

Chemical Oceanography Science Questions

- ▣ How will retreating sea ice and increasing runoff impact freshwater cycling and its impact on DOC and other chemistries?
- ▣ What are the distributions of, and impacts from, hydrate deposits, cold seep and hydrothermal environments including areas covered with multi-year ice.
- ▣ What are the fluxes of CO₂ and other radiatively important gasses throughout appropriate (annual, decadal) cycles?
- ▣ What are the relative contributions of melting glacial and/or sea ice to the freshening of polar seas (next generation (isotopic or other) tracers)?

Chemical Oceanography Science Questions

- ▣ **What is the role of micronutrients and contaminants in high latitude biological productivity, including those from hydrocarbon extraction operations?**
- ▣ **What is the impact of atmospheric deposition on sea ice and ocean biology?**
- ▣ **Will photochemical processes in polar surface waters change with decreasing sea ice, and as a result change the cycling of many photoactive/label compounds?**

Chemical Oceanography Science Questions

- ▣ **What are the long-term (decades to century+) changes in seawater properties (T, S, O₂, pH nutrients, ocean carbon, CFCs) and ecosystems?**
- ▣ **What are the trajectory and impacts of ocean acidification in polar oceans?**

Sampling Requirements

- ▣ **Dedicated over-the-side sampling capability**
 - Conducting but trace metal free cable
 - Incorporated into the ship
- ▣ **Dedicated analytical laboratory**
 - Positive air pressure, separate HVAC, temperature controlled, etc.
 - Complemented with specialized portable labs
- ▣ **Accommodate ROVs, AUVs, ASVs and gliders**
 - Advanced sensors on the horizon
- ▣ **Capability to accurately sample atmosphere**
 - UAVs
 - Bow tower?

Sampling Requirements

- ▣ **Uncontaminated surface seawater and sea ice sampling**
 - Ship must forego discharge (oil, sewer, cooling water etc) during 48+ hour station
 - Small boats for sampling: rapid deployment, clean, safe
 - Helicopters
 - Rapid/safe personnel and equipment deployment to sea ice

- ▣ **Accommodate analytical gear in labs**
 - Versatile configurations; ease of installation (corridor dimensions, elevators)
 - Ability to handle gas bottles efficiently/safely (with hard-wired plumbing?)
 - Dedicated scientific wiring trays and bulkhead passthroughs

Sampling Requirements

- ▣ **Efficient / safe hazmat handling**
 - Adequate capacity
 - Convenient location
- ▣ **Convenience considerations:**
 - Liquid nitrogen production
 - Science storage convenient to labs