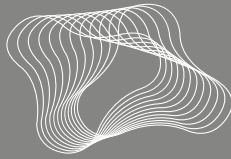


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Fira Barcelona



IN(3D)USTRY

FROM NEEDS TO SOLUTIONS

Additive & Advanced
Manufacturing Global Hub



**ADD
VOLUME,
ADD
VALUE**

Dear reader,

Fira Barcelona (Barcelona Exhibition Center) is developing a new platform IN(3D)USTRY From Needs to Solutions, fostering the adoption of Additive and Advanced Manufacturing technologies and tailoring innovation to learn from today's markets needs to prepare for the future applications.

With IN(3D)USTRY BOOK we want to share all the highlights presented in IN(3D)USTRY From Needs 2016.

But mainly, we hope is a tool to learn about real applications of the use of AM, discover the challenges that user companies are having, and an opportunity to approach them and give them solutions.

Our main objectives:

- **Share users business challenges. Innovation will come from users sharing their needs and the AM industry providing solutions.**
- **Promote the use of additive and advanced manufacturing through case studies**
- **Partner with new leads giving them solutions to the user's challenges**
- **Accelerate innovation by learning leading practices**

We were presenting a new format in Additive Manufacturing events and trying to do things differently it is always a challenge. A new IN(3D)USTRY ARENA concept where Top Industrial end-users launch their challenges to the Additive & Advanced Manufacturing Industry & the AM industry can provide such Solutions, shaping the future of advanced manufacturing technologies.

However, after all, the hard work paid off, with around 3,000 professionals, 40% of which decision makers and a constant flux of international media impacts exceeded our expectations for a new event.

Our intention is to create an IN(3D)USTRY Community, taking care of the ones who participated and tried to get more creative minds to take part in our next editions, having more speakers and companies sharing knowledge to a broader audience. Making IN(3D)USTRY, the event were companies, and brands come to share their stories about digital manufacturing.

We want to build with you the hub that helps you accelerate your business.

I am looking forward to seeing you in Barcelona in October 2017.

Warmest regards,



Miquel Serrano
IN(3D)USTRY From Needs to Solutions Director

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The arena

The first edition of IN(3D)USTRY From Needs to Solutions, which took place from June 21st to June 23rd 2016 at Fira de Barcelona, successfully introduced an entirely new concept for exploring the possibilities offered by additive manufacturing and 3D printing across four key industrial sectors.

The event showcased both the present of additive manufacturing, as well as its promising future, by focusing on the challenges 3D printing presents, and offering innovative, pioneering, and state-of-the-art solutions to manufacturers' specific needs.

Over the three-day event, prominent international speakers took to the stage to describe their experiences with additive manufacturing in the four most important vertical sectors: Aerospace & Automotive, Healthcare, Architecture & Habitat, and Consumer & Retail Goods.

This unique approach stimulated participants to explore the many different solutions already offered by additive manufacturing technologies today, and enabled representatives from both the academic and the industrial spheres to meet, exchange ideas, and debate the future of digital fabrication and advanced manufacturing.

To get to the heart this manufacturing revolution, leading representatives from global enterprises including SEAT, Airbus, IKEA, HP and many more were invited to the Main Stage to demonstrate their successful applications of 3D printing, and discuss what they expect to accomplish in the years to come.

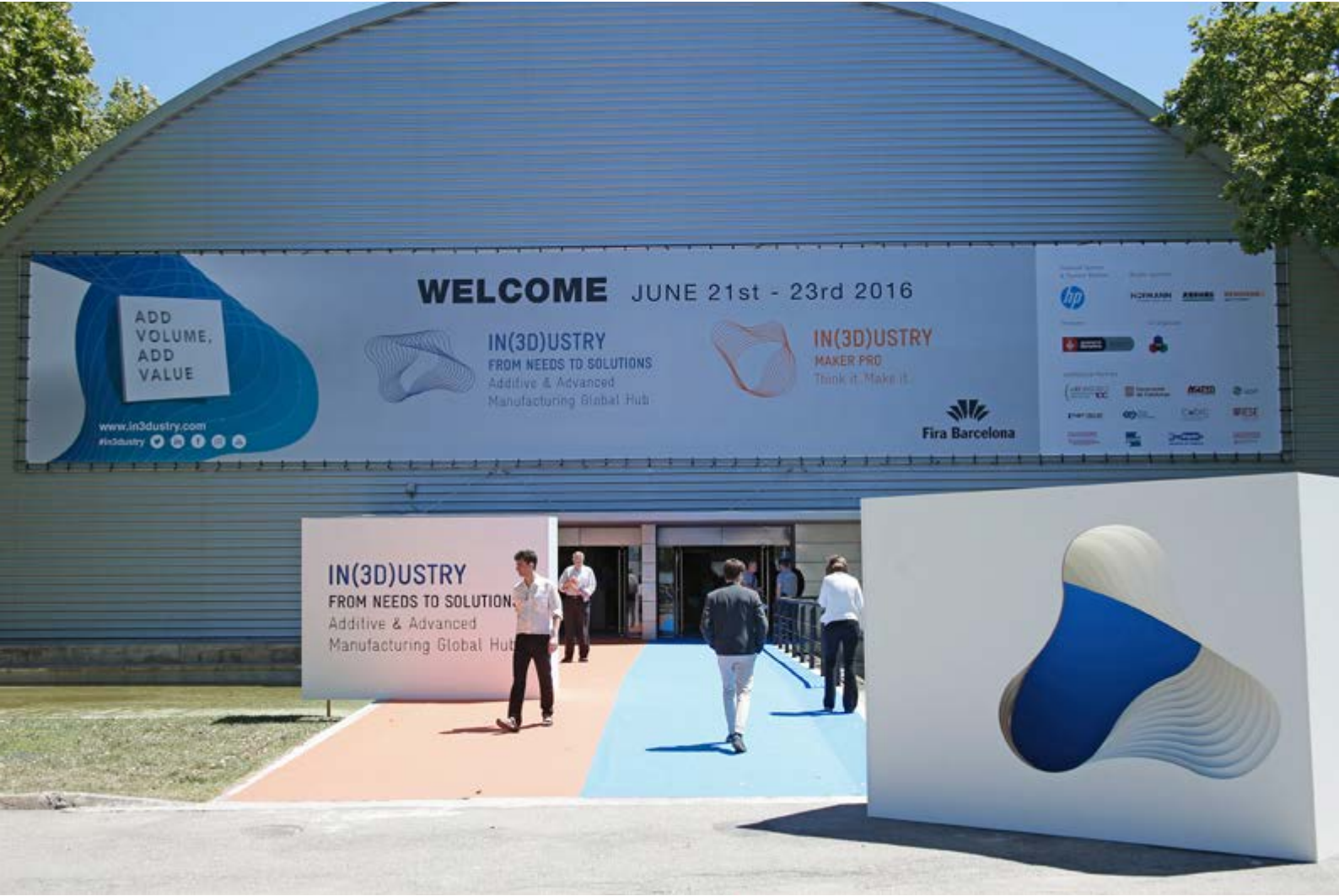
In-between talks, visitors and participants could explore the showroom floor, where manufacturers of high-end AM systems, including Renishaw, Concept Laser, Hofman and others, shared their specific solutions to various 3D printing manufacturing needs.

IN(3D)USTRY was also unique in its ability to combine professional level AM adopters with some of the most innovative projects from the maker community. Adjacent to the showroom floor, the Maker Pro area offered participants the opportunity to participate in workshops and lectures, and to see first-hand how end-users are already combining advanced manufacturing technologies with collaborative processes, an open-source philosophy, and unrestricted creativity to fundamentally change how we design, make, and use new goods.

Each of these synergies came together with the city of Barcelona's own innovative vision for a democratic, connected, global hub, generating an energetic space for debates, discussion, and partnerships.

IN(3D)USTRY From Needs to Solutions established that additive manufacturing and the Fourth Industrial Revolution is already transforming industry, both in its current applications, and future solutions. What's more, it did so in a unique and engaging format that did not disappoint.

Though aerospace parts and designer fashion may seem to be worlds apart, many industries are in fact facing the same challenges regarding materials, cost efficiency, customization and sustainability. IN(3D)USTRY brought them all together to find the most unique solutions.



Barcelona the Industry 4.0 Hub

FRANCESCA BRIA |
Chief Technology and Digital Innovation
Officer, Barcelona City Council

LOREDANA GHINEA |
Executive Director, Spire

TOMÁS DÍEZ |
Director, Fab City
Research Laboratory



More than a mere venue, the city of Barcelona played a key role at IN(3D)USTRY, further establishing itself as a central and critical hub of the Industry 4.0 Revolution:

"The show in general - and the fact that it is taking place here in Barcelona - is ideal: I didn't expect the first edition to be so well organized and with so many large companies participating from the very start. There has been a lot of support from the government and also from the municipality of Barcelona."

Over the past decade the city of Barcelona - and the region of Catalonia as a whole - has placed a particular emphasis on Smart City and Industry 4.0 policies in order to develop better and more sustainable standards for city living. Several international tech companies, including IBM, Intel and HP have important offices here.

One of the high profile guest speakers, Francesca Bria, was asked to contribute to the discussion bringing her experience as a member of the Internet of Things Council and an advisor for the European Commission on Future Internet and Smart Cities policy.

"Barcelona is a city that has always been open to an ecosystem that gathers different types of people from all across the world. [...] What is inspiring for me is that at IN(3D)USTRY we are collectively exploring the new socio-economic models that we need to make this sustainability mind- shift and real cultural change possible."

| Francesca Bria Chief Technology and Digital Innovation Officer,
Barcelona City Council

Along with the many industry-specific speakers, the show highlighted presentations by high profile guest speakers and high-level decision makers who will have a fundamental role

in determining the future of advanced manufacturing, both within the global hub of Barcelona, and abroad.

Loredana Ghinea, Executive Director of the SPIRE Public-Private Partnership, affirmed the city's unique positioning and vision within the global additive manufacturing market:

"From my own experience working with European-wide projects and initiatives, Spain and in particular Barcelona are very active in Europe in everything that has to do with industrial technologies. So, why not pick on a new industry and establish Barcelona as an environment that is really useful and friendly to things that are coming up in the next years?"

| Loredana Ghinea Executive Director, Spire

Globally renowned urbanist and director of Fab Lab Barcelona at the IAAC (Institute for Advanced Architecture of Catalonia), Tomás Díez spoke about how digital fabrication and additive manufacturing are crucial tools to transform how we produce, consume, and navigate our cities in more positive and sustainable ways:

"As co-organizers, we saw an opportunity not only to bring together these large companies, but also to create a fundamental connection with the maker movement and those people that are actually thinking 'out of the box' on how to do business, how to create new products, and how to use technology. What we have seen is a really interesting interaction between people that are really on the field - from makers to small companies, to large businesses like IKEA and enablers like HP - all together in the same room."

| Tomás Díez Director, Fab City Research Laboratory

As 3D printing emerged as the link between the virtual and the physical world in the future of IoT, experiences acquired with software – such as the open nature of the Internet – can help us find solutions for the needs of the still-young additive manufacturing industry. Vint Cerf, considered one of the Internet's founding fathers, explained how 3D printing companies and innovators could learn to share experiences and knowledge so that the entire industry can grow organically.

“The 3D printing community is going to have to recognize that it can't be simply competitive. In order for people to really use of this technology to build new businesses there has to be commonality, cooperation, and willingness to share ideas. Mixing those who are making the equipment and those who are using it here at IN(3D)USTRY is really important because that's where the feedback loop comes in.”

| Vint Cerf VP & Chief Internet Evangelist – Google





VINT CERF |

THE INTERNET AND 3D PRINTING

IN(3D)USTRY's Inaugural Address was given by Vinton Gray Cerf, an American scientist widely regarded as one of 'the fathers of the Internet.' His contributions have been acknowledged with honorary degrees and awards globally, including the National Medal of Technology, the Turing Award, the Presidential Medal of Freedom, the Marconi Prize and a membership in the National Academy of Engineering. At IN(3D)USTRY, Vint Cerf made the case for defining an open AM architecture just as he did decades ago with the development of the Internet:

“Let's just explore a little bit of the architecture of what the 3D printing ecology might look like. The first thing that we know is eventually, we'll need some standards so that the CAD/CAM systems can drive multiple different 3D printers.”

“Second, we're going to have to come up with a way of describing the things that the 3D printers are making so I can take a partially made thing from one 3D printer, move it into another one, and add more to it. So we have to have this rich ability to tell one 3D printer what it's getting from some other 3D printer.”

“Third, we have to figure out how to agree on standards for moving designs from one printing device to another. We want to make sure that the standards are rich enough that when new 3D printers come along with new capabilities, the standards allow us to express what it is that we are trying to do. And finally, I think it's going to be very interesting to make parts with the 3D printers, but have robots figure out how to assemble those parts. And so we can see this going step- by-step-by-step until finally we have invented an entirely new advanced manufacturing capability, different from the one that we use today.”

Despite the high levels of enthusiasm for those actively engaged in advanced manufacturing practices, others acknowledged that AM is still considered 'niche' by far too many. However, as Real Estate Director Francisco Sensat states, sooner or later, there will be no more denying AM's surprisingly vast reach:

"This exhibition is showing us the beginning of new technologies that will grow a lot. This is a great thing for many people, myself included, who may not know be fully familiar with these new possibilities and it can be a big help for the industry, not only for the 3D industry but all industrial sectors."

| Francisco Sensat Real State Director, El Consorci de la Zona Franca

New policies on industry, energy and tourism will shape the future of manufacturing in the Industry 4.0 scenario, as companies such as the ones present at IN(3D)USTRY will complete the transition toward full process digitalization.

