**Ocean Observatories Initiative Facility Board (OOIFB) &**
**Data Dissemination and Cyber Infrastructure (DDCI) Committee Meetings**
**Woods Hole Oceanographic Institution**
**Quisset Campus - LOSOS Building - Conference Room**
**Woods Hole, MA**

- Tuesday, 5/21/19: OOIFB Meeting
- Wednesday, 5/22/19 AM: OOIFB & DDCI Joint Meeting
- Wednesday, 5/22/19 PM: DDCI Meeting
- Thursday, 5/23/19 AM: DDCI Meeting

## Meeting Goals of the OOIFB and DDCI Committee

**OOIFB Goals:**

1) To collect any additional information needed to complete the Annual Work Plan by the end of May 2019.
2) To be informed on the current status and future plans of OOI 2.0.
3) Identify OOIFB focus areas for the coming year.

**DDCI Goals:**

1) To gather information needed to complete DDCI's NSF tasking to provide a report on OOI 2.0s Data Delivery and CI systems by December 2019 (via OOIFB).
2) To collect any additional information needed to complete the Annual Work Plan by the end of May 2019.
3) To be informed on the current status and future plans of OOI 2.0 Data Deliver Systems and CI so that the .

**Upcoming Deadlines and Events Affecting OOIFB and DDCI**

- OOIFB Response to Annual Work Plan (AWP) – May 31, 2019
- DDCI report due to NSF - December 2019
- NSF submits material for NSB review - Late Jan/Early Feb 2020

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**Meeting Appendices:**

I: Meeting Participant List
II: Key Dates for OOIFB and DDCI
III: OOIFB Action items
IV OOI 2:0 PMO Update
V Pioneer & Global Arrays Update
VI: Endurance Array Update
VII: Regional Cabled Array (RCA) Update
VIII: Annual Work Plan Overview & Scoping Consideration
IX: RCA Annual Work Plan considerations
X: User Metrics - Science Use of OOI
XI: Outreach and Engagement - Year-1 OOIFB activities and Plans for Year-2
XII: OOI Outreach and Engagement Activities
XIII: COL- OOI Synthesis & Education (OOISE) Project
XIV: COL-OOISC Workshop Recommendations
XV: COL- OOI Early Career Scientist Workshop
XVI: Ocean Data Lab Project
XVII: Cabled Array - Highlights from German Program (slides on request)
XVIII: OOIFB Membership
XIX: Endurance Array – Annual Work Plan considerations
XX: Summary of OOIFB Day-1 Meeting Activities and OOIFB/DDCI Day-2 Plans
XXI: CI and Data Delivery Updates from OOI Program Office
XXII: Observatory Best Practice Overview - by COL
XXIII: Current WHOI MIO Data and QA/QC Activities/Priorities
XXIV: Current OSU MIO Data and QA/QC Activities/Priorities
XXV: Current UW MIO Data and QA/QC Activities/Priorities
XXVI: Interactive Oceans - Cabled Array Value-Added (CAVA) Program
XXVII: ERDDAP and OMS++
XXVIII: Axiom Data Science – User Defined Cyberinfrastructure
XXIX: Moving into the cloud with Pangeo

**Action Item Summary:**

***New Actions (from May 2019 meeting):***

**OOIFB-2019-2: Future Annual Work Plan Feedback** – OOIFB should provide feedback to NSF on useful format/content suggestions regarding the AWP for Program Year 3.

**OOIFB-2019-3: Plan Town Hall session for 2019 Fall AGU Meeting –** Larry submitted the abstract and we are waiting for a confirmation from AGU. An organizing team is needed. Suggested themes include:

- Community survey presentation
- OOI website - new
- 5-minute video on OOI
- Lightning talks

**OOIFB-2019-4: Ocean Sciences Town Hall** – Should OOIFB submit and abstract for a Town Hall? Requests for Town Hall sessions will be open soon.

**OOIFB-2019-5: Form a task force on science outreach/engagement** -

- Review the OOI community engagement plan
- Prepare a task statement
- Form the task force – should have early career representation
- Consider webinar/speaker series.

**Other suggestions/activities:**

**Quarterly Reports** - Lisa - the science highlights are great. Can OOI share the quarterly reports with the OOIFB to see the science?

**Future OOIFB/DDCI in-person meetings** – A better understanding of Data Delivery and CI is important for OOIFB. Move these presentations to the beginning of future meetings (DDCI would meet before OOIFB).

**Minutes from OOIFB Monthly Web Conferences** - Annette will work with NSF to determine if the minutes of the OOIFB monthly calls should be shared with PMO.

**Schedule next in-person meeting:**

- Late Oct/early Nov
- At NSF
- Invite other agencies NASA, ONR, NOAA

***Continuing Action Items:***

**2017 – Postponed to OOI 2.0:**

- OOIFB- 2017-7 – Identify topics and issues of mutual interest to SOC and OOIFB that would benefit by joint discussion
- OOIFB- 2017-8 – Identify strategies for collecting OOI User Metrics.

**2018 - Pending:**

- **OOIFB-2018-9 – Draft a Science Plan/White Paper.**
  - **Discussed during May 2019 meeting:**
    - Create a science plan/ roadmap on how to use the data and propose the use.
    - Make it into a living document:
    - Review the 2005 science plan to see if it is still relevant.
    - Within the Plan, insert links to the systems that are deployed in the water.
    - Include broad statements that relate the systems to the science themes.
    - Add science sidebars

- Source material could include TOS journal articles and Ocean Obs 19 papers.

- **OOIFB-2018-11 - Develop education and outreach strategies. -** The education community is doing a good job. Perhaps we can close out this action item? We need greater outreach to the science community (see Action **OOIFB-2019-5)**.

**2019 – Ongoing:**

- **OOIFB-2019-1 – Review and provide input to the 2019 OOI Annual Work Plan (AWP).**

**Meeting Minutes:**

***Day 1, Tuesday, May 21st: OOIFB Meeting***

**Welcome, Introductions & Review agenda:**

OOIFB Welcome - Brian Glazer opened the meeting at 8:30 am and welcomed everyone. He explained that he is sitting in for Larry Atkinson as chair of this OOIFB meeting. However, Brian explained that he is not serving as the Interim Chair for OOIFB.

Meeting participants introduced themselves. The attendance list is included as *Appendix I*.

WHOI Welcome - Mark Abbott, President and Director of Woods Hole Oceanographic Institution (WHOI), welcomed everyone to WHOI. He thanked the OOI team members who go to sea to support the OOI program. Mark explained that he has a long tie to ocean observatories with his connection to NEPTUNE many years ago. He hopes to see a lot of new research ideas come from the data provided by OOI.

Agenda - Brian reviewed the OOIFB meeting agenda and the important deadlines (***Appendix II***). This meeting will have a focus on the OOI Annual Work Plan for Program Year II.

**Update from National Science Foundation (NSF)** – Lisa Clough and Bob Houtman provided the update for NSF.

Lisa Clough reported that there is not much news on the status of the NSF budget at this time. Lisa continues to serve as the Acting Division Director for NSF/Bio. Her first detail with NSF/BIO ends soon, but she will likely continue for the remainder of the summer. It has been valuable in seeing how the other major observatory (NEON) operates. Lisa expressed a huge thank you to the OOI operator and the OOIFB for there support. All are moving in the right direction.

Bob Houtman - The program transition from 1.0 to 2.0 has been completed and 2.0 has been operating for a while now. They are doing a good job at putting systems in the water and taking things out of the water. So now the challenge is getting the science users. Data deliver and QA/QC is the important part. This is the part of the equation that we need to focus on. Lisa and Bob have to regularly update the NSF Director on OOI.

**Review OOIFB action items** – The action item list and status was provided in advance of the meeting. Brian Glazer reviewed the open OOIFB action items (see ***Appendix III***). One of the most important Action items currently open is OOIFB's response to the Program Year 2 Annual Work Plan. The response is due to NSF by May 31st.

**Update from OOI Program Office and MIOs**:

**OOI 2.0 Program Management Office (PMO)** - John Trowbridge (WHOI) provided the update. His slides are includes as ***Appendix IV***. Before beginning his report, John expressed his appreciation for OOIFB's efforts by presenting each member with a WHOI cap.

