Antarctic Research Vessel Oversight Committee (ARVOC) Meeting and Polar Research Vessel Planning

May 20-21, 2004
National Science Foundation
Arlington, Virginia

Attendees:
Robin Ross, Chair, ARVOC, Univ. of California, Santa Barbara
Scott Borg, NSF
Teresa Chereskin, SIO, Univ. of California, San Diego
Erick Chiang, NSF
Eugene Domack, Hamilton College
Steve Dunbar, RPSC
Chris Fritsen, Desert Research Institute
Jim Holik, RPSC
Deneb Karentz, Univ. of San Francisco
Bernhard Lettau, NSF
Chris Measures, Univ. of Hawaii
Skip Owen, RPSC
Bruce Robison, MBARI
Dawn Scarboro, RPSC
Jim St. John, STC
Al Sutherland, NSF

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ACTION 2: RPSC (ALICE DOYLE/BOB KLUCKHOHN) WILL PROVIDE TO ARVOC RPSC'S PLAN FOR NUTRIENT ANALYZING ON THE VESSEL. REPORT WILL INCLUDE PLAN, COST, AND EQUIPMENT INFORMATION.

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ACTION 10: CHRIS FRITSEN WILL SPEAK WITH STEVE ACKLEY AND UPDATE HIM ON TODAY'S DISCUSSIONS. STEVE MAY BE ABLE TO PROVIDE ICE IMAGERY CHARTS THAT MAY SUPPORT THE NEEDS FOR

4.5 FOOT ICE- BREAKING CAPABILITY. JIM ST. JOHN MAY BE ABLE TO USE THE CHARTS/MAPS TO PREDICT HOW THE PROPOSED VESSEL WILL OPERATE IN THE ICE.

ACTION 11: ROBIN ROSS WILL PREPARE THE LETTER FOR PRVA BOARD ON BEHALF OF ARVOC. TO BE INCLUDED: JUSTIFICATION, ADVANTAGES, TIMELINE ON WHAT'S BEEN DONE TO DATE, CURRENT STATUS, AND LIST OF WHAT'S LEFT TO BE DONE.
ARVOC WILL INCLUDE RECOMMENDATIONS.

ACTION 9 (cont'd): ARVOC WILL CONTINUE TO CONTACT THE GRANTEES REGARDING OUTBRIEF COMMENTS WHEN THEY CONTACT THE CHIEF SCIENTIST FOLLOWING HIS/HER CRUISE. RPSC (JIM HOLIK) WILL CONTACT PIS THAT SUBMIT NEGATIVE COMMENTS IN THE OUTBRIEF.

(refer page 12)

THE EXECUTIVE COMMITTEE GENERAL COMMENTS:

- RPSC should advise Committee Members and the NSF of the ARVOC meeting date well prior to the meeting. This will allow members to plan their travel schedules and to avoid conflicts with other meetings.
- RPSC should continue to submit reports (agenda topics) to the members prior to the meeting date. Members will be able to review topics/lists and will be prepared to discuss expeditiously.
- To maximize the Committee's usefulness, RPSC should prioritize proposed procurement items before the meeting and include justification for purchases. A rating identifying whether the item is a "must, should, or could" will also help members in their decisions.
- The Committee would like to know if the equipment listed for purchase is being requested as operational, maintenance, or life-cycle replacement. Also, ARVOC would like to know if the equipment already has NSF approval or if it is yet to be requested/proposed to the NSF.
- Between ARVOC meeting dates, the Committee would like to be kept informed of any/all large ticket items before they are purchased. Keep ARVOC in the loop and informed.
- ARVOC would like to be informed of items such as the upgrading of one of the existing berthing vans and the upgrade of LMG plumbing in the hold prior to funding approval and work being scheduled.
- ARVOC would like to see the status of all Action Items from previous ARVOC meeting. This information could be sent to members by email notification or presented as a report.

WELCOME AND INTRODUCTIONS

Meeting began at 9:00AM with Erick Chiang addressing the group. Erick: In the past, it was believed that the NSF/ARVOC were on a nice track- with funds for Marad, etc. However, things started to happen. The condition of the USCG icebreakers is impacting their missions and the USCG is in the midst of a study in preparation for long-range planning- at an anticipated expense of $400 million. Also, homeland security is factoring into the USCG projection and is impacting the polar research board requirements and plans. Jim Swift gave an informative report to our office advisory committee. This report is available from Al Sutherland.

Taking into account the above and overlaying this information with a somber budget outlook, not only government in general but the Foundation is looking at a flat budget for FY04 and FY05. Even inflation increases will not make up for the shortfall.

Today, there is not much more Erick can add. A clear picture cannot be formed until all the dots can be connected. We, (NSF) should continue to look at what the science community wants. We can look at what can be accommodated with what we have today. We may have to look at the Antarctic re-supply options or we have one vessel that breaks in to the ice and also does the research. These are ideas that Al Sutherland has on his plate.

Robin Ross: In terms of the polar research review board, what is the timing?

Erick: This is on the fast track and is expected to take up to a year – this has not been funded yet. A year from now would be optimistic. The icebreaker study will be ready a year from now. Al Sutherland noted that a proposed draft is available on the web. The polar research review board tends to look out 20 years into the future and what is best for the nation to invest in. If $400 million is what the USCG determines to be the cost, Congress will want our two agencies to work together…Polar research will be providing recommendations. The snowball that we were working on was sort of in a vacuum. We knew the USCG was working on their plans. If anything this USCG situation might bring attention to our situation. Dr. Erb was at Town Hall meeting in San Francisco and stated that we need to look at why we couldn't use the NBP hull, per Jim Holik. Deneb agreed that she had the same impression. Question: Do we look at options using the NBP hull?

Erick: What kind of improvements could you make with what you have in the NBP. This might be what we need to look at. We may just want to extend the contract with no change. Then look at what kind of

improvements we can make. Cost will be important. Right now there's no competition for the NBP.

Deneb: Dr. Erb also indicated that he wants us to look at what other countries are doing. Do we need a survey of other research programs?

Erick: My impression is that the Antarctic/Arctic scope is too broad.- time transiting, etc. Could a collaboration with other countries be an option?

Al: Dr. Erb sees a lot of cooperation in the Arctic but not so much in the Antarctic. It's a rare circumstance when you would find the opportunity to work collaboratively in the Antarctic. Robin agreed that it's not been conducive logistically to work with those other vessels.

Chris Measures: Has there been any linkage with NSF's review of the UNOLS fleet? UNOLS has done a twenty year study with a lot of work already being done. Erick: This might be helpful to look into.
Skip Owen: UNOLS design options have already been looked at when designing/working on our proposed vessel.
Again, Chris noted that, if this turns into a long range plan, it would be beneficial to look at those UNOLS reports- these might be applicable to our work.
Chris will provide Al Sutherland and other members with copies of the report.
Eric: It's important that we continue to look at scientific requirements- we are not designing a vessel.

