Meeting Summary
Submarine Arctic Science Program
Science Advisory Committee (SAC) Meeting
20 – 21 May 2014
4501 N. Fairfax Drive, Room 2064, Arlington, VA

Attendees

SAC members attending:

Jackie Richter-Menge (Chair) – Cold Regions Research and Engineering Laboratory
Ray Sambrotto – Lamont-Doherty Earth Observatory
Bill Smethie - Lamont-Doherty Earth Observatory
Larry Mayer – University of New Hampshire
Jamie Morison – University of Washington
Terry Tucker – Terry Tucker Research

Interagency Committee (IAC) members attending:

Scott Harper (Chair) – Office of Naval Research
John Farrell – US Arctic Research Commission
Erica Key – National Science Foundation
Jeff Gossett – Arctic Submarine Laboratory
CDR Nick Vincent – OPNAV N2/N6 - Navy Task Force Climate Change

Other Attendees:

Paul Bienhoff – Johns Hopkins Applied Physics Laboratory
Pablo Clemente - Colon – National Ice Center
Dan Eleuterio - Office of Naval Research
Kathy Farrow – US Arctic Research Commission
Florence Fetterer – National Snow and Ice Data Center (by phone)
Stuart Goemmer – Johns Hopkins Applied Physics Laboratory
Jeff Hooper - Johns Hopkins Applied Physics Laboratory
Laura Raines – US Arctic Research Commission
Mark Wensnahan – University of Washington (by phone)
Ann Windnagel – National Snow and Ice Data Center

Day 1: 20 May 2014

Introduction and Overview

• Chair, Jackie Richter-Menge, reviewed the agenda and objectives of the meeting. The primary aims of the meeting were to:

- Review the State of SCICEX from the SAC, ASL and NSIDC perspectives
- Provide an update of data collection and processing on SAMs during 2011, 2012, and 2014
- Discuss how recent National and DoD interest and focus on the Arctic might be leveraged to promote SCICEX

● Jackie gave a quick review of the history of the SCICEX program from its days of dedicated missions in the 1990s to the current SAMs. The challenge of a SAM is that no previous notice of a mission is provided to the science community thus prior planning is not possible. For that reason, the SAC developed a Science Plan that recommended data collection priorities for ASL to use to maximize SAM opportunities.

● Jackie introduced Jamie Morison as a new SAC member. Jamie was a member of the scientific team on SCICEX – 93, the first SCICEX mission. Jamie noted that the mission was one of the highlights of his career as it provided a snapshot of a section of the Arctic Ocean and was key in determining that the Arctic Ocean was undergoing significant changes.

State of SCICEX

SAC Perspective on the State of SCICEX – Chair Jackie Richter-Menge

● Support of the SCICEX program was acknowledged:
    - USARC for logistics support for SAC meetings and the publication of the SCICEX Phase II Science Plan.
    - ONR for research project support and support for NSIDC data assimilation and the web site.
    - US Navy for support of ASL and providing the platforms for SAMs
● Recent Progress
    - New data collected on SAMs
        - 2011: Bathymetry, ice draft, XCTD, water samples
        - 2012: Bathymetry, ice draft
        - 2014: Bathymetry, ice draft, XCTD, water samples
    - ASL with USN support is maximizing SAM opportunities
    - Methods for on-board water sampling have been greatly improved
● Data Management: The current setup is working well
    - NSIDC is receiving and archiving data and hosting the SCICEX website
    - An oral history of the SCICEX program by George Newton is on the website
● SCICEX publication:
    - 2013 Fall AGU meeting – Wensnahan poster paper contrasting 2011 ice draft to earlier years
● Increasing National Interest in the Arctic
    - National Arctic Strategy published May 2013
    - DoD Arctic Strategy published November 2013
        - Visual of submarine surfacing at ICEX camp
    - US Navy Arctic Roadmap 2014 – 2030, published by Task Force Climate Change
        - SAMs listed as accomplishments
        - SCICEX mentioned as a priority

