

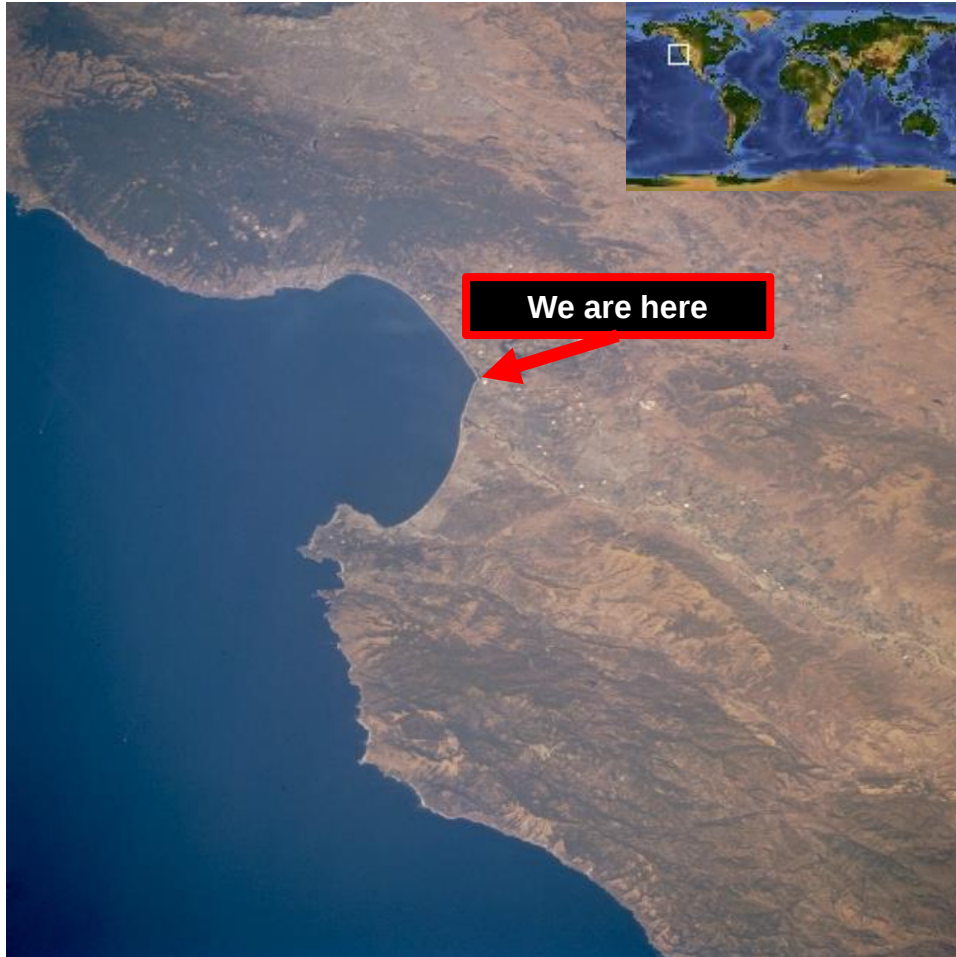
A photograph of two humpback whales breaching the ocean surface. The whales' dark, wrinkled skin is visible, with white foam from the water splashing around them. In the background, a large, multi-story building with a grey roof and many windows is situated on a sandy beach. Several seagulls are flying in the sky above the building.

FIDO: A Low-Cost, Scalable Autonomous Robot for Environmental DNA Sampling and Preservation

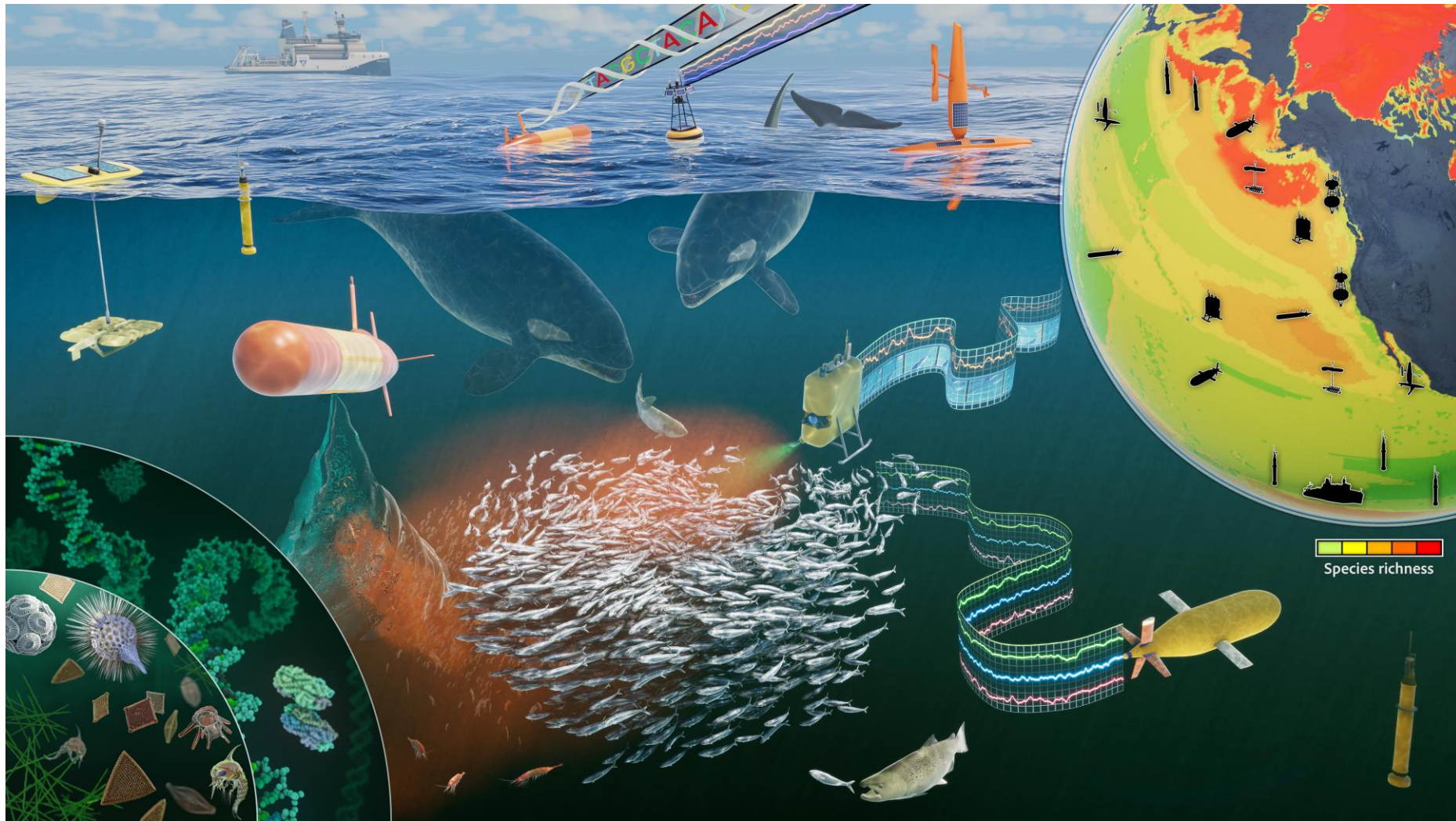
Enoch Nicholson, Scott Jensen, Adam Sepulveda, Kevan Yamahara, James Birch

