Strategic and Implementation Plan

Ice Drilling Program Office /
Ice Drilling Design and Operations Group

(IDPO / IDDO)

February 25, 2009

Lead Institution:
Dartmouth College

Partner Institutions:
University of New Hampshire
University of Wisconsin

Sponsor:

National Science Foundation

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Executive Summary

One of the most pressing environmental issues of our time is the potential that greenhouse gas warming may trigger abrupt climate change. In order to predict the future with confidence, we need a clear understanding of the past changes recorded in and under the climate archives of glaciers and the polar ice sheets. Detecting climate change in ice core records is a relatively new science that has evolved since the International Geophysical Year 1957 - 1958. Ice core records have led to many important discoveries, for example the discovery that dramatic changes in climate can occur abruptly, in less than ten years (NRC, 2002). This discovery has revolutionized climate science and also has important impacts on policy; it established some of the key groundwork leading to the 2007 award of the Nobel Peace Prize to the IPCC for climate science. Members of the U.S. ice coring community have led the efforts for these and a multitude of other important findings in fields ranging from climate to life in extreme environments to geophysics. U.S. scientific productivity in these areas, including both knowledge generation and creation of the next generation of scientists, critically depends upon a mechanism for ensuring continuity and international cooperation in ice coring and ice drilling efforts, along with availability of appropriate drills, drilling expertise, and innovations in drilling technology. This plan outlines a new approach to science and technology planning and coordination, one that relies on ice coring and drilling science communities input for current and future planning, but that is coordinated nationally and internationally, conveyed to the public, and carried to fruition for NSF through the daily efforts of an Ice Drilling Program Office (IDPO) that works hand-in-hand with the Ice Drill Design and Operations group (IDDO).

There are four interrelated goals of IDPO/IDDO: 1) to produce and maintain long-term and short-term integrated science and drilling technology plans in collaboration with the U.S. ice coring and drilling research communities, 2) to identify new technology needs, seek funding for technology development, and acquire new technology, 3) to provide the drills, equipment, and drilling expertise needed by the science, 4) to enhance communication and information exchange related to drilling science and technology.

Broader Impacts: The IDPO/IDDO will work with the US ice science and drilling communities to facilitate planning efforts and be proactive in the planning and coordination that is necessary to form and execute continuously evolving ice drilling and science programs. The formation of an ongoing, continuous program will nurture the inclusion of students of all ages, races, and genders, and will help to launch graduate students into promising careers, and the resulting discoveries will help all citizens. Achieving the goals of this project will enable the US ice coring and ice drilling research communities to realize implementation of their internationally coordinated science goals, lead the world in ice coring and drilling science discoveries, nurture the education and development of the next generation of scientists and engineers, and communicate the importance of their discoveries to all.

We have completed this strategic and implementation plan with the help of facilitators provided by the National Science Foundation. As part of the strategic planning process, we developed and examined the IDPO/IDDO vision, mission, goals, and objectives. The plan includes criteria for evaluating the performance of IDPO/IDDO and allocating resources toward meeting the IDPO/IDDO goals and objectives.

The bubbles visible in this piece from an Antarctic ice core contain carbon dioxide and other gases that were trapped in the ice when formed many thousands of years ago. Ice cores provide the only natural archive of ancient air. Credit: *Oregon State University*

Vision

To enable discoveries about changes in climate and the environment, using evidence from glaciers and ice sheets, to inform environmental policy.

Mission

To conduct integrated planning for the ice drilling science and technology communities and to provide drilling technology and operational support that will enable the community to advance the frontiers of climate and environmental science.

The DISC drill is employed at the WAIS Divide site to retrieve high-resolution ice cores that may hold clues to abrupt climate change in Antarctica. Credit: Kendrick Taylor

Situational Analysis

Strengths

- Experienced Principal Investigators (PIs) with leadership abilities
- PIs and staff of IDPO and IDDO have a long history of working well together
- Endorsements of senior members of the research community
- Close associations with U.S. and international science and technology communities
- National Science Foundation (NSF) support
- Strong Senior Advisory Board (SAB) seed
- Experienced and knowledgeable Technical Advisory Board (TAB)
- Successful history of science-technology partnerships
- Good working relationships with researchers for both science and technology
- Existing equipment and infrastructure at the University of Wisconsin (UW)
- Engineering expertise in UW's Ice Drilling Design and Operations group (IDDO) and its parent Space Science and Engineering Center (SSEC)
- Cadre of experienced, knowledgeable drillers
- Strong commitment to quality and safety
- Successful history of field support

Weaknesses

- Insufficient resources for new equipment, and for modifying existing equipment
- Thin management and engineering staffs
- No existing partnerships with other federal agencies, foundations, or industry
- Some equipment is old and in need of upgrade or replacement
- Very limited pool of experienced polar engineers from which to recruit staff

Opportunities

- Explore partnerships with other federal agencies, foundations, and industry
- Explore collaborations with research groups not currently involved in community long-range planning
- Explore graduate student activity in engineering technology at Dartmouth, UW, University of New Hampshire (UNH), Colorado School of Mines, and other universities
- Robust programs will attract ice drilling engineers and technologists
- Student competitions for engineering, possibly funded by industry or foundations
- Augments to education and outreach from new proposals
- A new entity/approach – proactively garner community support
- Funding cross-cutting opportunities through other NSF programs

Threats

- Conflicts between science objectives and technology availability
- Misperceptions by the community
- Lack of research community consensus on priorities
- Inability of community to articulate detailed science requirements
- High cost and low availability of logistics and unpredictability of costs
- Unpredictability of annual NSF budgets and strong competition for NSF grants
- Short timelines and large challenges
- Competing interests among subsets of the research community
- Loss of key drilling technology personnel
- Uncertain stability of the general economic environment

Goals

- To produce and maintain long-term and short-term integrated science and drilling technology plans in collaboration with the U.S. ice coring and drilling research communities
- To identify new technology needs, seek funding for technology development, and acquire new technology
- To provide the drills, equipment, and drilling expertise needed by the science
- To enhance communication and information exchange related to ice coring and drilling science and technology

Objectives for each goal

- To produce and maintain long-term and short-term integrated science and drilling technology plans in collaboration with the U.S. ice coring and drilling research communities
    - Develop IDPO long-range science plan
    - Develop IDPO-IDDO long-range drilling and technology development plan in response to science plan
    - Document IDPO and IDDO progress
- To identify new technology needs, seek funding for technology development, and acquire new technology
    - Identify future technology needs from glaciology and related science community input and get prioritization from NSF on technology acquisition goals
    - Work with community members to seek additional funding for new technology development
    - Oversee production or acquisition of new technology
- To provide the drills, equipment, and drilling expertise needed by the science
    - Develop and deploy new drill systems and related equipment needed by the science community
    - Maintain inventory of high-quality drills and related equipment
    - Provide drilling and related support to funded NSF projects
- To enhance communication and information exchange related to ice coring and drilling science and technology
    - Serve as a focal point for community input
    - Enhance information exchange with the community
    - Establish and maintain an education & outreach program

Strategy

- Develop IDPO long-range science plan
  Use existing documents for initial draft, elicit input from community, get SAB input and direction, be inclusive and involve key stakeholders. Provide opportunity for community comment on the draft.

