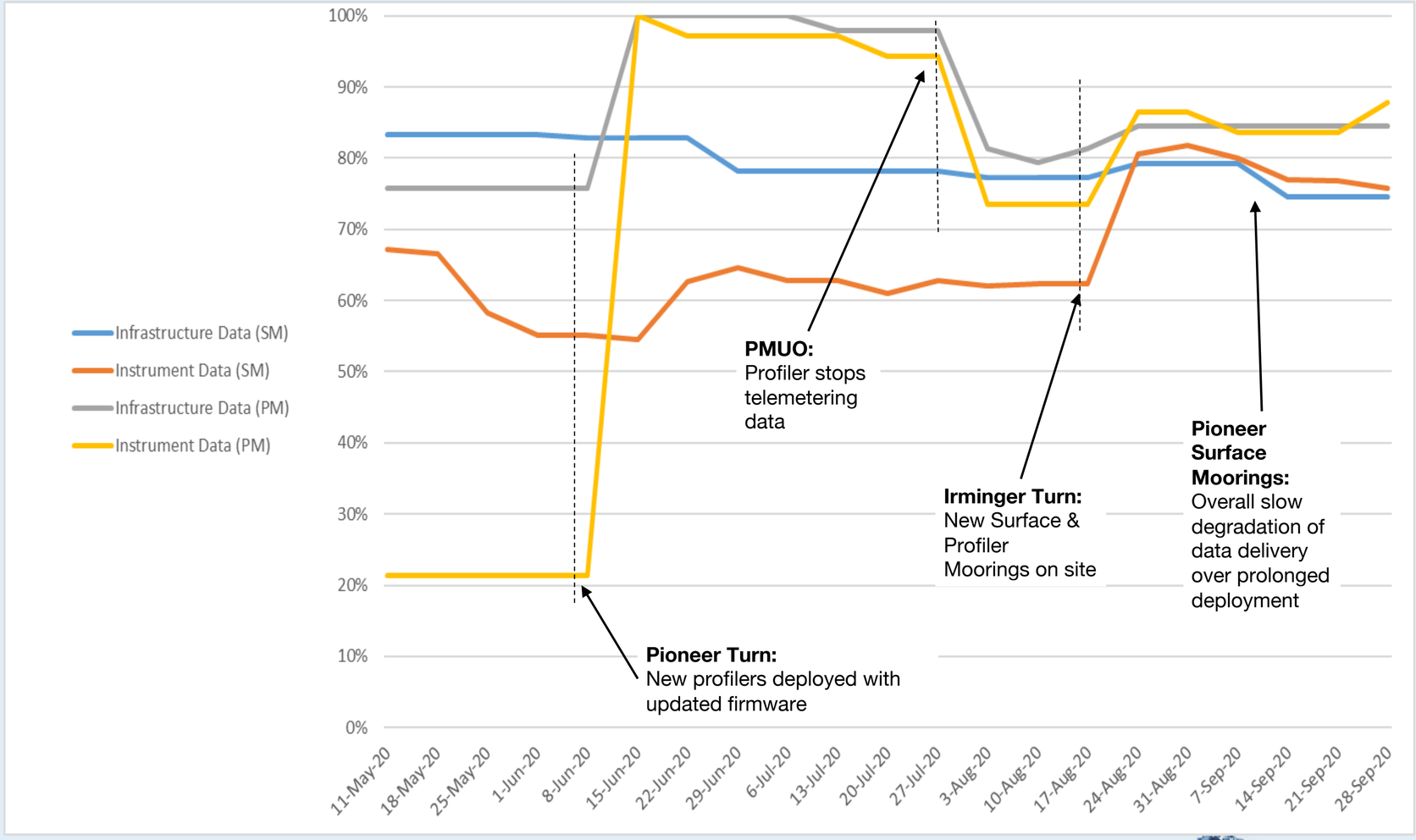
# Infrastructure & Instrumentation: Last 6 Months

- 6 month surface (SM) & profiler mooring (PM) status
- Irminger deployed 12 months
- By Pioneer 15, surface moorings will be deployed 13 months
- Includes:
  - Instrument assessment
  - Infrastructure health
  - Risks to infrastructure such as storm events
  - Actions and potential interventions

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# Technical Developments

- **Mechanical component updates:**
  - Mitigating sole-source risks
    - New stretch hose manufacturer currently up and running producing hoses, new wire manufacturer supplying wire
    - 2 further stretch hose manufacturers, and 4 wire manufacturers under review

- **Telemetry Services:**
  - All surface moorings currently operating on Iridium services
  - Continuing review of alternate services (Iridium Certus) as information is available
  - Iridium Certus would provide greater bandwidth if instruments were added to moorings (ie; FlowCytobot)

- **Glider Operations**
  - Modified optode mount, re-locating from body to tail, increasing data quality
  - 300 additional glider days in PYII over PYI
  - 3 x G3 gliders procured at the end of PYIII, gliders will replace lost vehicles

# Technical Developments

- **Ongoing power systems review and actions:**

  - Obtained and tested higher efficiency solar panels for Pioneer and EA.
    - Endurance Array has shown significant increase in power generation using new solar panels
    - Next phase will be full implementation on Pioneer Array, planned for Fall 2021

  - Wind Turbines
    - Developing proposal ECR for additional vertical wind turbine to be test deployed on Irminger. Vertical turbine with metal blades will supplement existing turbines, may provide better survivability storm conditions.
    - New wind turbine mount to be deployed on Pioneer 15. Design updated to mitigate damage due to turbine vibration and mooring motion.

