

Accident Investigation Course

“Physical Evidence Collection”

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Content:

1. Physical evidence collection
2. Case Studies: Evidence gathering.

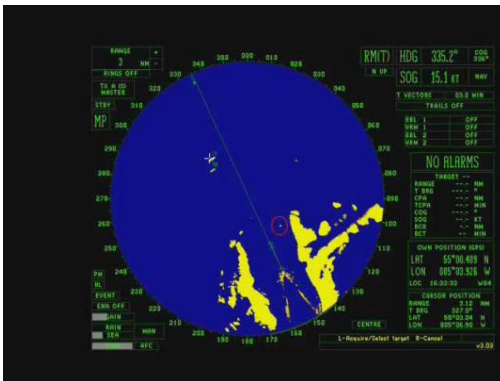


Initial stages of investigation, gathering evidence to determine

- Who (key persons)?
 - What?
 - When?
 - How?
 - and crucially Why?
-
- Evidence crucial to support findings
 - Beware of danger of reaching conclusions too early!
 - Beware of **your own safety!**



-
- An illustration of a business meeting. Three people are seated around a large, light-brown wooden conference table. On the left, a man in a grey suit and tie is gesturing with his right hand while speaking. In the center, a woman with short dark hair, wearing a grey blazer over a pink top, is looking down at a document on the table. On the right, a man in a brown suit is seen from the back, also looking at a document. The background is a simple, solid green wall. The style is a flat, modern illustration with soft shadows.



Case Study 1: Evidence gathering (30 min)



Look at summary of accident provided

Plan your actions, concerning:

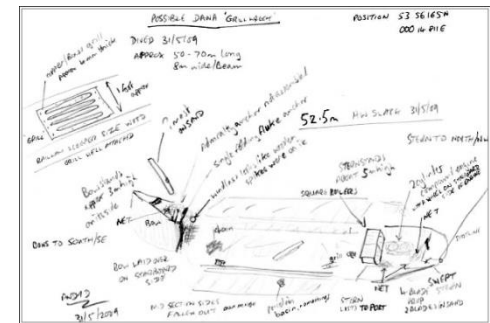
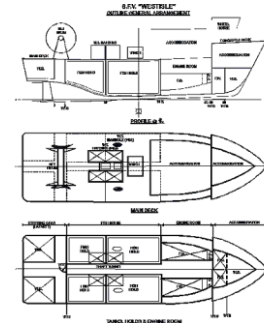
- What evidence needs to be collected to support your investigation?
- Sequence of your actions for evidence collection.
- What precautions and constraints there might be?



Class discussion to follow afterwards

Witness evidence

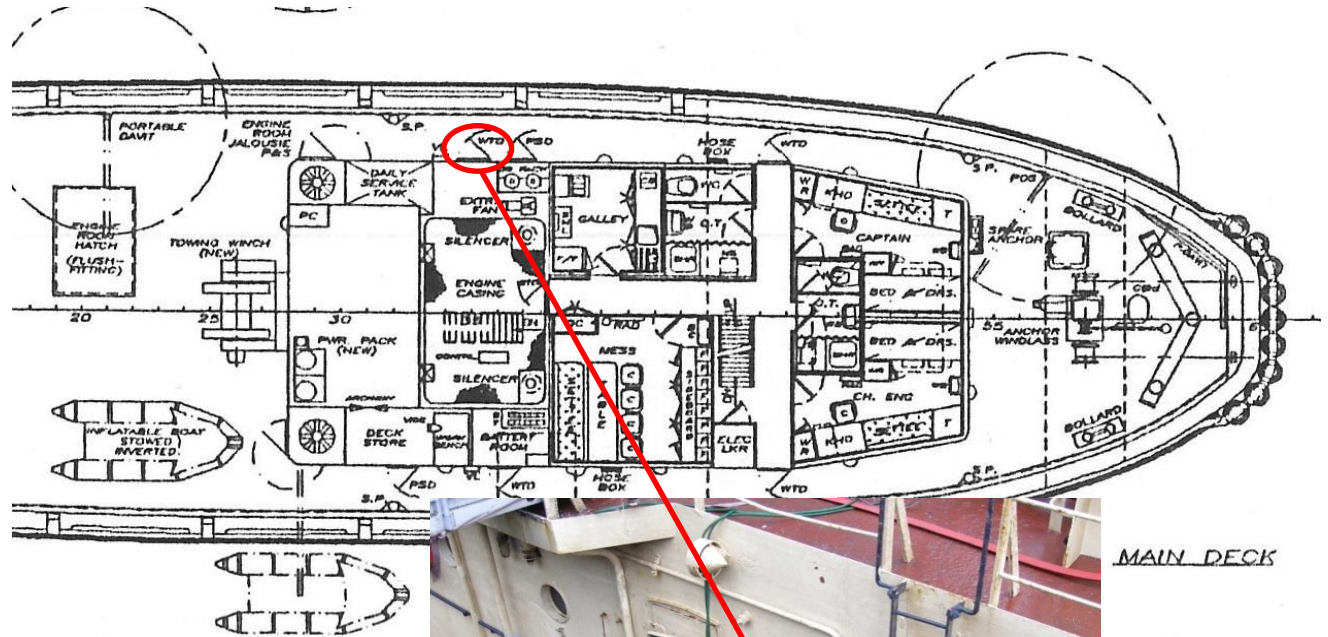
- Acquire the skills required (will be covered separately in the course)
- Try to request specific evidence from the right person
- Try to collect the same evidence from more than one witnesses if possible
- Try to link witness evidence with physical evidence
- Try to acquire any supporting evidence for witnesses' interviews (schemes or sketches, photos, audio-visual recordings, etc.)



