UNDERWAY DATA COLLECTION

Multibeam swath mapping in ice covered regions, probably can not expect to collect swath mapping data during ice breaking but that would be nice.

Sub-bottom profiling to at least 100 m below the seafloor.

Underway collection of magnetics and gravity.

Ability to collect multichannel seismic reflection and refraction data in ice covered (up to 90%) areas (without losing the equipment).

MG&G Station sampling

Sediment sampling capabilities including:

surface grabs,
mega cores (not sure what a Mega Core is)
3-10 m gravity cores
kasten cores, box cores and piston cores
Jumbo piston cores exceeding 25-m in length.
Some requests of up to 100 m in length.
The ability to azimuthally orient sediment cores is desirable. TV-guided sampling equipment.

Ability to hold station while heat flow measurements are made – requires about 20 minutes on station with probe in bottom, then pull out probe, move ship ~1 km and redeploy heat flow instrument. Stations last up to 12 or more hours.

Dredging – ice covered areas present distinct challenges both on maintaining heading but also being able to operate under heavy winds and seas. Windage of both Healy and Palmer present problems. Having a wire in the water presents real hazards with backing and ramming.

Shore deployments for glacial geology and GPS surveys along coast via small boat or aircraft.

DRILLING – mentioned by numerous folk.

OTHER MG&G NEEDS:

Use of AUVs, ROVs and UUVs (whatever they are). with precision sampling capabilities sub-ice and in localized deep water-habitats (e.g., corals, seeps, vents, canyons, other seafloor features)

Use of UAVs (Unmanned Air Vehicle system). Also known as drones. Fugro pioneered these for at sea collection of aeromagnetic data. Steve Cande has had experience with these on Palmer.

Shore deployments for glacial geology and GPS surveys along coast via small boat or aircraft.

Scientific drilling capability for SHALDRIL type projects. (A.) Obtain well-dated, strategically located geological records that directly sample past Antarctic ice sheet dynamics to:

1. Determine the range of temporal and spatial variability of the marine-based West Antarctic Ice Sheet and the low elevation margins of the East Antarctic Ice Sheet (e.g. ice extent, ice volume & contribution to global sea level, thermal condition) that may occur due to changes in Earth's climate and ocean temperatures projected for coming decades and centuries;
2. Determine the structural, tectonic, geological and geophysical boundary conditions (e.g. paleogeography and paleo-orography) during past ice sheet oscillations;
3. Determine the effect of ice sheet/shelf variability on the regional extent of sea-ice, oceanic conditions (e.g. temperature and salinity), water mass variability, ocean circulation, and impacts on Southern Ocean marine biogeochemical cycles.
4. Determine the broader impacts of ice sheet/shelf and climate variability on ocean circulation processes within the ACC and its Southern Ocean gyres and investigate the downstream influences on global thermohaline circulation (e.g. as tracked along the Eastern Margin of New Zealand by previous ocean drilling).
5. Determine the relative influence of local insolation-driven atmospheric warming vs. oceanic warming on ice sheet/ice shelf variability.

(B.) Integrate climate and ice sheet proxy data (e.g. ice extent, frequency of variability, rate of variability, sea-surface temperature, air temperature, basal hydrology, geothermal gradient, paleogeography/paleotopography) from well-dated geological records with the latest generation of coupled ice sheet climate models to:

6. Determine the thresholds and climate sensitivities (e.g., CO2 concentrations, tectonic, local insulation intensity, positive degree days, ocean temperature) that lead to local, regional and continental scale growth and collapse of the marine-based West Antarctic Ice Sheet and the low elevation margins of the East Antarctic Ice Sheet;

7. Determine the rates of ice-sheet/ice shelf variability at a range of spatial and temporal variations. Can non-linear 'runaway' processes be identified? Can the most vulnerable/sensitive regions be identified? At high resolution does the Antarctic ice margin respond synchronously?

8. Determine Antarctic ice volume contributions to global sea level change at a range of temporal and spatial scales and reconcile with 'far-field' sea level evidence (e.g. oxygen isotope record, sequence stratigraphy and stranded or submerged paleo-shorelines);

9. Resolve the relative roles of East and West Antarctic Ice Sheet dynamics in controlling the variability and sensitivity of the Antarctic ice sheet system. Reconcile the contrasting modes of hysteresis behavior displayed by East and West Antarctic Ice Sheets.

The USGS Gas Hydrates Project has plans to survey the Beaufort continental slope for slope failures and degassing methane hydrates, in collaboration with university colleagues.

Venting of Methane may be the most important problem to address in the near future, else we may wind up toast.