SAC Concerns of the SCICEX program

- Sustained support for SCICEX
    - Funding for ASL
- Need to demonstrate rapid access to quality SAM data
- SCICEX is a non-PI driven data collection program; Support is required for:
    - Basic equipment and lab work
    - Data transfer and derived products
    - Quality assessment and control
    - Data archive and website
- Increasing program visibility within the military and civilian communities
- Leveraging increased National and DoD interest to maintain support for SCICEX
    - Typically consider 1D view of SCICEX: Data collection
    - Other contributions:
        - Arctic operations are training opportunity
        - Improving safety and efficiency of operation
        - Civilian and military partnership
- IAC membership
    - Should there be increased agency representation?
    - Need to increase active support
    - Determine SAC membership and rotation schedule
- Discussion followed regarding the value of SCICEX
    - Should be more prominent in National and DoD Arctic Strategies as well as Task Force Climate Change
    - Emphasize unique contributions from SCICEX, for instance some Arctic locations where data is lacking cannot be accessed by other means
    - Jeff noted that the CNO would like the ICEX to revert to its 2-year schedule

<u>IAC Perspective on SCICEX</u> – Scott Harper

- Classified IAC meeting in spring 2013
    - Discussed other possible submarine SCICEX opportunities
    - Talked about membership of the IAC
- Agency level (Navy) support for SCICEX and Arctic research by ONR is good
- Need other Federal agencies to help fund SCICEX
    - Ice draft is high priority measurement and could be supported by other agencies
    - ONR sponsoring Johns Hopkins Applied Physics Lab (JHAPL) to develop new topsounder recorder
    - Need to do PR to other agencies about SCICEX e.g. could advertise that data is available
- National Strategy – DoD is the lead to develop framework for observations and modeling to predict sea ice
    - SCICEX provides key data for this effort
- NSF does not want to fund just data collection and processing efforts, but would entertain proposals that involve the analysis of SCICEX-derived data
- Convince NOAA and NASA to become partners?
    - NASA interested only in measurements related to satellite algorithm development, etc

Ice Draft Data and Processing - *Mark Wensnahan (by phone)*

● Examined effect of speed and depth on ice draft data
- Applied multiple regression to analog data
- Draft is not dependent on depth
- Draft is dependent on speed; bias towards thicker depth – a function of analog chart resolution; should be mitigated with recorded digital data with full signal return
- NSIDC will publish Mark's findings as a white paper

● 2011 SAM ice draft data analysis
- Very high quality data
- 2011 drafts compared to earlier years (70s and 80s)
- PDF of 2011 ice draft has narrower distribution with mode shifted to thinner ice
- Ice draft decreased by 1 to 2 m over the last 20 years
- Ice draft compared to buoy derived ice age, PIOMAS model ice thickness and CRYOSAT derived ice thickness
- Results presented at Fall 2013 AGU meeting

● Quick look at 2012 SAM ice draft data
- Many isolated deep drafts that may be noise
- Data may be difficult to use; isolated deep drafts may be able to be filtered out

● Jeff pointed out that recorded data from Common Topsounder (2011, 2012, 2014) is "peak return" rather than "first return"
- This is a serious issue that creates problems contrasting results of new SCICEX data to all previous "first return" draft data until effects can be resolved
- Of the two 2014 ICEX boats one may have recorded peak and the other first return; This would allow statistical comparison of ice drafts from same region (Update from Gossett): One of the boats used in the SCICEX Sam 2014 recorded both digital and acoustic data and a software update made it so the digital data should be first return, which will allow an assessment of first return versus peak return.)