- ## Evidence Log

Case No.:

Documenting and sketching



MAIN DECK

Plotting and sketching

Document what is found

Inspecting physical evidence (1)



Following initial mapping, systematic inspection:

- **Plan** the inspection (usually you will be escorted)
- A **walkthrough** with key crew members may assist
- A **checklist** of complex equipment components to help ensure a thorough survey
- Make sure that critical areas are not **accessed** by people outside investigation.



Inspecting physical evidence (2)



Following initial mapping, systematic inspection:

- Note the **position or indication** of switches, valves, mechanisms, etc.
- Look for indication that component parts were **missing or out of place before** the accident
- Note the **absence or removal** of any parts **after** the accident
- **Identify** any equipment or parts prior to examination or testing
- Prepare **checklist** for complex equipment to be examined
 - Record such observations.



Removing physical evidence

NOT until witnesses have been interviewed

NOT until position/status has been recorded

Locations of removed parts should be marked

Care during extraction/collection of items

Agreement with other interested parties **BEFORE** extraction takes place.



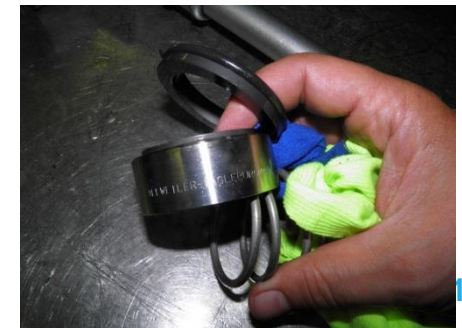
Physical evidence collection

Examples:

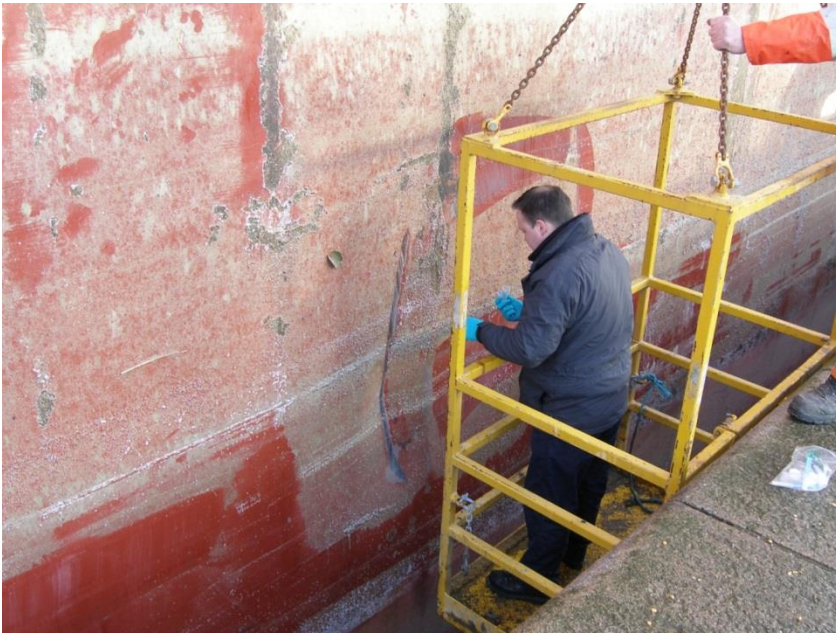
- Equipment
- Tools
- Scatter debris
- Pattern, parts and properties of physical items

