



# SOLIDWORKS SERVES HUMANKIND WANDERCRAFT'S REVOLUTIONARY EXOSKELETON PROJECT

Wandercraft's mission, motto, and commitment is "Building an ordinary life for extraordinary people." Team Wandercraft is achieving this mission by designing a robot to enable dynamic walking.

### **Challenge:**

To enable those who no longer have motor function to walk, thanks to a technological innovation that pushes the boundaries of science: Wandercraft's crutchless exoskeleton.

### **Solution:**

Implement SOLIDWORKS 3D Solutions, including SOLIDWORKS Premium for density, surface, and panel work; SOLIDWORKS Electrical design for the electrical wiring of the motor; SOLIDWORKS Simulation to run tests and iterations; and SOLIDWORKS Composer for technical documentation, to design the entire Wandercraft exoskeleton.

### **Benefits:**

It's a race against time for those who can no longer walk and who are seeing their health seriously deteriorate. The processes must ensure both the speed and reliability of the designs, optimizing and securing the final result: an exoskeleton that offers paraplegic people in wheelchairs the chance to walk dynamically, both in rehabilitation centers and at home.

Wandercraft is a young company, of which we need more, that endeavors to combine innovation with humanity. The story began in 2005 with three engineering students at Paris' École Polytechnique, all experts in robotics, one of whom faced a motor disability in his family. How to create a solution to this problem? Before the end of their studies, they founded Wandercraft with the aim of developing walking algorithms and then enabling wheelchair users to walk using an exoskeleton. A crazy idea? No, an innovation that pushes the boundaries of science.

Twelve years later, Paris-based Wandercraft employs a team of around 35 people, including 25 engineers. Most of them have an international education and are experts in mathematics, algorithms, real-time software, mechatronics, mechanics, biomechanics, regulations, quality, etc. They are one of the best walk robotics teams in the world. Nicolas Simon, managing director, Alexandre Boulanger, managing director, and Matthew Masselin, president, the company's three founders, have been joined by specialists in their field, including Jean-Louis Constanza, originally a Board Member and now Chief Business Officer.

The Wandercraft principle: breaking down the barriers of disability with robotics and enabling extraordinary people to lead an ordinary life. Jean-Louis Constanza adds: "My son, who is in a

wheelchair because of a genetic disease, asked me one day why robots couldn't help him. Today, or tomorrow, he will be able to go to university freely. There will be fewer constraints and things he cannot do in his everyday life."

### **ROBOTICS SERVING HUMANKIND**

The first robot to move dynamically ... this may have seemed unthinkable given the progress in this field, but that was before Wandercraft. "We had to design an exoskeleton that would be at the cutting edge in the field of robotics; that would enable people to walk without crutches and would be easy to use," explains Jean-Louis Constanza. "Our walking companion is so simple. The user leans forward to get up, then again to move forward, and can change direction using shoulder movement."

But simple does not mean easy to design. The engineers have to overcome technical and regulatory obstacles one by one. To do this, they need a 3D solution that's up to the challenge. This solution is SOLIDWORKS by Dassault Systèmes, which the founders had already used during their studies and implemented thanks to the SOLIDWORKS for Entrepreneurs program, which encourages young entrepreneurs of all kinds (agitators, do-it-yourselfers, creators, innovators, or members of an incubator). This program is perfectly suited to our robotics troublemakers.

**"SOLIDWORKS is—simply and effectively—the backbone of our designs. The Dassault Systèmes 3D solution is a necessary step in getting the exoskeleton certified and making the Wandercraft technological and human adventure an industrial reality,"**

— Jean-Louis Constanza, Chief Business Officer

### **AN EXOSKELETON DESIGNED ENTIRELY WITH SOLIDWORKS**

Wandercraft is evolving in the field of health, a strictly regulated environment, both for the initial design and then for the robot's documentation.

Let's look at the example of an exoskeleton actuator to understand all of the different cogs at play. This part plays the role of a muscle in the human joints and is therefore one of the robot's main parts.

It all begins with precise specifications, which are defined by the team at Wandercraft. Those specifications—which may include mechanical, electrical or physical (materials, weight,



resistance, bulk, etc.) requirements—are then sent to the design office. The team led by Thomas Dartois, an engineer with expertise in mechanics and Research & Development, researches standard components on the Internet. “We conduct several parallel studies to narrow down our choices. To begin with, there’s no need to go into too much detail; a macro view of the actuator is enough for us to select the right components and determine our technical choice,” he explains. “It’s a bit of a race against time. For some components, the supply times are between 10 and 14 weeks, which is why it’s important to choose the technology quickly and scrutinize it later.”