OCEANS Brest
June 18th, 2025

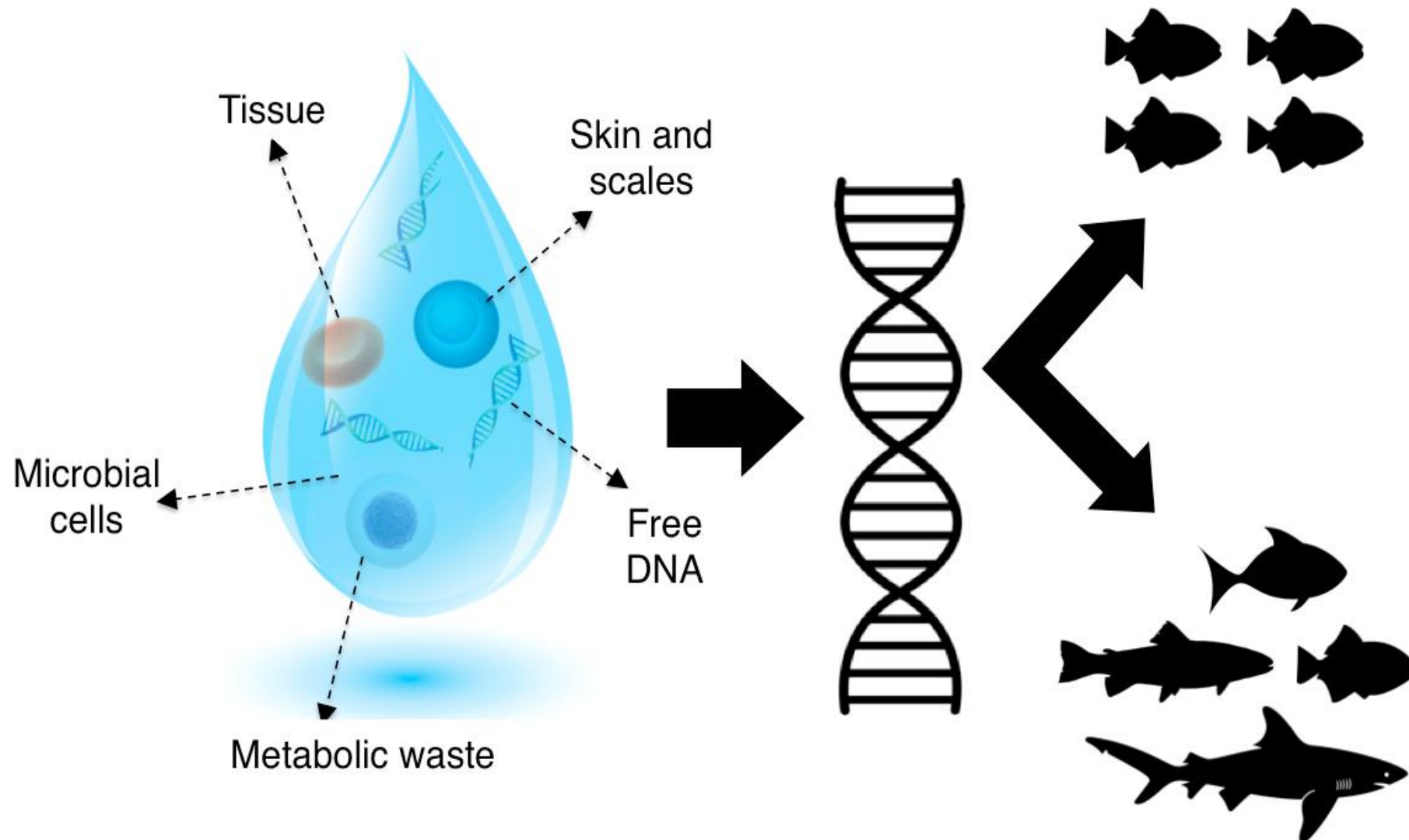
MBARI (Monterey Bay Aquarium Research Institute)



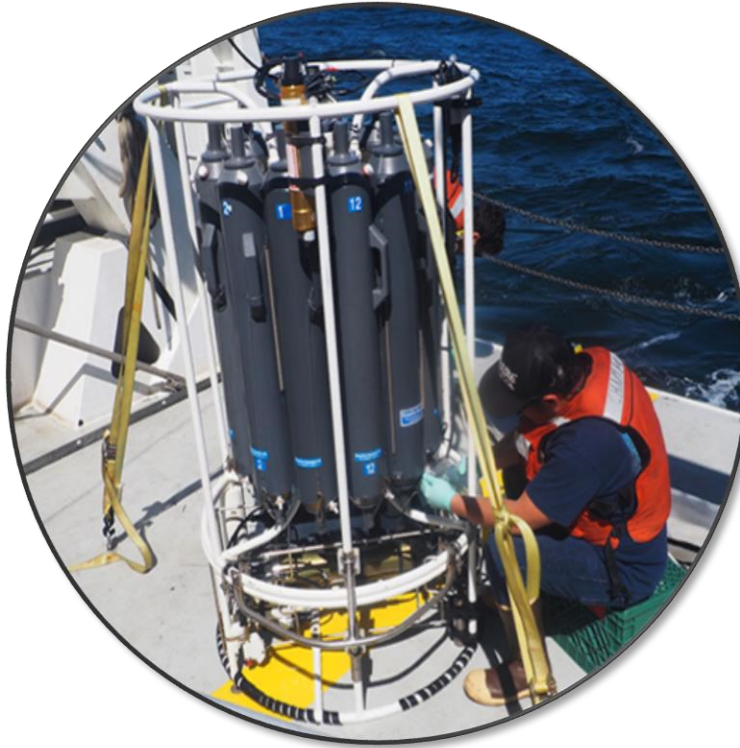
MBARI (Monterey Bay Aquarium Research Institute)



