
CLEANING THE OCEANS WITH EDGE AI: THE OCEAN CLEANUP'S SMART CAMERA TRANSFORMATION

ROBIN DE VRIES, THE OCEAN CLEANUP
3 MARCH 2026 | EDGE AI AND VISION ALLIANCE ONLINE

FOUNDED 2013

Dutch inventor Boyan Slat founded The Ocean Cleanup at the age of 18 in his hometown of Delft, the Netherlands.

NON-PROFIT FOUNDATION

We are fully reliant on donations from individuals, corporations, governments and institutions.

HQ ROTTERDAM

The Ocean Cleanup's team consists of more than 150 professionals with different backgrounds and expertise; all bound together to one vision: rid the world's oceans of plastic.

BIG PROBLEMS REQUIRE BIG SOLUTIONS

Every year, hundreds of thousands of tons of plastic enter the oceans, primarily from rivers. And the plastic that's afloat within the oceans isn't going away by itself. To effectively solve the problem, we need to both **halt the trash flow from rivers**, and **remove legacy plastics from the oceans** at the same time.

The Ocean Cleanup, a non-profit organization, is developing and scaling technologies to rid the world's oceans of plastic. Our aim is to put ourselves out of business once the oceans are clean.

THE OCEAN CLEANUP IN 2025

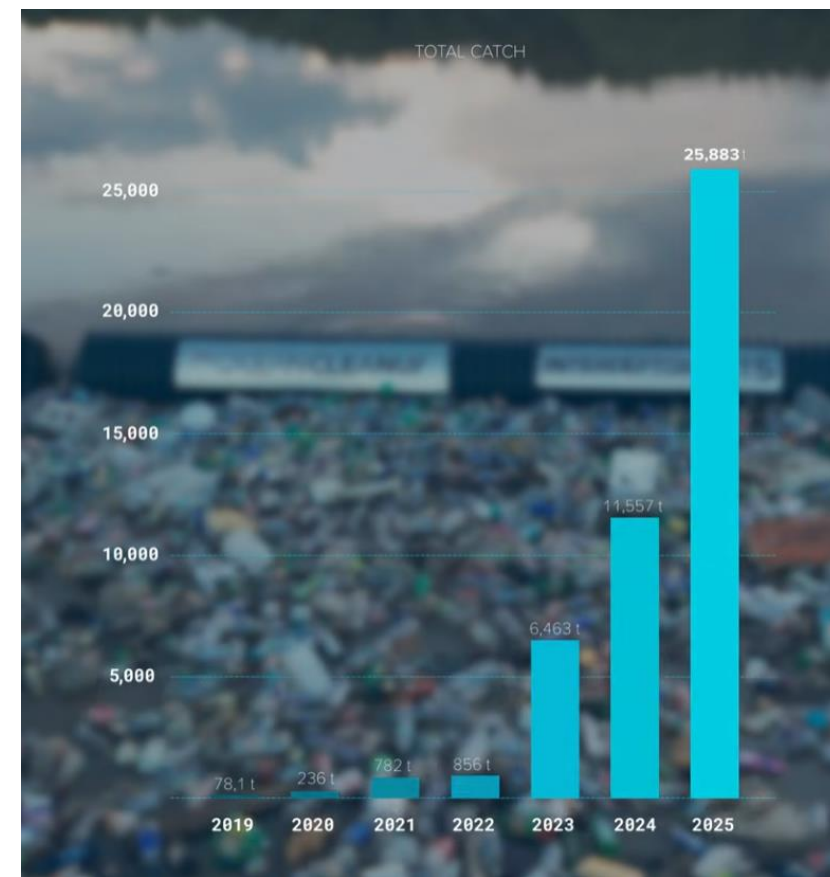
Interceptor in Kingston Bay, Jamaica



Drifter release for Ocean Plastic Research



Interceptor in Rio Abajo, Panama



Total catch (metric tonnes) in 2025 is more than double that of 2024

<https://theoceancleanup.com/dashboard/>

OCEANS AND HOTSPOTS: THE DATA CHALLENGE

- Quantifying total stock of floating plastic
- Monitoring our cleanup progress
- Effective routing towards **hotspots**

- How to regularly scan an area of this size?

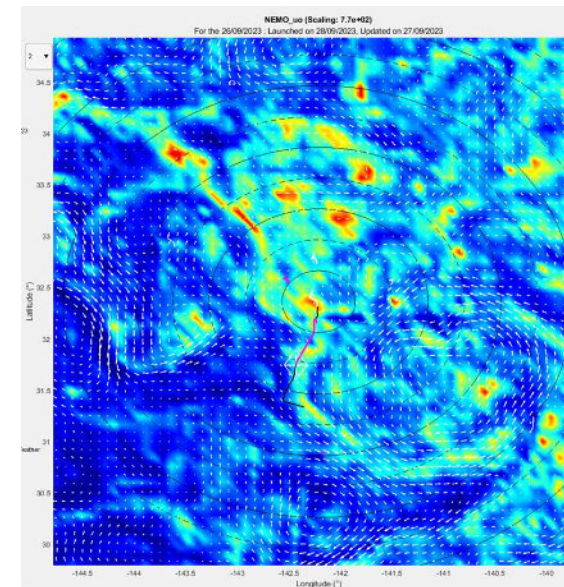
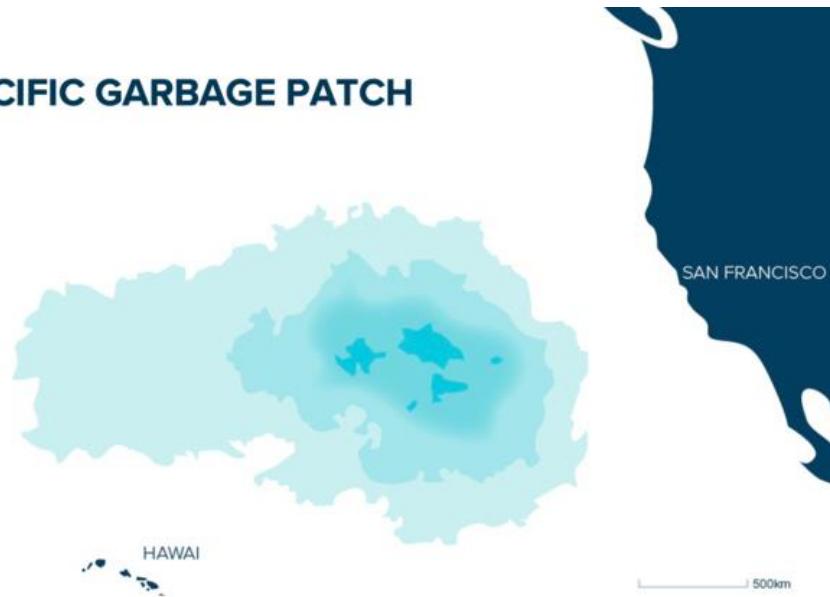
THE GREAT PACIFIC GARBAGE PATCH

- 1,6 million km²
- 1,8 trillion pieces
- 100.000 tons of plastic

2x
THE SIZE OF TEXAS

3x
THE SIZE OF FRANCE

100 KM
0, 1 10 100



*Cleanup System route optimization
using dispersal modeling*

KEY PRINCIPLES

- To get us to the next level of efficiency, we need data on the GPGP...
 - At continuous rate, and
 - At much larger volume than we ever had before
- The power of slow but steady
- Minimalism for scalability

POTENTIAL:
GLOBAL VESSEL
FOOTPRINTS



APPROACH

- Central idea: Help The Ocean Cleanup's mission by collecting lots of observations from ships of opportunity
- Challenges:
 - Rough environment
 - Almost no expert supervision
- Opportunities:
 - Onboard power supply
 - Low risk of theft
- So: simple, minimalistic, 'self-contained'
 - Standardization as a unit
 - Minimize modules & interfaces
 - Eliminate work onboard ships (independent from maintenance)

