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Lessons from maritime emergencies based on video evidence: analysis of accidents involving passenger ships and safety proposals

J.A. González-Almeida[1,*], M.C. Adrián de Ganzo[1], J. Almenar de Luz[1]

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ABSTRACT

Using audiovisual material captured during the emergencies themselves (videos from passengers and crews, as well as documentaries incorporating original images), we present a chronological overview of accidents involving passenger ships between 1991 and 2016: Oceanos, Norwegian Dawn, Star Princess, Pacific Sun, Louis Majesty, Clelia II, Grand Holiday, Costa Concordia, Sewol, Explorer of the Seas, among others. The analysis reveals recurring patterns: structural deficiencies (e.g., bilge valves, vulnerable bow glazing), unsecured furniture that becomes a projectile with sharp swings, listing that renders decks and means of abandonment impracticable, and -most notably- shortcomings in leadership, public address communication, and real-world training of crews. On this basis, we propose specific and operational measures: double glazing with methacrylate in exposed areas; systematic securing of furniture and effective lashing; continuous handrails on both sides; access to lifeboats at deck level and launching systems less sensitive to list; specific protocols for vulnerable groups with early transfer; and realistic crowd control and communication exercises without contradictory messages. The objective is simple: to translate what we see in the images (what works and what does not) into useful knowledge and tangible improvements that reinforce the safety of human life at sea.

1. Introduction.

Below, we present a study with two objectives: firstly, to provide readers with a selection of emergencies aboard passenger ships that we consider exemplary; and secondly, to draw from these situations a series of practical lessons and specific proposals regarding safety. To this end, we have not focused on static images-which are abundant and come from a wide variety of sources-but rather on audiovisual material taken during the emergency itself: videos made by passengers or crew members and, where applicable, sequences included in documentaries produced afterwards by third parties. The reason is simple: only moving images allow us to clearly appreciate the temporal dynamics of events, the way in which an apparently routine situation deteriorates and how this deterioration affects the passengers, the crew and the ship itself. We have placed the cases in ascending order by date, aware that the closer the event is to our time and the greater its media impact, the more abundant the available material will be. The list that makes up the corpus of analysis is as follows: Oceanos (1991), Norwegian Dawn (2005), Star Princess (2006), Pacific Sun (2008), Louis Majesty (2010), Clelia II (2010), Grand Holiday (2012), Costa Concordia (2012), Sewol (2014), Explorer of the Seas (2015), Ecoquest Catamaran (2015) and Anthem of the Seas (2016).

First and foremost, it is important to highlight a methodological limitation that, paradoxically, justifies the chosen approach: when an accident occurs on board, there is rarely a systematic audiovisual record of what happens inside the ship. The priority of professional personnel is to fulfil their assigned role in the emergency, not to record what is happening; therefore, the vast majority of images of interest come from passengers -and, to a lesser extent, from junior staff- or from closed-circuit television cameras, where available. This explains both

[1]Lecturer, Departamento de Ingeniería Civil, Náutica y Marítima. Universidad de La Laguna. Tenerife. Spain.
[*]Corresponding author: J.A. González-Almeida. E-mail Address: jagonal@ull.edu.es.

the richness and the biases of the sources: what can be recorded from the witness's position is documented, with its limitations in terms of angle, sound and continuity, but even so, the material allows us to observe details that rarely appear in a written report: effective movement through corridors and stairways under list, collapse of unsecured furniture, messages over the public address system and, above all, the real interaction between crew and passengers.

The value of these videos lies not in the anecdotal, but in the fact that they open an operational window onto the 'minute-by-minute' unfolding of the crisis. On the Pacific Sun (2008), for example, security cameras starkly show how chairs, tables and other heavy objects become projectiles when the ship heels sharply; this simple physical fact, so often overlooked in passenger interior design, translates into avoidable trauma if basic solutions such as securing furniture or reconfiguring lounges had been adopted. Similarly, in cargo holds, the images reveal cargo shifts that could compromise watertight integrity. Beyond the shock value, these cases point to simple, high-impact measures: redesigning dining rooms, effective lashing and comprehensive CCTV coverage with monitoring from the bridge.

