Analyses of Arctic Research Support and Logistics Reports from 1997 and 2003: Supporting Arctic sciences in a dynamic environment

for,
NSF, Office of Polar Programs, Arctic Research Support and Logistics Program

by,
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Introduction

In 1997, the report, *Logistics Recommendations for an Improved U.S. Arctic Research Capability*, produced by the U.S. Arctic Research Commission, developed priorities for logistics capabilities necessary to address pertinent Arctic research questions (*Schlosser et al*., 1997). That report was created by a working group representing a variety of Arctic scientists and logistics providers. The group considered community survey responses and the results of a one day workshop while producing the report which presented five main goals containing 37 specific actions. These actions were also presented on a chart showing the communities recommended prioritization (6 mo. – 2yrs, 2-5 yrs, 5-10 yrs). The publication of the 1997 report initiated three noteworthy items; 1) it provided a focus for logistical needs in the Arctic, 2) it justified a $22M increase to the National Science Foundation (NSF) budget for arctic logistics and 3) it led to the creation of the Arctic Research Support and Logistics (RSL) program in 1999 (*Schlosser et al.,* 2003).

In 2003 an update to the 1997 report was published by the Arctic Research Consortium of the United States (ARCUS). The report, *Arctic Research Support and Logistics: Strategies and Recommendations for System-scale Studies in a Changing Environment*, outlined the progress made since the 1997 report was published (*Schlosser et al.*, 2003). It also developed recommendations for the future based on changing needs for arctic logistics. As before, the 2003 report was produced by a working group with input from the research community by way of workshops and surveys. Three overarching goals and 67 specific actions were identified in the report and it was a catalyst for the creation of the Study of Environmental Arctic Change (SEARCH) and subsequently the Arctic Observing Network (AON). The intent of the 2003 report was that it become a living document to be updated as US research priorities changed and logistics assets improved. This report is the first step in consolidating the recommendations and actions into a living document.

Since 2003, research has focused increasingly on changes in the Arctic. In the US this has specifically been facilitated through SEARCH and AON. Public interest in polar regions also increased during the 4th International Polar Year: a large science effort held from March of 2007-March of 2009 that focused on the Arctic and Antarctic. Most recently, the eight member Arctic Council released the Tromsø Declaration reinforcing international interests/concerns in the Arctic. These activities, as well as others, are timely, and set the stage for updated analyses of recommendations presented in the 1997 and 2003 reports. The following discussion is an analysis of the RSL program grounded in these earlier recommendations. Its intent is to provide material for discussion within NSF, and potentially the broader community, regarding accomplishments and future directions of the RSL program.

Approach

The Arctic Research Support and Logistics program was reviewed based on its current mission to "…support the field component of research projects funded through science programs in the Arctic Sciences Section of the Office of Polar Programs and through other programs at the National Science Foundation (NSF). The program accepts proposals that: support long-term observations of the Arctic; support the acquisition of data sets useful to a broad segment of the arctic research community; will lead to Cooperative Agreements to operate multi-use arctic research facilities; or provide services that broadly support the arctic

research community, such as facilitating communication, developing research ideas in an arctic-wide community setting, and cooperating with arctic communities" (*Arctic Research*, 2009).

Due to the quantity of information and the varied formats of the reports, there was a need to organize and reduce repetitive data. Combined, the reports contained 8 main goals, 25 recommendations and104 recommended action items. Since authors of the current analyses and report were not part of the 1997 or 2003 efforts, it was necessary to make inferences about the meaning or intent of several actions. Similar actions contained in both reports were combined for clarity, and thus 82 of the original 104 actions remained for discussion in this report. The subsequent analyses were structured based on the format of the 2003 report which contains four main goals:

- G1 – Supply critical components for development of a pan-arctic perspective.
- G2 – Supporting the infrastructure for safe and efficient research.
- G3 – Organizing agreements and relationships to maximize resources and cooperation.
- G4 – Other.

