The Arctic's Role in Global Change Program Planning Group (APPG)
Minutes of 2nd Meeting
June 26-27, 2000
Geological Survey of Canada, Calgary, Canada

Members present

Jan Backman	(Stockholm U, Sweden)
Bernard Coakley	(Tulane U, New Orleans, USA)
Dennis Darby	(Old Dominion U, Virginia, USA)
Jean Paul Foucher	(IFREMER, Brest, France)
Tim Francis	(Geotek Ltd, UK)
Mikhail Gelfgat	(Aquatic Co, Russia)
Martin Hovland	(Statoil, Stavanger, Norway)(**Chair**)
Wilfred Jokat	(Alfred Wegener Inst., Germany)
Michael Kaminski	(U College, London, UK)
Yngve Kristoffersen	(U of Bergen, Norway)
Kozo Takahashi	(Kyushu U, Japan)
Chris Wiley	(Dept. of Fisheries & Oceans, Canada)
James Zachos	(U of California, Santa Cruz, USA)

Members absent

Timothy Collett	(US Geological Survey, Denver, USA)
Anatoly Gorshkovsky	(Murmansk, Russia)
Jörn Thiede	(Alfred Wegener Inst., Germany)

Liasons present

Ted Bourgoyne	(IPSC, Bourgoyne Enterprises Inc., USA)
Hans J. Brumsack	(ESSEP, Oldenburg U, Germany)
Alister Skinner	(Tedcom ECOD, British Geological Surveys, UK)
Shiri Srivastava	(ODP, Canadian Geologial Surveys, Canada)
Jürgen Thurow	(ESSEP, U College, London, UK)

Observers/Alternates/Guests

Rudiger Stein	(Alt. for Jörn Thiede, Germany)
Art Grantz	(Presenter, Stanford U, USA)
Robin Browne	(Presenter, ACAN Inc., Calgary)
Arno Keinonen	(Presenter, ACAN Inc., Calgary)
Roger Pilkington	(Presenter, ACAN Inc., Calgary)
Ron Ritch	(Presenter, ACAN Inc., Calgary)
Shiri Srivastava	(Observer, CanadaODP Secretariat Office, Canada)

1. Introduction

Meeting began at 0830 AM with introductory remarks by Chairman and host (Chris Wiley).

2. Member statements

The members of the APPG not present at the first meeting were given time to introduce themselves and to state their speciality relevant for the PPG:

Wilfred Jokat provided an overview of available aeromagnetic and gravimetry data in portions of the Arctic Ocean (flown 1998 – 2000). Also a review of deep seismic lines run on the western Svalbard margin and lines north of Svalbard was given. This work was performed by Polarstern together with the Russian icebreaker Arctica. During the 1998-cruise the Alpha Ridge was targeted (300 line km acquired), and also the Lomonosov Ridge (700 line km). It was not possible to reach the Northwind Ridge. It seems that the Alpha Ridge is of oceanic origin (over 100 Ma old). Reflection seismic events were also found on the Gakkel Ridge. A US/German survey is scheduled for 2001 with the Polarstern on the Gakkel Ridge.

Kozo Takahashi provided an overview of micropalaeontological work performed by coring and sediment traps in the Bering and Okhotsk seas. These basins contain sediment climate (Pleistocene) material of very high resolution. However, drilling is needed to gain information on the source area of the North Pacific Intermediate Water mass. The critical initial opening and closing event of the Bering Gateway has still not been exactly resolved (4.8 - 7.3 Ma ago?). Sampling of suspension sediments with traps has shown that the opal fluxes due to diatoms in the Bering an Okhotsk seas are the highest in the world (about 70 % of total particle flux).

3. The Lomonosov Ridge Drilling Proposal

In order of making sure that there are no aspects of Proposal 533 (The Lomonosov Ridge) that have been overlooked, so far, a brief status review of this proposal was requested by the Chairman.

Jan Backman provided the following status of planning etc.:
The development of this proposal started with piston coring and collection of seismic data in 1991, 1996, and 1998. The primary targets for this proposal are located on the eastern sector of the Lomonosov Ridge between 87^{o} and 88^{o} N.

Based on previous experience and an attempt to drill on the Lomonosov Ridge in 1996, Backman concluded that a successful drilling program in the high Arctic Ocean appears to require a 3-ship operation, consisting of one drilling platform and two support icebreakers.

