LASKARIDIS SHIPPING CO.LTD.

DRONES INSPECTIONS

HOW DRONE TECHNOLOGY IS IMPROVING SAFETY IN MARITIME INDUSTRY - PRESENTATION OCTOBER 2020

BY CATHERINE RETI / DPA/HSQE DIRECTOR



LASKARIDIS SHIPPING CO.LTD

LASKARIDIS SHIPPING CO.LTD has defined its strategy towards safety and walks the pathway of digitalization, acknowledging the risks that the seafarer faces at the marine environment taking every measure to eliminate the risks.

The initiatives include installation of cameras around and inside the ship to detect safety and technical anomalies with the **use of AI and use of telemetry** to review the **alarms** of each vessel and obtain situational awareness of vessel' performance with ultimate target to prevent stoppages and downtime.

One of the initiatives is the implementation of DRONES to substitute the entry into enclosed spaces by ships crew.

DRONE is an unmanned aerial vehicle (UAV), a powered aircraft without a human pilot onboard, controlled remotely.

The DRONES can be utilized to:

- Inspect ENCLOSED SPACES and take photos and videos
- Facilitate Class Surveyors at ESP (Enhanced Survey Program) surveys
- Obtain Ultrasonic Thickness Measurements at remote and dangerous positions such as confined spaces and remote locations at heights
- Verification of Cranes Operation
- Volume Calculation of Piles
- Verification of Cargo Holds Cleanliness

HAZARDS IN PLACE

- Entry into enclosed space is a high-risk operation
- To comply with ESP survey requirements a Class surveyor should reach positions at the distance of one arm, so he has to use cherry picker, or use boat after filling of cargo hold with water or to use ladders and scaffolding.
- Technicians to take UTM are exposed to risks since they have to be secured at heights with safety harness in order to take measurements (the so called "Enaerites")

ADVANTAGES OF USE OF DRONES IN BALLAST TANKS

- No Human Entry
- More time to be provided to the inspection of the area
- Focus to details that with the human entry was limited
- In case of L - type ballast tanks, the crew member should enter from top and walk long way to reach all the tank
- No limitation due to signal transmission throughout the tank structure
- The collection of photos and thickness measurements can assist to comparison with past data

CHALLENGES

- DRONES are not intrinsically safe, therefore the gases within the tanks should be measured in advance.
- There are cases that MANHOLES DIMENSIONS will not allow the entry of the drone, therefore prior arrival of DRONE operator onboard, review of structural drawings is required.
- Adjustment of deballasting or ballasting schedule is required so to facilitate as many empty ballast tanks as possible
- Unpumpable quantities of ballast will burden the inspection of ballast tanks

WHY IS TANK INSPECTION REQUIRED?

- Class requirement for ballast tanks and void spaces when the COATING CONDITION is FAIR OR POOR to be sighted.
- When CLASS SURVEYOR requires to inspect a tank as per ESP regime at annual and special surveys.
- RIGHTSHIP requirements
- SHIP ACCESS MANUAL requirements for inspections of CARGO HOLDS in BULKERS.

RIGHTSHIP QUESTIONNAIRE – SECTION 6.2



Section 6: Ship's Structure

6.2

Yes No N/A Com

Note to Inspector

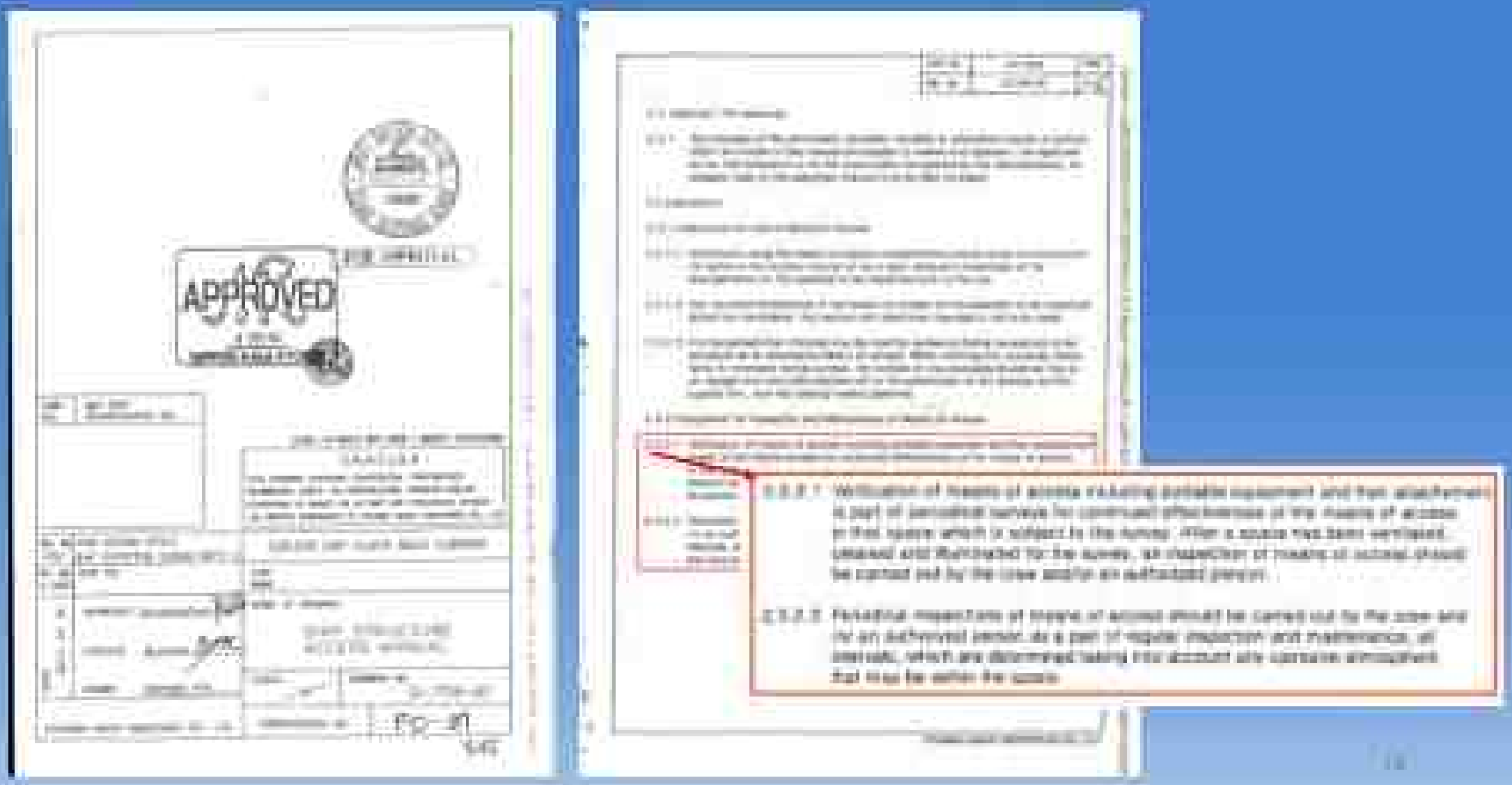
Record of inspection, photo and/or video evidence of hull inspection shall be available. Record a Finding:

1. When the inspection report is not available; or
2. When inspection report was not supported with photos and/or video evidence.

INSTRUCTION: record a finding when the inspection report is not available or when the inspection is not supported with photos or video evidence.

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EXTRACT FROM " SHIP STRUCTURE ACCESS MANUAL"





IACS





"Safety First!"

Surveys improve ship safety and protect both the seafarers and environment

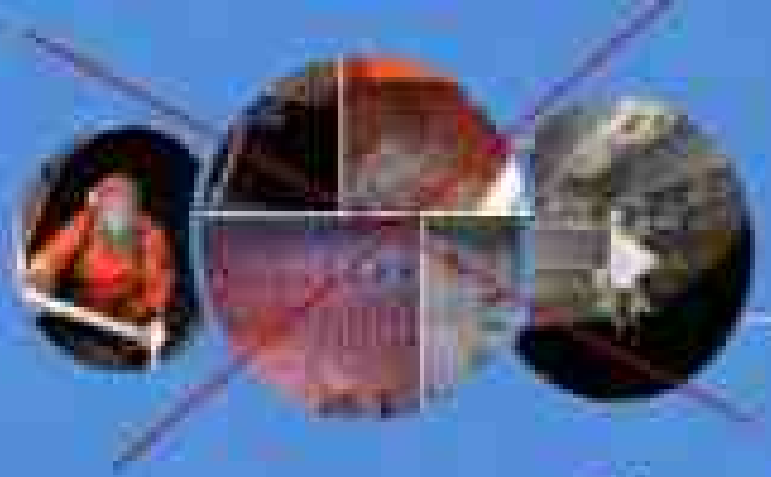
IMO

Scope and scheme of surveys are specified by international conventions

The International Maritime Organisation (IMO) has adopted mandatory regulations for the safety of seagoing ships, with several international conventions

Flags and the International Association of Classification Society (IACS) have well established their regulations and directive contents for ships owners

Administrations/bodies carefully supervise the implementation of, and compliance to, the ships' survey regulatory framework





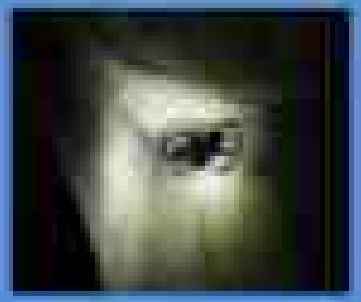
"Safety First"

"Close-up Surveys with Drones enhance ship safety and provide protection for both seafarers and the environment."

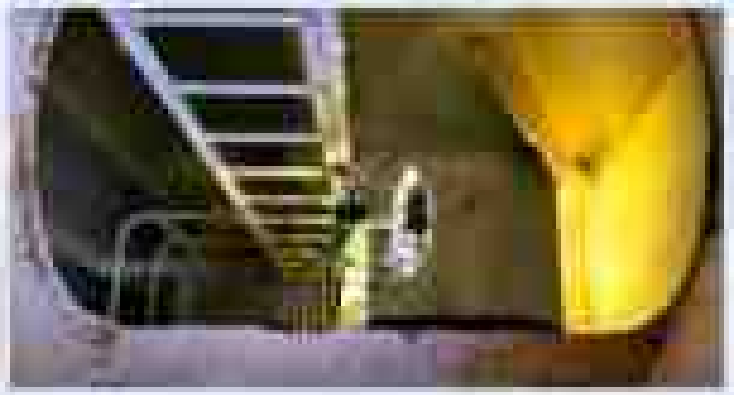
No Human entry in confined Spaces is needed which eliminates all the potential dangers related to the access in confined spaces and hard-to-reach areas













Traditional Methods :

Top dangers a confined space worker may experience includes:

- Working at height (Slips and falls)
- Working in confined spaces
  - Limited opening for entry and exit
  - Inadequate ventilation
  - Not designed for continuous worker occupancy
  - Tank or chamber
  - Hazardous vapors
  - Leakage of hazardous materials
  - Insufficient ventilation
  - Restricted space
  - Inadequate lighting
  - Not all procedures for entering



VS



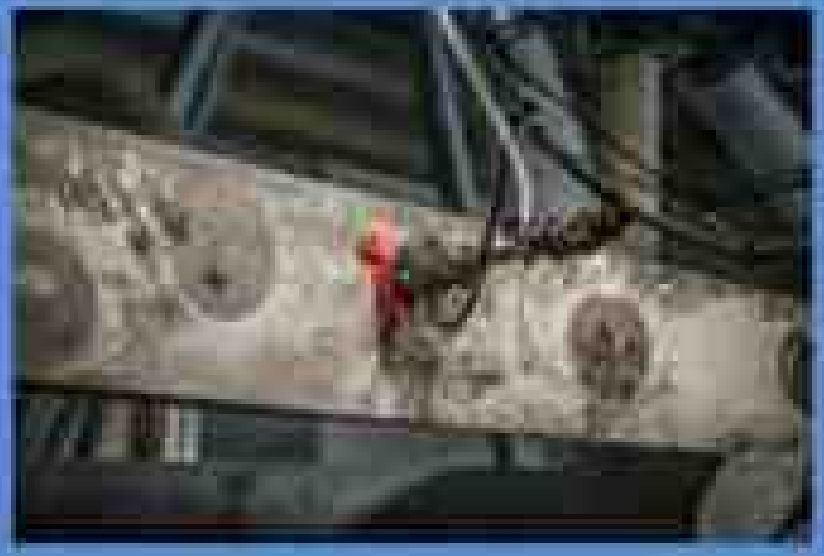


"Safety First"