Category G4 was added to account for 1997 actions that did not easily fit elsewhere. *It is important to note that ratings contained herein are only made on actions put forth in previous reports. Consequently, this report may not touch on all actions or large programs initiated by the Arctic RSL program in recent years.*

A variety of resources were used to complete these analyses. They include advances described in the 2003 review of the 1997 report, arctic science funding announcements, RSL award abstracts, personal communications with researchers who perform work in the Arctic, background provided by the primary support contractor CH2M HILL Polar Services (CPS), publicly available online resources and information from the current NSF RSL Program Managers. In particular, the RSL award abstracts as well as information provided by CPS were important sources of new information. The initial objective was to develop a rating system with clearly defined standards to ensure consistency. Ratings were then determined for each specific action based on information gathered on that topic. The rating system is:

3 (green) –	Expectations were exceeded due to Arctic RSL or support contractor efforts/initiatives.
2 (yellow) –	The basics of the action were met.
1 (red) –	Little progress was made or the action was not addressed at all.
n/a (black) –	The action is no longer relevant to the program or was addressed by the completion of other recommendations.

Following the initial review of ratings and a discussion with the RSL Program Managers it was determined that special markers were required for two unique cases regardless of their rating; Continuing RSL Priorities (marked with orange stars), and Actions to be Passed on to Other Programs (marked with a purple arrow). The colors and shapes indicated are for reference when viewing the attached presentation (Appendix A). These particular designations were made by the RSL Program Managers.

It is important to note, prior to discussion of the results, that the very creation of the RSL Program caused some 1997 actions to be ranked "n/a" and other actions were ranked "n/a" due to subsequent technological advances. Additionally, a score of 2 should be viewed as sufficient because the recommended action was satisfied, or the intent of the recommendation was addressed and RSL resources can now be used elsewhere to support current program objectives. Lastly, in some instances a rating of 1 should be viewed as a flag for the RSL Program to consider lobbying for future resources to support additional programs or initiatives.

Results

In each section below, the main goals and details of representative actions in that topic area are highlighted and discussed. The report provides justification and supporting data for the selected actions and their associated ratings. Pie charts depicting the total number of actions receiving each rank and a table illustrating which actions require continued priority and/or should be moved to another program are also included. The information presented herein is by no means a comprehensive compilation of every action item. The intent of this discussion is to highlight representative and/or highly relevant items in each topic area. A complete list of every action item and its associated ranking is contained in Appendix B.

G1 - Supply Critical Components for Development of a Pan-Arctic Perspective

A total of 26 actions were reviewed for this goal and the average rating was 2.2 (Fig. 1). One of the highlights of actions rated as a 3 was to "Encourage NSF support of long-term observations (3-20 years) in cases where no other support is available." As noted above, the RSL Program accepts proposals for long-term observations that provide critical data. However, there should be some consideration for eventually moving these to observation programs (e.g. AON), or to agencies that conduct monitoring (e.g. NOAA, NASA, etc.) to free up funds for evolving RSL needs. Another highly rated action was to "Provide access to satellite communication systems that are reliable for the locations where research is being conducted." This action has been met through the support contractor who provides iridium phones and other technology to all science parties that require them in the field. The action to "Support development of new technologies for instrumentation and measurement systems" received a rating of 2. The RSL Program supports proposals made to the NSF Major Research Instrumentation (MRI) program as well as funding small grants for exploratory research (SGER) and general proposals for instrumentation development or upgrade. Though no fundamental leaps have been made with this action that would warrant a 3, it sufficiently met the community's needs through the existing mechanisms discussed above.

The action to "Foster development of dependable power for remote, harsh environments including conventional generators, batteries, solar wind generation, and fuel cell technology," was rated as a 1. While RSL has made some recent efforts to become more energy conscious (e.g. new work with wind turbines, interagency agreement with Department of Energy to provide technical assistance at Summit), it was deemed that little progress has been made for the Arctic program to develop a comprehensive suite of robust, autonomous, remote power solutions. This is an area to consider for increased effort in the near future.

There are a total of four actions in this goal that are considered to be continuing priorities for RSL and five that are thought to belong to other programs (Chart 1). These are the previously mentioned cases that needed to be highlighted outside of the normal rating system.