# Technical Developments

- **Ongoing power systems review and actions:**

  - Implementation of automated turbine shunting on Irminger:
    - Using METBK and MOPAK data, the mooring will shunt wind turbines during storm periods, protecting the turbines from damage.  This was previously manually managed by the ops team.

  - Investigation of increased battery capacity
    - Vendor provided initial Lithium battery designs for Pioneer profiler moorings
    - Developed initial mooring design updates to accommodate additional batteries

# Technical Developments

- **Ongoing Tech Refresh activities for Instruments:**
  - Tech Refresh Process developed and approved, Common Instrument Specification updated and approved.
  - PHSEN:  First instrument in tech refresh process
    - Completed data review, delivered RFI to vendors, receiving responses
  - METBK: Implementing upgrade to new CPU board
    - Tested on Pioneer, being implemented for PRC modules, procured new boards
  - ZPLSC: New transducer
    - Should mitigate failures experienced in prior deployments
    - Phased implementation plan; initial transducers procured in PYII

# Performance Reviews

- **Glider Review:**
  - February 2020: Provided an overview of glider operations & performance since NSF 2017 review. Presented options for expanding glider fleet to meet data delivery expectations. Responded to panel report and recommendations.

- **MFN Review:**
  - June 2020: Completed MFN performance review. Included mechanical and electrical design, failure modes, and overall performance.

- **Profiler Review:**
  - September 2020: CGSN completed Coastal & Global Profiler portion of performance review. Included vehicle and system design, failure modes, and overall performance. Panel report pending.

# PYII COVID-19 Impacts

| Impacts | Successes |
|---|---|
| **Resource availability impacting refurbishment/integration/ cruise activities:**<br>• Stay At Home orders<br>• Required pre-cruise isolation<br>• Decreased cruise personnel<br><br>**De-scoped cruise activity:**<br>• Papa cruise cancellation<br>• Pioneer 14 profiler only cruise<br>• Pioneer AUV cruises delayed<br>• Glider test cruises (Globals tested at Pioneer)<br><br>**Data impacts:**<br>• No AUV cruises after March 2020<br>• Decreasing data from surface moorings due to delayed turns<br>• Papa HYPM and FLM telemetered data gaps due to lack of gliders, recovered data gaps expected (starting Sep/ Oct 2020) due to power loss<br>• Lack of gliders on site due to delayed or cancelled glider cruises, vendor issues | **Refurbishment & Integration:**<br>• Successfully refurbed and integrated Pioneer and Irminger without incident maintaining strict schedule, social distancing, and PPE<br><br>**Cruise Activity:**<br>• Pioneer 14 first WHOI cruise through risk assessment and approved by NSF, ONR, UNOLS. Replaced all profilers successfully.<br>• Irminger 7 completed a full turn cruise, along with OSNAP ancillary activities, without incident.<br>• Completed 2 x third party vessel cruises to recover gliders at Irminger and Papa. 3 x gliders recovered.<br>• Completed 1 x third party cruise to deploy gliders to Papa.<br><br>**Data/Software Activities:**<br>• Successfully completed Critical Metadata Review; ongoing Tech Refresh Process & QARTOD development, Completed Roundabout CI specification and all planned PYII tasks.<br>• Add'l 300 days of glider time |

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# PYIII Ongoing COVID-19 Risks

- **Cruise impacts:**
  - Pioneer 15 fall turn: reduced scope, surface moorings and winter profiler moorings only
  - Irminger 8: Currently planned as foreign port cruise, with Galway build and local isolation, risk assessment required
  - Papa 8: Currently planned as Alaska cruise, with local build and isolation, risk assessment required
  - Currently assuming isolation, decreased science team will be required

- **Data delivery impacts:**
  - Pioneer CPMs will be deployed greater than 6 month typical turn, may cause data gaps as power levels are impacted
  - Pioneer AUV missions continue to be on hold until procedures can be in place for WHOI personnel on 3rd party charters
  - Papa HYPM and FLM recovered data gaps expected (starting Sep/Oct 2020)

- **Financial impacts:**
  - Additional costs for isolation, cleaning, testing, transits
  - Additional 3rd party charters to support vehicle activities (recovery & deployment) and/or lost vehicles

