ADDITIVE MANUFACTURING IN HIGHER EDUCATION

Discover how cutting-edge 3D printing technology, training opportunities and curriculums can help you differentiate your educational institution.

Lead the way to the industry of tomorrow

The Fourth Industrial Revolution is already transforming the way products are created. Modern design thinking and the latest additive manufacturing (AM) technologies mean that production has moved closer to the end user. Customers can get a better quality and more personalized product, and it's delivered faster, with lower distribution and production costs.

An increased share of the value of the product moves back to the design phase. Modern design engineers can enjoy greater design freedom and create intricate and complex geometries that break through traditional parameters. It's now easier than ever to create sophisticated products and functional parts without expensive or complicated processes.

Yet, designing for additive manufacturing (DFAM) requires critical new skills. Traditional thinking about specific dimensions and geometries in the conventional production world won't always work. New design approaches are essential to create parts that are optimized for additive manufacturing (AM) and that unlock its true value.

Research has indicated that 3D printing technologies could create 3-5 million new jobs in the next ten years in the USA alone[1]. Universities and other higher learning institutions will be at the forefront of supporting that by helping evolve the culture of design and production. Your students will need to build their knowledge and confidence in DFAM and AM processes if they are to take on the digital manufacturing roles of the future.

So how will you support your students with the very latest, most reliable, flexible and high-quality tools?

What technologies should you invest in today that will create the strongest foundation for learning about the new methods of design and manufacture?

Indeed, how will you differentiate your educational institution in the face of fierce competition for these increasingly sought-after skills?

If you make the right decisions you will be able to recruit more students, choose from the very best talent, and build your reputation as a center of excellence. Indeed, the right technology will enable your students to learn skills that will help optimize the Product Life Cycle end-to-end – from accelerating design and pushing design boundaries, through to manufacturing.

If you already have an additive manufacturing lab, other key objectives for you will be keeping costs to a minimum, optimizing students' production schedules – especially during peak usage such as the end of semester – and offering a cutting-edge solution that's as easy to use as possible.

Read on to discover how other educational institutions are successfully using additive manufacturing to equip their students with the right skills for tomorrow's labor market.

[1] '3D Printing: Ensuring Manufacturing Leadership in the 21st Century', AT Kearney and HP, 2018.

3D PRINTING: REAL-WORLD APPLICATIONS

3D printing will come to play a role across the Product Life Cycle in almost every sector in industry.

3D printing enables high-performance, customized designs – that can be produced quickly for faster time-to-market and increased customer satisfaction – making it ideal for a wide range of applications.

Companies in multiple industries, like Automotive, Healthcare and Consumer Goods, are already pioneering Additive Manufacturing applications for prototyping, during the manufacturing process (e.g. manufacturing aids or robotics) and for final part production, so students must be ready to face the employment market with confidence.

It's highly likely that many departments within your educational institution could benefit, or are already benefitting, from having a shared 3D printing capability on site.

"We're exposing students to how 3D printing processes work. They're able to use that in their education, but we're also teaching them how things are going to be made in the future."

John Desjardins,

PH.D, Bioengineering Professor, Clemson University


Data courtesy of Clemson University

TURNING IMAGINATION INTO INNOVATION

Clemson University in South Carolina, USA, is enabling the production of advanced prototypes and various precision engineering components through additive manufacturing.

"When they realize they can do anything they want to, you know, anything that they can design basically we can print, I think that's going to change what they want me to print."

Tim Pruett,

Manager of 3D Printing Lab, Clemson University

As well as its students, some local organizations are using the university's facilities to unleash their creativity. Both groups are taking advantage of the 3D printing services to bring their complex designs to life as precision objects that can withstand functional testing.

HP's Multi Jet Fusion (MJF) technology is delivering real detail and precision. One student's project involved creating flexible fins to enhance the swimming performance of a robot. The solution involved producing multiple sections connected by springs, which other 3D printing technology simply couldn't manage. Another student was able to print components for his ventricular bioreactor (a device that mimics the human heart) at millimeter scale

"Being able to print on the micron scale is mind blowing. It's extremely helpful to have a printer that has that really low tolerance, and that can pick up all of the specific details we really need."

Spencer Marsh,

PH.D Candidate, Clemson University

Designing for additive manufacturing is part of Clemson's senior design course, teaching students to produce product components and evaluate how well they will work. They can print with complete precision – on the micron scale – ensuring every detail is included. Other previous designs have included medical tools such as catheters and devices to hold infants' heads.

The ability to include color is a major draw for students, who are able to incorporate their own product branding designs on their manufactured items. And the speed, relative low cost and physical robustness of the finished article, enabled by HP MJF, has excited everyone.

"When I first saw this machine, color is what got me excited about it. But now this machine is so awesome I'd almost be just as happy as if it never had color – even though it is nice to print the Clemson orange!"

