

RELYING COMPLETELY ON YOUR OWN IN-HOUSE DESIGN EXPERTISE COULD MEAN YOU RUN THE RISK OF MISSING OUT ON THE ADDED BENEFITS A CONSULTANCY CAN PROVIDE – SUCH AS MODEL-MAKING FOR REAL-LIFE TESTING

Next top model

In the industrial vehicle industry there seems to be a tendency toward keeping design in-house. After all, material handling OEMs benefit from teams of engineers who understand the unique market requirements of their vehicles and are able to focus on any specific engineering challenges that arise. But are they missing out on a whole new dimension by not using a consultancy?

Having spent almost 10 years working on reach-truck projects for Linde Material Handling, IDC (Industrial Design Consultancy) believes there are great opportunities for similar in-house teams to benefit from outside support.

In possessing excellent in-house resources and experienced teams of engineers focusing on specific development areas, Linde already enjoyed a first class setup for new product developments – but still recognized it could complement its extensive knowledge by drawing on the unique expertise of an outside product design consultancy in a number of different ways.

As a result of working on a wide variety of projects in a spectrum of industries, one of the great strengths of product design consultancies is their wide-ranging experience of different manufacturing techniques and materials, with the right contacts at their fingertips.

Linde initially came to IDC to benefit from its expertise in this area, due to its need to convert an expensive suite of painted structural foam parts to a more cost-effective injection-molding process. Initially the OEM reviewed the parts in situ on a finished truck to establish any limitations and access issues, and then supplied the existing CAD data, which was used as a basis of the redesign. These, together with the requirements of the injection-molding process, were used to create new master CAD files.

There were, however, a number of challenges due to the very different manufacturing processes and, in particular, the requirement to produce a ready-to-use part with no painting, which put a constraint on the draft angles required. IDC was

MAIN IMAGE: Control console developed for Linde's new reach truck

FAR LEFT: Main body under construction

BELOW: Driver's console and alternative display prior to painting

BOTTOM: Check fit assembly prior to painting





LINDE RECOGNIZED IT COULD COMPLEMENT ITS KNOWLEDGE BY CALLING ON THE UNIQUE EXPERTISE OF AN OUTSIDE PRODUCT DESIGN CONSULTANCY



involved throughout the tooling phase; first obtaining quotes from potential suppliers, then supporting the OEM in selecting the preferred toolmakers. The company also managed the tooling and trialing of tools prior to handing over to Linde's production team.

Model support

The OEM was also in the process of developing its R14-R20 series, a new range of reach-trucks for taller warehouses. Their forks would need to reach heights of over 12m, meaning the truck range had to introduce new features for this to be possible.

Having already produced 3D CAD models of the new reach-truck, Linde was keen to see the design in the flesh, using a physical model to test the concept before proceeding further with detailed design.

With facilities for both micro-scale SLA models and large scale models and prototypes, IDC Models, the consultancy's model-making division, was able to quickly develop an incredibly realistic block model of the proposed truck that was not only employed for marketing and promotional purposes, but also to

help evaluate ergonomics. To do this, it used a variety of model-making techniques. Supplied with a steel chassis by Linde, the team built the lift-truck to the OEM's CAD design specifications. For the larger parts, extensive use was made of a high-speed router (2.4x1.2m bed), along with 3D printed components made on a Viper SLA for smaller, fine detail parts.

The highly skilled modelmakers also produced several component parts by hand, prior to spraying each of them in its paint facility. The finished model was assembled and graphics applied to accurately represent the production design.

Linde recognized that, while CAD is an excellent resource for rapidly turning ideas into a visual concept that can be gradually refined as the development progresses, a real life-size model is essential to exactly represent the product and test the concept visually before embarking on more costly engineering definition and testing.

By producing a flawless life-sized model of the new reach-truck range, its marketing team was able to make an assessment of suitability for the

1: Smaller components, such as the windscreen, joysticks and knobs, were developed by 3D printing the components with SLA to form masters and then producing vacuum casts based on these

2: A large-format CNC router was used to create the main components from polyurethane precision modeling board

3: To make the model as realistic as possible, Linde supplied additional finishing touches such as rubber seals and other smaller components

4: The components were pieced together with an exceptionally high standard of workmanship before being sprayed and finished

market and ensure that it was an attractive proposition to customers, as well as make decisions on brand positioning. Due to the long lead times of reach-truck production, models like these can also act as effective stand-ins at photoshoots for the development of marketing literature and photography.

Not for the first time

In a similar project, which supported the development of reach-trucks for use in taller warehouses, IDC had been called upon to design and

CASE STUDY

research the usability of a new seat headrest for reach-trucks, which required the creation of working models for user testing.