Environmental DNA (eDNA) and marine biodiversity assessments



eDNA requires sample collection



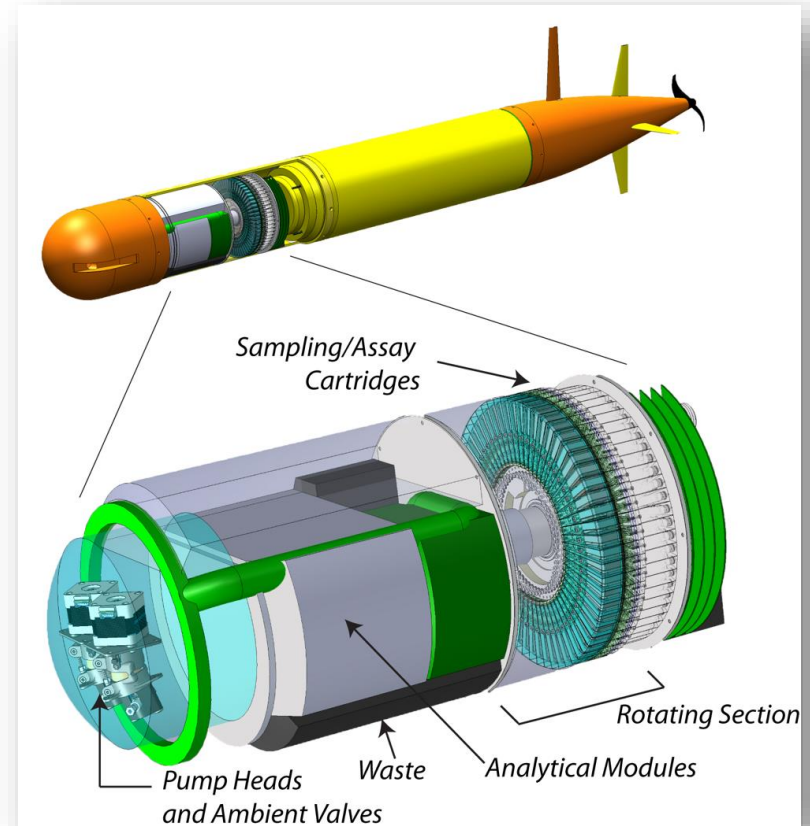
In the quest for answers, this is boring...

