

D2.5 WP2 Executive Summary

Foldable Shipping Containers for Sustainable Blue Growth, ZboxBlueLogistics

Blue Economy SME Window call

EMFF-BEW-2019

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HISTORY OF CHANGES		
Version	Publication date	Change
1.0	31.01.2021	Initial version

1. Introduction & Objectives

In view of the paramount need of efficient container fleet management, NAVLANDIS has redesigned the shipping container to the next level. Zbox is a patented ISO shipping container based on innovative Z-folding mechanism. Zbox easily folds to bundle a stack of 5 Zbox units and transport them in the space of 1 standard box (5 in 1). Robust as standard containers, Zbox has been designed to minimize empty container travels towards changing the global logistics in a more efficient and sustainable supply chain. The project *ZboxBlueLogistics* will perform a thorough validation inland and on board of routes with early adopters. The global expansion, with +20.000 Zbox units, expects to generate relevant socioeconomic impacts, such job creation (around 80 new jobs) and environmental benefits (e.g. savings of 30 Mton CO₂).

This deliverable summarizes the work performed and the conclusions extracted of the Work Package 2 of the project, entitled “Technical / Operational validation”, whose purposes were:

- To manufacture 15 Zbox containers,
- Certificate them (ISO and CSC),
- Test them on maritime and land trips,
- Analyse their performance,
- And with the lessons learned, to prototype a new improved version, and certificate it.
- Design, prototype and test an IoT device for the Zbox containers.

2. Technical / Operational validation

Most R&D projects use iterative processes in order to achieve marketable products. *ZboxBlueLogistics* project includes two iterations (Figure 1) where an industrial series of Zbox containers is manufactured, tested, inspected and with the conclusions of all the process, an enhanced version of Zbox is created.

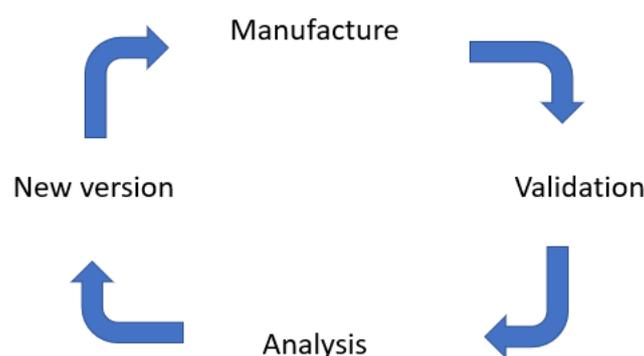


Figure 1. Iterative process followed in Zbox Blue Logistics project.

The first turn to this loop corresponds to WP2 of the project, where an industrial series of 15 Zbox units have been manufactured, tested on field, then inspected, and a new version prototype has been designed and constructed.

2.1 Zbox manufacturing and certification

The first months of the task were dedicated to the manufacture of the fifteen units of Zbox 20' size (Figure 2 and Figure 3).



Figure 2. Manufacturing activities



Figure 3. Finished containers at depot.

Prior to the start of Zbox Blue Logistics project, the design of the containers was already certified as per ISO 1496 standard, in both folded and unfolded state. But Navlandis wanted to go further and during WP2 conducted also the certification of the bundle of five folded containers. So it has been proved that both the container and the bundle are nine-stacking and can travel in any place of the boat (Figure 4).



Figure 4. Finished containers at depot.

CSC certifications of each manufactured unit were also conducted successfully, and it was also issued the Customs Seal Approval (Figure 5). After that, the containers were ready to travel.

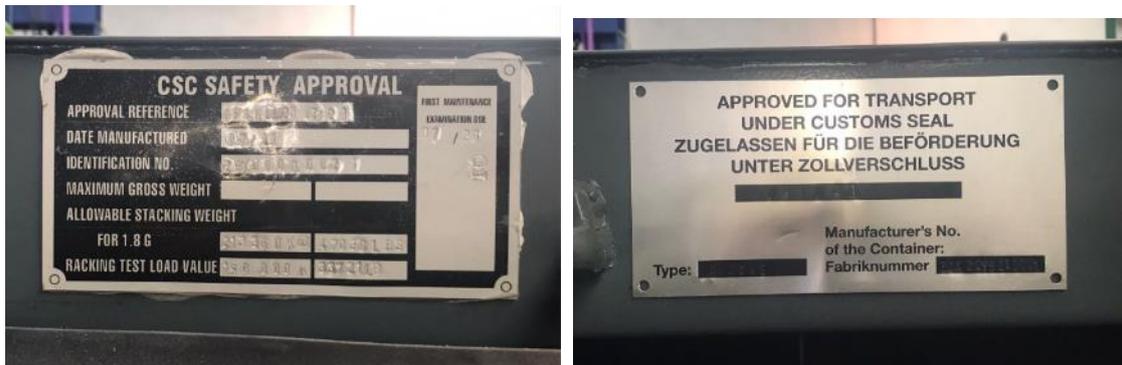


Figure 5. The Under Customs Seal approval plate of the Zboxes.

2.2 Operational validation

The fifteen manufactured containers underwent testing in real field, on land and sea travels.

A round trip by sea was completed, departing from Navlandis headquarters in Valencia (Spain) with destination Bata (Equatorial Guinea), with one Zbox container unfolded and loaded, and five folded containers in a bundle (Figure 6).



Figure 6. Unloading and loading process carried out at the Port of Bata.

Zbox containers have been also tested in several road trips, both unfolded and loaded, and empty and folded (bundled), Figure 7. Starting from Navlandis headquarters in Valencia (Spain), the containers reached destinations like Toledo, Madrid or Zaragoza. Road trips accumulate today more than 3.000km.



Figure 7. Zbox loading process (left) and loaded truck with the bundle and the loaded Zbox (right).

After each of the trips, a procedure was followed to check whether the load or the containers had been damaged. Navlandis technicians inspected thoroughly the load and the containers (Figure 8) and conducted folding and unfolding tests on each container (Figure 9).



Figure 8. Zbox inspection at depot



Figure 9. Zbox folding and unfolding trials at depot

Apart from some inevitable bumping and rust appearance (Figure 10), the result was that everything worked correctly, included the folding/unfolding mechanisms, so the operational validation was considered successful.



Figure 10. Some bumping and external rust appeared in the corners

2.3 Upgrade of Zbox

There is always room for improvement, and Navlandis engineers know it.

After their manufacturing and operation experiences, some points of the design could be improved. This is how an upgraded version of Zbox was born: designed, prototyped (Figure 11), tested (Figure 12), certified and approved.



Figure 11. Updated prototype being processed at Navlandis headquarters



Figure 12. Prototype being tested at Navlandis headquarters (left) and at the official testing entity (right).

2.4 Logistic tools integration

In this work package an IoT device for tracking position and status of the Zbox containers has been designed and prototyped.

Two different prototypes were built and tested, and different embeddings inside the container were considered. The second prototype was tested also in one of the road trips, giving satisfactory results.



Figure 13. First prototype (left) and allocation trials (right).



3 Conclusions & Next Steps

Work Package 2, 'Technical and Operational validation' has ended with successful results.

All the forecasted tasks have been accomplished with minor adjustments on their schedules.

Navlandis team is grateful to have encountered good partners with whom carry out the validation and the project.

Although the validation task ended, Navlandis continues to perform some validation trips. Currently, a second road trip Valencia (Spain) - Bata (Equatorial Guinea) is about to end, and a test trip by train is due to be performed next month.

Next step will be Work Package 3, where the second turn to the iterative loop to make Zbox even more marketable will take place, this time with the manufacturing and operation of 75 Zbox units, equipped also with their own IoT device.