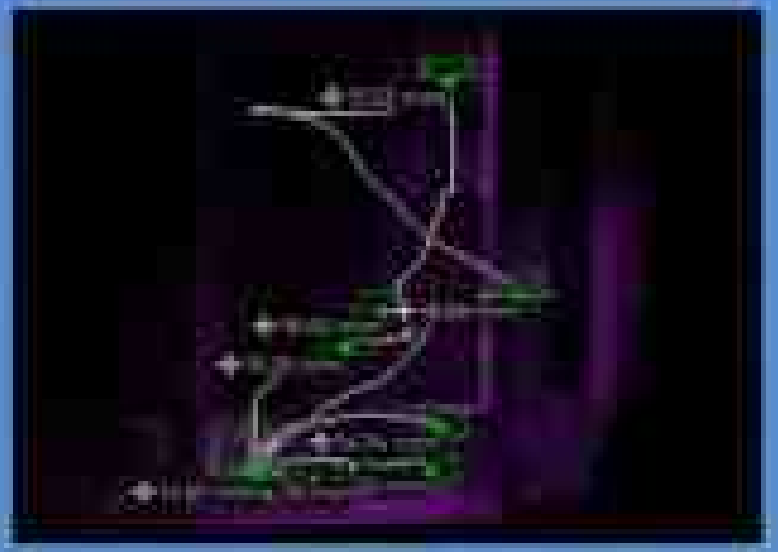
UTM WITH DRONES



TM Measurement point



Drone Flight Pattern



3D model Build-up



Underwater ROV Drones (Remotely Operated Vehicles)

In addition to aerial drones, **underwater ROV Drones (Remotely Operated Vehicles)** are robotic systems used for underwater inspections, controlled remotely from the surface.

Unlike traditional diver-based inspections, ROVs operate swiftly and efficiently, minimizing downtime and risks to personnel. Whether you require routine inspections or suspect specific issues, Diving Status ROV services provide the comprehensive picture you need to ensure the safety, performance, and compliance of your vessel.

USED FOR:

- Hull and underwater structure inspections
- Propeller, rudder, and stern gear checks
- Sea chest and grate inspections
- Underwater damage assessment



SAFETY BENEFITS

- **Risk Reduction**
  Eliminates the need for diver deployment, reducing exposure to hazardous underwater conditions.
- **Compliance with ISM Code Principles**
  Supports hazard identification and risk assessment by minimizing high-risk operations.
- **Improved Safety Culture**
  Promotes the use of technology to enhance crew safety and incident prevention.
- **Controlled & Repeatable Inspections**
  Inspections can be conducted under controlled conditions with consistent results.
- **Documented Evidence**
  Video recordings provide objective evidence for investigations, audits, and continuous improvement.



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Close up Case Study

Project scope:	Cleaning/ inspection
Ship type:	Bulk carrier (KAMSARMAX)
Inspection trigger:	CP condition of stating, Ball ballast tanks, void spaces, cofferdams)
Time:	2.5 working days
Deliverables:	Detailed Condition Report
	• more than 1,000 high res images in POS.
	• 4K videos for each compartment





	X (m)	Y (m)	Z (m)	Distance (m)	Heading (°)
Position Original	4.56	-12.55	12.67	17.64	252

Description: COATING BREAKDOWN LOCAL BREAKDOWN GROOVING POSSIBLE CRACK - NEEDS FURTHER INVESTIGATION

Inspection Summary



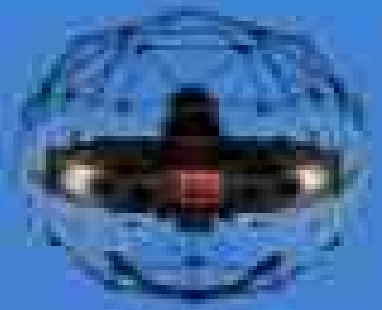




- **Safety:** *Inspecting confined and hard-to-reach spaces can be dangerous. Drones can do this job instead of putting human life at risk*
- **Efficiency:** *Drones can quickly and easily access hard-to-reach or difficult-to-inspect areas. Reduced downtimes and costs*
- **Precision:** *Drones equipped with high-resolution cameras and other sensors can capture detailed images and data, allowing for a more accurate and comprehensive inspection*

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RECORD OF INSPECTIONS OF CONFINED SPACES UTILIZING UNMANNED DRONES



- **2021:** 1 inspection at tanks and cargo holds (Piraeus)
- **2022:** 2 inspections (Rotterdam)
- **2023:** 3 inspections (Taichung, Vietnam, Italy)
- **2024:** 5 inspections (Durban, Rotterdam, Guangzhou, La Coruna)
- **2026:** 4 inspections (Patra, Amsterdam, Hamburg, Ijmuiden)

ENCLOSED SPACES REMAIN RISKY AREAS ONBOARD

One of the most persistent safety challenges in maritime operations is the **entry into enclosed spaces**. Each year, a significant number of seafarers are injured or lose their lives while entering or working in these areas, often due to insufficient training, limited awareness of procedures, or a failure to recognize invisible hazards.

Tragic incidents in enclosed spaces often stem from decisions made under pressure—whether due to time constraints, operational demands, or misplaced confidence. These fatalities can occur on any vessel, at any time, and to anyone.