● Important to pursue independent recording of topsounder

● Jeff to determine whether first return can be requested on future missions

Independent Topsounder Recording System – Stuart Goemmer

● Johns Hopkins Applied Physics Lab developing topsounder recorder
- Minimally invasive, stand-alone comprehensive approach
- Sponsored by ONR
- Record full signal return
- Recommend developing TempAlt packages for Los Angeles, Virginia and Seawolf classes
- May incorporate in Cluster Nova system which is sailor operated digital recording system
- One issue is that Cluster Nova is rarely installed on submarines being used for SCICEX collection

- Goal is to provide a cost-effective, fleet-wide, simple system to maximize quality, analysis-ready ice draft data
- ICEX – 2016 is likely the next opportunity that JHAPL recorder may be deployed
- SAC recommended coordinating with ASL

● Erica Key used the topsounder data situation as an opportunity to explain what is necessary to receive funding under auspices of AON
- Need sustained, frequent observations
- No other means of measurement
- Continuity of measurements should be in place

ASL Perspective on SCICEX – Jeff Gossett

● Review of SCICEX Data Collection since 2010
- ICEX 2011 – USS Connecticut and USS New Hampshire
- 2012 – USS Topeka interfleet transfer
- ICEX 2014 – USS New Mexico (Virginia class, east coast) and USS Hampton (Los Angeles class, west coast)
- **Since 2010 any submarine in data release area (i.e. SCICEX Box) has collected data**

● 3 data collection phases on ICEX 2014 – transit to ice camp, transit to pole, departure transit
- Two submarines used: USS New Mexico and USS Hampton
- Attempted to maintain 440' depth, and 16 knots
- Continuous navigation data, topsounder, bathymetry
- 52 stations for XCTD and water samples; 26 stations on each submarine

● Ray Sambrotto spoke about water sampling
- Sampling details worked out prior to cruise
  -Hazmat issues, protocols, station and sample plan
- Trained crew members at ASL in January

● Jeff noted both submarines had nice tracks extending from Pole to Beaufort Sea
- USS New Mexico completed 26 stations – 20 underway and 6 stairstep water depths
  - Water samples off loaded in Groton, CT
  - 26 XCTDs out of 34 successful (80%)
  - New Mexico digital data held by ASL – Navigation, Topsounder, Bathymetry
- USS Hampton also completed 26 stations
  - 25 of 26 XCTDs successful (96%)
  - Hull-mounted CTD failed near North Pole
  - Frozen, chilled water samples shipped in April, remainder offloaded about 5/15/14

● Ice camp Nautilus survived only 1 week due to poor ice conditions

● Ray Sambrotto spoke about his sampling wish list:
- Upgrade SeaBird CTD to SBE 19 plus

- Additional sensors for SBE19 (O2, flourimeter, pH, CDOM)
- Flash freezer for bio samples
- Portable -80 C freezer
- Portable standard refrigerators and freezers

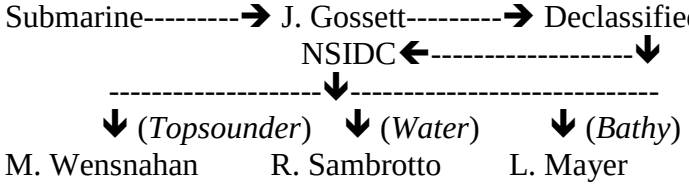
● Ray Sambrotto also mentioned some problems with CTD data:
- integration of navigation and CTD
- interpolation and averaging of raw CTD data to 0.1 and 1 km grid based on speed and heading

NSIDC Perspective on SCICEX – Ann Windnagel

● Website updates:
- New tabs added
- Number of views have fallen slightly in the past year
- Possibly register viewers and notify them when new data is posted

● Historical data update:
- Bathymetry data for 2001, 2003 and 2005 SAMs posted
- All data from LDEO SCICEX website downloaded
- Currently working on 1999 SeaBird CTD data
- Nutrient bottle data for 98, 98 2000, 2001, 2003 and 2005 posted

● Data flow chart from collection to processors



● Raw data is available if users have a need
- Should be noted on the site
- Should require contacting IAC or SAC Chair
- Should request feedback from users about the raw data

● Future
- Post 2012 ice draft data – may have data quality issues
- Post any 2014 data that is made available
- Post documentation on protocols and processing
- Distribute data from LDEO site