# CGSN Community Engagement

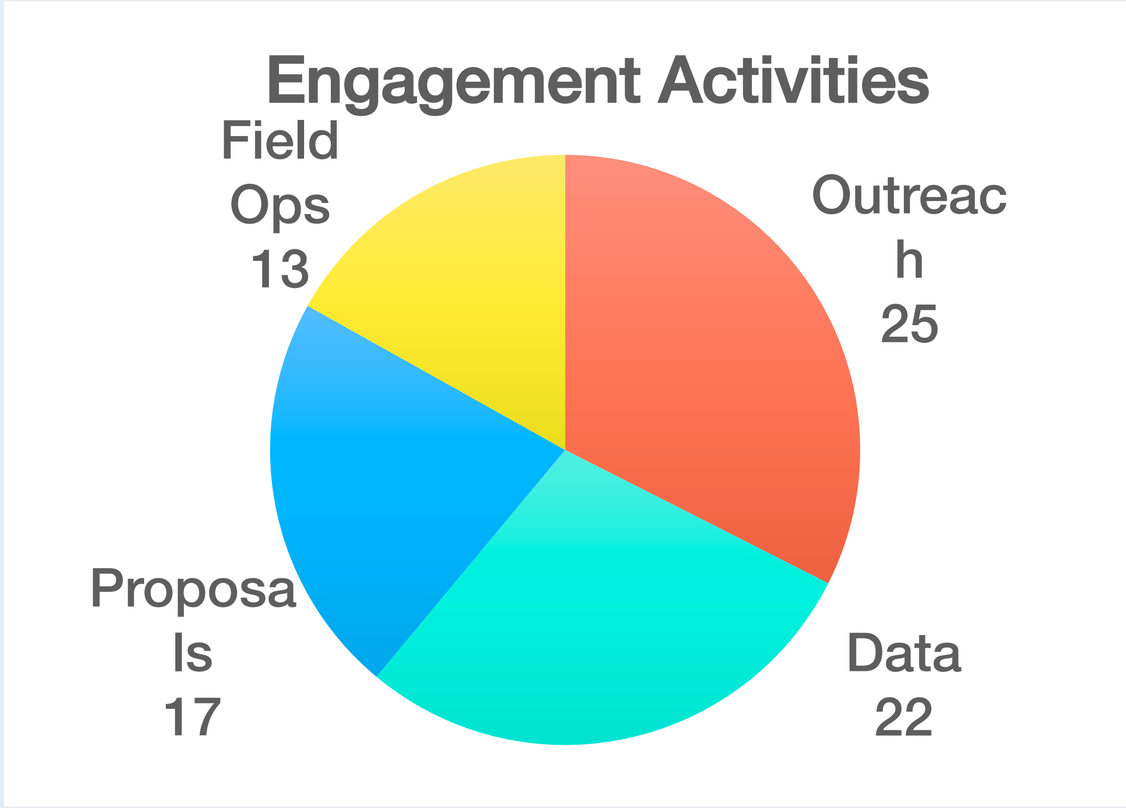
**Highlights PY-II**

- **Outreach:**
  - The CGSN Team supported a broad effort including talks and tours for high school students and college undergraduates, engagement with the local community, and presentations at national conferences.
- **Data and Proposal-related:**
  - CGSN engaged with ~30 researchers from a dozen institutions to facilitate data access, respond to data quality questions and support proposal preparation
- **Field Operations:**
  - Continuing engagement, but opportunities limited due to COVID-19

# CGSN Community Engagement

**77 reportable activities in PY-II**

- **Outreach:**
  - Talks, tours, advice, opportunities
- **Data-related:**
  - Access, availability, quality
- **Proposal-related:**
  - Sampling change, add sensors, …
- **Field Operations:**
  - Cruise participation, coordination



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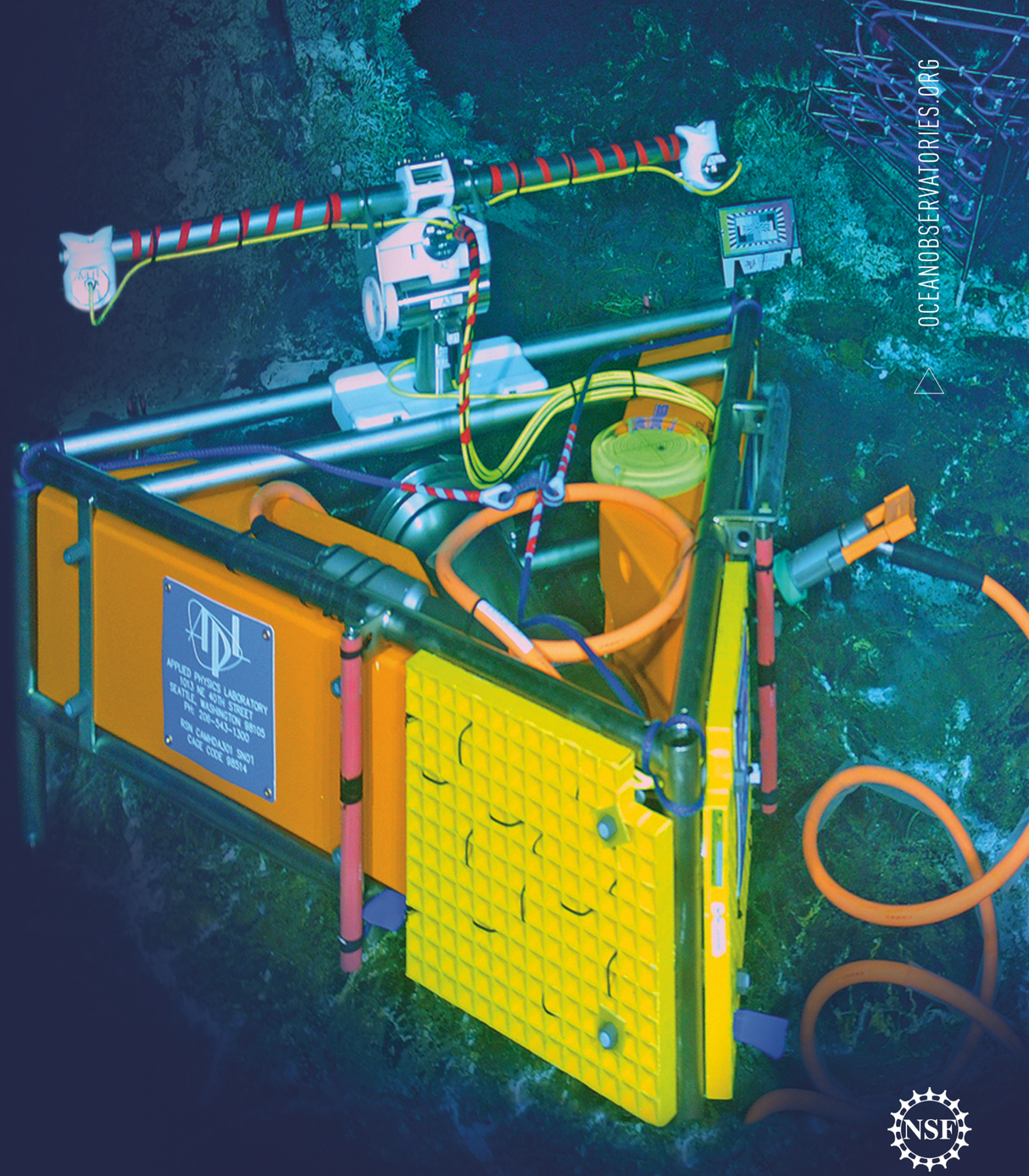
# Questions?

