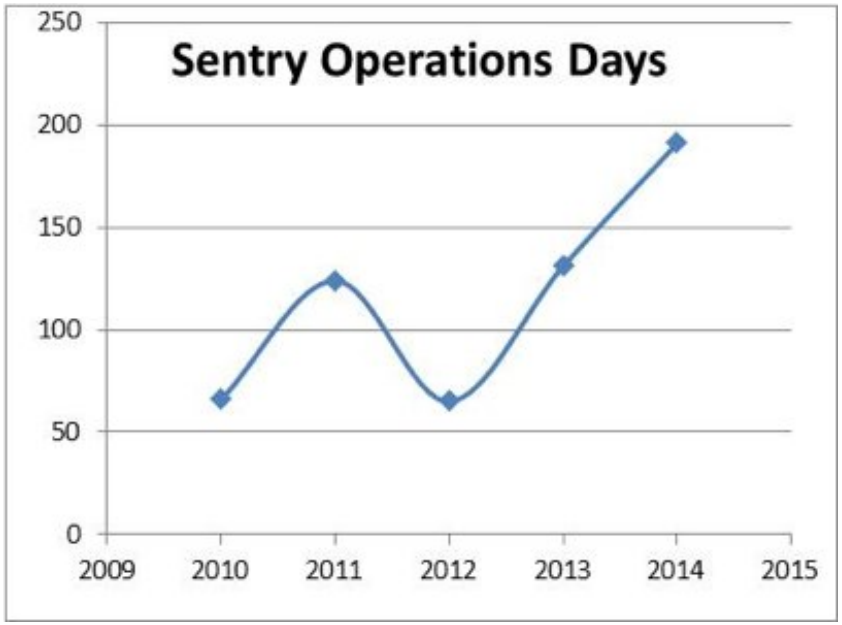
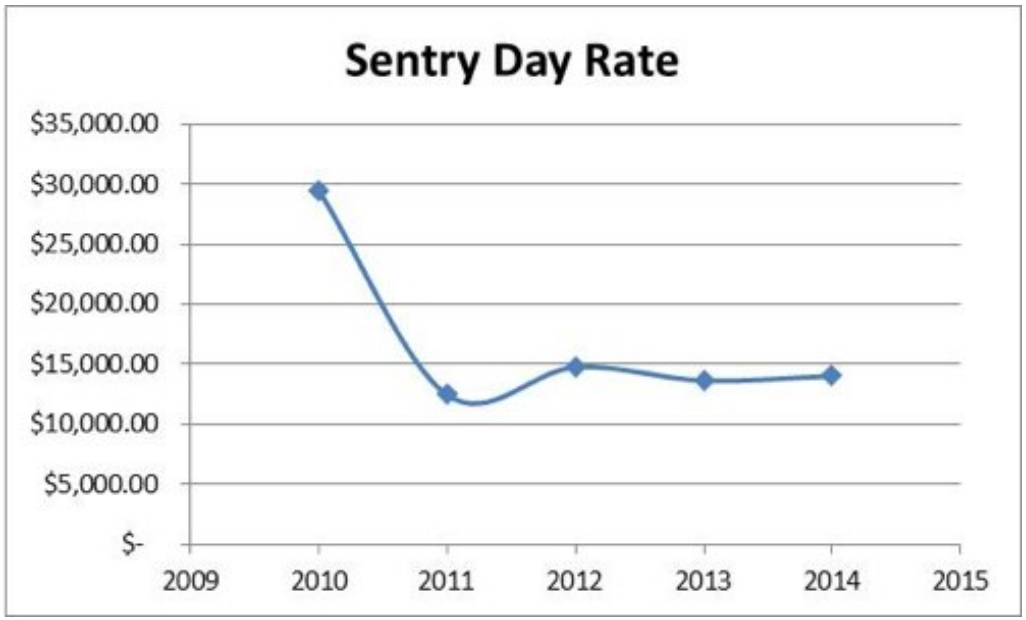
2 Year Review
Outline

- Summary of *Sentry* NDSF Operations
- Concerns
  - Staffing
  - Depth Capability
  - Specification Matching and Testing
  - Documentation
  - Website
- Future Vision

