PROMPT

UCPM-2022-PP/G.A-101101263

Work package 3 Del. Number D3.3

REPORT ON THE TEST OF FLOATING CONTAINER

WP N.	Del N.	Del. No	Title	Description	Lead Ben	Nature	Diss level	Est.Del. Date
WP 3	D.3.3	D.8	Report on the test of floating container	A field report will be prepared illustrating the activities carried out during the real scale test developed to test the container tracking algorithm	UGE	Public Report	Public	31/10/2024

Summary

Figures

1. REAL SCALE EXPERIMENT OF FLOATING CONTAINERS

OEPT is a pilot site where the real-scale test for containers was implemented after deep research, communication, and collaboration with WASDI.

1.1. The aim of this experiment

- Improve surveillance, detection, and recovery operations, particularly for detecting floating objects like containers in the sea.
- Carrying out a real-scale test of container drifting in the coastal waters of Tripoli harbor will facilitate the development of an innovative algorithm to detect lost containers in the sea. The algorithm was tested against a real scale experiment carried out in Tripoli port.
- Update the port's contingency plan and train emergency response teams for future steps.
- Capacity building (training) to the port workers and HSE team on how to track containers on-site in case of any accident occurrence and on marine pollution generally.

1.2. Meetings and discussions with WASDI

The updates were communicated through online meetings and emails with our collaborative colleagues from WASDI during this experiment.

On 14 March 2024, the OEPT team had a meeting with Mr. Cristiano Nattero and his colleagues from WASDI to discuss the experiment details.

Plans discussed during this meeting:

- Organizing a preliminary experiment before the real experiment.
- Making a first trial experiment, where OEPT will float the containers.
- Trying to observe and spot the floating containers using public satellite images, by WASDI.
- Taking pictures of the containers and coordinating with WASDI regarding the daily updates.

On 4 July 2024, OEPT team had another meeting with Mr. Cristiano Nattero and his colleagues from WASDI to agree on the experiment conduction date and some points related to the container's location and measurements. Based on this discussion, OEPT planned to do a first trial, possibly in July 2024 before the implementation of the real one, on-site, from 29 July 2024 until 12 August 2024. In addition to taking daily photos of the containers during the real-scale exercise, taking into consideration also the other points discussed in the meeting of 14 March 2024.

1.3. Description of the experiment

Duration of the experiment: From 24 July 2024 to 25 September 2024.

This time window was chosen to minimize the chance of encountering clouds that could obstruct the observation with optical satellites-borne instruments.

Due to the critical situation in Lebanon, OEPT, in partnership with WASDI conducted the final experiment directly without the initial trial.