Prior to the meeting, OOIFB sent NSF a list of questions regarding the AWP. NSF forwarded these questions to WHOI. John provided the answers to the OOIFB's AWP questions in a handout.

John's slides include information on:

- The OOI structure - John presented the organization chart and introduced the PMO staff. Hanna Piecuch has recently been hired to work on the OOI website. Content for the site will include material provided by the MIOs.
- Selected PMO Milestones, including:
  - Completion of the OOI 1.0 to 2.0 transition in 2018
  - Several CI and Data Delivery actions including:
    - Implementation of strategy and recruitment of staff for CI improvements
    - Coordination of distributed data QA/QC functions by Marine Implementing organizations
    - Transfer of selected CI scope from Rutgers to WHOI
    - Process for management of Redmine tickets
    - CI self evaluation has been completed and the Analysis of Alternatives (AoA) is on-going.
  - Submission of the Annual Work Plan for PY II
  - Ongoing activities
- OOI 2.0s guidance from NSF is to "Keep the airplane aloft," i.e. ensure continuity of data streams and maximum science value for the investment
- John's goals for PYII are to:
  - Ensure the continuing success of the marine operations
  - Ensure success of CI and data delivery
  - Enhance use of metrics
  - Enhance community engagement

Discussion:

- Sarah Gille - What are your thoughts on community engagement? John - Science use and proposals. Education is not part of their scope
- Rouying He - What are the weekly, quarterly and annual reports? John - There is a weekly report that is typically a few pages long. NSF requires the quarterly report

and it provides accomplishments, risks, etc. The Annual Report is a requirement and is submitted to NSF via Fastlane.

**Pioneer & Global Arrays** – Al Plueddemann (WHOI) provided the Coastal Global Scale Nodes (CGSN) update. His slides are included as ***Appendix V.***

Al presented the CGSN Organizational Chart.

- Blue boxes are the specialists with full-time tasking.
- Green boxes are positions with primary, core functions
- Orange is crossover, support functions.

In individuals and functions in CGSN Operations are listed in the slides and are all primary functions.

The status of Pioneer was provided:

- The key platform status is illustrated in in the summary matrix (red light/green light). Pioneer is operating well and the matrix is mostly green. Profiler telemetry failed and is shown as a red light at 0%.
- For the Mobile assets, 2 of 7 planned gliders are in the field.
- AUVs working well.
- All moorings completed refurbishment.

At the Southern Ocean Array, data delivery is at about 50%. The telemetry is working well, data to deliver is lacking. There has been some deterioration of equipment.

At Irminger, data delivery is at 60%. One of 3 planned gliders is in the field. They lost a glider about two months ago and it might have been hit by something. There is a lot of risk due to ship scheduling issues. The gliders risk of loss is higher as their battery power runs low.

Discussion:

- Jim O'Donnell - Do you lose data when you lose the glider? Ed Dever - Although there is telemetry, you lose some data.
- There were vendor delivery problems for the gliders.
- Jim O'Donnell - What is the failure rate of the gliders? Al Plueddemann - The rate of failure is 30-60%, but they are providing useful science data in an adequate amount.

Al reviewed CGSN Technical Developments:

- ROV - Falcon DR ROV was procured in 2018 and was used on the April Pioneer cruise. It has been a successful operation.
- Power Generation – They are testing higher efficiency solar panels on Pioneer and Endurance Array (EA)
- Power System Controller – they made a targeted use of COTS equipment.
- Glider refurbishment – They negotiated a service agreement with TWR. It should allow for better advance planning by TWR and should increase turnaround speed for glider refurb.

Discussion:

- Bob Houtman – The Energy Department has been contacting NSF about ocean power generation. Al P - There are great ideas for deploying instruments to capture energy from the sea. The real challenge is applying the captured energy to the instruments on the sea floor or mooring.
- Bob Houtman - We need to revisit this. The Energy Dept. is interested in this and has funding.
- Ruoying He - What is the turnaround time? Derrick Buffitt - Months, not weeks. Ed Dever - They are also starting to deal with aging equipment. Some systems on the gliders take longer to turnaround tha others. The glider vendor has requested that OOI not send them entire systems, but instead just the systems that need refurb. The Glider workshop held in 1.0 was useful.

Back to slides:

Al reviewed the PY2 AWP highlights and the CGSN response to reduced operating budgets. The need to reduce the budget is due to WHOI's overhead increase, increased ship costs, inflation, and a 2.5% charge for the CI improvement effort. Efficiencies can be realized with technical developments and process improvements, such as, just replacing parts/cables as opposed to the entire system. They also were able to achieve one-time cost savings through equipment re-use, instrument spares pool, and deferred refurbishment. Proposed scope changes include:

- Reduce profiling gliders from 2 to 1 - this won't have much science impact.
- Reduce trackline gliders from 3 to 2 - this will have more of an impact.

Discussion:

- Tim Crone - You said that the descope will be temporary? Why do you think this? Al – They are hoping that the CI improvement of 2.5% will be temporary.
- Sarah Gille - Is there another glider vendor? Ed – Yes; however, it would take a significant CI effort to get data from a new glider.
- Rouying He - Is there insurance on lost gliders? Al - No. They are self-insured. They have suffered enough attrition that they need to buy more gliders. Derrick Buffitt – They will look into the feasibility of cannibalizing the gliders from Southern Ocean.
- Annette - Who are the other glider users? Paul Matthias – The Navy. OOI is second to the Navy. Others use the gliders, but mostly in campaign mode.

Al provided a review of science highlights from CGSN: The slides for list the programs using OOI data along with the PIs.

Al reported on the challenges facing CGSN:
One-time cost savings - Many PY2 savings cannot be repeated in PY3. Also, continued re-use of systems increases risk.

- Glider delivery

- Technical refresh
- Ship scheduling and cost.
- Other challenges - ship schedule and cost.

Paul Matthias - The 50 to 60% glider performance that you are seeing now is quite poor. It wasn't always like this. It was 80% in the earlier years. Derrick - These systems are coming to the end of their turns and performance is degrading. Ed Dever - We have passed through the infant mortality phase and now we have aging systems.

Lisa Clough - The science highlights are great. Can OOI share the quarterly reports with the OOIFB to see the science that is being done.

**Endurance** - Ed Dever provided the report. His slides are included as ***Appendix VI***.

- Ed showed the Organization chart.
    - There are three people shown in yellow who are full time on OOI.
    - There are many showing in blue that are part time.
    - Surge technicians are used when needed and come from within OSU.
    - There are about 5 student workers, mostly undergrad. Several have gone on to grad school.
- The Endurance Array Turn Cruises 11A and 11 B aboard R/V *Sikuliaq* and R/V *Oceanus* in April and May were successful.
    - They have used *Sikuliaq* a lot lately. The ship is more expensive, but provides excellent support. They can do the glider recoveries quickly.
    - They had to adjust to a vessel change before the cruise when *Atlantis* was no longer available.
- The Endurance Array Platform status is very successful.
- The Endurance Array Glider coverage since the Oct 2018 meeting:
    - 9 gliders deployed (as opposed to 12 planned). There is less than a full complement of glider deployed due to slow servicing.
    - 5 were recovered.
    - 3 were deployed to full duration.
    - 1 glider leaked after 58 days - they had some leaks that pointed out the 200m pump. They shortened the service schedule. They are also inspecting and cleaning them more often.
    - 1 glider recovered 74 days early due to ship availability
    - A memorandum of negotiation is planned with the glider vendor.
- Endurance Array CSPP deployment summary since October 2018 – There have been 0 deployments completed normally.

- Endurance 11 status is all green lights. The % takes into account electronics that are intentionally turned off. Systems are operating fairly well on Endurance.
- There are some notable technical progress. New solar panels are in test configuration.
- Some ancillary/data verification activities include:
    - Continued to add biofouling settling plates.
    - Participated in the UNOLS cruise volunteer program.
- The Endurance team contributed three articles in the OceanObs 19 collection of white papers published.
- Endurance expects to stay within budget for the AWP PY1.
- Challenges include:
    - CSPP failures
    - Instruments
    - Glider servicing
    - UNOLS ship scheduling
    - Heavy lift winch.