Rushing a task can lead to poor judgment. Never compromise safety in the name of speed. Everyone involved in the task must be fully prepared—confident in the plan, competent in their role, and ready to respond in an emergency. Preparation is key. So is communication. A strong safety culture is one where every crew member feels empowered to speak up and stop the job if something feels wrong. That single moment of courage could save a life.

Even with thorough training, no one can predict how they'll respond in a real emergency. That's why realistic, regular rescue drills are essential. They help build the instincts and confidence needed to act safely under pressure.

" No shortcut is worth a life. Enclosed spaces are no joke "

ALARMING STATISTICS

Despite regulatory efforts, the rate of enclosed space accidents has not significantly decreased since InterManager began tracking such incidents in 1998. In both 2022 and 2023, 14 enclosed space incidents were recorded. However, the number of casualties rose sharply in 2023—34 fatalities compared to 18 in 2022—nearly doubling the previous year's total.

As of January 2025, InterManager estimates that approximately 350 seafarers and third-party personnel have died from asphyxiation in enclosed spaces since 1998. Alarmingly, 43 incidents since 2022 have resulted in 70 fatalities.

Atmospheric hazards remain the most critical threat in these spaces. Before entering any enclosed space, the following must be thoroughly checked: oxygen level, the flammable gases level and the harmful gases level.



Incident distribution by space type (1996–May 1, 2024)

- Cargo holds: 47%
- Cargo oil tanks: 17%
- Hold access: 10%
- Accommodation areas: 9%
- Ballast tanks: 4%
- Hold access via auxiliary ladder: 4%
- Water tanks: 3%
- Chain lockers, forepeak tanks, bow thrusters, duct keels, DB voids, FCSLE: 1% each
- Other spaces: 1%

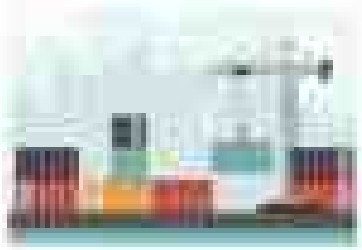
Who enclosed space accidents happen to, all ship types
1996 to 1st December 2024



