

## Ice Sheet Stability - iSTAR

### Implementation Plan

#### 1. Introduction

This *Implementation Plan* details the method of execution of the science plan of the *Ice Sheet Stability Research Programme* and describes the implementation of the *Programme Components* underpinning four *Deliverables* in this 5 year research programme.

The *Implementation Plan* will be periodically updated to address programme delivery issues such as on-going liaison between projects, science meetings, reporting and general programme coordination activities.

#### 2. The Research Programme's Objective

The objective of this programme is to improve understanding of the key ice sheet and ocean processes that affect ice sheet stability, and to enable the incorporation of this understanding into models leading to an improved ability to predict future ice sheet behaviour. The programme will focus on the West Antarctic Ice Sheet, with an emphasis in the Amundsen Sea sector and Pine Island Glacier.

#### 3. Delivering the Research Programme

The Programme *Objective* will be achieved through four science *Deliverables* detailed in the programme's *Science Plan*.

*Deliverable A: Increased understanding of the processes driving ocean heat transport on to and across the continental shelf towards ice shelves, and the sources of variability in that transport.*

*Deliverable B: Increased understanding of the sub-ice shelf processes that lead to changes in the melt rate experienced by ice shelves*

*Deliverable C: Increased understanding of the nature and dynamics of the processes controlling the response of Pine Island Glacier to grounding line migration.*

*Deliverable D: Improved estimates of the contribution to sea level change from the Amundsen Sea Sector.*

The funding level for each deliverable is indicated in section 3 and summarized in section 5.

The programme will be delivered through one open main grant round, and a closed studentship round. This studentship round will aim to allocate four studentships to the successful proposals from the main grant round, principally to develop the links between the four programme deliverables. It is considered highly desirable for students to participate in the field operations.

Proposals to address the deliverables will be encouraged to identify synergies between themselves and other deliverables. In particular, emphasising the acquisition of data that will benefit more than one aspect of the project; e.g. regional meteorology, bathymetry and bedrock topography, and the integration of individual model elements of the coupled ice sheet – ice stream – ice shelf – cavity – shelf sea – open ocean system. Proposals will also be required to justify their approach in the context of international research activity in the area and focus on how they are filling 'gaps' within the current understanding of the system.



*Increased understanding of the processes driving ocean heat transport on to and across the continental shelf towards ice shelves, and the sources of variability in that transport.*

- i. What processes govern the influx of CDW on to the continental shelf?
- ii. What factors influence the distribution and properties of CDW once on the continental shelf and how do they affect the delivery of heat to ice shelf cavities?
- iii. How variable are these processes on time scales up to centennial?

It is anticipated that this deliverable will be implemented through a single project of approximately £1.25m. Proposals should provide information on the basic oceanographic processes driving water exchange and transit in a form that will aid climate modellers to incorporate parameterizations of these processes into predictive global climate models at relatively coarse spatial resolutions. It is anticipated that questions (i) and (ii) should ideally be addressed using a blend of process modelling with oceanographic observations based around the programme's moorings and, potentially, the use of ship-based measurements, Autosub and/or gliders. Another potential aspect of the research is the influence of seasonal variability, as well as the development of an understanding of such variability on decadal and centennial timescales from the use of proxies to create a palaeo-environmental record and/or modelling studies of the recent past.

*Deliverable B:*

*Increased understanding of the sub-ice shelf processes that lead to changes in the melt rate experienced by ice shelves.*

- i. How do conditions within the sub-ice shelf cavity respond to changes in oceanographic conditions at the ice front?
- ii. What factors govern the spatial distribution of melt experienced by the ice shelf and how might these factors change?

It is anticipated that this deliverable will be implemented through a single grant of approximately £0.85m. Proposals should aim to provide detailed observations of the heat exchange, mixing processes and water circulation within an ice-shelf cavity, which will help in constraining process modelling of cavity and ice-melt processes. Question (i) focuses on the response within the sub-ice shelf cavities to oceanographic changes over the continental shelf seaward of the ice-shelf front and question (ii) targets the response of the basal melt rate to oceanographic changes within the cavities, and to changes in the shape of the cavities that result from evolving ice shelf thickness. Ideally research should lead to the development of parameterizations suitable for use in large-scale climate models and for coupling with prognostic ice sheet models. A range of observational techniques is possible, including the use of Autosub and access via hot-water drill holes through the ice shelf.