WHAT IS ADIS

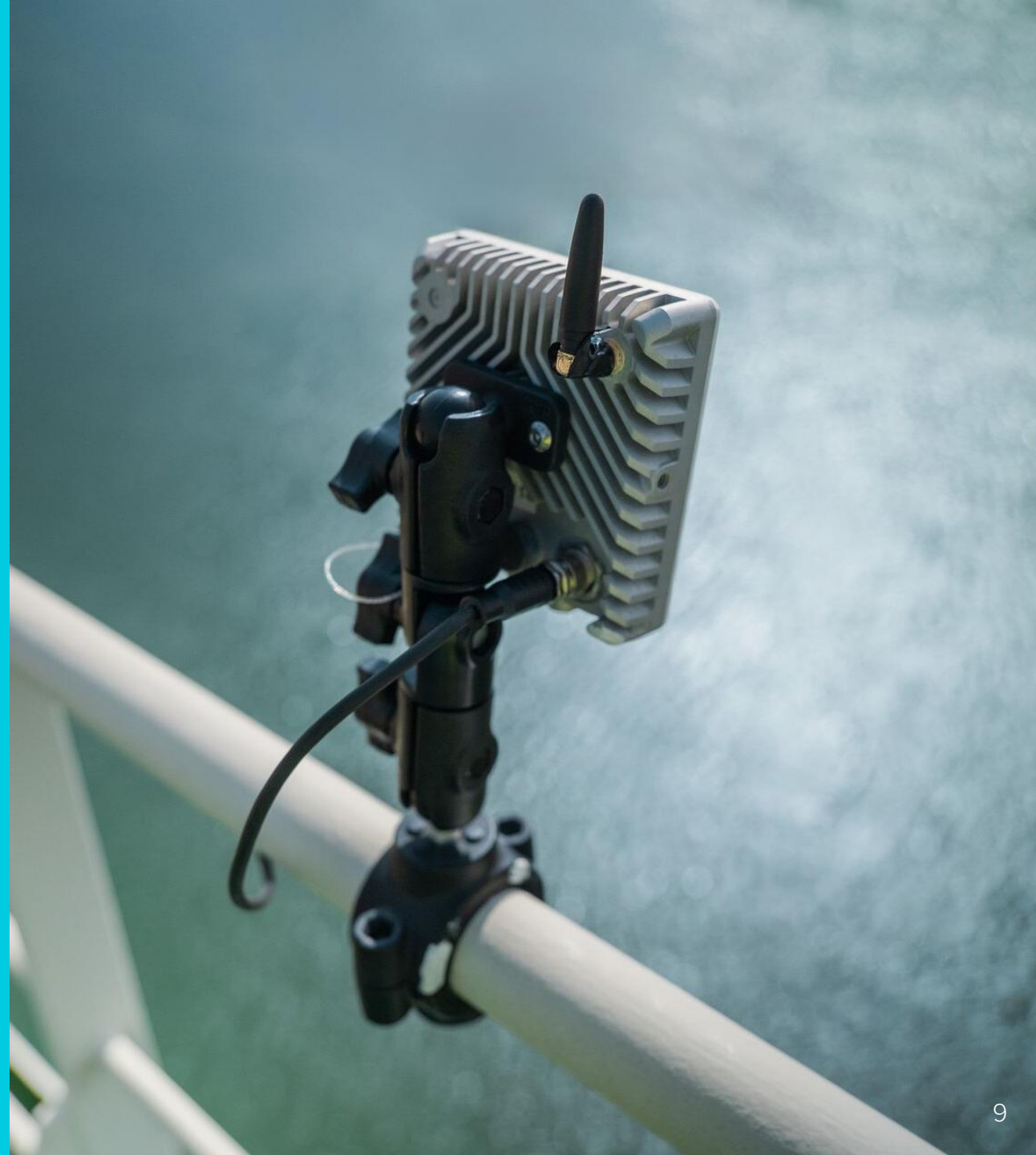
- **A**utomated **D**ebris **I**maging **S**ystem;
- Detect plastic from images of the ocean,
- By running AI live;
- On a high-resolution RGB camera;
- Results are uploaded to the cloud from each individual camera by 3G/4G;
- Mapping & quantification of floating mega plastics > 50 cm around the world;
- Collaborations with vessel owners: cargo ships, research vessels, cruise ships, etc;



X



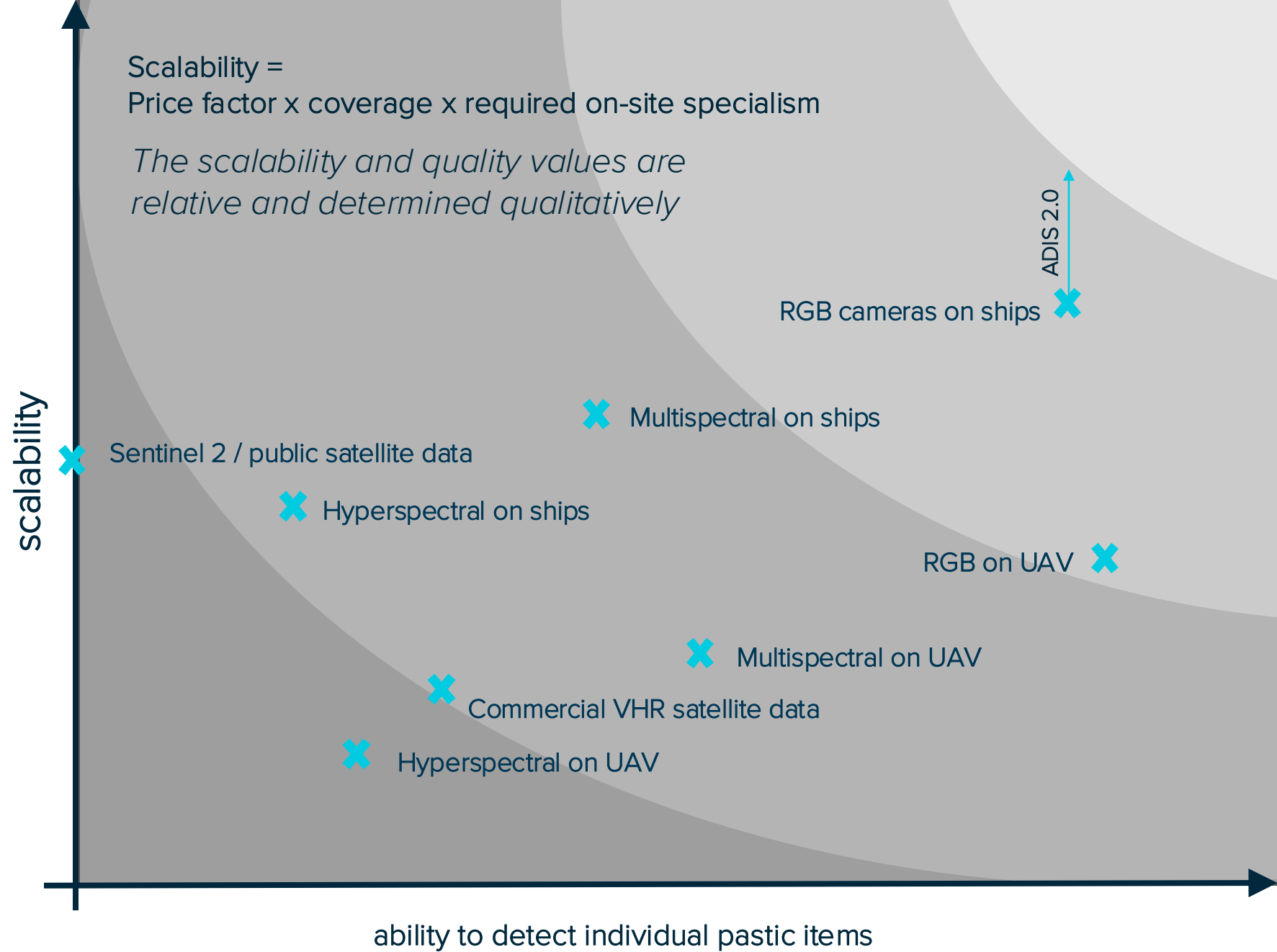
TECHNOLOGY



REMOTE SENSING APPROACHES TRIED IN THE OPEN OCEAN (PLATFORM VS SENSOR):

	UAV/Aerial	Ship	Satellite
Multispectral	Yes, 2018	No	Yes, 2018 - 2021
Hyperspectral	Yes, 2016 & 2021	No	No
RGB	Yes, 2016 - 2022	Yes, 2018 - now	Yes, 2018 - 2022
Lidar	Yes, 2016	No	No

COMBINE BETWEEN SCALABILITY AND QUALITY



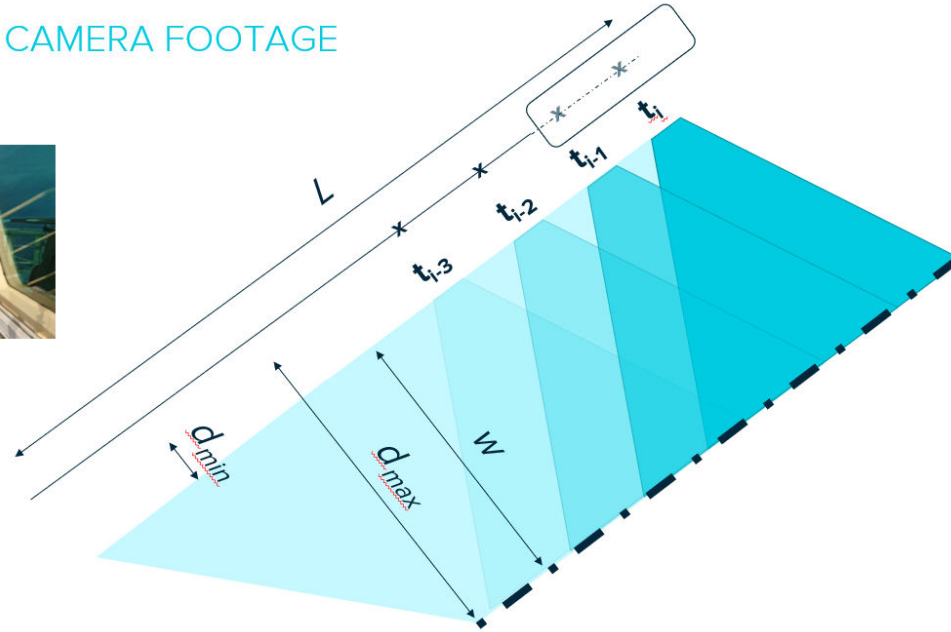
KEEPING THINGS SIMPLE AND SCALABLE;

