



An  **ECO** | MINERALS company

Pan Am Flight 526A • NC88899

Finding Clipper Endeavor

Synthetic Imagery and bathymetry from a HUGIN AUV with HISAS — and why the industry hasn't caught up

Craig Wallace COO Eco Minerals FEMME 2026

With our partners

AIR|SEA HERITAGE
FOUNDATION





A prediction, nearly twenty years old

FEMME Lisbon · 2011?

“The future of bathymetric sonar lies in synthetic bathymetry”

—Erik Hammerstad

Uptake is still limited. Why?



Management Team and Board of Directors



Anthony Romeo

Founder, CEO & Director

- U.S. Air Force Academy graduate — #1 in Military Order of Merit; former Intelligence Officer with Top Secret clearance
- Founder of KWKLY Mobile Solutions, acquired by Market Leader (a Zillow company)
- Entrepreneur and investor with experience building and monetizing multiple businesses



Craig Wallace

Founder, President of Operations & Director

- 15+ years in subsea engineering and Autonomous Underwater Vehicles (“AUV”); former HUGIN Product Manager at Kongsberg
- Deep expertise across navigation, acoustic positioning, and subsea survey technologies
- Co-winner of the Shell Ocean Discovery XPRIZE and various other mapping projects



Rita Nodier

Chief Financial Officer

- CPA and former EY Assurance Senior Manager with 9 years of audit and assurance experience for public and private companies in the United States and Europe
- Director of Finance at Envana Software Solutions, leading corporate finance, accounting and financial reporting, FP&A, treasury, audit coordination and financial controls.
- CPA with experience in corporate finance, financial reporting, S-1 registrations, comfort letters, and SOX compliance



Chris Bauer

President of Deep Sea Vision, a subsidiary of Eco Minerals

- 10+ years of marine construction and subsea operations experience
- Former Executive Vice President of Operations at Ballard Marine Construction
- Led operational performance, strategic growth, and robotics/survey operations



Deep Sea Vision

Who we are

Deep Sea Exploration Company

- Deep water AUV's (And shallow)
- EM304 Mk2 Surface system
- Positioning and motion systems
- All electric winches
- Box Cores and other sampling equipment XRF;s etc

Amelia Earhart and Fred Noonan





Our partners in the Clipper Endeavour

The people who never stopped looking



Who they are

Air/Sea Heritage Foundation, led by President Russ Matthews — airseaheritage.org

The archive work

Radio logs, a USAF witness aircraft, Coast Guard positions: the research that drew the search box

Years of searching

2019 multibeam re-analysis · 2022–23 re survey with EM304, ROV dives with NOAA and Schmidt Ocean · 2024 side-scan survey

Their goal

Find, identify and document Clipper Endeavor — and bring closure to the families and to Puerto Rico



The expedition team aboard Fugro Brasilis

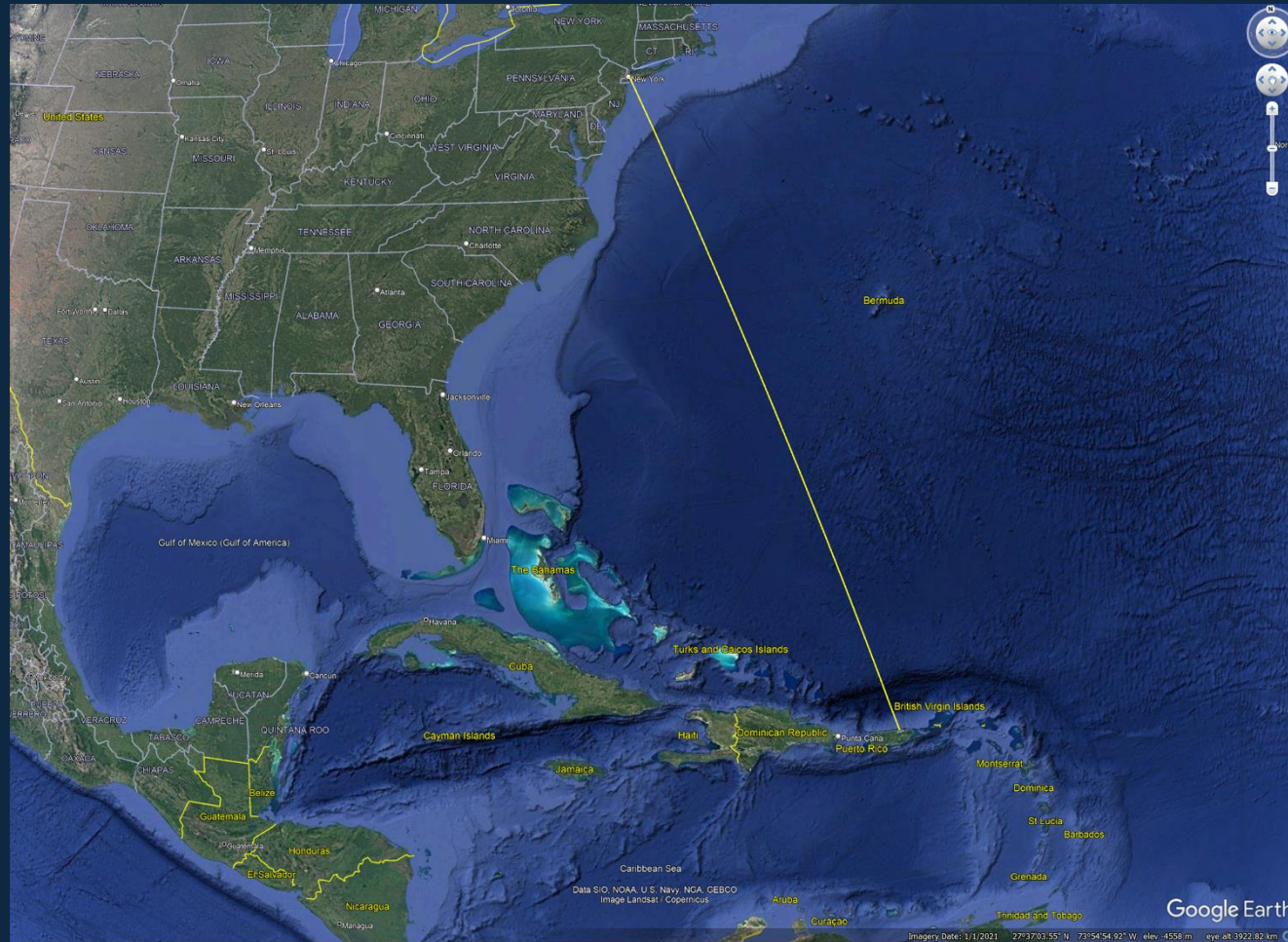
March 2026 a chat in a cab going to an event

Deep Sea Vision | FEMME 2026 · Italy | 1 October 2026 | 04



Good Friday, 11 April 1952

01 · The loss



Douglas C-54B Skymaster, built for the USAAF, converted to a DC-4 and christened **Clipper Endeavor** for Pan Am's Latin American Division.

San Juan (Isla Grande) → New York Idlewild. Eight hours nonstop, **\$64** one way.

On board: **64 passengers**, mostly Puerto Rican residents, and **5 crew** under Captain John C. Burn.





A nine-minute flight

01 · The loss

- **Takeoff**
Isla Grande, bound for New York
- **Engines #3 and #4 lose power**
Aircraft shedding altitude
- **Ditching**
Heavy seas, a few miles offshore — everyone survives the impact
- **Two or three minutes**
The cabin floods and she sinks

17 survivors 52 souls perished and 39 never recovered





The people behind the headline



National news: Captain Burn was married to singer Jane Froman.

PAN AMERICAN WORLD AIRWAYS SYSTEM

CHECK SERVICE DESIRED
☐ RUSH
☐ ROUTINE
☐ OVERNIGHT
☐ MAIL

TELEMESSAGE

ROUTING

CT NO. STATION I.C.A.O. PRIORITY ORIGIN & SERIAL NO. NO. WORDS

To: MR ALFRED BRIGNONI
133 W 112 ST.
APT 5B.
N.Y. N.Y.

WE DEEPLY REGRET TO ADVISE THAT AS A RESULT OF THE ACCIDENT TO OUR FLIGHT 526A APRIL 11TH PASSENGERS RAFAEL JOSE MONSERRATE PEDRO LILLIAN EVELYN ROSA AND JOSE BRIGNONI WERE NOT AMONG THE SURVIVORS AND ARE PRESUMED LOST REQUEST IDENTIFICATION IN EVENT BODIES RECOVERED

PAN-AMERICAN AIRWAY
80 E. 42 ST.
NEW YORK 17, N.Y.

Eight members of the Brignoni family were lost. None were ever recovered.

A USCG PBV landed in 10-15 ft swells, then taxied back to San Juan.





Seventy-four years of near misses

02 · Why it stayed lost

1952

Fuel slick marks the site: ~11 mi from the airport, 4.5 mi offshore

2019

Gary Fabian reviews NOAA Okeanos Explorer MBES — two passes, 500–600 m, soft flat seabed. Four anomalies within 1 nm

2022

Okeanos Explorer ROV 'stop and drop' on the anomalies

2023

Falkor (too) ROV completes the set: all four are geology. Repeats surface MBES with no new targets

2024

ASHF towed side-scan: weather loses 3 of 5 days; ~10 sq mi cleared

**Good archival positions.
The wreck was never far away — the tools
just couldn't see it**



April 2024: the weather wins

02 · Why it stayed lost



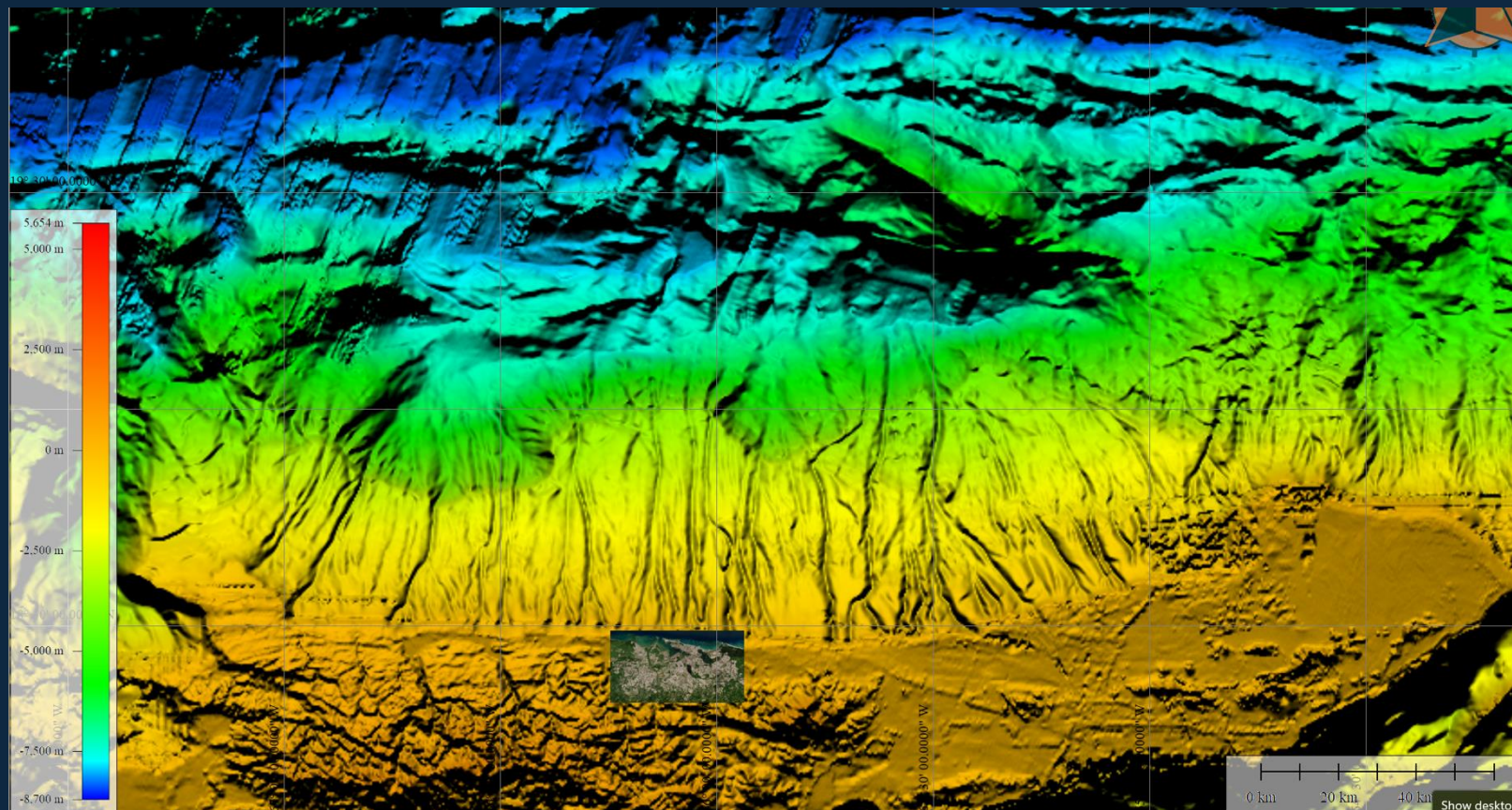
Towed side-scan
search but no
strong contacts

Core box
searched and
eliminated —
time ran out
before it could
be widened.



April 2024: the weather wins

02 · Why it stayed lost

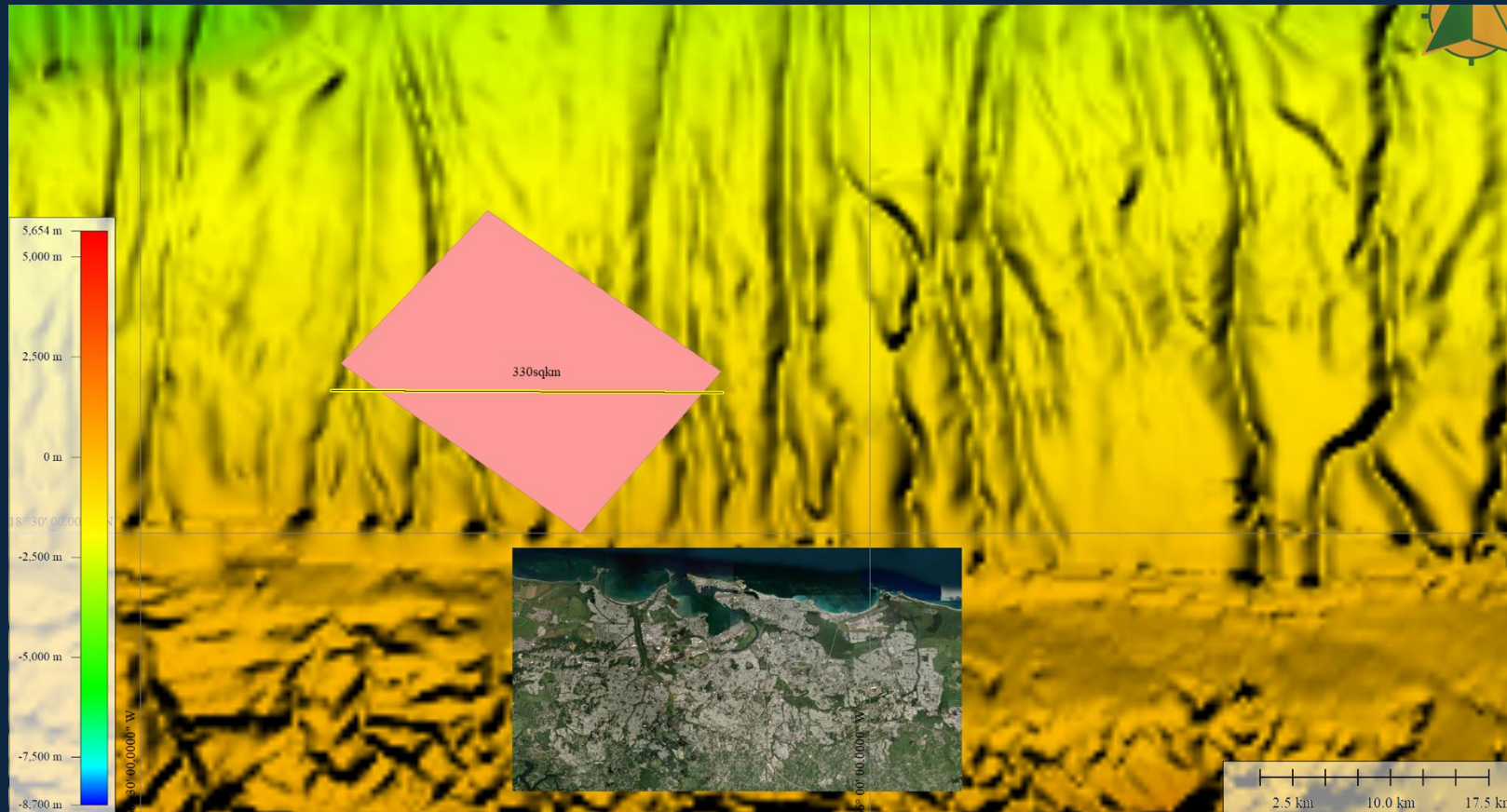


Towed side-scan
search but no
strong contacts
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April 2026 Gathering info