Other incidents force us to look at the ship's materials and their interaction with the environment. On the Louis Majesty (2010), the impact of wave trains on the bow windows shows that conventional glass is not a 'last line of defence' in exposed areas. We propose-and will discuss this in detail-double glazing with exterior methacrylate, capable of deforming and dissipating part of the impact energy, and protocols for preventive removal of passengers from windward windows when conditions warrant. These are not mere speculations: they arise from observing what went wrong, where, and with what consequences.

The reader will also find cases where the problem was not a wave or glass, but emergency management and communication. On the Costa Concordia (2012), the delay in sounding the alarm, contradictory messages ('everything is under control') and the imposition of calm without verifiable information visibly undermined the confidence of the passengers, while the increasing list made decks and stairs impassable. The footage shows crowds, boats being lowered compromised by asymmetry and a lack of expertise in critical manoeuvres. Similarly, the Sewol (2014) illustrates the devastating effect that an instruction to remain in cabins can have when stability is already compromised: almost total obedience, time lost and exits blocked by the list. Comparing the two accidents, with their enormous differences in ship and environment, is instructive in understanding how culture, chain of command and clarity of orders directly influence survival.

This work, therefore, does not seek to judge 'with hindsight', but rather to use what the images show us to adjust procedures. From each case, following the same pattern, we have extracted a brief ANALYSIS of what we observed and some SAFETY PROPOSALS that are practical and feasible in operational terms: from engineering solutions (double glazing, continuous handrails on both sides, deck-level access to lifeboats, lowering systems less sensitive to heel) to procedural measures (crowd control, consistent public address announcements, early transfer of vulnerable groups to designated areas and equipment). The aim is for these proposals to be discussed and, where appropriate, incorporated into manuals, roles and emergency plans.

Finally, we must not forget the training aspect. Nautical and marine qualifications, however much practical experience they incorporate, find it difficult to convey to students how it 'feels' to be inside a ship during a real emergency and what it means, in terms of decision-making and leadership, to look into the eyes of a family with children who are asking for answers. Here, videos fulfil an educational function that is difficult to replace: they shake up inertia, force empathy and raise uncomfortable questions (when is it too late to order abandonment? How do you control panic? What message is credible?). In the following pages, readers will find this combination: images that challenge and proposals that land, always with the idea that what we saw yesterday should serve to act better tomorrow.

In short, we start with a set of varied and well-documented cases to offer a comparative reading that connects design, operation and the human factor. The chronological sequence helps to understand the evolution of practices and shortcomings; the audiovisual analysis helps to locate the blind spots in the doctrine; and the proposals help to transform the experience into tangible improvement. That is, in essence, the spirit of this work.

2. Theoretical Background.

This work is based on a regulatory and conceptual framework which, as seen through the audiovisual material, should be -grounded- on three levels: (i) design and equipment that does not cause harm, (ii) procedures that anticipate the actual flow of people, and (iii) people and organisations capable of deciding earlier and communicating better. Below, I summarise this framework with references that actually operate on current passenger ships.

From SOLAS to operational detail. The technical -core- is provided by SOLAS and its codes: damage stability in Chapter II-1 under a probabilistic approach and its revised Explanatory Notes ([1]); fire prevention/detection/fighting in the FSS Code ([2]) and its recent amendments ([3], [4]); and the means of rescue in the LSA Code ([5], [6]). Together, they define the ship's resistance threshold and the minimum -kit- for people to get out.

Safe Return to Port (SRtP): designing to remain operational when damaged. For large passenger ships, SOLAS II-2/21-22 sets criteria for -returning to port- and for systems that must remain operational to support orderly evacuation ([7], [8]). The IMO provides explanatory notes on post-fire/flooding capability assessment ([9]) and unified criteria for applying II-2/21.4 ([10]), as well as operational information for the captain when the ship is sailing in a degraded condition ([11]). This set of guidelines ties in directly with what the videos show: useful time, clear communications and routes that are still passable.