Ships Crew



Will % of officer deaths are from the ship leadership team

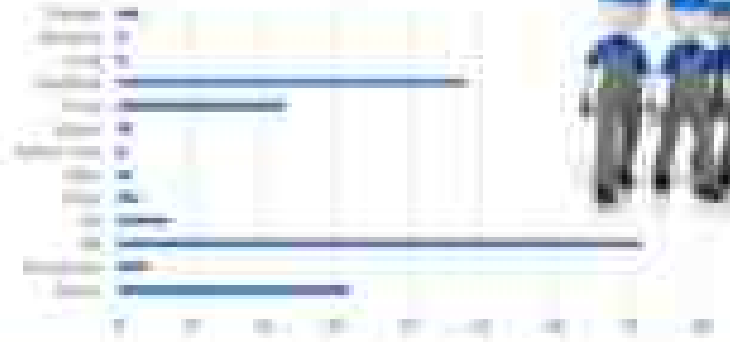


6.5 % of total ships staff deaths are Volunteer Officers

3rd Parties

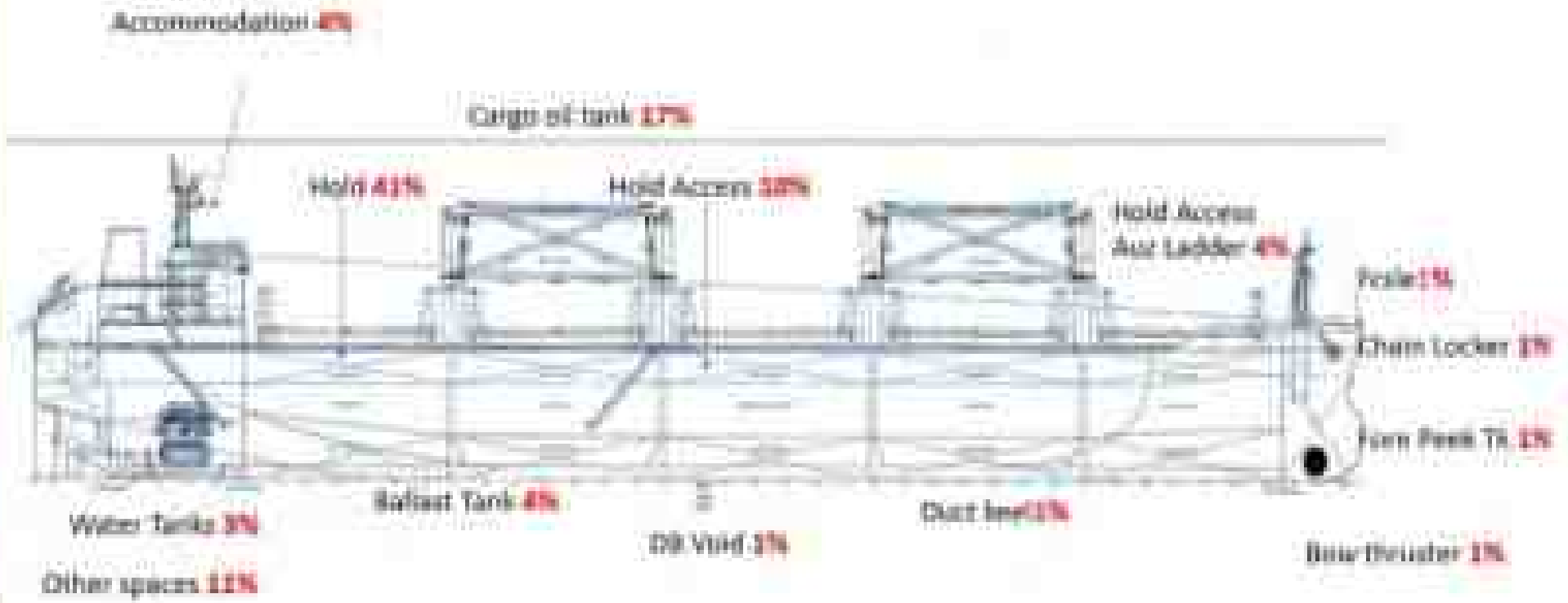




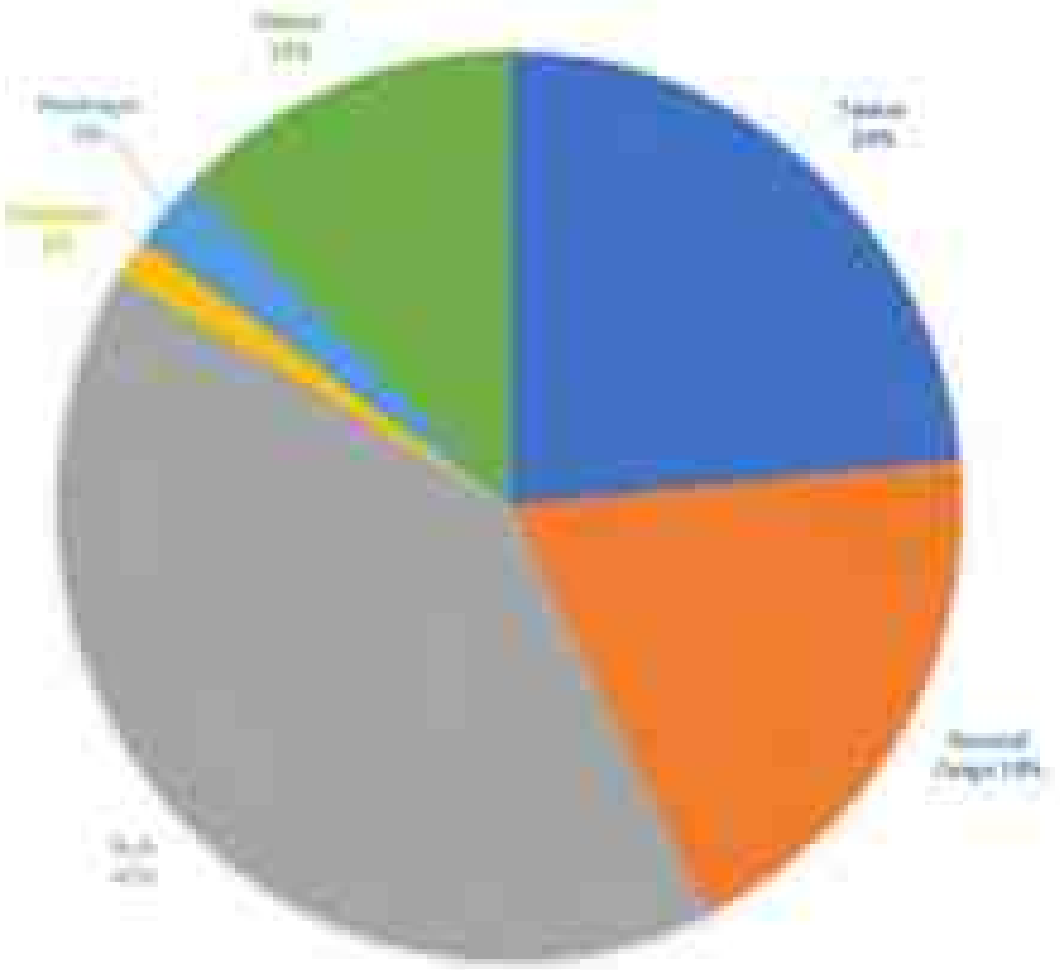




Where enclosed space accidents happen all ship types
1996 to 1st May 2024



ENCLOSED SPACE ACCIDENTS BY SHIP TYPE, 1999 TO 1ST DECEMBER 2018



The analysis of DRONE taken data can assist to the prevention of potential damages.

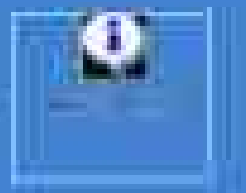
With the use of trained AI algorithms, the trend of damages and corrosion patterns can be reviewed and lead to potential developed cases (cracks etc.) which we will be taken care before lead to incident.

IMO acknowledging the high number of enclosed space entry accidents has recently revised the instructions for entry into enclosed spaces IMO RES.A.1050 (27) with IMO MSC.581(110)

Human Factor is a contributory factor to enclosed space accidents.

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RESOLUTION MSC.581(110) (adopted on 27 June 2025)
REVISED RECOMMENDATIONS FOR ENTERING ENCLOSED SPACES ABOARD SHIPS



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The revised ENTRY INTO ENCLOSED SPACES resolution addresses the elevated risk when the crew should enter the cargo hold for any reason including the inspection of the ship structure access means themselves

Extract from "RESOLUTION MSC.551(108)"

10.3.1.3 Where such type of access trunk is fitted on ships, the nature of the hazard should be identified outside the entrance to the space and should be listed in the Enclosed Space Register. When a cargo which may generate a hazardous atmosphere is loaded, the access door/hatch should be locked with a dedicated and unique locking arrangement, distinct from all other such arrangements, from the commencement of loading until the space is certified safe for entry by testing after completion of discharge.

10.3.1.4 Entry of personnel into a cargo hold using a hold vertical ladder should only be permitted when:

.1 the atmosphere in the hold has been tested and found to be safe;

.2 wearing a personal gas detector;

.3 wearing a safety harness; and

.4 an emergency response plan is in place.

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The following slides were taken by presentations of the AMERICAN BUREAU OF SHIPPING and FLYABILITY (maker of drones)

STATISTICS

The use of the drones mitigates risks associated with traditional methods, reducing the need to work at height or in confined spaces says ABS.



15+ days downtime

According to AUTOASSESS, an average vessel going in for their 5 year class inspection **spends 15 - 30 days of downtime**.



1010+ fatalities

According to the IMO, between 2000 and 2024, there have been **>1010 fatalities in enclosed spaces aboard ships**.



> 50% lower costs

According the Sigsens, drones can deliver **"50-90% lower vessel inspection cost** compared to scaffolding or rope access."