Less obvious example

- Liquid and gas samples



Examples



Photography

Vital tool in evidence collection

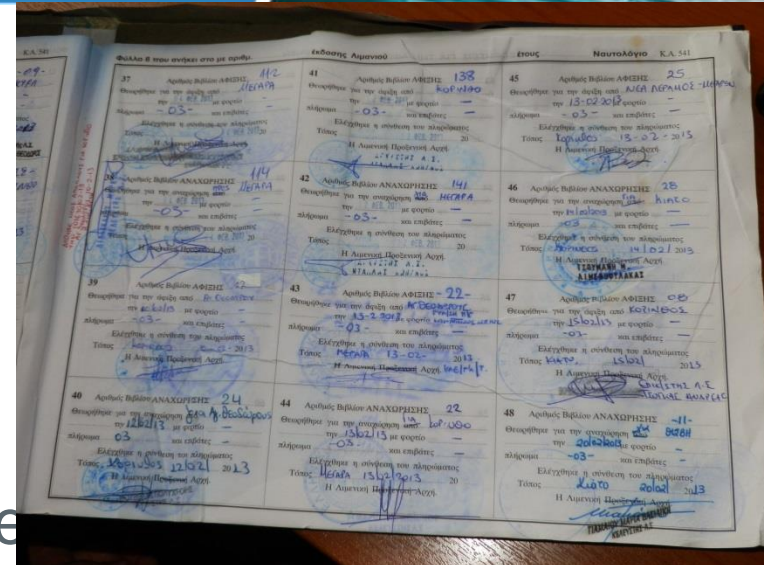
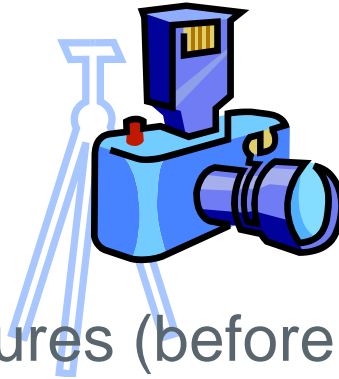
- assist with recall

Areas to photograph

- general layouts
- damaged areas, fractures (before repair)
- views from positions of key witnesses
- instrument and control settings
- **documents** if photocopying is unavailable

Some spots need careful access

Always take more photos than you think you need!





Equipment



Controls



Failed components

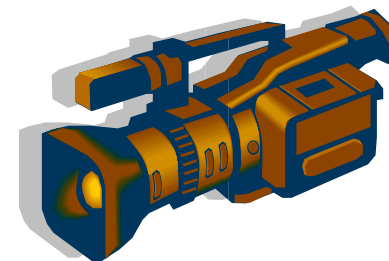


Hull



Can greatly assist with

- recording layout
- reconstructions



Ensure reference points are included

Commentary allows easier understanding later

[Sample Video \(Hook release\)](#)

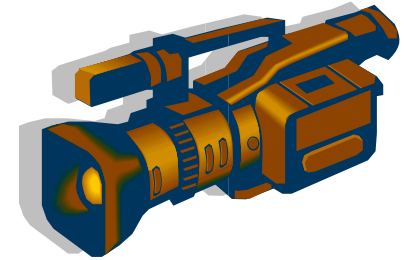
[Sample Video \(general view from bridge\)](#)

Concerning visual evidence



In general:

- Better use digital cameras
- Add clarity when included in investigation report
- Digital photography enables high quality / ability to take numerous photos
- Often video and still photography now combined
- **Practice to ensure familiarity with equipment**
- Look for other possible visual data sources (facility cameras, witnesses mobile phones, etc.).



Examples of visual evidence



Collecting documentary evidence

Have a template list of all available documents-certificates to choose from

Examples of documentary evidence:

- Logbooks
- Equipment readouts
- Equipment manuals
- Licenses
- Certificates
- Photos
- Procedural documents
- Check lists



Sometimes available in electronic form

Ensure photocopies are truly representative.