The need to create a complete ecosystem in order to address each of these issues and explore the solutions that 3D printing can offer today is perfectly in line with the vision that HP has for the future of digital additive manufacturing, as explained by the General Manager of HP 3D Printing Ramón Pastor:

"One of the unique things of IN(3D)USTRY is that you actually have the whole ecosystem, from makers, to software, to post-processing to different technologies [...] Our approach at HP is that we cannot do anything alone. We need to incorporate others and leverage on global innovation. The best way to do this is through open standards in material, in software, and in workflows."

| Ramón Pastor VP & General Manager, HP 3D Printing

From beginning to end, the inaugural IN(3D)USTRY show provided fresh perspectives on the undeniable future of additive manufacturing, bringing together government, industry, creatives and all forms of collaborators. The event set the stage for an extremely promising industry, and a new global show, to continue thriving in the years to come:

"All the companies that are here today are part of the fundamental economic transformation that comes from the digitalization of the industry. 3D printers are one of the most important digital enablers that industrial companies have to work with."

| Mario Fernando Buisán Coordinador Estrategia "Industria Conectada 4.0", Ministry of Industry, Energy and Tourism/Government of Spain

IN(3D)USTRY NEEDS AND SOLUTIONS

- 1

Finding out what kind of socio-economic, sustainable new models we need to make the future of manufacturing possible
- 2

A cultural change and a sustainability mind-shift
- 3

Commonality, cooperation and willingness to share ideas to make the industry grow as a whole
- 4

Mixing those who are making the equipment with those who are using the equipment
- 5

Discovering the new possibilities offered by 3D printing technologies
- 6

Exploring the future of the industry, year after year
- 7

Bringing the entire digital manufacturing ecosystem (makers, software, hardware, post processes, adopters) together
- 8

Developing open standards for everyone to be able to work together
- 9

Establishing Barcelona as a hub for the future of manufacturing
- 10

Gaining more support from Governments and Municipalities



FRANCISCO SENSAT |
Real State Director,
El Consorci de la Zona Franca

RAMÓN PASTOR |
VP & General Manager,
HP 3D Printing

MARIO FERNANDO BUISÁN |
Coordinador Estrategia "Industria
Conectada 4.0", Ministry of Industry,
Energy and Tourism/Government of
Spain

A&A

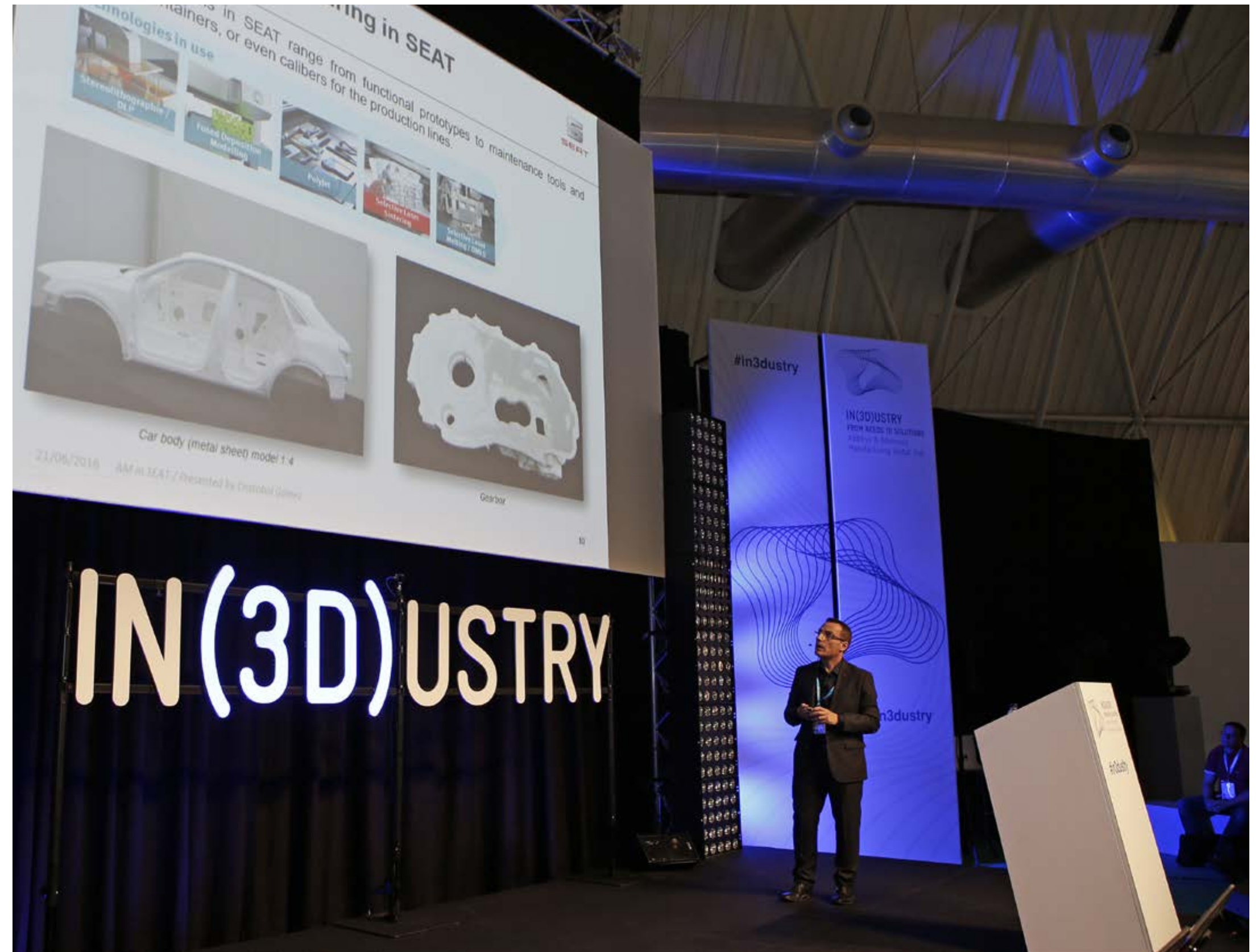
AUTOMOTIVE & AERONAUTICS

As early adopters of rapid prototyping, the Automotive & Aerospace sectors have already implemented more 3D printing applications than most other sectors, particularly in terms of rapid prototyping structurally complex new parts.

Digital additive manufacturing has proven itself as an ideal tool to verify or communicate repeated design iterations while reducing lead times, weight, and manufacturing costs.

Over the next decade, AM adoption in these sectors is expected to shift from prototyping to actual digital manufacturing of short series runs. Applications will range from 3D printed production of car parts and accessories, to creating new concepts from scratch in a fast, flexible, and cost-efficient manner.

International speakers from the highest levels of the Automotive & Aerospace industries discussed their current AM applications and the future challenges in adopting additive manufacturing on a mass scale.





AUTOMOTIVE



Vicenç Aguilera |
President, CIAC/Automotive
Cluster of Catalonia



Cristóbal Gómez |
DKM Models @ Development
Prototypes - SEAT

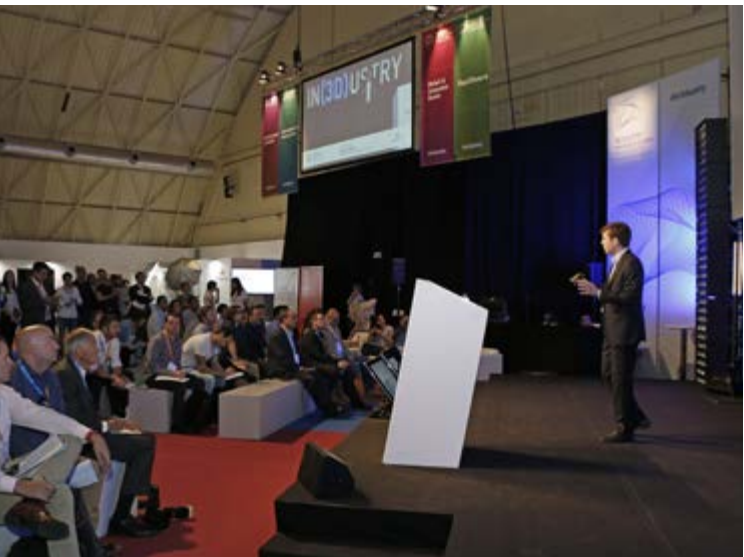
As president of CIAC, the Automotive Industry Cluster of Catalonia, Vincenç Aguilera is fully aware of the possibilities that additive manufacturing can offer in terms of advanced research on new manufacturing processes. Furthermore, the importance of AM in the development of new components was confirmed by those who actually use it in automotive manufacturing and prototyping, like SEAT's prototyping expert Cristobal Gómez.

"At CIAC/Automotive Cluster of Catalonia we have more than 160 associates, companies like SEAT, and many others with whom we are talking about the possibilities of 3D printing. We are very happy to be at IN(3D)USTRY and we find this event perfect for showing a little bit of this iceberg that is the revolution of 3D printing."

| Vicenç Aguilera President, CIAC/Automotive Cluster of Catalonia

"The main advantage of AM in automotive and for SEAT is the possibility to change very quickly the design of the parts, and also to accelerate the time to market. We can build parts with very low weight because the interior of the parts can be made up of specifically designed structures. We have the freedom to design and produce anything we can think of. Since we are not limited by the geometries of a milling machine, we can freely design any part of component we can think of."

| Cristobal Gómez DKM Models @ Development Prototypes - SEAT



Rapid testing of design variations dramatically shortens the time to market but one of the most fascinating aspects that 3D printing will influence in the near future is the possibility of implementing full digital serial production of parts. This is what HP's Market Development Director Virginia Palacios focused on. HP wants to be the solution to the automotive manufacturing need described by Applus+ IDIADA's Ricard Statué: further reducing the cost and especially the times of additive manufacturing as has already happened in prototyping.

"For production in the automotive sector it is going to be very important that the cost and the time of the additively manufactured parts are reduced significantly, as is already happening in prototyping. The final appearance and functionality of the parts also needs to be improved so that we can use use them and obtain real data from them."

| Ricard Statué Rapid Prototyping, Applus + IDIADA

"When you start thinking about final part production you need to really think in verticals—you need different materials and you need to follow different regulations. So it is important to have a show that focuses on the different verticals, where we can specifically address the needs of the different types of customers."

| Virginia Palacios HP 3D Printing Market-Development Director

Thus, while the focus for many speakers was how we can already today use additive manufacturing in the critical processes of design and iteration, the possibility of producing end-use, mechanically optimized parts remains the 'holy grail' of AM in automotive:

"We think the market is not ready yet to produce complete new parts only with additive manufacturing, but combining this technology with the current ones will lead us to produce and sell new parts with less weight, less cost and better performances."

| Ricardo Molina R&D BIW Material Joining Manager, Gestamp

"All of the biggest technologies that we are applying today in mass production of automotive came from the racing world. The same of course is true for rapid prototyping. As we are able to obtain better mechanical properties and more flexible creative processes beyond prototyping, it will start to make sense to move to real production by additive manufacturing."

| Rubén Espín General Manager, Campos Racing Technologies



Ricard Statué |
Rapid Prototyping,
Applus + IDIADA



Virginia Palacios |
HP 3D Printing
Market-Development Director



Ricardo Molina |
R&D BIW Material Joining
Manager, Gestamp



Rubén Espín |
General Manager,
Campos Racing Technologies

AERONAUTICS

In the high-demand aerospace and aviation industries, additive manufacturing is attracting the attention of leaders such as NASA, the US Air Force, and Airbus. Thanks to advances in metal 3D printing materials and processes, aerospace-grade parts are lighter, stronger, safer, and more structurally complex than ever before, and are leading us to the next frontier of exploration here on Earth and beyond.



