The Secret of LUSITANIA
written by Dr. Tamás Balogh

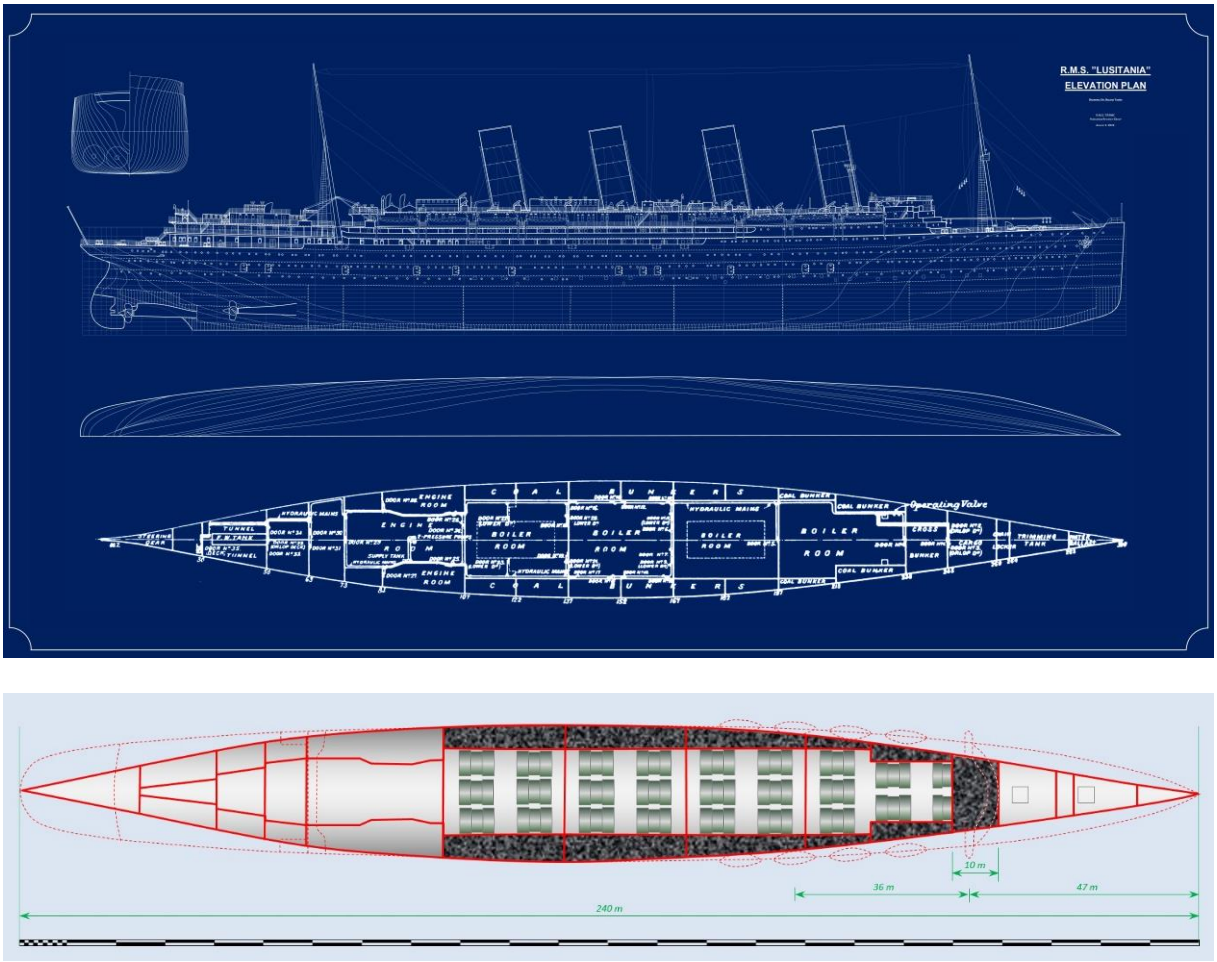
Between July 6-14, 2022, the wreckage of the British ocean liner LUSITANIA, sunk by a torpedo in 1915, was searched in the Atlantic Ocean. The expedition - carried out for the first time with the cooperation of Hungarian historical and technical experts - can put an end to 107 years of speculation.

