Draft SEARCH Sea Ice Goal: Improve understanding and prediction of sea ice changes with implications for ecosystems, coastal communities, transportation, commerce, and climate for stakeholders and decision-makers.

Objectives (activities in the next 5 years):

OBSERVING-

i. Update the SEARCH/AON sea ice observing needs and define a cross-agency AON implementation plan that facilitates sea ice predictions across time and space scales. Establish a review working group to ensure optimal network deployment and identification of critical gaps. Provide summary to agencies for their planning purposes and implementation strategy development.

Implementation: (1) Review team consisting of Sea Ice Outlook (SIO) core group, Sea Ice for Walrus Outlook (SIWO) representative and a few key others reviews SIO and other prediction products to recommend observations that improve prediction. (2) AON Design and Implementation (ADI) Task Force and Proof of Concept Study (POC) team provide recommendations from ADI report/workshop relevant for network design/implementation. (3) Interagency ad-hoc working group with SEARCH representation (appointed by IPMC or IARPC) synthesizes findings and initiates implementation.

ii. Develop capability to link sea ice prediction products to measures and prediction of change in marine ecosystems and impacts on Arctic communities, from local to regional to basin scales.

Implementation: Build on SIWO to determine specific information of the affected stakeholders; modify standard ice prediction products where possible to address these needs.

iii. SSC or OCP should be represented in the upcoming NRC's Polar Research workshop and/or study on coordination of sea ice observations/forecasting (ostensibly a multi-agency review or study on needs and coordination).

Implementation: Make recommendation to workshop/study selection committee for inclusion, propose update on i-1 or i-2 for workshop.

iv. Pursue integration of AON sea ice observations into global observational network through SAON mechanisms, international working groups (such as CliC Arctic Sea Ice Working Group) and data assimilation efforts.

Implementation: (1) Organize review and discussion of i-1 and i-2 and existing observations (as summarized in State of AON report and elsewhere) for CliC Arctic Sea Ice Group workshop in October 2011 at WCRP OS Mtg. (2) Schedule working session at Arctic Observing Summit in 2012 to further specific coordination and planning of activities in international context.

UNDERSTANDING-

i. Update SEARCH sea ice related ‘key science questions’ (including a reassessment of Thresholds and Feedbacks --what pre-conditioning and triggers instigate state change for sea ice, what are the feedbacks onto the system, etc.) and assess any progress or
outstanding issues from 2005.

**Implementation**: Initiate ad-hoc SEARCH Thresholds Working Group to examine this and other threshold questions? Pose question to SIO community? Discuss at CliC Arctic Sea Ice Working Group meeting? Encourage submission of relevant proposals to NSF/NOAA under SEARCH banner. Discuss topic in context of SEARCH newsletter with call for action?

ii. Advance research on the interactions between Arctic sea ice and global physical systems such snow cover extent, ocean and atmospheric circulation patterns, mid-latitude effects.

**Implementation**: Work with CLIVAR to set up joint CLIVAR/SEARCH Arctic Panel and let panel propose activities for implementation.

iii. Identify any remaining research gaps and needs, including integration of observations and modeling needed to improve forecast products; work with agencies to implement activities to fill research gaps.

**Implementation**: Task UCP, IPMC and other key groups to propose viable approach on how to address this goal.

**RESPONDING**-

i. Assess current sea ice data, knowledge, and existing agency activities to be utilized and integrated for the prediction product development (including any downscaling and regional prediction efforts). Identify partners.

**Implementation**: Work with SIO, SIWO and AON projects (in context of ad-hoc working group, possibly linked to OBS i-1?) for assessment; SEARCH Project Office works on identifying key partners.

ii. Identify audience and user group(s) for product(s); Work with user group(s) to define specific decision-support needs and the scope and format of product(s), including timescales for prediction. Identify candidates for urgent seasonal prediction products and establish community wide, interdisciplinary working groups to develop operational outlook protocols. Develop a sea ice product geared to the scientific community that provides seasonal ice forecasts and assessments of relative accuracy of different modeling methods.

**Implementation**: Under leadership of NOAA/NIC/NWS build on OBS-i and RESP-i activities to implement; requires dedicated funding support – viable mechanisms need to be explored.

iii. Develop initial suite of products and iterate on product development and refinement.

