

Retrieval activities on the Franken shipwreck

Badania wraku storku Franken

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Abstract: On April 23-28, 2018, an expedition was carried out to the German tanker FRANKEN, located in the central part of the Gdańsk Bay. The purpose of this expedition was to gather as many photos, videos and information as possible, which after processing could be used to produce a coherent, technical description of the wreck. The main purpose of the project is to present the outcome of the expedition. This outcome is a compilation of the measurement data, photographic material as well as samples collected at the sea bottom, next to the Franken wreck, according to the objective set out in the project. The analysis of activities carried out and the research results are intended to contribute to achieving the two main objectives of the project: • to reduce the possibility of an ecological disaster in the Gdańsk Bay through the development and preparation of the best technical and environmentally safe recovery plan of the oil remaining in the Franken shipwreck and, • to mobilize the political will of the maritime administration in the region, where the wreck is located as well as political decision-makers to take over the responsibility for securing the wreck and to undertake actions mitigating the risk of a large oil spill in the Gdańsk Bay. The preparation of the Action Plan for cleaning of the shipwreck will help to show the decision-makers the scale of this undertaking.

Keywords: Video and acoustic inspection, ground sampling, oil spill risk mitigation, wreck clean up, action plan

Streszczenie: W dniach 23-28 kwietnia 2018 roku w ramach projektu „Redukcja negatywnego wpływu wycieków paliwa z wraku tankowca Franken przeprowadzona została ekspedycja na wraku niemieckiego tankowca FRANKEN, znajdującego się w centralnej części Zatoki Gdańskiej. Celem przeprowadzonego badania było zgromadzenie możliwie jak największej ilości zdjęć, filmów oraz wszelkich informacji o wraku, które po zebraniu, opracowaniu i końcowym przetworzeniu posłużyły do wytworzenia spójnego, technicznego opisu aktualnego stanu tego obiektu. Głównym celem raportu jest pokazanie i omówienie wyników ekspedycji. Można to osiągnąć przez opracowanie danych pomiarowych, materiałów fotograficznych oraz pobranych prób dna w okolicy wraku Franken zgodnie z założeniami projektu. Analiza przeprowadzonych działań oraz wyniki badań mają posłużyć do zrealizowania dwóch głównych celów projektu tj.: • ograniczenia możliwości katastrofy ekologicznej w Zatoce Gdańskiej poprzez opracowanie i przygotowanie najlepszego technicznego i bezpiecznego dla środowiska planu oczyszczenia wraku statku Franken z paliwa pozostającego w jego zbiornikach, • do zmobilizowania woli politycznej administracji morskiej na obszarze, na którym zalega wrak, jak i politycznych decydentów do przejęcia odpowiedzialności za zabezpieczenie wraku oraz podjęcie działań mitygujących ryzyko wielkiego rozlewu olejowego w obszarze Zatoki Gdańskiej. Przygotowanie planu oczyszczania wraku ma za zadanie pokazanie decydentom skali przedsięwzięcia, możliwych rozwiązań wraz ze wstępnym szacunkiem kosztów takiej operacji.

Słowa kluczowe: Inspekcja wizyjna i techniczna na wraku, pobór prób gruntu, mitygowanie ryzyka wielkiego rozlewu paliwa, oczyszczenie wraku z paliwa, planowanie działań

THE FRANKEN SHIPWRECK

The Franken wreck has been identified by the Maritime Institute in Gdańsk in the framework of a program investigating the

negative impact of motor shipwrecks on the environment and ecosystems of the southern Baltic as a potential serious threat to the marine environment (Figure 1). Historical documents such as loading plans (plans of the hold), copies of the Krieg-