Josep Maria Gascón |
Chairman, World Chemical Summit/Fira de Barcelona



Lior Zilbermann |
Chairman, AATiD Consortium



José Manuel Martín |
Expert Engineer, Airbus Defence and Space



Miguel Ángel Castillo |
VP Technology Development, Aernova

Josep Maria Gascón, Chairman of the World Chemical Summit and moderator of the Aerospace panel at IN(3D)USTRY, made it clear that in this global effort to expand mankind's reach, Catalonia intends to make great strides:

"In Catalonia we have this industrial base that is looking toward the future and looking at what is happening in the U.S. and in Germany. We are really following the leaders and we want to take this opportunity to make a great contribution to the future of manufacturing."

| Josep Maria Gascón Chairman, World Chemical Summit/Fira de Barcelona

And yet, as with automotive, the need for additive manufacturing to mature is strongly felt, since flight-safe parts require a process reliability and repeatability which, many agreed, still has not been fully achieved. Elbit System's Lior Zilbermann, who is also chairman of the AATiD Consortium, revealed that these needs must be addressed by an international cluster of companies and institutions:

"We need co-operations between consortiums or between companies that have data on how to design these complex geometries, on how to optimally 3D print the part, how to perform the best finish process, how to test it in order to validate that it is working... in my opinion the best way is to cooperate all together to navigate through this ocean of data and this show can help us start this process."

| Lior Zilbermann Chairman, AATiD Consortium

José Manuel Martín of Airbus and Miguel Angel Castillo of Aernova, two more speakers in the Aerospace sector who are actively using additive manufacturing in the production and tooling of critical parts, agreed with the need for more R&D. During their respective talks, they committed to pursuing further development to drive the future of additive manufacturing in aerospace:

"In my presentation I showed part with a double wall that was 3D printed in titanium, demonstrating that it is possible to significantly reduce lead-time. This encourages us to look for more samples of parts that would take a very long time to produce by conventional means and that could easily be made with AM."

| José Manuel Martín Expert Engineer, Airbus Defence and Space

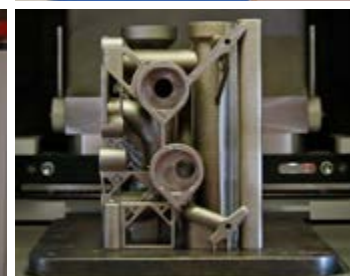
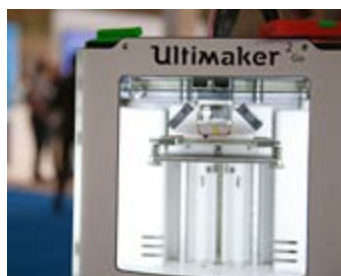
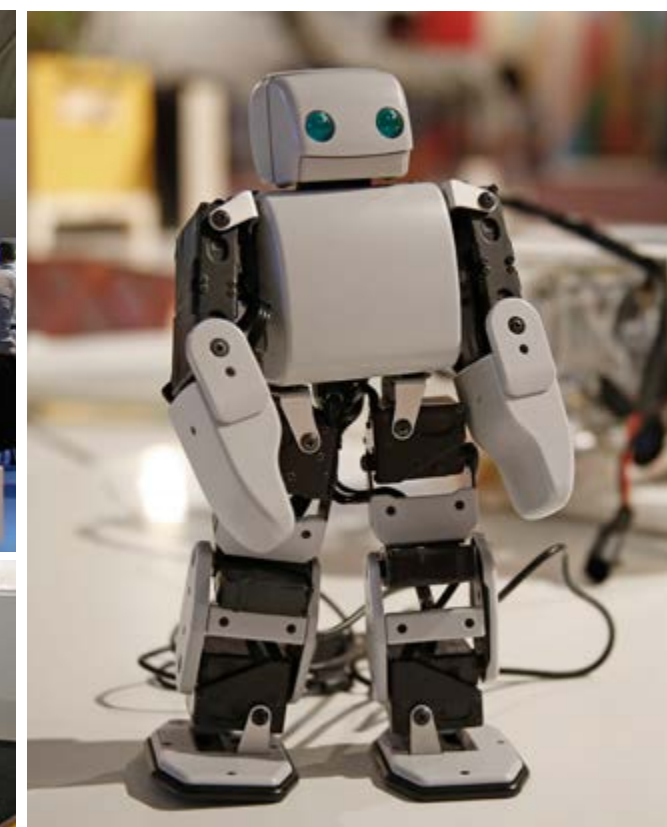
"The aerospace industry has already embraced additive manufacturing, but mainly in the tooling domain and also in space applications. Additive manufacturing does not provide today the necessary mechanical properties demanded for primary structure applications in aeronautics. Having that in mind, we will keep on developing tooling, developing space parts and secondary parts that are more complex in terms of part numbers."

| Miguel Angel Castillo VP Technology Development, Aernova

AUTOMOTIVE & AERONAUTICS CHALLENGES

- 1 Uncovering the hidden possibilities of additive manufacturing
- 2 Learning to fully exploit geometric freedom in engineering
- 3 Focusing on different verticals to address different customers
- 4 Combining additive manufacturing with current technologies
- 5 Applying racing technologies to automotive manufacturing
- 6 Reducing the cost and times of additive manufacturing to make viable for serial production
- 7 Finding real examples of parts that would benefit from being additively manufactured
- 8 Cooperating between companies and institutions to share and compare data and experiences
- 9 Exploring what is happening all over the world
- 10 Improving the mechanical and reliability properties for parts that are exposed to the extreme conditions in flight





Jose Manuel Martín |
Expert Engineer, Airbus
Defence and Space

Q: Airbus Defence and Space has been heavily involved in optimizing components for defence, security, and space exploitation – some of the most demanding and stringent areas of production – using additive manufacturing. Can you provide a specific example of how Airbus is using AM and what benefits this technology provides?

A: In my presentation, I showed a video of an aerospace part with a double-wall that was 3D printed from titanium. This exact case study demonstrated that it is possible to reduce the lead-time of the part, and thus encourages us to look for more samples of parts that would take a very long time to produce by conventional means, yet can be easily made with metal additive manufacturing.

Q: If complex metal additive manufactured parts are indeed faster to produce, what does this mean for the future of other, more traditional manufacturing technologies? Will they simply be eclipsed by more advanced 3D printing capabilities?

A: This is a commonly held misconception, but I disagree. Traditional technologies share the manufacturing space: they don't compete among each other. Of course, additive manufacturing offer significant advantages in terms of lead time and other aspects, so it does compete with some of these technologies – I'm thinking of processes such as machining, welding, double-elbow part manufacturing – but I do not think any technology will ever be completely replaced. It's more about optimizing the technologies to work together. Units that used to require several welds could now be replaced by a single additively manufactured part.



José Manuel Martín leads a distinguished career as an industrial engineer and mechanics specialist within Spain's aerospace industry. Beginning as a Software Test Engineer at DaimlerChrysler Aerospace, Martín soon worked upwards to Head of Material Review Board Engineering at Spanish aircraft manufacturer EADS-CASA. Today, he is Expert Engineer at Airbus Defence and Space, one of the leading companies for technology-driven space and defense solutions in the world. With his distinct expertise in metal parts manufacturing (ranging from machining, welding, casting and now, AM), Martín is perfectly positioned to talk about the true value of metal additive manufacturing in current and future aerospace production. At IN(3D)USTRY, he presented specific examples from Airbus Defence's research and development of metal additive manufactured parts, and spoke frankly about the uses of AM versus other manufacturing methods.



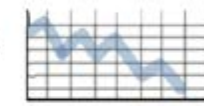
TECHNOLOGIES

Metal	Plastics
Powder wire	Wire

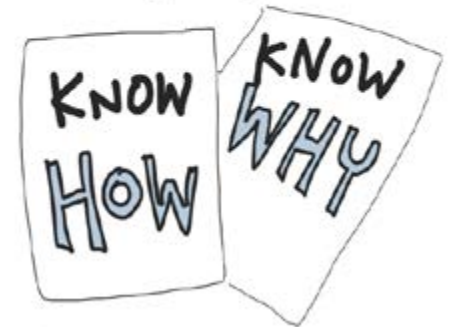
AM in AERONAUTICS

- Integration of parts
- Avoid time demanding operations
- no maintaining

lead time
REDUCED



CURRENT
DEVELOPMENT



Prototypes
★ time cost

★ Tooling

★ Low stressed
and highly
complex parts

And
yet it
moves!

HIGHLY CUSTOMIZED
Products → New
Niche!

SUPPLIERS!

MATERIAL
need qualification

CUT COSTS
PARADIGM
CHANGES



QUALIFICATION

NEW
Requirements
Needs

H

HEALTHCARE

If there is one industry in which additive manufacturing's complete customization and personalized service can truly benefit and empower users, it's healthcare. From incredibly precise digital 3D imagery of internal bones and organs, to complete customization of geometries, to a range of biocompatible materials for implants, prosthetics, and more, healthcare is one of the biggest and fastest developing markets for additive manufactured enduse parts.

In addition to 3D printed surgical guides and prototypes for new surgical tools, serial, large-scale production of medical implants and is already taking place in many segments, from dentistry to hearing aids. These are parts that are not just being studied in labs, but are actually in-use by those who need them most: children born with cranial defects, amputees, individuals in need of dental or facial reconstruction, and much more. Imminent breakthroughs in 3D bioprinting offer even more life-saving promises.

By current estimates, there are currently more 3D printed end-use parts in medical than all other industry sectors combined.

At IN(3D)USTRY, top-level doctors, academics and medical supply manufacturers discussed and showcased real AM applications, spanning the entire spectrum of the possible present and future benefits that AM can bring to the healthcare industry.

While all four verticals made their cases for the future of additive manufacturing, the healthcare speakers, which took to the main stage on day two, attracted a large and engaged crowd, inspired by the real-world and highly personalized applications of medical 3D printing:

"We were surprised about the amazing response to the medical health care sector. One of the main strengths of advanced manufacturing is personalization, so anyone that needs a medical implant or prosthetic can benefit enormously from advanced manufacturing's capabilities for very precise production of parts in very short series production."

| Miquel Serrano Director of IN(3D)USTRY





Dr. Lucas Krauel |
MD, FEBPS, FACS,
Hospital Sant Joan de Déu



Dr. Jordi Serrano |
CEO, Universal Doctor –
Healthio, Fira de Barcelona



Albert Giralt |
General Manager, Avinent



Bartolomé Oliver |
Director Neurosurgery Department,
Centro Médico Teknon



Several of the event speakers spoke enthusiastically on medical 3D printing, with all agreeing that current applications and future solutions – including those identified by IN(3D)USTRY – can only serve to benefit those in need:

“AM technologies are amazing. Having all these technologies available will help surgeons to do a better qualification, a better planning for the surgery, and that obviously means a better outcome for the patients.”

| Dr. Lucas Krauel MD, FEBPS, FACS, Hospital Sant Joan de Déu

“It is really important that doctors and hospitals connect with the manufacturers. Companies are very used to working with big companies in other fields, such as aeronautics... but in healthcare, there is still a barrier that this event in particular can help to bypass, creating new bonds. “3D printing a tumor before going into the surgery should not be a privilege, it should be slowly become the standard””

| Dr. Jordi Serrano CEO, Universal Doctor – Healthio, Fira de Barcelona

At IN(3D)USTRY, examples of medical AM solutions were found in the custom implants provided by GAES, Avinent Implant System, SLM Solutions, Renishaw and Concept Laser. Or Jiri Rosicky’s customized 3D printed helmets, built for children born with cranial weaknesses, by his company Invent Medical. These are now just prototypes but examples of real, final, customized digitally manufactured products.

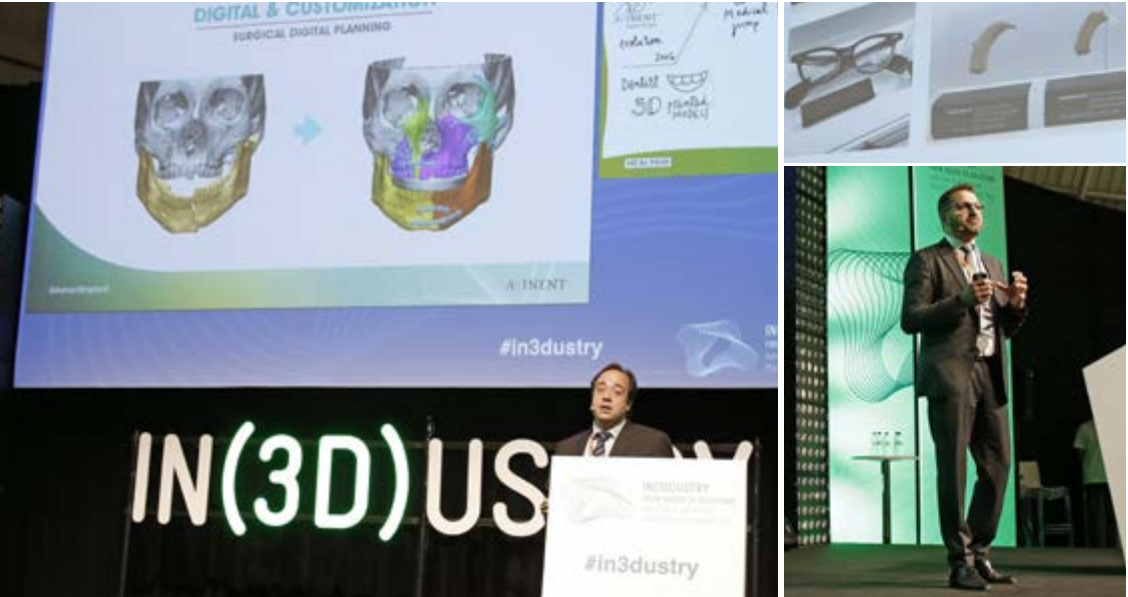
“We started manufacturing medical parts in 2006 as a company and in 2009 we started to introduce 3D printers into the production process. From that moment on, we have been adding new technologies, always based on 3D printing.”

| Albert Giralt General Manager, Avinent

“We partnered with Renishaw to develop implants for cranial defects from head injuries, surgeries, or tumors. In these cases we operate on the skull to insert a final 3D printed, patient-specific metal implant. [...]

