

Meeting Report

from the 8th annual

Polar Technology Conference

April 3-5, 2012

Fairlee, Vermont

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1. Summary

The primary purpose of the Polar Technology Conference (PTC) is to bring together polar scientists and technology developers, to exchange knowledge regarding design, implementation, and deployment of systems which will operate successfully in polar environments and assist researchers in achieving their research goals.

The PTC is unique in that it does not focus on scientific results of a particular project or data set. Instead, the conference asks **how** was a project executed, and **how** was the data collected? The PTC offers the opportunity to compare notes, lessons learned, new product innovations, technical solutions, and projects of interest across a wide range of disciplines.

2012 marked the 8th year of the PTC, and the first time it has taken place on the east coast. Each year the event is hosted by a different entity, and for 2012 that responsibility was shared by the Dartmouth College Institute of Arctic Sciences and the Ice Drilling Program Office at Dartmouth's Thayer School of Engineering as well as the US Army Cold Regions Research and Engineering Laboratory (CRREL).

2. Overview

The Polar Technology Conference is a unique event in that its focus is not what data was collected and the science that resulted, but rather what technology enabled the collection of that data. From individual instruments and communications devices to facility-scale operations and logistics concerns, the unifying theme is what worked, what didn't work, and possible innovations on the horizon. The content is beneficial to individuals new to polar research as well as seasoned veterans.

The role of the PTC, and its internet analog, PolarPower.org, is to pass on information, share lessons learned with colleagues, reduce the amount of “reinventing the wheel” among technical developers, and increase the chances for success in fielding research projects in environmentally challenging high latitude locations. Although the conference was initially focused on small autonomous power and communications systems, a third day was added for 2012 to share information on larger scale infrastructure projects.



Conference attendees.

All photos courtesy of Bryan Armbrust, ERDC public Affairs.

Since the challenges of polar research span the Arctic and Antarctic, conference organizers have sought to find a time of the year conducive to participants active in both spheres of operation. The March – April time frame seems to work reasonably well.

In April 2012, about 70 scientists and technology developers converged at the Lake Morey Resort in picturesque Vermont to share their experiences with their colleagues. The attendance was slightly lower compared to recent years, likely because the location was far from any urban center, and the registration came online rather late.

Nevertheless, the conference was a great success and many new faces were in attendance this year. This is a virtue of annually changing the host institutions and venues. Participants came together for three days of sharing ideas and experiences focused on polar technology. While the scientific foci and type and scale of the various systems ranged widely, the challenges of supporting polar research were familiar and shared by all across the board.

Vermont Public Radio also visited to cover the story. Interviews can be heard here: http://www.vpr.net/news_detail/94042/cold-regions-researchers-engineers-gather-in-fair/



Veteran polar researcher Dr. Mary Albert interviews with Vermont Public Radio as CRREL's TJ Melendy looks on.

3. Presentations and Common Themes

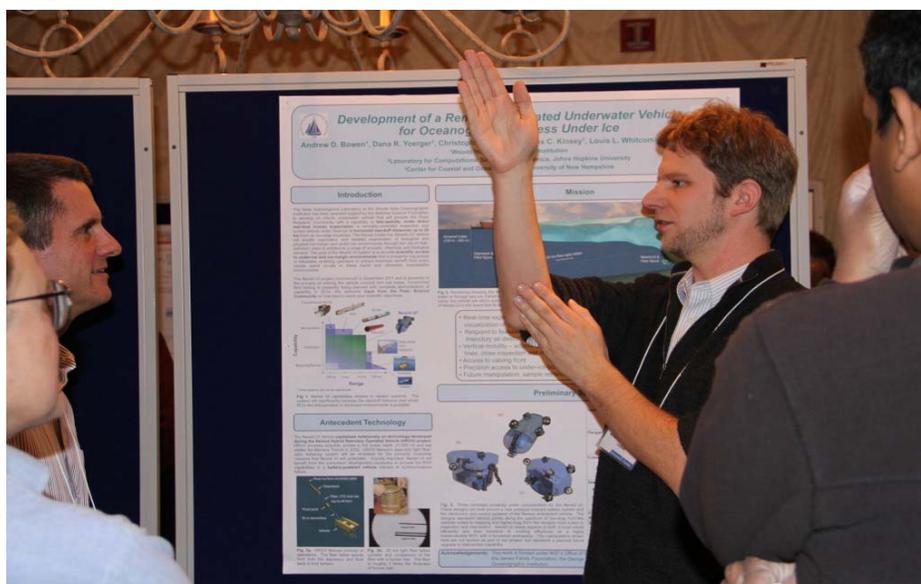
Presentations given at the 2012 PTC encompassed a wide spectrum of technical topics, in support of numerous scientific and logistical projects. All presentations are available online at PolarTechnologyConference.org, including those from previous years. The discussion on Summit: Past – Present Future is also available.