A standard tool

9 IACS members have now accepted surveyors using the Elios 3 UT for ship inspections, making it a reliable NDT tool

1010+ fatalities

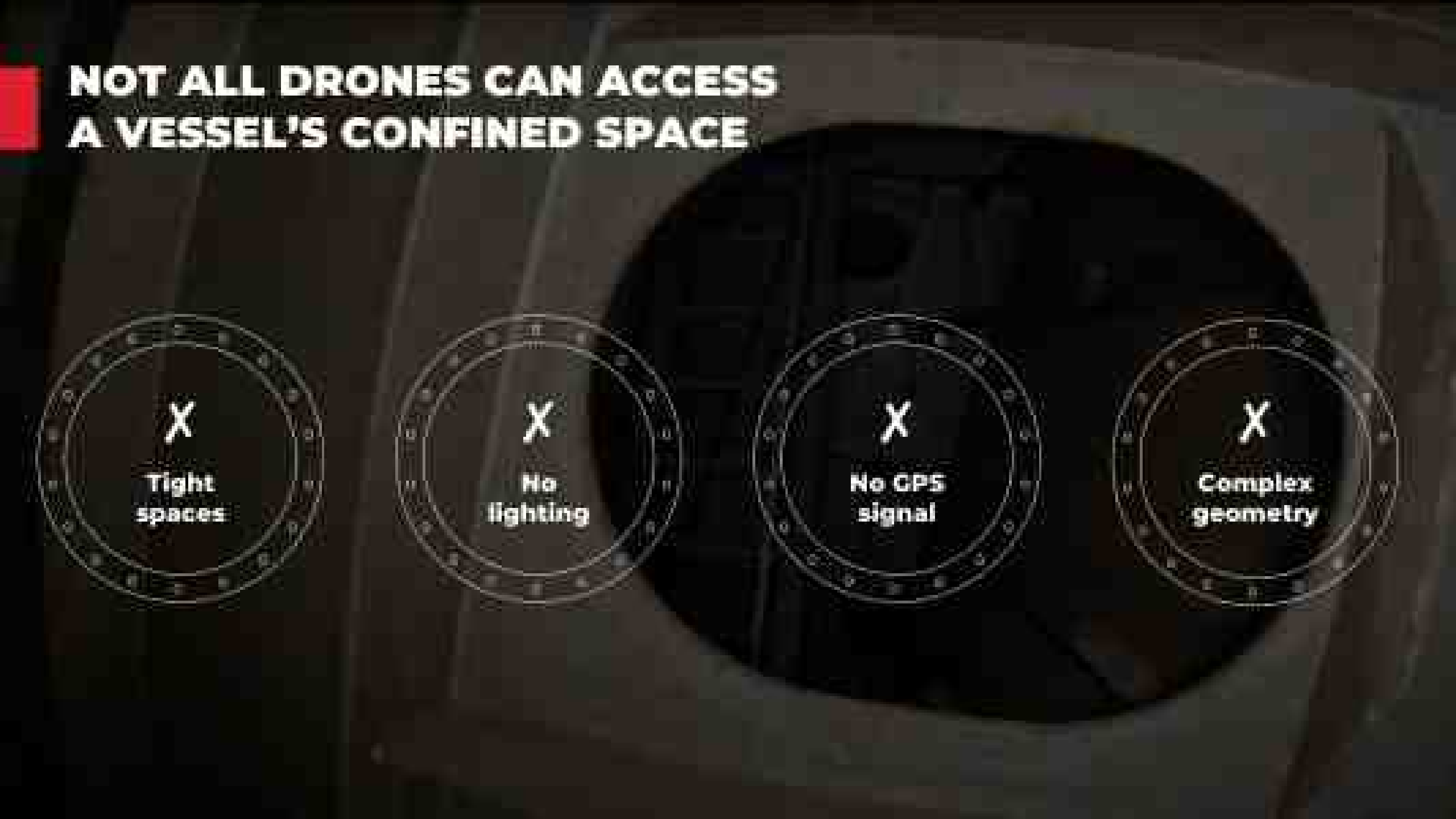
According to the BG, between 2011 and 2021, there have been 1010 fatalities in enclosed spaces aboard ships.

Why an indoor drone in maritime?

Inspecting tall infrastructures requires skilled workers to scale an asset on ropes, or to use expensive assistive devices like scaffolding and manlifts. In all cases, human lives are at risk.



