Jason Upgrades

Control Van Upgrade 2017/18

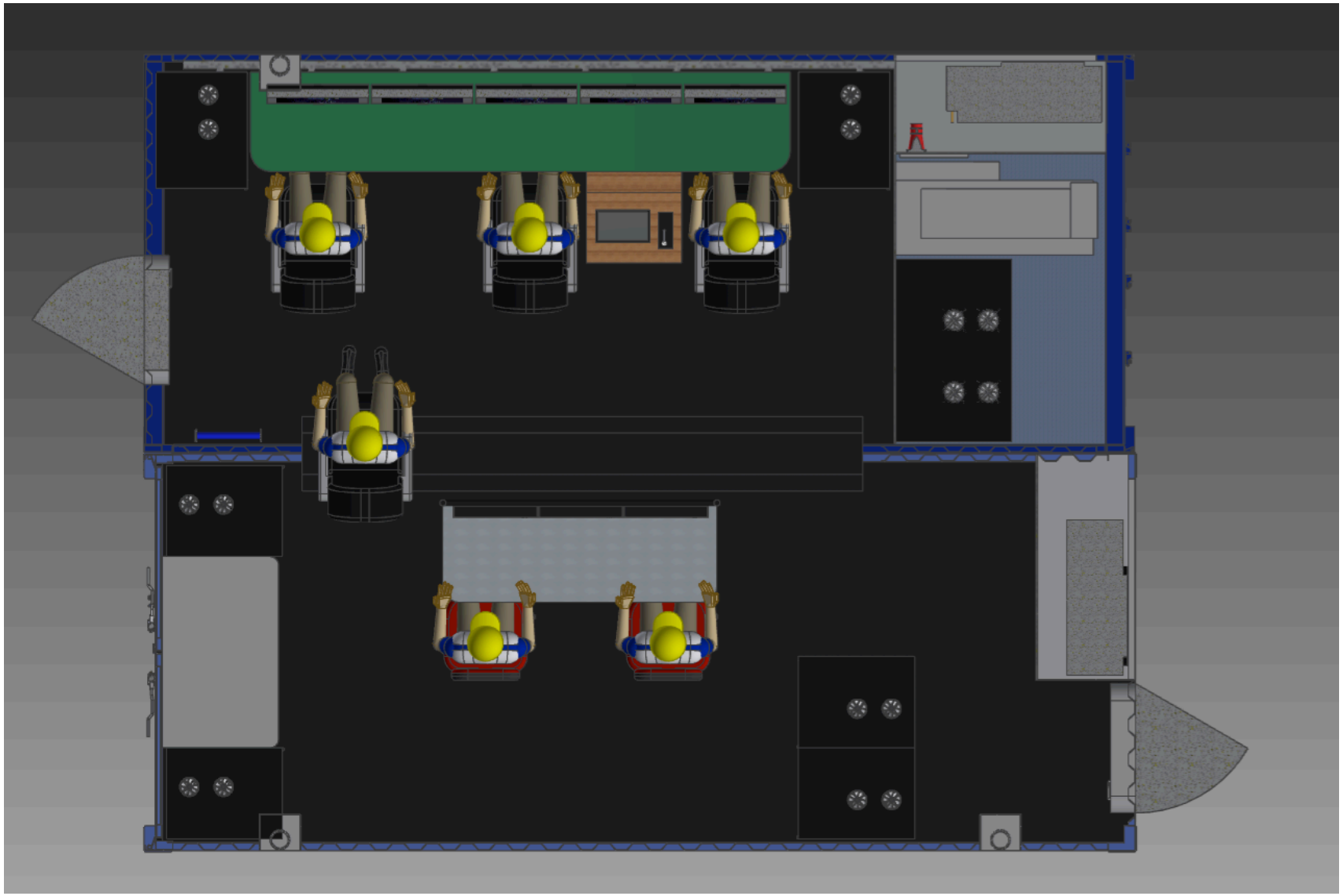
- Control van infrastructure at end of life
- Deck space for certain operations is limited
- System will be operated from a single van *or* dual vans
- Second van will not contain mission-critical equipment