<u>List of events so far:</u>
Submission of preliminary proposal: March 1998.
Establishment of team (Lomonosov Ridge NAD Research Program Group): December 1998.
SCICEX and SCAMP data acquisition programs: April/May 1999.
Proposal 533 included in SCICOM's ODP prospectus.

<u>List of future actions:</u>

Year 2000
1) Will attempt to acquire funding for seismic x-lines at main proposed drilling locations, in order to meet the suggestions by the Site Survey Panel (SSP).

2) Establish a time frame for the remaining schedule if the 533 proposal is scheduled by SCICOM (optimal timing will be to drill during the window July - Sept., 2003).

3) Proponent group to meet at Lamont for an update of the site survey package.

Year 2001
The Swedish Polar Research Secretariate is organizing an expedition to the Lomonosov Ridge. Five days can be allocated to a reflection seismic program provided that funds for shiprate is obtained (SEK 1 mill.).

<u>Proposal priority list</u>
The main stated scientific priorities of the proposal are:

1) To continuously recover 500 m thick sediment section for paleoceanographic studies in 1000 m water depths at 87^{o} 41'N, 144^{o} 40'E

2) To sample the underlying sedimentary basement and study the rifting and timing of tectonic events that affected the ridge.

3) To sample sites towards the Siberian Margin and recover Neogene sediments at higher resolution.

4) To execute a logging program where and when possible.

<u>Remaining work / problems</u>:
* Review by science steering and evaluation panels (SSEP) and external experts.
*Scheduling by SCICOM in early Aug. 2000 (for a leg in the summer of 2003?).
*Sweden is committed to provide one icebreaker to support the drilling platform.
*2nd necessary icebreaker for ice management to be identified.
*Updating of site survey package and review of site location strategy.
*Additional seismic reflection lines to be acquired in 2001.

There was then *a brief discussion* on this proposal, with the following items addressed:

<u>x-lines at drilling locations</u>.
It was suggested that a waiver was sought from the SSP and PPSP (Pollution Prevention and Safety Panel) to drill without x-lines if it proved difficult to acquire the necessary data during 2001. ODP had under certain conditions accepted drilling on sites without crossing seismic lines.

<u>BSR's and hydrocarbons</u>.
Wilfred Jokat suggested that there are no indications of a BSR at any of the proposed locations, but he will once more scrutinise available airgun data with respect to BSRs. Normal organic geochemical sampling and on-board gas chromatography analyses for hydrocarbon monitoring will be performed.

Core analyses onboard
There will be containers onboard the drilling barge for a minimum on-board scientific analysis of the cores, e.g., hydrocarbon monitoring (gc), micropaleo, and multi-sensor core logger (MST). There was a suggestion to add containerized lab facilities for pore water analysis and, perhaps microbiology.

Timing
Because the time between now and mobilization of vessels is dearly needed, it is very important that ODP (SCICOM) can commit a time-slot for the eventual Lomonosov Ridge Leg as soon as possible.

Contingency planning.
In complex marine operations, where several vessels and new eqipment is involved, it is necessary to plan with some contingency, i.e. there must be some planning and budgeting with this in mind. A rich number of backup sites will be identified, so that there is ample flexibility in difficult ice conditions.

Sensitive PR-issues (pollution and native issues)
This proposal is for drilling in international waters, and is purely of a scientific nature, with the intent to find out more about previous climatic changes. In PR-terms it is necessary to state the importance of the expected results in understanding Earth's natural (pre-anthropogenic) climatic changes.

4. Assigned tasks

Three main tasks were assigned by the Chairman at the previous meeting:

A) Provide some high-priority science plans and include at least 3 other aims or goals with the drilling besides the main scientific objective.

B) Provide a list of systems available for Arctic drilling, complete with technical specifications and capabilities (up to 2000 m water depth and 500 m penetration).

C) Provide a detailed list of aspects we need to plan for especially in Arctic drilling: i.e. Safety, Pollution, Politics, Logistics, etc.

The reporting on these tasks were started on the first day and continued on the second day in Calgary. However, in this minutes they are reported below in a collective manner.

