

IMOS 20TH ANNIVERSARY | DATA KEYNOTE

# Going AI-Native

Enabling Organizations to Function  
Effectively in the Age of AI

---

**Bob Currier**

Data Scientist | Texas A&M University — Oceanography  
Enterprise AI Architect, OCEANCODA LLC



# Twenty Years of Observations

IMOS — enabled by NCRIS, led by the University of Tasmania — has operated 13 Facilities across Australia's coastal and open oceans since 2006. All data openly and freely accessible through the AODN.

**12**

National Observing  
Facilities

**11**

Partner  
Institutions

**10,000**

Instruments  
Calibrated

# The Game Just Changed

In the past two years, AI has shifted from a specialist tool to a general-purpose capability that every team member can use.



*Specialist-only*



**Everyone can use it**



*Narrow tasks*



**Broad reasoning**



*Months to deploy*



**Minutes to prototype**



# What Does "AI-Native" Mean?

*An AI-native organization doesn't just use AI tools – it redesigns its workflows, decision-making, and data culture so that AI is a core participant, not an afterthought.*



## AI as a bolt-on

"We added a chatbot"  
"IT bought an AI license"  
"We tried it once on a project"



## AI as infrastructure

Every team member uses AI daily  
Workflows redesigned around AI  
Data pipelines are AI-aware



# Three Stories from the Ocean

How AI is transforming gliders, acoustics, and data management

---



# The Challenge: Real-Time Fleet Management

National observing programs operate fleets of ocean gliders (Slocum and Seagliders)

Event-Based Sampling missions must deploy rapidly to capture critical data. Decisions are time-critical.

Each mission generates continuous streams of temperature, salinity, oxygen, chlorophyll, and bio-optics over 3–20 weeks

Scaling beyond a handful of simultaneous deployments quickly overwhelms human piloting capacity



# OLORIN

## Conversational AI for AUV Operations

We built an AI-powered portal that tracks Slocum gliders, Seagliders, and 4300+ Argo floats across the planet in real time — with natural language as the primary interface. Ask about weather, navigation, fleet status, or platform proximity. No menus. No query builders. Just ask.

**4300**

Platforms Tracked  
in Real Time

**1,422**

GOM Drilling Platforms  
With Proximity Alerts

**1**

Interface



# AI-Native in Production — Not Theory

## Natural Language Fleet Ops

"How far is RU38 from Key West?" — AI extracts entities, local haversine formula calculates deterministic distance and bearing. Works vehicle-to-vehicle, vehicle-to-location, even vehicle-to-platform

## Summary First Pattern

Leading AI context with fleet aggregates boosted counting accuracy from 68% to 100% — a reusable design pattern for any large-dataset AI system

## Structured Outputs = Zero Errors

Anthropic's constrained decoding guarantees identical JSON schema every time. Moved from defensive parsing with code-block stripping to API-enforced reliability

## Platform Safety Awareness

1,422 BOEM drilling platforms with proximity queries, animated highlighting of nearest platforms, and distance-based safety zones — all through conversational commands



# The AI-Native Approach

## Marine Heatwave Early Warning

AI models detect emerging MHW signatures in satellite and mooring data, triggering Event-Based Sampling deployments faster

## Adaptive Mission Planning

AI recommends glider course adjustments in near-real-time to track boundary current features and MHW subsurface structure

## Automated QC at the Edge

Quality control against subsurface climatologies that used to take hours happens in seconds, freeing scientists for interpretation

## Cross-Platform Integration

AI synthesizes glider, mooring, and satellite data streams into unified situational awareness via platforms like OceanCurrent



# The Challenge: Needle in a Sonic Haystack

Passive acoustic monitoring networks produce terabytes of audio — more than any human team can review

Endangered species produce faint, infrequent calls buried in shipping noise, weather, and biological choruses

Manual annotation of spectrograms is painstaking, subjective, and doesn't scale.

Conservation decisions need timely data, but analysis typically lags months behind collection.



# AI in Action: From Sound to Insight

## Automated Species Detection

Deep learning models identify whale vocalizations with 96%+ accuracy, processing months of audio in hours

## Real-Time Alerting

Detections can trigger immediate alerts to vessel operators, supporting dynamic management of shipping lanes

## Multi-Species Classification

AI distinguishes between species, call types, and even individual animals, building rich ecological datasets

## Noise Budget Analysis

AI quantifies anthropogenic noise impacts, supporting evidence-based conservation policy



# GUARDIAN

## AI-Powered Marine Mammal Acoustic Detection

We built a species-specific deep learning toolkit that detects endangered Rice's whale vocalizations in passive acoustic monitoring data — processing terabytes of ocean audio that no human team could review. GPU-accelerated, cloud-native, and extensible to any marine species.