Jason Upgrades

Jason Control Room

Jason Upgrades

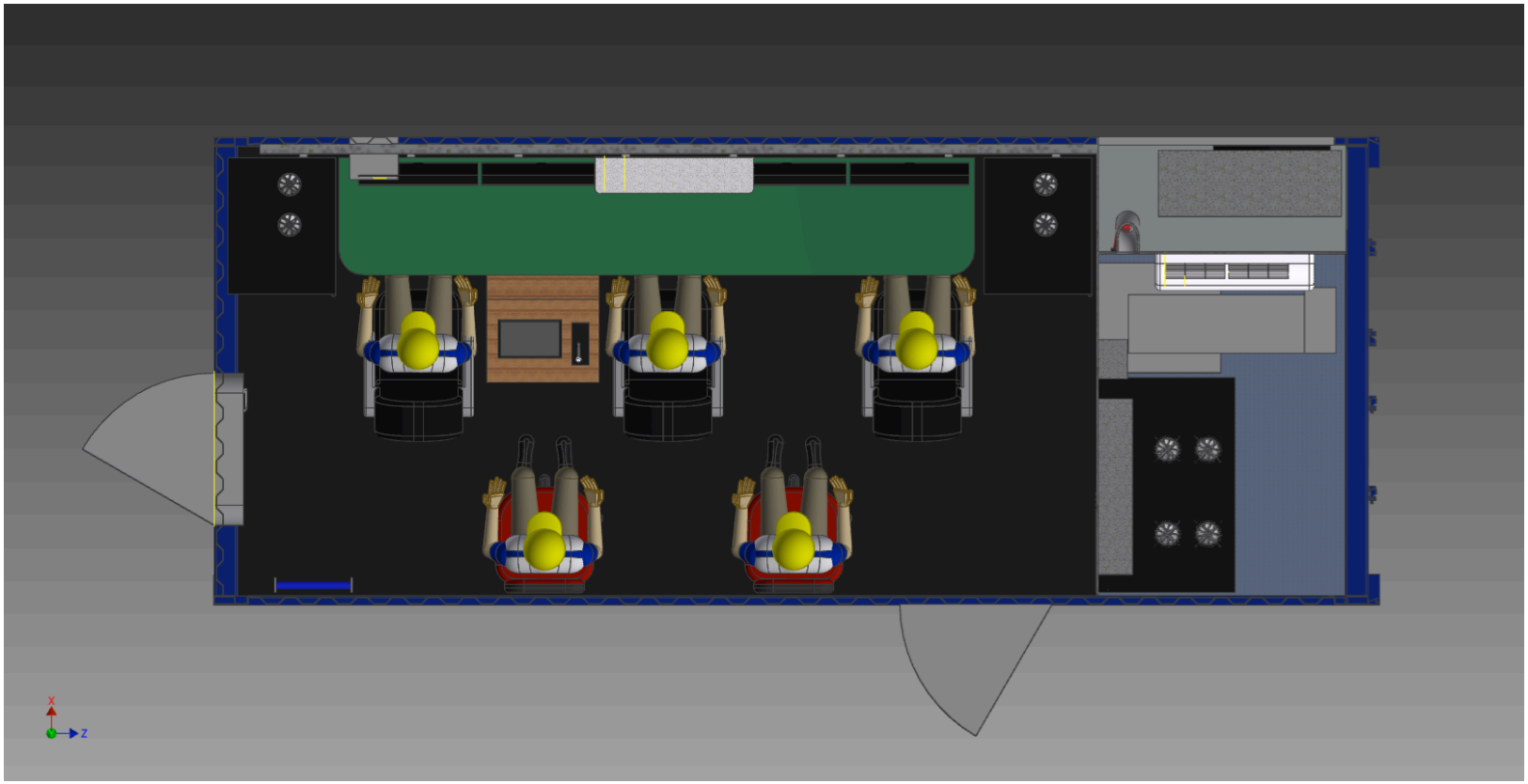
Dual Van Layout



Jason Upgrades

Single Van Layout

- Single van will accommodate three *Jason* team & two scientists
- Remainder of the science participants at remote station
- Remote station will have 2 x 65” split screen monitors to duplicate the views in the single van
- Live communications with van to alleviate confusion