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# CGSN Science Discussion

October 13, 2020

Isabela A. Le Bras


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Geophysical Research Letters

RESEARCH LETTER
10.1029/2019GL085989

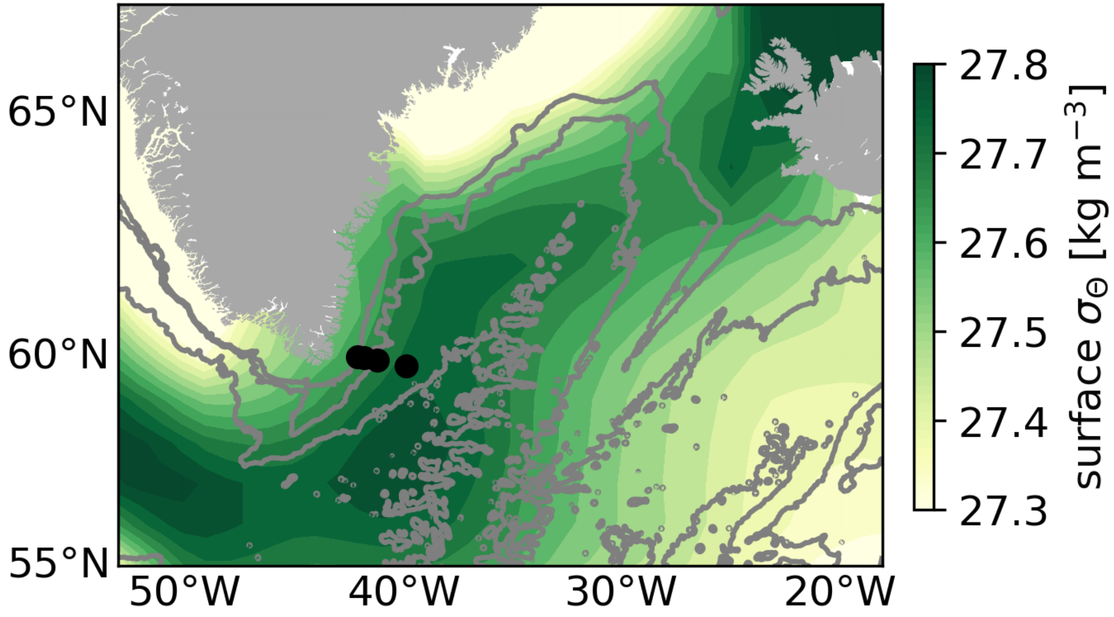
# Rapid Export of Waters Formed by Convection Near the Irminger Sea's Western Boundary