Environmental Sample Processor

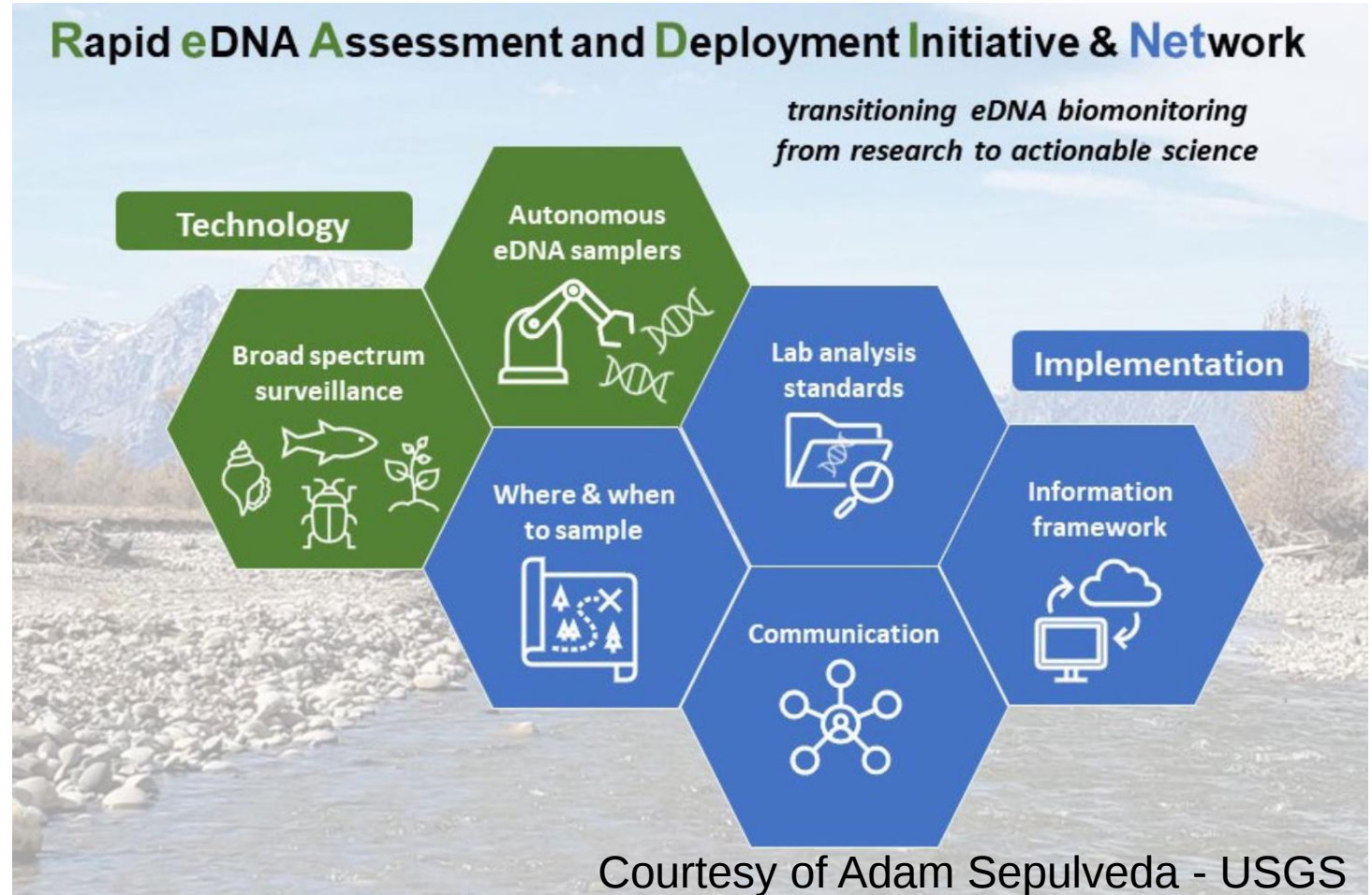
2nd Generation ESP



3rd Generation ESP



READI-Net



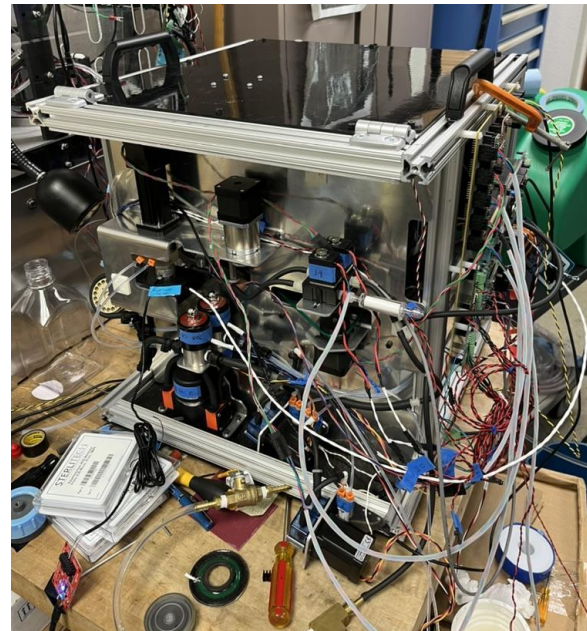
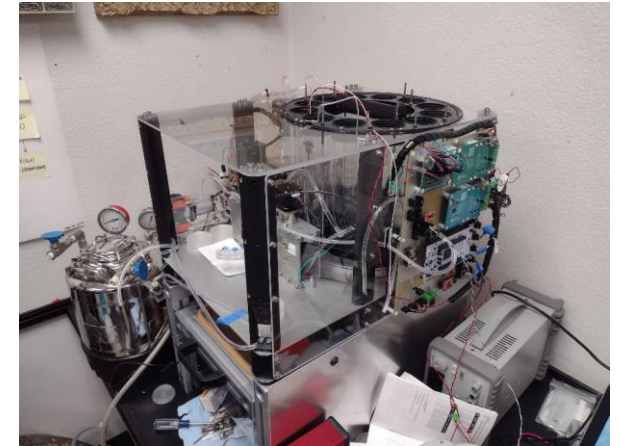
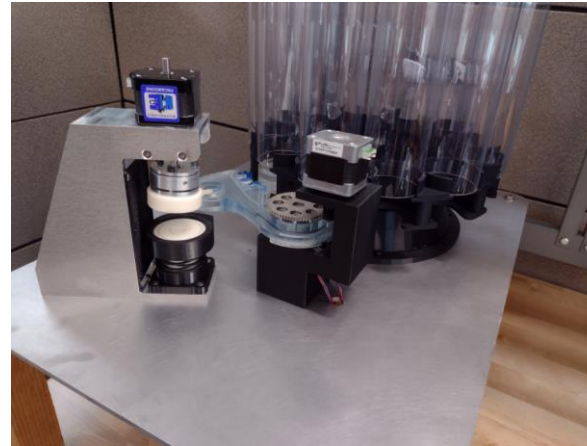
FIDO: Filtering Instrument for DNA Observation

Hardware:

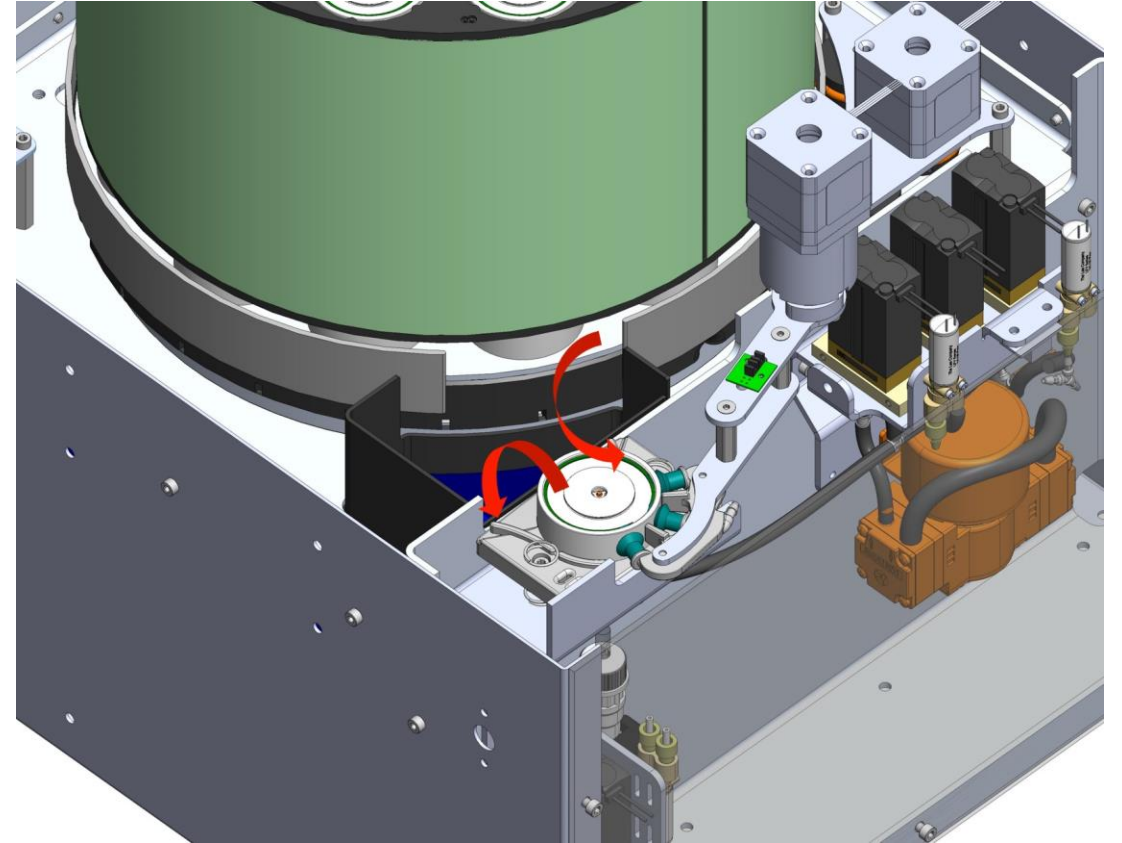
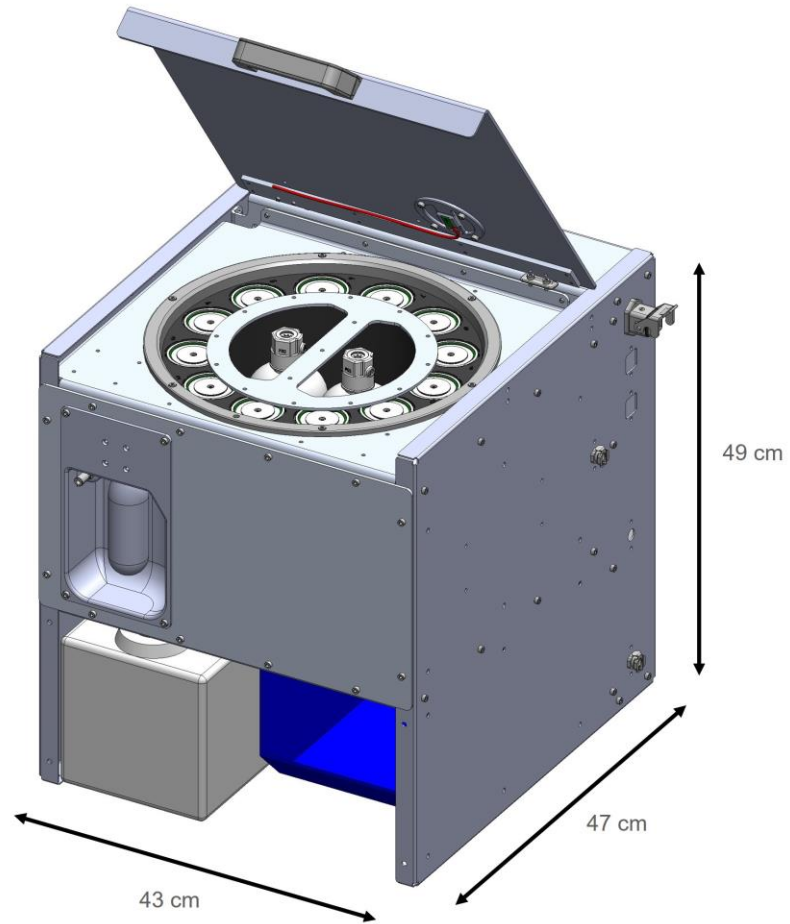
- Affordable enough for wide adoption
- Acquire at least 100 samples
- Deployable by 2 people (max)
- Simple setup and maintenance
- System must decontaminate itself
- Comms options (WIFI, Bluetooth, Cellular, Satellite)
- Maximize sample volume