Bob Houtman - Ocean metrics on ocean acidification is an important area for the interagency group. Ed - They have worked with vendors to improve their measurements.

***Break***

**Regional Cabled Array (RCA)** – Deb Kelley (UW) provided the report. Her slides are included as ***Appendix VII***.

- The Organization Chart for RCA was reviewed.
- 5th 2019 Maintenance Cruise - 44 days with 14 days of Mobe/demobe; > 40 dives
    - Leg I: May 29-June 9 was a partial mooring recovery operation.
    - The Shallow Profiler Mooring is a workhorse with more than 40,000 profiles. It is very smart and will hide if the wave height is too large.
    - There was an Axial connector issue. The ROV attempted to connect to the connector. It is a tricky operation and if not done correctly will damage the connector. They are now introducing new connectors.
    - The *Atlantis* cruise is a high-risk operation. They will recover the platform on deck and replace the leg. There is risk since they never did this before. The remainder of the cruises are more standard. They will be live streaming again.
- Deb reviewed the Cabled Array operational status and what data are flowing.
- Deep profiler status:
    - In 2018 two moorings were turned.
    - Axial Base data is still not in CI. It is unclear if it is a buoyancy issue or fouling on the cable.
- The Weather map provides the status of all instruments with live updates. The cabled array operational status is 84% operational since March 2019.
- The NW GigaPop-UW partnership operates and maintains the west coast cabled array network including backhaul. The Portland Pittock building is now a pass through
- IRIS users seeking seismic data continue to increase. Total Gigbytes downloaded is 14,857.

- There is a request to NSF to incorporate Cabled Array Data into ShakeAlert, and early warning system for the West Coast.
- There has been and expansion of the cabled array with PI instruments.
    - There are 11 PI Instruments now on the Cabled Array
        - 2017 - Chadwick
        - 2018 – Bemis, Sasagawa and Zumberge, Wilcock, and Breedlove
        - 2019 – Bemis, Wilcock, Chadwick, Reimers and Girguis, Breedlove, and Bohrmann and Marcon.
    - PIs must indicate their recovery plan for their instruments before deployment.
- The slides describe the exciting science planed.
- Instrument highlights:
    - The Axial Seamount Bottom Pressure Tilt will allow the prediction of the volcano eruption applying a model created by Bill Chadwick.
    - ONR's Turbo-Rankin Power system is a high security program, so not much can be reported. This is one case where things don't show up on-line.
    - NASA Exobiology is a platform with 3 laser spectroscopic and imaging instruments.
- Deb reviewed user statistics showing demand and diversity of users.
- Access to PI Data is available via OOI's RSN FTP Site UW.
- The PI instruments will also be accessible from the OOI website menu.
- To avoid situations like the one where the fisherman dragged the cabled array last year, they have created a virtual aid to navigation (ATON). AIS is transmitting information where no physical ATON exists (lighthouses, buoys, moorings).
- VISIONS: training next generation students:
    - Over 150 undergraduate and graduate students have participated in the NSF-RCA-UW VISIONS
    - It entrails diverse population of students.
    - It encourages science and outreach projects.
    - There have been several senior thesis projects.
- UW is launching a new interactive oceans website. It is a Cloud-based science-education site. Orest will present information about the website during the DDCI portion of the meeting.
- There is a highly interactive map interface showing RCA assets that serve as entry point into the Data Visualization Portal.
- There is a data visualization portal with enhanced data search and visualization capability.

Discussion:

- Ruoying - What is the German incentive? Deb - it has been a good collaboration with Germany, Navy, And UW. It took a lot of work at UW. There were export concerns.
- Sarah Gille - There are Navy cruises with security concerns. You take students out on your cruises from all over the world. Has this been an issue? Deb - The students are very respectful of the security concerns.

**Annual Work Plan (AWP):**

**NSF guidance on OOIFB review:**

- Lisa Clough remarked that OOIFB did a nice job with providing questions regarding the AWP. The questions are on the right track. OOIFB provides input. OOI Program Year 2 is an important year becaus in Year 3 it needs to be decided if there will be a recompetition of the OOI Program Management. It is time to be seriously considering return on investment.
- Bob Houtman - The OOIFB perspective should be from the community. NSF will be interested in the metrics and performance. Has performance met the standards? If the community feels that there needs to be changes, NSF needs to know.
- Lisa Clough - From an academic perspective, this is the time to consider course corrections.
- Bob Houtman – Program changes cost money. We want to make sure that we make smart decisions. Do we stay with certain systems?

**AWP Overview & Scoping Consideration** - John Trowbridge provided the report. His slides are included as ***Appendix VIII***.

- The budget total is unchanged from Program Year 1
- Relative to 2017 proposal, the 2.5% budget reduction to MIOs to support CI improvements continues.
- 2.5% budget reductions for each MIO were described during the presentations by the PIs.
- Details of the CI improvements will be addressed in depth during the DDCI portion of the meeting include:
    - Mission-critical enhancements reviewed by the PI Team
    - Bug fixes
    - Support.

**Summary of DDCI Feedback to AWP Excerpts** - Tim Crone, DDCI Chair, provided a summary of DDCI's feedback to the AWP.

- The AWP is too vague.
- There is no mention of the Data Portal. The Data Portal is what the community knows. The portal isn't mentioned in the Plan, should it be mentioned in the Plan. We need to understand it better.

Discussion:

- John Trowbridge - In creating the AWP, they are following the template of the 1.0. Going forward, should they put in more detail? They could do this. That could be an outcome. It would require a lot more effort. PMO executes what NSF wants.
- Jim O'Donnell – He appreciated the reports that were provided. We hear about the problems and understand it now. Delivery of the data is the biggest area of concern and the area that needs to be addressed. We understand the operations, but going forward perhaps we should start the OOIFB/DDCA meetings with data deliver. OOIFB and DDCI need to focus on the areas that aren't working well.
- Lisa Clough - We could flip the meeting agenda going forward by putting DDCI before OOIFB.
- Lisa - If additional details on Community engagement and Data Delivery/CI are needed for the AWP, OOIFB should provide that as feedback to NSF.
- Bob Houtman – OOIFB should be clear about what we want to be included in the AWP going forward.

- Brian Glazer - If OOIFB can get copies of the OOI quarterly reports, we may better understnad the status of the program and may not need a longer, more detailed AWP.

**RCA – PY1 and PY2 Budget, Scope of Work** – Deb Kelley provided the report. Her slides are included as ***Appendix IX***.

Deb explained that the PY1 Proposed Budget was, but with the 2.5% MIO reduction to support CI efforts the revised budget was $10.502M. To meet the $10.502M reduced budget:

- AWP1 had ship-ROV reduction from 31 to 28 days.
- Deep profiler installations reduced from 3 to 1. However, all docks were working, so they were able to reallocate the budget for 1 complete refurb/installation of the Deep Profiler to refurb of 3 vehicles. Hence, all three Deep Profiler Moorings were fully installed in 2018 and three vehicles are refurbished and tested for 2019 installation.

In PY2, PMO requested continuation of the 2.5% reduction to support CI efforts. The proposed PY2 Budget is $10.502M, same as PY1. However there were cost increases from PY1 to PY2 that included:

- Ship and ROV: costs increased by $246,800: LOE increased $117,081.
- Shallow Profiler Mooring: During 2017 or 2018, *Jason* damaged the main connector to the Axial Base mooring. PY2 budget scope included complete recovery and refurb of the mooring to replace the connector. **$122,557** allocated to refurb recovered mooring.

To meet the $10.5 cap, RCA proposed:

- One Deep Profiler would be installed in 2020 (same as AWP1)
- Defer Mass Spectrometer (2); flow meters (2); HPIES (2); and Digital Cameras (6)
- Remove all engagement budget.

Deb explained how the reductions/deferrals were chosen:

- The priority was to keep infrastructure in water; Kelley maintains engagement through UW support.
- Assume only one Deep Profiler would be installed 2020
- Mass Spectrometers - complex instruments and abnormal behavior re vacuum and voltage drops and inconsistent behavior of instrument response to calibration solutions. Decided to defer mass spectrometer installations in 2019.
- Flow Meters: They are investigating moving analyses in-house to RCA to reduce costs?
- HPIES: Highly specialized instruments, long deployment times required (12 hours) for each platform; data not yet in CI (parsers and algorithms)
- Cameras: Kongsberg informed RCA they would no longer support future refurbishment. RCA pursuing incremental refresh option. UW is reviewing the potential to refurb Kongsberg cameras in house.