Bruce Robison: Is there a stage in the evolution of design that we should shoot for? Could we prepare what would be an adequate stage of configuration? Then pull this out when the time is right to come back and propose?
Eric: I don't know what stage. You've seen the MARAD design. Because of political issues raised, we have to look at financial ramifications to see how far we can go. We need to look at options. Once we establish a procurement strategy, MARAD will pull this together in six to eight weeks. Then NSF has to decide which way to go. We need to be able to define what we want to a degree that will be appropriate for seeking the funds.
Bruce Robison: Town Hall meetings, feedback has been really good and we would like that incorporated before this gets frozen.

Skip Owen: On a broader scale, an overall management plan needs to be worked out. Management/procurement/, and vessel specs, all three, need to be worked out. We have looked at what other people are doing. The SCC needs to continue to look at what is being done in

other programs. Then we need to see how we fit in with the USCG and others.

Deneb: We need an understanding of what we (ARVOC) can do. We need to know how we can channel through our ideas to NSF. Where would our report go?
Erick: If report is given to NSF, we could channel it through to the PRV committee. A good succinct report whether it's through RPSC or whatever, we have no problem sending that report through to the PRV committee.

Al: I would be astounded if you (ARVOC) weren't a part of the strategy planning.
Skip: I see the report coming from ARVOC through RPSC on to the NSF.

Al: Dick Voelker will pull together his report but I think this will still be delayed until the RPV committee moves. Also, use "guidance" design not "conceptual" design to better describe what we (ARVOC) are doing.

Since the end of the cold war, it's sort of a dead-end for the polar. Next year we want two icebreakers but the USCG says we can't have the POLAR SEA next year. Only one icebreaker will go down. The USCG vessels need replacement/repair. The HEALY may not be sent down as she was last year. There's limited help (Canadians, Kapitan Khlebnikov) but if the ice stays the same, and blows out completely, everything is stable. The NBP may be able to break in but that would kill science going on. The NBP may have to be diverted to break ice if, by chance, the USCG vessel has failure.

Robin: In order for the PRV to make a recommendation, they need to know the science requirements. The kind of facilities that we need to meet our science objectives. Until the community comes together and makes it clear what is needed, the PRV will not have all the information. Deneb noted that ARVOC should be able to come up with a really good report for the RPV.

Chris Measures: One recommendation- ARVOC should look at design and design projects even if we can't proceed with procurement at this point. Even if it's not clear that this is going forward, ARVOC still needs to design and develop concepts. Have it more or less ready to go just as UNOLS has in the past.

Al Sutherland: ARVOC can put together some guidelines. A very early phase that incorporates the Town Hall discussions. NSF has

asked MARAD and STC to back off somewhat. We hope to pull it all together and have it in order to put this in the budget in October. Another thing, the USCG hasn't been funded yet. Dr. Erb wants to do that but he wants commitment from USCG that they will put in funds.

Following today's meeting, ARVOC and the SCC should be able to write the report that validates the ARVOC's and the science community's requirements, per Robin and committee consensus.

RPSC UPDATE

Steve Dunbar echoed Erick's remarks that the budget is somber. Gas increases for vessels, power plant expenses at McMurdo, steel prices rising by 30% all impact the program. RPSC expects to see a tightening of the budgets until the war winds down. Steve spent the last two days with the NSF discussing strategic ways to use our discretionary funds. Projects are costing more.

Al: The NSF has been told to expect a flat budget without even an inflationary increase. Jim Holik noted that with the Vessel Charter fees increasing, gas costs rising, our budget will actually be less.
Steve: The NSF has directed us to do what we can with the funds we have.

ARVOC BUSINESS

In an effort to have the meeting flow more effectively, Jim Holik provided ARVOC with all reports prior to today's session. This allows members to review the information and prepare questions on issues of concern. If this format works for today's meeting, ARVOC will ask RPSC to continue the early reporting for future ARVOC meetings.
Presentations follow.

PERSONNEL CHANGES

Dr. Steffi Suhr-Sliester has been hired as the biology Science Cruise Coordinator. Steffi has sailed as a grantee on the LMG, NBP, and British Research Vessels, and we are confident that she will provide excellent support to our customers.

Dr. Gerald (Jerry) Bucher has been hired as the Supervisor of Marine Electronics Services, replacing Todd Johnson. Jerry is a former McMurdo grantee (geology) and is a former owner of a geophysics surveying company.

Mr. Marc Pomeroy has been hired as the Assistant Supervisor for Vessel Laboratories. Marc is our in-house expert for lab equipment. He also has commercial field experience as an instrument repair technician for Water's instruments.

PROCUREMENTS -PROJECTS COMPLETED

(For complete report/list, see page 18)
General discussion of the SHALDRIL project. Jim Holik reported that SHALDRIL will be testing off the coast of Cape Town, South Africa. There is much more work to do with SHALDRIL and there is cost involved. RPSC has hired a naval architect and held more meetings. All of this has brought the project over-budget. A large part of the cost this year has been the startup, design, and engineering. Next year, RPSC will see the operational costs, per Jim.

Al: Everyone is watching this project with interest. If this is a success, there will be more requests for this type of drilling research.

Jim: The next SHALDRIL meeting is June 08, 2004.

Chris Measures asked about the MOCNESS systems (line items 12 and 13 page 18). Jim explained the WHOI subcontract to upgrade and make redundant the MOCNESS system. With this completed and both systems operational, RPSC informally ended the WHOI support agreement.

Assigned life-spans for all equipment. Jim reported that Paul Olsgaard and Randy Sliester have reviewed life-cycles for all vessel equipment. This life-span reporting is now routine and eventually will factor into RPSC's budget process. Steve Dunbar added that RPSC has approximately 3,500 line items in the program-wide. These capital equipment items are being looked at and reviewed for their life-cycles. With this information, RPSC will be able to spread out the financial load.

Al: Operations is one cost factor, wear and tear life cycles another, and computers yet another factor. Costs for projects such as SHALDRIL must be accounted for, too. NSF/RPSC must decide what is more important and weigh out the funds that are available. This is all complicated and life cycle input is very important with deciding how to spread the funds.

ACTION 1: RPSC (JIM HOLIK) WILL PROVIDE ARVOC MEMBERS WITH THE LIFE CYCLE REPORT FOR THEIR REVIEW/INFORMATION.