*Deliverable C:*

*Increased understanding of the nature and dynamics of the processes controlling the response of Pine Island Glacier to grounding line migration.*

- i. What is the current configuration of the grounding line, and what is the nature of its control on the Pine Island Glacier?
- ii. How do dynamic effects (including internal ice processes, deformation rates, longitudinal stresses, diffusion and lateral drag) propagate upstream of the grounding line?
- iii. How dynamic are the properties of the bed and till?

It is anticipated that this deliverable will be implemented through a single grant of approximately £1.35m. Question (i) refers to our lack of basic knowledge of the grounding zone of Pine Island Glacier: whilst its general vicinity is well known, the detailed basal configuration will determine the near future response of the ice sheet. Question (ii) focuses on the physics of how the changes occurring at the grounding line are propagating into the interior of the ice sheet and the effects they

may have therein. Finally, question (iii) concentrates on the properties of the till over which the glacier is flowing, which may be important on decadal to centennial timescales.

The response to these questions is expected to provide comprehensive and detailed observations of Pine Island Glacier, and its internal processes. A range of observational techniques are possible, including the use of seismic techniques, GPS surveying and detailed measurements of the ice properties.

*Deliverable D:*

*Improved estimates of the contribution to sea level change from the Amundsen Sea Sector.*

- i. What is the variability both in a spatial and temporal sense of the region's mass balance?
- ii. What are the observational uncertainties in the current measurement techniques?

It is anticipated that this deliverable will be implemented through a single grant of approximately £0.95m. This deliverable is focussed on the impressive series of satellite-based measurements that confirm that the WAIS is rapidly changing in the area of the PIG. Question (i) is focussed on all components of the mass balance of the glacier system and its variability, whilst question (ii) is designed to quantify the uncertainties in our current (mainly satellite) techniques for estimating the contemporary mass budget of the WAIS. It is expected that for both questions measurement of snow properties, shallow ice cores and GPS stations will be important.

### Programme Logistical Support

Extensive logistical arrangements have been developed to support the programme, and will be managed for the programme by BAS. Full details of the logistical arrangements can be found on the [BAS iSTAR web pages](#)

It is anticipated that proposals under Deliverables A and B will be supported by a ship based research programme and have a geographical focus on the Amundsen Sea sector of the WAIS (unless a very compelling case is presented for studying analogous oceanographic processes occurring elsewhere around Antarctica). It would be expected that there will be an emphasis on the acquisition of key oceanographic observations including the use of a ship for deployment and recovery of AUVs, gliders and/or moorings; however, this should be integrated with an appropriate level of process modelling linked to the development of parameterizations for use in predictive Earth System Models.

At present, two cruises have been preliminarily scheduled: an initial cruise in early 2012 (on which time is not available to proposals) solely to deploy community oceanographic moorings; and the programme's main research cruise tentatively scheduled to take place in early 2013. On this cruise the oceanographic moorings will be recovered and it is anticipated the bulk of the ship-based observations will be obtained. Proposals requiring ship time should take into account that this will be a joint cruise between the successful proposals, for which it is anticipated that no more than 30 science days in total will be available. A cruise planning meeting between the relevant groups will be arranged to facilitate the arrangement of the joint cruise post award.

Data from the moorings are available for all of the research projects in the programme (detail provided on the [BAS iSTAR web pages](#)<sup>1</sup>). The programme cannot support the extension of moorings beyond 2013; however, proposals may wish to explore such extensions through external collaboration. It is likely that RRS *James Clark Ross* will be the platform for the 2013 cruise.

Funds have been separately allocated for the community moorings and their support (£650k). Other costs associated with a cruise (e.g. costs associated with Ship Time and Marine Equipment applications) will need to be met from the proposals.