- Develop IDPO-IDDO long-range drilling and technology development plan in response to the science plan
  Formed hand-in-hand with the science plan as it develops, look for upcoming technologies and be aware of what is possible, be aware of likely costs. Make sure it is driven by science needs. Seek input from the IDDO Technical Advisory Board (TAB).

- Document IDPO and IDDO progress
  Produce required reports for NSF. Maintain an ongoing database for activities and achievements, submission of formal reports will be preceded by ongoing discussions with NSF program managers – avoid surprises, make the reports accurate, short, concise, and useful for NSF, include highlights useful for Government Performance and Results Act (GPRA) reporting as well as lessons learned

- Work with scientists to identify future coring and drilling and related needs
  Use community-produced documents and hold additional workshops as necessary to identify future needs in drilling technology

- Seek additional funding for new technology development
  Perform the research to identify potential funding sources, i.e. foundations, industry, oil companies, etc, and identify amounts they are accustomed to giving. Learn how to approach individuals, industry, and other agencies for funding; they might want their name associated with exciting science. Thin management structure makes this a challenge. Take action once we are ready.

- Develop or acquire relevant new technologies

- Develop and deploy new drills and related equipment for scientific research

- Maintain inventory of high quality drills and related equipment
  Institutionalize drilling knowledge, maintain quality control on drill maintenance, plan ahead for upgrades and replacements

- Provide drilling and related support to funded NSF projects
  Encourage Principal Investigators to seek advice and info and letters of support for proposals, get info on what the field conditions and circumstances and expectations are for the proposed project, maintain good staff of experienced

drillers. Give NSF language for solicitations saying that proposers need a letter of support from IDPO/IDDO for the proposal, put table of drill commitments on web site and provide it to NSF, get feedback from Principal Investigators after the drilling

- Focal point for community input
  Engender/promote cooperation between the IDPO and the community to build receptivity using such things as SAB, NSF, previous relationships, and seeking third parties to help promote goodwill for us

- Enhance communication and information exchange with the community
  Employ a multi-faceted approach: advertise and market to promote information exchange, use long-term existing relationships, web site, interactions and community meetings, distribute updates via listserve as well as one-on-one exchanges

- Establish and maintain an education and outreach program
  Act on behalf the ice coring and drilling community to promote student and public understanding and awareness. Engage as opportunities arise and as funding becomes available to develop a robust outreach program.

Jay Johnson, driller, talks with others at Onset D field camp while the shot hole drill operates to create a hole in the ice sheet in the background. The drillers work ahead of scientists, who follow with explosives to conduct seismic research. The scientists are using seismic studies to profile the ice stream bed and learn why the ice at this location moves faster than the ice around it. Credit: Melanie Conner, NSF

IDPO/IDDO Strategic Implementation Plan

The actions, responsibilities, and schedule for each of the major goals and objectives are assigned as shown in the following chart.

Goals	Objectives	Major actions	Responsible person	Time frame
Produce and maintain long-term and short-term integrated science and drilling technology plans in collaboration with the U.S. ice coring and drilling research communities	Develop IDPO long-range science plan	Establish the SAB	Albert	By mid-March '09
		Acquire existing community plans	Albert	March '09
		Solicit community input	Albert	March '09
		Identify new technology needs	Albert, Twickler, Bentley	Ongoing
		Hold a meeting with the SAB/ICWG to discuss elements of the plan	Albert	April '09
		Presentation at NSF to acquire their comments and engender increased PM participation	Albert	April '09
		Produce the draft science plan	Albert	By May '09
		Solicit NSF and community comments on the draft plan	Albert	June '09
		Submit plan to NSF	Albert	End of June annually
		Revise and update the plan	Albert	Ongoing
	Develop IDPO-IDDO long-range drilling & technology development plan in response to science plan	Establish TAB	Bentley	Feb '09
		Hold a meeting to get TAB input on elements of plan	Bentley	By May '09
		Produce the draft plan	Bentley	By May '09
		Get IDPO approval of plan and NSF input	Bentley	By mid-June '09
		Submit plan to NSF	Albert	End of June '09
		Revise & update the plan	Bentley	Ongoing
	Document IDPO and IDDO progress	Produce quarterly reports on progress	Albert	Quarterly
		Produce annual progress reports	Albert	Yearly, end June
		Produce strategic & implementation plan	Albert	By March '09 & update as needed

Goals	Objectives	Major actions	Responsible person	Time frame
Work with the community to identify new technology needs, seek funding for new technology, oversee technology development	Determine the science need, technology requirement, and NSF prioritization for new technology development	Follow up on technology needs identified by research community members	Albert, Twickler	Ongoing
		Work with community members and IDDO staff to articulate the technology specifications	Albert, Twickler, Bentley	Ongoing
		Present findings to NSF and obtain direction from NSF program manager for technology priorities	Albert	Ongoing & for annual plan
	Seek additional funding for new technology development	Seek additional funding from NSF as appropriate	Albert	Ongoing
		Write proposals in response to calls for proposals as appropriate	Albert	Years 2,3
		Develop strategies and contacts for obtaining funds from foundations & industry	Bentley	Year 1
		Pursue promising leads for foundation & industry funding	Albert, Bentley	Years 2-5
	Produce or acquire new technology	Oversee production or acquisition of new technology from IDDO or other source	Albert, Bentley, Twickler	Ongoing
Provide drilling technology and drilling operational support needed by science	Maintain inventory of drills and equipment	Maintain existing drills & equipment	Bentley	Ongoing
		Develop new drills and technology	Bentley	Ongoing
	Provide equipment and drillers to NSF-funded projects	Provide information, advice, and cost estimates to PIs proposing research	Bentley	Ongoing

Goals	Objectives	Major actions	Responsible person	Time frame
		Provide drills and drillers to funded projects	Bentley	Ongoing
Enhance communication and information exchange related to ice coring and drilling science and technology	Serve as a focal point for community input	Inform the communities about the new IDPO-IDDO through email, web, and through EOS	Twickler – email & web Albert - EOS	Web announcement March '09; Write EOS article in year 1
		Reach out for community input through email, web page, & use community white papers in planning	Twickler	Ongoing
		Assist NSF with solicitation information	Albert	As requested by NSF
	Enhance information exchange with the community	Establish and maintain the IDPO-IDDO web site	Twickler	April '09
		Develop a listserve so that community members can subscribe and unsubscribe, and produce quarterly IDPO updates	Twickler	Quarterly
		Attend, give talks & get community input at community meetings (e.g. AGU, IPICS, WAIS-D, etc)	Albert, Bentley, Twickler	Ongoing
	Establish & maintain an education & outreach program	Participate in NSF-sponsored education activities with NSTA, Polar Palooza, etc as opportunities arise	Albert, Bentley, Twickler	As opportunities arise
		Provide links & educational materials for the web site	Albert	Ongoing
		Give talks at schools	Albert, Twickler	Ongoing

Metrics

* Report on long-range science plan
Addresses objective: Develop IDPO long-range science plan
Measures*:* Timely completion, input obtained from variety of stakeholders/contributors, specific enough to be useful for drilling and technology development plan, useful for NSF planning