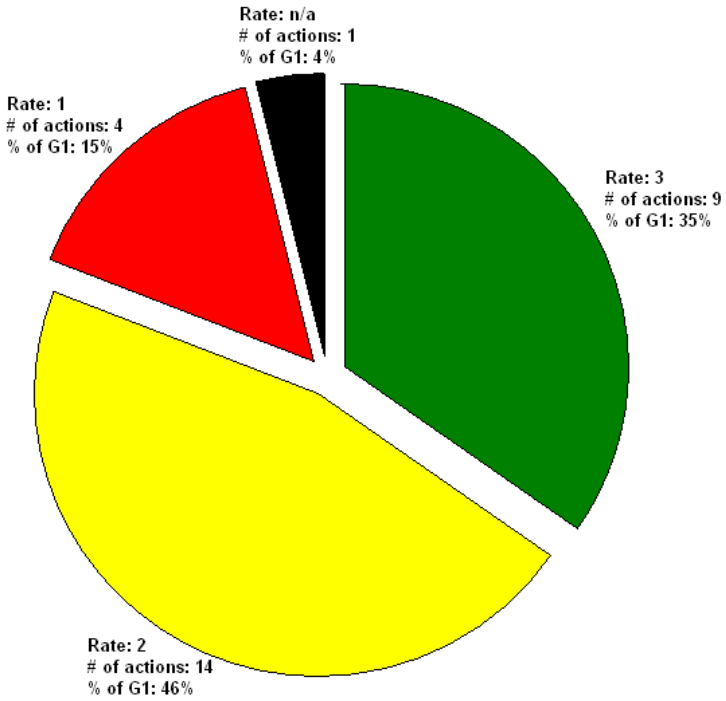

Figure 1 – Overall results of G1: Supply critical components for development of a pan-arctic perspective. There are a total of 26 actions in this goal.

Chart 1 - Specific actions from goal one that are continuing priorities or that need to be passed to another program.

Action	Rating	Year	Continuing priority (star)	Belongs to (arrow)
Improve researchers' access to data and modeling results through central web-accessible archives.	2	2003	Yes	Cyber-infrastructure
Promote means to share responsibility for increased arctic monitoring among government agencies supporting arctic research.	2	2003		IARPC
Foster spatial data infrastructure (SDI) and standards to support the development of regional SDI nodes that would contribute to a pan-arctic SDI.	2	2003	Yes	
Establish a clearinghouse for integration of specific types of data from disparate sources.	1	2003		Cyber-infrastructure
Improve the synthesis of field observations and model-based understanding.	1	2003	Yes	Cyber-infrastructure
Foster development of dependable power for remote, harsh environments.	1	2003	Yes	
Ensure adequate computer capacity for data transfer, synthesis, assimilation and modeling.	n/a	2003		Cyber-infrastructure

G2 - Supporting the Infrastructure for Safe and Efficient Research

A total of 24 actions were reviewed for this goal and the average rating was 2.23 (Fig. 2). There are several highly rated actions in this group dealing with infrastructure upgrades. Notable progress has been made at Toolik Field Station, Barrow and Summit Station. In addition to significant enhancements, all of these locations are now capable of operating year round. Most actions dealing with infrastructure needs at these three locations were rated as a 3.

With the continued effort by the support contractor to provide “Learn to Return” training the action to “Continue and expand personal safety, survival and medical training” was rated a 2. The support contractor is also continuing to build field equipment caches in a variety of locations (e.g. Cherskii, Seward Peninsula, etc.) giving “Continue to make equipment centrally available as is currently done in Barrow…” a rating of 2 as well. “Promoting safety and field mentoring of young and inexperience researchers and field support staff through formal apprenticeship programs” was given a rating of 1. While the Office of Polar Programs (OPP) does support the Polar Postdoc program and “Learn to Return” is available for all researchers, a continued focus on these new grantees will strengthen the next generation of Arctic scientists. Although this is an area within the RSL Program that could

be supported if an appropriate proposal were submitted, it is difficult to envision how this could be accomplished without some direction and incentive from the NSF Arctic Science Program Managers.

There are a total of five actions in this goal that are continuing priorities for RSL and one that was thought to belong to other programs (Chart 2).

