Enhancing Productivity with Immersive Human-Centric Engineering

Addressing the challenges that New Products and Processes Bring to the Factory of the Future

Experience assembly & capture process with Digital Human Model(s). Model data is Courtesy of Volkswagen

What does a Program Manager do when faced with a start of production pulled ahead by four months for the product to launch ahead of competition, and a Design & Validation budget slashed at the 11th hour to match the competitor's offer? There is neither time nor resources available to work according to standard processes anymore: activities must be rushed, reduced and/or bypassed and risk mitigation becomes pivotal.

Keeping up with market disruptions

Every day, new disruptive companies emerge and challenge the established organizations with lower structural costs, more nimble processes, and a simpler approach. Smart, dynamic entrepreneurs devise clever strategies leveraging new technologies and new mentalities to overrun the slower, historical processes of larger corporations. Existing companies must align to the new market conditions or dwindle.

To cut costs and hope to reduce lead times, Program Managers can no longer afford to design iteratively based on physical prototype trial and error. Design, validation, and manufacturing teams must be involved from the start to reach a common understanding of the design without constructing a prototype. They have to understand and experience the product before it exists. This is as true for manufacture and assembly on the factory floor as it is for the engineering design of the product.

Recognizing the interactions of people with proposed products and processes

In an experiential discovery mode, an immersed engineer performing a virtual build or service task might conclude that, while a process is "feasible" to be accomplished in the space provided with the proposed tools, the process is sub optimal for comfort or ease. In contrast to a deterministic simulation that might compute that a motion path is plausible for the installation of a component, a human operator will observe that, without super-human powers, they won't be able to see the workspace clearly enough to complete the task. Computer animations that demonstrate a process can take hours to prepare as they require specialized skills to manipulate a digital human model in a puppeteering manner. Working in a Virtual Reality (VR)-enabled Virtual Build, an engineer can, within seconds, evaluate, perform, and optimize an assembly sequence and tooling manipulation intuitively, just like they would in a pilot production facility.

First-person exploration only gets you so far because the circumstances are unique to the individual. However, the ability to record and playback object animation

sequences coupled with advance anthropometric digital human models, allows Virtual Build users to apply their first-person actions to “manikins” reflecting any number of regionalities, gender, and proportions. It becomes easy to explore, in the virtual environment, the build of a new product, and directly arrive at objective analytics for a diverse range of potential workers. Thereby it is possible, for example, to learn that, a 95% European male who performed an assembly action with ease could assign that same action to a 5% Asian female manikin and discover that she would find the same task uncomfortable or even unfeasible.

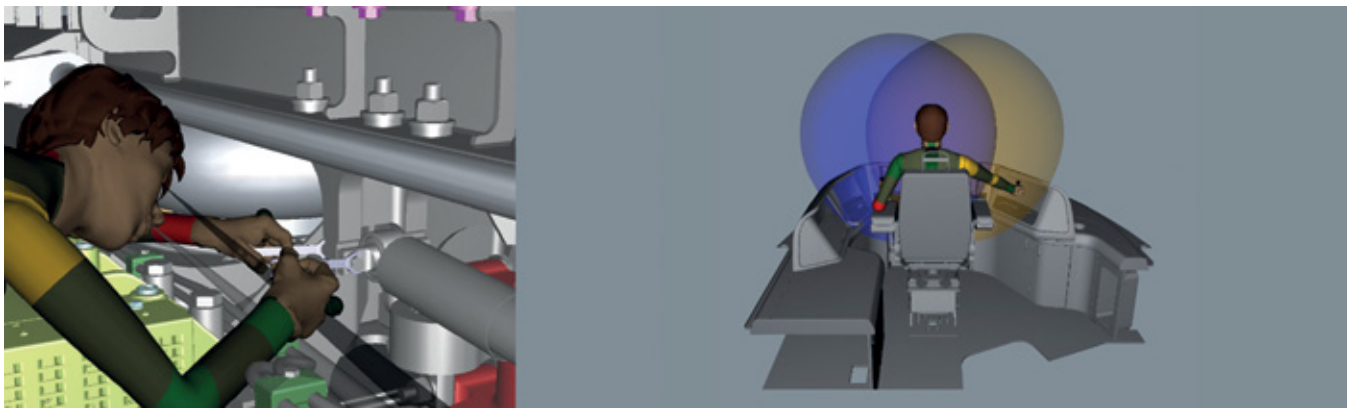
Augmented Reality and Virtual Reality

Assembly sequences are also required for creation of documentation and deployment of work instructions. Recent technology advances in the factory of the future point to a range of digitally guided assembly processes. Augmented Reality (AR) is one hot topic in this area, wherein digital model data can be overlaid with the real product to indicate the required sequence of operations. In a Virtual Reality Build environment, one can validate assembly sequences using only digital data. The findings from Virtual Builds can then be captured and exported as the basis for Augmented Reality digital guided assembly operations. It is not a question of VR versus AR, but instead that Virtual Reality can be used to validate what will eventually be deployed on Augmented Reality, before the physical products are ready.