Discussion:

- Ed Dever - He will put together a slide to discuss the Endurance Array AWP2 reductions. They are cutting 1 FTE from mooring refurbishment, but they are more efficient. The cameras may not be deployed. Effectively they are not deploying instruments that aren't working.

- Lisa Clough - NSF wants specific responses on AWP that is before them. As a follow-on effort, NSF would like feedback on what OOIFB would like to see in the AWP for PY3. Comments directed to NSF are fine too. As an example, the question of why NSF would level fund OOI when facing a 4% inflation increase annually, is reasonable to ask?
- Bob Houtman- Generally speaking, programs at NSF are level funded.
- Deb Kelley - It seems odd to her, that existing infrastructure has a budget cap, yet NSF has solicitations for new infrastructure through "Big Ideas" initiative.
- Annette - Can OOIFB provide comments for AWP PY3 after the PY2 feedback is submitted on May 31st? Bob – yes.

***Lunch***

**Assessment of science use of OOI and User Metrics**:

**Science Use of OOI - OOI PMO 2.0 –** John Trowbridge provided the report. His slides are includes as ***Appendix X***

John reviewed the types of metrics:
- Platform performance
- Instrument performance
- Data delivery
- Data quality
- Data downloads
- OOI-related scientific and technical publications
- Citations of OOI-related publications
- Funded projects that use OOI data or infrastructure

John shared plots that the number of ARGO publications with OOI pubs.
In 2016 there was an eruption and there have been a lot of OOI pubs that came out of it.

Sarah Gilles commented that people should be encouraged to write quickly.

**User metrics – NSF:** Lisa Clough reported that this has been a challenge. We have to show OOI data use. Is the community using it? We have some leading indicators. LTER got funded, but there will be a lag before we see papers. She is concerned. NSF is seeing more proposals submitted into education. For science, the proposals and awards are not good. How do we make the case?

Discussion:
- Jim O'Donnell - We have to separate the numbers that are easily collected.
- Lisa Clough - Are we transforming the way science is being done?
- Bob Houtman – There are over 500 repeat users. It isn't going to be a single metric. It will need to be a combination of metrics.
- Tim Crone – Is there Google analytics on the OOI website?
- Lisa Clough - The science proposals are still small numbers.

***Break***

**Outreach and Engagement:**

Review Year-1 activities:

OOIFB Activities in Year 1 and plans for Year 2 - Annette DeSilva provided the report. Her slides are includes as ***Appendix XI***. Year 1 activities included an OOIFB Town Hall at the 2018 Fall AGU meeting.

In Year 2 OOIFB has requested a Town Hall at the 2019 Fall AGU Meeting.

OOI Program activities – John Trowbridge reviewed OOI engagement and outreach activities. His slides are included in ***Appendix XII***.

OOI has developed a Community Engagement Plan with three high-level goals:

- Optimize the OOI
- Build a robust, active, and inclusive OOI user community
- Cultivate new users

Year-1 selected OOI activities are listed in John's slides.

OOI activities at OceanObs - John Trowbridge continued the report with a list of OOI-related publication for OceanObs 19 (see ***Appendix XII***).

OOIFB Town Hall at 2019 Fall AGU meeting - Annette DeSilva reported that if AGU accepts OOIFB's Town Hall request, an organizing group will be needed. Ideas for themes for the Town Hall were discussed and included:

- Community survey results
- New features of OOI's website
- A 5 minute video on OOI data access
- Early career initiatives
- Etc.

Lisa Clough added that on a related topic, OOI could have virtual brown-bag webinars. Presentations can be recorded.

OOI Booth - Ocean Sciences Meeting 2020? – There was a discussion regarding whether or not OOI should have a booth at the 2020 Ocean Sciences meeting.

- John Trowbridge - There will be OOI sessions at Ocean Sciences and they will be announced before the 10 July abstract submission opening.
- Ed Dever - Endurance will submit abstracts for the sessions.
- Lisa Clough - The past OOI booth had a couch and it was useful in drawing people into the booth.
- Jim O'Donnell – It would be useful to have OOI data team members at the booth.

- Bob Houtman - Focus on specific data streams would be useful. Mention where the data is, products, QA/QC, etc.

SOC Outreach White Paper - John Trowbridge explained that their OOI Community Engagement Plan drafted this year is actually the outreach document.

**Education Programs**

**Review of NSF supported education programs from the past year:**

**COL's Funded OOI-related Activities** - Kristen Yarincik provided a report on COL's education activities via WebEx.

First, Kristen reported on COL's OOI Synthesis & Education (OOISE) Project. Her slides are included as ***Appendix XIII***.

A Data review was conducted and a web portal was established: https://datareview.marine.rutgers.edu/. It included instrument-stream deployment reviews: "system" or "operations" checks to make sure the data that is available is being delivered properly through the system. Review notes are entered on an instrument report page to be used by OOI 2.0. Monthly reports are sent to OOI 2.0. The review is ~30% complete.

Part of the project is to identify data "nuggets" of reasonably good quality, or in some cases that demonstrate well a measurement quality issue (e.g., biofouling). This is being applied to an undergraduate introductory course curriculum. Fifteen "nuggets' identified to date.

An education workshop was held on April 26-28, 2019. The purpose was to discuss undergraduate educator experiences using OOI in the classroom. An outcome will be a manuscript to be submitted to *Oceanography* highlighting OOI as a resource for using data in the undergraduate classroom.

A major barrier that was identified in the workshop was: Identifying, downloading (reliability), and quality controlling OOI data are too time consuming for educational use. Professors don't have time to search through, QA/QC & process raw data, as well as build exercises for their students. Additionally, students don't have enough time within class to download or access current data and do exercises.

The workshop provided education recommendations to OOI 2.0. The recommendations were also provided as a handout and included as ***Appendix XIV.*** They were categorized into 3 categories:

- Data Delivery and QA/QC:
    - There needs to be an easy way for an educator/researcher to determine a data set's value before committing time to download, review and build curriculum around the data.
    - Consider moving OOI data into the cloud with associated computational capacity to mitigate current inefficiencies.

    - Provide curated datasets (version controlled & regularly updated).
    - QA/QC must be performed at the OOI level.
- Support - Need responsive help desk.
- Other - Develop 'second generation' widgets.

In a separare activity, there is a self-motivated early career group that will hold a workshop next week at COL. Details about the workshop are provided as ***Appendix XV***. Kristen offered to provide a report after the workshop.

**Rutgers Workshops** - Janice McDonnell (via Webex) provided a report on the Ocean Data Lab Project. Her slides are included as ***Appendix XVI***.

New educational content for OOI is being developed as part of the project. A goal is to address the challenges of teaching with data and support opportunities for professors and undergraduates to become more expert users of OOI data. 2) Increase undergraduates engagement in and understanding of OOI data.

Data Explorations workshops were held in:

- 2016 (1 Biology workshop)
- 2017 (2 workshops- Chemistry and Geology)

Janice reviewed the plans for the OOI Data Labs Project in 2018-2020:

- Develop, test, refine, and disseminate easy to use Data Labs that will engage, motivate, and support undergraduates to use data from OOI
- Develop a sustainable mechanism for community college, PUI, and HBCU professors to access, use, and update OOI data for teaching.

Data Labs Workshop Goals for participants are to:

- Learn about the OOI program and key science questions it addresses
- Access existing tools and resources designed to integrate OOI data into undergraduate teaching
- Introduction to Python
- Learn how to effectively incorporate OOI data labs into undergraduate teaching
- Create a customized new resource to bring OOI data into their classes
- Have an opportunity to network with other professors interested in using oceanographic data in undergraduate teaching.

The Data Labs Workshop schedule for 2019 was reviewed (see slides) along with the agenda.

The progress to date and participant satisfaction survey results were presented.

Dax Soule added that they think the approach is working in part because they use Python, but if they want to use any other data, they are welcome. They provide the participants with a support network. The feedback from participants reflects that it is working.

Annette - How do you select the participants? Janice - Priority was to the community college applicants.