The aim of the new headrest was to enable drivers to comfortably and safely look up to the top of tall warehouse racks; this required in-depth ergonomic studies so as to understand the implications of the design in supporting the driver's head, back and shoulders.

Consultancies often benefit from experience in other sectors that can be brought into play and this is an example of how IDC's extensive medical product experience, particularly related to the user experience, could be applied.

IDC's industrial design and engineering teams therefore worked together to develop several concepts, which were turned into prototypes and then fully evaluated at Linde's test facilities. The team also needed to test different materials to ensure a balance of flexibility for maneuvering, support and comfort, and overall wear for a factory environment. It supported Linde in developing these headrests right through to product field trials.

Engineering finesse

With a constant turnover of different projects, across a variety of industries, many design consultancies are often blessed with a great deal of untapped potential when it comes to expertise in mechanical and electronic engineering. This proved useful when it came to helping develop a control

console for the R14-R20 reach truck range, which the manufacturer intended to be a sophisticated next-generation design focusing on both ergonomics and safety.

Faced with many challenging design requirements, the consultancy was briefed to produce an engineering design and working model of the control console which would house control devices in specific ergonomic locations as well as in very restricted spaces. The console was therefore mounted on a scissor system that provided adjustment both vertically and horizontally so as to ensure a comfortable working position.

Another key aspect of the design involved the use of finite element analysis to understand the stress resistance of the design and ensure that the console was robust enough to withstand large abuse forces. To ensure it met Linde's strict safety requirements, the console had to be able to withstand a 90kg man standing on it.

The OEM had already completed the industrial design of the console, which meant that a solution had to be engineered that worked within the design confines that had already been set. With the position of the control devices established by ergonomic requirements, a design had to be engineered that would overcome any potential weak spots in the structure caused by mounting fixtures, control valves and other features. A design was devised with two main parts, producing a strong assembly made from Dupont Zytel



TOP & CENTRE: Check fit assembly prior to painting

BOTTOM: Headrest prototype being tested at Linde

HTN53G50LRHE, an innovative 50% glass-filled nylon material which was injection molded to create a strong structure with good aesthetics. Eight sets of full-size vacuum-cast models were produced for testing and evaluation.

By working closely with Linde's toolmaker/molder and DuPont, IDC was able to assist in the development of the production tooling. This combination of engineering and models was instrumental in helping Linde develop this pioneering new range of reach trucks, which went on to win a Red Dot design award.

Research for the future

Gaining a competitive advantage by keeping one step ahead of the market and customers is another area where design consultancies can lend support, particularly if there are limited research resources in-house. Given the emphasis on productivity and sustainability in the industrial vehicle industry, it is no surprise that a leading OEM such as Linde wanted to explore potential new technologies for the future.

The consultancy was also able to use its technical knowledge to research opportunities for the OEM, conducting research into factories and solutions for future power supply that may lead to more continuous productivity in material handling. With this groundwork completed, the OEM was able to refine its development program to exploit cutting-edge technologies in future designs. **ALT**

CONSULTING INTELLIGENCE

Don't underestimate the resources that are available to you by using a design consultancy! There are many benefits:

- Take advantage of a consultancy's design thinking. They follow defined design processes which focus on quality and innovation to develop technology that goes beyond what customers expect.
- Use their research and user-insight skills to gain empathy with customers and ensure real solutions are created to match needs, as opposed to just delivering new technology.
- Consultancies are familiar with working to tight timescales and will often work hand-in-hand with in-house design teams to provide resources at

key times in a project to keep it on track. With a team of well-trained and highly skilled individuals to represent all design specialisms, consultancies can be useful in fortifying a weaker area in-house. It's easy to underestimate the cost of maintaining skilled in-house teams, but consultancies will provide a stream of specialists on tap to support any phase of a development.

- As consultancies work for a wide variety of clients, they will usually bring valuable cross-industry experience to a project. This often brings benefits in unexpected ways and, with such broad

experience, there is invariably an opportunity for a fresh pair of eyes to provide a new approach for a winning design.

- With a rapid turnover of products and ever-changing applications, consultancies have to continually explore the latest advances in materials and technology. Access to this knowledge resource can bring many benefits to a new product development.

In addition, consultancies' experience of tooling and manufacturing will often pay off when it comes to selecting the optimum manufacturing process, and

with contacts throughout the industry, could also bring improved quality and cost savings.

- Some consultancies will also have a presence in China, which can be useful if you are keen to take advantage of production opportunities but lack the contacts on the ground to oversee development.
- It is important to bring designs to life through modeling at all stages of a project to help visualize and evaluate a new approach. While CAD has certainly revolutionized the industry, the benefits of models should not be overlooked.