

# THE FUTURE OF MAKING THINGS

5 UK Manufacturing customers on their journey to repetitive advantage





# The Future of Making Things



Image courtesy of Autodesk

Asif Moghal, Manufacturing Industry Manager at Autodesk

**Asif Moghal, Manufacturing Industry Manager at Autodesk, explains why manufacturers who take advantage of Autodesk's range of products are one step ahead when it comes to the future of making things.**

British manufacturing continues to experience incredible pressure thanks to increasing globalisation, competition, and rising complexity in both the products they develop, and the realities of trading across multiple geographies.

Combine that pressure with technology disruptors like cloud, mobile, social media and advanced manufacturing techniques and you've pretty much described the environment in which British manufacturing companies are fighting to differentiate and compete.

The traditional idea is to try even harder to improve productivity, drive process improvements or innovative. But these approaches are not sustainable in the long term because of the decreasing amount of time it takes for others to replicate a new method. These approaches also lock a company into the world of selling products at a fixed value. What British manufacturers need is the ability to develop a competitive advantage on a regular basis, or what I like to call repetitive advantage.

## Breakaway from tradition

I actually think that British manufacturers are amongst the best placed to respond to these challenges and come out on top, globally! Britain has serious pedigree when it comes to design & innovation which are powerful disruptors in the industry. An agile product development process would enable British manufacturers to deliver smarter, more connected products which

change the relationship with the customer from one of selling fixed value products to one where the product itself becomes the basis of a service, and the lifetime value delivered to that customer will increase over time.

## Embrace new technology

We believe that the future belongs to companies that quickly figure out how to collaborate and personalise their products and services, flexibly design and manufacture them, and ultimately step into the world of connected services. The Future of Making Things is all about a journey to a cloud based Product Innovation Platform, that will enable British manufacturers to design, make and sell great British Products anywhere.

Autodesk is certainly playing its part by offering every British manufacturing company an opportunity to look at where they are now and where they want to be, and enabling them to start their journey into the Future of making things with us today.

I'm pleased to be able to share with you some real world examples of customers who have already started their journey into the Future of Making Things.



# Content



**6** BAC adopt Autodesk software to accelerate development of premier formula-racing car Mono



**8** Polypipe – Planning for the future of manufacturing with Autodesk



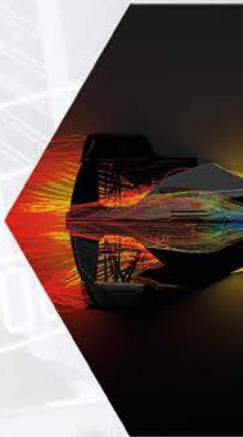
**10** Breakthrough for buses as Vantage Power release hybrid powertrain that cuts emissions by 40%



**12** Attempt to break World Land Speed Record by Bloodhound SSC backed by Autodesk



**14** Reinventing the toilet to make waste cleaner





# BAC adopt Autodesk software to accelerate development of premier formula-racing car Mono

## Vehicles now more realistic than ever thanks to new Autodesk visualisation tools geared towards greater precision and simulation

Briggs Automotive Company recently decided to adopt a number of new tools from Autodesk to equip themselves with the resources they need to assist them during the design and development stages and remain at the forefront of their industry.

From the evolution of the world-famous Mono to the aspirational sports cars they create, BAC have been able to accelerate their development at every stage using the following products.

### **AUTODESK® VRED™**

VRED has revolutionised the way BAC visualises current and future products. Their new car configurator utilises the product's powerful rendering capability, delivering a heightened user experience of the car's aesthetics and drive.

BAC can now also demonstrate their bespoke livery in animated HD, showing customers a true-to-life representation of how their Mono will look.

The showroom configurator takes the customer through a variety of options including colour, carbon finish, stitching, steering wheels and brake discs.

Using a tablet, customers can now check out how their car would look in realistic simulated environments.

Bespoke helmet liveries can be visualised alongside the custom Mono livery and race suit, giving customers the definitive representation of their car.



Image courtesy of Briggs Automotive Company



Image courtesy of Briggs Automotive Company

### **AUTODESK® PLM 360**

PLM360 gives BAC the power to share and communicate better. With the addition of a Bill Of Materials (BOM), each and every car has total transparency in terms of components, cost, and margin.