Example of template document list

List of Certificates and other Documents for IHBAN

Certificates	Books and Manuals	Notes
Cert. of Registry	Vessel's Particulars	
International Tonnage Cert.	Bridge Log Book	
International Load Line Doc.	Engine Log Book	
Minimum Safe Manning Doc.	Engine Bell Book	
Class Cert.	Radio Log Book	
Cargo Ship Safety Construction Cert.	Previous PSC Reports	
Cargo Ship Safety Equipment Cert.	Compass error Book	
Cargo Ship Safety Radio Cert.	Compass Deviation Table	
Cargo Ship Safety Certificate	Log Book Entries with respect to records of tests - drills - inspections and maintenance of lifesaving appliances and arrangements	
High speed Craft Safety Cert.	Safety Management Manual	With regard to:
Permit to Operate High Speed Craft	Work/Rest Hours Records	For Crew members:
Passenger Ship Safety Cert.	Familiarization Records	For Crew members:
Special Trade Passenger Ship-Space Cert.	Master's Standing Orders	With regard to:
List of Operational Limitations (if any) (For Passenger Ship)	Master's night orders	With regard to:
Safety Management Cert.	C/E Standing Orders	
International Ship Security Cert.	Ship Security Plan and Associated Records	
International Oil Pollution Prevention Cert.	Stability information	
International Air Pollution Prevention Cert. (IAPP)	Damage Control Plans and Booklets	
Engine International Air Pollution Prevention Cert. (EIAAPP)	Damage Control Booklets for Passengers (574-1/C II-1/2 23)	
Engine International Air Pollution Prevention Cert. (EIAAPP)	Instruction for on-board Maintenance (PMS)	
Noxious Liquid Substances Cert. (NLS)	Ship-specific Plans and procedures for recovery of persons from water (expected to enter into force 1/7/2014)	
Cert. of Fitness for Carriage of Dangerous Goods	Muster List	
Cert. of Fitness for Carriage of Dangerous Goods	Fire Control Plan	
Document of Compliance with special requirements	Fire Safety Training Manual	
Cert. of Fitness for Carriage of Liquefied Gases	Fire Safety Operational Booklet	
Cert. of Fitness for Carriage of Liquefied Gases	Maneuvering Booklet and Information	
International Sewage Pollution Prevention Cert.	Fuel Oil Changeover Procedure and Log Book	
International Anti-Fouling System Cert.	Oil Record Book Part I	
International AIS	Oil Record Book Part II	
Declaration of AIS	Cargo Record Book	
Record of AIS	Material Safety Data Sheet (MSDS)	
CLC 92 Cert.	Procedures and Arrangements Manual (P&A Manual)	
Bunker CLC Cert.	VOC Management Plan	
Exemption Certificates (if any)	STS Operation Plan and records	
Maritime Labor Cert. (PAL)	Capacity Plan	
Certificates of Compliance	SOPEP - SMPEP	
Medical Certificates	SOPEP - SMPEP Drill Records	
Unattended Machinery	Garbage Record Book	
P&A Cert. of Entry	Garbage Management Plan	
Continuous Discharge	Cargo Securing Manual	
VOR Type Approval	SAR Co-Operation Manual for Passenger Ships trading on	
VOR Approval	AIS Annual Test Report	
	Decision Support System for Masters	
	Information on the A/A -max Ratio for Ro-Ro Passenger	
	15/CI-1/RB-1)	
	Dangerous Goods Manifest or Stowage Plan	
	Grain Loading Stability Booklet	
	Document of Authorization for the carriage of Grain	
	Enhanced Survey Report File	

Diagrams - Schemes	Notes
General Arrangement	
Ballast Arrangement	
Engine & Stowage Piping	
Fire Fighting System	
Shed Expansion Plan	
Mid ship's Section	
Mooring/Anchor Gear Arrangements	

Other Documents	Notes
Master's report to the company with regard to the accident	
Safety Committee meeting records	
Risk Assessment records	
Safety Investigation records	
Near Miss accidents reporting record	
Internal audit report	

To the Master of _____
 For the purpose of the safety investigation please provide copies of the
 above marked Certificates and Documents.
 For the Investigation Team (see 6.1.1.1)