Ice-resistant moorings for IVARS Jim responded to Robin Ross' question on the procurement of ice-resistant moorings)line item 6 page 18). RPSC shifted money around to cover the extra expense when the moorings were lost on Walker Smith's cruise. Rob Dunbar noted that, if someone with more mooring expertise had inspected the moorings prior to deployment, these might not have been lost. RPSC might want to ensure this on future mooring cruises.

PROCUREMENTS-PROJECTS COMPLETED- OR IN-PROCESS OF COMPLETION FY04

(For complete report/list, see page 19)

Acquired a liquid nitrogen plant and dewar (line item 4 page 19)Chris Measures noted that, in his past experiences with liquid nitrogen plants on vessels, the equipment was functional but they never worked properly. Following general discussion, Jim stated that if the equipment does work properly aboard the NBP during the Detrich Cape Town cruise, this will more than pay for itself. At the next meeting, Jim will inform ARVOC members how the liquid nitrogen plant performed.

Completed general prupose/trace metal clean van and garage van- (line item page 19) Robin Ross asked how the new grantee knows he/she has space for storage? The POC will tell the new grantee about the weigh station. Steve Dunbar added that RPSC expects the grantee to tell us what they need; then we tell them what capability is available.

Markey DUSH9-11 oceanographic winch for the LMG (line item 5 page 20) Jim reported that the original quote was understated (was originally quoted as $80,000- quote is now $370,000). There were numerous reasons given by the vendor for the error in original quote. Because of the large difference in the quotes, RPSC is getting two new bids from other vendors and is looking at a T&M bid.

Procured new 21-foot aluminum hull landing craft for the LMG and Palmer Station (line item 4 page 20) Robin asked for more specifics on the new landing craft and if it is heavy enough for LTER island work. Jim informed that the craft requires the main crane for on-off load to the LMG; it has a reinforced floor and will be used primarily for island hopping and shore work at Palmer Station.

NOX analyzer as SIP identified or Nutrient Autoanalyzer (line item 3 page 23) Jim reported that this item is still under discussion at RPSC and with the NSF. It's uncertain what will be done but ARVOC will be kept informed on what direction RPSC will take on this equipment. It was noted that the budget is the driving force. **ACTION 2: RPSC (ALICE DOYLE/BOB KLUCKHOHN) WILL PROVIDE TO ARVOC RPSC'S PLAN FOR NUTRIENT ANALYZING ON THE VESSEL. REPORT WILL INCLUDE PLAN, COST, AND EQUIPMENT INFORMATION.**

FOTIS imaging system (line item 6 page 23)ARVOC requested that more information be provided to them prior to listing items on the proposed procurements list. For ARVOC to make informed suggestions, more information is needed. **ACTION 3: RPSC (BOB KLUCKHOHN) WILL WRITE JUSTIFICATION FOR THE FOTIS IMAGING SYSTEM.**

Also, ARVOC would like to know how RPSC is classifying "replacement" when this designation is used for proposed procurements. Is the "replacement" because of malfunctioning equipment, lifecycle, no longer performs to standards, lost equipment, etc. ARVOC asks for more explanation on proposed purchases so they can better prioritize items.

Replacement Beckman LSC (line item 7 page 23) **ACTION 4: RPSC (BOB KLUCKHOHN WILL SUBMIT JUSTIFICATION FOR THE BECKMAN INSTRUMENT AND THE FLUOROMETER SCANNING EQUIPMENT.** This justification will allow ARVOC to make a recommendation and prioritize this item.

Steve Dunbar spoke of how purchases are classified for McMurdo, South Pole, and Palmer Station. Items are determined to be one of the following:
Must- item is required for science support/operations and is absolutely necessary
Should- item should be purchased but operations will continue even if not purchased at this time. Is an important item for consideration.
Could- item could be used but if not purchased operations will not be negatively impacted. This is a "nice to have" classification.

RPSC and ARVOC might want to use the M, S, or C as a step to aid in prioritizing.

JPC Capability for LMG (line item 3 page 24)Gene Domack discussed Option 2: modify current rail system to get the same length core. In his opinion, option 2 would be a mistake. Modification could cause safety issues and the lost deck space would be detrimental to operations. Discussion on an Option 3- redesigning the cradle. **ACTION 5: RPSC (SKIP OWEN) WILL INVESTIGATE WHOI'S CORING OPERATIONS TO DETERMINE IF A REDESIGN SIMILAR TO WHOI'S CORING SYSTEM MIGHT WORK FOR OUR VESSEL. RPSC WILL REPORT BACK TO ARVOC.**

Forward looking sonar for the LMG U(line item 5 page 25) Skip Owen discussed the need for a forward looking sonar. He noted that because of the work done at the islands, the vessel stands off shore 2 miles and tactical sonar is a very important, tremendously needed piece of equipment in avoiding loss of equipment. Gene noted that the sonar would be used at other opportunities as well. Skip asked that ARVOC mark the forward looking sonar as a priority. **ACTION 6: ARVOC SUPPORTS PURCHASING A FORWARD LOOKING SONAR FOR THE LMG.**

RPSC (Jim Holik, Skip Owen, Paul Olsgaard) will get an estimate from ECO on the cost of the hole for the sonar valves. The hole may be a possible dry dock task this year. Skip will write a justification for ARVOC review.

ACTION 7: RPSC (JIM HOLIK) WILL FINALIZE/EDIT THE PROPOSED PROCUREMENT LIST AND THE LIST, ALONG WITH JUSTIFICATIONS, WILL GO TO ARVOC MEMBERS FOR THEIR PRIORITIZATION AND COMMENTS. MEMBERS WILL RECEIVE THE LIST BY THE END OF JUNE 2004 AND SHOULD RETURN COMMENTS BY LATE JULY.

SCIENCE OF OPPORTUNITY

(for list of Science of Opportunity activities see page 27)
ARVOC needs to revisit policy regarding ownership of data. An issue recently arose regarding proprietary status of ADCP data.
Jim Holik began discussion by noting that the "science of opportunities" events are not just opportunities but are NSF funded projects. ARVOC was asked to review/discuss the SoO policy and to give guidance regarding, specifically, ownership of collected data.

Collection, publication, release of data by the grantee who is the "science of opportunity" PI may, on occasion, conflict with the chief scientist's need to keep the data unpublished for two years.

General discussion resulted in an action that should help clarify how data is to be handled on the science of opportunity cruises.