02 · Why it stayed lost



Towed side-scan
search but no
strong contacts

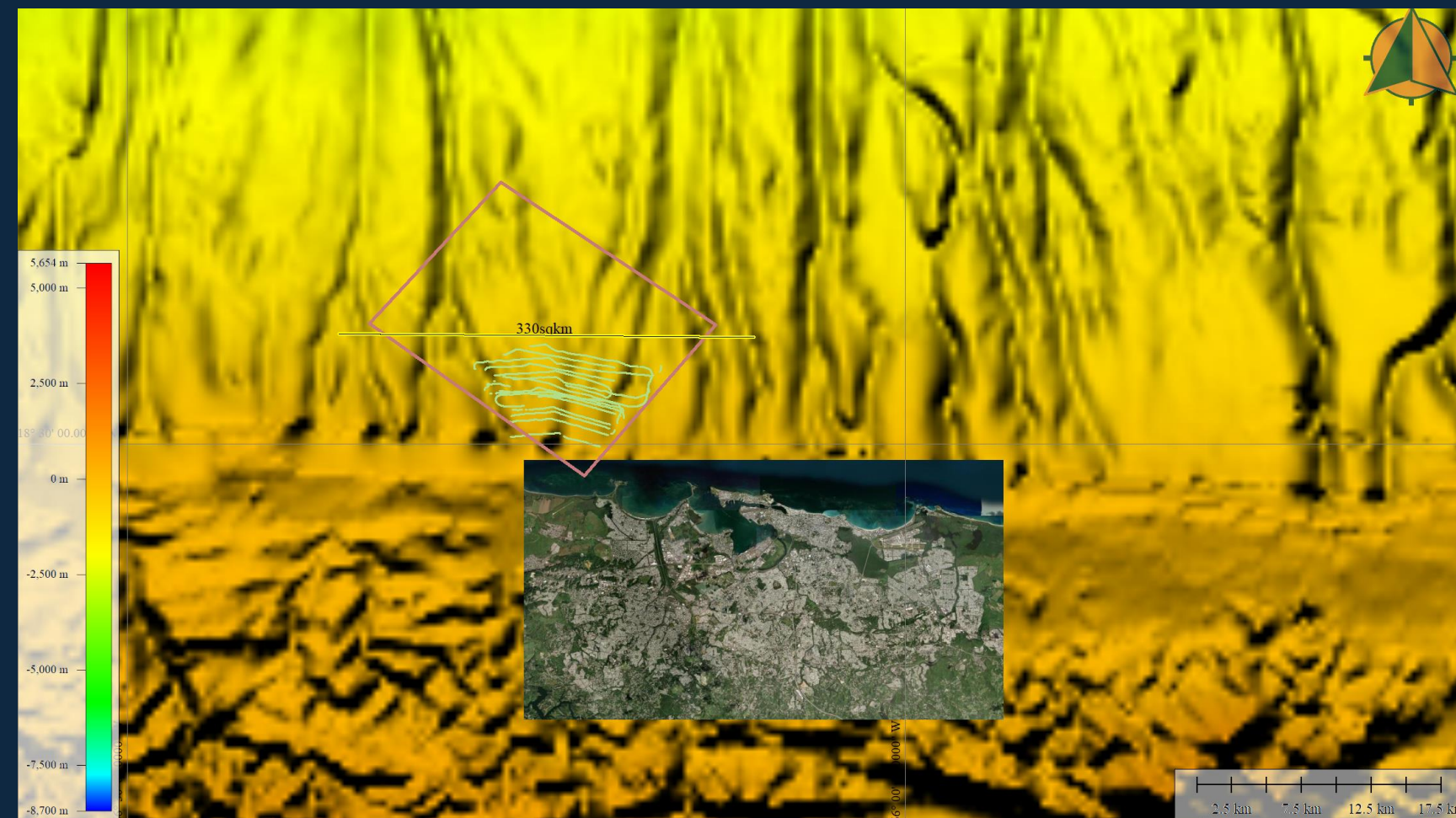
Core box
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April 2026 Gathering info

02 · Why it stayed lost

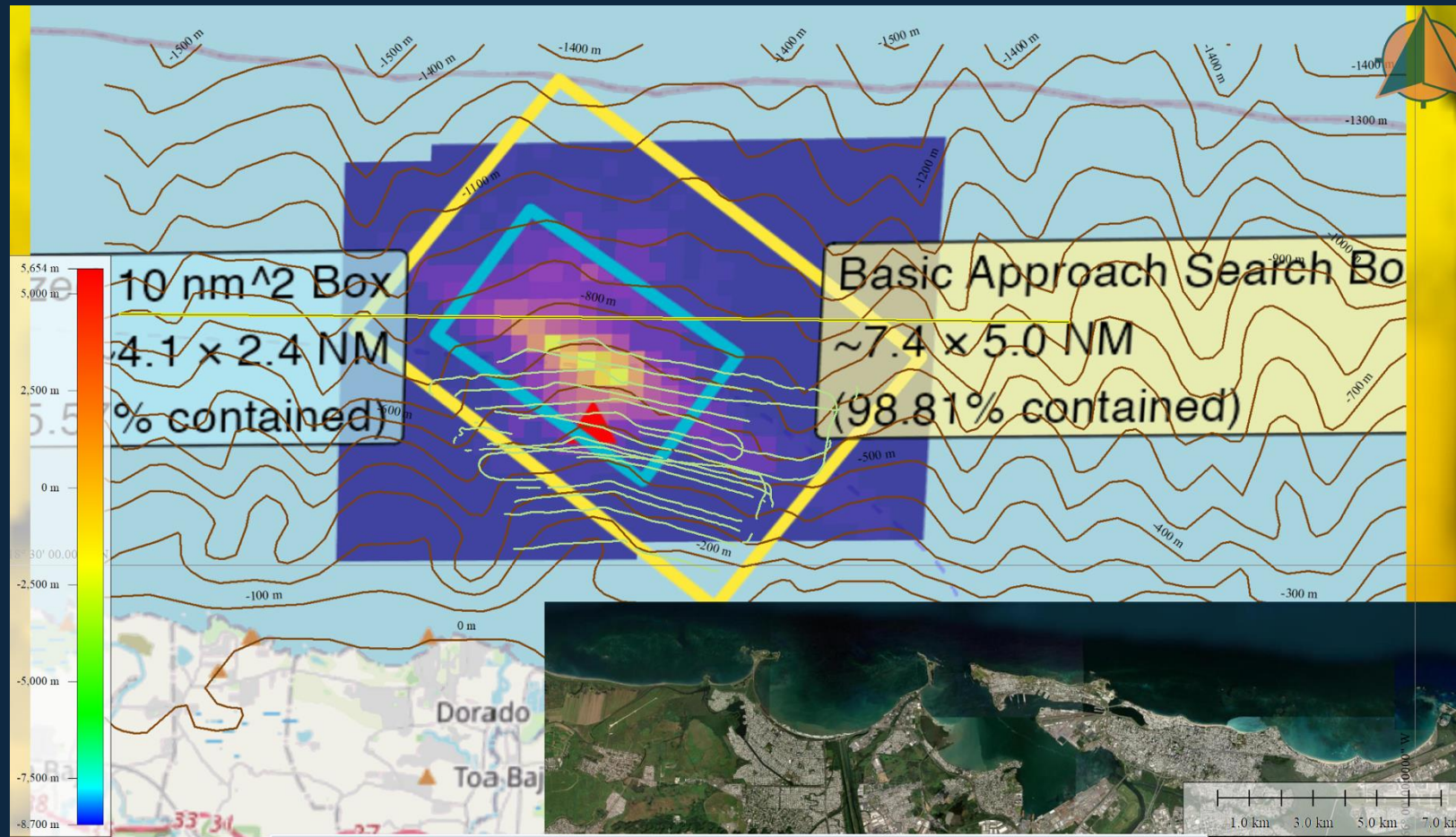
Towed side-scan
search but no
strong contacts
Core box
searched and
eliminated —
time ran out
before it could
be widened.





April 2026 Gathering info

02 · Why it stayed lost



Contacted Antoine Nomandin

Responsible for the location of Quest,
Shackletons last vessel

03 • The find

One AUV. Three sensors. One aircraft.

HUGIN • HISAS 1032 • EM multibeam • CathX camera





The platform: HUGIN AUV

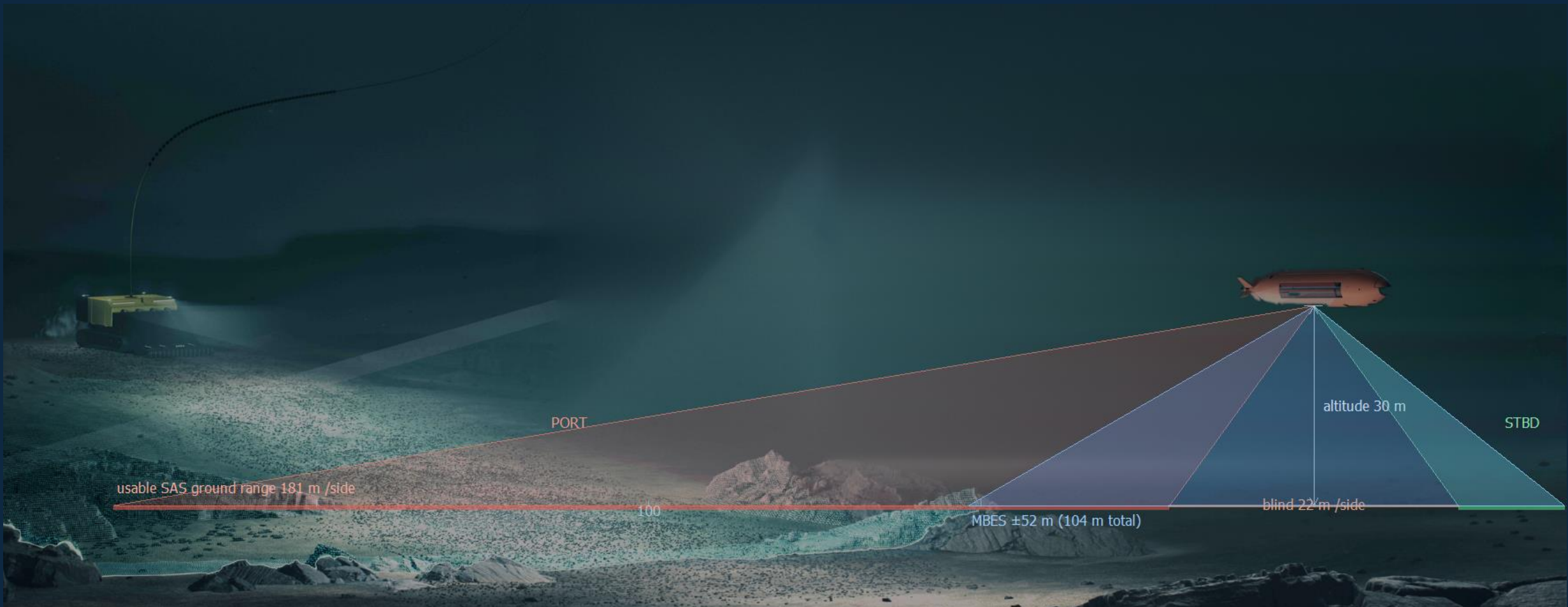
03 · The find



Payload	Role on this job
HISAS 1032	Synthetic aperture sonar — imagery plus synthetic (interferometric) bathymetry
EM 2040	Conventional multibeam — the bathymetric reference
CathX colour camera	Photogrammetry for identification and a 3D ground truth
Navigation	[INS · DVL · USBL / aiding]

Below the surface, the weather that stopped the 2024 tow no longer matters.

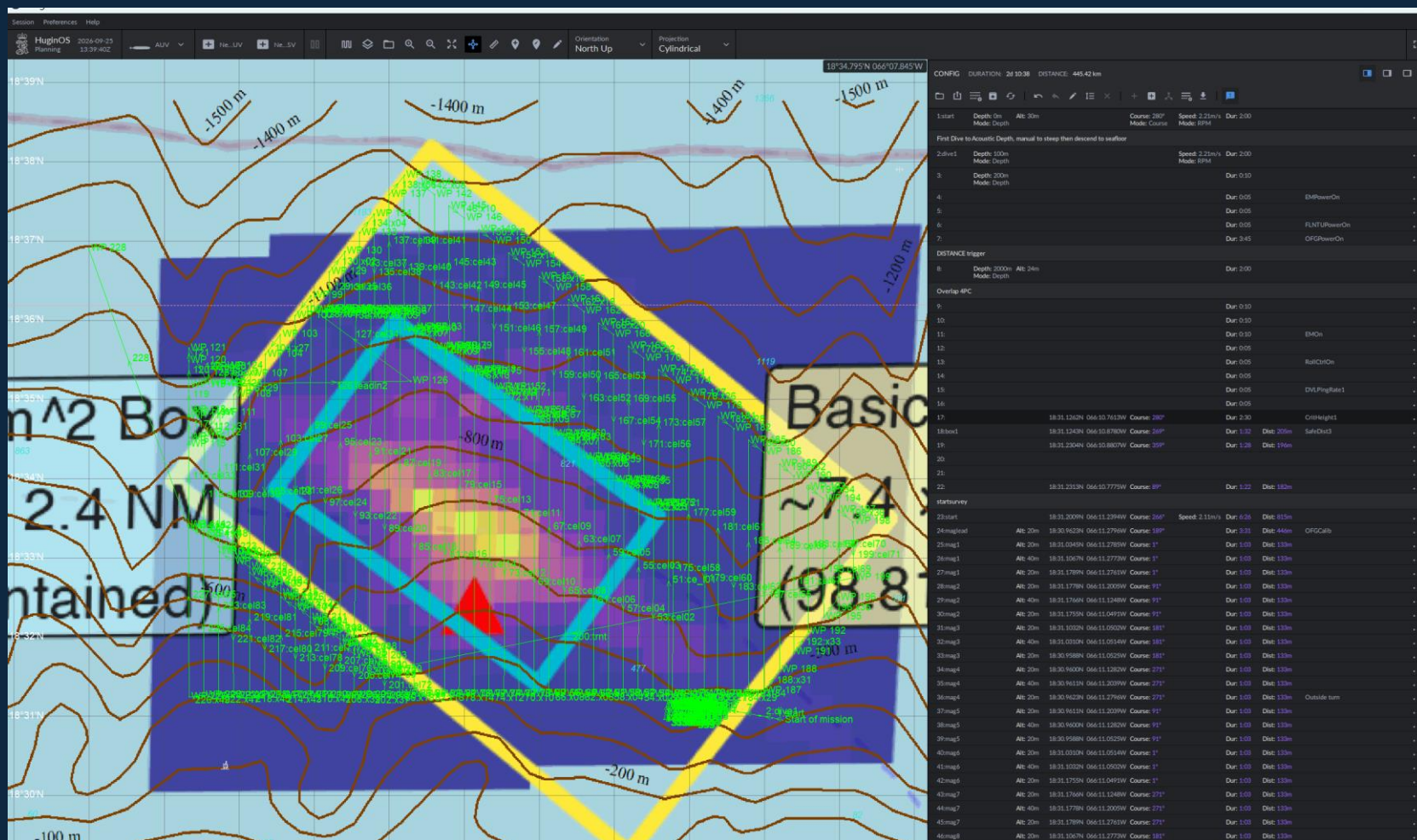
- Area Coverage Rate = $2.6\text{km}^2/\text{Hr}$, Combine SAS/EM
- SAS Imagery better than 5cm
- EM Backscatter ~





