Welcome to C-TEC, Constellium Technology Center

C-TEC is Constellium’s Technology Center, a leader in research and technology for aluminium products and related solutions. A global entity, C-TEC is operated by professionals from over 16 countries and is connected to all Constellium businesses and sites worldwide, as well as a network of renowned scientists.

C-TEC is at the heart of Constellium’s innovation process – a global sector leader for a broad scope of markets and applications, focusing in particular on automotive, aerospace and packaging. In addition, C-TEC is:

- Delivering through best-in-class R&D a stream of sustainable, innovative, value-adding solutions to Constellium and our customers.
- Developing options for future business growth and supporting digital transformation of Constellium.
- Maintaining technology networks in our key, shared processes (recycling, casting, fabricating), to ensure best-practice sharing and excellent knowledge and talent management.

INNOVATION BEYOND MATERIALS

Whilst new products and solutions are imagined and incubated in our labs, C-TEC does not stop there. C-TEC benefits from a unique set-up in the industry, with prototyping capabilities at industrial scale both for the Constellium Group’s processes with, for example, a full-scale plate and billet casting installation within the new Airware® casthouse, and for our customers’ processes.

For example, our automotive stamping press can form parts with dimensions representative of mass production, and our set of tools can produce beverage cans to test new designs.

Thanks to this “lab to industrial scale” approach, innovations are fully tested to ensure they can be produced at the best quality, cost and time for our customers.

Customers also call upon C-TEC’s simulation and numerical modelling capabilities, to help develop and design their products, using our metal. Thanks to a unique set of tools, numerous options can be quickly tested. This reduces development time and ensures very short time to market.

We innovate beyond materials for our customers.

Welcome to C-TEC, welcome to innovation at Constellium
Core competencies & special equipment

- Recycling and molten metal processing
- Casting and solidification
- Physical and mechanical metallurgy
- Surface treatment, coatings and corrosion
- Data mining
- Process modelling (rolling, finishing, extrusion)
- Product modelling and design
  - Integrated metallurgical modelling of alloys
  - Structural application design, e.g. aerospace
- Joining & forming

- Physical materials characterization & testing, chemical analysis and microstructural characterization, e.g.
  - Non-destructive, phased array ultrasonic testing
  - Large scale tensile and fatigue testing rig (2500 kN)
  - Field Emission Gun Scanning Electron Microscopes (FEG-SEM)

- Prototyping at industrial scale, e.g.
  - Friction stir welding
  - Breakthrough Airware® pilot casthouse
- 3D printing

Over 190 patent families and trademark
21* patents filed in 2017

16 Nationalities
220 Full-time employees

*Overall Constellium scope
AEROSPACE
Where innovation takes flight

Global leader in:

- Aerospace plates
- Aluminum-lithium flat rolled products and extrusions
- Fuselage sheets

With the help of C-TEC’s key competencies and equipment, Constellium offers innovative, high performance products and manufacturing services that bring performance and cost benefits to aerospace companies of all kinds – whether they build commercial aircraft, military aircraft, or work on space programs.

Our plates, sheets, extrusion and precision casting aerospace products are used for a wide range of applications such as bulkheads, fuselage shells, wing skins, stringers, door frames or engine gearboxes.

PACKAGING
Creating out-of-the-box solutions

- Global leader in closure stock
- Leading positions in Europe and in North America for can body stock

For the packaging market, C-TEC is working in partnerships with key customers to develop and industrialize innovative value-adding solutions. Research activities include: the development of thinner sheets to lightweight can body/end stocks, Drawn and Wall Ironed (DWI) aerosols & adaptation of an existing alloy to the specific needs of the new aluminum bottle. We also bring innovative aesthetic and functional attributes to aluminium closures.

In parallel C-TEC is contributing to optimize Constellium and customer manufacturing processes to make our aluminium solutions the best choice for their packaging applications.

Reducing global carbon footprint remains a key target in this market as in others. In this context, C-TEC is developing sorting and recycling technologies to expand our end-of-life scrap sourcing.

AUTOMOTIVE
Helping to drive the future

- A global leader in Crash Management Systems (CMS)
- Leading position in Europe in Auto Body Sheet

Constellium’s advanced aluminium solutions, designed in C-TEC Voreppe & Plymouth and/or in Brunel, help global automotive manufacturers produce lighter, safer, and more fuel-efficient vehicles, as well as electric vehicles with greater range.

Automakers turn to Constellium for a wide range of applications, including car body closures, Crash Management Systems, Body-in-White structural components, battery enclosures, chassis and mechanical parts, heat exchangers, and functional surfaces for interior and exterior design.

OTHER MARKETS

C-TEC is also deeply involved in developing the next generation of products and processes for other attractive markets to Constellium, in particular: Transportation (trucks, boats, rail, leisure vehicles), Industry and Defense, Heat Exchangers and Specialties (cosmetics, decorative parts...
Innovation at our core

Our ambition is to be our customers’ premier choice for innovative, next generation aluminium solutions in all the markets that Constellium is serving.

