Polar

- Science questions
  - Baseline for fishing, biodiversity, polar organisms – do this before fishing moratorium and ongoing
  - What are the changing dynamics of fluids and gases on the continental slopes including permafrost and gas hydrate
  - How is the ice changing and how will it change in the future - how does this contribute to sea level rise
  - How do ecosystems evolve following ice shelf collapse, how does this tie into ecosystem services
  - What is the seafloor bathymetry below ice and how does this affect currents (/nutrient transport??) and melting
  - How do seafloor fluid events differ in the arctic and under ice – e.g. hydrothermal at the Gakkel Ridge
  - How do we mitigate human impacts and disasters, e.g. how do we deal with an oil spill/shipwreck/etc
  - What are the ecosystems and ice shelf grounding lines?
- Significance
  - We have essentially no baseline characterization under ice
  - Arctic currents and changes thereto may significantly affect the global carbon cycle
  - Methane hydrate and permafrost melt may contribute greenhouse gases
  - Arctic provides numerous and increasing ecosystem services
  - Arctic may be bellwether for other changes throughout the planet

- What are the new opportunities
  - Ocean worlds funding
  - Leverage private investment oil/gas/commercial shipping
  - Increased international interest in the arctic
- What are the challenges
  - Cold, dark, far away, not one environment
  - Limited prior exploration -> hard to do hypothesis driven research -> need exploration
  - Need to move quickly to get baseline – change is already happening
- What do we need to accomplish our goals
  - Under-ice robotic systems for characterization – persistent systems that span years
  - Deep water AUV/ROVs (5/6 km)
  - Vehicles that can work on seafloor, midwater, and ice bottom
  - Public outreach to raise awareness of arctic change and change impact – need advanced visualization - documentation
  - Could we ground crawl all the way to the back of the Ross (etc) ice shelf and lay cable, optical nodes, acoustic nodes, AUV docking stations, etc,
    - could trickle charge nodes, vehicles etc over relatively small cable. Expect to loose the occasional vehicle/node
    - Crawl part of day, trickle charge the remainder