They will submit a session proposal on the Ocean Data Lab project for Ocean Sciences 2020.

**Cabled Array - Highlights from German Program** - Deb Kelley provided the report. Her slides can be provided upon request to Deb.

In past few years 1000 bubble plumes have been imaged from seep sites along Cascade Margin There are gigatons of methane trapped in the sea floor. Lantern fish have been observed at the depth of bubble plume dissipation.

Einstein's Grotto, located at Southern Hydrate has been an active methane seep. Deb showed a video clip from the site. There is no long-term data. They visit the site only one day a year and it changes dramatically from year to year.

At Smokey Caverns, blocks of hydrate were observed.

The Germans have an overview sonar. It was designed to image a 200-meter radius, but now has a 700-meter radius. The sonar provides an unprecedented 360-deg imaging of all methane plumes issuing from Southern Hydrate Ridge. It was the first time flux measurements co-registered with seismicity. They would like to be able to tell how big the bubbles are. There is a strong tidal influence on emissions. There is automated bubble detection from the RCA digital still camera.

The Schmidt Ocean Institute's vessel, R/V *Falkor,* visited the Smokey Caverns Site in 2018 to do 3D imaging of the entire seep area.

**OOIFB Other Business:** There was discussion on the various open action items and paths forward.

**Science Plan** – Should OOIFB update or recreate the OOI science plan?

- Bob Houtman – A science plan will be prepared for the *Jodies Resolution*. They are going to have a series of workshops and create a plan.
- Deb Kelley - There is not integrated document showing what is in the water.
- Annette DeSilva – UNOLS has a Fleet Improvement Plan.
- Bob Houtman - Is there an easy way to say what OOI is focusing on.
- Sarah Gille - if OOI has to scope down, it would be good to have the Science Plan to rely on.
- We want to be able to state that OOI is a good investment with societal value.
- Lisa Clough - What is the most unique aspect of OOI? Explain this in the Plan.
- Al Plueddemann - How can we create a science plan/ roadmap on how to use the data and propose to use it?
- Bob Houtman - What are the big unanswered questions that OOI can address?
- Lisa Clough – We don't want to go back to the traceability matrices.
- Deb Kelley - Sideboards of exciting science is very interesting.

- Al Plueddemann – An approach could be to use information from the *Oceanography* journal and then overlay it on the science themes.
- Annette suggested that the Science Plan be made into a living document.
- Brian Glazer - What is in the quarterly reports? John Trowbridge - The first one was a greatest hits. Bob Houtman – Perhaps you can relate these back to the science questions.
- Ken Kostel - You should ask the community - what do you want to do with OOI?
- This can be a focus of a future phone meeting.

In summary, the suggested path forward with the Science Plan is as follows:

- Create a science plan/ roadmap on how to use the data and propose the use.
- Make it into a living document:
- Review the 2005 science plan to see if it is still relevant.
- Within the Plan, insert links to the systems that are deployed in the water.
- Include broad statements that relate the systems to the science themes.
- Add science sidebars
- Source material could include TOS journal articles and Ocean Obs 19 papers.

**Form an education subcommittee** (begin process). -

- Ruoying He - He feels that we need outreach to the science community. The education community seems to be doing a good job.
- Lisa Clough – There could be A task force on science outreach/engagement for OOI.
- There could be monthly webinars.
- Sarah Gille – We could start a speaker series.
- Al Plueddemann – The Ocean Obs contributers could be contacted. We can take the OOI community engagement document and make it a living document.
- Ed Dever – There could be an OOI roadshow.

In summary:

- We will close the action item to set up an education committee,
- There will be a new action item to form a task force Form a task force on science outreach/engagement:
    - Review the OOI community engagement plan
    - Prepare a task statement
    - Form the task force – should have early career representation
    - Consider webinar/speaker series.

**Membership Review** - OOIFB membership terms were reviewed, see ***Appendix XVIII***.

**Next in-person OOIFB & DDCI meeting – Early November was suggested. The meeting will be a**t NSF. We will invite other agencies to the meeting, including NASA, ONR, NOAA.

**Continue AWP Discussion:**

**Endurance Array - AWP 2 Budget adjustments** - Ed Dever reviewed the Endurance Array budget adjustments for AWP PY2. His slide is included as ***Appendix XIX***. They were able to

meet the 2.5% CI budget reduction through efficiencies (less servicing, reducing small ship costs, etc.).

- Bob Houtman - As systems are getting older, what is the life expectancy for each of the components? The risk for failures of these components will increase. There will need some consistency across the program. It would be helpful to NSF if they knew when the component would need to be replaced.

***Adjourn Day-1***

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**Day 2, Wednesday, May 22nd AM: OOIFB & DDCI Joint Meeting**

**0830 Welcome & Introduction** – Brian Glazer opened Day 2 of the meeting. The morning will be a joint meeting of the OOIFB and DDCI. He explained that he is chairing the meeting in place of Larry Atkinson. Participants introduced themselves

Overview of OOIFB Day-1 Meeting - Brian Glazer reviewed the Day-1 meeting highlights and action items. His slides are included as ***Appendix XX***.

During day-1 it was recommended that a Community Engagement and Outreach Task Force be formed.

- Rich Signell is interested in the task force.
- Annette indicated that the task force should include early career representation.
- This would be more like an ad-hoc committee (as opposed to a standing committee)
- Lisa Clough indicated that she would like to see a specific task statement for the action item.
- The task force should review the Community Engagement Plan.

John Trowbridge asked if the OOIFB monthly calls are open. Annette – T he web conferences are for OOIFB only. John asked if the minutes could be provided to PMO.

- Annette will look at the minutes of the OOIFB monthly calls and determine if it is appropriate to send to PMO. She will discuss this with Lisa and the FB.

Overview of DDCI tasking, progress and timelines & Goals for this meeting - Tim Crone, DDCI Chair, reviewed the DDCI tasking, progress, and goals. A summary is provided in ***Appendix XX***.

**CI and Data Delivery Updates from OOI Program Office** – Jeff Glatstein, OOI Data Delivery Manager, provided the report. The details of his report are included in ***Appendix XXI*** and covered the following topics:

- Review action items from October meeting
- Software Achievements and CI Milestones
- New Management Processes
- Self Evaluation
- Analysis of Alternatives (AoA)

- Work Plans
- 5 Year Budget and Resource Plan
- Plan Forward Assumptions and Risks
- Software Administration Move to PMO
- Software to be Released
- Quality Assurance and Control

Comments and Discussion:

- The action items from the October meeting that are still on going are asterisked.
- Software – there is now an ingestion heartbeat that allows them to monitor ingestion, instead of having to be told that it is down.
- CI Milestones – There is a data management working group that met weekly at the beginning. They have formed working groups - Qartod, communications, Redmine redesign, and ADCP.
- Brian Glazer - Do you have the rate of turnover on the Redmine tickets? Jeff Glatstein - They can provide these stats through Redmine. They haven't seen double-digit tickets in one week. It really varies from week to week on how many tickets are resolved.
- Jeff displayed an AoA Implementation Timeline illustration. There are three timelines: Keep as is, Replace fully, and Hybrid. Even with he "Keep as Is' you still need to replace aging systems and fix bugs.
- CI Work Breakdown over 3 years estimates 14,853 hours of planned work.
- A question was asked about ERDDAP. ERDDAP needs to be redesigned because it only handles 1/3 of the data. Jeff – ERDDAP is not included in the 14,853 hours.
- Jeff reviewed the hour distribution by task for the PY1 and PY2 work plans.
- His slides include a CI 5 Year Budget and Resource Plan chart. Some of the PY budget is higher than the original budget. They will use in-house labor instead of vendors. The 2.5% budget increase for CI goes away in PY3.
- A Quality Assurance and Control kick-off meeting was held in January 2019.
- Jim Potemra - Have you thought about how these flags will be captured into the system. This is a huge issue.
- Tim Crone - Is there a way of getting the information that Jeff provided in this presentation into the AWP for PY2? Tim's concern is that if it isn't included in the AWP, it may not be carried out. Lisa Clough - The DDCI could recommend that they would like to see the Data Delivery topics added as an addendum to the AWP. Paul Matthias - A summary of the PPT that Jeff presented could be added as the addendum.
- Jim Potemra asked about the QA/QC automation. Orest – There is still a human in the loop. It is costly. Derek Buffitt – If a PI introduces a new instrument to the OOI system, he/she is charged with the cost of adding that Parser to the system.