Recent Constellium innovations

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<tr>
<th>Year</th>
<th>Innovation</th>
<th>Market</th>
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<tbody>
<tr>
<td>2018</td>
<td>Ultralex®</td>
<td>AUTOMOTIVE</td>
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<td>2018</td>
<td>Airware® 2074 Fuselage</td>
<td>AEROSPACE</td>
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<td>2017</td>
<td>Airware® 2065/2076 Wing Stringers</td>
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<td>2017</td>
<td>AA7160 Plates</td>
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<td>2017</td>
<td>Securalex® UHS</td>
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<td>2016</td>
<td>Modalex®</td>
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<td>2016</td>
<td>Aeral®</td>
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<td>2015</td>
<td>Formalex® Remote</td>
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<td>2015</td>
<td>Billet Casting for Airware®</td>
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<td>2014</td>
<td>Kool X® Light Evaporators</td>
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<td>2014</td>
<td>Kool X® Exhaust Gas Recirculation Loop</td>
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<td>2014</td>
<td>HSA6™ CMS* Technology</td>
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<td>2014</td>
<td>Securalex® HS</td>
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<td>2013</td>
<td>Dokima®</td>
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<td>2012</td>
<td>Formalex® Plus</td>
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<td>2010</td>
<td>Strongalex®</td>
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<td>2010</td>
<td>Securalex®, Surfalex®</td>
<td>AUTOMOTIVE</td>
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*Crash Management System

International Scientific Council

In 2013 we created the International Scientific Council of Constellium to nurture and broaden our perspective on emerging domains, key drivers, and technological trends related to our strategic activities. The council comprises six academic members from laboratories and universities around the world.

Our innovation teams at C-TEC and Plymouth work closely with the International Scientific Council to identify trends and upcoming opportunities. They provide us with high level advisory support and recommendations regarding R&D, approaches to innovation, research collaborations, and enriching our scientific network.

For example, in recent years the council has advised us on the “aluminisation” trend in the automotive market, as automakers seek out the benefits of lightweighting for electric and hybrid vehicles. We consulted the council about 3D printing and additive manufacturing, particularly in the aerospace industry, where we are partnering with several major manufacturers and suppliers. And as Industry 4.0 becomes a reality, the council has helped guide our decisions on using big data, the internet of things, and autonomous robots to maximize performance.

University partnerships

Constellium maintains scientific partnerships - many of them long-term - with approximately 50 of the most prestigious universities and laboratories around the world. These include:

- **USA**: MIT, Northwestern University, University of South Carolina, Worcester Polytechnic Institute
- **UK**: Brunel University London, University of Manchester, University of Oxford, Cranfield Aerospace Institute
- **France**: CNRS/University laboratories in Paris, Grenoble, Nancy, Saint-Etienne, Toulouse, IRT M2P (Metz), IRT Jules Verne (Nantes)
- **Germany**: RWTH Aachen, German Aerospace Center DLR, Stuttgart University, Dresden Technical University, Paderborn University
- **Switzerland**: EPFL Lausanne
- **The Netherlands**: TU Delft

Customer Collaboration

Constellium's engineers and technicians work together with our customers to design and make cost-effective products and processes that correspond perfectly to their needs. Some of Constellium's most exciting innovations have come out of these collaborations.
Why is C-TEC so special in the aluminium industry?

Constellium’s R&D center has state of the art capabilities which allow our researchers to continuously innovate to meet our customers’ needs and drive the future growth of Constellium. More importantly, Constellium’s technical experts represent the best and brightest minds in the aluminum industry. Our team is constantly working on product and process innovations that will advance the use of aluminium in our key markets.

What are the next big innovation challenges for your industry?

In aerospace, composites continue to pose a threat. However, we believe aluminium has significant potential to remain the material of choice through new alloys and innovative processing solutions. In automotive, the big opportunity is the impressive demand and ramp up of aluminium for this industry. We have always believed that this day would come, and now aluminium for the auto mass market is becoming a reality – at an accelerated pace. Our latest alloys already offer increased strength such as Strongalex®Plus and Securalex®HS for structural and crash applications together with HSA6 extrusion-based crash management systems. The challenge is to continue to increase formability, strength and energy absorption while meeting all the other technical requirements competitively. Light weighting and recyclability are the key drivers.

What are other, longer term megatrends that you are looking at?

We continue to look at multi-material solutions, where aluminium is one part of the equation and is combined with other materials. This will enhance properties and create new applications. 3D printing / additive manufacturing is also an area of great interest. With our extensive knowledge of aluminium metallurgy, we are developing next generation powders for 3D printing. Last but not least Constellium is taking large steps to aggressively implement a Digital strategy that will accelerate innovation for new products and processes, thereby allowing C-TEC to meet our customers’ needs at a faster pace.