Received by the _____ of the _____
 Date, Signature and Vessel's Stamp

Documentary evidence types



- **Shipboard and Shore management control documents**
- **Records of work activities**
- **Reports of:**
 - Results of special studies
 - Analyses
 - Audits
 - Appraisals
 - Inspections (deficiencies)
 - Inquiries
- **Previous occurrences**
- **Investigations related to work activities**
- **Follow-on documentation that describes actions taken.**



‘Black Box’ of the seas (VDR & Simplified-VDR)

Can provide:

- Date & time
- Position
- Speed
- Heading
- Bridge audio
- Comms audio
- Radar (or AIS)

Items below not required for S-VDR

- Echo sounder
- Wind speed and direction
- Accelerations & hull stresses
- WT and fire door status
- Engine order and response
- Hull openings
- Rudder order and response
- Main alarms

Data storage - minimum of 12 hrs of data

Voyage Data Recorder carriage



For ships on international voyages

- **VDR required on**
 - All passenger ships
 - Other ships >3,000GT constructed on/after 1/7/2002
- **S-VDR (simplified VDR) or VDR**
 - All Cargo ships >20,000GT
 - Cargo ships >3,000GT <20,000GT (by 1/7/2010)

From July 2010 all ships >3,000GT on international voyages must have a VDR or S-VDR!

Make sure VDR data has been saved!



VDR equipment



VDR cabinet

SAVE
button
panel



VDR capsule



Removable drive





Case study 2 (15 mins)

- RoPax Arion (135 passengers, 25 cars and 6 trucks)
- The vessel had 2 economizers (economizer is a heat production system, which on Arion consisted of an exhaust gas thermal oil heater, using the ME's exhaust gases to heat thermal oil which circulates through conduction pipes). .
- The fire broke at the economizer nr.1
- Power supply failure of the thermal oil circulation pump, stand-by pump leak.
- C/E: Both pumps were stopped for approx. 10 minutes and then the main pump was put back in operation.
- Any other actions taken: (C/E) speed of main engine nr.1 was reduced.

Tasks:

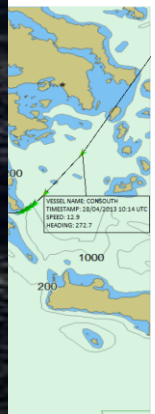
- Check VDR index
- Suggest any following actions

Electronic evidence - Other sources

Other data

- Electronic Data Interchange (ECDIS)
- Integrated Bridge Systems (generally)
- AIS data
- VTS radar
- CCTV
- Mobile

Man survives plane crash and takes an epic selfie





May include:

- Fire protection systems
- Communications systems
- Security cameras
- Electronic log books
- Alarms' logs
- Engine management systems
- Safety management systems



View 1: 03:11:00 to 03:16:00

KEY

■ Sequence of activation of stateroom heat detectors

■ Ventilation system smoke detectors shown to illustrate probable external smoke path

■ Initial activations of manual call points

Zone 2 Zone 3

Zone 3 Zone 4

Zone 4 Zone 5

Zone 5 Zone 6



	GPS Time	Detector	Deck	Zone	Cabin location
	03:09:20		11	2	By B258
	03:10:46		15	6	Fan room frame 105 port side
	03:10:55		15	5	AC stn frame 110 port side
	03:11:02		10	3	By C334
1	03:11:05	Det-44.011	10	3	C318
2	03:11:22	Det-44.010	10	3	C316
3	03:11:40	Det-44.013	11	3	C320
	03:11:50		10	3	By C304
	03:12:21		10	3	By C303
4	03:12:43	Det-44.014	10	3	C322

	GPS Time	Detector	Deck	Zone	Cabin location
5	03:12:50	Det-44.130	11	3	B322
6	03:13:20	Det-44.131	11	3	B318
7	03:13:21	Det-44.126	11	3	B330
8	03:13:56	Det-44.127	11	3	B334
9	03:14:06	Det-44.015	10	3	C326
10	03:14:44	Det-44.126	11	3	B338
11	03:14:54	Det-44.016	10	3	C330
12	03:14:58	Det-43.139	12	4	A402
13	03:15:21	Det-44.125	11	3	B342
14	03:15:30	Det-44.017	10	3	C334

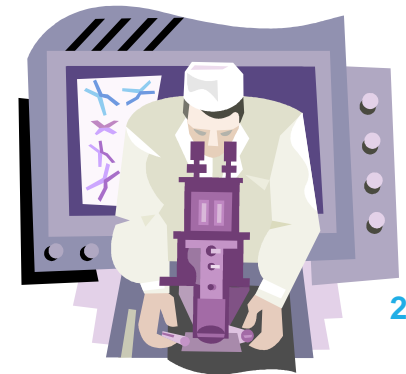


Investigators cannot be experts in everything!

