Hot Topic

The constant review of the role of industrial design within the temperature-assured packaging industry raises the prospect of a move from single-use products to a more environmentally friendly, closed-loop solution for companies engaging in cool chain logistics, while also creating a vital competitive advantage

Liam Holmes at Sonoco Thermosafe

Industrial design – particularly within the temperature-assured packaging (TAP) industry – constantly strives to create, develop and optimise the function, value and appearance of products, ultimately for the benefit of both the user and the manufacturer. Crucially, it has the potential to add value and carve out a sustainable competitive advantage in the marketplace. By engaging in this creative process, it becomes possible to identify, understand and anticipate the needs of the end user and the manufacturer.

For the purposes of this article, we will consider a recent project carried out by our design team as a prime example of what can and should be done to achieve this.

TAP-Specific Challenges

Before beginning any product review, it is important to recognise and fully understand the impact of the large number of specific challenges facing the TAP industry, which include the following:

- Maintaining product integrity – whether frozen, between 2-8°C, or at controlled room temperature (CRT)
- Enhancing package performance using phase change materials (PCMs)
- Reducing package size, weight and volume
- Packout simplification and operational efficiency
- One-time and reuse options with PCMs
- Making sustainability affordable and achievable

These challenges also raise further questions, such as:

- How to maintain the temperature range against extreme profiles and the longest durations?
- How to support the greatest amount of payload within a given shipper outer volume?
- How to lower the weight of that shipper to reduce both cost and risk of injury?
- How to incorporate total cost of ownership in terms of material, shipping, labour, conditioning, reuse and disposal?
- How to address Environmental, Health and Safety guidelines with regard to recycling, disposal, toxicity and handling issues?

A need for TAP to move from single-use products to a more reusable and sustainable solution can be clearly identified from this. But how far can a concept be pushed? Is it even possible to maintain product integrity and maximise package performance and payload, while simultaneously simplifying the packout, reducing the size, weight and volume and making the end result sustainable, affordable and, most of all, achievable?

Optimisation

Design teams will have to work around and factor in a number of constraints before they can even begin the new product development process. Looking specifically at the TAP industry, these include dimensions, physical weight, existing components and the number of components, efficiency goals, cost, conditioning challenges, dimensional weight and the packout.

Any potential solutions will also have to address one of three timeframes: short-term, by making a simple change to an existing product; mid-term, by implementing additional changes to current products; or taking the long-term view, to really push towards a future conceptual idea.

Engineers and product developers do not and cannot work in isolation. The support of top management is crucial to allow valuable time and resources to be invested in the project. The design team must also work closely with the commercial/sales team as they

Figure 1: Global Hybrid Platform Concept – 30L payload capacity maintaining 2-8°C for 48 hours

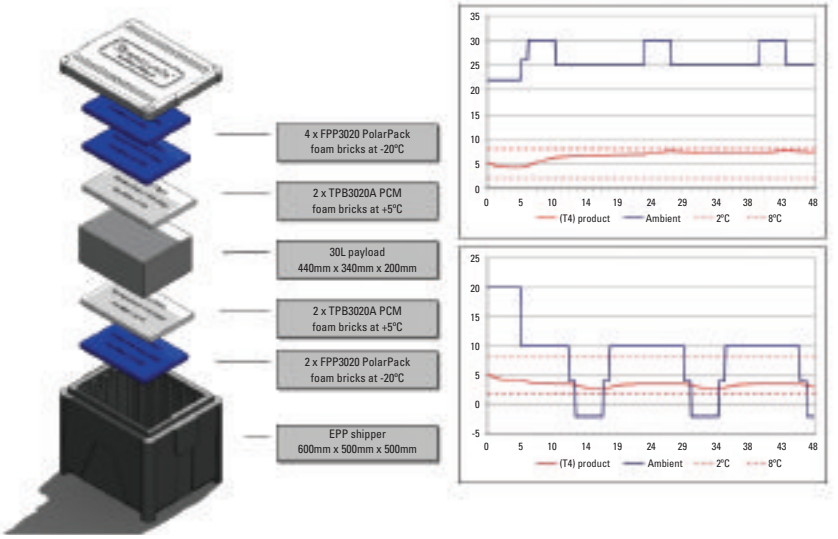
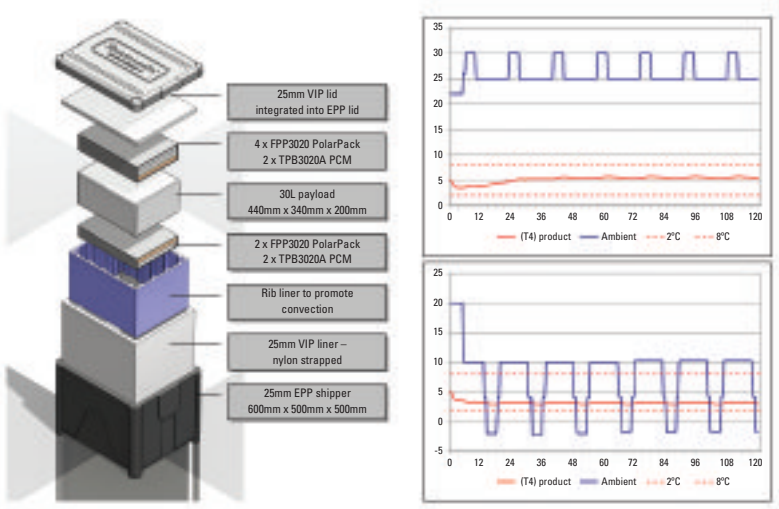