Task A)
High resolution coring (reported by Dennis Darby)
Because the Arctic Ocean represents a harbinger of climate change information, it is necessary to seek out potentially high-resolution sedimentation sites. Whereas the expected average sedimentation rate is only <10 mm / kyr, there should be sites in the Arctic Ocean of perhaps 100 mm / kyr or even > 250 mm / kyr. There are also several processes which are unique to this ocean: i.e., rapid changes in freshwater input and also in ice rafted debris (IRD). This is actually the only ocean where you can expect to move sediments from one continent and deposit them on another continent.

The locations with highest sedimentation potential are:

1) Continental slopes
-Kara Sea & Santa Anna Trough (North Atlantic Oscilation).
-Laptev Sea (freshwater influx to the Arctic Ocean).
-Chukchi Sea (influx from the north Pacific).
-Banks Island (sea ice fluctuations)
-North Greenland area (90% of the ice that leaves the Arctic Ocean transits here).

2) Ridges and Rises
There are abundant grabens with ponded sediments: On the Gakkel Ridge; the Lomonosov Ridge (thickens towards the south); Alpha-Mendeleyev Ridge Complex (difficult ice conditions); and the Northwind Ridge and Chukchi Plateau.

Task A)
Cenozoic objectives (reported by Jan Backman)
It is expected that the Arctic plays a vital role in the Cenozoic climate change. However, so far, we have acquired a total of

-about 800 cores for the time-span	0 - 1 Ma
-NIL (zero) cores for the time-span	1 - 35 Ma
-1 (one) core for the time-span	36 - 37 Ma
-NIL (zero) cores for the time-span	37 - 70 Ma, and
-3 cores (Alpha Ridge) for the time-span	> 70 Ma

from this cruicial ocean bottom.

If we are able to acquire cores from the Arctic Ocean Cenozoic it is expected that they will tell us the history of

-distribution of sea ice through time
-density structure of the water masses (freshwater balance)
-biogenic sedimentation (biociliceous muds), and
-the opening of the Fram Strait.

Task A)
Site survey data (reported by Bernard Coakley)
Bernard gave a brief review of the available site survey data. The hottest news is the beautiful new chart over the Arctic Ocean published by Martin Jakobsson, Stockholm University. This map incorporates all previous GEBCO data and all new bathymetry data up to 1998. This version is, however, already being revised to incorporate the new bathy-data from 1999.

A general comment for the acquisition of site survey data from the Arctic Ocean is that such data are very, very hard (expensive) to acquire. Perhaps the biggest task for this group

(APPG) will be to acknowledge and report that the Arctic Ocean is remote, hostile, and therefore calls for alleviated restrictions on "normal" site survey data.

Task A)
Mesozoic objectives (reported by Rudiger Stein)
Although global anoxic events are common, very little is known about them in the Arctic. It is known that the Alpha Ridge is well layered with possibly some anoxic layers? Art Grantz reported that some Mesozoic sediments had been acquired with gravity coring on the Northwind Ridge.

Task A)
Tectonic evolution objectives (reported by Yngve Kristoffersen)
The Lomonosov Ridge and its lithosphere is suspected to represent a 1500 km long and 100 km wide slither of continental crust ripped away from Siberia by slow spreading along the Gakkel Ridge. If this proves to be the case (by drilling), then it represents a unique structure in a Global perspective. The subsidence history of the Ridge is one of the targets in the current 533 proposal.

The Alpha Ridge is suspected to represent a Large Igneous Province (LIP) structure. Drilling will here be used to address the nature and age of the basement of this structure. The marginal plateaus Yermak and Morris Jesup Ridge are possibly of dual origin. The nature of the crust below the Chukchi Borderland is unknown. Also the tectonics associated with the Arctic Gateways needs to be targeted by future drilling campaigns.

Task A)
Hydrates/Fluids/Microbiology (reported by Jean Paul Foucher)
In the Arctic large amounts of methane can be released from melting permafrost by dissociating gas hydrates. Because permafrost is probably located underwater as well as on land, it is important to find out more about the distribution of underwater permafrost in the Arctic Ocean. The main relevant questions are: What is the size of the hydrate reservoir associated with permafrost in shallow waters? How much methane is potentially released to the atmosphere from this reservoir and through which processes (from steady state to epicodically massive)? What is the size of the hydrate reservoir in the deep marine Arctic basins?

Although it will not be called for a dedicated gas hydrate leg in the Arctic Ocean in the forseeable future, the two following priorities are flagged:
1) Investigation of shallow water gas hydrates associated with destabilized permafrost. Ideally such an investigation should be carried out first on land and then out into the ocean.
2) Any Arctic Ocean drilling leg needs to incorporate standard gas hydrate detection and characterization techniques as discussed by the Gas Hydrate PPG.

