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National Science Foundation

Raytheon
Polar Services

Optimization of South Pole Operations

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Antarctic
Infrastructure & Logistics

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1.0 Preface

In April 1992 the NSF and various strategic partners convened in St. Michaels, Maryland for the purpose of defining concepts and requirements for a new science facility at the South Pole. The output from that retreat put in motion a long series of further studies, reports and panels culminating in congressional funding approval for the design and construction of the third South Pole research station. The project was funded in two phases, the first phase addressed the significant safety and environmental concerns, and the second replaced the obsolete facilities that had been commissioned in 1975. This was called the South Pole Station Modernization (SPSM).

Fifteen years later, the SPSM project is 92% complete with major new facilities fully functional and utilized as intended to support science. The new station and enhanced infrastructure increased the United States Antarctic Program's ability to significantly support science over past capabilities. Several new signature science projects are now operational and being supported successfully.

The South Pole campus is now a relatively large and extensive assembly of facilities, utilities, storage areas, and temporary work zones and camps. The operations and maintenance of the station coupled with the demanding science needs that is supported, requires a level of expertise that is challenging to meet, particularly with limited support staff. Increasing the support population to meet these demands is undesirable and the objective for the workshop was to challenge current paradigms and to rethink ways of doing business in each area to streamline the support functions.

As SPSM moves closer to final completion and the station transitions from 10 years of construction to sustaining support functions and operations, the summer population, depending on future science needs can be expected to be 25% - 50% over the planned level of 150. In addition, the complex station operating systems, coupled with the increase in science at a level exceeding expectations have changed many of the original requirement assumptions. Meeting all desired commitments has become difficult and a large backlog of operational and project tasking has developed.

Under these circumstances NSF/DAIL considered it to be the right time to reconvene at St. Michaels and conduct a thorough review of the original planned requirements and assumptions for operating the station compared to current actual conditions. The objective was to identify what has changed and why; and to set a course to aggressively manage capacities within the programs' fixed constraints but do so creatively such that operational processes are continuously improved without increasing site presence.

As reflected in these proceedings, the focus of the participants at the 2007 St. Michaels workshop was to identify issues, outline a strategic plan, then set goals to streamline each functional area. The resulting interactions yielded insights on the interactions needed across the Program vs. being South Pole centric, new ideas and a broadened appreciation of what it takes to maintain safe and reliable operational support in such a severe environment.

2.0 Summary of Proceedings

2.1 Overview

The workshop was held April 30 – May 2, 2007 and attended by 37 persons representing NSF, Raytheon Polar Services Company, various government and military support organizations, and several technical consultants. Opening remarks were given by Mr. Erick Chiang, Dr. Scott Borg, and Mr. Sam Feola.

Ms. Sandra Singer and Mr. Erick Chiang, of NSF's Division of Antarctic Infrastructure & Logistics (DAIL) facilitated the proceedings and the working groups. The Antarctic support contractor, Raytheon Polar Services Company (RPSC) presented case studies that highlighted areas of station operations that could benefit from re-assessment and optimization. This common working knowledge base session set the stage for the six working groups to address of high priority concerns.

2.2 Workshop Purpose and Scope

Purpose:

Identify and address operational issues associated with managing and maintaining the station facilities based on a realistic understanding of the evolving science support needs and the significantly more complex station systems.

Scope:

Find ways to operate as close to the basis of design as possible. Make direct comparisons of current conditions vs. original assumptions. Using plenary sessions and reports from the small focus groups, conduct broad based and detailed reviews of the current business practices, validate or re-baseline requirements, and develop the basis for an updated management plan.

Goals:

1. Understand the differences between the way the station was conceived to be operated and managed to how it should be managed and operated. All underlying assumptions are to be challenged.
2. Define the optimal steady state; outline a strategic plan to achieve that.
3. Optimize the current resource model to one that maximizes productivity for operations and support services.

2.3 Plenary Session: Problem Description / Issue Identification

The group convened to discuss the current state of operations and identify critical issues for discussion by the working groups. Raytheon presented case studies on subjects that illustrate areas of difficulty at Pole. Key strategies and recommendations developed by the breakout teams are in Section 2.4. The full content of all presentations and discussions are in Section 5.0 Appendices.

2.3.1 Case Study: Population

Table 1: Population Comparison – Construction and Operations Phases

Functional Area	Construction Phase 1994 Assumption 200 people	Construction Phase FY07/08 Actual 270+ people	Operations Phase 2011 Assumption 154 people
Station Management	5	9	6
Operations & Maintenance	38	75	51
Science Support	14	15	14
IT-COMMS	4	8	6
Science (Grantees)	50	72	75
Other (NSF, NSFA, Tech Events)	9	13	2
Construction	80	80	0
Total:	**200**	**272**	**154**

Three primary issues were identified that have triggered systemic concerns.

1. For several years population has been well over the assumption of 200, creating over-subscription of limited resources and deferral of various tasking.
2. The plan for sustaining a maximum 154 persons on site post SPSM may not be realized for some time. Committed tasking of high importance will carry on for several years beyond 2011 before easing.
3. The complexity of the new facility mechanical-electrical, power and IT systems drives the need for staff with specific skill sets to manage the interfaces. Adjustments to the original staffing model assumptions are needed.

Managing high population with high demand for construction and equipment is a significant challenge in light of increasing demand for support. Increasing population to meet new support needs contributes to station over-population. Meeting demands for additional tasks before completing prior tasks creates and prolongs the "bow wave" of work, extending the need for more persons farther into the future. This problem is exacerbated by unforeseen resource requirements not in the basis of design; examples include IT Security, a fuels department, and the Air Crash response team (ARFF) all have increased the summer O&M population. Problems that have become evident are:

1. Facilities maintenance is in danger of getting deferred to sustain real-time operational demands and science support.
2. Existing staff must volunteer significant time to augment other areas of station support such as emergency response, retail, recreation, and food service, contributing to staff burn-out and loss of retention.
3. High population compromises designed occupancy and capacity limits, increases life-support system maintenance intervals, and prevents support of new science.

Working group tasks:

- Examine drivers for population, reduce on-site requirements
- Find ways to optimize critical resources that are required on site

2.3.2 Case Study: Operations – Vehicle Maintenance Facility (VMF)

The three areas of primary concern in operating the VMF are:

1. Size of the fleet vs facility: the fleet size has tripled in number. Designed to support 20 pieces of equipment in 4 maintenance bays, 61 pieces are being maintained creating over crowding, deferred service, and delays as heated space is too small for current requirements.
2. Increased Maintenance Labor: staff and required shifts have more than doubled. Plan was 3 persons on one shift; actual conditions are 7 persons on 2 shifts with consideration for a 3rd shift to meet increasing demand for service.
3. Aging fleet: maintenance requirements continue to increase. Prompt service is performed on critical items only, older pieces of lower priority continue running without maintenance contributing to larger requirement backlog.

Working group tasks:

- Meet requirements operating within the existing space
- Prevent increasing labor effort to 24x7
- Optimize the size, age and condition of the fleet

2.3.3 Case Study: IT & Communications

The three areas of primary concern in IT & Comms are:

1. Satellite bandwidth: requirements have increased 50 fold. 1996 projections for science transmissions were ~907 MB/day requiring 2 servers to manage. 2007 actual bandwidth use is ~50,000 MB/day with 66 servers, projected to increase to 85 servers within five years. Management/maintenance capacity is stretched.
2. Staffing level: below industry standard for scope of services. The requirement for data security was not foreseen to the degree that today's environment demands, and larger bandwidth needs with the variety of non-commercial satellite service providers creates a more complex system.
3. Electromagnetic Interference (EMI): needs dedicated management. Scientific instrumentation and life/safety systems are sensitive to EMI. Resources for determining EMI direction and sources have limited effectiveness. More effort applied to this area is necessary, yet doing so contributes to population issues.

Working group tasks:

- Optimize the volume of hardware/software to manage.
- Meet increased requirements for EMI and Security without more staff.

2.3.4 Case Study: Logistics

The three areas of primary concern in logistics are:

1. Waste management: unable to effect the timely removal of solid waste products increasing the backlog and physical space for storage. Driven by high population and increased cargo/supplies, the volume of waste is significant and processing is back-logged due to inefficient practices to control and prevent waste.

2. Unconsolidated storage: spread out depots cannot be utilized effectively. Time and productivity is wasted trying to find things. "Do Not Freeze (DNF) space requirements are expanding, creating further demand on energy resources.
3. Inventory control: manually labor intensive and inaccurate. The amount of materials on site is excessive to needs; significant retrograde must occur followed by implementation of an automated system. An integrated solution is needed.

Working group tasks:

- Optimize waste systems management; meet ACA regulations for removal.
- Reduce the manual intensity of inventory control
- Develop aggressive plans for material management and retrograde

2.3.5 Case Study: Facilities Maintenance

The three areas of primary concern in facilities maintenance are:

1. Open Positions: maintenance requirements are not being met. Attracting and retaining qualified technicians is difficult, each season some positions are unfilled.
2. Increasing workload: high facility usage creates additional work orders. Technicians work 60 hour weeks (10%> 54-hr base) and complete 90% of required procedures.
3. Training Time: difficult to acquire and time consuming to provide. Maintenance personnel are responsible for high tech complex systems with interdependent electronic monitoring; keeping up with industry is not occurring.

Working group tasks:

- Optimize staffing to fulfill all work orders with the right skill sets
- Look at shifting more maintenance to winter
- Explore offsite training options

2.3.6 Case Study: Construction

The three areas of primary concern in construction are:

1. Inadequate resource matrix: shared pool is too small for the current requirements. Inefficiency exists when multi-tasking and "start/stops/re-starts" occur across a large area. Leveling requirements lengthens schedules.
2. Rollover work: optimistic planning does not equal realistic results. Risk events, labor shortfalls, weather, late material deliveries, etc. cause work to shift to the right adding an unmanageable volume to following season. Managing expectations and priorities needs continuous focus, everything is a priority.
3. Risk and contingency planning: too little over many years. Schedules have been set by unrealistic commitments without risk assessments or contingency resulting in a bow-wave of unfinished work.

Working group tasks:

- Optimize risk and contingency planning
- Strengthen the personnel resource matrix system
- Create strategies for dealing with prioritization

2.4 Working Group Summary

Mr. Erick Chiang, Director of DAIL charged the six groups to solve the issues that were identified in the case studies and answer the following question – "How will proposed strategies optimize future operations?" Six teams applied common methodology to define efficient end states, create strategic road maps, and set goals accordingly.

Following is a summary of output. Appendix B contains the full reports.

2.4.1 Science

The optimal state of science includes a broad mixture of large and small scale research, timely sunset and decommissioning of projects, science facilities that are managed strategically (e.g. MAPO/Cryogens), grant proposal guidance that is aligned with station support variables, and project turnover is managed effectively to benefit new science.

DAIL and the prime contractor must work closely with the Division of Antarctic Sciences to project out year commitments, identify resource availability, and plan within agreed upon resource constraints.

Optimization strategies:

1. Minimize cryogenic infrastructure in proportion to decreased use. Optimizes Dark Sector needs by freeing up facility space and power, both critical resources.
2. Create a supervisory group to oversee grant project plans and lifecycles. Optimizes project life spans, controls extensions, and increases turnover for new science.
3. Revise proposal guidelines to facilitate supportability assessments. Optimizes the review process by providing detail that will reduce review time and questions.

2.4.2 IT & Communications

The optimal state for IT & Comms is achieved when critical services (telemedicine, science and operational data transfers, telephone & video service, Internet access) are provided without significant interruption, qualified technical staff is consistently available, and risks from EMI are managed and reduced.

Optimization strategies:

1. Enhance contingency plans for communication failure modes. Optimizes the ability to respond, minimizes downtime, and addresses infrastructure weaknesses.
2. Re-evaluate SPSM architecture interfaces and assess redundancy. Optimizes and maintenance and service requirements by eliminating duplications in functionality.
3. Increase IT services through Denver based support. Optimizes South Pole labor by reducing on site needs through upgrading to automated equipment.

2.4.3 Operations

The optimal state of operating the station is achieved when a high level of service and flexibility is provided by all functions in support of science and projects. Industry best practices are in place, equipment is fully maintained, personnel are properly trained, and volunteer assistance in meeting extra requirements is minimal.

Optimization strategies:

1. Reduce use of snow machines and outsource maintenance to McMurdo. Optimizes the VMF operation by down sizing the fleet and reducing service requirements.
2. Utilize the Basler aircraft for realizing earlier Station Open dates. Optimizes the sequence of opening operations by deconflicting station open duties with science support and construction. Supports improved project transitions and start-ups.
3. Utilize Christchurch and McMurdo as venues to hold required training. Optimizes staff readiness to perform duties upon arrival, maximizing productivity.

2.4.4 Logistics

The optimal state of performing logistics functions is achieved by replacing site intensive manual methodologies with integrated systems management for waste, storage, inventory control, material handling, re-supply, and retrograde. Storage space is consolidated and retrograde is performed timely.

Optimization strategies:

1. Update the concept of operations for utilizing the logistics facility. Identify critical materials and optimum inventory levels and rely on a "just-in-time" philosophy for re-supply to the extent possible. Optimizes logistical functions by streamlining inventory, storage and material handling.
2. Transfer material receiving and repackaging functions to McMurdo and Pt. Hueneme. Optimizes station inventory, and increases site productivity.
3. Utilize the Traverse to accelerate retrograde. Optimizes the flow of material out of Pole, and reduces waste processing requirements.

2.4.5 Facilities Engineering, Maintenance & Construction (FEMC)

The optimal state of executing FEMC requirements is achieved when schedules and budgets for engineering and construction are met; facilities are operated, monitored, and maintained at appropriate service levels, training and supervision meet requirements, projects are planned with adequate contingency, construction is productive and supported by a strong matrix organization, risk assessments prevent setbacks, personnel retention is maximized, and the core body of institutional knowledge is utilized to produce results in line with best practices.

Optimization Strategies:

1. Document and incorporate specialized institutional knowledge into standard training. Optimizes productivity by avoiding the "starting-over" syndrome.
2. Plan to meet some critical coincident resource peaks independently. Optimizes and strengthens site resource matrixed labor by reducing the volume of mobilizations.
3. Increase QA/QC on all major planning and procurement processes. Optimizes the ability to meet milestones by preventing incompleteness prior to construction.

2.4.6 Environmental, Safety & Health (ESH); Station Services

The optimal state of ESH is achieved by maximizing use of renewable resources, minimizing waste and emission generations, keeping safety as the number one focus, and realizing zero-accidents. An optimal state of providing Station Services requirements for medical and emergency responses (fire and trauma, aircraft rescue and fire fighting, search and rescue) is achieved when various groups are united.

Optimization Strategies:

1. Implement environmental targets for reducing solid and hazardous wastes before sending materials to South Pole. Optimizes program costs by lowering volumes that need processing.
2. Integrate government and contractor safety policies. Optimizes safety by eliminating duplicative efforts of two separate endeavors, reinforces common practices.
3. Enhance emergency response by integrating volunteers with dedicated staff. Optimizes the whole organization by eliminating duplications.

3.0 Implementation

The final workshop product will be a "South Pole Strategic Management Plan", a living document updated annually. Strategies from the workshop will be tracked, evaluated and revised as needed. The following actions will complete the goals for the workshop:

1. Collect comments and feedback
2. Implement short-term strategies for FY08
3. Evaluate the mid and long range strategies, perform Cost/Benefit, and develop proposals.
4. Develop a Strategic Management Plan - Phase I (operations with SPSM ongoing)
5. Develop Strategic Management Plan - Phase II (operations post-SPSM construction when population can be sustained at lower levels)

4.0 Conclusion

Recurring themes throughout each function identified the same core needs – improved planning processes, right sized and appropriately skilled staff, and understanding infrastructure limitations to create realistic schedules. Optimization and correction of these identified needs can be achieved. The Appendices contain all detailed proceedings.

Planning

- Emphasize managing stakeholder requirements proactively
- Apply realism to commitments, seek details and avoid being too optimistic
- Assess risks and apply contingency, develop multiple back-up plans

Staffing

- Minimize stress on population levels, create stand alone concepts for surge capability
- Apply new approaches to achieve goals, revise outdated assumptions and paradigms, and control future schedules.
- Increase incentives and career path opportunities, create flexibility.

Infrastructure

- Maintain the infrastructure
- Manage within the designed capacities
- Conserve energy, prevent waste, and consolidate the footprint

5.0 Appendices

A. Terms and Definitions

B. Working Group Reports

C. Working Group Action Items

D. Meeting Notes

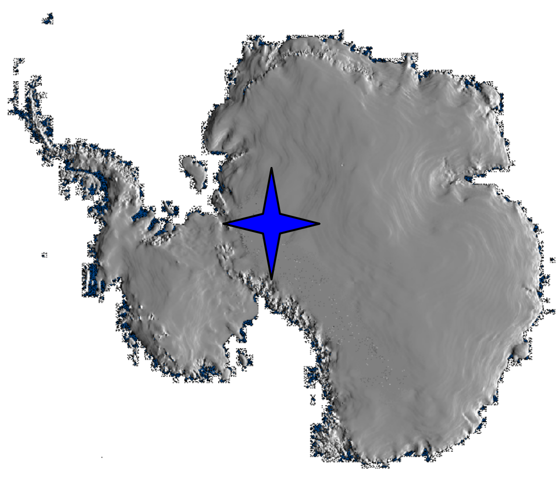
E. Power Point Presentations

F. Station Population Comparison Chart

G. Agenda

H. Participants

I. References



TERMS AND DEFINITIONS

A-1, A-2, A-3, A-4	Wings of Pod A on the elevated South Pole station
AIA	American Institute of Architects
AIL	NSF/OPP Antarctic Infrastructure and Logistics division
AMANDA	Antarctic Muon and Neutrino Detector Array (see "IceCube")
ANG	Air National Guard
APC	USAP Annual Planning Conference
APP	Annual Program Plan (budget)
ARFF	Aircraft Rescue Fire Fighting
B-1, B-2, B-3, B-4	Wings of Pod B on the elevated South Pole station
Basler	Ski-equipped, turbine propulsion DC-3 aircraft (BT-67)
Berm	Raised snow platform used for outdoor storage of materials
BICEP	Background Imaging of Cosmic Extragalactic Polarization (science event # A-033-S)
BIF	Balloon Inflation Facility
BoD	Basis of Design
CCR	Configuration Change Request
CEE	Comprehensive Environmental Evaluation
CEMP	Comprehensive Emergency Management Plan
CMB	Cosmic Microwave Background
CMP	Centralized Materials Planning
CONUS	Continental United States
Dark Sector	Science sector located (grid) west of the main South Pole station
DASI	Degree Angular Scale Interferometer (see "QUAD")
DDC	Direct Digital Control
DNF	Do Not Freeze
DOS	Disk Operating System: computer operating system
EH&S	Environmental Health & Safety
EM	Electromagnetic radiation
EMI	Electromagnetic Interference
FEMC	Facilities, Engineering, Maintenance, and Construction
FGC	Food Growth Chamber
FY	Fiscal Year
GHe	Gaseous helium
GOES	Geostationary Operational Environmental Satellite
HAZMAT	Hazardous Material
HVAC	Heating, Ventilation, and Air Conditioning
IceCube	South Pole neutrino observatory (science event # A-333-S)
IMS	Integrated Master Schedule
IT&C; IT-Comms	Information Technology and Communications
Jamesway	Portable, rigid frame, insulated tent
JIT	Just In Time
kW	Kilowatt
LAN	Local Area Network
LC-130	Ski-equipped C-130 turbo-prop aircraft
LHe	Liquid helium
LMR	Land Mobile Radio
LN2	Liquid nitrogen
LO	Planned South Pole warehouse/logistics facility
MAPO	Martin A. Pomerantz Observatory
MCM	McMurdo Station

NANA	Subcontractor who provides retail, recreation, and food & beverage services for the USAP
NSF	National Science Foundation
NYANG	New York Air National Guard
O&M	Operations and Maintenance
OJT	On-the-job training
OPP	National Science Foundation Office of Polar Programs
PE	Professional Engineer
PI	Principal Investigator
POL	Petroleum, Oils, and Lubricants
PPE	Personal Protective Equipment
PTH	Logistics hub in Port Hueneme, California
QA/QC	Quality Assurance/Quality Control
QUAD	QUEST experiment on DASI (science event # A-366-S)
QUEST	Q and U Extragalactic Submillimeter Telescope (see "QUAD")
Retrograde	Cargo being shipped out
RF	Radio Frequency
RFI	Request for Information; Radio Frequency Interference
RFID	Radio Frequency Identification technology
RPSC	Raytheon Polar Services Company
SAR	Search and Rescue
SCOARA	Science Coordination Office for Astrophysical Research in Antarctica (science event # A-370-S)
SHIELD	Database used to track incidents and injuries
Six Sigma	A system invented by Motorola, Inc. to measure defects and improve quality of products or services
Solar Camp	Proposed replacement for South Pole's current "Summer Camp"
SPAWAR	Space and Naval Warfare Systems
SPCC	Spill Prevention, Control, and Countermeasures
SPIT	South Pole Information Technology
SPRESO	South Pole Remote Earth Science Observatory
SPSE	South Pole Safety and Environmental upgrade
SPSM	South Pole Station Modernization project (elevated station)
SPT	South Pole Telescope (science event # A-379-S)
SPTR-2	South Pole TDRSS Relay #2
SPUC	South Pole Users Committee: advisory group of representatives from the South Pole science community
SPUD	Silicon Pop-Up Detector (proposed science event)
SSC	McMurdo Science Support Center
Summer Camp	Summer-only housing and work areas located (grid) south of the main South Pole station
TDRS	Tracking and Data Relay Satellites
Twin Otter	Ski-equipped DHC-6 aircraft
USAP	United States Antarctic Program
VMF	Vehicle Maintenance Facility
WAN	Wide Area Network
WBS	Work Breakdown Structure
WINFLY	Winter Fly-in

Optimization of South Pole Operations Working Group Reports

Saint Michaels, Maryland
April 30 – May 2, 2007

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OPTIMIZATION OF SOUTH POLE OPERATIONS WORKING GROUP REPORTS

CONTENTS

SCIENCE SUPPORT WORKING GROUP REPORT

1.0 Introduction/Purpose of Group

The Science Support working group looked at the current status of science support at South Pole Station. The group consisted of the following personnel:

- Brian Stone, NSF (Chair)
- Scott Borg, NSF
- Pat Haggerty, NSF
- Mike Scheuermann, NSF
- Steve Kottmeier, RPSC
- Paul Sullivan, RPSC

Currently the South Pole research program consists of two very large projects (IceCube and the South Pole Telescope, or SPT) and roughly 20 small to medium research projects. Of these small to medium projects, many have been active at South Pole for several years and are considered “established” science that continues to be funded year after year.

Most of the research supported at South Pole is actually done at the station, meaning that there is very little science that uses the station as a base for logistical activity. This limitation comes from the fact that resources at South Pole are already heavily allocated, and in fact the use of South Pole as a staging point is discouraged.

The working group recognized that the current state of over-allocation of capabilities is not a suitable situation for research support, either in the short or long term. The desired future state is one in which a mixture of large and small scale research can be accommodated, with a regular completion and closeout of projects to allow for the cycling in of new projects. NSF has previously stated that in an ideal situation there would be sufficient turnover to accommodate 30% addition of new projects annually. The current turnover rate at South Pole is on the order of 10% per year, which includes renewals of long-standing projects.

2.0 Summary of Discussions

The working group considered several issues that were considered to be challenges and areas of potential optimization for both the current and future science at South Pole Station.

2.1 Current State

2.1.1 Cryogenics Strategy

Fiscal Year 2007 (FY07) cryogenic support includes liquid helium (LHe) and liquid nitrogen (LN2) for Dark Sector experiments and gaseous helium (GHe) for the Balloon Inflation Facility (BIF). At present the cryogenic infrastructure is optimal for support of the cosmic microwave background (CMB) science projects, namely BICEP[1], QUAD[2], and SPT. The current (i.e., FY07 austral winter) combined cryogenic consumption (as seen by the cryogenic facility) is as follows:

- LHe ~ 80 liters/day
- LN2 ~ 60 liters/day

The maximum supportable cryogenic consumption rates are:

- LHe ~ 85 liters/day
- LN2 ~ 75 liters/day

The contingency for the LHe usage is between 5-10%, while the LN2 is closer to 20%. It is noted that LHe can only be recaptured and not manufactured, but LN2 is produced on-site.

2.1.2 Project Lifespans-Decommissioning

Discussions within our science group led to the perception (REALIZATION?) that, historically, projects seem to have a life of their own and often do not meet the end dates contained in the proposal and/or project plan, e.g., AMANDA[3]. For the South Pole to operate and be maintained optimally, projects must/should be decommissioned per schedule or as amended by a supervisory board/committee or some other governing group. There really is no such thing as a “no cost extension.” Closeout is not occurring on a regular basis, so task lists at the South Pole continue to grow with a concomitant paucity in resources to affect a cure.

2.1.3 MAPO Lifespan

The Martin A. Pomerantz Observatory (MAPO) was built in 1994 and has been the site for numerous astronomy and physics experiments. The facility is currently the site for two primary experiments: AMANDA and QUAD. The building also houses a machine shop and the liquid nitrogen generator for South Pole Station. The power draw for the facility, including currently installed equipment and instrumentation is approximately 60-70 kilowatts.

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[1] BICEP = Background Imaging of Cosmic Extragalactic Polarization
[2] QUAD = QUEST (Q and U Extragalactic Submillimeter Telescope) on DASI (Degree Angular Scale Interferometer)
[3] AMANDA = Antarctic Muon and Neutrino Detector Array

The working group recognized there is a need to determine the long-term status of the facility due to several key factors:

- When the current QUAD experiment is retrograded during the 2007-2008 season, the AMANDA experiment will be the only tenant in the building, assuming no further science is funded.
- During the 2007-2008 season the liquid nitrogen plant will be relocated to the cryogenics facility. The plant is currently the major source of heat for the facility, and a major upgrade to the heating, ventilation, and air conditioning (HVAC) system will be required to continue operation.
- The current projection is that the MAPO facility will need to be either raised or relocated in not more than three years time.
- The working group acknowledged that determining the short and long-term status of the MAPO facility should be a priority for the NSF because of the resources, particularly power, currently being used by the facility.

NSF is currently working with the IceCube collaboration to determine whether the AMANDA experiment will continue to operate as a stand-alone experiment or fold into the large IceCube detector network and data acquisition system. If the decision is made to bring AMANDA into the IceCube array permanently, then a feasibility analysis and plan will need to be developed to connect the AMANDA strings to the IceCube Laboratory.

In addition, the machine shop will need to be relocated to another site on station. However, this is not seen as significant issue and may represent an opportunity for consolidation with other machine shop activities on station.

2.1.4 Footprint Issue–Possible Logistics Hub

The current footprint constraints and allocation of resources at South Pole Station preclude supporting additional science projects for at least the next three years, pending completion of four major projects at South Pole Station: SPSM, SPTR-2, IceCube, and SPT. A significant “bow wave” of uncompleted tasking has existed since inception of IceCube and SPT, and currently unforeseen circumstances may cause this condition to exist beyond 2010.

NSF has a current need to install a field camp to support transit to East Antarctic sites. Consideration should be given to locating this camp at or near South Pole, and exploring the possibility of using this stand-alone camp to increase footprint support capability at Pole during the interim period prior to design and completion of the future "Solar Camp" discussed at this conference. The type of camp proposed could be designed, fabricated and installed by a vendor such as Weatherhaven, and could possibly be in place as early as January 2008. The camp could be located in the Downwind Sector across the skiway from the new Elevated Station, permitting use of the existing skiway, to minimize impact on Station Ops. Consideration could be given to upsizing the camp to house construction personnel for completion of the SPT and IceCube, opening up space at the existing summer camp for additional resources to complete SPSM and SPTR-2

2.1.5 Proposal Guidance for USAP/Pole Standards

Until recently, March 2007, NSF grant proposal guidance has not provided specific guidance to proposing PIs on the support constraints and USAP standards for conducting research at South Pole Station. PIs submit proposals that are unconstrained with respect to station support and potentially non-compliant with respect to USAP standards. The constraining/limiting resources include:

1) Power
2) Data/voice bandwidth
3) Fuel
4) EMI/RFI
5) Computer hardware/operating systems/software
6) Equipment/instrument readiness
7) Berthing

This results in grant proposals being submitted to the NSF that contain significant gaps in supportability by South Pole Station and rework of the proposal by the PI (and of the IMS by RPSC) to accommodate proposals of excellent technical merit for implementation. Occasionally this results in postponement of excellent research proposals until the station can accommodate support of that research.

2.2 Desired End State

2.2.1 Cryogenics Strategy

FY08 & the outyears will experience reductions in both LHe & LN2 consumption rates for the Dark Sector. The final goal as in the past will be effective cryogenic support to end users but with reduced energy consumption & logistical support. To achieve this state of operation, the cryogenic infrastructure will be minimized in proportion to the decreasing support requirements. Therefore, a review of both short-term & long-term commitments will be generated to determine their resource profiles over the next 1-2 years, 3-5 year periods, and 5-10 year periods.

2.2.2 Project Lifespans-Decommissioning

Desired end state: Projects at Pole need to be decomm'd per the proposal or per an approved/amended project plan. This is essential if planning of future work and required resources is to be of high fidelity. Realizing that projects are often managed in a dynamic environment, "End date" extensions may be a fact of life. But, these changes to the project plan end date need to be made and approved by a supervisory group sanctioned by OPP. Hence, OPP needs to standup such a supervisory/review group whose function is to regularly review projects for adherence to "the plan."

2.2.3 Proposal Guidance for USAP/Pole Standards

NSF grant proposal guidance provides specific details to proposing PIs on the support constraints and USAP standards for conducting research at South Pole Station. The NSF and RPSC, working with the South Pole Users Committee (SPUC) and Science Coordination Office for Astrophysical Research in Antarctica (SCOARA), should develop detailed guidance for PIs on the constraining resources of the station and USAP/South Pole standards for research.

2.3 Challenges to Achieving End State

2.3.1 Cryogenics Strategy

Maintain proportionate levels of support for next 1-2 years & explore options that could replace bulk storage of LHe over the next 3-5 years.

The BICEP2 & SPUD poster publication also states the requirement to change from LHe & LN2 usage to direct application of cryogenic refrigeration technologies in FY11. This would effectively reduce and transfer the cryogenic power consumption needed for BICEP & BICEP2 currently supplied by the new cryogenics facility back over to the Dark Sector power grid. Ensure that sufficient electrical power is available and that any changes in the overall station grid load are understood.

2.3.2 Project Lifespans—Decommissioning

Closing out a project requires planning and, often, money beyond what was identified in the program plan; too often, closeout is not considered in the program plan, especially the costs of closeout. There's often a resistance to decommissioning a building that is part of the project closeout process. There's an inherent tendency to fill any vacant building as opposed to removing it from the Ice. OPP will have to overcome the tendency/history of letting projects or project remnants continue to exist because it's the path of least resistance or it's the easiest decision.

This remedy will be constrained by historic tendencies and lack of a defined process by which periodic "end date" reviews can occur.

2.3.3 Proposal Guidance for USAP/Pole Standards

The NSF grant proposal guidance is published annually in March for June proposal submittal deadline. NSF (Winnie Reuning) requires the narrative proposal guidance from Antarctic Science by early February to realize the March publication of the proposal guidance. The goal is to have revised proposal guidance by February 2008. This will require first a coordinated effort with NSF Antarctic Science, SPUC, SCOARA, and RPSC South Pole support and Science Planning Group departments to detail the constraining resources and USAP/South Pole standards for research and then revision of the proposal narrative language.

2.4 Strategies to Address Challenges and Issues

2.4.1 Cryogenics Strategy

Determine what volumes of LHe are optimal for next 1-2 years, 3-5 years, and beyond based projected users. This can be summarized by reviewing the following set of options.

<u>Option 1</u>

FY08: Total: LHe ~ 46 liters/day, LN2 ~ 35 liters/day

FY09: Total: LHe ~ 11 liters/day, LN2 ~ 5 liters/day (Baseline Requirements)

FY10: Total: LHe ~ 11 liters/day, LN2 ~ 5 liters/day

FY11: Total: LHe ~ 11 liters/day, LN2 ~ 5 liters/day

Based on BICEP2 and SPUD poster publication, cryogenic fluid consumption rates for the next 4 years would be:

<u>Option 2</u>

FY08: Total: LHe ~ 46 liters/day, LN2 ~ 35 liters/day

FY09: Total: LHe ~ 46 liters/day, LN2 ~ 35 liters/day

FY10: Total: LHe ~ 46 liters/day, LN2 ~ 35 liters/day

FY11: Total: LHe ~ 11 liters/day, LN2 ~ 5 liters/day (Baseline Requirements)

The difference between Option 1 & Option 2 is when the Baseline Requirements would begin. In the former case, they could begin as early as FY09 while for the latter they wouldn't commence until FY11. Therefore, this would also dictate when optimization of the cryogenic support would begin as well.

Mark cryogenic technology advances and discuss the potential of these as possible integration into an optimized version of the new cryogenics facility. Achieve NSF/Grantee agreement for incorporation of cryogenic refrigeration into all future experimental design.

2.4.2 Project Lifespans—Decommissioning

OPP to recognize that project lifespan is an issue affecting O&M optimization at Pole and agree on a remedial course of action.

2.4.3 Proposal Guidance for USAP/Pole Standards

Discuss with NSF Antarctic Science, at the next SPUC meeting, with SCOARA, and RPSC South Pole support and Science Planning Group departments.

Form a Working Group to detail by end of FY07.

Incorporate details in revision of proposal guidance narrative by January 2008.

Incorporate revised proposal guidance in March 2008 publication of proposal guidance.

Develop performance measures for evaluation of success (e.g. minimize rework of schedules, proposals, etc).

2.5 Interactions Needed with Other Divisions to Implement Strategies

2.5.1 Cryogenics Strategy

RPSC/FEMC power needs. The reduction in power loads in the new cryogenics facility would need to be calculated both in magnitude and timing depending on outcome of funding for BICEP2 & SPUD experiments. Conversely, the increase in power loads in the Dark Sector would need to be calculated both to see if the electrical grid could adequately handle the transfer of the load.

RPSC/Logistics transportation needs. The reduction in delivery of bulk LHe containers would need to be identified in parallel with any stated power reductions resulting from future funding decisions on BICEP2 & SPUD. At present Option 1 shows that beginning in FY09 the total number of LHe transports for delivery & storage will decrease, while for Options 2 this process wouldn't commence until FY11.

2.5.2 Project Lifespans—Decommissioning

Close coordination with OPP/Science section must occur.

2.5.3 Proposal Guidance for USAP/Pole Standards

Discuss with NSF Antarctic Science, at the next SPUC meeting, with SCOARA, and RPSC South Pole support and Science Planning Group departments.

3.0 Recommendations

3.1 Group Recommendations, Short Term

3.1.1 Cryogenics Strategy

Provide LHe support volumes adequate for 1-2 year transition period

Recommend supporting BIF GHe requirements with reduced but adequate LHe volumes for the next 3-5 years.

Plan to switch a proportionate LHe power load from new facility back to Dark Sector over 3-5 year period.

Determine how much space in the new cryogenics facility would be required to effectively support either Option 1 or Option 2.

3.1.2 Project Lifespans—Decommissioning

OPP or a sanctioned body conduct an “end date” review process of all Pole projects on a regular basis.

End projects per the original plan or, wnd projects per an approved, amended project plan.

Do away with “quasi” or “gray” project schedules where end date is not defined or well understood by management.

Approved Pole project end date extensions must be well publicized (high programmatic attention/acknowledgement).

3.1.3 Proposal Guidance for USAP/Pole Standards

<1 Yr Revise the NSF proposal guidance for South Pole research proposals for the March 2008 publication.

3.2 Group Recommendations, Long Term

3.2.1 Cryogenics Strategy

Determine viable course of action for > 5 years based on results of two periods defined in the short term recommendations.

Work with both the NSF & science community to see if other cryogenic support options need to be evaluated as the science goals and strategies would dictate.

Look into viable options for replacing the current LN2 plant with a more efficiently sized system to meet the reduced consumption rates in the outyears.

3.2.2 Proposal Guidance for USAP/Pole Standards

Annually evaluate effectiveness of the guidance and revise the NSF proposal guidance incrementally for March publication.

4.0 Proposed Actions

4.1 Short Term (<1 year)

4.1.1 Cryogenics Strategy

For the upcoming FY08 field season, the projected cryogenic fluid consumption is: Total: LHe ~ 46 liters/day, LN2 ~ 35 liters/day. These amounts are roughly 60% of current LHe & 50% of current LN2 consumptions respectively.

For LHe the USAP can do one of two things, either:

1. Purchase, ship & store the same amount of LHe for FY08 as in FY07 which would result in surplus product that would propagate into FY09 the season or 2. Purchase, ship, & store a proportionately reduced amounts coincident with support requirements. The main constraint with this approach is the limitations of the standard shipping container volumes used for delivery & storage.

For LN2 the USAP can simply reduce the amount of production required by the LN2 plant to be proportionate with the stated LN2 consumption rates in the outyears.

4.1.2 Project Lifespans—Decommissioning

Assuming that OPP adopts these recommendations, then charge a sanctioned “end date” review group and give them responsibility to conduct reviews on periodic basis with a report deliverable.

First deliverable would be to create a review process.

Second deliverable: provide explanations as to why end date extensions are being entertained with a final written recommendation to OPP for projects to be extended and why.

4.1.3 Proposal Guidance for USAP/Pole Standards

1) Address this issue at the 12 June 2007 meeting of the SPUC and identify SPUC and SCOARA representatives for a working group to collaborate with NSF Antarctic Science and RPSC South Pole support and

Science Planning Group departments to detail the constraining resources and USAP/South Pole standards.

2) Target the definition of the constraining resources and USAP/South Pole standards by the working group by 30 September 2007.

3) Antarctic Science (Scott Borg) and RPSC Science Support (Steve Kottmeier) revise the proposal guidance narrative and submit to NSF (Winnie Reuning) by 31 January 2008.

4.2 Additional Actions

4.2.1 Cryogenics Strategy

Continue to engage the grantees via the working group mechanism.

Continue to keep abreast with advances in cryogenic technology.

Recruit qualified technicians to work with latest cryogenic technology.

5.0 Conclusion

5.1 Cryogenics Strategy

- The above strategies will reduce overall cryogenic power and logistics footprint at South Pole
- The workload of the cryogenics technician will be reduced as a result of not maintaining current levels of bulk LHe storage at South Pole
- The space footprint in the new cryogenics will be reduced to only support GHe needs of BIF

5.2 Project Lifespans—Decommissioning

Projects will end according to plan or a well justified, extended end date. This will free up, on schedule, critical resources for other projects. It will also permit higher fidelity planning since project schedules will be white or black – no gray (or light green) projects.

5.3 Proposal Guidance for USAP/Pole Standards

Having revised proposal guidance will reduce rework of proposals, IMS, etc. as potential late discovery of problem areas such as incompatible power requirements or insupportable communications/computer support issues will be thwarted.

LOGISTICS WORKING GROUP REPORT

1.0 Introduction/Purpose of Group

The Logistics working group consisted of the following individuals:

- Dave Bresnahan, NSF (Team Leader)
- Jerry Marty, NSF
- Paul Sheppard, 109^{th}
- Paddy Douglas, RPSC
- Bill Turnbull, RPSC

The group was tasked with developing a strategy to optimize these functions:

- Waste
- Storage
- Inventory and Inventory Control
- Materials
- Re-supply
- Retrograde

2.0 Summary of Discussions

2.1 Logistics Facility (LO)

Current thinking on this project is that its interior design should be evaluated both in terms of capacity and also in terms of design efficiency. It was agreed by all parties that running the summer cargo operation on the surface next to the skiway, to include keeping the current outbuildings (cargo office and DNF jamesway), was the most efficient. This would leave the new facility primarily as winter storage and work space. Issues related to the facility also must be addressed prior to its construction. These issues consist of the settlement of (and fire doors in) passageway 3, the cargo elevator and its reliability, the 10% grade into the facility and its limited DNF space. Ultimately, the goal of the station is to greatly reduce or eliminate all surface storage of materials but this may be unrealistic given the current populations. It is assumed that the LO will be constructed. Upon the construction of the LO, a transition plan into the facility will need to be applied. This will require a thorough look at the inventory required to support the current population and a plan to identify and move the inventory into the facility. Labor considerations must be addressed with regard to this endeavor.

2.2 Storage

Storage is identified as a significant issue, especially for the Do Not Freeze (DNF) material. The LO only provides for 500 cubic feet of storage which is inadequate. It is the recommendation of the working group to continue to identify “just in time” (JIT) delivery options during the austral summer to reduce the overall summer space requirement and to continue the current practice of utilizing vacant berthing for winter DNF storage. While this adds to the maintenance of the berthing due to wear it appears to be more cost effective all around than building and heating additional facilities. Wear could be reduced by installing some wall and floor protection during storage.

