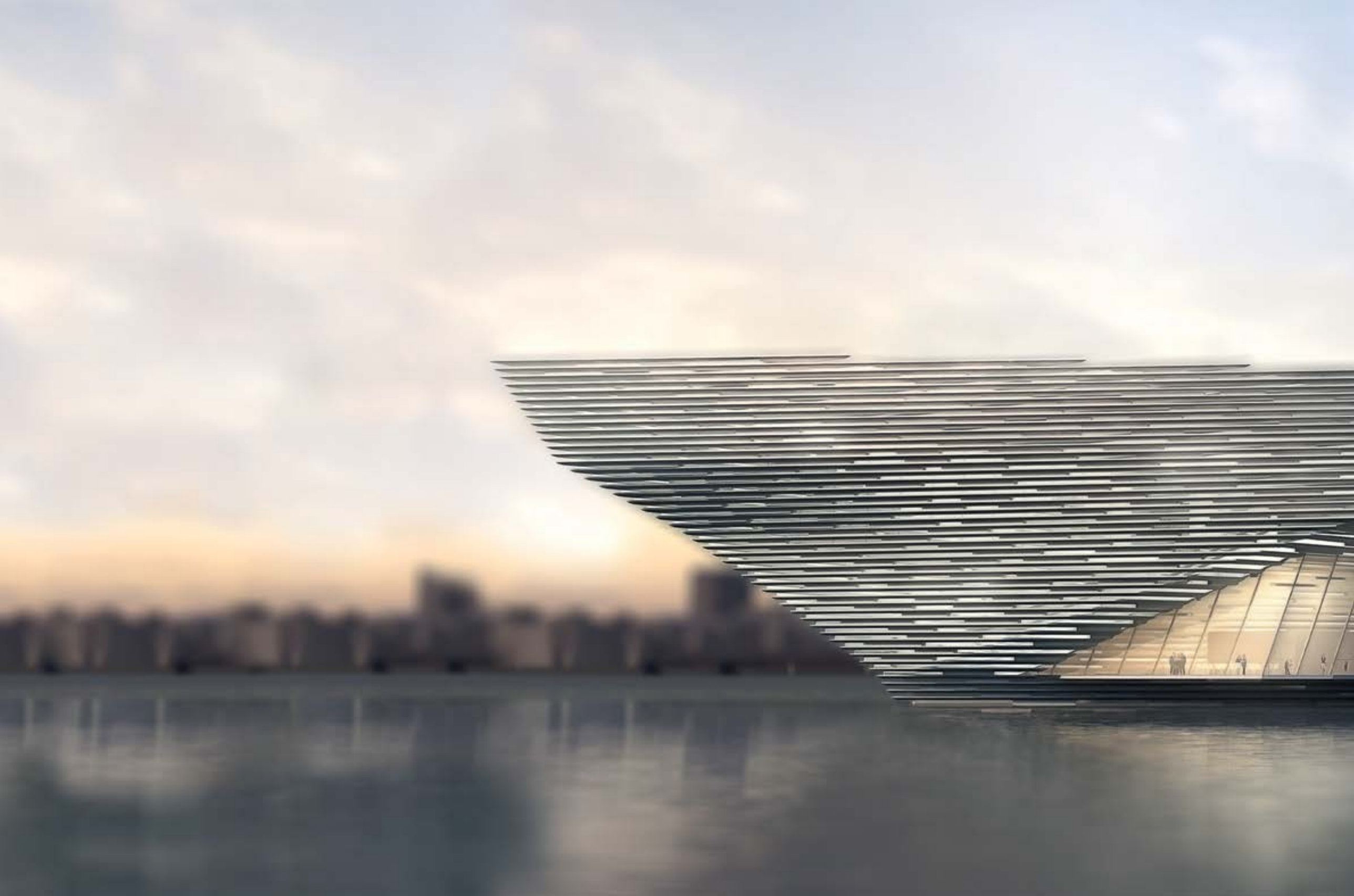
2017 3DEXPERIENCE® ANNUAL REPORT

CORPORATE REPORT

THANKS

We would like to thank all those who helped us to create this corporate report:
Zaki ABIZA, Christophe ALBENQUE, Anne ASENSIO, Jonathan ASHER, Marie-Pierre AULAS, Mirko BARONE, David L. BEEMAN, Jérôme BERGERET, Santanu BHATTACHARYA, Nadja BINTERT, Virginie BLINDENBERG, Chiara BOGO, François-José BORDONADO, Karen BUCKNER, Fanny CABANNE, Rachel CALLERY, Julien CALVIAC, Cindy CHABAL, Séverine CHAPUS, David CHASSAN, Cyril COHEN, Laura COLIN, Martin DACHGRUBER, Galina DANILINA, Caroline DECOTTIGNIES, Maryann DENNEHY, Steffi DONDIT, Terrence DRULA, Jonathan DUTTON, Bradley D. ELMENHURST, Lauriane FAVRE, Stefanie FEIH, Valérie FERRET, Hillary FORSYTHE, Matthieu FRANCOZ, Géraldine GANDVEAU, Nicolas GAZERES, Laurence GERMOND, Guillaume GERONDEAU, François GRUSON, Bernadette HEARNE, Kristina HINES, Hirotaka ITO, Suchit JAIN, Patrick JOHNSON, Guillaume KERBOUL, Alessandra KETLER, Florent LAFARGE, Dora LAINE, Guillaume LENOEL, Pierre MARCHADIER, Michael MARSHALL, Frédéric MARTIN, Laura MARX, Sébastien MASSART, Florence MATHIEU, Tomohiro MATSUNAGA, Xavier MELKONIAN, Jörg MEUER, Ségolène MOIGNET, Ellen MONDRO, Jonathan MONFROY, Suzanne MORAN, Akio MORIWAKI, Grace MU, Deepak NG, Josephine ONG, Tony PAREZ EDO MARTIN, Paul PECHENART, Jennifer PETROSKY, Antoine PICON, Marie PLANCHARD, Thomas PUPETER, Alyssa ROSS, Greg SABEY, Reza SADEGHI, Yukiko SATO, William SAURIN, Laurent SERROR, Cédric SIMARD, Archana SINHA, Jeff SMITH, Erik SWEDBERG, Magdalene TAN, Kim TERCA, Martin TIMM, Jutta TREUTLEIN, Frédéric VACHER, Carola VON WENDLAND, Tim WEBB, Kris D. WEBER, Jungwon YANG, Heesoo YOON

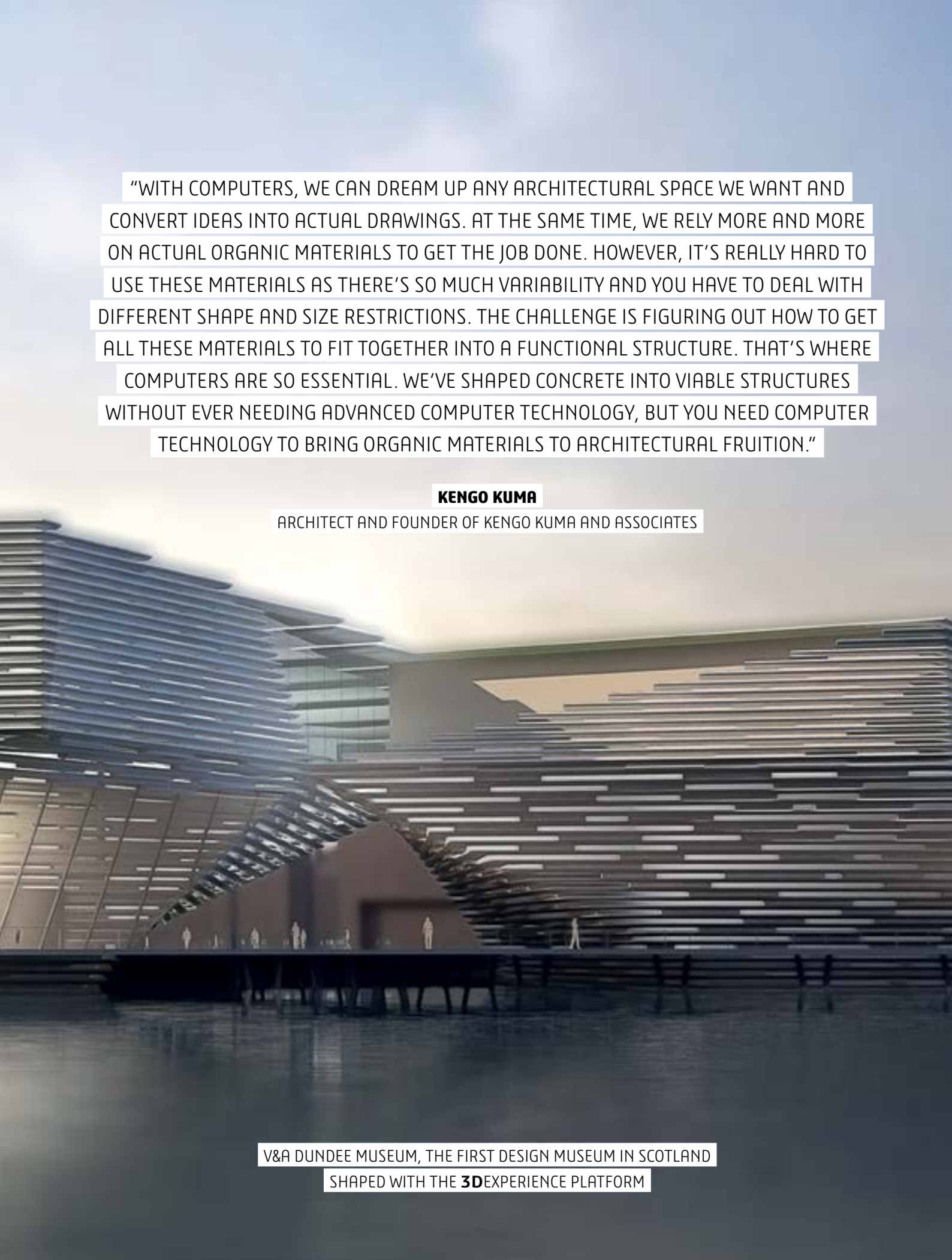
DASSAULT SYSTEMES | The 3DEXPERIENCE® Company



"WITH COMPUTERS, WE CAN DREAM UP ANY ARCHITECTURAL SPACE WE WANT AND CONVERT IDEAS INTO ACTUAL DRAWINGS. AT THE SAME TIME, WE RELY MORE AND MORE ON ACTUAL ORGANIC MATERIALS TO GET THE JOB DONE. HOWEVER, IT'S REALLY HARD TO USE THESE MATERIALS AS THERE'S SO MUCH VARIABILITY AND YOU HAVE TO DEAL WITH DIFFERENT SHAPE AND SIZE RESTRICTIONS. THE CHALLENGE IS FIGURING OUT HOW TO GET ALL THESE MATERIALS TO FIT TOGETHER INTO A FUNCTIONAL STRUCTURE. THAT'S WHERE COMPUTERS ARE SO ESSENTIAL. WE'VE SHAPED CONCRETE INTO VIABLE STRUCTURES WITHOUT EVER NEEDING ADVANCED COMPUTER TECHNOLOGY, BUT YOU NEED COMPUTER TECHNOLOGY TO BRING ORGANIC MATERIALS TO ARCHITECTURAL FRUITION."

KENGO KUMA

ARCHITECT AND FOUNDER OF KENGO KUMA AND ASSOCIATES



V&A DUNDEE MUSEUM, THE FIRST DESIGN MUSEUM IN SCOTLAND
SHAPED WITH THE **3D**EXPERIENCE PLATFORM

THE WORLD IS WATCHING US

THE WORLD ENLIGHTENS US

THE WORLD INSPIRES US

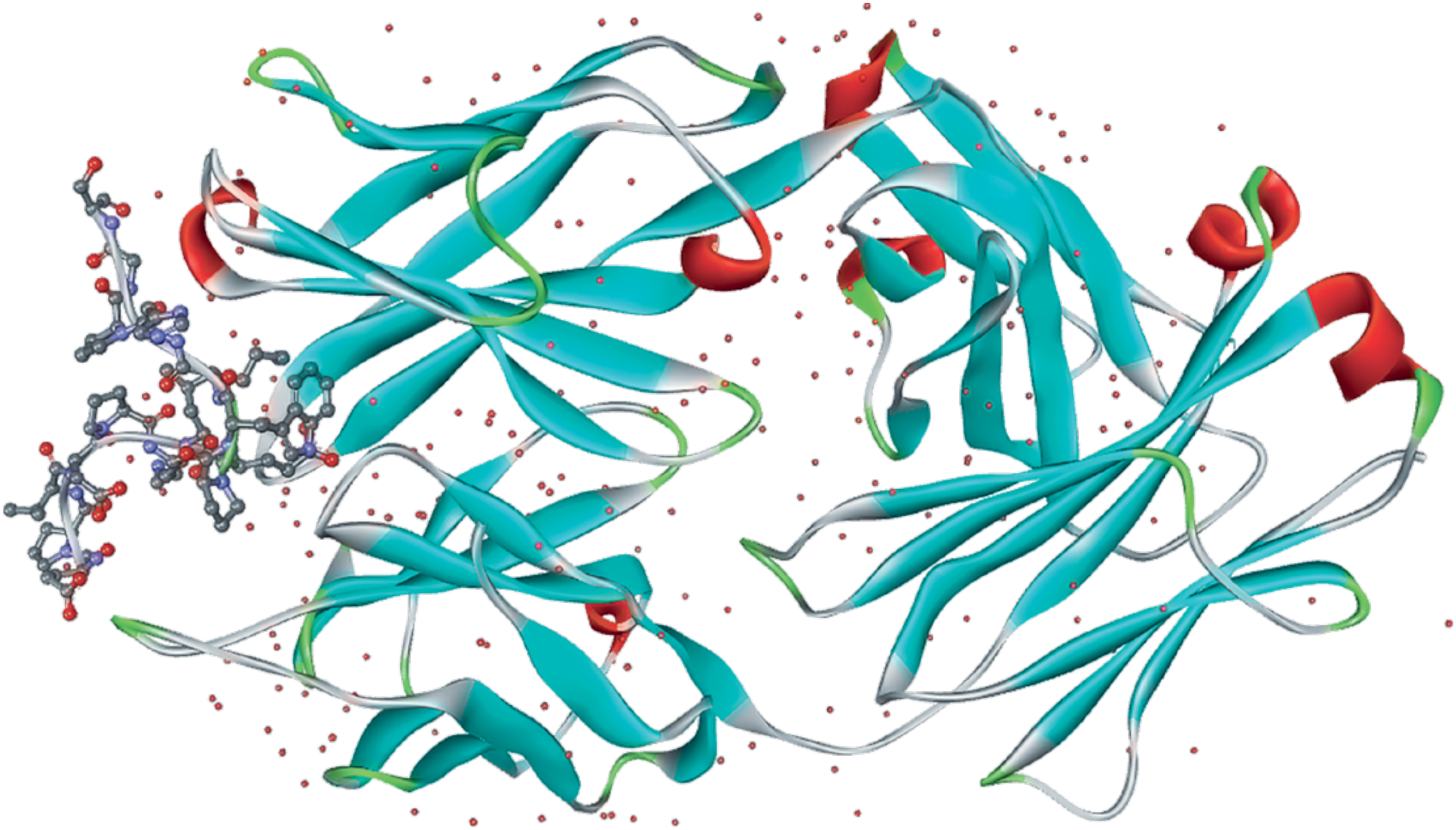
PORTFOLIO 2017

HOW AERODYNAMIC
Realistic aerodynamic simulation of fluid dynamics of an electric vehicle made with Exa PowerFLOW, a new addition to the growing multiphysics capabilities of Dassault Systèmes' SIMULIA brand.

PORTFOLIO 2017

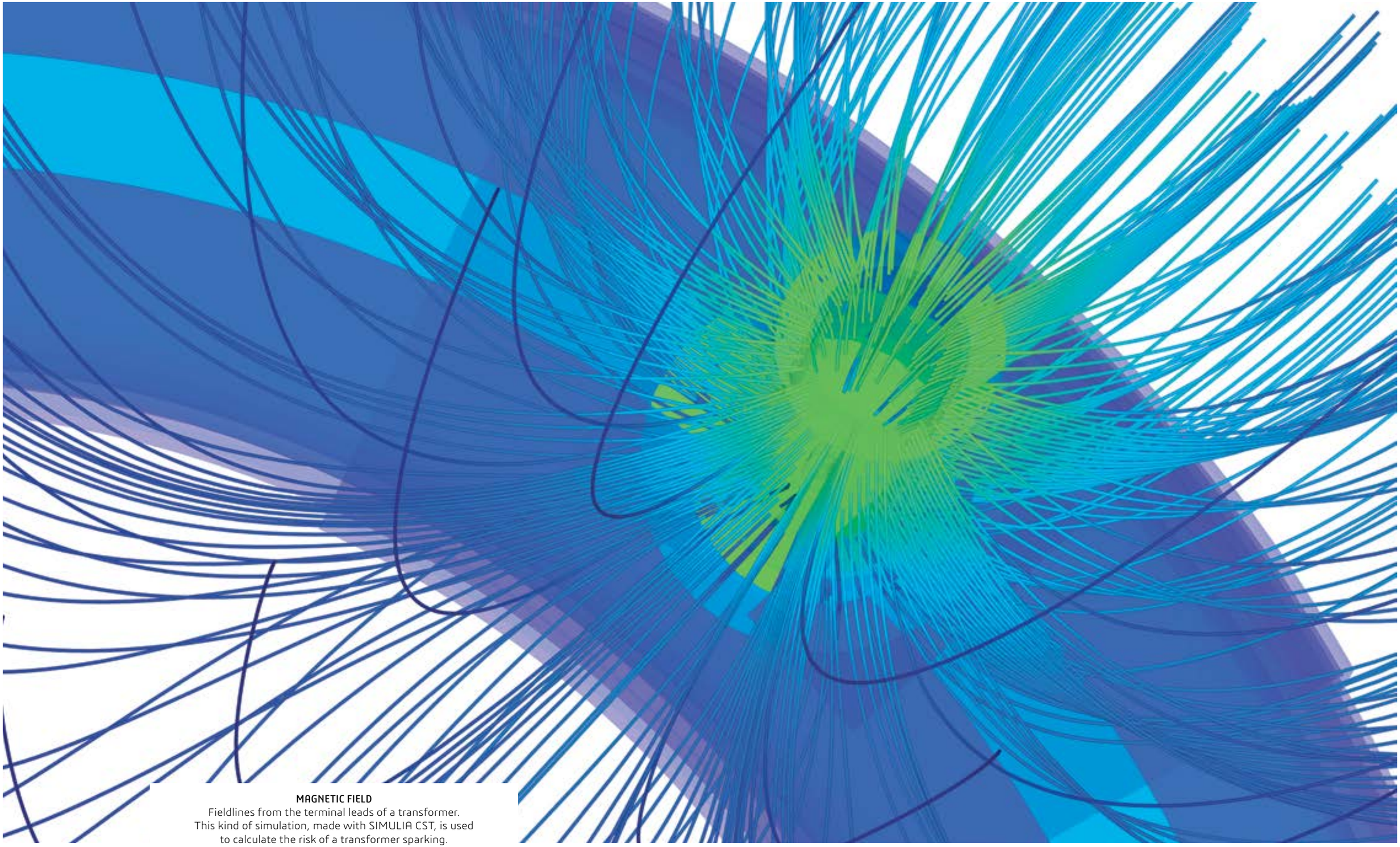
FLYME
Model of an insect and creation of realistic
materials by the CATIA design team.
This exercise demonstrates CATIA's organic shaping capabilities.

PORTFOLIO 2017



ANTI-TAT HIV 11H6H1 FAB' MOLECULE
Anti-Tat HIV 11H6H1 Fab' complexed with a 15-mer Tat peptide.
3D model by BIOVIA.

PORTFOLIO 2017



MAGNETIC FIELD
Fieldlines from the terminal leads of a transformer.
This kind of simulation, made with SIMULIA CST, is used
to calculate the risk of a transformer sparking.

DASSAULT SYSTÈMES: STRATEGY AND GROWTH DRIVERS AT WORK IN 2017

BERNARD CHARLES
Vice Chairman of the Board of Directors
and Chief Executive Officer

CHARLES EDELSTENNE
Chairman of the Board of Directors

For Dassault Systèmes, 2017 has been a memorable year, where our business successes demonstrated the value of our strategy, with companies adopting our **3D**EXPERIENCE platform to innovate, creating new customer experiences, building new business models and new ways to manufacture, deliver and operate facilities. What we propose to our clients is going far beyond a basic process digitalization it's a new approach for innovation, based on experience driving knowledge and know-how, enabling clients' transformation. That's why traditional production and supply chain business models should be replaced by value creation partner networks in an experience economy that will make a real Industrial Renaissance possible.

Illustrating this value, the agreement signed with one of our very large clients, The Boeing Corporation, will significantly expand our long-standing partnership.

Driven by our **3D**EXPERIENCE successes, we have delivered on all our commitments, notably achieving double-digit growth in new licenses revenue as well as improving our business and financial performance. Finally, with the evolution of our executive committee composition, we're preparing for our next phase of development.

DASSAULT SYSTÈMES RANKED MOST SUSTAINABLE CORPORATION

We were honored to have Dassault Systèmes ranked first among the 2018 Top 100 Most Sustainable Corporations by *Corporate Knights* for our vision of harmonizing product, nature and life and for implementing this vision in everything that we do. We are empowering industry and individuals to create **3D**EXPERIENCE universes to imagine, invent, and deliver innovative solutions that advance sustainability in domains as ambitious

as energy, mobility of the future, cities, life sciences and high-tech.

EXTENDED PARTNERSHIP WITH THE BOEING CORPORATION

Dassault Systèmes and Boeing announced the extension of our long-standing partnership, clearly endorsing our strategy and illustrating the value we bring to our clients. Boeing will be adopting Dassault Systèmes' **3D**EXPERIENCE platform for Manufacturing Operations Management and Product Lifecycle Management across its commercial aircraft, space and defense programs.

3DEXPERIENCE, THE NEXT GENERATION INNOVATION PLATFORM POWERING OUR GROWTH

With **3D**EXPERIENCE, Dassault Systèmes is pioneering the next generation innovation platform, enabling breakthroughs for clients in products, customer experiences, new business models and manufacturing. Many industries are disrupted by new technologies and we believe that the **3D**EXPERIENCE platform, providing digital continuity and reducing the difference between the virtual and real worlds to zero, and our Industry Solution Experiences, address our customers' most critical needs and requirements.

With **3D**EXPERIENCE, Dassault Systèmes is now serving a much larger software market, at least US$26 billion, doubling our previous perimeter. Dassault Systèmes performance, is driven by **3D**EXPERIENCE adoption, which now represents more than 20% of our software revenue and by our new license growth of 11%. Diversification Industries now represent 32% of our software revenue.

BUSINESS SUCCESSES, ACQUISITIONS AND THE PLATFORM IMPROVED CAPABILITIES, FURTHER SUPPORTING OUR GROWTH STRATEGY

Led by **3D**EXPERIENCE, with strong activity in large transactions, 2017 performance was driven by the high value our Industry Solutions Experiences provide to our clients, reinforcing their innovation capabilities in ideation, design, manufacturing and operations.

We also strengthened our brand leadership, with the Exa acquisition, which became part of our SIMULIA portfolio. Exa will provide customers with a proven and diverse portfolio to simulate the impact of highly dynamic fluid flows, critical for design processes notably in Automotive, Aerospace and Natural Resources industries.