**OOI Data Delivery Community Survey -** Tim Crone provided an update on the community survey and reviewed the results in the Google Drive (there are no slides).

- There were 127 responses.
- Many people don't use the OOI data.
- The Cabled Array had the most users.

- Sarah Gille - Why was the Argentine Data not listed? - Lisa Clough - It is no longer collecting data.
- Lisa Clough - NSF is sensitive to distribution of the survey data and requested that it cannot be made public before it is provided to NSF.
- Tim Crone - Research scientists are the biggest users of the data.
- OOI Net was how most people tried to access the data.
- Data Latency- how soon do you need the data after collection? Most people who took the survey do not need the data that is time critical.
- How well does the OOI Data Delivery meet your needs – Reponses were distributed.
- Of the various Data Delivery systems, the users who used IRIS indicated that it was very easy to find the data.
- Tim reviewed the open-ended question feedback.
- Tim indicated that he is still working on synthesizing the data and welcomes feedback.

**Best practice white papers - Development by COL** - Data Identification, Data Product Quality, Performance Metrics and Community Engagement. – Tom Kearney provided the report. His slides are included as ***Appendix XXII*****.**

Under a work activity approved by the NSF, COL has examined observatory industry trends and best practices. These trends and best practices were iteratively documented using extensive literature research and website reviews of major observing systems. This information is presented in four white papers, describing ~46 best practices:

- Data Product Quality (29)
- Data Identification, Citation and Tracking (6)
- Community Engagement (7)
- Observatory Performance Metrics (7)

Tom is the lead on the papers with assistance from Chris Rutherford and Sue Banahan. Leslie Smith was the editor. They are currently validating the best practices. There were four best practice research sources. 46 best practices were identified and grouped into 7 self-assessment tools.

The scope of the effort was to:

- Examine best practice trends and drivers for current industry best practices, provide analysis, recommendations and reference material
- Provide a best practice Self-Assessment Tool that enables an existing or new organization to assess their current best practice capabilities and maturity level.

The methodology for the effort was:

- Best practices were iteratively researched, synthesized, refined and validated using extensive literature reviews and website reviews of major observing systems.
- Validate best practices and best practice self-assessment tools through interviews with 2-3 mature observatories.

The 46 Best Practices are grouped into 7 Categories and there are 7 best practices self-assessment tools.

- Data QA/QC Procedures (8)
- Data Support/Services (7)
- Metadata (4)
- Interoperability (7)
- Data Identification and Usage Tracking (6)
- Community Engagement (7)
- Observatory Performance Metrics (7)

The best practice and self-assessment tool overview and examples are provided in the slides. The Best Practice White Papers will be delivered to NSF by June 30th. The OOIFB will have access to the documents.

***Break***

**Annual Work Plan - OOIFB and DDCI joint discussion:**

- The DDCI comments pertaining to the AWP were reviewed. The comments were compiled into a document in the Google Drive.
- All agreed that they would like to see the level of detail that was presented in Jeff Glatstein's presentation. This could be included as an appendix to the AWP.
- There was discussion on the OOI data portal. DDCI doesn't wasn't want the data portal to look the way it does now. There was concern about how the AWP for PY2 would reflect the recommendations from the AoA study. The AoA won't be complete until after the AWP is submitted.
- The DDCI has concern with attrition of OOI personnel. Paul Matthias - He doesn't see much of a risk for the attrition. The attrition is just one of 10 methods for reducing cost.

**Tour of OOI Facilities**

***This concludes the joint session of the OOIFB/DDCI meeting.***

***Lunch Break*** [Note: OOIFB and DDCI Members were asked to stay in the meeting room for OOIFB discussion.]

Discussion:

- Jim Potemra asked about the OOI website. There was just one line in the AWP regarding update and maintenance of the website (page 13). Perhaps we can request additional detail as an addendum of what that entails. Also state that we would like to see upgraded sites by next year this time.
- Annette DeSilva – The initial OOIFB Google Drive was created under the UNOLS Office Drive when UNOLS was serving as the interim admin office. Over the next months I will migrate the OOIFB Google folder from UNOLS to the OOIFB Admin Support Office Google drive. If you can't find something, let me know.
- Annette - I recently updated the content on the OOIFB.org website. In doing that, the content became very slim and additional content is needed. Please send me content of interesting OOI events, news, and images.

**Day 2, Wednesday, May 22nd PM: DDCI Meeting**

**Current MIO Data and QA/QC Activities/Priorities:**

**WHOI MIO** - Sheri White provided the report on CGSN Data QA/QC. Her slides are included as ***Appendix XXIII***.

Sheri introduced the CGSN Data team and responsibilities that include:

- Asset Management
- Data Ingestion/Availability
- Data QC
- Annotation - Example: explaining why data is not being telemetered, operational issues, metadata, algorithms, etc.
    - Lisa Clough - What are you communicating to the community? Jeff Glatstein - They put information on the website, but they need to catch up.

CGSN is conducting a critical metadata review. Metadata is reviewed and compared to other documentation (vendor sheets, cruise logs, etc.). Critical Metadata Review Process includes comparing GitHub calibration CSVs with vendor documentation. They verify deployment details and component serial numbers.

- Richard Dewey asked about how the metadata is stored. Sheri - It is in GitHub.
- Richard Dewey - Is there a plan in time to align the three MIOs? Orest - they try to find commonalities, but they have different systems. Jeff Glatstein - It is 80:20.

Sheri reviewed the Critical Metadata Review status. Efforts include creation of automated tools for metadata checks. Over half of the files show inconsistencies. They have reviewed about 50% of all of their calibration files and aim to complete the review by the end of PY1.

Accomplishments to data include:

- Full-time CGSN Data QC hired in November 2018 (Andrew Reed)
- Attended OOI Data Team Workshop at UW in January 2019
- Completed re-ingestion of backlog from OOI 1.0
- Participated in creation of a common format/spreadsheet for OOI Water Sampling data across the program
- Successful Asset Management updates and Data Ingestion for Pioneer 11, 11a, 11b, 11c; Southern Ocean 5; and Pioneer 12, 12a cruises.

Going forward they will continue critical metadata review. They will continue to develop and implement automated processes for metadata and data review.

**Oregon State University MIO** - Chris Wingard provided the Endurance Array current data and QA/QC activities report. His slides are included as ***Appendix XXIV***.

Chris introduced the CGSN Data team and responsibilities that include:

- Asset Management
- Data Ingestion/Availability
- Data QC
- Annotation - Example: explaining why data is not being telemetered, operational issues, metadata, algorithms, etc.
- Supporting CI

The Asset Management critical metadata review of all past Endurance deployment will complete by end of July 2019.

- Bob Houtman- Do you always have to use the 2-person verification? Chris - It is only when they are ingesting. He doesn't think that they will ever get away from this. Two sets of eyes are needed. Richard Dewey – He wouldn't be surprised if ONC has more than 2 people for their verification. Revealing a problem later is a big problem. One set of eyes is prone to errors. Ed Dever - It will be interesting to do the person review and compare it to the automated process.

Chris reviewed the Data Ingestion/Availability for Glider DAC. They assumed responsibility in 2.0 for transmitting OOI Endurance glider data to the Glider DAC. Glider DAC code for Endurance OOI glider data is complete and running. All Endurance glider deployments will be uploaded to the Glider DAC by end of May 2019. Automating real time processing and uploading of data to the Glider DAC is in progress. They are working to generalize code and documentation for Pioneer, Global and possibly other glider users.

Accomplishments to date include:

- Transitioning roles and responsibilities within group to adapt to new role.
- Attended OOI Data Team Workshop at UW in January 2019.
- Completed re-ingestion of backlog assigned by 1.0 Data Team and has made significant progress toward completion of data availability assessment.
- Participated in creation of a common format/spreadsheet for OOI Water Sampling data across the program.
- Successful Asset Management updates and Data Ingestion for Endurance 10; Endurance 11a, 11b; and multiple glider and CSPP cruises.