ACTION 8: ARVOC SUGGESTS THAT "SCIENCE OF OPPORTUNITY" DATA CAN BE PUBLISHED UNLESS THE PRIMARY PI ON THE CRUISE, STATES THAT THE DATA IS TO REMAIN UNPUBLISHED FOR TWO YEARS. ONE METHOD FOR COMMUNICATING THIS REQUEST IS THROUGH THE ORW. ALSO, IT IS RECOMMENDED THAT THE PRIMARY PI COMMUNICATE WITH THE DATA COLLECTING PI TO ALERT THAT HIS/HER DATA IS PROPIRATORY AND SHOULD REMAIN UNPUBLISHED FOR TWO YEARS. RPSC SCIENCE CRUISE COORDINATORS SHOULD ALSO BE MADE AWARE OF THE PRIMARY PI'S REQUEST TO HELP FACILITATE DATA COLLECTION AND APPROPRIATE DATA DISBURSEMENT.

NSF POLAR RESEARCH OUTLOOK

Al Sutherland presented slides from Jim Swift's presentation to the NSF OPP Advisory Committee May 10, 2004. Documents are available to the committee from Al or Jim Swift.

Al also provided members with a copy of *The National Academies Division on Earth and Life Studies Polar Research Board -Ship Dependent Science Needs in the Arctic and Antarctic.* The study provides a comprehensive overview of ship-dependent polar science priorities, their ship-based support requirements, and the ship assets needed to accomplish these priorities. To access the report by web site go to
http://www.nsf.gov/od/opp/opp_advisory/briefings/may2004/ship_needs_prop.doc

EXECUTIVE COMMITTEE COMMENTS

The executive committee general comments:

- RPSC should advise Committee Members and the NSF of the ARVOC meeting date well prior to the meeting. This will

allow members to plan their travel schedules and to avoid conflicts with other meetings.

- RPSC should continue to submit reports (agenda topics) to the members prior to the meeting date. Members will be able to review topics/lists and will be prepared to discuss expeditiously.
- To maximize the Committee's usefulness, RPSC should prioritize proposed procurement items before the meeting and include justification for purchases. A rating identifying whether the item is a "must, should, or could" will also help members in their decisions.
- The Committee would like to know if the equipment listed for purchase is being requested as operational, maintenance, or life-cycle replacement. Also, ARVOC would like to know if the equipment already has NSF approval or if it yet to be requested/proposed to the NSF.
- Between ARVOC meeting dates, the Committee would like to be kept informed of any/all large ticket items before they are purchased. Keep ARVOC in the loop and informed.
- ARVOC would like to be informed of items such as the upgrading of one of the existing berthing vans and the upgrade of LMG plumbing in the hold prior to funding approval and work being scheduled.
- ARVOC would like to see the status of all Action Items from previous ARVOC meeting. This information could be sent to members by email notification or presented as a report.

The executive committee reviewed the Outbriefs and noted that responses were very positive overall. **ACTION 9: ARVOC WILL CONTINUE TO CONTACT THE GRANTEES REGARDING OUTBRIEF COMMENTS, RPSC (JIM HOLIK) WILL CONTACT THOSE GRANTEES WHO MAY HAVE NEGATIVE COMMENTS.**
Robin remarked that enormous good will is generated when outbrief comments are recognized. Jim offered that RPSC contact the PI/grantee to discuss outbrief comments before web posting.

OTHER

Al Sutherland discussed Miles McFee and his work involving upper water profiling in the Weddell Sea. McFee would like to use a mini ctd through the moon pool. Jim Holik will investigate putting a door on the moon pool. Chris suggested having a hot water drill on board to help unfreeze the moon pool. Jim will discuss this with ECO. It may be that McFee will need to use a hut on the ice but the moon pool option will be looked into.

Al mentioned that recent USCG inspections have brought to light a federal regulation, sub chapter U reading that may impact future haz waste transports. Determination of whether the cargo being transported is brought on board or is actually generated on board may affect whether we are able to transport the cargo. ECO received a letter informing them of the regulation and possible repercussions if regulations are not followed. The USCG, ECO and Al met to discuss the issue and the USCG seemed to be willing to work to resolve the confusion.

POLAR RESEARCH VESSEL ARVOC/SSC

Skip Owen provided a brief chronology of major activities for the PRV project, procurement milestones

The Committee continued, in working session, on how best to develop the letter of recommendation to the Polar Research Vessel Advisory Board.

ACTION 10: CHRIS FRITSEN WILL SPEAK WITH STEVE ACKLEY AND UPDATE HIM ON TODAY'S DISCUSSIONS. STEVE MAY BE ABLE TO PROVIDE ICE IMAGERY CHARTS THAT MAY SUPPORT THE NEEDS FOR 4.5 FOOT ICE-BREAKING CAPABILITY. JIM ST. JOHN MAY BE ABLE TO USE THE CHARTS/MAPS TO PREDICT HOW THE PROPOSED VESSEL WILL OPERATE IN THE ICE.

ARVOC will give letter/recommendation to RPSC. RPSC will provide the NSF with the ARVOC letter. NSF will then give the letter to the Polar Research Vessel Advisory Board.

The Committee Members, following much discussion, laid out a plan to develop the PRVA letter.

ACTION 11: ROBIN ROSS WILL PREPARE THE LETTER FOR PRVA BOARD ON BEHALF OF ARVOC. TO BE INCLUDED: JUSTIFICATION, ADVANTAGES, TIMELINE ON WHAT'S BEEN DONE TO DATE, CURRENT STATUS, AND LIST OF WHAT'S LEFT TO BE DONE.
ARVOC WILL INCLUDE RECOMMENDATIONS.
The Committee assigned various sections of the report to individual

members. The sections will be compiled into one report for presentation to the PRVA Board. Jim St. John will provide information from earlier ARVOC/SCC sessions for input. Skip and Robin will work on timelines and consolidate Skip's reports into a section. The Standing Committee will continue to be a functioning group.

Suggestions for Science Cruise Coordinators:
The Committee noted that the RSPs are received by the PIs in a more timely fashion than in past years. However, there can be some items/issues in the RSP that still require attention, i.e., permits, orders, etc. The Science Cruise Coordinator should follow up with the PI after the RSP is sent and before the cruise begins to discuss any unresolved items. If, for instance, a TCN is missing or late, the PI needs to know. It is also crucial for the Science Cruise Coordinator, if deploying, to well inform anyone assuming his/her tasking after he/she deploys.

Vessel Outbriefs
The Executive Committee, recommends that the contributing PI be provided an opportunity to review his/her outbrief prior to the outbrief being posted to the website.

Also, ARVOC members would like to be informed of any actions taken by RPSC as a result of outbrief comments. This could be through a generic list periodically, email, or some other method with the intent that ARVOC is kept informed on what action is or isn't being taken.