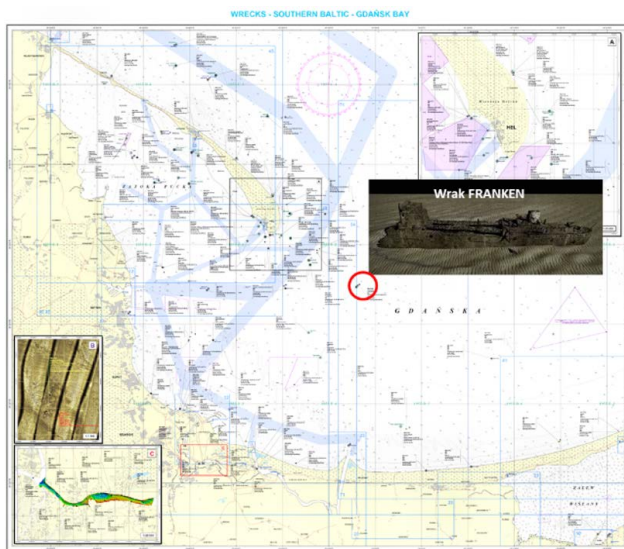


Fig1. Position of the Franken shipwreck in the Gdansk Bay (source: BHMW Nawigacyjna Mapa Wraków ESC_OP-Woo1 akied4).



Fig2. T/S FRANKEN – View of the Długi Targ in Gdańsk, projection of the decks (below T/S FRANKEN on the square in Długi Targ in Gdańsk (B. Hac/ Google Earth).