* Report on IDPO-IDDO long-range drilling and technology development plan
Addresses objective: Develop IDPO-IDDO long-range drilling and technology development plan
Measures: Timely completion, responsive to needs articulated in science plan, credible cost estimates, addresses multiple drills/technology needs

* Quarterly and Annual Reports
Addresses objective: Document IDPO and IDDO progress
Measures: Timely, complete, accurate, concise, well-received

* EAGER and other proposals
Addresses objective: Seek additional funding for new technology development
Measures: List of prospective and new sponsors, income generated, number of contacts made and number and type of contacts received by IDPO/IDDO, proposals submitted and their outcomes

* Inventory of drills and drill-related equipment, their history, and their readiness for use
Addresses objective: Maintain inventory of drills and related equipment
Measures: Fraction of drills ready for issue, record of availability and on-time issue when needed

* Summary of drilling achievements and PI support
Addresses objective: Provide drilling and related support to funded NSF projects
Measures: Favorable PI feedback, number and scope of projects supported by NSF and others, timely project deliverables, projects on time and within budget

* Web site, quarterly updates for community on listserve, participation in community meetings
Addresses objective: Enhance information exchange with the community
Measures: number of web site hits, inquiries, and other feedback indicators, community response to surveys

*Education and outreach activities
Addresses objective: establish and maintain an education and outreach program
Measures: response from audience, requests for more information or activities, list of outreach activities conducted, number of participants reached, list of number of school and community talks given.

Financial Resources

The financial resources listed below reflect the conditions at the start of the cooperative agreement in 2008. Changing demands and opportunities may require future revision as we adapt to evolving situations.

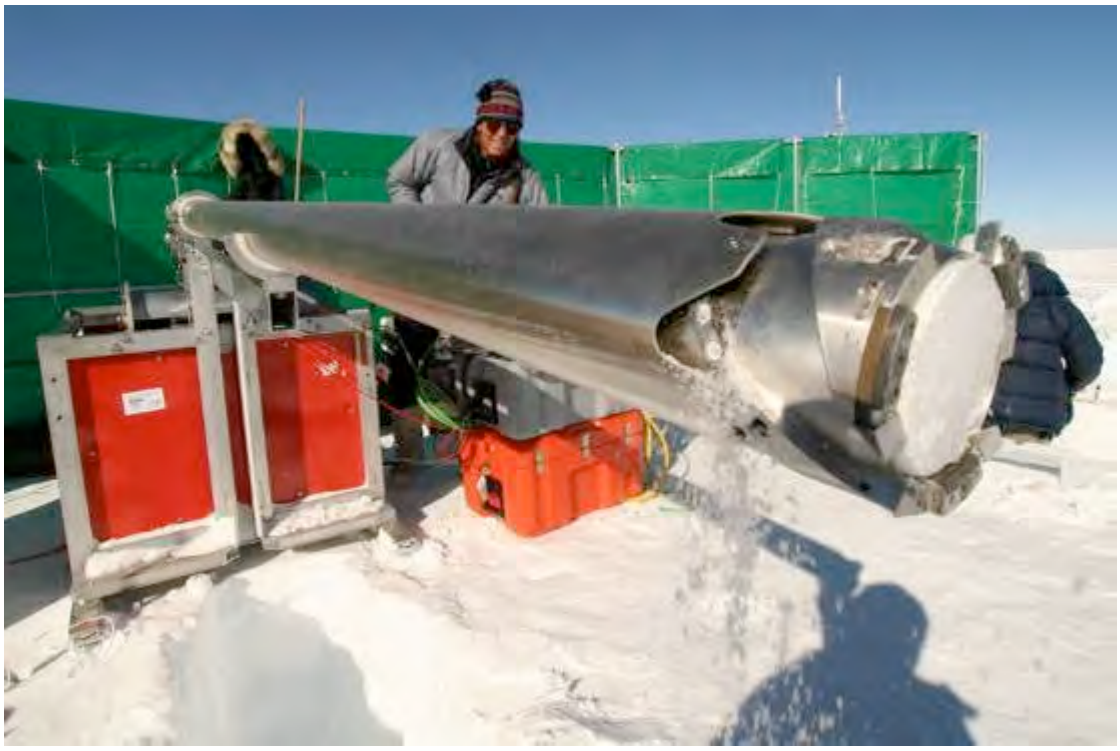
Table 2. Resource allocation toward the goals ($1000)

	Year 1		Year 2		Year 3		Year 4		Year 5		
Goal	IDPO	IDDO	IDPO	IDDO	IDPO	IDDO	IDPO	IDDO	IDPO	IDDO	Total
Plans	183	43	209	47	210	49	248	51	268	53	1361
New technology	163	43	190	47	191	49	228	51	247	43	1252
Drilling operations	31	2,402	36	3,918	36	3,920	45	3,131	49	2,750	16,318
Communication	134	38	115	40	120	43	128	43	135	45	841

Detail for IDDO Budget for Goal 3: Drilling Operations

IDPO Budget Component	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
Program Management [1]	375	404	422	437	452	2,090
Field Project Support [2]	1,156	1,190	1,218	1,267	1,310	6,141
Devel./Main – Base [3]	871	873	916	950	988	4,598
Base Budget per CA [4]	2,402	2,467	2,556	2,654	2,750	12,829
Additional Development [5]	0	1,451	1,364	477	0	3,292
Total – Provide drills, equipment, and drilling expertise.	2,402	3,918	3,920	3,131	2,750	16,121

1 Assumes that 25% of amount budgeted for Program Management (including warehouse, shop costs) will be used for the achievement of other joint IDPO/IDDO goals
2 Projected while developing revised budget for IDDO proposal
3 Amount estimated available from "base" budget provided by CA.
4 Proposal amount less the 25% of Program Management that would be used for other goals
5 Total amount needed for development (includes replicate coring and basal sampling – original estimates, they may be higher depending on what the requirements become) less the amount available in the base budget.



Lead Driller Lou Albershardt uses a modified eclipse drill to retrieve a shallow core for the Norwegian-US Scientific Traverse of East Antarctica. *Credit: Stein Tronstad*

Managing the Strategic Plan

Mary Albert will maintain the Strategic and Implementation Plan, will update it as changes occur, and will lead development and maintenance of the organization chart for the management plan for IDPO and IDDO.

Succession plan
If there are changes in any one of the IDPO PIs, the other two IDPO PIs will make a recommendation to the institution about a replacement PI for that institution. The succession plan for senior personnel below the PI level at any institution is determined by the PI, but should be discussed with the other PIs before a selection is made.