On the southern coast of Ireland, the Old Head of Kinsale is just as characteristic a landmark for Atlantic Ocean sailors as the Tihany Peninsula is for their Balaton counterparts. Every day for two weeks in the summer of 2022, the Irish research vessel SEAHUNTER - with 12 divers and researchers from 6 countries (Belgium, Germany, Hungary, Ireland, Spain and the USA) on board - left the port of Kinsale, a small fishing village hidden at the base of the headland, to search for answers to the questions related to one of the greatest history-making mysteries of the 20th century, the circumstances of the torpedoing of the giant steamer LUSITANIA, the details of which were summarized by National Geographic Magazine on the 100th anniversary of the tragedy.

Picture 1: *The lighthouse at Old Head of Kinsale, where the keeper witnessed the nearby tragedy in 1915 (photo: Péter Könczöl).*

On May 7, 1915, the seventh largest passenger ship in the world at the time, the LUSITANIA, sank. 1,197 passengers were killed when the German submarine U-20 torpedoed the ocean liner to prevent the delivery of military equipment carried on board. Among the victims were 128 neutral American citizens, whose deaths contributed to the fact that the United States entered the World War in 1917 on the side of the Entente and against the Central Powers, thus deciding its final outcome. The LUSITANIA is therefore a ship made history, as the 1,197 people who perished on board contributed in a unique way to the victory of their country in a struggle, which their homeland might have lost without this sacrifice. In this sense, the importance of their sacrifice is similar to the importance of the heroic death of soldiers who died on the land fronts of the war (even if this sacrifice was made without their knowledge and agains their will), and has not yet been officially recognized in this sense.

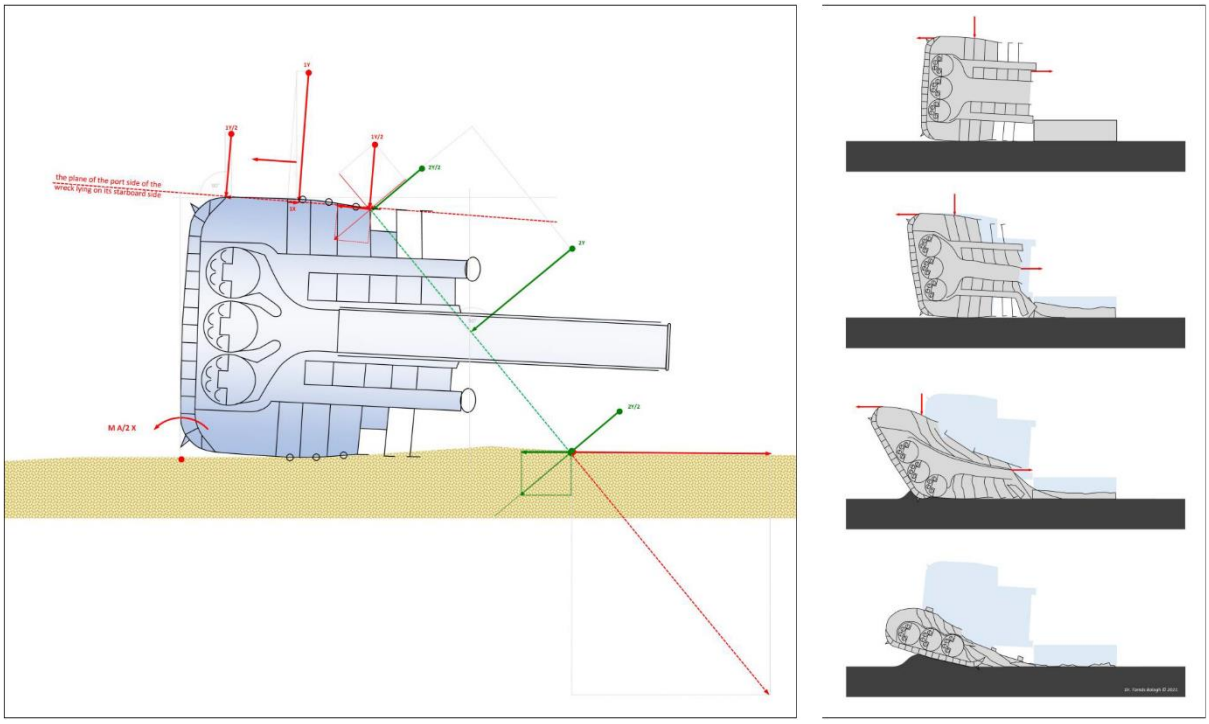
In the time since the tragedy, a total of 14 wreck-research expeditions have taken place, most of which added something to the history of the research: In 1935, Jim Jarret identified the wreck's position. Between 1960/63, John Light identified that the ship was lying on its starboard side and had broken in two. In 1982, the team of Oceaneering International Inc. confirmed that the ship was transporting ammunition and 3 propellers were brought to the surface. In 1993, the continuous deterioration of the wreck was confirmed and its final collapse was predicted by Robert D. Ballard. In 1995, the wreck was declared protected. In 2007, salvage was allowed. In 2008, the team led by Eoin McGarry discovered that there was far more munitions in the wreckage than the amount previously assumed. In 2011, one of the engine telegraphs and a 1st class cabin window were brought to the surface by an expedition initiated by Gregg Bemis. The 3D visualization of the wrecks began in 2017 and continued in 2019 and 2020 by the teams of Peter McCamley. And the 2022 expedition led by Darragh Norton succeeded for the very first time in conducting an internal inspection of the first boiler room, which is of outstanding importance from the point of view of the second explosion after the torpedo hit, refuting the popular belief since 2011 that the explosion of the first two single-ended boilers in the boiler room - aft from the bulkhead between the No. 1. boiler room and the No. 2. cargo hold (used sometimes as a reserve coal bunker) - accelerated the sinking of LUSITANIA.