● NSIDC needs
- 2014 data
- 2012 ice draft if viable
- Documentation of processing procedure
- Permission to post white papers
- Feedback

Data Collection, Processing and Distribution

● General:

- Most data received as text files
- Data are transferred to Excel files
- Obvious bad data from ice draft and bathymetry removed

● Bathy Data
- Current process:
    - Larry Mayer; UNH receives the spreadsheet
    - Sounding vs. time, position vs. depth
    - UNH merges the data
    - Produces spreadsheet with corrected depth and ICBAO depth
    - Some matches with ICBAO are good; others are off
    - Need time to more closely examine matches with ICBAO
- Improvements for bathy data
    - Position at time of sounding
    - Harmonic mean sound speed
    - Calibration locations
    - 2012 data seems to have 1000 m cutoff
- Larry emphasized the importance of high quality bathymetry data
    - Bathymetry controls ocean circulation
    - May influence sea ice formation
- Issue of whether collecting concurrent gravimetry would be worthwhile
- Possibly need a white paper describing locations where bathy data is needed
    - Could be an amendment to the science plan

● Ice draft data
- Peak return vs. first return is a major issue
    - Need to look for a way to assess bias
- Draft data route from NSIDC to Mark Wensnahan seems to be working well
- Steps in data processing need to be documented and posted at NSIDC
- It is important that the new topsounder recording system by JHAPL be pushed forward, in coordination with ASL

● XCTD data
- Need to sort out why one boat had 20% failure rate and other boat had less than 5% failure rate
- Data still shows some depth bias
- XCTDs seem ok if they pass pre-launch check
- Jamie Morison will assume responsibility for data QA/QC

● Water samples
- Question was raised whether samples could be collected on non-ICEX transit?
    - For non-ICEX transits, sample bottles and chemicals must be stored at ASL
    - Need simple protocols; no opportunities available for pre-cruise training
- Desired sample locations to be determined
- Need Plan of Arctic Mission (POAM) for sample collection
- Cost of titration system to be provided to ASL

Day 2: 21 May 2014

Summary of Yesterday's Meeting by Jackie Richter-Menge

- State of SCICEX reviewed
- Ice draft data collection, processing and analysis presented by Mark Wensnahan
- Data collection, processing and distribution reviewed
- Shortcomings and gaps identified

Remaining Agenda Items

- Leveraging National interest in the Arctic
- Promoting SCICEX
- SAC membership – rotation schedule and composition of Committee
- Review of action items

Leveraging National Interest

- National Strategy – Lots of high level hooks
    - Maintaining and building Arctic presence
    - Collection of data to improve forecasts
    - Innovative partnerships
- DoD Strategy
    - Build cooperative strategic partnerships
        - Enhance regional expertise and cold-weather operational experience
        - S&T provides non-contentious opportunities for cooperation
    - Continue to train and operate routinely in region
    - Seek opportunities to contribute to observations and modeling
    - Make use of existing infrastructure and capabilities
- Navy Roadmap Update: TFCC
    - 1D view: SCICEX contributes observations
    - Other potential linkages
        - Operations and training – currently only ICEX is mentioned
        - Development and evaluation of forecast tools
        -Multiyear hydrographic/bathymetric survey plan
- Discussion on Navy interest initiated by CDR Nick Vincent
    - ADM White has discussed Arctic Roadmap
    - Polar sea routes gradually opening
        - 1980's was most active time for Russian NSR; it is slowly coming back with Russia and other commercial users
    - CNO asked for unambiguous estimate of when the Arctic would be ice free
        - Estimated 2025 NSR will be open for 6 weeks; trans-Arctic for 2 weeks
    - Navy is working with USCG on next icebreaker; it is 13 years out
        - Interested in SCICEX input to icebreaker specs since they may work together