Finally, representing an additional value for our customers, our last **3D**EXPERIENCE 2018 release is introducing two important innovations: POWER'BY, which will enable all customers to benefit from the **3D**EXPERIENCE platform's value on their legacy environments, and **3D**EXPERIENCE Marketplace, which connects designers with 3D printing facilities and with spare parts providers.

INDUSTRIAL SECTORS PERFORMANCE

Core Industries software revenue growth in 2017 was led by Industrial Equipment and Transportation & Mobility, our two largest industries. In Industrial Equipment, we are continuing to extend our leadership thanks to **3D**EXPERIENCE and SOLIDWORKS, with a record year on broad-based strength.

Diversification Industries represented 32% of total software revenue in 2017, with strong growth in High-Tech, which increased 11% in constant currencies. In Consumer Packaged Goods & Retail, software revenue increased 17%. We saw good traction with QUINTIQ for supply chain planning and optimization with key wins at food and beverage companies. Finally, with DELMIA, we expanded in Beauty & Personal Care and in Consumer Electronics.

DASSAULT SYSTÈMES 2017 RESULTS REINFORCING OUR STRATEGIC POSITIONING

Non-IFRS total revenue increased 7% in 2017 to €3,242 million, driven by new licenses revenue growth of 11% and an increase in recurring revenue of 7%, representing 70% of our total software revenue. The non-IFRS operating income crossed the €1 billion milestone and our non-IFRS operating margin expanded 80 basis points to 32.0% for 2017 on underlying organic improvement of 100 basis points offset in part by acquisition dilution of 20 basis points. Non-IFRS EPS growth was 8% at €2.68 or 10% at constant currency.

On a regional basis, software revenue increased 10% in Europe and was driven by Southern Europe, France, Germany and high growth in Russia. In the Americas, software revenue increased 7%, driven by North America. Software revenue in Asia grew by 6% with double-digit growth in South Korea, India and South-East Asia, partly offset by mixed performances in Japan and China.

Our unique brand portfolio performance has been driven by SOLIDWORKS, with software revenue increasing 14% at constant currency. CATIA reached a key milestone, surpassing €1 billion in software revenue. SIMULIA significantly enhanced our multi-physics simulation capabilities over the last two years with the acquisition of Computer Simulation Technology AG and Next Limit Dynamics in 2016 and in 2017 with Exa Corporation. DELMIA's major wins included Boeing.

Finally, Dassault Systèmes is continuing to advance our Cloud portfolio, resources and services, the largest in our market. To further our Cloud resources and services, we acquired a majority stake in Outscale, a global provider of enterprise-class Cloud services.

OPERATING CASH FLOW GROWTH

Net operating cash flow increased 20% to €745 million for the year ending December 31, 2017, compared to €622 million in 2016, reflecting strong growth in net income and improvement in working capital.

EVOLUTION OF EXECUTIVE COMMITTEE COMPOSITION

The evolution of our Executive Committee composition aims to prepare Dassault Systèmes for the future. Joining the Group, Florence Verzelen has been appointed Executive Vice President of Industry Solutions, Marketing, Global Affairs and Communication.

Furthermore, with his strong knowledge of our brands, it is a natural fit to combine the position of Chief Financial Officer and Corporate Strategy Officer for Pascal Daloz. Finally, Thibault de Tersant is taking new responsibilities as General Secretary to help shape our future corporate structure, business model strategy, Ethics & Compliance, and La Fondation Dassault Systèmes.

BUSINESS OUTLOOK

We expect to deliver a very solid performance in 2018, as the year started with a good level of demand. In the years that follow, we expect an acceleration of our revenue and EPS growth, reflecting the ongoing adoption of **3D**EXPERIENCE by customers in need of new user experiences and business model improvements.

FINANCIAL PERFORMANCE

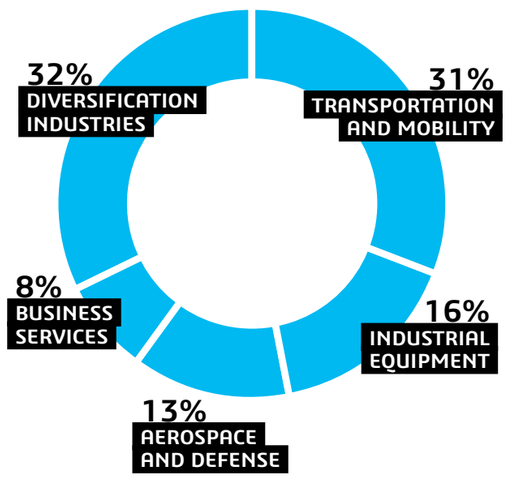
ACCELERATED REVENUE GROWTH

Total revenue growth[1] **+7%**
New licenses revenue growth[1] **+11%**
Earnings per share **+8% at 2.68€**
Net cash provided by operations **+20% at 745M€**

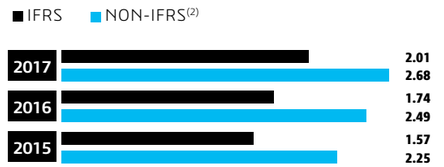
REVENUE
(M€)

OPERATING MARGIN
(%)

INDUSTRY DIVERSIFICATION



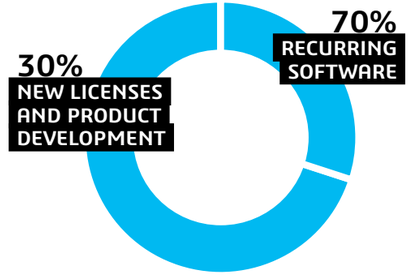
DILUTED EPS
(€)



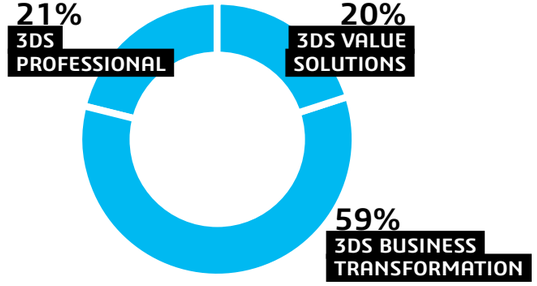
NET CASH PROVIDED BY OPERATIONS
(M€)

REVENUE BY REGION

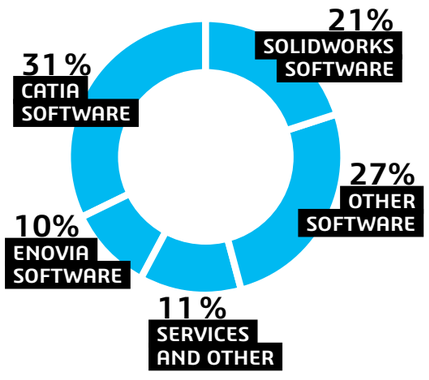
HIGH LEVEL OF RECURRING SOFTWARE REVENUE



WELL-BALANCED DIRECT AND INDIRECT SALES CHANNEL



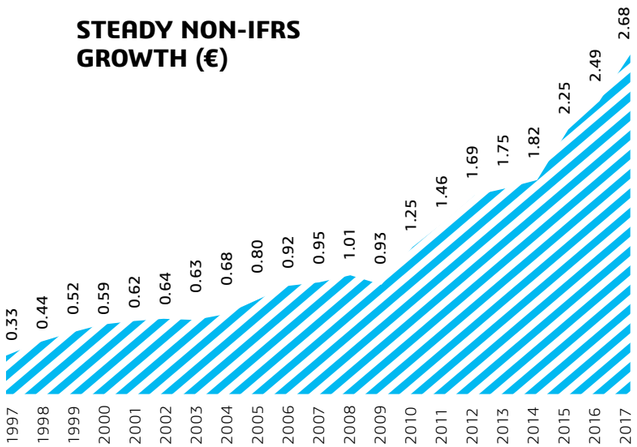
LEADING BRANDS SERVING OUR USERS



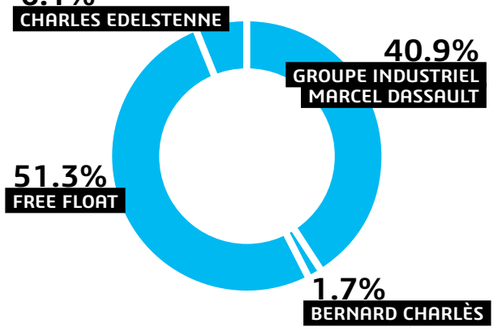
(1) Non-IFRS, revenue growth figures in constant currencies.

(2) All financial information is reported according to IFRS. In addition, the Company has provided supplemental non-IFRS financial information, which excludes the effect of adjusting the carrying value of acquired companies' deferred revenue, the amortization of acquired intangibles, share-based compensation expense, certain other operating income and expense, net, certain one-time items included in financial income and other, nets, and certain one-time tax effects and the income tax effects.

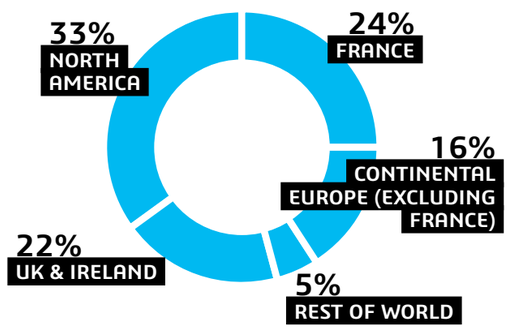
STEADY NON-IFRS GROWTH (€)



SHAREHOLDERS' COMPOSITION



SPLIT OF FREE FLOAT



DASSAULT SYSTÈMES STOCK DATA

LISTED ON NYSE, EURONEXT PARIS AND TRADED ON THE AMERICAN OTC MARKET

STOCK PRICE AS OF 31/12/2017
€ 88.59
$ 106.04

MARKET CAPITALIZATION
€ 22.6 MD
$ 27.0 MD

COMPARISON OF THE STOCK PERFORMANCE
DASSAULT SYSTÈMES
+22%
CAC 40
+9%
EURONEXT 100
+10%

DAILY VOLUME OF STOCK TRADED ON EURONEXT PARIS
295,136 SHARES

KEY 2018 SHAREHOLDERS' EVENTS

WEDNESDAY, APRIL 25, 2018
RELEASE OF FIRST QUARTER EARNINGS

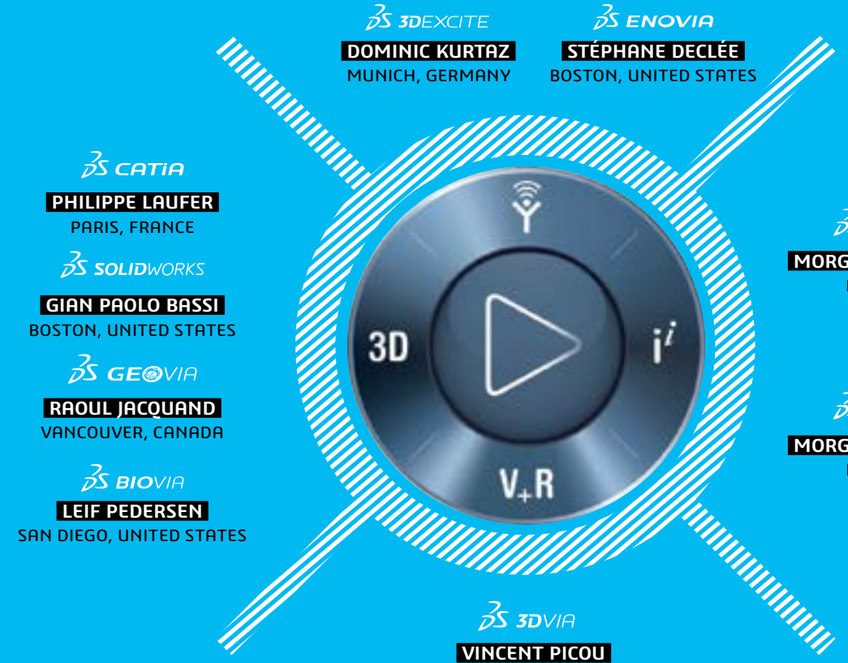
TUESDAY, MAY 22, 2018
ANNUAL SHAREHOLDERS MEETING

TUESDAY, JULY 25, 2018
RELEASE OF SECOND QUARTER EARNINGS

WEDNESDAY, OCTOBER 24, 2018
RELEASE OF THIRD QUARTER EARNINGS

SHAREHOLDERS CONTACT
TEL.: +33 (0)1 61 62 69 24
FAX: +33 (0)1 70 73 43 59
E-MAIL: INVESTORS@3DS.COM
WWW.3DS.COM/INVESTORS

A CROSS-FUNCTIONAL ORGANIZATION THAT ENCOURAGES achievement



OUR LEADERSHIP PER INDUSTRY

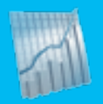
AEROSPACE & DEFENSE
DAVID ZIEGLER

ARCHITECTURE, ENGINEERING & CONSTRUCTION
JERRY JACKSON

CONSUMER PACKAGED GOODS & RETAIL
PHILIPPE LOEB

CONSUMER GOODS & RETAIL
PHILIPPE LOEB

ENERGY, PROCESS & UTILITIES
THOMAS GRAND



FINANCIAL & BUSINESS SERVICES
GUILLAUME DUFOUR

HIGH TECH
OLIVIER DE PERCIN

INDUSTRIAL EQUIPMENT
PHILIPPE BARTISSOL

LIFE SCIENCES
JEAN COLOMBEL

MARINE & OFFSHORE
ALAIN HOUARD

TERRITORIES AND 3DEXPERIENCITY
SÉVERINE CHAPUS

TRANSPORTATION & MOBILITY
OLIVIER SAPPIN

OUR LEADERSHIP IN THE

WORLD.

DEAN MARSH
NORTH AMERICA

"In May 2017, we opened the **3D**EXPERIENCE Center in partnership with Wichita State University's National Institute for Aviation Research (NIAR). The on-campus center enables companies to bring their projects to life and experience hands-on how the **3D**Experience platform can help re-invent their design, development and manufacturing processes."

OLIVIER LETEURTRE
WESTERN EUROPE

"We engaged a long term agreement with Bouygues construction, AEC global leader. Also, we started disruptive projects in Real-estate domain on **3D**EXPERIENCE on cloud with QUARTUS for BIM platform project and with WOODEUM for BIM and terrain modeling. This involvement with all AEC stakeholders demonstrates our involvement in this sector which is rethinking its complete value chain."

ALEJANDRO CHOCOLAT
LATIN AMERICA

"In Latam, Grupo Boticário selected our industry solution experience "Perfect Production." The Grupo Boticário brands and stores can be found throughout Brazil. It has close to 4,000 points of sale, in 1,750 cities. This makes it the largest beauty franchise in the world."

JOHN KITCHINGMAN
NORTHERN EUROPE

"2017 was a year where our partner channel saw great success across Northern Europe and our alliances with systems integrators brought new expertise in growth industries. We closed significant wins with customers beyond our traditional industries in each country, all of which extend our reach and reputation; and in our traditional sectors of Aerospace & Defense and Transportation & Mobility, new customers joined some of our biggest, who extended their commitment to the platform as part of their strategy for growth."

KLAUS LÖCKEL
CENTRAL EUROPE

"In September 2017, we announced that Kreisel Electric selected the **3D**EXPERIENCE platform and the Industry Solution Experience (ISE) "Electro Mobility Accelerator" to accelerate its business growth. This customer win is a perfect showcase of how virtual technology lets disruptive companies accelerate the industry shift to electric."

GUIDO PORRO
SOUTHERN EUROPE

"In 2017, we grew our business, increasing our market share and serving large enterprises and SMEs across all industries. We engaged in innovative projects to support our clients to embrace the 4th Industrial revolution. We developed a strong value proposition on the cloud that is emerging a strong innovation driver to make the best of our technologies accessible for SMEs, Start-ups, Makers, FabLab, ..."

ALEXEY RYZHOV
RUSSIA

"2017 was the year of great results with significant business growth on the market, while executing major business transformation in partner network, territory coverage and solution offerings. With that we successfully entered new markets bringing the **3D**EXPERIENCE platform and full specter of Dassault Systèmes value solutions."

YING ZHANG
CHINA

"Dassault Systemes achieved double digit growth in China in 2017. With the enhanced capacity and capability in sales & marketing, Dassault Systemes technology took #1 position in market share in R&D and software including CAD, CAE, CAM and PLM."

YOUNGBIN CHO
KOREA

"Dassault Systèmes Korea makes efforts to support growth of start-ups in Korea. We have launched a **3D**EXPERIENCE Lab in 2017, which is the third of its kind in the world, in collaboration with INNO Design, to nurture a start-up ecosystem and allow an entrepreneurial spirit to take root. INNO Design is the company that designed the Olympic cauldron and torch of the 2018 PyeongChang Olympics and world festival using CATIA."

YUJI YAMAGA
JAPAN

"Throughout 2017, we saw a remarkable advancement of awareness in the context of the City segment. We conducted three keynote presentations on the City topic at Japan's top smart city expositions and at trade shows such at CEATAC Japan, increasing interests of city governments and industries will serve as a tail wind in 2018."

SAMSON KHAOU
INDIA

"In August 2017, we launched the **3D**EXPERIENCE on Wheels (#3DXOnWheels) that toured 12,000 km by covering 13 cities and reaching out to 16 industrial hubs, 138 companies and educational institutions to showcase our **3D**EXPERIENCE platform."

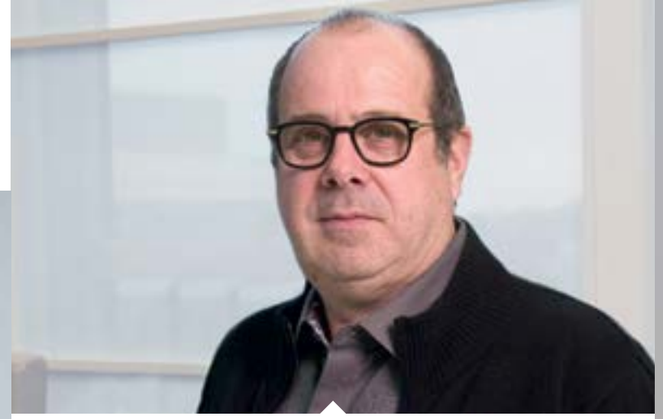
SOX KONNO
SOUTHERN ASIA, PACIFIC

"We empowered the Government of South Australia to build Australia's first Virtual Shipyard in Adelaide, enhancing competitiveness of local suppliers in the global defense supply chain through digital transformation. To take this initiative further, we partnered with universities to co-create industry-focused curriculum to reinvent next generation industry roles and power the future workforce."

EXECUTIVE COMMITTEE

Driven by their passion for virtual worlds, the Dassault Systèmes management team nurtures talent throughout the **3D**EXPERIENCE Company. They guide their customers' transformation with sustainable innovation solutions that harmonize products, nature, and life.

SYLVAIN LAURENT
Executive Vice President,
Global Field Operations Asia / Oceania,
Global Direct Business Transformation Sales Force



BRUNO LATCHAGUE
Senior Executive Vice President,
Global Field Operations Americas, Global Brands,
Indirect channels

BERNARD CHARLES
Vice Chairman of the Board of Directors,
Chief Executive Officer

LAURENCE BARTHÈS
Executive Vice President,
Chief People
& Information Officer

PASCAL DALOZ
Executive Vice President,
Chief Financial Officer and Corporate Strategy Officer

THIBAULT DE TERSANT
Senior Executive Vice President,
General Secretary

LAURENT BLANCHARD
Executive Vice President,
Global Field Operations EMEAR,
Alliances Strategy

DOMINIQUE FLORACK
President,
Research and Development

FLORENCE VERZELEN
Executive Vice President,
Industry Solutions, Marketing,
Global Affairs and Communications

INDUSTRY RENAISSANCE

DASSAULT SYSTÈMES, CATALYST AND ENABLER OF THE INDUSTRY RENAISSANCE FOR SUSTAINABLE INNOVATION

by
BERNARD CHARLÈS

Through virtual experiences, augmented reality and realistic simulation, digital technology revolutionizes our relationship with knowledge, just like the printing press did in the 15th century. The new book is the virtual experience that adds knowledge and know-how while eliminating the gap between experimentation and learning.

As a result, a real Industry Renaissance is emerging worldwide. Combining the real and the virtual leads to new ways of seeing the world, of inventing, learning, producing and doing business. It creates new ways for industries and technologies to interact. New categories of industrial companies are creating new categories of solutions for new categories of customers. Tesla has forever changed the automotive market, and Joby Aviation or Blue Origin the aerospace market. Value today is in the usage rather than the product. In today's experience-based economy, subject and object are inextricable. The industry of the 21st century is a network of creation, production and exchange of experiences.

What we are seeing, therefore, is not Industry 4.0 trying to digitalize 20th century industry, but the need to invent the industry of the 21st century. With its Internet+ and Made in China 2025 programs, China aims to transform the "workshop of the world" into a design studio. In South Korea, the Creative Economy program seeks to develop new markets through the convergence of science, technology and culture. In the U.S., investments are made in new industrial ecosystems that include local and federal government, businesses and education. Tomorrow's game-changers will not be those with the most automated production systems, but those who build a culture of knowledge and know-how to reveal and train the workforce of the future, able to solve the challenges of a planet lacking sustainable solutions. The sciences of life and matter are at the heart of this change, harmonizing product, nature and life. Biomimicry and biomaterials are set to transform the way we design things. Additive manufacturing makes the imaginary achievable.

We must no longer think of industry as a set of means of production, but as a process of value creation. The industrial sectors of the 21st century are much less concerned with flows of parts than with flows of usages and of virtual models, in an economy that eliminates friction and optimizes the life cycle using intelligent systems whose data is energy. This century will be a time of high-added-value ecosystems in which the real and the virtual merge, each complementing and amplifying the other to produce goods and experiences. This becomes the very definition of an industry. Amazon is a full-fledged industry player, since it has created a unique consumer experience. The automotive industry no longer just makes cars but imagines new methods of transportation, working through innovative ecosystems that bring together cities, businesses and citizens. With the **3D**EXPERIENCE platform, Singapore has integrated urban development, services, economic performance and healthcare.

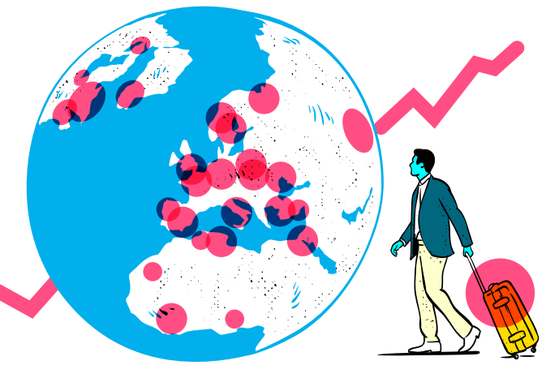
This new economy of value creation is illustrated through marketplaces that bring together supply and demand, the global and the local. Digital experience platforms are the infrastructures of this industry renaissance. They transform retail, transportation and tourism, and are set to change industry. Within the **3D**EXPERIENCE Marketplace, the largest virtual factory in the world, the model of a product can be posted and printed in 3D where it will be sold. Digital platforms, which combine bookwork with laboratory benchwork, transform learning through virtual experiences. Artificial intelligence will not replace thinking, but it will facilitate access to knowledge and know-how.

France must and can believe in an industry of the future. Europe, with its diverse talents and cultures, has considerable assets to build regional and interconnected industrial ecosystems: scientific research, industry leaders, SMB network, interdisciplinary education centers and innovation platforms. Let us gather around an industrial vision faithful to our common humanistic culture, which focuses on man and uses, frugality and sustainable development.

Welcome to the industry of the 21st century.

“A CITY IS MORE THAN A PHYSICAL REALITY; A CITY IS MADE UP OF MILLIONS OF URBAN EXPERIENCES.”