Customized implants are very important to ensure excellent surgical results, both for cosmetics and for the patient’s complete recovery.”

| Bartolomé Oliver Director Neurosurgery Department, Centro Médico Teknon



“As specialized suppliers of hearing aids, we are already doing production with 3D printers for both shells, for in-the ear products, and molds for behind-the-ear products.”

| Antonio di Lorenzo Production and Service Manager, GAES

“We have been manufacturing cranial remolding braces for years through a combination of digital and manual processes, but now, we can make them entirely with 3D printing. We are now looking to introduce a fully digital process starting from 3D scanning, computational modeling and 3D printing. This business model has no barriers, no limits. We can import the scans from all over the world and we can, after modifying and designing the orthoses, send them everywhere to 3D print locally. These unprecedented possibilities for scaling are one of the main benefits of 3D printing and Multi Jet Fusion technology for us.”

| Jiri Rosicky CEO, Invent Medical



Antonio di Lorenzo |
Production and Service
Manager, GAES



Jiri Rosicky |
CEO, Invent Medical



On the Industry side, AM expert Lee Dockstader took a moment to explain how HP's new Multi Jet Fusion 3D printing technology can help direct production of medical devices and prosthetics enter into a whole new order of magnitude in terms of production capabilities and cost reduction:

"Multi Jet Fusion technology represents an entirely new range of AM economics: the machine is about half the price of a similar sized machine, it is ten times faster, the materials are also about half the price, so the cost per part on a spreadsheet works out really, really well. [...] Two hundred and fifty thousand parts a day are being 3D printed in medical already."

| Lee Dockstader HP 3D Printing Vertical Market Development

While these 3D printing medical solutions are great, some challenges must still be addressed. In their respective talks, Drs Fenollosa, Samitier, and Krauel highlighted the need for more collaboration between hospitals, researchers, and larger industry bodies to push medical additive manufacturing applications and solutions. This is the greatest promise of additive manufacturing: to develop standard processes for many different verticals sectors that share similar needs and can therefore share the same solutions:

"The medical world and engineering world were two separated professional spheres. Our effort has been more about interacting, exchanging knowledge, and learning about needs and possibilities. Talking to medical doctors and engineers, we have understood that there are technologies that need to be developed. Now we are at the point that we can push technology forward with new research and development."

| Dr. Felip Fenollosa Director, Fundació CIM

"It is clear that for the development of 3D printing, it is necessary to have a collaboration between clinicians, industry, and research centers. In Barcelona, there are excellent hospitals and research centers working in biomedicine and bioengineering. Combined with startups working in new technologies such as nanotechnology, photonics and 3D printing we can rapidly share knowledge to obtain amazing results in a much shorter time."

| Dr. Josep Samitier Director, Institute for Bioengineering of Catalonia

"Years ago, hospitals were in one place and the technological centers were in another place. The future is working together, like we are doing now, here at IN(3D)USTRY."

| Dr. Lucas Krauel MD, FEBPS, FACS, Hospital Sant Joan de Déu



HEALTHCARE CHALLENGES

- 1 Doctors and hospitals connecting with the manufacturers of 3D printing systems and solutions
- 2 Helping doctors and surgeons do better qualifications and pre-surgical planning
- 3 Bringing together those who are forging the future of 3D printing applications
- 4 Identifying the production applications: what needs to change, what materials do we need, what software do we need?
- 5 Partnering with systems manufacturers to develop new solutions together
- 6 Collaborations between clinicians, industry, and research centers
- 7 Scaling up the business models for customized medical devices and implants
- 8 Making custom implants affordable to more people
- 9 Consolidating serial manufacturing of medical devices using AM processes



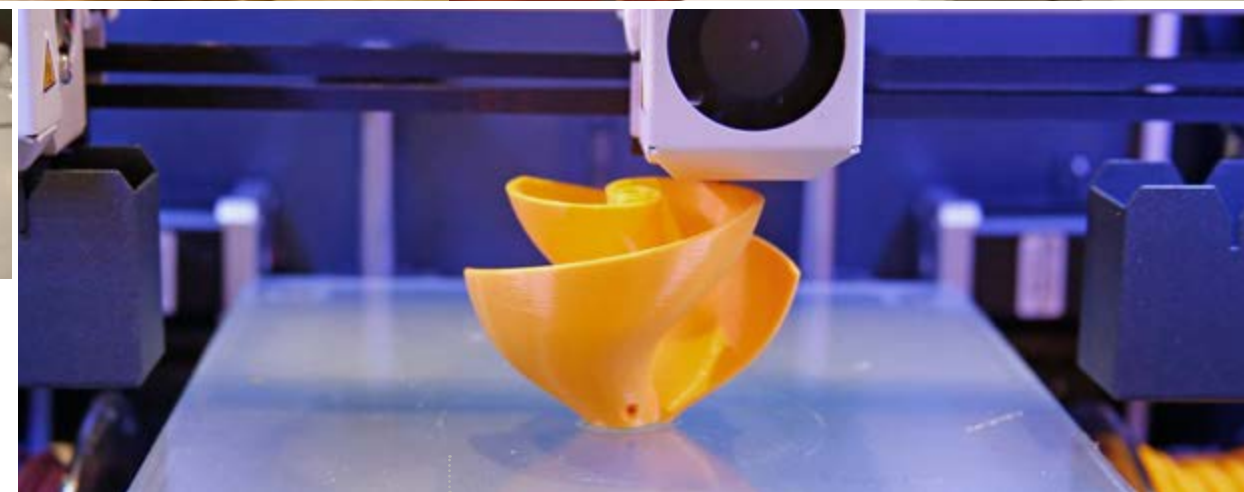
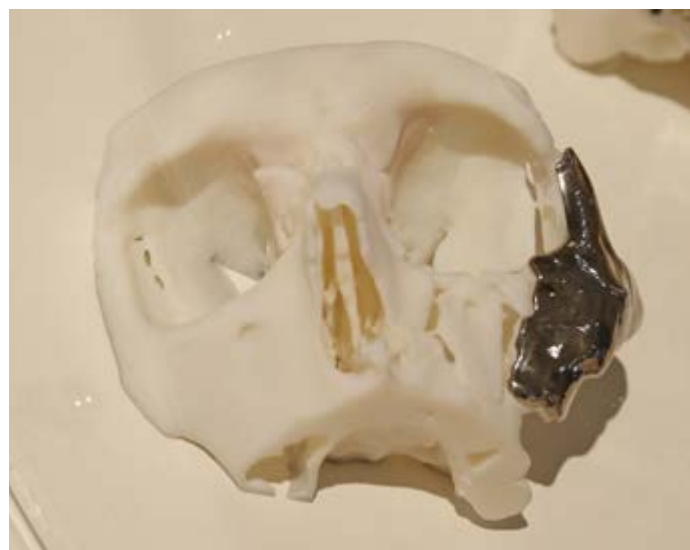
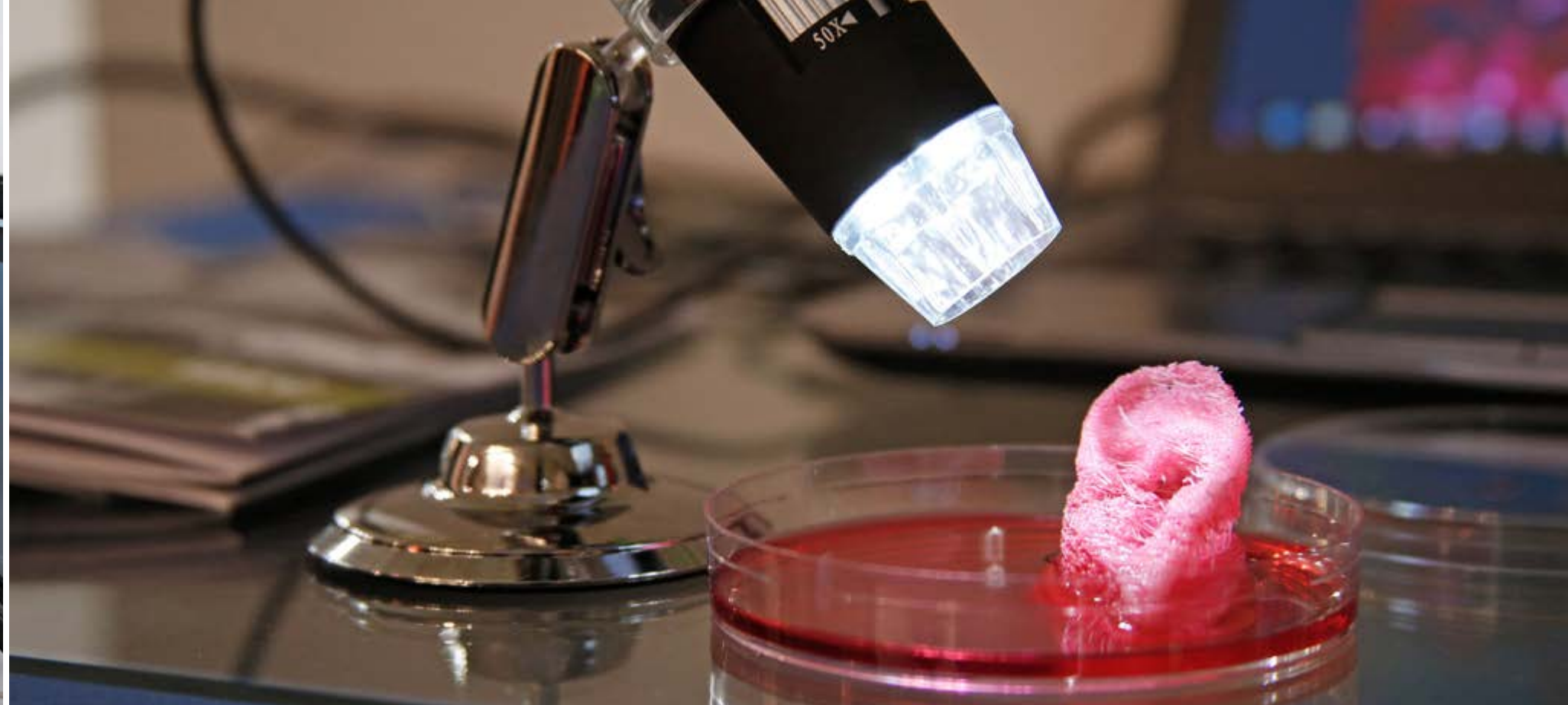
Lee Dockstader |
HP 3D Printing Vertical
Market Development



Dr. Felip Fenollosa |
Director, Fundació CIM



Dr. Josep Samitier |
Director, Institute for
Bioengineering of Catalonia



Josep Samitier |
Director, Institute for
Bioengineering of Catalonia
(IBEC).

Q. What are the needs for the development of AM and more specifically bioprinting?

A. It's clear that for the development of 3D printing, it is necessary the combination and the collaboration between clinicians, industry, and research centers, because at this moment there are many different problems. First, we need to define the problem, which is the problem in the case of bone, in the case of the heart or of the kidney, and what the damage to the tissue is. And how the combination of engineering technologies together with new materials and biological cell engineering, can allow to combine all of them to build 3D tissues that can be used for regeneration and for therapy.

Q. What is the main challenges in bioprinting?

A. Usually, during many years, the biologist worked with two-dimensional cell cultures, that was the usual element. The problem was how to build real 3D structures and 3D tissues, because in this case, usually you need to allow the vascularization of the tissues. We need the oxygen and the nutrients to arrive at all the cell to allow the tissue to grow in appropriate conditions. This is the main problem.

At the moment, the use of this new 3D bioprinting system allows us to combine structural materials together with soft materials, hydrogels, that include in this case the cells. By using different heating conditions, it is possible to build, layer by layer, complex 3D structures to combine structural materials and cells in the same device, in the same tissue. In the appropriate conditions, the bioreactor, these first constructions can grow and develop, and finally obtain tissues that can be used for regenerative purposes.

Q. How participating in IN(3D)USTRY helps you to solve this challenges?

Here it is possible to observe and to learn about the new materials, new options to combine these new materials, in the same system to increase the speed of the system to grow, and to increase the level of resolution. These are key issues in the development of tissue engineering in order to be used for clinical purposes.

Q. Can Barcelona become the global HUB for AM and for bioprinting?

A. At this moment in Barcelona, there are excellent hospitals who work in the top level of their different specialties, also there are very good research centers working in biomedicine, working in bioengineering, as in our institute. Also, there is the capacity to create of new startups, new companies, working in these new technologies—nanotechnology, photonics, 3D printing. The combination of all of these ecosystems allows at this moment that we can very quickly combine the knowledge of clinicians with industrial people in a new startup, we will work in collaboration with research centers, so this is the most easy way in order to obtain in a short time new results that can be used in this field.



I am Josep Samitier, I am the director of the Institute for Bioengineering of Catalonia (IBEC), a research institute located in Barcelona, Spain, focused in the combination of life science and engineering to develop new diagnostic systems and therapies.

2005

- ★ Nanomedicine
- ★ Cell ENGINEERING
- ★ ICT for HEALTH

Benefits

from Regenerative
Medicine

Personalisation
of CELL

3D BIOPRINTING

Cardiac Tissue Construct



NANOTECHNOLOGY

for regenerative
TISSUE

MICROFLUIDIC

devices

ORGAN on a
CHIP

Nanoparticles

3 TYPES of
PRINTING HEADS



SKIN

Bones



A&H

ARCHITECTURE & HABITAT

From city infrastructures to the design of our own homes, advanced and additive manufacturing is already playing a more in-depth role in shaping our surroundings than most of us realize. Thanks to digital technologies, rather than one-size-fits-all boxes, our environments are once again being filled with individually crafted products, tailored to specific lifestyles, and made from locally sourced, cost- and energy-efficient materials and practices.

Moving beyond the skepticism relating to scalability challenges, speakers from architecture studios, infrastructure groups, and the world leading IAAC (the Institute for Advanced Architecture of Catalonia) discussed how to change the way large structures are built, and how these new approaches will open paradigm-changing scenarios full of opportunities and freedom of design, thus making our living environments more unique, sustainable and energy efficient.

The topics of the Architecture & Habitat panel were far-reaching: from 3D printing houses on the moon, to finalizing the construction of the 134-year-old Sagrada Familia in Barcelona, to transforming every city into a thoroughly connected Smart City.





As Areti Markopolou, renowned architect and Director of the IAAC identified, despite these very different topics, an over-arching need ran throughout: to find and develop new and more sustainable practices to optimize outdated construction methods.

"It was very important to have the opportunity to collect ideas from different professionals coming from different fields, from professional architects to academics and industry professionals. It is interesting to bring people together from different fields and understand how they deal with the possibilities but also with the limitations of advanced and additive manufacturing."