From plan to actual flow: evacuation analysis. The IMO requires passenger ships to verify-in design and retrofit-that their architecture allows for timely evacuation. First with MSC.1 /

Circ.1238 (2007) and now with the revised MSC.1/Circ.1533 (2016) guidelines, which offer a simplified and advanced method, performance parameters and simulator validation tests ([12], [13]). What is relevant to our case: identifying bottlenecks, sensitivity to list, and times to assembly/abandonment points.

Training and crowd management (STCW). The STCW and its 2010 Manila amendments specify mandatory competencies for personnel assisting passengers: crowd management, communication, guidance, flow control and crisis behaviour (section A-V/2) ([14]-[16]). This training standard is the link between the equipment available and what people actually do when the ship is no longer upright.

Management system: ISM Code. Regarding procedures and continuous improvement, the ISM Code (mandatory via SOLAS IX) imposes objectives, auditing and organisational learning; its implementation guidelines reinforce the link between leadership, reporting and emergency preparedness ([17]-[19]). In short: without a live system, the technique is not activated in time.

Search and rescue (IAMSAR). When evacuation depends on external resources (helicopters/rescue boats), the IAMSAR Manual standardises functions, communications and mission coordination (Vols. I-II), with periodic amendments to maintain operational consistency ([20], [21]). This is why the -air bridge- works even in chaotic scenarios.

Human factor and high-reliability organisations. Accumulated evidence in the maritime field shows that the outcome is decided less by the initial failure than by leadership, communication and teamwork ([22]). To understand why some crews -own the scene-, the HRO literature (Weick & Sutcliffe) offers five practices: attention to failure, sensitivity to operations, resilience, etc. ([23]). In parallel, Reason's models (latent/active errors, -Swiss cheese-) help translate chain failures into preventive and mitigating actions ([24]).

Evacuation simulation and validation: from metrics to models. Alongside IMO guidelines, the technical community has generated validation datasets and protocols (e.g., SAFEGUARD, Galea et al.) that allow software to be tested against real data ([25], [26]). There are cross-validations of advanced tools ([27]) and studies that incorporate variable trim or evaluate specific measures (e.g., thermal protection) under mass passage scenarios ([28]-[30]). This corpus supports the critical use of simulation: useful for comparing options and redesigning routes, provided that it remains anchored to data and the limitations seen in real operations.

Key idea of the framework. The design-procedure-people triangle does not contradict what has been observed: it explains it. Designing to fail without causing harm (SOLAS/FSS/LSA), analysing flows with realistic assumptions (MSC.1/Circ.1533) and training people to decide earlier and communicate better (STCW/ISM/HRO) is, in view of the cases, the short path between the norm and the safety that matters.

3. Data Analysis and Results.

We present a review of the available material, in the same spirit in which the dossier was compiled: prioritising moving images captured during the emergency and ordering the cases in chronological sequence to facilitate reading and comparison. The starting point is clear: we are interested in real scenes -recorded by passengers or, to a lesser extent, by crew members or CCTV- because they allow us to observe the temporal dynamics of the events and the interaction between passengers, crew, and the physical space of the ship.

3.1. Scope and selection criteria.

Emergencies on passenger ships between 1991 and 2016 are compiled (Oceanos, Norwegian Dawn, Star Princess, Pacific Sun, Louis Majesty, Clelia II, Grand Holiday, Costa Concordia, Sewol, Explorer of the Seas, Ecoquest Catamaran, Anthem of the Seas), chosen for the adequacy of audiovisual material that allows us to reconstruct what happened and accompany the analysis with safety proposals.