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<sup>1</sup> [BAS iSTAR web pages](#)

Deliverables C and D are designed to address the response of the Pine Island sector of the WAIS, and proposals will be supported by participation in a tractor train traverse (here after referred to as Traverse) gathering the majority of the field data. The Traverse will operate in the region over two Antarctic field seasons in 2012/13 and 2013/14, and the total scientific party will consist of 9 scientists. Two skidoos will be available for work remote from the central facilities and full details of the logistical constraints of the Traverse are available from the BAS iSTAR web pages<sup>2</sup>. It is again expected that the measurement programme for Deliverables C and D will be supported by process modelling linked to the development of parameterizations for use in predictive Earth System Models.

Funds have been separately allocated to support the Traverse capability (£1.2m) but other costs associated with joining the Traverse and activities carried out from the tractor train will need to be met from the proposals.

## **4. Programme Management**

### **4.1 Programme Executive Board (PEB)**

The *Ice Sheet Stability Programme* will be managed by NERC Swindon Office. The PEB will be chaired by NERC and include the chair of the Programme Advisory Group and a representative of any co-funders and stakeholder/user groups.

### **4.2 Programme Advisory Group (PAG)**

A Programme Advisory Group (PAG) will advise the PEB, as required, on the delivery of the *Ice Sheet Stability Programme* and will consist of national and international experts, including representation from end users and original member(s) of the Ice Sheet Stability expert groups. It will work closely with the Science Management Team and the Programme Administrator and will be appointed by NERC in 2011.

The **activities** of the PAG (working with the Science Management Team, SMT) may involve:

- advising on all aspects of the *Ice Sheet Stability Programme* to ensure that the scientific issues identified in the Science Plan are being addressed
- advising on the integration of the programme's science deliverables
- advising on the progress of projects against the programme's *Objective* as necessary to ensure delivery of the *Ice Sheet Stability Programme*
- advising on key results and messages from the programme that could be conveyed to the user community
- advising on managing the risks to the programme

Members of the PAG may also participate in the Grant Moderating Panel, along with other independent experts (including members of the NERC Peer Review College) to evaluate the proposals and make funding recommendations to NERC.

### **4.3 Grant Moderating Panel (GMP)**

A Grant Moderating Panel (GMP) will have the responsibility for assessing research proposals, both in terms of quality of proposed science and their ability to deliver the requirements of the *Ice Sheet Stability Programme*. It will consist of national and international experts in the field, representatives nominated by any co-funders and at least one member of the NERC Peer Review College. These assessments will inform the PEB's decisions on the award of funding to deliver the programme's *Objective*.

### **4.4 Programme Management Team (PMT)**

The PMT will consist of two bodies that will work in conjunction to deliver the programme:

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<sup>2</sup> BAS iSTAR web pages

- The **Programme Secretariat**, housed at NERC Swindon Office and including the Programme Administrator - has overall financial management of the programme, operates grant processes and leads on PEB/PAG activities.
- The **Science Management Team**, based at BAS.

#### **4.5 Science Management Team (SMT)**

The Science Management Team is provided by the British Antarctic Survey and will be responsible for planning, development, promotion and leadership, co-ordination of activities (i.e. science, logistics, knowledge exchange, data management) and monitoring in order to achieve the programme objectives and to attain added value.

The SMT will be responsible for the day-to-day management and coordination of the programme, and will work closely with the Programme Administrator based in the Swindon Office in the delivery of its responsibilities. Both the SMT and the Programme Administrator will report to the NERC Executive Officer, also based in the Swindon Office.

The SMT will continue to develop the implementation plan (this document) and a data management plan in conjunction with the relevant data centre(s). The SMT will lead on and co-ordinate the logistics in support of the science programme. They will also be responsible for the development and implementation of the Knowledge Exchange Plan and will be resourced to deliver it. This will include collaboration with all scientists in the programme, users and stakeholders to ensure the successful delivery of the KE plan.

The SMT will work to ensure coordination between the science deliverables for the *Ice Sheet Stability* programme and will organise workshops to facilitate interaction across the programme as well as annual meetings. The SMT, together with the Programme Administrator, will administer the awards process, feeding back information to unsuccessful candidates and, where necessary, negotiating modifications to the work plan and/or finances of successful applications. The SMT will also be responsible for the monitoring and reporting on behalf of the whole programme, including annual reporting and the completion of output performance measures (OPMs). In addition, the SMT will maintain an overview of the scientific progress made against the programme objectives. The SMT will liaise with all programme participants, facilitate the development of the community and develop the links between this programme and international collaborators.