- Currently the Navy has no real mission in the Arctic except for maritime mission awareness
- Navy's National role is prediction and forecasting of sea ice
- The way ahead:
    - Sea ice and weather forecasting
    - High resolution Arctic system models
        - Coupled ocean/wave/ice /atmosphere
    - Expanded forecast capabilities: 7 days, 1 – 3 months, 5 – 10 years
        - Detailed ice location, thickness, age, movement
    - Global ice/weather model in 2018; High resolution model in 2022
- Platform/sensor development (buoys, hydro sensors, UAVs/UUVs)
- Remote sensing exploitation and algorithm development
    -High resolution SAR; data assimilation
- Mitigation of effects of sea ice impacts and ice loading

● Side bar discussion: Can data be collected and released in areas outside the designated release area?
- General discussion of methods to obtain data in other geographic areas
- Joint studies with other Nations (e.g. Canada)?
- Can size of designated release area be increased?

●

● Making the case for SCICEX
- Contributes **unique** observations (best argument)
    - Increased domain awareness
    - Improved forecasting tools
- Operational and training experience with detailed maneuvers
- Innovative partnership – military and civilian

Promoting SCICEX

● NSIDC website: connecting with users
- User registration: Alert when new data and features are added to the website
- Provide guidance on how to access raw data
- Provide guidance on referencing SCICEX data

● USARC: Include SCICEX in widely distributed updates

● Popular forums
- ArcticInfo
- Cryolist
- FAMOS
- Others?

Action Items

● Bathymetry
- Map of priority sites (LM and JM)
- Initial inquiries about adding gravimeter (JM)
- Bathymetry calibration location to ASL (LM)

● Ice Draft

- Proceed with JHU ice draft recording system: work with ASL
- Documentation of data processing protocol (MW and NSIDC)
- Re-evaluate 2011 data regarding peak vs. first return (MW and JG)
- 2012 data: worth evaluating (MW and ONR)
- 2014 data: Support for processing (IAC)
    - Opportunity for statistical comparison if one boat recorded first return and the other recorded peak return
- 2015/2016: Can we revert to recording first return? (JG)

● XCTD and CTD
- 2014: XCTD performance differences between boats (JG)
- 2014: NPEO comparison (JM and JG)
- QA/QC of new data (JM)

● Water samples
- List of samples for non-ice camp SCICEX (BS and RS)
- POAM for SCICEX SAM (JG)
- 2014 Lessons learned (BS, RS, JG)
- Planning letter for 2016 (BS and RS)
    - Titration systems
    - Instrument TEMPALTs
- Resource requirements (JRM, BS, RS)

● NSIDC
- Tracking usage
    - Register users
    - Guidance on citation and acknowledgement
- Raw data: guidance for general access
- Postings
    - Sambrotto SCICEX white paper
    - Boyd white paper: XCTD performance
    - MW assessment of speed/depth impacts
- Historic data
    - Water samples: RS to contact T. Whitledge
- Documentation
    - Work with SAC on protocols

SAC Membership and Composition

● Rotation (IAC)
- 2014: Tucker and Smethie
- 2015: Sambrotto and Richter-Menge (New chair?)

● Composition will be determined by the IAC
- Modeler with experience or interest in using SCICEX data
- Ice Draft, preferably someone with direct applicable experience

ASL

● SCICEX SAM POAM

● Looking ahead: Plan for filling Gossett's role

Odds and Ends

●
● Posting record of IAC 2013 May meeting (JRM, NSIDC)
● Add Jamie's name to SAC (NSIDC)
● Announce new data via ArcticInfo, Cryolist, FAMOS, etc (JRM, NSIDC)
● JRM to coordinate delivery of additional topsounder data from ICEX2011 PBL
● Gossett to provide coordinates for SCICEX box
● NSF looking forward to receiving SCICEX science proposal: Data analysis
● Add SCICEX to Arctic Observing Viewer?
    - Larry Mayer will examine quality of SCICEX 2011 bathymetry data and develop recommendations for 2014
● Jamie discussed possibility of using SAMs for new tasks e.g.
    - Deploying bottom pressure sensors
    - Recover data from moorings

End of Meeting