Software:

- Device should have two-way communication
- Control via simple web-based GUI
- Sample data logging (volume, date-time, flowrate)
- Manual and Schedule-Based Sampling
- Instrument State (Current State)



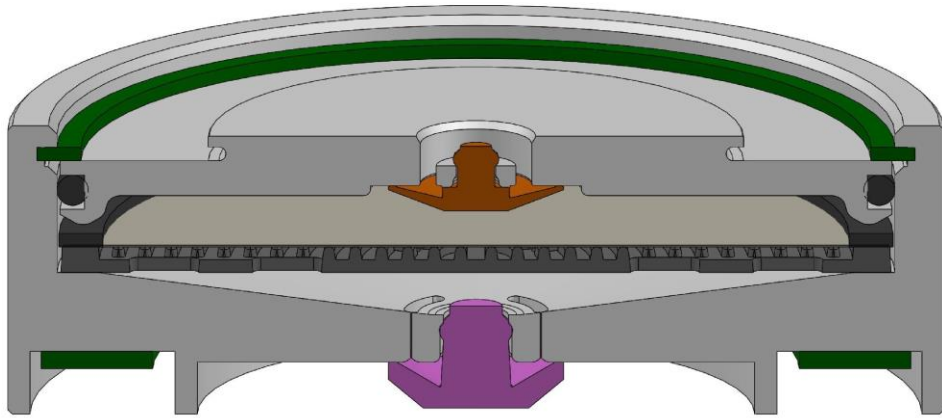
FIDO: Instrument Overview



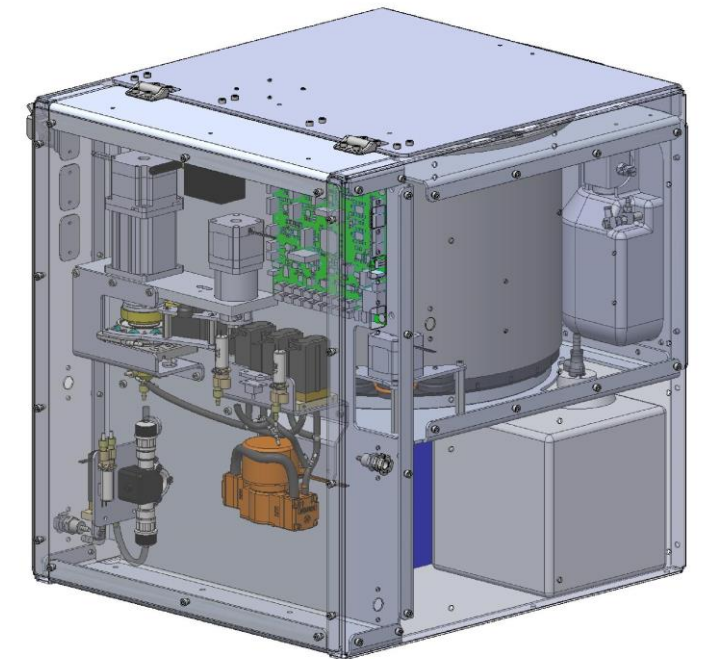
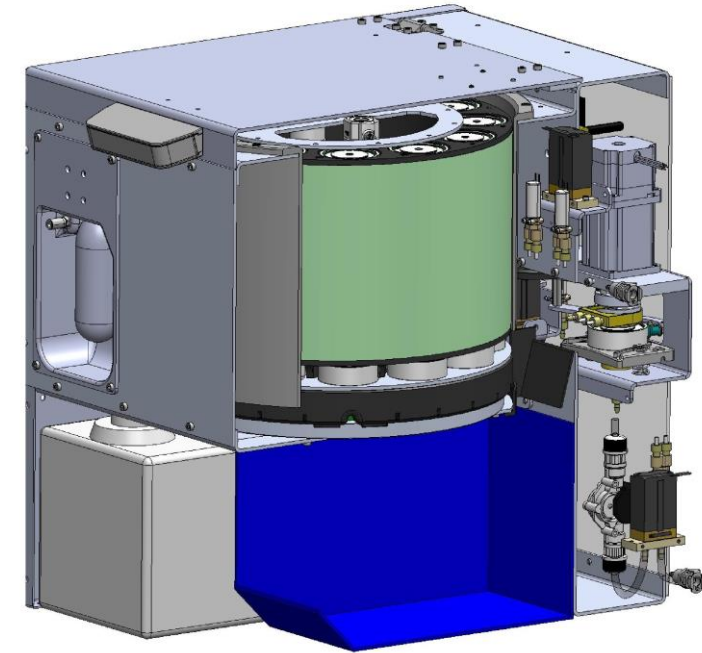
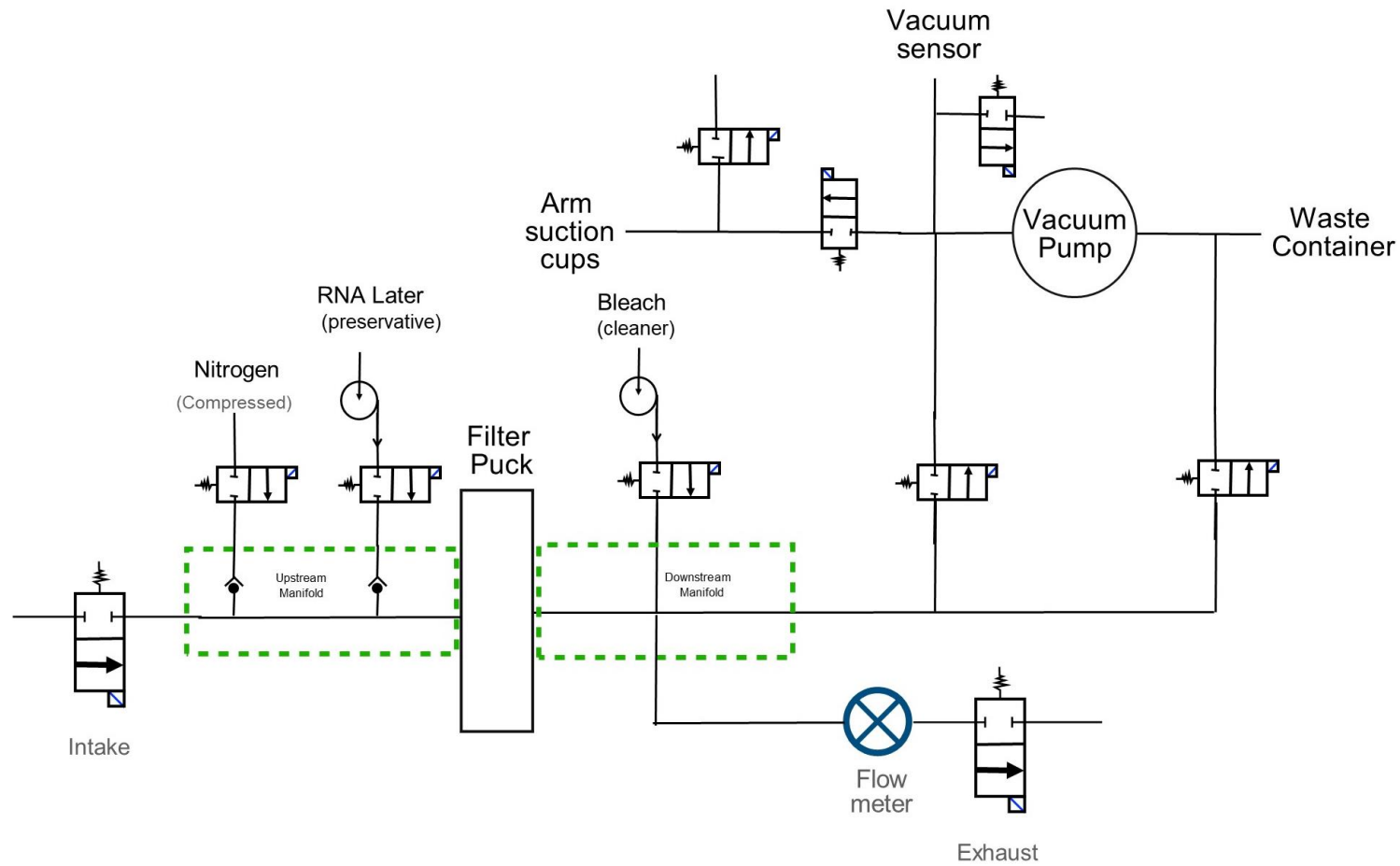
FIDO: Instrument Overview

