Next Generation Bluefin-9:

A COTS AUV Enabling On-going and Advanced Platform Research

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Overview

- Sealion II Bluefin-9
- The Next Generation Bluefin-9
- Vehicle Overview
- Payload Modularity
- Empty Payload Options
- Removable Data Storage Modularity
- Summary
- Questions

The Status Quo: Sealion II

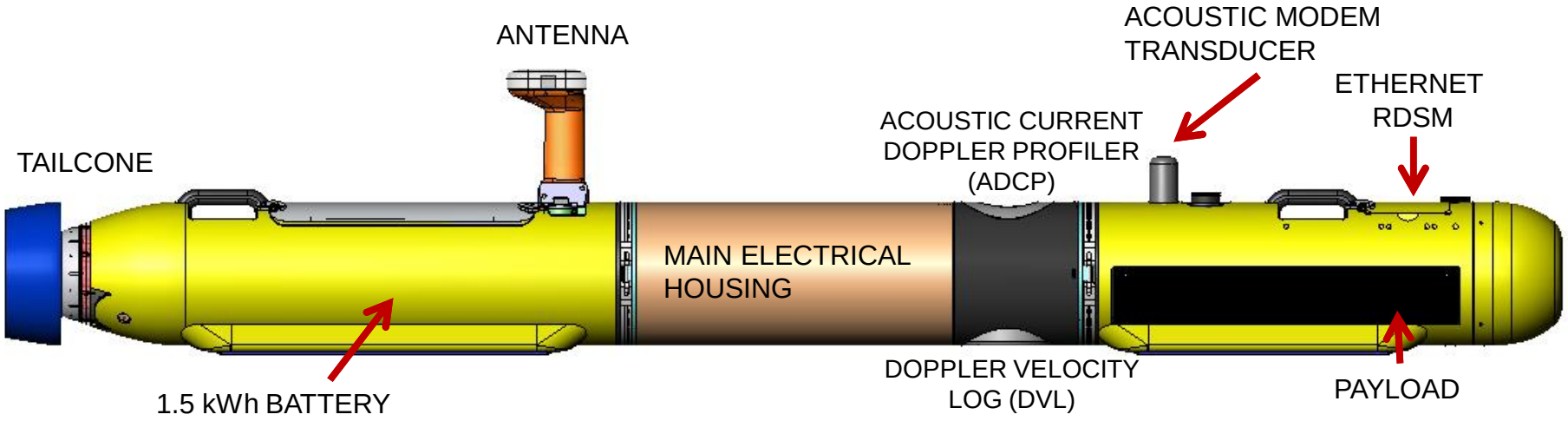
- 2-man-portable vehicle weighing in at about 60 kg
- Designed specifically for mine hunting operations
- Designed for the Marine Sonic 900/1800 kHz SSS
- Includes a turbidity sensor and video camera
- Does not have the ability to swap payloads
- 4GB removable data storage module (RDSM)

- MOOS-IvP backseat driver installed on CPU in the main electrical housing in July 2011
- Capable of running AUV software thatôs plug and play on a Gumstix via the RDSM USB port demonstrated July 2013

Next Generation Bluefin-9

- Maintain **2-man portability** and **recoverability**
- **Increase flexibility** (for customization) and **modularity** (for operation) compared to existing Sealion II model
  - Adds in the capability of a modular free-flooded payload
  - Modularity in manufacturing to reduce any added lead time
  - Modularity in maintenance
- Bring the **technology** up to date
- **Increase commonality** with the Bluefin-12 and Bluefin-21
- Standard payload interface for **rapid integration** of sensors such as:
  - Side scan sonar
  - Multibeam
  - Empty Payload

Vehicle Overview



Bluefin-9 Specifications	
Depth Rating	300 m
Length	2.5 m
Weight	70 kg with sidescan sonar payload
Endurance at 3 kts	Up to 11 hours with sidescan sonar payload
Speed	3 to 5 kts
Navigation Accuracy	0.3% of distance traveled CEP 50 using IMU/Compass 0.1% of distance traveled CEP 50 using INS
Launch and Recovery	2-man deployable and recoverable Crane or ramp recovery