Early assessment of the need for specialist services essential to:

- look for State specialists
- find appropriate contractors
- determine what preservation steps are needed
- List of specialist services (pre-planned action!)

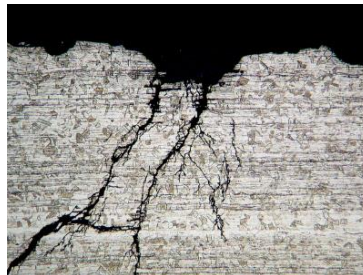
Ideally having some specialist contacts and/or mechanism to enable contracts.



Material testing

Tensile testing

Shear testing

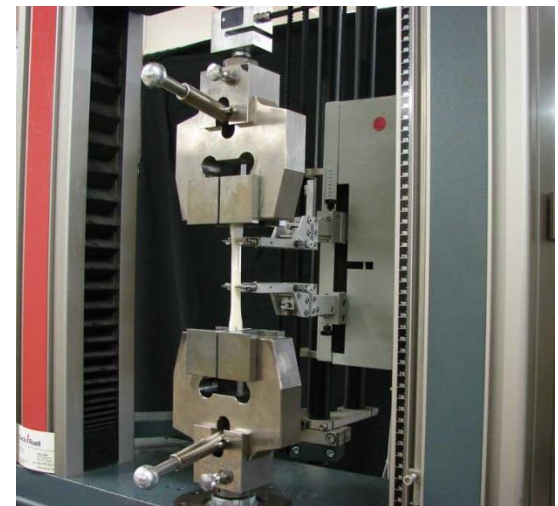


Microscopic examination

Failure mechanism,

- brittle/ductile fracture

Fatigue testing



Cable and rope testing



Determining failure mechanism

Load to failure prediction

Rope/cable condition

Rope properties

Rope certificates



Equipment and machinery inspection



Cause of failure

Faulty finding

Retrieval of data

Evidence of service history

Performance testing



Independent testing

Lifejackets

Life rafts

EPIRBs

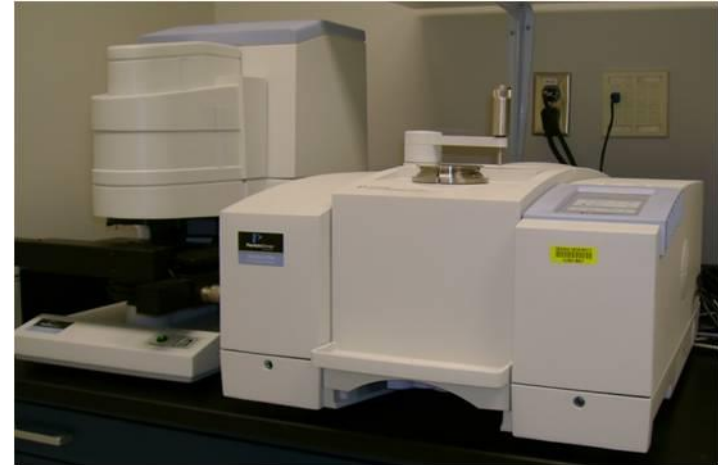
Testing by certified entity

(e.g. against ISO standards)