Initial review stated the Logistics Facility was inadequate for the amount of general material to be stored. The immediate task over the next year is to evaluate the inventory requirements for the station to confirm how much current storage is required.

Another storage issue is that of the galley. The galley and its potential to support large populations delimit station capacity more than bed space availability. Currently, products in the galley’s thaw box run the risk of cross contamination due to the volume of product that must be stored and thawed. Serious consideration will need to be put into either supplementing summer camp with a field kitchen or enlarging the thaw box area or limiting population.

2.3 Inventory and Inventory Control

Inventory control has been difficult because station material is kept in outside storage areas that are not secure. The honor system for issuing material is not always understood or adhered to. Education of the population occurs during deployment but employees do not always comprehend the ramifications of the staff’s inability to keep track of station inventory. Wall to wall inventories, a very time consuming process, are conducted every season on critical materials such as food and medical supplies. Berm maintenance is also labor intensive. This includes removing all materials from the berm, reshaping the berm, replacing, inventorying, photographing, and mapping the materials.

True inventory levels are yet to be determined and material that will need to be transitioned into the LO have not been identified. Currently, it is assumed that there will still be a need for outside storage areas but that they can be significantly decreased in volume.

Inventory management systems and personnel have been inadequate to keep up with the demands. Reduction to inventory and construction of the LO will aid in inventory control. Combining the materials departments across station will also aid in standardizing database management. Researching new technologies such as radio frequency identification (RFID) and updating the database to a system that is not DOS based as well as scrubbing the actual datum in the database are also advised. Having quality information allows for better re-supply efforts and the ability to keep a smaller inventory and work more in the JIT arena. Finally, we need to staff to manage the inventory.

2.4 Materials

Material handling has been targeted as an area for improvement. Currently, there are no single reliable methods for putting material into the station. Exterior hoists work well and several additional hoists have been ordered to supplement the one on the A2 deck.

The controls on the hoist are subject to breakage during the winter due to the extreme cold. The cargo elevator has not proven to be safe or reliable. There is currently a thought to convert it to a hoist. The other method for getting material into the station is by hand. This is labor intensive, time consuming and potentially dangerous.

Materials are also spread out over a vast area on station. If the berms are not inventoried and mapped well during the austral summer, winter retrieval of materials becomes quite difficult and time consuming. Construction of the LO will aid in consolidation but until the issues with passageway 3 and the elevator are rectified, material movement into the station will continue to be a huge issue in terms of human capitol.

Having a centralized material handling department will aid in standardizing procedures and providing station support.

Another area of concern is the receipt of materials at South Pole. When discrepancies are discovered it is often too late to correct the situation. The consensus is that all material should be received in PTH to avoid the problems of shipping wrong, over or short orders. Another strategy for reducing the receipt of wrong materials is to implement a submittal review to WBS managers prior to procurement. Similarly, having clear direction early in the planning season with regard to expected tasking (which determines amounts and type of materials) will greatly reduce procurement and shipping of excess, wrong or late materials.

Uniform reusable packaging has also been suggested such as break down boxes for the food order. Food would be received in PTH, packed into the break down boxes as McMurdo’s food is and sent to pole. These boxes are easy to open to that food receipt can be confirmed and if they are created in the correct dimensions, could be placed directly into the pushback racks in the LO. When the boxes are emptied, they can be knocked down flat and returned to PTH for re-use. The process would eliminate double handling. This concept might be used for more products than food.

The LO is designed so that all material is received and then repacked onto 4’ x 4’ wooden pallets. Any opportunity to eliminate handling that can be accomplished in PTH should be pursued.

2.5 Re-supply

Over the past few years South Pole has been working to reduce dependency on the re-supply vessel, and have reduced the need for vessel material greatly. We stand at a crossroad now as to how far to continue this reduction. Priority 2 and 3 cargo is based on current tasking that can change during the austral summer, therefore making it difficult to predict on a regular basis. Consequently the material will need to be shipped via commercial surface transportation in order to be completely decoupled from the re-supply vessel. Transporting this re-supply material to McMurdo as it becomes available will allow for opportune airlift into Pole to be taken advantage of.

Just in time delivery is recommended for much of the austral summer re-supply but will require some upgrading of the McMurdo facilities. Currently the South Pole frozen food is stored over winter in 10 refrigerated containers, which is inefficient. Future plans will be to incorporate the South Pole frozen food with the McMurdo food in a larger freezer.

Another area to pursue will be to use McMurdo as a supply depot for common materials. This will aid in reducing Pole’s footprint. McMurdo is currently working on a common product procurement project (centralized materials planning and control – referred to as CMP). It has been successful and has allowed procurement of general station supply materials to be procured and shipped in a more timely and regular fashion to PTH. This material moves to McMurdo via the re-supply vessel. South Pole has numerous items that could easily fall into this program. Continental buys of this type of material, housed in McMurdo, allow Pole to better utilize opportune airlift for its normal re-supply.

2.6 Waste

As the SPSM project is moving close to completion, demolition activities have increased. This has added to the current backlog of waste awaiting removal from South Pole. In addition, carrying large populations over the austral summer also contribute to high levels of sustaining waste. It is suggested that the current labor used to process sustaining station waste be evaluated. Similarly, the waste facility is unheated and inadequate for processing many of the hazardous materials that are handled. This building should be evaluated for safety concerns and addressed to facilitate the processing of normal sustaining waste levels.

At the end of the 2006/07 season there were 50 pallets of waste wood still remaining and several demolition projects this winter will significantly contribute to the material waiting to be packaged and moved off station. With heightened tempo at South Pole waste removal has not always received top priority.

Logistics working group strategies include developing a timeline of 1 year to address the processing of the waste backlog. Dedicated labor and materials are necessary to process the continued accumulation of waste. The purchase of an industrial grinder for volume reduction could reduce labor requirements. Once the backlog is processed the grinder could replace aging equipment at McMurdo.

Packaging materials adds to the waste stream and recommendations to look at the reduction in those areas by utilizing standard items focused on reuse as opposed to waste. One area of improvement within 1 to 3 years is the use of reusable knock down boxes for food shipment and storage.

The final goal is to eliminate the backlog of waste and appropriately manage the annual waste stream.

2.7 Retrograde

There is a large amount of obsolete and excess material at South Pole. A comprehensive retrograde plan should be developed, funded, and implemented over the next 1 to 3 years. Near-term goals would be to identify candidates for retrograde, as well as develop a policy for discontinued science project material. RPSC HQ staff may be able to assist in the initial identification of retrograde material. Transient materials teams may be brought to the South Pole to pull and package retrograde when population levels allow. Efforts will need to be made to change the current hoarding mentality.

Another strategy to remove the retrograde materials would be to utilize the overland traverse as a mode of transportation. This will be ideal when it comes time to remove the dome and with any other outsized material. This mode of transportation won’t be in production until FY10.

3.0 Proposed Actions

3.1 Short-term (< 1 year)

3.1.1 Clearly understand what it means to be fully decoupled

Dave Bresnahan, Jerry Marty: 15 June 07

3.1.2 Develop a timeline to address the processing of backlog waste

Mark Furnish, Paddy, Bill Turnbull: 1 August 07

3.1.3 Submit the proposal for the shredder for the FY07 APP for this season’s vessel

May 07

3.1.4 Identify materials that will need higher inventory control (LO)

Paddy Douglas: March 08

3.1.5 Implement a submittal review process

Fred Lehn: 1 July 07

3.1.6 Develop and fund a retrograde project

Derrold Kimmes, Paddy Douglas: March 08

3.1.7 Identify retrograde material

Derrold Kimmes, Paddy Douglas: March 08

3.1.8 Policy decision for discontinued science materials that are still on station

Scott Borg, Jerry Marty and Paul Sullivan: 1 August 07

3.1.9 Review impacts and advantages of utilizing vacant spaces for winter DNF storage

FEMC, BK Grant, Paddy Douglas, Jerry Marty, Paul Sullivan: March 08

3.1.10 Evaluate the inventory requirements needed to support populations in increments

Paddy Douglas, Jerry Marty: August 07

3.1.11 Evaluate the functionality of the current LO design

SPSM, EH&S, Paddy Douglas, Jerry Marty: August 07

4.0 Conclusion

Tasking drives population and population drives waste, inventory, support, and storage needs. The station was designed for 154 occupants, but is operating with 260 currently and for the foreseeable future. There was a consensus that the station will be operating at these levels for the next 5 years or so. Consequently implementing inventory, waste and retrograde management plans will be critical to move forward. Labor saving tools for inventory control and re-supply should be installed. Better utilization of human capitol across station and with McMurdo would help—for instance, there may be opportunities to outsource some cargo tracing and record research to McMurdo and HQ or to bring in specific groups of people for short periods of time to address such areas as waste or retrograde. Coordinating “no fly” days to South Pole could help by utilizing cargo personnel to process waste during that time. All processes should be reviewed for improvements. Legacy tasking or procedures can no longer be the status quo. Improving the way business is done will reduce cost and build in capacity for future projects.

IT-COMMS WORKING GROUP REPORT

1.0 Introduction/Purpose of Group

IT-COMMS working group discussed ways to optimize South Pole Information Technology (SPIT) and other South Pole operations. The group consisted of the following personnel:

- Jack Buchanan, SPAWAR (Team Leader)
- Kevin Culin, LTJ and Associates, Inc.
- Henry Malmgren, RPSC
- Joe Tarnow, RPSC

The group focused on several current issues, including the following:

- Bandwidth in and out of South Pole and the impacts to science and operations due to the forthcoming losses to the current fleet of satellites used to provide the bandwidth.
- Short- and mid-term staffing of IT O&M to support the new systems installed by the SPSM project.
- Electromagnetic interference (EMI) at South Pole station and how to better determine sources of the interference.

2.0 Summary of Discussions

2.1 Current State

2.1.1 Staffing

During the past several years, South Pole IT&C (Information Technology and Communications) has been deploying and operating a completely new infrastructure. The transition from the historic dome to the new modern station has been challenging and productive. New capabilities have been introduced, and the amounts of services that are provided have increased. However this has not come without cost, mainly in the form of a more complex environment. During the past several years, requirements for support have required more skilled technicians, with the skill set trending away from direct user interaction towards a more behind the scenes approach.

This effect has been largely unnoticed by users because the extra engineers required to implement the new systems have been able to maintain the infrastructure, freeing the O&M staff to focus on their customers. However, as the SPSM IT project moves to completion, support and maintenance duties are transitioning to the O&M staff, who will find more of their resources being directed towards supporting the back end systems, with user interaction suffering as a result.

2.1.2 Bandwidth

Hi-speed bi-directional communications via existing satellites is a valuable resource that is becoming more fragile with every passing year. Recent years have brought improvements in 24x7 low bandwidth communications, and the upcoming SPTR-2 project will address the need for continuing high speed data transfers northbound out of South Pole.

The missing component in future planning seems to be the infrastructure required to maintain a wide window of bi-directional high speed communications. This is the capability required to support such things as tele-medicine, normal phone calls, Internet access, and southbound file transfers. Current projections show this capability being reduced from 11.5 hours per day to less than three hours per day by the year 2012.

2.1.3 Contingency Planning

Contingency planning in IT needs to be addressed. This area has been neglected during the past several years, and must be seriously looked at. Plans should be made for several scenarios, including loss of satellite capacity, loss of station power, and loss of a critical infrastructure building. Plans to maintain communications infrastructure in the event of the loss of the RF building need to be fleshed out, and plans to support science in the event of an early loss of TDRS need to be developed.

2.1.4 EMI

The EM environment at South Pole is poorly understood. SPAWAR has conducted surveys every few years; however these provide only a “snapshot” view of the environment, and leave us unable to make real time assessments of the current situation. Often, we are asked to locate a mystery signal or source on station, and we are unable to respond effectively. Tools and training must be provided to the O&M staff in order to allow us to respond to new RF sources effectively.

2.2 Desired End State

IT&C will slim-line and optimize on-ice staffing without affecting our service levels. In addition, we will offer services to assist other departments with reducing their on-ice footprint. A baseline minimal permanent staffing level will be established, and front line help desk and supplemental communications technicians will be added to this based upon station demand. As the station population drops towards the desired 150 person level, IT&C staff will be able to reduce to just the base level. Staffing at this base level will heavily depend on off-ice support staff in the Denver office.

Staffing reductions will depend heavily on the ability to have near real-time high speed communications for a reasonable amount of time per day. In addition, science heavily depends on an uninterrupted stream of data northbound, and IT envisions providing a near seamless transition to the TDRS F3 satellite. IT also expects that with the support of the NSF, we will be provided with the WAN resources required to maintain the number of hours per day of high speed bi-directional communications.

IT&C realizes that the best of intentions may be spoiled by external factors, whether they are fiscal, personal, or technological. A well thought out and practiced series of contingency plans must be designed and tested. There are several likely failure scenarios that IT faces, including loss of WAN connectivity, loss of power to run the entire infrastructure, and even the loss of the entire RF building.

Finally, IT wishes to procure equipment to be deployed at strategic points around the station that will enable real time monitoring of the EM environment. Training will be provided to the communications technician who will then have the ability to react in real time to any new sources of RF that are detected.

2.3 Challenges to Achieving End State

Implementing this vision will face some significant challenges. Primary to these is the funding and commitment required by the government to look for additional WAN opportunities. Significant progress has been made in connecting Pole to the Internet via a low speed 24x7 data link, and plans are well under way to supplement the high speed northbound connection via TDRS F3. The immediate weakness in the WAN infrastructure is the upcoming loss of either or both Marisat and GOES. Replacing the capability provided by these two satellites will require a significant investment in both time and resources.

Additional challenges include the chronic shortage of bed space. IT can do much to reduce its on station footprint, but eventually a lower limit is reached. In addition, while the core staff is sufficient for a 150 person station, higher station population will require additional front line support staff. Just as you wouldn’t expect a galley crew to remain at the same amount of staffing, IT must increase its support staff in response to continual demands.

2.4 Strategies to Address Challenges and Issues

To reach these goals, IT must re-evaluate the architecture provided by SPSM. The SPSM architecture has provided tremendous amounts of redundancy, at the cost of greater complexities. A study should be done on the cost/benefit of this greater uptime. If it is determined that the extra redundancy comes at too great a cost, the infrastructure could in theory be scaled down.

Alternatives to on station staff should be investigated. Increasing RPSC staffing in Denver may be preferable to taking up valuable bed space on station. With the proper automated tools, the Denver team can provide valuable assistance to the on-station staff. While remote administration will never replace local personnel, assistance from afar can postpone the need to grow the staff.

Alternatives to the current ways of doing business should be investigated. Can new equipment help reduce the demands on the staff time? One possibility that comes to mind immediately is a conversion to a different type of LMR radio. A significant saving in radio reprogramming time can be achieved by either gradually or all at once replacing the existing radio fleet with a model that can provide a more homogenous programming scheme.

A search for additional WAN bandwidth needs to be undertaken immediately. A Tiger team with the same backing as the recent power improvement team should be formed to look for creative, but realistic methods of delivering high speed bi-directional communications to the station.

Finally, a project to identify and procure EM detecting equipment should be started. The goal of the project should be to install a system at pole capable of real-time scanning of the entire RF band, from HF all the way through frequency ranges detected by the larger telescopes. A user should be able to identify both signal strength and direction, using both portable and fixed antenna systems.

2.5 Interactions Needed with other Divisions

IT&C should not always assume that the best way to get a task done is to rely on in house skills. Other resources are available, including SPAWAR, Raytheon Corporate, or other experts in various fields. IT&C must realize when a job is too big, or specialized, and when it is appropriate to subcontract tasks.

IT&C can and should reach out to other areas on station to assist them in reducing their footprint. Using technology, we can off-shore workers to Denver, further reducing the amount of resources expended on station.

3.0 Recommendations

At the highest level, SPIT can summarize its goals as follows:

- Reduce risk to data transport services, i.e., satellite availability
- Prepare for and plan for possible satellite failure
- Maintain current level of IT services by adjusting SPIT staffing as needed
- Enable other groups to remote functions and staff via technology

4.0 Proposed Actions

In order to achieve the goals discussed above it is recommended the USAP take action to do the following:

Note: responsibilities and due dates for items below are TBD

4.1 Policy

Create/update data management, ownership, and transport policy. The policy will reiterate/clarify roles and responsibilities for data management, i.e., all data producers should have adequate plans/facility to respond to a long term connectivity outage. In short, the policy will be a precautionary measure help the various data producers that may have become dependent on the current inbound/outbound transport capability.

4.2 Bandwidth Contingency Plan (NO WAN PLAN)

In addition to a clear policy South Pole IT (SPIT) should prepare for the worst case by creating a plan and subsequent operating procedures to respond to a major reduction and/or outage of satellite connectivity. At a minimum, a plan should consist of storage strategies for data and address continuous voice capability.

4.3 Prepare a Bandwidth Optimization Analysis (Project)

Fund a project to identify ways to optimize the MARISAT and GOES bandwidth.

Project should assess what capabilities can be achieved and make recommendations for follow-on action, i.e. Bandwidth Optimization Project.

4.4 SPTR-2 Prioritization

As 93% of current outbound traffic is transported via the “at risk” TDRS F1 satellite, it is important that senior management give the SPTR-2 project highest priority with respect to other important projects. Successful completion of the SPTR-2 project on time will facilitate data transport across the TDRS F3 satellite and significantly reduce the risk of catastrophic data transport failure. Currently there are schedule and resource conflicts with other project.

4.5 EMI (Project)

In the short term, allow SPAWAR to send a team to Pole this summer season to aid in locating the source of recent EMI activity. In the mid-term, provide funding to allow IT O&M to procure and install EMI detection equipment to be available for use year round. EMI detection equipment will facilitate autonomous capability and allow for quick responses to EMI problems.

4.6 Land Mobile Radios Plan and Radio Upgrade (Project)

SPSM-IT should work with IT O&M to provide a hardened LMR dial plan. This dial plan will need to have as its primary objective the ability to reduce the amount of time a technician needs to either touch a radio or update the dial plan. Some features may have to be cut as simply not feasible to provide. For example it has been found that providing a list of radio numbers for the community takes a large amount of time. Providing personalized programming to the end-user, while helpful, is too time consuming for the technician to provide.

Replace the current handheld radios with the next generation radio that has reformatted functionality that fits better the radio scheme needed at South Pole. Completing this will help reduce the amount of hours needed to maintain the LMR system freeing up staff.

4.7 Architecture and Standardization (Project)

In an effort to improve efficiency and possibly reduce SP IT staff, a project to assess current architecture and standardization opportunities, complete with a recommended plan of action, should be funded.

4.8 Automation Tools (Project)

To improve efficiency and possibly reduce SP IT staff, a project to assess current automation tools, complete with a recommended plan of action/implementation should be funded. Note the use of automation tools will likely be bandwidth dependent and is therefore subject to satellite availability.

4.9 Off-Shoring (Project)

In an effort to improve efficiency and possibly reduce SP IT staff, a project to assess off-shoring technologies and opportunities, complete with a recommended plan of action, should be funded. Note off-shoring will likely be bandwidth dependent and is therefore subject to satellite availability.

4.10 Bandwidth Tiger Team (Project)

Given the current at risk state of satellites and the ever increasing need for more bandwidth by the customer base it is imperative that maximum effort be given to research all possible avenues/alternatives to the current satellites such as other satellites, fiber options, physical transport, etc. Outcome of project should at a minimum be a clearly define plan of action.

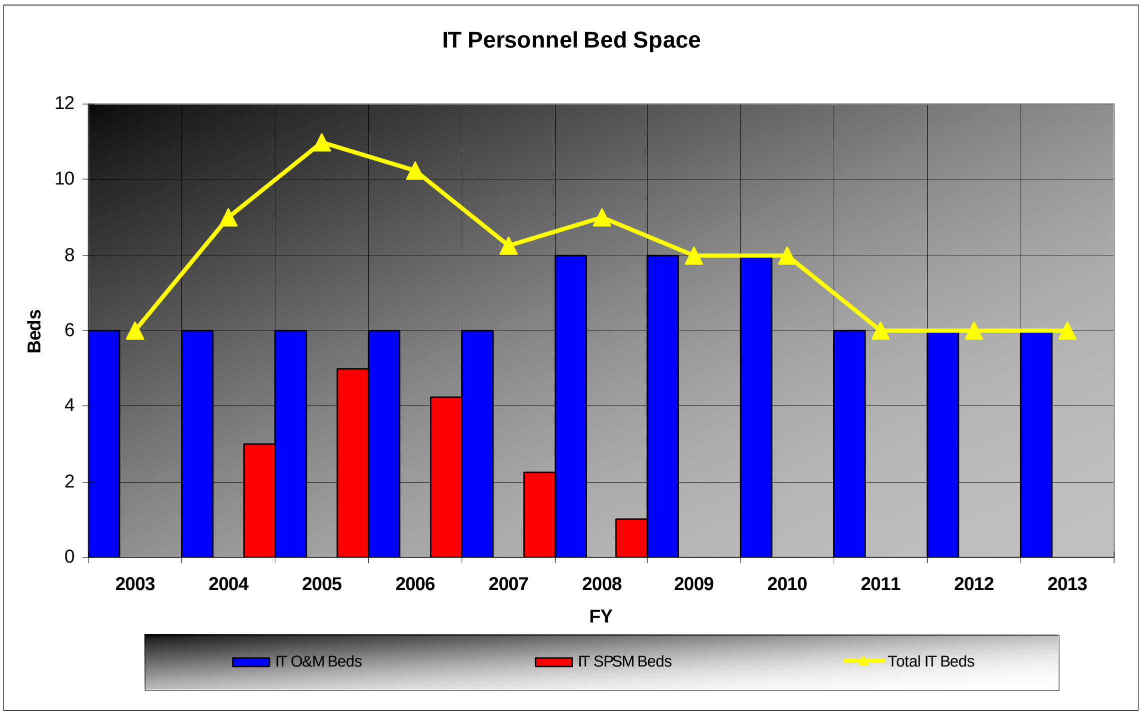
5.0 Conclusion

The successful completion of projects and actions identified above will help optimize South Pole operations by:

- Reducing risk data transport services, i.e., satellite availability

- Planning/preparing for possible satellite failure
- Maintaining current level of IT services by adjusting SPIT staffing as needed
- Enabling other groups to remote functions and staff via technology

Staffing levels can be adjusted as a function of services provided, population served, access to automation tools and off-shoring capabilities. A plausible SPIT staffing forecast (bed space) is depicted below and is dependent on the success of the projects mentioned above.



FEMC WORKING GROUP REPORT

1.0 Introduction/Purpose of Group

The FEMC Working Group consisted of the following team members:

- Randy Yuen, NAVFAC (Team Leader)
- Dick Armstrong, RSA
- Sandy Singer, NSF
- Ron Carpenter, RPSC
- Brad Coutu, RPSC
- Neil Miller, RPSC
- Cory Shaddox, RPSC
- Dave Scheuerman, RPSC

The purpose of the group's discussion was to review the current FEMC operating paradigms, identify areas of inefficiencies and opportunities for improvement that will lead to optimizing the FEMC portion of overall South Pole operations. The group drew on the individual expertise of the members to understand how and why the division is currently performing its functions and how to re-structure the way it conducts the business of providing and maintaining facilities that support Science.

Key areas of discussion focused on the following:

- Maintenance
- Central Office Support
- Construction
- Engineering
- Planning

2.0 Summary of Discussions

2.1 Maintenance

2.1.1 General

The South Pole station has seen some dramatic changes over the past few years as the new station has been constructed and occupied. The building systems and equipment used in newly constructed or renovated facilities incorporates advanced technology to improve energy efficiency, increase reliability and decrease maintenance impacts. With these improvements, the equipment and systems have become more complex. Additionally, the new facilities include more individual pieces of equipment simply because there are more buildings which are larger and service a larger population.

Not surprisingly, the changes associated with the new station facilities bring several issues. The following issues were identified as the primary obstacles preventing optimal facilities maintenance operation.

2.1.2 Staffing

With the new station fully occupied, additional staff is required to perform recommended and emergency maintenance. During the FY07 summer season, there were seven maintenance personnel on site. These workers logged approximately 10% more hours than the standard on-ice work week (60 hrs/wk vs.54 hrs/wk). However, only 90% of preventive maintenance operations were completed during the season. This statistic indicates approximately 1½ additional people are required to meet the maintenance operations. Looking ahead, we also anticipate increased requirements as building architectural systems require maintenance and the Cargo Facility comes on line.

The optimum condition is to have the maintenance staff working the standard 54 hours/week on station. To reach this state, hiring and retention of qualified staff is paramount. This is difficult to achieve because of the extended stay at the station and available pay. This situation can be overcome by incorporating the human resource department and developing strategies for increased pay, career development and other benefits. The career development is an important issue because if the candidate is willing to spend a few seasons on the ice and has the potential of returning to the main office to assist in developing, optimizing and caretaking of the maintenance program the maintenance aspect will improve.

2.1.3 Skill Sets

Increased complexity in individual pieces of equipment and interdependent systems requires maintenance personnel to possess greater skills. Magnetic motor starters replaced by variable frequency drives, furnace units replaced by air handling units, and centralized controls are some examples of increases in technology. Technicians can no longer rely on ‘common sense’ to work through unfamiliar equipment. Workers must be trained and familiar with specific equipment.

It would be ideal to have the entire maintenance staff trained to provide maintenance on all pieces of equipment located at the station. This may be unrealistic and hence cross training is a desirable compromise. In this state, maintenance personnel will acquire some specialties and will train others in their field of expertise as well as receive training from other specialist in their field of expertise. In addition, headquarters will provide "reach back" services where when assistance is needed, the field can call back (reach back) to the main office for additional guidance or confirmation. Formal training is also required to keep personnel up to date with the latest information and new techniques. The key to success of this issue is the ability to get and train qualified personnel. Funding is a limitation and time away from the job is an issue. Recommend to have personnel attend formal training when away from the site, back on CONUS. It will be a challenge to cross train personnel on site but it must be done to keep a pool of qualified individuals available to handle the maintenance.

2.1.4 Roles & Responsibilities Not Clearly Defined

Within the RPSC organization, it is not always clear who has responsibility for maintenance on certain pieces of equipment. This issue is usually associated with the phased construction effort and equipment that is installed in facilities that are not fully occupied.

The goal is to have the maintenance be performed in a timely manner once the construction is completed. However, due to phasing of construction this is sometimes not clearly defined. Recommend a transition plan be developed with approval by the FEMC Director. This plan would then become the policy to determine the time or condition that construction ends and the maintenance begins. This should be easily attainable and can be developed quickly.

2.1.5 Recommendations

2.1.5.1 Short-term Goals (< 1 year)

FEMC shall develop a transition plan to exactly specify when equipment is turned over from construction to maintenance. FEMC shall coordinate with the human resources to develop a plan and strategy to acquire skilled personnel. This strategy will include total number of personnel required and the skill sets required. The current personnel qualifications shall be reviewed and placed where most effective.

2.1.5.2 Mid-term Goals (1-3 years)

Once the transition plan is developed, the team needs to execute. Clear direction will provide tremendous dividends. The HR strategy also needs to be implemented. Hiring and training of qualified personnel is required to execute the strategy.

2.1.5.3 Long-term Goals (3-5 years)

Continue the staffing and training and execute the transition plan and HR plan. Initiate cross training initiatives with the maintenance personnel.

2.1.5.4 Long-term Goals (5+ years)

Continue to review and improve the staffing, training and quality of personnel.

2.2 Central Office Support

2.2.1 General

Upon reviewing FEMC, there were core issues found in Central Office Support. Several subject issues were identified: DDC support, institutional knowledge, and staff turnover, retention, and succession management. In reviewing the state of the DDC system, it was found that the system requires specific knowledge, skill sets, and management in order to provide specified functionality. The need for good technical direction about the facilities revealed the issue of institutional knowledge. Institutional knowledge involves the long term familiarity with the Station, Station systems, Station procedures, cold climate operations, and specific Pole issues that are learned over time by working on Station. This information will be used to make good decisions, predict maintenance issues, and coordinate preventative measures. Finally, after reviewing recurring site issues, it was evident that the high turn-over rate of staff is a root significant problem. There is a need for a clear succession plan for field technicians, and a retention plan to minimize and deal with turnover.

2.2.2 DDC Support

The general opinion of the working group was that the DDC system has a key role in the future of Polar Programs, and that support for the system is inadequate.

The goal is to achieve a DDC system which yields an accurate picture of the health of the facilities, provides accurate and timely information, is intuitive to all users, requires minimal on-site personnel time, and is continentally consistent in terms of how the system is designed and operated.

Key challenges include the following: system complexity, high skill sets to operate and maintain, change configuration control, and connectivity through satellites. The system is complex and requires a specific knowledge base and skills. Engineers and technicians who are familiar with the particular equipment installed, the specific programming used, and the mechanical systems controlled are difficult to find. A high level of technician is required to calibrate sensors, verify functionality, address alarming, update and document changes, produce procedures, handle security, capture raw data, and interface with different systems. The DDC system has an Internet interface; therefore the satellite window is limited to less than 12 hours per day which makes more challenges when the satellite window occurs opposite normal working hours at Denver.

The strategy to handle the support of this system is to employ more experienced technical personnel for the Denver Office, and support activity on site from a "Central Command" station. The group recommends standardizing the DDC systems manufacturer and models in order to minimize the knowledge required to understand, troubleshoot, and repair the installed equipment.

Coordinating this effort will require cooperation of FEMC, operations and outside specialist contractors.

The group recommends attaining personnel required to manage the DDC system either through an internal training program or through hiring technically skilled personnel. The group recommends writing a DDC standards document. The group supports the concept of the "Central Command" station.

The group proposes the following actions:

- Immediately attain an out-source commitment with a contractor familiar with the installed system equipment.
- In year 1, produce DDC procedures, write the requirements document for the "Central Command" station, and prepare an internal training plan.
- Within 5 years, implement the "Central Command" station.

With the resolution of the DDC Support subject issue, facilities will run more efficiently - saving energy; facilities will be more reliable; information will be more accurate; making decision more clear; tasking on site will be more focused and efficient; and more tasking will be handled state side versus on site.

2.2.3 Institutional Knowledge

The general opinion of the work group is that there is a lot of valuable institutional knowledge that is lost due to the high turnover rate presently experienced. Things that are learned the hard way, by trial and error, need to be retained and passed along to others so lessons learned are taught to newcomers.

The goal is to reduce turnover, as mentioned below, so that experience and lessons learned are retained and passed along to others. In addition to reducing turnover, documentation of lessons learned and procedures that are known to work, and internship of newer people to pass along Pole specific experience is essential.

Key challenges include retaining experienced high level technicians who can pass along lessons learned and specific information to interns so problems are consistently addressed based on a good knowledge of the Station and all of its unique characteristics. New people in technical and management positions would be at a loss to make good decisions if the institutional knowledge of past practices is not passed along to them.

The strategy to handle institutional knowledge is to document all procedures and technical issues so the next group of workers has access to the lessons learned of their predecessors.

The group recommends writing a procedure for storing data which will stabilize the knowledge base and make data more readily available for all newcomers to the organization.

The group proposes the following actions:

- Immediately, identify core bodies of knowledge.
- Immediately, search for staff able to process data.
- In year 1, produce detailed technical procedures, write the standards document, and write an internal training plan.
- Within 5 years, have a detailed procedure manual for all aspects of all systems at Pole.

2.2.4 Staff Turnover, Retention, and Succession Management

The general opinion of the work group was that fewer mistakes would be made, work would be done more efficiently, and many problems could be avoided or quickly resolved and if there was less staff turnover.

The goal is to hire more qualified staff and retain them for at least five years by giving technical personnel a career path for their professional development.

Finding qualified and motivated staff, tradesman and professionals, and then retaining them after the initial training time investment has been made is the challenge to resolving turnover issues.

The strategy to resolve staff turnover is to provide more incentives, such as retention bonuses, career paths and competitive wages, as well at an opportunity to work full time from the Denver Office, eventually relieving the staff of the responsibility to continually deploy to the Pole, which is rough for people with a family life. The group sees a value in outsourcing some specific tasking, such as controls programming, to a manufacturer's representative who is constantly involved in the product line and maintains current competency in the state of the art equipment.

Coordinating this effort will require cooperation of FEMC, operations, outside contractors and the human resources department.

The group proposes the following actions.

- Immediately, design a bonus incentive program for those that return after the first year, if they have proven to be productive.
- In year 1, outsource the controls programming and major troubleshooting to a manufacturer's authorized controls representative contractor.
- Within 5 years, outsource technical design and installation projects and retain project managers for continuity. Also, standardize control systems across the continent to provide cross training and familiarity of systems no matter what station is involved.

With resolution of the staffing subject issue, there will be more highly skilled engineers and technicians doing specific tasking, yield a higher quality product. The full time staff will be more focused on their core skill, yielding more productivity.

2.3 Construction

2.3.1 General

After reviewing the construction departments function within the FEMC division and the current footprint on South Pole operations three major areas were identified which are in need of improvement. This is not an all-inclusive list; however these three areas have been validated to ultimately add strain on the South Pole operation sector in the form of construction roll-over and increases in footprint.

- Lack of a constructability readiness review before construction begins.
- Lack of adequate material back-checks and inadequate deliveries.
- Unrealistic scheduling practices and the lack of contingency identification or allocation.

2.3.2 Construction Readiness Reviews

The group feels that the lack of a process and procedure for performing constructability reviews before projects are awarded a notice to proceed has resulted in premature advancement into construction without adequate, approved designs and without formal identification of pending or potential impacts on infrastructure or outlying projects. These premature advancements have undoubtedly led projects to increased construction rollover, rework, and reliance on unplanned station support.

The action will be to structure a comprehensive review process that will cover all faucets of a project from budget and planning to design acceptance and material procurement. This review will be conducted in a timely manner that coincides with project planning milestones and encompasses all stake-holding organizations or departments. It will measure feasibility and risk as well as potential impact on resources.

Challenges to achieving this level of review were found to mostly lie within staffing requirements and allocated budget. To overcome this RPSC will identify areas in need of additional staffing and submit with FY08 APP. The formal constructability review process format will be expedited and instituted into all projects within six months of the May 2007 St. Michaels South Pole Optimization conference.

2.3.3 Material Issues

Material procurements and inadequate deliveries were found to be the second largest areas of impact for the construction sector. Unidentified, missing or damaged materials has been one of the key factors that have contributed to project punchlists, resulting in subsequent construction activity rollover from season to season. To achieve optimal performance in this area, materials must be identified and procured in a timely manner and then delivered to the project site in such a way as to not impact schedule deadlines or activities.

It is essential that material is identified to meet all design criteria and specifications before it is released for purchase. This process must be afforded time for back checks from the appropriate parties and then incorporated and cataloged into a submittal package for engineers and owners approval. Only upon required approval should the material be released for a purchase. Once material is in the procurement process a second competent process of QA/QC checks should be performed on orders upon receipt in Pt. Hueneme before being processed for delivery to Pole.

Only after material has passed procedural QA checks and been found acceptable may it be delivered to site. From this point, material and equipment should be documented and controlled within a computerized central control system. This system will be utilized to store, stage and track material on station from the point of purchase to installation.

Another area of improvement identified for construction material operations should be the complete enrollment and integration of FEMC materials into the South Pole Logistics department. This would unify and standardize material movements and operations throughout all work centers and departments.

2.3.4 Construction Scheduling and Project Contingency

Historically as new projects have been identified and incorporated into the seasonal schedules, it has been found and validated that unrealistic timelines and milestones have been set for construction. This practice has also been a key factor that contributes to construction activity rollover and added work loads due to multiple mobilization and demobilization efforts. As construction processes and installations are hurried in a fashion to meet an unrealistic deadline, it has been proven that a lower standard of quality has often surfaced adding to additional project punchlists and subsequently added project cost and over runs in the form of backlog and roll over. The standard practice of identifying a timeline contingency for construction projects and incorporating this into schedules as realistic float is a process missing from IMS planning and controls.

FEMC must work with the planning and controls department in association with all project teams to fully develop realistic timelines of construction that adequately meet all project requirements, while not adding unforeseen tasking or increasing unsupported or unscheduled operating footprint. All construction activities must be weighed and measured to identify possible areas of contingency and then said contingency should be identified, reviewed, and agreed upon with project teams and stakeholders. Only then may timeline contingency be added and clearly identified in the seasonal schedules.

A full review of all project schedules must be incorporated into the above mentioned project constructability readiness review and agreed upon by all stakeholders before being considered or entered into the seasonal Integrated Master Schedule (IMS). Project schedules should be measured for realistic timeline, affordable areas of contingency and a risk assessment conducted, then put forward to be reviewed and set a priority level according to the NSF.

All projects must be formulated into a prioritized cadence that will help to ensure construction resources are utilized to their fullest potential without competing with concurrent projects for support. This cadence should be identified through the practice of prioritization and have full support from all stakeholders.

2.3.5 Actions and Implementations

As the FY08 planning season continues, RPSC/FEMC will within 60 days have a written procedure prepared for incorporating a construction readiness review into all project planning. This procedure will be drafted and submitted to all stakeholders for review and acceptance. It will then become USAP procedure and policy for out year planning. Due Date: July 9th, 2007

RPSC/FEMC in association with South Pole logistics will produce a draft plan within 120 days for incorporating construction material operations and movement into the South Pole logistic department. This plan will be reviewed by all stakeholders and upon acceptance and agreement incorporated into the FY09 season. Computerized tracking of all materials must be an integral part of this process, so construction managers will know the exact location of any piece of equipment or material required for his project to be constructed.

RPSC/FEMC will with in 90 days draft a procedural material submittal policy that will follow all industry best practices and standards. This procedure will be available for review and acceptance where upon it will be incorporated into the fourth quarter of the FY08 season.

2.4 Engineering

2.4.1 General

In order to perform any design function, Professional Engineer and Registered Architect sealing of documents is expected and contractually required. This industry standard was not met for many years but now the process and means are in place to correct design process deficiencies.

2.4.2 Provide Complete Drawings Prior to Construction

All too often, construction of and/or modifications to facilities are executed before the design is completed. In some cases, projects are given to FEMC just prior to the summer season, without allocation of adequate time for the design and review phase of the project. This late identification of projects and competing priorities on limited engineering staff cause projects with some designs complete while others are in their infancy, although all must be constructed in the same season. Regardless, reorder and rework are common on those projects that are constructed from incomplete drawings. It behooves the Construction section to act as the "gate keeper" to not proceed with construction without signed-off "Approved for Construction" drawings. The proper implementation and enforcement of the program will have stamped plans on-site that have been reviewed and completed in a timely fashion, and accepted by all stakeholders before commencement of construction.

Within one year, RPSC will not proceed with construction for any project that does not possess Approved for Construction drawings. Within 3-5 years, all projects assigned to properly staffed Engineering section with enough time to publish completed designs before commencement of construction.

2.4.3 Engineer/Architect Staffing

The professional level of expertise (PE or AIA certification) does not exist within RPSC for stamping of drawings. Knowledge legacy dwindles with every passing year of the program as senior engineers leave the program at a faster rate than their replacements are acquired. In addition, planning and procedures must be revisited and reinforced, as SPSM Engineering (project) transitions into the FEMC engineering structure. In addition to accelerating replacements for exiting personnel, RPSC will supplement engineering resources through pre-qualified design firms with applicable disciplines. Funding for adequate staff and/or outsourced engineering must be identified and allocated accordingly. A proactive, dynamic approach to staff retention and recruitment needs to be developed by Human Resources and FEMC management to acquire and retain qualified professionals, including internships, mentoring, and succession planning.

Within one year, obtain adequate resources internally or externally to provide needed professional support to meet design requirements. All completed drawings to include Registered Architect and/or Professional Engineer seal.

2.4.4 Establishment of Design and Design Review

A disciplined project design phase, using clearly defined project development procedures, must be adhered to, including the preparation, review, and approval of the Requirements Document, Basis of Design, and progress drawings, resulting in coordinated and complete plans and specifications. This includes the review of plans and specifications by the construction staff responsible for the project's construction, and incorporating active participation by NSF, Grantees and RPSC disciplines. Reviewers will be held accountable for their sign-off of the drawings. With proper implementation and enforcement, the program will have stamped plans on-site that have been reviewed and completed in a timely fashion, and accepted by all stakeholders before commencement of construction.

Within one year, improve and expand open communication with NSF, grantees & RPSC on all design assignments. Within 3-5 years, all project designs to be scheduled 1-2 years ahead of construction, with rolling annual updates.