Oceanos (1991)

- **MTS Oceanos - Hundimiento (2'32")**
  https://www.youtube.com/watch?v=yGA78AaLCF0
- **The Oceanos Sinks (7'44")**
  https://www.youtube.com/watch?v=4rQ3Uhl__CE
- **Oceanos - Simulation of sinking (1'33")**
  https://www.youtube.com/watch?v=Q9Z_Hcg2wF8
- **Miracle on the Wild Coast - Sinking of the Oceanos (Part 1)**
  https://www.youtube.com/watch?v=E6Ifnl3Iung
- **Miracle on the Wild Coast - Sinking of the Oceanos (Part 2)**
  https://www.youtube.com/watch?v=QZHyll-Mkzc
- **Miracle on the Wild Coast - Sinking of the Oceanos (Part 3)**
  https://www.youtube.com/watch?v=4WuAiDy9Xqc
- **Miracle on the Wild Coast - Sinking of the Oceanos (Part 4)**
  https://www.youtube.com/watch?v=Aq-3EruOUW0
- **Miracle on the Wild Coast - Sinking of the Oceanos (Part 5)**
  https://www.youtube.com/watch?v=eT16nqNj0i4
- **Miracle on the Wild Coast - Sinking of the Oceanos (Part 6)**
  https://www.youtube.com/watch?v=oc1G6gux1pk
- **Oceanos sinks off Wild Coast of South Africa (6'11")**
  https://www.youtube.com/watch?v=GFPYqT4Jbg8

Norwegian Dawn (2005)

- **Huge wave turns cruise-ship holiday to horror (5'36")**
  http://www.nbcnews.com/id/7533945/ns/us_news/t/huge-wave-turnscruise-shipholiday-horror/#.WKMxIG_Jxpg

Star Princess (2006)

- **Star Princess Fire (0'32")**
  https://www.youtube.com/watch?v=IfiFtheA0BU
- **Fire (1'08")**
  https://www.youtube.com/watch?v=VbL1E_QmDqs
- **Star Princess Cruise Ship Fire - photos of the damage (2'59")**
  https://www.youtube.com/watch?v=lFr6OF8eneg

Pacific Sun (2008)

- **Cruise ship Pacific Sun hit by tropical storm CCTV 7 Min version (7'25")**
  https://www.youtube.com/watch?v=VchsHhPIx_s
- **Pacific Sun Cruise Liner In Heavy Seas (3'21")**
  https://www.youtube.com/watch?v=R2Ch397Ipps
- **Another internal view of the Pacific Sun during a severe storm (1'13")**
  https://www.youtube.com/watch?v=J1kWjmDy85w

Louis Majesty (2010)

- **Louis Majesty cruise ship hit by wave**
  https://www.youtube.com/watch?v=6rS1_-Jb56Q
- **MONSTER WAVE HITS THE LOUIS MAJESTY CRUISE SHIP!! (1'19")**
  https://www.youtube.com/watch?v=ZsTOZ6sI3OY
- **Raw Video: Huge Waves Slam Cruise Ship (2'05")**
  https://www.youtube.com/watch?v=mO_xLED4Fa0
- **The Tragic Accident on Louis Majesty (4'09")**
  https://www.youtube.com/watch?v=eqylmxP79gI
- **Wave Hits Louis Majesty Cruise Ship (1'32")**
  https://www.youtube.com/watch?v=lvOceI6egg0
- **Louis Majesty Chaos as Waves Hit**
  https://www.youtube.com/watch?v=3BD69L6UV48

Clelia II (2010)

- **Clelia II in Antarctica Storm (7'31")**
  https://www.youtube.com/watch?v=i_NpT4WVPx8
- **Dramatic video of Clelia II Antarctic cruise ship slammed by giant waves (1'47")**
  https://www.youtube.com/watch?v=eDTbopUYg20
- **Clelia II-crewmember....MOV (1'42")**
  https://www.youtube.com/watch?v=BXpKp_0q3ug
- **Big Cruise Ship crippled by 30 foot wave in rough ocean near Antarctica**
  https://www.youtube.com/watch?v=rkPVwE8XQCs

Grand Holiday (2012)

- **Espant al Grand Holiday - Escola Vedruna Palamós 2012 (8'22")**
  https://www.youtube.com/watch?v=Km2TwpfFoWM
- **Acidente navio Grand Holiday 27/10/2012**
  https://www.youtube.com/watch?v=aaJmph4hbKI
- **Un crucero que pudo terminar en tragedia**
  https://www.youtube.com/watch?v=Z4N4D4s6olg
- **Susto en crucero a bordo del Grand Holiday 27-10-12 3º - Tormenta**
  https://www.youtube.com/watch?v=8-jWBINEh14