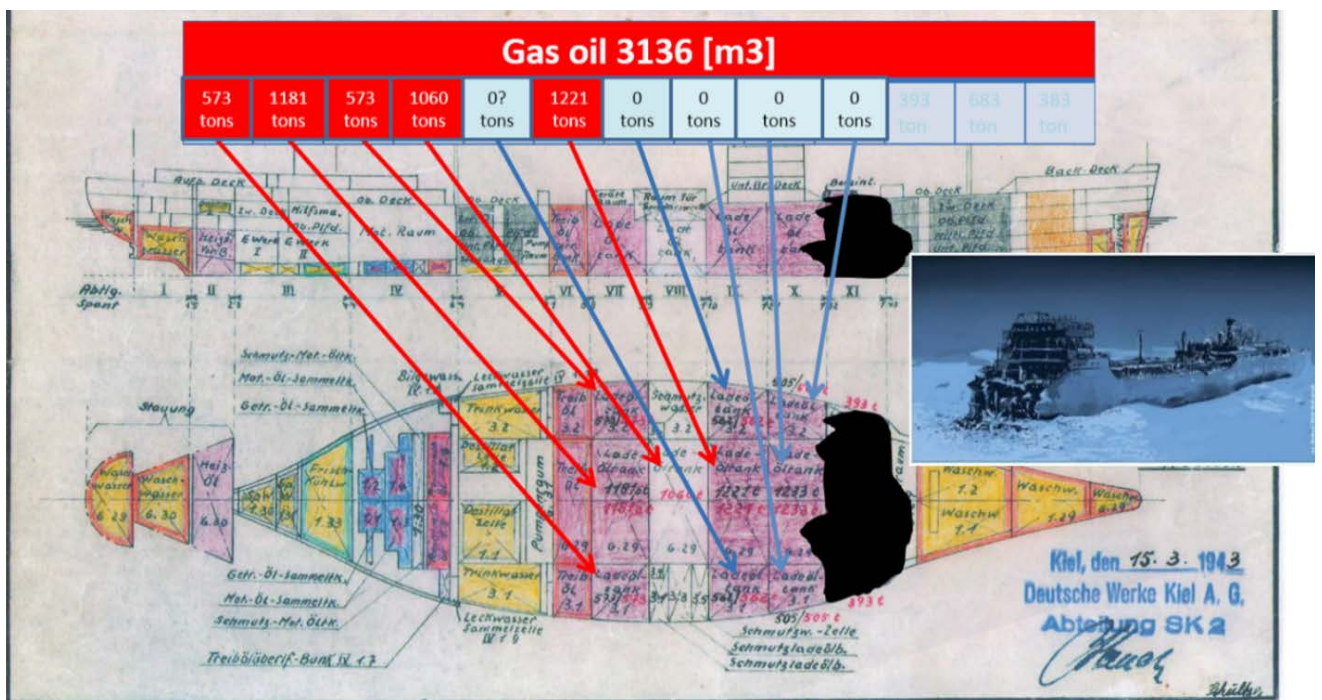


Fig3. T/S FRANKEN—undamaged tanks can accommodate approx. 4,000 tons of oil. On the basis of data from the reports, the amount of oil was estimated at maximum 3,000 tons, and most probably much less, that is 2,000 tons (source: historical plans, own description) It could be aviation oil (on the deck, in front of the forecastle, these tanks do not exist), light diesel marine oils (MDO), medium marine diesel oil (DMB), heavy marine diesel oils, or the heaviest heating oils used for supply turbines. There is no documentation on the basis of which such assessment could be carried out. According to the general rules, during transportation each type of oil must be stored in separate tanks. This means that the oil was transported in several tanks. Almost half of the tanks are still closed (5 out of 13), without access, therefore they can still contain oil. Sealed tanks have a capacity of 573 tons up to 1,221 tons. Oil from even one unsealed tank could contaminate the water and shores of the Gdansk Bay. Heavy oil from the tanks could only cause local contamination of the sea bottom.

smarine commands related to the tasks of the Franken in April 1945, testimonies of witnesses and historical photos of the ship made during the attack, as well as today's photos made by the divers, who often visit the wreck were used to investigate the wreck's current status and the possible risks it could pose.

On the basis of the collected documents, it was assumed with

an absolute degree of certainty that at the moment of sinking, the Franken's tanks were filled with 2,700 tons of oil, not including the oil for the ship engine (approx. 300 tons). Ten days before sinking, the Franken ship delivered supplies for the battle group Thiele in the Gdansk Bay. The British Secret Service had captured German radio signals, which indicated that the ship was supplied with 2,066 m3 of oil from the Thalatta tanker. On

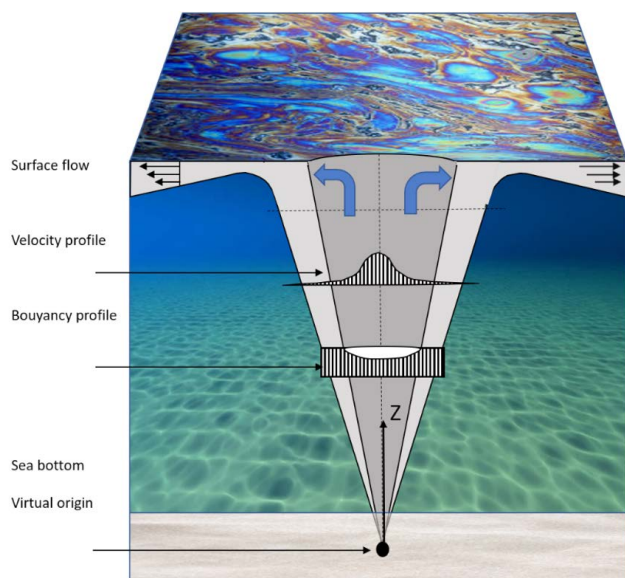


Fig 4. Distribution of oil spills from the wreck.

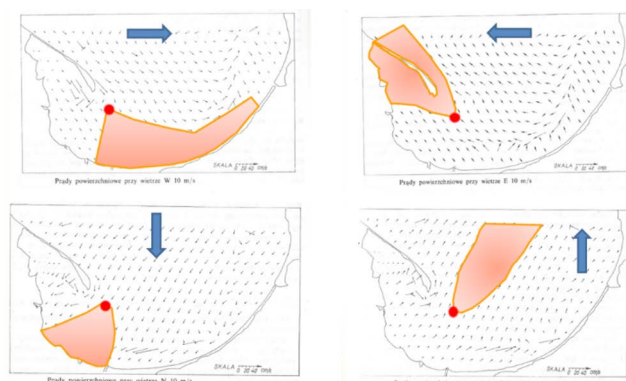


Fig 5. Distribution of the surface currents in the site of the Franken wreck, caused by winds from different directions, together with an illustration of the direction of oil from the wreck (source: IMG).

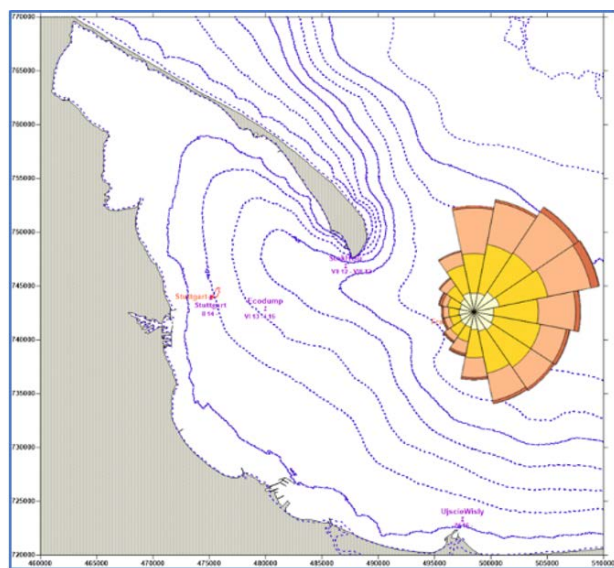


Fig 6. Distribution of surface currents in the site of the Franken shipwreck (data from a model, own elaboration).