ANTOINE PICON
ENGINEER, ARCHITECT AND HISTORIAN

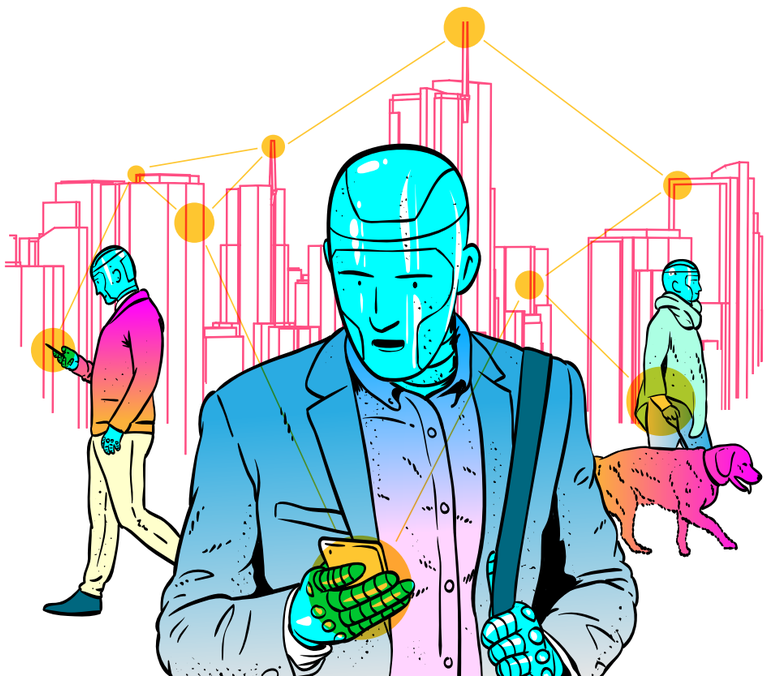


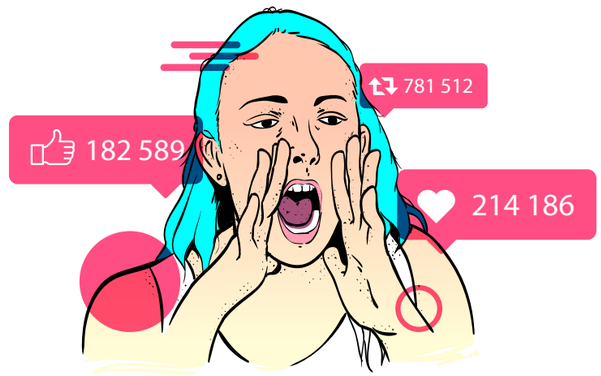
THROUGHOUT THE WORLD, THE POPULATION IS BECOMING INCREASINGLY CONCENTRATED IN CITIES. WHAT CHALLENGES DOES THIS PRESENT AND HOW ARE URBAN PLANNERS RESPONDING TO THIS GENERAL SHIFT?

It is indeed a substantive shift, which, in some regions of the world, is very quickly gaining speed. Cities are playing an increasingly strategic role in the global economy. In light of this acceleration, there is somewhat of a crisis in traditional planning tools. Cities have become so spread out, so complex, and are evolving so quickly that traditional urban planning solutions no longer meet the needs of planners. The success garnered by the first proposals of digital cities and the global movement towards smart cities are exactly in line with this expectation of new tools for managing cities. Another essential point concerns environmental uncertainty, related to climate change and the proliferation of extreme weather-related events. Many cities are threatened. Populations are attracted to the coasts, and it is especially in these areas that the effects of climate change will be felt the soonest. A third important point is the increased competition between cities that are vying with each other to attract talent, companies and capital. This trend correlates with discussions about the knowledge economy, according to which a city's competitiveness comes from its ability to attract brainpower and successfully synthesize academia, research and cutting-edge companies. What's more, when we speak of cities, we need to speak more specifically about urban metropolises, even though many cities have had difficulty abandoning the municipal framework. More and more problems, particularly environmental, are emerging at the regional level.

WHAT IS THE ROLE OF DIGITAL IN THE RECENT EVOLUTION OF CITIES?

In *La ville territoire des cyborgs*, I explained in a somewhat provocative way that the cyborg is to the contemporary city what the ideal man was to the regular city imagined by Leonardo da Vinci in the Renaissance. Let me explain. You have technologies, like the car, which have had a direct impact on the urban form. Digital has very profoundly changed the nature of the urban experience, but has not yet altered its form. Today, all cities are experienced and used to augmented reality; thanks to your smartphone, you are simultaneously in the street and in the digital world, like a kind of cyborg. It is a worldwide phenomenon and is profoundly changing modes of sociability, the way the city is used, and even the way we look for a restaurant. We are no longer the same city dwellers we were during the first industrial revolution or even during the middle of the 20th century. Now, it seems abnormal to us not to know how many minutes we will have to wait for our bus in Paris. Twenty





years ago, the bus arrived "within a certain time." As for the impact digital has had on the urban form, in my opinion, we are only at the start of the process. Digital has slipped into everything, from dishwashers to cars, from stoplights to Velib bike sharing, but it has not yet profoundly modified the urban form. However, it has completely changed the modes of managing cities. Today, we are able to generate huge amounts of data that make it possible to follow certain aspects of the urban metabolism in real time, and we can cross-check this data in a much finer way than before. This does not mean, however, that all problems have been resolved.

INDEED, WE HAVE THE IMPRESSION THAT THE CITY ITSELF IS NOT CHANGING A GREAT DEAL, IN EUROPE AT LEAST...

We can't forget that a city is more than a physical reality. A city is made up of the millions of urban experiences and people who live there. The historically constructed framework can be preserved, but we are no longer living in the same inner Paris we used to. Cities have in a way been transfigured by digital, that is, they are lived, understood and experienced in a different way. The two books I've written on smart cities were related to my observation that the theme of smart cities came primarily from the digital industry, while the traditional players in architecture and urban planning had made very little use of it, especially in France. I explained that the smart cities movement would have enormous consequences on the way cities are designed. We are moving from a traditional city of flows to a city of happenings, of events. Geolocation represents one of the greatest disruptions in the relationship humans have to space. It is somewhat amusing to see to what degree everyone finds this completely natural. The real disruption is not that we no longer have to unfold a map, but that our life takes place on a map. The planet has become a map, a bit like the famous text by Jorge Luis Borges* on the map of the empire that is the same size as the empire. And this is one of the most fascinating aspects of the digital world, which allows us to zoom in and out continuously, from the planet to our garden and back again. It also carries many risks. The first is to imagine that reality is made the same way, with a risk of losing landmarks and scales. The information world is a world that has no scale, unlike the traditional physical world.

HOW CAN DIGITAL INTEGRATE CITIZENS INTO THE URBAN FUTURE?

We now have tools that allow us to consult with citizens, obtain feedback, and communicate. This is one of the assets of digital technology. There are still problems, however. Any mayor or technical department will tell you that this ease of communication can prove to be very disruptive! The problem is that you can make a lot of noise on the Internet without being very numerous in the physical world: a very organized group can mobilize against a project without being especially representative. It's a problem for urban planning, which used to begin from the principle that people needed to be represented based on their number in reality. On collaborative sites, 10% of the people author 90% of the contributions. This is true for Open Street Maps, and it was already true in the first online communities. On the Internet, as in many other areas, very few people are behind the majority of the contributions. One of the major challenges in the coming years will be to move past this issue. We will need to explore and create a new civic education, reconsidered for the digital era. Furthermore, smart cities cannot be

reduced to the matter of technical management only because the city remains fundamentally a political reality. Cities are not factories or machines. Even if their operation needs to be optimized, they cannot be reduced to a series of processes to roll out. It is much more complicated, and cities need collective imagination, hope and dreams. They are places of tension and conflict, and imagining that they can be easily managed in a digital world is, in my opinion, taking a very big risk.

WHAT DO YOU FORESEE FOR THE DEVELOPMENT OF PLATFORMS USED FOR DIGITAL EXCHANGES, DATA MANAGEMENT, AND SITUATIONAL UNDERSTANDING? IS IT INEVITABLE?

I think that it is certainly one of the most promising directions to explore today, and this is the reason why digital city projects are developing so quickly. Many social science researchers believe that we are in the midst of moving from a traditional way of thinking about infrastructure to thinking about platforms, and I am fairly convinced that something along these lines is being worked out. With digital platforms it is possible to combine more important initiatives, both quantitatively and qualitatively: more numerous, and in a wider range of fields; traditional infrastructure operated based on a very marked distinction between managers, operators and users. Platforms no doubt make it possible to be more flexible, and to involve very different players. Platforms open up new possibilities, in a world in which traditional roles seem a little too limited. They also enable combining traditional infrastructures and encourage inter-modality. They can integrate resources of very different types, which is also one of their strengths. The people who are connected to platforms are no longer solely users because this relationship can come in a variety of forms. Not everything is completely clear yet, but we are in a period of change. Finally, I am interested in the epistemology of cities and technical systems, and I tell myself that in the transition currently taking place, something fundamental is occurring.

THE PLATFORM MODEL THAT FACILITATES EXCHANGES IS BEGINNING TO BECOME CENTRAL, WHETHER IN TERMS OF INFORMATION OR PHYSICAL MOVEMENT. ARE NETWORKS THEREFORE ESSENTIAL?

Networks will in any case be managed by platforms, that's what is happening: a city's transportation system is integrated into a platform, to certain degree. To return to my idea about flows, what I find very striking is that with Uber, in the end, they are managing occurrences, meetings between a vehicle and a user. We are moving beyond the traditional, aggregate figure of the flow, to connect with issues related to collisions between particles. This is also what is changing the nature of the representation of the network. A traditional network managed flows. Today, we are managing occurrences that are much more atomized or individualized, with much greater granularity. What platforms also allow is to considerably increase an image's resolution, to zoom in to a certain degree, and on this point, in my opinion, we may still tend to underestimate the revolution this represents. But here again, a very profound transformation is taking place.

** On Exactitude in Science*

AUTHOR OF TWENTY BOOKS ON THE HISTORY OF URBAN PLANNING AND ENGINEERING, INCLUDING

Smart Cities
Théorie et critique d'un idéal auto-réalisateur, Paris, 2013

Digital Culture in Architecture
An Introduction for the Design Profession, Basel, 2010

Dictionnaire des utopies
(with Michèle Riot-Sarcey and Thomas Bouchet), Paris, 2003

Les Saint-Simoniens
raison, imaginaire et utopie, Paris, 2002

La ville territoire des cyborgs,
Paris, 1999.

L'art de l'ingénieur
constructeur, entrepreneur, inventeur,
Paris,1997

Architectes et ingénieurs au Siècle des Lumières,
Marseille, 1988

Chairman of the Fondation Le Corbusier

ANTOINE PICON, SHORT BIO

1957
born in France

1979
graduated from l'*École Polytechnique*, Paris

1981
Government civil engineer

1984
DPLG Architect.

1984-1994
Research Director at the *École nationale des Ponts et Chaussées*

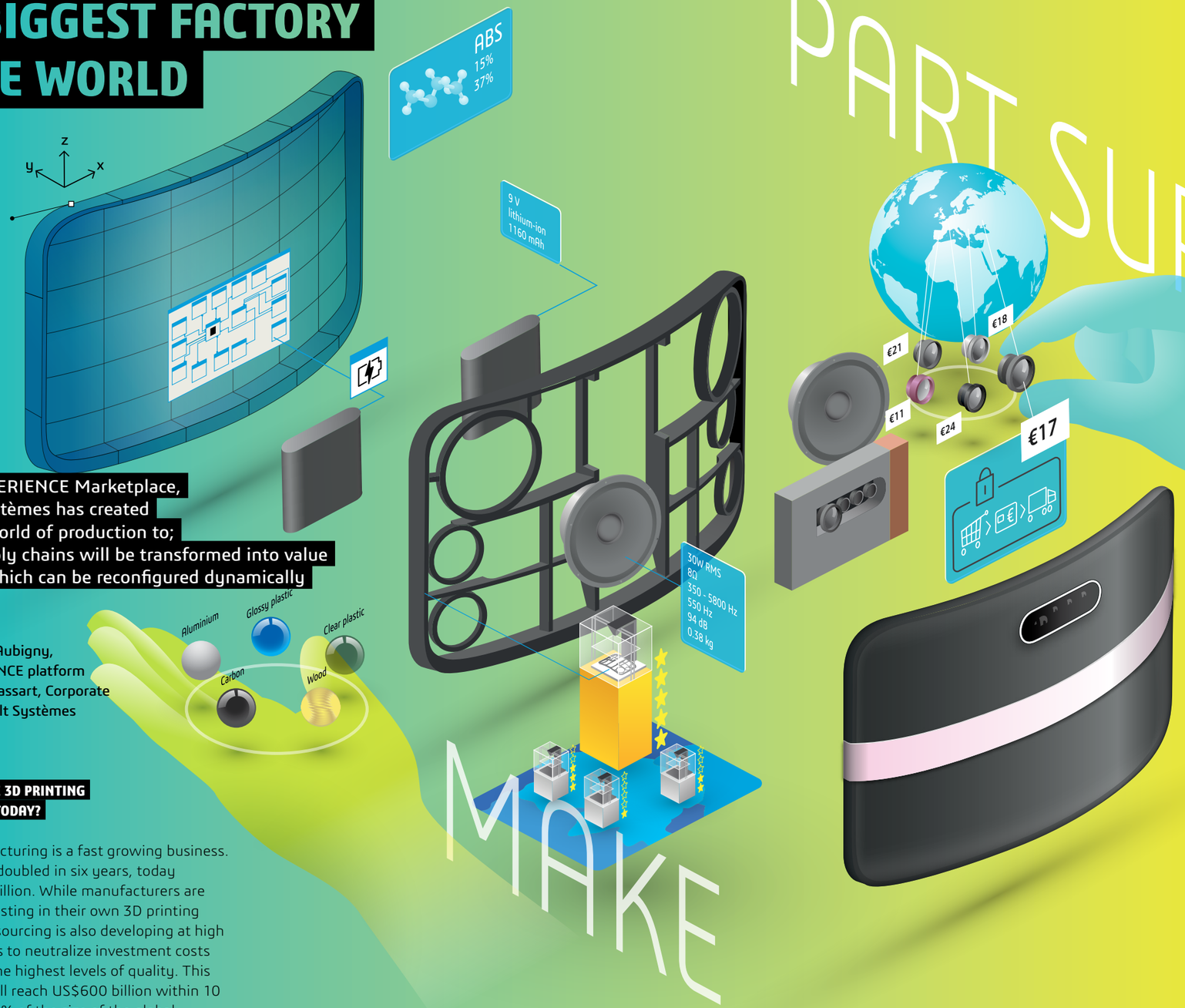
1991
Ph.D. in History prepared and defended at the École des hautes études en sciences sociales (EHESS)

1997
Professor at the École nationale des Ponts et Chaussées

2002
Professor of History of Architecture and Technology at the Harvard Graduate School of Design

THE WORLD IS WATCHING US

THE BIGGEST FACTORY IN THE WORLD



With 3DEXPERIENCE Marketplace, Dassault Systèmes has created the future world of production to; today's supply chains will be transformed into value networks, which can be reconfigured dynamically

By Florence Hu-Aubigny, R&D 3DEXPERIENCE platform and Sébastien Massart, Corporate Strategy, Dassault Systèmes

WHERE DOES THE 3D PRINTING MARKET STAND TODAY?

Additive manufacturing is a fast growing business. The market has doubled in six years, today reaching US$8 billion. While manufacturers are increasingly investing in their own 3D printing capabilities, outsourcing is also developing at high speed, as it helps to neutralize investment costs and guarantee the highest levels of quality. This market could well reach US$600 billion within 10 years, which is 5% of the size of the global manufacturing sector. Indeed, the challenge for companies is not necessarily to have their own 3D printing capacity, because this requires significant capital investment and the maintenance of specialized internal skills. Furthermore, there are peaks and valleys in resource demand, for example, if we think of prototyping activity. In most cases, the true challenge for a company is to know how to mobilize the right suppliers according to meet its own criteria of quality, responsiveness and price.

WHY IS ADDITIVE MANUFACTURING SO IMPORTANT TO INDUSTRY?

Additive manufacturing first developed in the world of small runs, or even single models and in particular for prototyping. Today, machine and productivity costs have fallen sharply and additive manufacturing is entering the world of production. Several of Dassault Systèmes' customers are using additive manufacturing for industrial production of parts, for example in the aeronautics and defense sector. The key point is that these new processes open up totally new possibilities. They enable creation of lighter parts than those machined with traditional manufacturing techniques, and it is possible to offer customized parts to customers, adapted to their situation and their structure.

3D printing not only refers to new ways of manufacturing, but also new ways of designing. There are no longer any limits on the complexity of shapes. The development of 3D printers goes hand in hand with the power of the associated software, which offers new solutions and other advantages. Generative design, for example, is based on artificial intelligence methods that enable the machine to propose the best shape in relation to given constraints. The role of the designer is no longer to draw a shape, but rather to express the intention – which corresponds to the etymology of the word "design." Design also is shifting toward bio-inspired forms, which capitalize on solutions developed by living beings over millions of years of evolution.

WHAT ARE THE CHALLENGES WE NEED TO MEET NOW?

One of the main challenges to be met is the use of additive manufacturing on a large scale. Today, it remains difficult to increase production to the required volume. Cost reduction will be achieved through increased market size. Moreover, to control costs, scalability and reproducibility need to be guaranteed for large volumes. Printing a part has no value outside the design, manufacturing and distribution chain. Digitalization is an essential vector throughout this whole chain, which does not tolerate any interruption. For example, 3D printing can be used in equipment maintenance, if digital models of spare parts are available. This is why Dassault Systèmes has created Part Supply, a one-stop shop where buyers can directly access 3D models of tens of millions of components. This will eliminate the logistics and management of unused inventory, since suppliers simply have to ensure that the 3D model for the replacement part is accessible, with the corresponding qualified printing process. We are witnessing the emergence of a new model for equipment manufacturers, and this will have considerable value for end customers!

HOW DOES 3DEXPERIENCE MARKETPLACE CONTRIBUTE TO THE EVOLUTION OF THIS LANDSCAPE?

Dassault Systèmes created **3D**EXPERIENCE Marketplace as an industrial marketplace. This means that suppliers are selected and assessed first and foremost on the basis of industrial criteria: certifications, reliability, respect for deadlines, for example. The **3D**EXPERIENCE Marketplace is thus a qualified industrial ecosystem them is suited, for example, to the medical or aeronautical fields. As we have built this marketplace according to industrial requirements, data traceability and protection are at its heart, especially because 3D models are a crucial aspect of industrial intellectual property. The Marketplace works in full continuity **3D**EXPERIENCE platform solutions, which providing all its functionality with regard to collaboration, geometric compliance and industrial standards. For example, the "geometry check" allows the manufacturer to test the geometry of the part and correct it if necessary before sending it out for production, taking into account the specifics of the technique and the machine selected. Using the **3D**EXPERIENCE platform means that design and manufacturing can be linked through a single solution, starting from generative design and optimization with CATIA or SOLIDWORKS, through the selection of materials with BIOVIA, part resistance tests with SIMULIA, piloting the manufacturing process itself with DELMIA, as well as searches in the 3D model databases with EXALEAD. It is not just an aggregate of functionalities, but a revolution in perspective: we will no longer create the same objects if we can estimate the price in the context of creation and design.

3DEXPERIENCE Marketplace can thus be considered the largest factory in the world, accessible in just a few clicks by all of our industrial customers.

WHAT ARE THE NEXT STAGES?

3DEXPERIENCE Marketplace was launched publicly in January 2018. Anyone can now print a product using the network of suppliers selected by Dassault Systèmes. Since January, we have been expanding this network and developing an "enterprise offer," enabling an industrial group to reference its own internal production capabilities to facilitate manufacturing management among its factories. A large group has many capacities that are not optimally exploited, because it is often difficult to identify them or to know their availability; with **3D**EXPERIENCE Marketplace, a factory can be mobilized by another factory for manufacturing sequences, with a price defined by the world market. This is what we are doing with Alstom, for example. Companies with productive capabilities will try to maximize the use of their assets by offering these services externally as well. Marketplace meets this objective, and its deployment will also be supported by 3D printer manufacturers, with whom we have set up partnerships, as they seek to offer their customers additional opportunities. Dassault Systèmes doesn't intend to stop at the production stage, but will again this year extend its offer by developing a Marketplace for engineering services, providing our customers with access to the best expertise in this domain worldwide.

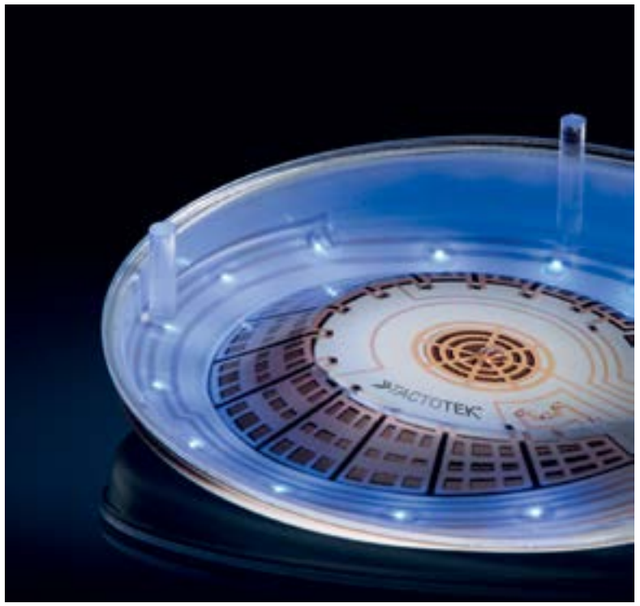
HOW DO YOU SEE PRODUCTION IN THE INDUSTRY OF TOMORROW?

Just as the fields of mobility and distribution are undergoing radical changes, the world of manufacturing must completely review its fundamentals because of the digital revolution. The example of 3D printing shows that it is not a question of digitalizing existing processes. In reality, the processes themselves must be revamped, with a new perspective on value. The radical transformation we are experiencing takes us back to "why?" before even examining "what?" and "how?." Industry is reshaping itself in the face of a new system of design, production and consumption. Dassault Systèmes is positioned at the heart of this Industry Renaissance. We can see that manufacturers who master the fundamentals of their value know how to turn things around to find a new role for human operators and reorganize their production capabilities. The **3D**EXPERIENCE platform has been designed to provide solutions in terms of knowledge and know-how, which allows capitalize on past experience and to consider situations that had never been imagined before.

We are observing this Industry Renaissance in a very practical manner, since our customers are now creating new products as quickly as people were creating websites 20 years ago, as hardware and software merge. No supply chains anymore! In the new industry, manufacturing is ensured by value networks that reorganize themselves dynamically and reactively, according to customer and geographical constraints. By providing direct access to a network of qualified suppliers, Dassault Systèmes' Marketplace is the vehicle for this revolution in the world of production.

NEW HORIZONS OPEN UP
FOR 3D PRINTING

Initially limited to modeling and prototyping, additive manufacturing is broadening its field of application. It is now being used for the mass production of certified original parts, as well as encapsulating molded electronics when mounting equipment.



AIRBUS APWORKS DEVELOPS THE PRODUCTION OF 3D PRINTED PARTS

Dassault Systèmes has signed a partnership agreement with AIRBUS APWORKS, a subsidiary of the aerospace group, which is specialized in 3D printing using metal. Its objective is to further develop the use of additive manufacturing for large-scale production in various industries, including aerospace, automotive, machinery and robotics. This collaboration will take full advantage of the **3D**EXPERIENCE platform and the expertise of APWORKS in consulting, engineering and production, in order to virtually validate additive manufacturing processes.