With this software, BAC can now further enhance the visibility of timeline-critical items for closer control over delivery dates.

### **HELIUS and MoldFlow®**

BAC is working with HELIUS and MoldFlow to enhance the development process for creation of molds and key composite structures.

These Autodesk products will enable the company to optimise material usage, resulting in weight and cost savings, greater precision and quality and less waste.

### **AUTODESK® RECAP 360™**

Using a simple upload/download functionality Recap 360 removes the strain of processing. Once uploaded to Autodesk's servers, this smart software returns an intricate polygon model for use in programmes such as VRED.

Using Autodesk's Recap 360 program, BAC recently captured and imported the company's test driver as a detailed accurate polygon model and incorporated it into the car configurator used by customers.

Unlike conventional scanning, this wonderfully simple solution saved BAC considerable time and expense.

### **ALIAS® AUTOSTUDIO**

Used for all freeform surface modeling and extensively in the product development



Image courtesy of Briggs Automotive Company

department, Alias AutoStudio has proved an invaluable tool at BAC, enabling the company to work accurately, faster and more intelligently.

Because of BAC's confidence in the software, the company went direct from CAD data tooling when designing Mono.

### **AUTODESK® INVENTOR® PUBLISHER**

BAC have decided to create their entire build manual in Autodesk's Inventor/Publisher due to the unlimited benefits that it will deliver to factory assembly teams, customers and their mechanics for the purposes of initially building, using and maintaining Mono cars.

Each step of the process will be illustrated with animated three-dimensional clips, allowing even the most difficult processes and steps to be understood by all levels of staff.

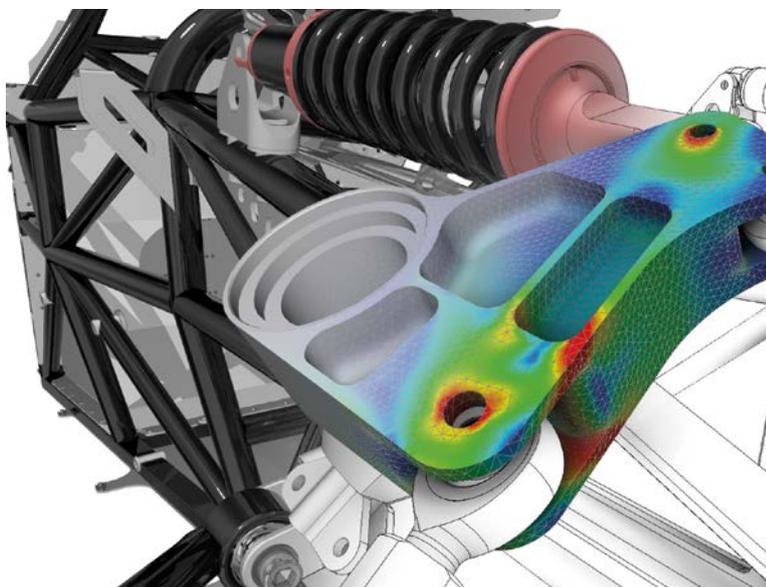


Image courtesy of Briggs Automotive Company.



# Polypipe – Planning for the future of manufacturing with Autodesk

A leader in its industry, Polypipe is using technology to explore a number of areas where it's looking to innovate and stay ahead of the competition.

With over 2,200 employees, Polypipe is one of Europe's largest and most innovative manufacturers of plastic pipe systems for residential, commercial, and civil infrastructure sectors. Their clients include major construction companies, power, rail and water networks. The company is also at the heart of some of the UK's largest ongoing infrastructure projects.

## Andrew Cullum, Marketing and Development Director at Polypipe Civils

"As a manufacturer working primarily with the construction sector we're very aware of how both industries are changing and we're always looking ahead at how we can adapt and innovate to meet our clients' needs for both now and in the future. We're working with Autodesk to help us overcome both our short-term challenges such as getting ready for BIM, as well as our longer term challenges in terms of how we manufacture for the future, from exploring connected products to additive manufacturing."

## A total water management solution

One of Polypipe's key business priorities is to offer clients a 'roof to river' total water management solution. This requires the sharing of knowledge and expertise from across its three main divisions: Residential, Commercial and Civil Infrastructure. A piping system that works well in a residential environment could potentially work equally well on a commercial project.