March 29, 1945 the total load of oil of the Franken ship amounted to 3,136 m³, which is an equivalent of approximately 2,700 tons, depending on the oil type. Loading plans (Figure 3) show where the ship broke in two. Summarizing, the capacity of the seven remaining tanks, which (potentially) showed little to no damage, amounts to as many as 5,772 tons. This means that there is a lot of free space in the undamaged tanks and after considering the principles of oil distributions on tankers, the amount of potential oil could be estimated at approx. 2,000 tons. This estimation had been made before the start of the expedition in April 2018 and without considering the knowledge that was obtained later.

The current state of the loading of the Franken wreck is unknown. During the expedition, it was not possible to identify clearly which are filled with oil, but it was possible to determine, which tanks are empty due to unsealing.

The documentation collected during the expedition (photos, films, measurements) indicates that five tanks which appear sealed could contain 4,608 tons of different oils. We know that at the time of the sinking, the ship was carrying a lot of load, including oil in the amount of 2,700 tons (3,136 m³), not including the oil for the ship engine. The photos taken during and after the attack show slight oil leakage from destroyed tanks remaining at the water surface. The type of oil in different tanks has not been identified. We do not know all scenarios of such a spill (Figure 4), although on the basis of the identified surface current flow patterns () we can accurately model the scope and distribution of the contaminations (Figs. 5 and 6).

Since the wreck is located in a region which is particularly sensitive to contamination, and the currents in this region will cause dispersion of the spill in the direction of the shores, located from 10 to 25 km away from the wreck's location, the environmental losses will be enormous. Very intensive contamination of the entire Gdańsk Bay area, in particular the shore (beaches) from Piaski to the port of Hel could be expected. Fortunately, the analysis of the directions and speed of the surface currents around the wreck performed on a yearly basis indicates that the current directions and speed are favorable 40% of the year, whereas during another 40% the currents move the oil to the Vistula Spit (including the protected area in the Vistula river cone) and the Russian part of the Gdańsk Bay. During 20% of the year, all oil is moved to the central part of the Gdańsk Bay, posing a real threat to the protected areas and the beaches of the Tricity and Hel.

The estimates of the quantities of petroleum products should include other products (oils, lubricants, fuel oils, bilge water) in the amount of approx. 1,000 tons which were located in the undamaged part of the shipwreck. The exposure of steel from which the ship was built to salt water causes its rapid degradation, thus very seriously affecting the structural strength. Due to the corrosion of the ship's hull, every year the ship's plating is decreased by approx. 0,1 millimeters (a value typical for this area of the Baltic Sea) and thus, 70 years after sinking, the ove-

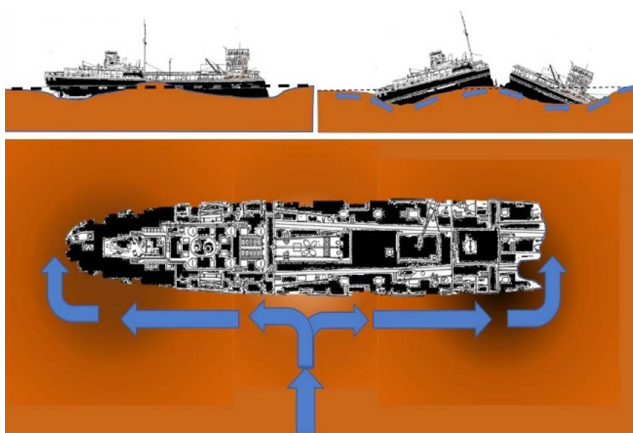


Fig 7. An example of how the wreck is destroyed by strong currents washing out the hull (source: own information).