Map of the site

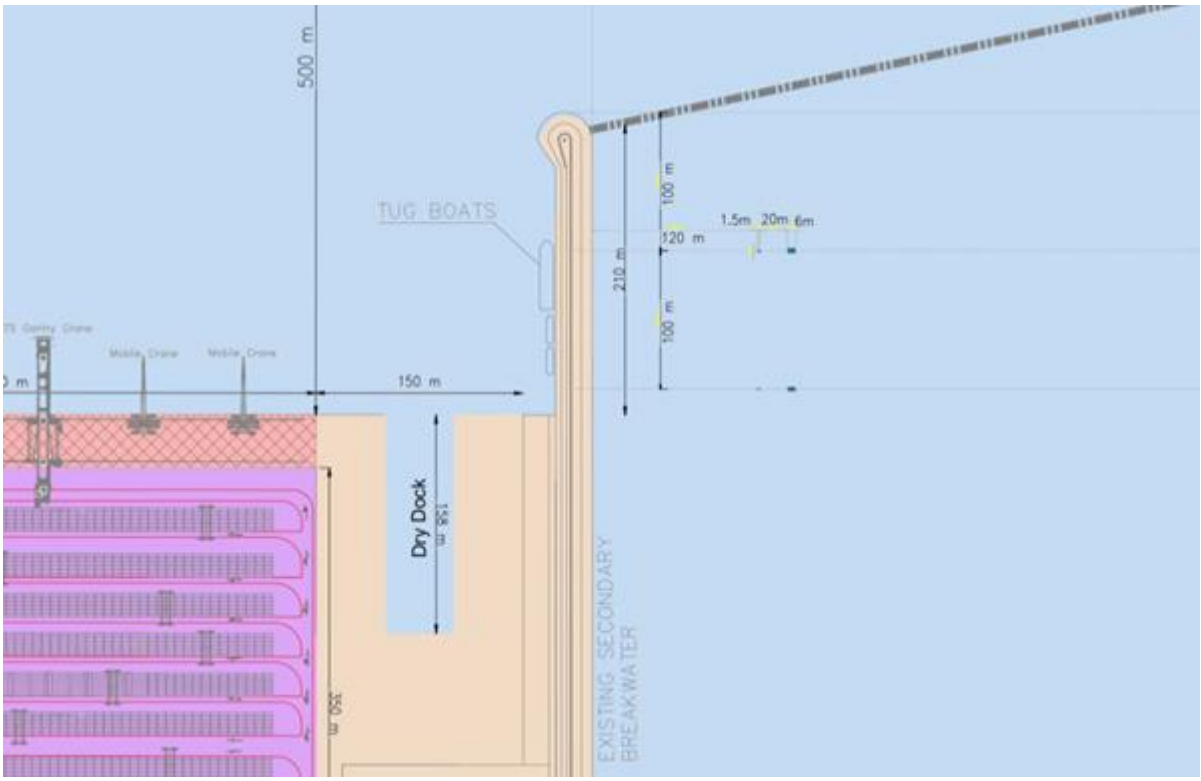

Figure 1 - Map of the installation site

Location and measurements of the containers

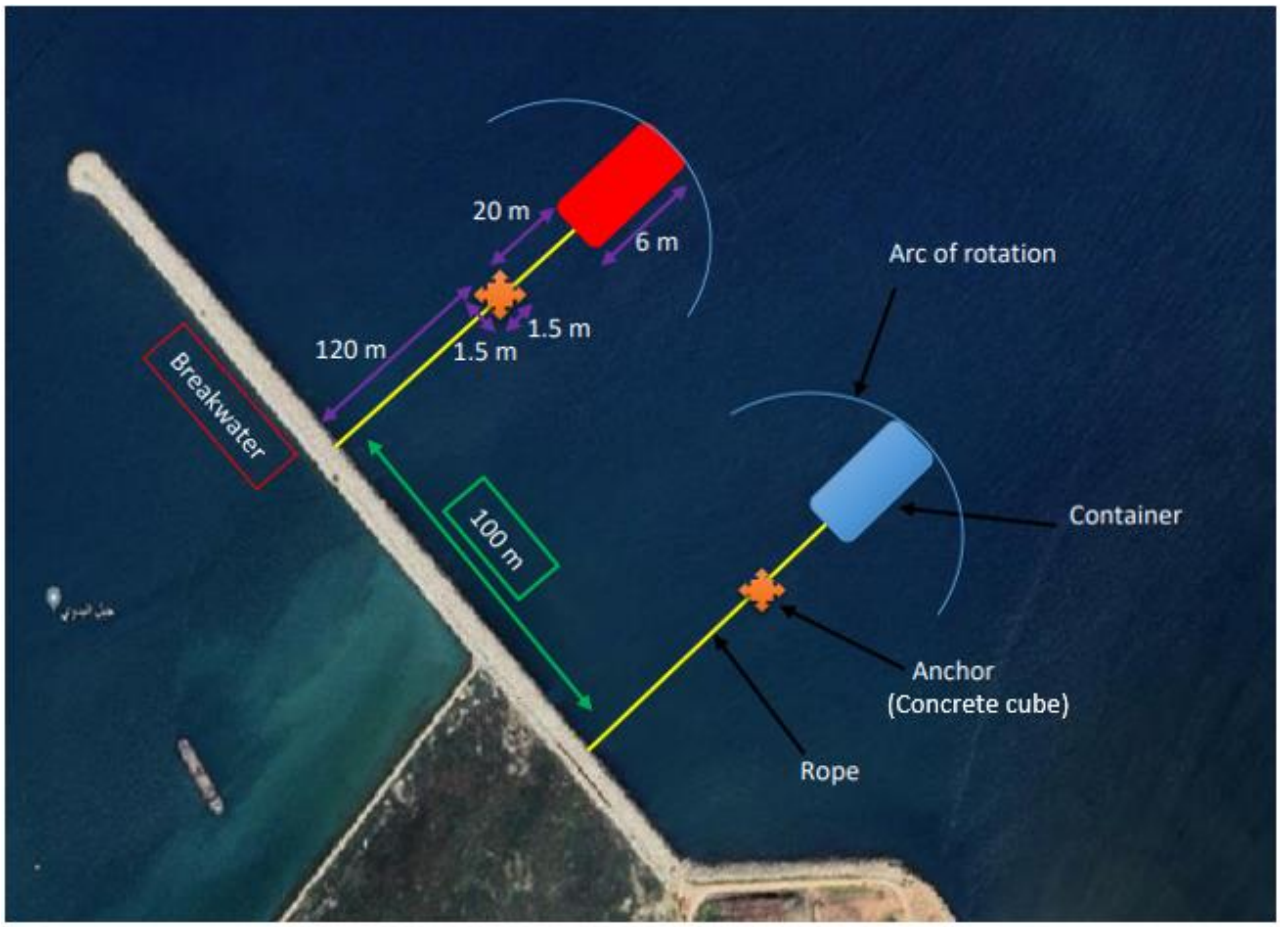

Figure 2 – Details of the container deployment

Implementation process on site

The implementation process started on 24 July, in collaboration with the captain and the workers in the Port of Tripoli. The workers threw the two containers into the seawater via a crane.

Figure 3 - Installation of the containers

The two containers were transported to the secondary breakwater tying them to the pilot boat with a rope.

Figure 4 - Container movement within the port

The blue container was afloat (totally filled with floating cubes) and the red one was submerged at a distance of at least 140 meters from the breakwater, and sufficiently apart from one another (100 m between the two containers to avoid hitting each other or colliding with the breakwater).

Note: the containers were filled with floating cubes on 16/07/2024.

Figure 5 - Blue (left) and Red (right) container filling

Figure 6 - Container installation in the harbor

Figure 7 - Container floating in the harbor waters

The containers were anchored by merged concrete cubes. The distance between the breakwater and the anchor was 120 m while the distance between the anchor and the container was 20 m. This allowed us to avoid accidents in case of any rotation of the containers.

Location of the concrete cubes on the google map:
https://www.google.com/maps/place/34%C2%B027'59.4%22N+35%C2%B050'05.6%22E/@34.466511,35.8323141,17z/data=!4m4!3m3!8m2!3d34.466511!4d35.834889?entry=ttu

https://www.google.com/maps/place/34%C2%B028'01.2%22N+35%C2%B050'02.6%22E/@34.467008,35.8314721,17z/data=!4m4!3m3!8m2!3d34.467008!4d35.834047?entry=ttu

Each container was equipped with small lamps to highlight their location and improve visibility, especially at night to prevent accidents mainly related to ships. This kind of precaution is crucial for ensuring the safety of both maritime operations and the containers themselves. On 31/07/2024, the HSE team at the port visited the site for documentation purposes and took some photos and videos.