**97%**

Detection Accuracy  
(Rice's Whale)

**2**

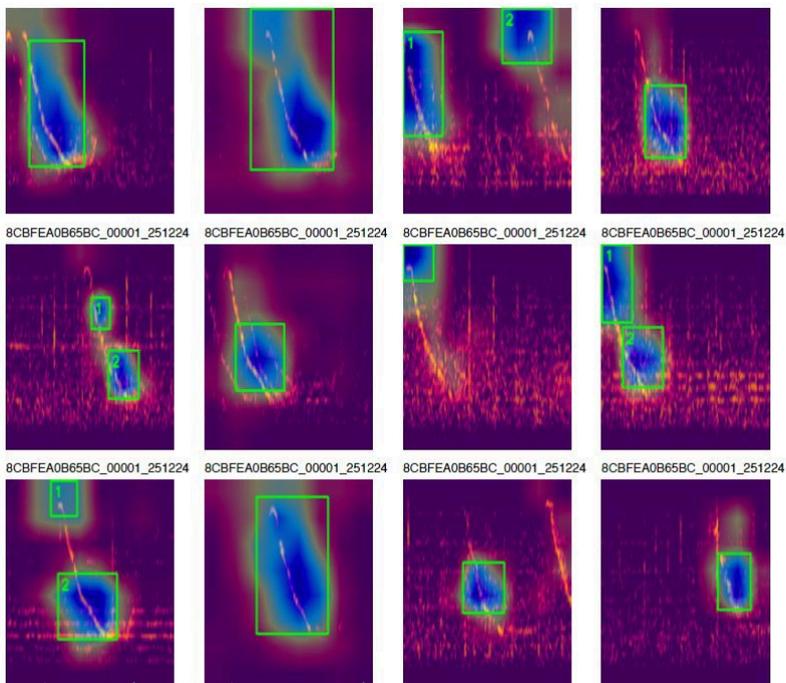
Species Configs  
(Extensible Framework)

**3-Step**

Automated Pipeline  
(Audio → Detection → Report)



# Every Detection Is Visually Verifiable



## Grad-CAM Heatmaps

Gradient-weighted Class Activation Mapping highlights exactly where the model sees whale vocalizations — blue hotspots on the spectrogram show model attention regions

## Multi-Vocalization Detection

Green bounding boxes numbered 1, 2, 3 identify multiple calls in a single spectrogram — downsweeps, longmoans, and overlapping vocalizations detected independently

## Automated Deployment Pipeline

Three-step automation from raw audio to spectrograms, batch classification with Grad-CAM, and PDF report generation — processing GCS field recordings at scale



# The Challenge: Data Overload

Decades of multi-facility observing networks generating data in diverse formats across physics, biogeochemistry, and biology

Quality control frameworks ensure interoperability, but applying them consistently at national scale still requires expert judgment

Vast data catalogues exist — researchers know the data is there but can't always find or integrate what they need efficiently

Metadata creation and curation across distributed partner institutions remains tedious, manual, and perpetually incomplete



# AI-Native Data Operations

## Intelligent Quality Control

AI learns QC rules from expert decisions and applies them consistently at national scale — the same rigor, without the bottleneck

## Natural Language Data Access

Ask a data portal in plain English: "Show me SST anomalies off Tasmania from last summer" — AI translates intent to structured queries

## Automated Metadata Generation

AI reads incoming datasets and generates standards-compliant metadata, reducing curatorial burden across distributed institutions

## Cross-Facility Discovery

AI links related observations across facilities and platforms — connecting glider, mooring, satellite, and biological data automatically



# The Organizational Shift

Technology alone isn't enough — your people and processes matter most

---

# Building an AI-Native Organization

## People

- Train everyone, not just IT
- Build AI literacy across teams
- Celebrate early adopters
- Create safe spaces to experiment

## Process

- Audit workflows for AI leverage
- Start with high-effort, low-judgment tasks
- Keep humans in the loop
- Iterate — don't try to boil the ocean

## Infrastructure

- AI-ready data pipelines
- Accessible compute resources
- API-first architecture
- Clear data governance

# What Doesn't Work

Common mistakes organizations make on the path to AI adoption

## The Shiny Object

Buying AI tools without a clear problem to solve.  
Technology looking for a use case rarely finds one.

