NASA Mike Report on the North Pole Educational Expedition 2003 – May 18, 2003

We did not do the North Pole Drifting Station (NPDS) project this April, because the Russian hosts were not ready for us yet. Instead, we took NASA Code Y and CRREL suggestions to wait and see what happens and we intend to propose an Ice Thickness Survey there in the Fall or next year, depending on how the three-man Russian crew and that floe fare this Summer.

What we did was the educational expedition to the Borneo Floe, which had scientific spin-off benefits. I recognize that not everything we planned worked as well as planned, which is not unusual, but we were nevertheless very successful with all the educational and with the primary spin-off scientific objectives. Any problems we encountered were, quite frankly, overstated in some media reports, to make the stories more appealing to the public. For example in one article the anticipated helo flight back to the main camp at the end of the job was called a, "rescue". No injuries of any kind were sustained and the environmental difficulties encountered were as expected routinely by all expeditions to Borneo this season. Russian AN74 flights were fantastic and on schedule. This is the best way to go! Russian Helo flights were great because they could land almost anywhere, anytime, but their fuel shortage and onboard GPS problems made for unpredictable scheduling the short flights around Borneo. A Russian interpreter is a "must have", and although they plan to provide one for charter groups, ours never showed up. Lesson: Always bring a person along in your group, who speaks Russian.

Here is a summary of the sponsorship we had for this expedition:

- Bay Mills Community College (BMCC) received a number of grants outside of NASA for the purposes of exposing Native Americans and their teachers to the technological world around them. The purpose is to inspire more Native Americans to get involved in technical careers rather than to assume there is no place for them.
- NASA HQ, Code N, Minority Programs contributed $40k to this effort to "get the word out" on the minority initiative. This was predominantly needed to do the webcasts, including the cost of my SPI office contractors. Travel for me and for Brent Holben'/923 was provided by our respective management.
- Senator Stabenow (D-MI) wrote a letter to Sean O'Keefe requesting NASA's unique support to do webcasts in the high Arctic regions, to support this educational initiative. NASA's response in a letter from Code L indicated that we would attempt to provide the webcasts requested on a best effort basis and that NASA strongly supported the educational objectives.
- There were a number of very positive scientific spin-off benefits that were intended to be part of this effort, which warranted NASA's positive response to the Senator's request.
    - This Ice Survey would be the most northern floe ever surveyed by a considerable distance (~600 miles farther North than ever attempted prior). As such it would lend itself to comparisons of all higher latitude floes, investigating the impact of location on these data sets. We did in fact note several significant differences as evidenced in the data we collected;
    - The Borneo Ice Thickness Survey was conducted on a floe where one of the CRREL Mass Balance Buoys was placed shortly thereafter. The buoy will provide CRREL with a time series of the mass balance. Our Borneo Survey provided an initial picture of the thickness distribution in the vicinity of that buoy, so that CRREL can extrapolate the ongoing buoy data to the larger surveyed area.
    - The Borneo Ice Thickness Survey will add to the relatively sparse historical record of changes in the thickness of the Arctic sea ice cover.

In addition, Code 923 sent along Brent Holben with an independent scientific agenda that had both scientific and educational benefits. (see below)

- My Special Project Initiatives (SPI) Office provided mainly my time to coordinate all this and then some time for my videographer to edit her videos and produce a short documentary.

We took 25 persons to the North Pole for $60K and everyone of them received a complete set of Russian ECW gear (total value $15k). Typical Twin otter charters from my three previous North Pole expeditions cost $45k for 6 persons and about 1/8 the equipment.

- I am the one primarily accountable for NASA's part in this. Scientifically, we did not need to "succeed", only to "attempt" within the guidelines provided by CRREL and Code 923. Success is measured in terms of the learning about the scientific objectives, tools, and processes via hands-on activities in a realistic environment. Code 923/Holben can speak to his branch's scientific accountability. However, the fact that the scientists who followed us did in fact use our data to place their instruments speaks highly of the scientific success of our efforts. We also learned some valuable things from the instrument failures we had.
- Each university is accountable for their own involvement
- BMCC is accountable for providing the Charter flight and the Russian arrangements, but I was their chief negotiator, since they asked me to help produce some scientific spin-off benefits.
- Dr Janie Fouke, the Dean of Engineering from Michigan State University, was with us as per their arrangement with her state senator.
- Our 25 persons included:
    - Myself as the Expedition Leader and three contractor experts from my office who Code N enlisted to provide the webcast, video, and computer support.
    - 2 Native American students and 2 Radford Earth Science/Physics Students, and a grad student from the University Centre on Svalbard (UNIS).
    - Engineering Students from Yale and George Mason
    - Professors from Radford, American International College, Bay Mills Community College, Dean of Engineering from MSU.
    - 6 persons with polar survival experience including 2 Antarcticans from NSF's RPSC. and two Norwegians from Longyearbyen, a Native American Arctic Ranger, and myself.
    - Teachers from Michigan secondary schools in the Tribal community.