Jim Holik and Al Sutherland commented that it would be difficult to respond to every outbrief recommendation and that every outbrief recommendation does not necessarily require a response. **ACTION ACTION 9 restated: ARVOC WILL CONTINUE TO CONTACT THE GRANTEES REGARDING OUTBRIEF COMMENTS WHEN THEY CONTACT THE CHIEF SCIENTIST FOLLOWING HIS/HER CRUISE. RPSC (JIM HOLIK) WILL CONTACT PIS THAT SUBMIT NEGATIVE COMMENTS IN THE OUTBRIEF.** Robin added that even if the comments are all positive, it creates enormous good will when comments are acknowledged. Also, if the outbrief is excellent, there may be recommendations that need to be addressed.

Al Sutherland discussed the two following items of general interest:

- A PI involved with upper water profiling is requesting use of the moon pool to deploy baby ctds. Jim Holik will investigate if this is feasible. Ice build-up or ice accumulation in the moon pool may be a problem. If so, the grantee may have to deploy the ctds from a hut on the ice. RPSC will continue to work on this issue.
- ECO received a letter from the USCG regarding federal regulations and clarification regarding cargo transport- whether the vessel is operating as a resupply or cargo transport. No fine was issued at this point in time. Al Sutherland met with ECO and the USCG representatives. It expected that all of the questions raised by the USCG will be answered satisfactorily and that this will not continue to be an issue. Al will keep ARVOC informed.

PRV WORKING SESSION

Following Skip Owen's opening statements and chronology slides of activities to-date, the Committee began their working session on developing the PRV letter for the Polar Research Advisory Board.

Jim St John will provide Robin Ross with documentation that will add support the letter. As the PR Advisory Board is not yet formed, it's anticipated that ARVOC will have the summer to work on the letter.

The Committee assigned various sections of the report/letter to individuals in attendance today. The various sections will be compiled into one for presentation to the PRV Advisory Board.

MAY 03, 2003, ACTION ITEMS/STATUS

Recommendation	Status
ACTION: RPSC/ARVOC/MARAD WILL CONTINUE TO STUDY THE MOON POOL; HOW TO KEEP IT ICE FREE; HOW IT MIGHT BE CONSTRUCTED TO ALLOW DIVING/OTHER; BEST PLACEMENT FOR OPTIMAL USE; DOOR OR NO DOOR; ROV INSTRUMENTS, ETC	To be discussed at meeting.
ACTION: RPSC WILL LOOK INTO UPGRADING THE HOTEL/LINENS/ TOWELS ON THE R/V L.M. GOULD. (AS THIS MAY REQUIRE A CONTRACT MODIFICATION ECO WOULD BE INVOLVED PER S. DUNBAR. HOTEL/QUALITY OF LIFE WILL BE ADDED AS A METRIC FOR NEXT YEAR	New linens have been purchased.
ACTION: THE SONAR THAT WAS PREVIOUSLY ON THE NBP WILL BE ADAPTED AND INSTALLED ON THE LMG. JIM HOLIK WILL REPORT/UPDATE ARVOC AT THE NEXT MEETING ON THE FORWARD LOOKING SONAR OPTIONS.	To be discussed at meeting.
RPSC (JIM HOLIK) WILL REPORT BACK TO ARVOC ON THE HIGH/LOW PRIORITY ITEMS.	Report to be presented at meeting.
ACTION: RPSC SHOULD PROVIDE COMMITTEE MEMBERS WITH REPORTS/ACTION UPDATES PRIOR TO THE MEETING DATE.	Reports/action updates were provided prior to meeting.
ACTION: RPSC (BOB KLUCKHOHN) WILL REPORT TO ARVOC (NEXT MEETING), THE ACTUAL COST OF DRY ICE PURCHASED TO-DATE IN CHILE FOR USE WITH SAMPLE SHIPMENTS. THIS REPORT WILL BE USED FOR COST COMPARISON BETWEEN BUYING DRY ICE IN SANTIAGO AND BUYING A DRY ICE MACHINE.	Report/data -see page 37.

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Items 3, 6, 10, and 13 were discussed during May 20 session

Procurements-Projects Completed	
Marine	
Supported Arctic cruise, outside of the Antarctic Program Plan.	
Supported northbound and southbound Pacific transits (to and from the Arctic) as full science cruises, outside of the Antarctic Program Plan.	
Continued with development of the SHALDRIL project.	
Continued with development of the PRV project.	
Through NSF funding and management, provided RADARSAT imagery support to both ships.	
Procured ice-resistant moorings for IVARS work in the Ross Sea.	
Provided extensive content input for development of POLAR ICE.	
Provided Iridium phones and cards for morale phone calls on both vessels.	
With AWS grantees, developed plan for gradual life-cycle replacement of the Peninsula area AWS systems. Also agreed to some standardization of the AWS's that the LMG supports in order to match some of the sensors to the LMG Meteorology System. The resul	
Assigned life-spans (draft and first iteration) to all Marine equipment, participating in the NSF effort to plan and budget for life-cycle replacements program-wide. Considerations were given to past communications from grantees, equipment history, techn	
Continued with outfitting of technician's shop in Punta Arenas warehouse. We have been able to obtain free (used) test equipment from within the program, and as excess from government property offices.	
Completed outfitting of the three MOCNESS systems (one 10-meter and two 1-meter systems) so that they are three modern and fully independent (spared) systems.	
After completion of the MOCNESS systems, informally ended WHOI support agreement.	

Procurement Projects Completed with dollar amounts

Marine Science Technicians (Labs)	
Completed LMG Science Van upgrades.	$ 200,000
Completed general purpose/trace metal clean van and garage van. This van is also designed to bolt on to a Thermo King freezer/refrigeration unit to create a temperature control van that can hold 0 +- 4 C range.	$ 90,000
Completed NBP #3 (USCG) van. This van is specifically designed to support USCG power and design requirements for radiation research and incubation experiments on the Coast Guard Icebreakers. (This van will replace the USM van that has been used for the past three seasons).	$ 100,000
Acquired a liquid nitrogen plant and dewar. This is also a safety improvement as we won't need to carry as much liquid nitrogen on board at any one time since we will generate what we need as the cruise goes along.	$ 43,000
Procured two non-refrigerated centrifuges and one refrigerated centrifuge for the NBP.	$ 15,000
Procured portable acrylic 3' hood and blower for vans or NBP snorkel system.	$ 5,000
Procured laminar flow hoods to support clean methods research.	$ 5,000
Procured two Langdon O2 titrators and calibrated bottles for use on the LMG.	$ 5,000
Completed weigh station at Punta Arenas warehouse.	$ 1,000
Acquired R-40 freeze safes and U-tec ice for shipping retro samples back to home institutions.	$ 2,000