Swapping Payloads

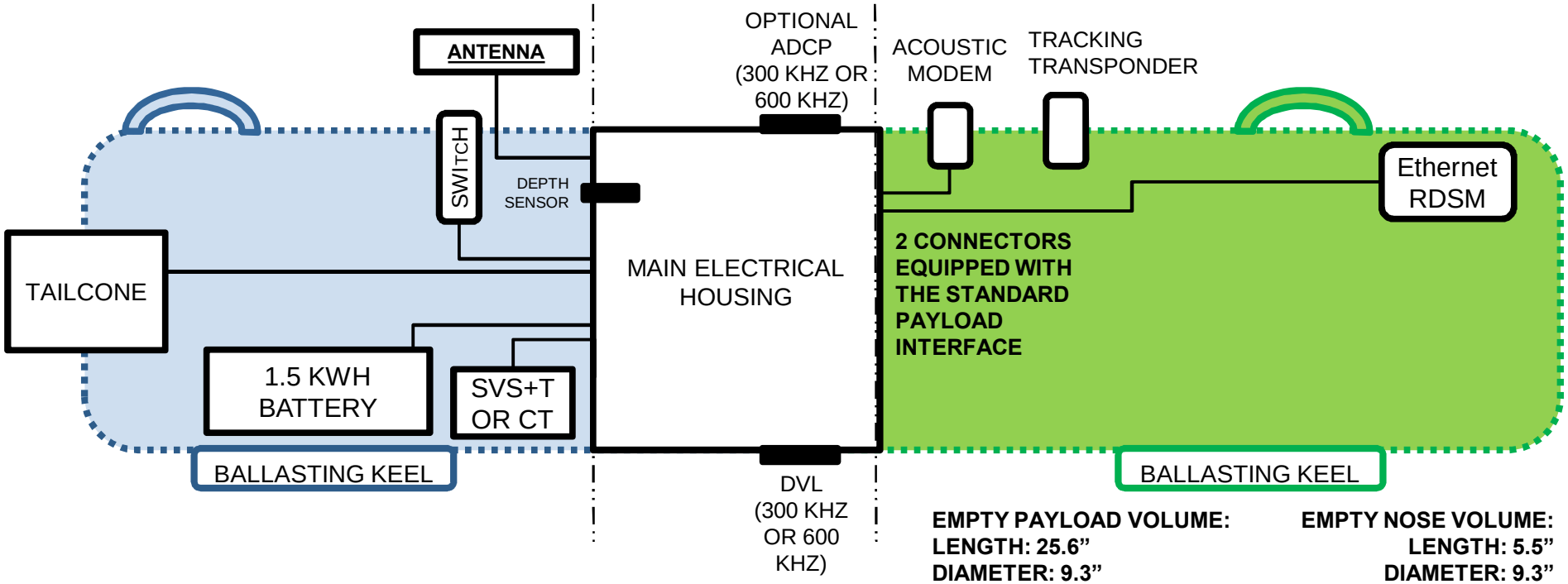
This Bluefin-9 allows for swappable payloads. Whether the user wants to swap out a SSS payload and install a camera payload, the user must do the following steps:

1. Power off the vehicle
2. Remove the section joining band mechanism using an Allen wrench provided with the system
3. Disconnect the payloadôs wet cable connection to the main electronics housing
4. Connect the new payloadôs wet cable connection to the main electronics housing
5. Reinstall the section joining band mechanism using an Allen wrench
6. Power on the vehicle and select the new payload configuration in the Operator Interface

A trained operator can swap a payload section in under 15 minutes. No specialized tools are required, and no pressure seals are breached during the removal or installation of a payload section.