Having both consistent file formats and a standardised approach to product development, project solutions and manufacturing is therefore critical, because it helps avoid duplication within the business as a whole and reduces waste. Polypipe uses Autodesk's Product Design Suite and Infrastructure Design Suite for 3D modelling project solutions and off-site modular manufacturing and development, which allows the company to more easily create products in a consistent file format, that are also 'BIM ready'.

"Creating product files that are 'BIM-ready' is obviously important for ensuring we are in-step with our construction clients and meeting their needs, but actually having a better, more consistent approach to how we integrate our



Image courtesy of Polypipe

products in project designs and manufacture products also opens up a lot more opportunities for us as a business," explains Cullum. "Our aim is to create a product library that our clients can access, providing a more immersive and engaging experience and giving them the opportunity to work with our engineering experts to configure their Polypipe solution to their requirements.

"This will play a key role in our drive to extend our engineering expertise and to add value to client projects - streamlining the enquiry, validation, quote, and order process to support our clients and help them to achieve their goals. Extending this concept to link client requests and orders directly to production, resourcing, and finance systems will in turn drive efficiency and leverage new disruptions in the production process to improve production flexibility and agility. This could be a real game-changer for our business in terms of how we manufacture products in the future."

## A journey to the future

Polypipe is also looking at how closer relationships with clients and more consistent and accessible data could open up completely new business models. "We have the tools now that could in

the future be used to design and manufacture 'connected' products that once installed will be able to provide real-time data to both ourselves and our clients," says Cullum. "This would not only allow for better monitoring and maintenance of a product following installation, but also provide valuable information that could help us improve our products so we have a continuous cycle of innovation. Connected products could enable us to provide our clients with value and services beyond the initial supply of systems - it's a really interesting area for us to explore."

## Additive manufacturing

Another area of excitement for this forward looking company is the area of additive manufacturing, with 3D printing already being harnessed alongside configurable robotics to accelerate product development and production processes.

"3D printing is a hugely exciting area as it enables us to innovate even more quickly and cheaply, and to react and adapt to market changes or advances in materials," says Cullum. "We will soon be able to develop prototypes for specific customer projects in much shorter timescales and we see huge potential here for prototyping and customised product manufacture too."



Image courtesy of Polypipe

“Ensuring we are ready to support BIM is clearly important, but as a company we are conscious it’s just one factor contributing to the wider disruption of the manufacturing landscape. Understanding and addressing all these wider disruptions will allow us to better deliver our ‘roof to river’ vision for our clients, and give us a real competitive advantage. As we continue our journey towards engineering excellence we’re glad to be working closely with a company like Autodesk that can help us understand ‘what’s coming next’, where the future of manufacturing is heading, and how we can take advantage of new trends and technologies to grow our business.”

“We’re always looking ahead at how we can adapt and innovate to meet our clients’ needs for both now and in the future.”

**Andrew Cullum,**  
**Marketing and Development Director at Polypipe Civils**

# Breakthrough for buses as Vantage Power release hybrid powertrain that cuts emissions by 40%

Developed in conjunction with Autodesk's Inventor, the B320 System could save operators £20,000 and improve the quality of life for millions

Buses are the backbone of transport infrastructure networks in urban areas all over the world. However, they are also responsible for emitting huge amounts of pollutants into the air we all breathe.

## Pollution matters

Buses have arguably the largest impact on emissions as they consume vast quantities of diesel in densely populated urban areas. While in the UK more funding has been granted to reduce pollution, the ongoing global scale issue of pollution still remains.

## Hybrid buses not proven popular

The World Health Organisation estimates that seven million people died as a result of air pollution in 2012, with diesel vehicles being a big contributor. While hybrid buses help to reduce emissions and cut fuel costs, currently the only way to get a hybrid bus is to buy a new one. And since they cost 50% more than the diesel equivalent, this choice has not proven popular.

## Vantage Power step up

This challenge was what inspired Alex Schey and Toby Schulz – two recent mechanical engineering graduates – to develop a solution, which ultimately led to the creation of Vantage Power.

The pair had already shown what they were capable of when they developed the world's longest-range electric car and drove it from Alaska to the southernmost tip of Argentina, catching the eye of the BBC who documented an eight-part series on them.