Jason Upgrades

Jason Upgrades

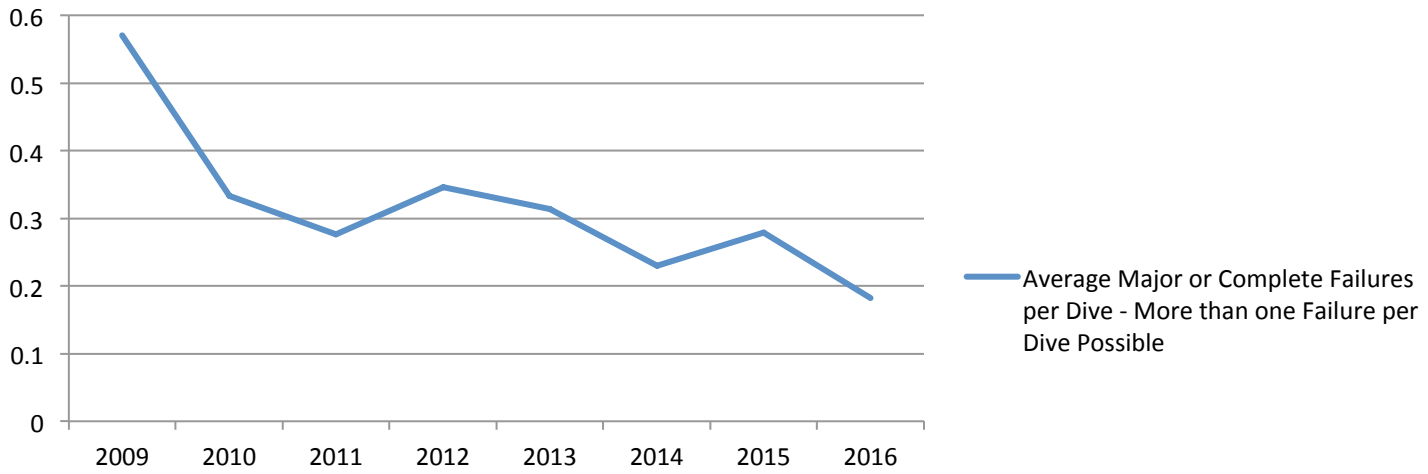
Jason Upgrades

Sentry Upgrades
Staffing

- Sean Kelley now "*Sentry* Operations Manager"
  - ~1/3 of his time – focus on day to day, cruise to cruise
  - Carl Kaiser retains program management but will scale back time by approx 1/3 as Sean comes up to speed
- Zak Berkowitz now an EL – four ELs available
- Ian Vaughn on board adding a lot of value to software and fast tracked toward an additional EL
- Jennifer Vaccaro – new grad software engineer starts August 1, 2018
- Significant cross training underway for *Alvin* ops personnel to work on *Sentry* at sea