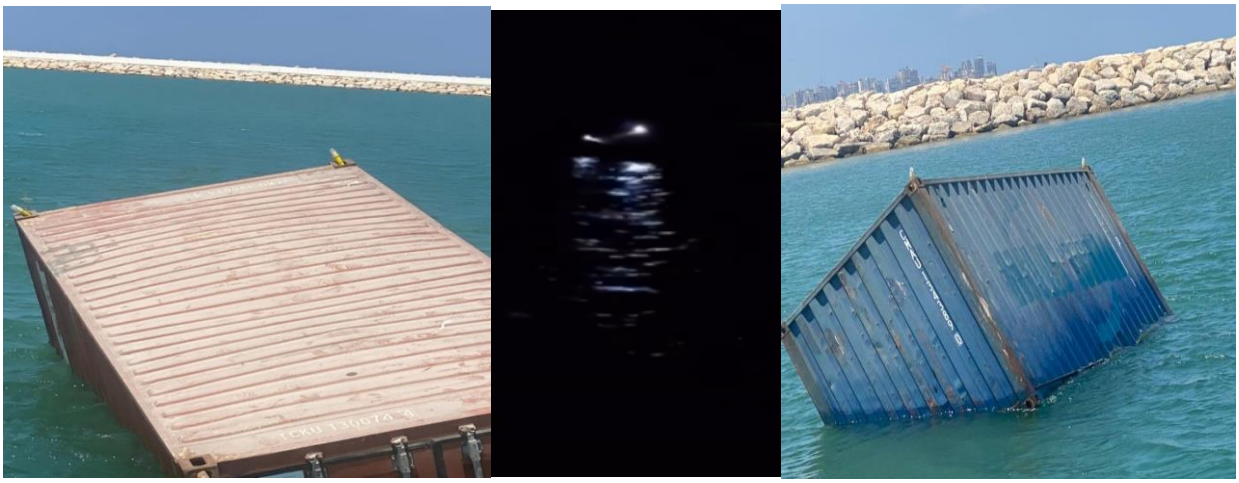

Figure 8 - Containers during the experiment

The commercial satellite imagery acquisition started on the 26th of July. The types of satellite imagery successfully obtained during the experiment are the following (according to WASDI):