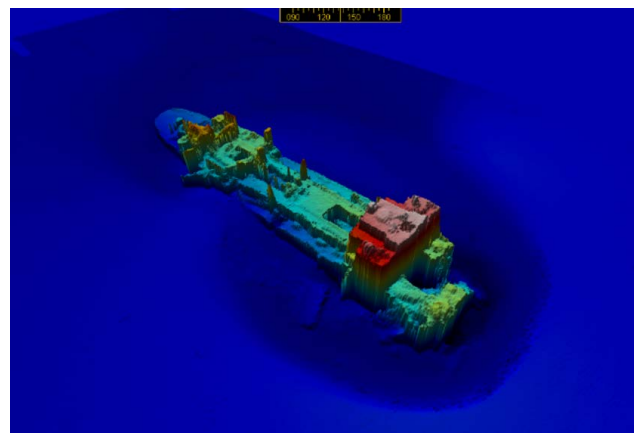


Fig 8. Distribution of the depth around the Franken wreck, visualization of data obtained by MBES (source: own information).

all corrosive loss is estimated at approx. 7 mm. This means that the shipwreck is at the verge of collapse under its own weight (the photos show serious losses in the ship structure). This will soon cause a violent collapse of the wreck and thus uncontrolled spill of fuel, oils and other substances, which will pollute the environment.

ANALYSIS OF THE WRECK DECOMPOSITION PROCESSES ON THE BASIS OF SONOGRAMS AND ECHOGRAMS FROM A MULTIBEAM ECHOSOUNDER

The analysis of wreck sonograms indicates that its present state is bad. The stern is heavily destroyed and is slowly sinking into the bottom, as a result of being covered by underwater dunes created by water currents around the underwater objects found at the sea bottom in this part of the Gdańsk Bay. Wrecks are most often destroyed by long-term stay at the sea bottom in the area of strong bottom currents, which cause very strong movements of bottom sediments, composed of sand and small gravel, that wash out around the hull. In consequence, natural decomposition of the wreck is caused by collapsing and covering by sand. The process of natural decomposition of wrecks at the sea bottom is shown on the photographs (Figure 7 and Figure 8).

Sediments washed away from the considerably heavy bow section (the weight of the Franken might amount to approx. 8,000 tons) cause very strong tensions resulting in breakage of the hull. Further washing away of the bottom below the stern section creates tensions leading to further breaks in the hull and a total collapse of the wreck

MEASUREMENT AND RESEARCH WORK CARRIED OUT ON THE FRANKEN SHIPWRECK

The following two teams took part in the research expedition:

- ◆ team conducting technical activities on the r/v IMOR vessel,

- ◆ team of divers (photographers) preparing a photographic documentation and a survey directly on the wreck.

In order to reach the objectives, the expedition tasks were realized according to the procedure established for all projects carried out by the Maritime Institute in Gdańsk. According to this procedure, all activities start with a tool box for all persons engaged in the project. The project manager divided all the tasks. The objectives of the project, use of the equipment and security measures were discussed. One of the important elements of these briefings is to precisely identify the human resources, diving schedule (sequence and composition of diving teams), equipment needed for filmmaking, measurement or sampling of oil. This was extremely important, as two teams of divers worked together, carrying out different tasks at the same time, supported by an underwater vehicle Cougar XTi.

After completing the diving operations, further briefings took place onboard the IMOR ship to discuss the objectives, present film and photographic material obtained during previous operations. Tasks for the next day were given.

DIVING ACTIVITIES, THE LITORAL SHIP

In the period of April 23-26, 2018, the crew of the LITORAL ship and 4-5 divers (the composition of the divers team was subject to a change) carried out the project tasks. In total, the divers spent 60 hours underwater, including 13 hours on the wreck.

The group performed the following tasks:

1. Executing photographic documentation for the film.
2. Executing photographic documentation for a documentary mosaic (Figure 9).
3. Inspecting the part of the wreck with tanks.
4. Placing containers for oil sampling.