April 2026 Gathering info

02 · Why it stayed lost

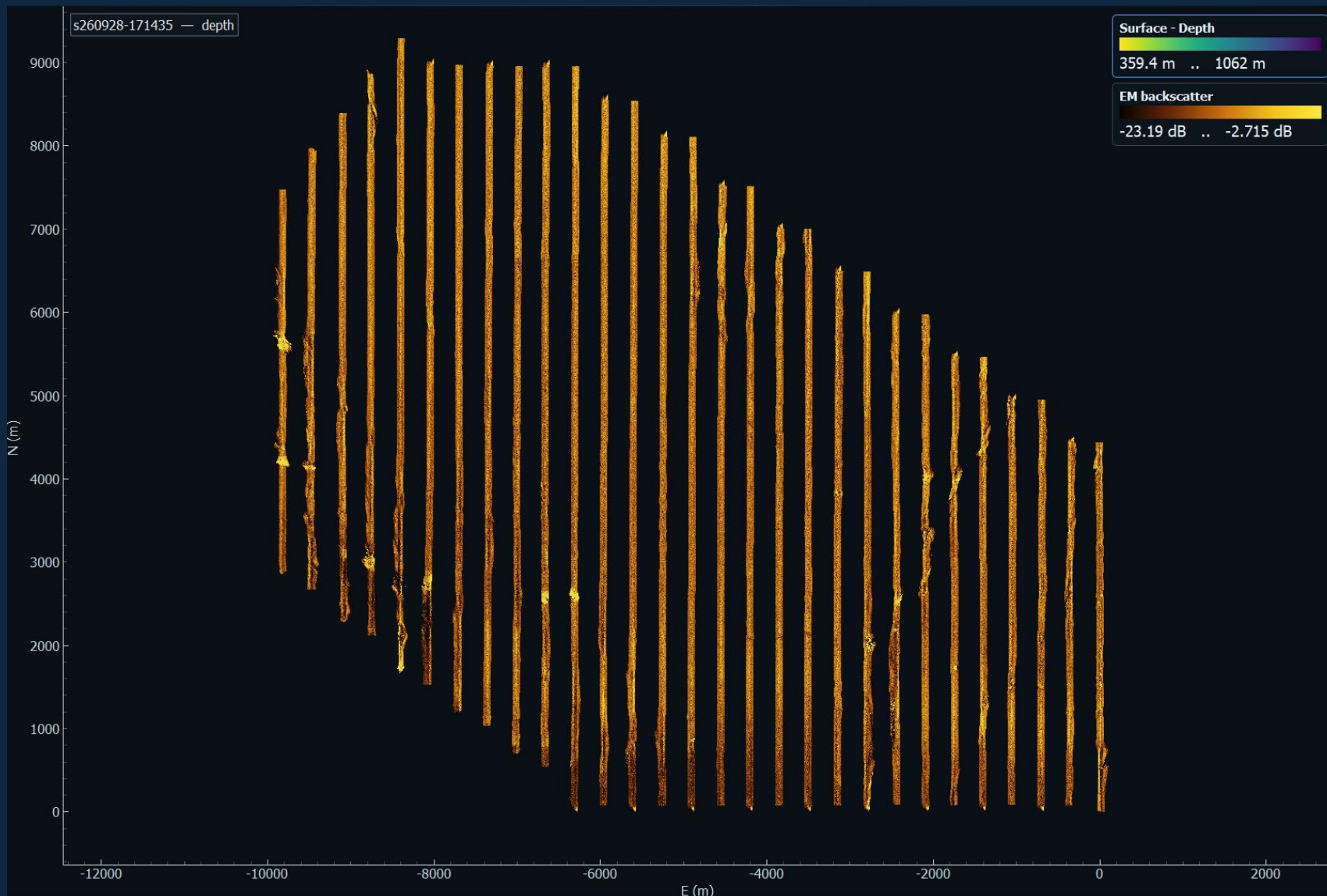


- 60 hours, single dive potential
- 0% overlap
- 360m line spacing and 180m range expected



Skipping recovery and onto review, EM2040

03 · The find

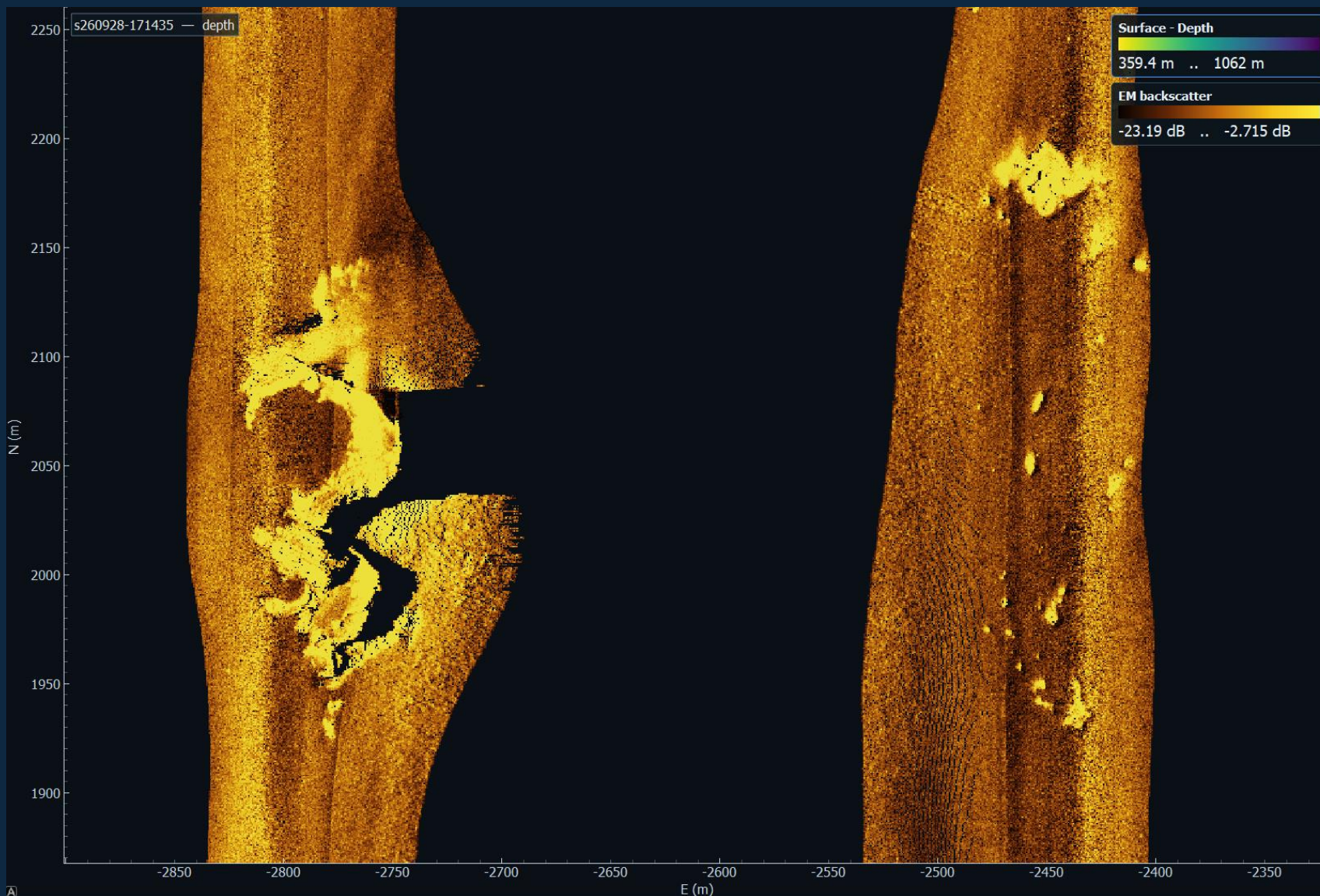


- 34 hours of data
- Resolution of around 45cm
- Watched as a streaming waterfall because we don't trust AI



Skipping recovery and onto review, EM2040

03 · The find

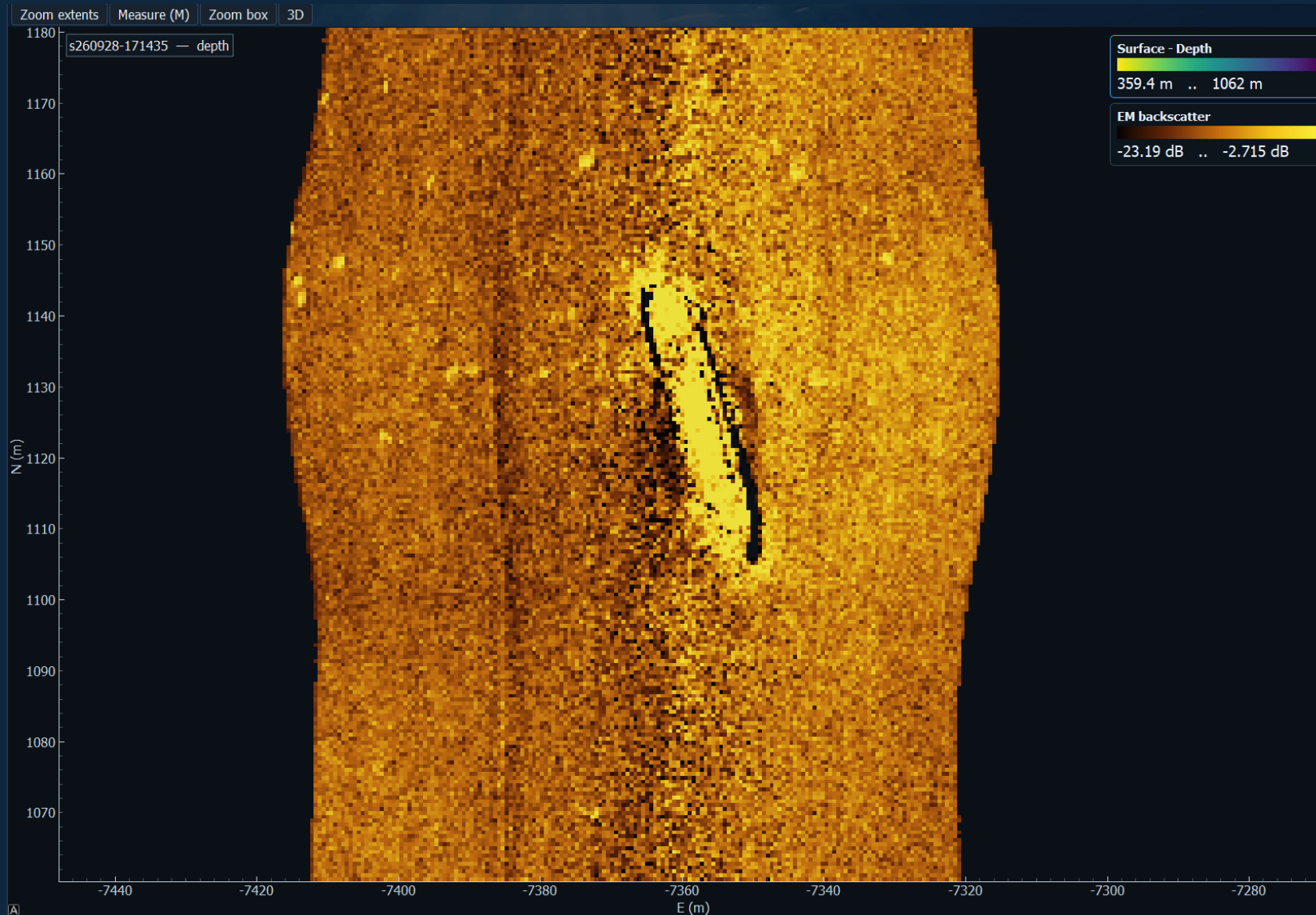


- Coverage at 34 metres altitude around 90 metres swath
- Terrain shows some shadow but generally no aircraft



Skipping recovery and onto review, EM2040

03 · The find



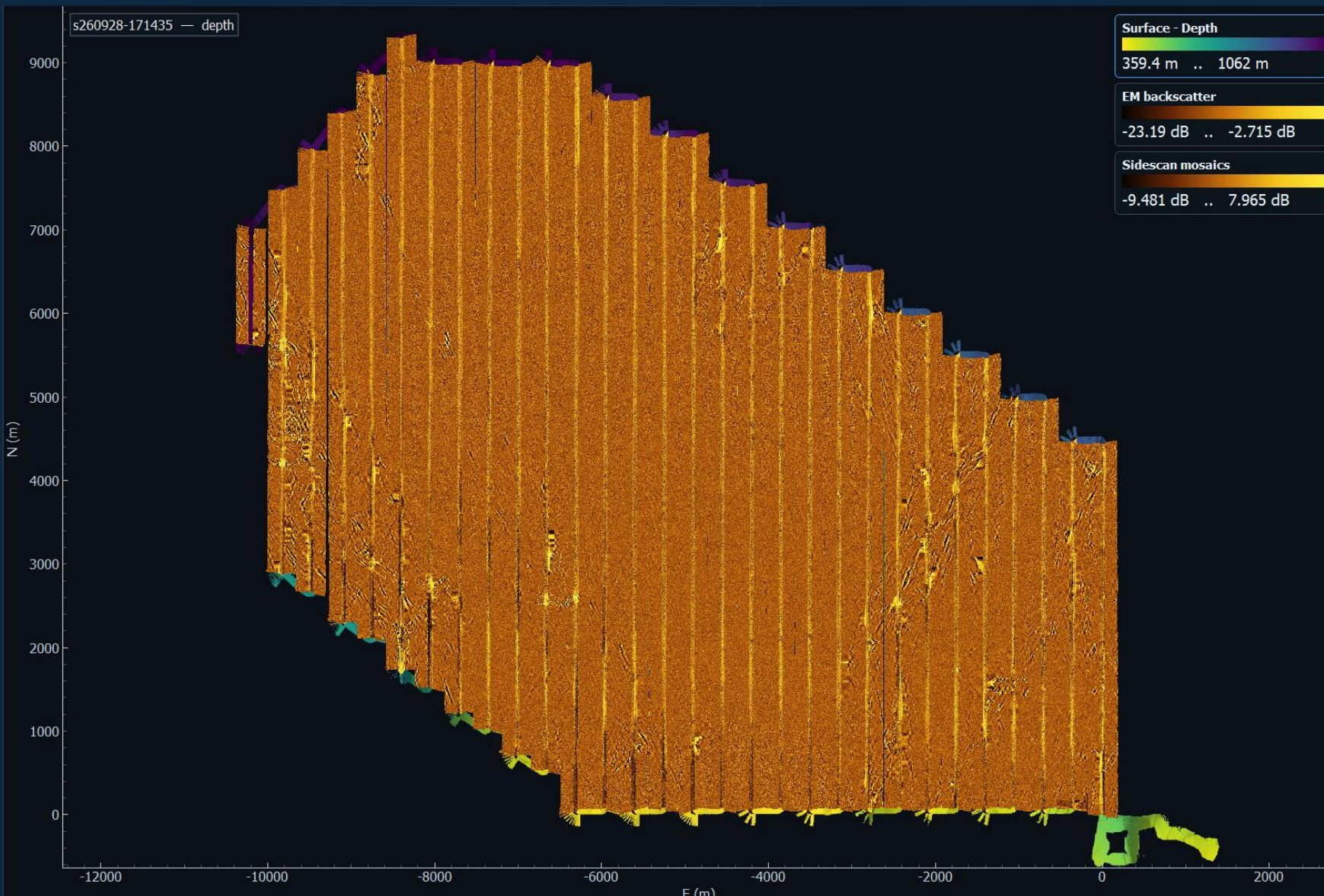
- Bermuda Triangle lost wreck
- 40 metres by 8
- Camera at 8 metres