Task B)
Review of hardware systems (reported by Chris Wiley)
Ice-strengthened vessels are calssified in standardized terminology as "Polar Class". For Ice management and support tasks in the Arctic Ocean, Polar Class four (PC4) or better is needed. Of such vessels the following fleet currently exists:
- 25 Russian
- 6 Swedish
- 10 Canadian

- 2 US
- 2 Finnish

The most powerful (PC6) vessels are the Russian nuclear powered, that should be used for far distance ice management (basically severe ice crushing) tasks. However, the politics of such vessels needs to be addressed by the PPSP and others in our scientific society.

There does not currently exist a dedicated Arctic Ocean drilling vessel, however, several vessels and or platforms can be modified for "light" drilling in drifting ice. If we were asked to go into the Arctic Ocean to drill to 500 m at 2000 m water depth right now (for example on the Lomonosov Ridge) two scenarions could be envisaged:

<u>Scenario 1</u>
-A drilling rig is mounted onboard an Ice Class Barge (for example the Sea Sorceress, a dynamically positioned vessel with azimuth thrusters, currently located in Halifax).
-2 dedicated ice management vessels, one of which should be the most powerful in the market (i.e. a Russian nuclear icebreaker).
-Tow the barge to site and keep in place by anchors or another support vessel (Oden?).
-Use continuous ice management and early warning systems for oncoming heavy ice conditions.

<u>Scenario 2</u>
-Mount drilling rig on the after deck of an icebreaker.
-2 dedicated ice management vessels.

The second scenario may have a severe flaw in that the drilling-icebreaker will not have enough fuel capacity to sustain long periods in heavy ice conditions. "Bashing ice" is very energy consuming, and it may take a large Ice Class Barge to carry such fuel reservoirs for itself and the supporting vessels.

Task B)
Review of hardware systems (reported by Mikhail Gelfgat, MG)
Although there certainly exist large oilfield class drilling vessels that can be operated in the Arctic Ocean, the costs will be prohibitive. In addition to the Resolution, which could possibly be ice strengthened in order to handle heavy ice, there are two other geotechnical drilling vessels available on the market, one Russian and one Norwegian. These could possibly be modified to handle heavy ice conditions, but also this at a high cost.

<u>Drill rig selection (MG)</u>
Offshore drilling rigs are normally built as an integral part of drilling vessels. While some mobile rigs are available they are usually built with specific sea conditions in mind. The conditions in the close polyniya are very mild in comparison to usual offshore conditions. However a proper heave compensator should be integrated in a drillrig.

The table below introduces the technical characteristics of the Seacore geotechnical marine C-100 drill rig. At this stage this rig is preferred as the most adequate to the estimated drilling conditions.

<u>Coring tools/technology selection (MG)</u>
A comparison analysis of the basic coring systems has been performed. If it is assumed the ABTRK-164x9 is chosen as the drillstring for the "Baikal-3" (new “Baikal-2” coring system

expanded accordingly to 164-mm ADP dimensions option) this coring system would be designated as the most adequate. As the selected drillrig C-100 allows operation with a dual drillstring and has sufficient hookload capacity, the “Piggy-back” coring scheme could be used as a backup coring system when the drillstring length does not exceed ~2000 m.

Conclusion (MG)

Table 4 summarizes our attempt to select preliminary the Arctic Drilling Program equipment setup. At this stage it includes the dynamically positioned drilling barge (optionally the icebreaker-based drilling platform) supported by one or two icebreakers for ice management. C-100 drillrig, or similar could be installed on the platform and operate with ABTRK 164x9 aluminum drillstring. The basic coring system should include the hydraulic-type Piston Sampler, Hydraulic Percussion Sampler, Pilot (Extended) Core barrel and the standard Wireline core barrel (CCS, or Baikal-3 system for example). The backup “Piggyback” technology with Longyear HQ coring system could be used for coring in hard formations. The final decision could be made only after the full-scale feasibility analysis and predesign works.