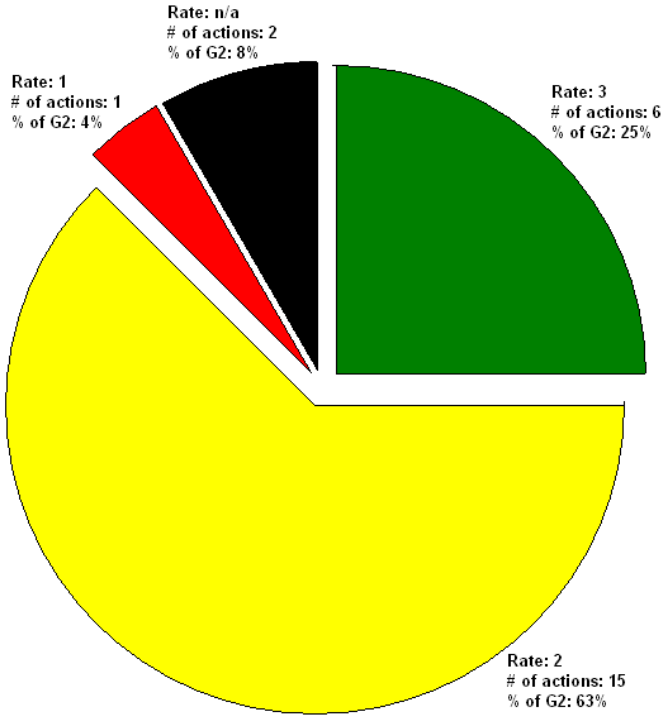

Figure 2 – Overall results of G2: Supporting the infrastructure for safe and efficient research. There are a total of 24 actions in this goal.

Chart 2 - Specific actions from goal two that are continuing priorities or that need to be passed to another program.

Action	Rating	Year	Continuing priority (star)	Belongs to (arrow)
Extend the infrastructure that supports communication among scientists to support communication between scientists and communities.	3	1997		Cyber-infrastructure
Determine what safety equipment is needed and assess if these needs are being met.	2	2003	Yes	
Conduct a combined risk assessment and emergency response inventory for areas where arctic research is being done.	2	2003	Yes	
Establish protocols for communication and emergency evacuation for US researchers working the US and foreign territories.	2	2003	Yes	
Streamline the process for getting equipment to the right place at the right time.	2	2003	Yes	
Conduct contingency planning for possible accidents and emergencies.	2	2003	Yes	

G3 - Organizing Agreements and Relationships to Maximize Resources and Cooperation

A total of 23 actions were reviewed for this goal, and the average rating was 2.2. Four items received a rating of 3; one of which was the action to "Set up logistics facilitators at the regional level." The support contractor, enabled by the RSL Program, provides a very customizable and dynamic support system in this respect, and regional science, technology and logistics support is now available at many locations including Thule, Barrow, Toolik and several Russian locations. The results of this effort have enabled successful projects like deep core drilling at Lake Elgygytgyn in far eastern Russia, and tundra water flow studies at the Barrow Environmental Observatory.

The majority of actions, 16, were rated a 2 (Fig. 3). Several of these actions dealt with increasing collaborations with Russia and Russian scientists to achieve goals of increased access, collaboration and aid in completing projects in that region. In support of these actions, collaborations with the Northeast Science Station, the US Civilian Research and Development Foundation (CRDF) and the Chukotka Science Support Group (CSSG), among others, have been strengthened.

"Promote international collaboration, data sharing, information exchange, and reciprocity," was rated as a 1. While international collaboration is well documented there appear to be

gaps in data sharing, information exchange and reciprocity and is recognized as a continuing priority for the program.

Overall in this goal area seven actions were noted as continuing priorities (Chart 3) which highlights and emphasizes room for improvement. Additionally, there are four actions that should be considered for shifting to other programs.

