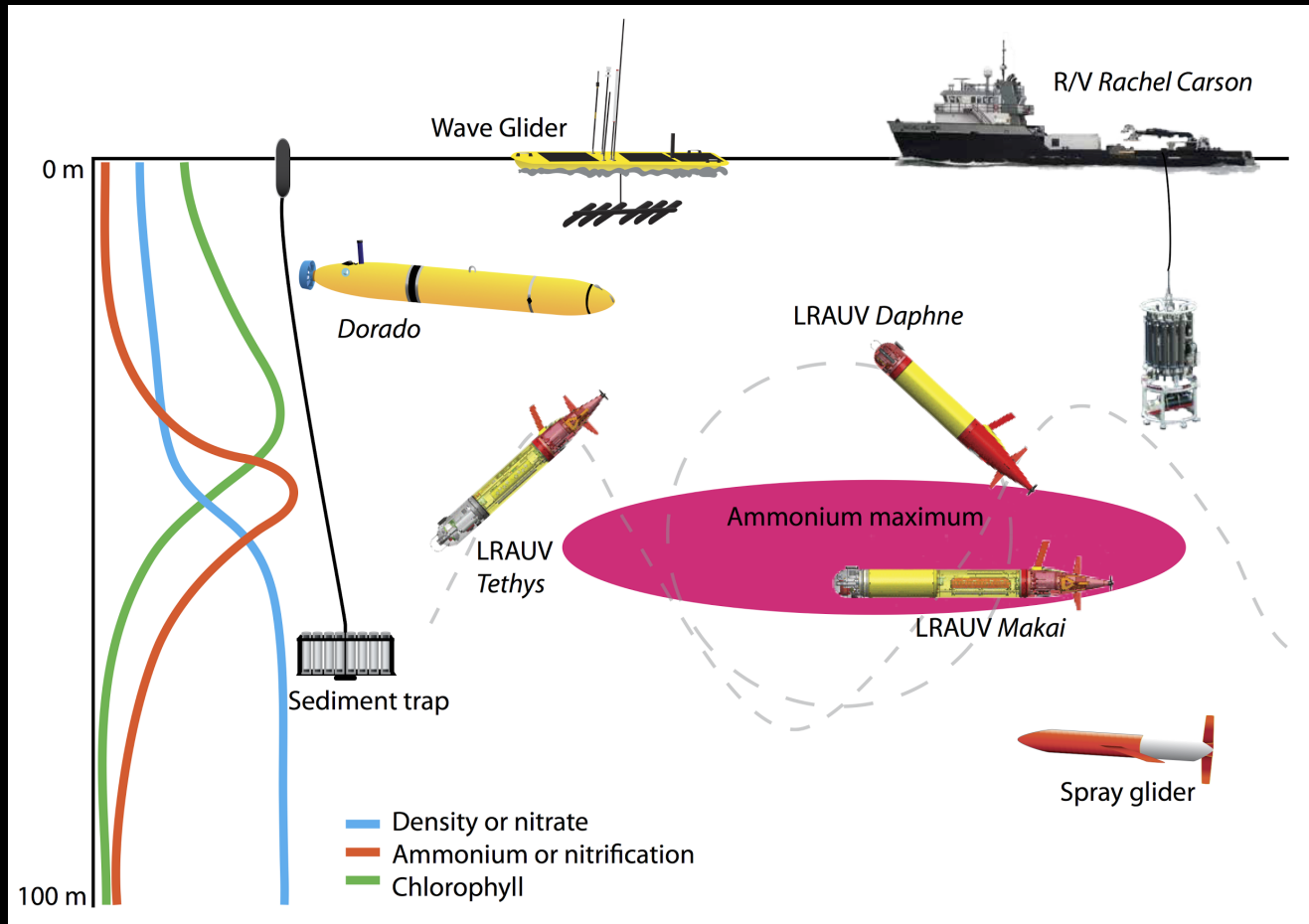


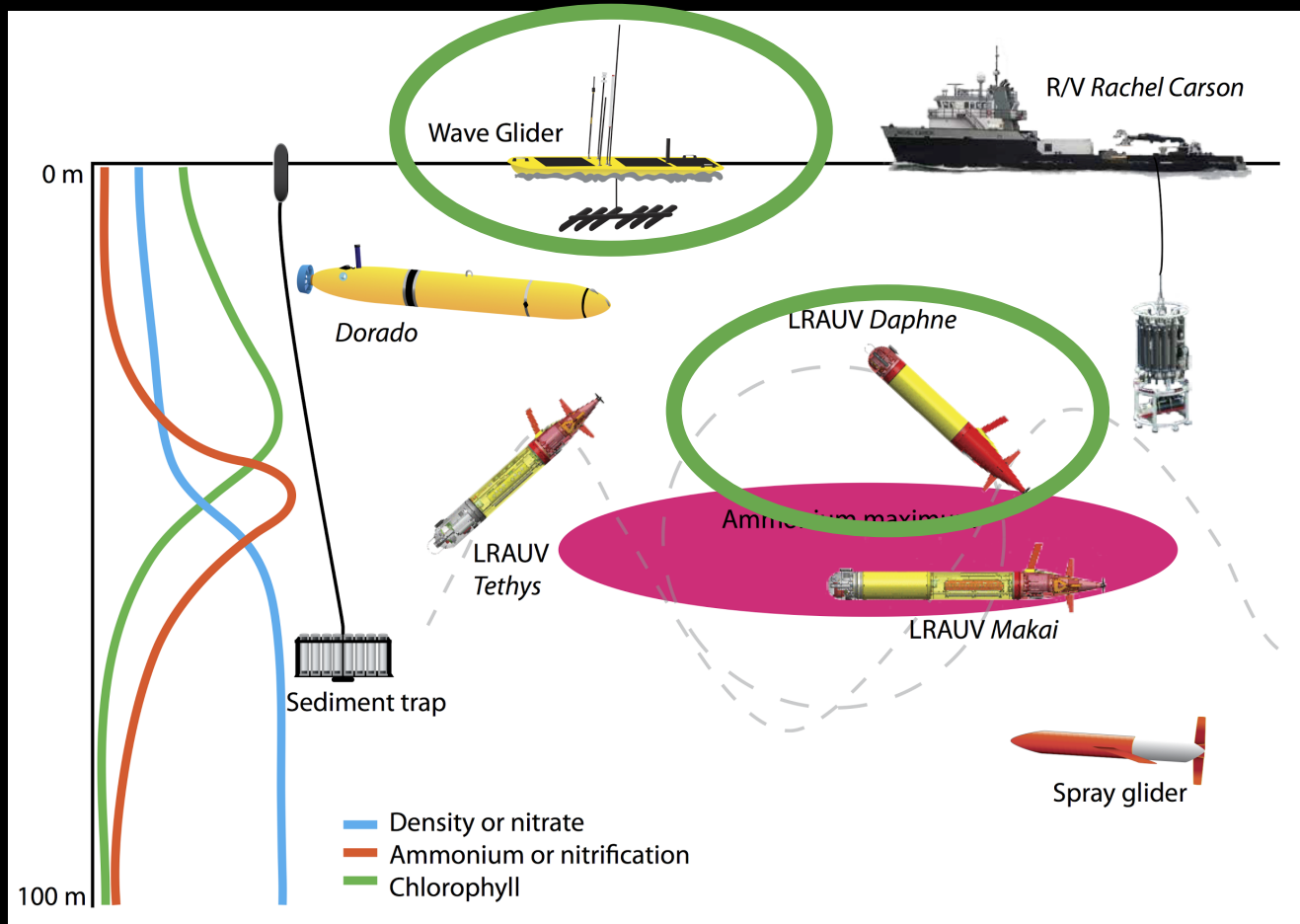
Integrated acoustic tracking and communication system for multi- platform operations