Acquired a large double door upright freezer for the warehouse and vessels. (presently slated for the ICE FISH cruise.)	$	5,000
Installed new Barnstead water purifications systems on the NBP.	$	5,000
Marine Technicians (Deck)		
Procured new CTD blocks for the LMG. New blocks meet CFR for wet-weight handling gear. Much safer with a longer life-span due to the sealed bearing systems. Old Nylatron sheave block saved for trace metal rosette.	$	18,000
Procured new GO-Flow rosette bottles refurbished for trace metal work.	$	12,000
Procured and integrated new cable-leveling system for multi-channel streamer system.	$	90,000
Procured new 21-foot aluminum hull landing craft for the LMG and Palmer Station. Will provide safer operations for shore support. Expanded science capabilities for away from vessel work. Enhanced dive support platform. Palmer station will evaluate to see if this type of system will work for them.	$	49,000
Procured new Markey DUSH 9-11 oceanographic winch for the LMG. Will enhance science mission capabilities.	$	370,000
Procured 7,300 meters of 9/16th mechanical wire rope.	$	50,000
Procured 5,000 meters of .680 coaxial wire.	$	50,000
Completed MT Deck Safety Manual.	$	-

Marine Electronics Technicians	
Procured and integrated new proton-precession magnetometer.	$ 42,000
Procured and integrated new Biospherical GUV/PUV systems for each ship.	$ 144,000
Procured and integrated new Biospherical PRR system for the vessels and Palmer Station.	$ 82,000
Procured and tested new lead-in section for the multi-channel streamer.	$ 25,000
Upgraded Gravimeter	$ 92,000

Proposed Procurements-Projects

Marine		
Will supply an MT and seismic source (two G.I. air guns) for the ANDRIL project out of McMurdo.	$	30,000
Marine Science Technicians (Labs)		
Upgrade LMG plumbing in hold to support bathroom facilities upgrade of berthing van. Upgrade includes hot and cold fresh water, grey/black water plumbing, salt water for head and air ventilation ducting.	$	15,000
Upgrade one of the existing berthing vans to include bathroom facility, new ventilation, network connection and small desk.	$	50,000
Relocate remote thermosalinograph temperature sensor on LMG to reduce noise in data.	$	500
Replace leaking strainer on LMG USW lab circuit.	$	5,000
Expand LMG USW system to include a 2” SW line to Baltic Room.	$	7,500
Increase diameter of LMG Wet Lab drains.	$	7,500
Replace pCO2 air line on NBP.	$	500

POLAR ICE upgrades to include descriptions of science van capabilities, choices of selectable components to use with equipment such as microscope lenses, centrifuge rotors, and the generation of automatic allocation spreadsheets by cruise event.	$	-
Improve digital camera capabilities of dissecting scopes and compound scopes.	$	2,000
NOX analyzer as SIP identified,	$	25,000
or		
Nutrient Autoanalyzer	$	50,000
Con-Ex box design to support LN2 plant on NBP, LMG, Palmer Station and Punta Arenas warehouse. Design will enable a modular system to move completely self-contained. Will provide for a temperature controlled environment, ease in operator use, and will extend the life-span of the system.	$	8,000
One Con-Ex size box for secondary containment of flammable chemicals in the Helo Hanger on the NBP.	$	15,000
FOTIS imaging system. This system has received positive support from three grantees, however the remaining four have not responded. This is a high-definition forensic camera imaging system that captures images in milli-seconds. The design is attractive because vessel vibration would prevent a researcher from capturing high resolution imagery for later study or publication.	$	250,000
Replacement LSC. The Beckman LSC instruments have become dated and Beckman has no plans to upgrade the capabilities of their instruments. Perkin Elmer has purchased Wallac and Packard Instruments. It is not clear what instrument or design will replace these instruments.	$	45,000

Dual Beam spectrophotometer to compliment the Lambda 18. Presently this instrument is circumnavigating the globe to support SIP requests.	$	25,000
Replacement instrument for the LS5B scanning fluorometer.	$	35,000
Marine Technicians (Deck)		
Procure a 10,000-meter spool of 9/16th mechanical wire rope to replenish pool.	$	50,000
Procure a 10,000-meter spool of .680 coaxial wire to replenish pool.	$	50,000
JPC Capability for LMG:		
Option 1. Replace STBD A-frame; modify deck to accept the JPC Cradle.	$	135,000
Option 2: Modify current rail system and get the same length core, as above modifications.	$	12,000
Procure a real-time towed body video system to replace the SCUD camera system. To include altimeter and video ranging.	$	60,000
Procure two tugger winches to replace aged and unsafe current ones.	$	6,000
Procure three additional Yamaha outboards to bring ship's inventory up to full capacity.	$	14,000
Procure two new JPC coring blocks. Current blocks have been in service for 10 + years.	$	30,000
Rebuild and install LMG seismic compressors in a portable van.	$	50,000

Marine Electronics Technicians		
Spare GUV sensors, one spare for each ship.	$	14,000
Spare Magnetometer.	$	8,000
Four new racks, for remote installation of LMG instruments computers, servers, electronics, in the Bosun Locker.	$	5,000
Bathy-2000 (W) sonar for the LMG.	$	162,000
Forward Looking Sonar for the LMG.	$	65,000
New identical time standards for each ship. Includes GPS, GMT, UNIX, RVDAS, Network Server, Seismic and Event times.	$	40,000
Installation of a 38 kHz phased array ADCP (Ocean Surveyor 38) on the NBP during dry dock in Auckland, August 2004.	$	200,000
Installation of the transducer and window, for a 38 kHz phased array ADCP (Ocean Surveyor 38) on the LMG during dry dock in Fourchon, July 2004.	$	30,000
Standardization of all science 220 and 440 VAC supplies and loads to the International IEC-309 code. This includes both ships, the Palmer Station pier, the Punta Arenas warehouse, and all science systems requiring 220 VAC single phase, 220 3-phase, and 440. All plugs and receptacles will be color coded and keyed for quick connection. This will eliminate roughly one day of ET labor, per ship per port call, previously spent	$	42,000

rewiring feeds and loads. This will also significantly improve safety as the ET's will no longer be required to perform high-voltage electrician work. This project also includes, with the cooperation of ECO, the implementation of a mandatory tag-out/lock-out system.

Sea Floor Acoustic Positioning System to support SHALDRIL.	$	85,000
Create safety procedures for electrical work, tower climbing and confined space entry.	$	-

Deployed 24 ARGO/SOLO CTD drifters for Scripps during the NBP Pacific Transit, NBP04-03

LMG ADCP, Science Event O-317-L, Dr. Teresa Chereskin, year-round

NBP ADCP, Science Event O-315-N, Dr. Eric Firing, year-round

LMG XBT Drake Survey Program, Science Event O-260-L, Dr. Janet Sprintall, year-round

LMG pCO2 Drake Survey Program, Science Event O-214-L, Dr. Taro Takahashi, year-round

LMG Support of the Peninsula Area automated Weather Stations, Science Event O-283-M/P/S, Dr. Charles Stearns, year-round

NOAA Drifters for Dr. Bender, deployed from LMG, year-round

TeraScan pass tapes from NBP: DMSP tapes are sent to Polar Center at Scripps; SeaWiFS tapes are sent to NASA, year-round

Provided two technicians to sail on a cruise based on a Coast Guard Icebreaker

ARVOC needs to revisit policy regarding ownership of data. An issue recently arose regarding proprietary status of ADCP data.