Costa Concordia (2012)

- **sinking of the concordia caught on camera hdtv x264 c4tv p**
  https://www.youtube.com/watch?v=4MtWxnRBVvg
- **Terror At Sea - The Sinking Of The Concordia (46'07")**
  https://www.youtube.com/watch?v=5SaaBLhW2p4
- **Costa Condordia disaster: live on board footage evacuation (1'42")**
  https://www.youtube.com/watch?v=ZBiLRRZRCMw
- **Costa Concordia: Chaotic Footage from Inside the Crash (5'12")**
  https://www.youtube.com/watch?v=QXs2eWNf_n8
- **Ricostruzione 3D incidente Costa Concordia (0'53")**
  https://www.youtube.com/watch?v=ruzgkIIesKQ
- **3D Costa Concordia sinking - L'affondamento (2'42")**
  https://www.youtube.com/watch?v=0JnRReFJ4x0
- **Costa Concordia sinking 13.1.2012 - The End (5'51")**
  https://www.youtube.com/watch?v=V2GGShZmiXc
- **Costa Concordia cruise ship sinking 2012 (0'36")**
  https://www.youtube.com/watch?v=SmQD1wCxMLI
- **Concordia captain appears to abandon sinking ship (1'01")**
  https://www.youtube.com/watch?v=3FSp8yF3F0A
- **Shocked Costa Concordia passengers escape sinking liner (1'24")**
  https://www.youtube.com/watch?v=mcrBboNWVZ8
- **Coast guard tape: Get back on board Captain Schettino! (4'00")**
  https://www.youtube.com/watch?v=wM9sam2u_Tk

Sewol (2014)

- **What happened inside Sewol ferry 2014.04.16 (21'41")**
  https://www.youtube.com/watch?v=MkyFbcnIQV4
- **Last moments on capsized ferry caught on tape (2'18")**
  https://www.youtube.com/watch?v=lPhZLYetJ7w
- **Final goodbyes of South Korea ferry passengers (1'39")**
  https://www.youtube.com/watch?v=r6VSoceCAXY
- **Fisherman rescued students from sinking ferry (2'57")**
  https://www.youtube.com/watch?v=YwkkgXb6jHs
- **Captain Abandoning Sinking Sewol (1'23")**
  https://www.youtube.com/watch?v=7VRgslbpIXI
- **Cellphone Video From South Korea Ferry Disaster (1'17")**
  https://www.youtube.com/watch?v=UeDJJdq9edg
- **Coastguards save people from sinking South Korea ferry (4'52")**
  https://www.youtube.com/watch?v=Ka14Ee9vobc
- **Teens' Final Moments on South Korean Ferry (3'03")**
  https://www.youtube.com/watch?v=6h0AEIMMFjY
- **Father releases footage taken by dead son's mobile phone (1'19")**
  https://www.youtube.com/watch?v=KrMyR-TEKS0
- **Students on doomed ferry before sinking (1'47")**
  https://www.youtube.com/watch?v=9U-TQrxBOxY
- **Sunken Sewol-ho ferry pulled up above surface in three years**
  https://www.youtube.com/watch?v=X64qnHmeIl8

Explorer of the Seas (2015)

- **Explorer of the Seas 2015 - storm lean over (0'44")**
  https://www.youtube.com/watch?v=JNs23HPbyZ0
- **Royal Caribbean Explorer of the Seas 2015 (1'29")**
  https://www.youtube.com/watch?v=FRUnJML6FF4

Ecoquest Catamarán (2015)

- **Student films moment tourist boat capsizes off Costa Rica (3'20")**
  https://www.youtube.com/watch?v=MKVwWywvtvc
- **(VIDEO EXCLUSIVO) Sobreviviente del Catamarán narra el naufragio (5'35")**
  https://www.youtube.com/watch?v=iN0TqVQAlzo

Anthem of the Seas (2016)