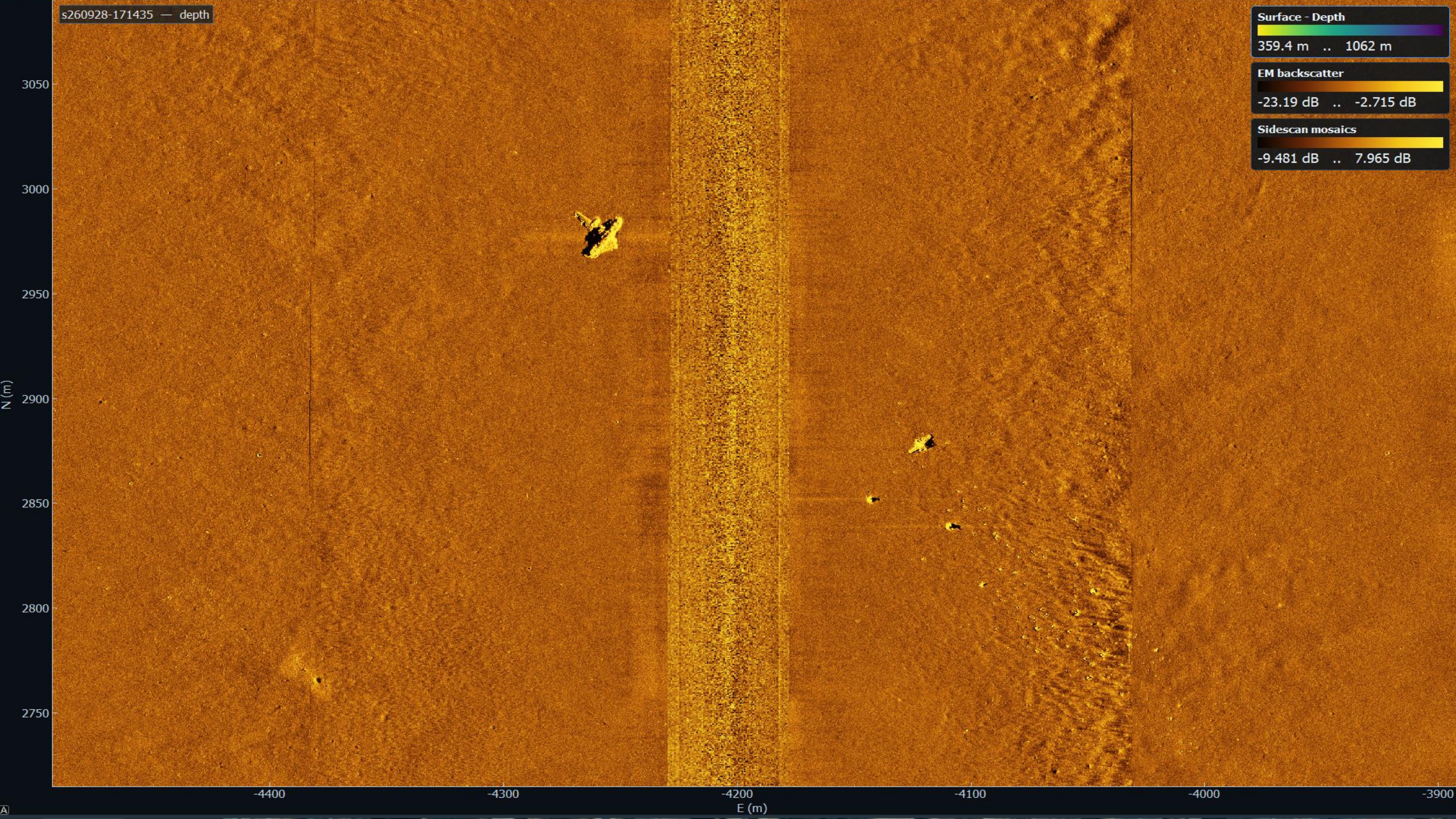


Skipping recovery and onto review HISAS

03 · The find



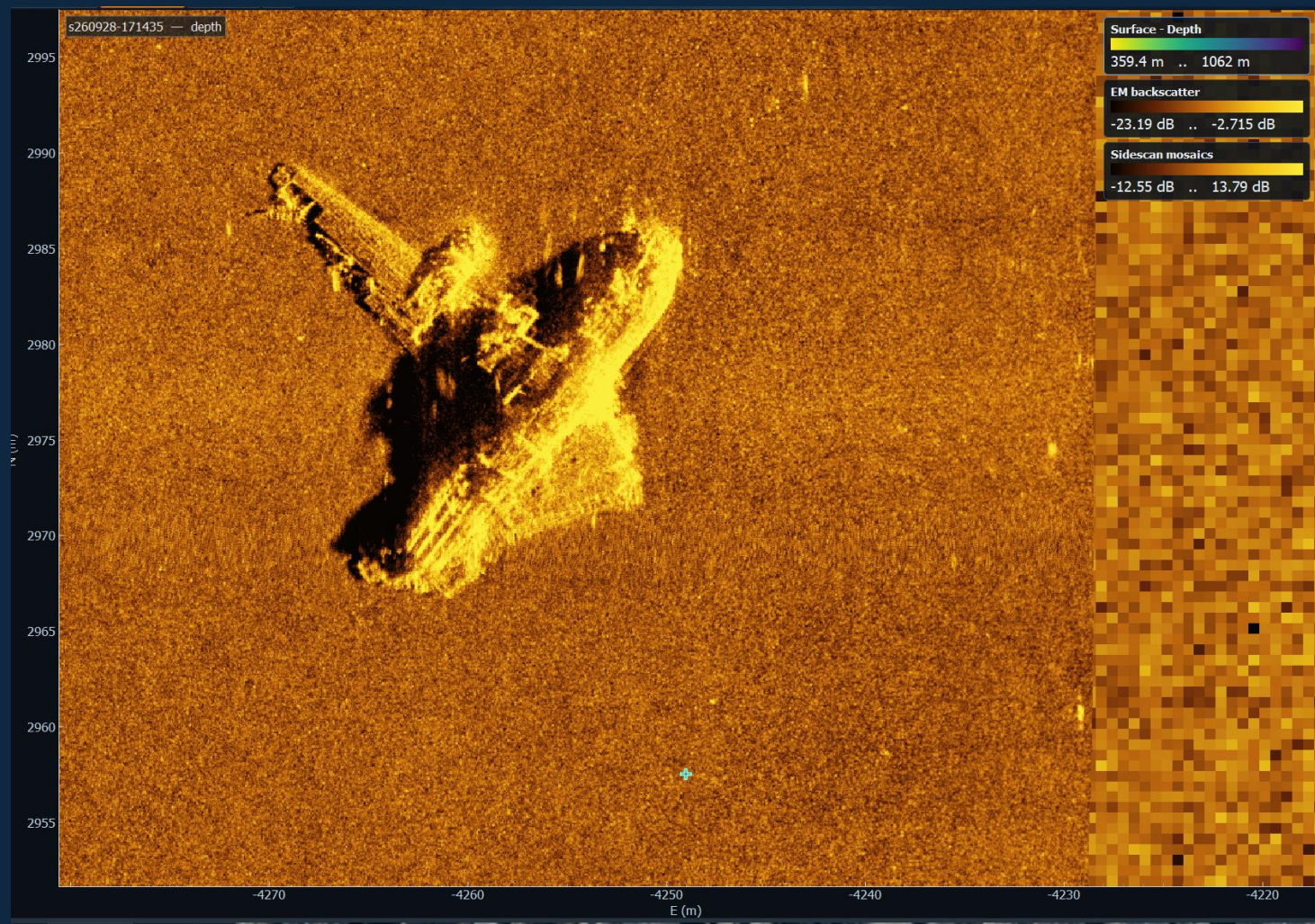
- Combined SAS and EM Backscatter mosaic
- SAS like EM viewed as a Waterfall





First look on HISAS

03 · The find



Wingspan

117.5 ft (35.8 m), Shown wing around 16

Engines

Four P&W R-2000 Twin Wasp radials one the wing leading edge

Tail

Reported missing in part

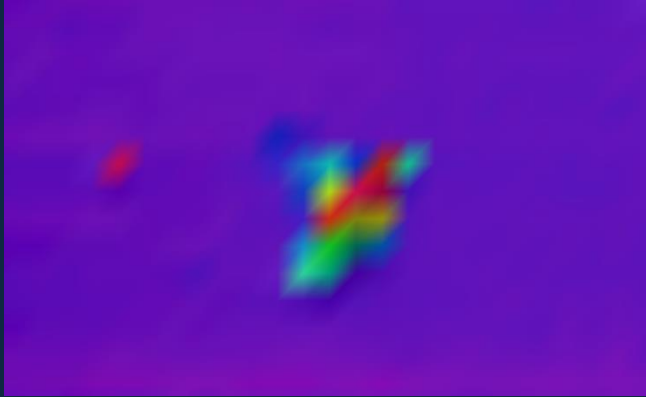
Markings

Pan Am markings / NC88899?
confirmed?