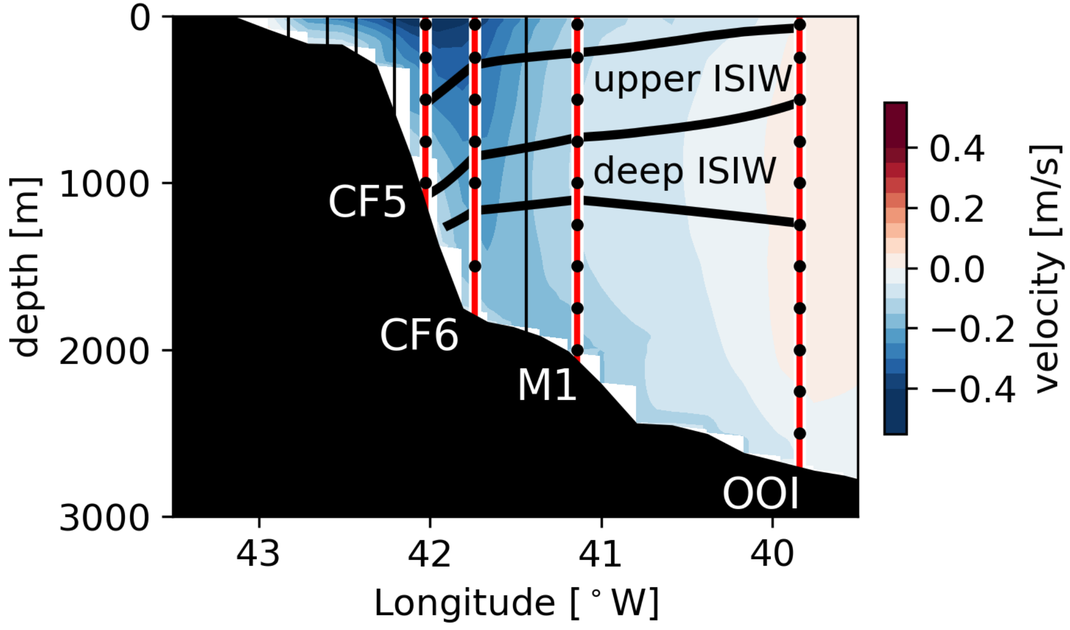
**Key Points:**

- From 2014 to 2016, two modes of intermediate water were formed by convection in the Irminger Sea
- Waters formed by convection near the boundary are exported more effectively by the boundary current

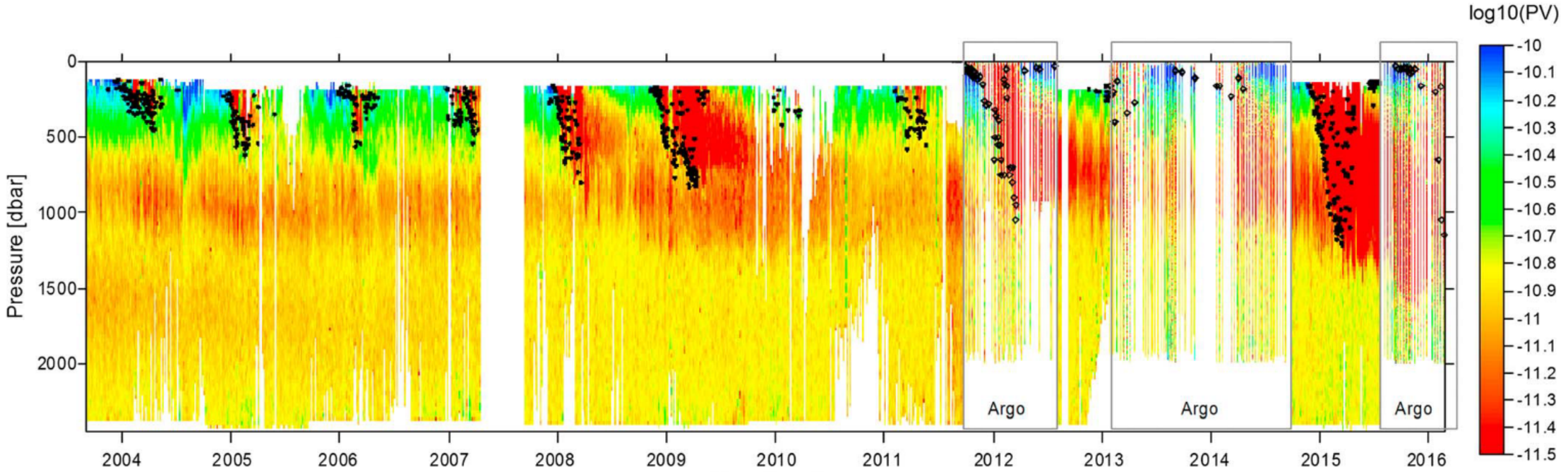
**I. A.-A. Le Bras[1], F. Straneo[1], J. Holte[1], M. F. de Jong[2], and N. P. Holliday[3]**

[1]Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, USA, [2]NIOZ Royal Netherlands Institute for Sea Research and Utrecht University, Texel, the Netherlands, [3]National Oceanography Centre, Southampton, UK