This year's presentations included:

- An overview of CRREL's EPOLAR program (J. Mercer, CRREL)
- Photonic Measurements of Firn and Ice Structure (D. Breton, Dartmouth)
- Updates on UNAVCO's polar instrumentation systems (S. White, UNAVCO)
- Camera equipment for autonomous polar systems (T. Valentic, SRI)
- The US Naval Academy's IceGoat1 arctic buoy project (B. Aspholm, USNA, et al)*
- Amateur Satellite and APRS Data Links (B. Bruninga, USNA)
- The development of a subglacial lake ROV (MSLED) (A. Behar, JPL/ASU)
- RUV for under-ice oceanography (L. Whitcomb, JHU)
- Latest innovations and drivers in ice coring and drilling (M. Albert, Dartmouth)
- Updates on the AGO power systems (A. Stillinger, NJIT)
- EFOY fuel cell operation in arctic environments (F. Heid, SFC Energy)
- Updates on advances in GPS trackers (R. Stehle, SRI)
- Technology for autonomous monitoring of polar environs. (A. Behar, JPL/ASU)
- New Iridium SBD and Full Data modems (N. Hoang, NAL Research)
- AGO station monitoring in real time using Iridium SBD (G. Jeffer, NJIT)
- The 2012 SAE Clean Snowmobile Challenge (T. Dahl, CPS)
- The Ross Island wind energy system (O. Roberts, NREL)
- Development of the ARRO project and systems (P. Riley, UNH)
- A new snow miller/paver for snow roads and skiways (S. Shoop, CRREL)
- Icing – how it forms and how to treat it (C. Ryerson, CRREL)
- Mount Washington Observatory capabilities (K. Rancourt, MWO)
- Construction of Halley VI research station (D. Blake, BAS)
- Hot water drill development for Lake Ellsworth project (D. Blake, BAS)
- USAP proof of concept projects (Armstrong, CRREL, et al)
- Satellite imagery and GPR to detect crevasses on GrIT (J. Mercer, CRREL)
- The YETI autonomous robot for detecting crevasses (R. Williams, CRREL)*
- GrIT – The Greenland Inland Traverse (J. Burnside, CPS)
- SPoT – The South Pole Overland Traverse (P. Thur, Lockheed)
- Technology to maximize efficiency of heavy traverses (J. Weale, CRREL)
- Summit Station– Past, Present and Future; APEX Station (J. Dibb, UNH, et al)

Ten graduate students were among the 75 conference attendees. Two oral presentations (* in list above) were presented by students. NSF Arctic Research Support & Logistics (RSL) underwrote the registration fees for all of the student attendees, offering them a special opportunity to meet experienced polar system developers.

In addition to the presentations, posters were also available for viewing during breaks and during an official poster session, spurring many constructive conversations between attendees. A banquet was also held on the second evening of the conference, so that attendees might have an opportunity to become better acquainted and to have time to discuss topics of mutual interest.



Dr. James Kinsey (WHOI) explains details of under-ice robotics to Clay Ross (SRI) and others



Opportunities for educational outreach abound at the PTC.
Here, midshipmen from the US Naval Academy listen to a presentation.