Utilization

- 226 dives since 2010
- 17 different PIs since 2010
- Multiple NSF-sponsored and external cruises where *Sentry* was requested but could not be scheduled





Major Upgrades

- 4500m → 6000m
- Sustainable staffing
- Simplified operation → Easier to staff
- Many new instruments
- New support infrastructure
- Several new data pipelines
- Documentation and web site
- New propulsion
- Much larger payload

Total Staffing

Category	Regular and Fully Trained	Regular and in Training	Emergency Backup (at sea w/ *Sentry* at least once)	Total
June 2010				
Mechanical	2	0	0	2
Electrical	1	0	0	1
Software/Data	2	0	0	2
EL	1	0	0	1
June 2014				
Mechanical	2	1	2	5
Electrical	2	1 crossover w/ sw	3	6
Software/Data	5	1 crossover w/ EE + 2	0	8
EL	4	1	0	5

Depth Upgrade

- Extensive root cause analysis
- Extensive modifications and testing
- 28 dives > 5000m since correcting the issues
  - *No depth-related failures*

Testing and Qualification

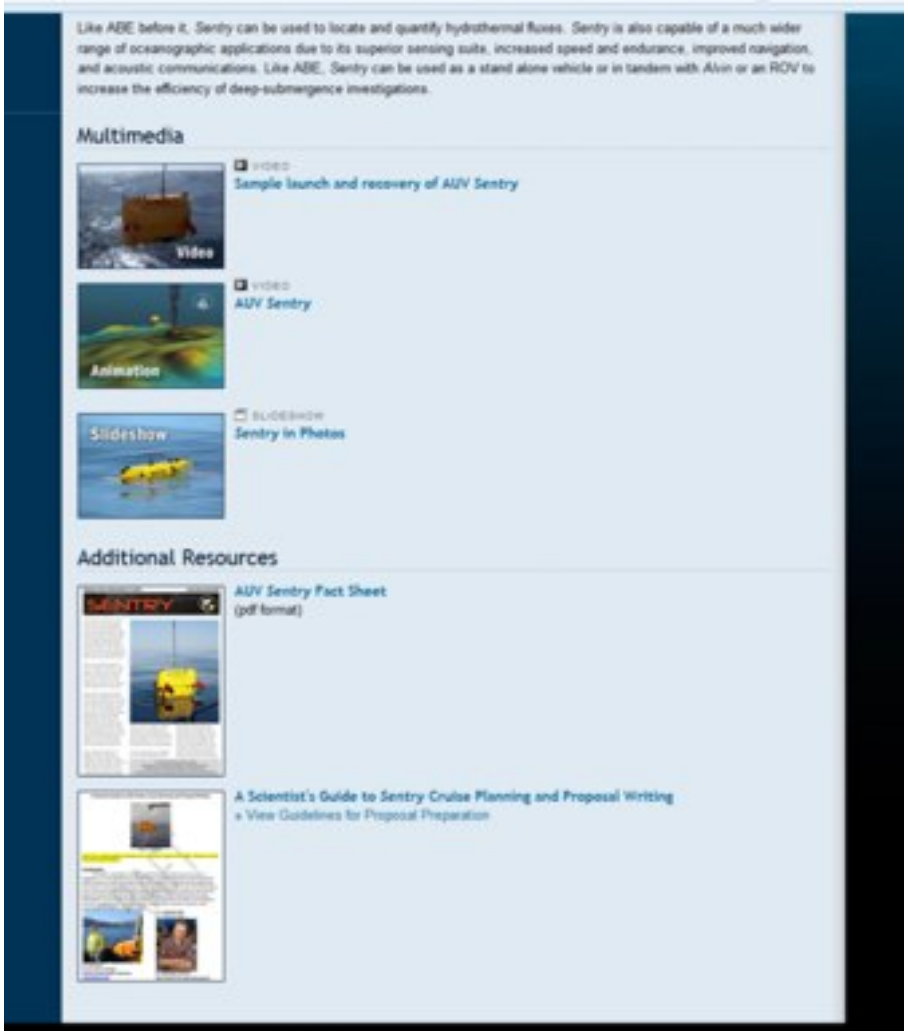
- Requested and received 2 engineering dives per year
- Much more extensive and formal pressure and functional testing requirements before integration

