

SOUTH POLE USERS' COMMITTEE (SPUC) MEETING

August 30, 2004
Denver, Colorado

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Distribution List

Committee and Affiliated Members

R. Morse	*R. Schnell	*G. Hernandez
B. Vasel	**A. Stark (Chair)	*A. Karle
R. Pernic	A. Weatherwax	R. Loewenstein
*J. Peterson	A. Clark	*J. McConnell
C. Martin	R. Morse	

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National Science Foundation

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J. Marty	D. Bresnahan	P. Smith
J. Palais		

Raytheon Polar Services Company

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C. Kaminski	P. Sullivan	P. Douglas
M. Lewis	B. McAfee	A. Baker
M. Perry	D. Scheuerman	T. Howard
R. Score	M. Lewis	E. Watson
D. Leger	J. Corbin	S. Holbrook
E. Jensen	M. Buckley	N. Powell
S. Kulinski	J. Wright	

South Pole User's Committee Agenda
Annual Meeting 30 August 2004
Raytheon Polar Services Company, Centennial, Colorado

7:30 – 8:00 Continental Breakfast

8:00 – 8:35 Opening

- Welcome and introduction of attendees (10 min)
- Overview of meeting agenda (10 min)
- NSF welcome and remarks (10 min)
- RPSC welcome and remarks (5 min)

8:35 – 9:20 IT and Communications

- POLARICE - Design, operation, and user experience (45 min)

BREAK (15 min)

9:35 – 11:20 IT and Communications (continued)

- INTERNET – Pole
 - Full-time Internet - plans
 - Security
 - Status, science impacts
 - SSH-based VPN
 - E-mail and e-mail security
 - Services – NTP, “scratch” disks, anonymous ftp in and out
- RFI (45 min)
 - Plans for minimizing RFI
 - SuperDARN

11:20 – 12:00 Operations

- Snow Grooming with emphasis on the Dark Sector (40 min)
 - Can MAPO and AST/RO be brought back with aggressive grooming?

BREAK FOR LUNCH (30 min)

12:30 – 1:30 Operations (continued)

- Power – what is being done to assure power sufficiency over the next few years? (30 min)
- Population (30 min)
 - Expected and scheduled population demands and availability during the next four years

BREAK (10 min)

1:40 – 3:00 Special Topics

- Cryogenics (40 min)
 - Raytheon support plans for LHe and LN2 supply
- MAPO machine shop plans (10 min)
 - Science impacts if shop does not move to DSL (slated for FY06)?
- Equipment – Common use supplies (10 min)
- Traverse (20 min)
 - Will the traverse be available for future science cargo?
 - Will it be possible to traverse to other sites on the Plateau for scientific purposes?

BREAK (10 min)

3:10 – 3:55 Committee Business

- Review and approval of membership (25 min)
- Working Group Status Reports (20 min)

4:00 – 5:00 Executive Session

SPUC Members

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Recommendations of the South Pole Users' Committee 2004

This memorandum summarizes the recommendations of the South Pole User's Committee (SPUC) for 2004. The topics on which these recommendations are based were discussed at the eleventh annual meeting in 2004; the minutes for that meeting are available as a separate document from Raytheon Polar Services (RPSC). The present memorandum was begun in executive session at that meeting and refined by committee members through email correspondence; it will be distributed in both email and paper form.

(1) Full-time, low-bandwidth Internet--- *The committee recommends that low-bandwidth internet over Iridium be done by SCOARA.* Full-time, low bandwidth email to and from the South Pole has been a top recommendation of the SPUC for the past four years. We were disappointed to learn that efforts by RPSC to construct such a system have been abandoned. The committee recommends that this project be taken over by the newly-created Science Coordination Office for Astrophysical Research in Antarctica (SCOARA), and that SCOARA be allotted sufficient funds to complete the work. These funds should be allocated from the logistics side of the OPP budget, not from science.