The digital continuity of the process provides a unique source of data, starting with the material design and test phases through the mass production of parts. By integrating 3D design with engineering and simulation, it is possible to optimize the parts for additive manufacturing, offer standardized settings and define standards for certification. The following stages, including tests optimization and the mass additive production of parts, can thus be adapted to the define settings.

TAKTOTEK INTEGRATES ELECTRONICS INTO 3D MOLDED PARTS

Injection-Molded Structural Electronics (IMSE™) solutions developed by TactoTek™ integrate functions such as lighting, connectivity and electronic controls into thin 3D-molded parts. Using SIMULIA's electromagnetic simulation, the functionality and performance of each electronic component can be optimized and checked. TactoTek develops prototypes and manufacturing processes with standard manufacturing equipment suitable for mass production.

IMSE solutions integrate control electronics and electronic components into injection-molded plastics. They replace the traditional multi-part electromechanical assemblies with one-piece, intelligent surfaces that are lightweight, thin and durable. IMSE solutions bring electronic functions into stylish cosmetic surfaces, as well as for unconventional locations and materials.

HACKATHON
A term composed from the words hack (indicating IT development that is intense... and a little wild) and marathon. Refers to an event during which a group of developers come together for collaborative coding in a short period of time. By extension, the term has expanded beyond the IT field.

ENERGIZED BY THE HACKATHON

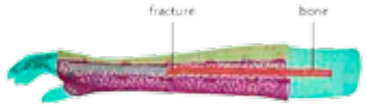
An exciting atmosphere, enthusiasm for an ephemeral event, and quality contributions: the future of additive manufacturing looks promising, and Dassault Systèmes solutions demonstrated their effectiveness in meeting the challenges of 3D printing.

This year, the "Science in the Age of Experience" event, held in Chicago from May 15-18, welcomed its first hackathon. Students from around the world invited to compete and were presented with four real engineering problems in the field of additive manufacturing. Over two days, the students worked feverishly in small teams at their workstations, supplied by Dassault Systèmes. They had access to all the necessary software: functional generative design, process configuration, simulation and topographic optimization, and were also able to benefit from the advice of business experts ready to answer their questions.

At the end of the hackathon, all of the groups presented their work to a panel of representatives from research labs and Dassault Systèmes. Each project was evaluated based on aesthetics,

originality, product performance, manufacturability and usability.

This kind of inspiring event will help address the challenges faced by additive manufacturing, which remain numerous: reduction of resistance and rigidity, design complexity for organic and hollow structures, new constraints and requirements in design (especially for support structures), warping of parts during the printing process and discrepancies between the designed parts and printed parts.



7 TEAMS, 4 CHALLENGES, 2 DAYS!

CHALLENGE 1:
PRINT A THIN-WALLED COLUMN ON A BED OF METALLIC POWDER

CHALLENGE 2:
DESIGN A WORKING BOTTLE OPENER

CHALLENGE 3:
DESIGN AN EXTERNAL SENSOR ASSEMBLY FOR THE AERONAUTICS INDUSTRY

CHALLENGE 4:
DESIGN A BICYCLE GOOSENECK

Some teams came with their own challenge: for example, optimizing of race car components, or an arm cast designed specifically for a given patient. The arm-cast project, from Purdue University in the United States, took top prize in the hackathon. The students demonstrated the relevance of digital simulation tools in creating this customized object intended to effectively support an arm and ensure quick recovery from a fracture.

THE DIGITALIZATION OF LEAN PRACTICES IN WORKSHOPS

Widely used in production units in all business sectors, Lean Manufacturing is taking on a new dimension, thanks to the power of digital

THE CHALLENGES OF LEAN MANAGEMENT

Companies that implement Lean must meet several challenges. In particular, they have to find answers to several key questions:

- How to ensure that Lean methodologies have been deployed?
- How to confirm that corrective measures are taken and followed up each time a problem is detected?
- How to create the conditions that encourage people to commit to a shared objective?
- How to sustain a good level of collaboration between the various teams?

THE ANSWER BY DELMIA 3DLEAN

DELMIA 3DLean digitalizes and facilitates the deployment of Lean practices in a customizable and interactive way. It benefits from tactile technology to moderate Lean meetings in workshops (daily, weekly, monthly, quarterly). DELMIA 3DLean provides full independence to teams by adding human intelligence to workshop data, and meets real operational needs by using interactive solutions led by a person.

DELMIA 3DLean also enables those leading the approach to disseminate Lean practices to the heads of workshops, and through them to their teams or internal suppliers.

By creating digital continuity across organizational barriers, 3DLean allows each team to implement the appropriate actions, follow up the decisions with stakeholders upstream and downstream, and collaborate transparently with them. In this way, it ensures that challenges – involving design, engineering or production, are dealt with and that comments are sent to those who can or must be involved in resolving them. Finally, DELMIA 3DLean records and preserves institutional knowledge, organizational practices, intellectual property and know-how on best practices in manufacturing.

DID YOU SAY LEAN?

Lean Manufacturing is the Western version of a production system originally invented in the Japanese automotive industry. It is based on eliminating waste (inventory, excessive safety margins...) and in processes, and aims to increase capacity by reducing costs and cycle times. Lean depends on knowing customer needs, just-in-time systems, systematic problem-solving, and the importance of involving operators in a continuous flow. Visual management is a key to Lean Manufacturing.

HOW INDUSTRIAL PRODUCTION WILL BE TRANSFORMED

THE VIEWPOINT AND ANALYSIS OF

JULIEN CALVIAC
IoT Cross-Industry Solutions,
Senior Director,
Dassault Systèmes

WHAT DOES THE 3DEXPERIENCE PLATFORM BRING TO INDUSTRIAL PRODUCTION?

The **3D**EXPERIENCE platform provides digital continuity, from the design phases right up to the manufacturing line and maintenance. As a result of this continuity, any update in product design naturally creates an update in the production line, so our customers gain in agility and reduce their time to market. If a manufacturer can interpret Internet of Things (IoT) data in the context of a **3D**EXPERIENCE twin, it will be able to make better decisions and enrich the virtual model. Above all, this twin can be used to optimize simulation models, so that they are as close to reality as possible.

HOW WILL THIS CHANGE RELATIONS AMONG THE DIFFERENT PLAYERS IN INDUSTRY?

Today, industrialists are investing in predictive maintenance for machines that are already on the production line, often machines that are old and not connected. The new machines of tomorrow will natively include this type of service. Manufacturers and users of machines will work hand in hand, sharing data and operational responsibilities. We will have an important role to play as suppliers of an environment conducive to this collaborative innovation, from the design phases right up to the operational phases.

CAN ARTIFICIAL INTELLIGENCE BE USED FOR PREDICTIVE MAINTENANCE?

Using AI and big data to predict breakdowns and optimize industrial processes is possible today, but only over the short term. Going beyond this first stage, AI and agile innovation offer a true opportunity to drastically reduce the impact of these breakdowns, and indeed, avoid them before they occur. Human beings will be at the heart of this innovation, assisted by AI. This will require much faster interaction between operating and design systems. We intend to bring these two worlds closer together to achieve a profound transformation of the 4.0 factory.

IN THIS CONTEXT, HOW CAN DASSAULT SYSTÈMES ACCOMPANY ITS INDUSTRIAL CUSTOMERS?

Our aim is to help our customers make the best possible use of their IoT data in the context of their business and their innovation. We do not intend to offer solutions for all types of connectivity architecture and data collection. To meet a certain number of specific needs, we will be calling on our partners, systems integrators and specialized IoT platforms. But we will be moving toward open platforms that are not potential competitors.

A NEW SOLUTION

FOR A UNIFIED LABORATORY

By integrating and standardizing the data, resources and processes of organizations dedicated to research, development and quality, ONE Lab improves operational excellence, collaboration and time to market of new therapeutic advances

THE CHALLENGES FACED BY THE LIFE SCIENCES INDUSTRY

Today, the life sciences industry, especially the pharmaceutical industry, is facing major challenges, including patent expiration, low R&D productivity, increased worldwide competition and reduced margins, as well as compliance constraints. Research for new molecules, pre-clinical studies on animal cells, phase 1, 2 or 3 studies that include numerous therapeutic trials and other investments related to research and clinical development are considerable and require long cycle times. They must be amortized after only a few years of use, before the patent becomes part of the public domain. This generates cost pressures in an already strained health economy.

In laboratories, the necessary information is difficult to access, and unstructured data lacks context when decisions are made. The shortage of reliable information represents a risk for strategic business decisions. These decisions must be based on scientific data from multiple sources, which need to be verified to guarantee their integrity and quality. Testing and documentation require significant time and effort; disorganized processes delay the research, development and commercialization of finished products, while also driving up costs. Finally, in a sector tightly controlled by regulations and standardized processes, the effort required for document compliance can weaken customer responsiveness.

3 COMPONENTS, ONE LAB

Research, development and quality control are essential for pharmaceutical laboratories and biotech companies. ONE Lab addresses these three specific functions: it strengthens collaboration and decision making by simplifying the exchange of data and providing more coherent information. It facilitates the design of therapeutic solutions in a more efficient and cost-effective way by automating processes.

RESEARCH

ONE Lab inventories the knowledge of systems and their interactions with certain therapeutic agents

DEVELOPMENT

ONE Lab improves data quality and reduces noncompliance risk through standardization and automation

QUALITY

ONE Lab improves success rates, beginning with the first trial, by driving compliance with procedures and policies while supporting quality and regulatory initiatives

THE ANSWERS PROVIDED BY ONE LAB

The ONE Lab solution unifies, integrates and standardizes resources, laboratory planning, recipes/methods, lab execution and reporting for improved efficiency and collaboration. Equipment, material, laboratory procedures and data, when used in a standard way, ensure a unified user experience.
ONE Lab reduces repetitive tasks and provides information faster. And it permits a better understanding of processes and data, allowing scientists to leverage knowledge empirically as they build and refine models that support laboratory experimentation and testing. Uniform and complete adherence to scientifically developed processes is necessary for a smooth transition from research to development to commercialization.

WHERE THE FUTURE BECOMES REALITY

The first two **3D**EXPERIENCE Centers opened in 2017 in Hamburg and Wichita, Kansas, to accelerate aerospace development.

NEW CHALLENGES IN THE AEROSPACE INDUSTRY

Airplanes produced today face multiple challenges, even as expectations for the industry grow, including speed at lower costs, requirements and standards, increased capacities, complex programs that require interoperability, intelligent manufacturing and supply chain integration. Meeting these imperatives is essential to competitiveness. Hybrid manufacturing – both additive and subtractive — as well as cobotics (human/robot collaboration), are two of the catalysts for the factory of the future. Virtual and immersive technologies make it possible to simulate the operation and accelerate wide-scale adoption of both hybrid manufacturing and cobotics. To succeed, however, users need to learn new ways of conceptualizing, designing, manufacturing, testing, certifying, and maintaining new planes. The **3D**EXPERIENCE Centers were created to accelerate innovation and provide training and experience.

April 2017:
Opening in Wichita

In partnership with Wichita State University and the National Institute for Aviation Research (NIAR), the **3D**EXPERIENCE Center is part of the 123-acre Innovation Campus

The Innovation Campus brings together academia, a community of researchers and multiple industries through companies that include Airbus and Spirit AeroSystems. The mission of the Innovation Campus and the **3D**EXPERIENCE Center is to advance the state-of-the-art for product development, manufacturing and operations through a "Learning by Experiencing" model. The "Learning by Experience" model develops the workforce of tomorrow and associated, required skill sets. The **3D**EXPERIENCE Center is composed of five integrated, state-of-the-art labs and three customer collaboration rooms (CCR), all unified on the **3D**EXPERIENCE platform.

THIS CENTER CONSISTS OF FIVE MAIN LABS:

- The Dassault Systèmes Lab (digital continuity and **3D**EXPERIENCE twin)
- The Immersive Lab (virtual and augmented reality).
- The Robotics and Automation Lab (multi-robotic advanced manufacturing [MRAM] and the factory of the future)
- The Reverse Engineering Lab (scanning, quality inspection and certification)
- The Additive Manufacturing Lab (various polymers and metals for prototype and production parts)

The **3D**EXPERIENCE Center has three customer collaboration rooms (CCR) where various disciplines can work together in a state-of-the-art collaborative environment. The collaboration rooms were at the heart of various projects, including the Airbus Thrust Reverser project and the UAS (unammed aerial systems) project, dedicated to unmanned aircraft systems and drones. The **3D**EXPERIENCE platform enabled participants to explore and validate a large number of designs, and to understand the programs' impacts. The center's ultimate goal is to create a new system of work, with an ambitious mission to reduce a 3-5 year lifecycle down to 90 days for UAS platforms, and for platforms such as satellites.

MRAM SOLUTIONS

In Wichita, Multi-Robotics Additive Manufacturing (MRAM) makes it possible to create any shape without restriction. In particular, MRAM can 3D-print chopped fiber-reinforced composites and execute many other advanced manufacturing techniques to accelerate production.

July 2017: Opening in Hamburg

The **3D**EXPERIENCE in Hamburg was created as part of the Applied Aviation Research Center, the Zentrum für Angewandte Luftfahrtforschung (ZAL). It is the largest collaborative aviation research center in the world.

Dassault Systèmes brings more than 35 years of expertise, a network of partners and a shared global platform to the ZAL. The result is a partnership that brings researchers and entrepreneurs together to transform ideas into fully functioning, high fidelity models and systems prior to committing physical resources.

The center's first research projects focused on cobotics, augmented reality and a detailed virtual definition of the factory of the future.

"Creating the future of aviation through open innovation and shared expertise, where innovation is reached faster and with lesser costs. A vision, which is shared by all of the strong partners that have made the ZAL TechCenter reality."

Roland GERHARDS
CEO, ZAL

"The factory of the future will be human centric on all aspects: quality of work, quality of the end experience and quality of imagination. The **3D**EXPERIENCE Center is a new environment where people can become true makers of great things for society."

Bernard CHARLÈS
Vice Chairman of the Board of Directors and Chief Executive Officer, Dassault Systèmes

"It is much easier to change and innovate the system of work in context of an innovation center like ZAL, where all the capabilities are there and where partners can come and experience, like they have never done before."

Jeff SMITH
Aerospace & Defense Idea Lab Vice President, Dassault Systèmes

"Creating digital continuity from one end of the A&D process to other end, and introducing all the technologies which will innovate the A&D industry, are here at the innovation centers like ZAL and NIAR. This gives the industry opportunity to industrialize and regulate these new processes and technologies."

Michel Tellier
Aerospace & Defense Industry Vice President, Dassault Systèmes

A COMBINATION OF EXPERTISE AND TOOLS

Each **3D**EXPERIENCE Center offers different options for its participants, including a one-day presentation of the **3D**EXPERIENCE platform, a personalized workshop for 3-5 days, an incubator that houses the customer's team for 3-6 months, or outsourced engineering work (test and simulation) for variable lengths of time.

VIRTUAL REALITY

The **3D**EXPERIENCE Centers in Wichita and Hamburg each has an Immersive Lab dedicated to virtual reality and augmented reality, facilitating the development of new user experiences associated with the product.

REVERSE ENGINEERING AND INSPECTION

Reverse engineering and inspection technology offers engineers the ability to scan complex parts, which can then be used to create new virtual representations and inspect new parts for certification and quality control.

NEW PARTNERSHIPS

Additional **3D**EXPERIENCE Centers will be followed by more openings soon, establishing new partnerships. In these centers, companies will be able to develop innovative materials; simulate and optimize systems; perform engineering and manufacturing processes; facilitate the multi-level certification of processes from start to finish, from the initial concept to production and maintenance; and visualize products in use at any stage of their life cycle.

INNOVATIVE ARCHITECTS UNLEASH THEIR CREATIVITY

During the 'Design in the Age of Experience 2017' event, architects and designers previewed and tested a new generative design solution as part of a hackathon

Creators, stylists, architects, urban planners, inventors: all of these professionals need inspiration. If the products and structures they develop create an emotional experience, they know they have reached their goal. The hackathon that took place in Milan as part of "Design in the Age of Experience", an event organized by Dassault Systèmes to help change the way creators and designers innovate, brought together six teams that paired 17 architects with Dassault Systemes technology experts.

MILAN HACKATHON

APRIL 4-5, 2017

24
HOURS, NON-STOP

6
TEAMS

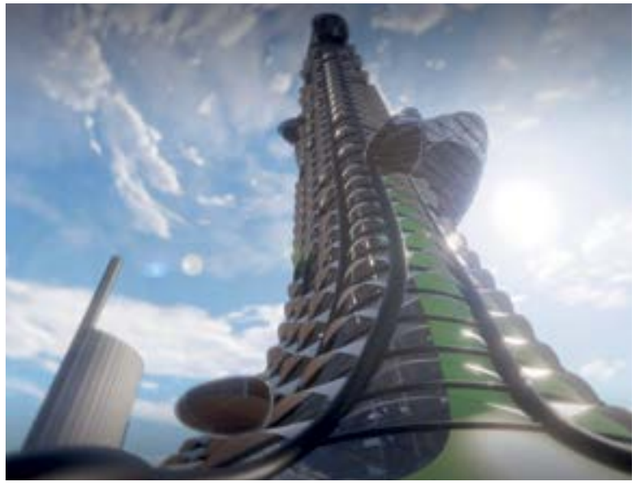
32
PARTICIPANTS

17
ARCHITECTS FROM AROUND THE WORLD, FROM THE MOST CUTTING-EDGE FIRMS

13
EMPLOYEES FROM CATIA R&D

3
COORDINATORS

+ THAN 60
ANIMATIONS AND VIRTUAL PRESENTATIONS



STIMULATING HUMAN CREATIVITY

The goal of the hackathon? To see what happens when some of the most creative architects work intensely with CATIA R&D teams in a fun environment. This shared work aimed to develop new capabilities for generative design, while also simulating a natural environment in a progressive way and making use of big data, artificial intelligence and virtual reality.

As designers imagine, the solution identifies the best-engineered solutions in terms of physical constraints, feasibility, reliability and even cost. Essentially, the software supports human creativity: generative design optimizes, while also opening new doors for architects to explore unexpected, complex and unique paths.

TESTING IN REAL CONDITIONS

The goal of generative design is to enable new solutions that encourage creation in the field of architecture, engineering and construction. Of course, Dassault Systèmes already offers solutions for development, engineering, simulation and manufacturing in this field. But this hackathon was all about providing geniuses with a quick creation tool and testing it in real conditions, with realistic time and subject constraints.

By including creative designers, architectural designers and R&D developers in the same project, the hackathon went beyond the customer-user and solution-provider relationship. By working alongside architects, our CATIA R&D experts gained an even better understanding of the professionals' daily needs. In the end, the goal of the event was to strengthen ties between the future product's first users and development teams, in a limited but very stimulating environment. From this point of view, it was a complete success!

ARCHITECTURE IS ALSO CREATIVE AND FUN!

In the field of civil engineering, architecture, engineering and construction, the initial creation phase is essential. Architects must be able to unleash their creativity and productivity by making use of tools that allow their visions to come alive and their dreams to take shape. Dassault Systèmes solutions unleash the imagination of architects by combining creation with design. They open up new perspectives, allowing creative people to see further, bigger, and more beautifully. They can be more creative and imaginative in 3D.

The rules of the game: invent a mixed-use center

A veritable industrial wasteland in Milan to re-develop.

10 perspectives, defined as the basis for submitting images to illustrate concepts.

An exemplary urban building, in terms of functional cohabitation, including:

A CONCERT HALL
AN EXHIBITION SPACE
OFFICES
GREEN SPACES AND A RECREATIONAL PARK
RESTAURANTS

THE WORLD IS WATCHING US

SUSTAINABLE DEVELOPMENT

N°1

Company in the 2018 Corporate Knights Global 100

Dassault Systèmes was rated the top company in the Corporate Knights Global 100 index, which ranks the world's most sustainable corporations. The list is announced annually during the World Economic Forum in Davos.

VALÉRIE FERRET
Public Affairs and Sustainability Director at Dassault Systèmes

"We don't just optimize; we also invent what doesn't yet exist."

For most companies, sustainability is a journey, but Dassault Systèmes has been following this route ever since its creation in 1981. We pursued sustainable development well before the term even existed, even if it wasn't always explicit in our communication. At the time, it was a question of optimizing the manufacturing processes. The company began working on product lifecycle management (PLM) in the 1990s, with the aim of helping the manufacturing industry to harmonize products, nature and life.

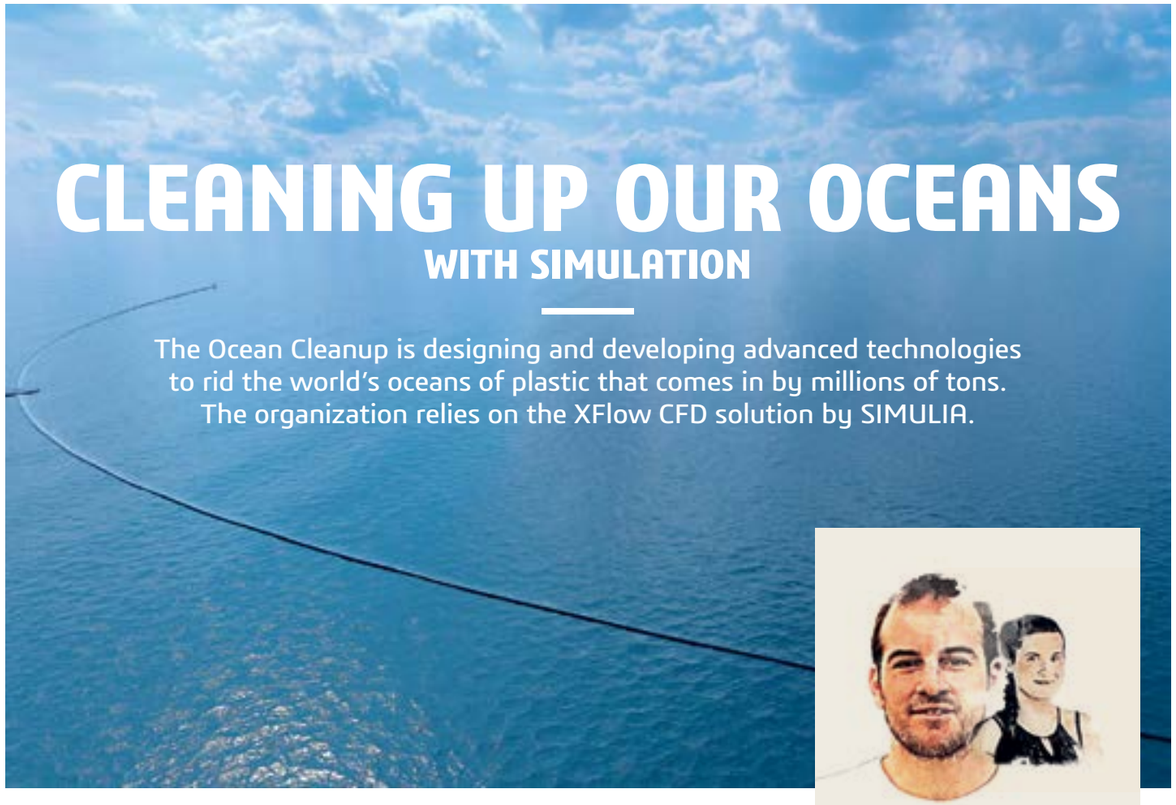
Virtualization is a powerful tool that saves resources and materials, but that also promotes innovation by testing an infinite number of possibilities. Our objective is to virtualize as many industrial processes as possible so that companies can get things right the first time and eliminate waste and errors in the real world, at all stages of production. Yet, although 3D design has created a wonderful opportunity to optimize production processes, this is not its main role. Digitalization also helps to transform economic models and create strategies based on the sharing economy and the circular economy. It is not just a question of optimizing, but also inventing.