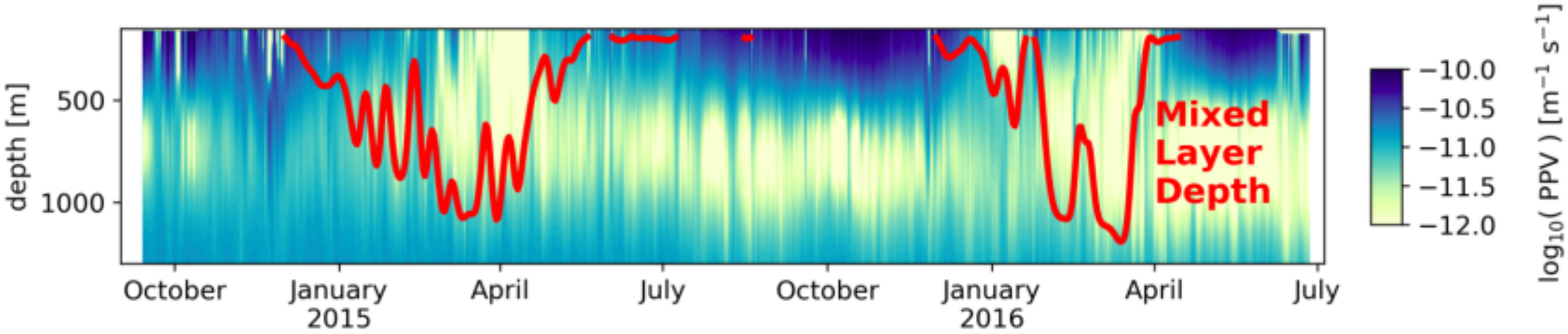



# Convection in the Irminger Sea: historical

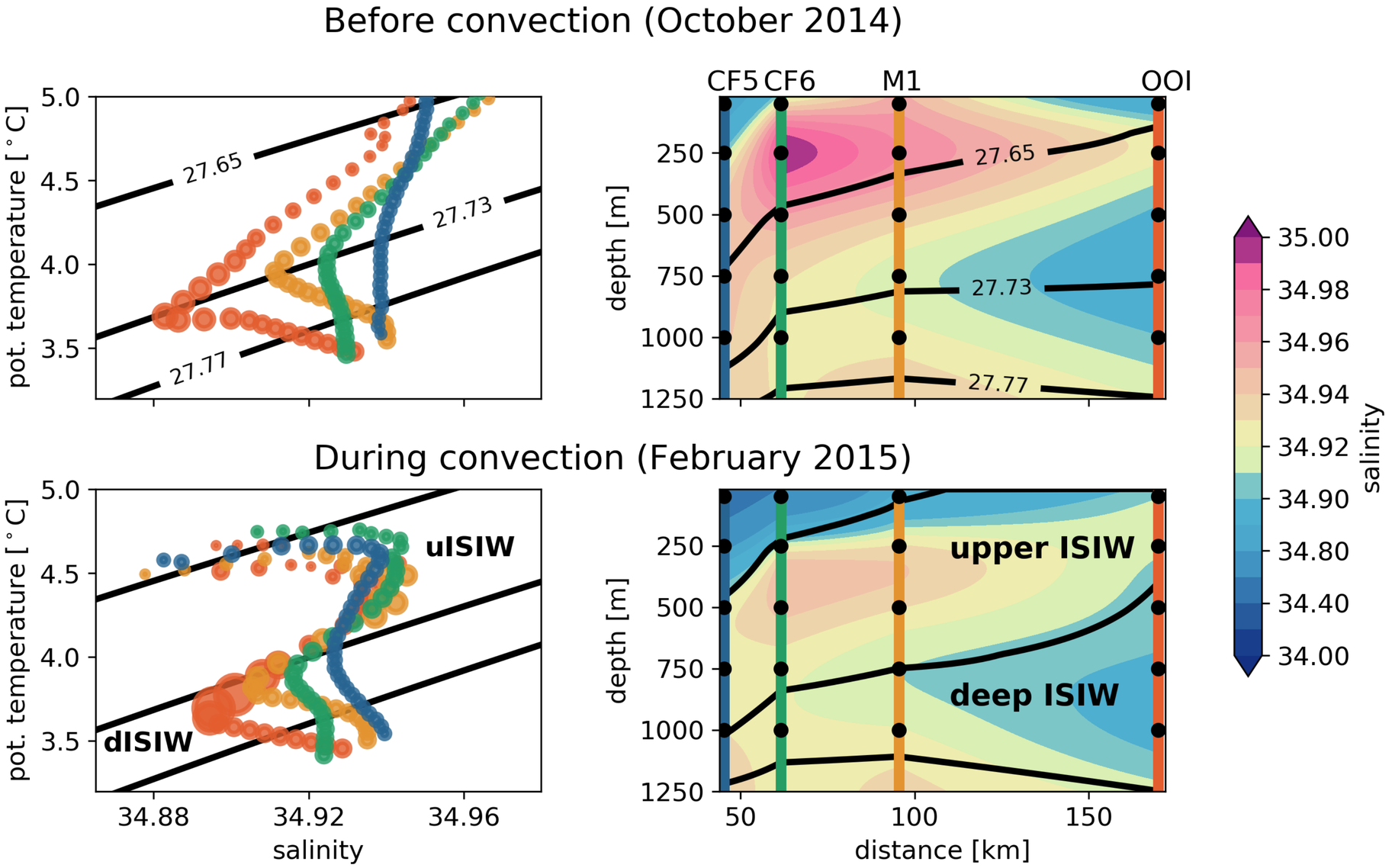



- Low PPV = low stratification, mixed layer waters
  - de Jong and de Steur 2016

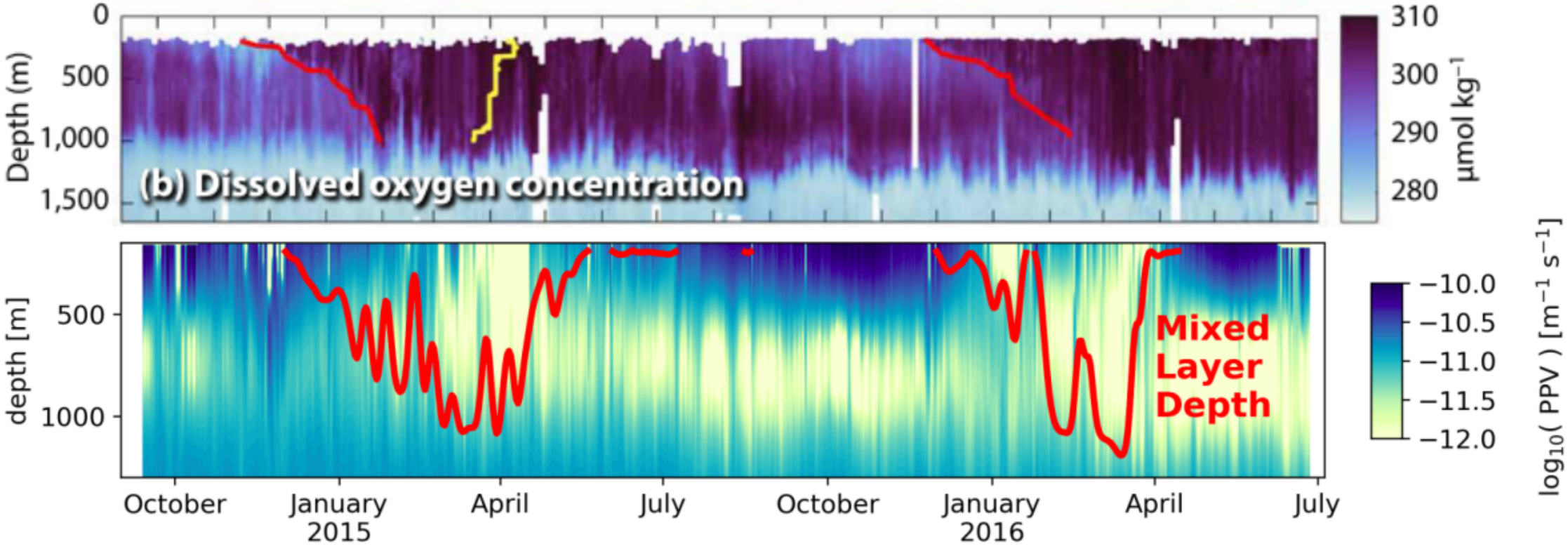
# Convection in the Irminger Sea: OOI




- Le Bras et al. 2020


Before convection (October 2014)
During convection (February 2015)
pot. temperature [°C]
salinity
depth [m]
distance [km]
CF5
CF6