Sentry Upgrades
Progress Check

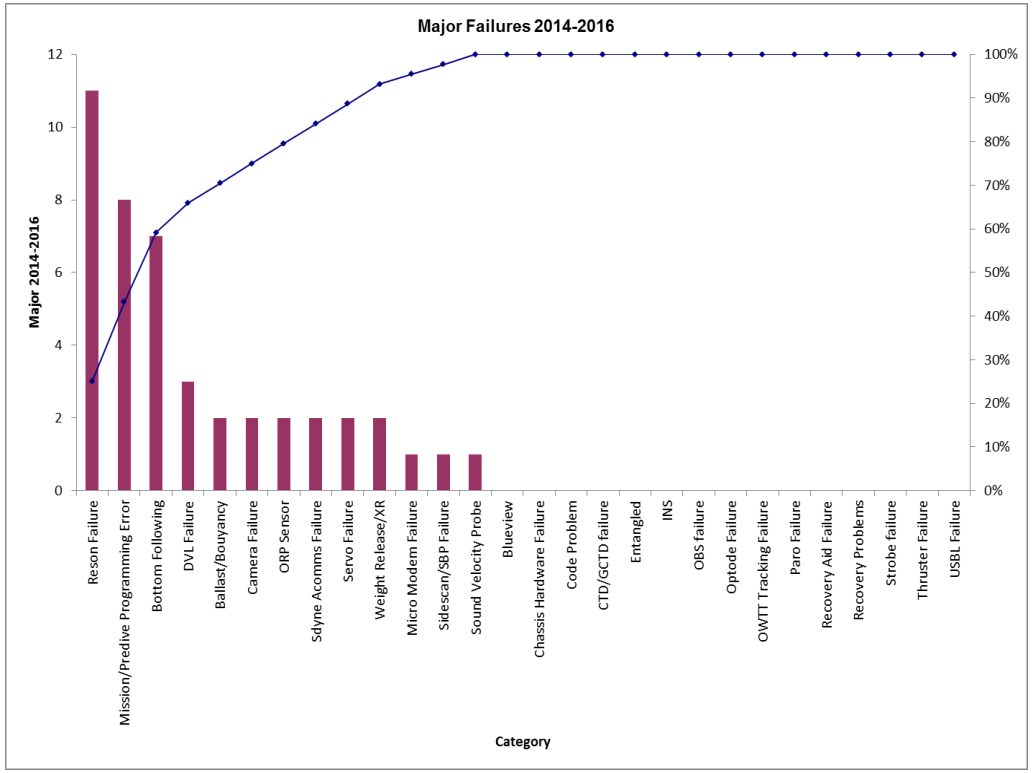
- Many upgrades over the years have led to a steadily declining failure rate while dramatically improving capability
- Full historical failure analysis underway
  - Major failure defined as any one key sensor or system has a problem for 25% or more of the planned dive
  - 2016: far more capability/complexity and 1/3 the failure rate



Sentry Upgrades
Focus

- Aside from new capability, where do we need more work to improve on problems?
- 60% of major failures last three years are from 3 things:
  - Reson – HW/SW
  - Pre-dive human error
  - Bottom following

Much more in-depth analysis to follow later this year



Sentry Upgrades
Mechanical

- Increasing max current to thrusters by 20%. Estimated to increase vehicle top speed to ~2.3 kts. Higher current tested now, new top speed established in Nov 2017.
- Replacing all remaining salvaged Sea Cliff foam (c. 1980's and cracking badly). Should add significant payload capacity as well.
- New wing servo design underway. Largest remaining mechanical failure on vehicle.
  - Direct drive and high reliability
  - Absolute position feedback

Sentry Upgrades
Data and Reporting

- Moving toward mission block concept
  - Each segment of the dive is assigned a globally unique ID and meta-tag
  - These tags follow the block all the way through post processing
  - Auto-generated figures in all dive reports
- Update to *Sentry* metadata website underway to make data discoverable
- Massive documentation effort continues. *Sentry* wiki now over 600 articles
  - Really helping with cross training new staff, especially *Alvin* staff

Name	Start / End	Hours	Description
autogenerated	2017/06/05 01:49:03 2017/06/05 02:14:23	0.42	Descent to start of mission
multibeam	2017/06/05 02:15:29 2017/06/05 02:32:16	0.28	Multibeam Crossing line
multibeam	2017/06/05 02:32:16 2017/06/05 06:27:53	3.93	Initial multibeam coverage of area
photo	2017/06/05 06:27:53 2017/06/05 09:54:02	3.44	Habitat characterization photo survey at Northern targets, 10 550m lines at 40 meter spacing
multibeam	2017/06/05 09:54:02 2017/06/05 10:31:39	0.63	Transit to mb survey #2 on wall edge
multibeam	2017/06/05 10:31:39 2017/06/05 11:21:39	0.83	Multibeam on wall edge
Ascent	2017/06/05 11:21:39 2017/06/05 11:44:45	0.39	Ascent from end-of-mission abort to the surface