Finally, we pay more than 30% of our income in taxes. We are convinced that this is a way of contributing to healthcare, education and other essential investments for social development. The fact that this indicator is used in the ranking means a lot to us.

GLOBAL 100: CLEAR METHODOLOGY

- An approach driven by data, not judgment
- Transparent methodology to shortlist 100 finalists out of the 5,994 companies initially evaluated
- Companies are only rated on criteria relevant to their respective industry.
- Companies are rated 0 in the case of non-disclosure of a criterion
- The methodology is based on indicators that can be measured objectively

The approach and methodology are reviewed annually through stakeholder consultations and expert input. Dassault Systèmes benefited from changes made in 2018, which for the first time emphasize the proportion of sales coming from services or products that are beneficial to the environment.



CLEANING UP OUR OCEANS

WITH SIMULATION

The Ocean Cleanup is designing and developing advanced technologies to rid the world's oceans of plastic that comes in by millions of tons. The organization relies on the XFlow CFD solution by SIMULIA.

A significant percentage of this plastic drifts into large systems of circulating ocean currents, also known as gyres. Once trapped in a gyre, the plastic will remain there, while breaking down into microplastics over time, and making it increasingly likely that sea life will mistake the plastic for food.

Going after plastic with vessels and nets is costly, time consuming, labor intensive and leads to vast amounts of carbon emission and by-catch. That is why The Ocean Cleanup is developing a passive collection system that moves with the currents – just like the plastic. The Ocean Cleanup's passive system consists of a floater with an impermeable screen underneath, which concentrates the debris so that it can be easily extracted and brought to shore for recycling.

The Ocean Cleanup is using XFlow computational fluid dynamics (CFD) software, developed by Dassault Systèmes' brand, SIMULIA, to improve the efficiency of its system designs for capturing plastics. Bénédicte Dommergues, a modeling engineer at The Ocean Cleanup, presented their achievements with XFlow at the 2017 XFlow User Conference held in Madrid, Spain.

In her presentation, Dommergues demonstrated how XFlow CFD simulations enabled researchers to study the effect of the screen design on its drag and on the flow around it. The screen is important for the system because it slows down the floating barrier and creates a difference in speed between the plastics and the barrier, allowing the strainer to concentrate and extract the plastics.

The importance of the topic and the high quality of this work led to the project receiving the conference attendees' vote for the Best Presentation, awarded by XFlow's General Manager, David Holman.

A testimonial from The Ocean Cleanup

"Being able to use XFlow in the design process of our systems helped us meet The Ocean Cleanup's ambitious timeline. XFlow was able to deliver insightful results in record time, allowing for fast iterations which addressed the complex multiphysics problems – free-surface, turbulence, particle transport, fluid structure interaction, porous media – involved in the capture efficiency of The Ocean Cleanup systems."

BRUNO SAINTE-ROSE,
Lead Computational Modeler, The Ocean Cleanup

THE WORLD ENLIGHTENS US

2030

230 M

VEHICLES IN EUROPE

2017

200 M

VEHICLES IN EUROPE

2030

1Km/3

WILL BE SHARED

2030

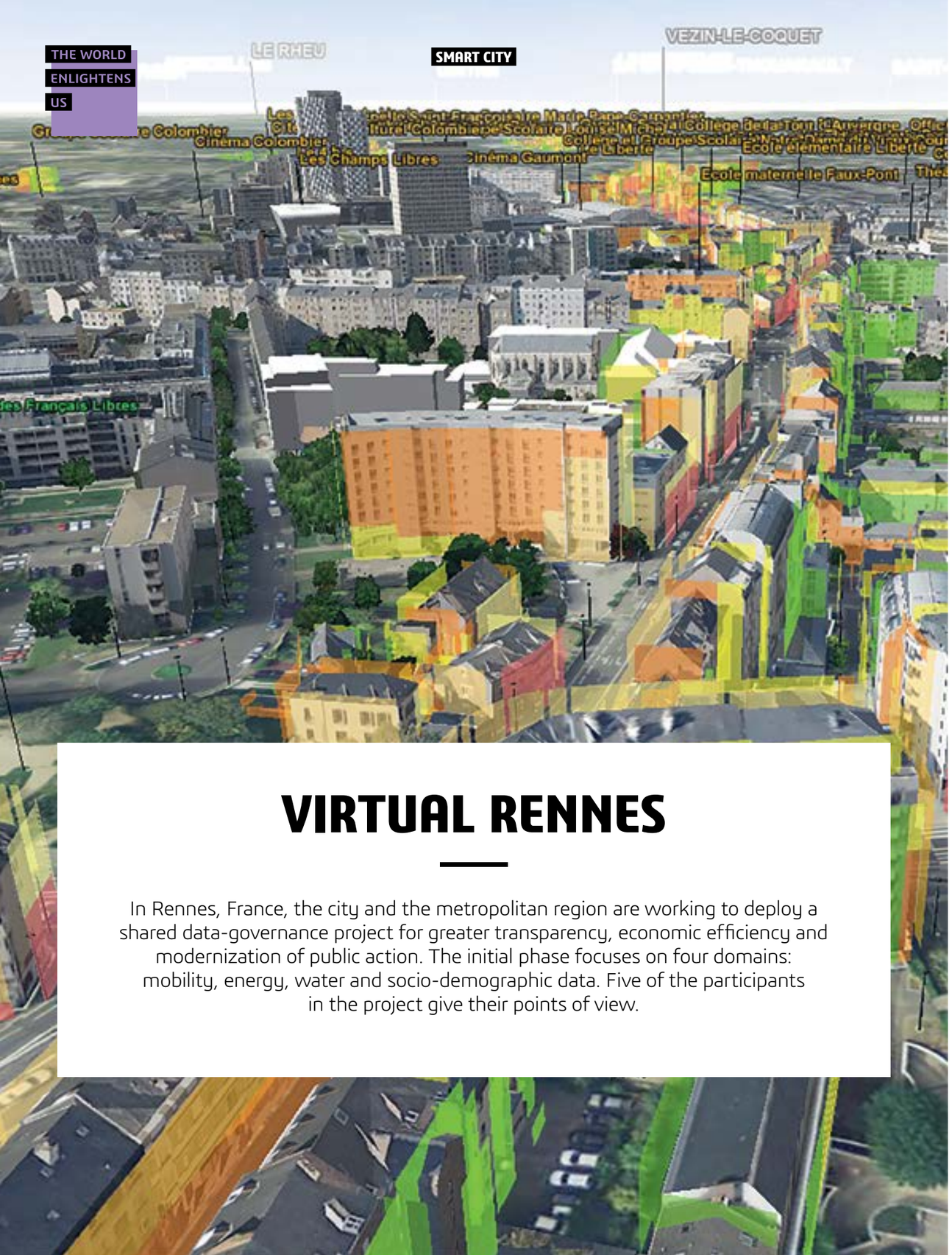
40%

OF KMS WILL BE TRAVELLED IN AUTONOMOUS VEHICLES

2030

55%

OF THE VEHICLES WILL BE ELECTRIC



VIRTUAL RENNES

In Rennes, France, the city and the metropolitan region are working to deploy a shared data-governance project for greater transparency, economic efficiency and modernization of public action. The initial phase focuses on four domains: mobility, energy, water and socio-demographic data. Five of the participants in the project give their points of view.

A HOLISTIC VISION OF THE CITY

Séverine Chapus,
Territories and **3D**EXPERIENCity Vice President

"The project that we are running in Rennes is at the heart of the **3D**EXPERIENCE platform. It is a collaborative project to transform the way in which our regions, in all their complexity and diversity, are understood, constructed, managed and developed.

Through a partnership of trust and high expectations between Dassault Systèmes and the city of Rennes, we are reproducing, in an integrated virtual environment, a holistic and operational vision of a set of complex systems – mobility, energy and resource management, built environment and citizen services. Understanding the past to make informed decisions that will have a long-term impact on quality of life - such is our ambition!"

TOWARD THE CITY OF THE FUTURE

Paul Pechenart,
Senior Solutions Consultant, Dassault Systèmes

"When Dassault Systèmes began reflecting on the city of the future, the company very soon started working with Rennes. Indeed it was in Rennes, in 1999, that we developed the first full 3D model of a city, shown to its inhabitants in real time, for the transition to the year 2000. In November 2014, we signed an experimentation contract with Rennes Metropolis, for a duration of three years. The aim was to show our capabilities with regard to an urban collaborative platform."

A DATA GOVERNANCE PLATFORM

Matthieu Francoz,
Senior Business Consultant, Dassault Systèmes

"The question of a trusted third party is an extremely important aspect of Virtual Rennes. This city can legitimately collect data and organize governance of this data. Accordingly, the project that we have built together is a data governance platform. It is linked to a new service offered by the entity known as Rennes Metropolis: SPMD - the Metropolitan Public Service for Data. This platform will be used by elected city representatives when they need to make decisions. It will first be opened to partners, startups and service companies, and then to citizens by around 2030. What gives great reassurance to the local authorities is the fact that Dassault Systèmes is an industrialist that proposes a solution. It does not produce nor claim to be the owner of the data. It works at the service of the Metropolis, which is not always the case elsewhere in the world."

NEW USES OF DIGITAL FOR LOCAL AUTHORITIES

Guillaume Lenoel,
R&D Globe Applications Manager, Dassault Systèmes

"Virtual Rennes is a research project that sets out not only to validate new digital uses, but also to test their deployment with the authorities. In terms of results, we have made good progress on subjects that highlight collaborative practices, which this platform emphasizes and encourages. And so in this project there is both a technical aspect and an economic aspect targeting the research and development of innovations. Ultimately, Rennes Metropolis will validate the application and the services offered by the platform in terms of business needs and functionalities."

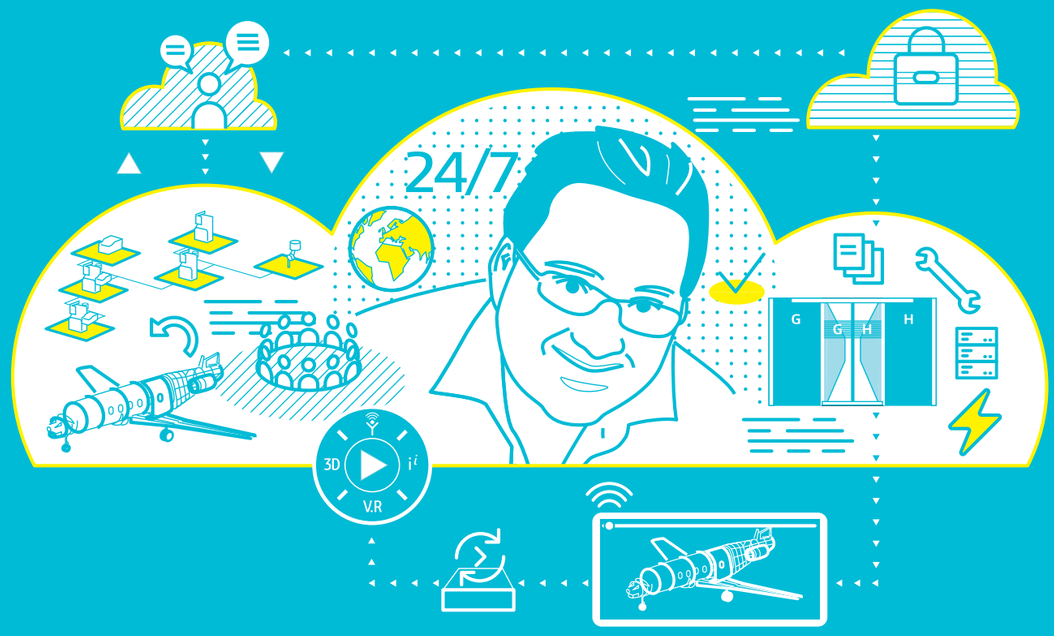
A MEDIATION TOOL THAT GIVES STAKEHOLDERS A VOICE

François Gruson,
CEO of ABFG4S, a Project Partner

"One of the strong points of Virtual Rennes comes from the fact that we are not just simply in discussion with a customer contact – in this case Rennes Metropolis – but with a whole ecosystem. The Department for Development and Urban Planning, which deals with land development and urban studies, the local urbanism plan and building permits, has developed the widest possible vision, including a systematic approach to town planning. The project includes relations with other players in town planning, but also with citizens and innovative small and medium enterprises (SMEs) in the city area. Another specific feature of the Virtual Rennes project, compared with other Smart City virtualization projects, is the existence of a scientific committee, run by Antoine Picon."

CLOUD

OUTSCALE: 3DEXPERIENCE IN THE CLOUD



OUTSCALE

2008
DECISION TO MAKE DASSAULT SYSTÈMES SOLUTIONS ACCESSIBLE IN THE CLOUD

2010
ARRIVAL OF LAURENT SEROR AS HEAD OF CLOUD COMPUTING STRATEGY. CREATION OF OUTSCALE, A DASSAULT SYSTÈMES SPIN-OFF, TO BENEFIT FROM THE AGILITY OF A STARTUP

2017
DASSAULT SYSTÈMES TAKES A MAJORITY STAKE IN THE COMPANY

2018
EMPLOYEES IN FRANCE, THE UNITED STATES AND HONG KONG

INTERVIEW WITH

LAURENT SEROR

Founder and CEO of Outscale, cloud services supplier for Dassault Systèmes

HOW WAS OUTSCALE FORMED?

Outscale was initially the idea of Bernard Charlès who, in 2008, decided to make Dassault Systèmes a major player in the cloud, most notably in Software as a Service (SaaS) solutions. The idea of making the wealth of functionalities of Dassault Systèmes solutions accessible through a web browser was visionary.

I joined Outscale to take care of back office operation; that is, the datacenter, servers, and storage, all the problems involved with the 24/7 operation and support in terms of infrastructure. Today, we are able to deploy our technology in a few months anywhere in the world, as soon as we have the required elements, such as a datacenter with reliable power, cooling capacities, etc. Our industrial solution suits any customer that requires performance, security and technical support, which our teams can provide.

WHAT MAKES OUTSCALE A MAJOR PLAYER IN ITS MARKET?

Making **3D**EXPERIENCE accessible in the cloud represents a 'tour de force,' because the requirements are very high for a product lifecycle management (PLM) solution like ENOVIA, for example, in terms of technical functionalities, network latency, and data base access time. Our competitors choose the "lowest common denominator." However, Outscale provides very industrialized components that make it possible to go further and use software in an HTML5 browser through streaming. And all of our network solutions have been specifically built to improve the performance of **3D**EXPERIENCE. Outscale is the perfect companion for this platform.

HOW DO YOU SEE YOUR MODEL EVOLVING?

In the same way that the printing press gave access to knowledge to the masses, **3D**EXPERIENCE will greatly increase access to 3D, and Outscale's role is to facilitate this availability.

Our objective is to provide access to **3D**EXPERIENCE not only to countries, but to companies as well. Moreover, today, the platform is also available on a company's network, which we operate and for which we provide the infrastructure and cloud service layers, just like on a public cloud. We are able to set up private or hybrid clouds, providing our customers with unlimited access to all the benefits of **3D**EXPERIENCE, even if there is no public cloud in their country. We are thus able to offer a turnkey solution to our customers: they do not have to do anything; they have their secure infrastructure that we operate and they can use **3D**EXPERIENCE. They buy their licenses online, which are then automatically deployed locally.

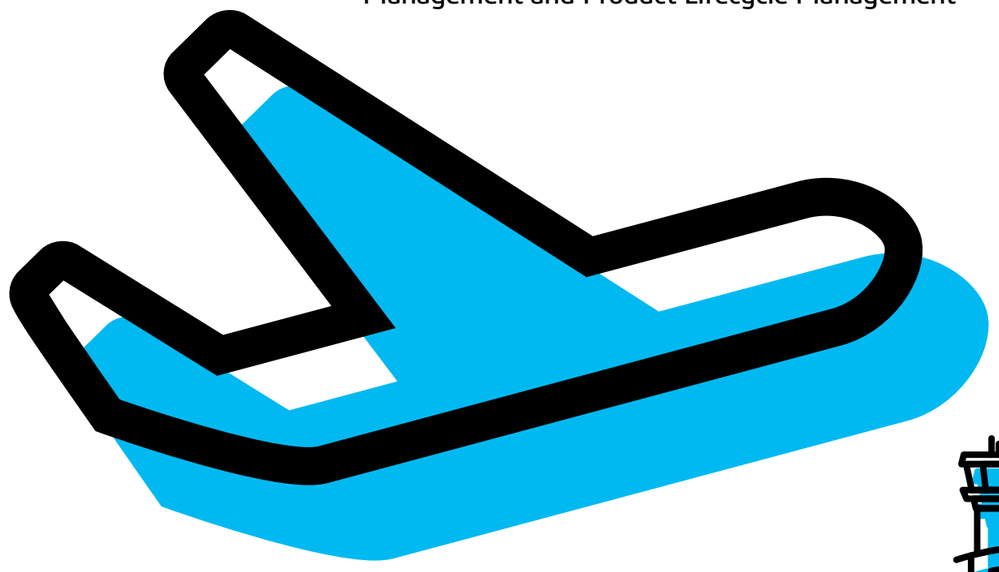
The entire process is conducted in a very industrial, quick way, and customers thus gain considerable agility: they have all the functionalities of the Dassault Systèmes platform, which is auto-deployed and auto-configured. There is no delay between the time that customers buy a license and when they can use it: this flexibility and fluidity clearly represent a model with a bright future.

THE WORLD ENLIGHTENS US

BOEING

AN EXTENDED PARTNERSHIP

Boeing Extends Use of Dassault Systèmes to Include **3D**EXPERIENCE Platform for Manufacturing Operations Management and Product Lifecycle Management



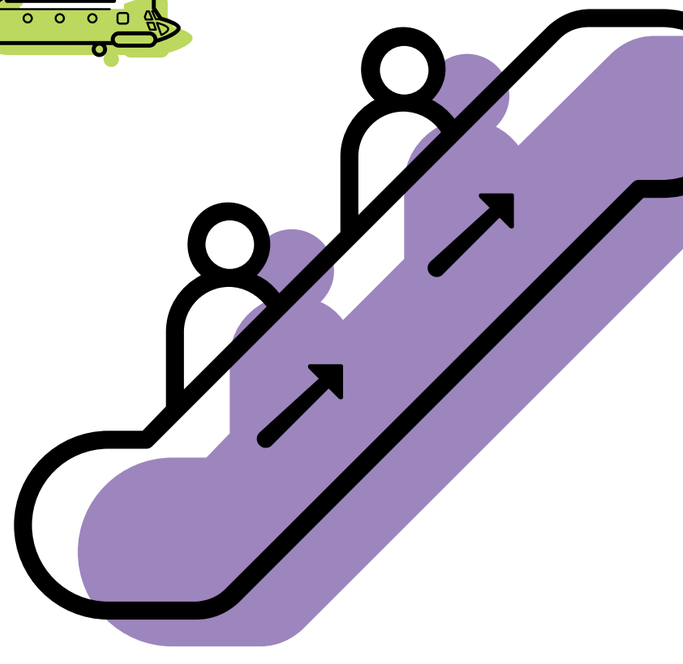
2017

Boeing will deploy the **3D**EXPERIENCE platform in phases and rely on Winning Program, Co-Design to Target, Ready for Rate, Build to Operate and License to Fly industry solution experiences for aerospace and defense to deepen its end to end digital collaboration, design, engineering, analysis, manufacturing planning and shop floor execution capabilities throughout the enterprise.

"Dassault Systèmes is proud to collaborate with Boeing as it embarks on another century of innovation with a partner it trusts. Boeing not only leads the way in its own industry, but influences the progress of all industries across modern society," said Bernard Charlès, Vice Chairman of the Board of Directors and Chief Executive Officer, Dassault Systèmes. "We are at the turning point of the industrial era, where we are shattering another industry paradigm. The parallel exchange of data between virtual and real operations will transform the value-adding chain into a value creation chain. The entire 'extended' enterprise can continuously measure and control business processes for maximum efficiency and potential top line growth. This is 'Business in the Age of Experience.'"

The **3D**EXPERIENCE platform can reduce integration and support costs, improve productivity, foster new innovation, and aid in the introduction of best practice processes to deliver standard work across the value chain. The platform's single source of data across all applications will provide reliable and actionable realtime information and seamless communication throughout the entire enterprise and supply chain as well as across product generations. This digital continuity will improve data and analytics capabilities.

"The decision to adopt Dassault Systèmes' **3D**EXPERIENCE platform is a key milestone in our digital transformation. This digital enabler provides global design and manufacturing capabilities that will fuel our second century," said Ted Colbert, Chief Information Officer and Senior Vice President of Information Technology & Data Analytics, Boeing. "The value of this extended strategic partnership is a mutual desire to transform how Boeing connects, protects, explores and inspires the world."



FROM KNOWLEDGE

TO KNOW-HOW, FROM KNOW-HOW TO LIFE SKILLS

Helping students acquire scientific knowledge: professional skills and the experience to implement them in a collaborative and multidisciplinary framework; this is one of the goals of the four cooperative career-preparation programs recently implemented by Dassault Systèmes

INDIA

THE CENTER OF EXCELLENCE IN AEROSPACE AND DEFENSE IN KARNATAKA

In association with the Government of the Indian state of Karnataka (capital Bangalore), Dassault Systèmes launched the Center of Excellence in Aerospace and Defense, located at the Visvesvaraya Technological University (VTU). India will most likely become the third largest aviation market in the world by 2020, and the sector's needs for a qualified workforce in R & D, manufacturing, assembly, maintenance, warehousing and training will continue to grow.

INDIA

THE 3DEXPERIENCE CENTER IN ANDHRA PRADESH

Based on the model of a public-private partnership, the Andhra Pradesh State Skill Development Corporation (APSSDC) is an organization that aims to develop skills and entrepreneurship in the state of Andhra Pradesh. A memorandum of understanding signed in early 2018 with Dassault Systèmes plans for the creation of a **3D**EXPERIENCE Center to prepare students for the sectors of aerospace and defense, automotive and shipbuilding. The center will improve the employability of engineering students, and will also serve as an innovation center for incubator startups. In the long term, there is a plan to offer more than 85 courses in aerospace, automotive and maritime engineering, and the center will be an important step in encouraging innovation and developing a startup culture in the country's key growth sectors.

SWITZERLAND

HE-ARC UNIVERSITY IS PREPARING ITS STUDENTS FOR THE INDUSTRIES OF THE FUTURE

More than 500 students and professors at the applied science university Haute École Arc Ingénierie (HE-Arc) use the **3D**EXPERIENCE platform to collaborate on more than 2,000 engineering projects each year. Complete teaching concepts, easy and secure collaboration and an intuitive user interface make it possible to create products, manage projects and engage in practical training with a multidisciplinary approach based on the real world.

At the same time, HE-Arc is actively participating in the peer learning experience launched by Dassault Systèmes. This collaborative teaching initiative brings together professors from around the world to think about the digital transformation of engineering instruction thanks to new methodologies and free courses for members of the **3D**EXPERIENCE for Academia community.

UNITED STATES

THE CENTER OF EXCELLENCE FOR AEROSPACE & ADVANCED MANUFACTURING

Eight colleges and universities located in the state of Washington have chosen the **3D**EXPERIENCE platform to prepare the workforce of the future. Available on the cloud, the platform is preparing the next generation of engineers and technicians for cutting-edge aerospace construction by helping the eight academic institutions train and prepare students for manufacturing in the new experience economy. Students can begin multidisciplinary projects on the campus, continue them at home and discuss any problems they encounter by using online communities or screen-sharing sessions, and they always have the latest version of their work available. At any time, instructors can remotely follow projects, manage the development of ideas, give advice and grade students' work. Collaboration becomes easy, dynamic and natural between educators, students and mentors in the industry.