The problems we encountered included:
- The brand new EM-31 purchased by BMCC would not stabilize in the extreme cold. It will need some augmentations, which CRREL is going to design now, using their cold room to simulate the conditions. This new unit has more sophisticated electronics, which are more sensitive to the cold than previous models. We learned this at no cost to CRREL.
- The older EM-31 owned by Radford Univ. failed due to a part broken in shipping. It was covered by UPS and is now being repaired under that insurance. Without either EM-31 we were not able to attempt the 2-dimensional mapping exercises that Dr Herman and CRREL were interested in. These were not our primary objectives but we had students on-line at George Mason University ready to participate in those activities in real time, so it was disappointing.
- The antenna connector on our TDRS terminal loosened up due to the adhesive freezing. This caused a poor RF link for the first webcast but was repaired in the field to better than the original. Second webcast was superb.
- The Russians never provided the guide as planned, so we were without a proper translator. Negotiating for work-arounds such as short helicopter flights was a problem.
- The Russians experienced a fuel shortage, which affected all the scientific parties at Borneo in our timeframe, especially U of Washington. (POC Andy Heiberg 206 543 1348). They did not want to fly unless multiple independent jobs could be combined to save fuel. A translator would have greatly facilitated arrangements during our 25-hour Borneo visit, which had to change for reasons beyond our control.
- The Borneo floe had broken up into two sections, but the main camp was on a very small piece that was not suitable for our survey. We had to stay on the runway floe to have a large enough piece to work with.
- The floe we were working on did not have as many facilities or food, but we were expecting to be there only 25 hours, and we did leave on schedule.
- The Russian food, unlike the previous year, was provided by a different management and was terrible. We basically ate whatever each of us brought. I was going to bring food etc, but was told it would not be necessary, so this was an inconvenience for 25 hours, but not a show stopper. Some reports are overstated. The University of Washington had a worse time according to Andy.
- We were also told the Russians would provide polar bear guns and personnel, but although they were on site, they were not assigned to us. We brought four persons ourselves and four guns for

this purpose, so we did not need the Russians for this. Wherever our people were spread out across our 3 km grid, we always had one person & gun with them for safety.
- The Russians did have enough unleaded fuel for our 4 generators, so this was not a problem.
- The Russians did bring us a ski-doo, but it took a few extra hours to get it to us, since they were conserving flights. We did not understand the delay at the time due to the poor verbal communications.
- We had three Iridium phones, which worked fine, but we did not receive calls during the first webcast, since only the DOD phone with no incoming service was active at that time. This was not the plan. We just didn't realize that the guy in our comm tent was not using them all. He had thought the one he was using did have the incoming capability. As a result we did not realize when our link dropped out until the webcast was almost over. The archived webcast is posted on our website along with the second webcast, and a follow-up chat session with the Code 923 scientist. "http://spioffice.gsfc.nasa.gov/frigid2003"

The scientific results included:
- We laid out a 3 km transect with 583 snow cover measurements, according to the directions provided to us by CRREL and Austin Kovacs (retired CRREL expert), who supervised this operation on site.
- We drilled 45 holes across the 3 km transect, many more than expected, because we had the time and manpower. The data are archived in great detail on our website under "data results" (see, "http://spioffice.gsfc.nasa.gov/FRIGID2003/north_pole_data.html" use tabs under the graph for details).
- We added a new measurement not suggested by others, but which is proving to add valuable information. This is a measurement of the Freeboard with respect to the total thickness at each hole. When we found that this ice floe was multi-year and it had multiple layers of ice and snow covers, we added this measurement to help sort out the results later.
- We met the incoming science teams at the main camp as our team was preparing to exit and we had time to discuss and deliver the data to Andy Heiberg (UWA). He then used our data to locate the thickest ice for his buoys. The following instruments were placed on our floe, using the data we delivered to Andy Heiberg (UWa) as we were leaving:
    - Stanton's Oceanographic Buoy
    - CRREL's Mass Balance Buoy
    - Sigrid's Thermistor String (one of two)
    - A Meteorology Station

Argos ID's for Sigrid's buoys are:

22206 Weather station
21076 CRREL thermistor buoy with pingers
21077 CRREL thermistor buoy, no pingers
09114 Eppley radiometer buoy
09115 Kip and Zonen radiometer buoy