NOT ALL DRONES CAN ACCESS A VESSEL'S CONFINED SPACE



ABS

Class-recognized NDT drones for vessel inspections

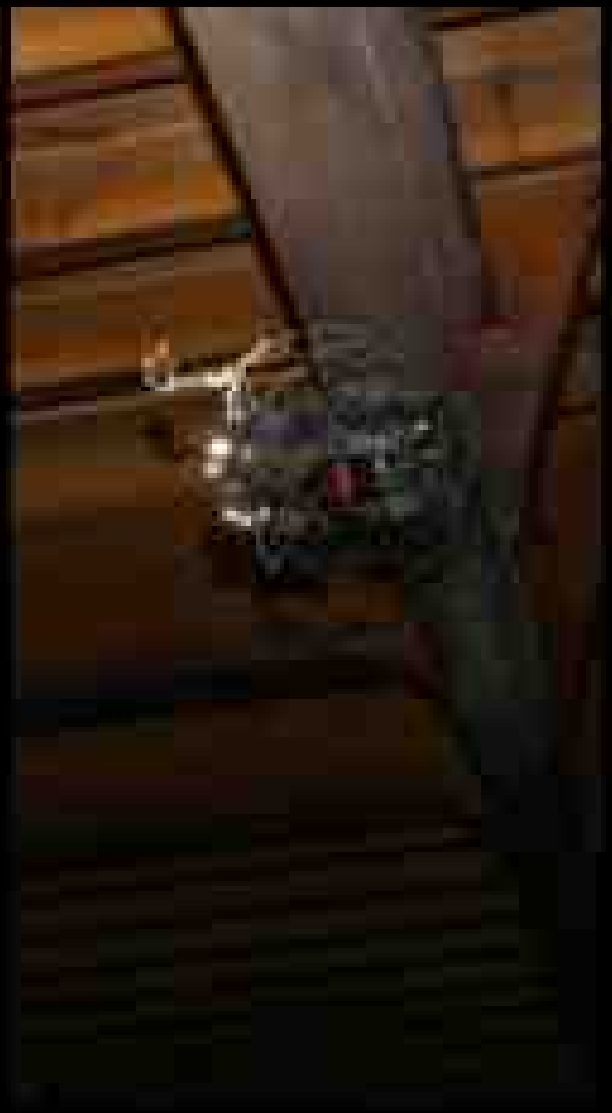


3D Digital Twins

Close-Up Visuals & Corrosion Mapping

Ultrasonic Thickness Measurements

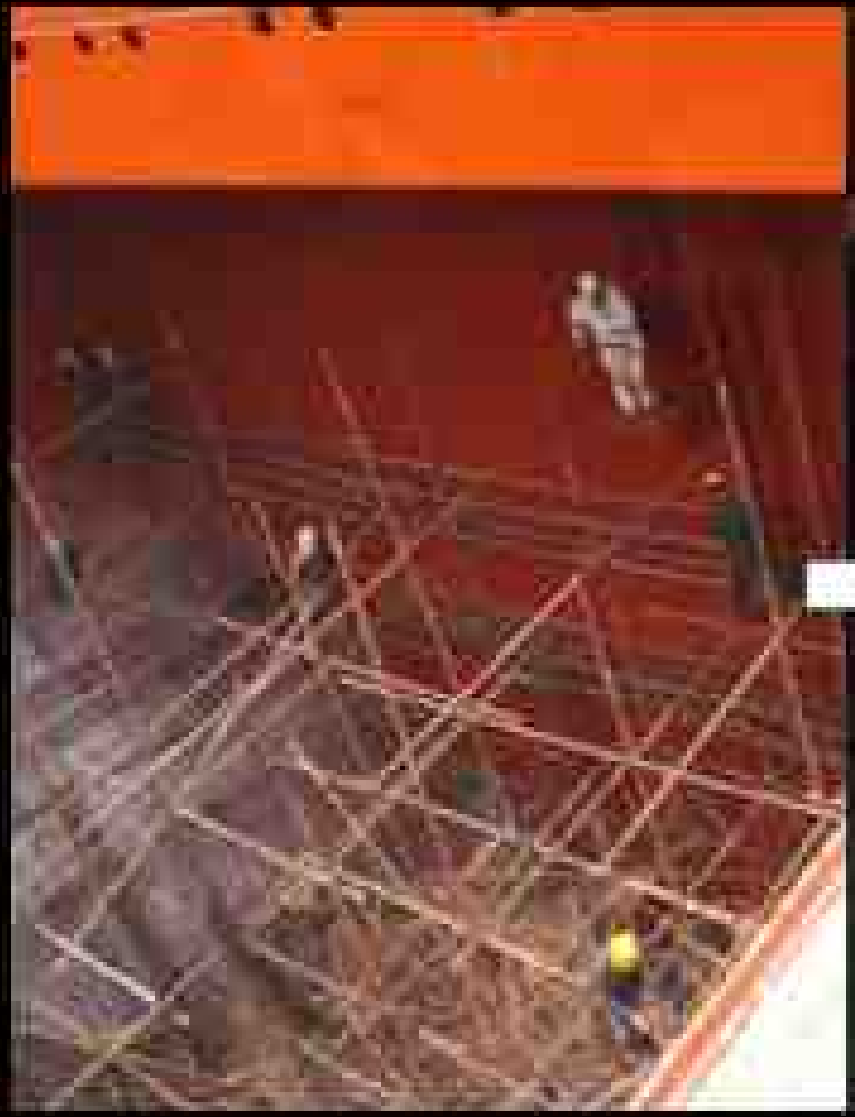
IMPROVE SAFETY: Avoid confined spaces entry and work at height during visual inspections.





REDUCE COSTS & DOWNTIME: Up to **80% faster** and **60% cheaper** inspection.