40,000
SCHOOLS AROUND THE WORLD USE VIRTUAL APPLICATIONS BY DASSAULT SYSTÈMES.

The quest for precision

3D printed parts are becoming more prevalent in the aerospace industry, but the precision and reliability of the printing are crucial if costs, lead times and quality criteria are to be respected. Some insights from Stefanie Feih, Senior Scientist at the Singapore Institute of Manufacturing Technology (SIMTech), which is a research institute of the Agency for Science, Technology and Research (A*Star).

HOW LONG HAVE YOU BEEN AN ABAQUS USER?

Personally, I have used Abaqus software for more than 20 years, well before it became part of the SIMULIA family. Our staff has participated in SIMULIA user conferences over the last eight years to share our research results and industry solutions. Abaqus has the ability to conduct highly nonlinear analyses, both in explicit and implicit formulations, and offers a wide range of material and failure models, along with the option to program customized user subroutines to interact with the main code. This makes the software a very versatile tool used widely by both research and industry organizations.

HOW DOES YOUR STUDY OF LIGHTWEIGHT COMPOSITE MATERIALS ENHANCE YOUR CURRENT WORK ON ADDITIVE MANUFACTURING TECHNOLOGY?

We are currently working on lightweight materials that combine a metal AM (Additive Manufacturing) lattice core with a high strength skin. The numerical work on the structural core and interface failure is done with Abaqus. Metal AM has the potential to create lightweight structures that exceed the performance of traditionally manufactured composites, but this approach is currently limited by printing size and accuracy. SIMULIA'S new AM process simulation framework allows for separate modeling of solid material, powder bed and platform. It is necessary to develop a systematic understanding of factors potentially influencing the print quality. Printed parts have to comply with strict manufacturing standards in order to be used on aircraft and any other means of transport.

3 QUESTIONS FOR

STEFANIE FEIH
a citizen of the world

After studying in Germany and the United States, with a Ph.D. in engineering at the University of Cambridge, Stefanie Feih embarked on a research career that took her from Denmark to Australia, with a focus on design of lightweight composite and metal materials. She joined the Singapore Institute of Manufacturing Technology (SIMTech) in 2014 to work in a more industry-focused research environment.

HOW LONG HAVE YOU BEEN COLLABORATING WITH DASSAULT SYSTÈMES?

Dassault Systèmes and SIMTech started collaborating on AM simulation three years ago. We quickly determined a mutual interest in terms of validation and prediction of distortion for our printed parts. Print failure is one of the greatest cost factors in terms of time and material waste. Enhancing our simulation capabilities to allow optimization of print orientation, support structures and print parameters for parts with minimum distortion is a key priority.

Ductile failure modeling under static and dynamic loading of 3D additively manufactured metallic kagome core structures.

SHOES MADE WITH MEASURE
WITH 3D PRINTING

Dassault Systèmes' FashionLab has been collaborating with the company ECCO Shoes on a 3D printed footwear project. An experiment that is pushing the boundaries of product customization

Formnext in Frankfurt is an international professional event dedicated to the industrial processes of the future and the next generations of manufacturing technologies. During the 2017 event, ECCO Shoes, known for its comfortable shoes, presented its experimental project of augmented footwear. The project is the result of a collaboration between innovation partners: the ECCO Innovation Lab worked with Dassault Systèmes' FashionLab.

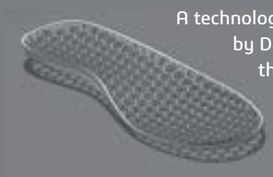
UNIQUE PARAMETERS

The project involves the complete customization of shoe midsoles, manufactured based on data captured by wearable sensors and 3D scanners. These sensors generate a complete digital analysis of individual feet and motion. The shoes are then automatically engineered to a wearer's unique biomechanical and orthotic parameters. High-quality medical silicon replaces the polyurethane midsole, and the 3D-printed mesh offers advanced quality in terms of visco-elastic performance, durability and temperature stability. The components created using this 3D-printing process do not need post-production treatment or cleaning, so they can be produced directly at points of sale in retail businesses.

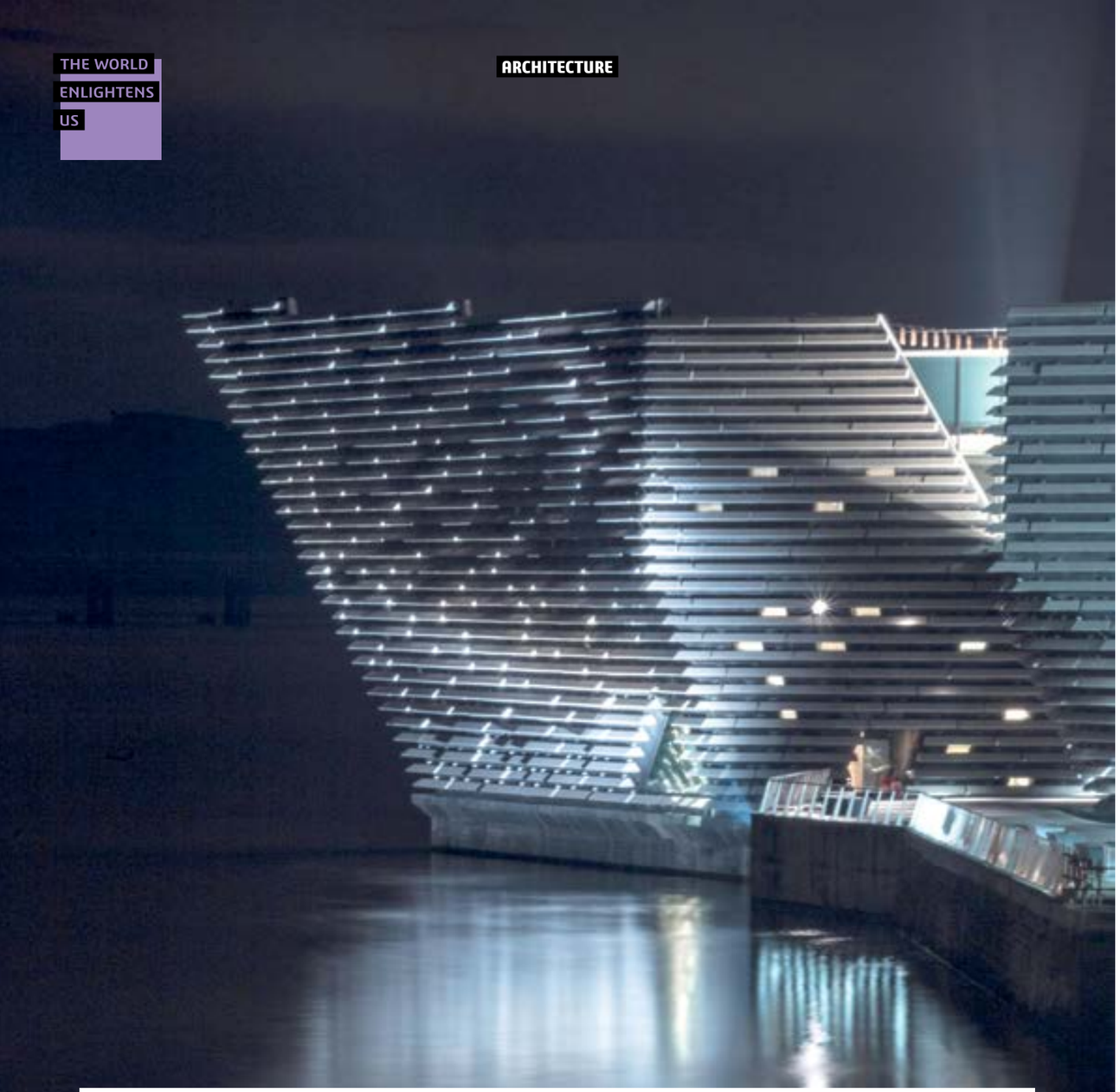
DYNAMIC BEHAVIOR

The cloud-based **3D**EXPERIENCE platform can transfer the biomechanical data into the geometries needed for 3D printing on the fly and in real time, without any operator intervention. Generative designs are validated by Finite Elements Analysis (FEA) simulations, providing an analytical representation of the sole's dynamic behavior.

LE FASHIONLAB



A technology incubator by Dassault Systèmes, this laboratory is dedicated to the use of design, simulation and 3D collaboration applications in consumer goods and fashion.



KENGO KUMA & ASSOCIATES

Kengo Kuma & Associates is a Japanese architectural firm founded in 1990 by Kengo Kuma. Its employees are based around the world: 177 in Tokyo, 24 in China and 26 in Paris The agency has designed architectural works in more than 20 countries and won prestigious prizes such as the Architectural Institute of Japan Award, the Spirit of Nature Wood Architecture Award (Finland) and the International Stone Architecture Award (Italy). Kengo Kuma & Associates designs architecture that blends readily with its cultural and natural environment, proposing gentle and people-oriented constructions. The company is always looking for new materials and is working towards a new approach to architecture in a post-industrial society.

KENGO KUMA

A NEW APPROACH TO ARCHITECTURE

The V&A Museum of Design in Dundee, Scotland, designed and simulated by Kengo Kuma & Associates using Dassault Systèmes solutions, will open its doors in September 2018.

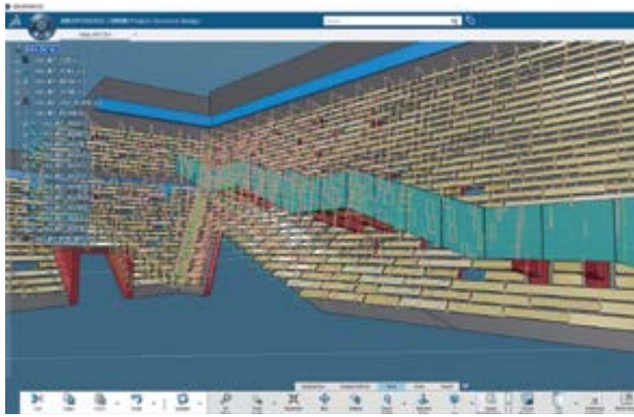
Limited by their initial design software, the architects of the firm Kengo Kuma & Associates gradually realized that all the parameters related to the complex shapes of the museum's original concept could not be controlled without also considering the aesthetic, functional and manufacturing constraints at the same time. By adopting CATIA, **3D**EXPERIENCE on the cloud, they were able to resolve problems related to the curved walls and automate the effective improvement and industrialization of the facade elements.

A UNIQUE PERSONALITY

CATIA enabled the firm to create customizable 3D models that were flexible and modular. The wall could be checked, visualized and various hypotheses could be tested before the details were finalized and the entire shape completed. To create the facade that gives the building a unique personality inspired by Scottish cliffs, the base modules had to be optimized to deal with the challenge of positioning approximately 2,500 different-sized panels of pre-cast rough stone weighing up to 3,000 kg each and measuring up to 4 m wide on a wall, while at the same time limiting the number of original shapes.

A MORE NATURAL INTERIOR

To give the interior a more natural, random and irregular ambiance, each facing panel has its own orientation and depth in relation to the supporting wall. The main challenge was to use a static support affixed to the wall and a piece that varied in its orientation and distance in relation to the wall. It is this variability that creates the distinct impression of natural flexibility. CATIA generated a file that included all the necessary information for each piece (orientation at two degrees, length, position on the wall, etc.).



LIGHT AS A MARKER OF EXPERIENCE

CATIA also linked each piece to the individual geometric information of the panel. To heighten the feeling of being in front of a natural wall, the shape of the panels is in fact not rectangular but trapezoidal. Each of the 2,000 facade panels were produced and installed without any mistakes. Their optimization made it possible to limit the number of types and reduce production costs. Furthermore, the way the light circulates was precisely tested during design as perception is key to ultimately obtain the desired effect. CATIA also enabled testing various layout rules and a few other principles to ensure a good balance between aesthetic irregularity and manufacturing constraints. The result is an architectural creation characterized by its natural shapes at every level.

MOVIN'ON

MOVIN'ON, WORLD SUMMIT ON CREATIVITY

DURING THE EVENT ORGANIZED BY MICHELIN IN JUNE 2017,

GUILLAUME GERONDEAU,

VICE PRESIDENT, TRANSPORTATION AND MOBILITY ASIA, DASSAULT SYSTÈMES, GAVE A PRESENTATION. HERE ARE THE HIGHLIGHTS OF HIS SPEECH.

WE ARE ON THE VERGE OF A REVOLUTION IN MOBILITY THAT HAS NOT BEEN SEEN IN THE PAST CENTURY

This profound revolution will require that mobility stakeholders make a profound change in terms of scope, scale and speed.

Winning organizations will be those that combine the strength of a global organization, its shared vision and access to global resources with the knowledge of local needs, speed, and creativity.

The situation as we know it today is that for more than a century, apart from a few very populated and dense cities, personal cars have continued to develop.

And yet, an individual car seat is on average only used 1% of the time. But for most people, cars are the only means that offers the flexibility and freedom to travel in increasingly comfortable conditions at an affordable cost.

We are at the dawn of a revolution that has not been seen in 100 years, which will eliminate the separation between collective and individual transportation. A new mobility for all that is connected, safe, non-polluting and shared will provide the benefits of a personal car without its disadvantages.

The missing link in this mobility, - autonomy - will soon be here.

AUTONOMOUS TRANSPORTATION WILL ARRIVE BEFORE THE AUTONOMOUS CAR.

We do not yet know how or how quickly this change will take place. It will begin with services offered in limited conditions and uses before gradually taking hold.

This revolution is inevitable because it will benefit consumers, who will be able to enjoy the time spent during transportation to engage in other activities, and because cities and regions want it to happen.

BEYOND THE ISSUE OF TRANSPORTATION, IT IS ALSO A QUESTION OF LIVING IN THE CITY.

In the competition between cities to attract talent and jobs, a proper, efficient transportation system will be a key distinctive element.

And this will not only concern downtown areas.

In Japan, for example, autonomous shuttles will be implemented first in the countryside, where older people can no longer drive and workers are scarce.

It is, therefore, not only technology that will steer this revolution, but the experience of mobility.

As a result, the era of cars with more or less the same specifications is coming to a close. Each particular case, each new experience will require an appropriate, locally defined solution.
Objects used for transportation will be varied, dedicated, flexible, innovative and produced in smaller numbers.

STRATEGY, SCALE AND SPEED

The first challenge for each player is to define its own strategy, vision and role. Players must determine their brand promise and how they will differentiate themselves from the competition.

The second challenge involves the scale of the transformation.

The system in which products are designed at the global level will have to evolve. The capabilities of structures close to the field and regions need to be reinvented, from understanding customers at a much more granular level to creating mobility experiences in a local context. It is, thus, the entire organization that will need to undergo a transformation.

And this leads to the third challenge, speed.

PLAYERS MUST BUILD A PROCESS THAT BREAKS WITH DEVELOPMENT TO DELIVER EXPERIENCES AND PRODUCTS.

In addition to the use of new tools such as machine learning, big data, generative design and systems engineering, it is through internal and external collaboration that the industry will reinvent itself.

The goal is to shrink the development cycle from years to months.

And this is the vision of Dassault Systèmes.

We are entering a new era, one of continuous collaboration from ideation to delivery on a unique platform that will enable companies to invent better mobility in a much faster and more targeted way.

HARVESTING NEW IDEAS

By inaugurating its Greenhouse, CLAAS, one of the world leaders in agricultural machinery, now has a multipurpose tool it can use for the creativity and reinvention of its business models.

Inaugurated in 2017 in Harsewinkel, Germany, the CLAAS Greenhouse is both a co-working space and a fabrication lab, a FabLab to put new ideas into practice. Installed in a former car dealership, the Greenhouse enables collaboration among various disciplines, to speed up process development, coordinate methods and carry out actual prototyping. The Greenhouse has 3D printing machines, Computer Numercial Control (CNC) milling machines and robots in order to test the complete industrial process chain, from the 3D model to the ready-to-use manufactured component, before implementing the new process in the company.

A FLEXIBLE WORK ENVIRONMENT

In a very startup atmosphere, the Greenhouse is a room devoted to creativity, encouraging new ways of working and thinking. The building has been converted into a co-working space so that original thinkers and logical minds can co-exist. Large bays open to the outside world, movable partitions and furniture with castors all create a flexible and dynamic work environment. In the center of the room, there is an immense table around which people can get together. "The special value of the Greenhouse is networking between all the company's departments," declared Thomas Böck, who is responsible for technology and systems and a member of the CLAAS Group Executive Board. "This means developing the entire process in one go, and during the design phase, the results of its deployment can be tested in virtual mode."

NEW DIGITAL BUSINESS MODELS

CLAAS has joined forces with Dassault Systèmes to create a virtual demonstrator environment with test access to the **3D**EXPERIENCE platform. "Our customers are invited," continued Böck, "as well as universities and research partners, but also companies we are not competing with directly. This ecosystem helps us to develop the next generation of technology to set up new digital business models." And another benefit: the spectacular acceleration of CLAAS' development, and the joint identification with the customer of which priorities to set.

CLAAS A GLOBAL LEADER

One of the world's leading manufacturers of agricultural tractors, CLAAS is the world leader for forage harvesters and the European market leader in combine.

SUMS INVESTED IN RESEARCH HAVE DOUBLED OVER THE PAST 10 YEARS, AND 11% OF THE STAFF WORK IN R&D.

This family business regularly wins international awards for the innovative character of its products.

DASSAULT SYSTÈMES, A COMMITTED PARTNER IN THE GREENHOUSE

SOLUTIONS AVAILABLE WITH THE 3DEXPERIENCE PLATFORM

- Engineering and additive manufacturing
- 3DEXCITE application for high-resolution graphics and marketing videos
- Development of DNC 5-axis milling programs, (Direct Numerical Control, networked with numerical control machine tools)
- Programming of a robotic handling system

JOINTLY RUN WORKSHOPS AND PROJECTS

- Systems engineering project for the simulation and testing of complex systems
- Proof-of-Concept of the functional and safety architecture for testing risk analysis and assessment
- Optimization of parts with additive manufacturing
- Simulation workshop to improve the engineering development process and enable rapid decision-making

TRAINS ARE MOVING TO VIRTUAL REALITY

After introducing and implementing visualization in the automotive industry with unmatched success, 3DEXCITE is adapting this experience to railways.

In order to meet the challenge launched by Trenitalia, the primary train operator in Italy, to provide passengers with more comfortable, spacious, brighter and safer trains, Alstom, a global leader in integrated railway systems, decided to reinvent its traditional design and engineering processes.

The capabilities of the Virtual Garage solution by 3DEXCITE have already transformed the automotive industry's approach to marketing and sales by using design data to offer a new customer experience. This is now also possible in the railway industry.

THE FIRST TRAIN CONFIGURATOR EVER DEVELOPED

Alstom takes advantage of Virtual Garage's 3D visualization application to present virtual train models corresponding to targeted customer requirements. Thanks to a product configurator, the railway operator can visualize, configure and have the public test detailed digital variations before building them. The client can select various combinations of train length, interior layouts and accessories: size and location of passenger seats, benches, bike supports, color options, materials, logos and trims. The virtual model then provides the data for manufacturing. In this way, Alstom can guarantee that the train it delivers matches the specifications that the customer and users validated virtually, instead of relying on paper files and physical prototypes that are much more cumbersome to produce. Once the entire train is configured, high quality visuals can be exported that are immediately available for communication campaigns and sales activities.

UNRIVALED PASSENGER EXPERIENCE

The configurator enables users to visualize the entire train at various stages of development. At Alstom, engineering, marketing and sales can work in parallel or together on the virtual model for design review sessions as well as product configuration to plan the configuration they will propose to the final customer, Trenitalia. To select the configurations together, a large screen is linked to an iPad that serves as a remote control. During demonstrations to a larger audience, the display can be extended to four large screens that have a simpler and more intuitive user interface with functionalities focused on the essentials, more geared towards marketing. The first unveiling of the new train took place at the Expo Ferroviaria in Milan, October 3, 2017: the configurator was unveiled for the first time to allow the public, through a virtual reality experience in the city, to participate in a unique passenger experience. Successively, a certain number of events have been held in the major Italian cities to repeat the experience.

A complete knowledge reference

system that documents all our projects

HOW DO YOU CARRY OUT THE INDUSTRIAL STEPS OF DESIGNING AND CREATING YOUR PROTOTYPES?

We develop and produce the highest performing batteries and energy storage systems for the road and home. But our specialization, and our reputation in the automobile industry in particular, is based on our ability to develop prototypes adapted to mass production much faster than the competition. We work in small teams and rely on the most advanced technology. Our engineers use the planning, engineering and 3D visualization solutions provided by the **3D**EXPERIENCE platform.

HOW DO YOU MANAGE YOUR PROCESSES TO MAINTAIN YOUR FLEXIBILITY?

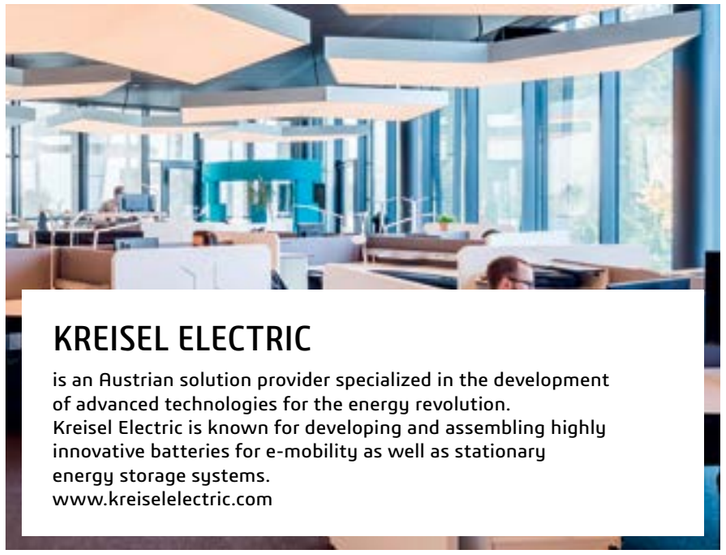
The **3D**EXPERIENCE platform offers us budgeting and planning tools, and allows our engineers to collaborate in real time. It also offers design and simulation applications in order to design, test and manufacture all the required components and systems. In addition, it covers our stock management and manufacturing processes. Because all of this takes place on a single platform, our employees have quick and reliable access to all the useful data, and the various systems are perfectly compatible. This greatly accelerates our processes and allows us to continue to be flexible and connected at complex and quickly evolving sites.

3 QUESTIONS FOR

PHILIPP KREISEL
Founder and CEO of R&D, Kreisel Electric.

HOW DO YOU PRESERVE YOUR KNOW-HOW IN ORDER TO MAKE YOUR KNOWLEDGE ACCESSIBLE TO NEW ARRIVALS?

We have several systems in place to ensure that knowledge and best practices are shared within our quickly growing organization. Our integrated Wiki functions as a complete knowledge reference system that documents all our projects and provides a space for us to exchange information. In addition, we regularly arrange for cross-discipline meetings, during which we discuss what we've learned during the most recent projects. This allows all our employees to benefit from each person's knowledge and avoid repeating past errors, and for the company to capitalize on all of its knowledge.



KREISEL ELECTRIC

is an Austrian solution provider specialized in the development of advanced technologies for the energy revolution. Kreisel Electric is known for developing and assembling highly innovative batteries for e-mobility as well as stationary energy storage systems.
www.kreiselelectric.com

AUGMENTED REALITY IS OPENING UP NEW HORIZONS FOR AUTO RACING

As part of the 24 Hours of Le Mans race, an experience for resolving technical issues presented new opportunities for using augmented reality in the industry.