## The Ivory Tower

Keeping AI expertise locked in one team. If only specialists can use it, you'll never scale.

## The Big Bang

Trying to transform everything at once. Start small, prove value, then expand.

## Ignoring Your Data

AI is only as good as the data it works with. No amount of AI sophistication fixes bad data.

# Four Steps to Getting Started

01

## Identify Friction

Find the workflows where your people spend the most time on repetitive, mechanical tasks. That's where AI delivers fastest ROI.

02

## Run a Pilot

Pick one high-value use case. Give a small team AI tools and 90 days. Measure before and after.

03

## Build AI Literacy

Train your people — not just how to use tools, but how to think about what AI can and can't do. Prompt engineering is the new spreadsheet skill.

04

## Scale What Works

Document what you learned. Create templates. Make it easy for the next team to adopt what the first team proved.



# The Next 20 Years

Autonomous observing networks — gliders, floats, and moorings — that adapt sampling in real time to ocean conditions and events

AI copilots for every IMOS researcher — reducing months of analysis across 13 Facilities to hours

An AODN where any scientist can find, access, and integrate data by simply describing what they need

A national ocean digital twin, continuously updated from IMOS observations, openly accessible and AI-interpretable

---

*The organizations that thrive will be the ones that learn to think with AI, not just use it.*