- **Chaos Aboard Royal Caribbean Cruise Caught in Storm (2'22")**
  https://www.youtube.com/watch?v=XsQOjAEovyg
- **Cruise ship caught in extreme storm**
  https://www.youtube.com/watch?v=Lr2WGXmFTmY
- **Passengers Describe What Happened During Weather Troubles (6'48")**
  https://www.youtube.com/watch?v=nn989XYHpVY
- **Anthem of the Seas Storm!! Video 2 (1'30")**
  https://www.youtube.com/watch?v=-ecXDovCTYE
- **Storm from Two70 (1'23")**
  https://www.youtube.com/watch?v=UFy-dgy0pvU

Methodological limitation -and rationale for this approach-: when an accident occurs, there is rarely a systematic internal record; the crew's priority is to perform their assigned role, not to film. Therefore, most of what can be observed inside comes from passengers (and CCTV, when available), with their biases in terms of angle and continuity; even so, the usefulness of reviewing movement under list, the behaviour of furniture and the quality of the public address system is evident.

3.2. Recurring themes observed.

1. Rough seas, rolling and 'projectile furniture'.
   The Pacific Sun CCTV footage shows how chairs, tables and heavy items fly across the saloons with each roll, becoming a source of injury; even 'seemingly fixed' items end up being torn from their mountings. The same cameras reveal cargo shifting in the holds, with a real risk of damage and flooding. ANALYSIS and proposals converge on the obvious but forgotten: systematic fastening of furniture, comprehensive lashing and CCTV with monitoring from the bridge.
2. Abnormal waves and fragility of bow glazing.
   On the Louis Majesty, the impact of a wave train breaks the windows of a saloon at the bow: sudden entry of water, dragging of belongings and victims due to the collapse of furniture. The lesson, explained in the dossier itself: double glazing with exterior methacrylate (which deforms and dissipates energy) and protocols for preventive removal of passengers from exposed windows.
3. Loss of integrity, increasing list and evacuation under asymmetry.
   The Oceanos allows us to follow, almost minute by minute, how a leak translates into list and the impracticability of decks and rooms; the evacuation is ultimately sustained thanks to external resources (helicopters, auxiliary boats). The analysis highlights the need for effective handholds and transit points even with list, and for a passageway that is visible from the outset.
4. Fires in passageways.
   On the Star Princess, the sequence compiled after the fire was extinguished shows the vertical and longitudinal extent of the damage. The operational proposal: careful management of extinguishing water so as not to compromise stability, preventive evacuation to a safe side if there is a risk of spread, and immediate assistance to nearby ships if evacuation is necessary.
5. Communication, leadership and crowd control.
   Costa Concordia and Sewol concentrate the essentials: delays in the alarm, contradictory messages ('everything under control') and inappropriate orders ('stay in your cabins') amplify the initial damage. Crowds are observed at stations, heaving to with a list and ineptitude in critical manoeuvres. The comparison also suggests that cultural factors condition the response of passengers and obedience to authority.
6. Redundancies and assistance between ships.
   On Clelia II, a broken bridge window leaves the ship without communications and with reduced propulsion in very rough seas; the solution comes with a satellite terminal transferred from another ship, an operation which, without clear guidance, entails the risk of collision and recommends the use of fast boats for transfers.

3.3. Analysis: Comparative summary.

- Human factor. What matters most is not usually the initial failure, but how it is managed: the clarity and timeliness of the alarm, the consistency between what is said over the loudspeaker and what the crew is seen doing, and the presence of personnel guiding flows and containing anxiety.
- Interior design. The images repeat the same moral: loose furniture = injuries. Corridors and stairs without handrails on both sides complicate mobility with moderate heeling; bow windows, if they fail, turn a lounge into a black spot.
- Means of abandonment. Lowering with a list is unforgiving: procedures and equipment must allow access 'at deck level' and be less sensitive to asymmetry. Early transfer of vulnerable groups to designated areas and equipment, without waiting for the situation to become irreversible.

3.4. Safety proposals (derived from viewing).

Physical and design prevention

- Comprehensive securing of lounge furniture; thorough lashing of interior cargo.
- Double glazing in the bow (external methacrylate + internal glass).
- Continuous handrails on both sides of corridors and stairwells.
- Access to lifeboats at deck level and lowering systems that are less dependent on verticality.