M1
OOI
27.65
27.73
27.77
uISIW
dISIW
upper ISIW
deep ISIW
35.00
34.98
34.96
34.94
34.92
34.90
34.80
34.40
34.00
20m
200m
OOI: Irminger gyre interior
M1: Offshore of the boundary current
CF6: Deeper boundary current
CF5: Boundary current maximum

# New directions using Oxygen measurements




- Palevsky and Nicholson 2018, Le Bras et al. 2020

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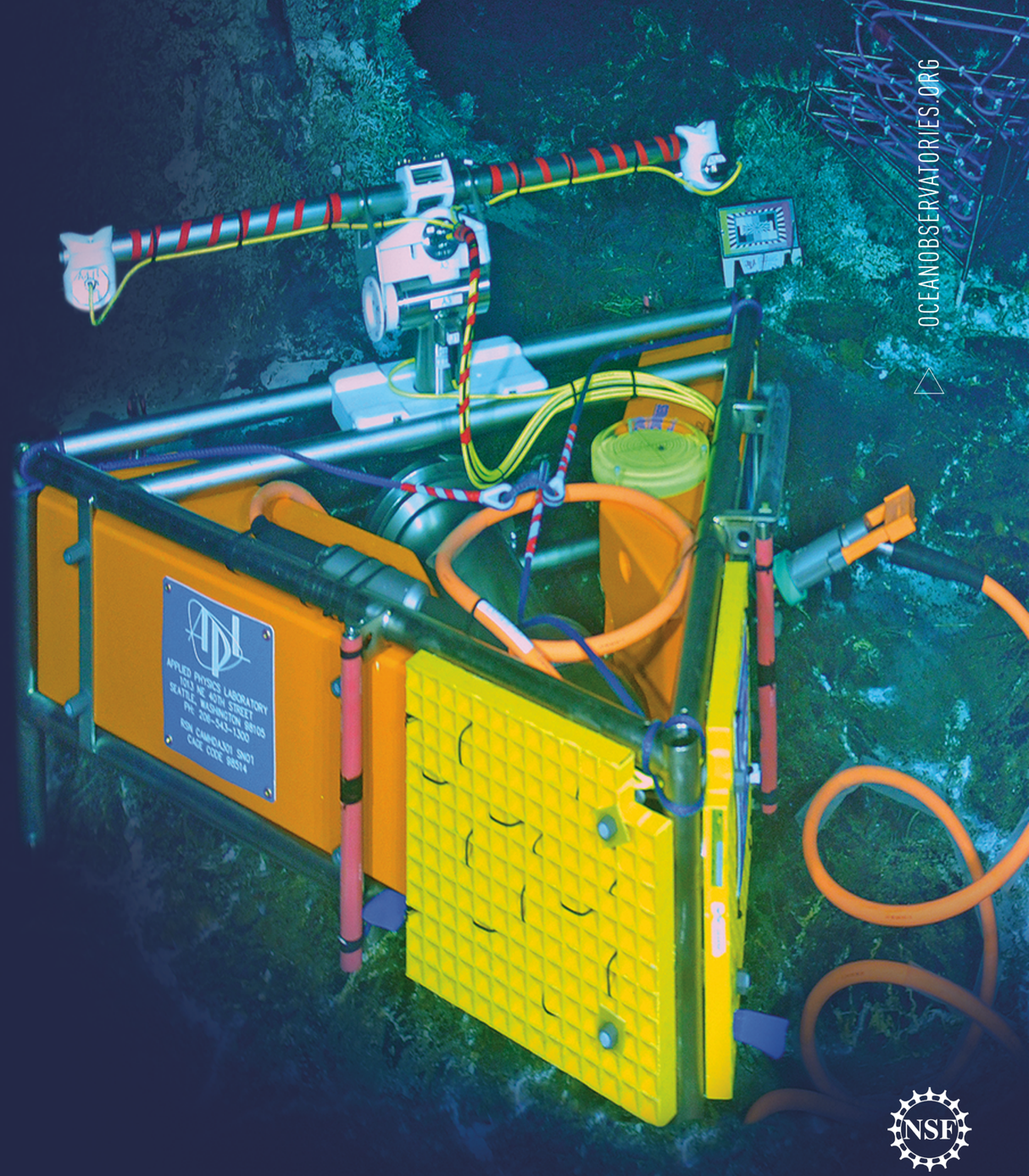
# Questions?