# Real-Life ‘AI-Native’ Applications

**HABscope: Automated classification and quantification of *Karenia brevis***

*Currier R, Kirkpatrick B, Kirkpatrick G*

**OLORIN: AI-enabled AUV piloting portal**





WEATHER

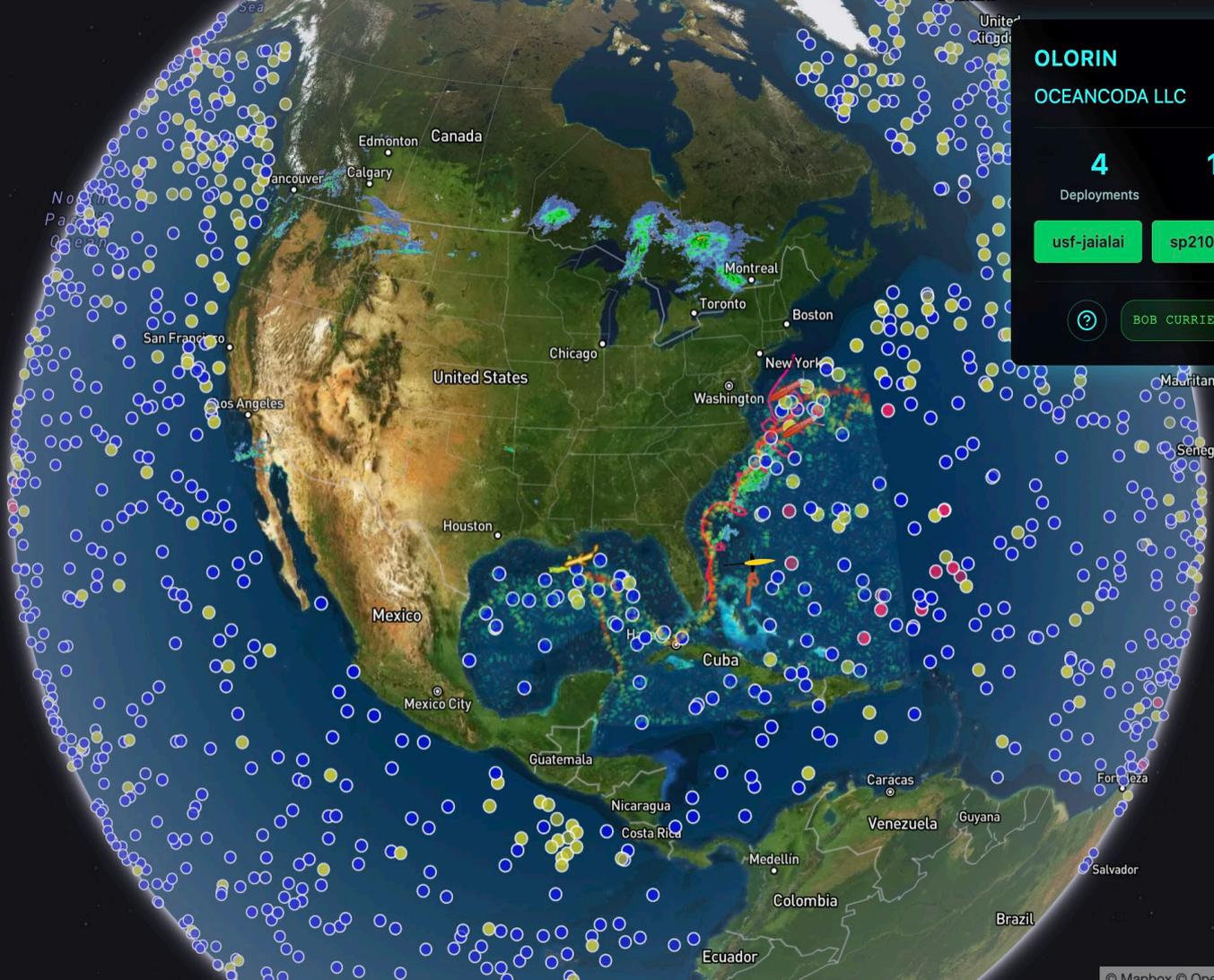
MODELS

- AOML Geostrophic
- Sea Surface Temp
- Salinity
- Sea Surface Height
- HYCOM Currents

NAVIGATION

PLATFORMS

SATELLITE IMAGERY



**OLORIN**  
OCEANCODA LLC

4

Deployments

154

Days

5,886

km

usf-jaialai

sp210

sg265

sp212



BOB CURRIER



ADMIN

# USF-JAIALAI

USF

SLOCUM

NOMINAL

LAST DATA: FEB 27, 10:06 AM EST



## FLIGHT DATA

LAST REPORTED

BATTERY

14.92

volts

GPS LAT

27.98

lat

GPS LON

-89.96

lon

VACUUM

7.75

inHg

AVG CLIMB

0.12

m/s

AVG DIVE

0.14

m/s

## SCIENCE DATA

DENSITY

FLBBCD BB UNITS

FLBBCD CDOM UNITS

FLBBCD CHLOR UNITS

OXY4 OXYGEN

SALINITY

SOUND VELOCITY

TEMPERATURE

WATER COND

WATER PRESSURE

★ MODEL COMPS

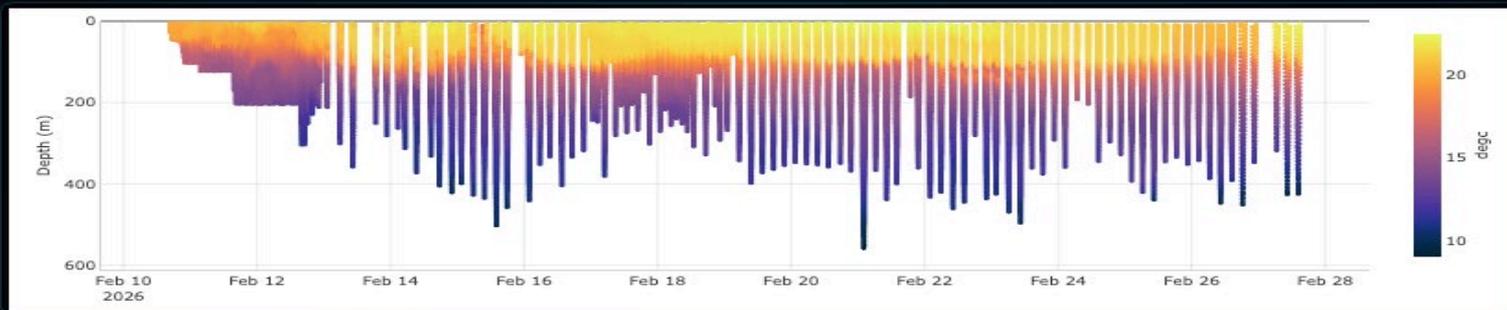
★ MODEL COMPS

7D

30D

90D

All



Here's a full breakdown of the **Australian Argo contribution** in the OLORIN database, perfect for your Hobart demo! 🦘

## 🇦🇺 Australian Argo Floats in OLORIN

### By Researcher & Float Type

Researcher	Institution	Core	BGC	Deep	Total
Susan Wijffels	CSIRO / WHOI	327	18	4	<b>349</b>
Peter Oke	CSIRO	233	1	—	<b>234</b>
Nathalie Zilberman	CSIRO / Scripps	8	—	28	<b>36</b>
Steve Rintoul	CSIRO	19	2	5	<b>26</b>
<b>Total</b>		<b>587</b>	<b>21</b>	<b>37</b>	<b>645</b>

### Key Points for Your Audience

- **~645 floats** in our database are associated with Australian CSIRO researchers — roughly **15% of the entire array** we monitor.
- The IMOS Argo Australia Facility, which is operated by CSIRO, is a major contributor to the global array, maintaining **10% of the international Argo**

Ask about deployments, sensors, data...



program.