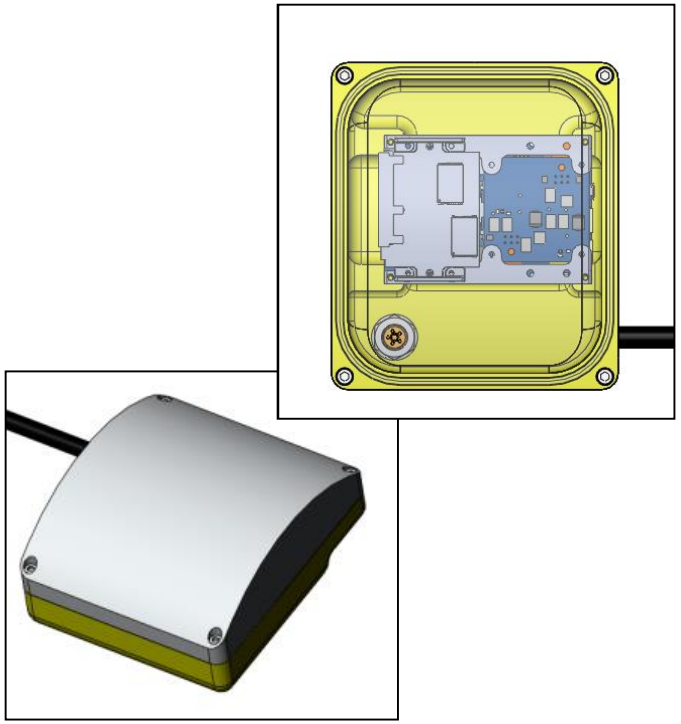
Standard Payload Interface

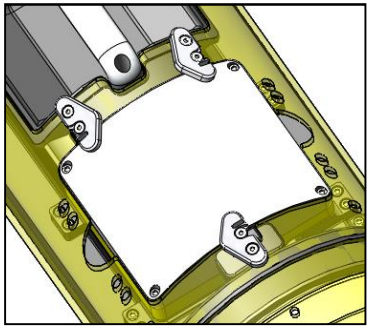
- Empty Payload: the user has the ability to put their sensors into the payload section
- This has been done in the past with Bluefin-21 and Bluefin-12 vehicles, now we are expanding this opportunity to our Bluefin-9 vehicles
- Bluefin will provide an empty section (shown in green) with all standard electrical interfaces and a RDSM if desired
- Bluefin will provide strict constraints on section buoyancy, trim, and vertical stability



Ethernet RDSM Features

- High capacity solid state drive
- Fast data transfer rates
- Low power
- Gigabit Ethernet Interface
- Supports multiple file systems
- Easily removable and swappable for fast turnaround ï no tools required
- Wet-mateable connector
- Lightweight and compact