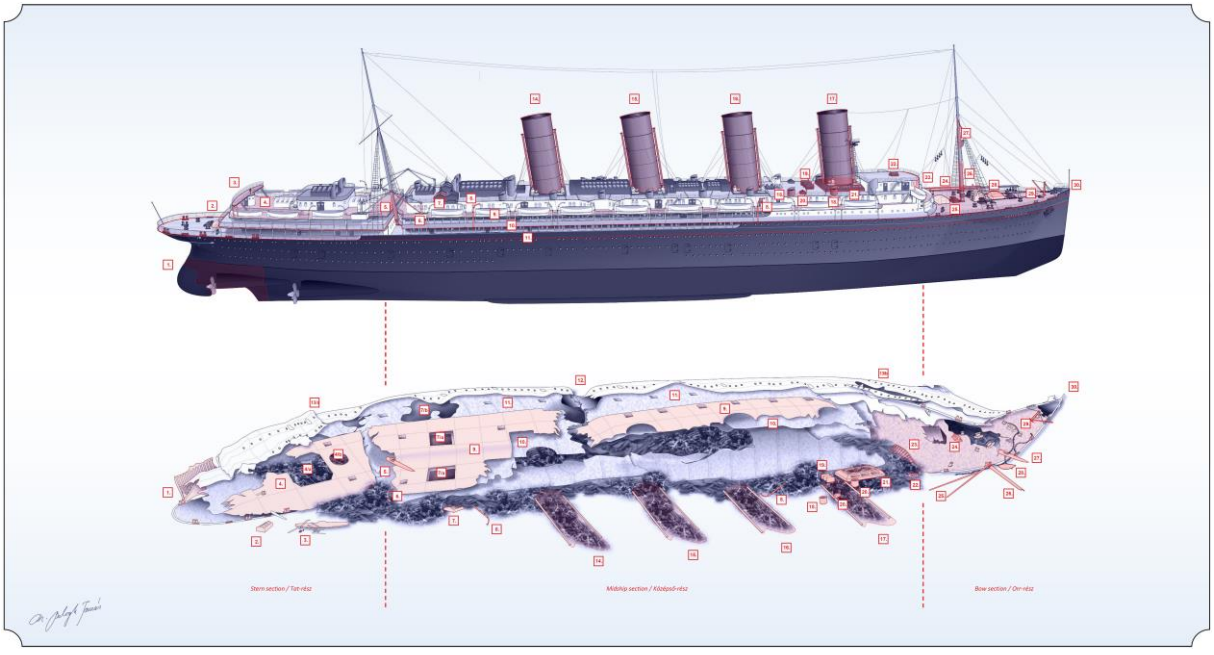
Pictures 2 and 3: *General arrangement plan of the LUSITANIA (above) and its boiler rooms (below) (made by Dr. Tamás Balogh).*

The extraordinarily short time of the LUSITANIA's sinking has produced a mystery that has yet to be solved as it is most likely that the ship was sent to the seabed by the second, internal explosion of unknown origin, just after the torpedo hit. The cause of this second explosion has been under investigation ever since. Even the commander of the German submarine that launched the torpedo indicated three possible causes in his war diary: the explosion of the ammunition/explosives transported on the ship, a boiler explosion, or the explosion of coal dust left in the coal bunkers. Since then, continuing research has been undertaken of which of the three possible causes can be supported by convincing evidence.