(2) Radio Frequency Interference Between Transmitters and Receivers--- *The committee recommends that transmissions be scheduled and logged.* The South Pole is one of the world's preeminent observatories for astronomy and ionospheric research. In particular, the South Pole has established world leadership in the measurement of the microwave background radiation, because the most sensitive radio receivers can be used to full advantage. All radio transmissions are a potential threat to these activities, and may have unanticipated consequences for other science operations. The committee recommends that transmitters be installed as far as possible from the Dark Sector. We note that every radar installed at the Pole to date has resulted in interference with scientific observations. At the same time, we recognize that radio frequency interference can be ameliorated in most cases. This requires additional effort and expenditure for the experiment receiving the interfering signal, however. The situation is not symmetric between those transmitting and those receiving interference. For example, modifying AMANDA to reduce radio interference from the VLF transmitter has cost about \$100,000 plus several person-months of software effort. AMANDA sensitivity is reduced during VLF transmissions.

Some radio astronomy experiments observe a single point on the sky for a year or more. For these experiments, interference by transmitters may not become apparent for many months. In order to definitively demonstrate that radio frequency interference is not affecting the data, it is essential that these experimenters be able to separate data taken when a transmitter is on from data taken when the transmitter is definitely off, and that the quantity of data taken in the transmitter off state be at least as great as that taken with the transmitter on. It is therefore essential that each transmitter be off at least half of the time. To be useful, the "off" periods need to be many minutes long, and the exact times of the on and off periods should be made available in a public log. These restrictions on transmission should be permanent.

(3) Science network Security Needs--- *Science computers at South Pole have different security needs from other parts of the network.* The science computers at South Pole contain no sensitive or proprietary information; science computers need only be protected from unauthorized use and denial-of-services attacks, a situation which is different from RPSC computers. Science computers also may run customized software, developed over many years, or use specialized operating systems (e.g., real time operating systems). Because of this, security updates or configuration changes often require special system administrator skills. The committee suggests that the science computers be isolated on their own separately-managed and fire walled subnet, so that RPSC can implement security requirements as needed on RPSC computers, without interfering with science computers. The committee notes that a demonstration of this idea (a firewall protecting the network inside the AST/RO building) has been running successfully for over a year.

(4) Wet chemistry in the new South Pole Station--- *Laboratory space suitable for wet chemistry will be needed in the new station.* The committee suggests that a section of the planned laboratory space be made into a separate room with sink, laboratory water purification system, fume hood, and chemical waste disposal (not a drain). This room should be light-tight so it can also serve as a darkroom and should be equipped with basic laboratory equipment (e.g., glassware, electronic balance) and full LAN connections.

Respectfully submitted for the committee,

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South Pole Area Users' Committee Meeting Minutes August 30, 2004

Opening

Welcome and Introduction of Attendees

Dr. Stark, Chairperson, stated that this meeting is a chance for the science community to let the NSF know what the needs are for science at the South Pole. Reiterating the support process, Dr. Stark reminded the meeting participants that in order for science to be accomplished in Antarctica, Congress grants the NSF funds so that Raytheon, in turn, can support the scientist. In order for this work to be carried out, logistics must be in place, which is the purpose of this meeting – to review problems and make recommendations. The result has been first class science being realized at the South Pole. Meeting participants introduced themselves.

NSF Welcome and Introductory Remarks

Dr. Scott Borg, Section Head, NSF/OPP, wanted to emphasize that this assembly is not meant to be just a one-day gathering. These discussions are to solicit feedback and potential solutions from the science community. He regards these meetings as important, useful and should be on-going. Dialogue between Raytheon, the NSF and the science community must continue to be open in order for these teams to work well together and be successful. These discussions identify how to change and strengthen structure and teamwork.

Dr. Borg observed that they have experienced more constraints and are discovering choke points that need to be addressed. They have more proposals submitted that can be funded; therefore, our support plans are critical. They are forced to make tough decisions and control planning. In order to accomplish these goals, a strong partnership needs to be maintained. These are our challenges as we move into the next decade.

Dr. Borg felt that it was beneficial for him, Brian Stone and Vladimir Papitashvili to be attending the meeting at Raytheon headquarters and not by telecommuting.

RPSC Welcome and Informational Remarks

Mr. Steve Dunbar, Director, Science Support, stated that RPSC takes direction from the NSF with input from grantees. He noted that the program is reviewing and analyzing budgets line by line, justifying costs in order to take advantage of every resource available. Science management is driven to be customer focused using feedback, recommendations and scheduling deadlines. We must address those areas that are weak and work on making them strong by implementing recommendations, scheduling deadlines and using our time wisely.