Figure 2: Global Hybrid Platform Concept – 30L payload capacity maintaining 2-8ºC for 120 hours



are the interface between the company and the customer base – their feedback is crucial. This ensures that the design is truly in tune with customer needs. It is vital that the end result is something that can be sold confidently by the commercial team and can generate a profit for the company once tooling and manufacturing costs are factored into the mix.

In our example project, the design team working on one particular new product – comprising of 20 people and split between premises in Chicago, Philadelphia and Ireland – added another layer of complexity to the process. Despite geographical and time difference distances, the team had to work cohesively to identify the product's advantages, craft a clearly defined design brief, detect any problems at the earliest stage possible, and implement a robust review process before proceeding to develop the prototype.

To ensure the best results for both the manufacturer and the end user, this prototype solution would also have to maximise pallet footprints; be a modular concept using inserts; use tool cores for flexibility, such as a combination of materials to increase performance; use partitions and/or PCM holders to ease the preparation and the packing; have clear and simple conditioning instructions; and have integrated handles and hinges.

Our design brief was to construct a container with a flexible system design, robust enough to provide superior protection of the payload, have reusable PCMs per temperature range – whether -20°C, 2-8°C, or CRT – be simple to assemble with clear instructions, and be easy to manufacture, use and understand. Most importantly, the new concept was to make all components completely reusable and recyclable, plus change the look, feel and perception of a container.

GHPC Concept

Enter the Global Hybrid Platform Concept (GHPC) – a simple, effective design, with a clear, uncomplicated focus, which still pushes boundaries.

The GHPC is a robust, reusable shipping container, made of 100 per cent expanded polypropylene (EPP), intended to replace traditional TAP boxes. The need to create a single box modular platform led to EPP as the main component. It is lightweight, yet incredibly stable and damage-resistant. It was the clear front-runner, as it can be used as part of a closed-loop system, which was one of the main goals.

EPP was also chosen as it is free of heavy metals or hazardous materials such as cadmium, lead, mercury or hexavalent chromium, and the production process does not require any blowing agents which would harm the ozone layer. Crucially, it has almost the same thermal properties as expanded polystyrene (EPS).