- **Steve Rintoul** (based right there in Hobart at CSIRO) is a leading figure in Southern Ocean deep-water observation. His work focuses on changes in the deep ocean around Antarctica — targeting changes in the deep ocean, where some of the strongest signals of change anywhere have been found in the waters around Antarctica.
- **Susan Wijffels** leads the largest Australian float contingent (349 floats), spanning Core and BGC types across multiple ocean basins.
- Australia recently expanded its BGC-Argo fleet with 12 additional BGC floats that will measure 3,600 ocean biogeochemical profiles over seven years, helping answer questions about **how the Southern Ocean absorbs human-made heat and carbon**.
- Argo floats measure temperature, conductivity (for conversion to salinity), and pressure in the upper 2 km of the ocean, providing continuous observations of the global ocean.
- Australia's **Deep Argo** contribution (37 floats, led by Zilberman and Rintoul) is particularly significant — IMOS will contribute 15 Deep Argo floats to the global array, with the Southern Ocean being a key focus region.

Would you like me to map the current positions of Australian floats, or dive deeper into any specific researcher's array?

Ask about deployments, sensors, data...



## USF Jaialai — Vehicle Health Report

As of 2026-02-28 11:10 UTC

### Mission Overview

Field	Value
Type	Slocum G3
Organization	USF
Status	<span style="color: green;">✔</span> Active
Mission Start	2026-02-10 16:44 UTC (~18 days ago)
Last Fix	2026-02-28 11:10 UTC
Position	28.049°N, 89.842°W (Gulf of Mexico)

### Battery Health

Metric	Current	24-hr Range
Battery Voltage	14.55 V	14.63 – 14.94 V

⚠ **Slightly low but acceptable.** The battery has dropped from ~14.94 V (24 hrs ago) to 14.55 V currently — a gradual decline over ~18 days of operation, which is normal for a Slocum G3. Worth monitoring as it approaches mission end.

### Hull Integrity (Vacuum)

Metric	Current	24-hr Range
Vacuum	7.63 inHg	7.27 – 8.17 inHg

✔ **Good.** Slocum G3 gliders typically operate safely in the **7–9 inHg** range. Readings are steady and well within normal bounds — no signs of a hull leak.

### Science Sensors (Most Recent Dive)

### Hull Integrity (Vacuum)

Metric	Current	24-hr Range
Vacuum	7.63 inHg	7.27 – 8.17 inHg

✔ **Good.** Slocum G3 gliders typically operate safely in the **7–9 inHg** range. Readings are steady and well within normal bounds — no signs of a hull leak.

### Science Sensors (Most Recent Dive)

Sensor	Value
Water Temp	21.89 °C
Conductivity	5.18 S/m
Pressure	0.58 dbar (~5.8 m depth)
Dissolved Oxygen	183.7 µmol/L

✔ All science sensors are actively reporting. Temperature (21–22°C near surface) is consistent with late-winter Gulf of Mexico conditions. Oxygen readings (183 µmol/L) are within a healthy range for these waters.

### Data Flow

The glider is surfacing and transmitting regularly, with **72–141 records per hour** in recent periods. The optical sensors (chlorophyll, CDOM, backscatter) show null in the most recent surfacing rows, which is expected — they typically only report during dive phases.

### ● Overall Assessment

**usf-jaialai appears to be doing well.** The vehicle is actively diving, surfacing, and transmitting science data. Battery draw is progressing normally for an 18-day mission. Hull vacuum is solid, and all science sensors are functioning. The main thing to watch is the **gradual battery decline** — depending on the mission target end date, it may be approaching the later phase of its deployment.

Ask about deployments, sensors, data...



# Thank You

---

## **Bob Currier**

Data Scientist — Texas A&M Oceanography  
Enterprise AI Architect, OCEANCODA LLC

**Questions?**