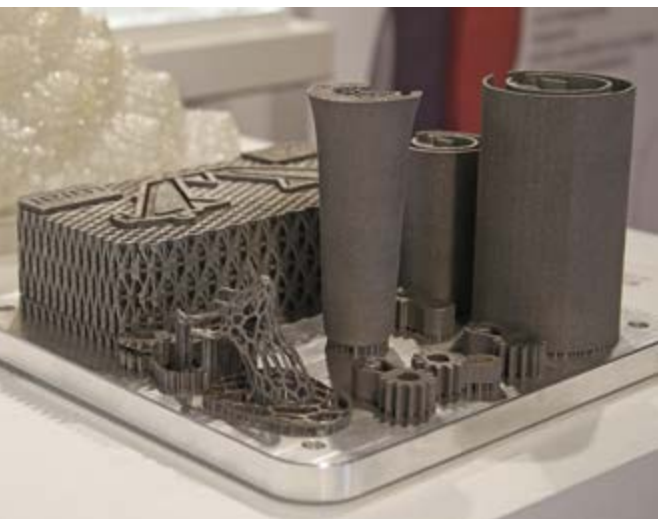
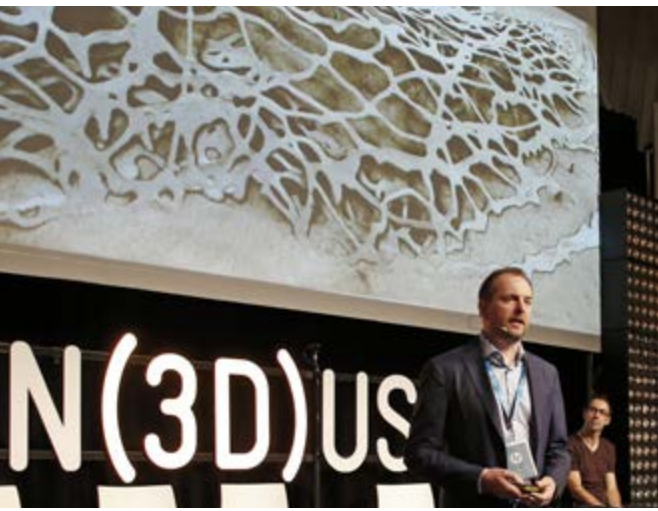
| Areti Markopolou Director, Institute for Advanced Architecture of Catalonia

The freedom of design enabled by digital technologies means we can build 'smarter' buildings that use or even produce clean energy, eliminate waste, and allow workers, citizens, and families to become more interconnected with themselves and their environments. Yet before this can become an everyday reality, advances in more sturdy and varied 3D printing construction materials is a firm need:

"The building and construction industry is perhaps one of the best places for additive manufacturing, because every building site is bespoke, it requires a unique solution, and often has a unique shape and constraints. [...] One of the biggest challenges is material, which materials are able to be a substantial replacement to existing building materials, in all kinds of situations. Particularly things like floor slabs, which appear simple, are one of the hardest things to 3D print right now. But we are slowly getting there with material science."

| Robert Stuart-Smith Founding Director, Robert Stuart-Smith Design

Like in automotive and healthcare, some of the most interesting talks related to how additive manufacturing can move futuristic concepts from labs into real-world applications. These can be new ways to manufacture traditional objects, like Cricursa's curved glass windows, or new materials and processes for entirely new approaches to construction and architecture.



Areti Markopolou |
Director, Institute for Advanced
Architecture of Catalonia



Robert Stuart-Smith |
Founding Director, Robert
Stuart-Smith Design

"This panel demonstrates what is required to get these things out of the research labs, off the computer screens, and into the world [...] Normally people don't talk about environment and sustainability and ornament at the same time, but with advanced manufacturing technologies, all these things can actually enrich each other."

| Dave Pigram Director, Supermanouvre

"At Cricursa we use 3D printing in a very simple way: all of our projects are different, which means that all of our glasses are different, and what we do is find a way of making 3D printed tools that we use in our manufacturing process. [...] We 3D print these tools for quality control and for manufacturing gaining in quality and cutting time to market."

| Ferran Figuerola CEO, Cricursa

These talks were particularly useful in once again bridging the gap between additive manufacturing needs and solutions, as explained by Nils Fischer, hailing from the world-famous Zaha Hadid architecture studio:

"We have developed very powerful computational models these that allow designers to work with a lot of data in the background while still intuitively interacting with the models. Digital fabrication helps us understand how things are built in order to things feasible or relevant as a designer. So that whenever we create a problem, we also start to think about the solution."

| Nils Fischer Senior Associate/CODE Computational Design Research Group, Zaha Hadid Architects

The variety of speakers, exhibitors and industry leaders also created a unique space for debate and discussion about the dual ecosystems—that of additive manufacturing, and the actual cities, habitats and structures in which we live:

"The IN(3D)USTRY show brought together people from architectural design, construction, manufacturers and material developers... I think having the whole ecosystem with different professionals in one place is really unique."

| José Daniel García Espinel Technology Transfer Director, Acciona Cluster of Catalonia



Dave Pigram |
Director, Supermanouvre



Ferran Figuerola |
CEO, Cricursa



Nils Fischer |
Senior Associate/CODE Computational
Design Research Group, Zaha Hadid Architects



José Daniel García Espinel |
Technology Transfer Director,
Acciona Cluster of Catalonia





ENRICO DINI | THE MAN WHO 3D PRINTED HOUSES ON THE MOON

Enrico Dini, creator of the D-Shape large-scale 3D printer and one of the foremost innovators in 3D printed construction, wrapped up by acknowledging a major shift in how architects, engineers, and manufacturers are approaching new technologies:

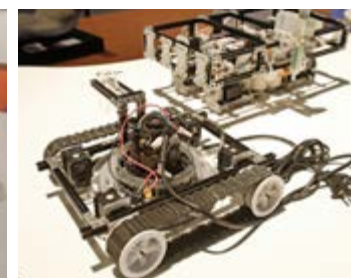
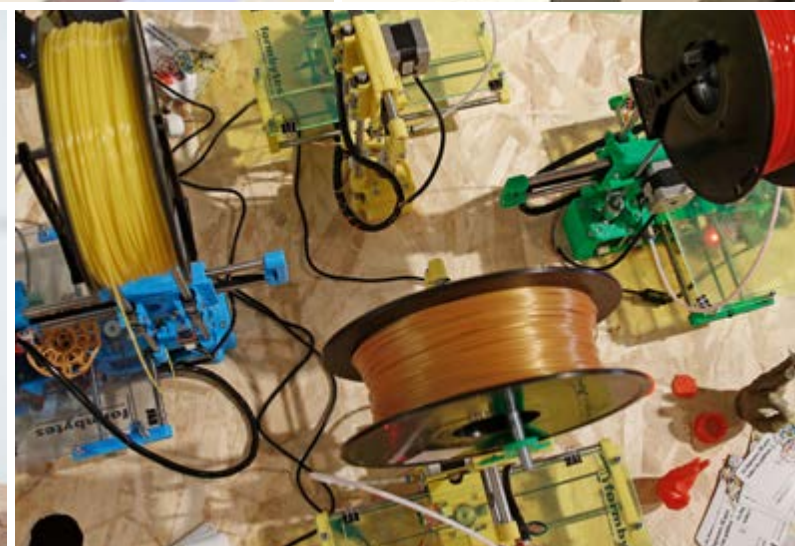
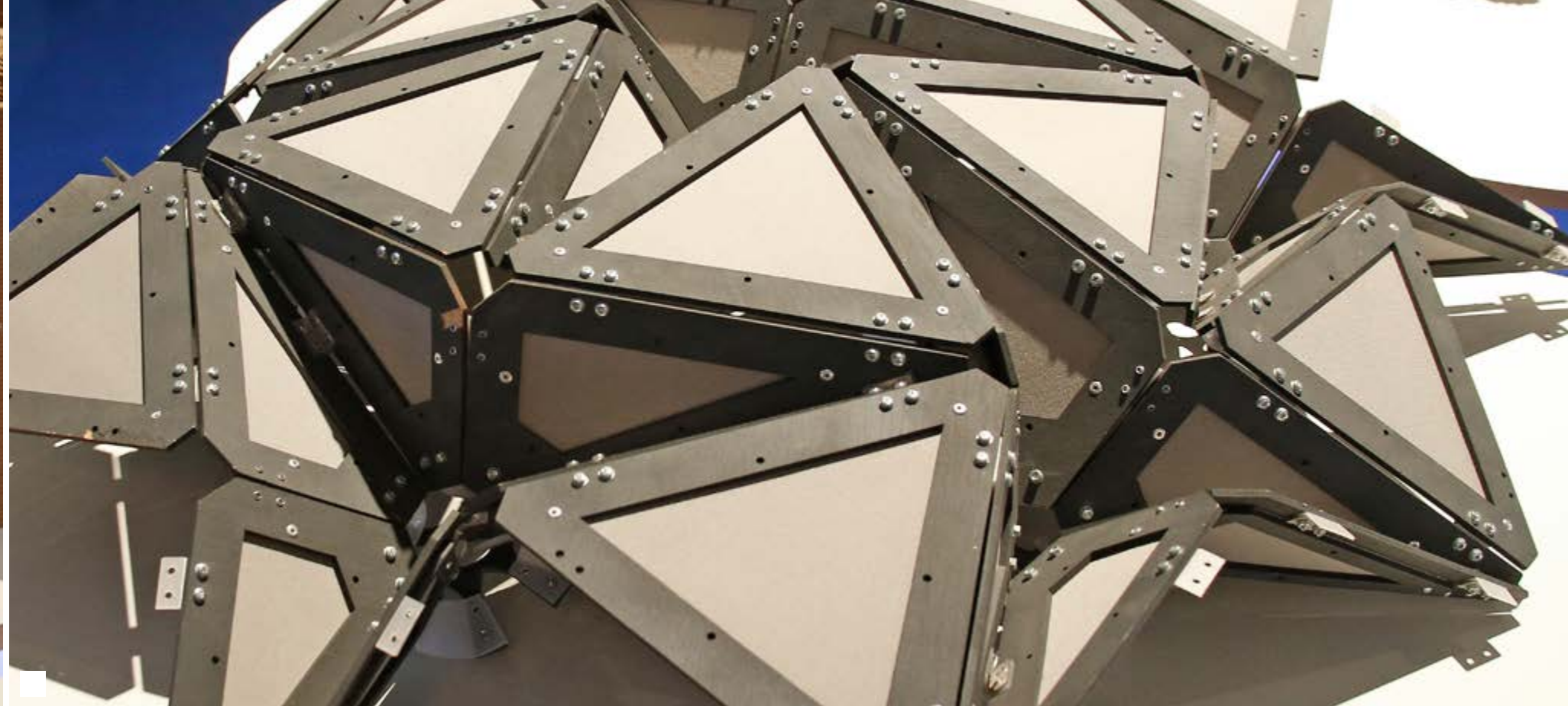
"I believe that there is a new generation of architects, mechanical engineers, robotics engineers, who are grabbing knowledge from a port that is not the port from which I grabbed my knowledge. This is a new platform that is based on a completely different scenario of access to knowledge, so this is absolutely good. This is the present of the next 40 or 50 years. This is the beginning of a new age, it is clearly visible."

Enrico Dini |
Founder, D-Shape



ARCHITECTURE & HABITAT CHALLENGES

- 1 Collecting ideas from different professionals coming from different fields
- 2 Understanding how to deal with limitations of additive and advanced manufacturing
- 3 Discovering new 3D printable materials and how they can replace traditional construction materials
- 4 Getting the new additive manufacturing approaches out of the research labs, off the computer screens, and into the world.
- 5 Developing new 3D printed tools that can be used to enhance traditional manufacturing processes
- 6 Learning from professionals in different sectors
- 7 Understanding digital fabrication in order to make things more feasible and relevant as a designer
- 8 Bringing together the entire ecosystem of architecture professionals to exchange experiences



Robert Stuart-Smith |
 Founding Director, Robert
 Stuart-Smith Design

Q: What makes additive manufacturing such a promising technology for the construction industry, which for many decades has relied on traditional building techniques?

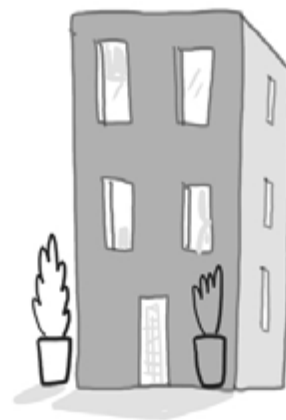
A: The building and construction industry is perhaps one of the best places for additive manufacturing, because every building site is bespoke, it requires a unique solution, and often has a unique shape and constraints. Additive manufacturing has perhaps been slower to be adopted, because buildings have to survive for quite a long time, and have quite rigorous safety standards, and use criteria, however it is already making great strides. We see a lot of 3D printing companies emerging and constructing buildings all over the world.

Q: What challenges need to be addressed in order to speed up the adoption of additive manufacturing by larger or more commercial construction companies?

A: One of the biggest challenges is material, which materials are able to be a substantial replacement to existing building materials, in all kinds of situations. Particularly things like floor slabs, which appear simple, are one of the hardest things to 3D print right now. But we are slowly getting there with more material science.



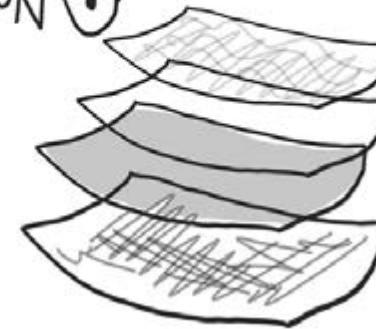
By combining architecture, design, autonomous robotic construction, and additive manufacturing, Robert Stuart-Smith is exploring the future of urbanism, and how advanced manufacturing technologies will define how and where we live. He is founding director of Robert Stuart-Smith Design, an international design practice based in London, as well as a co-founding director of the collaborative research practice Kokkugia, a Studio Course Master in the Architectural Association School's Design Research Laboratory in London, and a researcher at UCL Computer Science.