It's the story of an encounter and a passion for motor sports shared by Jacques Nicolet, race car driver and president of Everspeed Group, and Anne Asensio, Vice President Design Experience at Dassault Systèmes. Everspeed includes a dozen companies working within the performance and motorsports sector. Among them, the OAK Racing team and Onroak Automotive, builder of endurance sport vehicle prototypes, collaborated with Dassault Systèmes' Design Studio to develop the HoloOak project, which explores new uses for the **3D**EXPERIENCE platform. HoloOak uses augmented reality to enhance collaboration and design practices in the motorsport industry.

DIAGNOSTICS AND REPAIRS IN REAL TIME

Imagine a car race. You are in the pits with the team manager and mechanics, and you receive the connected vehicle's operating data directly as it is racing around the track. A technical problem arises. Every second counts in order to win. You put on your augmented reality headset and find yourself simultaneously in the workshop, the car and the engineers' HQ. Diagnostics and repairs are done collaboratively in real time, with the participation of all stakeholders. This interactive and immersive scenario of resolving an emergency is, as an experiment, one of the many areas the Design Studio is working on to anticipate the social, technological and industrial transformations brought about by augmented reality (AR), and to explore new areas for design and production.

NEW MODES OF WORKING

By superimposing a computer-generated image over a real-world view, AR adds data and information that can help with decision-making. The HoloOak AR experience was created in the context of the 24 Hours of Le Mans endurance race. Equipped with a Microsoft HoloLens AR virtual reality headset, users are immersed in a virtual environment where they can interact with the vehicle. The goal is to help improve existing methodologies and products, and continuously create new modes of working. With virtual reality (VR) and AR, users of design and production spaces have access to new areas of collaboration, which allow them to simulate innovative proposals by helping them take part in the decision-making process.

NEW MODES OF LEARNING

Digital solutions enable collaboration in real time by establishing an interative process between design, production and research and development teams. This allows for quick and ongoing improvements to be made and represents an important development for manufacturers.
The HoloOak approach can be adapted to various fields and uses. Real-time management and telemetry could be adopted to help monitor at-risk sites and manage power, for example. With contextual design and inquiry and real-time decision aids, it has the potential to benefit many industries. HoloOak is also a harbinger of emerging professions and new modes of learning, especially in technical training.

label 2018 observeur du design

NOMINATED FOR OBSERVEUR DU DESIGN 2018

THE HOLOOAK AR EXPERIENCE HAS BEEN NOMINATED FOR ONE OF THE MOST PRESTIGIOUS DESIGN COMPETITIONS IN FRANCE, OBSERVEUR DU DESIGN®.

THIS COMPETITION WAS INTRODUCED IN 1999 AND IS OPEN TO COMPANIES, DESIGNERS, SCHOOLS AND COMMUNITIES IN ALL BUSINESS SECTORS.

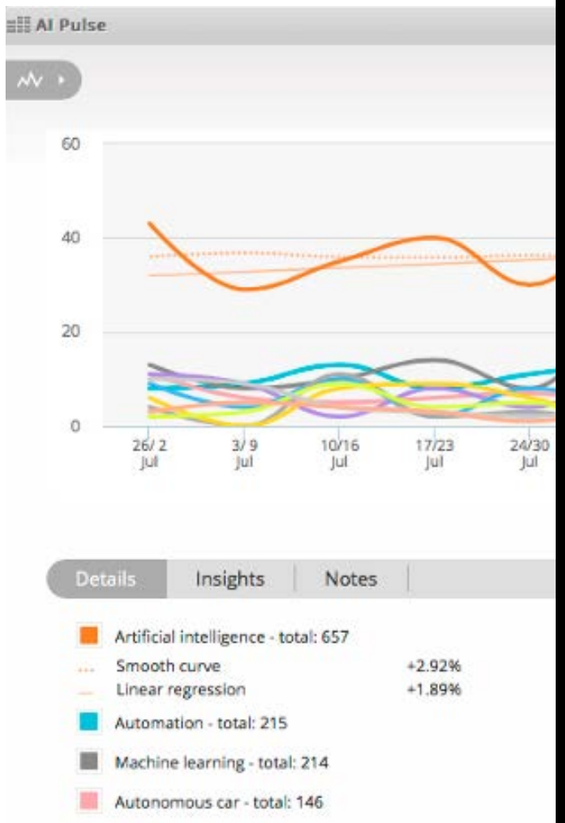
NETVIBES IS IDENTIFYING TOMORROW'S TRENDS TODAY

Always be a step ahead: by collecting and aggregating information from a wide variety of sources, it's possible to identify trends that are difficult to perceive, and then analyze them in order to make the most relevant decisions. This is what the Theme Recognition solution by NETVIBES helps our customers do.

THE POWER OF OPEN SOURCE AND PARTICIPATIVE PRODUCTION

Today, big data is everywhere: in the form of data streams that are constantly being exchanged by networked machines, stored in data warehouses, in personalized applications and on the web. Harnessing this information is opening up broad opportunities. NETVIBES dashboards automatically categorize the data so that it can be explored based on various entries: names, events, geolocation, etc.

The new feature provided by the Theme Recognition solution from NETVIBES is based on a direct connection with Wikipedia via DBpedia and DBpedia Spotlight. DBpedia is a university and community project for the automatic exploration and extraction of Wikipedia data. The tool offers a structured version for each encyclopedic entry, in the form of standardized data using the semantic web format, and makes it searchable by DBpedia Spotlight. The CloudView solution powered by EXALEAD then annotates the content of each entry integrated into the aggregated corpus by DBpedia and DBpedia Spotlight. Several connectors extend the collection functionalities of web and CloudView data and enable capturing and sharing relevant information from a large variety of sources. Finally, insights are generated from Themes Recognition.



BPIFRANCE SCANS FOR TRENDS USING NETVIBES

The world's most active sovereign wealth fund investing in private tech companies, Bpifrance is working with NETVIBES in an ongoing project to analyze major technological trends across Silicon Valley and France.

The most recent installment of this research project, presented on March 15, 2018 at Bpifrance (http://netvib.es/bpi), focused on six hot topics: agritech, big data, virtual reality, transportation, security, and blockchain/cryptocurrency, analyzing the feelings and general perspectives on both sides of the Atlantic. NETVIBES analyzes the evolving perception of these trends within the general press, specialized tech press, business in social commentary by venture capitalists. For example, the current focus in the transportation industry is to find cleaner transit solutions for growing human populations. Hydrogen seems to offer a promising solution for the future and is already being implemented today, including ten hydrogen-powered buses in Santa Ana, California.

The NETVIBES Dashboard makes the work of Bpifrance's financial analysts easier, as they are continuously updated about technological changes and opportunities, which ensures better decision-making and better returns on their investments.

ALL THE WEALTH OF THE COMMUNITY

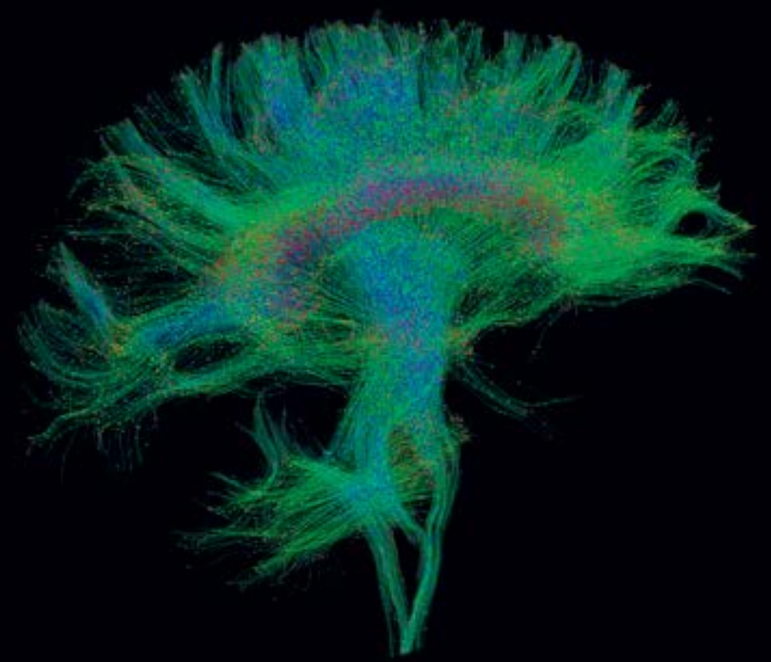
Subjects, brands, product or company names, theories and concepts found in an entry on Wikipedia are now automatically recognized as themes that can be analyzed using the NETVIBES dashboard.

A personalized dashboard can now identify a wide range of topics to provide a better understanding of what is happening in a business sector or company, or to detect the emergence of new trends. Theme recognition produces timely and intelligent insights that help businesses make better decisions. The reference corpus is based on Wikipedia, the largest encyclopedia in the world, which is constantly updated at any hour, day or night.

Because the solution relies on crowdsourcing, that is, open outsourcing and participative production, the ongoing efforts of the Open Source community continuously improve the categorization of the themes. The use of this participative principle opens the way to filtering that is constantly more efficient, as the technology evolves and the community grows.

THE WORLD INSPIRES US

Controlling an unmanned aerial system in virtual immersion at the Wichita State **3D**EXPERIENCE Center.



"WE ARE PARTNERING ON A CLINICAL NEUROSURGERY STUDY"

Dassault Systèmes is diversifying its research activities in life sciences by focusing on clinics and patient services. Patrick Johnson, sciences and corporate research VP, William Saurin, research, technology senior director, and Nicolas Gazères, manager, EPINOV research project explain this new direction.

EPINOV

Improving EPIlepsy surgery management and progNOsis using Virtual brain technology (EPINOV) is a project led by Professor Fabrice Bartolomei of La Timone Hospital in Marseille, France. Launched in January 2018, its goal is to evaluate the benefits of modeling the brain's neural networks when choosing surgery strategies. The Living Brain Project is financed by the Investissements d'Avenir program, which is partially funded by the French government and is managed by the ANR (French National Research Agency) with reference ANR-17-RHUS-0004. EPINOV involves 11 epilepsy surgery centers in France and relies on a neuro-computing technology for brain simulation to the virtual brain.

WHAT IS THE SCOPE OF THE LIVING BRAIN PROJECT?

William: It is a translational medicine project that aims to bridge the gap between fundamental medical research, clinical practice and care. Transferring a discovery from the academic world to clinical practice generally takes a long time. To accelerate this transfer, the goal of the ANR's call for tenders is to create partnerships between researchers, clinicians who are conducting human trials, and manufacturers that organize the distribution of the partnership's results. The EPINOV public-private program is a part of the university hospital research's call for tenders, and Dassault Systèmes is the industrial partner.

WHAT IS THE PROJECT'S OBJECTIVE?

Nicolas: It involves using a technology for modeling the human brain that aims to reconstruct a virtual clone of the patient's brain. In its details, the brain has enormous variability from one person to the next. Based on high-precision MRI, tomodensitometry and electroencephalogram scans, it is possible to reconstitute not only the geometric shape of the brain but also the connectivity between the regions – that is the bundles of white matter that connect them to each other. Once the virtual brain has been created, the clinical part begins: the model is used to identify areas in the brain that may be candidates for neurosurgery. This surgery is intended to take care of refractory epilepsy, a pathology resulting from an ionic imbalance that spreads electrical waves in the brain. Epilepsy is generally very well treated with medication, but in certain cases of drug resistance, traditional therapy involves identifying the area of the brain where the lesion generating these debilitating waves is found in order to remove it. It is a type of surgery generally reserved for difficult cases. When it works, it can be life-changing for patients, who move from a debilitating situation of ten crises per day, which requires hospitalization, to an almost normal life. But if the surgery does not work, such as in cases where the epileptogenic area is difficult to identify, additional deficiencies may occur. It is, therefore, very important to very precisely identify these areas.

HOW WILL THE STUDY BE EXECUTED

William: A group of patients will be recruited between the first and third year of the five-year study, they will be divided into two groups to ensure that clinical study principles are respected, which are very specific from a statistical and regulatory point of view. One group will be followed using regular tests, while the other also will benefit from a diagnosis provided by the virtual brain software. For the study to be conclusive, the two populations have to be comparable, with around 150 people in each group.

WHAT DOES DASSAULT SYSTÈMES SEEK TO UNDERSTAND?

Patrick: We have been working for many years in life sciences, in terms of research and development; it's at the heart of what we are – harmonizing product, nature and life. However, it will be the first time for us to partner with a clinical trial on a cohort of patients. It's a new challenge to offer health-care services directly at the center of care. And, in the long run, we want to develop a solution that professionals in clinics will be able to use. The completed initial trials have provided very promising results, and what's to come will be very exciting!

HOW DOES THIS PROJECT FIT IN WITH DASSAULT SYSTÈMES' STRATEGY IN LIFE SCIENCES?

Patrick: While the consortium is in place, we will propose a treatment pipeline prototype that takes the basic data of each patient and provides a 3D map that indicates the precise location for the operation. We will, of course, use Dassault Systèmes' solutions including SIMULIA, EXALEAD and BIOVIA, but we also may use third-party software thanks to the open nature of our platform. In the long run, we want to offer health services and the power of the virtual world for surgery that is highly tailored to the individual. It's something new for Dassault Systèmes, and is no doubt one of the major assets of this project.

IDEAS ARE BORN,
SPREAD AND TAKE SHAPE EVERYWHERE

The maker culture has the wind in its sails! Makers are the heirs of 20th-century tinkerers and inventors, and they foster the innovative use of technology by encouraging inventions, prototyping and sharing experiences. Dassault Systèmes stands alongside them.

A NEW OPEN INNOVATION LAB IN BOSTON

Opened in May 2017, the **3D**EXPERIENCE Lab at Dassault Systèmes' Boston campus is dedicated to incubating and accelerating startups. Following the success of our lab in Vélizy, it was created in collaboration with MIT and the Fab Foundation and has become a flagship! It is connected to a global network of more than 2,500 fab labs. The lab helps develop a maker culture, enables testing software on hardware integration platforms, and supports the prototyping needs of startups.

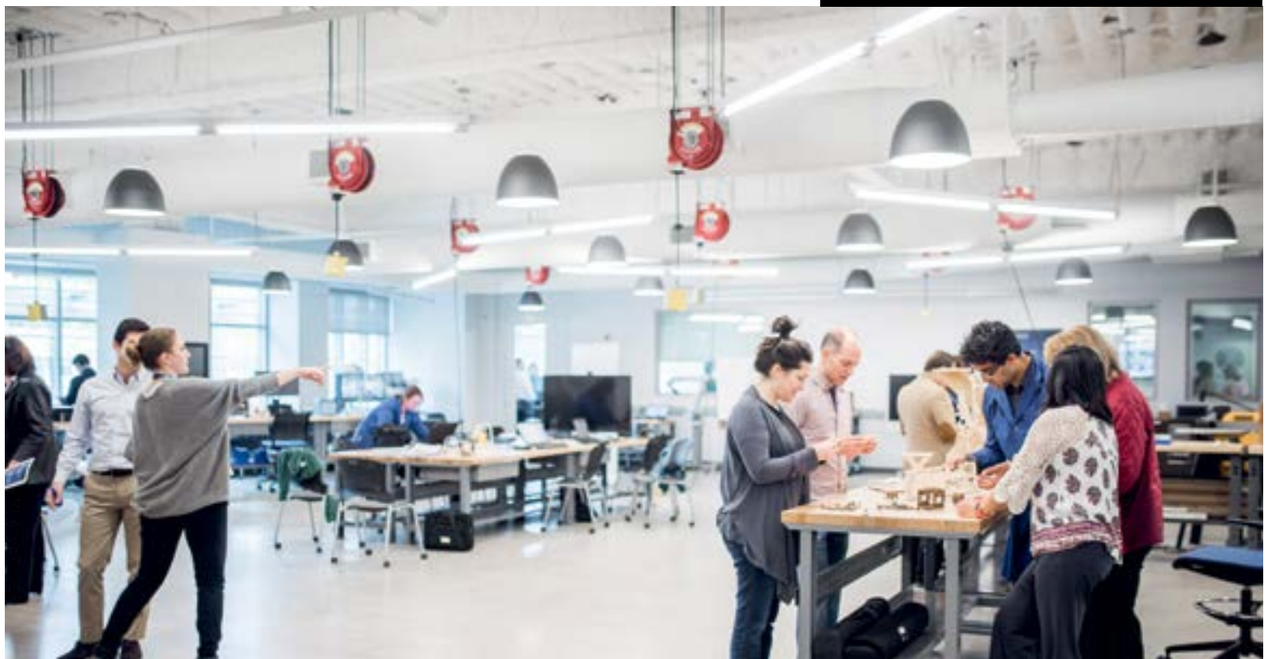
The lab features state-of-the-art digital manufacturing tools, including high-end CO_2 and fiber-optic laser cutters, precision mills, CNC routers, a vinyl cutter, a robotic arm, an electronics station, and a variety of 3D printers and scanners, as well as tactile interfaces and augmented and virtual reality equipment.

The lab also is used to test the human-machine interface module using an MIT browser called MODS, which connects the various types of equipment in the lab, with the aim of simplifying their interfaces.

Like the **3D**EXPERIENCE Lab in Velizy, the Boston lab is manned by Dassault Systèmes employees. Fifteen mentors, trained by MIT in the use of all of the machines, supervise and train new users, or "fabbers." All aspects of a collaborative environment are found here: assistance between experienced and new users, learning by example, coaching, members challenging one another, etc.

AN ORIGINAL CROSS COLLABORATION

The first projects in the Boston campus **3D**EXPERIENCE Lab are remarkable because of the broad range of subjects explored and the network of skills involved. For example, Zenith Aircraft Company used SOLIDWORKS to create, design and simulate an entire airplane from scratch. And it's being manufactured in an innovative multi-disciplinary way: three times a week, construction sessions bring together ten participants in the lab to assemble a small part of the plane. To date, more than 310 employees, partners, customers and user groups from Dassault Systèmes have collaborated on the assembly.



Other projects – by students in residence, employees and passionate people – include a longboard , which required – from design to applying decals – the use of every machine available in the lab; a fully reusable rocket with dual parachutes; studio speakers; and even a system that detects obstacles for the visually impaired.

CATIA XDESIGN, AN INNOVATOR'S FRIEND

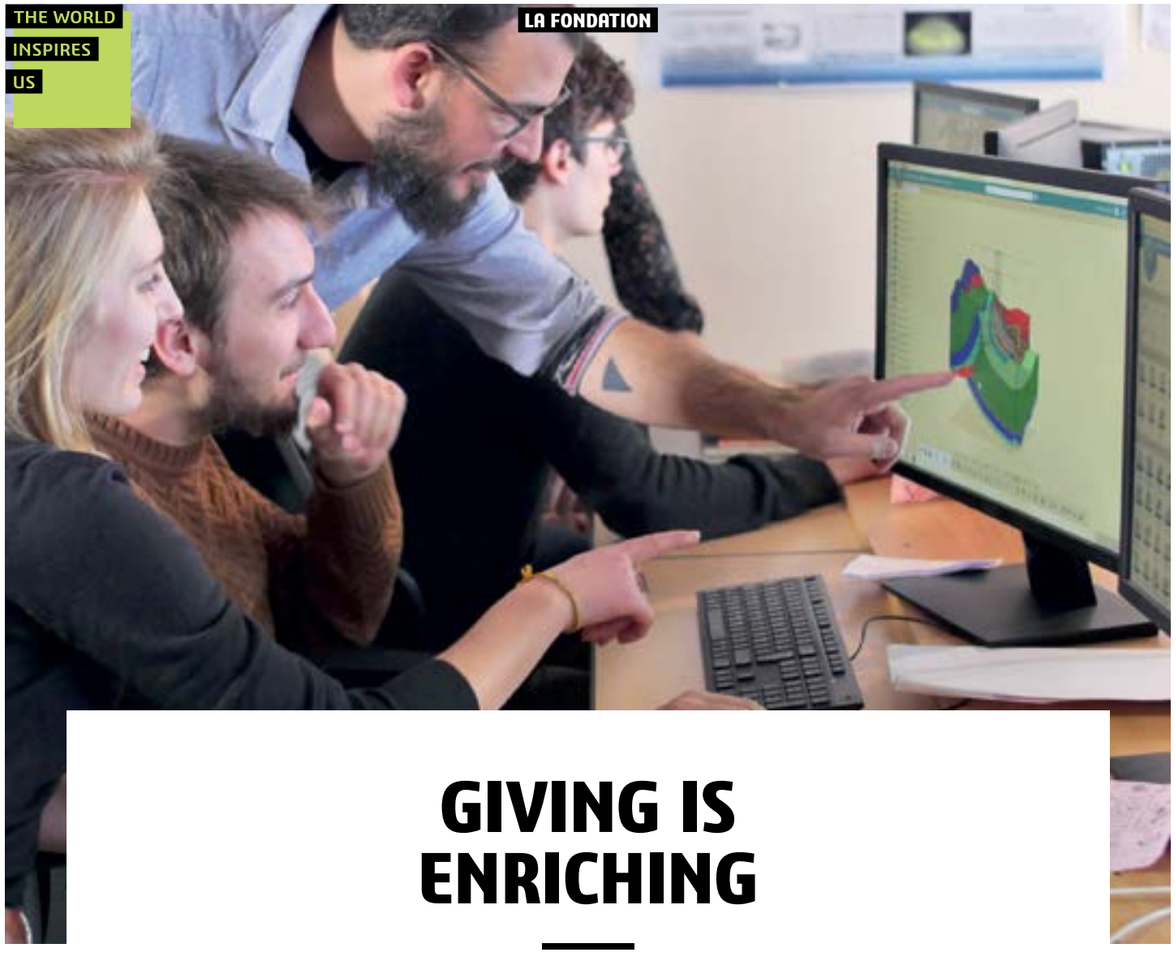
As the leading figure of a new generation of design software accessible at any time, anywhere and on any peripheral, CATIA xDesign is available on the web, regardless of the operating system or the device used. And yet it still maintains all the security, control and sharing capabilities of the **3D**EXPERIENCE platform.

CATIA xDesign was conceived as a unique modeling environment. It provides the accessibility of a web browser application, without needing prior installation or configuration. Available as a service for mechanical designers, it enables easy creation and sharing of designs. The modeling goes beyond what has previously existed. It is fluid, immersive and guided by contextual design assistance. As a solution from the CATIA product family, it meets the most rigorous constraints and expectations in terms of shaping, size requirements or compatibility with industry standards. Its collaborative aspect is a real extension of design. Transparent and fully controlled by the designer, it combines the sharing of parts and elements designed within a team – between partners or team members – with a controlled level of security.

It is a new paradigm in innovative design, involving unequaled mobility and access, the power of CATIA, and the design extension to supervised, sharing environment.

THE WORLD INSPIRES US

LA FONDATION



GIVING IS ENRICHING

In two years, La Fondation Dassault Systèmes has established its mission and shown how its actions can transform education and research.

AS TOLD BY

Thibaud de Tersant

President of La Fondation Dassault Systèmes

LA FONDATION DASSAULT SYSTÈMES IN THE WORLD

La Fondation was launched in Europe in November 2015. It was expanded to the United States in May 2017 and then to India in February 2018. Anyone based in these regions can submit an application that complies with La Fondation framework: the implementation of new educational and research practices that make use of the power of 3D technologies to create virtual universes that result in innovative 3D educational content.

WHY DID DASSAULT SYSTÈMES CREATE A FOUNDATION?