MBARI Internal Proposals
abstract presentation
2015-07-07

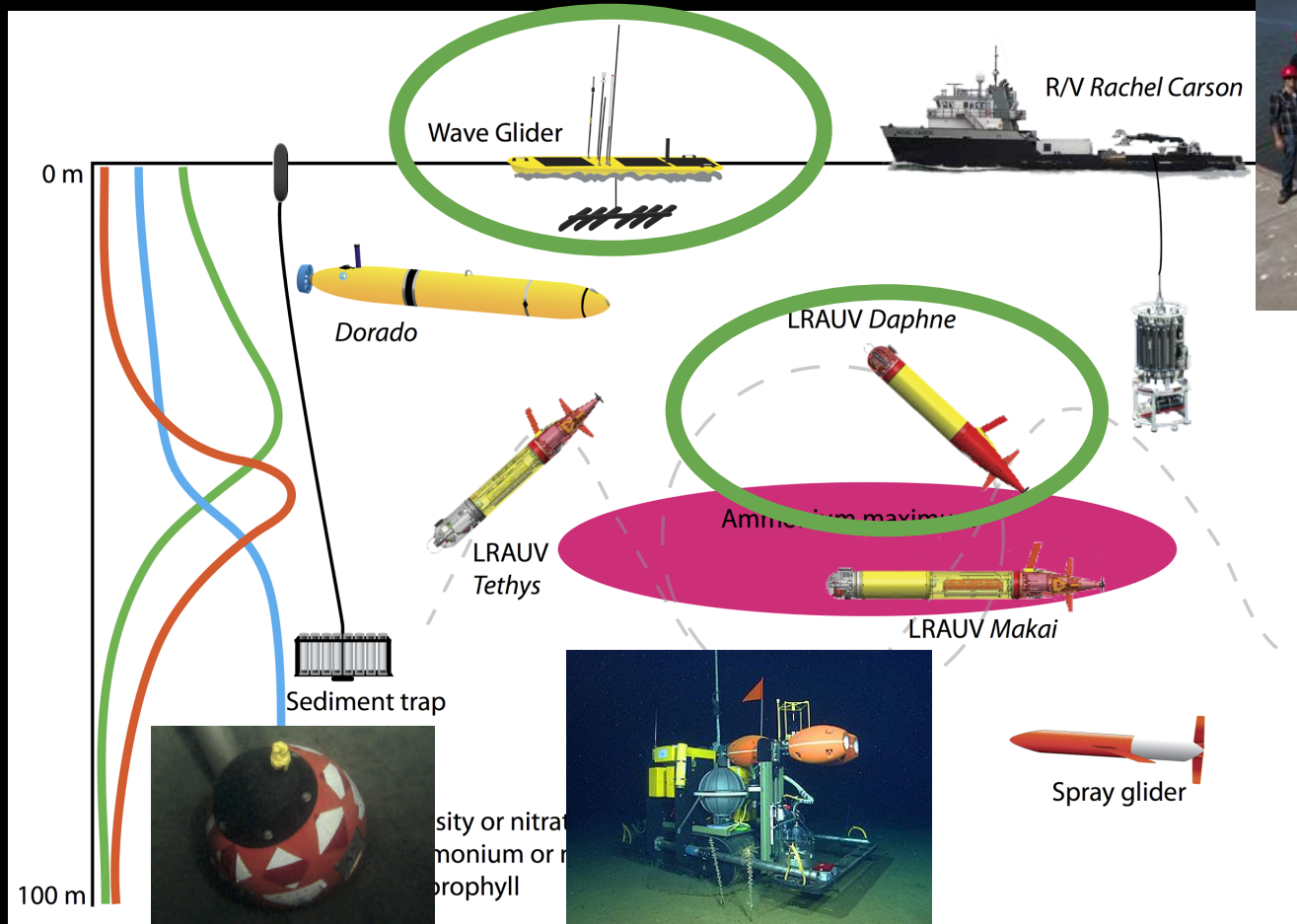
motivation: coordinated and cooperative operations



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CANON Fall 2014 experiment schematic from MBARI 2014 Annual Report at http://www.mbari.org/news/publications/ar/2014ann_rpt.pdf

BEDS & CPF photos from MBARI 2013 Annual Report at http://www.mbari.org/news/publications/ar/2013ann_rpt.pdf

R/V Paragon & Benthic Rover photos from MBARI website at <http://www.mbari.org>

prerequisite to cooperative operations between autonomous platforms

To effectively execute a cooperative task, team members need:

- to know where each other are
- to be able to exchange information

Right now we primarily do this through satellite and cellular links on the surface, and often with a human in the loop.

where are we right now?



- basic tracking
- no real communication
- proof-of-concept sensor integration
- rewrite software for each platform

We can already do a lot with just what we have.

Data CSUMB SFML, CA OPC
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

where do we want to be?

Tracking

- integrated, portable hardware package
 - minimize and calibrate offsets and misalignments between components
 - mountable on wave glider, R/V Paragon, surface buoy, etc.
- portable software
 - stop rewriting basic USBL solution for each platform
 - start leveraging more sophisticated approaches and keeping track of uncertainty

Communication

- get human out of the loop
- leverage existing open-source frameworks where possible
 - evaluate gobysoft & DCCL
- avoid screen-scraping
 - evaluate Benthos MMP
- enable other platforms
 - evaluate Micromodem (users include WHOI, JHU, NPS, U Michigan)

how will we get there?

Hardware

Required:

- Benthos MF DAT
- dedicated GPS
- MEMS IMU (e.g., VectorNav)
- embedded computer (e.g., BeagleBone Black)

Desired:

- Benthos LF DAT
- WHOI Micromodem
- chip-scale atomic clock

how will we get there?