2.4.5 Standardization of Equipment and Components

Develop and implement standardization of design and equipment for all facilities on-Ice. Steps include standardized architectural products, mechanical and electrical equipment, and other applicable items that are used through out the Antarctic program. Obtain alignment to standardization by the various design groups and NSF, and address government requirements related to sole-source acquisitions. Adopt a list of accepted and standardized equipment and component manufacturers and models for application on all projects. Eventually, this will reduce the maintenance inventory as standard equipment/components are utilized throughout the continent. It will also ease training requirements, since maintenance personnel will be working on familiar equipment.

Within one year, publish a standardized equipment/component list, and obtain agreement from all parties. There must be exceptions permitted, when good reasons exist. Within 3-5 years, procure only standardized products and change out expired equipment/components as they become obsolete. Within 10 years, all new on-ice facility equipment and components are standardized.

2.5 Planning

During the period of time RPSC has had the contract with the NSF for Antarctica, planning and controls requirements have increased significantly. At the beginning of the contract, construction projects and limited sustaining tasking were scheduled using planning software. Now, all projects as well as the South Pole station sustaining tasks are planned and monitored in the Integrated Master Schedule (IMS). Having the IMS allows RPSC to view all station tasks and analyze potential impacts and risks that may occur.

Though this narrative is being included in the Facilities, Engineering, Maintenance & Construction portion of the report, it must be remembered that planning issues cover all areas of South Pole station, including Science, Operations, Health & Safety, and IT.

Five issues have been identified regarding the use and management of the IMS:

1) Assess schedule impacts prior to approval of new projects
2) Clearly identified contingency built into all construction schedules
3) Realistic timeline to create, review and prioritize schedules

4) Realistic deadlines for go/no-go on work

5) NSF buy-in of realistic schedules and baselines

2.5.1 Assess schedule impacts prior to approval of new projects

When new science or construction projects are proposed, the potential impacts to station power, population, or equipment have not always been taken into account at the level necessary. A project timeline is frequently developed by NSF prior to integration into the IMS. This can result in over allocation of human and equipment resources in Denver and on site. Such over allocation has resulted in deferral of project work to later seasons.

The goal is that all projects be reviewed in the IMS to determine if the project is feasible and will not impact other previously scheduled work.

The key challenge to meeting this goal is having suitable time and resources to conduct an appropriate impact analysis of any new, re-scheduled, or change order work to the overall IMS.

A method to manage this issue is to ensure that the RPSC Denver headquarters is adequately staffed to handle requests for impact assessments. An additional position dedicated to out year planning would be beneficial in the development of new schedules and impact analysis. Additionally, the National Science Foundation should allow sufficient time for a review and not commit resources without understanding the full impact to station resources.

It is recommended that all new proposed projects be reviewed alongside other planned work to determine if there would be any impact to station power, population, or equipment availability. Once a review is conducted, and it is determined that there are no impacts to power, population, or equipment usage a project timeline can be realistically developed.

Implementation of such actions could happen in the immediate future (6-12 months) if a paradigm shift occurs within NSF and RPSC to not make commitments without complete and thorough impact review to all work presently scheduled. Further Planning & Controls staff could be acquired in the next 6-12 months.

2.5.2 Contingency built into all construction schedules

Current project construction schedules are planned to the 110 day season and do not contain any contingency to allow for delay or change requests.

Almost every year South Pole station has encountered some type of delay during the season as a result of weather, lack of flights, and shortage of resources or change orders. Adding contingency to the construction schedules would help mitigate these delays and potential carryover work that impacts following seasons. Every project should be reviewed and analyzed for risk impacts and potential change orders, and determine what level of contingency would be required.

The challenge here is that adding contingency to a project may result in additional funding that may not have been originally identified. The contingency should be clearly identified and released only after reasons for not making the estimate are understood and approved.

Again, a paradigm shift must occur within NSF and RPSC to begin reviewing and determining what level of contingency should be included in a project schedule. Once a contingency level is determined RPSC must present their findings to NSF and make a request for additional funds, if required. This is a goal that could be realized in the next 6-12 months.

2.5.3 Realistic timeline to create, review and prioritize schedules

When a new project is proposed realistic schedules must be allowed for development, review, and prioritization of the required work. Presently projects are not prioritized until just prior to season start. For the 2006/2007 season, prioritization of projects was not set until mid-October, less than 3 weeks before the start of the season. Such a short timeframe does not always allow necessary time to successfully hire required construction resources for the station or determine if the workflow is even feasible.

The challenge here is similar to the challenge in the first issue of identifying impact assessments – time and resources. Again a change in the current process of how business is conducted is required to achieve the end result. Planning for a project must occur well before actual site work and priorities must be set so that work can be performed in an optimized manor across all parts of the station.

All projects should follow a 2-3 year approach where initial funding would be for requirements definition followed by new proposal for the actual implementation portion of the project. This allows for adequate review and input into the projects needs. During each phase, the IMS will be further refined to include greater detail and inter-project relationships. This process will enable RPSC to provide NSF with realistic options for completion milestones for each project. A minimum of 1 year prior to construction should be used to determine if all work can be completed in the requested season. If it is determined that work can be completed within station population constraints, prioritization should be set no less than 9 months for each project so that work can be scheduled in series to best optimize available resource.

2.5.4 Realistic deadlines for go/no-go on work

The idea of having a milestone for a go/no-go decision ties into the previous issue. Construction work is often impacted due to late decisions on what work will occur during the construction season. Late decisions can result in lack of design, missing materials or inadequate staffing. For example, the late addition of work in FY07 to correct deficiencies in the Elevated Station systems controls resulted in planned work that was not completed in the season. The late addition of the work did not allow enough time for proper design and planning.

It is recommended that multiple go/no-go timelines be instigated throughout the planning portion of a project. Potential decision milestones include: design, procurement, and transportation of materials to the site. For example, perhaps all projects should be at a 50% design level before a commitment to a particular field season is established. A final constructability review, between RPSC and NSF, should be conducted in mid April to provide a final go/no-go for work required to occur the following summer season. Additionally, sufficient time in the pre-season is required to allow for hiring of necessary resources. If these milestones cannot be met, the decision should be made to defer work to the following season when all prerequisites are met.

2.5.5 NSF buy-in of realistic schedules

In the past, construction seasons have started without final approval of baseline schedules for work required in a season. In October of 2006, a risk management meeting was held by RPSC and NSF to review season schedules and determine potential risks and their mitigation. This was the first time that a seasonal review was held for the station. Though the meeting was valuable, risks still remained due to the close proximity to the season.

The key challenge to meeting this goal is having suitable time and resources to conduct an appropriate impact analysis of any new, or re-scheduled, work in the overall IMS. This challenge can be mitigated by approval of funding for additional personnel to assist with the creation of new project schedules.

It is recommended that station planning meetings be held 9-12 months prior to the construction season in order to allow significant time for proper schedule review by NSF. NSF should not issue a notice to proceed until there is complete buy in, and approval of the project schedule by all stakeholders.

3.0 Conclusion

The issues that concern the planning element of FEMC are primarily a result of a lack of sufficient planning time before a project is given approval and is authorized to proceed with construction. The key challenge is essentially providing time necessary to conduct adequate reviews and analysis of the IMS to determine if planned projects are achievable in the allowed timeframe without impact to other projects or station sustaining work. These impacts often result in carryover of work from one season to the next which further exacerbates the impact to station population.

In order to overcome this challenge a paradigm shift must occur within RPSC and NSF to look at the “broader picture” of work that is happening within a season. Additionally, work must be reviewed well before the start of a season. Reviews 2-3 months prior to season start should not be acceptable. A minimum of 6 months should be allowed for a constructability review, with 9-12 months being preferred. Implementing constructability reviews of projects to ensure that all necessary design is complete and materials are on site should be required before authorization is approved to proceed.

The addition of staff to the planning department would also be required to manage the necessary schedule development and analysis essential in identifying any impacts to projects or station operations. Identifying impacts early in the project phase would be pivotal in assisting the NSF with determining priorities and developing realistic project timelines.

Establishment of processes to control how a project will be reviewed should be created. Having a process in place with an established timeline would better streamline the planning process and allow for optimization of station resources throughout the projects.

All of the solutions can easily be implemented in a 6-12 month timeframe as they primarily require development of processes and a change in how projects are managed. Additional funding would be required for any new planning positions and would require approval by NSF.

None of the issues that effect the optimization of South Pole Station personnel are insurmountable and would benefit the program significantly.

OPERATIONS WORKING GROUP REPORT

1.0 Introduction/Purpose of Group

The Operations Working Group consisted of the following team members:

- George Blaisdell, NSF (Team Leader)
- John Rand, CRREL
- BK Grant, RPSC
- Rita Pittmann, RPSC
- Martin Lewis, RPSC
- Liesl Schernthanner, RPSC

Group – Station Operations entails all basic functions associated with keeping operational and effective for the long- and short-term, all infrastructure and projects present at South Pole. This includes but is not limited to: power, heat and water production; food service; equipment operations; civil and snow engineering; fuels; flight support; and construction support.

Focus – What can Station Operations do within the areas they have influence become more efficient (less power, less equipment, less labor, less cost)?

Goal – To provide efficient support on a platform that is flexible to accommodate changes in scope.

Why – To efficiently support the science initiatives safely and optimally at South Pole.

2.0 Summary of Discussions

2.1 List of Issues

2.1.1 Equipment Operations

- Loader Pool (reduce equipment hours)
- Snowmobile repairs at McMurdo
- Swap Van Shuttle and Truck for Snowmobile Shuttle
- Third VMF Shift

2.1.2 Food Growth Chamber

- Outsource

2.1.3 Food Service

- Safe food service procedures are put at risk when population is above station design capacity

- Completion of LO Facility will allow for more effective adherence to good food practices (e.g., shelf life limits)

2.1.4 WINFLY/Extended Season

- More effective turnover and set-up time
- Better Ready for Green Light – Full Go
- More summer hours available for exterior tasking
- Reduces pressure on garage shop space during the first month of the season

2.1.5 Training

- “Intro to Pole” Video / off-site mock-up for specialized training
- VMF / Fuels / Equipment Ops cycle through McMurdo

2.1.6 Technology

- Snow Drift Modeling (reduce equipment hours)
- Monitoring processes using Electronic Tools
- Reliance on rigorous analysis of data for decision making

2.1.7 Push Planned Work into winter seasons

- Focus summer work on exterior activities
- Attempt all interior work in winter

2.1.8 Personnel Development/Retention

- Salary Incentive
- Outsource specialty/expertise functions
- Full-time instead of contract for more key functions
- Back-up people from McMurdo

2.1.9 Initial Planning Improvements

- Detailed (e.g., 50% design level) operational review must take place prior to funding commitment
- More accurate identification of collective support requirements prior to fielding commitment

2.1.10 Flight Sequencing

Improve coordination of on-continent flights – days of no flights

- Continue with only one passenger flight per day; perhaps reduce the number of passenger flights per week
- Prefer tankers in the afternoon

2.1.11 Outbuilding Arch Facilities Sewage/Wastewater Handling

- Safe collection/transport/disposal of human waste
- Garage drainage sump pump

2.1.12 Fuel Storage

Bulk/Emergency fuel storage requirements and storage location, e.g., bladders

2.2 Current and Desired End States

2.2.1 Equipment Operations

Current fleet size and composition is not optimized. For example, three departments operate dedicated loader fleets. A single pooled loader fleet could be smaller, better maintained and dispatched to be efficient. Pool size should be flexible to accommodate changes in requirements.

Analysis, leading to a plan is required to determine better mix, type, and quantities of vehicles depending on near term projects and long-term sustaining needs. An optimized fleet will realize an improvement in VMF utilization and workload.

Snowmobiles provide excellent and efficient transport means at SP, but represent a significant maintenance load for which the station is not currently configured. “Outsourcing” major snowmobile maintenance to McMurdo appears to be an attractive solution, facilitated by the frequent MCM-SP airlink, the easy portability of a snowmobile, and the excellent facilities and trained maintenance staff at McMurdo.

A van- and pick-up truck-based personnel movement system is present at SP, but represents a high maintenance cost and relies on non-standard fuel (gasoline). An effective alternative, with much less maintenance, cost and complexity, could be provided using a snowmobile-based system.

Bay space in the VMF is currently a critical resource with the current volume of planned and unanticipated maintenance requirements. A 30% virtual increase in bay space can be realized by adding a third work shift. This would increase population, but optimize a critical resource.

2.2.2 Food Growth Chamber

It is not clear if the FGC is an operational, scientific/technical or morale facility. Thus, staffing has been difficult due to identification of ultimate goals of facility and technical complexity of its systems. Current staffing is one RP winter staff person and volunteer labor in summer (with external technical guidance). A determination of the intent and goals of the FGC must be made. Irrespective of what is ultimately decided, we recommend that operation and monitoring of the FGC be “outsourced” to an organization with the interest and technical expertise to best manage it to the stated goals (including energy budget).

2.2.3 Food Service

The existing facilities associated with food storage, preparation, serving and dining were designed for serving 4 meals per day for a maximum population of 150 persons. In particular, physical constraints make sustaining a population of 250 in the summer difficult and risky. Safe food handling procedures include segregation of food types and established time limits for certain processes. Both of these are currently compromised in order to provide traditional (discrete, limited length, mealtimes) food service.

The food inventory storage and tracking system is inadequate and leads to a high risk for losses, damage, and violation of shelf-life limits. Completion of the LO facility will allow for more efficient food service operations and better adherence to established best-practices standards.

2.2.4 Extended Season

Early Season – The current scenario where SP station population changes from its winter to summer levels in the span of one week leads to gross inefficiencies in hand-off, acclimatization, site-specific and job-specific training, facilities “wake-up” and supporting the science projects eager to begin their research season.

A “ramped” opening is viewed as a means to greatly improve safety, efficiency, and productivity. A SP ”WINFLY” period of 10-20 days dedicated to transition from winter to summer activities, both for operations and for science can be achieved prior to the traditional opening day if the Basler or Twin Otter aircraft is used.

Late Season - The current SP summer work season is defined by the temperature operating limits of the LC-130 aircraft. With the introduction of the Basler aircraft to the USAP, the potential exists to extend the “summer” work season. This allows better spreading of work load during the short, intense period of sunlight and warmer temperatures, allowing either more work to be achieved, or fewer personnel to accomplish the same level of tasking.

A “ramped” closing facilitates a smooth transition from summer activities to winter tasking, ensuring that in-progress work proceeds with little interruptions or efficiency loss.

2.2.5 Training

Eighty percent of training is conducted on-site. Much of this could be achieved off-site including season overview, job specific training, safety training, familiarization of policies and procedures. By using modern technologies, group sessions in Christchurch, or OJT in McMurdo the percentage of on-site training with a target reduction to 20% on-site.

2.2.6 Technology

A number of functions at SP are now accomplished using labor-intensive methods. For example, the dynamic snow surface is measured using multi-person traditional surveying methods, and analyzed minimally using simple graphics tools. System monitoring and maintenance tracking is routinely done with pencil and clipboard, making it difficult and time consuming to analyze or to archive. Hardware and software tools are commercially available for most of these functions, and in many cases are industry standard practices to utilize. Considerable labor could be saved by engaging available technology, as well as improvements in monitoring and predictive capabilities. Decision-making and resource planning can then be driven by rigorous data analysis.

This example can be applied to most of the operations support activities. Improvements in this area can increase facilities and equipment efficiencies resulting in labor reductions and fuel/energy savings.

2.2.7 Push Planned Work into winter

The majority of key activities are currently scheduled to occur in the summer season. While the winter season in longer by more than two times, twice as much work is achieved in the 112-day summer. Since the station is capable of supporting a much higher level of activity in the winter than is currently practiced, all planned tasking should be reviewed to determine if it has to, and can only, be done in the summer. If it doesn't it should be required to transpire in the winter season.

2.2.8 Personnel

Retention rates over the past few years have decreased to a level of approximately 50%. Effects of high turnover are seen in the loss of efficiency due to increased training and familiarization requirements. This current level of turnover results in a decrease in the knowledge base on station. An ideal return rate would be 80%. This allows for a steady stream of new personnel and ideas while maintaining the necessary expertise to effectively maintain station systems.

Attrition occurs each summer because of altitude sickness, personal crisis, or new or different skill requirement identified. This problem causes disruption, inadequate staffing, and inability to complete scheduled tasking. Utilizing McMurdo as a location to stage a pool of critical over-hires would avoid positions going unfilled for a significant length of time.

Certain skill sets are hard to recruit due to a competitive market. Outsourcing or in-house training will ensure appropriate skill sets are available to accomplish the required tasking.

2.2.9 Initial Planning Improvements

Current system makes funding and later fielding commitments prior to adequate Ops review/input to realize coordinated/integrated support efficiencies difficult. Timeline and departments involved need to be enhanced to allow full understanding by all parties as to levels of resources necessary for successful execution. For example, the equivalent of a 50% design review should be complete prior to OPP making a funding/decline decision. The equivalent of a 90% design level should be present prior to OPP determining the date of field entry for a project.

With enhanced definition and integrated scheduling of support requirements, at an earlier date (wrt fielding) significant efficiencies can be realized throughout many departments.

2.2.10 Flight Sequencing

The current flight schedule and sequence of deliveries is well coordinated between SP and MCM with respect to ACL and aircraft availability. Potential for improvements in SP activities optimization likely can be realized by deliberate scheduling of flights and types of payloads. For example, crews who service aircraft routinely parse their day into many small components to remain efficient even between flights. With planned no-fly days, considerably more can be accomplished by many of these staff by focusing on larger, more involved tasks. Likewise, careful sequencing of cargo, fuel, and passengers arrivals in the course of a day, can also allow enhanced efficiency for flight servicing personnel.

2.2.11 Outbuilding/Arch Facilities Sewage/Wastewater Handling

Drainage and pumping systems associated with SP garage were designed to efficiently collect and remove melt water and POL contaminants from floor area of working bays. Drains located nearest the doors freeze-up and currently require considerable manual labor and externally applied heat to remediate. The originally-designed pumping system was never installed. The current system requires use of a portable pump, hose and collection system to “vacuum” out the drain troughs, temporarily containerize the waste, and manually transport it to the oil separator, then the wastewater transferred to a container to be manually moved to a drain in the New Power Plant arch where it is pumped into a drain. Collection of this approximately 400 gallons per week consumes a shift’s-worth of labor each week. The originally designed system needs to be inspected, analyzed, and made to function as planned.

Lavatories were designed to be included in all major facilities outside the elevated station. None have been installed throughout the Dark Sector, and they are missing in the garage/shop area. Bucket and barrel collection of human waste is now practiced in the Dark Sector. This requires frequent handling and risky exposure to human waste, as well as labor-intensive disposal. The arch staff (garage, maintenance, electrical/plumbing/carpentry shop, power plant, and potentially logistics) and people working in or near the subterranean area (equipment operations and others) of the station share the single, small uni-gender facility located in the Power Plant, which for some work sites is a long trek. There is no running water in the garage arch facility and none planned for the logistics arch facility.

2.2.12 Fuel Storage

Bulk fuel storage must be re-evaluated to establish how much fuel storage is needed for future operations and winter emergency fuel needs and how/where that fuel is to be stored. Bladder (pillow tank) usage is not recommended as a permanent measure

2.3 Challenges to and Strategies for Achieving End State

2.3.1 Equipment Operations

Dark Sector projects have become accustomed to on-demand access to some equipment/transportation resources. Communication of goals and integrating all affected groups can successfully lead to acceptable solutions and manage expectations.

2.3.2 Food Growth Chamber

Lack of agreement on ultimate role of FGC makes approach for management difficult.

NSF needs to provide a decision on the primary role for FGC and Station Operations freedom to manage thusly. Recommendation from Station Operations is that FGC become managed and operated by through outsourcing to specialty group with keen interest that is allied with determined FGC primary role.

2.3.3 Food Service

Completion of LO Facility and solution for efficient passage from LO to second level of elevated station (i.e., underground passageway doors and levelness; elevator) is primary challenge to providing safer and more efficient food services. Proximal storage and food preparation (e.g., thawing) areas will also be required.

Prioritize completion of LO facility (to include re-visiting BOD to ensure that it can best meet a 250 person requirement, rather than the 150 population envisioned during initial design and ensure the current shelving scheme is the most efficient use of precious storage space). Propose and gain agreement for rezoning of certain spaces within the elevated station.

2.3.4 WINFLY/Extended Season

Major challenge is to show cost/benefit analysis for earlier, phased opening and later, phased closing of Station, in light of the requirement for costly contract airframe support.

Continue to refine scenario(s) for phased and extended season, showing perceived major benefits to summer productivity and safety (for both science and non-science-specific projects).

2.3.5 Training

Requires development of syllabus and scheme for efficiently and effectively using off-site (i.e., not at South Pole) venues to provide as many levels of training as possible. Basic training is easy to visualize, but specialized training may require “mock-ups” which could be a combination of virtual and physical tools. Training courses may also be applicable. Changing and augmenting the current training scenarios requires investment.

Form a “Tiger Team” or 6sigma group to develop ideas and derive plan to achieve maximal benefit from off-site training.

2.3.6 Technology

Principal challenge is to show cost/benefit for various technological solutions and then to obtain approval for investment.

Vigorously pursue “proposal” development showing efficiencies, especially long-term ones that can derive from application of technological tools.

2.3.7 Push planned work into winter

Generate paradigm shift from “two season” year to a “four season” year, with rule for tasks to be scheduled initially only in the season that most minimally meets its requirements in order to better spread workload over 365 day periods.

During development of IMS, consider potential for utilizing not just a "summer" and "winter" period for execution, but also a WINFLY (i.e., spring) and autumn season. Seek to "fill" the spring and autumn seasons with work that can effectively be performed then, but that does not require environmental and physical assets that are only available in summer.

2.3.8 Personnel Development/Retention

Numerous challenges can be identified including:

- Summer work schedule at South Pole is nearly always for all personnel greater than 54-hr contract states and is at same base rate as McMurdo workers who enjoy more favorable work and recreation conditions.
- World demand for many specialized trades is fierce, making salary competitiveness difficult for USAP. South Pole must begin to require only very high-level trades' personnel in order to operate safely, efficiently and professionally.
- Severe summer-season start-up pace is not conducive to adjustment to altitude, extreme cold, and a new job and job site for the majority of workers.
- The very limited summer-to-winter transition has led to sub-optimal winter staff expertise for the first third of the winter season.
- Lack of ability to fill certain positions and maintain a high return rate has led to inability to execute projects as planned because of numbers of workers and/or vital skills.

Outsourcing of specialty and highly expert functions is seen as a potential strategy for obtaining suitable workforce with competitive remuneration. Off-site training and a phased (e.g., WINFLY) opening are also seen as having the potential to strongly impact achievability.

2.3.9 Initial Planning Improvements

Operations personnel with knowledge of day-to-day specifics of completing tasks may, with the current proposal review process, not see a proposed activity until it has been funded and perhaps even committed for a specific time period in the field.

A detailed (e.g., 50% design level) operational review must take place prior to funding commitment in order to allow a more accurate identification of collective support requirements prior to fielding commitment. Careful review of the proposal development/review process, perhaps by a 6sigma team, can be used to ensure that the proper levels of individuals have input to the process at the most appropriate steps to ensure that a full understanding of the project's needs is compared with the collective support requirements on Station.

2.3.10 Flight Sequencing

South Pole LC-130 flight schedules are currently optimized for McMurdo and NYANG elements. Adding another variable (South Pole operations) to the mix may make overall optimization difficult. Nonetheless, the potential exists to modify the flight schedule in such a way that certain South Pole operations elements may better utilize their time and talents.

A small group of appropriate staff could assemble all the factors that impinge on LC-130 South Pole flight schedules and determine if a different pattern could meet all affected party's needs.

2.3.11 Outbuilding/Arch Facilities Sewage/Wastewater Handling

Completion of BOD facilities on out-buildings is lagging. However, re-review is needed of the BOD performance assumptions compared to current and envisioned facility utilization (e.g., conditions are close to those assumed in the BOD for the arches areas, but considerably different in the Dark Sector). The principal challenge will be to show cost/benefit for various solutions and then to obtain approval for investment.

Vigorously pursue "proposal" development showing efficiencies and safety/health improvements that can derive from completion of sanitary "cradle to grave" systems.

2.3.12 Fuel Storage

South Pole has a current "safe fill" bulk fuel tank capacity of approximately 518,000 gallons. Two 25,000-gallon bladders are on site as potential auxiliary storage, but no fixed location for auxiliary storage has been identified. The use of bladders or additional bulk tank fuel storage requires examination in the station current operational context.

2.4 Interactions Needed with Other Divisions

2.4.1 Equipment Operations

Primarily "in-house" but will involve McMurdo SSC (snowmobile mechanics) and Dark Sector science population.

2.4.2 Food Growth Chamber

NSF (DAIL), University of Arizona

2.4.3 Food Service

FEMC and Logistics

2.4.4 WINFLY/Extended Season

NSF (DAIL), Science Support and Science Planning groups.

2.4.5 Training

IT, Travel and Deployment

2.4.6 Technology

NSF (DAIL), FEMC, IT

2.4.7 Push Planned Work into Winter

NSF (DAIL), Science Support and Science Planning groups, FEMC.

2.4.8 Personnel Development/Retention

NSF (DAIL), HR

2.4.9 Initial Planning Improvements

NSF (DAIL), Science Support and Science Planning groups.

2.4.10 Flight Sequencing

Logistics, NYANG, SFA

2.4.11 Outbuilding Arch Facilities Sewage/Wastewater Handling

NSF (DAIL), FEMC

2.4.12 Fuel Storage

NSF, FEMC

3.0 Recommendations/Proposed Actions

Table 1 summarizes the issues, their development time-frame and the action items required to bring them to fruition. They are listed in priority groups; however, all are worthy of pursuit.

4.0 Conclusion

Table 1 also lists the most acute impact of the proposed actions on South Pole optimization (see next page).

Table 1 Proposed Actions, Operations Working Group

Priority	Activity	Short vs. Mid vs. Long Term	Goals/Action Items (year)				Anticipated Results
			<1	1 to 3	3 to 5	>5	
1	Personnel Issues	S-L	create incentives; overhire for attrition, foster teamwork	explore potential for outsourcing to obtain special expertise, high-skill-level and continuity	arrive at methods to attract and retain proper skill set workers, including reachback and know pool of candidates		potential for major reduction in re-work labor; potential for major improvement in complex systems understanding and operation thus reducing need for persistent outside review and assistance
1	Training	S	propose and design new training plan and program; develop training tools	implement new training plan	evaluate results; determine value and improvements & modifications needed		vastly improved seasonal transitions for all worker/projects; better worker retention; improved safety
1	Planning / Scheduling	L	confirm sequence of schedule development and commitments; identify steps where thorough operations review is required to ensure full understanding of support needs	develop protocol in collaboration with science planning group to ensure accurate and timely operations input to arrive at an integrated schedule for all projects	adapt OPP solicitation, review schedule to allow earlier and more complete definition of requirements and schedule development		potential for reduction of labor hours due to better, more complete development of performance needs of each project
2	Extended Season	S	execute Basler Winfly	execute Basler Winfly and late season extension	analyze results to determine value/benefit as function of cost		more efficient and safer summer season start-up; better employee retention (and lessened attrition); reduced/eliminated severe summer population spikes/peaks

Priority	Activity	Short vs. Mid vs. Long Term	Goals/Action Items (year)				Anticipated Results
			<1	1 to 3	3 to 5	>5	
2	Fuel Storage	S	Establish new estimate of bulk and emergency fuel needs	If bulk fuel needs are greater than current capacity, design auxiliary fuel storage	Stay within fuel capacity of station		Permanent solution will allow design that reduces labor and increases safety
2	Equipment Operations	S-M	outsource snow machine maintenance to McMurdo; analyze loader fleet pool options; establish 3rd shift in heavy shop	pool loaders (coord with FEMC/Log/Ops); phase out light vehicle usage,	eliminate requirement for 3rd shift		reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)
2	Food Service	S	potentially move Food Service Materials person into Logistics group	decide best system for food storage, inventory and movement on station; implement system as facilities become available	construct/rehab facilities to streamline long-term servicing of large population		improved food safety; slightly reduced labor through more efficient materials movement and tracking
2	Technology	M	develop proposal for information monitoring and tracking; research software and hardware available for surveying snowdrifts, tracking maintenance and equipment usage data, etc.	identify and implement desirable solutions	use results of tools for making operational decisions; explore additional targets for technology		high potential for dramatically reduced labor and equipment operations expenditures and moderate reduction in staffing; potential for off-site monitoring, analysis, trouble-shooting, and decision making resulting in reduced staffing

Priority	Activity	Short vs. Mid vs. Long Term	Goals/Action Items (year)				Anticipated Results
			<1	1 to 3	3 to 5	>5	
3	Shift Work to Winter	M	carefully review IMS to identify what activities planned for the upcoming summer season might be moved to "shoulder" season performance; make list for study of impacts	in concert with development of WINFLY and extended season capabilities, identify activities that should be moved from summer to either shoulder seasons or winter	engage practice		potential for labor reduction in summer season as a function of seasonal task "smoothing"
3	Waste Collection	M	review BOD to discover planned facilities not yet installed and learn why some existing ones are not functioning as envisioned;	remediate VMF drain system; design appropriated facilities in remote and subterranean infrastructure; schedule and complete facilities	design and procure safe, non-contact system for collection and disposal of human waste from remote holding tanks		reduced labor in VMF; reduced labor and risk for waste handlers (especially in Dark Sector); improved hygienic conditions for Dark Sector personnel
3	Food Growth Chamber	S	establish consensus on goal/purpose for FGC	outsource FGC operation with high value placed on autonomous and remote operability			reduced Operations tasking and monitoring

SERVICES WORKING GROUP REPORT

The Services Working Group consisted of the following personnel:

- Scott Myers, RPSC (Chair)
- Gwendolyn Adams, NSF
- John Maier, Metcalf & Eddy
- Lee Anne Hess, RPSC
- Katy Jensen, RPSC

This group addressed topics that either 1) overlap all functional areas, e.g., Environmental, Safety, Occupational Health, or 2) depend on station volunteers for staffing, e.g., Emergency Response, Medical, Retail, and Recreation.

1.0 ENVIRONMENTAL

1.1 Introduction/Purpose

The Services group evaluated the current state of environmental capabilities to maximize efficiencies while minimizing waste.

Note: Additional solid waste issues are discussed in the Logistics working group's report, and additional wastewater issues are discussed in the Operations working group's report, above.

1.2 Summary of Discussions

Environmental discussions included waste (and hazardous waste), air emissions, wastewater, fuel (storage and handling), and renewable resources.

1.2.1 Current State

1.2.1.1 Waste and Releases

Waste generation and releases to the environment, e.g., air emissions, wastewater discharges, for the South Pole are described in the *USAP Master Permit*. Quantities are reported each year in the *Annual Report for the USAP Master Permit*.

Currently, there are no documented plans for minimizing waste generation or processes resulting in releases or emissions.

The current facility used for segregation and characterization of wastes is located in a wooden structure that is not equipped with fire suppression systems, ventilation, or heat.

Wastes are often stored without secondary containment or proper segregation due to limited storage space.

1.2.1.2 Wastewater Treatment

The new station constructed during SPSM is not meeting the Basis of Design (BoD) with respect to grey water recycling and black water treatment. A formal decision was made to deviate from this element of the BoD based on subsequent recommendations (SPSM EIS, 1998) and it is not feasible to retrofit the station for these systems. However, opportunities may be available to develop these systems for any new support facilities at the South Pole, such as the proposed Solar Camp.

Other wastewater issues (esp. lavatory facilities in outlying buildings) were discussed by the Operations working group.

1.2.1.3 Renewable Resources

Minimal renewable energy sources (e.g., solar, wind) are being used at the reconstructed station. However, opportunities may exist to incorporate these sources into any new support facilities at the South Pole, such as the proposed Solar Camp.

1.2.1.4 Fuel Storage/Secondary Containment

Current USAP performance standards require the use of secondary containment or spill prevention features in all bulk fuel storage and fuel transfer facilities. Although bulk fuel storage facilities at the South Pole are equipped with secondary containment, certain fuel dispensing and transfer facilities are not equipped for spill prevention. Examples include fuel dispensing hoses or multiple transfer points prior to point of use.

1.2.2 Desired End State

The group determined that the desired end state is to minimize the generation of waste, emissions, and releases from the South Pole Station through a documented plan to achieve optimal performance.

1.2.3 Challenges to Achieving End State

1.2.3.1 Solid and Hazardous Waste

The temporary facility used to process solid and hazardous wastes at the South Pole is deficient with respect to worker health and safety and efficiency of operations. For example, the facility is unheated and cannot be used to characterize hazardous wastes which have become frozen. In addition, the facility is poorly ventilated and lacks an automated fire suppression system.

Waste processing systems or equipment which can be used to effectively reduce the volume of demolition waste are also lacking.

For examples, wood wastes are not reduced in volume prior to transport to McMurdo, thereby requiring additional flights to airlift the same amount (by weight) of material.

1.2.3.2 Wastewater Treatment

The new station constructed under SPSM was not equipped with wastewater treatment systems (e.g., grey water recycling, black water treatment). Because of the utility configuration in the completed modules, it is impractical to retrofit the elevated station with these treatment systems. However, additional opportunities may become available in the future to provide wastewater treatment to new support facilities constructed at the South Pole. It should be noted that discharge of untreated wastewater to the underlying ice sheet is allowed by the Protocol for Environmental Protection to the Antarctic Treaty and the terms and conditions of the USAP Master Permit issued to RPSC.

1.2.3.3 Renewable Resources

Limited solar-powered devices and wind-powered devices and equipment have been used at the South Pole. Solar devices are only useful during the austral summer, and wind-powered devices have not been able to compete with the combination of power & heat provided by burning fossil fuels and capturing waste heat.

1.2.3.4 Fuel Storage/Secondary Containment

Some fuel storage facilities and transfer equipment at the South Pole is inconsistent with accepted Spill Prevention, Control, and Countermeasures (SPCC) requirements. These SPCC standards include the use of secondary containment and spill prevention features for fuel tanks (including day tanks) and fuel transfer facilities.

1.2.4 Strategies to Address Challenges and Issues

Define requirements to minimize environmental impacts in the minimization plan

1.2.5 Interactions Needed with Other Divisions to Implement Strategies

South Pole Operations; EH&S; FEMC; Logistics

1.3 Recommendations & Goals

1.3.1 Short-term (<1 year)

Continue current operations; perform analysis to modify waste facility

By the end of the 2007-2008 operational season, modify the internal waste processing facility to provide adequate ventilation for workers.

Develop Waste Management Plan for the South Pole that identifies waste characterization, packaging, storage, transport, and disposal methods and strategies prior to the beginning of the 2007-2008 austral summer season.

1.3.2 Mid-term (1-3 years)

By the end of the 2007-2008 seasons, develop a Waste & Release Minimization Plan that identifies methods and strategies to reduce the amount of waste generated at the South Pole and the type of materials that are expected to be released to the surrounding environment.

By the end of the 2008-2009 seasons, modify the interim waste processing facility to provide fire suppression devices adequate to reduce risk of fire that may result from activities performed.

Provide containment for vehicle refueling facility at the South Pole consistent with the structure described in the SPSM BOD.

Update the SPCC Plan to reflect current conditions at the South Pole, including Ice Cube Project fuel storage and distribution resources.

1.3.3 Long-term (3-5 years)

Reduce annual waste generation (following completion of SPSM) by 15% (193,000 lbs), yielding annual waste generation of 1.09 million pounds.

Provide a permanent waste processing facility at the completed station of sufficient capacity to handle projected annual waste generation (1.09 million lbs.) and containing features adequate to prevent spills and protect worker health and safety.

Remove demolition waste resulting from SPSM activities from the South Pole within 2 years of its generation, where feasible; reduce volume to facilitate its packaging and removal (e.g. grind wood).

Utilize renewable energy sources, where feasible (e.g. solar, wind), particularly in newly constructed facilities and installed equipment.

Provide resources and equipment of sufficient capacity to treat wastewater generated at any new support facilities (e.g. solar camp); provide resources and equipment adequate to collect sanitary wastes generated at remote science facilities, particularly during the austral winter

1.4 Proposed Actions

1.4.1 Short-term (<1 year)

1.4.1.1 Coordinate with other working groups to address environmental issues: S. Myers

1.4.1.2 Develop Waste Management Plan: M. Furnish by Oct 2007

1.4.1.3 Design & install localized ventilation system: S. Myers, R. Carpenter by Feb 2008

1.4.1.4 Develop Waste & Release Minimization Plan: All RPSC Divisions, S. Myers, Dr. Montopoli by Feb 2008

1.4.2 Mid-term (1-3 years)

1.4.2.1 Design & install fire suppression devices: S. Myers, R. Carpenter by Feb 2009

1.4.2.2 Update SPCC Plan: S. Myers; Dr. Montopoli by Oct 2009

1.4.2.3 Install containment beneath vehicle fueling: R. Carpenter, S. Myers by Feb 2010 Facility review: S. Myers, R. Carpenter, B.K. Grant, M. Furnish, Dr. Montopoli

1.5 Conclusion

Minimizing waste generation will reduce the costs associated with those operations and the Logistics functions. Construction of a new waste processing facility will allow us to implement lean manufacturing techniques thus reducing labor costs associated with management and transportation of waste.

2.0 SAFETY

2.1 Introduction/Purpose

The Services Working Group evaluated the current state of safety activities to ensure participants operate in a manner that promotes safety and achieves science with minimal impact on operations and cost.

2.2 Summary of Discussions

2.2.1 Current State

In spite of aggressive training programs, there are still too many accidents and injuries among USAP participants.

2.2.2 Desired End State

Zero accidents and injuries.

2.2.3 Challenges to Achieving End State

Especially with South Pole's short season and aggressive schedule, how to convince participants to take time for safety? How to bring in science participants?

2.2.4 Strategies to Address Challenges and Issues

Incorporate safety training, education, and awareness into job performances; hold management and employees accountable; hold management accountable; Review all science safety plans for safety concerns; improve timeliness of SHIELD system

2.2.5 Interactions Needed with Other Divisions to Implement Strategies

All divisions & agencies must be involved

2.3 Proposed Actions

2.3.1 Short-term (<1 year)

2.3.1.1 NSF to provide OPP vision & policy statement to RPSC
(M. Montopoli) 15 May

2.3.1.2 Implementation plan for reducing injuries, including recreational
(TBD)

2.3.1.3 Improve timeliness of SHIELD reporting
(TBD)

2.3.1.4 Meet with ANG on a regular basis to make sure safety goals are aligned

2.4 Conclusion

Working toward a common safety goal eliminates duplicative efforts
Preventing/reducing accidents and injuries

3.0 OCCUPATIONAL HEALTH

3.1 Introduction/Purpose

The Services Working Group evaluated the current state of occupational health awareness to maximize efficiencies while minimizing illness.

3.2 Summary of Discussions

3.2.1 Current State

Documented program and mechanisms are in place for equipment planning, purchasing, and maintenance; need to maintain awareness

Occupational health program is in place. Needs are identified by position; PPE is available & inspected. Program to identify what each position needs; most PPE available

Maintenance and replacement issues

3.2.2 Desired End State

Realize improved awareness of occupational health goals and job-specific PPE requirements.

3.2.3 Challenges to Achieving End State

Effectively communicating and coordinating all persons and activities that influence changes will be complex and require attention to detail.

3.2.4 Strategies to Address Challenges and Issues

3.2.5 Interactions Needed with Other Divisions to Implement Strategies

Requires active participation from all groups

3.3 Proposed Actions

3.3.1 Short-term (<1 year)

3.3.1.1 S. Myers convey to divisions PPE by job description testing right to know briefings develop monitoring program. Procedures implemented training monitoring who received training testing/results….POSTING results

3.3.1.2 Develop staffing and equipment plan based on Operations/Science projections

3.3.1.3 SP personnel will have priority in McM for occupational health testing (hearing conservation, respirators) Radiation exposure right to continuous monitoring.

3.3.1.4 Monitoring realistically & in concert with physician (right to know)

3.3.1.5 Provide more monitoring, inspections, etc.

3.3.1.6 Work with manufacturers to overcome cold weather effects on equipment

3.3.1.7 Coordinate with all major activities.

3.4 Conclusion

Follow up on these discussions will improve overall safety and contribute toward the zero-accidents goal.

4.0 EMERGENCY RESPONSE

4.1 Introduction/Purpose

The Services Working Group discussed the following emergency response topics:

- Contingency planning and Comprehensive Emergency Management Plan (CEMP)
- Fire Brigade & Trauma Team

- Aircraft Rescue Fire Fighting (ARFF)
- Search and Rescue (SAR)

4.2 Summary of Discussions

4.2.1 Current State

Capabilities are appropriate for current requirements, but the South Pole Comprehensive Emergency Management Plan (CEMP) has not yet been finalized. Fire brigade and ARFF capabilities and requirements need to be reevaluated (temperature, location, people, training, etc.). SAR is not a formalized process at the South Pole Station, currently rely on McMurdo.