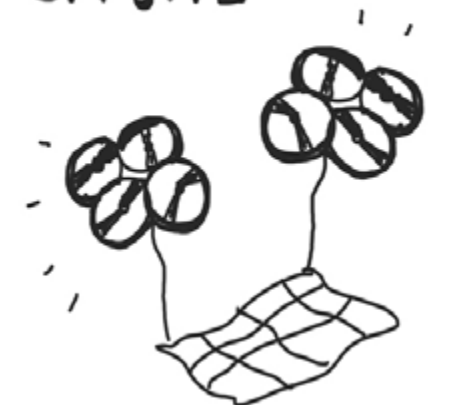
ARCHITECTURE + 3D PRINTING



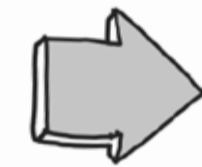
Computer
VISION



ON SITE



We need to
ADJUST the
TECHNOLOGY



Better
PERFORMANCE

THE FUTURE
sky is the limit

We need to
develop it
more !

R&CG

RETAIL & CONSUMER GOODS Manufacturing the Future

In-store production, on-demand creation cycles, recycled materials, new approaches to product individualization and mass customization: retail, as many other sectors, is and will be growingly disrupted by the use of additive manufacturing technologies—not just in prototyping, but increasingly, in store-ready products.

As 3D printing moves from a niche category in high-end fashion runways to the core technology behind Nike, Adidas and New Balance's newest and most advanced athletic products, we are not only seeing new types of consumer goods hit the shelves, we are witnessing a profound shift in how we make, buy, and use everyday products: mass standardization is out, customization is in, and at all times, cost, time, and resource efficiency is top of mind for all.





Speakers from both the making and the design communities explored how the new, digital approach to product design and manufacturing enables them to envision new products and entirely new consumer business opportunities. Speaking for Industry, Luiz Baldez revealed HP 3D Printing's vision for transforming retail:

"My contribution was about retail and how consumer goods are going to be affected by 3D printing. Retail is facing several issues in terms of inventory, in terms of products that are not successful and need to be promoted, and in terms of figuring out exactly how much demand it's going to be. Going digital in such cases is really a breakthrough in efficiency, by reducing costs and running operations more efficiently."

| Luiz Baldez HP Solutions & Partners Lead for 3D Printing Business

According to Baldez a lot of the customers who were thought to be using 3D printing for prototyping are actually saying 'okay, how do I do that for production? Because now, I can get the same quality, with a much more competitive cost...' In order to achieve mass customization of goods, they will need a powerful technology behind them that has the right quality, the right cost, and the right speed. One particularly interesting segment on the IN(3D)USTRY main stage was the Made Again in the Fab City Panel, curated by Space 10 and the Fab City Research Lab, in which urbanists, industrial designers, and creators discussed how digital fabrication and advanced manufacturing can positively shape everything from the products we use to the cities of the future.

"Fab City's research lab is the operational body of the Fab City project, which aims to develop locally productive and globally connected cities. We want manufacturing to come back home, because it has really huge implications in terms of social impact, bringing new skills for people, new types of jobs, new opportunities, and positive environmental consequences [...] Using digital fabrication tools, we are not only able to produce the things that we need to exist, but we can produce our own tools in order to thrive."

| Tomás Díez Director, Fab City Research Laboratory





Luiz Baldez |
HP Solutions & Partners Lead
for 3D Printing Business



Tomás Díez |
Director, Fab City
Research Laboratory

"For me as an innovator, this place is super inspiring because what I see here are not only machines and companies, I see new opportunities, I see better and more advanced manufacturing possibilities, and I see pieces of this big equation that we need to solve together moving forward. And as long as the different pieces move forward, the future is bright."

| Guillaume Charny Director of Innovation, Space10

What's most exciting about additive manufacturing in the retail sector is that products can truly be made-to-order, and as AM technologies improve, making these personalized goods at scale is becoming possible, too. Importantly, these goods are both affordable and accessible to consumers around the world, as demonstrated by major players such as IKEA taking part in the maker movement:

"We're seeing that there are certain products and cases, where 3D printing as a technology and as a manufacturing process is absolutely the best way to go because of the ability to do far more complicated geometries, which allows us to manufacture in ways and produce structural elements that we couldn't do before. In my own work, 3D printing now makes a lot of sense for the creation of prosthetics, so producing something that is unique every single time is not something that we can manufacture at scale, but with a 3D printer it becomes very, very easy to do just that."


| Paul Sohi Product Design Expert /Autodesk Resident Artist

"I see that my field is an industry itself; it's the creative industry. So what I'm doing is exploring how 3D printing affects and will affect the creative industries. 3D printing and additive manufacturing give us the opportunity to think about unique people, to make objects that are unique for everyone. So we need to develop tools and platforms that allow for this personalization and customization."


| Bernat Cuní 3D Print and Digital Fabrication Designer, Cunicode.com

"I think 3D printing and local-making may not ever replace injection molding and traditional manufacturing, but you will use it for personalized products, or for repairing products, or to do something that prolongs the life of products. Yet I do think it is still possible that in the near future we will mass-produce with 3D printing."


| Mikael Axelsson Designer, IKEA Design




Guillaume Charny |
Director of Innovation,
Space10



Paul Sohi |
Product Design Expert /
Autodesk Resident Artist



Bernat Cuní |
3D Print and Digital Fabrication
Designer, Cunicode.com



Mikael Axelsson |
Designer, IKEA Design





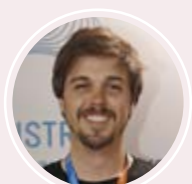
Danit Peleg |
Designer, Danit Peleg



Ben Lazarus |
Vice President Business
Transformation & PMI, Stratasys



Prisca Vilsbol |
Designer, Vilsbol de Arce/
Autodesk Resident Artist



Samuel Bernier |
Creative Director, LeFabShop

Fashion designer Danit Peleg, who became a global name after designing an entire collection of clothes with only a desktop 3D printer, is an example of how personalized production may be. Her range of dresses, skirts and accessories are made from a variety of rigid to flexible filaments that provide beautiful fluid movement one wouldn't expect from a 3D printer. As she explained during her talk, one of the most important things is that she began with a vision and then executed it on her own – and with digital fabrication, nearly anyone can do the same.

"Now I think people are very much into making stuff by themselves, and the technology is another way that you can do things from your house, like I did. I did fashion by myself from my house without using any industrial machines or anything that would need help from employees. So with this technology, with the 3D printing, there is a world of opportunities for makers."

| Danit Peleg Designer, Danit Peleg

While makers, consumers, and manufacturers are excited by the novelties of customized furniture, sustainable fashion, and even 3D printed electronics, Stratasys' Ben Lazarus highlighted one often overlooked yet extremely important way that additive manufacturing is revolutionizing how we make everyday goods:

"People focus on medical and educational applications... and those are phenomenal. But we also see the huge opportunity is in the tooling and manufacturing space, where thousands and thousands of employees work on relatively repetitive processes everyday. 3D printing, because of its ability for customization, to be flexibility, fast manufacturing, lower costs, is having a profound effect on the way factories are being designed and built."

| Ben Lazarus Vice President Business Transformation & PMI, Stratasys

The retail and consumer goods sector also demonstrated the strong and mutually beneficial relation between the contemporary Maker Movement and long-standing Industry conventions:

"I think that the industry gets a lot out of seeing processes that they don't necessarily use. Some of the things that are on the table here are extremely inspiring for a designer in terms of asking 'how can you use materials in a different way' and 'how can you re-think the processes?' This is great because in a big company you kind of get comfortable in what is not so risky. And the other way around: makers also get an insight into what the big industry does."

| Prisca Vilsbol Designer, Vilsbol de Arce/Autodesk Resident Artist

"To me one way the industry could learn from the maker movement and from what has been happening in 3D printing is by sharing their process a bit more, opening up even to their competitors, to innovate faster. Opening up would benefit everyone."

| Samuel Bernier Creative Director, LeFabShop



3MF | A NEW FILE FOR 3D PRINTING

An open innovating strategy was key to the conception of 3MF, a new 3D printing format that will allow design applications to send full-fidelity 3D models to a mix of other applications, platforms, services and printers.

The 3MF specification allows companies to focus on innovation, rather than on basic interoperability issues. It is engineered to avoid the problems associated with other 3D file formats. Scott White, Distinguished Technologist at HP 3D Printing, explained the important rationale behind open standards and how better collaboration can help resolve the most common 3D printing industry needs.

"We started working with Microsoft and a few other companies a year and a half ago to fundamentally change the conversation. What we found is that everyone we were talking to in the industry was talking to each other and they were all having one-on-one conversations about how best to drive a more seamless workflow into the 3D printing industry, because it's very messy today, and we finally just realized that the best way to do that is to actually all talk together and then come to an agreement about how we can all drive it forward together."

Scott White |
Distinguished Technologist,
HP 3D Printing





Dr. Juan-Carlos Dursteler |
Chief Innovation Officer, INDO



Laia Mogas-Soldevila |
Researcher, Tufts University
Biomedical Engineering Silklab



Francis Bitonti |
CEO, Francis Bitonti Studio

FUTURE PRODUCTION SCENARIOS

Once again, one of the great strengths of IN(3D)USTRY was to bring together diverse voices, influencers, and social-changemakers within progressive and forward-thinking city of Barcelona:

"I think that one important thing is to spread out the idea that 3D printing is the future. Markets are still very traditional, so I think that spreading the voice, letting people know that this is possible, is one of the first things that we can get from meetings like this."

| Dr. Juan-Carlos Dursteler Chief Innovation Officer, INDO

"We are looking more at the 'what's next in 10 years' than 'what's next tomorrow', so we are always looking at what everybody else is doing. In pharmaceuticals, biomaterials, architecture, design, biohacking, makerspaces everybody is pushing forward, and to see everyone in the same space, from nano to micro, is really, really interesting."

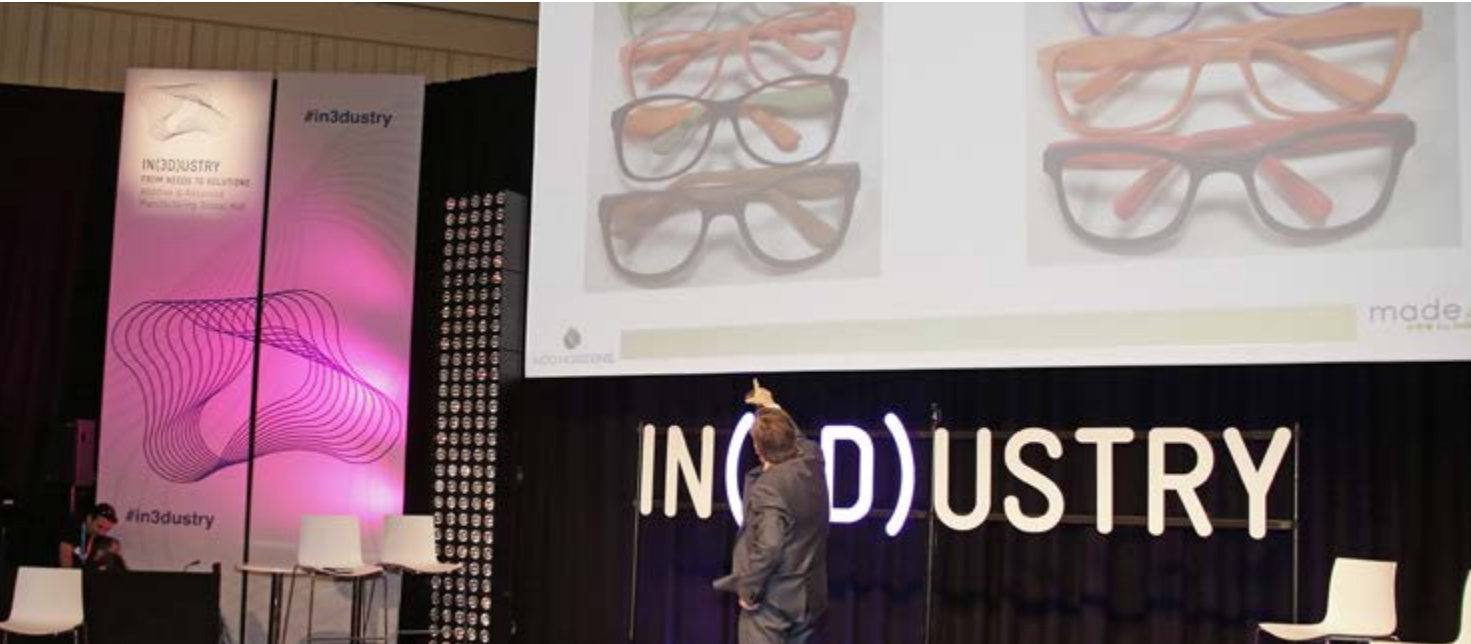
| Laia Mogas-Soldevila Researcher, Tufts University Biomedical Engineering Silklab