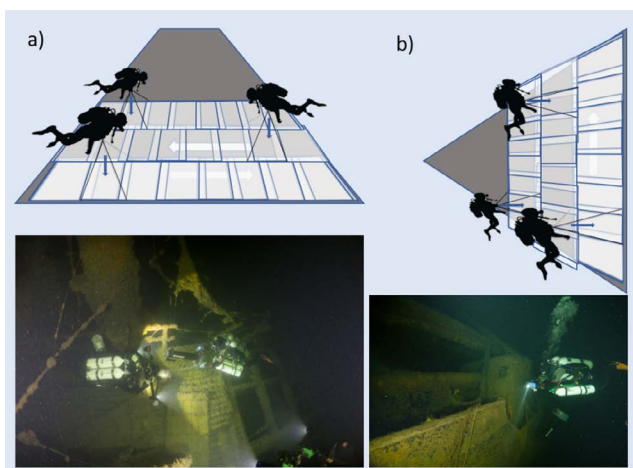


Fig 9. A scheme for photographing the mosaic of the main deck. The photographer should move along the profiles, so that subsequent strips overlap (source: 2018 expedition).

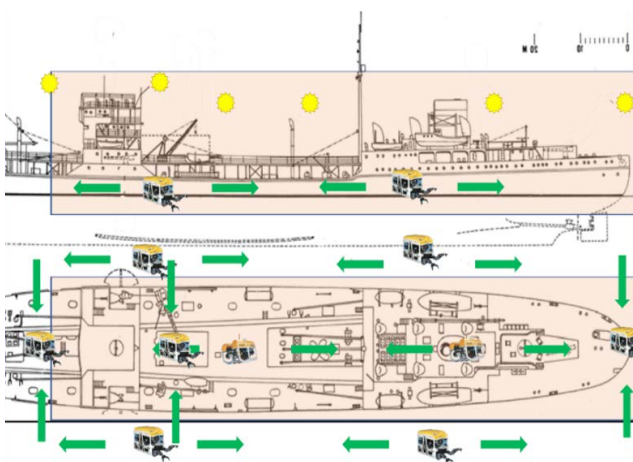


Fig10. Documentation scheme of the Franken using an acoustic camera (own source).



Fig11. Work class ROV Cougar XT (source: 2018 expedition, © S. Pačko).

5. Searching for places where oil is visible.
6. Selecting and preparing spots to measure the plating thickness.
7. Measuring the plating.
8. Collecting containers for oil sampling.

MEASUREMENTS, THE IMOR SHIP

In the period of April 23-27, 2018, the crew of the ship, the measurement team and the communication team in the total number of 14-16 persons performed the following tasks:

1. Placing lights on the wreck.
2. Taking photographic documentation using the ROV camera.
3. Taking photographs for a mosaic.
4. Measuring the plating.
5. Measuring the plating with an acoustic camera.
6. Assessing the technical condition of the wreck.
7. Sampling the sea bottom around the wreck.

In total, the ROV spent approx. 30 hours under water, including the inspection of the entire wreck during 10 hours and approx. 20 hours executing other tasks.

SUMMARY

The test results indicate possible contamination of the sediment samples collected around the Franken wreck with oil from the sunken vessel. This is evidenced by very high values of mineral oils, PAH, substances extracted with light petroleum and phenols, as well as high value of organic carbon. In order to determine the degree of contamination of bottom sediments around the wreck, as well as the risks posed to the marine environment, the density of the sample collection sites of surface sediments should be higher. In addition, core samples should be collected in the most contaminated areas, to conduct the analysis of different layers and determine the depth to which the sediment can be contaminated by oil spills.

The values of the samples collected in the close vicinity of the wreck (near the field) dramatically exceed the limit values. The level of PAH in the bottom depression amounted to 1,780 mg/kg DM, which means that the limit values have been exceeded by more than 200 times, and the value of the sample collected on an elevated sea bottom (near the field) amounted to 899 mg/kg DM, which means that the limit value has been exceeded 120 times.

The level of mineral oils in each kilogram of dry matter exceeds the limit value by 500-1,000 times. A large quantity of phenols, ether extracts as well as a very large quantity of organic carbon were found in the detected substances. The presence of such a large amount of organic carbon indicates that a quick sedimentation of organic substances (apart from contamination)

takes place around the wreck. This is not surprising, because the wreck lies within the range of water flowing from the Vistula river (it is located just in front of the Vistula river's mouth) and the verge of the Gdańsk Deep, where the conditions for biological life are extremely unfavorable due to shallow layers of hydrogen sulfide.

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