**Implementation**: same as ii above.

iv. Advance research on the interactions between Arctic sea ice and societal aspects such as energy and large-scale resource development, transportation, territorial issues, and impacts on ecosystems and living conditions of Arctic residents.

**Implementation**: Discuss in the context of Responding to Arctic Change Workshop in November 2011 and then issue recommendation for dedicated call for proposals through NSF for responding studies, including on this topic.

v. Develop an end-user interface ‘test bed’ -- assess users and usage.

**Implementation**: t.b.d.
5-Year Goal: Improve the understanding of the status and changes in permafrost so that the implications for human infrastructure and greenhouse gas emissions can be projected with substantially more confidence than is possible in 2011.

The response of permafrost to ongoing climate change has the potential to affect human infrastructure and greenhouse gas emissions. Both of these issues are relevant to climate policy. With respect to human infrastructure such as roads, bridges, airports, and buildings, the threat of permafrost degradation caused by climate change may result in substantial additional costs to maintaining the infrastructure in northern high latitudes. Some of this additional cost will be fall on the private sector and some will fall on the public sector, and it is important to better quantify these additional costs for decision makers. With respect to greenhouse gas emissions, permafrost degradation has the potential to result in enhanced emissions of radiatively active gases such as carbon dioxide and methane. Enhanced emissions of these gases could set up a positive feedback loop in which the climate warms and causes the further enhancement of emissions. Such a feedback loop could result in substantially accelerated warming throughout the globe, which has implications for ongoing climate mitigation efforts and climate adaptation planning. It is important to better quantify the likely degree of accelerated warming so that policy makers can make more information climate policy decisions related to climate change mitigation and adaptation.
SEARCH Goal #. Land Ice Loss – (robert.a.bindschadler@nasa.gov)

5-Year Goal: improve predictions of future land ice loss and its impact on sea level

*Objectives:*

i. develop interfaces that downscale AOGCM output to forcing fields to drive changing surface mass balance of ice sheets, ice caps and glaciers

ii. measure basal melting along the underside of floating tidewater glaciers and correlate with ocean and atmospheric circulation patterns

iii. determine the intraannual and interannual impact of surface melting on ice discharge of glaciers, ice caps and ice sheets.

iv. Quantify the regional pattern of changing sea level driven by predicted pattern of land ice loss
**DRAFT SEARCH Arctic Observing Network (AON) goals:**

Launch the AON onto a trajectory that results in substantial use of AON data by the scientific community and decision-makers, and generates first answers to urgent SEARCH science questions.

This goal entails the following:

(i) Formulate overarching guidance on network design; evaluate promising network design approaches to guide cross-network optimization and integration; promote such approaches in the context of research projects;
(ii) Create working group/body that represents key AON contributors, data and information product users and funding agencies capable of overseeing and guiding AON implementation at the decadal scale;
(iii) Complete implementation of an AON v1.0 that cuts across sectors, agencies and stakeholder interests and is driven by a coherent, overarching design philosophy;
(iv) Foster integration of AON into pan-Arctic and global observation networks, where appropriate promoting standardization of protocols and products for improved coordination;
(v) Work with key partners (e.g., IPMC, IARPC, and others) in charting a stable funding and oversight structure for a sustained observing system;
(vi) Identify the type of data and data products most urgently needed by scientific community to address key SEARCH science questions (e.g., data on ice volume, extent and other characteristics to address whether ice retreat is continuous or associated with thresholds separating episodes of rapid, irreversible retreat);
(vii) Support decisions by stakeholders and policy-makers through information products available at the end of the first phase of AON implementation.
**GOAL:** To determine the relative importance of the Arctic as a driver of and a responder to global environmental change.

- Identify the most important physical and social linkages between the Arctic and global systems
- Assess which “sphere” plays the largest role (e.g., cryosphere, atmosphere, biosphere, anthrosphere, hydrosphere, etc.)
- Assess how these interactions are likely to change in the future and how these changes could feed back to further change Arctic environments
- Establish how the Arctic’s importance in the global system differs between the physical and socioeconomic realms, including cross-cutting impacts such as resource development, marine transportation, and territorial issues
- Determine attitudes about Arctic issues by surveying people outside the Arctic to develop more effective strategies for communicating polar science knowledge to the public and policymakers