### ONCE THE PARTS ARE CHOSEN, THE DESIGN CONTINUES...

All parts of the actuator are designed with the Dassault Systèmes 3D solution. To assemble everything, the design office requires:

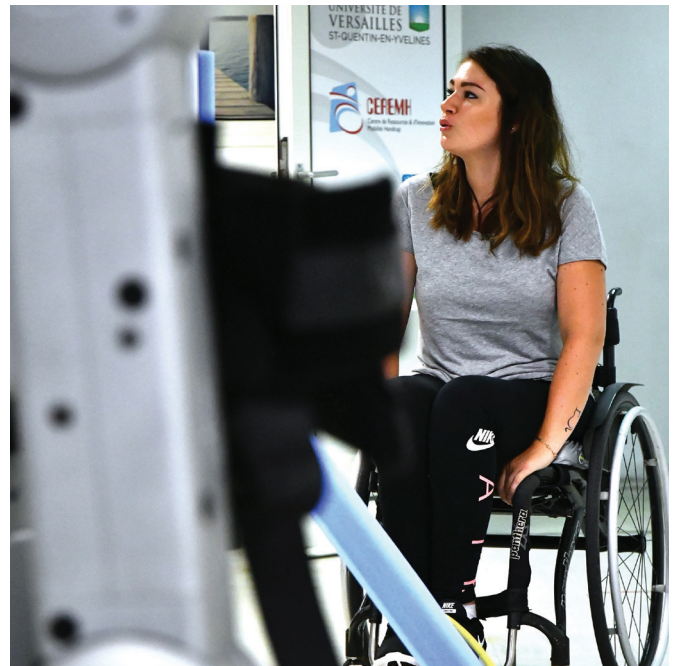
- SOLIDWORKS Premium for 3D CAD (density, surface, and panelwork)
- SOLIDWORKS Electrical for the electrical wiring of the motor
- SOLIDWORKS Simulation for the different tests and iterations
- SOLIDWORKS Drawing for mapping
- SOLIDWORKS Composer for the technical documentation

Besides the design, SOLIDWORKS serves as a base platform for inter-service communication. “All of the skill teams, including Research & Development and purchasing, have access to the virtual mock-up, so we can collaborate easily and more quickly submit our designs, visualize their integration into the exoskeleton, and order components,” adds Thomas Dartois.

This cooperation continues outside of Wandercraft. The company’s partners, suppliers and manufacturing partners often use SOLIDWORKS. This greatly simplifies the exchange of files. When the part, in this case the actuator, is submitted, it is integrated in the exoskeleton. It will form part of the 300 parts that make up the walking robot. Everything will be checked again using a full digital mock-up.

Then there is the documentation that accompanies every detail of the exoskeleton. This information is crucial in getting the Wandercraft robot certified by the relevant authorities. This is an essential condition of its release onto the market.

Jean-Louis Constanza concludes on the use of SOLIDWORKS: “It is our staple, everyday tool. We are extending our hand as well as our pen.”



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## 2017 AND 2018: TWO PIVOTAL YEARS FOR WANDERCRAFT

“For the last 12 years, we have been moving forward step by step, pushing the boundaries of science, adapting, and inventing. Our disruptive innovations serve humans, and we are proud of that.

“Our first clinical trials are encouraging—100% of paraplegic people have been able to walk at least ten yards with our crutchless exoskeleton, without pain or discomfort,” reveals Jean-Louis Constanza. “We have managed to create and build the first robot capable of replicating the movements of the human body, with 12 robotic joints powered by ultra-fast electronics. This is a first that will allow many people with reduced mobility to walk again and return to an almost ordinary life.”

2018 will be the year that the exoskeleton becomes certified and can be marketed. It will initially be aimed at rehabilitation centers, and in a few years, at wheelchair users. Wandercraft has taken up the challenge to bring therapy and autonomy together.

## Focus on Wandercraft VAR:Visiatiiv Solutions Entreprises

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Front view of the exoskeleton. A creation made possible thanks to Wandercraft and SOLIDWORKS !

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