Three views of one wreck

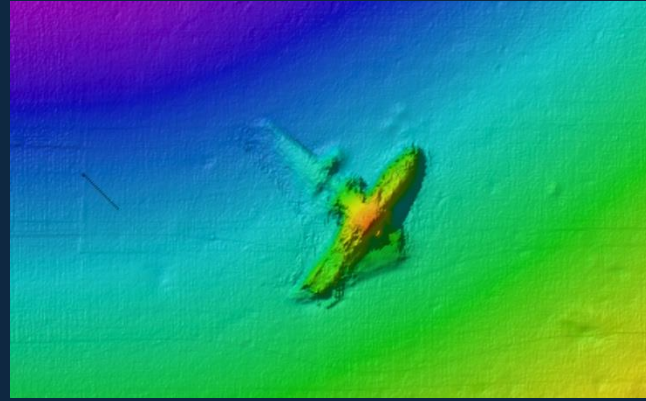
03 · The find



Sidescan bathymetry

Altitude: 35m Grid: 50-175cm · swath 360/180 m

ACR = 2.6km²/hr



AUV multibeam

Altitude: 6 Metres Grid: 10 cm · swath 30 m

ACR = 0.21km²/hr



Photogrammetry

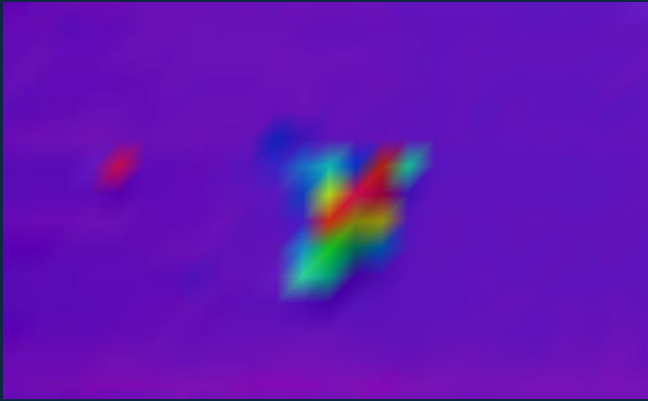
Altitude 6m Grid: 1cm · footprint 5 m

ACR = 0.0431km²/hr



Three views of one wreck

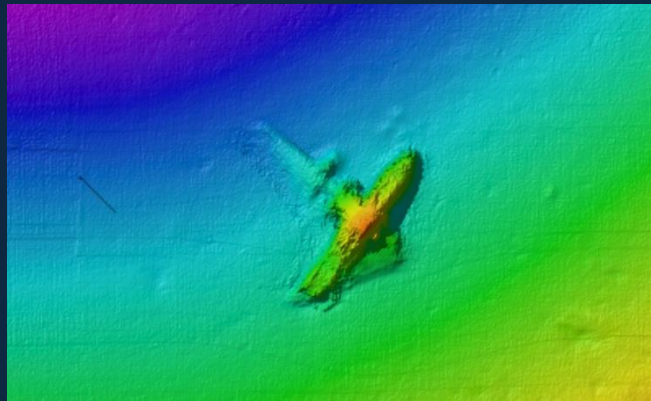
03 · The find



Sidescan bathymetry

Altitude: 35m Grid: 50-175cm · swath 360/180 m

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AUV multibeam

Altitude: 6 Metres Grid: 10 cm · swath 30 m

ACR = 0.21km²/hr



Photogrammetry

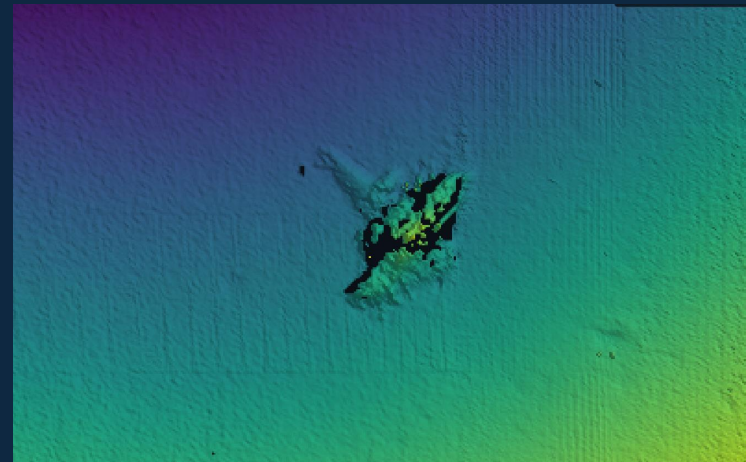
Altitude 6m Grid: 1cm · footprint 5 m

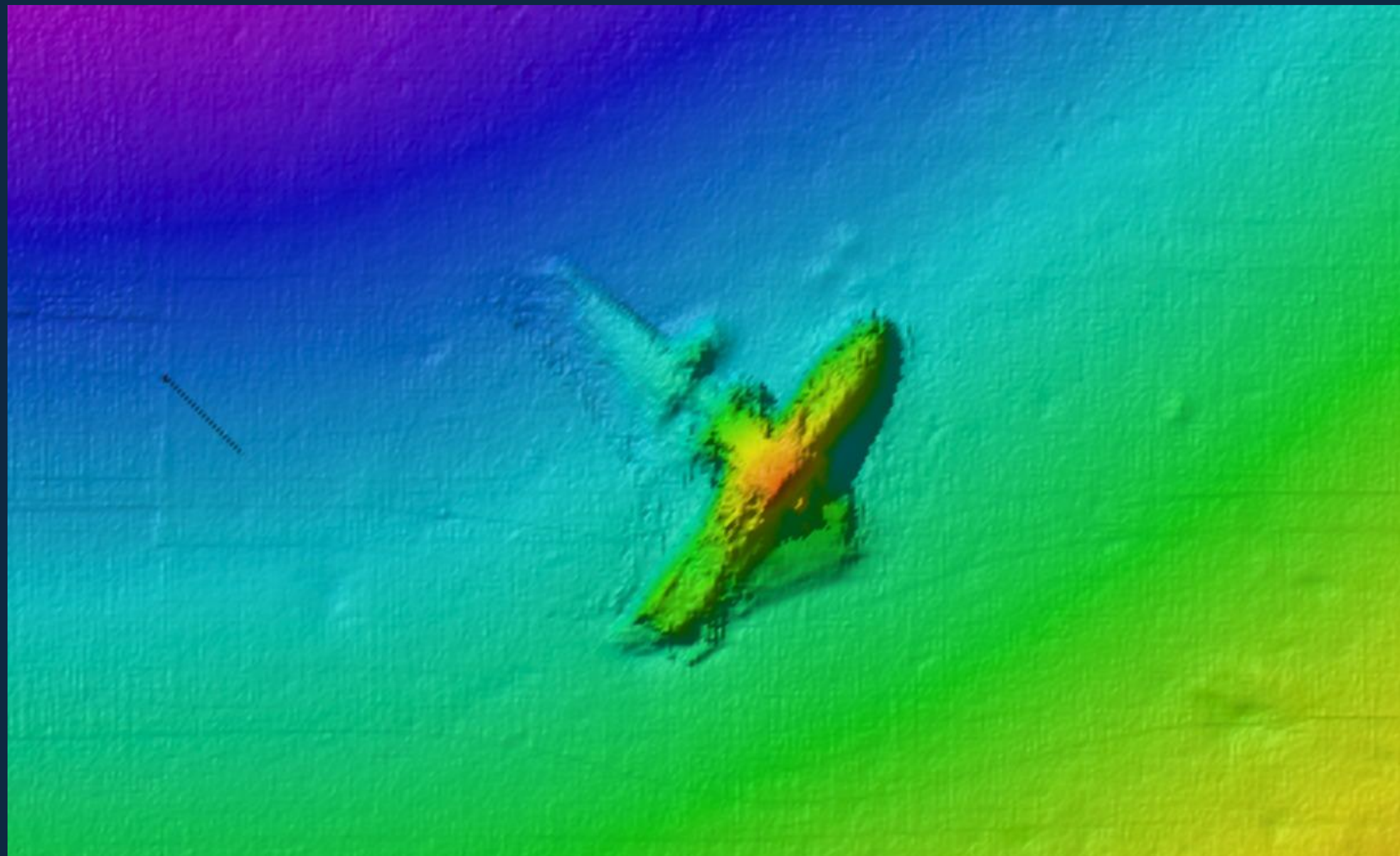
ACR = 0.0432m²/hr

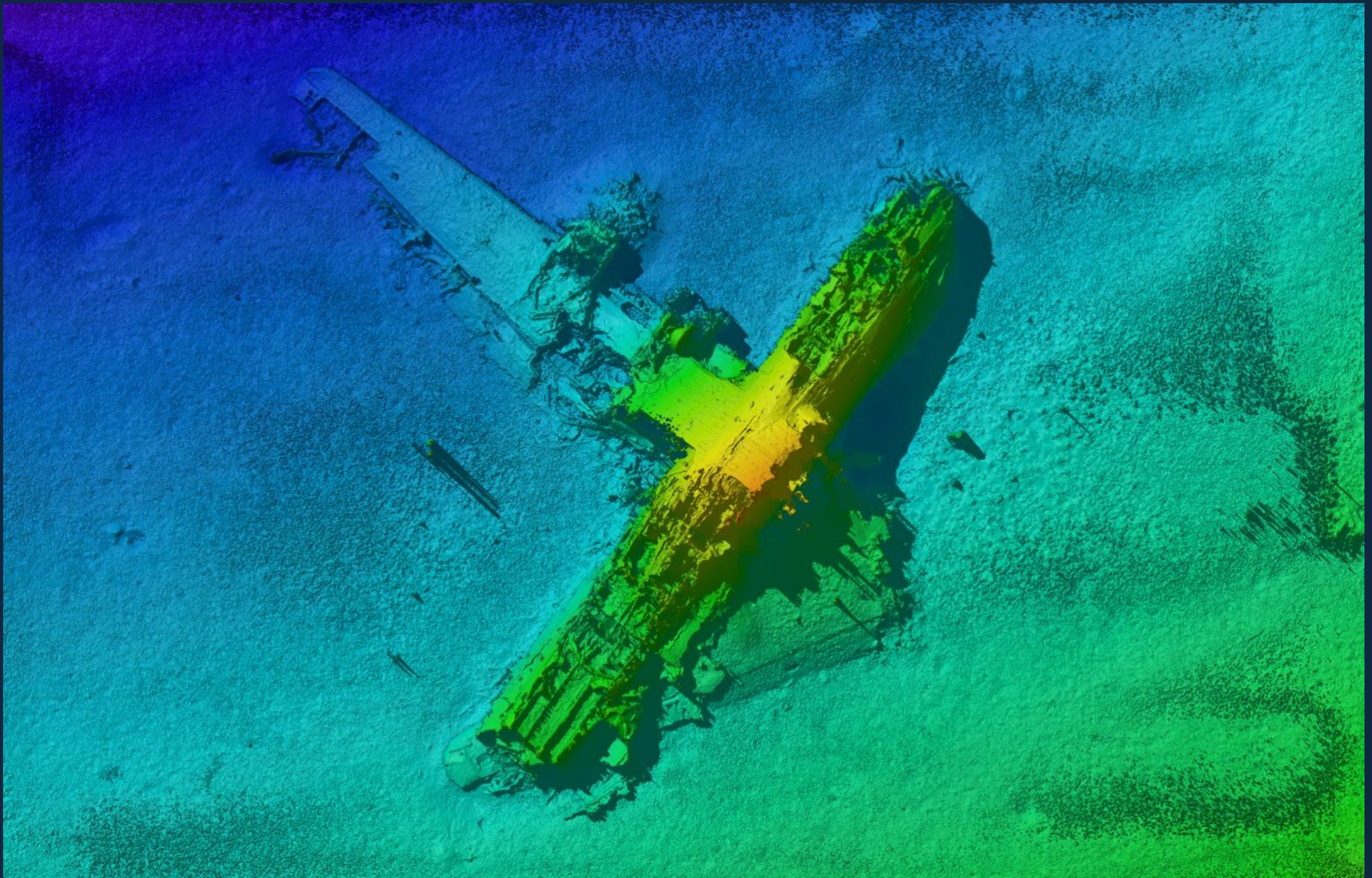
SAS bathymetry

Altitude: 35m Grid: 25cm · swath 360/180 m

ACR = 2.6km²/hr – 4km²/hr







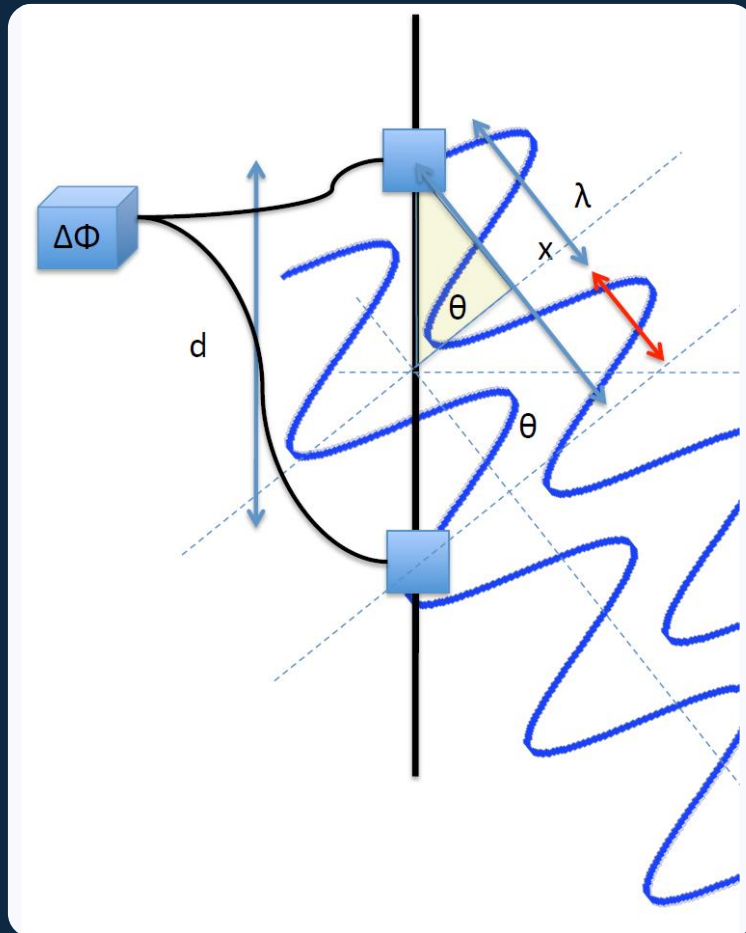
- $1/25^{\text{th}}$ of the resolution of photogrammetry
- 60 times the coverage of camera
- Better resolution than MBES and 5 times the coverage rate?
- So whats wrong?





Phase angle ambiguity

05 · Interferometry



Measured phase is $-\pi$ to π

The receivers only ever report a phase within one cycle.

When the aperture is too big...

...the path difference x can exceed a wavelength, and the measured phase wraps from π to $-\pi$ (or vice versa).

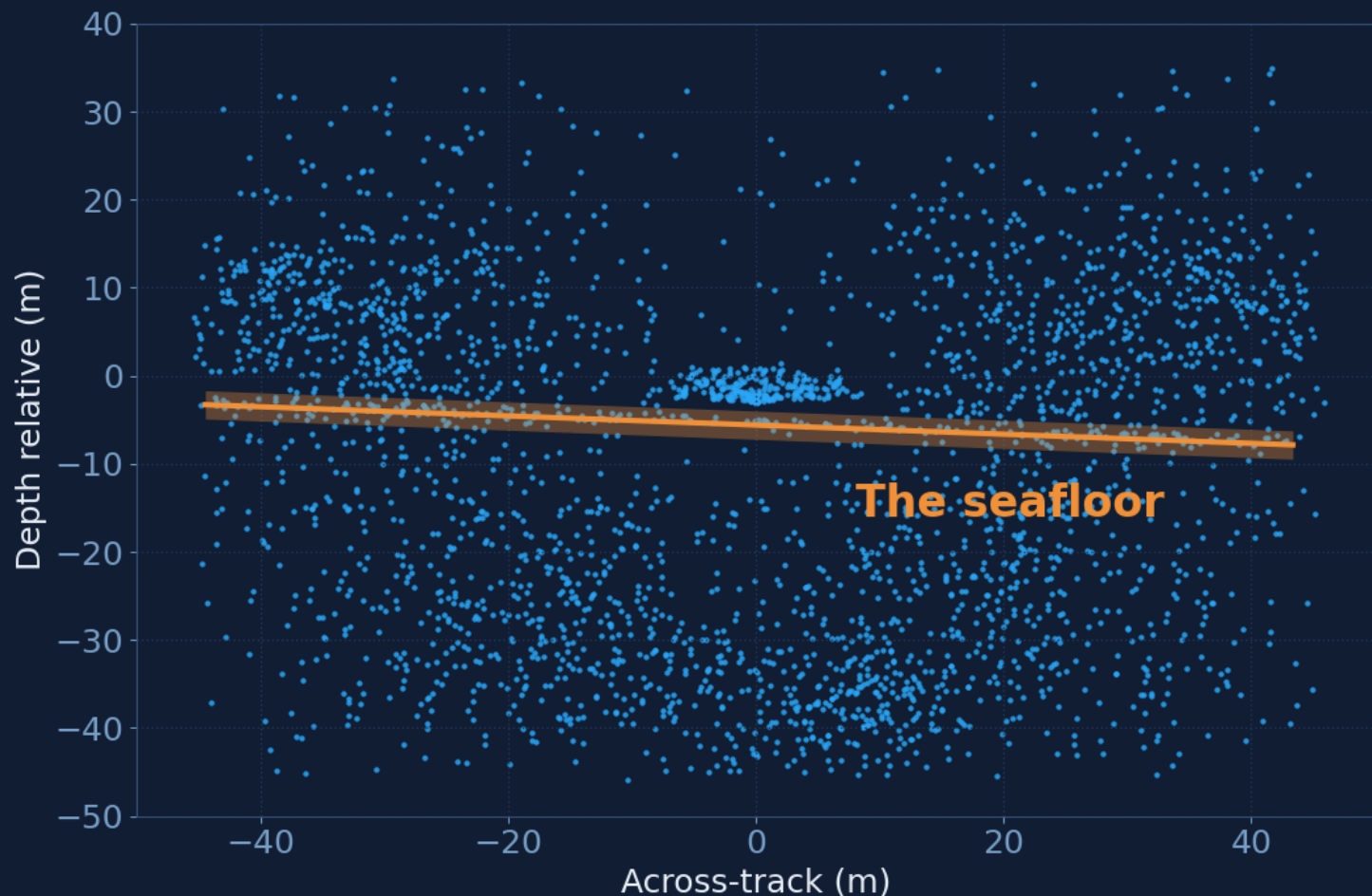
Cannot resolve the proper direction.

First phase wrap: $\theta = \text{asin}(1 / 2n)$, $n = d / \lambda$



Bottom trend sanity check

05 · Interferometry



Raw interferometric soundings
from one ping

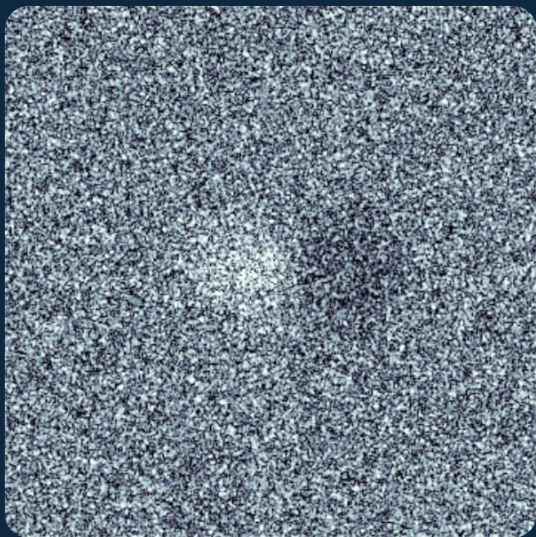
**The seafloor is in there.
Can you find it?**

It is — But needs careful tuning to
extract



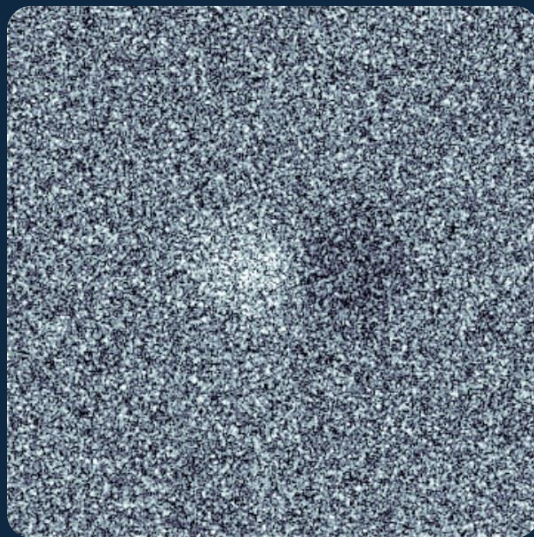
Synthetic aperture bathymetry is a difference

05 · SAS bathymetry



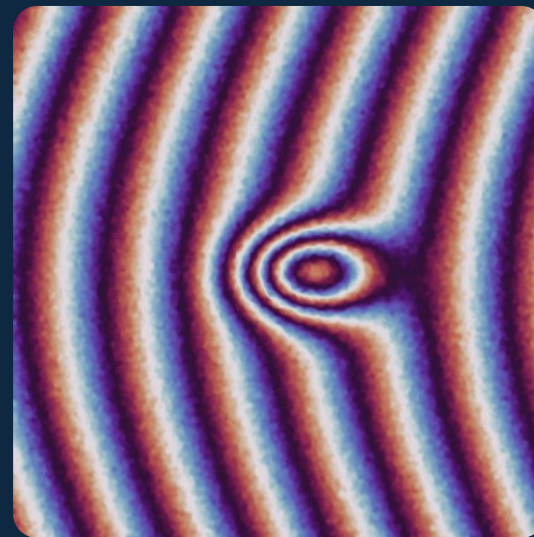
SAS image · upper array

×



SAS image · lower array
(conjugate)

=



Phase difference $\Delta\phi$

The two images look identical. The bathymetry is in the phase variation **between** them — not in the signal itself.



The HISAS bathy processing chain

05 · SAS bathymetry

01

Raw HISAS

Pings, both arrays

02

Navigation

INS + micronav

03

Inerferrometry

Sidescan Seafloor

04

Image formation

SAS focusing

05

Interferometry

Phase → angle →
depth

06

.all file generation

Compare with MBES

What's Missing?

Calibrations

Solved with Flat Earth

Depth, large variations

Managed with Flat Earth

Motion Tolerance

Managed with Planning

Industry Trust and Skill set

Commercially Delivered



The HISAS bathy processing chain

05 · SAS bathymetry

01

Raw I

Pings

02

03

04

05

06

tion

BES

What is missing?