Discussion:

Dr. Peterson asked if the NSF would like to have more specific recommendations from the committee. Mr. Brian Stone, NSF Research Support Manager, said that the more specific the scientists can be, the better they can act and follow up on issues. He also noted that each of the users' committees have different styles on how they present their recommendations to RPSC and the NSF. Any changes to this committee will envelop all the users' committees.

Dr. Lowenstein said that he would like RPSC to let the science community know what decisions and recommendations have been made regarding problems so they will know what actions will be taken. Dr. Morse recommended that the chairperson and the principal lead from each committee meet to address global issues.

Mr. Dunbar stated that RPSC would need guidance from the NSF to do that. It would have to be a steering committee that would be useful and have measurable goals. Integrated Planning Teams (IPTs) is a direction they are considering. But how do we set global objectives; who would be on these teams; how much would it cost; and what resources would be used?

Mr. Pernic wanted to know where this vision coming from.

Dr. Papitashvili, NSF Aeronomy and Astrophysics Program Manager, said that this vision comes out of the workshops from each discipline and their needs for five years and beyond. And, they use the recommendations from the users' committees. We want to be a working body that can consider and allocate limited resources for priorities. We must carefully weigh these recommendations and we must all be on the same page.

Mr. Stone added that the recommendations from the SPUC do help the NSF in their direction. Science, communications, infrastructure, logistics are all areas of NSF focus.

Dr. Stark mentioned that these decisions that are made and implemented, often times do not reach the scientist on the Ice. There are reports that they do not see and sometimes appears to be a confidential decision made by RPSC and the NSF.

Mr. Dunbar said that there is no incentive to keep these decisions private. He recommended that there be more follow-up to these meetings and allow the science community to be advised of decisions and recommendations made by RPSC and the NSF.

Dr. Borg commented that when recommendations from the last meeting were asked for, there seemed to be a scramble to put them together. He wants to see these recommendations publicized sooner so the NSF can respond with a potential resolution. We should get them on the Web as soon as possible. Issues may be addressed in stages. He felt that the time that it takes would be well spent. Mr. Dunbar agreed.

Dr. Lowenstein asked that the final recommendations not be published until there has been discussion between scientists and NSF.

Mr. Dunbar agreed, but added that would be a time consuming process.

Dr. Stark suggested that one person be selected to consolidate this information; i.e., IT issue recommendations that all have agreed upon.

Dr. Borg said that we do need to find a solution to this. In looking over the last records of the SPUC it seems that it would be useful to have one person who has the facts from everyone so that recommendations can be made with consideration of all the pros and cons.

Dr. Morse suggested we set dates, get the right people involved, target and prioritize. Mr. Pernic emphasized the need for teamwork.

ACTION: The committee shall work with the NSF and other scientists to prioritize and publish recommendations from this meeting in a timely manner.

Dr. Papitashvili commented that the process is changing and that there is communication especially with logistical requests. He added that the science community needs to be more realistic when filling out their SIPs. They need to be self-disciplined and think about logistical needs three to five years ahead so that resources can be allocated to include the future. He said that the scientists should be allowed to know what monies are available and the limitations of support to their projects.

Mr. Stone said that the NSF will be examining feasibility studies and changing the way they estimate for a project. Issues that are complicated will involve a greater scope. They recognize that the PIs are in a precarious position and have purposely low-balled their requirements just to get funded. We will have to change the process and what is expected.

Dr. Borg said that a lot of things that are not expected create a lot of little fires that have to be put out. The NSF realizes that a change of scope is not a bad thing, but we need to know the resources available so we can make it work.

2004 Agenda Topics for South Pole Users' Committee

POLARICE

Representatives present for POLARICE discussions are Scott Holbrook, Josh Nelson, John Dowd and Brian Woodrich.

Mr. Holbrook began with a Power Point presentation demonstrating the SIP submission rate, detailing the SIP process and discussing the improved itinerary for POLARICE. He said that the capability for an "updated" SIP will be available, but it will not be a "copy SIP-to-SIP". This automated process will not be available until next year. A survey was sent to 170 grantees, but only 27 responded. Points of the survey were discussed. All disciplines responded to the survey with an exception to those who will be conducting science on the vessels. He said that these responses would be sent to the NSF for

recommendations. Mr. Holbrook called attention to the Instant Response managed by John Dowd, which was very popular. He explained that the slow network performance issue had been fixed, but they are still working on improvements. The POLARICE team wants to know how they can make this process easier for the scientist and meet their needs. Further discussion included choosing maintenance priorities so that the POLARICE team can still provide support to the grantees and work on next year's improvements. These include a transition to Version 3, tying the SIP to the ORW, and improving the itinerary. He said that the tutorial and training formats did not get a lot of hits.