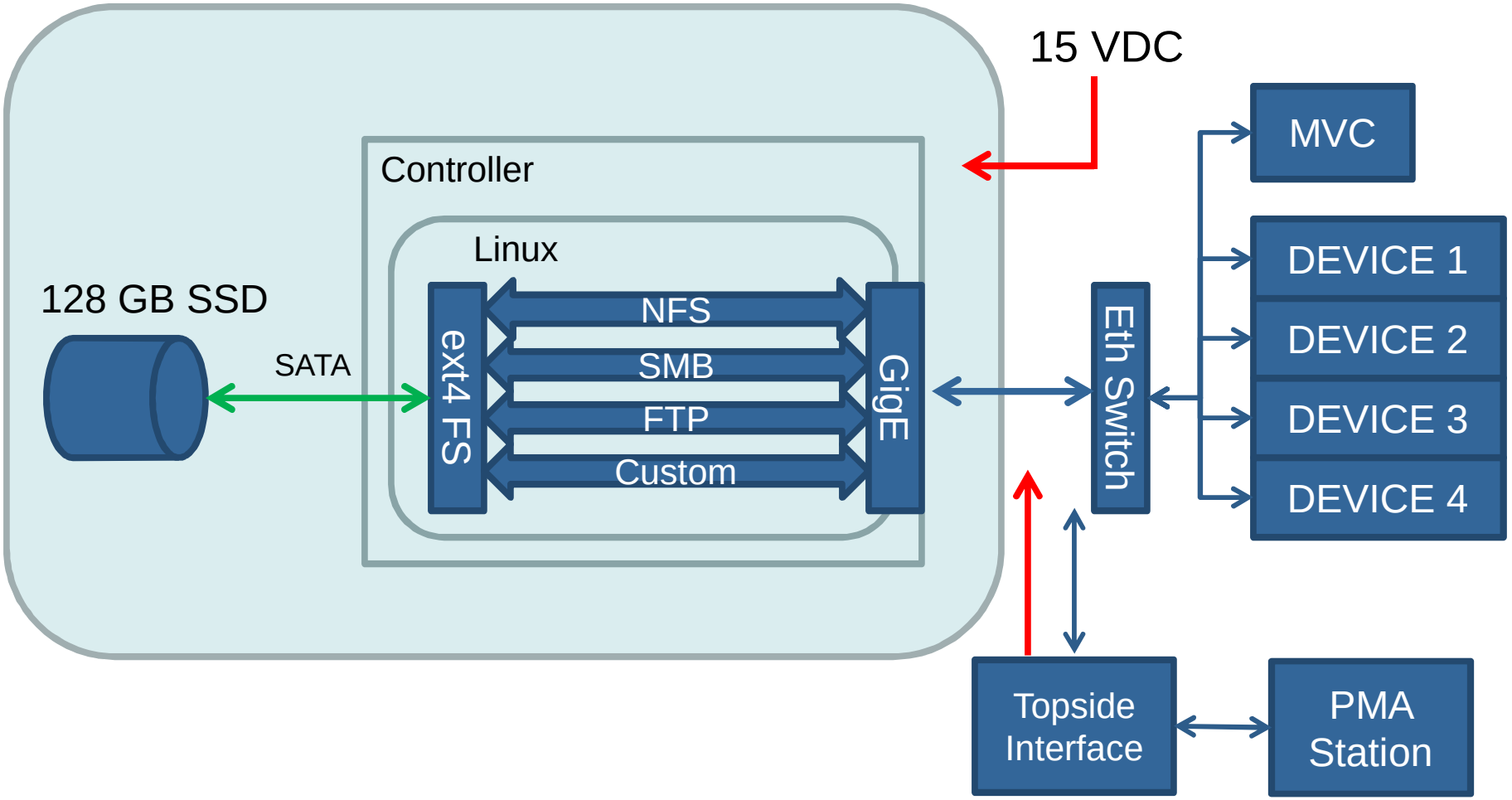


Bluefin-9 Ethernet RDSM

Specifications	
Configuration	Computer On Module (COM) on COTS carrier board
Storage Capacity	128 GB industrial-temp MLC SATA SSD
Raw TCP throughput **	626 Mbits/s down, 917 Mbits/s up
NFS storage throughput **	68 MBytes/s read, 27 MBytes/s write
Supported Network Speeds	10/100/1000 MBit
Supported Protocols	NFS, SMB, FTP
Operating System	Debian GNU/Linux 7
Internal Operating Temperature	-40ºC to 85ºC (-40ºF to 185ºF) ambient
Dimensions	159mm W x 138mm L x 76mm H (6.25ðW x 5.45ðL x 3ðH)
Weight	2 kg
Depth Rating	300m
Connector	Subconn Low Profile Power Ethernet
Housing Material	Aluminum 6061-T6, Hard Anodized

** Note: does not include losses due to wet cabling

Ethernet RDSM Integration Architecture

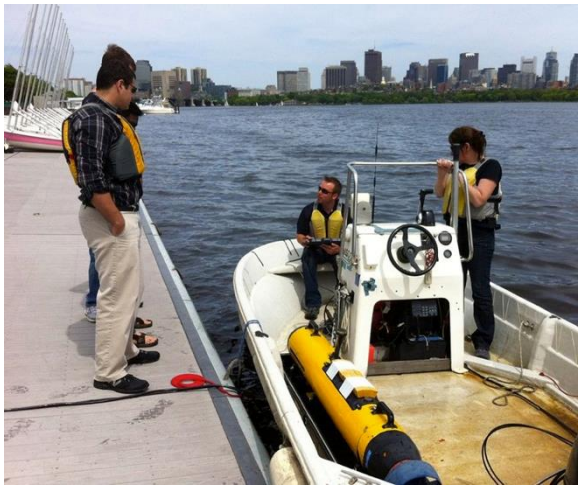


Ethernet RDSM Third Party Options

- Third parties may want to run processing tasks on RDSM
  - Currently: Gumstix in BF9 RDSM enclosure
- Options:
  - User replaces contents of eRDSM, maintains the file storage for the vehicle
    - Internal volume: 49in^3
  - User brings own COM module
    - This involves minimal mechanical/manufacturing impact
    - The carrier board stays the same; board-set height is part of the standard (carrier, module, heat spreader, standoffs)
  - User installs software under existing Linux installation on eRDSM board
  - User plugs a Gumstix into carrier boardôs USB port

Summary

- Upgrades to the Bluefin-9 have provided a customizable, flexible, and inexpensive AUV system to support sensor development and autonomy for all users
- The free-flooded payload section provides sensor integration
- Electrical and software standard payload interface allows for rapid sensor integration
- The new innovative flexible interface of the eRDSM can straightforwardly accommodate MOOS-IvP, Backseat Driver, and other third-party interfaces to the vehicleôs autonomy



Questions?

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