Crowd control and management

- Early warning, consistent messages (without visual contradictions) and active presence of crew at assembly stations.
- Preventive removal from areas with exposed windows during storms.
- Early transfer of children and PRMs to designated teams, even without a formal abandonment order, if degradation indicators advise it.

Technology and redundancy

- Extensive CCTV coverage (passageways and holds) with surveillance from the bridge.
- Safekeeping of satellite communications in watertight containers; transfer of critical material by speedboat if the affected vessel is ungovernable.

3.5. Gaps and areas for improvement.

Systematic documentation: institutionalise the use of CCTV and the preservation of records for post-incident analysis.

'Balance-proof' interior guides: clear criteria for anchoring, layout of circulation routes and furniture in high-occupancy rooms.

Realistic drills: practice of lowering on a list, exercises with noise, darkness and dense flows, and message protocols adapted to different cultural contexts.

This review confirms that images 'from within' are not anecdotal, but operational evidence. Through them, we see where the design fails, when communication breaks down, and how a crowd behaves when the ship is no longer upright. The natural translation of what we have observed is twofold: engineering (securing, reinforcing, facilitating abandonment) and procedure (alerting earlier, speaking clearly, always guiding). That is what the above proposals aspire to: that what we have seen on screen becomes real safety the next time.

4. Discussion.

- Evacuations that work vs. evacuations that go wrong.

  If these cases teach us anything, it is that the initial damage does not determine the outcome on its own: management does. On the Oceanos, the progressive loss of integrity led to a list that made the decks impracticable, but the combination of clear operational decisions, early external support and a guided evacuation (even by entertainment staff when the officers were absent) allowed all passengers to be extracted with reasonable coordination using helicopters and auxiliary boats. The sequence shows boat hooks, zodiacs and air bridges operating at the bow and stern until the ship was emptied, with 16 helicopters involved in a continuous mission; the contrast with the previous minutes - disorganisation on board, almost impossible transit due to the list - reinforces the point: with leadership and resources, even if untimely, the emergency can be redirected.

  On the Costa Concordia, the opposite happens: the delay in raising the alarm, the contradictory messages ('everything is under control' while the crew wears life jackets) and the delay in ordering the abandonment cause crowding at stations, unsafe lowering with the list and visible panic. The interior recordings and the reconstruction of events show this starkly: when the order comes, there are already physical barriers (slopes, doors, stairs) and psychological barriers (mistrust) that multiply the risk.

- The human factor as a lever-or Achilles' heel.

  There is no mystery: leadership, training and communication are decisive. In Concordia, the lack of consistency between what is said and what is seen on board disrupts crowd control; the footage itself shows ineptitude in evacuations and the absence of a 'visible' presence to direct flows and prioritise the vulnerable. In Oceanos, on the other hand, the evacuation becomes more orderly when someone takes charge of the scene and channels external help. The discussion is not about heroes, but about trained roles that are activated without waiting for the perfect order.

- Organisational and national culture: obedience, initiative and useful time.

  The Sewol illustrates the cost of literal obedience to an instruction to remain in cabins whose stability has already been compromised: early self-evacuation is blocked and the ship becomes a death trap as the list increases. The dossier highlights the almost total adherence to the order and the tragic result. In contexts such as Concordia, there is more individual initiative towards lifeboats and decks, with its own risks of lack of coordination, but which sometimes keeps a window of escape open. The conclusion is uncomfortable and practical: protocols and messages must take into account the real cultural context of obedience/initiative of the passage.

- Technical limitations: when the ship 'hits' from the inside.

  Two types of failures appear repeatedly in the video. First, bow windows vulnerable to wave impact: Louis Majesty shows broken windows, sudden water ingress, collapsed furniture and victims crushed; the recommendation in the document itself - double glazing with external methacrylate - is a direct and reasonable engineering measure.