Drill rig C-100 technical characteristics

Description	
Model No.	C-100
Dimensions of rig	24.4x2.4x2.6 m
Guy wires required	Yes x 4
Top drive	
R.P.M. (rotor)	0 – 200
Torque (rotor)	25000 Nm (max)
Max pull up	100,000 kg *2)
Pipe lengths, handled	12 m
Max diameter through slipbox	450 mm (18")
High speed piggy-back top drive	
R.P.M.	5 – 900
Torque	37 – 875 Nm
Max pull up	150 kN
Type of power supply	Hydraulic
Heave compensator (air over oil, passive type)	
Heave compensator stroke	4.8 m
Heave compensator capacity	60 ton
Mud pump flow (3 pumps)	800 lpm
Mud pump pressure	39 bar

Alister Skinner mentioned that IODP/ESF (ESCO, France, UK, Germany) have recently put down money to study alternate platforms. They are, however, adamant that industry has to be more involved in this issue.

Rudiger Stein showed a drawing of a drilling vessel discussed in Germany (AWI / HSVA) for future scientific drilling in the Arctic Ocean. This proves that there are serious thoughts and plans for the future.

Task C)
Specifics of Arctic Drilling Planning (reported by Tim Francis)
Jurisdiction.
It should be noted that only a relatively small (central) portion of the Arctic Ocean is International waters. The five states bordering this ocean are: Canada, Denmark, Norway, the Russian Federation, and the United States of America. Of these five nations only Russia and Norway have ratified the United Nations Convention of the Law of the Sea (UNCLOS). It should also be noted that the decisions of some governments might be influenced by pressures from indigenous populations.

Environmental aspects
It is well known that this is a very "hot" theme, which needs to be addressed in a professional manner by any organisation doing international scientific work in the arctic. The PPSP may have to look into these aspects. Reference is made to MARPOL (International convention on pollution from ships), AEPS (Arctic Environmental Pollution Strategy), AMAP/PAME (Arctic Monitoring of Polluion), and also other intergovernmental organisations and conventions that deal with the Arctic environment. It should also be stressed that various NGOs (e.g. WWF, Greenpeace) are deeply concerned about oil and gas exploration in the Arctic. Shallow penetration scientific ocean drilling is very different from oil and gas drilling and has minimal environmental impact. The difference between the two types of drilling needs to be emphasised.

Project management
Because we are here going into an unknown realm (remote and hostile), with unproven and complex technology, project management will be essential for the fulfillment of our goals. It is therefore strongly recommended that project management of the first Arctic Drilling leg is addressed as soon as possible by the responsible bodies (EXCOM and SCICOM?).

5. Guest presenters

On the second morning of the meeting, four guest presenters from ARCAN and R.P.Browne Marine Consultants Ltd. were given the floor to inform about their experience with marine operations in Arctic conditions.

Robin Browne stated that drilling in drifting ice demands careful planning. Their company has long experience in "Stationary Marine Operations in Drifting Ice" (STAMARDI) offshore Sakhalin (Okhots Sea) and in the Beaufort Sea, pioneered by Dome Petroleum. One main factor of any such operation is to know the maximal allowable movements. This parameter determines how long time remains for decisions to be made, i.e., response time. Therefore all STAMARDI requires work to be carried out according to an "Operational and Alert / Response Plan" (OPARP).

(The above acronyms are courtesy the Chair, as these terms seem appropriate also in the following).

In order to manage ice during a STAMARDI, at least one primary and one secondary icebreaker is at least needed. The appropriate ice management system can be modelled by combining icebreaker performance models, ice regime modification models, and ice drift force models. The appropriate OPARP predicts when one needs to tend to any approaching ridges and to increases in ice pressure.

Ron Ritch stated that when one enters into regions with 9/10 and 10/10 of ice cover, the ice management vessels increase their fuel consumption by perhaps 100 percent. Refuelling and fuel carrying capacity of these vessels therefore have to be carefully evaluated before embarking on a prolonged STAMARDI.

Roger Pilkington stated that some further essentials of STAMARDI are:
-Ice data from satellites.
-An ice management team capable of interpreting and judging ice data
-An officer responsible for directing the ice management vessels
-Forecasting ice drift and hazardous ice.

The ice is capable of drifting 12 km per day (from drift buoy observations)!