2021 PROOF OF CONCEPT STUDY WITH GOPRO CAMERAS

AUTOMATED CAMERA FOOTAGE TRANSECTS



$$\hat{D} = \frac{fn}{Lw}$$



Quantifying Floating Plastic Debris at Sea Using Vessel-Based Optical Data and Artificial Intelligence

by [Robin de Vries](#) ^{1,*}, [Matthias Egger](#) ^{1,2}, [Thomas Mani](#) ¹ and [Laurent Lebreton](#) ^{1,3}

¹ The Ocean Cleanup, Batavierenstraat 15, 3014 JH Rotterdam, The Netherlands

² Egger Research and Consulting, 9000 St. Gallen, Switzerland

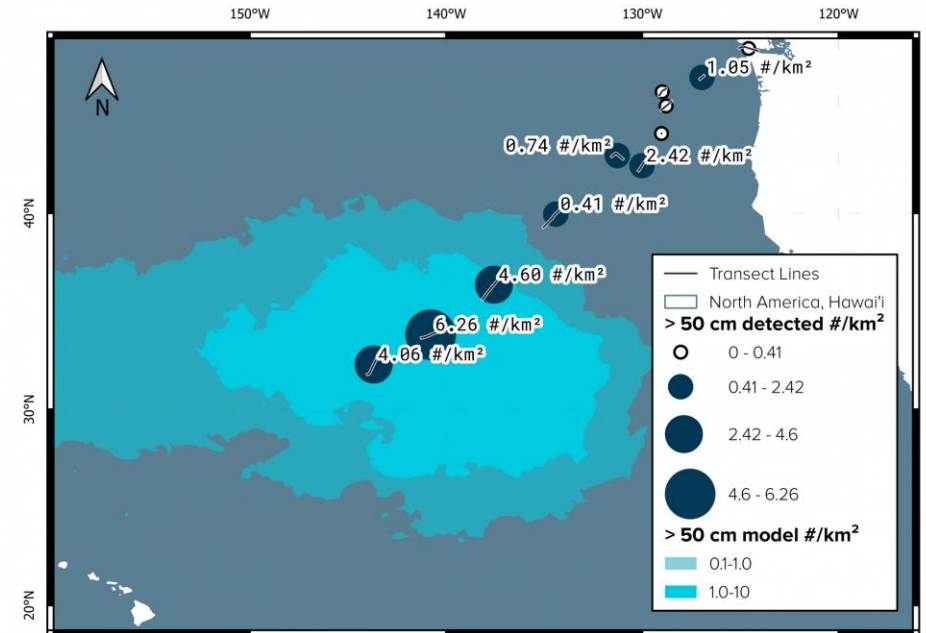
³ The Modelling House, Raglan 3225, New Zealand

* Author to whom correspondence should be addressed.

Remote Sens. **2021**, *13*(17), 3401; <https://doi.org/10.3390/rs13173401>

Received: 30 June 2021 / Revised: 14 August 2021 / Accepted: 19 August 2021 / Published: 27 August 2021

GPGP outline:
 Lebreton, L., Slat, B., Ferrari, F. et al. Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. *Sci Rep* **8**, 4666 (2018).
<https://doi.org/10.1038/s41598-018-22939-w>



OBSERVATIONAL EFFORT 2018 - 2022

Acknowledgements to:

- Maersk
- SEA expedition
- Gennady Kankatov, FECC Ltd.
- Bark Europa
- NIOZ, Erik Zettler, NL

Maersk
Trader/Tender



RV Akademik Mstislav
Keldysh



RV Pelagia



Bark Europa



SSV Robert
C Seamans



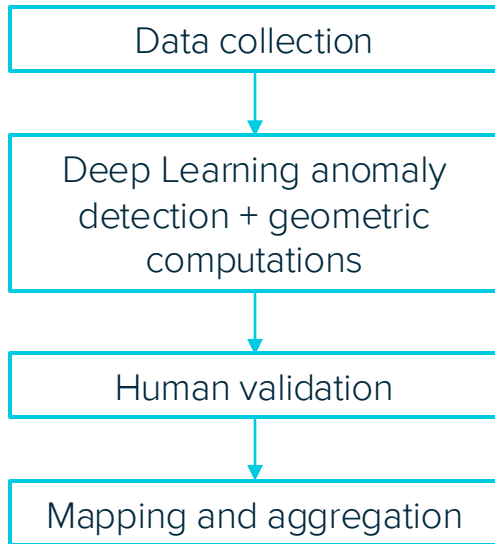
Antsiva



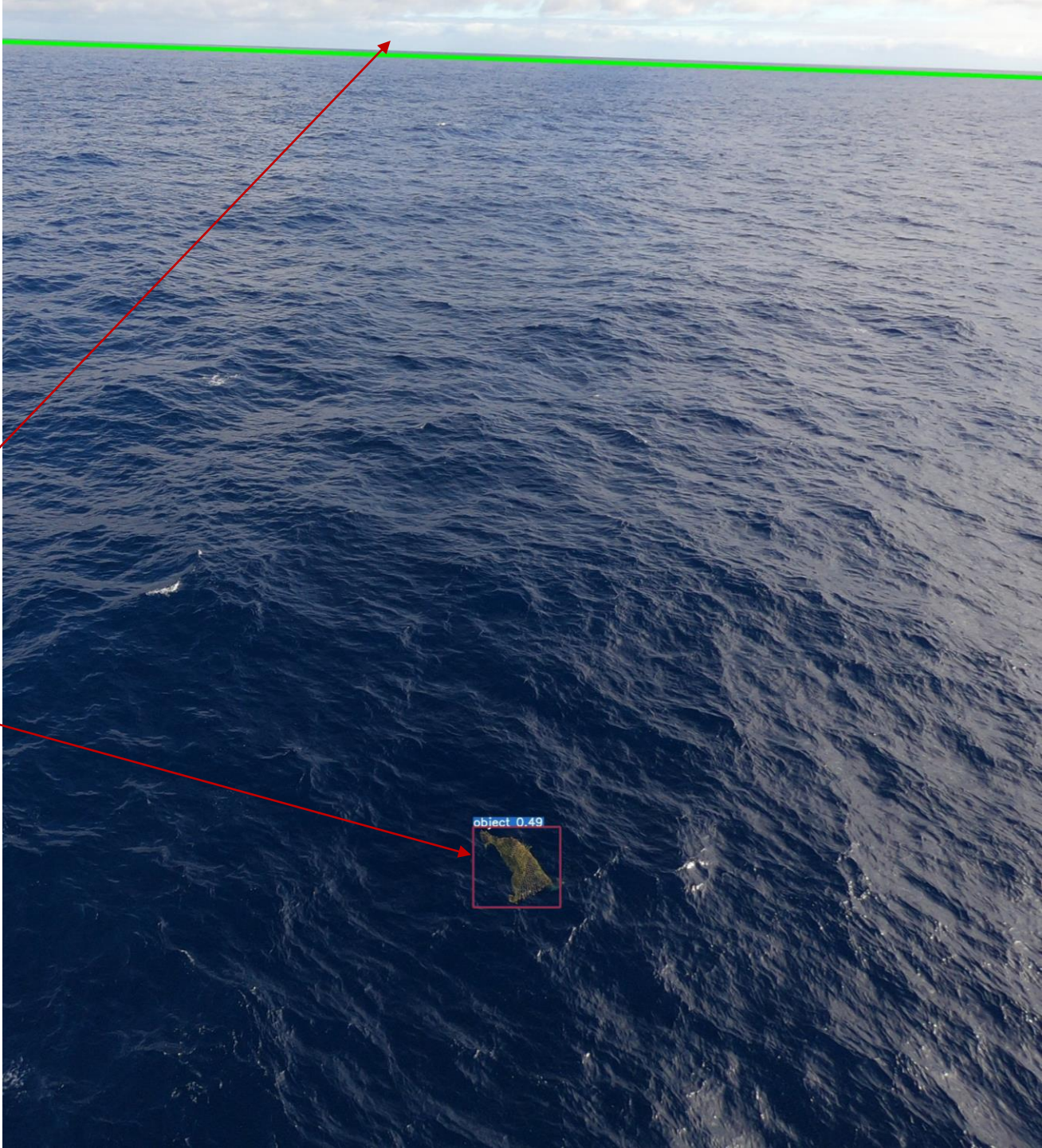
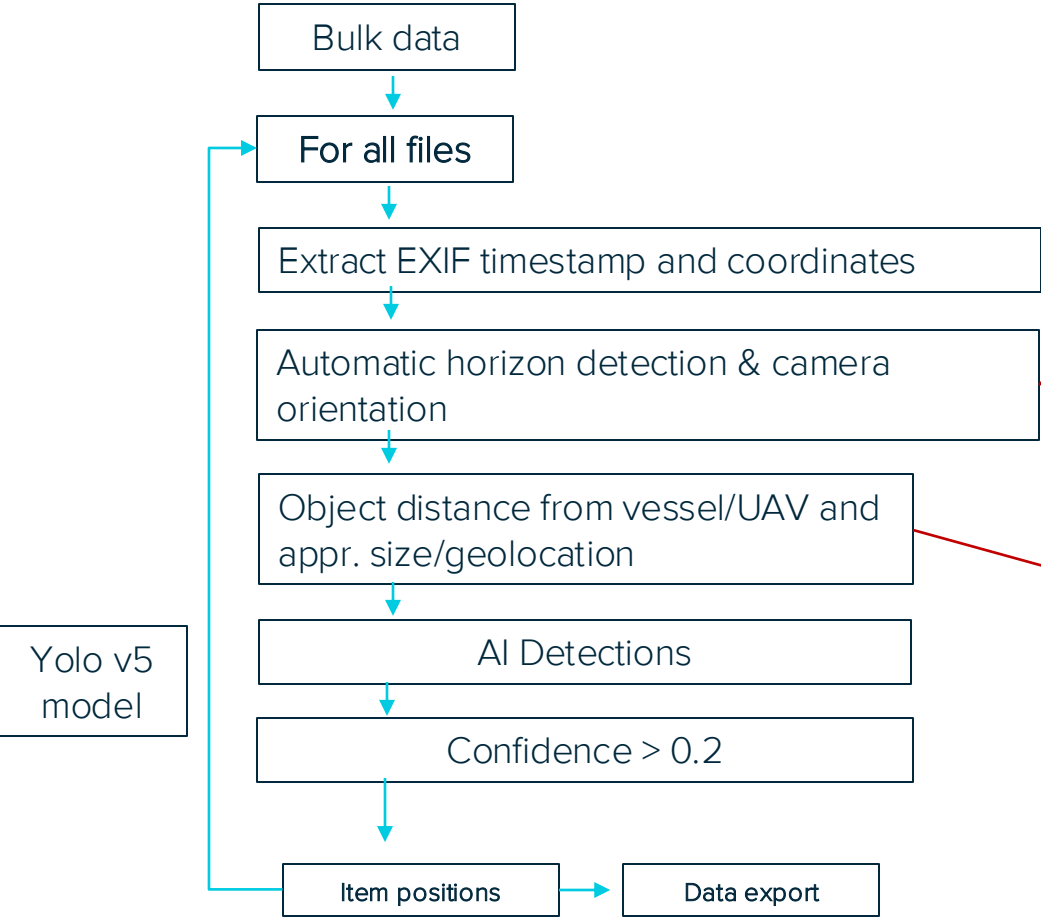
M/V Bold Horizon