Tim Pruett,

Manager of 3D Printing Lab, Clemson University


Data courtesy of Clemson University


Data courtesy of EBK-Hungary Kft.

MOTORING TOWARDS MANUFACTURING QUALIFICATIONS

Students at Szent István University – in Gödöllő, Hungary – are able to learn all about 3D printing technologies through the university's partnership with EBK, a leading regional additive manufacturer.

"EBK supports the university and also the students during the learning process by giving them the opportunity to learn 3D printing with HP Multi Jet Fusion technology."

László Máthé,

EBK Technical Manager and Lecturer at Szent István University (SZIU)

The company organizes training courses in additive manufacturing for aspiring 3D engineers. Students are able to see and touch the machines, and to design and produce their own products to prepare them for careers in additive manufacturing. They also provide 'dual training' opportunities for interested students to come along and study the most advanced techniques.

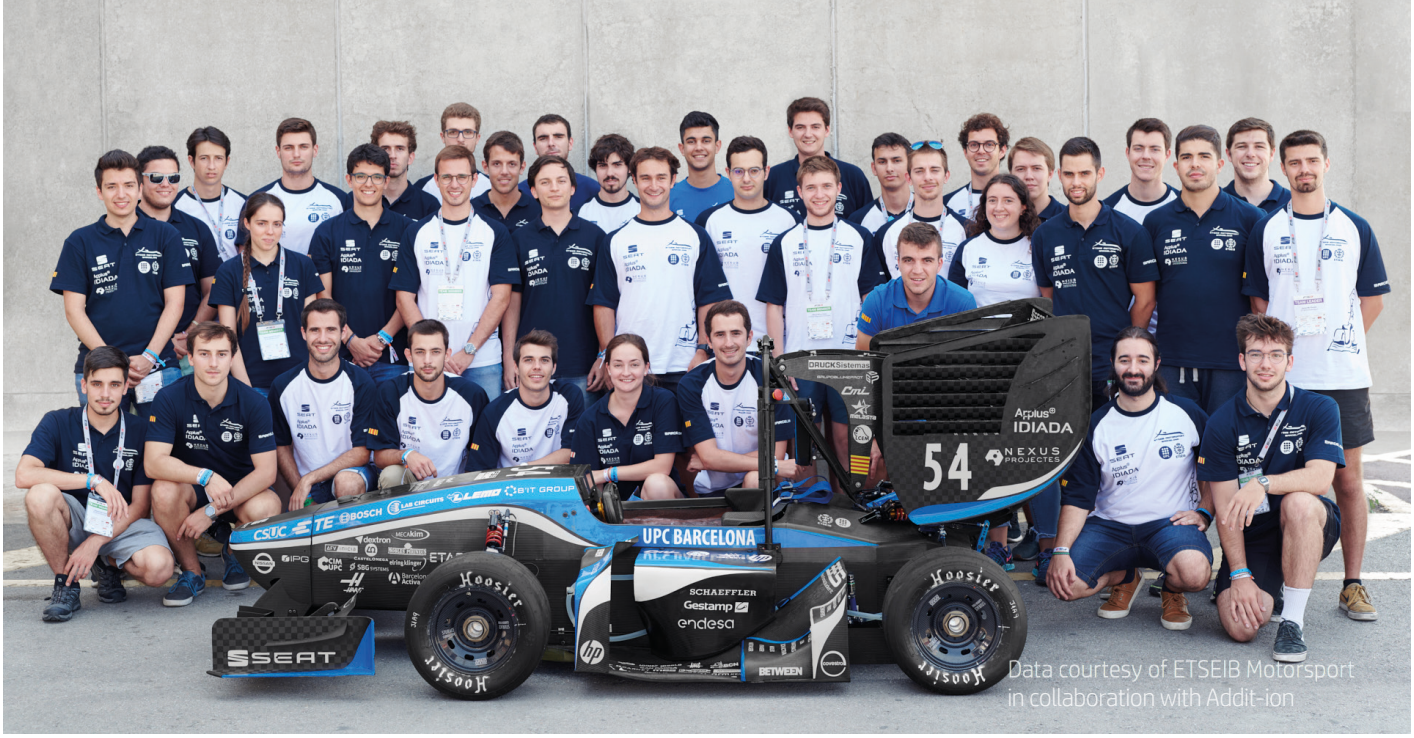
EBK, itself, provides engineering, production, and research and development services to a range of customers. They are specialists in automotive technology, with strong expertise in safety features for vehicles, and accident research and analysis. EBK's engineering team provides additive manufacturing services, such as prototyping, and creating components that meet highly technical, bespoke specifications.

For the students, the partnership provides fantastic opportunities to design and produce highly intricate and colorful parts. They also gain exposure to the production of real-world components as diverse as engine oil filters and crash-test dummies.