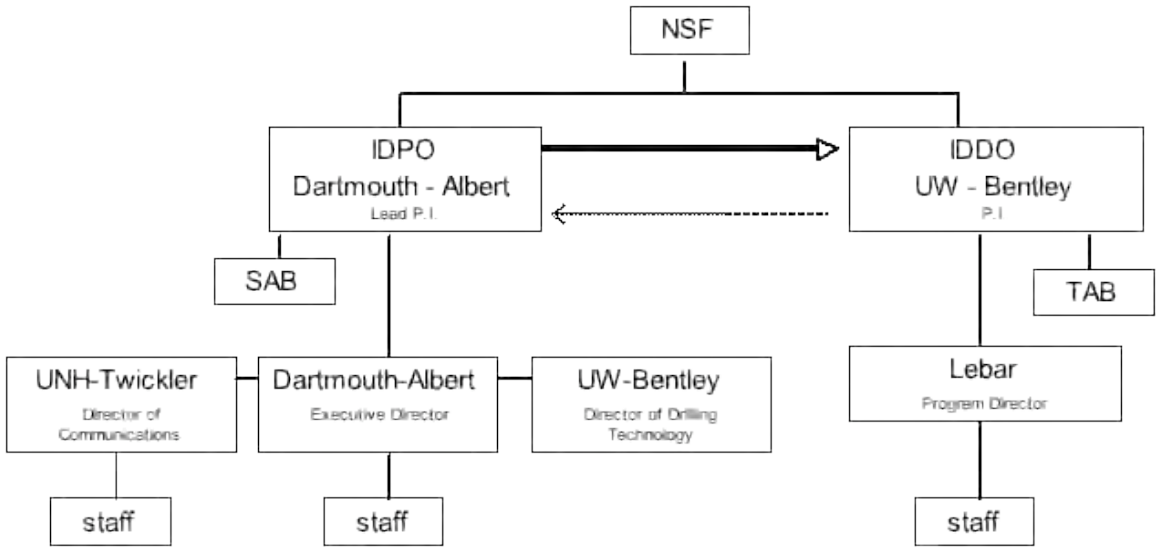
Conflict resolution
If unresolvable differences occur between the three IDPO PIs, then, if appropriate, we may approach SAB with a joint statement of the problem and ask for their suggestions or advice, which we can accept or reject. If all else fails, we may formulate a joint statement of the problem and contact NSF for assistance in resolution.

Management Plan

1.0 Ice Drilling Program Office Management Plan

The primary tasks of the IDPO are to 1) conduct integrated planning and establish and maintain the long-term science plan in collaboration with the U.S. ice coring and drilling research communities, 2) provide oversight and direction of IDDO activities, 3) identify new technology needs and seeking funding for their development, and 4) enhance communication and information exchange related to ice coring and drilling science and ice drilling technology. Within the context of these tasks crosscutting activities such as leadership, outreach, reporting, planning and coordination take place. IDPO will use a management plan in order to accomplish these primary tasks. This plan will evolve over the course of the cooperative agreements in response to new needs and requirements. Elements of this plan are given here.

Figure 1. IDPO/IDDO Organization



1.1 Organization

The organization of the IDPO (Figure 1) consists of staff from the three collaborating universities: Albert, representing Dartmouth; Twickler, representing the University of New Hampshire (UNH); and Bentley, representing the University of Wisconsin (UW). Dartmouth is the lead institution for the Cooperative Agreement. Work of the IDPO will be shared among these three universities according to the unique strengths and experience of each, and the three will work together closely. Decisions will be made by consensus on matters designated major by any of the three parties. Decisions on matters not designated

major can be made by any of the Directors for his or her area of responsibility. Specific tasking (e.g. the production of a specific report or proposal, the development of content for the website, consultation with drilling technologists in the private sector, etc.) will have an identified lead collaborator who has ultimate responsibility for the product with extensive input and review provided by the other collaborators. Albert (IDPO Executive Director) will be responsible for ensuring coordination between IDPO collaborators, will maintain the office for IDPO, and will be the lead collaborator responsible for tasks primarily directed toward or involving the research and education communities; Twickler (IDPO Director of Communications) will be the lead collaborator for the website development, content, and major revisions over time, and Bentley (IDPO Director of Drilling Technology) will serve as the lead collaborator for activities primarily directed toward or involving the drilling technology community. Table 3 shows the lead and contributing responsibilities for each of the collaborators.

The IDPO and IDDO PIs participated with NSF-funded facilitators to develop this IDPO/IDDO Strategic and Implementation Plan. The plan is a living document, and Albert (IDPO Executive Director) will be responsible for updating the plan when changes occur.

1.2 Scope – The IDPO has four primary activities:

1. *Establish and maintain the long-term science plan in collaboration with the U.S. ice coring research community*. Working closely with the IDPO Senior Advisory Board and the research community and their agents (e.g. the Ice Core Working Group (ICWG), International Partnerships in Ice Core Sciences (IPICS), etc), IDPO will produce and update yearly a **Long-Term 5-year Science Plan** that articulates near-term and long-term research goals, timelines, and associated technology requirements of the ice drilling research community. The plan will include long-term goals to the extent that they are known and will provide most detail and timelines on the upcoming five years. Topics will also include discussion of possible implementation constraints imposed by time, environmental considerations, and the plan and will include both logistically large and small endeavors that involve ice coring and drilling.

2. *Provision of oversight and direction for IDDO activities*: Figure 2 provides the annual process outline envisaged for oversight of IDDO activities and indicates the critical pathways for ensuring the alignment of IDDO activities to the science requirements. Scope, cost, and scheduling management control internal to IDDO is accomplished by a project planning and management system already in place that conforms to the requirements of the SSEC (1008-0024 SSEC Project Management Plan Quality System Procedure, 1008-0007 SSEC Product Lifecycle Process Quality System Procedure, among others). Important aspects of IDPO oversight and direction include:

    a) **IDPO/IDDO 5-Year Drilling and Technology Development Plan** – IDPO will collaborate with IDDO to generate and annually revise a

comprehensive five-year Drilling and Technology Development Plan that includes goals, emphases, specific drilling projects that will be supported, drill allocation, and technology development activities, all to the extent they are known with timelines for IDPO/IDDO actions over the next five years. The NSF will provide target budget levels for planning purposes to IDPO and IDDO to help guide development of the goals. The Plan will have specific, measurable products, timelines, and accompanying budgets, and it will directly respond to the IDPO 5-Year Science Plan. The Drilling and Technology Development Plan will provide the baseline for IDPO's monitoring of IDDO progress in achieving goals of the plan.

b) **IDPO/IDDO Quarterly Reports** – IDPO will maintain frequent informal interactions and information exchange to maintain awareness about current IDDO actions. The UW IDPO is responsible for keeping the UNH and Dartmouth IDPO frequently updated on IDDO activities, challenges, and opportunities. The IDPO will conduct formal quarterly reviews of IDDO activities, and will generate Quarterly IDPO/IDDO Reports with progress of both IDPO activities and IDDO activities for NSF. These reviews and assessments will include measurements of IDDO progress against the schedules and budgets of the IDPO-IDDO Drilling and Technology Development Plan.

c) **Annual IDPO/IDDO Progress Report and Program Plan** (APRPP) – In spring, a meeting will be held to discuss progress of IDPO and IDDO that year, and to determine activities and budgets for the Annual IDPO/IDDO Program Plan for the coming year. The Program Plan will include details of the goals and budget for IDPO for the coming year as outlined in the IDPO 5-Year Science Plan. In addition, IDPO will work with IDDO to create goals and budgets for IDDO that are guided by the 5-year Drilling and Technology Development Plan, and which includes specific activities, drill allocations, and budgets for the coming year, in accordance with budget levels determined by NSF. Deliverables, schedules, and budgets developed for IDDO in the plan will provide the baseline for IDPO's monitoring of IDDO progress in achieving their goals. The IDPO/IDDO annual Progress Report and Program Plan will be submitted to NSF by July 1st of each year.

d) Project PI Feedback – IDPO will solicit feedback from PIs whose projects have been supported by IDDO during the year. Feedback and suggestions for continued improvement of the IDDO performance will be provided to the IDDO as appropriate and will be described in the Annual IDPO/IDDO Progress Report to NSF.