The success of that inspired them to go on to found Vantage Power and develop an energy efficient transport solution on a greater scale.

## An innovative solution

Using state-of-the-art technology, Alex and Toby created the B320 System – a self-contained hybrid powertrain that retrofits into existing bus models. It's designed to be both robust and reliable while reducing fuel consumption and emissions by over 40%.

It ticks all the regulatory boxes too with Euro 5 (and soon Euro 6) compliance. A B320-powered double-decker bus could save operators up to £20,000 in fuel costs plus markedly reduce the amount of pollution in the environment, enhancing people's quality of life all over the world.

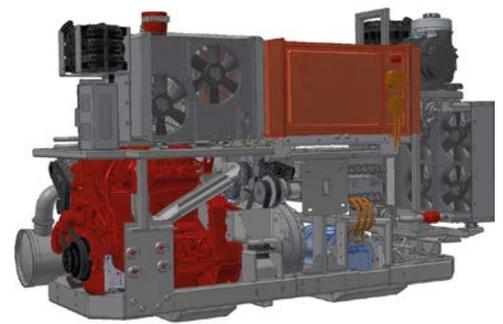


Image courtesy of Vantage Power



Image courtesy of Vantage Power



Image courtesy of Vantage Power

### How Inventor helped

Having access to the right software tools meant that Vantage Power was able to prototype its design rapidly. This is where Inventor from the Autodesk® Product Design Suite played an invaluable role. Autodesk Inventor® and Computational Fluid Dynamics (CFD) helped speed up the process and get the product ready for market.

Simulation tools also helped avoid design flaws by amending and correcting elements of the system before its manufacture, saving crucial time and money.

### A positive response

The response to the B320 has been very positive – buses are now quieter, more eco-friendly and save operators money. The future for Vantage Power looks bright with the company already speaking with bus companies about installations on UK roads before expanding into the European market.

“Our system allows not only for reduced costs and fuel consumption but will also improve the quality of life for people all over the world.”

**Vantage Power**

# Attempt to break World Land Speed Record by Bloodhound SSC backed by Delcam

We're proud to be supporting Bloodhound SSC – a global engineering project aiming to break the 1,000mph land speed barrier

Inspiration is one of the driving forces at Autodesk. So it's fitting that a division of our company is supporting the aspirational Bloodhound SSC – a project that aims not only to break the 1,000mph land speed barrier but also inspire the next generation about the brilliance of science, technology, engineering and mathematics.

## Supersonic ambition

The Bloodhound SSC (supersonic car) will be an astonishing 14m in length, 7 tonnes in weight and produce more than 135,000 horsepower – more than 6 times the power of all F1 cars on a starting grid. Behind the wheel will be Andy Green, a British Royal Air Force fighter pilot and World Land Speed Record holder.

As well as aiming to break the world land speed record, the Bloodhound SSC project has two key objectives:

- To confront and overcome the impossible using science, technology, engineering and mathematics
- To motivate the next generation to deal with global 21st century challenges

## Delcam in full support

Delcam, a subsidiary of Autodesk, is supporting the project with its manufacturing software and expertise, as well as producing components for the record-breaking vehicle in Delcam's Advanced Manufacturing Facility at its Birmingham headquarters.

Several Delcam customers and technical partners are using the company's CAD/CAM software to manufacture parts for the ultimate jet and rocket-powered racing car.

## Front Suspension Sub-Assembly

Delcam and the AMRC (The University of Sheffield Advanced Manufacturing Research Centre) partnered together to manufacture the front suspension sub-assembly for Bloodhound SSC. They did this using Delcam Power MILL's Vortex machining strategy on a Starrag Ecospeed machining centre.



Image courtesy of Bloodhound SSC



Image courtesy of Bloodhound SSC

### Steering Support Column

Delcam Professional Services manufactured the steering support column for Bloodhound SSC, an essential component for ensuring that the car remains on track during its world land speed record attempt. The steering support column was produced in Delcam's Advanced Manufacturing Facility on a Hermle C50 UMT machining centre, which offers 5-axis machining through the incorporation of a trunnion for the A-axis and a rotary table to produce the C-axis.

