Folding containers look to the future

Folding container concepts have existed for more than a decade, with many advantages clear to see, but they have never gained widespread support. Could this be about to change?

Based on conversations with delegates and having listened to various presentations on folding container designs and innovative business models associated with their use at the recent Intermodal Europe 2022 conference in Amsterdam in November, there is evidence to suggest a mood change could be taking place when it comes to their viability.

In part, this is related to the significant challenges that have confronted the liner shipping industry over the past two years. Over this period, trading imbalances have become more extreme, equipment surpluses and deficits in various regions of the world increasingly pronounced and the repositioning of containers more complex and, above all, expensive. In addition, the industry has to cut its emissions and become more sustainable.

The scale of the problem can be shown by the fact that each year, an estimated 25% to 27% of containers handled by the world's main ports are empty. Based on the latest global container throughput projection for 2022 from London-based Drewry Maritime Research, that would be equivalent to between 218M and 235M TEU and amount to over US$100B in equipment repositioning costs. Moreover, analysts estimate that repositioning empty containers could account for as much as 30% of the global maritime industry's carbon emissions.

Stacking up the equation

Designers/producers of folding containers argue that the concept addresses all of these issues. First, four or as many as five foldable containers can be loaded into a single container for stacking (in terminals, depots and yards) and repositioning purposes, thus saving on handling and transport costs, freeing up space/shipboard slots for other containers and reducing emissions. All folding containers can be stacked anywhere on a vessel.

Richard Danderline, co-founder and CFO of US-based Staxxon LLC, explained: "Today's boxes, if they were part of a mathematical equation, would not be a variable but a fixed constant, and to increase productivity, you must add to the equation by buying bigger and more expensive equipment, expanding terminals to accommodate larger and larger ships, and so the process would go on. On the other hand, the Staxxon folding container increases productivity without adding anything to the equation other than the folding and unfolding functions, the cost of which is but a small fraction of the cost to reposition a second, third, fourth, or even fifth container."

He continued: "At the port, you move more empty containers with less equipment, you position more empty containers in less space, reducing the storage footprint in the yard, keeping up to five at ground level, thereby reducing the total number of lifts and moves. In addition, carriers typically have a fully loaded leg and a mostly empty leg and Staxxon containers not only allow for faster loading and unloading, but improved distribution of the boxes as our containers can be positioned anywhere on the ship, not just on the top of stacks."

Danderline believes that even with port congestion easing the industry now realises that the supply chain is fragile and vulnerable to crisis events including labour actions. "The industry is also pushing for emissions reductions, which are achievable with the use of Staxxon foldable containers", he said. "All in all, this makes for a compelling case for the industry to take a fresh look at adopting folding containers."

But there are still challenges. Foldable containers are complicated and up to five times more expensive to build than standard dry freight boxes. They are also heavier as more steel is needed and this affects the amount of cargo that can be loaded in them, although not significantly. In addition, the moving parts, such as hinges, are more susceptible to damage, which can mean higher maintenance and repair costs and shorter trading lives. Concerns have also been expressed about their security and performance levels, particularly when it comes to insurance underwriting and loss prevention measures.

Furthermore, there are various time and safety issues when it comes to the assembly and dismantling processes, although this varies according to individual designs.

Finally, in an industry as deeply conservative as that of container shipping, new ideas always take time to be adopted, especially if they involve higher 'upfront costs', as folding containers inevitably do.

Automated process

Addressing the Intermodal Europe conference, Nicholas Press, managing director and CEO of Sydney-based Spectainer, stressed the importance of developing a holistic solution, which he claimed Spectainer had achieved. "Our COLLAPSECON box is the first horizontally collapsing container designed to work in tandem with the world's first fully automated COLLAPSECON operating station [COS], IoT devices and a suite of support services," he told delegates. "It offers customers both vessel and voyage savings, helps reduce their emissions and it provides them with new business opportunities."

Press explained that the COS could assemble and collapse a container in just two minutes, that the station could be deployed wherever it was needed, and that it was fully automated and, therefore, completely safe.

The COLLAPSECON automated operating station, developed by Australia's Spectainer for its horizontally folding container design

In his presentation, Press illustrated the savings that could be achieved by using 1,000 COLLAPSECON 40ft HC dry freight containers instead of 40ft standard HC units and four COS on a Shanghai-Sydney-Shanghai service. The trade is heavily imbalanced with mainly empty containers moving northbound. "We calculated overall savings of 54% [US$45.3M] with voyage costs 35% lower and vessel costs about 75% lower," he said.

Also speaking at Intermodal Europe 2022, were Miguel Navalón, CEO and co-founder of Navlandis, and Roberto Fernandez, the company's chief commercial officer.

"It is important to hear the players of the supply chain in order to understand all the parts involved in the ecosystem where a container is operated, and correctly address the specific needs of all of them," explained Navalón. "Our goal has been to make the right decisions during the development process by minimising the barriers in terms of cost, operations and maintenance."

Continest, which was founded in Hungary in 2019 and has mainly been supplying 10ft and 20ft foldable containers for the events and military sectors, displayed its first cargo unit, a foldable 20ft palletwide container, at Intermodal Europe 2022. "We expect to fully roll this out over the next 18 months and it will be followed by a 40ft version and then a unit specifically for carrying bulk [grain] cargo," said Joris Moerkerken, head of development at Continest.

Various options

Fundamentally, it is the design of the folding mechanisms and associated systems that differentiates the various producers of folding containers.

Units designed by Delft-based Holland Container Innovations (HCI), which pioneered the concept, fold horizontally with a CHE machine lifting the roof of the container, the sides then being folded inwards and the roof lowered to rest on the folded sides. Four folded units are then placed on top of one another to form a standard container size.