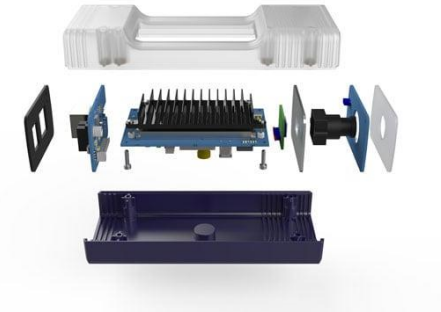
ADIS1 TECHNOLOGY: SEMI-AUTOMATED PROCESSING



PROCESSING METHOD



TOWARDS A **SMARTER** EMBARKED CAMERA SYSTEM



Storing and uploading raw data (full 4K dataset) volume:

- 2 TB per month per camera
- Satellite or 4G/5G port uploads not feasible

Storing and uploading detected objects only:

- ~ 0.0005 TB (500 MB) per month per camera (400 x less)
- Data uploads feasible

ADIS2 DEVELOPMENT AND TESTING

- Regular deployment of new types on Tender and Trader since March 2023
- Optimal opportunity for weather exposure testing
- Datasets used for diagnosis and further improvements



August 2022
Prototype

March 2023
Prototype +
improved
image sensor

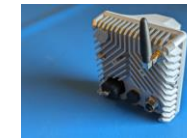
June 2023
Development
agreement

August 2023
ADIS Alpha

October 2023
ADIS Alpha,
+ GPS,
+ LTE

February 2024
ADIS Beta

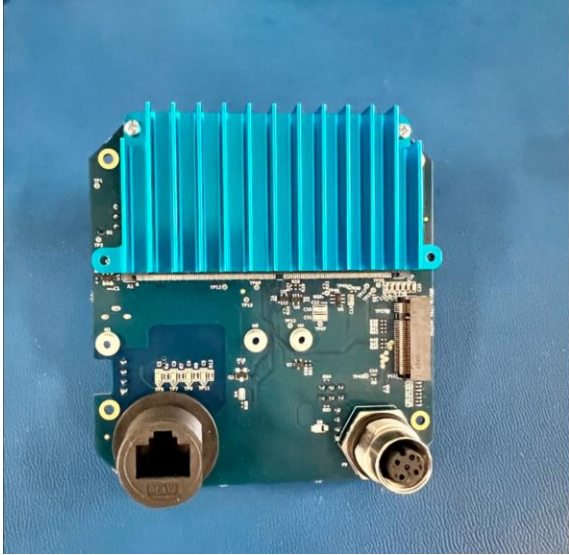
2025
ADIS



HIGH-LEVEL REQUIREMENTS

- Image quality: 4K
- Processing: Quick enough for 1 frame per second inference
- Power: Low enough for passive cooling
- Wide field of view
- IP67
- Remotely configurable
- Autonomous data transfers
- Easy installation

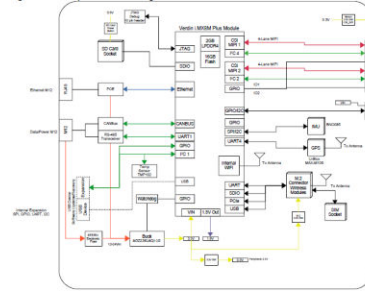
SPECS



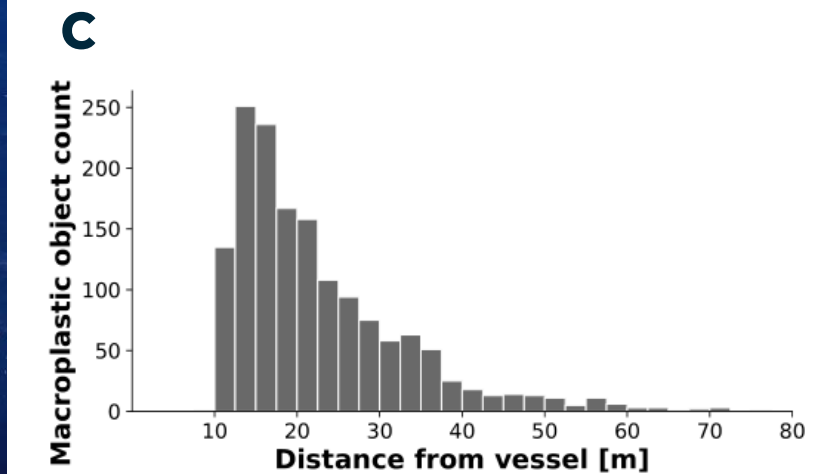
Perception Latency	2 fps – 30 fps (depending on resolution of model)
Field of View	84° ↔ 52° ↓ 105° ↗
Detection Range	1 - 100m (3 - 300ft)
Resolution	4K / 8MP (3840x2160) CMOS Sensor 2 μm x 2 μm pixels for low light sensitivity
AI Processors Integrated Peripherals	i.MX8M Plus (Quad A53 + 2 TOPS NPU), optional 26 TOPS AI Accelerator LTE Modem, GNSS, 9 axis IMU, internal temp & humidity sensors
Environmental	-40°C to +65°C Industrial Temp, passive cooling IP67 rated enclosure
Electrical	RJ45 IP67 waterproof Ethernet with optional POE M12 10 - 27VDC (7W), RS-485/CANbus 2 SMA connectors for external GPS + LTE antennas
Mechanical	110x115x90mm (4 ¼ x 4 ½ x 3 ½ in) 450g (16 oz) Multiple ¼ - 20 mounting points