However, this research is an extraordinarily complex task, as it is made difficult by the position of the wreckage and its deteriorating condition. The LUSITANIA sank 22 km off the Old Head of Kinsale, the headland at the entrance of the St. George's Channel, which is the gateway between the Celtic Sea and the Irish Sea. Due to the tidal change, there is a constant flow in the strait, so the shipwreck sunk on the shallow seabed - only 85-92 m deep - lies in the path of constant, strong currents, which constantly weaken and destroy its structure, and at the same time make the work of divers more difficult. Dives are only possible when the current slows down when the tide changes direction, known as slack water. Added to this the wreck lies in an area of poor visability, typically 3-5m. At the same time, the period suitable for diving in the North Atlantic Ocean, which is generally known for its violent storms, is further shortened by the frequent change of the weather. Only three months a year - June, July and August - are suitable for organizing diving expeditions, but even in these three months, a period longer than 3-4 consecutive days, suitable for diving, is a rarity.



Pictures 4 and 5: *The causes and process of the disintegration of LUSITANIA. Immediately after sinking, the ship capsized and laid on the seabed on its starboard side is affected by the forces indicated in red. Namely: 1) Nearly vertical pressure forces. 2) Near-horizontal pulling forces arising from the pressuer forces (due to deviation of the hull - lying on its side - from the vertical). 3) torque, arising from the pulling forces (and acting around the point where the double bottom standing on the seabed). The LUSITANIA was the first ocean liner in which a large amount of high-strength silicon steel was installed (so that hull, supported by two wave crests at both ends, hanging freely above the wave valley, could flexibly bear the internal tension arising from the huge bending moment). The portside, loaded with silicon steel plates installed in two layers in the upper part of the midship section, rose 26 m above the seabed when the ship turned to its starboard side after the sinking, and was not supported by any other, but deck beams, which installed between the side frames. However, they were not designed for this load, and therefore – as soon as the compressive force resulting from the weight of the double plating was transferred to the decks – they bent under the weight over time. Adding to the loss of strength due to corrosion, the process was accelerated. As the deck beams bent due to the weight of the port side, their length and thus the width of the hull decreased. But - because these beams were attached to the side frames supporting the side walls of the ship - bent deck beams started the downward movement of the port side, which generated an extremely high pulling force. This also had an effect on the structure of the ship's double bottom, which - as a result of the pressure from the port side, which is now pressing on it at an angle - began to tilt from its almost vertical position towards the seabed, (i.e. to the left), while the structures in the ship's hull moved in the opposite direction, obeying the weight of the downward moving port side. The decks gradually began to slide out to the right of the collapsing hull. As a result, the forces marked in green (compressive forces resulting from their weight acting on the decks that slid out of the hull in an inclined plane) occurred, which accelerated the process (their effect was added to the forces that started the movement of the structure to the left). The collapse of the wreck was already spectacular during the 1993 expedition led by Robert Ballard, but since then it has significantly increased. Even Ballard was shocked to find that the hull lying on its side - instead of rising 24-26 m above the seabed, as one might expect - was only 19 m high. However, the latest SONAR images taken in the 2000s confirmed that the height of the ship's hull is now only 13 m. The collapse of the ship's hull is accompanied by other deformations and distortions due to the forces acting on the structure as a whole. Today, not only is the wreck almost completely flattened, but its upper decks (belonging to the former superstructures) have also completely slipped out of the ship. The former structure is becoming less and less recognizable, and it is likely that it will soon completely collapse. (drawings made by: Dr. Tamás Balogh).*