Table 1: Mission blocks during dive sentry439

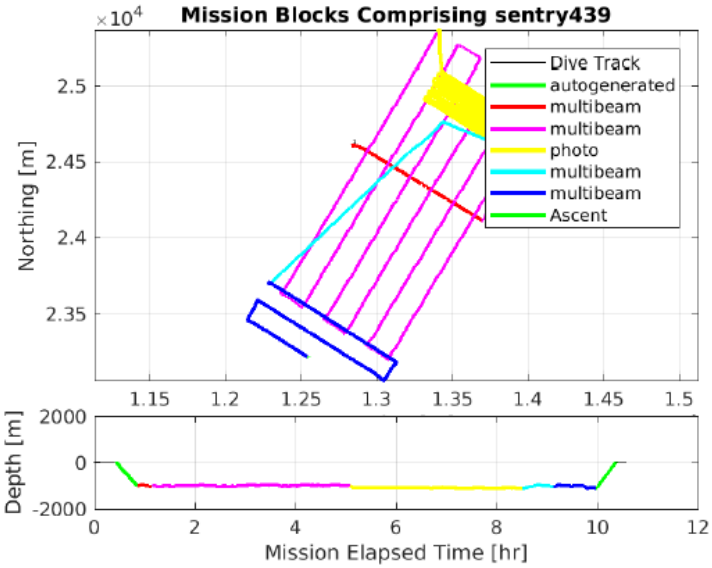
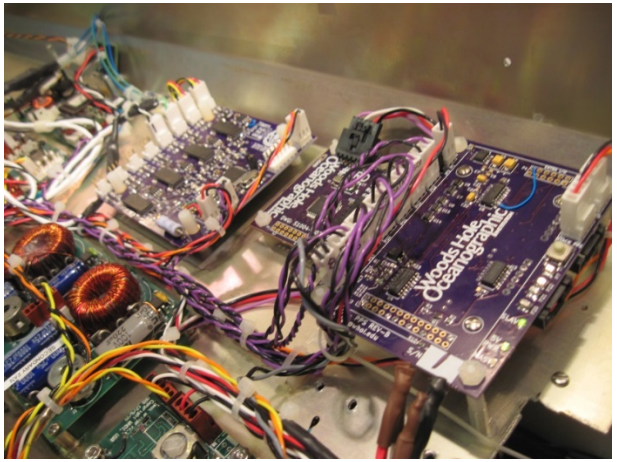
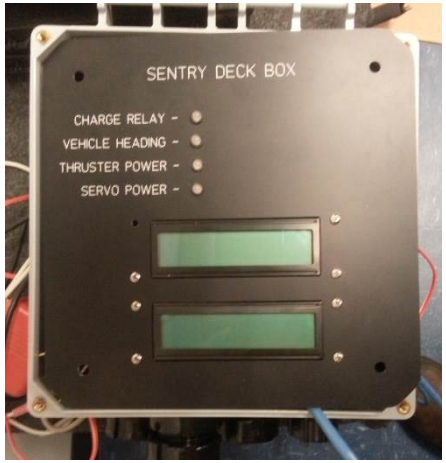


Figure 1: Mission Blocks in Sentry 439

Sentry Upgrades
Electronics

- New: Bootstrap system, precision time base, acoustic triggering system
  - All three boards last designed in early 1990's, now modern and supportable
  - Triggering allows complex new mission and sensing modalities
  - Bootstrapping board another step toward realistic anchoring
- Deck box for on-deck control and status during pre-dive, plus automated burn wire testing





Sentry Upgrades
Major Command and Control Upgrade

In order to continue to improve the science we can deliver we need to:

- Replace bottom follower and thruster allocation – enables steeper terrain
- Replace the electronics chassis including computer and power distribution
- Migrate to Nereid-CORE architecture – leveraging major NSF and private investment to modernize software
- Replace mission executive –> new science capabilities
- Replace planning software

Replace Out of Date System	Leverage NUI and NHT	Enable Next Generation Science

Sentry Upgrades
Simulation Environment

- Building a much more sophisticated *Sentry* simulation environment to support software development while minimizing field testing
- Goal is to facilitate overall software upgrade and quick turnaround new science capabilities
- Includes significant hardware in the loop

Replace Out of Date System & Improve Reliability

Leverage NUI and NHT

Enable Next Generation Science

Sentry Upgrades

Near Term Software Goals

- New battery driver for simplified charging and better battery management – done, on vehicle
- New thruster allocation for better bottom avoidance – under development in simulation
- Migration toward centralized control of all dive parameters and configuration, significantly reducing the human workload and potential for human error
- Development of new mission executive – perhaps from IFREMER – to enable new science missions, especially adaptive ones.