We are convinced that virtual worlds can improve the real world. By helping to harmonize products, nature and life, virtual worlds contribute to creating a more sustainable world. They must be made available to high school and university students and researchers who will create the world of tomorrow. Virtual worlds can also motivate young children and enable them to learn more quickly. Finally, to leverage and give meaning to all the education and research programs we are involved in, we felt that La Fondation was a good vehicle. It gives greater visibility to what Dassault Systèmes is capable of doing and also allows us to select the best projects to meet our goals. However, research and education are not the only areas we are developing. Virtual worlds serve to invent the to future and recreate the past. This is why La Fondation is committed to preserving the heritage of humanity and supports, for example, scientific studies that seek to understand the internal structure of the Cheops pyramid.

IS THIS ALSO A WAY TO ENCOURAGE THE PROFESSIONAL INTEGRATION OF YOUNG PEOPLE AND PREPARE THEM FOR JOBS OF THE FUTURE?

Of course! Nothing is more crucial than giving young people the opportunity to obtain the best education possible, and to give them the techniques to find their place in the world, a world that will see new developments in innovation, manufacturing, mobility and data use. Through this educational mission, we are helping students to become employable. Too often, educational systems repeat courses inherited from the past, without much concern for what is truly necessary to prepare for the future. In many countries, in spite of a high unemployment rate, companies are not able to recruit the employees they need. Dassault Systèmes encourages the digital transformation of companies and orients them towards the industries of the future. We are, therefore, well positioned to contribute to changing the way people learn and to encourage students to take courses that will prepare them for new jobs.

HOW ABOUT SCIENTIFIC RESEARCH?

Virtual worlds are invaluable for scientific research and innovation. Many Nobel Prize winners have used Dassault Systèmes software, in the life sciences, for example. La Fondation clearly has a role to play, because research is not always financed as it should be and does not always have the resources and software tools it needs. La Fondation modestly tries to remedy these shortcomings.

WHAT WERE THE TOP SUCCESSES IN 2017?

La Fondation in Europe has continued to grow by increasing support for a very wide range of projects. Since its founding, it has supported 32 high-quality projects. In Spain, for example, a partnership with eleven universities focused on the industries of the future. To further the model, La Fondation was created in the United States in May 2017. It has already selected 13 projects, including Base 11, which aims to train high-potential students in engineering who face hardship in financing their studies. Finally, in November 2017, La Fondation expanded to India. There it is supporting a project developed by students who are designing a solar-powered vehicle as part of the Indian government's sustainable development policy. The remarkable impetus of La Fondation Dassault Systèmes owes much to the energy of Marie-Pierre Aulas, its Executive Director.

HAS THE SPONSORSHIP OF SKILLS TRAINING, LAUNCHED AT THE END OF 2017 IN FRANCE, ALREADY MADE ITS MARK?

This activity has begun remarkably well. We are committed to this unifying project. It connects Dassault Systèmes employees with training that is geared towards, for example, school children interested in engineering professions. All of our employees who have participated in this program have seen how they can have an impact, generate interest and provide assistance, in addition to feeling personally enriched. This is owed to the training they received in order to participate and, most of all, to give.

A SOCIAL COMMUNITY IS AN INCUBATOR'S ASSET

Dassault Systèmes announced its Global Entrepreneur Program to support startups, entrepreneurs and makers.

RESOURCES AVAILABLE TO STARTUPS

In early 2018, Dassault Systèmes launched its Global Entrepreneur Program, which offers a complete portfolio of customized solutions to support innovators at each phase of their project's development. They are able to use virtual worlds, collaboration tools, collective intelligence and communities to enhance their creativity and solidify their ideas. In this way, they can advance projects that integrate technologies such as the Internet of Things, as well as design and test products and access online prototyping services using the latest 3D printing methods. Additionally they can share their knowledge and know-how with a network of qualified experts.

Startups have different needs at each phase of their lifecycle. An approach involving technology, mentoring and initial marketing support is essential, but also must be long term. Young companies need support for bringing their products to market faster, while at the same time addressing business challenges to the startup world such as financing, staffing, IT infrastructure and developing and organizing a sales network.

RENAISSANCE BY INNOVATION

"Dassault Systèmes loves startups! Our Global Entrepreneur Program supports their innovation processes by providing cloud applications and online communities and services, whatever their industry, products, needs or maturity level.

Gone are the days when only large companies had the myriad skills, resources and capabilities to yield technological breakthroughs. We are a catalyst and enabler for large companies and startups alike."

Frédéric Vacher,
Director, Corporate Strategy Innovation,
Dassault Systèmes

ACCELERATING DEVELOPMENT

The Global Entrepreneur Program integrates design and training applications that are part of the SOLIDWORKS for Entrepreneurs program, especially useful for projects focused on mechanical innovation. It also includes access to **3D**EXPERIENCE Lab and a network of incubators and partner labs in the United States and Europe. Disruptive companies can immerse themselves in deploying their concepts and accelerating their development by benefiting from mentoring, prototyping and marketing support as part of a network of specialized professionals. The Global Entrepreneur Program also includes access to the cloud-based **3D**EXPERIENCE platform, community management, support and services that bring speed, agility, flexibility, experimentation and collaboration to projects that require more than just a new engineering product activity. In short, the power of a network.

70%
OF STARTUPS MANUFACTURING PHYSICAL PRODUCTS USE SOLIDWORKS

9 months
AVERAGE TIME TO MARKET BETWEEN IDEA AND SALE OF THE PRODUCT FOR A STARTUP

More than 130
INCUBATORS, ACCELERATORS AND STARTUP INVESTMENT GROUPS SUPPORT THE SOLIDWORKS FOR ENTREPRENEURS PROGRAM

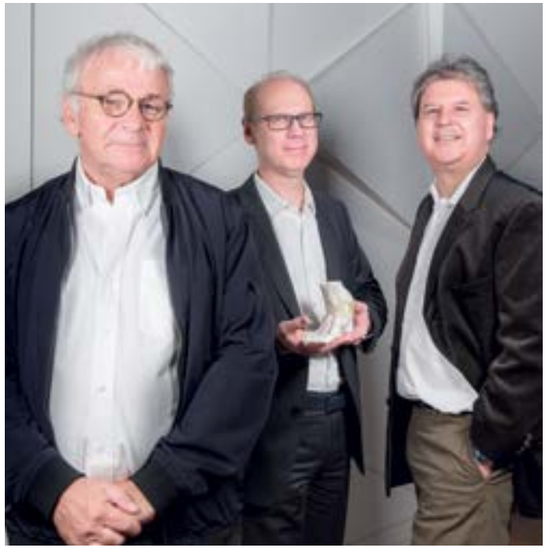
SOLIDWORKS FOR ENTREPRENEURS

Today, startups build functional prototypes in fewer than three months, and production can begin three to six months after that. In total, it takes less than nine months. In the minds of the founders, the main problem is to figure out how to obtain financing and resources to support this quick development.

To support the hardware startups, the SOLIDWORKS for Entrepreneurs program offers licenses for all SOLIDWORKS products, online training and co-marketing possibilities. Startup companies from around the world have benefited from the SOLIDWORKS for Entrepreneurs program. Boom Supersonic based in Denver, Colorado, planning to bring commercial supersonic flight to the mainstream, benefited from SOLIDWORKS software to design their XB-1 supersonic demonstrator jet.
A specific, more extended offering is available for organizations specializing in startup incubation and in providing mentoring, advice and resources to young startups.

HEALTH, SUN, MUSIC: LIFE!

The Global Entrepreneur Program, supports disruptive startups that are transforming society. Discover three outstanding companies in different fields of activity benefiting from the **3D**EXPERIENCE Lab.



Bruno FERRÉ, Thibaut LEEMRIJSE and Eric HALIOUA from Digital Orthopaedics.

LIFE

DIGITAL ORTHOPAEDICS, PERSONALIZED ORTHOPEDIC TREATMENT

Digital Orthopaedics is developing a complete clinical decision support system on the cloud that will transform the planning and execution of orthopedic surgeries. The ultimate goal is to personalize treatment through the innovative use of ideation, modeling and simulation.

The system's value proposition is articulated around three technological platforms:

- A knowledge base and diagnostic support for foot and ankle pathologies. It will allow physicians, health care professionals and patients to collect clinical signs, understand the pathology and choose treatments based on knowledge from the best experts.
- A personalized surgical simulation platform to assist orthopedic surgeons in developing a surgical plan with a clear root-cause analysis of the disease.
- An automatic learning platform comprising clinical cases that will enrich company knowledge.

3DEXPERIENCE LAB CONTRIBUTIONS

Mentoring, provided by Dassault Systèmes on SIMULIA and CATIA, helps to deploy and implement processes and tasks, as well as to refine the distribution strategy. Weekly meetings between Digital Orthopaedics' engineers and Dassault Systèmes' mentors have contributed to accelerating development in all areas.

The communication and marketing support provided by the Lab has strengthened Digital Orthopaedics' image internationally. The partnership with the **3D**EXPERIENCE Lab is perceived as a validation of the company's approach and helps reduce risk.

Furthermore, the **3D**EXPERIENCE platform on the cloud provides the framework and software to automate workflows. A connection to hospital imaging systems allows orthopedic surgeons throughout the world to access the solution. Finally, 3D modeling means that the clinical service's development, testing and deployment can be done much more efficiently.

LIFESTYLE

SYOS, PERSONALIZED MUSICAL INSTRUMENTS

SYOS offers saxophonists a unique sound through personalized 3D-printed mouthpieces. An algorithm links the vocabulary the musician uses to describe his dream sound and the geometry of the mouthpiece that can provide this sound. In less than two years, SYOS has become a strong brand with customers in 15 different countries, supported by popular ambassadors: Daro Behroozi from Lucky Chops, Dayna Stephens and Thomas de Pourquery (Victoire du Jazz 2017).

3DEXPERIENCE LAB CONTRIBUTIONS

SYOS was involved in the **3D**EXPERIENCE Lab program for seven months. SOLIDWORKS and the **3D**EXPERIENCE platform on the cloud were used for collaborative design, modeling and simulation. SYOS is regularly invited to events Dassault Systèmes participates in to showcase their product and the collaboration that helped create it. Through the program, the startup receives free access to all software as well as mentoring, which allows them to quickly master the platform's solutions.

Pauline EVENO from SYOS

Benjamin DAVID from XSun

CITY

XSUN, AUTONOMOUS SOLAR DRONES

XSun proposes Solar X One, a flying machine that is powered and piloted autonomously. The startup designs new types of long-ranged, solar-powered drones that open doors to continuous flights. By relying on solar power, these machines are designed to cover long distances and carry a wide variety of sensors. The system will rely on a network of ground-based control stations.

3DEXPERIENCE LAB CONTRIBUTIONS

In addition to the use of the **3D**EXPERIENCE platform on the cloud for design with CATIA and simulation with SIMULIA (especially for aerodynamic simulation), XSun receives training, mentoring and marketing support. Furthermore, the company is invited to events that Dassault Systèmes and the **3D**EXPERIENCE Lab participates in such as CES in Las Vegas, thus taking part in a broader partner ecosystem.

FIRST ROBOTICS

IS A ROBOT A PERSON LIKE ANY OTHER?

Energy, emulation and a desire to go beyond their limits inspires hundreds of thousands of young people and students each year who participate in the challenges organized by the FIRST® organization. Dassault Systèmes' SOLIDWORKS brand is FIRST's modeling solutions partner.

DID YOU SAY FIRST?

FIRST (For Inspiration and Recognition of Science and Technology) is an organization whose goal is to inspire an interest in science and technology in young people from the age of 14, and to encourage them to pursue studies and careers in these fields, as well as in engineering and mathematics. Various challenges are proposed to these young people, which involve designing, manufacturing and operating robots that have to complete specific tasks.

THE VALUES OF FIRST

Designing a robot requires precise, high-quality work. Tournament competition is fierce and learning is difficult. Thanks to their professionalism, all of the participants treat each other with respect and help each other throughout the process. All FIRST programs are based on values that help young people pursue a more balanced life and encourage greater involvement in society, while giving them the satisfaction that their actions are carried out with respect and integrity.

"Robots are only a pretext for young people to learn about important life skills. They often get involved without knowing exactly what to expect – neither from the program nor from themselves.

At the end of their first year of participating, they leave with a new vision and self confidence, and with the feeling that they will be able to create their own future."

Dean Kamen,
FIRST founder

WHAT IS THE FIRST® ROBOTIC COMPETITION?

Combining the excitement of sport with the rigors of science and technology, FIRST is the ultimate sport for the mind. High school student participants call it, "the hardest fun you'll ever have." Under strict rules, limited resources, and an intense six-week time limit, teams of students are challenged to raise funds, design a team "brand," hone teamwork skills, and build and program industrial-sized robots to play a difficult field game against like-minded competitors.

GLOBAL MOBILIZATION FOR NUMEROUS CHALLENGES

FIRST ROBOTICS COMPETITION AND FIRST TECH CHALLENGE

460,000
STUDENTS PARTICIPATED IN 2016-2017

230,000
MENTORS, COACHES, JUDGES AND VOLUNTEERS IN MORE THAN 85 COUNTRIES

17 MILLION
HOURS OF VOLUNTEER WORK IN 2016-2017

50 MILLION
US DOLLARS IN SCHOLARSHIPS OFFERED BY CLOSE TO 200 PARTNER COMPANIES

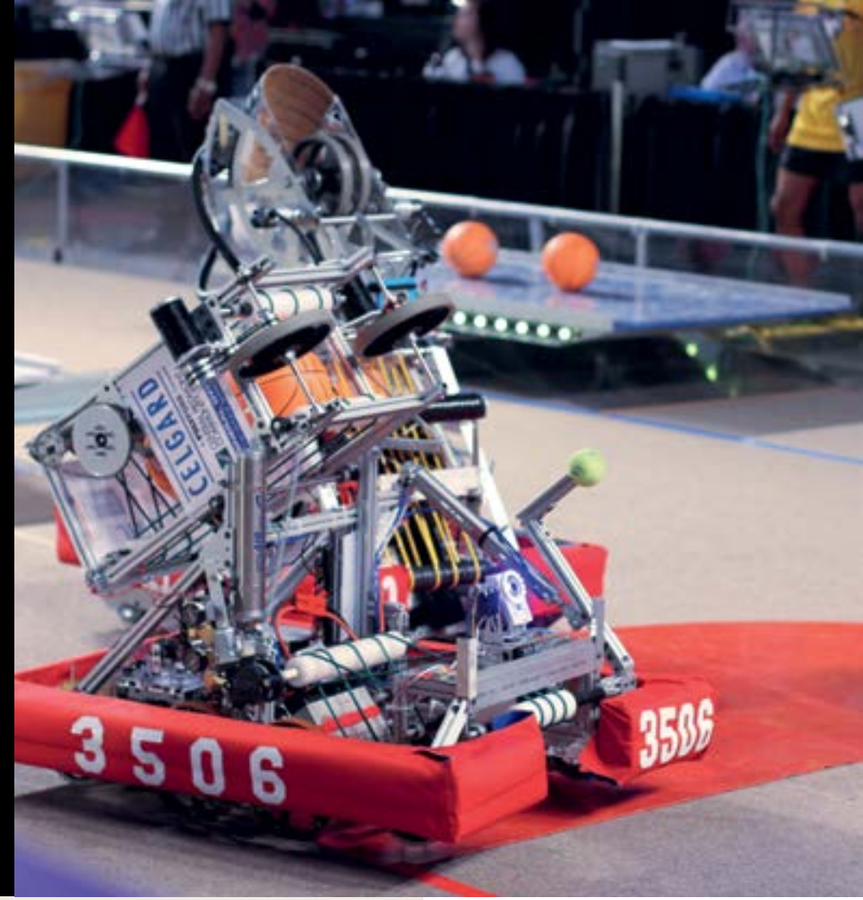
2,600
OFFICIAL EVENTS WORLDWIDE

65,000
PARTICIPANTS AT THE ANNUAL FIRST CHAMPIONSHIP

SOLIDWORKS, PARTNER OF REFERENCE

Each year, SOLIDWORKS supports thousands of FIRST teams in a movement that involves tens of thousands of students, Dassault Systèmes employees, certified resellers and partners during regional, national and global events.

SOLIDWORKS provides software kits adapted to the needs and level of the students. These solutions can be used to quickly model the robots, both in terms of mechanics and electronics. For the mechanical part, this involves modeling all of the parts, to see how they operate together and to fine tune the robot's motions and movements. Once verified, each component can be physically created thanks to the execution plans generated by SOLIDWORKS, or directly through additive manufacturing.



2017 RULES

Each contest follows precise rules that define the tasks to complete, which change each year. In 2017, FIRST Robotics adopted the name FIRST STEAMWORKS, capitalizing on the steampunk craze, a retro-futurist trend very much in vogue in literature, graphic novels, fashion and design. Two opposing groups were each composed of three teams. They had to prepare their dirigible – an eminently steampunk mode of transport – for a long-distance trip.

Each group was given three assignments:

1. GENERATE STEAM

The robots had to collect the fuel, symbolized by balls, which they had to throw into a basket.

2. START THE ROTORS

The robots had to pick up equipment, in this case sprockets, and deliver them to the pilots on their dirigible. Once the gear train was completed, they turned the crank to start the rotor.

3. CLIMB THE MOORINGS

The robots had to attach themselves to their dirigible before the launch by climbing up the length of the moorings to signal they were ready for lift-off. This step marked the end of the match.

For this type of challenge, various strategies can be deployed, but it is fairly common to hinder or block the robots of the opposing team: this is also part of the game!

AND IN 2018?

In 2018, SOLIDWORKS is the modeling solutions partner for FIRST. The company will provide the engineering documentation tools with SOLIDWORKS Composer to help create the game manual, field drawings and assembly instructions on site. For the fourth consecutive year, SOLIDWORKS takes part in FIRST events with more than a thousand teams potentially using its solution.

ADDITIONAL
INFORMATION

Headquarters Dassault Systèmes
10, rue Marcel Dassault – CS 40501
78946 Vélizy-Villacoublay Cedex,
France
Tel.: +33 (0)1 61 62 61 62

GEO Headquarters North America
175 Wyman Street,
Waltham, MA 02451, United States
Tel : +1 781 810 3000

Latin America
85 Avenue Jornalista Roberto Marinho
13th floor – suite 131
04576-010 São Paulo, Brazil
Tel.: +55 (11) 2348-9900

Central Europe
Meitnerstrasse 8
70563 Stuttgart, Germany
Tel.: +49 711 273000

Northern Europe
Riley Court, Suite 9, Milburn Hill Road
CV4 7HP Coventry, United Kingdom
Tel.: +44 (0) 247 685 7400

Russia
Kuntsevo Plaza
Yartsevskaya Street, 19
121552 Moscow, Russia
Tel.: +7 495 935 89 28

Southern Europe
Innovazione 3
Via dell' Innovazione, 3
20126 Milano Bicocca
MI, Italy
Tel.: +39 02 3343061

Western Europe
10, rue Marcel Dassault – CS 40501
78946 Vélizy-Villacoublay Cedex,
France
Tel.: +33 (0)1 6162 6162

India
CB - 32, Stylus Serviced Offices
R-Tech Park, Nirlon Complex
Goregaon (E)
400063 Mumbai, MH, India
Tel.: +91 2244764567

Southern Asia-Pacific
9 Tampines Grande #06-13
528735 Singapore
Tel.: +65 6511 7988

China
China Central Place, Tower 2,
Room 707-709 No.79, Jianguo Road
100025 Chaoyang District (Peking),
China
Tel.: +86 10 6536 2288

Korea
ASEM Tower 9F, 517 Yeongdong-daero
Gangnam-gu, 135798 Seoul,
South Korea
Tel.: +82 232707800

Japan
ThinkPark Tower
2-1-1, Osaki, Shinagawa-ku,
141-6020 Tokyo, Japan
Tel.: +81 3 4321 3500

For more information,
visit www.3ds.com

Investor relations
Tel.: +33 (0)1 61 62 69 24
Fax.: +33 (0)1 70 73 43 59
E-mail: investors@3ds.com

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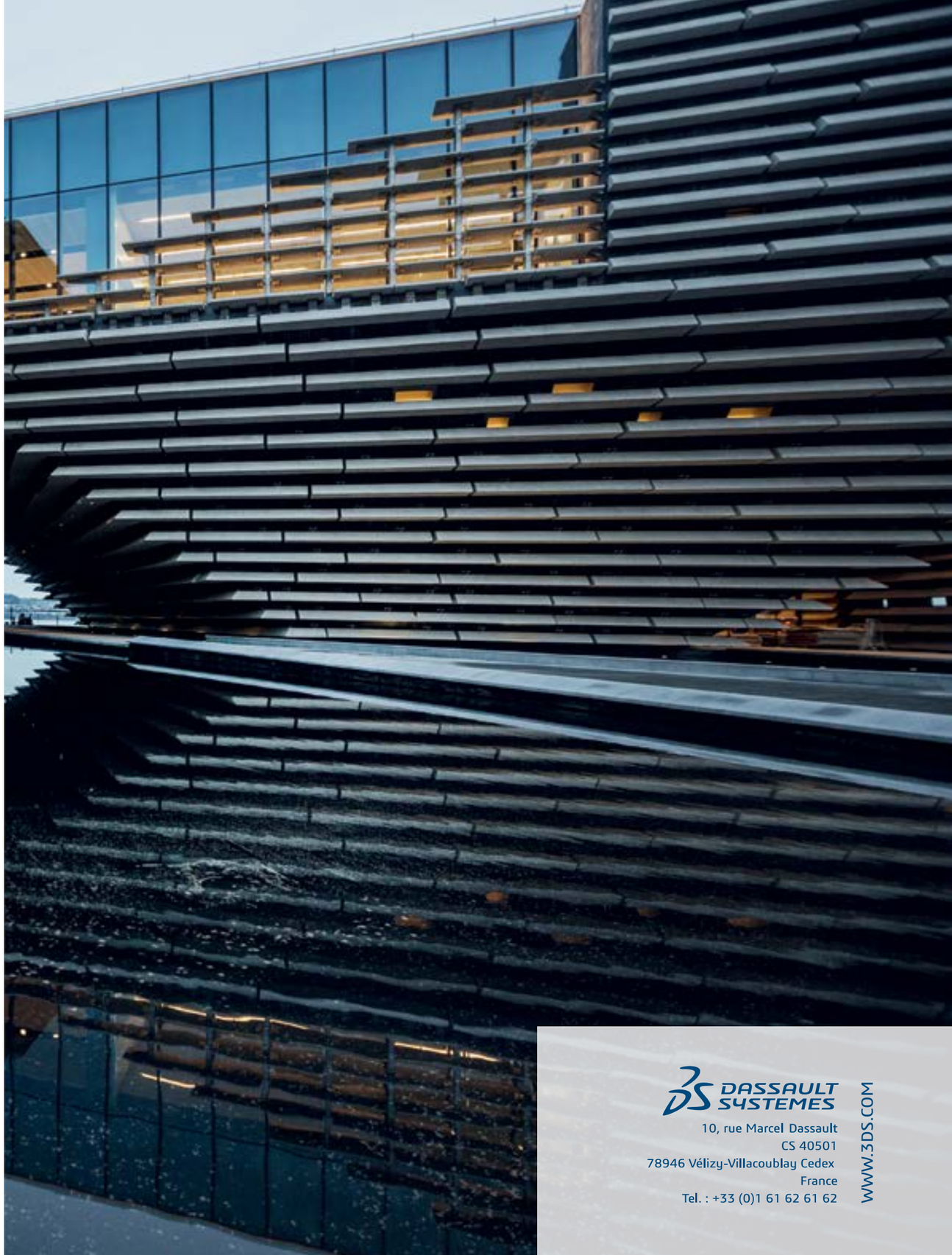

DASSAULT SYSTEMES
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France
Tel. : +33 (0)1 61 62 61 62

WWW.3DS.COM