Endurance Plan Going Froward:

- Bi-Weekly meetings to identify tasking for Mooring and Data Operations.
- Complete critical metadata review, end of July 2019.
- In-depth review of existing annotations.
- Evolution of OMS++ system to improve mooring and data monitoring (alerts & alarms, data visualization).
- Engaging SMEs to confirm/determine best practices and data review methodology.
- Continue to develop and implement automated processes for data reviews.
- Continue OOI Data Team work on program-wide issues/processes.

Discussion:

- Bob Houtman - Are you planning to have the ability to see the status of all of the data (i.e. if there has been a correction)? Once QA is complete, will the community be able to use that data and not have to worry about it changing? Richard Dewey - ONC used the DIU.
- Kyle Wilcox - Are the quality flags carried with the data? Chris - He doesn't have the ability to do a human in the loop flag.

**UW MIO** - Wendi Reuf (via Webex) provided the report on the Regional Cabled Array (RCA) Current Data QA/QC Activities and Priorities. Her slides are included as ***Appendix XXIII***.

- Wendi explained that the causes of the missing streamed data are due to network outages, port agent/parser errors, and the cable array or instrument being offline.
- The RCA historical critical metadata check is a 3-phase process. In phase 1 they prioritized the data streams. They are now in phase 2 and about to start phase 3 for the final critical metadata checks.
- The calibration verification resulted in 479 total files modified and of these 28% were data-affecting.
- Deployment Assignment Verification is 90% complete. There are 548 deployment instances on GitHub.
- They learned a lot from this critical metadata check. Missing files accounted for the majority of calibration errors. Scripted entry does not eliminate all errors - "don't trust anyone." There is a need for consistent gold standards.
- On-going data team activities include:
    - Created Shipboard Discrete Summary template
    - User and Community Outreach
    - Asset management upload and verification for Visions 2019 deployments
    - Data Management Working Groups
- Phase I and II milestones have been completed. Phase 3 will be carried out from June -Sept. Milestones include:
    - Implementation of revised workflows for Visions 2019
    - Pursuing RCA-initiated Cabled Playback
    - Sensor Deep Dives

Discussion:
- Richard Dewey - if something changes, is it up to the user to go back and check for updates. Wendi - This wasn't in their scope. They have noted it, but they don't have a way to get the data out to the users.

***Break***

**Special Announcement** – Dax Soule reported that as of today Google has agreed to host OOI Data on their cloud. Dax and Tim Crone worked on an arrangement with Google. They just signed the agreement. Everyone's input is welcome. It is a 3-year term. Google will host the OOI data for 3 years. They will host 1/2 a terabyte initially. This is a pilot program. It will not

replace what OOI is doing. They are starting with video data and they can also handle still images.

**Reports from other observatory/data groups –** This part of the meeting offered an opportunity to hear about other data deliver and CI technologies:

**Ocean Networks Canada (ONC)** - Richard Dewey provided the report.

- He displayed the ONC Data web page <http://www.oceannetworks.ca> and logged into the ONC 2.0 Data Preview. He guided us through the ONC site.
- Richard displayed an oxygen plot from 2007 to 2019. These are pre-generated plots for the past 24 hours.
- The plotting utility was highlighted and it allows users to plot in real time.
- All of the ONC 2.0 data access has been custom built.
- Richard showed the Complex Data Viewer Beta. This utility might be a part of the future Version 3.0.
- The SeaTube Pro site provides access to videos and playlists. ONC "Annotations" refer to the content/observations of the videos. This is different from OOI. What OOI referred to as annotations would have been considered metadata with ONC.

**Interactive Oceans** - Orest Kawka provided a report on the Interactive Oceans Regional Cabled Array Value-Added (CAVA) Program. His slides are included as ***Appendix XXVI***.

The CAVA program is non-OOI funded. It uses OOI data and was UW funded. It is an effort to improve the user experience and provide value added. The data comes from UFrame.

The project goals are to:

- Increase active use of RCA data by scientists and support educators and public exploration of data in the future.
- Provide additional tools for scientists to discover, access, visualize, and use RCA data sets suitable for addressing specific science hypotheses.
- Provide an intuitive, user-friendly data search and visualization interface, coupled with a convenient data downloading scheme.
- Accelerate research output and engage a broader user base, as envisioned when OOI was funded.

Orest reviewed the Project development outline:

- Easy-to-use Application Programming Interface (API) for accessing and downloading OOI data (simpler syntax and request construction)
- Implementation of a proof-of-concept back-end and front-end for hosting and serving data from a cloud-based system
- Interactive Map interface highlighting RCA assets that serves as an entry point into the Data Visualization Portal
- Data Visualization Portal with enhanced data search and visualization capabilities
- A set of executable Jupyter notebooks that can be directly executed on the CAVA JupyterHub. They are using GitHub to host notebooks.

- Educational and outreach tools including science stories and galleries of stunning photos and figures.

The sites and instruments were prioritized. They considered systems that people are most interested. Priority instruments were identified. Orest displayed the CAVA back end infrastructure and front end. The back end is on the cloud. All data is from UFrame with M2M functionality and every 24 hours is updated. On the CAVA front end, there is a map interface.

They use an open source plotting app. This is great for students and instructors. There is a lot of flexibility. All the processing is done on Amazon web services.

Two UW people have been developing the site, Dwina Solihin and Rob Fatland.

Orest reported that the CAVA will be available in about a week.

Discussion:

- Jim Potemra - What is your annual bill for this? Orest - It is reasonably priced. Jeff Glatstein - Sometimes the cost can depend on how popular the site is.
- Ed Dever - This seems powerful. Is it considered as an AoA? Orest – This was simply an initiative from UW.

**EDDAP and OMS++** - Chris Wingard provided the report on the CGSN Dashboard (OSM++ and ERDDAP). Chris and Stephanie Petillo prepared the presentation. Their slides are included as ***Appendix XXVII***.

The CGSN dashboard is the next iteration on the current OMS mooring user interface. It is used to monitor the Pioneer, Endurance, and Global Surface & Profiler moorings. The CGSN Dashboard (OMS++) will:

- Improve and expand upon OMS functionality
- Add more features to reduce the operators' status reporting and monitoring loads
- Include subsurface mooring, Glider/AUV, & Coastal Surface Piercing Profiler status displays (future).

The system capabilities include:

- Automated parsing & processing of raw mooring data
- Parsed & processed data available to mooring operators for monitoring & analysis
- Configurable automated alerts & alarms and notification system
- Alert trigger, plot, & L3 variable cloning
- Support for multiple deployments of a mooring
- Uses Yaml files for simplified configuration of mooring deployments and specific asset metadata
- System overview & status pages
- Access to external tools
- Links to Glider & AUV monitoring & status (in development)
- Uses up-to-date software and operating systems

- Uses open source tools.

Chris provide information on (see slides)

- System Architecture Diagram
- CGSN-Parsers: Logs —> JSON
- CGSN-Processing: JSON—> NetCDF
- PYSEAS
- CGSN Dashboard Demo

Discussion:

- Ed Dever - Is the thought that this could serve up data to general users? Stephanie Petillo (via WebEx) - AoA is considering this as another way to serve users the data. The idea is that with a few tweaks and coding, you could have a similar system for end users.

**Moving into the cloud with Pangeo** - Ryan Abernathey provided the report.

Ryan began by showing a demo of Pangeo at: https://tinyurl.com/pangeo. The video shows an example of a binder. It shows the import process. The entire data set has been loaded and the metadata is with the data. This is so easy. Do we really need a portal, when we can just get the data from the cloud? The data lives in the Google Cloud surface. They did everything within the cloud - computing with no download.

Ryan continued the report by referring to his slides (***Appendix XXIX***). A lot of fields are facing challenges in dealing with big data. Pangeo is a community platform for big data geoscience:

- Open community
- Open source software
- Open source Infrastructure

Pangeo community is mostly made up of scientists who were frustrated with the tools that were available. The Pangeo timeline starts in 2013. The first Pangeo workshop was held in 2016. It is relatively new and wasn't around with OOI started.

Ryan reviewed the Pangeo software. Scientific Python for geosciences is used along with Xarray datasets (multidimensional variables with coordinates and metadata. Xarray makes science easy, https://github.com/pydata/xarray. Jupyter is open-source and also very important. Community, open source software is far better than anything a single institution can build on.