Dr. Stark commented that scientists were pleased with the POLARICE improvements over all.

Break

Internet

Mr. Don Ravenscroft discussed the Internet with the committee members. He said that the LES9 would be replaced by 24/7 Iridium.

Prioritizing e-mails was one of the suggestions made considering the instability of Iridium use. We could also broadcast once an hour on a 24-hour per day basis. The only way to get a 24-hour connectivity is through low speed Iridium. There are four channels that are in the test mode and RPSC should have a prototype available by the end of this summer. Their goal is to get a 24/7 low band server. Mobile-to-mobile was discussed, but was determined that the cost of \$13,000 per year for four channels is a little excessive. Pat Smith, NSF Technology Development Manager, via telecommunication, commented that the NSF is waiting for \$50k funding for Internet connectivity.

Mr. Stone stated that this is a high profile issue and needs high priority action for 2004. The NSF will need recommendations from the science community. In order to provide support, they will need to have something more tangible. BAS will be contacted regarding the system they use since it is similar to what our needs are. It is felt that the projection for Iridium is the most reliable system for the next five years and beyond.

It was suggested that the committee appoint a working contact to help determine priorities and rules for implementing connectivity.

Other satellite systems were discussed. MARISAT has stabilized; however, SPAWARS has the contract renewal concept. It is still operational and one year from now, we would be provided with another year of service. We are continuing to use TDRSS F1, F3 and MARISAT. The NSF is considering the use of Goes7 for next year, which is currently being used by Hawaii. We may be able to use Ausat3 in 2008, and we may be able to get one hour of data time from TDRSS F3 currently being used by NASA. Mr. Ravenscroft said that RPSC has conducted studies evaluating the costs and data rates in these other areas.

Dr. Papitashvili said that the working group of the committee would be addressing the support evaluations.

Mr. Stone commented that the bandwidth issue is a developmental issue where we will need input and evaluations from many sources before value judgments and investments are made for the benefit of the science community. Dr. Pat Smith added that the community should understand that this issue is a complicated one. The Iridium issue is a risk in regards to business and cost. We also need to keep in mind that by 2009 we will need enough bandwidth to support 250 gigabytes/day.

Scratch discs and anonymous ftp

Mr. Scott Holbrook said that there would be a need for an administrator to keep files cleaned. Mr. Dave Leger added that this would require NSF acceptance with confirmation that it will not violate security.

Dr. Borg reminded the committee that the NSF must conform to federal-wide rules. The university may run under the university protocols, but are different than the national federal rules. It was suggested that we use other agencies such as NASA as a model for national labs.

Security

Discussion with Mr. Scott Kulinski regarding the SSH-based VPN included considerations for manned and unmanned science system connectivity. It would involve more than IPsec and SSL. RPSC wants to provide connectivity for McMurdo, Palmer and South Pole stations, which would be simple and straight forward with a single set of credentials that would allow connection anytime anywhere. Requirements will be minimal. The NSF has seen the diagrams and implementation of the VPN will begin January 2005. This will allow anyone from the outside to use SSL and log on to the project computers at the South Pole as long as you have the software and web browser. However, being able to log onto the institutes computers from the South Pole requires the use of applications that are not normally used and must go through the firewalls. RPSC is working on exceptions and trying to get away from an IPsec. They are expanding to Internet II service, cleaning up firewalls and setting credentials. Dr. Stark said that he was pleased that RPSC and the NSF are including the science community in this loop. Dr. Darryn Schneider will act as mediator between RPSC and the NSF and will keep the science community informed of the implementation progress of their projects.

Dr. Borg reminded the committee that care must be taken that sensitive information not fall in the hands of people who do not need it. Important messages and decisions must be specifically worded to keep within the protocols, and whereby specific distributions lists are controlled. The VPN will need an ongoing management and credentials' process.

ACTION: Dave Leger will notify the PIs at the South Pole when the vendor is selected, and when VPN is executed. Mr. Leger will also provide Dr. Schneider with program wide distribution lists.