Operational Video

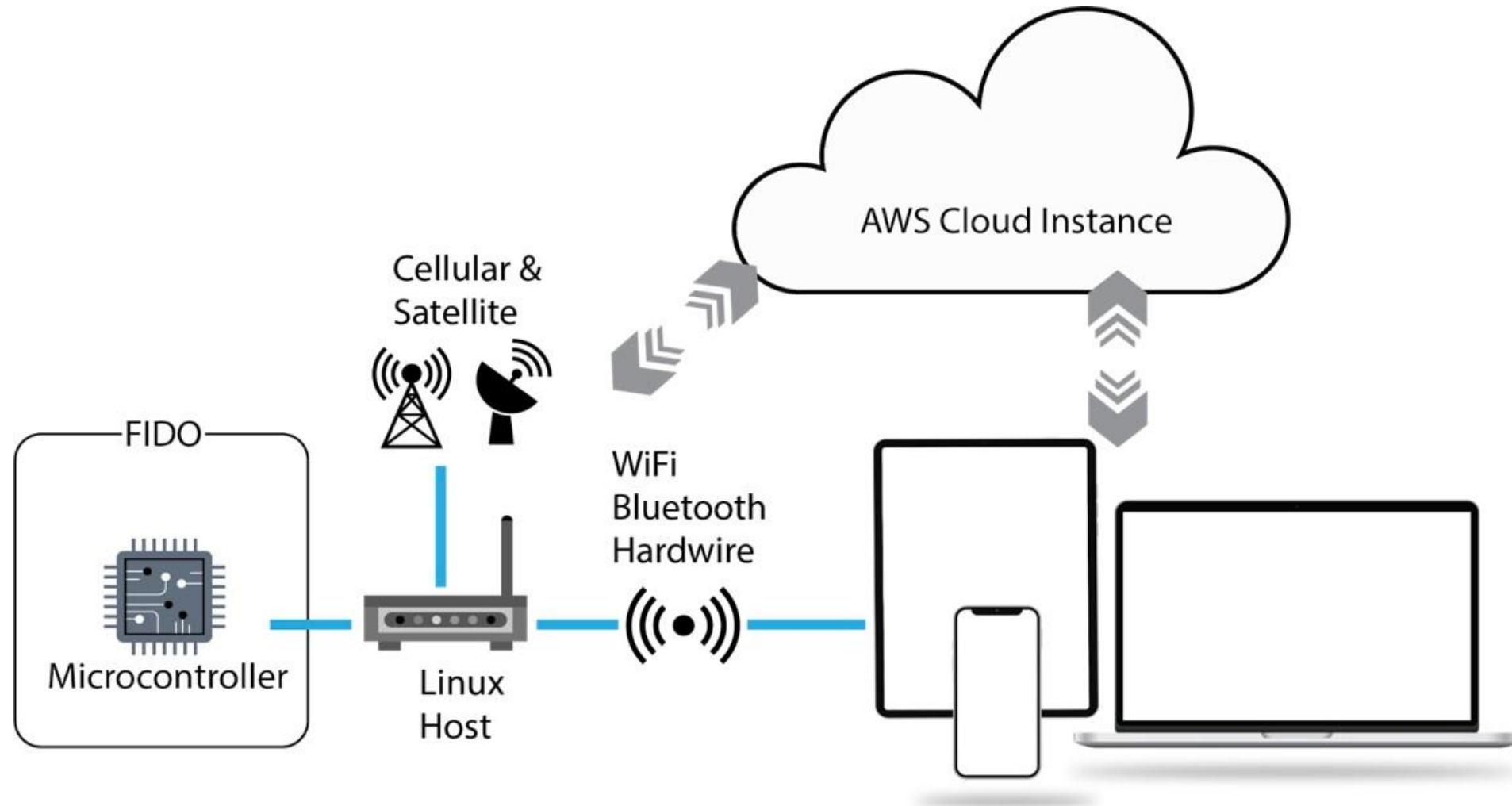
FIDO: Pucks



FIDO: Fluid System & Reagents



FIDO: System Architecture



FIDO: GUI Control

Device 528d7af6

Device

Schedule

Management

Events

Management

Sensor Management

Default Volume

1.0

Liters

Default Filter Porosity

0.5

μLiter

Scheduled Events

Enabled

☒ Next Scheduled: February 13, 2025 5:30 AM (Coordinated Universal Time UTC+00:00)