- **Optical:**
  1. 8x 3 m
  2. 15x 50 cm
  3. 7x 30 cm

The Figures below illustrate examples of such imagery, in the respective order

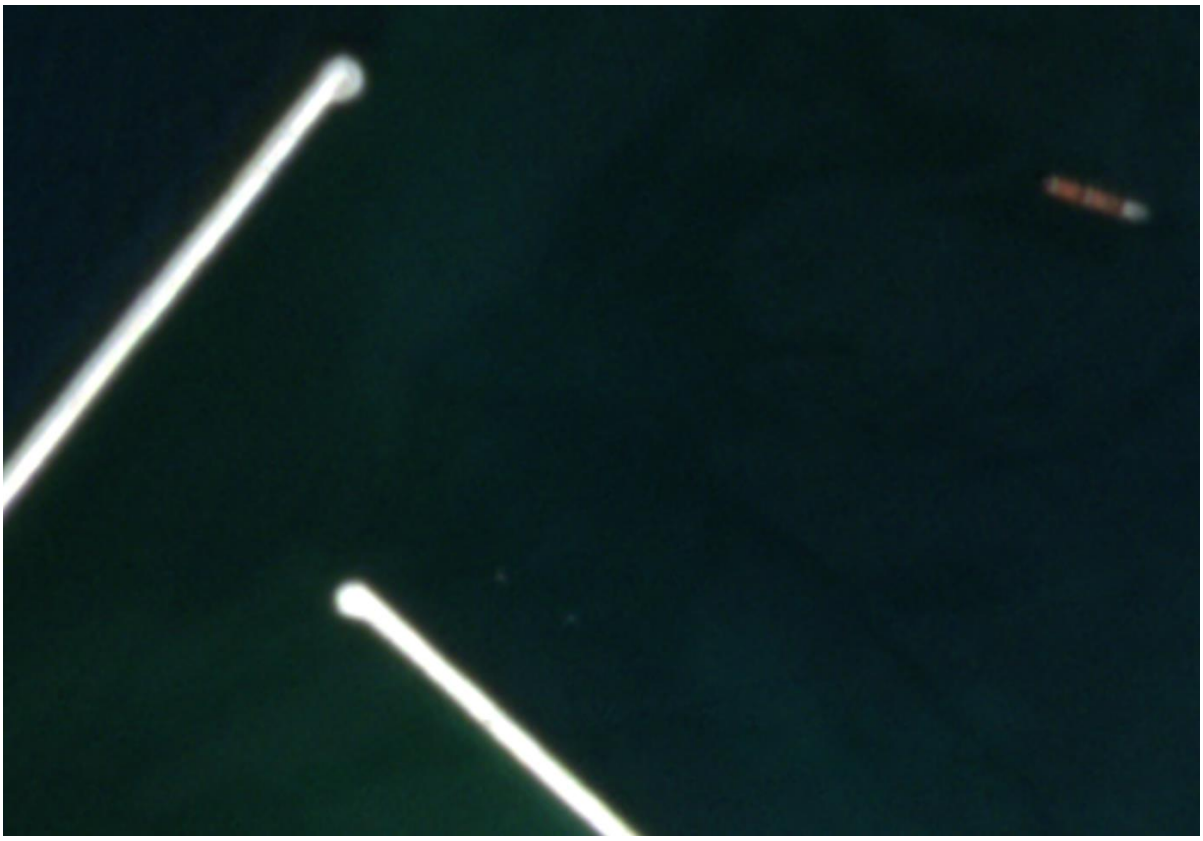

Figure 9: 3 m image