Reliability

Not on collection or physics but the actual
processing

Industry Trust and Skill set



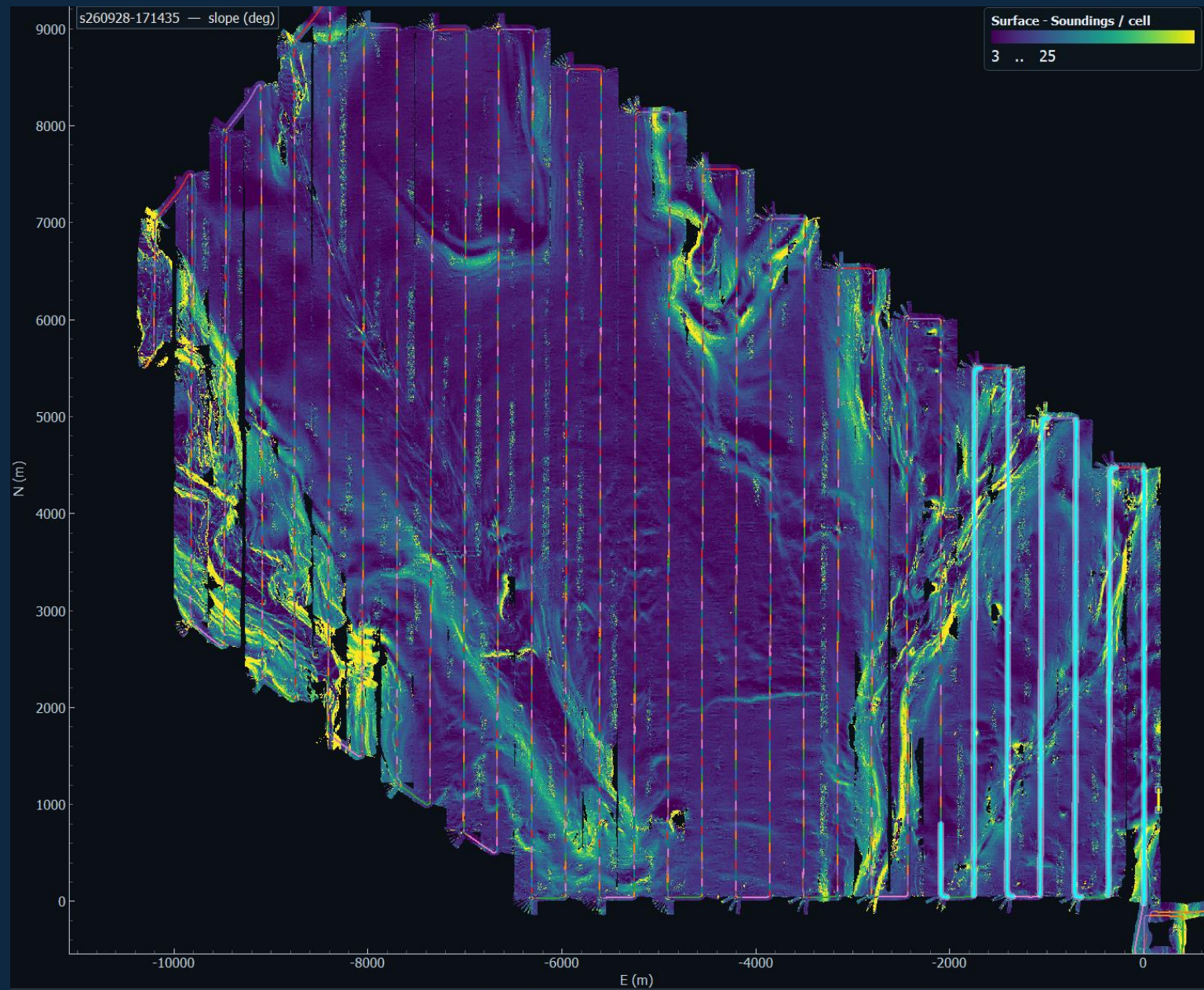
Commerically Delivered



Flat Earth

06 · Moving the industry

- Before bathy, note its not flat, average slope 7 peaking at 25+

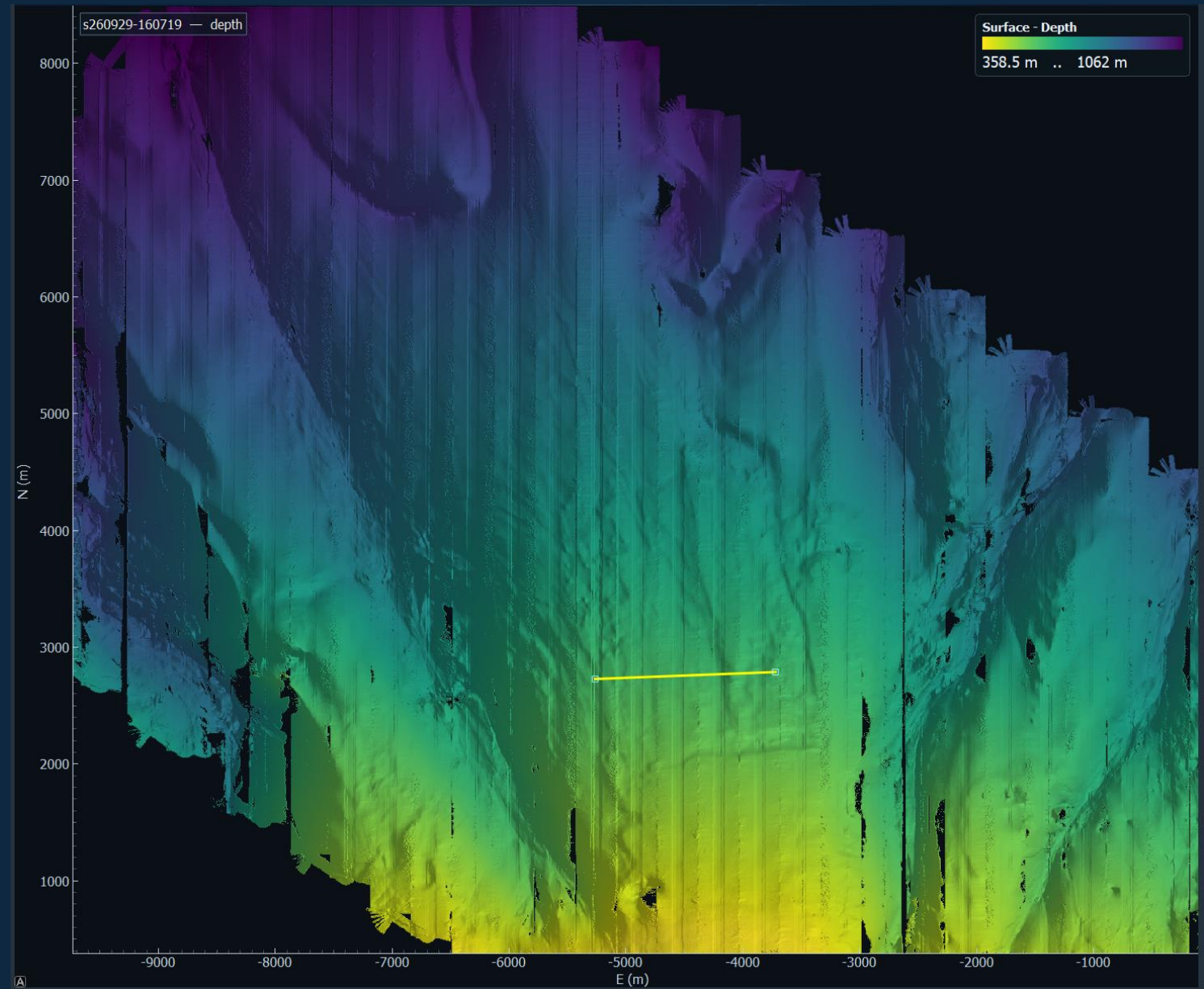




Flat Earth

06 · Moving the industry

- What you get out of the box?





DEEP SEA VISION
An EcoMinerals company

Add files...Add HUGIN mission...

Set NavLab...navlab_smooth_temp.bin

SVP tool...HISAP_ASPV.asvp

Tide tool...offsets: none

filter: e.g. cel26 or *trn*,*test*

FileNavSVPTide

✓ EM2040 (74)

✓ HISAS port bathy (3199)

✓ HISAS stbd bathy (3219)

■ HISAS sidescan [working set...]

LayersAllIonImage / GeoTIFFExport GeoTIFF

intensity

intensity (EM)

intensity (HISAS)

coherence (HISAS)

slope (deg)

hillshade

▶ s260929-095828 view

▼ s260929-100522 view

depth

std dev

count

Log

filter log ...

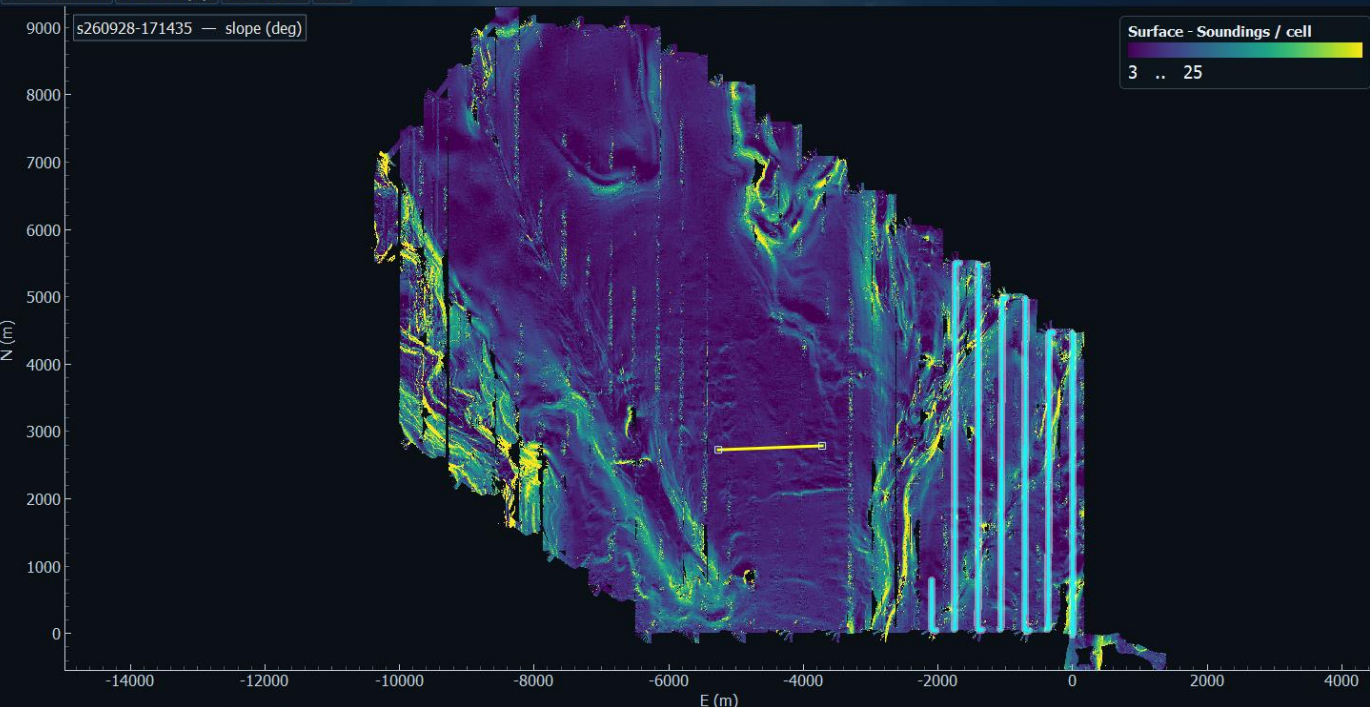
Copy

the UI thread | TIP: thousands of small files
- run Project + Pack caches for a large speed-up
14:01:20 z-track cleared - all views revert immediately.

Zoom extentsMeasure (M)Zoom box3D

s260928-171435 — slope (deg)

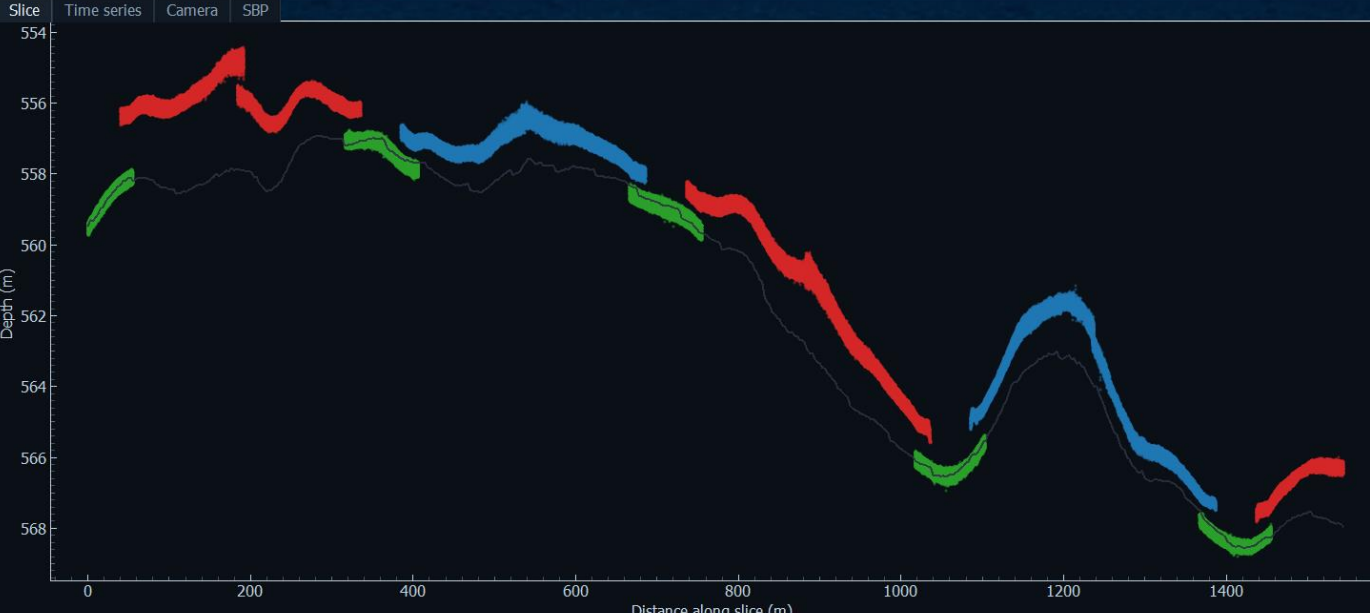
Surface - Soundings / cell
3 .. 25



N (m)

E (m)

SliceTime seriesCameraSBP



Depth (m)

Distance along slice (m)

HUGIN mission

Mission...MM17_D1_20260601_1 (not connected)

NavLab: (none)

Alt...Auto

BathymetryBackscatterSidescanCameraMagnetometerSub E

Build surfaceFileClearview only

3D points

sun az 315° alt 45°

Contours 5.00 m smooth 0.00 m

VE 3.00 layer slope (deg) cmap viridis

depth 3.0 .. 25.0 Auto

✓ Show track lines

filters (range gates + despike)

channel	min range (m)	max range (m)
port	0.0	2000.0
stbd	0.0	2000.0
em2040	0.0	2000.0

☐ surface despike: reject > k x MAD from 3.00 win 5.00 m

fill holes ≤ 0.25 m smooth 0.00 m ✓ noisy only

Slice corridor

Place slice (click 2 points on map)

Width (m) 5.00

colour by channel

☐ Preview SVP recast on slice (EM2040)

Lasso rejectFinishClear manualmanual: none

▶ Lever arms (m, re reference point)

▶ Rotations (tilt / baseline / Δc / dZ)

▶ port

▶ stbd

▶ em2040

Reset bathymetry params

▶ Intensity normalisation

▶ Along-track / analysis (run after calibration)

Analyse alignment (HISAS vs EM2040)

☐ tie to vehicle depth

Along-track Z (time base)ref: EM2040 (HISAS matches it)

HISAS flap slow (0) outer>0.40 6.00 m ext

referee: HISAS + EM2040view only (test)

▶ AT QC (local model)

z-track cleared - all views revert immediately. 18:32.3197N 66:13.6056W | 18.538661, -66.226761 | E -4,095.7 N 1,960.2 m | slope 4.39



Add files...

Add HUGIN mission...

Set NavLab... navlab_smooth_temp.bin

SVP tool... HISAP_ASVP.asvp

Tide tool... offsets: none | z-track: 4571 file(s) | flap: 6418

filter: e.g. cel26 or *trn*,*test*

Tick

Untick

File Nav SVP Tide

✓ EM2040 (74)

✓ HISAS port bathy (3199)

✓ HISAS stbd bathy (3219)

HISAS sidescan [working set...]