New Jersey-based Staxxon's collapsible containers are based on a vertical folding mechanism that the company has referred to as an 'accordion style' system. The container is collapsed from side to side to form a vertical and much flatter unit, with Staxxon claiming that "between two and five units can be folded and stacked in such a way as to form a regular container unit for transport and/or storage purposes".

Danderline explained: "You do not need to wait for a specific number of boxes – as required by collapsibles – to move the bundled empties. If only two empties are available to fold, they can be folded to half the width and joined with the safety beams provided. The same goes for three, four or five boxes and the bundles measure exactly to CSC standards."

The Zbox, developed by Navlandis and partly funded through grants from the European Union's Blue Economy programme in late 2020 (€2.2M), also allows five containers to be bundled in the space of one and for the box to have the same external dimensions and stacking capabilities as a single standard dry freight unit of the same size. Zbox is also certified to carry liquids in flexibags of up to 24,000-litre capacity.

Navalón was keen to stress that his company's Zbox could be folded and unfolded by all of the main types of terminal handling equipment, including reach stackers, forklifts and empty handlers, but that in situations where the number of folding containers in service was large, the process could be automated through the use of a specially designed folding station.

The executive also remarked on the company's 'Beyond the Box' proposition. "Our Zbox is equipped with IoT technology so its position, condition, such as temperature, status, including whether the doors are open or closed and the unit folded or unfolded, can be registered and monitored through a web platform," explained Navalón.

Moreover, the company has adopted a very different business model for Zbox. "We understand the reluctance of customers to invest in new [types of] container and have developed our 'Pay as you Save' plan," said Navalón. "It is a win-win situation that always generates savings for our customers and ensures payments to us, and it means they do not have to make any initial capital outlays on the equipment."

Commenting on foldable/collapsible containers' durability, Staxxon's Danderline said: "From the outset, we have engineered durability into our design. We have not only invented the solid vertical wall, but have focused on reducing the 'out of service time' resulting from the top failure modes of the current box – ease of door replacement in the field by changing out the flimsy J-Post, and ease of sill and header replacement in the field. Meanwhile, our hinges are located to the side of the four corner posts where no forces of compression or tension during stacking and lifting ever affect the hingeing of the roof and floor."

While Staxxon's containers can be folded and unfolded using a forklift and two labourers, the company is working with Konecranes on a high-volume folding and nesting machine that would be able to complete the process for a single unit in less than three minutes.

As to the trading life of a Staxxon folding container, Danderline anticipated that it would meet and probably exceed that of a standard container as its modular design allows for large assemblies to be replaced when required.

To date, very few foldable containers exist in the fleet despite HCI and Staxxon commencing their research and design work for such units in the early 2010s. While HCI secured certification from the International Organization for Standardization and Convention for Safe Containers for its 4FOLD unit – a 40ft collapsible container – in 2013, certification for Staxxon's 20ft unit was only forthcoming in 2020. However, the company has completed design work on its 40ft standard and 40ft HC units and anticipates certification for these containers to be approved in early 2023.

Staxxon is moving ahead with its commercial production plans. To date, the company has conducted some tests of its equipment on the road, "transporting bundled sets of containers on standard chassis", according to Danderline.

"With all the world's ports experiencing unprecedented congestion over the past two years, Staxxon has had no opportunity to conduct third-party trials beyond those on the road," he said. "We understand the need for meaningful trials and plan on using our first production sets of folding containers for trials in 2023 in conjunction with our terminal, carrier, and BCO-interested parties."

Nonetheless, Staxxon has been actively promoting its containers. In late 2021, it started a scheme whereby customers could deposit US$100 and secure access to the first containers off the production line. "This programme generated significant 'indications of interest' and resulted in a robust sales funnel of nearly 40,000 boxes, mostly from BCOs rather than traditional owners, such as ocean carriers and leasing companies," said Danderline.

Production runs

Discussions have taken place with several manufacturing entities in the US and Poland to produce the folding containers, with Staxxon planning small runs of 20ft, 40ft and 40ft HC containers in 2023 (an estimated 100 units), rising to 4,200 units in 2024 and at least 10,500 boxes in 2025.

HCI has undertaken extensive tests and put in place a number of programmes to encourage the use of its equipment, but with limited success. Among those companies involved in the trials have been Maersk Line and Procter & Gamble.

In the case of Zbox, extensive trials are continuing with Madrid-headquartered Marguisa Lines, which operates intra-regional Mediterranean and Mediterranean/West Africa liner services. "Since 2021, Zbox has travelled around 10,000 km on European land routes, and more than 50,000 km on maritime services in the Mediterranean and West Atlantic seas," said Fernandez.

He alluded to 75 to 100 box units being in service by the end of 2022, increasing to 300 to 400 units in 2023 and more than 1,000 units in 2024.

But again, Zbox is in its early stage of development, with Navalón stressing that much more work and partnerships were needed before commercial viability was assured. "Currently, we are searching for more collaborators for the market deployment of Zbox," he said. "We are also in search of industrial partners for the next stage of manufacturing Zbox units and we are looking for more early adopters interested in including Zbox in their services."

From the manufacturing perspective, Zboxes are currently being made in Spain, with Fernandez looking for partners elsewhere in the world so that production can be scaled up.

While the number of folding containers in the global equipment pool is expected to increase, they will still play only a niche role, featuring in a few very imbalanced trades and in the pools of some transport operators – mainly regional/single trade ocean carriers – and some BCOs that have an equipment ownership strategy. ❑

Staxxon's design of foldable containers allows between two and five containers to be folded with the same footprint as one standard ISO container