Feeling is Believing – Build, Test, Refine

When it comes to assessing the design of products that we are expected to interact with, to sit on, climb on, grip, push or pull, there is no substitute for physically interacting with them

CAD renderings and VR or AR environments can certainly help to gather feedback from users to inform the design process. However, even at their best, these technologies can lack the level of fidelity that hands on experience can provide to build confidence among stakeholders.

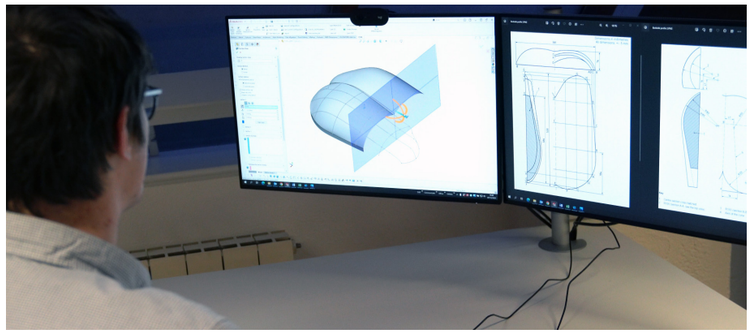
Efficient translation of ideas into suitably representative physical assemblies that can be tested and evaluated is one of the key challenges to reducing development lead times.

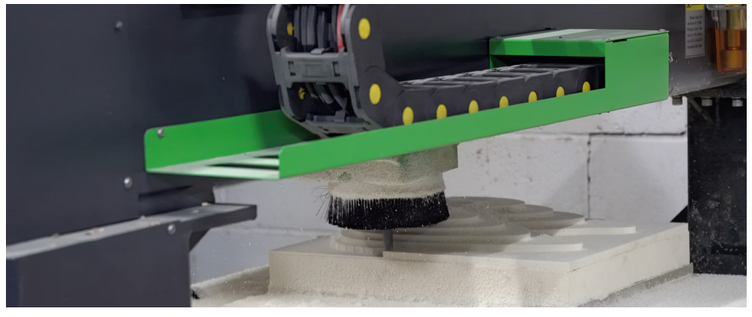
DCA is always looking for new ways to speed up the process of turning 3D CAD data into physical rigs, models and prototypes. Many of the products the company designs are small enough to be held in one hand, and rigs and prototypes for these can be rapidly prototyped using a range of in-house 3D printers and 5-axis CNC machinery centres. Transportation mock-ups are however, generally far larger and scale is often a problem for these machines.

The recent introduction of large scale CNC machining at DCA gives it the ability to profile much larger parts far more quickly than previous manual methods allowed, working directly from the design team's 3D CAD data.

The resulting large profiled sections are then assembled and finished by an experienced team of model makers and technicians to create full size rigs and mock-ups in the workshops. Using Human Factors (HF) expertise to review these with a suitable cross section of users and stakeholders provides the feedback necessary to establish how well the criteria for, say, comfort or anthropometric compliance can be achieved.

The process that DCA now offers links 3D CAD generated design data to an initial desk based HF review, followed up quickly with physical testing. For a large proportion of any new vehicle proposition, using dimensional checks of CAD data against established anthropometric data for the target operating region enables DCA to analyse and determine whether a design can meet the requirements of all the relevant regulations, the contractual demands and best practice expectations, including those for customers with disabilities and special needs. However, there will always be some issues that cannot be resolved by such a desk based assessment and need to be tested practically using physical rigs or mock-ups.



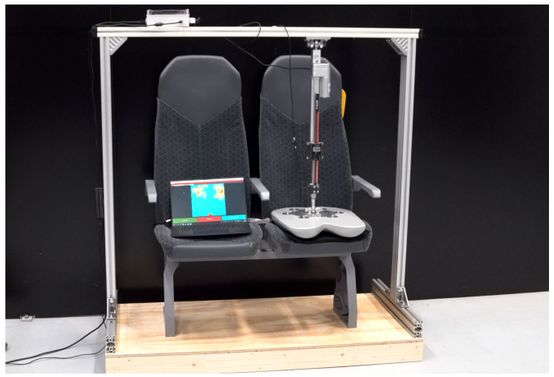


A good example of this is the forthcoming introduction of Rail Industry Guidance GMGN2696. This addresses the need to assess passenger seat comfort. A key part of the process is to establish just how well a seat design meets the objectives that determine comfort. The criteria are laid out by a series of tables with scores that are obtained by measurement, in the first instance from 3D CAD data. The next and vital part of the process is to run physical tests on the seat.

As part of DCA's response to this new Guidance, it has created its own seat comfort test rig, complete with a set of buttock profiles to simulate passenger loading on the seat. In combination with pressure pad instrumentation, this test rig has allowed it to test and assess the potential comfort of proposed seat geometries and cushion profiles and materials before committing to pre-production solutions and user trials.

DCA provides several quick and practical solutions that enable it to test its larger scale product design propositions. The first option combines a simple functional rig produced quickly using its 3D CNC router in structural foam or unfinished wood/ MDF with a Virtual Reality (VR) model overlay. The use of real time rendering and a VR headset enables true user interactions to take place, say a task analysis or a sequence of control events, with the action taking place in the virtual world while the mock-up provides just the physical touch points.

The second option uses a rapid build process to construct representative visual prototypes. For most of us, being able to see and touch a physical model provides the most tangible feedback. Being able to look round a model that represents the actual design vision allows a personal engagement to take place. In the context of a train driver's cab or a car interior, which deals with a complex 3D environment, it is hard to convey the design experience through visuals or VR alone. Vitally for mass transit solutions such physical mock-ups allow simultaneous interactions with multiple users drawn from a representative range of customer groups. Such interactions can incorporate boarding and disembarkation trials, including under emergency conditions.



The aim with this process is to establish quick results and confidence in the designs. By keeping all the activities during this rapid build, interactive review process in–house and using its own skilled team of designers, ergonomists, engineers, model makers and technicians, DCA controls the process and can gain valuable insights early on. This enables changes or improvements to be made and assessed while a design idea is still in its infancy before critical financial decisions have to made. This in turn, encourages more design options to be assessed, including some that might be considered too high risk without such physical assessment procedures. The time saved and flexibility to change or adapt, leading to better design outcomes, makes the investment in this interactive design and development process well worth making. RP

DCA

Tel: 01926499461
Email: transport@dca-design.com
Visit: www.dca-design.com