4.2.2 Desired End State

Maintain effective and efficient emergency response capabilities; CEMP formalized and followed

4.2.3 Challenges to Achieving End State

4.2.3.1 Concurrence with other agencies' regulations

4.2.3.2 Equipment limitations

4.2.4 Strategies to Address Challenges and Issues

Define how the ARFF personnel are incorporated into station population (aircraft only or what other capacities?) Maximize their expertise. Training, inspections, equipment maintenance

Fire Brigade: define fire brigade's responsibilities for augmenting ARFF team.

Update procedures

Formalize McM Fire Dept. responsibilities for South Pole: equipment evaluation: formal equipment review/lifecycle/replacement

Continue to use the volunteer force

4.2.5 Interactions Needed with Other Divisions to Implement Strategies

ARFF: ANG and McMurdo Fire Department; Fire brigade: McM Fire Dept

4.3 Proposed Actions

4.3.1 Short-term (<1 year)

4.3.1.1 Continue current procedures and perform gap analysis

SP Winter Site Manager, USAP Fire Chief, S. Myers

4.3.1.2 Define how the ARFF personnel are incorporated into station population (aircraft only or what other capacities?) Maximize their expertise. Training, inspections, equipment maintenance

4.3.1.3 Brigade: redefine fire brigade's ARFF responsibilities.

4.3.1.4 Update procedures

4.3.1.5 Formalize McM Fire Dept. responsibilities for South Pole: equipment evaluation: formal equipment review/lifecycle/replacement

4.3.2 Mid-term (1-3 years)

4.3.2.1 Complete and formalize SP CEMP; optimize fire brigade & ARFF

SP Winter Site Manager, USAP Fire Chief, S. Myers

4.3.2.2 Equipment modifications (if necessary)

McM Fire Dept

4.3.2.3 Define SAR functions at South Pole (in CEMP)

See above

4.3.3 Long-term (3-5 years)

4.3.3.1 Equipment/Facilities purchase (if needed)

B.K. Grant, S. Singer, Fire Chief

4.4 Conclusion

Maximizing the use of volunteer responders minimizes impacts on costs and footprint and provides a sense of ownership for station personnel.

5.0 MEDICAL

5.1 Introduction/Purpose

The Services Working Group discussed recent physicians' reports on the South Pole medical facilities and staffing.

5.2 Summary of Discussions

5.2.1 Current State

Issues discussed were centered on facilities, staffing, and formulary.

5.2.1.1 Facilities

Space issues; didn't envision equipment

Population – need to store more medicine

Patient transport – narrow hallway; how get into the station from the snow.

Space – vision did not include telemedicine, new technology/equipment

Patient Transport – narrow hallways; access to station

Storage – medicines, supplies – not enough space

5.2.1.2 Staffing

Requirements doc: one provider. 2 providers supplemented by volunteer staff. During some years, the PA's tasking is dedicated to Medical during the austral summer and then split 50/50 between Medical and Operations during the austral winter. This appears to be an appropriate level of staffing for current South Pole requirements.

5.2.2 Desired End State

5.2.2.1 Clinic Area

Balance use of technology (equipment) with space limitations.

5.2.2.2 Staffing

On-site staffing is appropriate but the RPSC staff in Denver has been without a Medical Director since January 2006, and Health Services Manager resigned in January 2007.

5.2.3 Challenges to Achieving End State

5.2.3.1 Clinic Area

Limited space and layout is problematic (columns, etc.)

5.2.3.2 Staffing

On-site staffing is adequate for current requirements: revisit as population or requirements change.

5.2.4 Strategies to Address Challenges and Issues

Recognize limitations and limit procedures & technologies accordingly.

5.2.5 Interactions Needed with Other Divisions to Implement Strategies

Medical department, IT-Comms, FEMC

5.3 Proposed Actions

5.3.1 Short-term (<1 year)

5.3.1.1 Continue current operations; RPSC and NSF to review recommendations made by physicians in their turnover reports.

5.3.2 Mid-term (1-3 years)

5.3.2.1 Make equipment/structural changes based on physician recommendations.

5.3.3 Long-term (3-5 years)

5.3.3.1 Re-evaluate requirements and effectiveness of changes made.

5.4 Conclusion

The on-site physicians have provided solid recommendations regarding the medical facilities at the South Pole. The Services working group recommends formal review and action based on those recommendations.

6.0 RETAIL

6.1 Introduction/Purpose

As with the other station facilities, the store was designed for a maximum population of 154 people. Assumptions included storage space within the logistics facility/warehouse (LO) and use of the elevator to transport materials from the warehouse to the store.

It is important to remember that the South Pole retail space is not only a store and post office, but it's also the only current venue for locking up/checking out entertainment materials such as DVDs, CDs, rare books, and video games. Increased populations result in larger inventories and longer store hours. (Hours are extended to accommodate larger numbers of people moving through a small space and also to provide off-duty access for three shifts of workers instead of two.)

Much like other station services, South Pole retail operations are provided as a "collateral duty" by station personnel during their off-duty hours.

The Services working group evaluated current retail facilities and operations to identify opportunities for streamlining/optimization.

6.2 Summary of Discussion

6.2.1 Staffing

The station store and post office are run completely by and for the community. Each austral summer, the South Pole Station Support Supervisor and the NANA Retail Coordinator (McMurdo) recruit and train part-time (nominally paid) "employees" and (unpaid) volunteers to work as cashiers, stockers, postal workers, and beverage distribution center (BDC) attendants.

Significant volunteer assistance from the community is required to hand-carry materials into the station when they arrive, especially in preparation for the austral winter season. This is a concern not only because of the time required to complete the tasking, but also because of the potential for accidents or injuries.

6.2.2 Storage

Much of the South Pole retail inventory is ordered by NANA staff and kept in McMurdo for just-in-time (JIT) delivery to the South Pole. Even so, the lack of storage space is another primary concern affecting retail operations, particularly during austral winter. (Although the crew is smaller during the winter, the store must stock enough supplies to last until Station Opening instead of relying on JIT delivery). The biggest challenge involves do-not-freeze (DNF) storage of beverages because the station "bar" is a bring-your-own facility and there are no vending machines on site for non-alcoholic beverages.

Another problem related to storing inventory in the elevated station is the unanticipated wear on the building itself:

- Floors are damaged by increased traffic of heavy carts laden with retail inventory
- Carpeting, walls, and ceilings are damaged by leaking/exploding cans of soda
- Unplanned stresses are put on the building by point-loading rooms that were not designed for storage of heavy materials.

6.2.3 Post Office

The biggest challenges faced by the South Pole post office include 1) finding and training enough people to run it and 2) processing outgoing winter mail at the beginning of the austral summer. In the past, this has required assistance from Christchurch personnel and/or several days of dedicated assistance from "super volunteers."

Nonetheless, the South Pole post office is an important service—not just for mailing personal goods and souvenirs, but because of its "geopolitical significance" as a United States outpost.

An interesting side note: during the Augustine Panel review meetings, when it was suggested that South Pole souvenirs could be ordered from an off-site catalog instead of being shipped to the South Pole, panel members were quick to recommend 1) continuing the on-site sale of postcards and 2) continuing to provide the South Pole cancellation stamp for those postcards.

U.S. mail is also the fastest and most economical method of transporting the many pounds of mail that moves in and out of the South Pole each year. Trying to manage that volume via CTS and "silver trunks" is not a practical solution to the staffing problem.

6.3 Proposed Actions

The two biggest concerns (storage space and transport of materials into the elevated station) are addressed in the Logistics section of this report, above. The staffing issue can be resolved by continuing to recruit early-season assistance from the Christchurch office or by temporarily assigning general assistants (GAs) to the Post Office.

6.4 Conclusion

Retail operations work well under the current organization at South Pole, but it requires a significant amount of time from the full time/returning contract staff to train new volunteers each season, and it requires the volunteers to contribute their time on top of a 54-hour workweek and other “volunteer” obligations. Any proposals to further extend the workweek or increase the types of services requiring volunteer labor will have an adverse effect on the current level of retail service.

7.0 RECREATION

7.1 Introduction/Purpose

Having access to a variety of appropriate recreational activities is essential for USAP participants’ mental and physical well-being. At the South Pole, outdoor recreation is limited by the extremely cold temperatures, and indoor activities are limited by the amount of space available.

The Services working group attempted to gauge the amount of space, equipment, and support required to provide adequate recreational opportunities for station populations of 250 people or more.

7.2 Summary of Discussions

There is no “recreation department” at the South Pole, so all recreational activities are dependent on the willingness of on-site personnel to organize events and manage resources during their off-duty hours.

Each austral summer, the Station Support Supervisor “hires” a part-time recreation coordinator. This individual is paid a nominal sum for managing recreation schedules and recruiting volunteers for the few station-sponsored events (e.g., Race around the World, Film Festival, and New Year’s Day Party). This person also creates flyers, posts “this week in recreation” updates, and provides assistance for individuals wanting to organize their own events.

For the most part, recreational facilities in the new station are consistent with expectations from the SPRP Requirements Document, which included: “…a gym, a weight room, a lounge, a library, and a television room.” Additional recreational spaces include a game room, 2 activity rooms (arts & crafts, musical instruments), a sauna, and a small sitting room incorporated into the food growth chamber. The station "bar" is a bring-your-own facility in the dining area, and the space that had originally been designated as a smoking lounge has been turned into a combination greeting area/reading room/television lounge instead.

While not technically a recreational space, the station's computer lab provides access to e-mail, the Internet, and a variety of software programs.

Limited supplies and equipment available for use include games, books, magazines, digital cameras, amateur radio, and a variety of CDs, DVDs, music videos, and video games.

Although new gym equipment was purchased and installed in association with the SPSM project, the weight room was designed for 154 people and populations continue to exceed 250 people during the austral summer. Even with a second weight room in Summer Camp, the recreational equipment at South Pole is experiencing heavier use than anticipated. In October 2006, RPSC submitted a proposal to NSF/OPP to purchase replacements for the oldest equipment in Summer Camp as well as rebuild kits for the newer SPSM equipment.

Brief discussions during the conference in St. Michaels led the working group to the following conclusions regarding recreation at the South Pole:

- Except for the weight room, station facilities seem adequate for current station populations.
- Higher populations mean greater wear & tear on exercise equipment and "consumables" such as electronics equipment (stereos, TVs, DVD players) and media libraries (books, CDs, DVDs, video games).
- Program-wide, there are too many recreational accidents and injuries (this topic was discussed in the Safety section, above)
- Longer work days = less free time for participation in recreational activities

7.3 Proposed Actions

7.3.1 Short-term (<1 year)

7.3.1.1 Follow up on recreation lifecycle replacement proposal

Jim Scott, Lee Anne Hess, Brian Stone (June 1, 2007)

7.3.1.2 Re-evaluate requirements based on projected populations

Beth Watson (include justifications/requests in FY08 APP)

7.3.1.3 Include appropriately sized lounge area(s), a weight room, and small meeting rooms/telephone booths in the proposal for a "Solar Camp"

RPSC FEMC, Sandy Singer

7.3.1.4 Add more safety reminders (rules and any training required) to recreation section of the station guide

RPSC Beth Watson, Katy Jensen (September 1, 2007)

7.4 Conclusion

In spite of improvements and expansion of recreational space at the South Pole, it is still not enough to support current summer populations.

The current (volunteer) system for organizing recreational activities works well as long as the associated equipment is available and maintained, and as long as volunteers are not overburdened with other tasking/obligations.

Optimization of South Pole Operations
Action Items Tracking Spreadsheet

timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		FEMC	StM-FEMC-2.1.5a	Roles & Responsibilities: RPSC to develop a transition plan to clearly define when equipment is turned over from construction to maintenance.		RPSC FEMC	2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.1.5b	Staffing: RPSC FEMC and HR to develop a plan and strategy to acquire skilled personnel. This strategy will include total number of personnel required and the skill sets required. The current personnel qualifications shall be reviewed and placed where most effective.		RPSC FEMC, HR	2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.1.5c	Skill Sets: Develop pre-deployment training program for maintenance personnel (see actions # StM-FEMC 2.1.5d and e).				
A short term (< 1 year)		FEMC	StM-FEMC-2.2.3a	Institutional Knowledge: Identify core bodies of knowledge (see actions # StM-FEMC 2.2.3b, c, and d).				
A short term (< 1 year)		FEMC	StM-FEMC-2.2.3b	Institutional Knowledge: Search for staff able to process data (see actions # StM-FEMC 2.2.3a, c, and d).				
A short term (< 1 year)		FEMC	StM-FEMC-2.2.4a	Staff Turnover, Retention, and Succession Management: Design a bonus incentive program for those who return after their first year, if they have proven to be productive (see actions # StM-FEMC-2.2.4b and c).			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.2.4b	Staff Turnover, Retention, and Succession Management: Outsource the controls programming and major troubleshooting to a manufacturer's authorized controls representative contractor (see actions # StM-FEMC-2.2.4a and c).			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.3.5a	Construction: RPSC to prepare a written procedure for incorporating a construction readiness review into all project planning (see actions # StM-FEMC-2.2.5b and c).		RPSC FEMC	9-Jul-07	

* Criteria for determining priorities can be found on Sheet 2 of the electronic version of this Excel workbook.

timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		FEMC	StM-FEMC-2.3.5b	Construction: RPSC to draft a procedural material submittal policy that will follow all industry best practices and standards (incorporated into the 4th quarter of FY08). (See actions # StM-FEMC-2.2.5a and c).		RPSC FEMC	31-Aug-07	
A short term (< 1 year)		FEMC	StM-FEMC-2.3.5c	Construction: RPSC to produce a draft plan for incorporating material operations and movement into the SP Logistics department, including computerized tracking of all materials (see actions # StM-FEMC-2.2.5a and b).		RPSC FEMC	14-Sep-07	
A short term (< 1 year)		FEMC	StM-FEMC-2.4.2a	Engineering: RPSC to develop a "not to proceed" construction policy as follows: Within one year, RPSC will not proceed with construction for any project that does not possess Approved for Construction drawings (see action # StM-FEMC-2.4.2b).			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.4.3	Engineer/Architect Staffing: RPSC to obtain adequate resources internally or externally to provide needed professional support to meet design requirements. All completed drawings to include Registered Architect and/or Professional Engineer seal.			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.4.4a	Design and Design Review: Within one year, improve and expand open communication with NSF, grantees, & RPSC on all design assignments (see action # StM-FEMC 2.4.4b).			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.4.5a	Standardization of Equipment and Components: Within one year, publish a standardized equipment/component list, and obtain agreement from all parties (see actions # StM-FEMC-2.4.5b and c).			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.5a	Planning: Establish a policy for assessing schedule impacts prior to approval of new projects (see actions # StM-FEMC-2.5b and c).			2-May-08	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		FEMC	StM-FEMC-2.5b	Planning: Build clearly identified contingency into all construction schedules. - RPSC and NSF to determine level of contingency to include. - RPSC to present findings to NSF and, if necessary, request additional funding to add contingencies (see actions # StM-FEMC-2.5a and c).			2-May-08	
A short term (< 1 year)		FEMC	StM-FEMC-2.5c	Planning: - Establish a realistic timeline to create, review and prioritize schedules. - Establish realistic deadlines for go/no-go on work. - NSF to buy-in on realistic schedules and baselines (see actions # StM-FEMC-2.5a and b).			2-May-08	
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.1	Data Management: Create/update the data management, ownership, and transport policy.				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.10	Bandwidth Tiger Team: Create a project to research all possible avenues/alternatives to the current satellites and develop a clearly defined plan of action.				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.2	Bandwidth: Create a contingency plan and subsequent operating procedures to respond to a major reduction and/or outage of satellite connectivity.				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.3	Bandwidth: Propose/fund a project to identify ways to optimize the MARISAT and GOES bandwidth.				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.4	SPTR-2: As 93% of current outbound traffic is transported via the “at risk” TDRS F1 satellite, it is important that senior management give the SPTR-2 project highest priority with respect to other important projects.				

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.5a	EMI: Create a project to evaluate South Pole EMI (see actions # StM-IT&C-4.5b and c).				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.5b	EMI: Allow SPAWAR to send a team to Pole this summer season to aid in locating the source of recent EMI activity (see actions # StM-IT&C-4.5a and c).				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.6a	Land Mobile Radios: RPSC to provide a hardened LMR dial plan (see action # StM-IT&C-4.6b).		SPSM-IT and IT O&M (RPSC)		
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.7	Architecture and Standardization: Create a project to assess current architecture and standardization opportunities, complete with a recommended plan of action.				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.8	Automation Tools: Create a project to assess current automation tools, complete with a recommended plan of action.				
A short term (< 1 year)		IT-COMMS	StM-IT&C-4.9	Off-shoring: Create a project to assess off-shoring technologies and opportunities, complete with a recommended plan of action.				
A short term (< 1 year)		Logistics	StM-LOG-3.1.1	Re-supply: NSF to define what it means for South Pole to be "fully decoupled."		Dave Bresnahan, Jerry Marty (NSF)	15-Jun-07	
A short term (< 1 year)		Logistics	StM-LOG-3.1.10	Inventory: RPSC/NSF to review inventory requirements needed to support populations in increments.		Paddy Douglas (RPSC), Jerry Marty (NSF)	31-Aug-07	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		Logistics	StM-LOG-3.1.11	Logistics Facility: RPSC/NSF to evaluate the functionality of the current LO design		RPSC: SPSM, EH&S, Paddy Douglas; NSF: Jerry Marty	31-Aug-07	
A short term (< 1 year)		Logistics	StM-LOG-3.1.2	Waste: RPSC to develop a timeline to address the processing of backlog waste.		Mark Furnish, Paddy Douglas, Bill Turnbull (RPSC)	1-Aug-07	
A short term (< 1 year)		Logistics	StM-LOG-3.1.3	Waste: RPSC to submit a proposal for the shredder for the FY07 APP/this season's vessel.			31-May-07	
A short term (< 1 year)		Logistics	StM-LOG-3.1.4	Inventory: RPSC to identify materials that will need higher inventory control.		Paddy Douglas (RPSC)	20-Mar-08	
A short term (< 1 year)		Logistics	StM-LOG-3.1.5	Materials: Implement a submittal review process.		Fred Lehn (RPSC)	2-Jul-07	
A short term (< 1 year)		Logistics	StM-LOG-3.1.6	Retrograde: Develop and fund a retrograde project.		Derrold Kimmes, Paddy Douglas	20-Mar-08	
A short term (< 1 year)		Logistics	StM-LOG-3.1.7	Retrograde: Identify retrograde material.		Derrold Kimmes, Paddy Douglas	20-Mar-08	
A short term (< 1 year)		Logistics	StM-LOG-3.1.8	Retrograde: NSF to decide what to do with discontinued science materials that are still on station.		Scott Borg, Jerry Marty (NSF); Paul Sullivan (RPSC)	1-Aug-07	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		Logistics	StM-LOG-3.1.9	Storage: RPSC to review impacts and advantages of utilizing vacant spaces for winter DNF storage.		RPSC: FEMC, BK Grant, Paddy Douglas, Paul Sullivan; NSF: Jerry Marty	20-Mar-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.11a	Waste Collection: Review BOD to discover planned facilities not yet installed and learn why some existing ones are not functioning as envisioned (see actions # StM-OPS-2.2.11a-d).	Reduced labor in VMF; reduced labor and risk for waste handlers (especially in Dark Sector); improved hygienic conditions for Dark Sector personnel		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.12a	Fuel Storage: Establish new estimate of bulk and emergency fuel needs (see actions # StM-OPS-2.2.12b and c).	Permanent solution will allow design that reduces labor and increases safety		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.1a	Equipment Operations: Outsource snow machine maintenance to McMurdo.	Reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.1b	Equipment Operations: Analyze loader fleet pool options (see action # StM-OPS-2.2.1d).	Reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.1c	Equipment Operations: Establish 3rd shift in heavy shop (see action # StM-OPS-2.2.1f).	Reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)		2-May-08	

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Optimization of South Pole Operations
Action Items Tracking Spreadsheet

timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		OPS	StM-OPS-2.2.2a	Food Growth Chamber: Establish consensus on goal/purpose for FGC (see action # StM-OPS-2.2.2b).	Reduced Operations tasking and monitoring		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.3a	Food Services: Potentially move Food Service Materials person into Logistics group (see actions # StM-OPS-2.2.3b and c).	Improved food safety; slightly reduced labor through more efficient materials movement and tracking		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.4a	Extended Season: Execute Basler Winfly (see actions # StM-OPS-2.2.4b and c).	More efficient and safer summer season start-up; better employee retention (and lessened attrition); reduced/eliminated severe summer population spikes/peaks		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.5a	Training: Propose and design new training plan and program; develop training tools (see actions # StM-OPS-2.2.5b and c).	Vastly improved seasonal transitions for all worker/projects; better worker retention; improved safety		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.6a	Technology: Develop proposal for information monitoring and tracking; research software and hardware available for surveying snowdrifts, tracking maintenance and equipment usage data, etc. (see actions # StM-OPS-2.2.6b and c).	High potential for dramatically reduced labor and equipment operations expenditures and moderate reduction in staffing; potential for off-site monitoring, analysis, trouble-shooting, and decision making resulting in reduced staffing		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.7a	Shift Work to Winter: Carefully review IMS to identify what activities planned for the upcoming summer season might be moved to "shoulder" season performance; make list for study of impacts (see actions # StM-OPS-2.2.7b and c).	Potential for labor reduction in summer season as a function of seasonal task "smoothing"		2-May-08	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		OPS	StM-OPS-2.2.8a	Personnel Issues: Create incentives; overhire for attrition, foster teamwork (see actions # StM-OPS-2.2.8b and c).	Potential for major reduction in re-work labor; potential for major improvement in complex systems understanding and operation thus reducing need for persistent outside review and assistance		2-May-08	
A short term (< 1 year)		OPS	StM-OPS-2.2.9a	Planning/Scheduling: Confirm sequence of schedule development and commitments; identify steps where thorough operations review is required to ensure full understanding of support needs (see actions # StM-OPS-2.2.9b and c).	Potential for reduction of labor hours due to better, more complete development of performance needs of each project		2-May-08	
A short term (< 1 year)		Science Support	StM-SCI-4.1.2	Cryogenics: Projected LHe usage for FY08 is roughly 60% of current consumption. Determine whether to purchase, ship, and store the same amount as in FY07 (resulting in a surplus for use in FY09) or to purchase, ship, and store proportionately reduced amounts for FY08 only.				
A short term (< 1 year)		Science Support	StM-SCI-4.1.3	Project Decommissioning: NSF to decide whether or not to create a sanctioned "end date review group" to conduct periodic reviews of science events that request extensions.				
A short term (< 1 year)		Science Support	StM-SCI-4.1.7a	Proposal Guidance (adding information about constraining resources and USAP/South Pole standards): Address the issue at the SPUC and identify SPUC and SCOARA representatives for a working group to collaborate with NSF Antarctic Science and RPSC South Pole support and Science Planning Group departments to draft proposal guidance (see actions # StM-SCI-4.1.7b and c).			12-Jun-07	
A short term (< 1 year)		Science Support	StM-SCI-4.1.7b	Proposal Guidance (adding information about constraining resources and USAP/South Pole standards): Target the definition of the constraining resources and USAP/South Pole standards by the working group by 30 September 2007 (see actions # StM-SCI-4.1.7a and c).			1-Oct-07	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		Science Support	StM-SCI-4.1.7c	Proposal Guidance (adding information about constraining resources and USAP/South Pole standards): Antarctic Science (Scott Borg) and RPSC Science Support (Steve Kottmeier) revise the proposal guidance narrative and submit to NSF (Winnie Reuning) by 31 January 2008 (see actions # StM-SCI-4.1.7a and b).		Scott Borg (NSF) and Steve Kottmeier (RPSC)	21-Jan-08	
A short term (< 1 year)		Services	StM-SERV-1.2.3.1a	Waste Management Facility: RPSC to modify interim waste processing facility to provide adequate ventilation for workers (see actions # StM-SERV-1.2.3.1b and c).		S. Myers, R. Carpenter (RPSC)	2-May-08	
A short term (< 1 year)		Services	StM-SERV-1.2.3.3a	Waste Management Plan: RPSC to develop South Pole Waste Management Plan that identifies waste characterization, packaging, storage, transport, and disposal methods (see actions # StM-SERV-1.2.3.3a-e).		M. Furnish (RPSC)	2-May-08	
A short term (< 1 year)		Services	StM-SERV-1.2.3.3b	Waste Management Plan: RPSC and NSF to develop a South Pole Waste & Release Minimization Plan that identifies methods and strategies to reduce the amount of waste generated and the type of materials that are expected to be released to the surrounding environment (see actions # StM-SERV-1.2.3.3a-e).		S. Myers (RPSC), M. Montopoli (NSF)	2-May-08	
A short term (< 1 year)		Services	StM-SERV-2.3.1a	Safety: NSF to provide an OPP Safety Vision & Policy statement for USAP participants.		M. Montopoli (NSF)	21-Sep-07	
A short term (< 1 year)		Services	StM-SERV-2.3.1b	Safety: RPSC to draft implementation plan for reducing on-ice injuries, including recreational.			14-Dec-07	
A short term (< 1 year)		Services	StM-SERV-2.3.1c	Safety: RPSC to improve timeliness of SHIELD reporting.			21-Sep-07	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		Services	StM-SERV-2.3.1d	Safety: RPSC to set up safety meetings with other USAP agencies to make sure safety goals are aligned.			14-Dec-07	
A short term (< 1 year)		Services	StM-SERV-3.3.1a	Occupational Health: RPSC EH&S and Medical to ensure SP participants receive priority for occupational health testing (hearing conservation, respirators) while at McMurdo Station.		RPSC EH&S, Medical	12-Oct-07	
A short term (< 1 year)		Services	StM-SERV-3.3.1b	Occupational Health: RPSC EH&S to continue developing PPE program; ensure occupational health is incorporated into all major activities, including training, testing, and monitoring.		RPSC EH&S	2-May-08	
A short term (< 1 year)		Services	StM-SERV-4.3.1a	Emergency Response: RPSC to perform gap analysis on current SP emergency response procedures (see actions # StM-SERV-4.3.1b and c).		SP Winter Site Manager, USAP Fire Chief (RPSC)	21-Sep-07	
A short term (< 1 year)		Services	StM-SERV-4.3.1b	Emergency Response: RPSC to define a) McM Fire Dept's responsibilities for SP--including equipment purchase/maintenance/modifications, b) how ARFF personnel are incorporated into SP station population, and c) SP fire brigade's ARFF responsibilities (see actions # StM SERV-4.3.1a and c).		SP Winter Site Manager, USAP Fire Chief (RPSC)	14-Dec-07	
A short term (< 1 year)		Services	StM-SERV-5.3.1a	Medical: RPSC and NSF to review recommendations made by recent/current on-site physicians regarding medical facilities & staffing. Deliverable: RPSC/NSF to publish a timeline of recommended changes (see actions # StM-SERV-5.3.1b and c).		RPSC Medical Director, M. Montopoli (NSF)	2-May-08	
A short term (< 1 year)		Services	StM-SERV-6.3	Retail (early season Post Office staffing): RPSC to continue to recruit early-season retail assistance from the Christchurch office or temporarily assign GA's to the SP Post Office.		RPSC	1-Oct-07	

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Optimization of South Pole Operations
Action Items Tracking Spreadsheet

timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
A short term (< 1 year)		Services	StM-SERV-7.3.1a	Recreation: RPSC to follow up on recreation lifecycle replacement proposal (see actions # StM-SERV-7.3.1a-d).		Jim Scott (RPSC) and Lisa Wright (NANA)	31-Jul-07	
A short term (< 1 year)		Services	StM-SERV-7.3.1b	Recreation: RPSC to re-evaluate SP recreation requirements based on projected populations (see actions # StM-SERV-7.3.1a-d).		Beth Watson (RPSC)	30-Apr-08	
A short term (< 1 year)		Services	StM-SERV-7.3.1c	Recreation: RPSC/NSF to include appropriately sized lounge area(s), a weight room, and small meeting rooms/telephone booths in the proposal for a "Solar Camp" (see actions # StM-SERV-7.3.1a-d).		RPSC FEMC, Sandra Singer (NSF)		
A short term (< 1 year)		Services	StM-SERV-7.3.1d	Recreation: RPSC to add more safety reminders (rules and any training required) to recreation section of the SP Station Guide (see actions # StM-SERV-7.3.1a-d).		Beth Watson, Katy Jensen (RPSC)	1-Sep-07	
B mid term (1-3 yrs)		FEMC	StM-FEMC-2.1.5d	Skill Sets: Develop on-site cross training program for maintenance personnel (see actions # StM-FEMC 2.1.5c and e).				
B mid term (1-3 yrs)		FEMC	StM-FEMC-2.2.3c	Institutional Knowledge: Produce detailed technical procedures, write the standards document, and write an internal training plan (see actions # StM-FEMC 2.2.3a, b, and d).				
B mid term (1-3 yrs)		IT-COMMS	StM-IT&C-4.5c	EMI: Dedicate funding to allow IT O&M to procure and install EMI detection equipment to be available for use year round (see actions # StM-IT&C-4.5a and b).				
B mid term (1-3 yrs)		IT-COMMS	StM-IT&C-4.6b	Land Mobile Radios: RPSC to replace the current handheld radios with the next generation radio that has reformatted functionality that fits better the radio scheme needed at South Pole (see action # StM-IT&C-4.6a).				

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.11b	Waste Collection: Remediate VMF drain system (see actions # StM-OPS-2.2.11a-d).	Reduced labor in VMF		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.11c	Waste Collection: Design appropriate facilities in remote and subterranean infrastructure; schedule and complete facilities (see actions # StM-OPS-2.2.11a-d).	Reduced labor and risk for waste handlers (especially in Dark Sector); improved hygienic conditions for Dark Sector personnel		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.12b	Fuel Storage: If bulk fuel needs are greater than current capacity, design auxiliary fuel storage (see actions # StM-OPS-2.2.12a and c).	Permanent solution will allow design that reduces labor and increases safety		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.1d	Equipment Operations: Pool loaders (coord with FEMC/Log/Ops). (See action # StM-OPS-2.2.1b).	Reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.1e	Equipment Operations: Phase out light vehicle usage.	Reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.2b	Food Growth Chamber: Outsource FGC operation with high value placed on autonomous and remote operability (see action # StM-OPS-2.2.2a).	Reduced Operations tasking and monitoring		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.3b	Food Services: Decide best system for food storage, inventory and movement on station; implement system as facilities become available (see actions # StM-OPS-2.2.3b and c).	Improved food safety; slightly reduced labor through more efficient materials movement and tracking		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.4b	Extended Season: Execute Basler Winfly and late season extension (see actions # StM-OPS-2.2.4a and c).	More efficient and safer summer season start-up; better employee retention (and lessened attrition); reduced/eliminated severe summer population spikes/peaks		by May 2010	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.5b	Training: Implement new training plan (see actions # StM-OPS-2.2.5a and c).	Vastly improved seasonal transitions for all worker/projects; better worker retention; improved safety		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.6b	Technology: Identify and implement desirable solutions (see actions # StM-OPS-2.2.6a and c).	High potential for dramatically reduced labor and equipment operations expenditures and moderate reduction in staffing; potential for off-site monitoring, analysis, trouble-shooting, and decision making resulting in reduced staffing		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.7b	Shift Work to Winter: In concert with development of WINFLY and extended season capabilities, identify activities that should be moved from summer to either shoulder seasons or winter (see actions # StM-OPS-2.2.7a and c).	Potential for labor reduction in summer season as a function of seasonal task "smoothing"		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.8b	Personnel Issues: Explore potential for outsourcing to obtain special expertise, high-skill-level and continuity (see actions # StM-OPS-2.2.8a and c).	Potential for major reduction in re-work labor; potential for major improvement in complex systems understanding and operation thus reducing need for persistent outside review and assistance		by May 2010	
B mid term (1-3 yrs)		OPS	StM-OPS-2.2.9b	Planning/Scheduling: Develop protocol in collaboration with science planning group to ensure accurate and timely operations input to arrive at an integrated schedule for all projects (see actions # StM-OPS-2.2.9a and c).	Potential for reduction of labor hours due to better, more complete development of performance needs of each project		by May 2010	
B mid term (1-3 yrs)		Services	StM-SERV-1.2.3.1b	Waste Management Facility: RPSC to modify interim waste processing facility to provide fire suppression devices adequate to reduce risk of fire that may result from activities performed (see actions # StM-SERV-1.2.3.1a and c).		S. Myers, R. Carpenter (RPSC)	by Feb 2009	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
B mid term (1-3 yrs)		Services	StM-SERV-1.2.3.1c	Waste Management Facility: Provide a permanent waste processing facility at the completed station of sufficient capacity to handle projected annual waste generation (1.09 million lbs.) and containing features adequate to prevent spills and protect worker health and safety (see actions # StM-SERV-1.2.3.1a and b).			by Feb 2010	
B mid term (1-3 yrs)		Services	StM-SERV-1.2.3.4a	Fuel Containment: RPSC and NSF to update the SPCC Plan to reflect current conditions at the South Pole, including IceCube fuel storage and distribution resources (see action # StM-SERV-1.2.3.4b).		S. Myers (RPSC), M. Montopoli (NSF)	10-Oct-08	
B mid term (1-3 yrs)		Services	StM-SERV-1.2.3.4b	Fuel Containment: After appropriate planning and facility review, RPSC to provide containment for vehicle refueling facility at the South Pole consistent with the structure described in the SPSM BOD (see action # StM-SERV-1.2.3.4b).		R. Carpenter, S. Myers (RPSC)	by Feb 2010	
B mid term (1-3 yrs)		Services	StM-SERV-4.3.1c	Emergency Response: RPSC to complete and formalize SP CEMP (see actions # StM-SERV-4.3.1a and b).			1-Aug-08	
B mid term (1-3 yrs)		Services	StM-SERV-5.3.1b	Medical: RPSC to purchase equipment/follow through on changes suggested in joint NSF/RPSC recommendations (see actions # StM-SERV-5.3.1b and c)		RPSC Medical, FEMC, IT-Comms	by May 2010	
C long term (3-5 yrs)		FEMC	StM-FEMC-2.1.5e	Skill Sets: Establish "reach back" services in RPSC main office to provide additional assistance/guidance to field personnel (see actions # StM-FEMC 2.1.5c and d).				
C long term (3-5 yrs)		FEMC	StM-FEMC-2.2.3d	Institutional Knowledge: Produce a detailed procedure manual for all aspects of all systems at the South Pole (see actions # StM-FEMC 2.2.3a, b, and c).				
C long term (3-5 yrs)		FEMC	StM-FEMC-2.2.4c	Staff Turnover, Retention, and Succession Management: Outsource technical design and installation projects and retain project managers for continuity (see actions # StM-FEMC-2.2.4a and b).			by 2012	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
C long term (3-5 yrs)		FEMC	StM-FEMC-2.4.2b	Engineering: RPSC to develop a "not to proceed" construction policy as follows: Within 3-5 years, RPSC/NSF will assign all projects to properly staffed Engineering section with enough time to publish completed designs before commencement of construction (see action # StM-FEMC-2.4.2a).			by May 2012	
C long term (3-5 yrs)		FEMC	StM-FEMC-2.4.4b	Design and Design Review: Within 3-5 years, all project designs to be scheduled 1-2 years ahead of construction, with rolling annual updates (see action # StM-FEMC 2.4.4a).			by May 2012	
C long term (3-5 yrs)		FEMC	StM-FEMC-2.4.5b	Standardization of Equipment and Components: Within 3-5 years, procure only standardized products and change out expired equipment/ components as they become obsolete (see actions # StM-FEMC-2.4.5a and c).			by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.11d	Waste Collection: Design and procure safe, non-contact system for collection and disposal of human waste from remote holding tanks (see actions # StM-OPS-2.2.11a-d).	Reduced labor and risk for waste handlers (especially in Dark Sector); improved hygienic conditions for Dark Sector personnel		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.12c	Fuel Storage: Operate within fuel capacity of station.(see actions # StM-OPS-2.2.12a and b).	Permanent solution will allow design that reduces labor and increases safety		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.1f	Equipment Operations: Eliminate requirement for 3rd shift (see action # StM-OPS-2.2.1c).	Reduced SP fleet maintenance staff by 2 or more by 5th year; frees 1 or 2 VMF bays; reduced parts inventory and hours on machinery (in short term likely increase by 2 in VMF staff)		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.3c	Food Services: Construct/rehab facilities to streamline long-term servicing of large population (see actions # StM-OPS-2.2.3a and b).	Improved food safety; slightly reduced labor through more efficient materials movement and tracking		by May 2012	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
C long term (3-5 yrs)		OPS	StM-OPS-2.2.4c	Extended Season: Analyze results to determine value/benefit as function of cost (see actions # StM-OPS-2.2.4a and b).	More efficient and safer summer season start-up; better employee retention (and lessened attrition); reduced/eliminated severe summer population spikes/peaks		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.5c	Training: Evaluate results; determine value and improvements & modifications needed (see actions # StM-OPS-2.2.5a and b).	Vastly improved seasonal transitions for all worker/projects; better worker retention; improved safety		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.6c	Technology: Use results of tools for making operational decisions; explore additional targets for technology (see actions # StM-OPS-2.2.6a and b).	High potential for dramatically reduced labor and equipment operations expenditures and moderate reduction in staffing; potential for off-site monitoring, analysis, trouble-shooting, and decision making resulting in reduced staffing		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.7c	Shift Work to Winter: Begin operations as defined in actions # StM-OPS-2.2.7a and b.	Potential for labor reduction in summer season as a function of seasonal task "smoothing"		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.8c	Personnel Issues: Arrive at methods to attract and retain proper skill set workers, including reachback and known pool of candidates (see actions # StM-OPS-2.2.8a and b).	Potential for major reduction in re-work labor; potential for major improvement in complex systems understanding and operation thus reducing need for persistent outside review and assistance		by May 2012	
C long term (3-5 yrs)		OPS	StM-OPS-2.2.9c	Planning/Scheduling: Adapt OPP solicitation, review schedule to allow earlier and more complete definition of requirements and schedule development (see actions # StM-OPS-2.2.9a and b).	Potential for reduction of labor hours due to better, more complete development of performance needs of each project		by May 2012	
C long term (3-5 yrs)		Services	StM-SERV-1.2.3.3c	Waste Management Plan: Utilize renewable energy sources, where feasible (e.g. solar, wind), particularly in newly constructed facilities and installed equipment (see actions # StM-SERV-1.2.3.3a-e).			by May 2012	

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timeline	priority 1-10*	Working Group	Action ID	Action Item	Expected Benefits toward Optimization	POC	Due Date	Status
C long term (3-5 yrs)		Services	StM-SERV-1.2.3.3d	Waste Management Plan: Remove demolition waste resulting from SPSM activities from the South Pole within 2 years of its generation, where feasible, reduce volume to facilitate its packaging and removal (e.g. grind wood). (See actions # StM-SERV-1.2.3.3a-e).			by May 2012	
C long term (3-5 yrs)		Services	StM-SERV-1.2.3.3e	Waste Management Plan: Reduce annual waste generation (following completion of SPSM) by 15% (193,000 lbs), yielding annual waste generation of 1.09 million pounds (see actions # StM-SERV-1.2.3.3a-e).			by May 2012	
C long term (3-5 yrs)		Services	StM-SERV-5.3.1c	Medical: RPSC and NSF to evaluate effectiveness of changes made; re-evaluate requirements based on current activities (see actions # StM-SERV-5.3.1b and c).		RPSC Medical Director, M. Montopoli (NSF)	by May 2012	
D long term (5-10 yrs)		FEMC	StM-FEMC-2.4.5c	Standardization of Equipment and Components: Within 10 years, all new on-ice facility equipment and components are standardized (see actions # StM-FEMC-2.4.5a and b).			by 2017	

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Optimization of South Pole Operations Conference Minutes
April 30 – May 2, 2007
St. Michaels, Maryland

Day 1 Monday, April 30, 2007

1:00 - 1:15 Opening Remarks

1. Erick Chiang – Director of Antarctic Infrastructure & Logistics
2. Dr. Scott Borg – Head of Antarctic Sciences
3. Sam Feola – RPSC Program Director

Erick Chiang. The station is on track for an FY10 completion. The Logistics facility is the last step and there are some conflicts to complete. Fifteen years ago, we looked at the station as a very large ship with the intent to automate all systems. That turned out to be cost prohibitive. Our objective today is to 1) make the station work the way it was designed. Clearly there are issues to address that affect everyone. He thanked Sandy for raising important issues like the need to raise standards and responsibilities to ensure the station operates the way it's supposed to. Tasked the team to look for efficiencies; specifically ways to reduce operations and support footprint. The product of the workshop will be information Scott Borg can provide to the scientific community so they can plan how to conduct science in future.