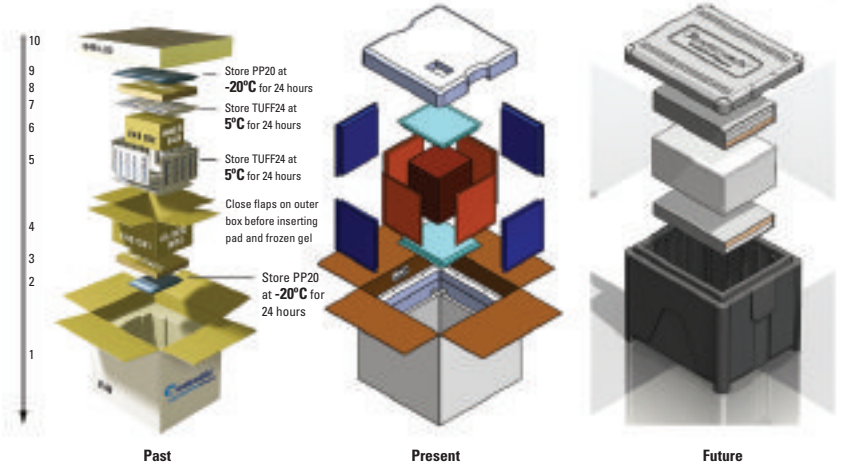
Research shows that a recycled cardboard/EPS box can be used up to eight times, but must be dismantled in an energy-draining production facility, while the GHPC can be used over and over again, enabling and encouraging people and companies to improve their environmental footprint. The more times a pack is used, the greater the positive effect on the environment.

So it can be said that the GHPC mirrors the good features of cardboard/EPS/vacuum insulation panel (VIP) boxes, while adding new attributes that lower the overall environmental impact of packaging.

Protecting the Payload

Rigorous testing of any new product is an essential phase of the development process. Its performance must be scrutinised against the initial expectations and the results carefully noted and independently verified.

Figure 3: 2-8ºC 48 hour qualified systems comparison – past, present and future concepts



The GHPC prototype was created and adapted to incorporate 30, 25 and 15 litre payloads and cover various durations.

To incorporate the 30L payload, the GHPC design provided:

- Interlocking stand-offs for stable stacking and airflow around the whole box, preventing heat ingress on the bottom
- Convection ribs inside to minimise refrigerants and improve performance
- Integrated, moulded handles
- Lid locks and slots for ease of use
- Robust design to minimise mechanical shock/movement of contents
- Simple packout with minimal refrigerants – top and bottom only
- Clear instructions
- No staging or bench time required for PCMs
- Pallet assembly ideal for automated warehouses, with no overhangs

But does it deliver the goods in practice? Using the ISC Silver profile – ideal for controlled temperature requirements, pharmaceutical distribution and overnight delivery – the 30L payload capacity maintained a strict 2-8°C for 48 hours – and even up to 120 hours when VIP inserts were included – which was directly comparable to the performance of the EPS version. The design team had answered the questions and provided a solution to the challenges faced by the TAP industry. They had discovered that it was possible to design a completely novel product from scratch which would operate in a closed-loop system and maintain high performances, while simplifying the packout and reducing the environmental footprint and cost of ownership.

Creating Competitive Advantage

Getting to the mass production stage does not happen immediately, but it is crucial to offsetting the cost of investing valuable time and resources in the project. The new design can provide a platform for the creation of multiple product lines. Looking again at our project example, our design team will look to take the best elements of the GHPC and incorporate it into a new product for the EU market. The team now know exactly how far they can push the design concept – while still tailoring it to meet customer needs and priorities, such as cost and simplicity – and they hope to form an initial simple, cheap EPS version, catering for strict 2-8°C, CRT and frozen capabilities.

New tools are being commissioned to allow EPS and the novel EPP versions to be created, and the product will then be extended from off-the-shelf to customisable versions. Theoretically, when variations and adaptations are factored in, this could generate many new TAP solutions for the EU marketplace, which would more than provide a worthwhile return on investment.

About the author

Liam Holmes brings 20 years of product design experience in consumer, electronic, automotive and medical device products, medical and pharma packaging, and exhibition design to his role as Engineering Team Lead (Europe and Asia) at Sonoco ThermoSafe. He has completed numerous projects for Rolls Royce, Bentley, MG, Nokia, Ericsson, Motorola, SCA, Ventilux, APP, Nomadic Display, Mednova, Depuy (J&J), ATSR, ATP and Tente. Liam works with global cross-function teams and is responsible for conception right through to new product introduction, and has a multitude of products currently in production. He holds four patents for product designs, is the published author of refereed conference papers and has spent time in New Zealand as a design lecturer.
Email: liam.holmes@sonoco.com