As diverse as these presentations were, several common themes appeared throughout:

- A picture is worth a thousand data points, and being able to view the research site can be an invaluable tool. Many remote sites are now incorporating webcams or similar equipment.
- Developing polar research facilities is an extremely expensive proposition requiring extensive research and planning, and it is difficult to accommodate all disciplines within a single facility.
- Pre-deployment testing of hardware is critical to project success.
- Logistics costs are high and expected to increase. This necessitates measures to optimize project logistics, such as traversing and co-location of instruments. However, traverse projects are also extremely expensive and return on investment must be considered.
- Powering equipment through the polar winter is being done with greater regularity than ever before. However significant room for improved performance remains, and sustained engineering is the key.

- Telemetry to remote stations is increasingly widespread and reliable. For example, state of health telemetry is now incorporated on most autonomous research platforms, providing an extremely useful metric for analyzing performance and planning future site visits. However communications challenges remain, particularly for projects requiring high data rates.
- Iridium communications is the primary option for remote instrument stations and field parties. Within NSF-OPP, use of the DOD system is critical to keep Iridium costs manageable. This arrangement must be maintained in the future.
- Wind power is a tremendous resource, and steady progress is being made, as demonstrated by a number of successful deployments. Wind turbine operation in polar regions is still difficult, but it must be fully harnessed to support winter polar research.
- The science being done and the technology used to support it are closely linked. Often the two are developed simultaneously, as the new technology enables new scientific research projects, and scientific goals drive the development of new technical tools. It is important to leverage existing technologies, however “one size fits all” is not an achievable or pragmatic goal, and selection of the appropriate is dictated by the nature of the job.

4. Future Conference Venues

The 2012 PTC was the first held near the east coast, resulting in a broadening of attendance and presentation topics. Maintaining geographic diversity will promote wide appeal and technical vitality among the polar scientific and technical community. At present, three potential venues for the 2013 PTC have been offered.

- National Renewable Energy Laboratory, Golden Colorado.

In some ways this would be returning full circle, since the PolarPower website was first suggested at a polar renewable energy workshop at NREL in 2003.

- The United States Naval Academy, Annapolis Maryland.

This would provide an excellent educational outreach opportunity along with a location near the National Science Foundation headquarters that may facilitate significant NSF attendance.

- New Jersey Institute of Technology, University Heights Newark, New Jersey

The system developers from NJIT have been strong contributors and attendees at past PTCs.

The location and dates for the upcoming PTC location must be finalized as early as possible, to accommodate extremely busy schedules of those involved in polar research. In particular, participants from international community have reiterated that advance notice, up to 9 months ahead of time, is critical to their attendance.



Dr. Jennifer Mercer of CRREL emphasizes a point during her presentation.

5. Future Recommendations

This year organizers held an open forum on the role and future of the Polar Technology Conference, facilitated by Roy Stehle and Vladimir Papitashvili. It is clear to attendees and supporters alike that the Polar Technology Conference is a valuable resource for advancing the interests of the polar research community.

The question is how to make the PTC more inclusive and far reaching, and provide definitive and measurable results. The dialog was vigorous and productive. The conclusion seemed to be that the conference and its online analog, PolarPower.org, can become whatever consensus dictates. Historically the PTC has been a relatively small happening, organized and run as a largely volunteer effort, and it could remain so. Alternatively, it could become a major event for polar researchers and technology developers. To a large degree, the future of the PTC lies with the agencies that fund polar research. Dr. Papitashvili stated that he would discuss the matter with his colleagues at the National Science Foundation Office of Polar Programs and help to define a path forward.

Following are specific recommendations, as distilled from the discussion by the Steering Committee.