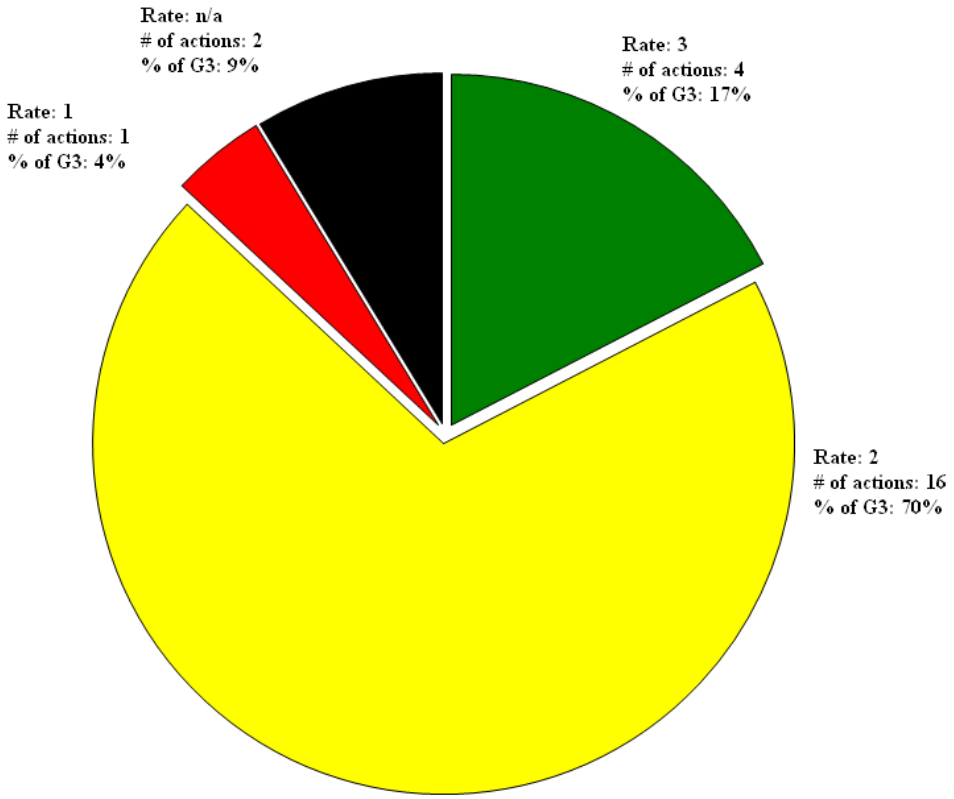

Figure 3 – Overall results of G3: Organizing agreements and relationships to maximize resources and cooperation. There are a total of 23 actions in this goal.

Chart 3 - Specific actions from goal three that are continuing priorities or that need to be passed to another program.

Action	Rating	Year	Continuing priority (star)	Belongs to (arrow)
Establish methods for shared use of major facilities, platforms, and equipment.	2	2003	Yes	
Establish international cooperation for programs that cover large space scales and/or long time scales.	3	2003	Yes	
Streamline customs and permitting processes for movement of scientific gear, data and personnel.	2	2003	Yes	
Establish international cooperation for instrument development, deployment and recovery.	2	2003	Yes	
Maintain the heavy-lift, ski equipped LC-130 capability for access to the Greenland ice sheet and work toward enhanced aircraft support from federal agencies.	2	1997	Yes	
Organize community/researcher meetings to establish communication between local communities and scientists to better use traditional knowledge and local expertise.	2	2003		Arctic program managers
Provide for outreach activities describing research products and possible impacts.	2	2003		Arctic program managers
Ensure for training of students in arctic field operations and encouragement of careers in arctic research.	2	2003		To education program or Arctic program managers
Provide training workshops for researchers unfamiliar with local customs, ethics, and procedures.		2003	Yes	
Establish interagency working groups for all major arctic research initiatives.	2	2003		IARPC
Promote international collaboration, data sharing, information exchange, and reciprocity.	1	2003	Yes	

G4 - Other

There were 9 actions assigned to this goal, and the average rating was a 1.7 (Fig. 4). This particular area is a catch all for 1997 actions that did not easily fit into the other three goal areas. While none of the actions in this group received a rating of 3, the majority were rated

as a 2. Examples include the “Use of differential GPS should be made available for precisely locating specific sites” and “Obtain surplus fishing boats for multidisciplinary research in coastal waters.” There are many examples of program support meeting these needs when requested by individual projects. The action to “Fully implement the Arctic Logistics and Information Access and Services (ALIAS) Program” was rated as a 1. While many other programs are starting to provide similar types of data (e.g. the Arctic Research Mapping Application, ARMAP), ALIAS never evolved much past a concept and thus the poor rating. In this category, two actions were marked as continuing priorities for RSL (Chart 4).