Arno Keinonen stated that STAMARDIs are only currently performed by Canadians, and that the centre of that knowledge is Calgary. Some other essential parameters to consider are "T-time", the decision time remaining for hazardous ice, i.e., how much time remains before a final decision to abandon site because of oncoming hazardous ice. One also has to define what is hazardous ice under the given environmental and technical conditions. This in turn reflects on the ice manageability given the vessels involved. Continual hazard assessments need to be made, and may lead to the issue of alerts. Such alerts contain the issue of T-times. If the hazard has not been mitigated by this critical period of time there is only one solution: to abandon site, or else equipment will be broken and perhaps destroyed.

From their STAMARDIs off Sakhalin with the vessel CSO Constructor (diving support vessel), in 1999, they had found that a dynamically positioned (DP) vessel could operate in 9/10 ice cover. For drilling in moving ice, powerful azimuth thrusters would have to be used. Drilling in the Polar pack ice should be feasible in summer conditions, also on the Lomonosov Ridge, but it will require at least 2 icebreakers for ice management (absolute minimum). The biggest challenge will be fast withdrawal in unacceptable ice conditions.

5. Presentation by Art Grantz

Art informed about dispersed gravity core sampling (122 samples) in the Beaufort Sea. He referred to articles having been and currently being published on these results. The Arctic Ocean seems to have been ice free during the Neogene, and at times with on-off glacial interglacial cycles. Prior to 2.6 Ma ago there was much less IRD input. Seismic records from the Beaufort Sea showed strong BSRs on the continental slope (400 - 2500 m water depth).

6. Visit to the Arctic Institute of North America

A brief visit to the Arctic Institute of North America on the University campus was then conducted during the break for lunch, second day.

7. Conclusion and recommendation regarding the Lomonosov Ridge drilling proposal

New and valuable insights were provided by the talks on the second day: Scenario 1 above is considered as the most suitable solution to achieve the proposed LR drilling. This scenario, involving 2 icebreakers and a separate drilling platform, is identical to what was originally proposed by the LR proponent group. The most suitable, currently available drilling platform is the Sea Sorceress, as discussed in the proposal. If available (which appears unlikely due to existing long-term contract in the North Sea during summers) the Botnica, a 100 m long new finnish icebreaker with moon-pool and DP, would be the most preferable drilling platform. The commercially available drill rig system presented by M. Gelfgat appears to provide a viable and appropriate solution which can be placed on a platform with moonpool.

A brief plenary discussion concluded with the following urgent requirements:
Because the operation which the proponents are currently planning includes several unknowns (drilling platform, rig, and 2nd icebreaker), it is essential that SCICOM appoints a responsible group (steering committee), lead by a responsible project manager, starts project planning work asap, and no later than 2 years ahead of drilling. The proponent group must be well represented in this work. There was also a short discussion about total cost of this drilling operation. Back-of-the-envelope-estimates varied from one to two times the cost of a standard ODP leg.

8. APPG deliverables

The group then embarked on the task of stating their deliverables. This will take the form of a final report, which will basically be in electronic format, with an appendix section where there are numerous links to relevant websites.

The group divided and worked on the following assignements:

Make suggestions to sub-chapters and topics to be included in the following main chapters of the final report:

1) Scientific drilling goals

2) Strategies for successful drilling

3) Current technological possibilities

When this was accomplished, the final report format was discussed. It was concluded that it will be a standard format report, i.e. will contain the following:

-Executive summary
-Introduction and background
-The Arctic environment
-Scientific drilling goals (includes 3 sub-chapters)
-Strategies for successful drilling (will have at least 9 items)
-Current technological possibilities (4 items identified)

-Future rechnological development.

Each of the APPG members will work on their appropriate text and submit a preliminary contribution to the Chairman by 24th of November, 2000. From this material, the Chairman will then make a final draft report which will be issued a couple of weeks prior to the third and final meeting. The objective of the final meeting will mainly be to make sure that all aspects of goals and mandate have been fulfilled.

9. Final meeting

Although the Chair had received an invitation from Naja Mikkelsen to stage the next meeting of the APPG in Copenhagen or Greenland, the group unamiously decided to ask permission for staging the final meeting in Stockholm (host Jan Backman) as this is seen as the centre of planning for the first ODP Arctic Drilling campaign (if proposal 533 is finally approved).

Permission will be sought to stage the next meeting on January 29 and 30, 2001.

The 2nd APPG meeting was completed on 27.06.2000, 1700 PM.

(The Chair would like to thank Chris Wiley and all others taking part in the well managed Calgary meeting arrangements.)