Tim Howard, via telecom, wanted to have Dave Leger pass him the technical information on this issue and how it will be designed and implemented so that this information can be discussed with the committee and the NSF. He did not know of any federal policies or policies within the NSF that would pose as roadblocks.

ACTION: Mr. Ravenscroft will review policies between the NSF and OPP and come back with a recommendation for an anonymous ftp conception, design, and implementation.

E-mail Security

Mr. Howard reiterated that we should not accept e-mail from anyone you do not know. Mr. Leger will have changes with direct send-mail hook ups this year. Setting up relay hosts without the satellites needing to be up based on Solaris machines. If any of the scientists have send-mail requested in the SIP then you should be set up, if not let him know.

Lunch

Radio Frequency Interference (RFI)

The RFI and its affects in the clean areas were discussed. The science community is concerned that the SuperDARN will create pollution and other studies will be contaminated. Dr. Papitashvili said that the SuperDARN would be built as far south as possible. There have been no problems with frequency contamination from MARISAT. Dr. Papitashvili said that if the scientists can provide data that RFI will be a problem, then he needs to be advised. Dr. Stark noted that since every instrument is different they may have a problem and not know it. Dr. Papitashvili pointed out that we must learn to coexist and respect each other, as there are 34 events with five or six different disciplines working at the South Pole this season. Dr. Stark also commented that since the NSF has spent millions on instruments that may or may not be contaminated by RFI, the committee can not determine who can and who cannot work at the South Pole.

Dr. Borg stated that there should not be any conflicts of interest between disciplines. As experiments become more complicated, it is our challenge to make sure the integrity of the experiments are protected.

ACTION: Dr. Papitashvili asked that the committee provide him with objective, nonpartisan advice toward what kind of process needs to be taken regarding the impact of one experiment affecting the integrity of another.

Not allowing certain kinds of science is not a viable solution. The NSF cannot make uninformed decisions and we must have confidence in our evaluations. He suggested perhaps some experiments could be executed at a nearby camp.

Mr. Dunbar noted that we have clear policies defined for each sector. Dr. Morse suggested that each group establish the characteristics of each experiment to see how they will affect others and identify the interfering factors.

Dr. Borg went on to say that if it is determined that one project is not compatible with others that are currently at the South Pole and may not be performed, then that determination would have to be made from higher management. Mr. Stone added that the NSF has been mandated to support science at the South Pole only. To set this kind of policy is out of their realm. It was decided that this is a question that this group cannot answer, but in order to understand the ramifications of such an issue it needs further NSF research.

Ms. Grant addressed a suggestion made earlier regarding moving experiments to an off-site camp; she said that it would not be supportable considering the existing infrastructure, funding and support required for the current science. Other conflicts, the long-range view, logistical problems, and impact to the station would all have to be considered.

Dr. Peterson suggested that these experiments should be physically separated. Dr. Papitashvili said that would not be possible at this time. Besides, the NSF would have to have a very good reason to move SuperDARN. Dr. Peterson went on to say the he felt that the NSF is making a mistake by letting transmitters into the South Pole. But, Mr. Stone explained that this is a policy issue and they would need to move this issue up the chain to the Academy. The committee should assess the situation with the understanding that each experiment is worthwhile and give their recommendations to the NSF. They may need to propose extra funding for this analysis or bring in a third objective party to review potential problems and risks. They need to ask such questions that will help them understand what exactly SuperDARN is, how interference can be identified, and to quantify the affects.

ACTION: Dr. Papitashvili recommended that the committee create a working group and assign them to assess and analyze the effects of one experiment (SuperDARN) to the others already there and make recommendations to deal with this issue in a rational way.

Break

Population

Dr. Papitashvili pointed out to the committee that we have population limits, which are exceeding bed space from 240 to 250. We now have IceCube, construction and other RPSC support and the scientists. We are asking if scientists can move their projects from the most populated time frame to a less populated time frame. There are 325 beds needed for year 2005-06 for projects that have already been scheduled and to work on what is continuing for this year. In year 2006-07 there will be a need for 270 to 275 beds. We are asking that everyone help and work together to accommodate each other.

Dr. Borg stated that the NSF is struggling with being able to accept new proposals for the South Pole because of population constraints and they would like to have some capacity for new projects. Mr. Stone also pointed out that when the population reaches absolute thresholds, the station starts demonstrating problems in providing facilities such as power, water, and sewer. Ms. BK Grant reiterated that RPSC has reviewed all avenues and still cannot find a solution.