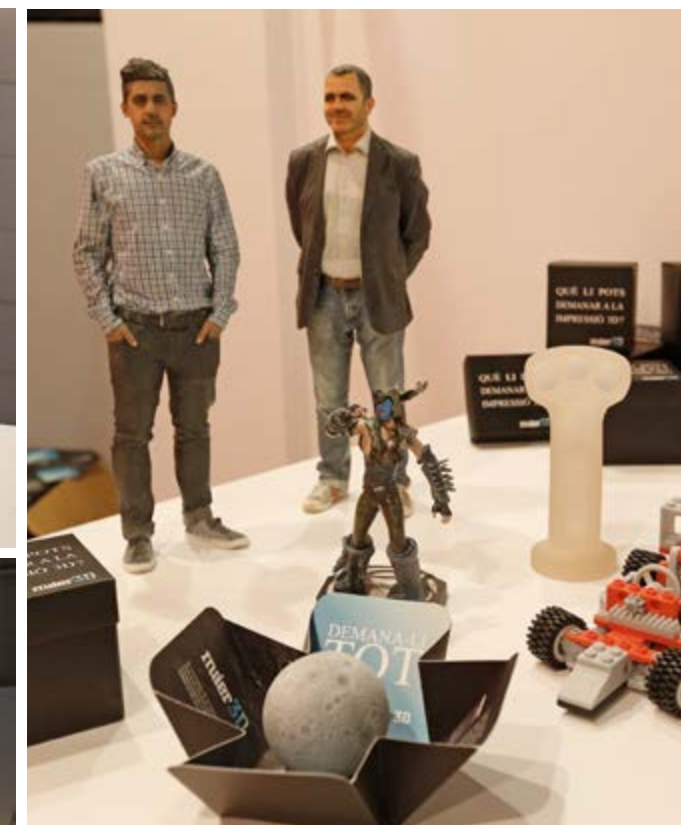
"I don't think I've really seen a community of makers quite like this anywhere. I would even say it's very different from New York. It's very heavily populated with actually very serious designers, which is something that I've always been somewhat critical of the maker movement for—for not having attracted as many 'professional' designers as they should have—and it actually seems like it's working very well here, and it's an incredibly well-functioning ecosystem, better than anywhere else I've been. It's amazing."

| Francis Bitonti CEO, Francis Bitonti Studio

RETAIL & CONSUMER GOODS CHALLENGES

- 1 Understanding how to use 3D printing for real production of consumer goods
- 2 Having the right technology available, providing the right quality, the right cost, and the right speed
- 3 Creating cities that are producing locally and connected globally
- 4 Transforming machines and companies into new opportunities
- 5 Making products that are unique
- 6 Exploring how 3D printing affects the creative industries
- 7 (Re)learning how to make things by yourself through technology
- 8 Using 3D printing to change the manufacturing process of consumer goods
- 9 Asking how can you use materials in a different way and how can you re-think the processes
- 10 Sharing processes, opening up even to competitors, in order to innovate faster
- 11 Raising awareness on what is possible
- 12 Creating functional ecosystems of designers, makers and industry professionals





Francis Bitonti |
CEO, Francis Bitonti Studio

Q: What are the latest consumer design projects that Studio Bitonti has brought to exhibit at IN(3D)USTRY?

A: We've done a lot of work with 3D printed shoes lately, including a collaboration with United Nude, and another with Feetz, which is making 3D printed shoes for everyday use that just went to market. We've also been showing some of our older works, such as our textiles research, which shows the potentials of multi-material 3D printing.

Q: How will you bridge the gap between your 3D printing research and the needs of both companies and consumers?

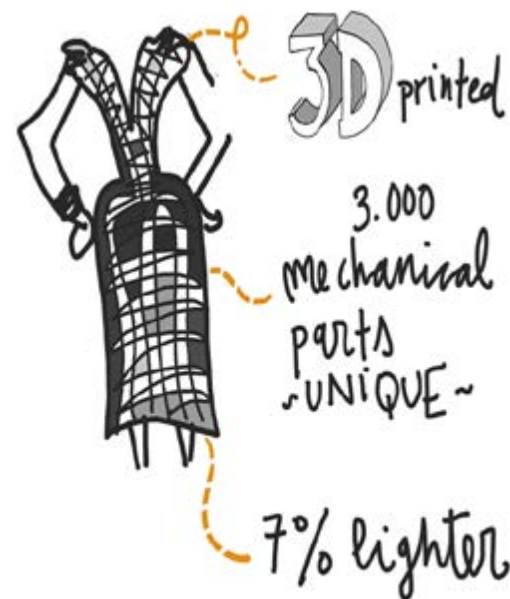
A: Research is very often done in a vacuum; applications may look good in the lab, but when you actually try to take them to market, there may be a whole set of issues that makes them not work as well. At Studio Bitonti, our objective is to be able to take things from the lab to scale – to help companies integrate new technologies, specifically around fabrication and material technologies, and help them understand what the applications and value of additive manufacturing will be. Mass customization is certainly one, but no two companies are alike.

Q: Along with researchers and industry, makers are helping to transform how we create and produce material goods. What are your thoughts on bringing together makers and industry at this event?

A: I don't think I've really seen a community of makers quite like this anywhere. I would even say it's very different from New York. It's very heavily populated with actually very serious designers, which is something that I've always been somewhat critical of the maker movement for—for not having attracted as many 'professional' designers as they should have—and it actually seems like it's working very well here. It's an incredibly well functioning ecosystem, better than anywhere else I've been. It's amazing.



Easily one of the most well known names in 3D printed fashion, Francis Bitonti is merging computational design, advanced manufacturing, and cutting-edge materials science to create high-end and consumer goods the likes of which we have never seen before. Studio Bitonti's work has been featured in prestigious museums and publications around the world, and his ongoing work in mass-customization, algorithmic design, and multi-material 3D printing is steadily changing how retail products can and will be made.



Maker Pro

While the motivation behind the IN(3D)USTRY show was to bring together top users and manufacturers from the leading industrial fields of automotive & aeronautics, architecture & habitat, retail & consumer goods, and healthcare, it would have been impossible to talk about the future of additive manufacturing without including an increasingly important voice: that of the maker movement.

Curated by open source hardware projects platform Wevolver and the Fab City Research Laboratory, the IN(3D)USTRY Maker Pro Space and Panel worked to connect highly innovative creators from the Maker Movement to bigger industry partners. Through the philosophies of collaboration, open- source, and circular economies, these makers are developing new products while promoting a positive impact on society and the environment by using digital fabrication and advanced manufacturing technologies.

"We live with a little bit of a 'tag' that the makers are just geeks, that they don't understand the world, we are maybe a little bit self-contained. But the truth is that people who are engaged in making the maker scene fabulous are people who really want to change things significantly, they don't want to be the next startup, they want to be the people that actually are game- changers."

| Tomás Díez Director, Fab City Research Laboratory

The Maker Pro Space itself was a unique and immersive section within the IN(3D)USTRY show. Combining a speaker stage, hands-on workshops, and gallery, the Maker Pro Space showcased various digitally fabricated projects, from robots and drones to plastic-recycling machines, in all stages of conception and production, creating an atmosphere of interactivity and inspiration.

These projects include the Hovalin 3D printed violin, PLEN2 desktop robot, the HACKBerry practical prosthesis, Faraday Motion's electronic skateboard, the Ultrascope Open Space Agency, and the Kniterate CNC knitting machine, to name just a few.

By giving mainstream companies and industry leaders direct access to the creative pioneers of the maker movement – and vice versa – both sides of the AM world were given the opportunity to learn from one another. Nowhere was it more apparent that in additive manufacturing, openness, collaboration, and a willingness to take risks and create are the keys to unlocking future challenges and solutions.



"It's really fascinating to see this combination of pro makers and industry experts coming together. For makers, the most important thing is coming and seeing what big industry does and how they do things, to learn from that and see what is the established way to of doing it. And then from the other side, industry experts going to makers who are completely liberated— they can do as they please, because if they get something wrong, it's not a big deal—they're also generating a lot of innovation, and they are succeeding in ways that the bigger industries are not capable of doing because they can't take those kinds of risks, so they can learn from each other a huge amount, so how to do things properly, but also how to learn in a new way that's not been done before."

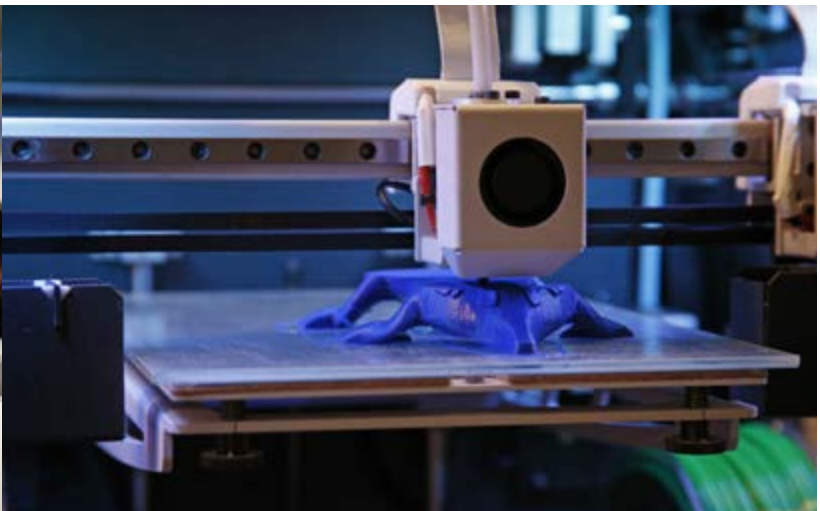
| Paul Sohi Product Design Expert, Autodesk

"What we see as a platform is that many more makers are now getting into making more high quality projects, so you see more and more people building more advanced technologies. And most of those projects come from young companies, so it's really good for the industry, the so called 'older' industry, to see younger startup companies that are now building these really advanced technologies. It's a great mix."

| Richard Hulskes Founder, Wevolver

MAKER PRO CHALLENGES

- 1 Seeing what the big industry does and how they do things
- 2 Understanding that making is not just about startup but also game-changing applications
- 3 Experimenting how to do things in new ways
- 4 Looking at how younger companies are working with new technologies



Richard Hulskes | Bram Geenen
Founders – Wevolver

Q: For a long time, the maker movement was seen as an amateur or hobbyist movement, but big industry players are starting to take note. What do you think has changed?

A: What we have seen as a platform is that many more makers are now getting into making more high quality projects, so you see more and more people building more advanced technologies. And most of those projects come from young companies, so it's really good for the so-called 'older' industry to see younger startup companies that are now building these really advanced technologies. It's a great mix.

Q: On the flip side, what benefits can makers gain from working directly alongside industry?

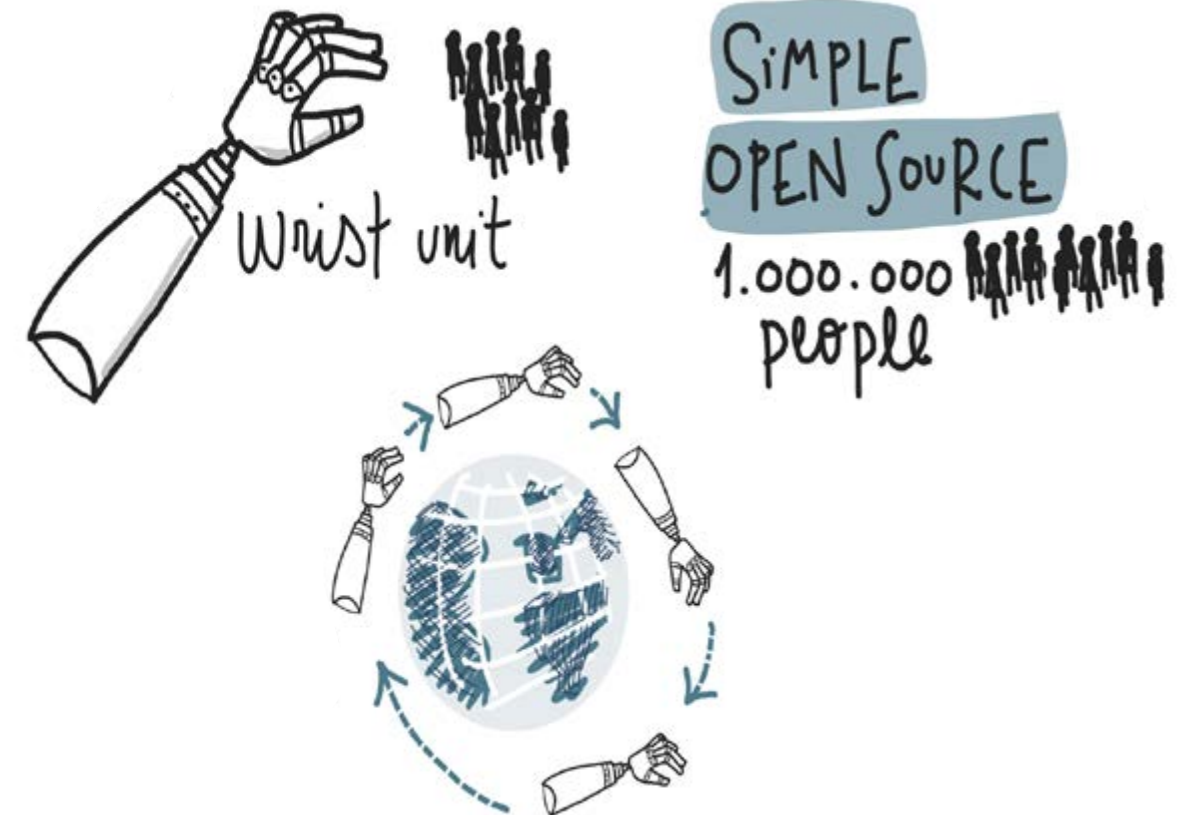
A: A lot of these young startups begin with very small production, with very unique projects, but once they really start growing, they need to move into a more professional area, a more professional field. While it's good for them to start within a small community, industry can help them by providing more professional machines and guidance to take them to the next level.



Richard Hulskes is the co-founder of Wevolver, a collaboration platform that provides open knowledge and files for public and private engineering projects, while leveraging 3D printing and digital fabrication. He is also the co-founder of Ground3D, a platform for the 3D printing industry in the Netherlands. At IN(3D)USTRY, Richard and fellow Wevolver co-founder Bram Geenen moderated the Maker Pro Panel.