Dr. Scott Borg. Dr. Borg thanked everyone for their efforts. The realization that power issues were problematic started this process. The Requirements Document was begun in 1992, published in 1994 and signed off by NSF in 1996. The Center for Astrophysical research in Antarctica (CARA) designated a peak winter load of 22kva but finished at three times that. The current science requirements are way beyond what went into the original document. Innovative thinking for this working group in particular is important because: 1) it is proposed within the context of the new station which raised awareness of the last proposal to look at constraints/requirements at South Pole, and 2) it will be very critical to have good documentation coming out of this meeting. Once we get a grip on optimal science, we can start looking at a longer future for the station (15 years from now). We will need to roll that information into workshops with the science community to lay the foundation and thinking for when this station reaches its design life.

Sam Feola. From a contractor's perspective, we are setting a new baseline. SPRP was well conceived at the time and its success is obvious. The "build it and they will come" saying was never more true. Today, we are supporting world class science. But, that has resulted in a lot of growing pains as the station is overtaxed in almost every area. A major vulnerability that has been identified is the dependence on satellites for communication and data transmission. Without them, we have no way to get data off the ice timely. The combined knowledge of the people in this room is extremely important. They are the designers, constructors, and operators that are working through the issues; who know what's worked and what hasn't. They know the station limitations and we need to listen to them as we seek innovative solutions. Opportunity equals change and change equals opportunity. If we could go back 15 years, I think we would have considered more contingencies. By not doing that we've burned out some really good people. At this point, we need to plan and execute rather than act expeditionary. There's nothing we cannot do at South Pole; all it takes is planning and resources.

Overview of South Pole Development Planning

John Rand – CRREL Consultant, former NSF SPSM Project Engineer

- Historical perspective of South Pole planning and evolution; highlights of St. Michaels 1 workshop
- Current view on the effectiveness of the SPSM model that was developed 15+ years ago
- Unforeseen challenges drive the need for updating the basis of design model

John stressed the need to not predetermine the outcome of issues. He admitted that the design team underestimated the skill level of the science, operations and maintenance staffs required to run the station. The current state is not effective.

Objectives now comprise two key elements:

- Live within our means, and,
- Manage the population better

To do this, we need to understand station capabilities to continue forward. The main critical issue is people and we need to manage that to meet objectives.

Session 1 Objective

Understand the original requirements and basis of design that specified how the station was intended to function and why, highlight how assumptions and requirements have changed and migrated from the basis.

PowerPoint Presentations: Design Team Members

Randy Yuen / Kevin Culin / Dick Armstrong

- Key facility design principals and assumptions
- Design Capacities: power, fuel, storage, airlift, bandwidth

1. Randy Yuen – NAVFAC-(previous team leader during design)

Requirements document for the development of South Pole included five categories:

1) Science – future requirements only considered 3 things. There were no indications of anything like what is going on now. Population was 75 persons max.
2) Infrastructure – everything in requirements document Water issues should be looked at in a working group session.
3) Logistics – Construction cargo and fuel totaled 194 flights.
4) Environment - SPSM construction phase – 349 flights.
5) Operations & Maintenance

2. Dick Armstrong – Facility/Utility Overview (for Steve Theno, mechanical designer of record)

We do not have any significant code issues at present. However, the Off Galley Exit should be hardened (this exit is the wooden stairs outside Destination Zulu). Since summer camp was going to go away, it wasn't envisioned that we'd keep it; however, we will need to maintain it, issue a change order to design and build a significant set of stairs. Erick challenged that as a given cautioning that unless we understand the downwind impact of that project (the building was designed to have free flow underneath), it could impact the amount of time we have before we can close the project.

Dick also confirmed that existing code details are acceptable versus having to upgrade to current year standards.

- Energy Budget. Erick confirmed that the graph (insert graph page number or some identifying marker here) depicted the actual design estimate and asked where we are today. George indicated that it will be approximately 15-20 percent in the summer but final figures would be based on the population. The plan is to go back to the goal to capture the current waste heat to end up with 100%.
- Water. The station has stood up quite well to the extra hundred people. BK noted that a contributing factor was that all water was not run through the treatment facility (e.g. Summer Camp water goes directly to summer camp). Dick confirmed that, had that not been done, it would have hampered us being able to do what we do now.
- Fire Protection is still compliant with current loading.
- Power system. While the station has held up pretty well under the current population, we are pretty much at the peak so we may have to look at an expansion. The Requirements document did require room for expansion. One area of note is that there could be cooling issues in generator room so we may have to look at an expansion there.
    - Emergency Power. With the additional science loads of SPT and Ice Cube power, it's not likely that the two generators can provide adequate power. During the December 26, 2006 power outage, wiring

issues were discovered and are being addressed. There is an emergency water and snow-melter built into the system. The December 26th incident also revealed some issues with the emergency communications and that is also being addressed. While it was unfortunate that it happened, the situation did uncover some critical issues that are now being addressed. Queries regarding the heat trace being kept on were addressed and it was confirmed that the system is on and turns out to be a pretty low draw. Action Item: Check and verify type of heat tape being used throughout the system. Replace if it's the older type that has heavy draw.

3. Dick Armstrong - Fuel Storage

Dick noted that expansion is not easy due to the physical constraint of the existing pump system. Discussions pursued regarding transferring fuel from the furthest tanks to closer tanks. A portable pump can accomplish this, but not with the fixed pumps. It was noted that we need to be aware of what it takes, in terms of resources (personnel, time), to accomplish this task. Consensus was it is not insurmountable, but it will be very time consuming. The time and personnel required is something that needs to be taken into serious consideration going forward. While it may be possible, it may not be practical in 'manual requirement' terms. If another pump is put in somewhere, we may be able to rise to the challenge. The single pump house is more susceptible to catastrophe (e.g. fire). While adding another building is a possibility, it will increase the footprint. The cascading affect of solutions is another factor to consider going forward. The more we can do off ice to address any situation seems the best solution. Discussions regarding water mist fire suppression systems determined that a waiver may be required for government facilities; however it was noted that these systems were in use in schools in Alaska. Obtaining a waiver is not out of the question. Again the cascading affect comes into effect here in that installing the 'latest and greatest' technology increases the labor and technical skill requirements to maintain it. All elements of any new system need to be considered.

4. Kevin Culin – IT/Comms Systems Requirements

The department was to put in 19 systems and subsystems and they are all in place now. However, we have to add INFOSEC requirements looking forward. Current staffing was discussed and noted that it is close to the post construction numbers with the following exceptions:

- No current back ops support
- A satellite technician is not reflected on the slide, and
- The computer technician has been broken out to several different skill sets (network engineer/server administrator, PC Tech and a Help Desk Technician)

The bandwidth jump in 2006 was caused by a 'steerable intent' installation. The 2009 slide is forecasting the use of TDRSS #3 capacity. Henry Malmgren noted that TDRSS 3 will be paid for by minutes used – a maximum of four hours a day. Clarification followed: TDRSS #1 was dedicated to NSF; however, TDRSS #3 will be shared between NSF and NASA. For the record, our current assumption is 4 hours per day. The reliability of the current constellation was discussed and it was noted that TDRSS #1 could cease functioning any day now but the rest of the constellation is reliable. It was determined that the IT Security requirements do levy a small amount of bandwidth during auditing scans done from Denver; however, they are done during the time the high speed satellites are up. Brian Stone requested a breakdown of distribution of use expectations vs. actual usage.
The depiction of what our projections have been each year and how they have changed versus what we actually use will be important to see in the final document. Inbound vs. outbound data stats would also be useful.

This completed the government overview.

Session 2 – Fact Finding & Issue Identification
Plan vs. Actual and Case Studies

Session II PowerPoint Presentations: RPSC

- Original staffing assumptions
- Population Trends

- Requirements for services and station facilities
- Examples of strained functions:
  - Storage Space (Do Not Freeze)
  - Equipment: Vehicle Maintenance Facility
  - IT / Comms
  - Waste

Introduction by Sandy Singer: we decided to present only a few scenarios to brief to give an idea of what employees at the station actually face. Be prepared to challenge assumptions and methodologies (e.g. do we really have to do it that way and what's preventing us from doing it differently?). As presentations are given, participants are asked to listen to identify root causes, contributing factors and related issues.

<u>Opening Remarks – BK Grant, Area Director South pole</u>

BK Grant stated that RPSC broke out some areas that aren't talked about often in order to increase familiarity with those aspects of the station and what it takes to run the station. RPSC will lead off with discussions of what the science was expected to be and where we are now. The briefing assumed that we are in the transitional stage because we are still in the construction phase.

- Population drives everything else and we are starting to hit limits. Right now we're looking at 300+ people (Tsunami graph). Ways to critically look at the tasks were discussed. The station is oversaturated with the big projects so other things get deferred. Instructions were to clarify the key things (lavender color on slides) that will continue over the next couple of days, so we don't lose focus. How projects flow down from this might be a distinctly different discussion.
- Areas that have increased significantly need a chart with comparisons of positions.
  - Fuels handling and management was not included in original staffing. Current flights exceed 200.
  - Food service requirements have nearly doubled.

While we are under on waste, we do need more than what we've got right now. Right now we cannot effectively provide services in all areas.

BK Introduced the current South Pole staff at the conference:

- Brad Coutu – FEMC Manager
- Patricia Douglas – Logistics Supervisor
- Martin Lewis – Technical Support Manager
- Henry Malmgren – IT Manager
- Liesl Schernthanner – Operations Manager
- Dave Scheuerman – South Pole Area Manager
- Paul Sullivan – Science Support Manager

<u>Paul Sullivan – Manager, South Pole Support – Science</u>

The bulk of power used is in the Dark Sector. A similar chart for operations (what it was in 1996 vs. today) was requested for the final report. Discussions ensued regarding whether the machine shop actually supports all science or just the Dark Sector. Paul confirmed that, although the bulk of support does go to the Dark Sector, anyone can go there for support.

<u>Martin Lewis - Technical Support Manager–Vehicle Maintenance Facilities</u>

Discussions revolved around the various reasons equipment needed so much maintenance. High utilization matches US annual requirements, but in South Pole, that amount is done in four months. Combined heavy equipment use for FY07 was 23,000 hours (the equivalent of starting 8.5 vehicles and leaving them running for the entire summer season). While warm storage is required and was identified in the base design, it does take away maintenance space.

Fleet growth discussions noted that the age of the fleet accounted for approximately 70% of maintenance issues; preventative maintenance made up the remaining 30%. Conditions and weather account for a larger percentage; however, the issue of the age of the equipment does need to be discussed at some point. The average normal life of the heavy equipment is about ten years. We would probably see a reversal of the statistics on newer equipment, but it's important to note that the training learning curve would increase. The amount of electronic systems on newer equipment (e.g. tier 3 emissions requirements, which do not do well in low temperatures), must also be taken into account.

Snowmobile maintenance discussions revolved around the fact that they did not receive the quality of maintenance that they need due to higher priority equipment. For example, if, due to limited warm storage space, the choice is between a crane that holds 10 people, and a snowmobile that holds two, the crane will win out. When maintenance slips, it tends to be on the smaller, lighter vehicles. Perhaps snowmobiles can be supplied to Pole out of McMurdo. Direction was given to use the projected vehicle usage numbers from 1999 vs. total vehicle hours used in FY07 but accurate 1999 data isn't available.

Action item: Calculate the number of hours the manufacturer intended for the vehicle with what we thought we were going to have and what we have now.

Going to three shifts this coming summer will be what's recommended as that will effectively give us four extra maintenance bays. Tasking was given to break out science vs. operations support for equipment by using the criteria that anything that goes across the skyway is typically in support of science. It was noted that this type of discussion is exactly what is needed and should be continued in the working groups.

Discussion on the percentage of time we have functional cranes yielded the conclusion that one was always down, so that left two running at any given time. Fortunately, one was brought down for the SPT erection and a smaller one was also available. The conditions for a hydraulic driven crane are not optimal, but the quality of the equipment is good. This type of discussion should continue in the Operations and Logistics working groups.

Henry Malmgren - South Pole IT Manager – IT

Server distribution and staffing were discussed. All 38 servers are administered by RPSC. We doubled every server putting one in the RF building (backup system) and one in the main station. However, they are not identical so they do require individual maintenance. Current staff is working approximately 60 hours per week and much of the maintenance is not getting done (Security patches, log checks, failures, etc.) Also, the servers are running several types of platforms (Lenox, UNIX, Microsoft, CISCO, etc.) and that requires combined skill sets that are difficult to find and it requires us to physically touch the servers vs. fixing them remotely.

Whether anything would be gained by standardization was discussed. Systems have been reduced from the original scope; however, one of the original objectives was automation; however, automated tools still have to be maintained so in a small environment it doesn't get a net benefit with regards to people. Going to an enterprise solution is the desired outcome, but funding hasn't allowed that. Ideally, administration would occur in Denver which would require 24/7 staffing; this is currently being worked.

Dot1x authentication (initial automated network screening process) would not benefit South Pole with regards to reducing personnel as all laptops have already been screened either in Christchurch or at McMurdo.

The different types of server platforms are historically driven. There are only 5-6 running on Lennox; however, the majority of those are supplier based. Personnel issues boiled down to the need for a helpdesk/server tech and an extra communications technician for the LMR system.

Direction was given to the IT working group to address the need for the amount of redundancy and to optimize.

The most emphasized point for IT is the ever increasing need for WAN bandwidth. This is largely due to the age of the current satellite fleet. While TDRSS 3 is coming on line quickly, it is a shared resource and usage must be scheduled and we won't use it for bi-directional bandwidth. By 2011/2012, the station will be down to approximately 3 hours of bidirectional data per day. The solution is finding alternatives to the current constellation.

EMI problems were briefly discussed. While possible sources could be harmonics on LMAR systems, DDC issues, or power plant gauge interference, there is no way to determine sources at this time.

Patricia Douglas – Logistics

EH&S (Scott Myers) mentioned that the original plan for SPSM had no plans for a waste management facility. Since much of the waste is hazardous and incompatible (needs to be segregated to process), we need to 1) ensure it is labeled and 2) plan for these type of facility as we move forward. The traverse was suggested as an excellent way to move the waste.

Discussions were held regarding identifying types of waste, how it's generated, and ways to limit it. "How would we understand what is coming on station and either not allow it on station at all or educate people regarding what they bring" It was noted that much effort goes towards reusing anything that can become useful, e.g. a crate used to bring food on station can be reused for storage, etc. WHIP forms are also a valuable tool to enable the staff to project what will be coming on station.

Instruction was provided to challenge the process from the front end to reduce waste reduction from the start e.g. don't bring it on station to begin with. That process, when implemented, would create a system where people think about what waste their project supplies would generate.

The issue regarding the station elevator's reliability and amount of functional time was discussed. It isn't used more simply because it doesn't work consistently. Other issues include narrow passageways and heavy fire doors to be negotiated.

Questions that need to be answered are:
- How are we going to actually use the facility?
- Is it going to come even close to the way it was originally planned?
- What kind of workarounds can we come to at this point?, and
- Are there valid issues associated with safety and the way it will actually be used?

The potential for using waste as an energy source was also discussed; ideas such as an incinerator that's environmentally sound, a wood burning boiler or a wood shredder. A purchase proposal has been sent forward. Instructions were to look into the environmental impacts and possibilities of a shredder feeding a wood burning boiler. Discussions should continue within the working groups.
Supplies and cargo handling procedures were reviewed. The objective is to be able to handle the material one time; that means moving it to its final location the first time it's handled. That reduces risks of breakage and increases safety. The slide showed the crew moving materials manually when the wench doesn't work. It is perceived to be a safety hazard.

This concluded case study presentations.

Day 1 – Wrap Up (singer)

Working Group instructions were to designate a note taker to capture all Issues/Options and Actions. Working Group participants can be found under section 1 of the binders. Leads were identified as:
- Brian Stone – Science
- Dave Bresnahan – Logistics
- Jack Buchanan - IT
- Randy Yuen - FEMC
- George Blaisdell - Operations

- Scott Myers - Services
- Note Taker – Issue/Options/Actions

Summary comments noted from the presentations that projects are a main driver to our problems so we need to look at that as a group. The presentations not covered were FEMC and Station Open/Close. Those will be covered in tomorrow's session. All presentations are in the binders.

Day 2 Tuesday May 1, 2007

Opening comments by S. Singer, summary from Day 1, review and direction for working group sessions.

- Operations personnel are making up for providing basically unlimited support for science by deferring resources from other jobs in order to ensure science requirements are always met.
- Backlog Bow Wave showing our backlog shows 5 years of work that needs to be finished. However, we don't always finish all the work that's planned; at least 25% of the planned work is deferred every season. We are not in a place where we can reduce it right now.
- Fleet Management highlighted that heated maintenance space is inadequate. We have three times the equipment anticipated; we need three shifts to adequately maintain the fleet. The age of the fleet and harsh conditions are hard on equipment.
- IT staffing is the number one issue due to technology advancements requiring many different skill sets. The issue of redundancy needs to be addressed. IT is the area of the largest leap of requirements.
- Logistics. Storage space is scattered all over the station. Do Not Freeze requirements for both construction and operational needs are inadequate. Adequate storage will increase power requirements. Processes are not optimal; many workarounds are required that increase safety hazards. Even when the logistics facility is finished in two years, it will need a critical review of its functionality; conceptual changes will be needed.
- Directed all working groups to critically look at all tasks, challenge everything and assume nothing.
- The main assumption in the requirements document was that when SPSM was complete, we would reach a stable state. However, is that a realistic assumption? Will there ever be a time where we will not be planning a new project? We need to focus on forecasting well in advance and planning to meet our needs.

Continue Fact Finding and Issue Identification

Dave Scheuerman – Maintenance Operations

Staff retention was a major topic of concern. Since there's at least a one year learning curve, high turnover of staff seriously impacts the amount of work that can be done. Full time staff would yield better productivity. Some training documentation does exist; for example, some of the folks created their own training videos. However there is still a learning curve on system interaction as no documentation for this exists. It was noted that RPSC is looking at converting contract personnel to full time. This has already been done in the power plant. The reason this hasn't been done in other areas is that a 'net add' of personnel would be realized.

Direction was given to come up with as aggressive a hiring plan for winter as we do for summer. It was cautioned that winter hires are on a year long contract so this would have to be done early. If projects are identified late in the season, this strategy will not work. The suggestion was made to have the leadership team work year round and not deploy as much because that creates a seasonal mindset. This may mean growing a corporate force vs. an on site force. It was also noted that the original staffing plan was not adequate so it may need to be increased.

System complexity: it was noted that RPSC is in the process of working more closely with the design team to simplify the systems. This should definitely be part of how we manage the system.

Off-site training at mock-up facilities - Training of this type prior to deployment also needs to be pursued aggressively. This could also be incorporated into Data Management.

Brad Coutu – FEMC

Over-tasking of resources - projects benefit the station however more projects mean more people and equipment to support them. RPSC identified that all resources are identified in the IMS, but they must be shared among resources. For example, SPSM had new equipment authorized, but utilizing it for other projects until the time it was needed for SPSM resulted in the equipment being run down. The effectiveness of labor is also a concern, e.g. the need for cranes to be walked around from a project on one side of the base to a project on the other side of the base. If it had been understood that was the intent, we could have assessed the incremental impact of using equipment on different projects and perhaps that would have changed the way the equipment was ordered. This results in insufficient planning time for projects to get done in the 100 summer season days. It was noted that these charts reflect two years for building the SPT shield based on the lessons learned from the test build.

George Blaisdell – Traverse Presentation

The goal for the traverse is to be completely autonomous; adding no additional tasking to the station. Four visits a season would mean 125 less flights. The time to get to South Pole would be 20 days and 12 days to get back. Ideally, 30 days is the target. Payback calculations should be done on total dollars committed vs. fuel savings was suggested. Temperature limits of equipment were discussed. An educated guess was in the range of -40 to -50 and rubber tracks can be run to the -65 range if it's kept moving constantly.

The overall cost and how it's allocated over the years compared to constructing a hardened runway will be a little less. The largest expenditure will be the initial capital equipment purchase. Each tractor consumes about the same amount of fuel and the crew cost is less than the unit cost of a flight crew. Maintenance costs are a little less. Rate tables for these numbers are available.

Equipment repair was discussed in the terms of affecting South Pole as unplanned tasking. George related that each traverse will have its own specially trained mechanics and they will carry their own parts. If needed in transit, parts can be air dropped. However, it is possible that a storage bay would be needed. The more likely scenario would be to have it left along the trail then picked up on the way back.

Contingency Planning- What are risks if South Pole plans on the fuel and the traverse fails to deliver it? The risk of failure is about the same as the LC-130's. Search and Rescue would come out of McMurdo.

Other benefits- Since the traverse can handle equipment in a larger state of assembly; that may have greater benefits with reducing the assembly time of components at the Pole, e.g. shield components.

Issues relating to C-17 fuel offload were discussed. Since C-17 engines must be kept running during off load, it causes damage to the runway in the 1 ½ hours it takes to off load 20,000 gallons of fuel. Wheel divots are also of concern. Construction impacts would be approximately 5-7 people for two seasons; then routine maintenance. Power draw would be minimal for landing lights (60kw per light for 20 minutes during landing and take off).

The main question was "why move forward with both the traverse and the runway?" We need alternatives to protect against catastrophic issues. The runway would provide a means to resupply station as a contingency measure.

Sandy Singer – Summer Camp

The bottom line is that Summer Camp has reached the end of its useful life and needs to be either demolished or replaced. The importance of replacing the camp will be evident if we continue our exploration into East Antarctica. Also, the demand for an increased summer population to work off the five year backlog will require the bed space. The recommendation is to design a new summer camp; zero energy, self sustainable, and independent. The same design could also be used for field camp replacements including kitchen facilities.

Erick Chiang's comments and direction to the Working Groups - 5/2/07

- Think about spreading out what's already in your plans. The objective is to finish reduction of backlog (associated with SPSM) by 2010. The objective is how to spread the current workload over four projects.
- NSF will work very hard to make sure no additional tasking comes to South Pole during that time frame. In exchange for that, we do need to focus on providing a definitive year when we will be able to have new science at the Pole.

Day 3, Wednesday, 5/3/07

Sandy Singer - Opening Discussion

- The focus of the group should have thoroughly assessed the current issues within each support function and devised strategies to mitigate them.
- The foundation for an updated management model will have been laid; and clear action items with responsibilities are set forth for continuing the process offsite. *Erick Chiang's comments: as you finalize your reports, we would like to see good, current state descriptions backed up with numbers as possible so that it becomes the baseline for the new desired state. Connect the numbers for current state with the desired state for a report that has more quantifiable information. (*Sandy also directed that reports should link back to the initial requirement as well.
  There should be an understanding of what will change for the next fiscal year and how a phased plan will roll out to the end of the decade and transition from SPSM 'the project' to a realized working station that is the best it can be.
  Sandy – list your short term goals and strategies that could serve as a five year plan to get us into the next contract phase. We need to get to some type of stabilized, steady operational state. That means we have three years to finish SPSM, SPT, and SPTR2 to reach Erick's goal to work off all backlog by 2010.

Erick Chiang - closing comments:

Erick expressed appreciation to Sandy for putting this together and noted it has been a team effort. The fact is the content of this report is going to be our roadmap. The end product will be a station that's not only very impressive, but run efficiently and effectively as a showcase for the program.

Sam Feola – closing comments:

We have accomplished a great deal in the last couple of days. We know some things still need development and for RPSC, this process is just beginning. We have much work to do back in Denver. RPSC participants need to meet at 3:30pm this afternoon to lay out our plan for future tasking. Much of what we've been thinking about, we've gotten on paper. Combined agencies are now addressing the same things. We have been successful; we have common goals we need to collectively go after now.

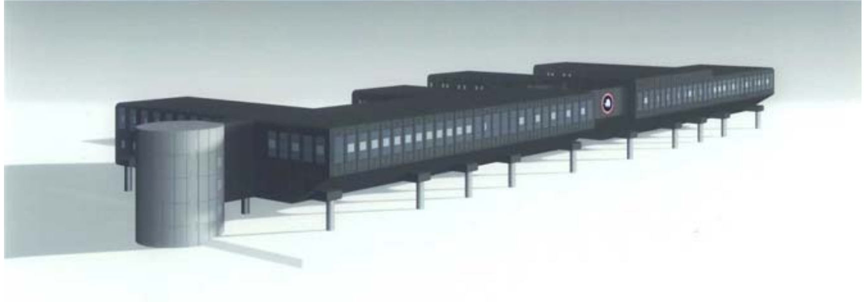
PowerPoint Presentations

1. Introduction, Agenda (S. Singer)
2. Perspectives on Requirements Development and Effectiveness (J. Rand)
3. Requirements for Redevelopment of South Pole (R. Yuen)
4. Design Process – Codes and Requirements (D. Armstrong/S. Theno)
5. Fuel Storage Requirements (D. Armstrong)
6. Electronic Systems Requirements Summary (K. Culin)
7. Optimization of SP Operations (B. Grant, RPSC Team)
    a. Science Support (P. Sullivan)
    b. Operations Case Study (M. Lewis)
    c. IT-Comms Case Study (H. Malmgren)
    d. Logistics Case Study (P. Douglas)
    e. Maintenance Case Study (D. Scheuerman)
    f. Construction Case Study (B. Coutu)
    g. Population and Staffing Case Study (B. Grant)
    h. Additional Information
8. South Pole Traverse: Near-Term Impact on South Pole Station (G. Blaisdell)
9. South Pole Wheeled Runway: Near-Term Impact on SP Station (G. Blaisdell)
10. Summer Camp Becomes Solar Camp (S. Singer)

UNITED STATES ANTARCTIC PROGRAM

Raytheon

Optimization of SP Operations
Raytheon Polar Services Company
April 30, 2007



Workshop: Optimization of SP Operations

Raytheon

Agenda

Day 1: Monday April 30, 2007

1:00 - 1:15	Opening Remarks – E. Chiang / S. Borg / S. Feola
1:15 - 1:30	Overview – John Rand
1:30 - 3:15	Session 1 – Background Assumptions & Requirements
3:15 - 3:30	Break
3:30 - 5:30	Session 2 – Fact Finding & Issue Identification Plan vs. Actual and Case Studies

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Workshop:
Optimization of SP Operations

Agenda

Day 2: Tuesday May 1, 2007

8:00 – 8:45	**Session 3 – South Pole 5 Year Outlook** Pending Operations & Facility Changes Presentations: Blaisdell / Singer
8:45 - 12:00	**Session 4 – Issue Resolution** Working Groups (break as needed)
12:00 - 1:00	Lunch
1:00 – 4:00	**Session 4 – Issue Resolution Continued** Working Groups (break as needed)
4:00 - 5:30	**Session 5 – Key Findings** Preliminary WG Results

Workshop:
Optimization of SP Operations

Agenda

Day 3 Wednesday May 2, 2007

8:00 – 9:00	**Session 6 – Station / Systems Management Model** Plenary: Principles for a 5 yr plan
9:00 – 11:00	**Session 7 – Station / Systems Management Model** Working Groups: Details for 5 yr Plan
11:00 – 12:00	Working Group Writing Time
12:00 - 1:00	Lunch
1:00 – 2:15	**Session 8 – Summary & Final Review** Plenary: Station Management Plan
2:15 - 4:00	**Session 9 – Wrap Up** Plenary: Action Items, Next Steps, Closing Remarks

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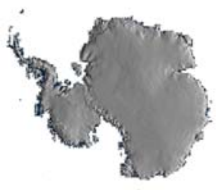

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Polar Services

UNITED STATES ANTARCTIC PROGRAM

Workshop:
Optimization of SP Operations
April 30, 2007

Perspectives on Requirements Development and Effectiveness

by
John Rand

Perspectives on Requirements Development and Effectiveness

Raytheon

Content:

1. Historical Perspective:
   South Pole planning and evolution; highlights of St. Michaels 1 workshop (1992)
2. Current Perspective:
   Effectiveness of the SPSM model that was developed 15+ years ago
3. Future Perspective:
   Unforeseen challenges (population, resources) drive the need for updating the basis of design and operations model

Perspectives on Requirements Development and Effectiveness

Raytheon

1. Historical Perspective

- Late 1980's Growing concerns to support an increasing Science presence
  - deterioration of South Pole Station
  - capability of the Station
  - existing logistics system
- 1990 Metcalf & Eddy Engineering Study completed
  - focus on functional and technical requirements
  - concept centered around keeping the dome and surface structures extending out from the dome
- 1991 South Pole Design Retreat in Enfield, NH
  - maintain the dome as the center design element
  - multiple elevated modular facilities streaming from the dome
- 1991 Ferraro Choi 10 % Design validation study
  - Study concluded that based on the given design parameters and programming requirements, inefficiencies would result from using the dome

Perspectives on Requirements Development and Effectiveness

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Historical Perspective

- **Requirements Verification / Incorporation Process**
  - 1994 Peer, Non-Advocate, Blue Ribbon Reviews
  - 1996 Requirements Document
  - 1996 SPSE Start Design of Garage/Shop in New Arch
  - 1996 SPSE Start Design of Fuel Arch Facility
  - 1997 Augustine Report
  - 1997 South Pole Environmental Impact Statement
  - 1997 SPSE Start Design of New Power Plant
  - 1998 SPSM Start Design of Elevated Station

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Historical Perspective

- **Mar 1992 St. Michaels Systems Management Seminar**

Objectives:

1. **Determine what the nature of the science will be for the next 10-20 years**
2. **Determine the supportability of the science requirements**
3. **Establish an approach to plan for the development of the most effective and efficient support system**
4. **Determine short and long term requirements to correct current station deficiencies**
5. **Meet on-going science programs**

Perspectives on Requirements
Development and Effectiveness

Raytheon

Historical Perspective

- **St Michaels 1992 Results**
  - **Provided a major focus to the future development of South Pole Station and remote scientific facilities**
  - **Through discussions and presentations, all personnel involved obtain an appreciation for the full spectrum of work to be accomplished.**
  - **At the onset, various definitions were discussed, particularly limitations and constraints. As the workshop progressed, realization occurred that many of the givens actually became limitations, and others thought to be constraints were not necessarily so as alternatives were explored.**

Be open-minded. Do not pre-determine the outcomes.

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Perspectives on Requirements Development and Effectiveness

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Historical Perspective

- **St Michaels 1992 Conclusions:**

  1. "It is clear from the St Michaels conference that to accomplish the science that is projected for the future, current logistical capabilities are inadequate, and
  2. pressing life safety and infrastructure upgrades need immediate attention; telecommunications are inadequate for both science and operations, and
  3. there is not enough fuel storage to operate current generators more that 40 weeks at full capacity; therefore future science power demands exceed what can be supported by current fuel delivery systems, and
  4. in order to lessen the environmental impact, alternative energy sources need to be demonstrated now"

Perspectives on Requirements Development and Effectiveness

Raytheon

2. Current Perspective:

A world class science facility has nearly been completed while facing the harshest environmental conditions and managing programmatic limitations that can't support many alternatives. An impressive feat in all areas, however the program planning fell short by under estimating:

1. The growth of science that would be in a parallel path with facility construction
2. The increased technical skills required to operate & maintain the new facilities
3. The true demands for all support, service and staffing activities due to continued elevated population

Because of these deviations, undesirable ripple effects have occurred throughout all functions in terms of labor, materials, equipment, capital, utilities, consumables, processes and human resources.

The current state is not effective.

Perspectives on Requirements Development and Effectiveness

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3. Future Perspectives: Two Key Elements

1. **Live within our means:**

   If there was a directive to increase the station; obtaining high dollar funding and then going through the entire requirements, design, procurement, logistics and construction processes all over again would take a minimum of 5-7 years to realize. Due to the inter-relatedness of the station's capacities and the program's logistical capabilities, there is no choice but to manage with what we have.

2. **Manage population better:**

   Currently it is not possible to realize the end state that was intended by this timeframe; that Summer Camp would be gone and the station population would be managed within 154 persons. Population is a major issue (more likely "THE" issue). The goal is to drive towards the intended capacity, but retain Summer Camp and utilize it for special needs, and not to maintain a steady state of 250 persons.

Perspectives on Requirements Development and Effectiveness

Raytheon

Summary

- The South Pole Station as we know it today, was conceptually developed through an exhaustive review process and approved by the National Science Board.
- The existing requirements are valid in that this station, as designed and constructed, facilitates the program's ability to operate within its resources.
- Increasing capacities is not desirable, the cascading effect becomes unsupportable by the program.
- The charge facing this selected body is to challenge existing methodologies and develop new strategies to optimize the performance within the available resource allocations and current capacities of the infrastructure.

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Workshop:
Optimization of SP Operations
April 30, 2007

Requirements for the Redevelopment of South Pole

by
Randy Yuen

Customer Success is Our Mission

Revised 8/19/03

South Pole Station Requirements Summary

Raytheon

Purpose

- **It was the intent of the OPP to expand the operational capabilities of the Dome station so that a new third generation station could better serve the emerging needs of the scientific community into the 21st century, while preserving the environment.**
- **SPSM was initiated to meet that objective through designing and constructing a suite of projects to modernize the facilities at the Amundsen-Scott South Pole Station.**
- **The foundation of the project and the station rests on the requirements that were developed, validated, and deemed to be adequately in line with program capabilities known at the time.**

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South Pole Station Requirements Summary

Raytheon

Content:

Summarized requirements from the approved document dated August 1996 for the following categories:

- Science
- Infrastructure
- Logistics
- Environmental
- Operations and Maintenance

South Pole Station Requirements Summary

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Science Requirements

- **1990's science included astronomy, astrophysics and aeronomy, biology, earth sciences, seismology, climate systems and glaciology.**
- **Future Science requirements were forecast to include**
  - 5 or 6 major multi-meter aperture telescopes for the Center for Astrophysics Research in Antarctica (CARA)
  - Expansion of South Pole Infrared Explorer (SPIREX)
  - Expansion of Antarctic Muon and Neutrino Detector Array (AMANDA).
- **Site Development support would include works in the Clean Air, Dark, Quiet, Downwind and Operations Sectors.**

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Science Requirements

– Electrical Power Support, load in KVA:

	Area (sq. ft.)	Connected Load	Summer Peak	Summer Avg	Winter Peak	Winter Avg
Existing Facilities	31,697	765	275	197	354	211
Future	6,400	150	35	26	49	33
Totals	38,097	915	310	223	403	244
Total (kw)		824	279	201	363	219
Watt/sq ft		21.6	7.3	5.3	9.5	5.8

South Pole Station
Requirements Summary

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Science Requirements

– Science Population:

Population	Current summer	Current winter	Construction summer	Construction winter	New station summer	New station winter
Totals	40	8	50	10	75	20

South Pole Station Requirements Summary

Raytheon

Infrastructure Requirements

– Electrical Power Support, load in KVA:

	Connected Load kW	Summer Average Running Load kW	Winter Average Running Load kW
Science	824	201	219
Operations	805	340	303
Totals	1629	541	522

South Pole Station Requirements Summary

Raytheon

Infrastructure Requirements

– Water Systems

- Water storage was sized for 40 GPD/person and 150 people. Facility to provide 2 days storage of treated water (12,000 gallons) and ½ day of raw water.

– Sewage Systems

- The sewage system shall recycle gray water for toilet flushing and treat black water.

– Power production

- The power requirements were 608 kW in the summer and 554 kW in the winter with a total peak of 881 kW.

South Pole Station Requirements Summary

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Logistic Requirements

– **Data from the 1993/1994 season**

People, O&M, Science	1,349,762 lbs	55 flights
Construction Cargo	1,213,987 lbs	51 flights
Fuel (318,250 gallons)	2,164,114 lbs	88 flights
Totals		194 flights

– **SPSM Construction Phase**

People, O&M, Science	1,349,762 lbs	55 flights
Construction Cargo (people, fuel & cargo)	4,944,000 lbs	206 flights
Fuel (318,250 gallons)	2,164,114 lbs	88 flights
Totals		349 flights

South Pole Station Requirements Summary

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Logistic Requirements

– **Post Construction Phase**

686 Passengers	213,000 lbs	9 flights	
O & M Cargo	1,213,987 lbs	52 flights	
Science Cargo	241,725 lbs	10 flights	
Construction Cargo	N/A		N/A
Fuel (393,000 gallons)	2,751,000 lbs	116 flights	
Totals		187 flights	

Based on LC-130 aircraft with 24,000 lbs per flight capacity

South Pole Station Requirements Summary

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Logistic Requirements

– **SPSM Phase Staffing Requirements**

- 80 persons per season
- 9 specific new positions:
  - cargo handling (3)
  - waste retrograde (2)
  - Materials management (4)

– The additional 9 persons are included as part of the 80 person construction force.

South Pole Station Requirements Summary

Raytheon

Logistic Requirements

– **Facility requirements for logistics**

- The Logistics organization requires adequate space to support the following functions.
  - Heated storage for construction cargo (construction only)
  - Cargo berms for construction cargo (construction only)
  - Heated and cold bulk storage for station supplies
  - Do-Not-Freeze (DNF) cargo staging area
  - Cargo cold staging area
  - Warehousing for station supplies
  - Cargo control office
  - Heated and cold flammable storage
  - Waste Management

South Pole Station Requirements Summary

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Environmental Compliance Requirements

- **Permits**
  - A new permit or modification to the existing permit was required for construction activities.
- **Best Practical Technology**
  - Construction and operation systems must support environmental management principles of compliance, conservation and prevention by implementing the following:
    - **Improving fuel storage and containment systems**
    - **Providing for sewage treatment and water conservation methodologies, including gray water recycle**
    - **Constructing thermally efficient buildings and systems and optimizing the use of waste heat**
    - **Maximizing the use of alternative energy sources**
    - **Improving hazardous material and waste storage and staging operations and minimizing waste operation**

South Pole Station Requirements Summary

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Operation and Maintenance Requirements

- **Population requirements:**
  - **These totals include the science requirements stated earlier.**

Population	Construction summer	Construction winter	New station summer	New station winter
Totals	200	53	150	50

Conclusion:

These summaries can be referred to when assessing requirements creep by function.