1. – Stern casting (separated from the stern section). / A farcikke ömlvénye (a tat-részről különválható).
2. – Skylight over the hatch to the steering gear. / A kormánygép szerkezetkönyének felülvilágítója.
3. – Docking bridge (with the fallen engine telegraph). / A hátsó híd (a kidőlt géptávírral).
4. – Boat deck of the 2nd class superstructure. / A 2. osztályú felépítménysor csónakfedélzete.
4/a – Opening for the 2nd class staircase on level of the boat deck. / A 2. osztályú lépcsőház nyílása a csónakfedélzeten.
4/b – Opening for the skylight of the 2nd class drawing room. / A 2. osztályú írószoba (hölgy-társaligó) felülvilágítója.
5. – Stump of the main mast with cleats for halyards around its base. / A főárboc csonkja, az alapja körül kötélrögzítőkkel.
6. – Arm one of the baggage cranes, with the pulley at its end. / Az egyik poggyászdaru karja, végén a kötélvezető csigával.
7. – Skylight of the engine room hatch. / A gépház szerelőaknájának felülvilágítója.
7/a – Opening of the hatch on the level of the boat- and the promenade deck. / Az akna nyílása a csónak- és sétafedélzeten.
7/b – Portside opening of the hatch ont he level of the shelter deck. / A bal oldali akna nyílása a védfedélzet szintjén.
8. – Lifeboat davit. / Mentőcsónak-daru.
9. – Boat deck of the 1st class superstructure. / Az 1. osztályú felépítménysor csónakfedélzete.
10. – Promenade deck of the 1st class superstructure. / Az 1. osztályú felépítménysor sétafedélzete.
11. – Shelter deck of the 1st class superstructure. / Az 1. osztályú felépítménysor védfedélzete.
12. – Break through the entire hull (formed during the sinking). / A teljes hajótestet átmetsző törés (a süllyedéskor keletkezett).
13/a – Fracture of the stern-section that broke off due to the lack of support (formed decades after the sinking). / Az alátámasztás hiánya miatt leszakadt tat-rész törése (évtizedekkel az elsüllyedést követően alakult ki).
13/b – Fracture of the hull plates in the bow section, due to the decomposition of the ship (formed decades after the sinking). / Az orr-rész bakkáló lemezein a hajó szétrohadása miatt megnyílt törés (évtizedekkel az elsüllyedést követően alakult ki).
14. – Funnel for the Nº 4. boiler room. / A 4. sz. kazánházhoz tartozó kémény.
15. – Funnel for the Nº 3. boiler room. / A 3. sz. kazánházhoz tartozó kémény.
16. – Funnel for the Nº 2. boiler room. / A 2. sz. kazánházhoz tartozó kémény.
17. – Funnel for the Nº 1. boiler room. / Az 1. sz. kazánházhoz tartozó kémény.
18. – Cowl vents to the stokeholds. / Ún. „csuklyás" ventilátorok a kazánházi fűtőterekhez.
19. – Water-tanks. / Víztartályok.
20. – Skylight of A23-as suite rooms. / Az A23-as lakosztály felülvilágítója.
21. – Cover of light and air intake around the Nº 1 funnel hatch. / Fény- és légbeömlő burkolata az 1. sz. kéményaknа körül.
22. – Skylight of the wheelhouse ont he navigation bridge. / A kormányállás felülvilágítója a parancsnoki hídon.
23. – Front wall of the navigation bridge. / A parancsnoki híd homlokfala.
24. – Winch. / Csörlő.
25. – Arms of cargo-cranes ont he foremast (two of four). / Az elárbóc darunak karjai (kettő a négyből).
26. – Stump of the foremast. / Az elárbóc csonkja.
27. – Fragment of the foremast with access tot he crows nest. / Az elárbóc töredéke az árbockosárba vezető kijárattal.
28. – Hatch cover of Nº 1. cargo hold. / Az 1. sz. raktérnyílás fedője.
29. – Anchor crane. / Horgonydaru.
30. – Tip of the bow. / Az orrcsúcs.

Pictures 6 and 7: *Overview of the wreck of LUSITANIA based on the results of the 2022 expedition (made by Dr. Tamás Balogh).*

Pictures 8.: *Team at work. Selection of the research area based on evaluation of the known rinformation. (prepared by: Péter Könczöl).*

However, the international expedition in July 2022 was lucky: the divers had 7 days of continuous diving and research! It is also due to this that on 11.07.2022 Trevor Pedlow, one of the divers of the expedition, penetrated through the gap opened by the splitting side plates of the wreck since 2007, and reached the forward boiler room of the ship adjacent to the cargo spaces directly affected by the torpedo explosion, which is the first time in the 107 years since the ship sank so far no one has succeeded. Here, the expedition clarified that the very first (the 2 single-ended) boilers, which were located next to the bulkhead between the boiler room No. 1, and cargo space No. 2, which was also used as a reserve coal bunker, had not explodeed (this is a great achievement considering that the conclusions of the 2011 expedition, it has so far been assumed that the torpedo that exploded in the cargo hold weakened the bulkhead between the cargo hold and the boiler room, which became unsealed, so that cold seawater got into the boiler room, where it came into contact with the heated boilers and blew them up). Darragh Norton, the expedition leader, entered the boiler room on 13.07.2022 - the last day of his expedition - and also managed to reach the farthest point inside boiler room N$^{o.}$ 1, taking photographs for the first time since the sinking.