Validating the production process across multi-disciplinary teams

Bringing in more competences for a product evaluation is always beneficial. That is why modern design processes usually call for a “multi-disciplinary approach” or simultaneous engineering in design reviews and risk assessments. Different sets of eyes spot more risks, different minds find more solutions. Where a test engineer might confirm that a button is too hard to press, an ergonomics engineer might point out that it is too small and not easily accessible, and a sales manager might wonder why there is even a button to begin with. The more interaction, the richer the analysis and the more potential to confirm solutions or to identify problems and suggest design opportunities as a group. The design team can then rework the product with confidence that all parties are aware and on board of the improved solution.

At the scale of a global enterprise being able to experience and interact with a product, before it is ever physically manufactured, on-screen, with a head-mounted display,



With ESI IC.IDO, CRRC ZELC improved the efficiency of the product development and subsequent assembly
Courtesy of CRRC ZELC

on a power wall or in a Cave, as an individual engineer, as a group, with a supplier or with a customer team, is invaluable. The discussions engaging team members and other stakeholders in an interactive quest for issues and improvements so early in the program, before tools are even kicked-off, inevitably lead to a stronger confidence in the design and manufacturability of the product from all involved, and ultimately from the whole company.

With IC.IDO, ESI offers a Human-Centric Assembly Process Validation. This immersive platform empowers multi-disciplinary teams to evaluate, discuss, and resolve the challenges that new products and processes bring to the factory of the future. It allows individuals or teams, together or on remote sites, to explore and interact with digital designs, so that engineering teams can identify necessary improvements and corrections before work starts on tooling for the manufacturing plants.

for more information
www.esi-group.com/human-centric

3 Questions for...

Marcelo Lima

Manufacturing Engineering Coordinator - Manufacturing 2020
FCA Brazil

FIAT CHRYSLER AUTOMOBILES

At Fiat Chrysler Automobiles (FCA) Brazil, you quickly moved ahead with implementing ESI IC.IDO in production, applying it to the Fiat Argo and most recently the Cronos line. Prior to that move, how did you perform production validation and what drove you to use Virtual Reality?

The processes validation was done manually with numerous physical prototypes with great chance of rework or modifications, which could consequently increase the cost and time of development of the project.

The market in Brazil has become increasingly competitive, forcing the adoption of global initiatives such as Industry 4.0 as well as development of FCA strategies for world class manufacturing (WCM) and world class technology (WCT).

The currently methodologies used in FCA consist of the constant search for simulations solutions to facilitate the day-to-day of our operations. In collaboration with the best specialists in the world we optimize our processes, seeking efficiency thinking about the quality of our products. During the development of the process we make several analyzes to minimize the physical tests implementing virtual tests, so we can devote more time from development to "best in class" in the operations that demand greater attention and assertiveness.

With this latest project, our goal was to digitize the engineering for a new launch of the upcoming "Cronos" automobile.

Courtesy of Diota

ESI IC.IDO allowed us to implement complex tooling evaluations, without the cost of building them, and also enabled us to arrive at the best assembly process through collaborative decision-making.

Of course we also eliminated tooling costs that would have been needed to support pilot builds in a physical process of trial the full extent of what we saved because of how many potential errors we avoided.

could also extend to allow collaboration with vendors and maintenance teams globally to make sure we are at the top of World Class Technology. After the validation step, IC.IDO and Diota for Augmented Reality would be a next step.

You recently shared your success with IC.IDO and reported that the initial investment paid for itself in just eight months. In which areas of the planning process did you apply VR and how were you able to quantify the value of the Virtual Assembly activity?

The estimate is based on the costs we avoided by not building physical prototypes and performing conventional pilot assembly. The largest saving was probably related to the costs we avoided for unnecessary downtime and launch delays because of the production risks we discovered and resolved ahead of time using Virtual Assembly in IC.IDO. We were able to predict potential issues before they became a problem. Therefore, we eliminated cost to acquire pre-production components needed for pilot assembly, plus weeks of waiting for prototypes from production and launch project timeline.

Given the success of Virtual Assembly Validation at the FCA LATAM facilities on those specific challenges, where do you see your team and Virtual Assembly Validation technology going next?

We will continue to use Virtual Assembly on the next generation of vehicle models and for the improvement of existing products. Because of the great success we had, it is also a possibility that we will use it in other LATAM plants and FCA sites globally. We are an innovative leader among the FCA Group and constantly share our success globally within the company. There is potential for VR collaboration with other IC.IDO users within FCA, using the capability for remote users to join and experience the same Virtual environment together. This way FCA Group could visit the FCA LATAM facilities virtually. Potentially Virtual Assembly Validation

About Fiat Chrysler Automobiles (FCA)

Fiat Chrysler Automobiles (FCA) designs, engineers, manufactures and sells vehicles and related parts and services, components and production systems worldwide through 159 manufacturing facilities, 87 R&D centers, and dealers and distributors in more than 140 countries. Its stable of brands includes Abarth, Alfa Romeo, Chrysler, Dodge, Fiat, Fiat Professional, Jeep, Lancia, Ram, Maserati and Mopar, the parts and service brand. The Group's businesses also include Comau (production systems), and Teksid (iron and castings). In addition, retail and dealer financing, leasing and rental services related to and in support of the Group's car business are provided either through subsidiaries or financial partners (such as captive companies, affiliates, joint ventures with leading banks and/or financial institutions, and specialized providers).

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