Forensic services

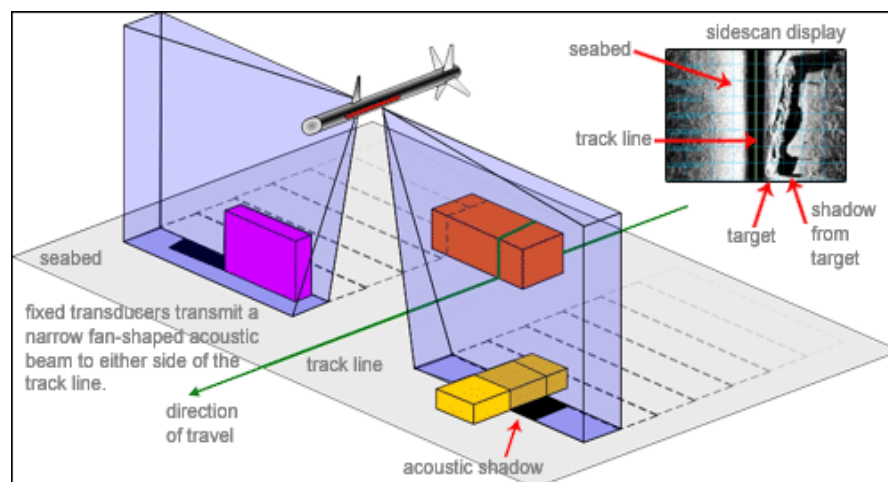
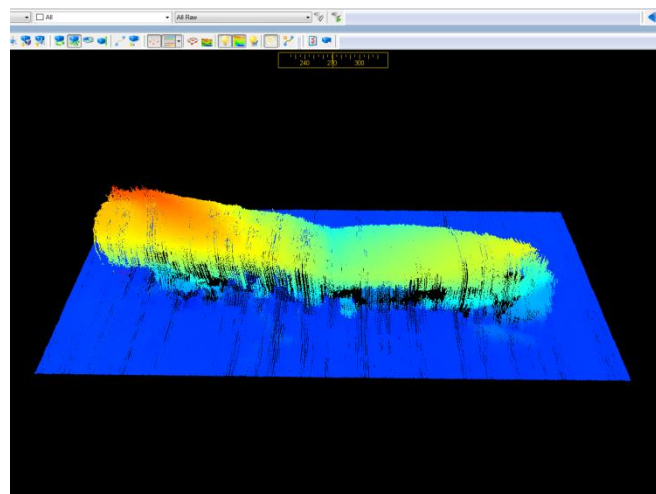
- Paint sample analysis
- Material composition
- Toxicology
- Document restoration
- Computer hard drive data retrieval
- Fire properties
- Post-mortem reports





Lost or missing vessels:

- **Still afloat:**
 - Coastguard other authorities may have drift prediction systems to define search pattern
- **Foundered:**
 - VDR's have sonar locating beacon
 - Multi-beam or side scan sonar searches



Underwater Surveys- using divers



- Brief diver fully as to what is required
- Understand the limitations of the diver, e.g. dive time, visibility, current
- Give as much information on any known hazards
- Beware of client responsibilities
- Ideally head mounted camera feeding back to the surface, with communications to allow some direction of the diver
- Diver not to interfere with the wreck
- Interview diver

[Sample video](#)



Underwater Surveys- using ROVs

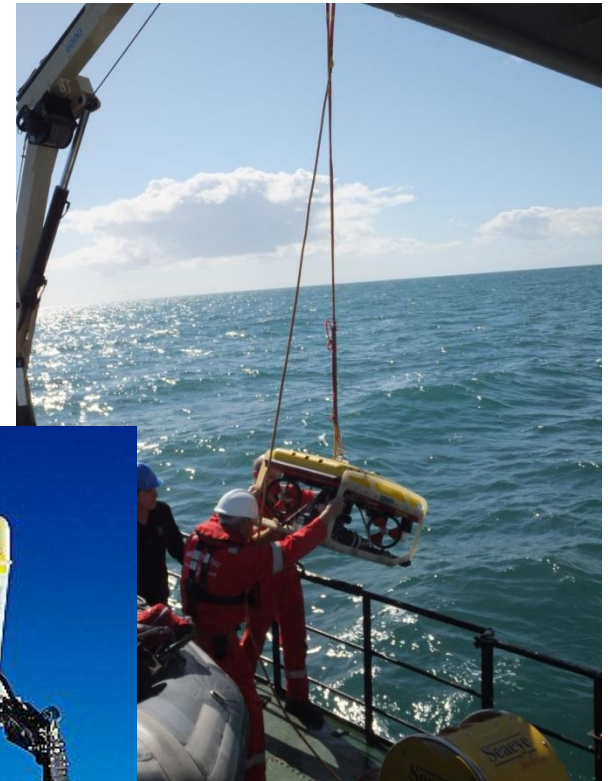


Compared to diver:

- Better endurance
- Safer
- Greater depth capability

But:

- Limited manipulation
- Current flow limitations
- Cost.



Salvage Operations

- Expensive/complicated
- Salvagers have single aim, not accident investigation
- Important to get alongside salvagers
- Determine thorough survey
- before salvage
- Witness operation (time consuming)
- Log/document salvagers' actions.





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European Maritime Safety Agency