Sensor Actions

Take Sample Now

Restock Sampler

Cancel Sample

Truncate Sampler

Decontaminate

Reset Sampler

Location

Latitude

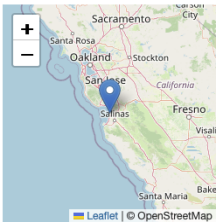
36.802151

Longitude

-121.788162

Notes

Internal notes



Device Management

Device Name

528d7af6

Device Timezone

UTC

Local WIFI SSID

readinet-528d7af6

Local WIFI Password

readinet

Uplink Internet

Uplink Type

WiFi/Hotspot

Uplink WIFI SSID

MBARI-Guest

Uplink WIFI Password

vampsqu1d

Remote Management

Adopted to Cloud Management

Adopt to New Organization

Rock Pi Software Version

readinet-server (02a9149)

Device 528d7af6

Device

Schedule

Management

Events

< today > UTC

Feb 9 – 15, 2025

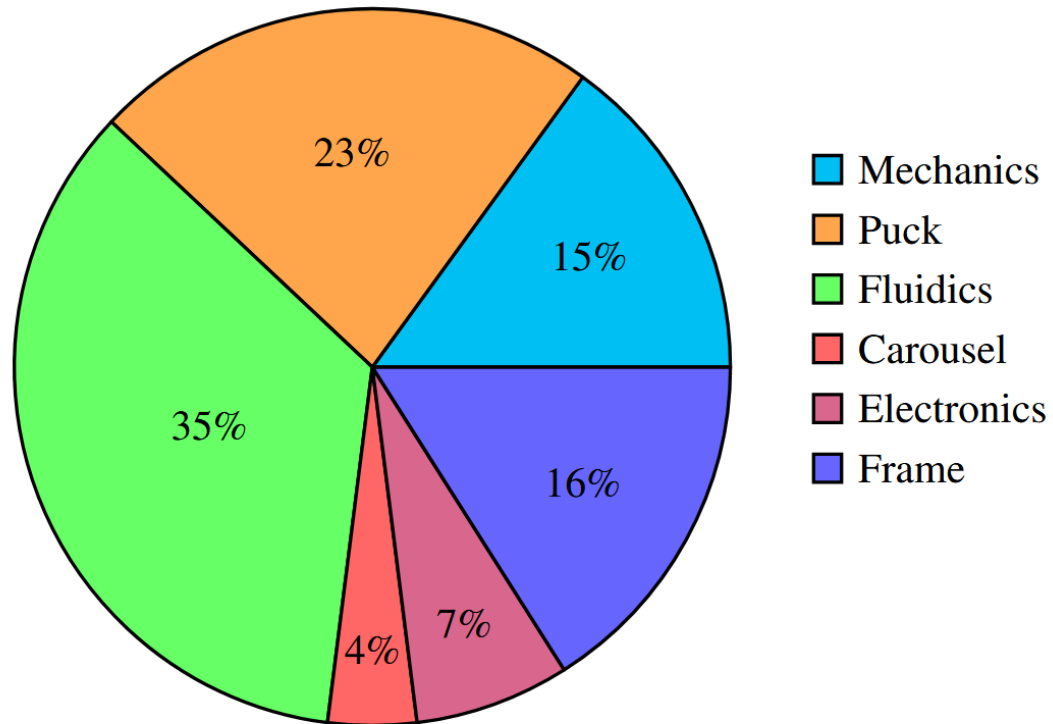
day week month

	Sun 2/9	Mon 2/10	Tue 2/11	Wed 2/12	Thu 2/13	Fri 2/14	Sat 2/15
3am							
4am							
5am							
6am						Scheduled Sample/Decon	Scheduled Sample/Decon
7am							
8am							
9am							
10am							
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Rock Pi Software Version

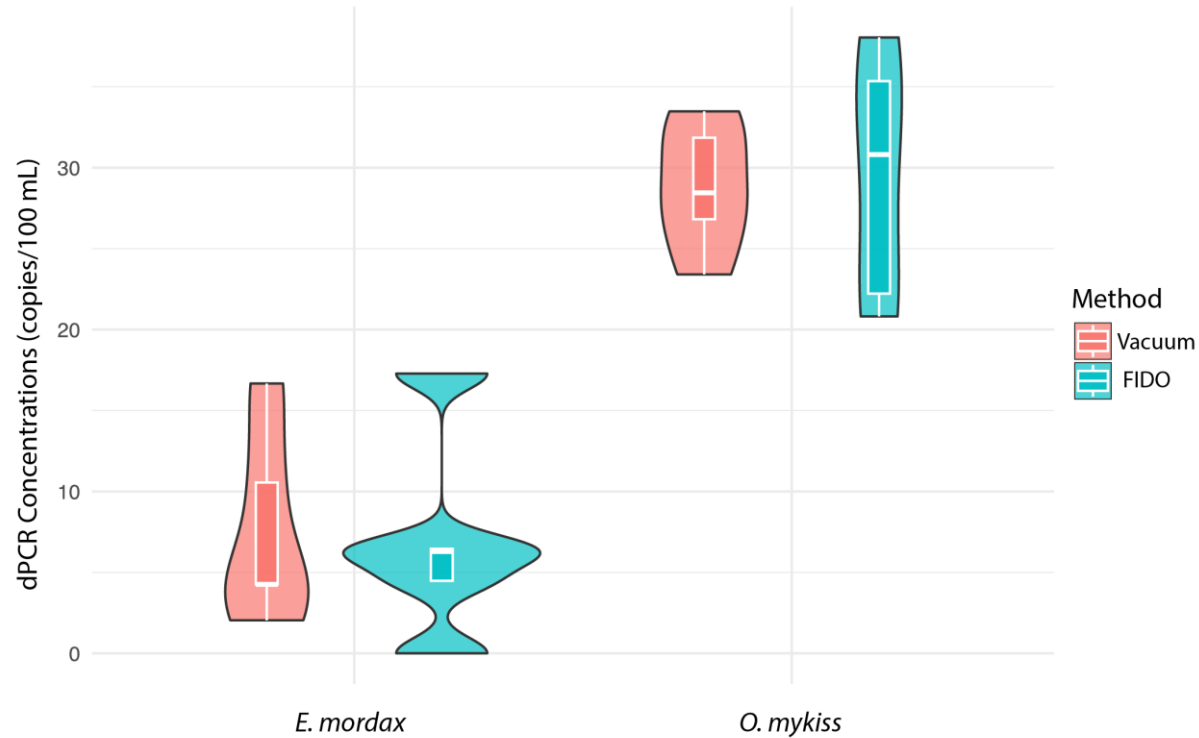
readinet-server (02a9149)