Design Process - Codes and Requirements

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- Codes and Standards
  - Fire and Life Safety – NFPA, NFPA 101, 1994/1995 editions
  - Other Issues – UBC; NPP 1994 edition, Elevated Station 1997 edition
  - No significant changes, more reliance on fire suppression
- Code Occupancy Classifications
  - Classifications have not changed
  - Exit off galley should be hardened for access to Summer Camp
- Code Occupant Loading
  - Not changed except galley, addressed through schedules
- Station Exiting Occupancy – 150
  - No problems with larger occupancies

Design Process – Population Changes

Raytheon

- Station Design Planned Occupancy
  - Winter – 50
  - Summer – 150
  - Construction Phase - 200
  - Summer now at 245
- Facility Impacts
  - Strained utilities
  - More energy use
  - More power use

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Heating/Ventilation System

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- **100% Waste heat utilization planned in summer**
  - **Supplemental boilers being used now**
- **95% Waste heat in winter, some finishing**
  - **Supplemental boilers being used now**
- **Control optimization required to reduce supplemental heat**
- **Infiltration issues being addressed**
- **Ventilation load increased**
- **CO2 Controllers had issues**

Station Energy Use

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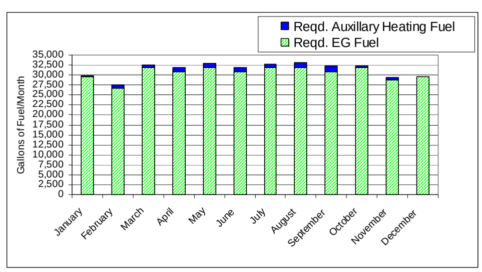
❖ **Energy Budget**

- Goal
- Annual energy use – power generation
- Annual energy use – supplemental thermal energy



Plumbing Issues

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- Water requirements greatly exceed with 245
  - Rodwell has kept up
  - Piping sizing has been adequate
  - Waterless urinals reduced potential impact
  - Rodwell life shortened
  - Station storage adequate, handling addl load
- Sewer
  - Sewer bulb fills faster
  - Lift stations handle extra load
  - Pipe size adequate for higher flow

Fire Protection Issues

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- Dry pipe preaction system installed
- Code compliant less fire hydrants
- Fire water storage adequate
- Mist type system now available
  - Uses less water
  - Uses smaller pipes

Power Issues

- Requirements had 663 kW Peak
  - 771 kW peak in ’06,
  - 711 kW peak in ’07
  - Rodwell #3 would have added 39 kW to peak
- Requirements had 500 kW Average
  - 600 kW average in winter ‘06
- Design had 989 kW peak generation
- Growth potential
  - Change one 239 kW to 750 kW
  - Buss can handle two at 750 kW – 1500 kW
  - Redundant buss exists
  - Engine room cooling possible issue, OSA ducting helps

Emergency Utility Issues

- Emergency Power
  - 2 each, 239 kW available
  - Not adequate for station and science
  - Distribution problems discovered, being addressed
- Emergency Water
  - Emergency snow melter
- Emergency Sewer
  - Redundant emergency sewage bulb
- Emergency Comms
  - Backup radio systems
  - UPS on phone systems
  - Recent outage identified problems, being addressed

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Workshop:

Optimization of SP Operations

April 30, 2007

Fuel Storage Requirements

by

Dick Armstrong

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Revised 04/30/07

Fuel Storage Requirements

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Overview:

- 1990
  - Existing fuel storage 225,000 gallons in uncontained bladders
- 1996
  - Design tasking required:
    - Increase storage to 400,000 gallons minimum
    - Provide secondary containment for all tanks and piping
- 1999
  - Completed project provided:
    - 45 tanks at 10,000 gallons each (nominal)
    - 434,000 gallons usable capacity
    - All arch storage and piping contained with cradles

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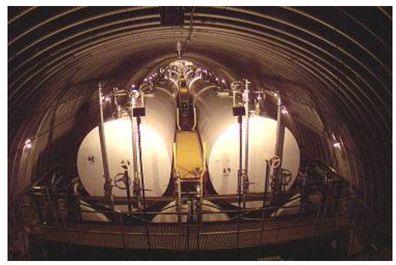
Fuel Storage Requirements

9 Fuel Bladders at 225,000 gallons

1975 - 1998

45 Steel tanks tanks at 450,000 gallons

1999 - Present



Fuel Storage Requirements

Defining the storage requirements:

1. Average winter power demand forecast of 500kw dictated fuel requirements
2. Maximum fuel storage capacity derived from volume available in existing arch, no funds allocated to a new or larger storage shell.
3. Number of flights available for fuel delivery was limited by program airlift capability
4. Constraint: distance from fuel pumps to furthest tank is limited by pump NPSH at 10,000’ altitude; the designed configuration maximized this.
5. Maximum size of tanks dictated by LC-130 cargo cube volume
6. Redundant storage / pumping not deemed a requirement

Fuel Storage Requirements

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Fuel Tank Size Based on LC-130 Dimensions

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Requirements Growth Cycle

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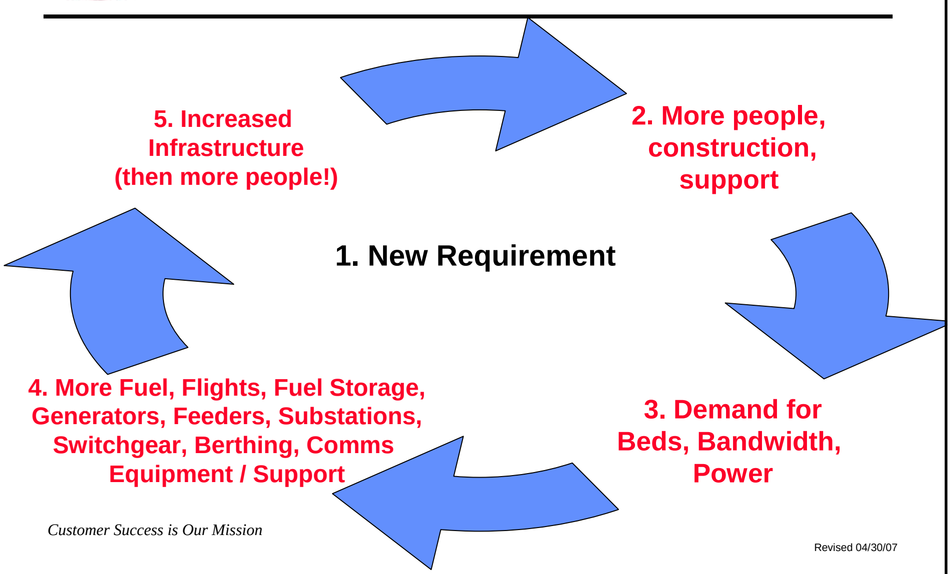

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Fuel Storage Requirements

Fuel Storage Summary

- A 100kw increase in average power demand requires 47,000 gallons of storage which requires 23 more fuel flights to fill that storage.
- Station winter power generation limited by fuel storage capacity
  - Currently 760kw and 478k gallons;
  - no ability to increase current winter demand without additional storage
- There is no place to put additional fuel storage except on the surface.
- No backup pumping and metering module
  - Fire could leave station with only surface capacity of 73k gal.

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Workshop:
Optimization of SP Operations
April 30, 2007

Electronic Systems Requirements Summary

by
Kevin Culin

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Electronic Systems Requirements Summary

- Assumptions
  - The IT element of SPSM lagged in concept maturity compared to the facility component.
  - Initial concepts were limited to:
    - Power to operate the systems would be available
    - Science bandwidth requirements would never exceed the capacity of the TDRSS Relay (45 Mbps)
    - System characteristics dictate the need for staffing, such as
      - Volume of computers and laptops
      - Information security requirements
      - Communications infrastructure
- Requirements
  - Technology changes required flexibility in design implementation
    - 19 separate subsystems planned for implementation at South Pole were to meet or exceed published requirements as of 1998

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Electronic Systems Requirements Summary

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1994 Requirements Document
Forecast Staffing for All Electronic Systems
(Summer & Winter)

Transition Phase

Position	S	W
Management	1	1
MAPCON Support	1	0
Comms Technician	1	1
Computer Technician	1	1
Totals	**4**	**3**

Post-Construction

Position	S	W
Management	1	1
MAPCON Support	1	0
Comms Technician	1	1
Computer Technician	2	2
Totals	**5**	**4**

(Source Table 8-3)

Electronic Systems Requirements Summary

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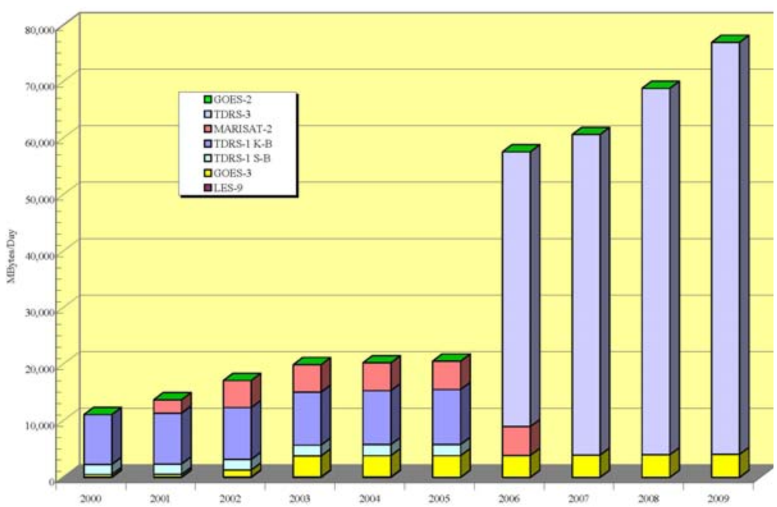
1998 Plan: Total Station Outbound Capacity (Science and Ops)



Electronic Systems Requirements Summary

Raytheon

Requirements were out of sync from the rest of SPSM, the IT component played catch-up as actual requirements became apparent.

- **Power Consumption**
  - **Original power budget was undersized for the data systems actually needed to meet SPSM requirements.**
- **Electrical Power Support**
  - **Sufficient detail was lacking to properly spec power requirements**
- **Bandwidth**
  - **Published science projections = ~907 MB/day for 1998**
  - **Bandwidth scope (SPTR-1) had to be completely reassessed**
- **Staffing**
  - **Newer, more complex systems require broader and more varied skill set of technicians than initially envisioned**
  - **Federal information security requirements being levied on data systems was unforeseen at the current magnitude.**

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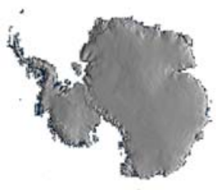

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Polar Services

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Optimization of SP Operations

Session 2: Issue Identification – Case Studies

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Several case studies have been selected for group presentation:

1. IT Services
2. Logistics
3. Facilities Maintenance
4. Vehicle Maintenance Facility

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Optimization of SP Operations

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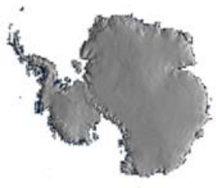
Session 2: Issue Identification – Case Studies

- **Recurring Areas of Concern**
  - **Staffing/ Population**
    - Number of persons required to complete work
    - Skill sets available in competitive market
    - Turnover of personnel
  - **Space**
    - DNF
    - Workspace
    - Storage space
  - **Timely planning and scheduling**
    - Schedule approval early
    - Changing requirements late in cycle
    - Prioritization of work
    - Contingency for unplanned events
  - **Infrastructure support**
    - Bandwidth
    - Satellite availability
    - Power
    - Maintenance
    - Life Cycle requirements
  - **Budget**
    - Support of increasing requirements



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Optimization of SP Operations
Raytheon Polar Services Company
Science Case Study
April 30, 2007

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Session 2: Issue Identification – Science Case Study

Scientific Disciplines	Mar 1996	Apr 2007	Comments
Astronomy, Astrophysics & Aeronomy	5-6 multi-meter telescopes Expanded AMANDA	SPT, BICEP, QUAD, DASI IceCube	DASI telescope for use in future (SPUD) IceCube/SPT > 20 yr
Earth Sciences	Near-real time seismology	SPRESSO	Seismic Arrays in future (GSN)
Atmospheric Research & Monitoring	Clean Air Facility NOAA	ARO NOAA	Next ARO

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Science Project Requirements

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Session 2: Issue Identification – Science Case Study

Sector Designation	Mar 1996	April 2007	Comments
Clean Air Sector (CAS)	Upwind, minimal snow disturbance & contamination	Clean Air Sector defined from ARO	NOAA looking to move CAS further upwind
Dark Sector	Electromagnetic quiet zone	Dark Sector established	SCOARA
Quiet Sector	Minimal vibrations & noise	Quiet Sector established with SPRESSO	Quiet Zone defined around SPRESSO
Downwind Sector	Balloon Launching	Downwind Sector has no permanent occupants	RF Sector defined within Downwind Sector
Operations Sector	Science & Institutional Support Functions	Immediate adjacent area around station	Includes the CUSP antenna field

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Science Sector Requirements

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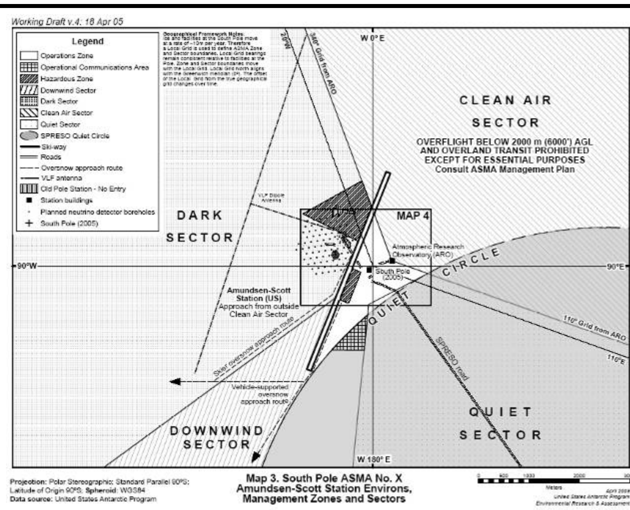
Session 2: Issue Identification – Science Case Study



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Science Sectors in Apr 2007

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Session 2: Issue Identification – Science Case Study

Projected Load KVA	Mar 1996 Table 3.1 SPRP	Apr 2007 Dick Armstrong	Comments
Astronomy, Astrophysics & Aeronomy	Summer Pk – 63 Summer Avg – 48 Winter Pk – 84 Winter Avg - 58	Summer Pk – 277 Summer Avg – 209 Winter Pk – 261 Winter Avg – 199	These disciplines represent about 90% of the total science power footprint
Earth Sciences & Future Remote Science Bldgs	Summer Pk – 35 Summer Avg – 26 Winter Pk – 49 Winter Avg – 33	Summer Pk – 71 Summer Avg – 114 Winter Pk – 71 Winter Avg – 114	Includes SPRESSO and New Cryogens Facility
Atmospheric Research & Monitoring	Summer Pk – 54 Summer Avg – 36 Winter Pk – 64 Winter Avg – 32	Summer Pk – 41 Summer Avg – 38 Winter Pk – 41 Winter Avg – 38	This is the only decrease in science power consumption documented

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Science Electrical Power Requirements

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Session 2: Issue Identification – Science Case Study

Mar 1996	Apr 2007	Comments
Continued support of current science activities	Ongoing	Major changes occurred in Quiet & Dark Sectors
Central Science Facility	B2	Contains common science equipment and wet chem
Balloon Launch Facility capable of 30M cu ft	BIF, no LDB type capabilities	Max capacity for balloons is 19k cu ft
EMI management	SPUC EMI subcommittee	Address specific/broad issues
Machine Shop	MAPO	Future of MAPO
Electronics Shop	IT/Comms & B2	T&M eq. & spare elec. parts
Proper waste methods	Ongoing	Conform with USAP standards
DNF staging areas	In building design	DNF space is at a premium
Cryogens Outside	New Cryogen Facility	LHe & LN2, GHe for balloons

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Science Infrastructure Requirements

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Session 2: Issue Identification – Science Case Study

Mar 1996

- **Ambient Storage of bulk cryogenic helium**
- **No cryogenics technician**
- **LHe: 20 l/day, LN2: 100 l/day**

Apr 2007

- **C/O in Feb 2007 new facility**
- **Controlled environment**
- **Continuous LHe since 2004**
- **Cryogenics tech for 7 years**
- **LHe: 60 l/day, LN2: 75 l/day**

Cryogenics Infrastructure Requirements

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Session 2: Issue Identification – Science Case Study

Cryogenics Infrastructure Requirements

- **Incorporation of cryogenic refrigeration technology results in zero-boil-off (ZBO) system**
- **Use of hard pipe LHe transfer lines to reduce loss rates**
- **Storage dewars with redundant methods for monitoring LHe volumes/weights**

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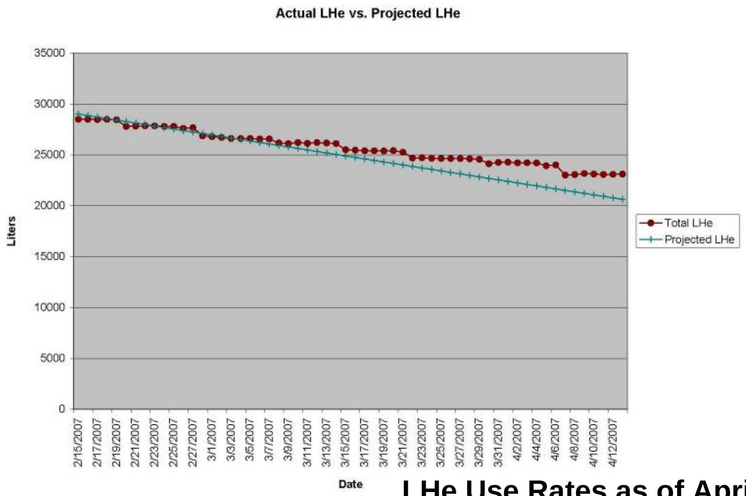
Session 2: Issue Identification – Science Case Study



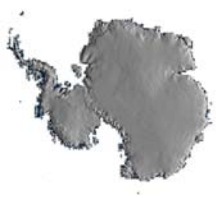
LHe Use Rates as of April '07

Optimization of SP Operations

Session 2: Issue Identification – Science Case Study

Science Population Requirements

Scientific Disciplines	Mar 1996 Summer	Mar 1996 Winter	Apr 2007 Summer	Apr 2007 Winter	Comments
Astronomy, Astrophysics & Aeronomy	27	4	60	9	Includes IceCube Drillers
Atmospheric Research & Monitoring	3	2	2	2	NOAA
Central Science	0	0	4	0	All other disciplines
Others	10	2	0	0	Not represented in Apr 2007
Totals	40	8	66	11	FY07 Average



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Polar Services

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Optimization of SP Operations
Raytheon Polar Services Company
Operations Case Study
April 30, 2007

- **Equipment / Maintenance / Work Orders**
  - Model and Assumptions
    - The BOD and identifies 4 shop maintenance bays totaling 2,520 sq. ft.
    - Current shop space requirements are 10.5 bays (for sustaining operations 3.3 bays, for project support 7.2 bays) The shop space requirements are based on national comparisons for a fleet similar to South Pole
    - Utilizing bays for warm-up of some equipment was also considered in the BOD and is a current practice subtracting from the available maintenance bays
    - Trends appear to be toward a growing fleet for near future based on equipment requests from projects.

Optimization of SP Operations

Session 2: Issue Identification – Ops Case Study

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- **Equipment / Maintenance/ Work Orders:**
  - 1994: BOD based on a fleet size of 20 pieces of equipment with 3 maintenance personnel
  - 2007: Fleet size 61 pieces of equipment with 7 personnel Over 2 shifts
- **Equipment Maintenance Issues:**
  - Inadequate shop space to support equipment maintenance over 2 shifts, if 3 shifts are used current fleet size approaches limit of shop capability and additional staff is needed
  - The sustaining support requirements for the new station are based on the original fleet size identified in the 1994 BOD
  - Equipment support requirements for existing, unanticipated projects has increased the fleet size over original projections
  - Maintenance requirements have increased with fleet size and high utilization over multiple shifts
  - FY07 combined equipment use was over 23,000 hours for all projects (equivalent to operating 8.5 vehicles 24 x 7 for the entire summer season)
  - Winter season and early start up for projects has increased requirements for warm storage of equipment displacing maintenance space during this portion of the season
  - Current shop space for sustaining operations is 3.3 bays for project support 7.3 bays
  - Trends appear to be toward a growing fleet for near future based on equipment requests from projects.

Optimization of SP Operations

Session 2: Issue Identification –Ops Case Study

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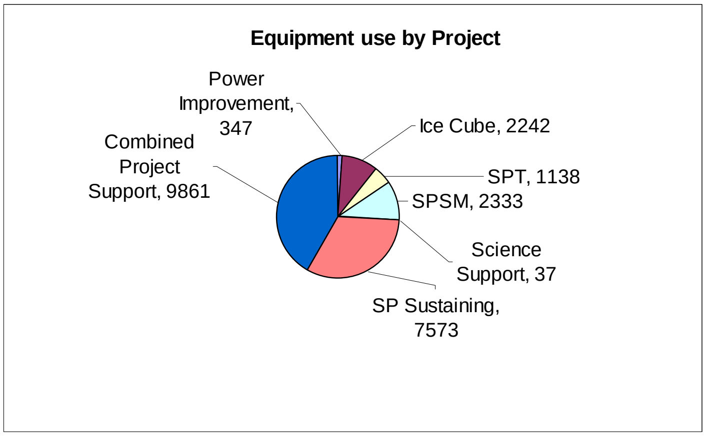
- **Equipment / Maintenance / Work Orders:**
  - **Fleet comparison by type**

	1990 SPSM Plan	Sustaining fleet FY07	Project fleet FY07
Dozers	2	2	3
Loaders	4	4	9
Cranes	1	1	3
Tractors	1	1	1
Light transport	4	2	2
Light track	3	2	2
ARFF support	0	2	0
Snowmobile	4	6	18
Telehandler	1	0.5	0.5
Trencher	0	0	1
Excavator	0	0.5	0.5
Total	20	21	40

Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Equipment / Maintenance / Work Orders:**



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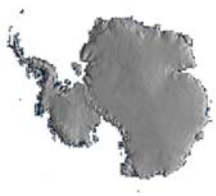

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Optimization of SP Operations

Raytheon Polar Services Company

IT Case Study

April 30, 2007

Optimization of SP Operations

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Session 2: Issue Identification – IT Case Study

- **Communications/Information Technology:**
- **Scope**
  - **Original scope was for 19 subsystems; two subsystems were removed:**
    - After the DOD reclaimed LES-9 satellite the ground station was deleted from the program
    - CATV System was put into indefinite hold from SPSM and programmed funds reallocated
  - **One system, SCADA, was partitioned into several sub-systems such as the DDC Network and never integrated**
  - **Remaining systems are mostly implemented and are in various stages of IOC certification**

Optimization of SP Operations

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Session 2: Issue Identification – IT Case Study

- **Requirements**
  - **Systems implemented at South Pole meet or exceed published 1998 requirements**
  - **Technology changes did dictate changes in design philosophy**
- **Assumptions**
  - **Power to operate the systems would be available**
  - **Science bandwidth requirements would never exceed the capacity of the TDRSS Relay (45 Mbps)**
  - **Systems dictate the need for additional staff**
    - Volume of computers and laptops
    - Information security aspects
    - Increased communications infrastructure

Optimization of SP Operations

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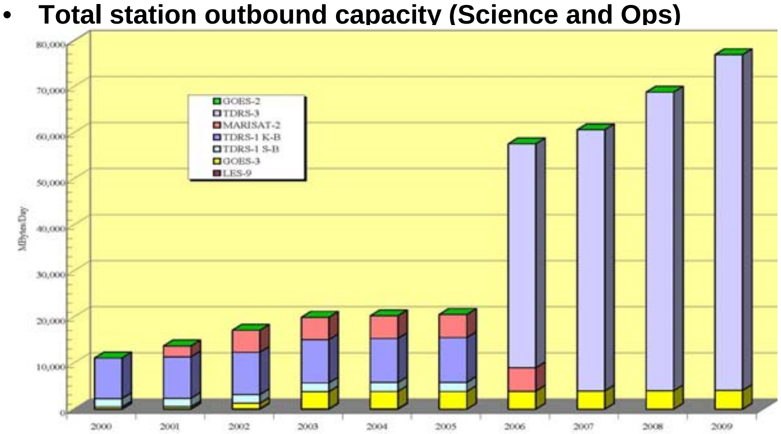
Session 2: Issue Identification – IT Case Study

- **2002 Capacity Plan**
- **Total station outbound capacity (Science and Ops)**



Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

- **Planned Operational Model vs. Actual**
  - **Power Consumption**
    - Telephone System / Network Backbone project
    - Network Management / Network Services project
    - Original power budget was undersized for the data systems actually needed to meet SPSM requirements.
  - **Electrical Power Support**
    - UPS status monitoring implemented only on RF Building UPS
    - RF building & IT Systems loads in SPRP lacked sufficient detail to properly spec power requirements
    - RF Building backup power requirements included a standby generator
  - **Bandwidth**
    - Published science projections = ~907 MB/day for 1998
    - Current science projections = ~50,000 MB/day for 2007
  - **Staffing**
    - Current number, different types and complexity of SPSM communications and data systems is driving a larger and more varied skill set of technicians to support than initially envisioned
    - Increase in federal information security requirements being levied on data systems

Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

- **Issue #1: Increased responsibilities, activities, and tasks**
  - **Increased responsibilities has overcommitted current staff**
    - **Science data systems have expanded in size and complexity (IceCube/SPT) driving increased infrastructure support requirements**
    - **Federal Information Security requirements have increased (monthly standard configurations, vulnerability management activities)**
    - **Number of users and their laptops on station is driving greater support requirements and bandwidth**
    - **Station operations had become more network centric and reliant on technology driving associated increase in distributed computing**
    - **Redundant systems have increased uptime, but induce greater complexity and increased staff support requirements**
    - **Increased complexity of South Pole IT environment requires a more diverse set of skills that can not be found in a single person**

Optimization of SP Operations

Session 2: Issue Identification – IT Case Study

- Issue #1: Increased responsibilities, activities, and tasks
  - Sustaining activities and IT discipline have been compromised in lieu of operational support
    - Configuration and information security management
    - Cable Plant and network as-built records and drawings
    - Operations manual updates for systems and communications
    - Radio dial plans and inventory documentation

Optimization of SP Operations

Session 2: Issue Identification – IT Case Study

- **Communication/Information Technology: Staff requirements**

Year	People	Servers	PCs	Radios	Phones	LAN devices	Technical Personnel
1996	150	2	17	~100	~90	~10	3 Summer 3 Winter
2001	210	8	~ 50	~ 100	~ 120	18	5 Summer 4 Winter
2007	260	66	250*	195	250	45	5 Summer 4 Winter
2008-2013	260	~85	400*	260	300	50	7 Summer 4 Winter
> 2013	154	~85	300*	154	300	50	5 Summer 4 Winter

*** A portion of these PCs are personal laptops brought down by staff, science and other station visitors.**

Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

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1994 Requirements document predicted staffing requirements (Source Table 8-3)

Transition Phase Staffing

Position	S	W
Management	1	1
MAPCON Support	1	0
Comms Technician	1	1
Computer Technician	1	1
Totals	4	3

Post-Construction Phase Staffing

Position	S	W
Management	1	1
MAPCON Support	1	0
Comms Technician	1	1
Computer Technician	2	2
Totals	5	4

Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

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- **Communication/Information Technology:**

2007 Actual and required staffing

2007 Staff

Position	S	W
Management	1	0
Satellite Tech	1	1
Comms Tech	1	1
Server Admin	0	0
Network Engineer	1	1
Help Desk / PC technician	2	1
Totals	6	4

2008 – 2013 Requested Staff

Position	S	W
Management	1	0
Satellite Tech	1	1
Comms Tech	2	1
Server Admin	1	1
Network Engineer	1	1
Help Desk / PC technician	2	0
Totals	8	4

IT works a standard single shift. Help desk services could be increased to 24x7 with an extra person in addition to the above.

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Session 2: Issue Identification – IT Case Study

Base	People	Servers	Phones	Radios/Pagers	PCs	Network Devices	Satellite Systems
NPX	260	66	350	195 Radios	250	54	2 Stationary 2 Mobile
MCM	1200	38	1200	600 Pagers 400 Radios	465	~100	1 Stationary

Base	Help Desk	Server Admins	Phone Techs	Comms Techs	PC Tech	Network Admin	Satellite Tech
NPX	1	0	0	1	1	1	1
MCM	3	3	3	7	4 Town 3 Crary	2	1

Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

- **South Pole is far below industry staffing averages.**
  - **ITAA (Information Technology Association of America) says average IT staffing in a small organization (<500 people) is typically 1:18.**
  - **Average ratio of servers to administrators is 40:1.**
- **To meet industry averages for IT Staffing:**
  - **A 260 person station would require 14 personnel.**
  - **A 150 person station would require 8 personnel.**
- **To meet industry averages for Server administrators:**
  - **We have no dedicated server administrators. We would need about 1.75 FTE to meet industry standards, but can get by with just one.**

Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

- Issue #2 WAN Bandwidth
  - Satellite bandwidth demand continues to grow in parallel with science
    - Science is generating increasingly larger amounts of data for off-continent transfer
    - Increasing pressures to reduce station foot-print will increase demand for bi-directional station-CONUS operations communications
      - IT Help Desk, FEMC work-order, data synchronization, SPAWAR
      - Other opportunities
    - South Pole is becoming a more collaborative station with world-wide institutions and other stations (VTC, data-sharing, real-time comms)
  - Satellite fleet is aging
    - The current satellite fleet is aging and in risk of failure
    - Flight 3 use is unpredictable and expensive due to it being a shared and scheduled priority resource
    - Reduced communications will limit options for reducing station foot-print by hosting activates off-shore
    - Fleet failure will increase demands on station personnel for store-and-forward of queued science data

Optimization of SP Operations
Session 2: Issue Identification – IT Case Study

- **South Pole has three separate but related concerns when it comes to satellite usage**
  - Science transmission capacity (TDRS F1 & F3 Ku-band)
  - Bi-directional Internet capacity (GOES 3, MARISAT F2, TDRS S-band)
  - Low bandwidth e-mail and voice traffic. (Iridium)

Bi-directional Internet capacity is the key to reducing the footprint at South Pole Station. Unfortunately, this is also the most fragile capability of the satellite systems.

Optimization of SP Operations

Session 2: Issue Identification – IT Case Study

- TDRS F1 Launched June 29, 1983
- S-Band bi-directional @ 3Mbps
  - Visible for 6.5 hours/day
- Ku-Band uni-directional @ 60Mbps
  - Visible for 5.5 hours/day

Satellite health extremely poor
- Attitude control system extremely susceptible to cosmic rays resulting in loss of satellite control.
- One axis of reaction control thrusters have failed.
- Fuel pressure extremely low.
- One remaining Ku-Band TWTA (RF Amplifier)
- NASA refuses to predict remaining lifetime for a satellite that should have died 14 years ago.

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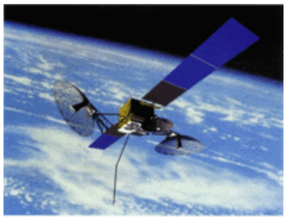

- TDRS F3 Launched Sept 30, 1988
- Ku Band bi-directional communications
  - Northbound ~150Mbps
  - Southbound ~10Mbps
- Requires NASA to realign the TDRS constellation before NSF can use this resource.
  - F7 will move to 85 degrees
  - F3 will move to 49 degrees
- Earth station scheduled for construction at pole during the next two summer seasons.
- Satellite will not be dedicated to NSF mission
  - Will require scheduling on a daily basis
  - NASA will charge NSF for usage on a per minute basis.

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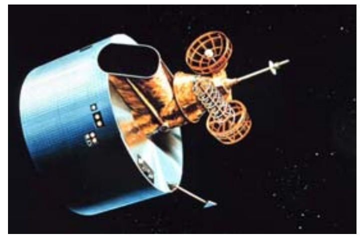
Session 2: Issue Identification – IT Case Study



- GOES-3 Launched June 16, 1978
- 1.5 Mbps bi-directional data.
- 5 hours visibility per day.
  - 4 hours effective due to overlap with MARISAT.
- Thrusters low on fuel.
- Batteries are dead.
- RF subsystem not designed for data, but works well with some ground adaptations.

Optimization of SP Operations

Session 2: Issue Identification – IT Case Study

- MARISAT-F2 launched Oct 14, 1976
- 1.5 Mbps bi-directional data.
- Potential to operate at up to 5 Mbps.
- Visible from Pole for 6 hours daily.
- Fuel status low, depletion estimated in late 2010.
- Batteries are unhealthy.
- Command and control system has known problems.

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- Iridium system activated in 1999
- Real time voice capability
- 2400 bps data capacity
- Pole uses 12 modems multiplexed together effectively providing 28.8kbps.
- 24x7 availability.
- Very healthy satellite constellation
- Large amount of built in redundancy
- Currently NSF has unlimited usage. Costs could increase in the future to a per minute billing.

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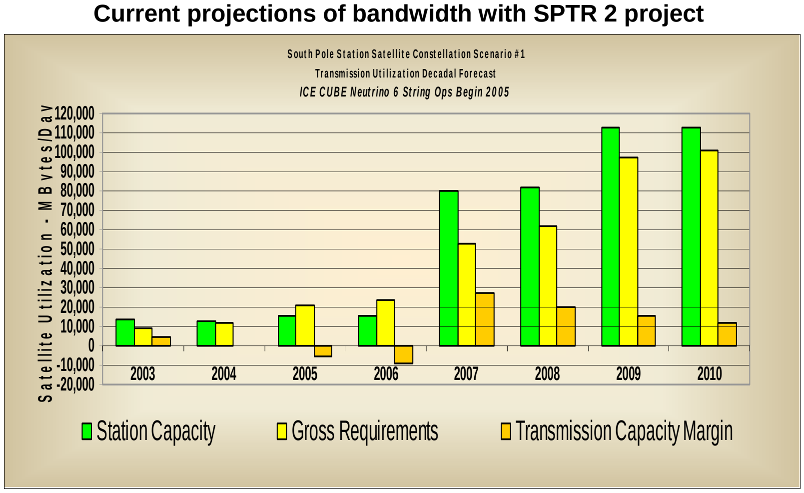
Current projections of bandwidth with SPTR 2 project



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Session 2: Issue Identification – IT Case Study

- Issue #3: EMI (Electromagnetic Interference)
  - Resources to determine direction and sources of EMI are extremely limited and are not continuous
  - As science builds more sensitive instrumentation, EMI becomes a greater community issue
    - Can potentially destroy perishable science data
  - EMI has the potential to interfere with life/safety systems
    - Air to Ground radios were frequently overrun with interference
  - Better EMI management is necessary to preclude affects to science and operations impacts.
  - Real time continuous spectrum monitoring is a necessity to prevent data loss.

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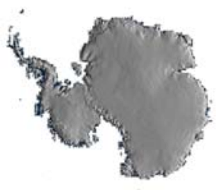
Session 2: Issue Identification – IT Case Study

- **Current known RFI/EMI issues:**

  - Noise sources (other than LMR) in the 375-450 MHz portion of the spectrum
  - Noise sources in the 125 MHz portion of the spectrum. Apparently there is something around 125 MHz that was recently discovered (1/2007)
- - A sweep through the spectrum from 60 Hz to 20 GHz to identify emitters (authorized/unauthorized and/or noise sources). This should probably be done at a few locations: RF Bldg, Dark Sector, and Main Station or BIF
- - Characterization of unlicensed wireless LAN spectrum (e.g. 802.11a, b, & g, WiMAX, etc.). Are there any emitters out there other than those officially approved. Currently we only operate at 2.4 GHz (802.11g). However, someone could have a 5.8GHz (802.11a) device radiating away and not know it



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Optimization of SP Operations
Raytheon Polar Services Company
Logistics Case Study
April 30, 2007

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Session 2: Issue Identification – Waste Case Study

- **Waste:**
  - Briefly addressed in the 1994 Requirements document
    - "Proper handling of waste and all waste will be retrograded"
  - Waste production
    - 2002 - 502,000 lbs
    - 2005 - 986,500 lbs (peak production)
    - 2007 - 852,000 lbs
  - Transition phase staffing = summer 7, winter 2
  - Current staffing is summer 4, winter 1
- **Waste Issues:**
  - Project waste
    - Short term issue due to high volume
    - Backlog has to be processed
    - Time limits for waste removal
  - NYANG shipping requirements
    - Waste wood must be cut to size or shrouded
  - Larger populations = larger amounts of waste
  - Inadequate Staffing
  - Inadequate waste facility for winter processing
  - Unheated polarhaven is the only facility for storing hazardous waste
  - Lack of waste processing equipment
  - Shortage of Air Force pallets program wide

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Session 2: Issue Identification – Waste Case Study

Unheated Polarhaven used for waste processing

Waste wood backlog

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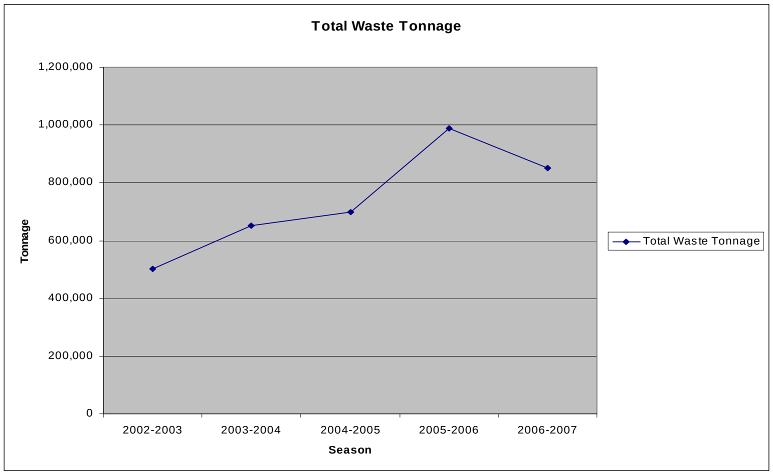
Session 2: Issue Identification – Waste Case Study



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Session 2: Issue Identification – Waste Case Study

YEAR	PROFILE	SPL TOTAL WEIGHTS	10-METER CONTRIBUTION	ICE CUBE CONTRIBUTION	SPSM CONTRIBUTION	NON SUST-OPS PERCENT OF TOTALS
2002-2003	DEMO	0				
	NON-R	177,150				
	WOOD	90,000				
	ALL OTHERS	234,945				
	TOTALS	**502,095**				
2003-2004	DEMO	18,900			18,900	100%
	NON-R	0			0	0%
	WOOD	173,700			118,550	68%
	ALL OTHERS	459,565			64,400	14%
	TOTALS	**652,165**			201,850	55%
2004-2005	DEMO	0			0	0%
	NON-R	205,375			170,650	83%
	WOOD	198,250			139,250	70%
	ALL OTHERS	293,898			88,950	30%
	TOTALS	**697,523**			398,850	57%
2005-2006	DEMO	25,750			25,750	100%
	NON-R	362,350			254,350	70%
	WOOD	143,250			95,250	66%
	ALL OTHERS	531,350			102,900	19%
	TOTALS	**986,500**			478,250	48%
2006-2007	DEMO	17,200	0	0	13,000	76%
	NON-R	366,525	21,600	81,000	86,400	52%
	WOOD	125,800	6,400	11,000	47,000	51%
	ALL OTHERS	509,525	12,045	20,600	24,850	11%
	TOTALS	**852,300**	40,045	112,600	171,250	38%

NOTE1: NO DATA AVAILABLE FOR 10-METER OR ICE CUBE UNTIL 2006-2007.

NOTE2: THREE SOLID WASTE PROFILES ARE ASSUMED TO BE CONSTRUCTION & DEMOLITION- RELATED -- DEMO, NON-R AND WOOD.

NOTE3: "ALL OTHERS" PROFILE TYPE IS DEFINED AS UNRELATED TO CONSTR & DEMOLITION; DOME TOTALS ARE EXCLUDED FROM "ALL OTHERS

NOTE4: THREE CONSTR & DEMOLITION-RELATED PROFILES FROM "DOME" ARE ASSUMED TO BE PART OF SPSM ACTIVITIES.