Finally the SMT will be responsible for the maintenance of the *Ice Sheet Stability* web site. It is anticipated that the research highlights from the programmes will be included within this site.

#### **4.6 Open call component and studentship grant round**

The open call component and studentship grant round of the *Ice Sheet Stability Programme* will be overseen by the PMT. Projects will be required to report regularly to the SMT and annually through NERC's Reporting and Outputs Database. The reports will be discussed by the PEB at their meetings.

#### **4.7 Risk management**

The PEB, together with the SMT will be responsible for managing the risks to the overall programme, with advice from the PAG where required. In the event that a project develops a problem with delivery that cannot be solved by the PI and his or her team, the SMT will, at the request of the PEB, discuss options with the PI for how these can be addressed to ensure the delivery of the science over the lifetime of the programme.

### **5. Programme timetable and programme calls**

Expert Groups were appointed in May 2010 (membership at Annex I) to draft the Science and Implementation plans which were submitted for approval by NERC in December 2010.

An open 'Research Programme' call will be made for proposals to deliver the programme's science deliverables and achieve the programme *Objective*. The mechanism for this will be an announcement of opportunity for full bids in December 2010 with the following timetable:

16 December 2010 Announcement of Opportunity  
22 March Full bid deadline  
Summer 2011 Panel meeting

The full proposals will be internationally peer-reviewed and final funding recommendations made by a moderating panel, consisting of a sub-set of members from the Programme Advisory Group (PAG) plus independent experts. PIs will be given the opportunity to respond to Peer Reviewer feedback.

It is anticipated that four projects will be funded with a budget of £4.6m.

Proposals and personnel funded under this call must:

- adhere to all relevant BAS procedures for participation in Antarctic fieldwork;
- satisfy BAS pre-deployment medical & training requirements if participating in Antarctic fieldwork;
- comply with standard NERC reporting requirements
- engage with and input to programme-wide Knowledge Exchange activities led by the Science Management Team;
- comply with the programme's data management policy
- comply with the programme's media policy
- include milestones and deliverables to ensure the science outputs are delivered effectively

Following the open call, a closed studentship round will be held for the successful applicants of the main grant round. Up to four studentships will be awarded with the primary aim of developing the links between the four programme deliverables.

## **6. Science Plan**

The *Science Plan* for the *Ice Sheet Stability Programme* is available as a separate document on the NERC website and should be read prior to submitting a proposal.

## **7. Partnerships and Collaboration**

Collaborations between UK scientists, research institutions, disciplines and other national and international programmes are strongly encouraged, where appropriate, in order to deliver more effectively the programme's *Objective*.

## **8. Knowledge Exchange**

The main aim for Knowledge Exchange (KE) in the *Ice Sheet Stability Programme* will be to facilitate the communication and application of the science delivered from this programme to a variety of users and stakeholders, in particular policy makers. This will be achieved through various activities coordinated by the SMT.

A Knowledge Exchange plan will be developed as part of the role of the SMT, who will work closely with PIs, users, stakeholders and partners to ensure the successful implementation of activities.

## **9. Data management**

NERC requires that research programmes implement a data management scheme which covers practical arrangements during the programme and subsequent long-term availability of the data set. In line with the [NERC data policy](#), the data from the Programme will be lodged with the appropriate NERC Designated Data Centre

Each grant will be required to include and fund a data management plan within their proposal in line with the NERC data management policy.

## **Annex I – Expert Group Membership**

### **Ocean Forcing Expert Group (Deliverables A and B)**

Professor Tony Payne - Chair  
Dr Mark Brandon  
Professor Karen Heywood  
Dr Adrian Jenkins  
Professor Colm O'Cofaigh  
Dr Alberto Naveira Garabato

### **Ice Sheet Response Expert Group (Deliverables C and D)**

Dr Mark Brandon - Chair  
Professor Michael Bentley  
Dr Rob Bingham  
Professor Tavi Murray  
Professor Tony Payne  
Dr Jeff Ridley  
Professor Andrew Shepherd  
Professor David Vaughan