- In order to keep pace with innovation, we still have to take many capabilities into the field not yet tested in deep water
  - AUVs are fast evolving
  - *Sentry* aims to both keep pace and innovate in order to be relevant to science
  - Not likely to change, but:
    - Changing how engineering dives are scheduled
    - Warn PIs well in advance
    - Distinguish between standard and experimental
    - Fallback plans in place

Web Site

- Still under construction, but most content now up
- Please tell us what else you want

Main *Sentry* Page:
http://www.whoi.edu/main/sentry
Planning Guide:
http://www.whoi.edu/fileserver.do?id=159424&pt=10&p=39047



2 Year Review
Operations Summary & Basic Metadata

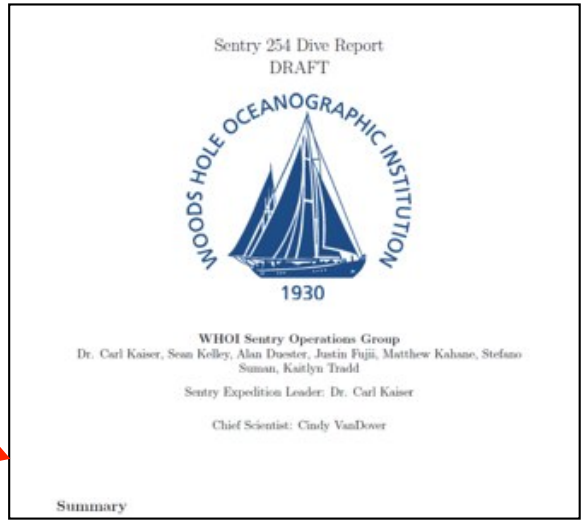
Eventually link to map

Eventually link to gridded data

Link to Chief Scientist e-mail

Link to Cruise Report if data embargo is over

Link to Dive Report if data embargo over and standalone dive report was generated