Software

Localization toolkit:

- Generalize observations required for each solver.
- Provide basic USBL and range-only solvers.
- Input & output using well-defined open-source middleware (e.g., LCM, ZeroMQ).
- Release open-source, then start working on more sophisticated solvers.

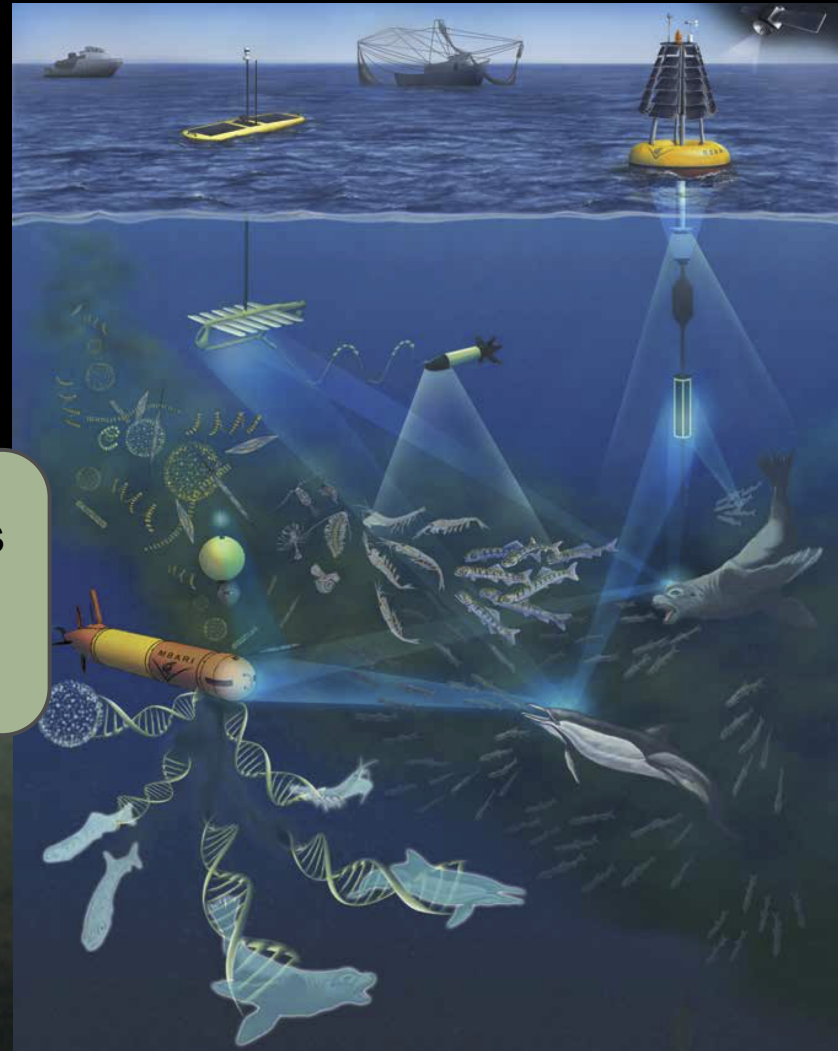
Communication toolkit:

- Interface description, type specifications, and services to ease working with low-rate, high-latency acoustic channel.
- Evaluate gobysoft & DCCL.
- May also extend to SBD Iridium communication.

activities in 2016

- acquire necessary hardware
 - design and build integrated package
 - test integrated package on wave glider
-
- define generalized observations for tracking
 - demonstrate USBL and range-only solvers
-
- evaluate gobysoft & DCCL
 - demonstrate vehicle status broadcasts between LRAUV and wave glider

should this be a separate project?



The goal is really to cut across several platforms and projects to provide a key engineering capability to enable marine science at MBARI.

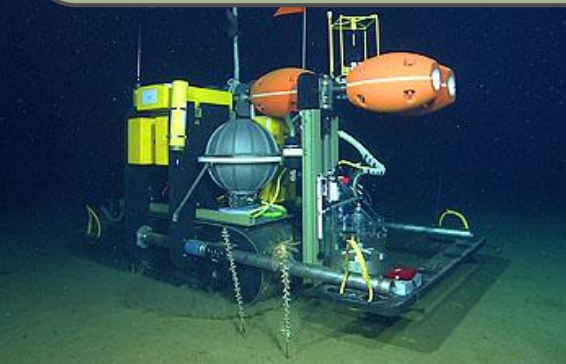


Illustration by Kelly/Lance © MBARI 2013