In addition, Code 923 received the following scientific benefits, as directed by Brent Holben on site:
1. Established a sun photometer with the Russian "drifting research station" located at the North Pole. This will provide the first full season of such measurements near the North Pole.
2. Compared performance of various sun photometers for operation in extreme cold.
3. Established the northernmost permanent AERONET site (Spitzbergen, Norway, 78° N) to begin routinely characterizing optical properties of arctic haze (figure available).
4. Made the first measurements at mid IR bands of Aerosol optical depth under arctic haze conditions from the North Pole.
5. Trained four GLOBE teachers for sun photometer measurements and provided them with sun photometers.
6. Four new schools are now collecting GLOBE sun photometer data useful for validation of satellite aerosol retrievals from MODIS and MISR on board Terra and providing a data base for local aerosol characterization as it may relate to pollution and human health.

7. Provided an opportunity for students to take real and vicarious measurements of atmospheric properties via webcasts from Spitzbergen.
8. Established scientific collaboration with UNIS for arctic haze characterization.

Comments from the participants included the following:
Dr Janie Fouke commented, "NASA has received tremendous positive coverage in the Michigan media as a consequence of our trip. Not only was there a lot of coverage on campus (and MSU is one of the largest universities in North America!), but the Lansing State Journal (the newspaper in the capitol city), local television stations, and a widely heard business/talk radio station provided substantial coverage. The theme throughout these various interviews is the role that the trip played in stimulating young people to chose science/math/engineering careers. The news coverage pointed to the archived webcasts so that students (and others) could access it and see the excitement for themselves. In addition, at MSU the webcasts were viewed live by students and staff, and the URL for the archived information has been widely disseminated.

As you know, I met with the administrators from UNIS (The University Centre on Svalbard) while we were there. Since MSU has one of the largest Study Abroad programs in the world and since we have an announced goal of 40% of our students participating in a Study Abroad program, this is a priority for me. I have distributed the information about the UNIS program to our Study Abroad staff and faculty. I have also met with our Civil and Environmental department chair to discuss the opportunities that exist there. This department is the best link for us in the College of Engineering because of the Arctic Environmental Technology program and the Arctic Construction program at UNIS. I'll keep you posted as this develops."

Radford University, Dr Rhett Herman, Physics Professor says, "We learned the harder side of science in that things don't always work. My students were used to hearing in class about things that did work, since those are the experiments that I so often cite as proof of something. Also, in general, students are only exposed to lab experiences whose outcomes are just about predestined. At least most well-designed labs are like that.

We also learned a great deal about working in conditions so far removed from our everyday lives here in Radford. And, frankly, in most of the continental United States. My hope now is to find a way back up there, at least for me and the two students I took, in order to get those numbers that we missed the first time around. I did learn to always have backup, especially for our EM-31. One thing that will be hard is to find a second EM-31 to take back up there.

I liked the idea of the survey being broadcast while it's being conducted. That is quite unique. Most times, you only hear/see the results of some survey long after it's finished. But, to see it while it's being done is like medical school, when you go and actually watch surgery being performed in order to learn how to do it yourself. It's all fine and good reading the manuals and seeing the snapshots of surgery, but it's a whole new ballgame to be able to interact/talk (at times) with the surgeon before you lay hands on a patient."

The **Bay Mills Tribal school** objectives were different from those of the other main line schools. Bay Mills wanted to inspire more Native Americans to get a higher education and to believe that they too could get involved and contribute to the developing technologies all around them. They were extremely successful in this regard. Since their return their expedition has been featured in many of their local newpapers and public media, as well as interviews by the NY Times. Nathan Beelen, teaches High School in the Upper Pennisula, Michigan and says, "My students are excited about doing field science. It does not, however, make much sense to get my students all fired up about doing science in the field if they do not have the opportunity to do it. I would love to be able to take some along on projects like this in the future. I am convinced, from the experience, that they can be a real asset and that they are as capable as anyone else of doing field science. Inspiring students to do this kind of science has never been the problem. Having scientists willing and open to invite me and my students along has been…. Are there others out their willing to take the chance at tapping that workforce or was this trip truly a once in a lifetime opportunity?"

Conclusion:

In spite of the few setbacks, which were not critical anyway, we were very successful overall. We accomplished the educational objectives and the primary science spin-off objectives within a very tight schedule and even tighter budget. I am very proud of how this group of very diverse people worked together as a fine team in an extreme environment and managed to produce such useful results. I intend to propose follow on activities of this sort, where my office will coordinate a small group of educators, who will follow scientists into the field for mutual benefits.