Sentry 254 Dive Report
DRAFT

WOODS HOLE OCEANOGRAPHIC INSTITUTION
1930

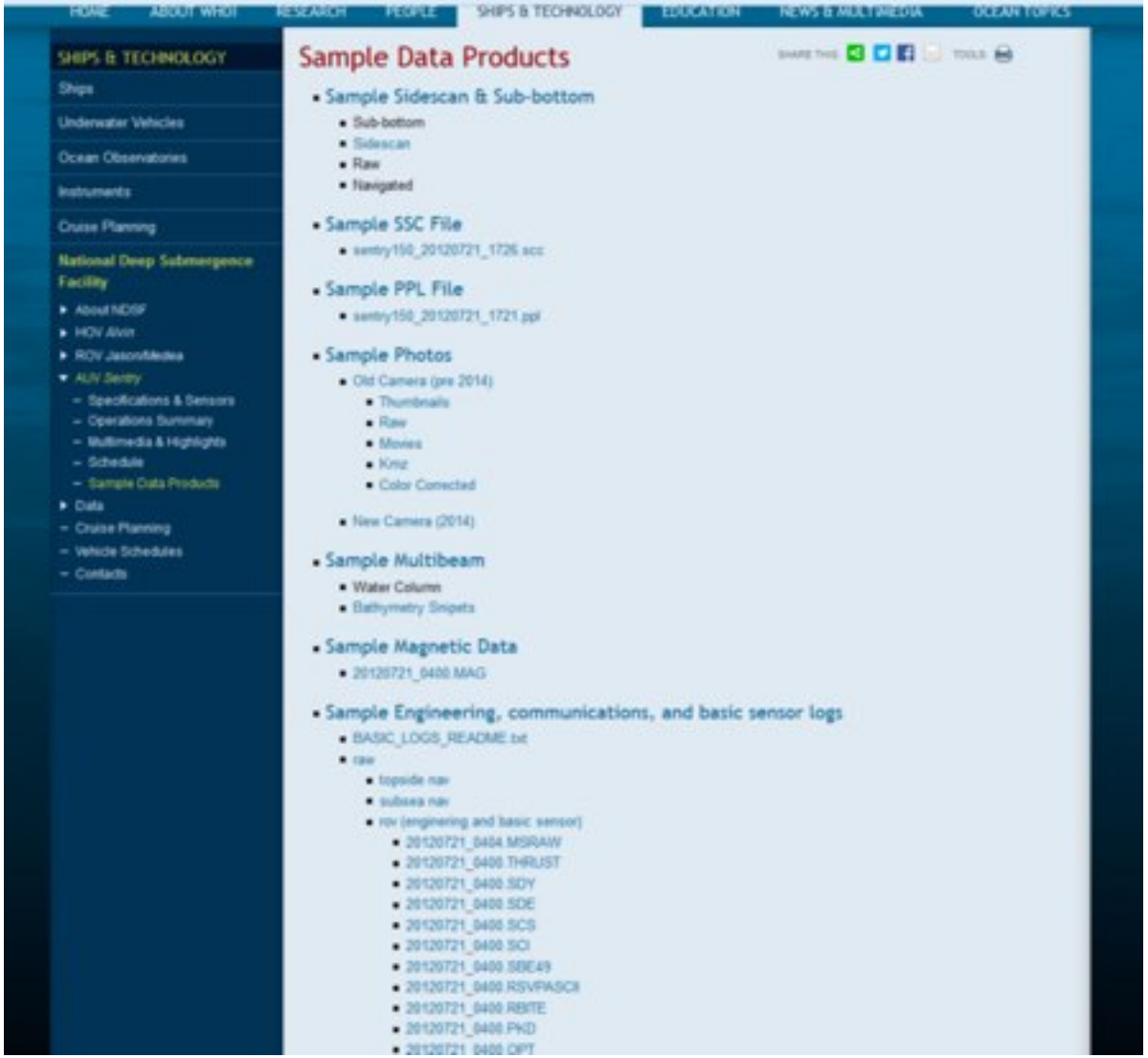
WHOI Sentry Operations Group
Dr. Carl Kaiser, Sean Kelley, Alan Duester, Justin Fujii, Matthew Kahane, Stefano Suman, Kaitlyn Tradd