SENSOR SCIENCE, DESIGN AND SPECIFICATIONS

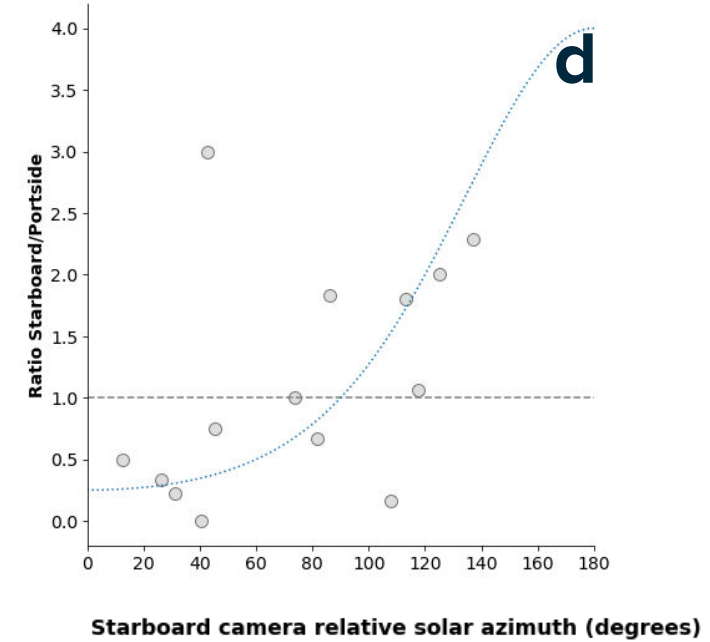
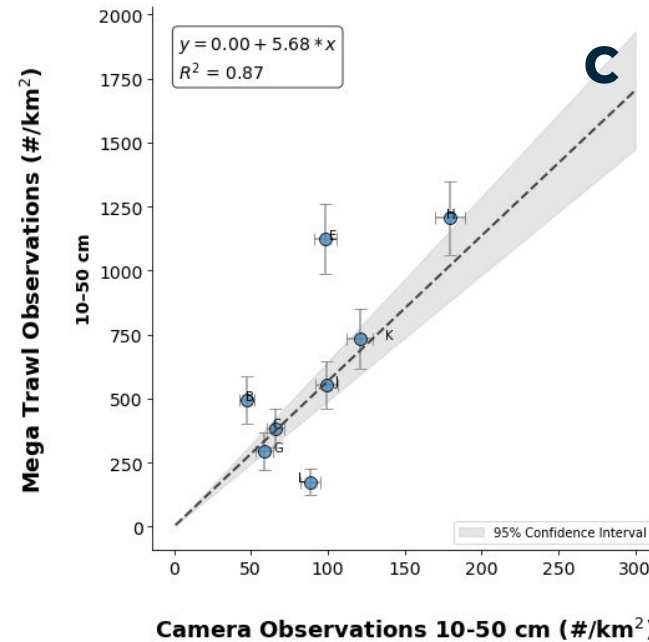
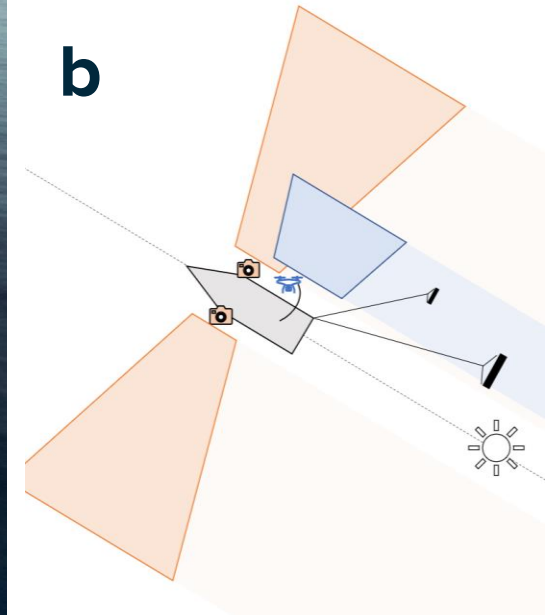
- 4K image sensor
- Size: ~ 10 x 10 x 8 cm
- Edge Processing
- Transmission of image snippets and metadata by LTE networks in ports of call
- Affordable unit cost
- Easy installation
- Only a power source is needed (6 Watt)
- Long-term deployment scale: 100 stations



DETECTION, TRACKING AND POSITIONING



CALIBRATION AGAINST PHYSICAL SAMPLING (GROUND TRUTHING)



DEPLOYMENTS

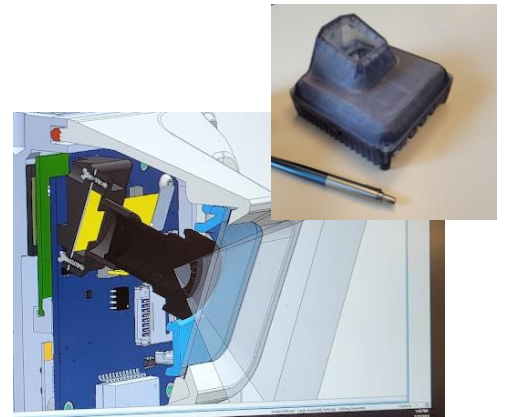


BRIEF HISTORY

2018 – 2022 Experimentation, proof-of-concept and ADIS1



2022 – 2024 Development phase



2024 ADIS launch, standardization

2025 Scaling, delivering first impacts



PARTNERSHIPS & ENDORSEMENTS



**HYUNDAI
GLOVIS**

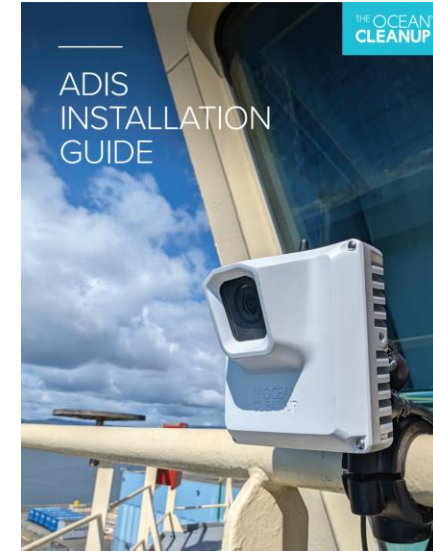
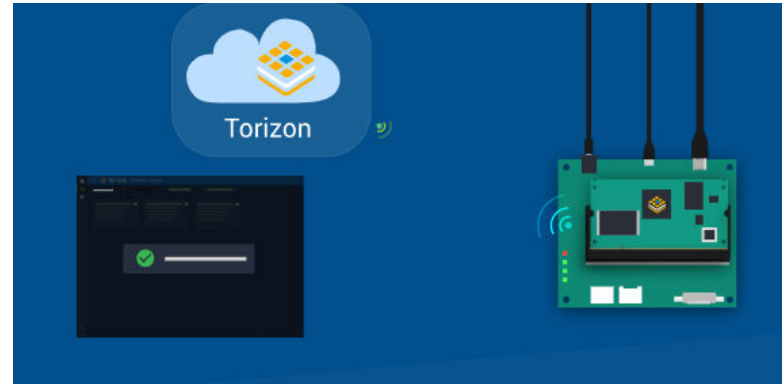


**2021
2030** United Nations Decade
of Ocean Science
for Sustainable Development

DEPLOYMENT AND DEVICE MANAGEMENT

Designed to eliminate dependency on vessel crews:

- Low-no maintenance
- Units swappable
- Remote diagnostics
- Remote configuration



Fleet Name ↓	Device Count	Actions
ADIS2 Beta	0	
Deployed	20	
QA	2	
Ready to Ship	37	
Shipped	15	