### APU Gearbox – HTP Pump Power Interface

Delcam PowerMILL was used by Jaivel to program more than 50 components for Bloodhound SSC. Components such as the housing and key parts for the gearbox for Bloodhound's Cosworth auxiliary power unit – a customised F1 engine which pumps fuel to the car's Falcon rocket – were then machined by the AMRC using PowerMILL and Vericut. Five parts were manufactured, each milled from aluminium 7075 on a MAG Cincinnati FTV5 2500 vertical machining centre.

The Bloodhound SSC has further evolved the long-standing relationship Delcam has with the AMRC. In their own words:

"We've dealt with Delcam for seven or eight years now. Delcam offers us a lot of functionality in terms of the programming capability within the software. We like its ability to give us rapid programming, and so reducing the time it takes to give us the cutter paths we require"

"We've dealt with Delcam for seven or eight years now. Delcam offers us a lot of functionality in terms of the programming capability within the software. We like its ability to give us rapid programming, and so reducing the time it takes to give us the cutter paths we require."

### Bloodhound SSC



Image courtesy of Bloodhound SSC



# Reinventing the toilet to make waste cleaner

## Loowatt is a British company rethinking how human waste is collected, stored and processed by harnessing new design and manufacturing techniques and embracing the future of making things

### A clean start

Ever since humanity started living in communities, disposing of human waste has been a major problem. For most in the developed world, inadequate sanitation is something they've never considered, let alone experienced. However, for people across the developing world, a lack of functioning sewage and waste disposal is a very real issue which can cause serious health implications. Clean and efficient toilet facilities can transform the lives of people without them, but it can be very difficult to make this a reality in overpopulated, developing areas. Now, Loowatt is reinventing sanitation by recycling human waste with its waterless toilet system.

### Rethinking the toilet

Since its inception, Loowatt has developed a number of different products. Each of these is based on the core Loowatt waterless toilet concept created by the company's CEO, Virginia Gardner, as part of her master's thesis at the Royal College of Art. The Loowatt system uses odour-inhibiting biodegradable film to automatically seal away waste each time the toilet is used. This waste then drops into a cartridge container which is periodically emptied. From here, the waste can be treated in an anaerobic digester, which kills 95% of the pathogens, produces usable biogas and, with some post processing, a safe fertiliser. Key to the whole process is that this system doesn't need water to work, which means it can be installed without any external plumbing infrastructure.

As a result of Loowatt's clean, water-free approach, its toilet system has found a number of uses around the world. In the UK, Loowatt delivers toilets to festival sites where they have many advantages over traditional solutions, not least being cleaner and more efficient. In the developing world, Loowatt currently has around 20 toilets in Madagascar, which was chosen as the initial site for this part of the project. Waste from these toilets is fed into Loowatt's anaerobic digestion (AD) system or into existing AD infrastructure in the local area. The overall goal of the Loowatt project is to turn its new ways of thinking about sanitation into a sustainable business, delivering tailored sanitation solutions to the communities that need them.

"At Loowatt, we understand there is no silver bullet solution for solving the world's sanitation problems. Each community is different and has its own particular requirements for sanitation. With the Loowatt system we can ensure waste processing, treatment and recycling is safe and efficient while also cutting down on water consumption and providing a useful by-product. The challenge is designing everything else around the core system so that it fits in with the community's needs and can be easily installed, repaired and upgraded," explains Chris Holden, Head of Design, Loowatt.

### Making it happen

The design and manufacturing process for a complete Loowatt toilet is a truly global operation, with teams based in both the UK and Madagascar. While the sealing technology itself remains relatively unchanged for the different toilet systems, much of the team's design time is spent creating the mechanical components that allow users to 'flush' the toilets, as well the larger parts that make up the toilet itself.

In order to make these parts, the Loowatt team uses a number of different techniques within its design and manufacturing workflow. Often starting from a cardboard model, the component is then modelled and prototyped using a 3D printer, so that the team can test it in the real world and ensure problems are ironed out before the part is sent to a third party for final manufacturing. This approach has allowed Loowatt to speed up and cut the costs for the development of new parts, and also repair toilets in the field without the difficulty of having to recall the entire unit.