Sentry Expedition Leader: Dr. Carl Kaiser

Chief Scientist: Cindy VanDover

Summary

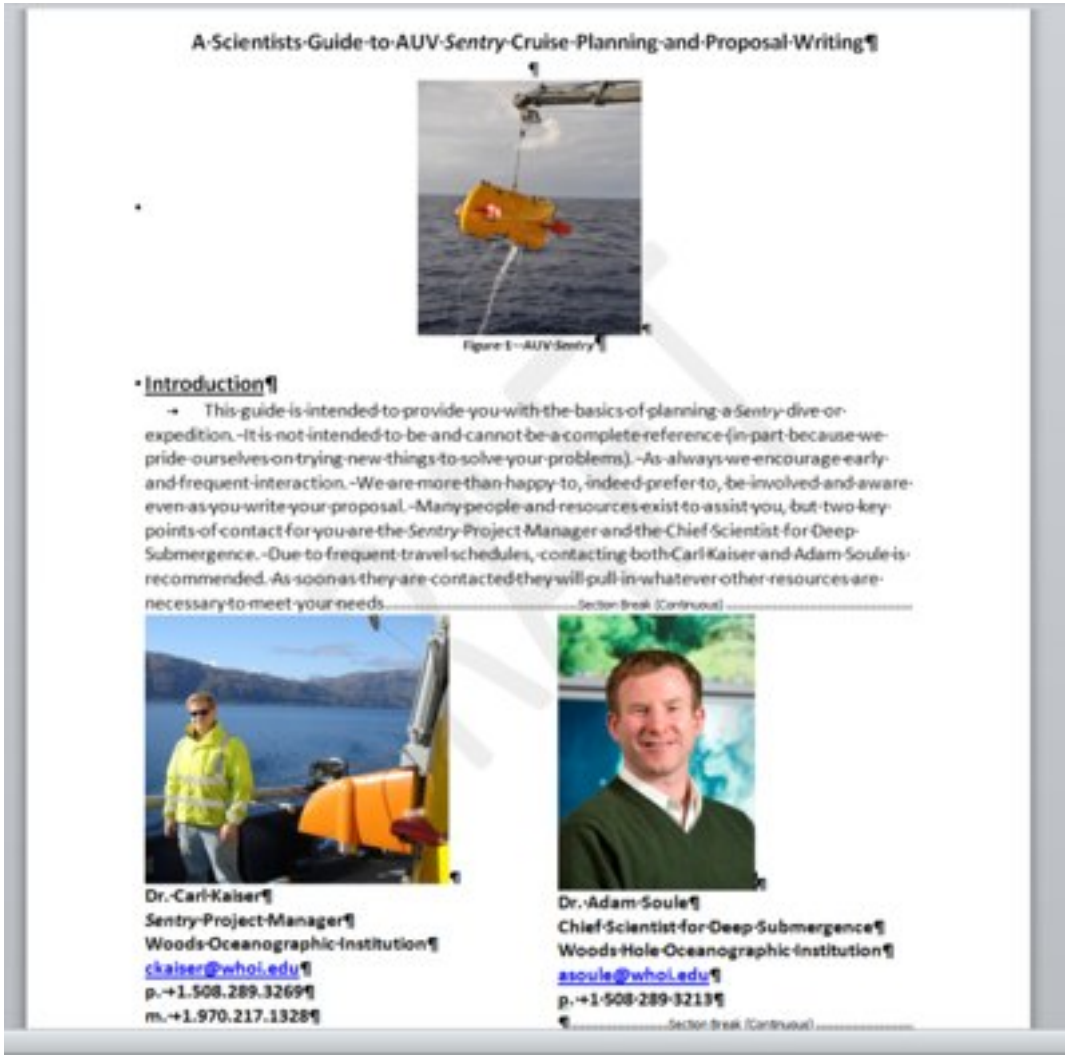
Sample Data



- Most types of data now on line for at least one dive
- If more detail needed, still best to contact us directly

Documentation

"A Scientist's Guide to *Sentry* Cruise Planning and Proposal Writing"



A Scientists Guide to AUV *Sentry* Cruise Planning and Proposal Writing

Figure 1—AUV Sentry

Introduction

This guide is intended to provide you with the basics of planning a *Sentry* dive or expedition. It is not intended to be and cannot be a complete reference (in part because we pride ourselves on trying new things to solve your problems). As always we encourage early and frequent interaction. We are more than happy to, indeed prefer to, be involved and aware even as you write your proposal. Many people and resources exist to assist you, but two key points of contact for you are the *Sentry* Project Manager and the Chief Scientist for Deep Submergence. Due to frequent travel schedules, contacting both Carl Kaiser and Adam Soule is recommended. As soon as they are contacted they will pull in whatever other resources are necessary to meet your needs.

Section Break (Continuous)