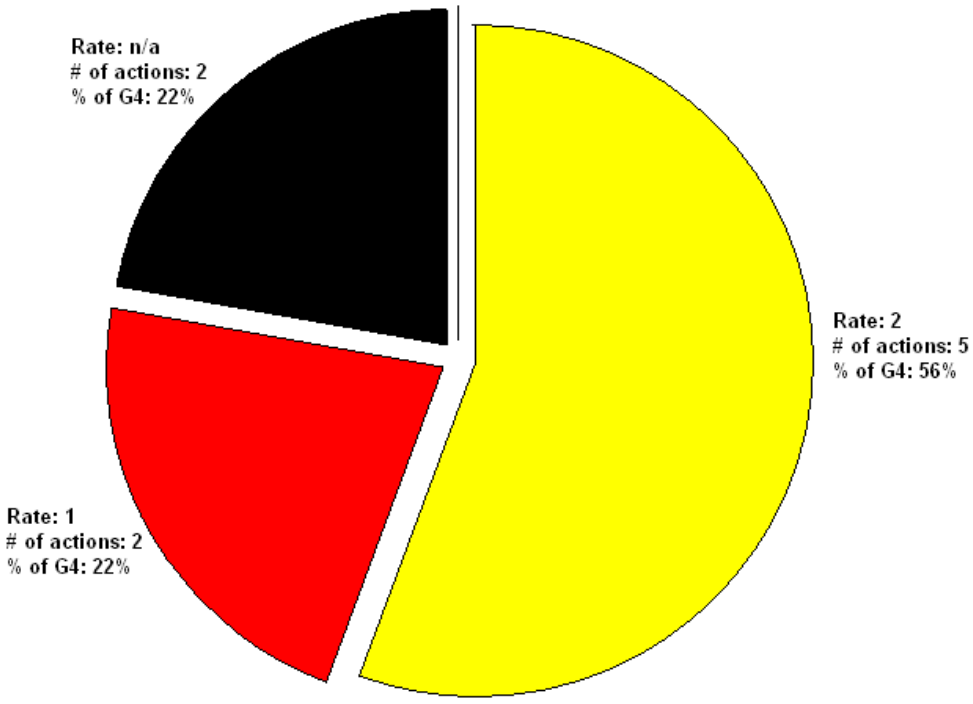

Figure 4 – Overall results of G4: Other. There are a total of 9 actions in this goal.

Chart 4 - Specific actions from goal four that are continuing priorities.

Action	Rating	Year	Continuing priority (star)	Belongs to (arrow)
Establish US bank accounts in local Russian cities to help researchers avoid problems with cash and means of payment in Russia.	2	1997	Yes	
Identify a provider for cost-effective travel and health insurance to address health emergencies in the Arctic that can involve extraordinary expenses to investigators and federal agencies.	1	1997	Yes	

Conclusions

The overall performance of the RSL program has been very good when its efforts are gauged by recommended actions presented in the 1997 and 2003 reports. Twenty-three percent of the actions were rated as exceeding expectations, 59% met expectations, and approximately 10% did not meet the basic requirements for the recommended action (Fig. 5). Several lines of thought resulted from this effort and the subsequent conversations leading to assignment of the ratings. One was the simple fact that while the RSL program has been dynamic, accommodating, and seems to have been able to cover the community's needs well, often it is 1) responsive to the funding from Arctic Science Program Managers and thus 2) it is largely PI driven. Thus it is reasonable to appreciate and account for the difficulty in maintaining a strategic approach while simultaneously responding to the daily needs of Arctic Science Program Mangers and individual PIs. The scores contained herein reflect the challenges associated with attempting to achieve that balance.