Figure 10: 50 cm image

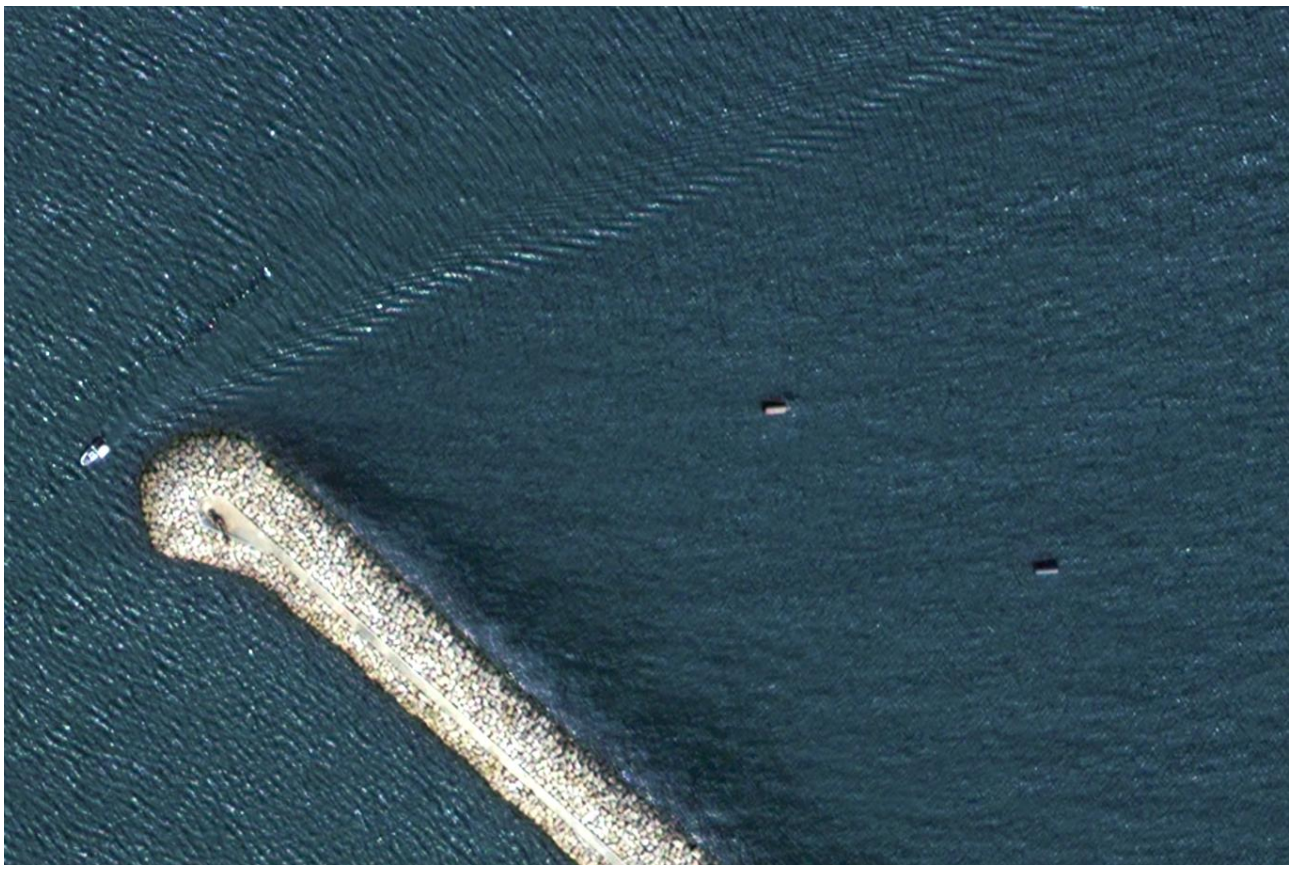

Figure 11: 30 cm image

- **SAR:**
  1. 2x 50 cm
  2. 4x 1 m

Examples of such data are shown below, in the respective order:

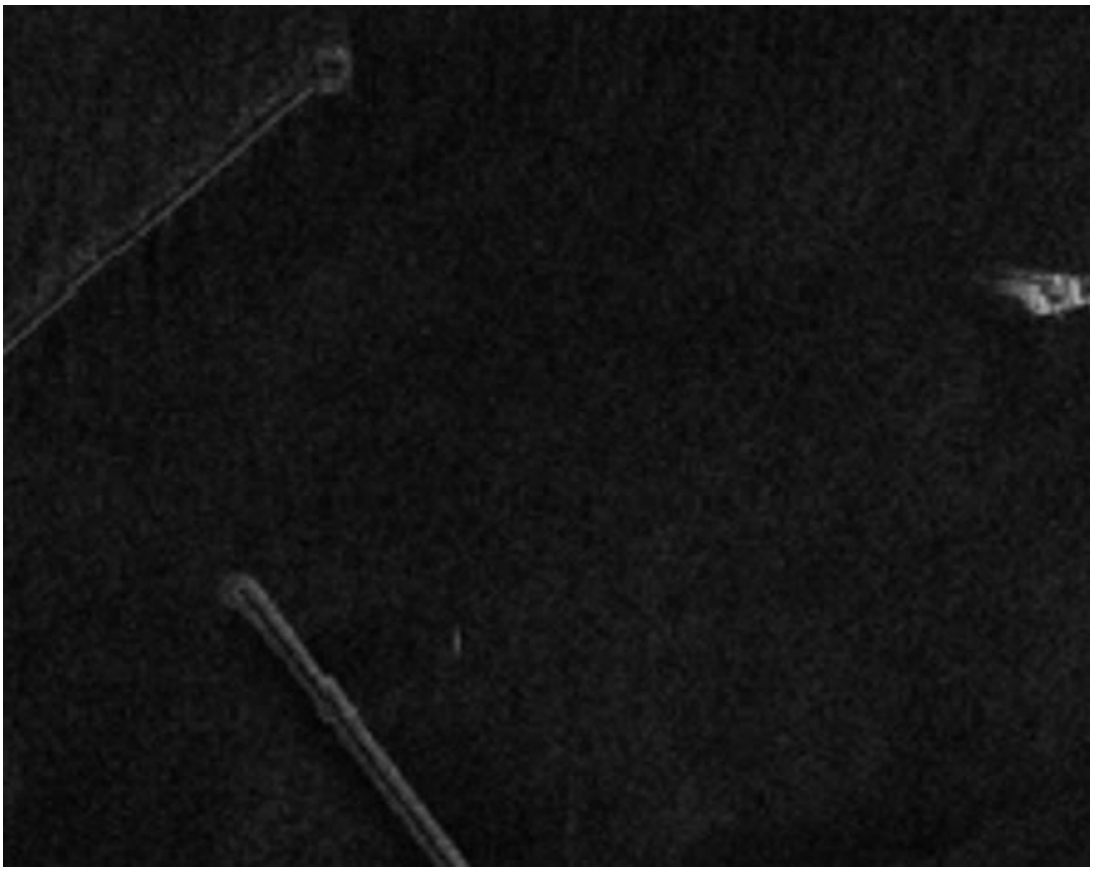

Figure 12: 1 m SAR acquisition

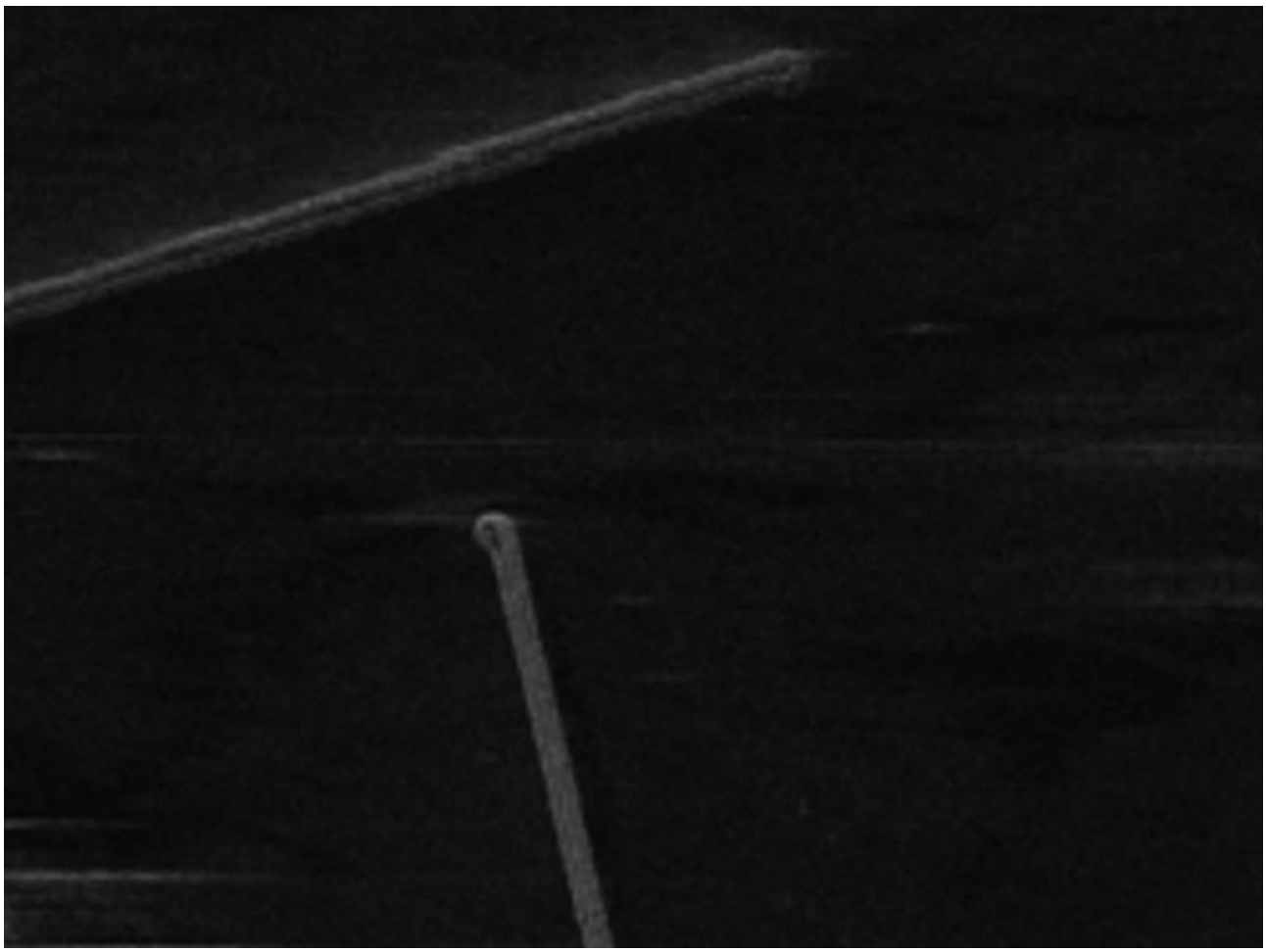

Figure 13: 50 cm SAR acquisition

The containers remained in the water for approximately two months to ensure plenty of possibilities to gain more and well-resolute satellite images. The commercial images had limited period of time (the credits purchased by WASDI for commercial images expired at the end of August). On August 8, WASDI and OEPT agreed to extend the experiment until the end of August so that they could collect more images. Then the experiment was extended until 25 September, where WASDI were trying for other types of acquisition. On 25 September, the containers were taken out of the seawater.

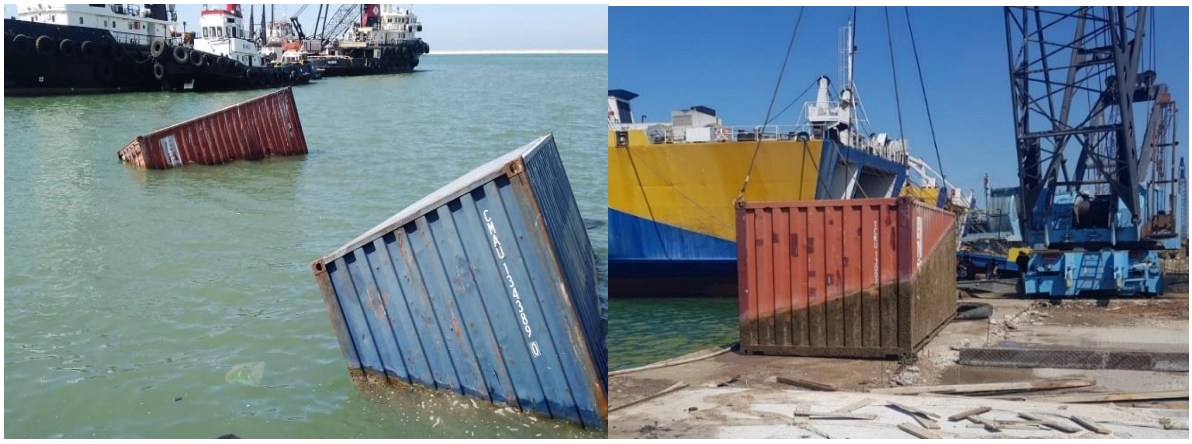

Figure 14 - Removal of containers from the harbor waters

2. RECOMMENDATIONS

- The more the containers float, the easier it is to detect them. However, waves can hide them completely from SAR and Optical data could be struggled too if they are submerged.
- In this experiment, the containers were positioned inside the port, however the conditions are less realistic. Effectively, the waves would have been less influential, especially that they were located 140 m from the breakwater which absorbs and redirects the energy of incoming waves.
- Planning the experiment required more effort than expected in terms of data providers permissions, specific types of satellites, and, in general, how to allocate the budget.
- It was noticed that the two different colors of containers do not make such a difference in satellite images.
- Good weather conditions: less clouds and calm, light sea color are recommended toward a good and clear satellite imagery.
- To prevent nighttime accidents mainly related to ships and navigation operations, each container was equipped with small lamps to indicate their location and enhance visibility.
- To prevent collisions between the two containers, they were anchored 100 m apart.
- It is also recommended to couple satellite technology with other systems for better tracking and locating of lost containers, such as Automatic Identification System, drones, Infrared (IR) and Thermal Imaging Sensors.

3. CONCLUSIONS

The real-scale experiment allows us to:

- Enhance our knowledge of how to track lost containers in the sea through this practical experiment.
- Improve preparedness for any type of lost container accidents along with strengthening prevention measures.
- Help in updating the port's contingency plan mainly the part related to oil spill by developing the previous ideas while incorporating preventive and preparedness measure.
- Maintain a well-trained and prepared response team.
- Help in developing strategies to minimize the environmental impact, especially the ones related to HNS and oil Spill.
- Foster better communication in responding to such types of incidents.