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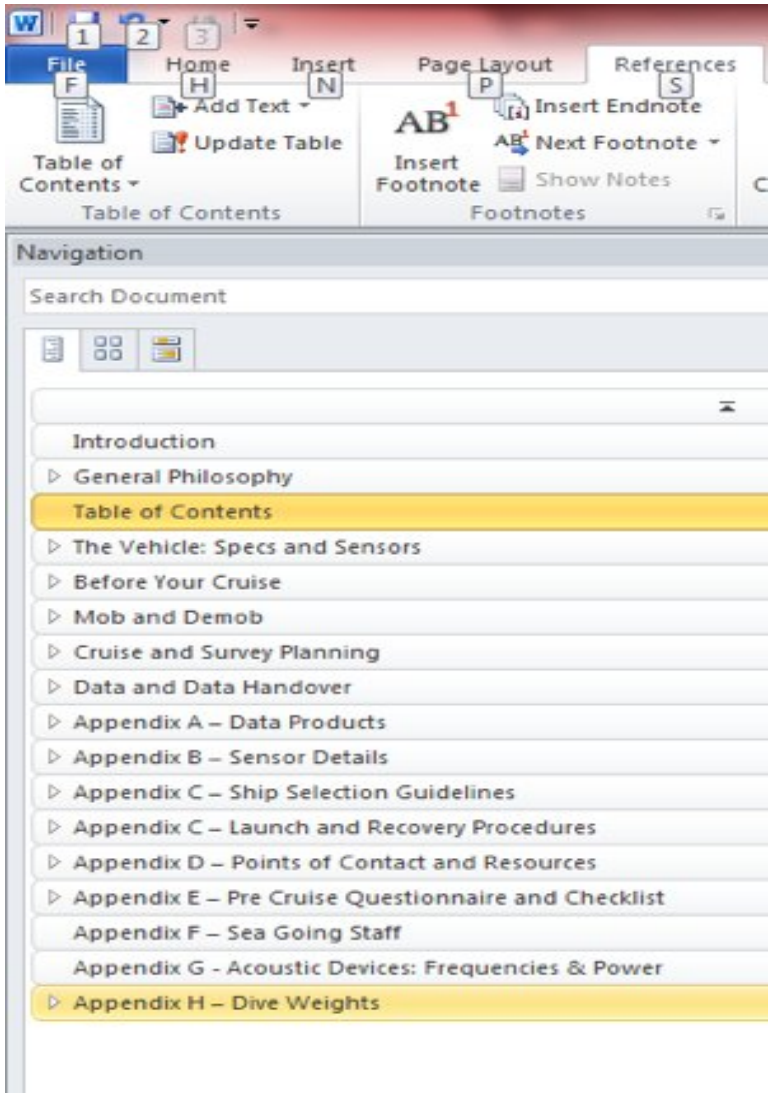
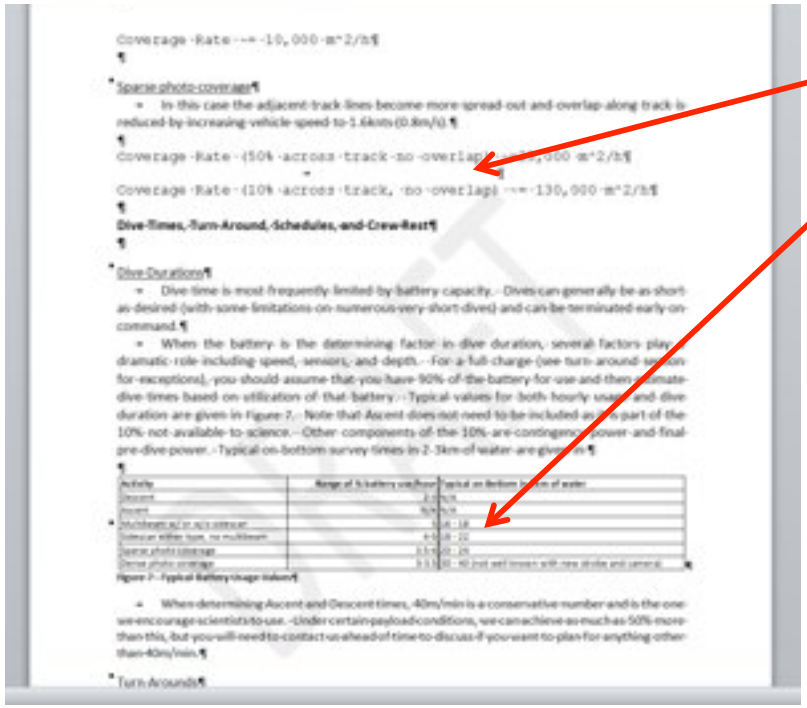
Section Break (Continuous)



Capabilities and Planning



Coverage Rate ~~ 10,000 m^2/h

Sparse photo coverage

- In this case the adjacent track lines become more spread out and overlap along track is reduced by increasing vehicle speed to 1.6knts (0.8m/s).