"3D printing has allowed us to be very responsive to the needs of our users in Madagascar. For example, some components taken from the UK system were difficult to access in the Madagascar context, making it harder to manually fix any problems with the toilet. So we designed a new component, 3D printed it and sent it straight to Madagascar where it was swapped with original part, allowing the toilet to continue functioning with minimal downtime," says Chris Holden. "We have now taken this a step further by installing a 3D printer in Madagascar meaning that new components can be printed and installed into the field within hours."

### Remodelling the toilet

Since May 2014, Loowatt has been part of the Autodesk Cleantech Partner Program, which has given it access to a wide range of design software. The three main pieces of software Loowatt has integrated into its design and manufacturing workflows have been the 3D CAD solution, Autodesk Fusion 360, and cloud-based product lifecycle management tool, Autodesk PLM 360.

Each software solution has helped Loowatt to transform the way the company operates across its various sites. Due to the nature of its work with Madagascar, the Loowatt team has facilities in both the UK and Madagascar. The Madagascan site is especially important as it plays a key role in ensuring the Loowatt solutions are tailored for the needs of the community that it serves. As a result, both the UK and Madagascan teams often collaborate on designs. Autodesk Fusion 360's cloud services allow multiple teams to work on a single design, ensuring all changes are reflected in one 3D model, and that any problems, such as clashes between changes to the design, are flagged early on.

"Using Autodesk Fusion 360, our separate teams have been able to collaborate more effectively on our designs. This has allowed us to speed up the design process and has helped us overcome the barriers that appear when working with globally disparate teams," explains Chris Holden.

"Autodesk PLM 360 has been used by Loowatt to control the design process and ensure the company is able to document every aspect of the design and manufacturing process. As part of this, Loowatt has been able to put the systems and processes in place to support its future growth. As a small business, Loowatt has also been able to easily tailor Autodesk PLM 360 to its needs, simplifying things like the design sign-off process, so it's more appropriate for a smaller business."

"As Loowatt has grown, it has become increasingly difficult for us to keep track of the various components, sub-assemblies and modifications that we've made, and PLM360 allows us to keep track of this. It also means



Image courtesy of Loowatt

that we can start compiling data on all of our products so that we can identify and fix any longer running issues that only show up when you have access to this kind of data," says Chris Holden.

### Flush with success

Over the next six months, Loowatt plans to bring the total number of toilets installed in Madagascar to 100 with the main focus on individual Loowatt units for single households. Thanks to Loowatt's water-free technology, any community can benefit from access to effective sanitation, even without access to a mains water supply.

In addition to these new units, Loowatt is also working on a brand new digester for one of its Madagascan sites, ensuring waste from this site can be put to good use. Beyond this, Loowatt is looking to understand more about how its toilets are being used in Madagascar in order to expand and grow its business and better meet the needs of its users. One product in the pipeline is a smaller scale version of its toilet for use within individual households, for areas where the current version of its toilet can't be installed.