Pictures 9 and 10.: *Trevor Pedlow and Michael Walz, who visited the LUSITANIA boiler room for the first time in 107 years on 11.07.2022, and Darragh Norton (with Trevor Padlow), who made thorough photographic documentation of the boilers for the first time on 13.07.2022 and penetrated the furthest into the boiler room (made by Dr. Tamás Balogh).*

Pictures 11., 12, 13 and 14: *Photographs taken in the forward boiler room of the LUSITANIA (by Darragh Norton) and a drawing to help identify where they were taken (by Dr. Tamás Balogh).*

Although a thorough evaluation of the underewater photos and footage is still ongoing (supported, among other things, by the simulation created by the ship design department of the Budapest University of Technology and Economics), despite the ongoing analysis, the following facts can be stated with certainty:

1) 5 of the 7 boilers in the boiler room are visible to some extent (both single-ended boilers of the first row, the left double-ended boiler of the middle row and the middle and left boilers of the third row).
2) Out of the 5 boilers seen, 3 must have moved from their original base and – looking towards the bow of the ship – jumped out of its original seat to the right of it (into the free space situated between their supports and supports of the adjacent boilers to its right).
3) The condition of 3 of the 5 boilers seen is known: 2 are intact, 1 shows damage (the cause of the damage - wether related to the sinking or the collapse of the wreck -, as well as the exact extent and circumstances of its origin will be determined by the currently ongoing investigation).
4) Around the bases of the boilers (in the former stokeholds) remains of the stokehold plates can be seen (on which the trimmers stood and walked during their work) and the row of thin columns supporting them.
5) However, further debris from the remains of other equipment of the boiler rooms (exhaust- and funnel uptakes, or assembly walkways and ladders, etc.) cannot be identified (just the remainings of the ash ejectors can be seen, directly attached to the boilers). The probable reason for this is that the wreck lay on its starboard side on the seabed for an unknown period of time, but later (sometime between the early to mid-1970s and mid-to-late 1980s) the double bottom of the hull tilted to the left side (looking towards to the bow), i.e. tilted back almost to its original horizontal position, dragging the left side of the hull with it. This means that for a relatively long time (50-60 years), the boiler houses were turned (hanging) about 90 degrees to the right compared to their original position. The resulting load could only be bore by the strongest structural and material connections, but the corrosion of the weaker joints and thinner materials took place in this turned position, so everything that loosened or broke during this period fell down to the starboard side inside the hull.

However, the research focused not only on the bow section of the ship, but also enriched the exploration of the stern section with additional results: The divers - with the exception of a 40 m long portion of the midship section - essentially researched the entire length of the shipwreck, and among other things, they were able to enter into the engine room, where they identified the remains of one of the steam turbines and the condenser.

Pictures 15 and 16: *From the largest to the smallest - pieces of the wreck. Above: Michael Walz in the port engine room of LUSITANIA. Below: a coffee cup in the mud. (by Darragh Norton).*

Photo 17: *Remains of LUSITANIA's engine telegraph near the docking bridge (by Darragh Norton).*