Safety Improvements

Acquired a liquid nitrogen plant and dewar. This is also a safety improvement as we won't need to carry as much liquid nitrogen on board at any one time since we will generate what we need as the cruise goes along.	$	43,000
Procured new CTD blocks for the LMG. New blocks meet CFR for wet-weight handling gear. Much safer with a longer life-span due to the sealed bearing systems. Old Nylatron sheave block saved for trace metal rosette.	$	18,000
Procured new 21-foot aluminum hull landing craft for the LMG and Palmer Station. Will provide safer operations for shore support. Expanded science capabilities for away from vessel work. Enhanced dive support platform. Palmer station will evaluate to see if this type of system will work for them.	$	49,000
Standardization of all science 220 and 440 VAC supplies and loads to the International IEC-309 code. This includes both ships, the Palmer Station pier, the Punta Arenas warehouse, and all science systems requiring 220 VAC single phase, 220 3-phase, and 440. All plugs and receptacles will be color coded and keyed for quick connection. This will eliminate roughly one day of ET labor, per ship per port call, previously spent rewiring feeds and loads. This will also significantly improve safety as the ET's will no longer be required to perform high-voltage electrician work. This project also includes, with the cooperation of ECO, the implementation of a mandatory tag-out/lock-out system.	$	42,000
Procured portable acrylic 3' hood and blower for vans or NBP snorkel system.	$	5,000
Procured 7,300 meters of 9/16th mechanical wire rope.	$	50,000
Procured 5,000 meters of .680 coaxial wire.	$	50,000
Completed MT Deck Safety Manual.	$	-

Terms and Limitations

Name	Institution/address	Term limitation
Dr. Steve Ackley	Clarkson University 8 Clarkson Avenue Potsdam, NY 13699 315-268-6480 sackley@pol.net	Original term expired December 31, 2004. Term extended to December 31, 2005 due to PRV process.
Dr. James Austin	The University of Texas, Austin Institute for Geophysics Austin, TX 512-471-0450 Jamie@utig.ig.utexas.edu	Original term expired December 31, 2004. Term extended to December 31, 2005 due to PRV process.
Dr. Teresa Chereskin	Scripps Inst. of Oceanography, University of CA at San Diego, MS 0230 9500 Gilman Street La Jolla, CA 92093-0230 858-534-6368 tchereskin@ucsd.edu	Original term expired December 31, 2003. Term extended to December 31, 2004 due to PRV process.
Dr. William Detrich	Northeastern University 414 Mugar Hall 360 Huntington Avenue Boston, MA 02115 617-373-4495 iceman@neu.edu	Original term expired December 31, 2003. Term extended to December 31, 2004 due to PRV process.
Dr. Rob Dunbar	Stanford University Dept. of Geological and Environmental Sciences Stanford, CA 94305 650-725-6830 dunbar@stanford.edu	Chair term expires December 31, 2007
Dr. Chris Fritsen	Desert Research Institute Division of Earth and Ecosystem Science 2215 Raggio Parkway Reno, NV 89512 775-673-7487 cfritsen@dri.edu	Term expires December 31, 2005. Term extended to December 31, 2006 due to PRV process.
Dr. Chris Measures	University of Hawaii, Manoa 1000 Pope Road Honolulu, Hawaii 96816 808-956-8693 chrism@soest.hawaii.edu	Term expires December 31, 2006.

Dr. Robin Ross	University of California Marine Science Institute Santa Barbara, CA 93106-6150 805-893-2096 robin@icess.ucsb.edu	Current Chair. Term expires December 31, 2004.
Dr. Jim Swift	Scripps Institute of Oceanography Mail Code 0214 San Diego, CA 858-534-3387 jswift@ucsd.edu	Term expires December 31, 2005. Term extended to December 31, 2006 due to PRV process.

Other members of the PRV working group:
Dr. Bruce Huber bhuber@lamont.ldeo.columbia.edu
Dr. Amy Leventer aleventer@mail.colgate.edu
Dr. Tom Janecek tjanecek@iodp.org
Dr. Bruce Robison robr@mbari.org
Dr. Chris Jones cdjones@ucsd.edu
Dr. Deneb Karentz karentzd@usfca.edu
Dr. Colm Sweeney csweeney@splash.princeton.edu

Charter

ANTARCTIC RESEARCH VESSELS OVERSIGHT COMMITTEE (ARVOC)
DRAFT DRAFT CHARTER DRAFT DRAFT

The Antarctic Research Vessels Oversight Committee (ARVOC) exists to ensure representation of the scientific community in the management and operation of the U.S. Antarctic Program (USAP) research vessels. An important function of ARVOC will be to provide advice and make recommendations regarding the ships and other scheduling issues, efficient utilization of shipboard equipment and instruments, and the shipboard computer network and hardware. Recommendations of the committee may also involve staffing, communications, allocation of space, and other matters related to improving the research support capabilities of the research vessels. ARVOC will provide advice and make recommendations to RAYTHEON POLAR SERVICES (RPS), who is responsible for making recommendations in turn to the National Science Foundation (NSF) Office of Polar Programs (OPP). RPSC will be responsible for implementing NSF/OPP approved recommendations.

Membership: Members of ARVOC will be drawn from the community of ocean research scientists, with particular emphasis on those with current or previous NSF/OPP support for research aboard USAP research vessels. Members will serve for three years with one-third of the membership replaced each year. Members will assist in the selection of a Chairperson, who will serve for three years in that capacity in addition to time already served as a member, and one additional year at their discretion as an ex-officio member to assist in the transition of the new Chairperson. Explicit details regarding membership term limits and selection criteria are provided below. On occasion, one or more persons with expertise related to a specific agenda item may be invited to participate in the ARVOC meeting. Decisions concerning the need for and selection of meeting guests shall reside with the ARVOC Executive Committee consisting of the ARVOC Chairperson. RPSC Representative, and NSF/OPP Representative. Guests will be identified in the meeting agenda which shall be distributed to ARVOC members at least one week prior to each meeting.

Meetings: ARVOC will meet at least once a year in appropriate locations. Minutes will be taken at each meeting by an RPSC staff person and provided to ARVOC members, and RPSC and NSF/OPP. The minutes will also be made available to the general scientific community via the World Wide Web (WWW) RPSC home page. ARVOC may also hold special meetings in association with major conferences in order to facilitate the communication of ARVOC-related matters to the general community.