Replace Out of Date System & Improve Reliability

Leverage NUI and NHT

Enable Next Generation Science

Sentry Upgrades

Synergistic Activities

- Autonomous Surface Vehicle tending demo – early 2018 – WHOI internal funding
- Improved telemetry via ACOMMS – early 2018 – WHOI internal funding
- Highly interactive real-time data transfer and display – side benefit of NOAA OER proposal currently pending
- NavG 3.0 – Significant upgrades to user interface for all three vehicles, which will include basic science data in the real-time vehicle control display
- Discussing use of IFREMER mission executive

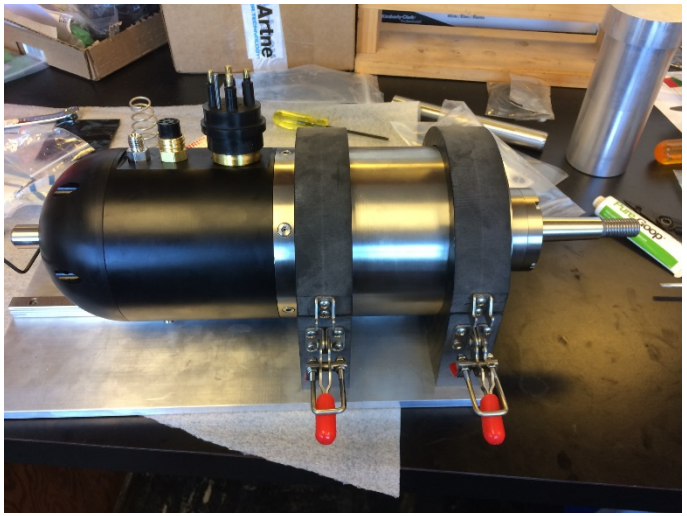
Replace Out of Date System & Improve Reliability

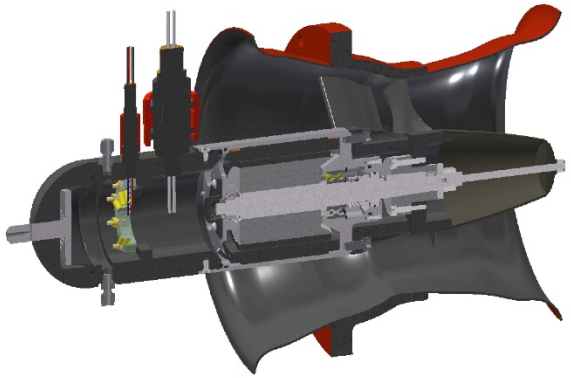
Leverage NUI and NHT

Enable Next Generation Science

Alvin Upgrades

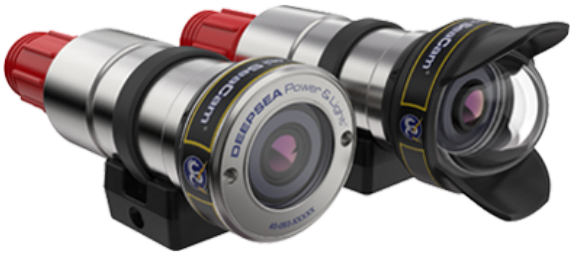
- **New *Alvin* thruster/pump motors**
  - **Total design by *Alvin*/DSL engineers to deliver better efficiency and improved thrust capabilities – new impellor**
  - **Over 200 pounds thrust per thruster**
  - **Incorporates new, significantly smaller, more efficient electronic motor controller**
  - **Replaces current obsolete designs – same form factor**
  - **Prototype testing in progress – new thrusters to be installed in 2018**





Alvin Upgrades

- **Addition of DSPL Flex-link HD cameras**
  - **Fixed focus, wide angle provides excellent forward imaging**
  - **Addition of camera provides little to no additional operator tasking**
  - **Excellent for wide angle imaging of forward work areas**



Alvin Upgrades

- **Preliminary design of replacement HP air spheres**
  - **Reduced number, improved ballast range, 6,500 m capable**
- **Design of replacement controller housings**
  - **Reduced number, smaller size/less weight, 6,500 m capable**
  - **Utilizes new motor controllers**
- **Purchase of additional 6,500 m syntactic foam**