Deployed

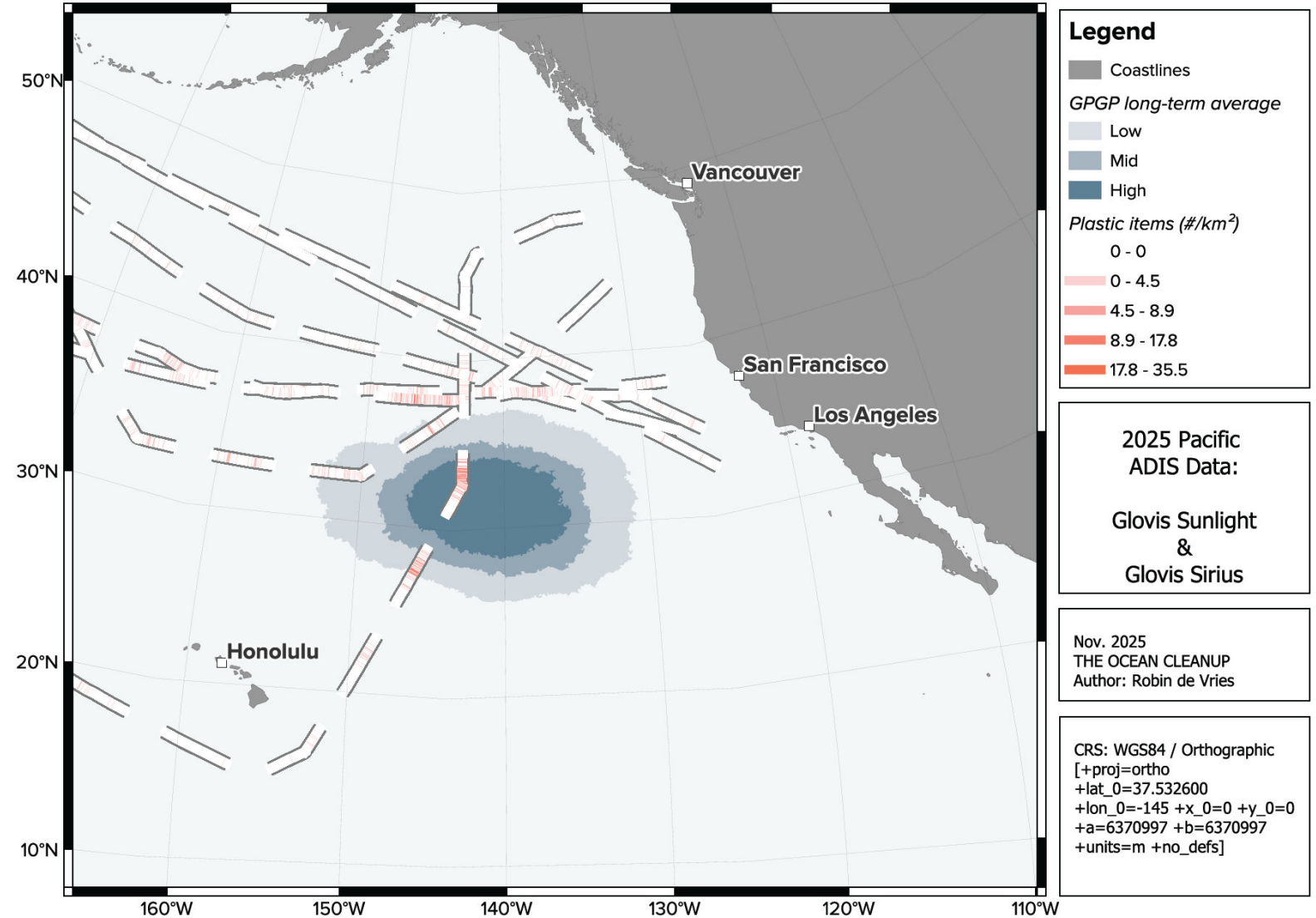
Devices

A102 Glovis Sirtu... ID: verdin-ims@mp-07... Last seen: 22 days ago Status: Up to date	A103 Glovis Sirtu... ID: verdin-ims@mp-07... Last seen: less than a mi... Status: Up to date	A104 Glovis Cent... ID: verdin-ims@mp-07... Last seen: 10 days ago Status: Up to date
A107 Plastic Ody... ID: verdin-ims@mp-06... Last seen: 2 months ago Status: Up to date	A109 Glovis Sunil... ID: verdin-ims@mp-06... Last seen: 4 minutes ago Status: Up to date	A111 Plastic Ody... ID: verdin-ims@mp-15... Last seen: 2 months ago Status: Update pending
A112 Century Sta... ID: verdin-ims@mp-15... Last seen: less than a mi... Status: Up to date	A113 Glovis Cha... ID: verdin-ims@mp-15... Last seen: about 1 mont... Status: Up to date	A114 Glovis Sunil... ID: verdin-ims@mp-15... Last seen: about 1 mont... Status: Up to date
A118 Glovis Cha... ID: verdin-ims@mp-15... Last seen: about 2 mont... Status: Up to date	A122 Kaying Port... ID: verdin-ims@mp-15... Last seen: 9 days ago Status: Up to date	A128 Kaying Star... ID: verdin-ims@mp-15... Last seen: 9 days ago Status: Up to date
A211 Glovis Sunr... ID: verdin-ims@mp-15... Last seen: less than a mi... Status: Update failed	A212 Glovis Sunr... ID: verdin-ims@mp-15... Last seen: about 9 hours... Status: Up to date	A215 Glovis Sym... ID: verdin-ims@mp-15... Last seen: about 1 mont... Status: Up to date
A217 Glovis Sym... ID: verdin-ims@mp-15... Last seen: about 1 mont... Status: Up to date	A238 Costa Deliz... ID: verdin-ims@mp-15... Last seen: 17 days ago Status: Up to date	A239 Costa Deliz... ID: verdin-ims@mp-15... Last seen: 16 days ago Status: Up to date
A244 Cosmic Ac... ID: verdin-ims@mp-15... Last seen: 17 days ago Status: Up to date	A259 Cosmic Ac... ID: verdin-ims@mp-15... Last seen: 6 months ago Status: Update pending	

OUTCOME

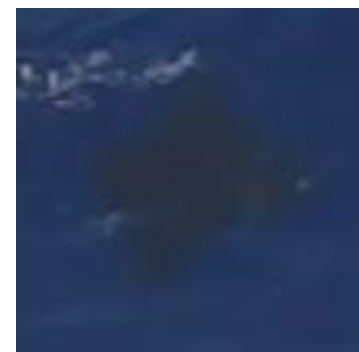


MAPPING NEW REGIONS OF THE GPPG WITH ADIS



EXCERPT: DETECTED HARD PLASTIC ITEMS

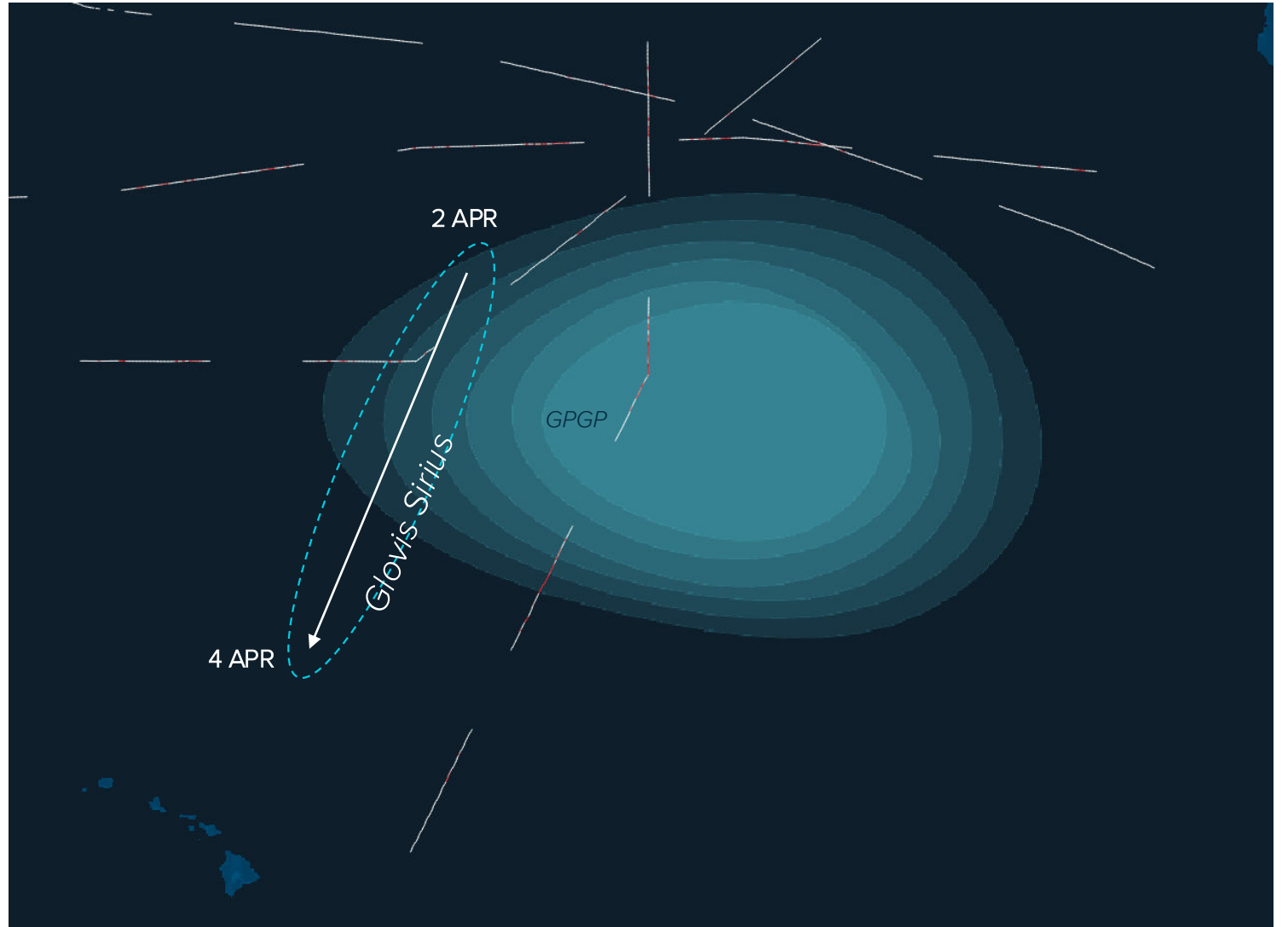
Great Pacific Garbage Patch 2025



COLLECTED ADIS DATA: CASE STUDY

Glovis Sirius

2 apr 2025 - 4 apr 2025



Geographical position of the data subset from Glovis Sirius, taken between 2nd and 4th April 2025 while traveling North-South through the GPGP.