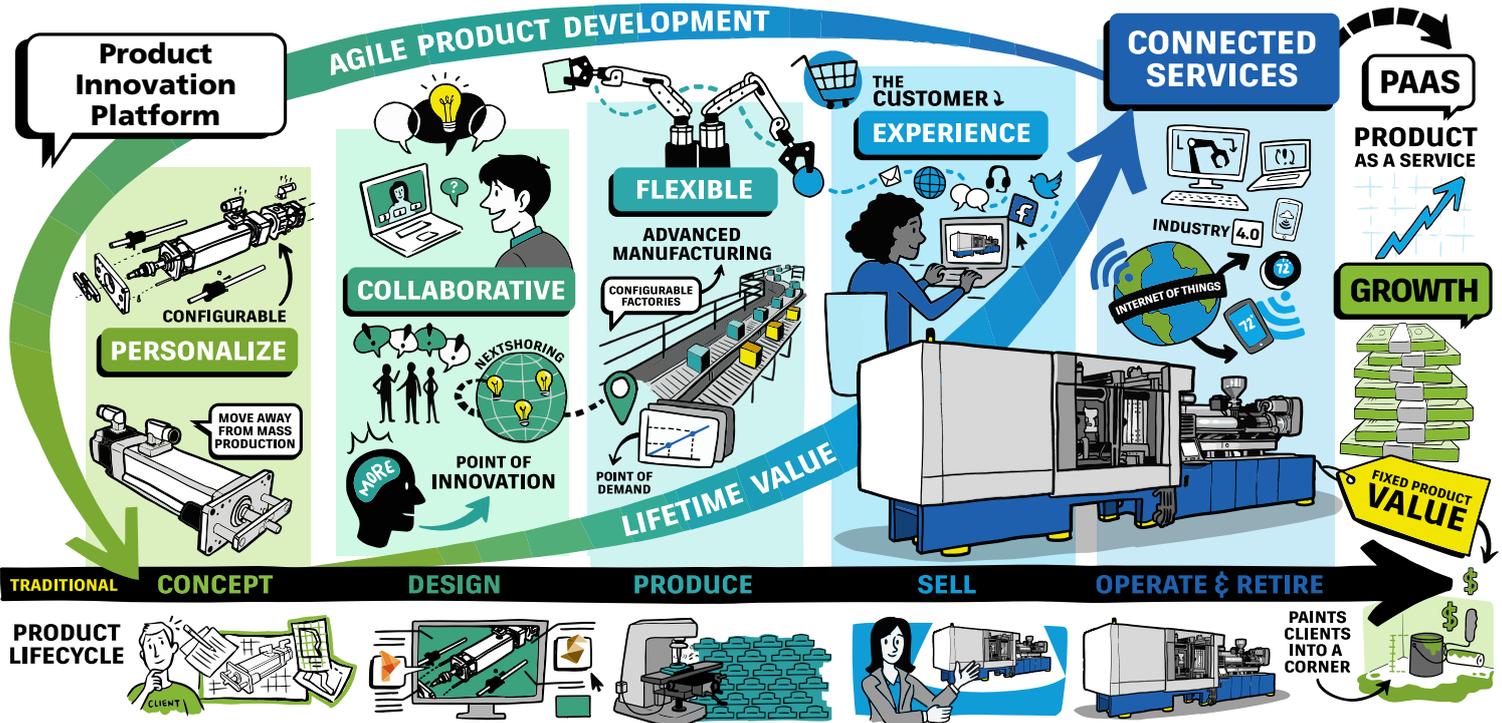
With sanitation a perennial issue for developing countries, Loowatt's toilet system has taken a fresh approach to solving the problem. Using clever design and manufacturing techniques, it's able to deliver the kind of sustainable sanitation solution that these communities can use, and the current toilets are only the beginning.

"Being able to collaborate in real time on designs has been incredibly useful, and has allowed us to improve how our teams work together, even when thousands of miles apart."

**Chris Holden, Head of Design, Loowatt**



Image courtesy of Loowatt



**Learn more or purchase**

Access specialists worldwide who can provide product expertise, a deep understanding of your industry, and value that extends beyond your software. Locate a reseller near you at [www.autodesk.co.uk/reseller](http://www.autodesk.co.uk/reseller).

**Autodesk Education**

Autodesk offers students and educators a variety of resources to help ensure students are prepared for successful design careers, including access to free\* software, curricula, training materials, and other resources. Anyone can get expert guidance at an Autodesk Authorized Training Center (ATC®) site, and validate skills with Autodesk Certification. Learn more at [www.autodesk.com/education](http://www.autodesk.com/education).

**Autodesk Subscription**

Autodesk® Subscription gives you a greater advantage with powerful cloud-based services, access to the latest software, online technical support, and flexible licensing privileges.\*\* Learn more at [www.autodesk.co.uk/subscription](http://www.autodesk.co.uk/subscription).

**Autodesk 360**

The Autodesk® 360 cloud-based framework provides tools and services to extend design beyond the desktop. Streamline your workflows, effectively collaborate, and quickly access and share your work anytime, from anywhere. Learn more at [www.autodesk.com/autodesk360](http://www.autodesk.com/autodesk360).

\*Free products are subject to the terms and conditions of the end-user license agreement that accompanies download of this software.

\*\*All Subscription benefits are not available for all products in all geographies. Please consult your Autodesk reseller or sales representative for more information.

Autodesk, Autodesk VRED, Autodesk PLM360, Helius, MolFlow, Autodesk ReCap, Alias Autostudio, Inventor Publisher, Autodesk Product Design Suite and Autodesk Inventor are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product and services offerings, and specifications and pricing at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document. © 2013 Autodesk, Inc. All rights reserved.