  Second, unsecured furniture that, with severe rolling, becomes a projectile: Pacific Sun offers CCTV footage of dining rooms that are 'swept away' in minutes, and of holds with shifts capable of compromising watertightness. The lesson is obvious and yet forgotten: permanent anchors, 'roll-proof' interior design and rigorous lashing in interiors. The usefulness of CCTV as an operational sensor is indisputable.

  Added to this is accessibility in abandonment with heel: boats and routes designed for verticality suffer from asymmetries; the analysis itself proposes 'deck-level' access, less sensitive lowering systems and early transfer of vulnerable groups to designated areas and equipment.

- Continuous training and drills that resemble what we saw.

  The videos show that many crews train for a static ideal and not for noise, list, darkness, incorrect language on the PA system or real crowding. Hence, the document insists on specific practice of lowering with list, crowd control and clear and early messages. The training challenge in nautical schools is to translate these scenes into learning situations that awaken judgement and anticipation, not just the completion of checklists.

- Support technology: from 'seeing' the problem to 'anticipating' it.

  The dossier itself already points to three technological levers that are viable today: extensive CCTV coverage

monitored from the bridge; redundancy in communications (the Clelia II case resolved with an Iridium satellite terminal); and computational reconstructions that help to understand the chronology of failures and useful times (Concordia). From there, the natural leap-beyond the material reviewed-is to integrate sensors (occupancy, doors, local list), operational simulation and analytics that prioritise routes and messages in real time; and explore the use of predictive models to anticipate evacuability degradation with simple criteria (list, flooding, flow density). Technology, without a clear procedure and leadership, does not fix anything; with them, it reduces seconds where they matter.

In short, the common thread in these cases is clear: decide earlier, communicate better, and design for failure. Decide earlier = activate alarms and external assistance while there is still time; communicate better = consistent, visible messages adapted to the culture of the passage; design for failure = interiors that do not cause injury, accessible boats with list, and systems that continue to function when the ship is no longer upright. The rest-the report, the investigation, and the trial-comes too late for those who were inside.

Conclusions.

In all the cases analysed, the same underlying idea emerges: useful time determines the outcome. Activating the alarm in advance, requesting external support and implementing the roles on board opens up escape routes which, if wasted, close as the list, darkness, noise and mistrust increase. This is the difference between evacuations that work, even with limited resources (as in Oceanos), and others that descend into chaos when the message arrives late or is contradictory (as in Costa Concordia).

The second common thread is the human factor. Visible leadership, the presence of the crew at assembly stations, clear instructions consistent with what passengers see being done, and practical training-not just checklists-support crowd control. When these pieces fail, crowding, unsafe lowering of boats, and panic ensue. Organisational and national culture also influences the collective response: literal obedience to an order to 'stay in your cabins' can be lethal when stability is already compromised (Sewol case), while in other contexts greater individual initiative emerges, with the inherent risks of lack of coordination, but which sometimes keeps exits open.

On a material level, the videos reiterate simple, high-impact lessons. An interior design that does not cause injury-fixed furniture, rigorous lashing in interiors, continuous handrails on both sides and clear circulation routes-reduces injuries and facilitates movement with moderate to high heeling. In glazed bow areas, vulnerability to wave impacts requires double glazing (external methacrylate) and protocols for preventive removal of passengers from exposed windows during storms.

Abandonment with a list deserves specific treatment: boats and routes designed for a 'straight' ship fail when the ship is no longer straight. It is essential to facilitate access at deck level, use lowering systems that are less sensitive to asymmetry, and move children and people with reduced mobility to designated areas and equipment early on, without waiting for a 'perfect' order when indicators of deterioration advise it. Technology helps if it is at the service of the procedure: CCTV coverage monitored from the bridge, real redundancy in communications (satellite) and 3D reconstructions for learning afterwards; looking ahead, occupancy/list sensors and operational simulation can prioritise routes and messages in real time, always subordinate to a present command.

In short, the lessons are operational and straightforward: decide earlier, communicate better and design for failure. Activate help while there is still room, communicate with credible and consistent messages, and configure the ship so that, even if damaged and listing, it does not harm those inside or block their exits. That is the shortest bridge between what is seen in the images and real safety on board.

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