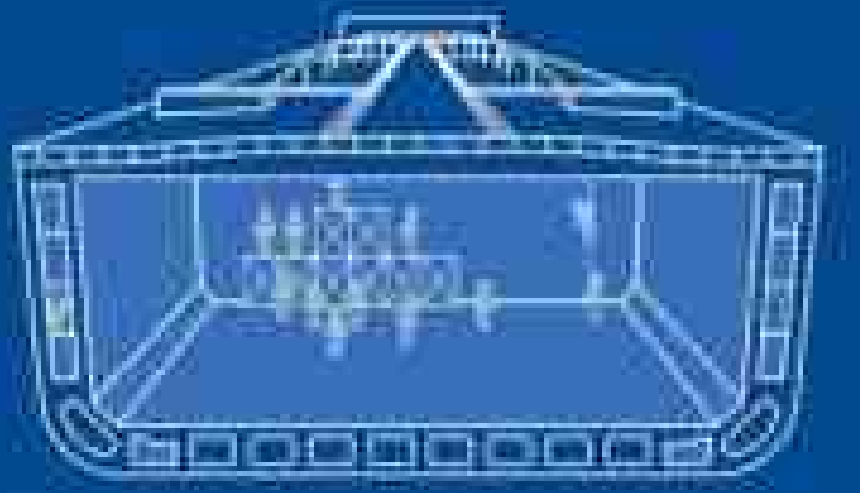




VS

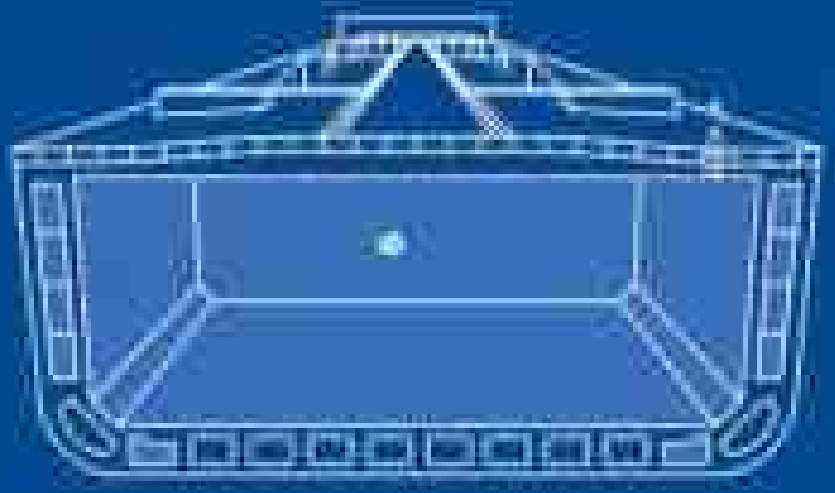
Traditional NDT tools

Traditional vessel inspections require personnel to enter confined spaces or work at height, using scaffolding or rope access, exposing them to safety risks and causing costly downtime. Manual inspections can take up to 80% more and cost twice as much.



Elios 3 UT drone

RITs (Remote Inspection Technologies), like drones, offer a safer, faster, and more effective way of collecting critical data, like detailed visuals and UTMs. Remotely pilot from the deck and see live A-scans that are localized in a 3D model of the vessel.



Elios 3 UT, the leading NDT drone for maritime inspections

Maritime inspections around the world have been approved by several classification societies to use the Elios 3 UT drone for visual inspections and UTM inspections in cargo tanks, ballast tanks, COTs, FPSOs, offshore units, and more. Below are some of the classification societies that approved the use of these drones for data collection.



ClassNK

ABS

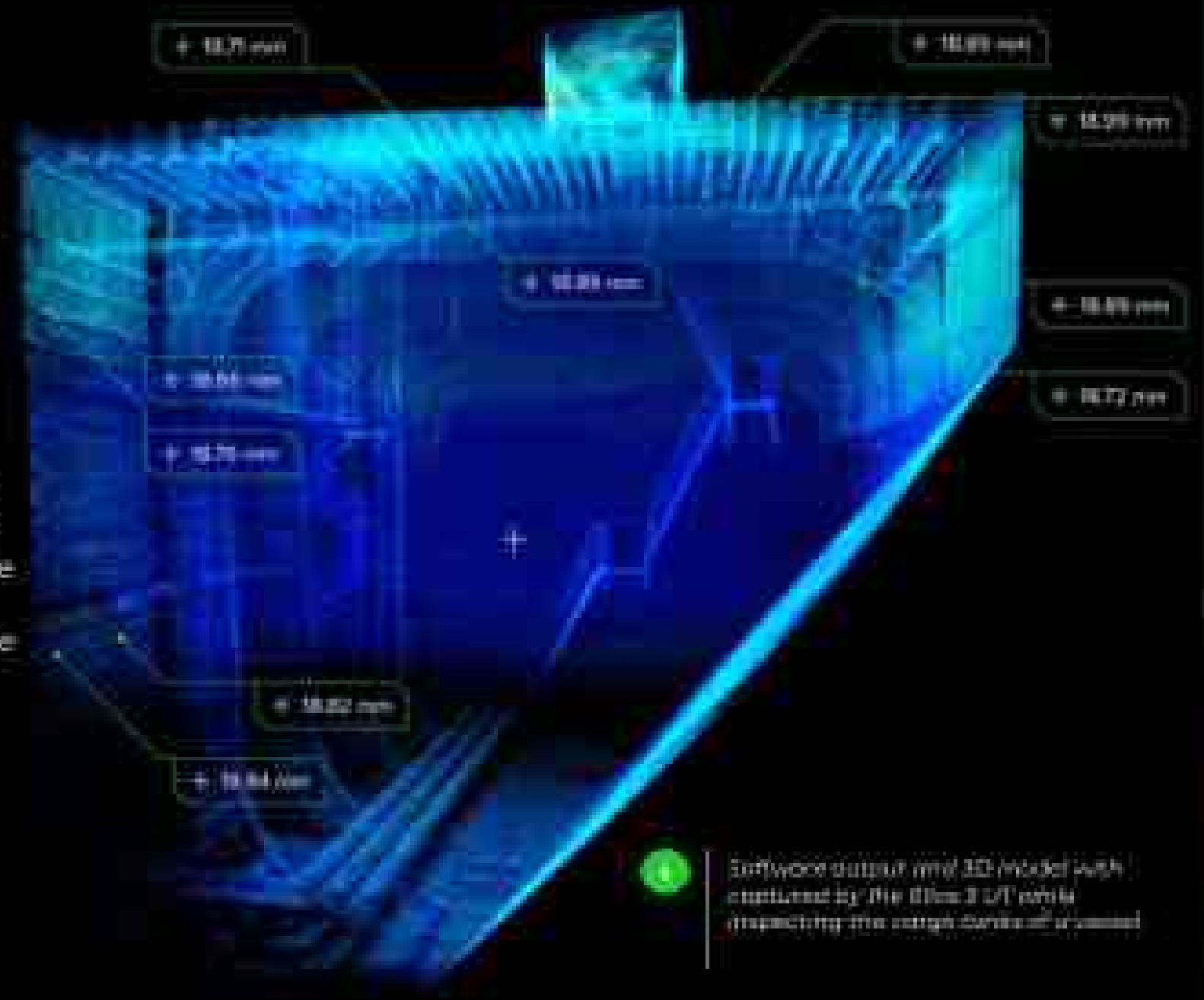
DNV

RINA

LR

Collect class compliant data with a single NDT inspection tool

The **Elios 3 UT** is the ideal tool for close-up visual inspections and UT measurements even in confined and gps-denied areas. The UT payload **developed in collaboration with Cygnus Instruments** allows the drone to perform accurate ultrasonic thickness measurements on vessels and other maritime equipment. **Collect up to 200 UTMs per hour at height.**



Our strategy is: to utilize DRONES for all the vessels of the fleet and obtain full photographic reports.

THE END

THANK YOU!!