- The event has grown and diversified over the years, and it has become increasingly difficult to put on a conference of this type with volunteer labor. It may be time to recognize this as an official NSF project and thus allocate appropriate resources for its administration. As a starting point, the Steering Committee will draft a document outlining the tasks necessary for organizing the PTC, along with funding levels commensurate with each task. We anticipate completion of this document well in advance of the 2013 PTC.
- The conference should remain primarily technical in nature, and not evolve into a scientific meeting. Although scientific questions are the ultimate motivation, the PTC is unique because it focuses on how projects are done, as opposed to the scientific results which are discussed at many other polar conferences.
- The PTC should work to increase attendance by polar scientists, as technical advances and sharing of ideas directly benefits their research. Additional online resources to the presently used lists (Cryolist, ArcticInfo, ANSWER), advertising at other conferences (e.g. AGU, EGU), and scheduling the conference far ahead of time will help; additional ideas are solicited.
- The added day for infrastructure projects was well received with an adequate number and diversity of presentations. The range of topics at the PTC should remain open to encourage the greatest participation and cross-pollination of ideas.
- International participation in the conference generally occurs each year, but the set of attendees changes, presumably due to travel costs. The presentations by David Blake of the British Antarctic Survey this year were very valuable and well-received. Greater efforts should be put forth to encourage increased international participation.
- Although it is impossible to schedule the PTC to allow attendance by everyone in the “bipolar” research community, the late March / early April time frame has proven to be the optimum.
- The exact location and date for the PTC should be finalized long in advance of the conference. This is especially true for international attendees, where advance notice (6-9 months) is often a requirement for such travel.

- The attendees at the Fairlee conference indicated that it would be acceptable to close presentation submissions 3 or more weeks before the event, to allow attendees to learn who is presenting what topics on what days. This time frame may be too short to help international travelers, but it was felt to be reasonable. A conference session could be reserved for ad hoc presentations that might be accommodated in time allocated within the schedule.
- This is a rare venue for sharing information between the Arctic and the Antarctic, particularly in regard to the NSF OPP. The contractor for the NSF USAP should “officially” encourage attendance by key staff and take an active role in assisting with the event.
- A short report should be produced following each PTC.
- Enhanced audio-visual equipment would allow for greater virtual participation for those unable to travel to the conference. However this would add a significant new level of effort, as those putting on and participating actively in the conference cannot simultaneously film and coordinate the event. As such virtual participation might cut down on physical attendance, any audio and video material might be made available after the event, along with the presentation copies now accessible from the website.
- The website PolarPower.org is the appropriate internet analog to the PTC. Specific suggestions regarding the future of this website are below.
 - This website should continue to exist as a resource for polar technology developers. However, an open question is the future scale and scope of the website and the resources required to maintain it.
 - This website has the potential to become a “best practices” repository for polar technology, a resource that is often championed by polar researchers, technologists, and program managers. The online format has many benefits over a paper document, in that it is widely viewable and more readily lends itself to being kept current. However, transforming the website into such a resource would take dedicated time beyond what is possible with volunteer labor.
 - Input from the polar technical community, in particular examples of technology deployments, is key to maintaining currency and relevance.

- The name should be changed to PolarTechnology.org to reflect the association and increased range of content in the website. This URL is already under NSF RSL ownership and it maps to PolarPower.org.
- Consideration should be given to making the PolarTechnologyConference.org website a section of the PolarTechnology.org website. This would enable a secure web portal to be established for handling PTC registrations, abstract submissions, and conference schedule development. Once developed, it would not need to be reinvented for each future conference.
- A wiki feature exists; however, it has not remained relevant, as the critical mass of users has not been maintained. This is true of several wiki attempts elsewhere. Therefore we believe this is a tool of marginal effectiveness.
- On a volunteer basis, names of specific individuals could be listed on the website as points of contact for specific technical areas. This would facilitate information sharing among the polar technical community as these individuals could either answer questions directly or forward requests on to others with relevant experience.



Roy Stehle (on left) has long been the chief champion and principal organizer of the Polar Technology Conference. Here he visits with Dr. Mary Albert of Dartmouth College and Dr. Vladimir Papitashvili of NSF during the poster session.

6. Steering Committee

The steering committee for the PTC appreciates all suggestions and feedback.

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