Mr. Stone stated that this is not just a South Pole problem, but all of the stations are at the point where the Antarctic Program is becoming completely saturated with logistical requirements. It is time to look at the bigger picture and other parts of the program.

Dr. Papitashvili wanted to know from the committee exactly how many days they thought it would take get their work done. He pointed out that all of the South Pole PIs need to work as a team in order to reduce the population at the station. Mr. Jerry Marty, NSF Facilities Construction, Operations and Maintenance Manager, also pointed out that even now they are working on how they can reduce the population for years 2006, 07 and 08 and are soliciting the committee's input regarding numbers of participants, reprioritizing deployment schedules and shifting project work days. Ms. Grant also pointed out that the station only has 75 beds for science and until the construction is complete, they will need the cooperation and support from everyone on station. Mr. Stone mentioned that in 2006 and 07 deep field camps and support will be geared up and the construction will be done. The NSF is considering several scenarios given the resource constraints and lack of flexibility, including extending the season. The committee further deliberated the population issue and resolved that it needed further discussion.

Power

Mr. Jerry Marty stated that the NSF is still preparing scenarios for South Pole power requirements, especially in the Dark Sector. He realizes that there will be a serious problem in FY07 supporting IceCube and the 10-meter telescope. They will further consider the increase in flights, fuel, procurements and money as well as the time frame, progress of IceCube, and the impact on the station.

Snow grooming

Mr. Jerry Marty mentioned that the aggressive grooming would not be of much benefit. He went on to say that the IceCube Counting House is on a pad with specific elevation in an attempt to maximize the number of years used before raising it. There are other buildings that need to be raised as well. MAPO and ASTRO will be raised in FY07 or 08. They will be raised 10 – 12 feet. The ASTRO building will need to be gutted out before the building can be raised. The NSF is working on a plan for best way to raise them and will have the engineering information available by the FY05 season. The NSF will have to consider how this process will affect science on the station. Some considerations they will review are affects of disconnecting power to these buildings and having the buildings cold for approximately 30 days.

Dr. Papitashvili noted that the NSF would discuss this issue further next spring after a detailed analysis is prepared.

Cryogens

It was mentioned that the liquid helium at the South Pole does not last through the winter. A subcommittee headed by John Ruhl is addressing this problem.

Equipment and Common Use Supplies

There was one million dollars set aside for new equipment for the new station. However, Mr. Stone stated that it has been used for the SPSM. He suggested that the committee project what equipment they would like to have purchased for the next three to five years for common use and an estimate of the costs. Stark recommended the instrument shop needs equipment and has to be near the instruments. Some of the infrastructure equipment has already been purchased, but these instruments are for specific experiments that are not always in use, but still needs to be available and able to give precise readings.

ACTION: The NSF will review and justify what different projects will be using what equipment. A list of instruments they have recommended in the past is on the web. It will be updated for committee review.

Traverse

Mr. John Wright, Project Manager for the South Pole Traverse Proof of Concept Project, discussed the traverse with the committee. He said that this is a three-year proof of concept project and that it is a heavy traverse, which needs the capability to travel on a repeatable route. They have not determined what material will be hauled and have not discussed retro cargo. All goals in FY03 were met and exceeded. The team encountered 32 crevasses over virgin terrain and filled them. During Year Two (FY04) they traveled across the Shear Zone to the Leverett Glacier. After which they found Dorniks, which are buried Sastrugis that hampered travel with soft snow. The team spent a lot of time repairing sleds, tractors, and testing sled performance. While assessing the route, they found that it had moved approximately six feet per day. The team will be able to make nine round trips each season. Each tractor, carrying out 90,000 lbs of fuel, should be able to deliver 60,000 lbs to the South Pole Station. Preliminary concepts estimate that with three tractor fleets running three traverses per season, this would replace between 70 and 90 LC-130 flights per year.

The economic viability was discussed. The team is developing other technologies, gathering data and exploring side benefits that have not been investigated yet. It is not clear what year the costs will begin to pay off, but the results so far have been well worth the investment and Dr. Stark expressed the committee's approval in the progress.

The meeting was adjourned and the SPUC members broke into Executive Section to review committee business.

End
4:04 pm