Optimization of SP Operations

Session 2: Issue Identification – Cargo Case Study

- **Cargo Handling:**
  - **Transition Phase Staffing**
    - Logistics Summer 8, Winter 2
  - **Post-Construction Phase Staffing**
    - Logistics Summer 7, Winter 2
  - **Current Staffing**
    - Summer 11
      - 2 shifts cover 20 hour flight period per day
      - Required to handle volume of inbound and outbound cargo
    - Winter 3

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Session 2: Issue Identification – Cargo Case Study

- **Waste/Cargo Handling:**
  - 1994 levels for reference

– People, O&M, Science	1,349,762 lbs	55 flights
– Construction Cargo	1,213,987 lbs	51 flights
– Fuel (318,250 gal)	1,164,114 lbs	88 flights
– Total	4,727,863 lbs	194 flights

  - SPRP Phase

– People, O&M, Science	1,349,762 lbs	55 flights
– Construction Cargo	<=4,944,987 lbs	<=206 flights
– Fuel (318,250 gal)	1,164,114 lbs	88 flights
– Total	<=8,457,876 lbs	<=349 flights

  - Post Construction Phase

– 686 Passengers	213,000 lbs	9 flights
– O&M Cargo	1,250,966 lbs	52 flights
– Science Cargo	241,725 lbs	10 flights
– Construction Cargo	N/A	N/A
– Fuel (393,000 gal)	2,751,000 lbs	116 flights
– Total	4,456,691 lbs	187 flights

  - Current Airlift based on FY07

– 841 Passengers	280,356	10 flights
– O&M Cargo	781,130	28 flights
– Science Cargo	1,787,113	63 flights
– Construction Cargo	1,059,945	36 flights
– TDE	428,461	13 flights
– Fuel (780,318 gal)	5,462,037	210 flights
– Total	9,799,042	360 flights including airdrop

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Session 2: Issue Identification – Cargo Case Study

- **Cargo Handling:**
  - **Requirements**
    - Post construction phase = 187 total flights
    - No project/construction cargo included in requirements document for post construction phase flights
  - **Cargo Handling Issues**
    - Current and out-year fuel requirements alone > 200 flights
  - **Outyear Projections**
  - **FY08**

• People,O&M,Science	110 flights
• Construction	4 flights
• Fuel	211 flights
• Total	325 flights

  - **FY09**

• People,O&M,Science	86 flights
• Construction	4 flights
• Fuel	203 flights
• Total	293 flights

  - **FY10**

• People,O&M,Science	83 flights
• Construction	37 flights
• Fuel	206 flights
• Total	326 flights

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Session 2: Issue Identification – Cargo Case Study

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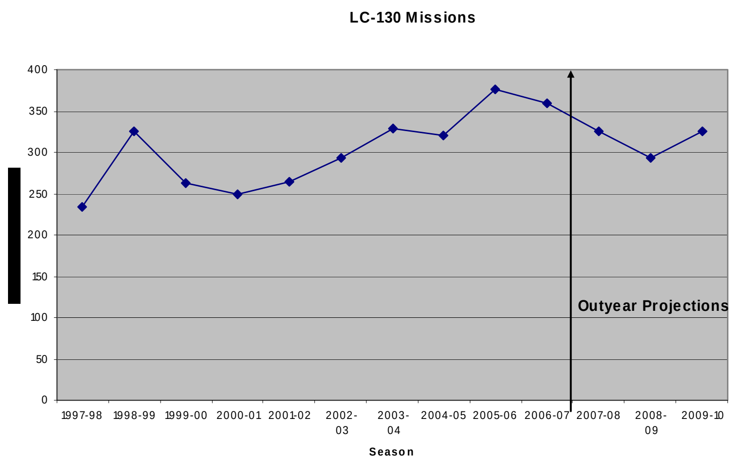

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Session 2: Issue Identification – Cargo Case Study

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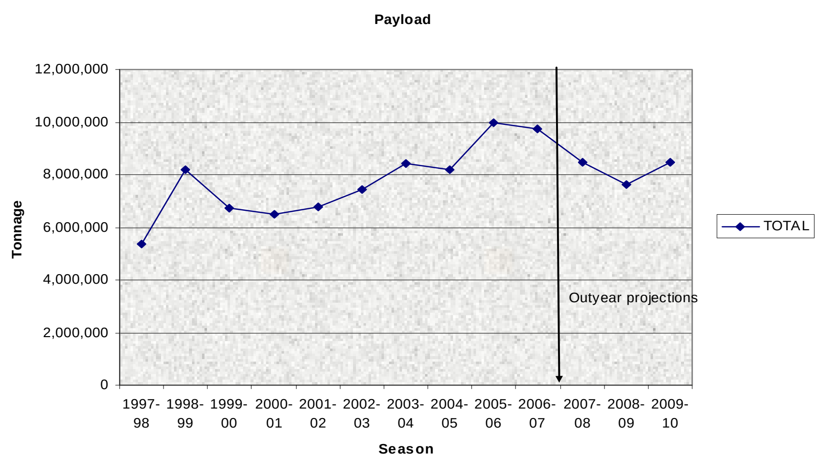

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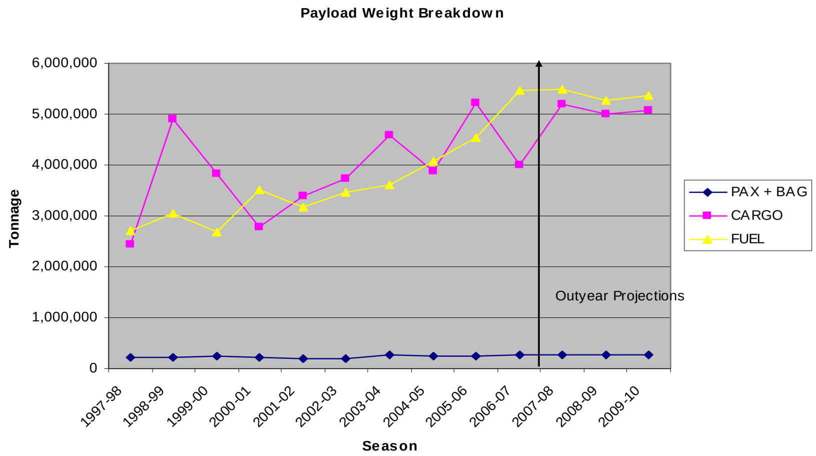
Session 2: Issue Identification – Cargo Case Study



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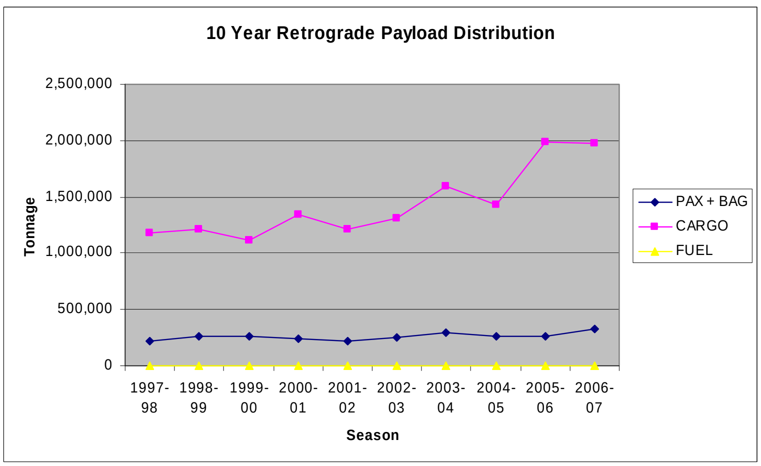
Session 2: Issue Identification – Cargo Case Study



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Session 2: Issue Identification – Storage Case Study

- **Storage Space/Do Not Freeze (DNF):**
  - Basis of Design
    - Storage 53,616 Cubic Feet
    - Of the total 500 cu ft would be DNF
    - Three types of inventory
      - Food – 1 year supply – 29,365 cu ft
      - Parts/supplies – 1 year supply – 24,111 cu ft
      - Hazardous Materials – 130 cu feet
  - Storage/DNF Issues
    - Currently, there is not enough general storage on station and specifically, not enough DNF storage
    - LO facility as currently designed will not provide enough cold or warm storage to support current operational levels
    - For the past 3 years an average of 15,694 cu ft per year of DNF has been received on station (Science 24%, Construction 30%, and O&M 46%)
    - Currently berthing is being used for Winter DNF storage
    - New DNF was constructed but does not solve the problem
    - Out buildings being used for storage (final plot slide)
      - Old Cryo (dnf)
      - Cargo Office (dnf)
      - New DNF (dnf)
      - Cheese Palace (ECW – cold)
      - Black Box (EHS – cold)

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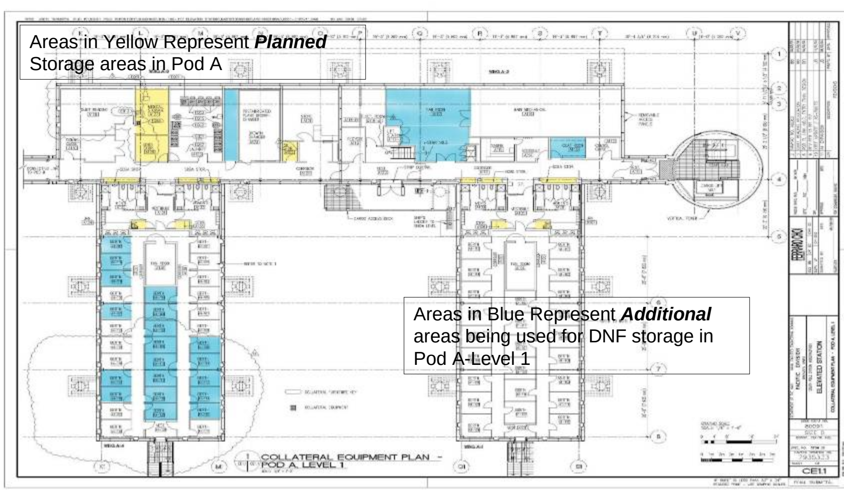
Session 2: Issue Identification – Storage Case Study



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Session 2: Issue Identification – Storage Case Study

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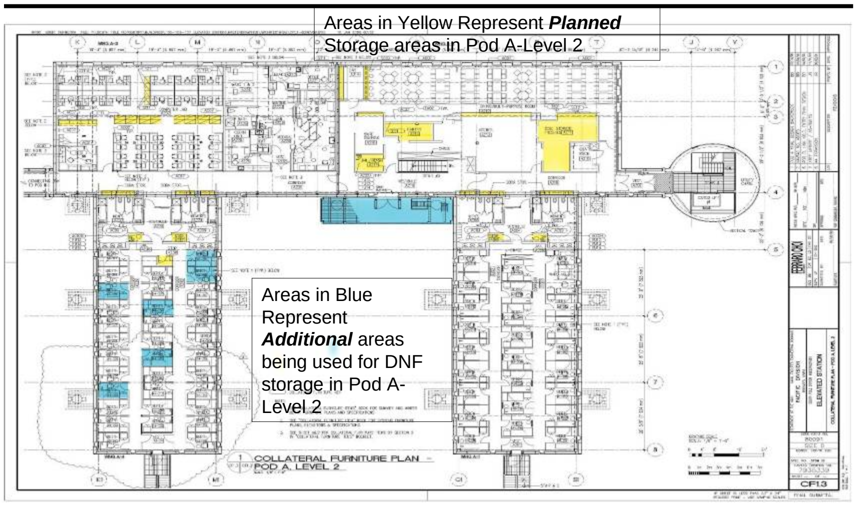

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Session 2: Issue Identification – Storage Case Study

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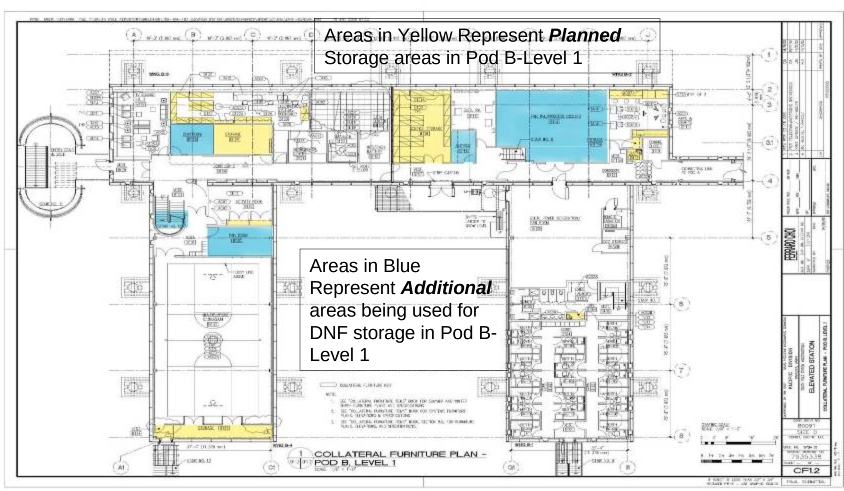

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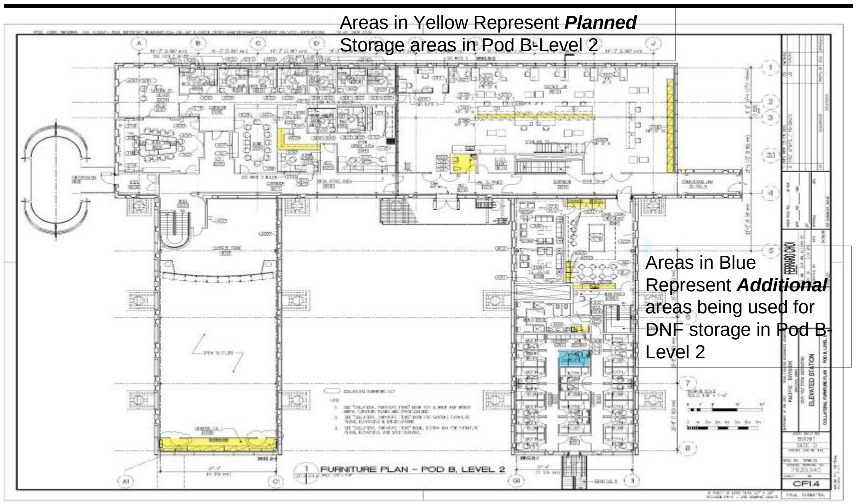

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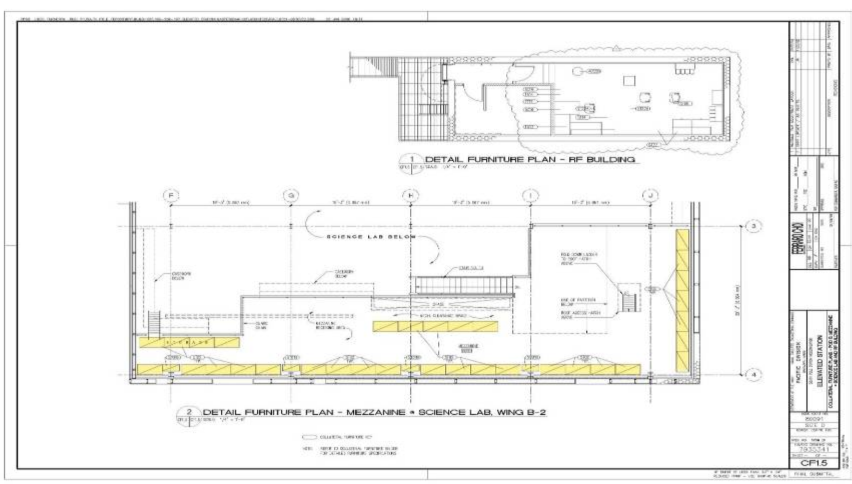

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Session 2: Issue Identification – Storage Case Study

A-2 Level 1 Coat closet

B-3 Coat closet

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Session 2: Issue Identification – Storage Case Study

A-4 berthing used for laundry

A-4 berthing vegetables

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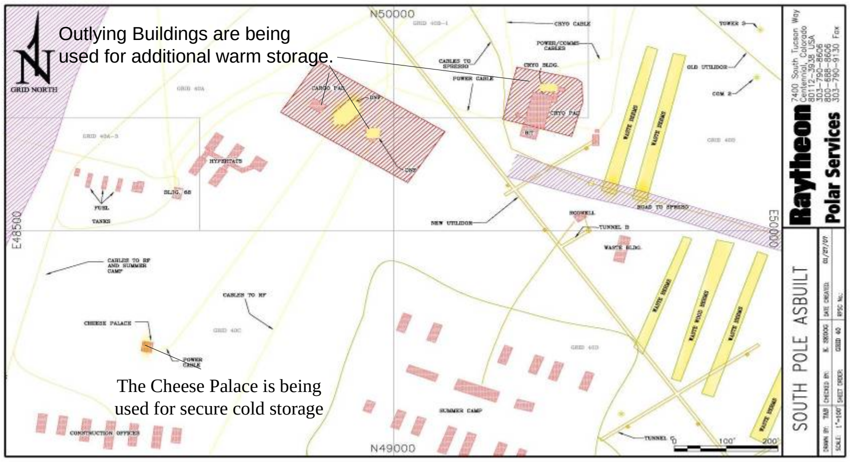
Session 2: Issue Identification – Storage Case Study



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Session 2: Issue Identification – Storage Case Study

New Do Not Freeze Building

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Session 2: Issue Identification – Resupply Case Study

- **Re-supply/Inventory Control:**
  - **Inventory 53,616 cubic feet**
  - **Delivered to Pole via LC-130 during 100 day season**
    - Additional possible delivery methods
      - Airdrop
      - Hardened runway
      - Overland Traverse
  - **Assumption – that normal resupply would be moved to McMurdo via resupply vessel**
  - **Inventory managed via MAPCON data base**
    - Mapcon administrator

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Session 2: Issue Identification – Resupply Case Study

- **Re-supply/Inventory Control:**
  - **Inventory Control Issues:**
    - All inventory is currently in open warehousing
    - Distribution is via the honor system
    - Maintaining good inventory counts is labor intensive
      - Currently, food is inventoried wall to wall twice a year
        - Cycle counts are completed during the year
      - Garage and Power Plant materials are inventoried wall to wall once a year
      - Smaller inventories such as those in Medical and Comms are inventoried with the help of Medical and Comms personnel once a year (this is not an inclusive list)
      - Berms are cleaned and inventoried once a year
    - Inventory levels need to be revisited based on expected populations for summer and winter and re-baselined
    - New Logistic Facility will need to be reevaluated in terms of physical issues
      - Appropriate Inventory levels in line with populations
      - DNF space
      - 10 % grade into facility poses safety and maintenance issues
      - Cargo elevator repaired or changed to a hoist
      - Issues for Passage way 3 need to be addressed (RFI submitted)
        - fire doors/settlement

Optimization of SP Operations
Session 2: Issue Identification – Resupply Case Study

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- **Re-supply/Inventory Control:**
  - **Re-supply Issues:**
  - **Current thinking is to decouple all resupply from the vessel**
    - Resupply food is currently decoupled
    - Housing, Office Supplies and VMF materials such as fluids are decoupled (the original criterion was that decouple material could not have a shelf life, could be stored outside and could be stored in McMurdo easily)
      - All priority 4 material will stay on the resupply vessel with the intent of wintering in McMurdo to be flown to Pole the following season
    - Priority 1, 2, 3 materials would be transported via commercial surface to McMurdo and then flown to Pole
      - If this material arrives in McMurdo early in the season, it will allow us to level our airlift resources
        - Utilize driftable material
        - Make use of opportune airlift when pole is the only destination available due to weather

Optimization of SP Operations
Session 2: Issue Identification – Resupply Case Study

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- **Materials:**
  - BOD for Logistic Facility
    - AFP brought to receiving dock
    - AFP pushed by hand into building
    - AFP is hoisted to de-palletizing area
    - Material is checked in and re-palletized onto 4'x4' wooden pallets
    - DNF is taken to hand stack area and put away
    - Re-palletized material is moved via electric fork lift to cold storage
    - Material that is too long for aisles will be carried by sling to racks
    - Material is moved into the station via passageway 3 and the elevator
- **Materials Issues:**
  - Passageway 3 is experiencing some settlement and fire door issues
  - Elevator is not currently a viable means to move cargo
  - 10% grade into LO will create safety and maintenance issues
  - Currently material movement into the station requires manual labor (gangs)
  - Material storage locations are physically spread out on station

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Session 2: Issue Identification – Resupply Case Study

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Polar Services

Optimization of SP Operations
Raytheon Polar Services Company
Maintenance Case Study
April 30, 2007

Optimization of SP Operations

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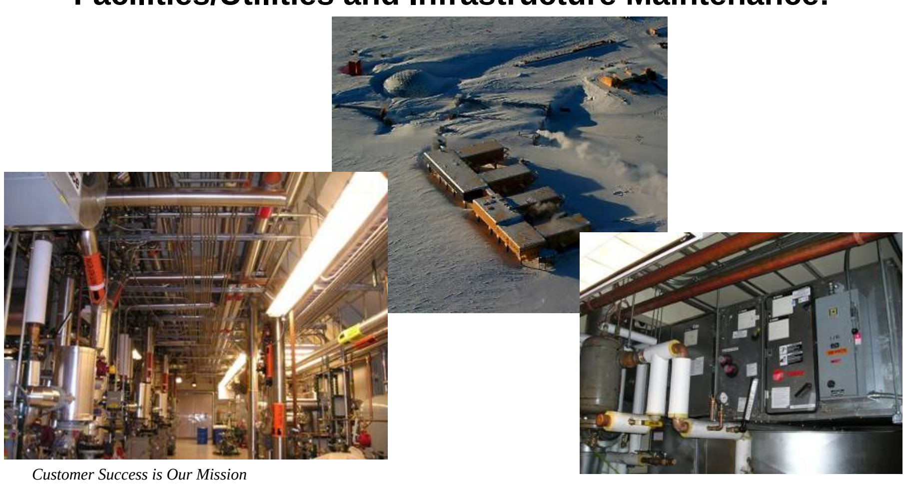
Session 2: Issue Identification – Facilities Maint Case Study

- **Facilities/Utilities and Infrastructure Maintenance:**



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Session 2: Issue Identification – Facilities Maint Case Study

- **Facilities/Utilities and Infrastructure Maintenance:**

Dome Buildings / Station "Low Tech"	Elevated Station "Complex"
Stand Alone Local Controls	Centralized Control System
Manual Generator Controls	Automatic Generator Controls
Waste Heat Recovery	Waste Heat Recovery
Boilers / Furnace Modules	Boilers / HX's / AHU's
Autonomous Building Systems	Interdependent Systems
Manual Water Treatment	Automated Water Treatment

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Session 2: Issue Identification – Facilities Maint Case Study

- **Facilities/Utilities and Infrastructure Maintenance:**
  - **PERSONNEL**
    - Historical Maintenance for Dome
      - 4 Summer
      - 2 Winter
    - '92 Requirements Document Identified
      - 7 Summer Personnel
      - 3 Winter Personnel
    - FY07 Actual
      - 7 Summer (1 Short of Plan)
      - 3 Winter (2 Short of Plan)

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Session 2: Issue Identification – Facilities Maint Case Study

- **Facilities/Utilities and Infrastructure Maintenance:**
  - **ISSUES:**
    - FY07 technicians worked 60 hr. vs. 54 hr. weeks (+10%), yet only completed 90% of preventive maintenance procedures.
    - Technology requires greater skill set from operations and maintenance workers.
    - Centralized control system (DDC) has enormous data capabilities, but requires staff to trouble shoot in the field and manage from HQ.
    - DDC System data is dependent on accurate devices. System has thousands of field devices and sensors that should be routinely calibrated. This has not been maintained to date.

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Session 2: Issue Identification – Facilities Maint Case Study

- **Facilities/Utilities and Infrastructure Maintenance:**
  - **ISSUES:**
    - Attracting and retaining qualified staff is difficult. Flow through of contract workers leads to perpetual “learning curve.”
    - With change out of seasonal staff, much of knowledge base is lost.
    - Building has been occupied since 2003 and is showing signs of wear and tear. No current capacity to address these issues.
    - Increased population accelerates maintenance requirements increasing overall cost.

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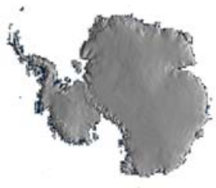

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Polar Services

Optimization of SP Operations

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Construction Case Study

April 30, 2007

- **Construction:**
  - **1994:** 1 Major Construction Project Planned through 2005.
  - **2005:** 3 Major Construction Projects in progress.
  - **1994:** 80 Full Time Equivalent (FTE) personnel planned for construction.
  - **2006:** 91+ average FTE's required from FY00 through FY07 and exceeding 100 construction personnel on station at peak times.
  - **1994:** 69,120 Planned construction hours in one season to sustain one project.
  - **2006:** 86,653 Actual construction hours worked for 3 projects. Variance= 17,533 Hrs or 20 FTE's.
  - **1994:** For 80 FTE's working on 1 major construction project – Support level equaled 6 Supervisors, 7 Materials people, 67 misc. trades.
  - **2006:** For 91+ FTE's working on 3 major construction projects – Support level equals 5 Supervisors, 7 Materials people, 78+ misc. trades.
  - **1994:** Contractors Engineering footprint planned and limited to design review and comment.
  - **2006:** RPSC Engineering footprint in Denver and on station elevated to Design Build thus increasing on-ice engineering and administrative tasking.

(Data does not include FEMC sustaining or science/minor projects)

Optimization of SP Operations
Session 2: Issue Identification – Const Case Study

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SPSM Elevated Station In progress
10-Meter / SPT in Progress
IceCube drill and Lab in Progress

Optimization of SP Operations
Session 2: Issue Identification – Const Case Study

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- **Construction Issues:**
  - Yearly Construction Activity Rollover.
    - No project contingency identified or allocated, resulting in unforeseen downtime and losses in production. (Examples below)
      - Weather delays / Airlift shortfall
      - Sickness / Injury
      - Insufficient hiring or available trades.
      - Unexpected turnover and attrition.
      - Under estimated workloads and/or resources.
      - Equipment failures or shortfalls due to unexpected shared resources.
      - Material issues including damaged or missing.
      - Unforeseen downtime such as power outages.
      - Unexpected change orders or redirections.
      - Rework

Optimization of SP Operations
Session 2: Issue Identification – Const Case Study

Raytheon

- **Construction Issues:**
  - Yearly Construction Activity Rollover
    - Inadequate resources to support 3 major projects
      - Population cap set by available bed space
      - Inability to acquire qualified candidates
      - Resources remobilized and redirected across multiple projects
      - Equipment resources allocated and planned for SPSM now shared across multiple projects
      - Trades person requirement goes up and required support remains same

Optimization of SP Operations
Session 2: Issue Identification – Const Case Study

Raytheon

- **Construction Issues:**
  - Yearly Construction Activity Rollover.
    - Project schedules run concurrently and not in a prioritized cadence due to projects set critical milestones (Examples below)
      - 3 Major projects all in need of personnel and equipment in same time frame
      - Supervision and coordination over taxed between work centers
      - Equipment travel downtime
      - Material coordination between work centers over taxed
      - Remobilization of resources across work centers compounds downtime

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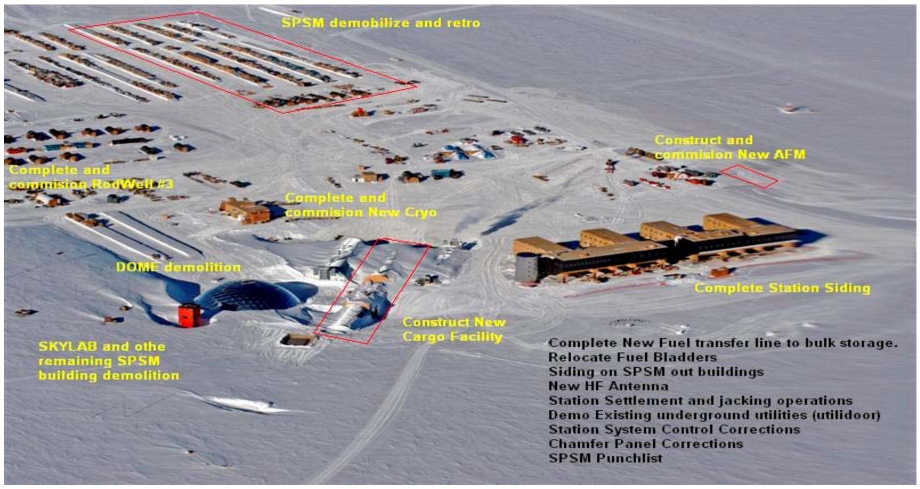
Session 2: Issue Identification – Const Case Study



Optimization of SP Operations

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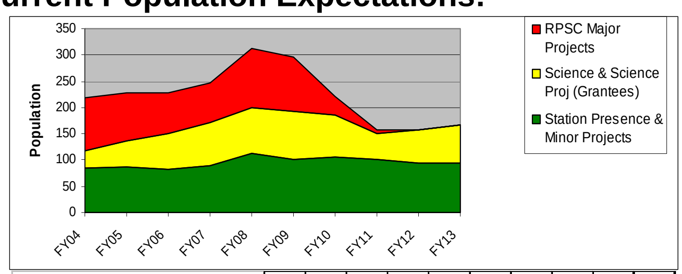
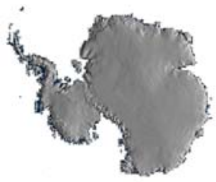
Session 2: Issue Identification – Const Case Study

- **Current Population Expectations:**



	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13
Station Presence & Minor Projects	84	86	83	89	112	100	106	101	95	95
Science & Science Proj (Grantees)	34	50	67	83	88	92	80	50	62	72
RPSC Major Projects	101	91	79	75	113	105	34	7	0	0
RPSC IceCube	9	9	9	28	20	20	14	7	0	0
RPSC SPT	4	4	3	16	12	13	0	0	0	0
SPSM	88	78	67	17	73	72	20	0	0	0
Power Improvements				14	8					
SuperDarn	0	0	0	0	0	0	0	0	0	0
Seasonal Totals	219	227	229	247	313	297	220	158	157	167

UNITED STATES ANTARCTIC PROGRAM



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Polar Services

Optimization of SP Operations

Raytheon Polar Services Company

Population and Staffing

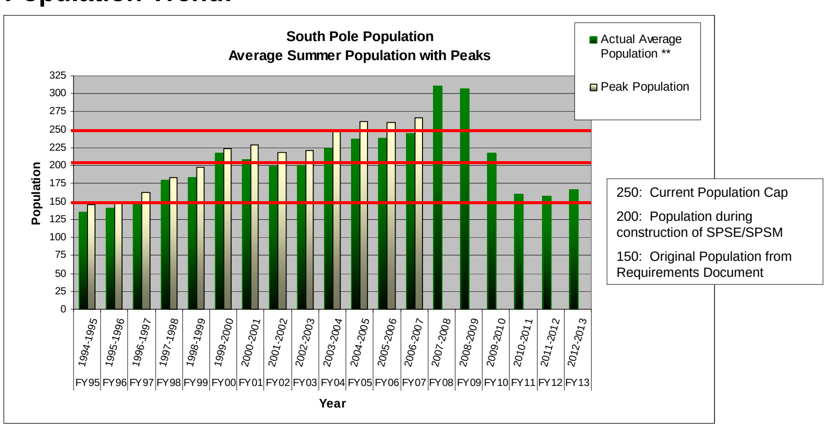
April 30, 2007

Raytheon

Optimization of SP Operations

Session 1: Assumptions and Requirements

- **Population Trend:**



Optimization of SP Operations
Session 1: Assumptions and Requirements

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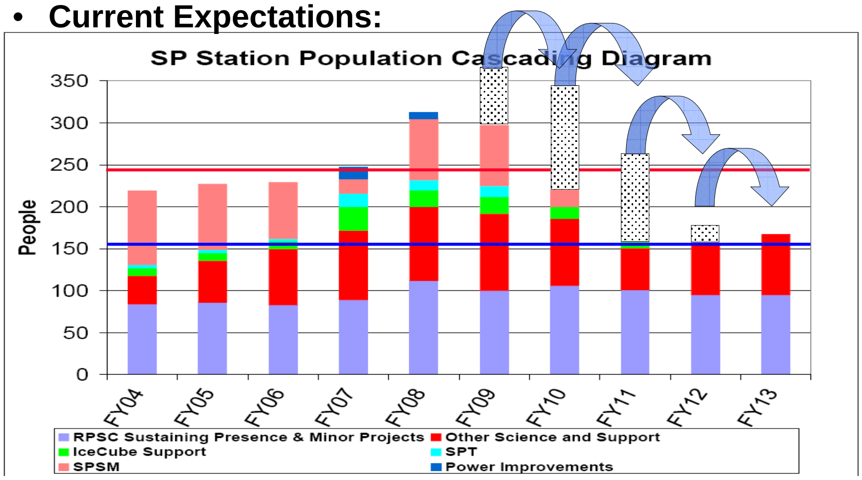
- **Current Expectations:**



Customer Success is Our Mission

Optimization of SP Operations
Session 1: Assumptions and Requirements

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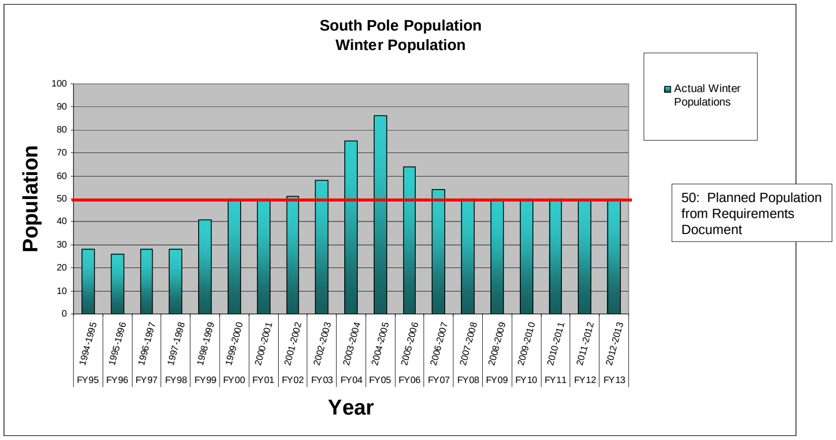
- **Population Trend:**



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Session 1: Assumptions and Requirements

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- **Current Expectations (Science):**
  - **Science efforts with likely 3 – 5 year footprint at South Pole**
    - IceCube
    - SPT
    - NOAA & ARO
    - SPRESSO & CTBTO
    - Auroral Instruments in ARO & B2
    - SuperDARN
    - CUSP Instruments in B2
    - Thermospheric & Mesospheric Studies
    - Balloon Inflation Facility

Optimization of SP Operations
Session 1: Assumptions and Requirements

Raytheon

- **Future Expectations (Science):**
  - **Science with potential to arrive at South Pole in 5 years**
    - IceCube additions
    - SPT additions
    - Revised Clean Air Sector & ARO2 under NOAA
    - Increases in CUSP antenna field
    - SPRESSO Expanded Seismic Array
    - Helioseismology
    - Growth in Downwind Sector
    - Field Science Presence
    - East Antarctic work and logistical support
    - Traverses
    - Tourism
    - Automated Stand Alone Science, UAV's, Robots

Optimization of SP Operations

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Session 1: Assumptions and Requirements

- **Current Expectations (Science):**
  - **Sector Management**
    - Current Status
    - Dark Sector SOP updates
    - SPUC Recommendations
    - ASMA

Optimization of SP Operations

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Session 2: Issue Identification – Pop Case Study

- **Original staffing/services model and assumptions:**

		Current Staffing estimates to reach 150 SUMMER	Current Staffing estimates to reach 150 SUMMER totals	Pre-2004 staffing estimates to reach 150 SUMMER	pre-2004 estimate SUMMER totals	Requirement Document projection SUMMER	St Michaels Projection SUMMER
NSF	NSF Representative	1		1			
	NSF Science Representative	1		1	2	10	
Other	NSF, Tech Events	0	2	0			5
Grantees	Misc Grantees	75	75	75	75	75	80
Management	Area Director	1		1			50
	Winter Site Manager	1		1			
	HR/Finance Rep	1		1	5	5	
Operations	Operations Manager	1		1			
	Work Order Scheduler	1	5	1			
	Power Plant Mechanic	1		1	2	1	
	Power Plant Engineer	1		1			
	Power Plant Tech	2	4				
	Heavy Equipment Mechanic	1		1	2	3	
	Light Equipment Mechanic	1		1			
	Heavy Equipment Foreman	1	3				
	Heavy Equipment Operator	1		1	2	3	
	Equipment Operator	1	2	1			
	Fuels Specialists	3	3	3	3	0	
	General Assistants	2	2	4	4	0	
Station Services	Station Services Manager	1	1	1	1	0	
	Food Service Manager	1					
	Sous Chefs	2		3			
	Production Cooks	3		2	7	6	
	Prep Cook	1					
	GA's/DA's	2	9	2			
	Retail Coordinator	0	0	1	1	0	
EH&S	Physician	1		1	2	1	
	Physician's Assistant	1	2	1			
	EH&S Coordinator	1	1	1	1	0	
	Waste Specialist	1	1	1	1	4	
Logistics	Logistics Supervisor	1		1			
	Cargo Person Sr	1		2			
	Cargo Person	2		2	10	7	
	Cargo Coordinator	1					
	Materialsperson Sr	2		2			
	Materialsperson	1	8	3			

		Current Staffing estimates to reach 150 SUMMER	Current Staffing estimates to reach 150 SUMMER totals	Pre-2004 staffing estimates to reach 150 SUMMER	pre-2004 estimate SUMMER totals	Requirement Document projection SUMMER	St Michaels Projection SUMMER
IT	IT Project Manager	1	1	1	1	1	
	MAPCON Administrator	0	0	0	0	1	
	Comms Supervisor	1		1	1	1	
	Comms Operator	3	4	3	3	3	
	Comms Tech	2		2	2	1	
	Network Administrator	1		1			
	LAN/WAN Specialist	1		1	3	2	
	Email/Help Desk	1		1			
	Sustaining Engineer	1	6	1	1	0	
Science Support	Science Support Manager	1		1	2	1	
	Science Support Coordinator	1	2	1			
	Aurora RA	1		1	2	5	
	Cusp RA	1	2	1			
	Dark Sector RA	1	1	1	1	1	
	Met Coordinator	1		1	3	2	
	Met Observer	2		2			
	Met Tech	1	4	1	1	2	
	Science Const. Foreman	1		1	1	0	
	Carpenter	1		1	1	3	
	Plumber	1		1	1	0	
	Electrician	1		1	1	1	
	General Assistant	1	5	1	1	2	
FEMC/Maintenance	FEMC Manager	1		1			
	Work Order Scheduler	1		1	4	7	
	Facilities Engineer	1		1			
	General Assistant	1		1			
	Maintenance Specialists	3		3	3	1	
	Janitors	2	9				
	CELSS	0	0	0	0	1	
Total:		**152**	**152**	**150**	**150**	**150**	**135**

Optimization of SP Operations

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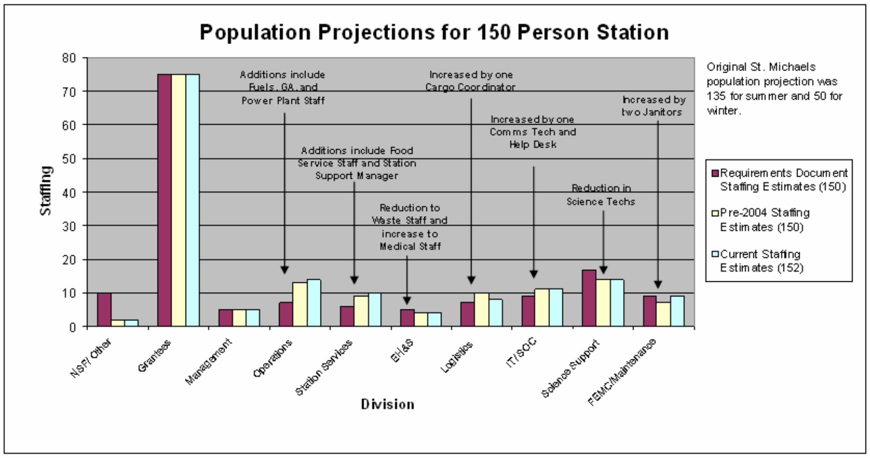
Session 2: Issue Identification – Pop Case Study

- **Population Trend:**



Optimization of SP Operations

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Session 2: Issue Identification – Pop Case Study

- **Population:**
  - Requirements Document: 150 summer/ 50 winter
  - During Construction: 200 summer/ 50 winter
  - Current: 250 + summer/ 54 winter
  - Post Construction: 150 summer/ 50 winter
- **Population Issues:**
  - Current requirements exceed capacity
  - Increased population wear and tear on facility
  - Insufficient DNF storage for food and beverage
  - Insufficient office space, common areas and access to telephones
  - Station Support Tasking (store, recreation, post office, janitorial, moving materials into the station) performed by volunteers after regular work day
  - Current populations prevent support of new science
  - Occupancy Limits are jeopardized

Optimization of SP Operations

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Session 2: Issue Identification – Planning Case Study

- **Planning Issues**
  - Requirements change as season schedule changes
  - Individual skill sets unknown until candidates are hired
  - Funding for training established a year earlier in APP
- **Staffing Issues**
  - Attracting and retaining qualified staff is difficult
  - Flow-through of contract staff leads to perpetual "learning curve."
  - With change-out of seasonal staff, much of knowledge base is lost.
  - Diverse requirements + limited population has resulted in the need for fewer people with wider range of skills; however:
    - Wages are not attractive to candidates with required experience
    - Fewer people = insufficient staffing for adequate coverage (time and tasking)
    - Complex systems require on-site specialists

Optimization of SP Operations

Raytheon

Session 2: Issue Identification – Training Case Study

- **Training Issues**
  - **Insufficient funds/flexibility for pre-season training**
    - Equipment complexity/diversity requires additional training
    - Training should be tailored to candidates' skill sets
  - **Insufficient time for on-site turnover at opening/closing**
    - Primary tasking, site orientation, safety training
    - Collateral/volunteer duties (emergency response, janitorial, etc.)
  - **Some training requirements unknown**
    - Training reqs for supplemental ARFF volunteers need clarification
    - Skill sets unknown until candidates are hired

Optimization of SP Operations Raytheon
Session 2: Issue Identification – Open/Close Case Study

- **Station Open / Close Process**
  - **Typically mid/late Oct. to mid Feb. (~110 days)**
  - **Opening/Closing dates temperature dependent**
    - LC-130 operational limit: -50 ˚C

Optimization of SP Operations Raytheon
Session 2: Issue Identification – Open/Close Case Study

- **Station Open / Close Process**

Average opening date near October 25

Average closing date near February 16

Year	Opening Date	Temp °C (Daily Avg)	Closing Date	Temp °C (Daily Avg)
1997/98	8-Nov	-36.4	17-Feb	-32.5
1998/99	25-Oct	-50.9	17-Feb	-48.6
1999/00	25-Oct	-44.8	14-Feb	-49.3
2000/01	23-Oct	-54	16-Feb	-39.3
2001/02	24-Oct	-51.3	16-Feb	-32.2
2002/03	26-Oct	-50.5	15-Feb	-41.1
2003/04	25-Oct	-49.1	15-Feb	-45.8
2004/05	22-Oct	-52	15-Feb	-35.3
2005/06	21-Oct	-52.4	21-Feb	-44.3
2006/07	31-Oct	-45.5	18-Feb	-44.7

Optimization of SP Operations

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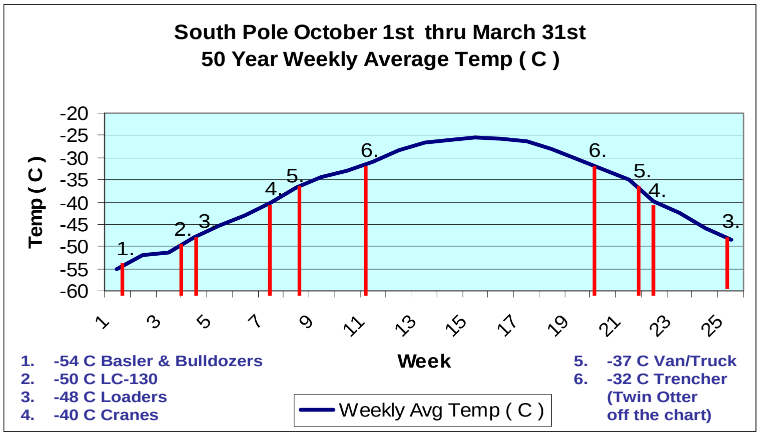
Session 2: Issue Identification – Open/Close Case Study