Figure 2. Oversight Process Diagram (annual cycle)

SCIENCE COMMUNITY		IDPO		IDDO
Articulate science goals and requirements	⇔	Convene SAB; develop/update 5-year science plan		
		↓		
		Develop/update 5-year drilling technology plan		
		↓		
National Science Foundation	⇔	Determine funding needs. Segment within-scope tasking and extended tasking activities	⇔	Evaluate equipment needs; prepare preliminary cost estimates and schedules
Ice Core Working Group *International Partnerships in Ice Core Science* *Individual PIs* *Other national and international organizations and programs (e.g. SCAR, ICARP, IASC, GCOS, etc.)*		↓		
		Develop/modify long-range tasking based on 5-year plans		
		↓		
		Develop proposals for new technology requirements based on extended tasking activities		
		↓		
		Verify annual tasking with NSF based on within-scope activities		
		↓	⇔	Develop cost estimates and schedules for within-scope tasks
		Develop Annual IDPO/IDDO Program Plan for within-scope activities		
		↓		
		Track progress by quarterly review and consultation		
		↓	⇔	Perform within-scope projects and funded extended activities
		Perform annual review and evaluation as part of annual report		

3. *Identify new technology needs and work with the research community to seek funding for their development:* Strategies for identifying new technology needs and pursuing their development will include:

    a) An annual consultation with NSF on upcoming requirements for funded and unfunded proposals submitted to them for consideration
    b) Review of currently active or proposed activities to extract new technology requirements (e.g. subglacial sampling, replicate coring)
    c) Scenario building with the Senior Advisory Board to identify long-term possibilities, including discussion of input from interactions with other research community-based groups and individuals
    d) Acquisition of planning/implementation documents generated by appropriate scientific groups, committees, or organizations (e.g. ICWG, IPICS, Scientific Committee on Antarctic Research (SCAR)) and soliciting input from the research community at large by email using the IDPO listserve
    e) Development of strategies for new technology development, including consultation with drilling programs in the private sector, other universities, and federal agencies external to the ice drilling community that are developing or contemplating developing applicable new drilling technologies (e.g. NASA, cold-region oil and gas producers, Department of Energy (DoE) microborehole technology program)
    f) Maintaining awareness of new ice drilling technologies developed elsewhere through consultation with international ice drilling and borehole technology entities

As science requirements needing new technologies are identified, IDPO will generate a requirements matrix in collaboration with the proposing community members and will work with community members to seek funding agreements through proposals, partnerships, and collaborations as appropriate to develop the required technologies.

4. *Enhance communication and information exchange related to ice core science and ice core drilling technology:* Strategies for enhancing communication and information exchange will include:

    a) The IDPO website – which will serve as a resource to the ice core science community, the drilling community, educational organizations and the interested general public

b) Contact with and/or attendance at appropriate scientific or technical meetings for the primary purpose of information gathering
c) Presentations by IDPO members at scientific and/or technical meetings and as outreach activities
d) Acquisition of science planning/implementation documents generated by appropriate scientific groups, committees, or organizations (e.g. ICWG, IPICS, SCAR
e) Articles in appropriate publications (e.g. EOS)
f) Participation in NSF-funded outreach programs and development of materials as resources permit.
g) Generation of electronic IDPO Updates that are sent to the IDPO listserve members on a quarterly basis

Responsibility for the execution of actions related to this task will be shared among the collaborators as appropriate to their primary roles identified in Section 1.1.

1.3 Role of external collaborators, advisory board and review committees

As the funding Agency, NSF will set performance requirements for IDPO. Close consultation with NSF is also anticipated in order for IDPO to identify the scope of emerging new science requirements for both funded and as-yet unfunded activities.

The IDPO will collaborate with established ice core science and drilling planning entities through consultation and joint planning (e.g. ICWG, IPICS). Articulation of emerging needs will also be solicited from the broader principal investigator population through the IDPO website as a mechanism for ensuring an inclusive approach to information gathering. Planning documents from community groups and input from individuals and small groups will be factored into the development of the IDPO 5-year science plan and into planning for seeking funding for new technologies that will be required to meet future science needs.

The IDPO will convene a Senior Advisory Board (SAB) for the purpose of forming and updating a 5-year Science Plan that will address multiple aspects of ice core and ice drilling science and technology – emerging frontiers, sustaining capabilities, maintaining relevance, innovative technologies, fostering the next generation of ice core scientists and engineers, to name a few. This plan will be revised and extended annually and will drive the 5-year Drilling and Technology Development Plan (and its annual updates) for IDDO and proposal writing efforts to seek funding for the development of required new technologies. The initial membership of the SAB will consist of up to 8 scientists and engineers with broad expertise in the scientific areas that currently benefit from ice coring and drilling research. At least one member of the SAB will be from the international community. A member of the SAB will be a member of the ice technology community. Memberships for the initial SAB will include representation from IPICS and

ICWG. For the startup year, the three initial members will recommend a process for selecting the remaining members to SAB. In later years, SAB will ensure that their membership will rotate to represent the spectrum of research areas dependent on ice drilling, and the SAB will solicit nominations for membership from the broader research community. IDDO will participate in the SAB in an ex officio capacity. (Similarly, IDPO will participate in the IDDO-TAB in an ex officio capacity.)

IDPO will be provided an evaluation by NSF. In years two, four, and five a Reverse Site Visit will be convened at NSF on or near September 15th. The Reverse Site Visits will enable NSF staff to review the joint progress of IDPO and IDDO as well as the degree to which they are working as an effective, collaborative team. On or near September 15th in year three of this Cooperative Agreement NSF will convene an external review panel that will conduct a Site Visit at one of IDPO's Institutions to review IDPO/IDDO progress on activities described in the 5 year Science Plan and Drilling and Technology Development Plans to review the collaborative integration of these two entities.

1.4 Transitioning of Large-scale Science Project Coordination and NICL-SMO functions

During the first 5 years of operation, IDPO will have the opportunity to acquire program management responsibility for large-scale drilling projects and the National Ice Core Laboratory – Science Management Office (NICL-SMO) as current agreements expire. The ability for the IDPO to do so will depend on funding and staff levels at the time of the contemplated transition. IDPO will perform a cost-benefit analysis for the acquisition of such functions and seek input from the science community as the current agreements approach their expiration and will present recommendations to NSF at that time.