Working Groups: Topics may occasionally arise that warrant particular focused attention. When such topics arise, an ad hoc Working Group may be formed to formulate a position, make recommendations to ARVOC, or directly to RPSC and NSF/OPP.

TERM LIMITATIONS AND SELECTION CRITIERIA

1. **Membership should be representative of all relevant areas of expertise with minimal institutional overlap.**

2. Members will serve only one three-year term, unless selected to serve as the Chairperson (and in an ex-officio capacity [see above]). This shall not rule out a non-consecutive term.

3. Membership will be staggered so that approximately one-third of the membership is rotated annually.

4. Nominations for new members will be solicited from the broader community through the ARVOC list-server, and will also be made by ARVOC members, and RPS and NSF/OPP representatives to the ARVOC.

5. Membership nominations will be prioritized in Executive Session, and then presented to the Chairperson, and RPS and NSF/OPP representatives for concurrence.

6. The committee size will be limited to no more than nine (9) members, plus the ex-officio former Chairperson, to maintain manageability. Advice on certain subjects may be required from experts possessing knowledge complementing that of the ARVOC members, which will be sought in writing and/or telephone. Guests may also be invited to participate in ARVOC meetings for their specialized expertise.

7. Nominees for Chairperson will be restricted to current ARVOC members to ensure continuity and "corporate memory", and solicited from ARVOC members, and RPSC and NSF/OPP representatives to the ARVOC. The nominations for Chairperson will be presented to the incumbent Chairperson, and RPSC and NSF/OPP representatives for review and concurrence.

Antarctic Research Vessel Oversight Committee and Scientific Standing Committee for the Polar Research Vessel
Draft Agenda 20 - 21 May, 2004
(National Science Foundation)

Thursday, May 20, 9:00 National Science Foundation, Room 120 (ground floor)

Opening Remarks, NSF/OPP outlook

Erick Chiang

RPSC outlook

Steve Dunbar, Jim Holik

10:00 Review of May, 2003 ARVOC meeting minutes and action items

General ARVOC business, reports

Science of Opportunity: Data Distribution Jim Holik

Outbrief comments, etc.

12:00 Break for Lunch (no host)

1:30 Reconvene, continue ARVOC general business

3:00 Polar Research Vessel outlook

Al Sutherland

(ARVOC executive session)

5:00 Adjourn for the day

Friday, May 21 National Science Foundation, Room 1235 (top floor)

9:00 Report from Executive Session Robin Ross

9:15 Review of ARVOC/SSC actions to date, major science requirements, possible interim tasks to continue efforts
Skip Owen

10:00 Break- administrative tasks- distribution of expense reports

10:15 Current design thoughts

Jim St. John

11:00 Working Group Comments, general discussion

11:30 Community Input – results, ideas, etc.

A. Review of Town Meetings:

-AGU, December (Jim Holik)
-Ocean Sciences, January (Skip Owen)
-ASLO, February (Chris Fritsen)

B. Webpage

C. Report to PRB?

12:00 Break for Lunch (no host)

1:30 Other Business, next meeting date

Adjourn

Improved air cargo capabilities between Punta Arenas and Santiago has greatly improved the availability of Dry Ice to the AGUNSA warehouse and the vessels. The cost benefit is worth visiting at a future date if a two vessel, large research project visits the peninsula. If the dry ice requirement to support a project exceeds the delivery capabilities of the Chilean air cargo system then the costs of installing a machine and Dewar at the AGA facility should be revisited.

Project Status: March 05 (Declined)

- Cost estimate for installation of Dry Ice Block/pellatized machine in 2003 was 180,000.00 USD. (See attached letter from AGA) The rental of the AGA dewar bottle and import of liquid CO2 is not part of this cost estimate so monthly charges would be incurred. Hopefully and with minimal effort, AGA could operate the machine and sell Ice to other vessels that visit PA and credit the program enough money to cover the cost of dewar rental and liquid CO2.
- Cost of Dry ice shipped from Santiago is approximately 7.32 USD/Kg. (cost includes air freight, labor, and AGUNSA mark up for support).
- In 2004, peninsula operations ordered 2,705 Kg of Dry Ice, total cost to the USAP 19,800.00. AGUNSA expects the cost in 2005 to rise approximately 7.3%. Anticipated cost in 2005 will be 21,245.40 USD.
- Cost of Dry ice from the installed machine is difficult to estimate but the machine has a 45% efficiency. If you make the following assumptions then an estimate would be:
    - The peninsula program will require 2,705 Kg of dry ice/yr for usual operations.
    - Cost of Liquid CO2 is 450 USD/ton. Assume 6.1 tons/year (2,705 Kg / 450 Kg of Dry Ice from 1000 kg of liquid CO2)
    - Cost of Freight is 120 USD/ton, Assume 7 deliveries per year.
    - Cost of Rental is 45 USD/month, 540.00 USD/year
    - (6.1 Tons of Liquid CO2 x 450.00 USD/Ton) + 840.00 freight/year + 540.00 rental/year = 4125.00 USD/year.
    - Average cost to program over a 10 year period/year:
        - 180,000.00 in 2003. Assume 3% increase in estimate in 2004, and 7.3 % increase in 2005. New estimate would be 198,378.00 in 2005. Ten year projection if installed in 2005 19,837.00/year
        - Year 2004 estimate 4125.00 USD/year. In 2005 AGUNSA expects a 7.3% increase in cost of dry Ice, primarily a result of the falling US dollar. Year 2005 estimate is 4426.13 USD/year
- 10 Year cost comparison assume an increase in cost of 3%/year:

    - <u>Cost of Santiago Ice vs.. Cost of Dry Ice Manufactured in PA</u>

	Santiago Ice		Punta Arenas Ice	
Year 1 (2005)	21,245.40 USD	vs	24,263.13	(4426.13)
Year 2 (2006)	21,882.76 USD	vs	24,395.91	(4558.78)
Year 3 (2007)	22,539.24 USD	vs	24,532.50	(4695.50)
Year 4 (2008)	23,215.42 USD	vs	24,673.41	(4836.41)
Year 5 (2009)	23,911.88 USD	vs	24,818.50	(4981.50)
Year 6 (2010)	24,629.24 USD	vs	24,967.95	(5130.95)
Year 7 (2011)	25,368.11 USD	vs	25,121.88	(5284.88)
Year 8 (2012)	26,129.16 USD	vs	25,280.42	(5443.42)
Year 9 (2013)	26,913.03 USD	vs	25,443.72	(5606.72)
Year 10 (2014)	27,720.42 USD	vs	25,611.93	(5774.93)