Best Practices used by the U.S. AMLR Program during the 2018/2019 Antarctic glider deployment

**Goal: to create a reliable system for instantaneous situational awareness while executing missions and reacting to problems using a combination of internal controls and critical external resources**

Internal Controls

* General structure of Glider Team:
	+ Three Mission Planners
		- Planners were responsible for establishing the science objectives for our mission, and for determining the configurations of science sensors and the best glider tracks for achieving our science objectives. Planners also provided guidance on appropriate courses of action in areas of ice or heavy currents, and either proposed or approved proposed changes to dive profiles or waypoint plans
	+ Three Glider Pilots
		- Pilots were responsible for executing the mission plans established by the mission planners. Pilots prepared the gliders for deployment (ensured proper ballasting, performed functional checkouts, etc.) and issued commands to the gliders via the Teledyne Slocum Fleet Mission Control (SFMC) website. Pilots maintained a good familiarity with the Masterdata document of glider commands, and were responsible for ensuring that all sensors were working properly each day and for all trouble-shooting throughout the deployment
* General structure of a glider deployment:
* At all times, one planner and one pilot were on duty. Duty periods were 24 hours (midnight to midnight). To minimize confusion during these periods, only the pilot on duty would issue glider commands, and only the planner on duty would provide input. When changes were made to the gliders (usually changes in dive depths or numbers of yos to complete before surfacing, or changes to waypoint plans to avoid ice or currents), the pilot provided detailed descriptions in the Log Notes section of the SFMC to keep other pilots informed and alert them to any changes they may need to make while on duty
* At the beginning of our deployment, planners devised several “rules of thumb” for piloting to help eliminate guesswork by the pilots. These rules were followed unless the planner on duty specifically instructed the pilot on duty to deviate
	+ Dive to 950 m if climb angle is consistently >= 20 degrees and altimeter appears to be working
	+ Dive to 600 m if climb angle is consistently < 20 degrees and altimeter appears to be working
	+ Always turn altimeter on at 65 m and initiate climb 30 m from bottom
	+ Perform 2 full yos before surfacing if bottom depth > 300 m
	+ Perform 3 full yos before surfacing if bottom depth <= 300 m
	+ Do not download TBDs if bottom depth <= 200 m
	+ Do not download MLGs unless needed to diagnose an ABORT or other situation and surface winds/currents unlikely to put glider at risk
	+ Maintain 1-pilot-1-planner approach unless otherwise needed
* To facilitate communication between ship personnel and pilots during the glider deployment, we developed a script to ensure that we followed the proper deployment procedure (see attached document)

External resources: critical tools used during mission development and execution:

* All team members maintained a GIS with publicly-available WMS layers for ocean currents, wind, sea surface temperature, and other variables necessary for piloting
* A static layer of iceberg positions was updated regularly based on available geo-referenced satellite imagery of sea ice (usually every 1 – 3 days)
* A static layer of glider tracks and positions was updated regularly by downloading KML files from the SFMC so that we could visualize glider positions in relation to icebergs
* Other meteorological products were consulted as necessary