1.5 Deliverables

Deliverables identified in the original proposal or required by cooperative agreement are shown in Table 4. Although all members of the IDPO collaboration will contribute to these deliverables, and consensus will be reached before the deliverables are sent to NSF or made public, primary responsibility for production is given here. Scheduling for the production of these deliverables will be negotiated with NSF as part of the terms of the Cooperative Agreements for IDPO. Additional internal documents may be generated on an as-needed basis among the IDPO collaborators.

1.6 Schedule

Scheduling of IDPO tasking and requirements will be determined at the beginning of each year of the cooperative agreements. As part of its operation, IDPO will maintain a joint program and project milestone chart utilizing program management software and will jointly review progress toward its program goals on a monthly basis.

1.7 Costs

Cost accountability for the individual cooperative agreements that fund IDPO will be maintained through the budget tracking systems of each of the collaborating universities. Program costs will be individually monitored to determine if expenditures track the anticipated payout rates and to provide a basis for comparison between anticipated costs and actual costs for out year cost projections. Reviews of total costs for the overall IDPO organization will be conducted to ensure cost control and overall financial accountability.

Table 3. IDPO Roles and Responsibilities

Dartmouth (Albert – IDPO Executive Director)

- Coordination between Dartmouth and IDPO. Responsible for all reporting and budgeting requirements for Dartmouth.
- Direct the day-to-day operations of the Office of IDPO and its administrative assistant, maintain virtual conferencing capability, and foster effective collaboration between IDPO collaborators.
- Lead generation and maintenance of IDPO Long-term 5-year Science Plan
- Participate in generation and maintenance of 1- and 5-year Drilling and Technology Development Plans.
- Lead for oversight of IDDO
- Lead education and outreach for the IDPO, and contribute education and outreach content for IDPO web site.
- Lead IDPO-IDDO quarterly reviews and write quarterly and annual reports, and review IDDO quarterly reports
- Establish Senior Advisory Board
- Lead for assisting community members in proposal development for new drilling technologies
- Lead for IDPO for information exchange and planning activities between US ice coring and drilling science and drilling communities and international groups (e.g. IPICS)
- Participate in identifying potential new industry or government partners, rationale for developing partnership with each, and fostering collaboration with external entities for drilling technology development
- Lead preparation for and attendance at NSF's annual review of IDPO

University of New Hampshire (Twickler – IDPO Director of Communications)

- Coordination between UNH and IDPO; responsible for all reporting and budgeting requirements for UNH
- Lead for establishing and maintaining a common website for IDPO and IDDO along with major revisions
- Contribute to generation and maintenance of the IDPO Long term 5-year Science Plan
- Participate in generation and maintenance of 1- and 5-year IDPO-IDDO Drilling and Technology Development plans
- Contribute to oversight of IDDO
- Contribute to IDPO-IDDO quarterly reviews and contribute to quarterly and annual IDPO-IDDO reports, and review IDDO quarterly report
- Lead for acquiring PI annual project feedback to IDPO on IDDO drilling projects
- Participate in information exchange and planning activities between US ice core research and drilling community and international groups (e.g. IPICS)
- Provide input relevant to establishment of Senior Advisory Board

- Manage communication and tasking for Senior Advisory Board through IDPO website, and participate in IDPO SAB activities
- Participate in identifying potential new industry or government partners, rationale for developing partnership with each, and fostering collaboration with external entities for drilling technology development
- Participate in education and outreach activities, especially those involving the joint web site
- Contribute to assisting community members with proposal development for new drilling technologies
- Participate in preparation for and attendance at NSF's annual review of IDPO

University of Wisconsin (Bentley, IDPO Director of Drilling Technology)

- Coordination between SSEC/UW and IDPO. Responsible for all reporting and budgeting requirements for UW and SSEC.
- Responsible for frequent communication between IDDO and IDPO, keeping Albert and Twickler advised of IDDO activities, progress, challenges, and potential problems
- Contribute to development of 5-year Science Plan
- Lead for development and maintenance of 5-year Drilling and Technology Development Plans
- Furnish useful information for IDPO-IDDO quarterly and annual reviews and reports
- Coordinate appropriate TAB participation in Senior Advisory Board, and ensure appropriate UNH and Dartmouth IDPO participation in the IDDO TAB
- Contribute to proposal development for new technologies
- Contribute to drilling technology information exchange between US drilling technology community and international drilling technology entities (IPICS)
- Lead for providing updated content on drilling technology for the joint IDPO-IDDO website
- Lead for identifying potential new industry or government partners, rationale for developing partnership with each, and fostering collaboration with external entities for drilling technology development
- Participate in preparation for and attendance at NSF's annual review of IDPO

Table 4. Deliverables

Product	Lead Institution
IDPO/IDDO Strategic and Implementation Plan 5-year Science Plan (initial development and ongoing revisions) Quarterly IDPO-IDDO reports Annual IDPO-IDDO Progress and Program Plans	Dartmouth
5-year and annual Drilling and Technology Development Plans	Wisconsin
IDPO-IDDO web site	UNH

2. Ice Drilling Design and Operations Group Management Plan

2.1. Program Scope

The primary purpose of IDDO is to provide ice coring and drilling support to the US scientific community. The activities of IDDO fall into three broad categories: support of scientific field projects, equipment development and maintenance, and program management/support.

1. Scientific Field Project Support – The ultimate function of IDDO is to provide equipment and personnel for ice drilling activities in support of science projects in the field. Field project support begins with the preparation of the drilling equipment prior to its shipment to the field and extends through the repair of the equipment when it is returned. Usually, but not always, field support entails providing one or more drillers for the field work.

2. Equipment Development and Maintenance – Having the appropriate ice drills and related equipment available for science projects is a major aspect of IDDO's responsibilities. This activity includes the conceptualization, design, fabrication, and testing of new drill and drill-related equipment as well as the modification of existing equipment. Maintenance that is general, i.e. not attributable to wear or damage incurred on a single field support project will also fall into this category.

3. Program Management and Support – Program Management and Support includes providing the day-to-day direction of the IDDO staff and all those activities that support the day-to-day activities and administration of IDDO including planning; personnel management; quality, safety and environmental planning; development of policies and procedures, etc. This function also includes, in cooperation with IDPO, assisting investigators in the development of their proposals for research projects involving ice drilling and coring.

4. Collaboration with the Ice Drilling Program Office – IDDO will collaborate with IDPO in fulfilling its responsibilities of providing support to the scientific community. IDPO along with IDDO will plan field support activities and equipment development and IDPO will provide the science community's oversight of IDDO activities.

2.2. Organization and Staffing

On October 1, 2008, in response to an award resulting from a National Science Foundation Office of Polar Programs (NSF-OPP) call for proposals for the formations of a scientific drilling support office and a separate ice drill design and operations group, the University of Wisconsin Space Sciences and Engineering Center (SSEC) started work on a Cooperative Agreement (CA) with NSF-OPP for the new Ice Drilling Design and Operations group (IDDO), which will provide all ice drill design and operations support to projects funded by NSF-OPP from October 1, 2008 through September 30,

2013. The IDDO activity replaces the previous NSF contract to UW-SSEC for the Ice Coring and Drilling Services (ICDS) activity; that contract expired on September 30, 2008. The UW-SSEC group known as ICDS will continue to be active in coring and drilling activities for agencies and funding sources outside of NSF-OPP, under the name ICDS. Under the new CA, the ICDS group will provide the personnel for IDDO operations, with IDPO oversight. The great majority of the ICDS group's resources will be devoted to IDDO; a small fraction, which could grow in the future (on a non-interference basis with IDDO), now goes to aid for graduate student research. The equipment purchased and developed by UW-SSEC-ICDS is now under the purview of the UW-SSEC-IDDO funded activity. In using this equipment for projects not funded by of NSF-OPP, ICDS recognizes that NSF-OPP projects have priority and that funds from outside of NSF-OPP will be used to maintain and repair or replace the equipment as necessary.