COLLECTED ADIS DATA: CASE STUDY

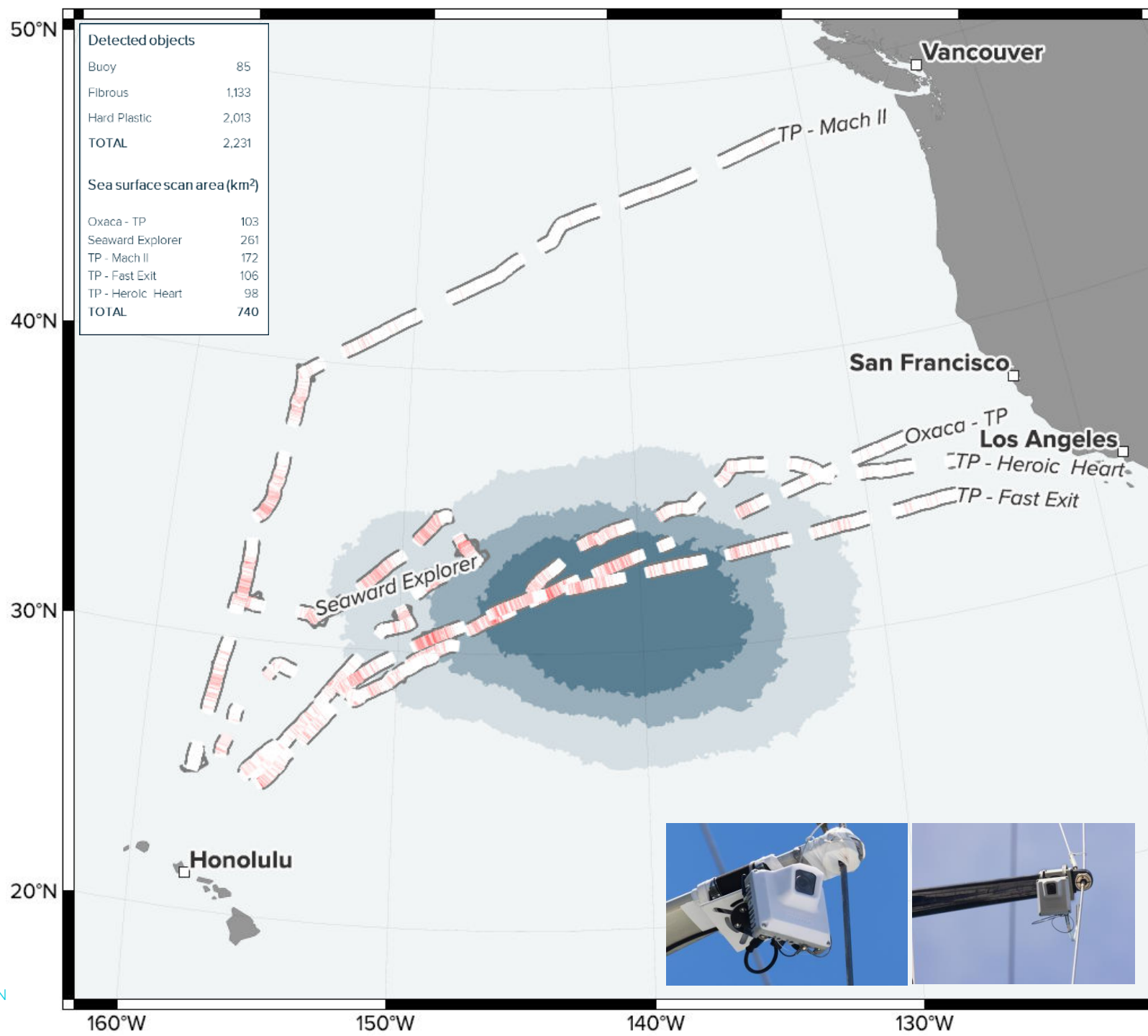
Glovis Sirius

2 apr 2025 - 4 apr 2025



A subselection of sightings by ADIS from Glovis Sirius between 2nd and 4th of April 2025. Sometimes, a wave is being detected.

2025 PACIFIC DATA EXPEDITION



Detected objects	
Buoy	85
Fibrous	1,133
Hard Plastic	2,013
TOTAL	2,231

Sea surface scan area (km ²)	
Oxaca - TP	103
Seaward Explorer	261
TP - Mach II	172
TP - Fast Exit	106
TP - Heroic Heart	98
TOTAL	740

Legend

- Cities
- Coastlines

ADIS detected items #/km²

- 0 - 1
- 1 - 30
- 30 - 100
- 100 - 300

GPGP 10y average density

- Low
- Medium
- High

**ADIS and Pacific Data Expedition:
Transpac and Seaward Explorer Results**

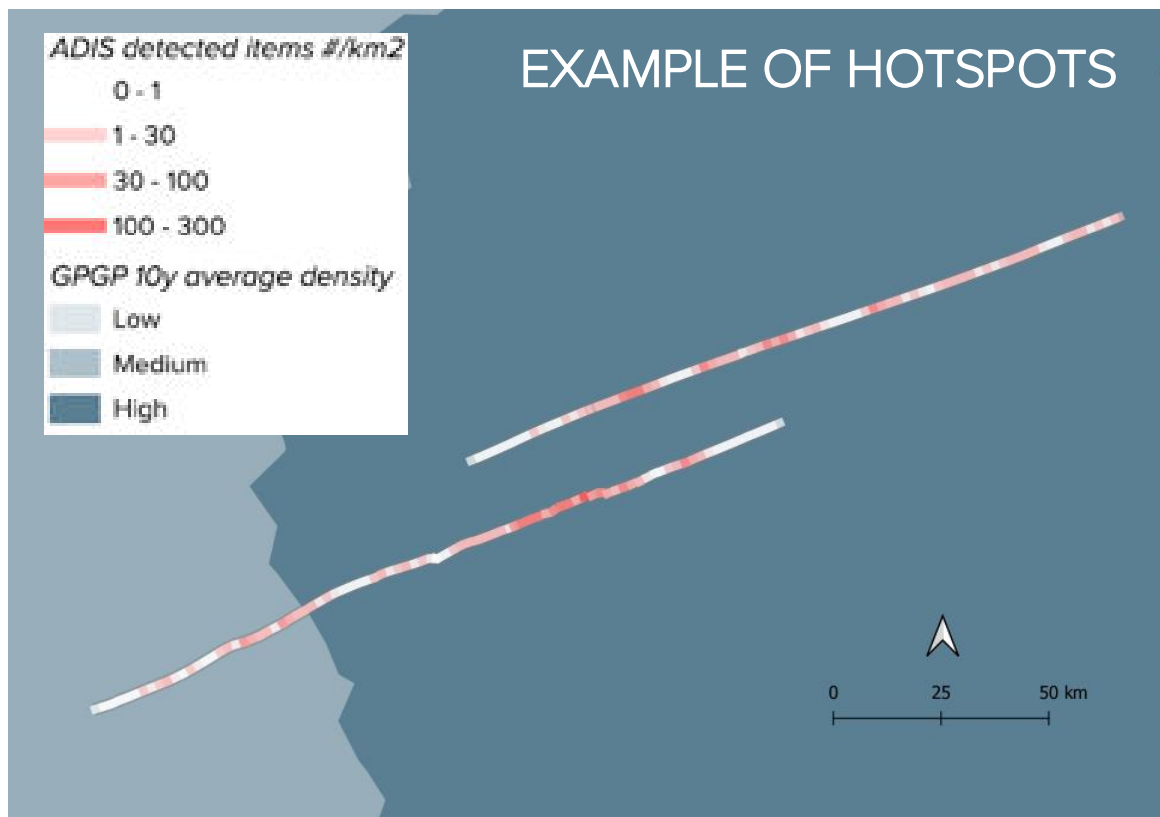
Jul - Oct 2025

Nov. 2025
THE OCEAN CLEANUP
Author: Robin de Vries

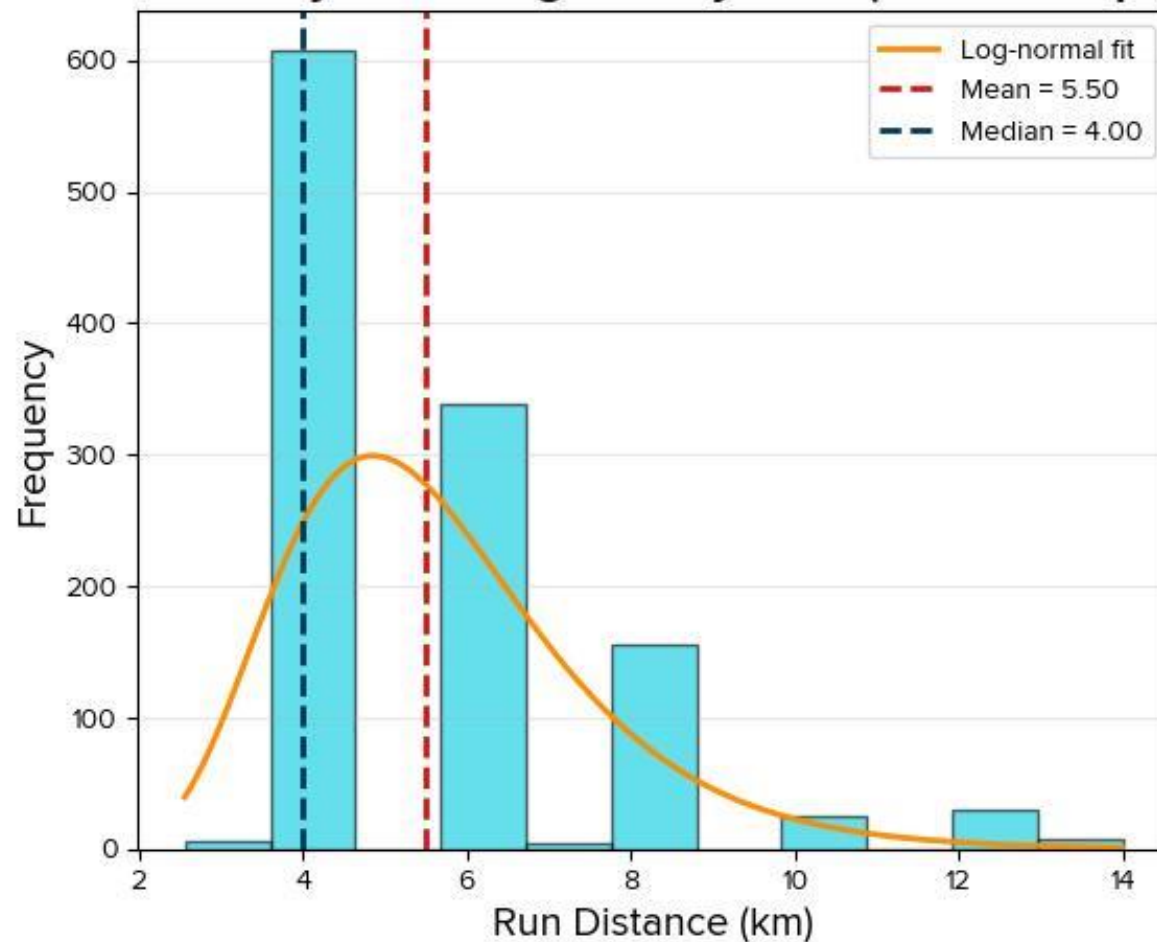
CRS: WGS84 / Orthographic
[+proj=ortho
+lat_0=37.532600
+lon_0=-145 +x_0=0 +y_0=0
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+units=m +no_defs]