- **Station Open / Close Process**



Optimization of SP Operations

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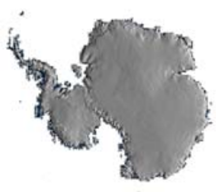
Session 2: Issue Identification – Open/Close Case Study

- **Station Open/Close:**
  - **Irreducible constraints:**
    - LC-130 operations limited to temperatures above -50C
    - Flight operations conducted during austral summer only
- **Station Open/Close Issues:**
  - **Constrained schedules**
    - Science wants to maximize time on station throughout the short summer season
    - Station personnel must ramp to full operation very quickly
  - **Safe and Thorough Turnover**
    - Up to 12 days of turnover required to adequately prepare for full-scale summer operations
    - Winter only staff require turnover at end of summer
    - Emergency response teams need additional time outside of primary job familiarization to learn facilities
  - **Preparation for Summer Activities**
    - Fuels staff require at least 4 days to set up fuels systems
    - Additional mechanics needed for equipment prep
  - **Maximizing Aircraft**
    - South Pole is the "only game in town" for LC-130s in Oct. (except for NAVAID flights near McMurdo)
    - Until ~15 November, contrails limit most cargo ops

UNITED STATES ANTARCTIC PROGRAM

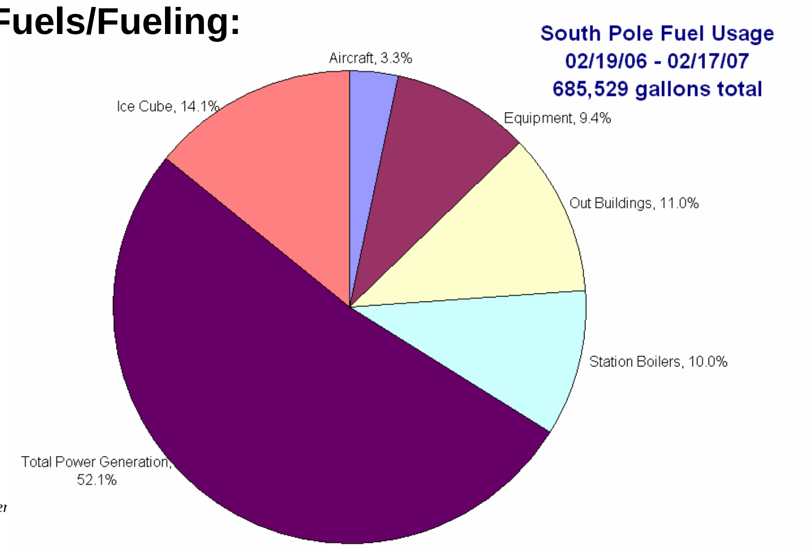


Optimization of SP Operations
Raytheon Polar Services Company
Operations (additional information)
April 30, 2007

Raytheon
Polar Services

Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Fuels/Fueling:**



Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Fuels/Fueling:**
  - 1994: Volunteer fuels team, antiquated equipment, 194 flights, 318,250 gallons of fuel
  - 2000: 2 trained fuelies, improved systems and environmental considerations, 249 flights, 393,592 gallons of fuel
  - 2007: 4 fuelies, system upgrades slated, 359 flights, 780,318 gallons delivered
  - Design requirements (400,000 gallons bulk AN8 storage ; 0 Mogas) exceeded
- **Fuels Issues:**
  - Bulk Fuel Storage: need to establish how much fuel storage is needed for future
  - Emergency fuel storage: define what emergency fuel requirements (what is it to cover) and amount needed during transition and post construction
  - Bladder use/storage
  - Equipment/Hose lifecycle replacement and improvement; e.g., need specialized hoses for winter ops – design and budget impacts, forged collars for aircraft hoses
  - Improved Mobile Fueling system needed for outbuildings (budget impacts)
  - New Aircraft Fueling Module to be assembled and put into use
  - Secondary containment needed for old tanks and fueling areas
  - Staffing turnover/training issues: adequate for current operations, but require time in McMurdo for training (budget impacts)
  - Operational pressures at Opening (getting fuels system set up) have potential safety and environmental impacts (pushing people too hard)
  - Currently supporting Mogas/Premix operations with barrels/hand pumps
  - Underside of Elevated Station to be clad before fuel piping is finished

Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Fire-Life-Safety:**
  - Meet design and operational requirements. Staffing requirements, not clearly defined in early documents
  - Current Emergency Response Team Components
    - Incident Command
    - Fire Brigade
    - Trauma Team
    - Search and Rescue
    - Aircraft Rescue Fire Fighting (ARFF)
  - Current Training
    - 40-hour pre-deployment structural fire fighting
    - 2-day specialized Polar Responder training
    - Coordination and practice with McM Fire Dept
    - Critical Incident Stress Management (CISM) lecture
    - SAR introduction
    - Experience elsewhere (EMTs, Fire Fighters, SAR trained personnel)
    - ARFF Team trained and qualified in an 80-hour course
  - Advantages of Volunteer Emergency Responders
    - Day-to-day knowledge of site/Heightened awareness

Optimization of SP Operations

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Session 2: Issue Identification – Ops Case Study

- **Fire-Life-Safety Issues:**
  - Aircraft Rescue Fire Fighting (ARFF)
    - Non-planned requirement: 3 qualified Fire Fighters to attend all ANG flights; this was implemented in FY07. This had and will continue to have budget, flight, population, and maintenance impacts.
    - Foam is rated to -40F, so early and late season usage is limited without a heated storage facility.
    - Equipment needs annual servicing/maintenance and warm winter storage not available on site
    - Waivers are needed to operate early and late season while equipment and staff are repositioned from McMurdo to Pole
    - Volunteer Brigade ARFF Training requirements to be clarified
    - ARFF capacity/design is under review may be significant budgetary impacts

Optimization of SP Operations

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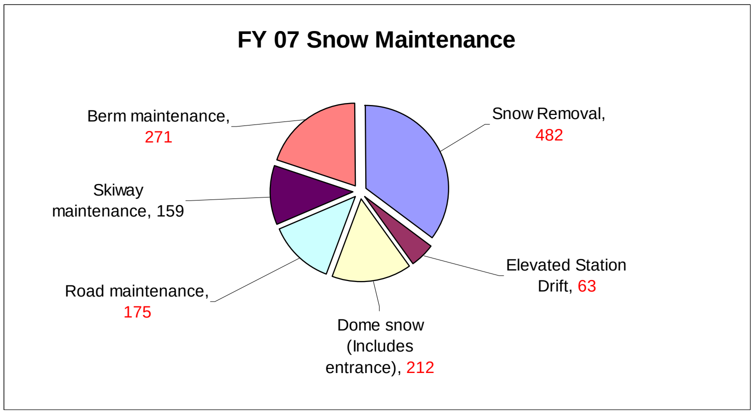
Session 2: Issue Identification – Ops Case Study

- **Snow Management:**

Aerial Photos by J.Fonseca 10/21/06;
Snow Dump photo Feb 07 by L. Schernthanner

Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Snow Management:**



Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Snow Management:**
  - Snow Management Current:
    - 1362 equipment hours used on snow management FY07 Summer
    - Mostly removal of drift snow with some drift shaping
    - Hours were reduced in FY07 Summer with the use of the "belly dump;" however, this was primarily related to the elevated station
  - Snow Management Issues:
    - Long term planning must include wind studies, modeling, and potential snow maintenance plans for new structures
    - Snow management for any new structures does not currently include engineering evaluation for drift shaping
    - Raising or removal of structures currently is not evaluated for long term impacts
    - Civil engineer with snow management expertise is currently being recruited by RPSC
    - Current "Temporary" facilities have no provisions for extended snow management or replacement (construction camp, material berms and summer camp)

Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **Growth Chamber:**
  - Originally the Closed Ecological Life Support System/CELSS
  - Hydroponics Requirement: to provide fresh produce stock for the population. Recycling the station gray and black water were also components of the early requirements, but were not design elements
  - The Growth Chamber is currently operating as designed
  - Food production significantly supplements the winter-over population's fresh produce and provides a quality of life element
  - Currently Staffed by volunteers in the summer and one dedicated individual in the winter
  - Operations are supported by the University of Arizona
- **Growth Chamber Issues:**
  - Evaluation of the Concept of Operations needed
  - Concept of Operation will determine staffing requirements and budget impacts
  - High level of expertise not available in-house thus the existing subcontract with UA.

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Optimization of SP Operations
Session 2: Issue Identification – Ops Case Study

- **New Power Plant:**
  - Requirement (short version): generate sufficient power to meet the power demands
- **New Power Plant Issues:**
  - Currently operating at capacity to meet demand with one prime mover and peaking generator working almost continuously
  - Need complete review of inventory needs and availability
  - Operational control shifting to FEMC
  - Currently operating with 3 persons during the summer/2 during the winter and the weekend volunteers throughout the year
  - Complex system needs full-time oversight/staffing and responsibility
  - Increases in power requirements need an additional source
  - Associated systems (e.g., pumps, valves) will need life cycle replacement in the relatively near future with high cost impacts
  - Monitoring/diagnostic systems need modernizing (IR, flow meters, vibration monitors, etc) – budget and implementation (labor) impacts

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South Pole Traverse
Near-Term Impact on South Pole Station


South Pole Traverse
Optimistic Development Timeline
• FY07: Equipment Procurement; Off-Site Performance Testing
• FY08: Route Maintenance; Equipment Delivery ; Retro-sled Staging
• FY09: Initial Production Traverse (one round trip)
• FY10: Production Traverses (one to two round trips)

South Pole Traverse

Likely South Pole Arrival Configuration

- FY08: January visit of two days by < 8 persons; drop off several cargo sleds for over-winter loading with retrograde; delivery of modest amount of fuel (perhaps 5k gallons)

- FY09: January visit of two days by up to 8 persons; delivery of fuel only (up to 100k gal), or combination of fuel and heavy equipment (total combined load of about 500k lb); back-haul loaded retrograde sleds

- FY10: December visit of two days by up to 8 persons; delivery of 100k gal of fuel or combined fuel/cargo/equipment load of about 500k lb. Possible early February visit of two days by up to 8 persons; delivery of 100k gal of fuel or combined fuel/cargo/equipment load of about 500k lb.

South Pole Traverse

Likely South Pole On-Site Activities

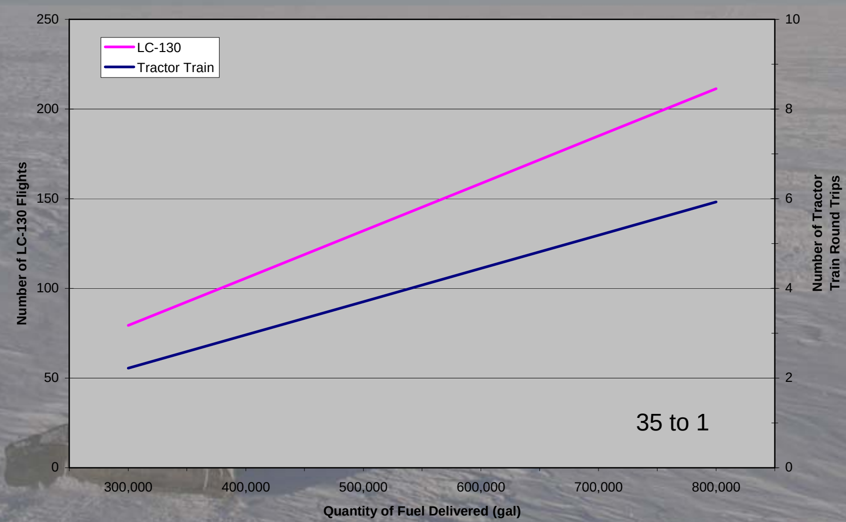
- FY08: Drop off and staging of retrograde sleds by traverse crew; fuel off-load by SP fuels personnel

- FY09: Fuel off-load supervised by SP fuels personnel, traverse crew will assist; Equipment unloading and staging; Retrograde sled hook-up and removal by traverse crew

- FY10: Fuel off-load supervised by SP fuels personnel, traverse crew will assist; Equipment/cargo unloading and staging performed by traverse crew at direction of SP personnel and likely using some SP equipment

South Pole Traverse

Equivalency Impact: LC-130 to Tractor Train



South Pole Traverse

Likely South Pole On-Site Impacts

- **Traverse equipment will provide berthing for traverse crew during SP visit**
- **Meals to be taken in SP dining facility if it can be accommodated**
- **No fuel taken from SP supplies**
- **No electrical power requirements**
- **Potential for limited shop/mechanic support on occasion**
- **Potential for pick-up of previously delivered (by LC-130) parts/supplies**
- **Potential for minimal access to communication resources (e-mail; Internet)**

South Pole Wheeled Runway

Near-Term Impact on South Pole Station

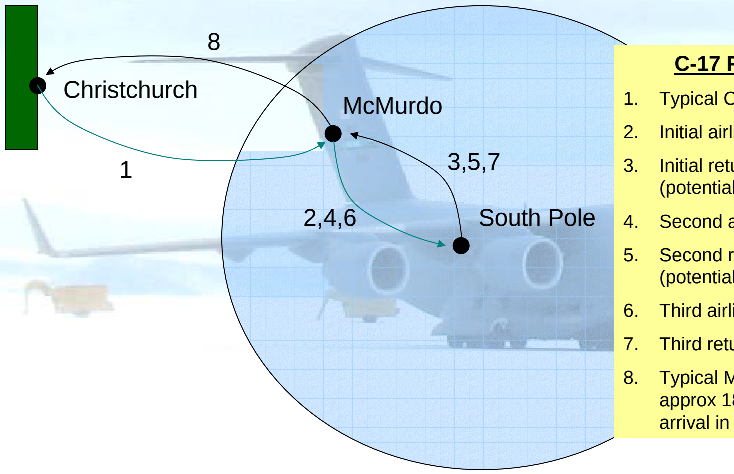
South Pole Wheeled Runway

Optimistic Development Timeline

- **FY07: Development Plan Established**
- **FY08: Equipment Purchase; Ship Delivery to McMurdo**
- **FY09: Equipment Delivery to SP via Traverse**
- **FY10: Begin Construction**
- **FY11: Complete Construction and Validation Test**
- **FY12: Full Utilization**

South Pole Wheeled Runway

Potential Utilization Scenario when Complete



C-17 Flight Legs

1. Typical CHC-MCM
2. Initial airlift to SP (~150k lb)
3. Initial return from SP (potential for retro)
4. Second airlift to SP (~150k)
5. Second return from SP (potential for retro)
6. Third airlift to SP (~150k)
7. Third return from SP
8. Typical MCM-CHC (TO approx 18 hours after initial arrival in MCM)

South Pole Wheeled Runway

Likely South Pole Arrival Configuration

- **Fuel Only Delivery: 20,000 gallons**
- **Cargo Only Delivery: ~150,000 lbs (up to 18 single pallets)**
- **Combined Cargo and Fuel: ~150,000 lbs**
- **Minimal Passengers Likely on Most Flights**

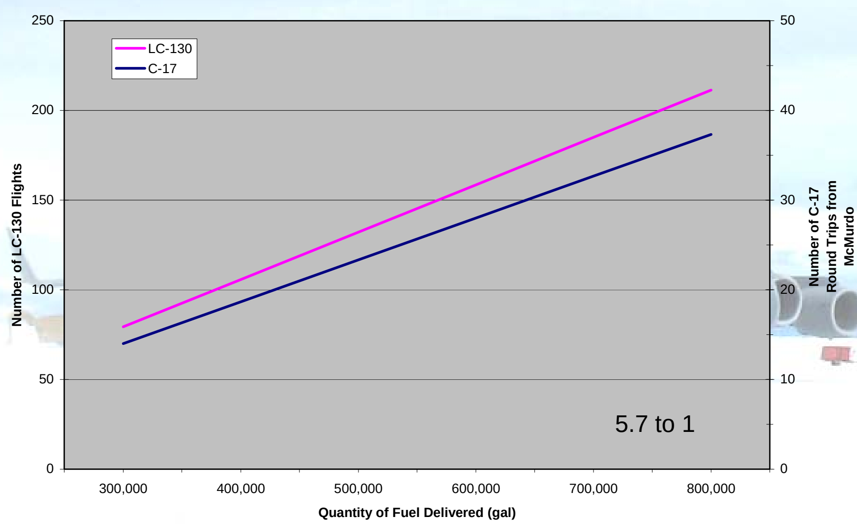
South Pole Wheeled Runway

Likely South Pole On-Site Activities

- **Fuel Off-Load: AF and SP personnel**
- **Cargo Off-Load: AF and SP personnel; SP equipment**
- **Passenger Delivery, including turn-around visitors: Ideally <20/flight**

South Pole Wheeled Runway

Equivalency Impact: LC-130 to C-17



South Pole Wheeled Runway

Likely South Pole On-Site Impacts

- Enhanced NAVAIDs (and ATC?)
- 50% Increase in required ARFF volumes (staff may remain at 4)
- Limited quantity of AGE available (perhaps 1 staff; training for sure)
- "Long duration, large volume" de-fueling events up to 10 times per summer season
- "Large volume" cargo off-loads up to 10 times per summer season
- Potential for 3 "big deliveries" (5 LC-130 equivalents) in a 14-hr period
- Potential for longer duration on-site presence of turn-around visitors
- Significant ramp damage with ERO and heavy wheel loads

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Summer Camp Becomes Solar Camp

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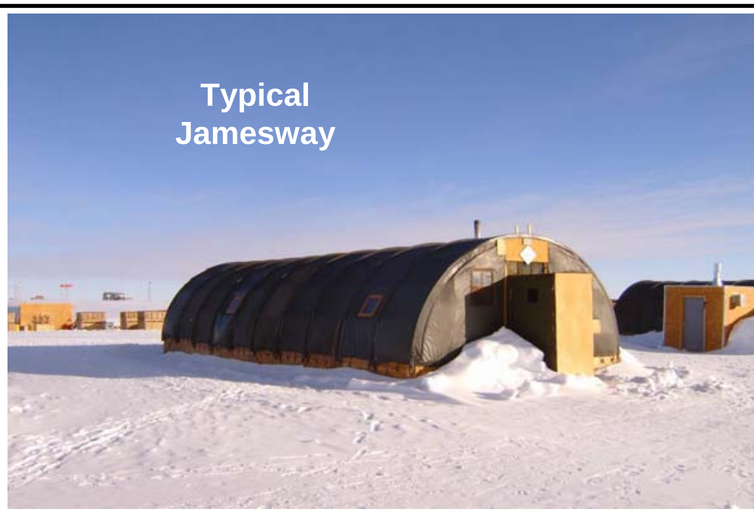

Summer Camp Becomes Solar Camp

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Summer Camp Becomes Solar Camp

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Summer Camp Status:

1. End of its useful life and should be demolished or replaced.
2. SPSM / EIS requirement is to demolish / retrograde the camp to meet the original design intent of a 154 person station.
3. Requirement to eliminate Summer Camp is subject to question; tasking and commitments forecast the need for population to continue to be supported at the current level of 245 beyond the completion of SPSM.
4. Requirement that the station "only" provide berthing in the Elevated Station may be too rigid; the program sees a need to be flexible and maintain the capability to provide auxiliary berthing on a special case, or surge basis for potential future projects.
5. Summer Camp could be decoupled from SPSM and replaced as a separate project.

Summer Camp Becomes Solar Camp

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Existing Summer Camp Condition

- 1950s re-locatable Jamesway tents
- 13 Jamesway tents for berthing
- 2 "head modules" for shower, toilet, laundry
- 120 beds in Jamesway tents
- 36 beds in Hypertats
- Use limited to 110 beds out of 156 total
- Poor energy efficiency
- Facilities not fire-life-safety code-compliant
- Outdated, worn out mechanical equipment
- Inadequate heating systems

Summer Camp Becomes Solar Camp

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Code Deficiencies

- Inadequate number of plumbing fixtures for population
- Exhaust fans in toilet/shower rooms inoperable
- Inadequate exit lighting
- Exit corridors are too narrow
- Jamesway construction is not fire resistant
- No fresh air ventilation
- No fire suppression
- Smoke detectors needed in enclosed rooms
- Inadequate fire alarm sound levels

Summer Camp Becomes Solar Camp

Energy Issues

- 60-80 kW power draw for summer camp
- Older design 40 watt lights
- Electric hot water heaters load down grid
- Boilers are inefficient, 78% could be 88-95%
- Hydronic circulators are oversized
- Piping is copper, subject to freeze damage
- Under floor ductwork leaks hot air
- Flush type urinals can be changed to waterless
- Electric clothes dryers can change to glycol
- Doors do not fit tightly
- R-value of Jamesway = 1” horsehair insulation

Summer Camp Becomes Solar Camp

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Charge to NREL: (National Renewable Energy Lab)

- Design a “zero-energy” self-sustainable Solar Camp

Initial Requirements:

- Take summer camp off station power grid
- Make summer camp self-sustaining, 0 energy
- Provide passive and active solar thermal for heat
- Provide solar PV cells to generate power
- Provide passive solar lighting
- Design in capability to add wind turbines
- Provide insulation appropriate to climate
- Make camp modular, skid mounted to relocate easily
- Build camp with fire resistant construction
- Provide code compliant fire-life-safety systems
- Provide tilt/turn escape/ventilation windows
- One Design applicable for other camp replacements

Customer Success is Our Mission
Revised 04/30/07

Summer Camp Becomes Solar Camp

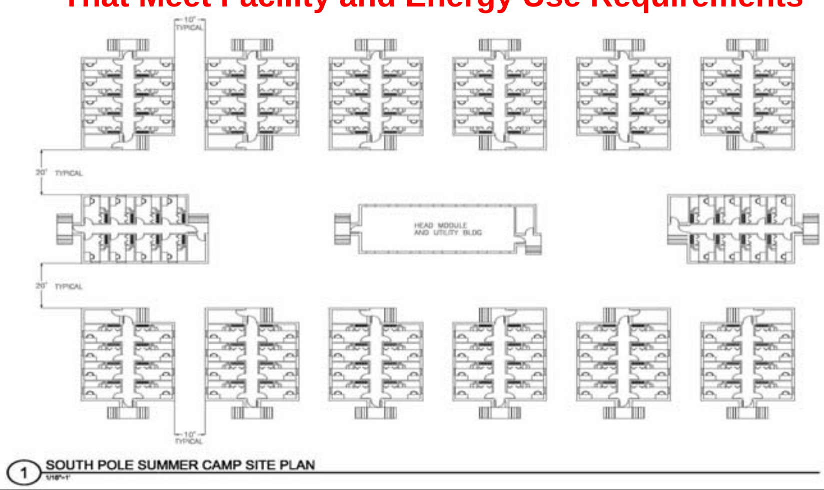
Potential Schedule:

- Design, test-build prototype 2007/2008
- Build production modules 2008
- Deliver to Port Hueneme by Dec 1, 2008
- Vessel delivery to McMurdo Feb, 2009
- Deliver modules to Pole (candidate for traverse?)
- Construction 2009 / 2010
- Occupancy Nov. 2010 (FY11)
- Coincides with "Post SPSM"

Cost and resources have not been assessed yet

Summer Camp Becomes Solar Camp

GOAL: Standardize Options for Antarctic Berthing That Meet Facility and Energy Use Requirements



Summer Camp Becomes Solar Camp

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Actions:

- Amend the station EIS for Summer Camp deviation
- Formalize “Solar Camp” as a project
- Establish governmental relationship with NREL
- Planning sessions to gather USAP requirements for design
- Establish energy design guidelines for new facilities
- NREL takes the lead on design, determines overall best approach and renewable technology to apply
- Implement design, make solar camp a reality

Results:

- Renewable energy demonstrated at Pole
- Less demand on station grid
- Blueprint for code and energy compliant field camps
- Effective means for managing surge population

Station Population Comparison Chart

Functional Area	"Transition Phase" (from 1994 Reqs Doc) 200 people	Current (FY08) 250+ people	Post Construction (from Reqs Doc) 150 people	Current projection for reducing pop to 150 people
Station Management	5	9	5	6
Operations & Maintenance:				
Logistics	8	13	7	8
Power	1	4	1	3
Medical	1	2	1	2
Vehicle Maintenance	3	8	3	2
Food Preparations	6	14	6	9
Station Maintenance	7	17	7	12
Waste Handling	5	2	4	1
Vehicle Operations	4	3	3	3
Communications Coordinator	1	1	1	1
Communications Operator	2	3	3	3
Fuels	0	4	0	3
ARFF Crew	0	4	0	4
CELSS (food growth chamber)	0	0	1	1
Science Support:				
Coordinator/Management	1	2	1	2
Science Technician	3	2	5	2
Cryogens Technician	1	1	1	1
Meteorological Observer	2	2	2	2
Meteorologist	2	2	2	2
Carpenter	2	3	3	2
Electrician	1	1	1	1
Plumber	0	1	0	1
General Assistant	2	1	2	1
General Maintenance Mechanic	0	0	1	0
IT-COMMS:				
Management	1	1	1	1
MAPCON Administrator	1	0	1	0
Communications Technician	1	2	1	1
Computer Technician	1	1	2	1
Help Desk	0	1	0	1
Satellite Technician	0	1	0	1
Server Administrator	0	1	0	0
IT Sustaining Engineer	0	1	0	1
Science (Grantees)	50	72	75	75
Other:				
NSF, NSFA, Technical Events	9	13	10	2
Construction				
Materials Handling	4			
Cargo Staging	3			
Food Service	3			
Facility Maintenance	1			
Waste Management	2			
Construction Management	6			
Inspector	1			
Construction Personnel	60	80	0	0
Total:	**200**	**272**	**150**	**155**

Science: 72 is the average value; peak (mid Jan) = 90

Other: 14 is the average value; peak = 22

Agenda

Intent:
Convene a Workshop to review the current operating paradigms of the SPSM facilities compared to the original St. Michaels (April 1992) planning assumptions that resulted in the approved Requirements Document for SPSM, and update that basis for requirements as necessary.

When:
April 30, May 1 – 2, 2007

Where:
St. Michaels, MD – Harbourtowne Conference Center www.harbourtowne.com

Why:
1) To establish a revised footprint and business model for sustaining functions and services as SPSM nears completion and withdraws support for station services.
2) To address maintaining the facilities and managing the station under increasing requirements.

Who:
Nominees from NSF OPP (AIL, EH&S, Science) and BFA/DACS, Raytheon, 109th, NAVFAC, CRREL, SPAWAR, Others

What:
Working meetings will combine presentations, group discussions, brainstorming and small break-out teams to focus on generating a new business model.

Goal:
Understand the differences between the way the station was conceived to be operated and managed; how it currently is managed and operated; and develop new strategies to maximize resource effectiveness in the face of significant challenges under fixed and varying constraints.

Objective:
Optimize a resource plan to support science through re-assessing the station's total current requirements, the main drivers, operational performance objectives, seasonal criteria, and actual life-cycle costs and then re-baseline the sustaining elements of the program.

Desired Outcome:
Draft a business model for sustaining the station operations that can maximize productivity for science and support services through elimination or application of technologies that can remove obstacles while remaining compliant within safety, environmental, health and quality standards.

How:
Through systematic analysis of critical interfaces with open-minded approaches to solve issues.

Logistics Overview

Participants will arrive at the venue independently and be ready for the general session by 1:00 PM on Monday April 30th. The first afternoon will be a group session to lay the ground work for following discussions. Tuesday, all meals will be arranged for at the conference center to maximize our productivity. Wednesday will be a full day; please do not plan on leaving early. Late checkouts will be secured for those departing Wednesday, or rooms reserved if you need to leave Thursday due to flight logistics. Bring your own laptop for wi-fi access. Prior to the workshop, various materials will be distributed for review. This is an opportunity to refresh our thinking, collaborate, and create the future.

Day 1 Monday, April 30, 2007

1:00 - 1:15 Opening Remarks

1. **Erick Chiang – Director of Antarctic Infrastructure & Logistics**
2. **Dr. Scott Borg – Head of Antarctic Sciences**
3. **Sam Feola – RPSC Program Director**

1:15 - 1:30 Overview of South Pole Development Planning

John Rand – CRREL Consultant, former NSF SPSM Project Engineer

- Historical perspective of South Pole planning and evolution; highlights of St. Michaels 1 workshop
- Current view on the effectiveness of the SPSM model that was developed 15+ years ago
- Unforeseen challenges drive the need for updating the basis of design model

1:30 - 3:15 Session 1 – Background Information
SPSM Assumptions & Requirements

Session Objective / Outcome:
Understand the original requirements and basis of design that specified how the station was intended to function and why, highlight how assumptions and requirements have changed and migrated from the basis.

PowerPoint Presentations: Design Team Members

Randy Yuen / Kevin Culin / Steve Theno / Dick Armstrong

- Key facility design principals and assumptions
- Design Capacities: power, fuel, storage, airlift, bandwidth

- **Task:** Q & A, discuss assumptions & requirements as needed

3:15 - 3:30 -Break

3:30 - 5:30 Session 2 – Fact Finding & Issue Identification
Plan vs. Actual and Case Studies

Session Objective / Outcome:
Understand what it takes to run the station behind the scenes. Thoroughly look at the interfaces that drive station services and the sustaining footprint. Identify and validate the issues surrounding deviations from the assumed requirements that need resolution.

PowerPoint Presentations: RPSC

- Original staffing/services model and assumptions
- Population Trends
- Cost of Operation
- Requirements for services and station facilities
- Expectations: support, projects, and IPY
- Examples of strained functions:
  - Storage Space (Do Not Freeze)
  - Equipment: Vehicle Maintenance Facility
  - IT / Comms
  - Waste

Task: Collate issues into discipline-specific lists. What kind of issue is it? Categorize by root cause element such as labor, material, equipment, process, funds, space, human resources, policy, third party, etc.

End of Day Goal: Identify working group teams to solve issues, review Terms of Reference

Day 2 Tuesday May 1, 2007

8:00 – 8:45 Session 3 – South Pole 5 Year Outlook

Pending Operations & Facility Changes

Session Objective / Outcome:
Informational session: update on implementing the traverse and how it will change logistics; overview of the hard runway potential project for C-17s, and a new concept for Summer Camp and how it could change to better support and augment the campus.

Presentations:

1. Traverse / Hardened Runway: G. Blaisdell
2. Summer Camp: S. Singer

Task: Use this information as needed to be proactive in forecasting and planning, and revising the affected functions by these changes in operations.

8:45 - 12:00 **Session 4 – Issue Resolution**
Working Groups (break as needed)

Session Objective / Outcome:
Discuss issues presented during fact finding; validate, rank and prioritize the list for your area. Compile root causes to the key issues, pair up cause and effect relationships, and identify obstacles that hamper current performance. Focus on how to realize efficient working scenarios. List ideas/strategies on how to change, adapt, streamline, reorganize, or eliminate inefficiencies or redundancies to get enhanced results in each of the major support categories. Outline alternatives to the way things are done now that would result in optimal on-site personnel requirements. Assemble into the following teams:

1. **SCIENCE**
2. **LOGISTICS**
3. **IT-COMMS**
4. **FEMC**
5. **OPERATIONS**
6. **SERVICES**

Task: Begin preparing a summary of findings to present to the group at the end of the day. Before the workshop is over, teams must submit a written paper to document these proceedings.

12:00 - 1:00 **Lunch**

1:00 – 4:00 **Session 4 – Issue Resolution Continued**
Working Groups (break as needed)

4:00 - 5:30 **Session 5 – Key Findings**
Preliminary WG Results

Session Objective / Outcome:
Summarize recommended changes that will solve the most pressing issues and serve as the basis for an updated systems management plan for the station. Agree on what strategies should be changed and how they will be implemented, discuss fresh ideas for management / planning, new results expected, impacts to the program plan, and identify success indicators and where responsibilities lie for execution.

Task: 10-15 minute presentations by each group leader - discussion, Q&A on each presentation.

End of Day Goal: Well-defined ideas and strategies that address all validated issues. The working groups should have a good outline with basic estimates for any plus or minus cost, resource, or material changes.

Day 3 Wednesday, May 2, 2007

8:00 – 9:00 **Session 6 – Station / Systems Management Model**
Plenary: Principles for a 5yr Plan

Session Objective / Outcome:
Using the key findings for each discipline, discuss the + or - effect on population projections if implemented. Quantify any new margins gained or lost in footprint or capacity and the associated trades to acquire that margin. Achieve group consensus on which strategies make sense to implement based on anticipated outcomes, and revise mission statements for the functions. Review a management plan template.

Task: Gain group agreement on the basis and structure for a revised station management plan.

9:00 – 11:00 **Session 7 – Station / Systems Management Model**
Working Groups: Details for a 5yr Plan (break as needed)

11:00 – 12:00 **Working Group Writing Time**

Session Objective / Outcome:
Teams brainstorm the plan details: scope, requirements, priorities, schedule, organization, cost impacts, third party implications, downstream effects, etc. Use intuition and best practices as guidelines, keep track of follow on actions required to firm up areas that need more analysis and investigation.

Task: Fill in details by function to the 5 yr outline, list action items for take home assignments. Prepare a written executive summary of total findings to be submitted before leaving.

12:00 – 1:00 **Lunch**

1:00 - 2:15 **Session 8 – Summary & Final Review**
Plenary: Station Management Plan

Session Objective / Outcome:
Walk through a complete summary of the stations proposed plan and how RPSC will reorganize functions. Group reviews details and progress by team, provides feedback on additional inputs to finalize each element. Highlight immediate changes that would affect planning for this summer.

Task: Team leaders summarize functional outlines; group provides input toward building a homogenous product. Agree on content and intent for change, pledge additional support as needed.

2:15 – 4:00 **Sessions 9 - Wrap Up**
Plenary: Action Items, Next Steps, and Closing Remarks

Session Objective / Outcome:
Group review of specific action item lists for completing the plan. Senior leadership provides concluding remarks and expectations for follow on deliverables.

Task: Collate all action items with due dates and responsibilities for completing the plan.
Task: Review workshop goals with closing remarks by Erick Chiang.

End of Workshop Goal:

The focus group should have thoroughly assessed the current issues within each support function and devised strategies and workarounds to mitigate them. The foundation for an updated management model will have been laid, and clear action items with responsibilities are set forth for continuing the process off-site. There should be an understanding of what will change for the next fiscal year and how a phased plan will roll-out to end the decade and transition from SPSM the “project” to a realized working station that is the best it can be.

Participants

Organization	Last Name	First Name	Working Group
NSF OD/OPP/ESH	Adams	Gwendolyn	Services
NSF Consultant	Armstrong	Dick	FEMC
NSF OD/OPP/AIL	Blaisdell	George	Operations
NSF OD/OPP/Antarctic Sciences	Borg	Scott	Not assigned
NSF OD/OPP/AIL	Bresnahan	Dave	Logistics
NSF OD/OPP/AIL	Chiang	Erick	Not assigned
NSF Consultant	Culin	Kevin	IT-Comms
NSF Consultant	Haggerty	Pat	Science
NSF OD/OPP/AIL	Marty	Jerry	Logistics
NSF OD/OPP/AIL	Scheuermann	Mike	Science
NSF OD/OPP/AIL	Singer	Sandy	FEMC
NSF OD/OPP/AIL	Stone	Brian	Science
109th	Sheppard	Paul	Logistics
CRREL	Rand	John	Operations
Metcalf & Eddy	Maier	John	Services
NAVFAC	Yuen	Randy	FEMC
SPAWAR	Buchanan	Jack	IT-Comms
RPSC	Carpenter	Ron	FEMC
RPSC	Coutu	Brad	FEMC
RPSC	Douglas	Paddy	Logistics
RPSC	Feola	Sam	Not assigned
RPSC	Folkers	Nita	Not assigned
RPSC	Grant	BK	Operations
RPSC	Hess	Lee Anne	Services
RPSC	Jensen	Katy	Services
RPSC	Kottmeier	Steve	Science
RPSC	Lewis	Martin	Operations
RPSC	Malmgren	Henry	IT-Comms
RPSC	Miller	Neil	FEMC
RPSC	Myers	Scott	Services
RPSC	Pittmann	Rita	Operations
RPSC	Schernthanner	Liesl	Operations
RPSC	Scheuerman	Dave	FEMC
RPSC	Shaddox	Cory	FEMC
RPSC	Sullivan	Paul	Science
RPSC	Tarnow	Joe	IT-Comms
RPSC	Turnbull	Bill	Logistics

Gwen Adams Safety & Occupational Health Manager	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	gadams@nsf.gov	(703) 292-7438
Dick Armstrong	2522 Arctic Blvd, Suite 200 Anchorage, AK 99503	darmstrong@rsa-ak.com	(907) 276-0521
George Blaisdell Operations Manager	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	gblaisde@nsf.gov	(703) 292-7447
Scott Borg Division Director, Antarctic Sciences	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	sborg@nsf.gov	(703) 292-7412
Dave Bresnahan Systems Manager, Operations & Logistics	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	dbresnah@nsf.gov	(703) 292-7441
Jack Buchanan Information Technology Operations Manager	SPAWARSSCEN J664 P.O. Box 190022 Attn: Code 66B North Charleston, SC 29419-9022	Jack.Buchanan@navy.mil	(843) 218-5583
Ron Carpenter FEMC Director (Acting)	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	ron.carpenter@usap.gov	(720) 568-2222
Erick Chiang Division Director, Antarctic Infrastructure and Logistics	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	echiang@nsf.gov	(703) 292-7437
Brad Coutu South Pole FEMC Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	brad.coutu@usap.gov	(720) 568-2301
Kevin Culin SPSM IT Engineer	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	kculin@nsf.gov	(703) 292-7452
Paddy Douglas South Pole Logistics Supervisor	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	paddy.douglas@usap.gov	(720) 568-2302
Sam Feola Program Director, Raytheon Polar Services	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	sam.feola@usap.gov	(720) 568-2003
Nita Folkers Executive Assistant	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	nita.folkers@usap.gov	(720) 568-2452

BK Grant South Pole Area Director	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	bk.grant@usap.gov	(720) 568-2017
Pat Haggerty Project Management/ P&C Manager	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	phagger@nsf.gov	(703) 292-8577
Lee Anne Hess Director of Operations	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	leeanne.hess@usap.gov	(720) 568-2010
Katy Jensen South Pole Station Operations Support Supervisor (Acting)	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	katy.jensen@usap.gov	(720) 568-2354
Steve Kottmeier Director, Science Support	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	steve.kottmeier@usap.gov	(720) 568-2008
Martin Lewis Technical Support Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	martin.lewis@usap.gov	(720) 568-2166
John Maier	Metcalf & Eddy, Inc. 3101 Wilson Blvd, Suite 400 Arlington, VA 22201	art.jung@usap.gov	(703) 682-5106
Henry Malmgren South Pole IT Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	henry.malmgren@usap.gov	(720) 568-2442
Jerry Marty Facilities Construction and Maintenance Manager	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	jmarty@nsf.gov	(703) 292-8032
Neil Miller Project Engineer	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	neil.miller@usap.gov	(720) 568-2122
Scott Myers EH&S Director	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	scott.myers@usap.gov	(720) 568-2022
Rita Pittmann Planning and Controls Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	rita.pittmann@usap.gov	(720) 568-2335
John Rand		jhrand@comcast.net	(603) 542-4672

Liesl Schernthanner South Pole Operations Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	liesl.schernthanner@usap.gov	(720) 568-3938
Dave Scheuerman South Pole Area Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	dave.scheuerman@usap.gov	(720) 568-2231
Mike Scheuermann Aviation Programs Manager	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	mscheuer@nsf.gov	(703) 292-7453
Cory Shaddox Senior Project Specialist	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	cory.shaddox@usap.gov	(720) 568-2236
Paul Sheppard DoD Liaison	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	psheppar@nsf.gov	(703) 292-7454
Sandra Singer Facilities Engineering Projects Manager	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	ssinger@nsf.gov	(703) 292-4897
Brian Stone Deputy Division Director, Antarctic Infrastructure and Logistics	National Science Foundation Rm 755 S 4201 Wilson Blvd Arlington, VA 22230	bstone@nsf.gov	(703) 292-7458
Paul Sullivan South Pole Science Support Manager	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	paul.sullivan@usap.gov	(720) 568-2255
Joe Tarnow Fire Systems Specialist	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	joe.tarnow@usap.gov	(720) 568-2433
Bill Turnbull Manager ATO	Raytheon Polar Services Company 7400 S. Tucson Way Centennial, CO 80112-3938	bill.turnbull@usap.gov	(720) 568-2267
Randy Yuen	Naval Facilities, Pacific CI 43, Attn. Randall Yuen 258 Makala Dr., Suite 100 Pearl Harbor, HI 96860	randall.yuen@navy.mil	

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