FIDO: System Costs & Manufacturing

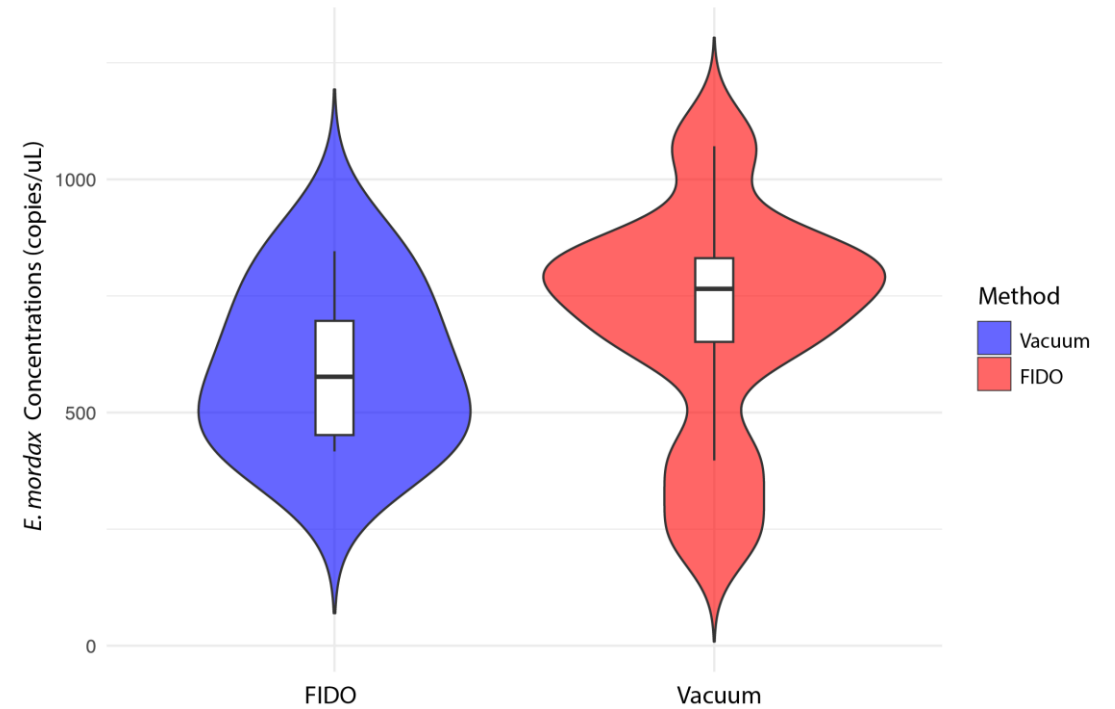


Testing & Validation: Laboratory Work

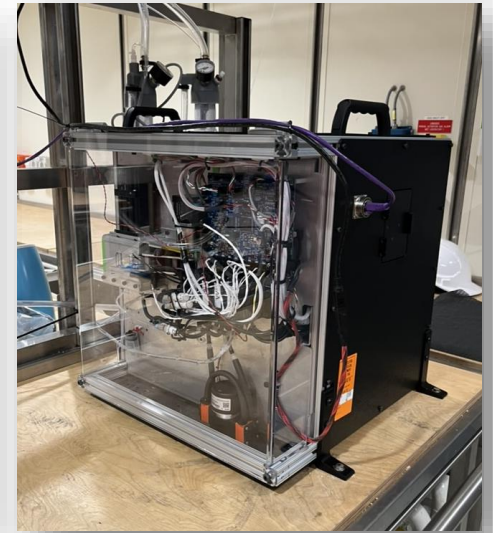
dPCR Anchovy and Rainbow Trout



qPCR Anchovy



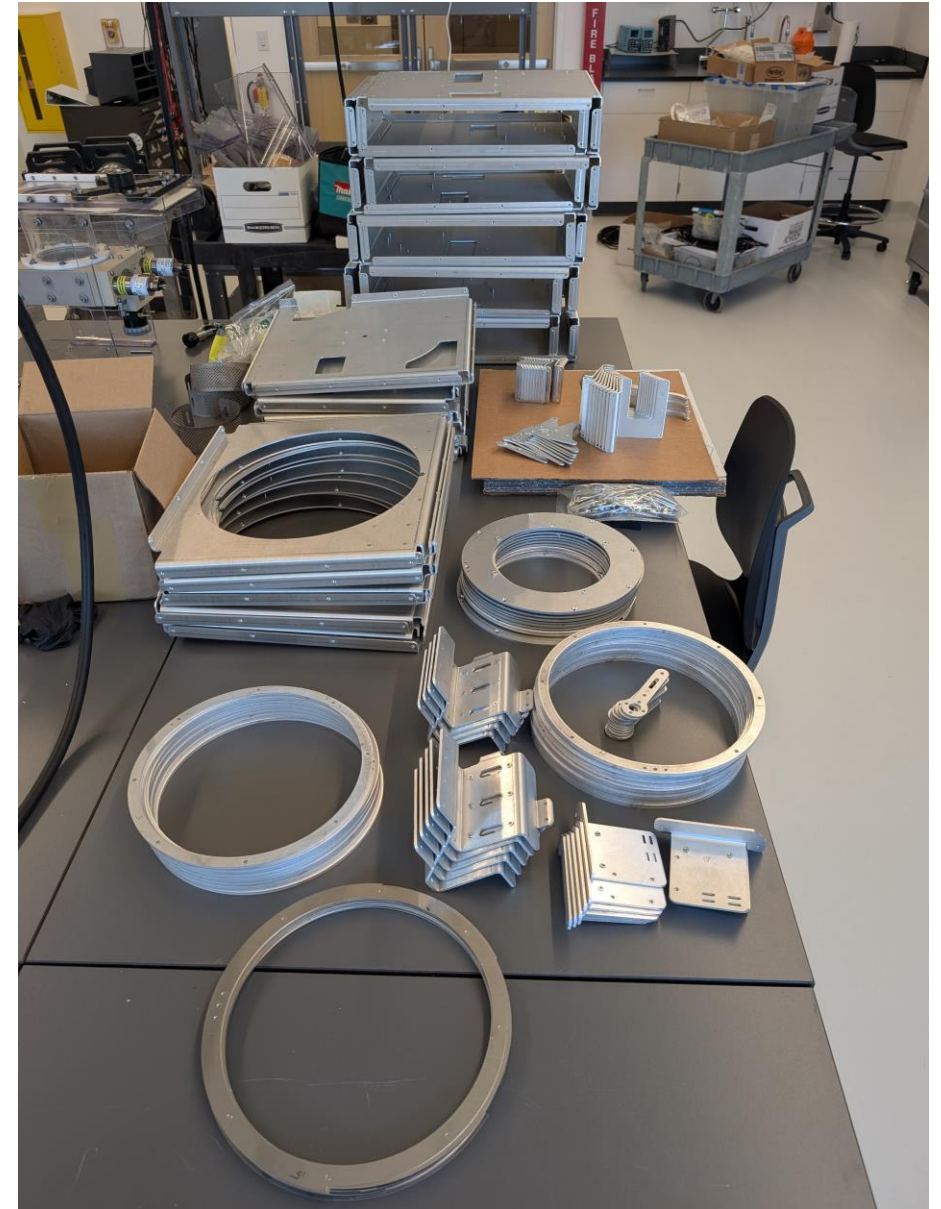
Testing & Validation: Field Tests



Integration on-board RSV Nuyina

Next Steps

- Validation is continuing
- 10 production units are currently being built
- Open to collaborate on field deployments
- Looking to license to commercial vendor



Acknowledgments