Coverage Rate (50% across track no overlap) ~~ 65,000 m^2/h

Coverage Rate (10% across track, no overlap) ~~ 130,000 m^2/h

Dive Times, Turn Around, Schedules, and Crew Rest

Dive Durations

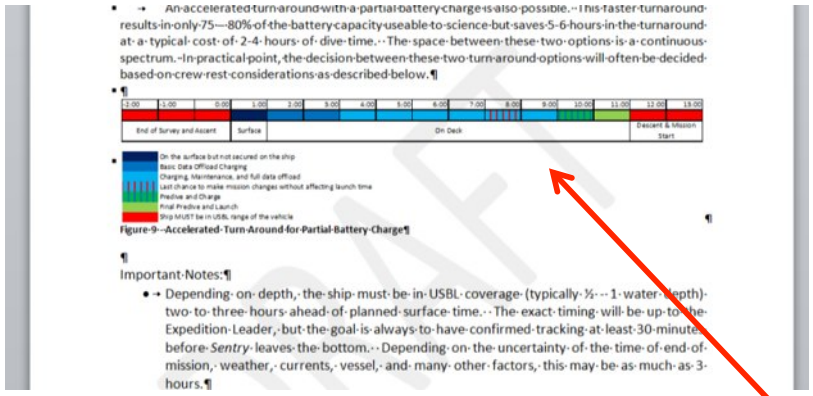
- Dive time is most frequently limited by battery capacity. Dives can generally be as short as desired (with some limitations on numerous very short dives) and can be terminated early on command.
- When the battery is the determining factor in dive duration, several factors play a dramatic role including speed, sensors, and depth. For a full charge (see turn around section for exceptions), you should assume that you have 90% of the battery for use and then estimate dive times based on utilization of that battery. Typical values for both hourly usage and dive duration are given in Figure 7. Note that Ascent does not need to be included as it is part of the 10% not available to science. Other components of the 10% are contingency power and final pre-dive power. Typical on-bottom survey times in 2-3km of water are given in

Activity	Range of % battery use/hour	Typical on-bottom survey of water
Descent	2-3%/hr	
Ascent	5%/hr	
Multibeam w/ or w/o sidescan	5-8% - 10	
Sidescan either type, no multibeam	4-5% - 20	
Sparse photo coverage	3-5% - 25	
Dense photo coverage	3-5% - 40 (not well known with new strobe and cameras)	

Figure 7 - Typical Battery Usage Values

- When determining Ascent and Descent times, 40m/min is a conservative number and is the one we encourage scientists to use. Under certain payload conditions, we can achieve as much as 50% more than this, but you will need to contact us ahead of time to discuss if you want to plan for anything other than 40m/min.

Turn Arounds



- An accelerated turn around with a partial battery charge is also possible. This faster turnaround results in only 75---80% of the battery capacity useable to science but saves 5-6 hours in the turnaround at a typical cost of 2-4 hours of dive time. The space between these two options is a continuous spectrum. In practical point, the decision between these two turn around options will often be decided based on crew rest considerations as described below.

Figure 9 - Accelerated Turn Around for Partial Battery Charge

Important Notes:

- Depending on depth, the ship must be in USBL coverage (typically ½ - 1 water depth) two to three hours ahead of planned surface time. The exact timing will be up to the Expedition Leader, but the goal is always to have confirmed tracking at least 30 minutes before *Sentry* leaves the bottom. Depending on the uncertainty of the time of end of mission, weather, currents, vessel, and many other factors, this may be as much as 3 hours.

Excerpts from Scientist's Guide

Coverage rate formulas for standard survey types

Battery Use Rates

- Goal was to provide sufficient information to scientists to plan standard cruises without help if they wanted
- Still need to contact us for unusual situations
- Still happy to help and/or provide plans to anyone who doesn't want to wade through this

Typical Turn Around Times and Dive Schedules

Future Vision

- Continued focus on simplification & reliability
  - Easy things easy – hard things possible
- Continued focus on innovation
  - Continue to expand relevance to Biology
  - Move up into the midwater – e.g. follow thermoclines/ haloclines
- Second vehicle (probably non-NDSF)
  - We're turning away cruises with good science and good engineering left and right because of schedule