IDDO is staffed by the ICDS group with a core of professionals with technical backgrounds led by a PI who has been actively involved in scientific research. The staff will be supplemented by engineering personnel from within the University and by contract to those outside the university as dictated by specific project needs. Drillers will be hired on a seasonal basis as necessary.

2.3. Program Planning

IDDO will collaborate with IDPO to generate and annually revise a comprehensive five-year Drilling and Technology Development Plan (see paragraph 2a in section 1.2, above). IDPO through its liaising with the science community and OPP will provide insight into the science projects likely to be supported by OPP and other organizations and longer term equipment needs of the science community. IDDO will prepare estimates of resources and time required for potential projects and, together with IDPO, decide what activities should be pursued.

2.4. Project Management

The activities of IDDO will essentially consist of a portfolio of projects and proven project management techniques that will be the basis of managing activities within IDDO. How these techniques will be implemented will be determined by the size and complexity of the individual projects. For smaller, more "routine" projects more general plans and procedures with addenda to address project specific issues will be used. Larger more complex projects, typically larger equipment development efforts such as the development of the DISC Drill, will require a project management approach tailored to address the more complex issues faced.

Critical aspects of all projects are scope, cost, and schedule. Taken together these form the baseline to be used in the monitoring and control of the projects.

1. Scope – Defining the scope of the project is critical to effective project management. It defines the boundaries of the project - objectives, requirements,

constraints, acceptance criteria, etc., as well as what is included. IDDO will develop a scope-of-work for each of its projects in conjunction with IDPO and the individual investigators for whom the project is being undertaken.

2. Schedule – The timely completion of projects is of the highest priority in the support of investigators using IDDO. The total amount of time available for all types of ice coring and drilling projects is usually dictated by the timing of the project proposal approval process and the date the investigator needs to be in the field. IDDO will develop schedules for each of the projects in its portfolio. Scheduling will recognize the need to utilize effectively the time of its personnel and other resources and the dependency of activities on one another. Progress toward the completion of each project will be monitored and compared against the project schedule, using reports from the personnel assigned to the project as well as by inspection of work completed when possible. Corrective actions, such as adding resources when necessary, will be taken timely to ensure completion of the project as agreed upon.

3. Cost – Control of costs is one of the primary functions of project management and begins with a good cost estimate for the project. The cost control system of IDDO will utilize the SSEC accounting system and its cost classification scheme. Project costs will be monitored using the reports from the SSEC accounting system along with information available from the SSEC purchasing department to determine if costs were consistent with the progress being made on the project and the cash flow estimates made for the projects. Corrective actions will be taken as necessary and to the extent possible to prevent project costs from exceeding budget while delivering the product or services outlined in the scope of work.

2.5. Scientific Field Projects Support – IDDO will utilize a documented Field Support Procedure to ensure that its support of each field project meets or exceeds the expectations of the investigators. The procedure has these steps:

1. Project Initiation – Once IDDO has been tasked through the Ice Drilling Program Office (IDPO) to support a project, the IDDO Program Director will assign someone (usually one of the IDDO staff) as the project engineer to coordinate the project. On larger, multi-year projects the individual may formally be assigned the responsibilities as the project manager, while on smaller projects the individual will assist the Program Director in managing the project.

2. Support Requirements – In most cases the general scope of project needs and expected outcomes will have been generally defined in the process of providing prospective investigators assistance during the preparation of their proposals. Once the project has been funded and scheduled, the project engineer along with the Program Director will work with the project PI to clearly define all factors that will influence project staffing, selection of equipment, etc. The project engineer

or Program Director will develop a project support requirements document that will outline these requirements.

3. Assign Remaining Field Support Team – The Program Director, or on larger projects the project manager, will select an individual to serve as lead driller and together they will select other members of the field crew.

4. Field Plan – The lead driller and the project engineer/manager, in consultation with the project PI, will develop a plan that fully defines the project purpose, staffing, responsibilities, tasks to be accomplished, schedule, risk management, safety, environmental protection measures, etc. The project PI along with IDDO management will approve the plan.

5. Logistical Support Requirements – The project engineer/manager will be responsible for working with the project PI to define the support needed from the appropriate logistic support organization.

6. Project Safety Plan – A documented Field Projects Safety Plan will form the basis of project safety. The project engineer/manager with the assistance of the lead driller will prepare a project-specific safety plan for the project addressing any special safety concerns and any special environmental requirements. IDDO management and the SSEC Safety and Quality Manager will review and approve the document.

7. Operating Procedures – The project engineer/manager and the lead driller will review existing procedures for the equipment to be used on the project and prepare any needed project-specific procedures and work instructions. IDDO management will review and approve the procedures.

8. Equipment and Supplies Preparation, Packing and Shipping – The lead driller and the project engineer/manager will be responsible for procuring, inspecting, preparing, and packing all needed equipment and supplies including spare parts. They will make arrangements with SSEC Shipping and Receiving to have the equipment shipped.

9. Training of Field Crew – The project engineer/manager will be responsible to see that the drill crew is properly trained. He/she will provide copies of the field support plan, safety plan, and operating procedures to each member of the crew. She/he along with the SSEC Safety and Quality Manager will determine and arrange if necessary any safety training needed. Most training for the operation of the equipment, if necessary, will be conducted “on the job.” For larger projects more formal training may be prescribed.

10. Deployment of the Crew – The IDDO Project Coordinator will assist the field personnel in making arrangements for travel and any required medical/dental exams.

11. Field Support – The lead driller will be responsible for all aspects of IDDO's operations on a project in the field, most importantly the drilling/coring operations needed by the investigators. He/she will provide periodic reports to the project engineer/manager and IDDO management if possible and will report any safety incidents to the SSEC Safety and Quality Manager or significant quality or performance issues to the project engineer/manager for review, investigation and remediation if appropriate.

12. Equipment Return – All equipment will normally be returned to Madison for repair at the end of the field season. However, if the equipment is scheduled to be used at the same location or for the same project in subsequent seasons, it might be left on site, with the lead driller determining which components to return to Madison for repair.

13. Project Completion Report and Project Debriefing – The lead driller as soon as practical will prepare a project report for submission to IDDO management. If a project spans more than one field season, a report for each season will be written. The report will contain a description of the execution of the project including logs of drilling activities showing depths, core quality, etc., a discussion of the performance of the equipment, any problems encountered, and suggestions for improvement. This information will be used by IDDO to improve equipment and procedures for future projects. As soon as possible after completion of the field season, IDDO management will conduct an end of season review of the project with the lead driller and, if necessary, other field crew members.