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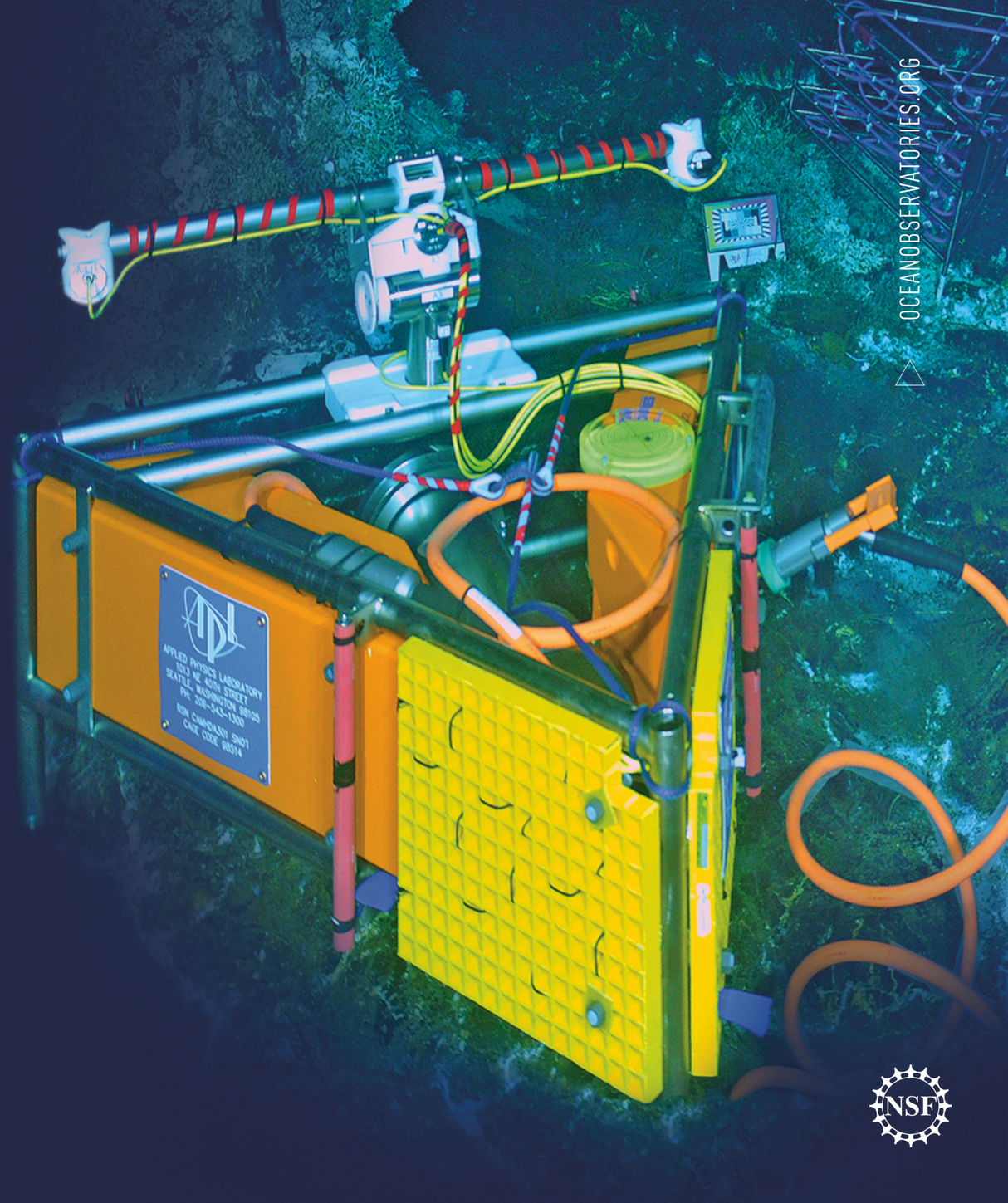
# Backup

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# 12-month Pioneer CSM Deployment

COVID period has demonstrated the issues with potentially ***deploying Pioneer surface moorings for 12 months***:

1. Mechanical performance is degrading (power generation, telemetry, etc.).
2. Transmitted data below our targets for a healthy system (10-50%),
3. Expectations are for recovered data at 70-80%, but quality of bio-optics and other fouling-sensitive instruments will be degraded.
4. We won't really know full impact until we complete the recovery and assess the mechanical systems and data quality.

Conclusion: Yes, we have a robust system that will continue to operate beyond 6 months, but as anticipated during the planning phase for OOI, ***mechanical and instrument degradation reduce data return and data quality to uncomfortable levels***.

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