Layers All Ion J image / GeoTIF Export GeoTIF

intensity
intensity (EM)
intensity (HISAS)
coherence (HISAS)
slope (deg)
hillshade

s260929-095828 view

s260929-100522 view

depth
std dev
count

Log

filter log ...

Copy

13:54:32 Click first slice endpoint on the map
...
13:54:55 Click second slice endpoint ...
13:54:56 Slice placed - drag endpoints to adjust.

Zoom extents Measure (M) Zoom box 3D

s260928-171435 — slope (deg)

N (m)

9000
8000
7000
6000
5000
4000
3000
2000
1000
0

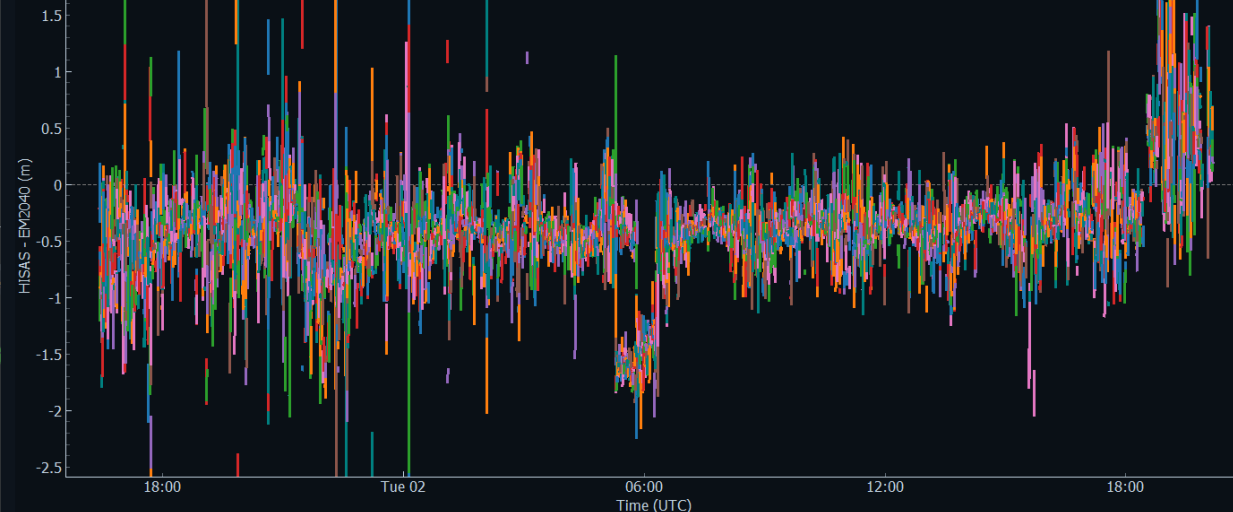
Slice

Time series Camera SBP

Depth (m)

558
560
562
564
566
568

Distance along slice (m)



Y range (m) -2.39 .. 1.70 Fit Y to curves (raw dots hidden: 4574 files - shown when ≤ 8)

dots = raw co-located residuals | solid = binned $\Delta Z(t)$ to correct | dashed = correction already applied (shown as the residual it removed)

sasb-P-20260601-162442-leadin-b6881d
sasb-P-20260601-162453-leadin-2c6a77
sasb-P-20260601-162503-ce_l01-40dba9
sasb-P-20260601-162553-ce_l01-94092f
sasb-P-20260601-162644-ce_l01-db71e9
sasb-P-20260601-162734-ce_l01-7f9c96

only 1 usable time bin(s)
only 1 usable time bin(s)
3 bins, range 37 cm
2 bins, range 10 cm
no overlap with EM reference
no overlap with EM reference

Apply to 4574 file(s)

Clear all z-track

Close

Lasso reject Finish Clear manual manual: none

Lever arms (m, re reference point)

Rotations (tilt / baseline / Δc / ΔZ)

port

stbd

em2040

tilt (deg) -0.135

 Δc (m/s) -0.5 ΔZ (m) 0.00

pitch (deg) 0.000

yaw (deg) 0.000

Reset bathymetry params

Intensity normalisation

Along-track / analysis (run after calibration)

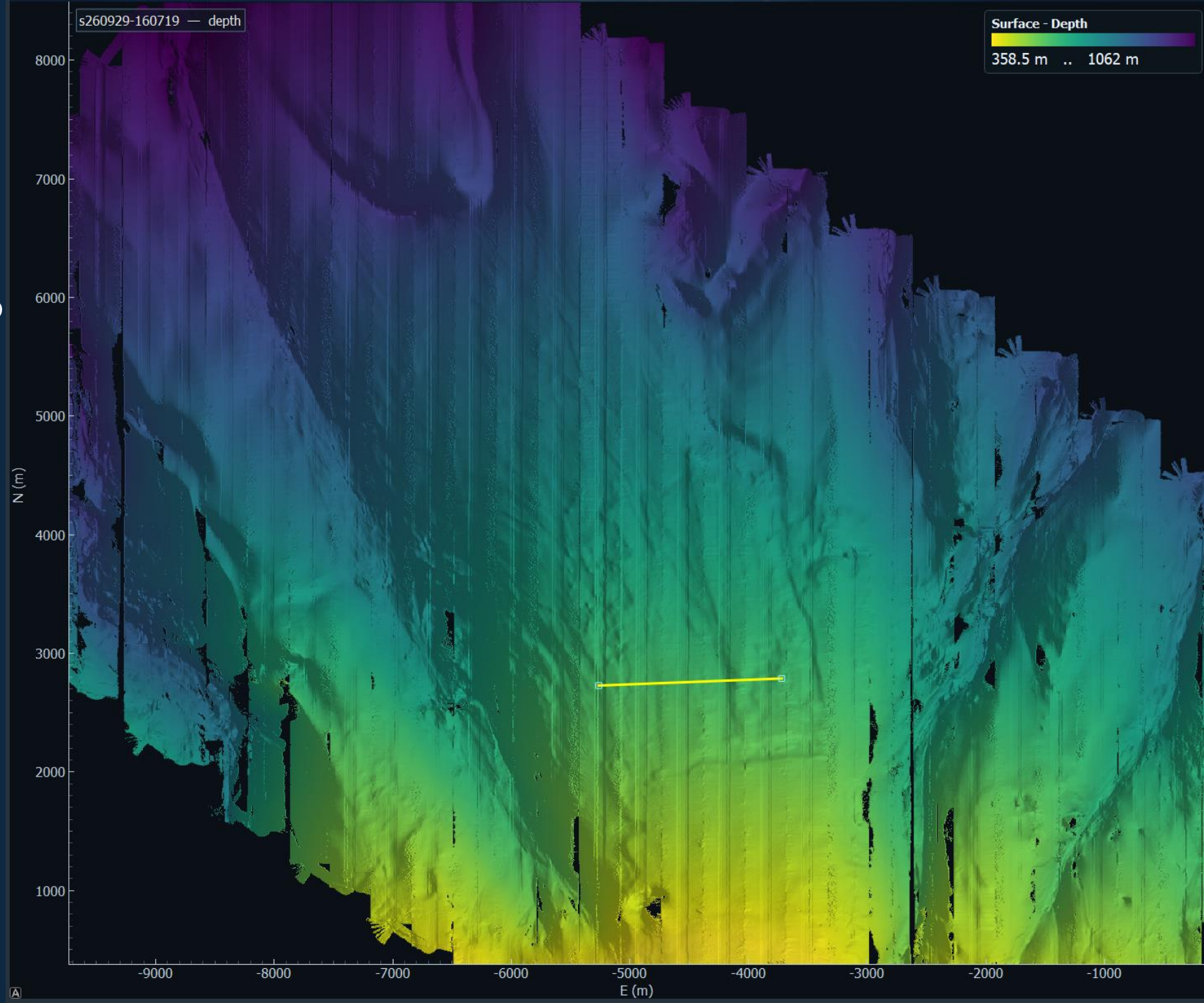
AI QC (local model)



Flat Earth

06 · Moving the industry

- What you get out of the box?

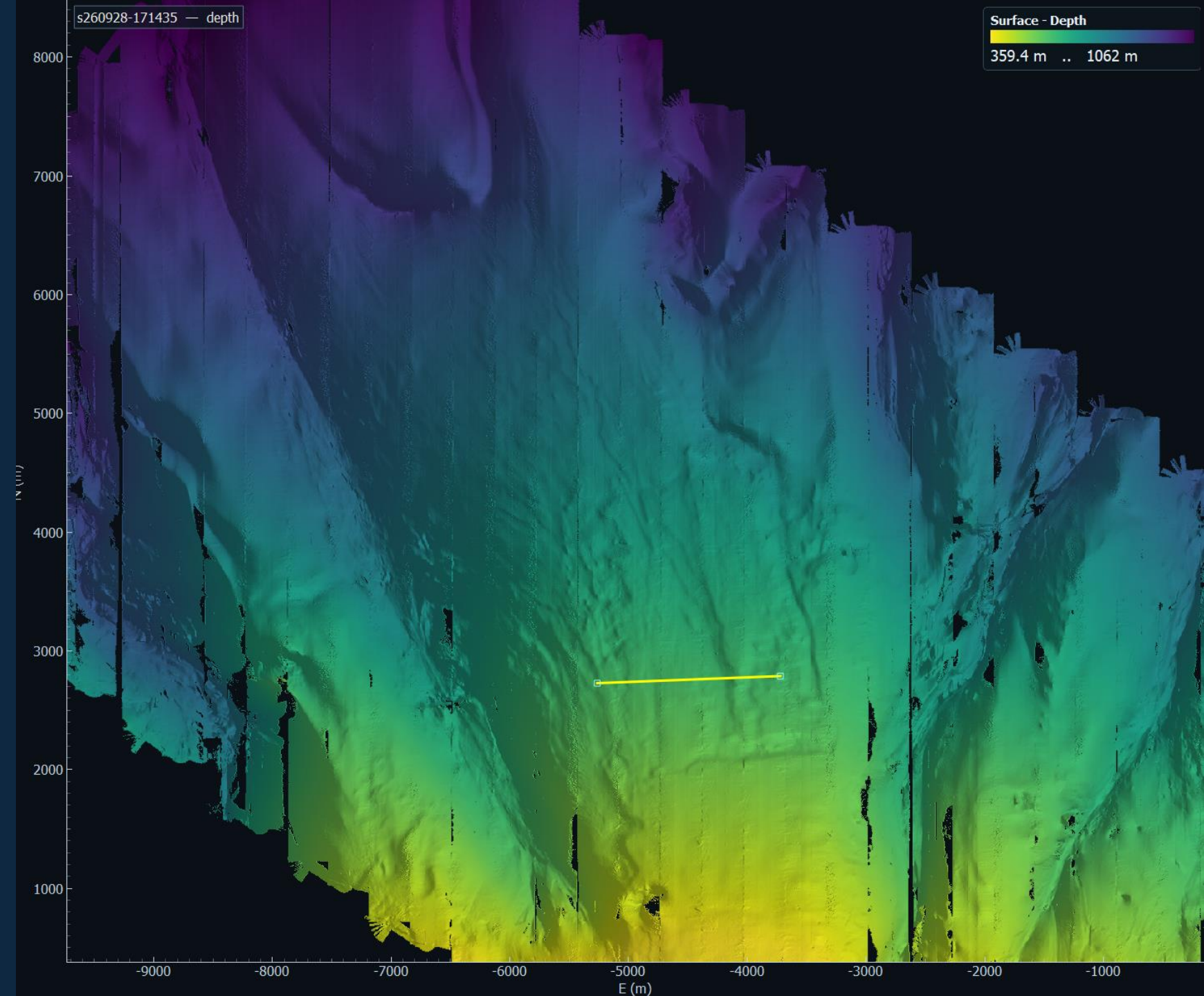




Flat Earth

06 · Moving the industry

- And fixed?