14. PI Evaluation of Project – IDPO will solicit feedback from the project PI or lead field scientist concerning IDDO's performance on the project. This feedback, along with IDPO suggestions, will be passed on to the IDDO Program Director for use by the IDDO staff to improve equipment and procedures and to rectify any personnel issues.

15. Repair of Returned Equipment – Equipment returned from the field will be unpacked, inspected for completeness and damage, and repaired to make it ready for its next assignment to a project. Appropriate procedures will be followed to bring the equipment back into proper working order.

16. Larger Projects – Large, multiple season projects may require a more comprehensive project management plan and related plans. An example of this is the WAIS Divide Project, which has a separate, documented project management plan and utilizes more specific non-controlled plans and procedures such as the WAIS Divide Staffing Plan.

2.6. Equipment Development Projects

Equipment development projects can range in size from simple modifications to existing equipment to the design, fabrication, and testing of large, complex pieces of equipment such as the DISC Drill. Development projects will generally be the responsibility of the IDDO Engineering and Research Director. The development procedure at IDDO will generally have several steps:

1. Project Initiation – Once IDPO has identified a need to modify existing equipment or to develop new equipment, IDDO will be tasked to begin the development process. IDPO with IDDO will define the scale and scope of the project. A project leader will be assigned by IDDO management to be responsible for the execution of the project. On larger projects this individual will be formally designated as the project manager and assigned a staff to design, fabricate and test the new or modified equipment. For smaller projects the project leader might be the only person assigned or others might be assigned to assist as necessary.

2. Project Management Plan – The project leader will work with the Program Director and IDDO Engineering and Research Director to develop a project management plan that will define how the project will be executed; details of how many of the following process steps will be executed might be included. For larger projects such as the development of the DISC Drill the plan could be fairly involved and will be treated as a controlled document, while smaller projects might only require a plan of a page or two, which probably will not be treated as a controlled document.

3. Science Requirements – IDDO staff members assigned by the Program Director will work through IDPO to define the scientific requirements to be met by the equipment. These requirements could include such things as core diameter, hole diameter, portability of the equipment, etc.

4. Engineering Requirements – The project leader along with any staff assigned to the project will translate the science requirements along with any logistical or other constraints into engineering requirements – top-level engineering specifications for the system and its subsystems. These requirements, if met, should satisfy all the science requirements.

5. Design Concepts – The engineers assigned to the project will develop and analyze design concepts based on the engineering requirements. Preliminary cost estimates and schedules will be prepared of the alternatives. The concepts will then be evaluated against the engineering requirements and a concept will be selected and reviewed with IDPO and, if advisable, representatives of the science community. For smaller projects, particularly those requiring the modification of

existing equipment, the design concept may be obvious and the step much simplified.

6. Detailed Design – Once the conceptual design has been accepted, detailed design will begin. Again for simpler projects some of the steps in the detailed design process may not be required.

a) Subsystems – Subsystems and interfaces between subsystems will be defined and subsystem requirements developed. A preliminary, high-level system operating procedure will be developed.

b) System Test Plan – As the subsystems are defined and specified; a system test plan will be developed. The plan will be designed to verify that the system will, in fact, meet engineering and science requirements.

c) Components – For each subsystem, the subassemblies and components comprising the subsystem will be identified and specified.

d) Subsystem, Subassembly and Component Testing – Plans will be developed for testing individual subsystems, subassemblies, and components to verify that they meet performance specifications.

7. Design Reviews – Formal design reviews will be conducted as appropriate throughout the design process. Typically there will be reviews after the development of the engineering requirements to verify that if met they will satisfy the science requirements, after the development of the conceptual design to verify that the proposed design meets the engineering requirements, after the design of each subsystem is complete to verify that each will meet its specifications, and finally after design is complete to review the entire system to verify that it meets the defined engineering requirements and, therefore, the science requirements.

8. Fabrication – Ideally, procurement of materials and components and fabrication will not begin until after all detailed design and design reviews have been completed. However, it is often the case that some subassemblies and subsystems must be fabricated before the entire design is complete. IDDO will make use of qualified vendors, university labs and shops, and its own and SSEC's shops and personnel for the fabrication of components and the assembly of equipment.

9. Testing – Testing will be conducted, when possible, at least on the subsystem and system level and when necessary on the component and subassembly level. Tests will be conducted in conditions replicating the expected operating environment when practical – the test of the DISC Drill in Greenland is an example.

10. Safety – The safety of personnel is of utmost importance and the protection of equipment from damage is also very important. IDDO will follow general SSEC

safety procedures and, where applicable, project-specific safety plans. As specified in these plans and procedures, analyses of hazards, both to personnel and equipment, are evaluated using a Failure Modes and Effects Analysis process throughout the development and risks are accordingly eliminated or mitigated.

2.7. Equipment Maintenance

Maintenance of equipment could fall into either the Scientific Field Projects Support or the Equipment Development and Maintenance category depending on the nature of the maintenance needed. If the repairs are the result of usage on a particular project, e.g., cutters are worn and need to be sharpened or replaced, they will be treated as part of the particular field project. If on the other hand the maintenance was the result of prolonged use over a number of field projects, e.g., the pumps on one of the portable hot water drills has served for several projects and needs to be overhauled, then it will be treated as a separate maintenance project in the Equipment Development and Maintenance category; in these cases it is possible that some needed modifications will be accomplished as well. Procedures will be developed for each type of drill maintained in inventory (e.g., the 10-cm (4-Inch) Drills) and the drills maintained in accordance with those procedures. Records of maintenance activities will be maintained in order to ascertain that equipment was being repaired and kept in serviceable condition. The records will also provide valuable information for planning purposes.

2.8. Equipment Inventory Management

IDDO will provide warehouse space for the storage and maintenance of ice drilling and related equipment. An inventory control system to track equipment was developed by SSEC and has been used by ICDS to track ice drill and related equipment; this system will be used by IDDO.

2.9. Safety

Safety is of primary concern to SSEC, which has adopted center-wide project safety and personnel safety plans along with a risk management plan. ICDS has also developed a safety plan specifically addressing the safety in its particular operations. IDDO will continue to use these plans and procedures as well as develop new ones as needed to ensure that its projects are conducted in a safe manner and that the equipment it designs and fabricates presents no undue hazard to personnel.

2.10. Quality

IDDO will use experience to systematically improve the services it provides the science community. ICDS has used a questionnaire to solicit and document feedback from investigators concerning its performance in supporting field projects with the goal of improving its service on field projects; IDDO will continue and improve this process with the assistance of IDPO. IDDO will also make use of the end-of-season project reports prepared by the lead driller on field support projects to improve its services and more

particularly to improve the drill equipment. IDDO will also make use of drilling reports and logs to establish baselines for drilling performance parameters such as core quality (ICDS established a core quality rating system that it implemented for use on coring projects) and then to measure improvements in those parameters resulting from equipment and technique improvements. Finally, IDDO will work with IDPO to obtain feedback on its services through advisory and working groups.

2.11. Reporting

IDDO will prepare and send the required reports to IDPO and, together with IDPO, to the cognizant Program Officer at OPP, as outlined in the IDPO Management Plan, above.