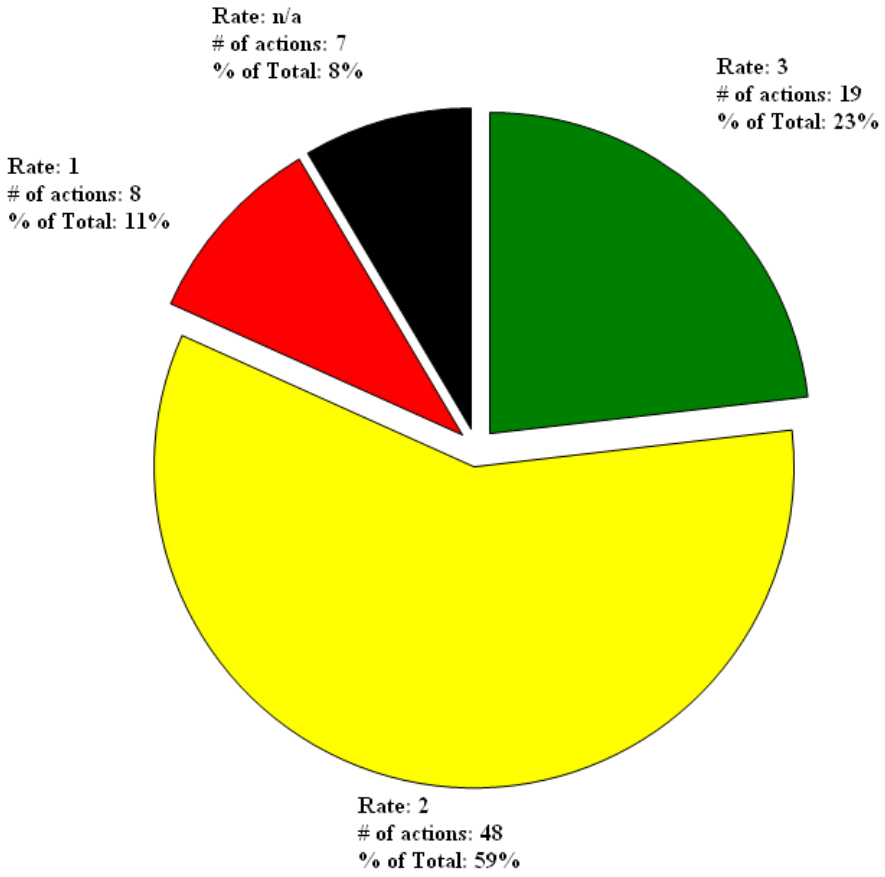

Figure 5 – Overall performance of RSL program based on the 82 actions presented in the 1997 and 2003 reports.

An additional challenge is that while the RSL Program is able to fund some projects and programs, the proposals (strong, well-defined proposals) must first be made by the research, support and logistics communities. That fact places significant pressure on the Program to shift toward tactical, rather than strategic approaches. Also, there are selected actions where the RSL Program Managers felt the program performs very well (e.g. interagency

cooperation, shared use of major facilities, etc), and indeed they are making great strides in these areas, but based on the recommendations it was recognized that these efforts are not always communicated to the general science community.

Several actions are marked as appropriate to shift to other programs. These recommendations were made because it appears the other Programs are better equipped to lead the efforts with the RSL Program acting in a supporting role. This is particularly true for actions concerning the newly created Cyberinfrastructure program or for the Interagency Arctic Research Policy Committee (IARPC), and for actions relating to high level, interagency goals. There are also several actions that the RSL Program can attempt to support but are probably better handled by the Arctic Sciences Program Managers (e.g. coordinating science/community meetings). Last, there are a wide variety of actions that the RSL Program is continuing to highlight including; interagency and international collaboration, safety and remote power and clean energy solutions. Most of these actions have been addressed to some degree, but require continued emphasis to bring greater impacts to the community at large.

Since the creation of the Arctic RSL Program, its performance has been outstanding when placed in context. There are many and significant challenges to support a multi-disciplined research program that was recently fueled by the concerns over global climate change. Continued success of the program will require attention to details highlighted in this report as well as continued response to the changes brought about by the "opening" of the arctic. Current and future challenges include greater competition for logistical assets and the ability to employ technical personnel who are familiar with operating in polar regions. However, it appears that with a skilled contractor and the current momentum of Arctic interest, the RSL Program can take the recommended actions and meet or exceed all these evolving challenges.

References

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Appendices

Appendix A – RecommendationsResults_Final.pdf
Appendix B – RecommendationsMatrix_Final.xls