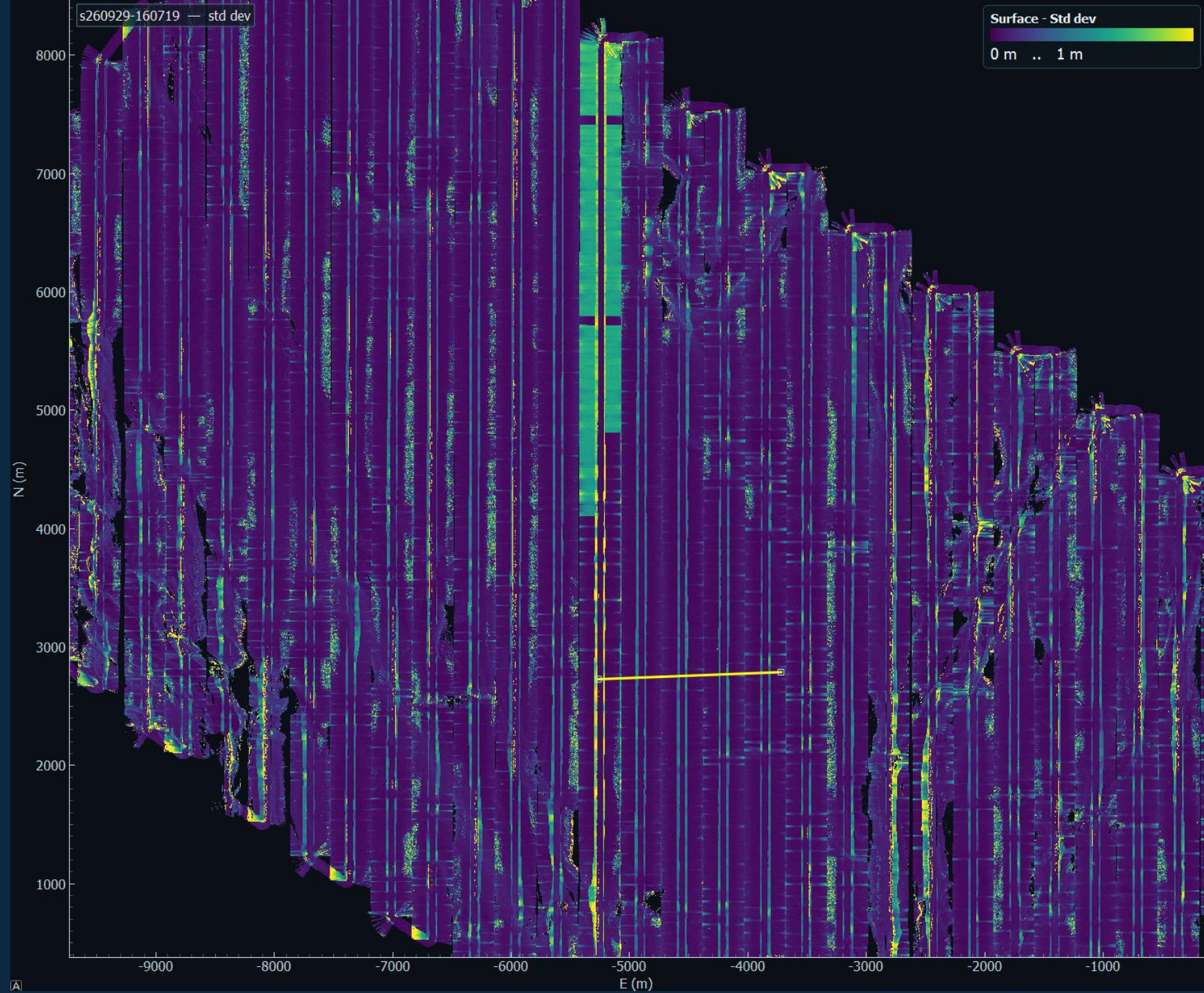




Flat Earth

06 · Moving the industry

- Std Dev of the original surface
- Scale 0 – 1 metres

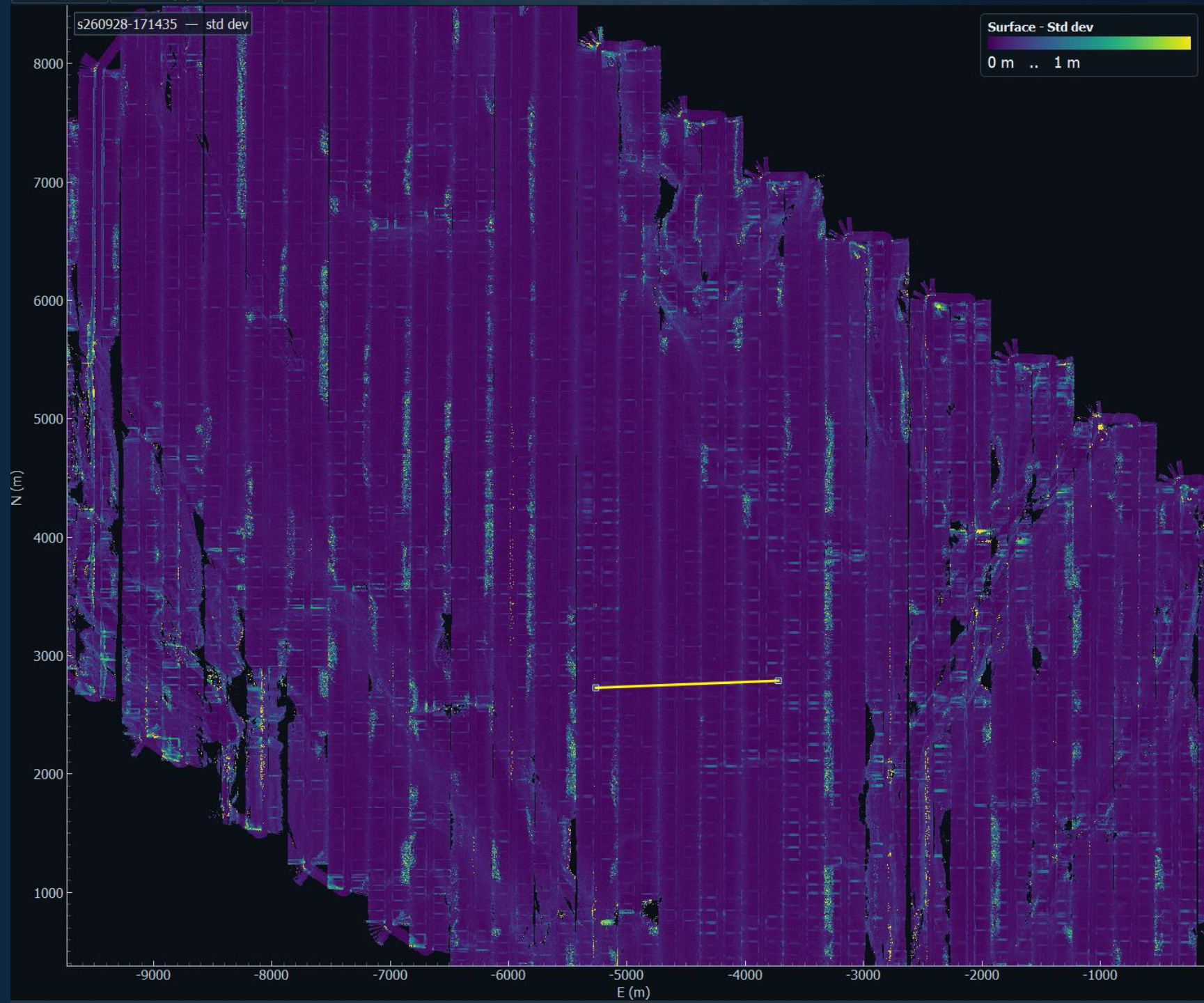




Flat Earth

06 · Moving the industry

- Std Dev of the surface
- Scale 0- 1 metres

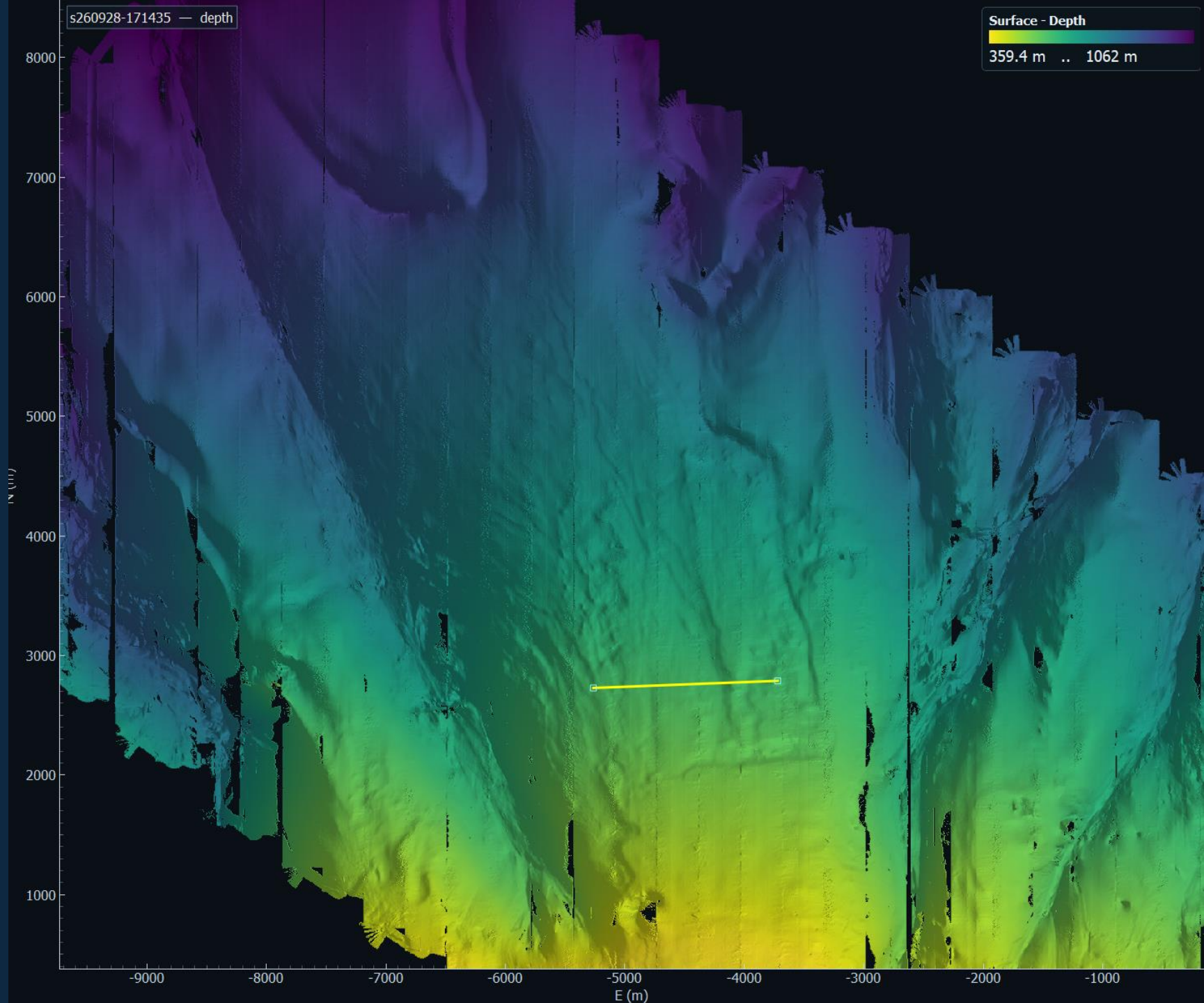




Flat Earth

06 · Moving the industry

- It is not an EM710 or anything else
- This has its own place
- Pipelines, Cable routes
- General Survey

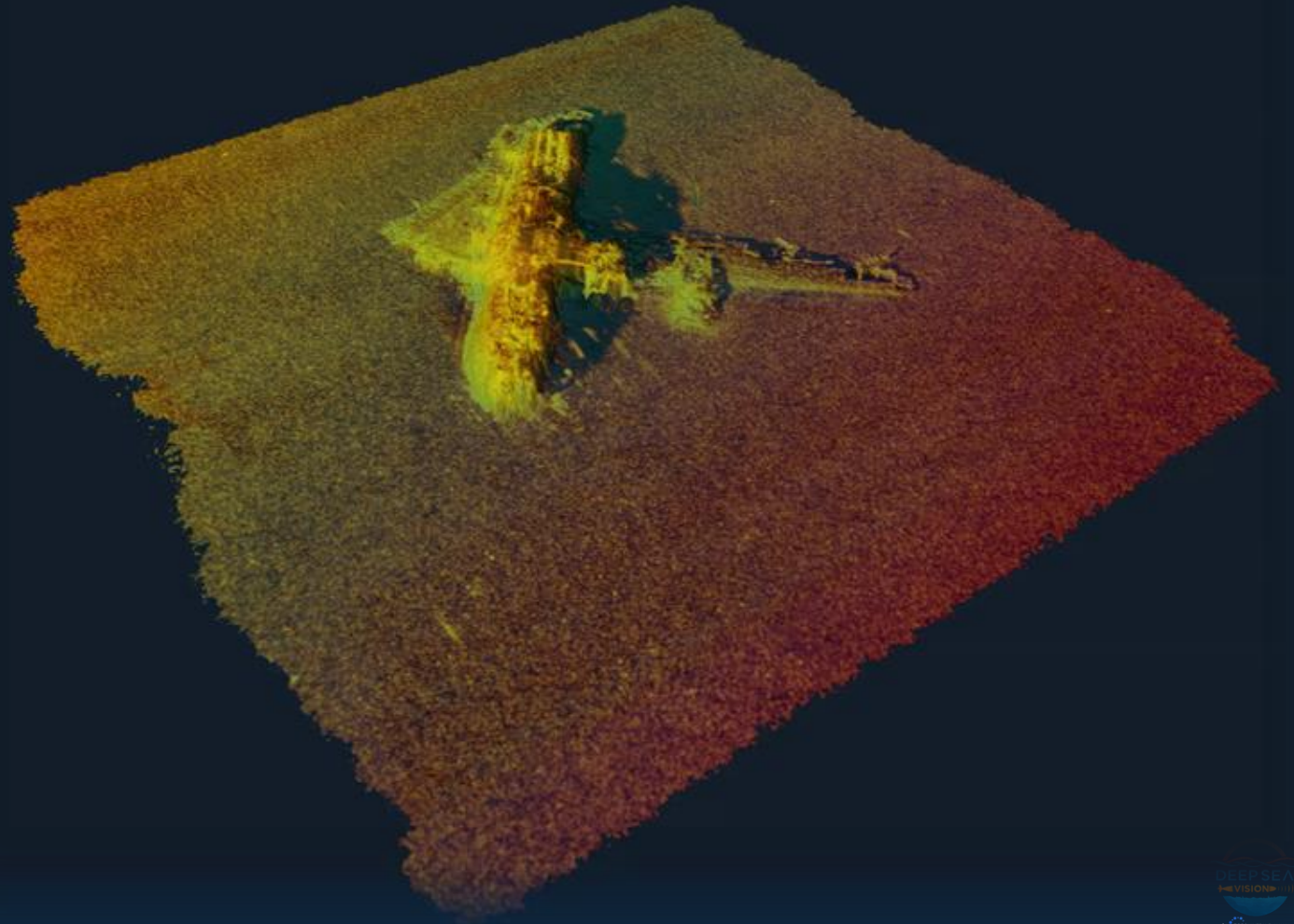




Flat Earth

06 · Moving the industry

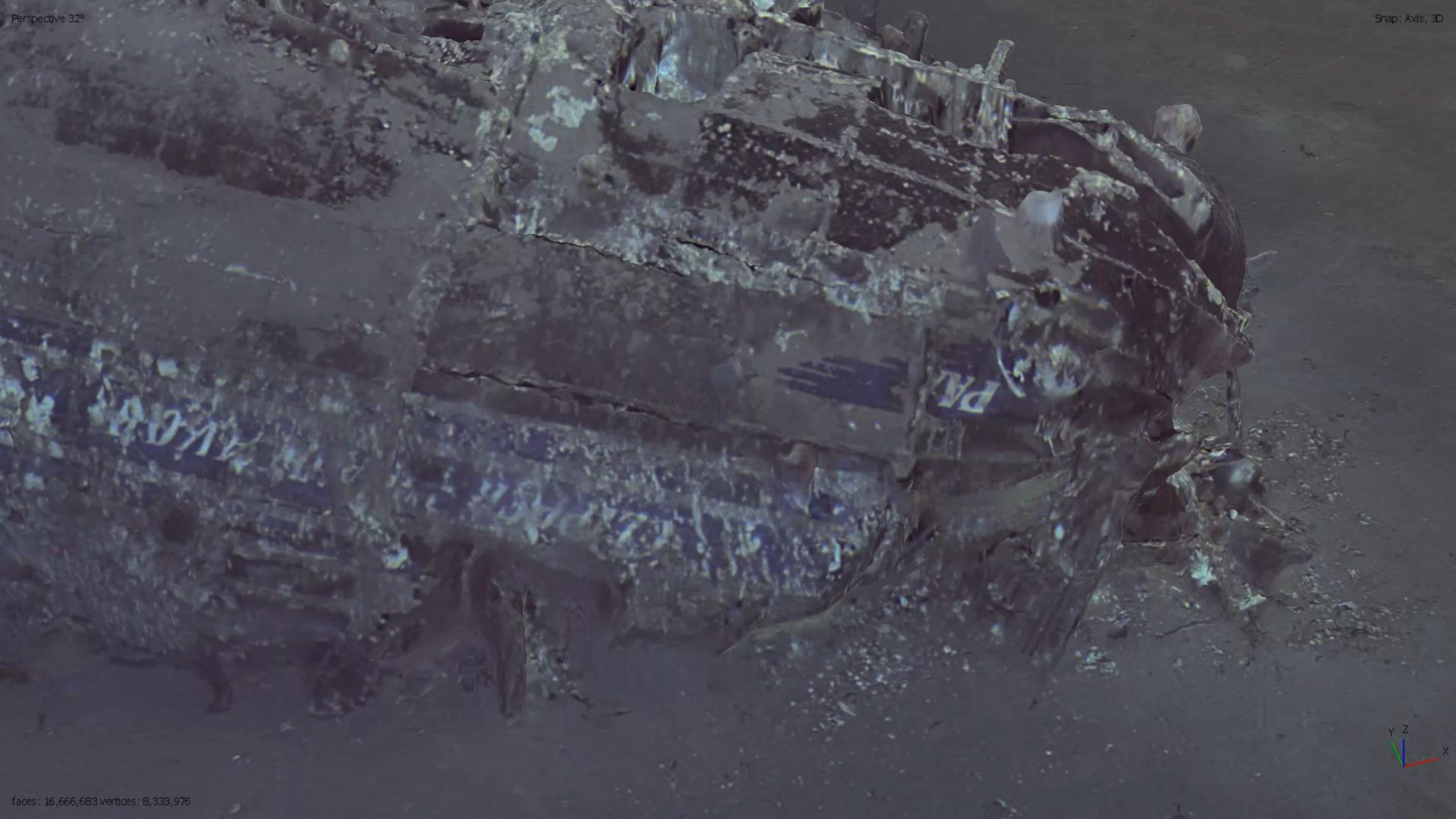
- As good as SAS is, it does not confirm the wreck, for that we need optical





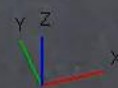
An **ECO** MINERALS company

cathx-0003-c1-0001-05
Date:20260603 Time:064425.20
Lat: 18.547905 Lon: -66.228392
D:574.81 A:6.30 H:105.54



Perspective 32°

Snap: Axis, 3D



faces: 16,666,683 vertices: 8,333,976





A ritual born off San Juan

04 · The legacy

“In the unlikely event of a water landing...”

The Civil Aeronautics Board report (26 September 1952) found inadequate maintenance as probable cause — and directed that carriers brief passengers on life vests, exits and rafts.

Every pre-flight safety briefing traces back to this flight.



A line from San Juan to the Hudson

04 · The legacy

1952

Clipper Endeavor

Passengers don't know where vests or exits are. 52 lost.



1952

CAB recommendation

Oral briefings on vests, exits and rafts.



1953 through to 1960

Regulatory milestones evolved citing 526A



2009

US Airways 1549

Ditches in the Hudson. All 155 aboard survive.

Two ditchings, 57 years apart.

Lost 11 April 1952 • Found 1 June 2026

Clipper Endeavor

With thanks to Air/Sea Heritage Foundation (Russ Matthews) and the Deep Sea Vision team.



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AIR SEA HERITAGE
FOUNDATION

Lost 11 April 1952 • Found 1 June 2026

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Questions

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Founder and COO