Ryan provided an overview of the Pangeo infrastructure.

- File-based approach
- Server side database
- Cloud-native approach

The Pangeo principles for Cloud-Native science infrastructure are:

- Community-driven - Our needs are no different from those of our peer institutions. By developing infrastructure collaboratively, we can accomplish much more than any one institution can alone.
- Open source - Because infrastructure is code, the code should be licensed in a way that enables the entire research community to reuse and build upon it.
- Modular - "all in one" solutions are impossible to maintain long term. Separation of concerns is a key principle of good software and systems engineering.
- Vendor neutral - Academic research infrastructure should use only vendor- neutral services APIs. If this principle is followed, it means we can redeploy our infrastructure anywhere.

The Cloud costs about $40 per day. There can be large egress fees.

Individuals who wish to get involved can go to: http://Pangeo.io

**Axiom Data Science** - Kyle Wilcox provided the report on User-defined Cyberinfrastructure. His slides are included as ***Appendix XXVIII.*** Kyle began with information about the company.

Kyle remarked that the important thing is that everything doesn't have to be on the cloud. It can be on any platform, just as long as the computational tools are with the data.

He then provided the definition of cyberinfrastructure. There is a data management lifecycle and it is important to support the entire data lifecycle. When you build a system, consider all parts of the cycle from the start. It is hard to put it in after the fact.

Data pipelines were described

- Connect pipelines together with a messaging system.
- Catalog pipelines together with metadata updates.
- Build in data update and invalidate at integration points.
- Design the pipelines and targets to meet user needs.
- Well defined integration points helps migrate and transition systems

Ryan showed some examples of pipelines.

Discussion:

- Al Plueddemann - How is the data being computed? Ryan showed an example of IOOS. The computing is sitting on top of ERDDAP that is sitting on NetCDF.
- Dax - We don't need solutions for all things, you can have a variety of processes.
- Kyle - The front-end interfaces are what people want to see.
- Al Plueddemann - What is the sweet spot for the OOI operators? They have limited resources to provide the right system for the next 15 years. Kyle - You need a standard data format.
- Tim Crone - There isn't any reason why you need to get away from M2M.
- Jeff Glatstein – OOI is leaning toward a hybrid system.
- M2M could be retained for real time data.

- Al Plueddemann - He is struggling with what OOI should stop supporting to implement these new things.
- Jeff Glatstein - There are some things that just don't belong in the stream engine.

**General discussion on the community survey:**

- There were 127 responses. Jeff Glatstein said that there are an estimated 800 OOI users. Based on the responses received, it appears that about 10% are users of the OOI data.
- Ryan Abernathy commented that he would have answered survey question regarding "do you use OOI data" with "no, he doesn't use the data."
- It was suggested that DDCI write a chapter on the community survey. This could serve as an interim report to NSF.
- Annette will set up a meeting with Tancy, Wendi, Tim and Lisa to discuss how to analyze the data further.
- Chris Wingard said that he analyzed the data and will post it in the Google Drive.

**Wrap up Day-2 –** Day-2 adjourned at 5:00 pm.

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**Thursday, May 23rd: DDCI Meeting**

**Tim Crone reopened the meeting and reviewed today's agenda.**

**Discussion of OOI Data Survey Results** *(continued)*

Tim compiled the survey's open-ended question responses. All of the survey data is in the DDCI Google Folder. We reviewed the Google Doc and inserted discussion comments directly into the document.

Tim reviewed the responses to "Why do you not use OOI Data?" The DDCI reviewed each of the responses and categorized the comments as follows:

- Awareness
- UX = user experience
- Unreachable
- Awareness
- Science
- Quality

The UX, quality, and awareness can be addressed.

Discussion:

- Comment - is 10% of the community using OOI data a good thing?
- Richard Dewey - There is a need for better marketing of OOI data. This could be addressed by the engagement.

- Lisa Clough - The information that DDCI provides will be the committee's interpretation of the community's response to the survey. DDCI's report to NSF will be one part of the input for NSF's report to the NSB. This represents the critical input that is needed to provide the status of the project and to set priorities. Bob Houtman – He and Lisa have to provide input to the NSF Director regularly.

Next the DDCI reviewed "Other Systems" Google Doc sheet. This is a list of systems that people are using to access data. DDCI can look at these and decide what attributes are useful. Tim wants the DDCI to visit these sites to determine if there are attributes that interesting. This is an idea generator. This question was for awareness. This is a DDCI homework assignment.

Moving to the "Anything Else" Google sheet. Respondents provided feedback on "Is there anything you would like to tell us about the OOI data delivery systems that we did not ask in this survey?" Again the DDCI categorized the input into the following categories:

- UX
- Support
- Cloud
- Insider
- Collaboration
- Quality
- Outreach
- Data Availability

The Google Doc includes a sheet for each of the Data Systems. DDCI members were asked to volunteer to review the feedback received for each system. The volunteers are as follows:

- OOI Net - Richard Dewey and Tom Gulbransen
- ERDDAP - Jim Potemra and Rich Signell
- M2M - Rich Signell and Chris Wingard
- Raw - Jim Potemra and Orest
- IRIS - Orest and Dax

***Break***

**DDCI Strategy Session on Report to NSF *(continued)*:**

**Report Outline -** Tim Crone created a draft outline for the report to NSF. The outline is in the Google Drive and we reviewed it on-line. This initiated a brainstorming session on sections of the outline along with the report recommendations.

Discussion on the report recommendations:

- Magic Layer:
    - Tim recommended that "magic layers" be created. This allows us to utilize the OOI systems, such as NetCDF. The magic layers would sit on top of the OOI systems.
    - The OOI systems provide the foundational and the Magic Layers are based on the foundation.

- Rich Signell - Everything should be in the netCDF file, all of the metadata and the annotations.
- Al Plueddemann - OOI is responsible for the foundation and they would not have to devote extra resources to the layers. The layers were be developed by others.
- The magic layer is the layer where all of the tools can be built from. Changes to layer result in the versions. The data that flows into the magic layer must be high quality and complete.
- Bob Houtman - The more specific that DDCI can be with their recommendations, the better.
- Al P – The user interface development will need to be prioritized.
- Orest - There could be additional recommendations, such as the ability to plot two parameters.
- Chris Wingard - Real time access would still need to go through M2M. It would not be QA/QC in real time.
- Dax Soule – A DDCI recommendation could be the need for more developers. Bob Houtman – Recommendations should be based on the end result. Dax - The end result in this case would be the recommendation is to have additional tools.
- Brian Glazer - A recommendation would be to create a gallery of access tools. This is similar to the IOOS Code Gallery.
- Chris Wingard and Orest offered to assist with providing the correct terminology for the recommendation.

- Rich Signell - Maybe we should have as a recommendation to cite use cases.
- Richard Dewey - Data Exploration and Discovery is needed.

Discussion on SWOT – are additional SWOTs needed?

- Tim Crone - Should we do a mini-SWOT on the data delivery systems?
- Tom Kearney - It would be good to have a visual of the magic layer concept that Tim described. Then DDCI can have a SWOT of the components of the visual. Tim - the SWOT would be on the magic layers. Some of these layers can be cloud based.

Discussion on data deficiencies: The report will address data deficiencies:

- Data deficiencies means data not well served - ADCP, Video, etc.
- Chris Wingard - the MIOs can provide this matrix. There are instruments where high quality data is being collected, but it is not making into he system.
- Al Plueddemann - There are some special cases were the data collected doesn't lend itself to OOI CI system.
- Chris Wingard – There are three categories of missing data or bad data:
  - Data not making it into the system
  - Data doesn't lend itself to the OOI CI System
  - Biofouling

**Action Item Review**

- Survey - Tim reported there we still have a lot of work to do on the survey data review. Each member is asked to work on their respective assignments and these will be reviewed at the biweekly calls.

- Outline - Tim will polish the report outline and then we will make writing assignments.

**Closing Remarks and Wrap-up:**
Tim Crone thanked everyone for their contributions and said it was a productive meeting. Bob Houtman added that this morning's session was very useful

**Adjourn** – The meeting adjourned at noon.