= more innovation



HYBRICK

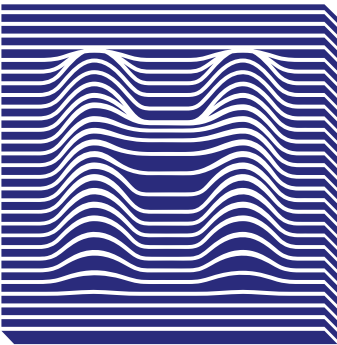
Digital Manufacturing Business Platform

The wider use of digital manufacturing technologies is contributing to a shift in the productive model which is already a reality in traditional industrial sectors such as the automotive industry, aeronautics, construction, fashion and health. This paradigm shift is giving rise to the emergence of projects that are able to address the challenges currently facing the industrial sector.

The creation of this platform is intended to promote technological projects that can transform market needs into marketable products and services in the field of advanced manufacturing. It aims to bring the challenges presented during IN(3D)USTRY 2016 to the market, acting as a permanent platform and an improvement of IN(3D)USTRY.

HYBRICK is to be the platform that turns challenges into business opportunities, boosts innovative projects that support open code collaborations and includes staff training, project prototyping and short-run products.

HYBRICK is the open innovation platform where technological innovation processes are speeded up in the field of advanced additive manufacturing. It provides a connection between client needs and the market's industrial solutions. The aim is to be able to visualise the results that these technological changes can bring about in production process optimisation.



HYBRICK is an initiative of:



Product & Service Portfolio



PRODUCT / SERVICE	SECTOR	DESCRIPTION
IDEA TO PRINT > 10 WEEKS	Maker + B2B	Learning program on sorftware + introduction to AM production
PROTOTYPING IDEA	B2B	Development of a prototype / demonstrator as technological feasibility assesment of a product idea
MANUFACTURING IDEA	B2B	Short Run of Final Parts / Prototypes
CONSULTANCY	B2B	Expert consultancy & business analysis

Conclusion

IN(3D)USTRY has just begun

For the past two decades we have been learning about the different systems and technologies that were making digital manufacturing a reality. Now 3D printing can really offer a solution to the needs that have emerged during IN(3D)USTRY.

These needs are no longer just related to learning how to use AM technologies. More importantly these needs are sector-specific manufacturing challenges that 3D printing can help to face and resolve. They are the needs of automotive and aerospace manufacturers, the needs of healthcare professionals and those of architects and those who are envisioning the mass personalized consumer products of tomorrow. Those who manufacture 3D printers, as well as those who already use them, can offer real solutions to these needs.

However there are also the needs of the 3D printing industry itself: making 3D printing more reliable, faster, more efficient and affordable. These are needs that can only be addressed through a active collaborations and exchanges between those who make the 3D printers and those who use them - at all levels.

Additive manufacturing is not simply a new process it is an entirely new, digital way of making everything: from personalized implants to airplane parts, from dresses to prosthetics. The solutions for one can be applied in the other: by sharing these experiences we can ensure that innovation moves faster than it ever has before and that it leads us toward a more sustainable and efficient way of making things. That is exactly what IN(3D)USTRY set out to do in this first edition and will continue to do, with all those who want to explore needs and discover solutions, starting with the next edition. See you October 3-5 2017.



Barcelona Industry Week

From concept to production

In 2016 we presented a new format in Additive Manufacturing events and launched the IN(3D)USTRY Community with two clear goals: Fostering the use of AM as an industrial solution by having user companies present best cases and applications while helping accelerate the innovation of the AM sector by sharing their needs and challenges to advance in their adoption.

In order to keep offering more to our community, we decided to widen the scope to cover the complete value chain from raw materials to how to adopt AM in industrial processes, targeting a broader industrial audience and vertical sectors.

For the 2017 edition we decided to integrate our event alongside the top industrial events at Fira de Barcelona, helping to promote AM as a key enabling technology in the industrial present and future. Moreover, helping companies to transition into the spectrum advanced manufacturing technologies improving their efficiency and sustainability.-

From the 2nd till the 6th of October 2017, Barcelona will host seven industrial events covering from raw materials, chemicals, plastics & plastic transformation, material processing and surface technologies, to the uses of data and sensing in an industrial environment (IOT).

IN(3D)USTRY From Needs to Solutions will cover the transition from the traditional manufacturing strategies to the novel digital manufacturing approach where data meets the physical world. And, as we did in our 2016 edition, represent all the stages in the Additive and Advanced Manufacturing value chain, from materials to end parts and from concept to production. This change of dates will not only help us offer more to our companies but also position Barcelona as a HUB for the industry

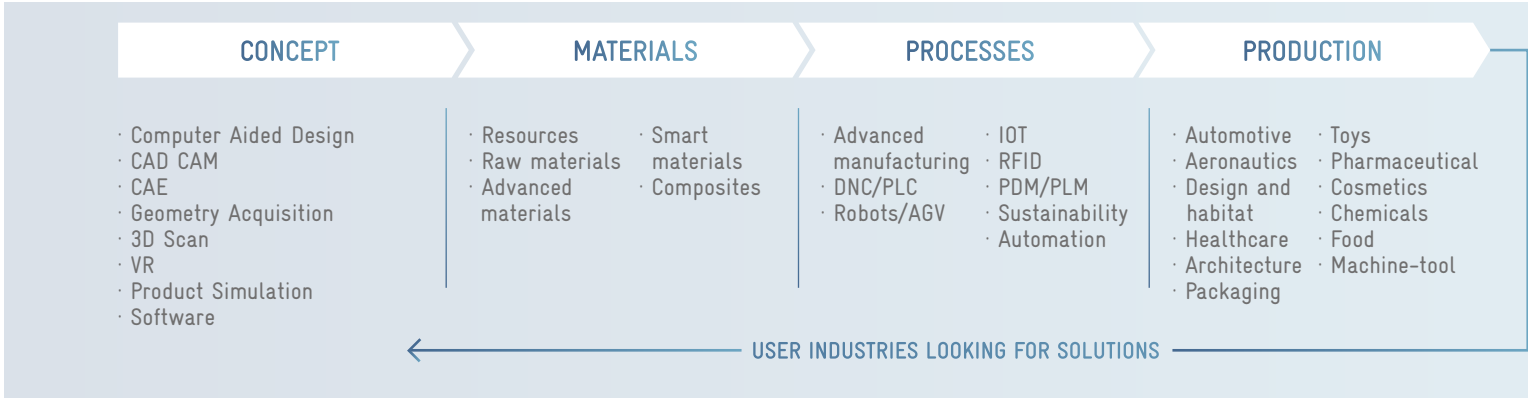
4.0 and advanced manufacturing technologies, following Fira de Barcelona's goal of covering the needs and challenges from the industry and anticipate the market's demands.

We want to help you accelerate the adoption of AM, Participate in IN(3D)USTRY From Needs to Solutions 2017.

- IN(3D)USTRY FROM NEEDS TO SOLUTIONS, Future state of advanced manufacturing, OCT 3-5, 2017
- EXPOQUIMIA, The International Chemistry Event, OCT 2-6, 2017
- EQUIPLAST, The International Plastics and Rubber Event, OCT 2-6, 2017
- EUROSURFAS, The International Surface Treatment Event, OCT 2-6, 2017
- WORLD CHEMICAL SUMMIT, Science, Industry & Society. Inspiring the Future, OCT 2-6, 2017
- 10th World Congress of Chemical Engineering, in conjunction with the 11 th European Congress of Chemical Engineering and the 4th European Congress of Applied Biotechnology (WCCE10+ECCE11+ECAB4), OCT 1-5, 2017
- Smart Chemistry Smart Future, The unique meeting fórum to encourage and promote the development of the chemical industry, OCT 2-6, 2017
- IOT Solutions World Congress, a unique event focused on vertical markets, OCT 3-7, 2017

BARCELONAINDUSTRY Week

Workflow of advanced manufacturing



Catalonia

A pioneer in promoting Industry 4.0

Under the umbrella of the concept of industry 4.0, the manufacturing industry is experiencing a profound transformation. Catalonia and Barcelona have once again shown their pioneering entrepreneurial spirit, and are leading the way in the implementation of new technologies in the industrial sector. This is nothing new. In the second half of the eighteenth century, Catalonia was already laying the foundations for an industry that by the mid-nineteenth century had adopted the steam engine, the driving force behind the English Industrial Revolution, to automate its industrial processes, especially in the textile industry. And at the beginning of the twentieth century, Catalan industry replaced steam with electricity. And now, in the twenty-first century, it

is committed to the digitalisation of its industry as the logical evolution in a process of modernisation which began in 1740 with the first printed calico factory in history.

And Fira de Barcelona, the venue for the 1929 Barcelona International Exposition, which has been one of the main driving forces behind this modernising process since it was officially established in 1932, has decided to support industry 4.0 by organising the first IN(3D)USTRY From Needs to Solutions, an event to promote additive manufacturing as one of the main factors in this new industry, which will transform today's economic relations.

“We want to be involved right from the beginning”

JORDI BAIGET

Minister for Business and Enterprise of the Government of Catalonia:

“Catalonia has always been an industrial country. We were around for industry 1.0 when steam power was invented. We were around for industry 2.0 when it was electrified and mass production was invented. And we are here for industry 3.0, when information and communication technologies are being incorporated into industry, and right from the outset we want to be part of something that is not the future. It is happening right now. It will be increasingly more widespread. And because this will lead to a qualitative leap - we want to be involved right from the beginning.”



JORDI PUIGNERÓ

Secretary general for Information and Communication Technologies Governance of the Government of Catalonia:

“Backing industry 4.0 means backing our future”

“If Gutenberg created the first printing press in 1440, printing 2.0, 600 years later we are promoting 3D printing, which is going to be the new way to print in this new millennium, and a new way of creating a new economy based around a technology that will completely transform our society and our economy. The Government of Catalonia believes that backing industry 4.0 means backing our future.”



NÚRIA BETRIU

Director General of Industry of the Government of Catalonia:

“I would like to answer two questions: Does Catalonia want to get its industry 4.0 off the ground? And can Catalonia do it? Yes, it can. Catalonia wants to do it. And we want to do it in a very ambitious way because first, we have a very important leadership from the private sector that is developing technology, and which is firmly convinced that this technology can transform industry, and second because the Government is strongly committed to providing public support for this private sector leadership, because it is through this partnership that we are convinced that we can move forward and make this transformation. And we can do it because we have an ecosystem. This ecosystem is not a recent development,

but is instead deep-rooted. We have an ecosystem based on industry. Catalonia has a strong industrial tradition, which means that 20% of its GDP currently comes from industry - the target established by Europe for 2016. This should give us a competitive advantage over other European countries, because we are already there. This is the starting point that should allow us to think not only about our industrial weight, but also about what form we want this added value industry to take, for it to give us high quality jobs, and what perhaps in the past was a commodities industry should today be an advanced and technological industry with added value.”



“What perhaps in the past was a commodities industry should today be an advanced and technological industry with added value”

MARIO FERNANDO BUISÁN

Coordinator of the Industry Strategy 4.0 of the General Secretariat of Industry of the Ministry of Industry, Energy and Tourism:

"For the Spanish Government it is vital that Spanish companies are transformed, digitalised and participate fully in this new era that is beginning. That is why the Government has designed the strategy 'Connected Industry 4.0', which is part of the agenda for reinforcing Spain's industrial sector, because our vision involves trying to favour Spanish industry. And support for Spanish industry means implementing many policies - most of which are horizontal, because industry is closely related to many other areas of economic activity. This strategy was launched in 2012 with 97 measures to promote this process. The 'Connected Industry 4.0' project consisted of a public-private partnership between the Ministry and Indra, Telefónica and Santander to develop the Spanish model of industry 4.0 - a concept that was coined in Germany. Our aim was to design the Spanish model for the digital transformation of business and industry - a model that contains a set of principles, objectives and areas for carrying out programmes. We want Spanish companies to be digitally transformed, and we want the help to come from Spanish bidders - we want our digital enablers to be Spanish, rather than Chinese or German. We want to promote this industry from here. For example, we want companies making 3D printers to be Spanish... to foster the competitiveness of Spanish companies. Carrying out this programme involves making various assumptions, but the first is that this exercise should be an example of basic cooperation between the public sector

and the private sector. And we are focusing this programme on medium-sized companies so that they act as dynamos for SMEs. This takes the form of eight strategic areas that are being implemented in three major programmes: the self-diagnosis programme for companies to make an initial approach to their technological level of digitalisation; the consultancy and advisory programme to establish a road map, as many companies do not know how to begin, and we are help them to produce an Action Plan for 25 companies in a pilot scheme in which we finance 85% of the cost and an economic support programme worth 100 million Euros to offer loans on very advantageous terms... Because we want to help businesses make the move to digitalisation because there is a lot at stake."

"We want our digital enablers to be Spanish"

LOREDANA GHINEA

Executive director of the Spire public-private partnership:

"The Spire public-private partnership is an instrument of the European Commission which aims to create an industry with sustainable transformation by means of efficiency of resources and energy. It is a partnership which is seven years old, and which works through calls and projects that are concerned with the main challenges in the processing industry today - mainly related to resource efficiency, energy efficiency and waste treatment to transform them into a resource and put them back into circulation. At Spire we have eight industrial sectors, ranging from steel to cement and ceramics, which are producers of materials for 3D printing. And we believe that we have to consider how to transform 3D printing processes using the resources we currently have and with a more efficient use of energy. For this reason, we want to see the synergies with the sectors that are producing these materials, and the challenges they will have to face."

"Resource efficiency, energy efficiency and waste treatment"



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IN(3D)USTRY
FROM NEEDS TO SOLUTIONS

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