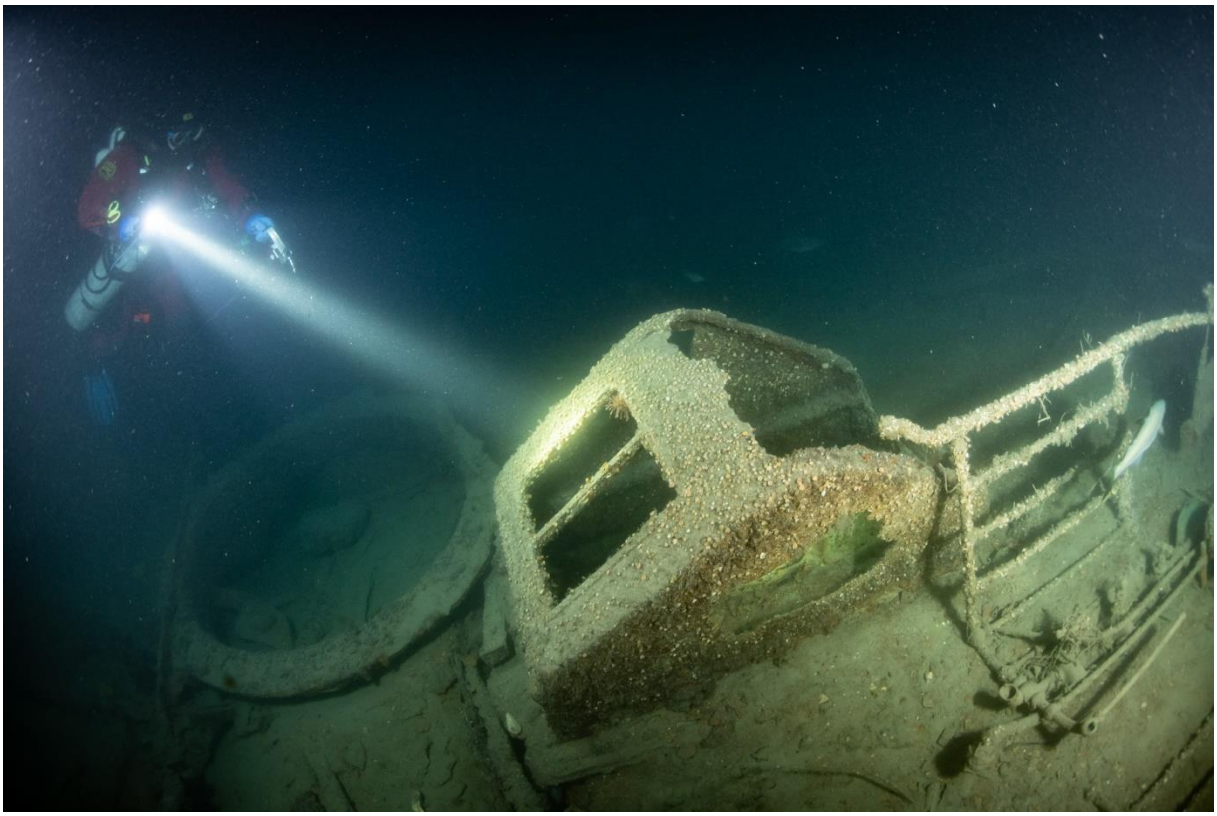


Image 18: *Skylight of en suite room A23 and holder of the shower curtain from the bath (by Darragh Norton).*

Photo 19: *A large amount of scattered small arms ammunition in the forward cargo hold of the LUSITANIA (by Darragh Norton).*

The results achieved are thus already of great importance, as they significantly expanded the photo and film material of the wreck, and also reliably refuted a position voiced 11 years ago, thus getting closer to learning the secret of the LUSITANIA. In addition, the research also had many long-term consequences, since the results achieved also raised questions that require further investigation. The researchers will try to find answers to these questions during the continuation of the expedition in 2023.

Members of the expedition:

Expedition leader, underwater photographer: Darragh Norton (IRL)

Research and security divers:vBrian Armstrong (USA), Graham Waters (IRL), Guy Deno (BE), Heather Choat Armstrong (USA), Kelly McGinn (ESP/IRL), Michael Walz (GER), Paul Tyrrell (IRL), Stef Teuwen (BE), Trevor Pedlow (IRL).

Historical, Engineering and Wreck experts: Dr. Balogh Tamás (HU), Könczöl Péter (HU).

The research and diving licence for the expedition was granted by the Underwater Archeology Unit (UAU) of the Irish heritage authority, Heritage Ireland, based on the consent of the owner of the LUSITANIA wreck, the Lusitania Museum / Old Head Signal Tower Herigate Company Limited by Guarantee and the memorial committee acting on its behalf, which we were able to obtain as a result of the helpful assistance of Con Hayes, Secretary of the Memorial Committee. The value of our work was acknowledged by Heritage Ireland at the end of the expedition in a message praising the official report prepared by Dr. Tamás Balogh (checked by Péter Könczöl and Darragh Norton): "The report is very interesting, comprehensive, and you have provided a lot of very useful information by comparing your team's observations with historical records, photographs, etc. Congratulations to you and your team for an excellent job." It was an honor to be part of the work. Thank you for the opportunity!

Image 20: *Participants of the expedition at the end of the closing dive of the research-week (by Kevin Shanahan).*