HOTSPOTS CHARACTERISTICS



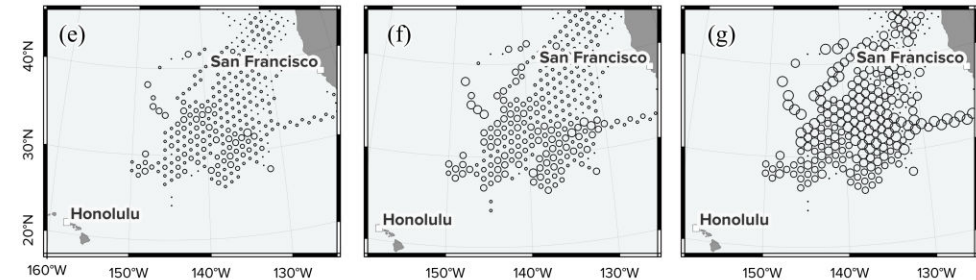
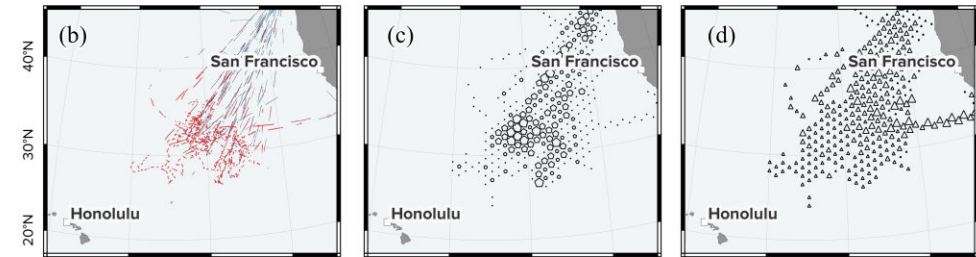
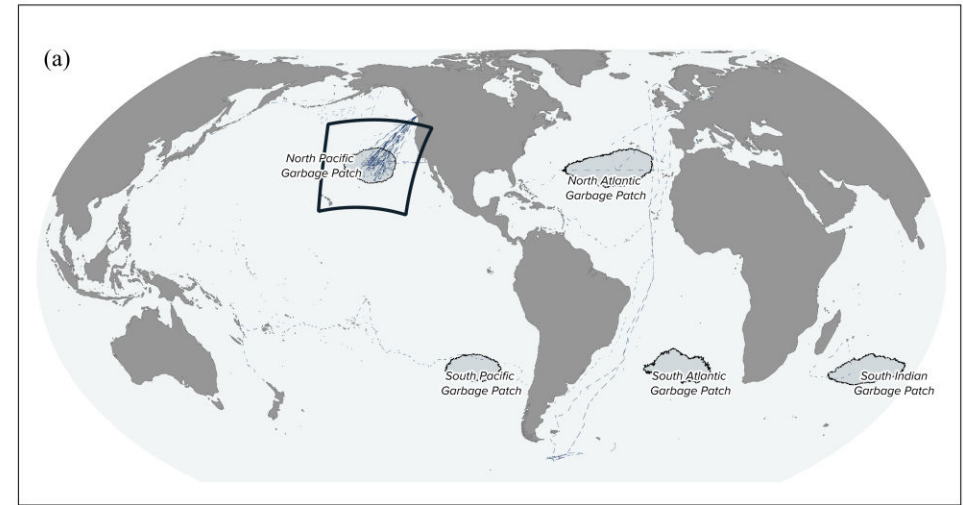
Gradually Increasing Density Runs (PDE All Ships)



ANIMATION: A GROWING NETWORK OF OBSERVATIONS (2021 – 2025)



AGGREGATION: TOWARDS GRIDDED DATA PRODUCT



Legend Item	Area scanned (km ²)	Calibration factor	>10 cm abundance (#/km ²)
• Detected objects	• 0 - 25	• 1 - 1	• 0
■ Cities	• 25 - 50	• 1 - 1.5	• 0 - 5
— Coastlines	○ 50 - 100	△ 1.5 - 2	○ 5 - 10
— ADIS Scan Locations	○ 100 - 200	△ 2 - 2.5	○ 10 - 50
■ Convergence zones		△ 2.5 - 4	○ 50 - 150
			○ 150 - 1500

THANKS TO ADIS, WE
CAN NOW GATHER
STATISTICS ABOUT
HOTSPOTS
CONTINUOUSLY

SUMMARY

- The Ocean Cleanup uses observations of floating plastics to allow efficient and monitored cleanup operations;
- Getting enough data coverage is a true challenge;
- Following small scale proof of concept, ADIS was facing scalability issues;
- Thanks to embedded AI, ADIS has now developed into a fully automated, low-maintenance sensor;
- Currently deployed on 17 active vessels, scanned a total sea surface area of 65,660 km², traveled
- Early data is already providing unique insights into distribution and statistics of floating plastics.

THE OCEAN[®] CLEANUP



Robin de Vries

ADIS Lead

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—Dan Teodorescu, Director of Product Architecture, Alcon

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edge ai + vision ALLIANCE™

Inspiring + empowering innovators to design systems that perceive + understand

The Edge AI and Vision Alliance



Empower product creators to harness physical AI and vision

The Alliance inspires and empowers system and solution creators to design better products that perceive and understand.



Accelerate technology supplier success

The Alliance helps companies that provide physical AI and vision building-block technologies, services and solutions to grow their businesses through leads, partnerships, and insights.



Empowering Product Creators to Harness Physical AI and Vision



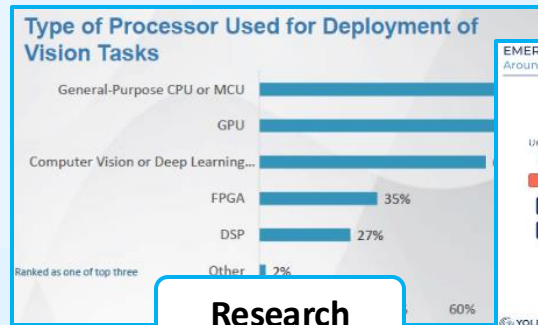
Alliance Mission

The Alliance inspires and empowers system and solution creators to design better products that perceive and understand:

Expand and sharpen your skills

Stay up to date

Connect with key technology suppliers



Research

EMERGING MARKETS
Around the image sensor: a few words on software

Unusual image processing methods: Embrase, MWIR, LWIR

Standard image processing methods: Reflective, Visible, NIR, SWIR

Requires adjustment, but still

Webinars

edge ai + vision INSIGHTS
The latest developments in computer vision and edge AI

VOL. 12, NO. 12 A NEWSLETTER FROM THE EDGE AI AND VISION ALLIANCE

To view this newsletter online, [please click here](#).

DEVELOPING SECURE VISION-BASED DESIGNS

IoT and Vision: Why it's a Security Minefield and How to Navigate it

Recent advancements in machine learning have enabled trained innovators to build insights from IoT sensors in the wild. These insights can be used to solve complex real-world challenges. The lack of security in typical vision-based IoT solutions is especially concerning, as they are typically responsible for managing sensitive data (PnD, CCTV) or critical systems (cars, machinery). Security is rarely the first thought for developers of new types of solutions, but making systems secure often isn't as difficult as it seems. A holistic approach is required. Exacerbating this challenge of achieving end-to-end security, the development and deployment of IoT systems often involves multiple handovers of responsibility, which can make security bodies have been underrepresented in the development and deployment of IoT systems.

Newsletter



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