"HP's Multi Jet Fusion technology is a very advanced technology for mechanical engineering students. I'm really happy to see the students' faces when they realize that their designed product can be delivered in one hour by MJF technology."

László Máthé,

EBK Technical Manager and Lecturer at Szent István University (SZIU)



Data courtesy of ETSEIB Motorsport in collaboration with Addit-ion

RACING AHEAD AND STAYING ON TRACK

A team in Spain has used additive manufacturing to produce 450 different components for their high-performance Formula Student Spain electric racing car.

Students at the School of Industrial Engineering (ETSEIB) at Polytechnic University of Catalonia (UPC) designed the car from scratch. They order and test all the components individually, optimize them for performance, and then assemble, test and race the car during the summer.

The car employs some major innovations, and additive manufacturing components have been used throughout – including in its motor cooling housing, aerodynamic system, the battery package and control system, and other electronic systems.

The two main reasons for using HP Multi Jet Fusion technology were performance and the ability to customize and rapidly prototype components. . The motor cooling housing, in particular, required precision engineering from HP's MJF technology to stay water-tight. Rather than having just two motors, ETSEIB designed their car with four – one per wheel to distribute traction force more evenly and reduce rear-wheel skid. These four motors each need their own cooling system, with a cooling jacket and external housing that circulates water around it.

"When we found HP MJF technology and we experienced the robustness of the parts, we found the opportunity to develop more functional final parts. We can now create more customized and optimized parts for the car that we were not able to produce with other 3D printing technologies."

Albert Gallostra,

Powertrain Engineer of the ETSEIB Motorsport Team

But the team has also reduced costs by an estimated €6,000, representing 2% of their overall €300,000 budget. And they've also saved two months of time in an overall production schedule of just nine months.

The financial savings have arisen from the fact that the integrated parts are typically unique or short-run, making other production technologies far more expensive. Moreover, the team is now creating more efficient solutions by transforming traditionally manufactured components into 3D printed parts.

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With the Data courtesy of Aldora Space Program in collaboration with Addit-ion

VERTICALLY MOBILE DRONES

Students at Spain's Polytechnic University of Catalonia (UPC) are using additive manufacturing techniques to create a range of autonomous, electric 'vertical take-off and landing' (VTOL) unmanned aerial vehicle (UAV) drones. Additive manufacturing techniques are essential to make sure these drones are strong enough, while also keeping them as lightweight as possible using complex internal lattice structures.

"HP Multi Jet Fusion gives us the opportunity to use new materials. It means we can bring an extremely high quality to our builds, thanks to the precision of the printers, and provide structural resistance to our solutions. We can also print parts with more complex internal structures, enabling us to optimize the weight."

The project is called Aldora, and the drones are able to perform VTOL because they're designed as one single, highly efficient wing. They can take off vertically and then level out and fly as normal aircraft.

The original idea was to use wood and carbon fiber ribs to support a polystyrene shell, but that proved too bulky. The team then tried molds, but they were too expensive and time-consuming. Since starting work with HP and the Nacar Design studio, the students have created structures that can be created entirely using additive manufacturing.

Key design objectives were creating as much internal space within the drones as possible without compromising their rigidity. It was also essential that they should be highly aerodynamic and maneuverable.

"HP Multi Jet Fusion technology means we can print more complex lattice structures than with conventional fused deposition modelling (FDM) printers, which require a lot of support material. You get better finish quality than with conventional FDM printers, and a better end result than with other technologies."

Arnau Reyes Fernandez,

Project coordinator, UPC Space Program


Data courtesy of Aldora Space Program
in collaboration with Addit-ion

TAILORING TWO WHEELS TO FIT PERFECTLY

Twelve students from a University in Spain have joined forces to create an all-electric, off-road motorcycle that can race in the annual Barcelona Smart Moto Challenge.

Elisava Racing Team has developed its bike using HP Multi Jet Fusion to produce various components. The motorcycle is modelled on the designs of Paris-Dakar bikes, and ergonomically customized around the rider's specific biomechanics. That detailed digital design is then brought to life using additive manufacturing, creating robust and functional bespoke final parts.

The team members are all in their fourth year of Design or Industrial Design Engineering degrees at Elisava design school, which is part of the Pompeu Fabra University (UPF) in Barcelona, Spain.

NOW IS THE TIME TO ACT

HP Jet Fusion 580 Color 3D Printer

With HP Multi Jet Fusion, 3D printing technology has truly come of age for both industrial and educational applications.

You can now, at last, produce quality, functional parts with complex geometries, full color and exceptional detail. You can do so quickly and economically, and you can support your students' journeys to the industrial roles of the future.

"If I could only have one printer, it would be the HP Jet Fusion machine just because it's easier to use and it's faster and it has super high-quality parts. These stronger parts are actually allowing the students to do physical testing on their apparatus."

Tim Pruett,

Manager of 3D Printing Lab, Clemson University

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