

# ACOME INSIDE

Connection makers

## #1 Innovations

**Ready for 5G and  
network convergence**

**POE - DAS - IoT: now  
is the time for smart buildings**

**Electromobility:  
focus on power**

CONNECTION MAKERS

#1 Innovations

ACOME INSIDE



# ACOME INSIDE #1 Innovations

ACOME INSIDE takes you behind the scenes of the ACOME Group, a video-based initiative launched on our social networks (LinkedIn and Youtube) during lockdown, which has found a new platform through this magazine.

This first issue is focused on innovation and how we drive it. Since its founding, ACOME has been taking on technological challenges and pushing its boundaries to master its core technologies. Driven by a fully customer-focused approach, research, innovation and development involves around one in every ten employees in France, in specialities ranging from materials science to development, including data science and simulation.

We hope that this magazine will give you the opportunity to see for yourself the commitment of our teams to meet the challenges of your markets and to recognise the value of the innovative solutions that they work on, most often in co-development with their customers.

CONNECTION MAKERS

#1 Innovations

ACOME INSIDE

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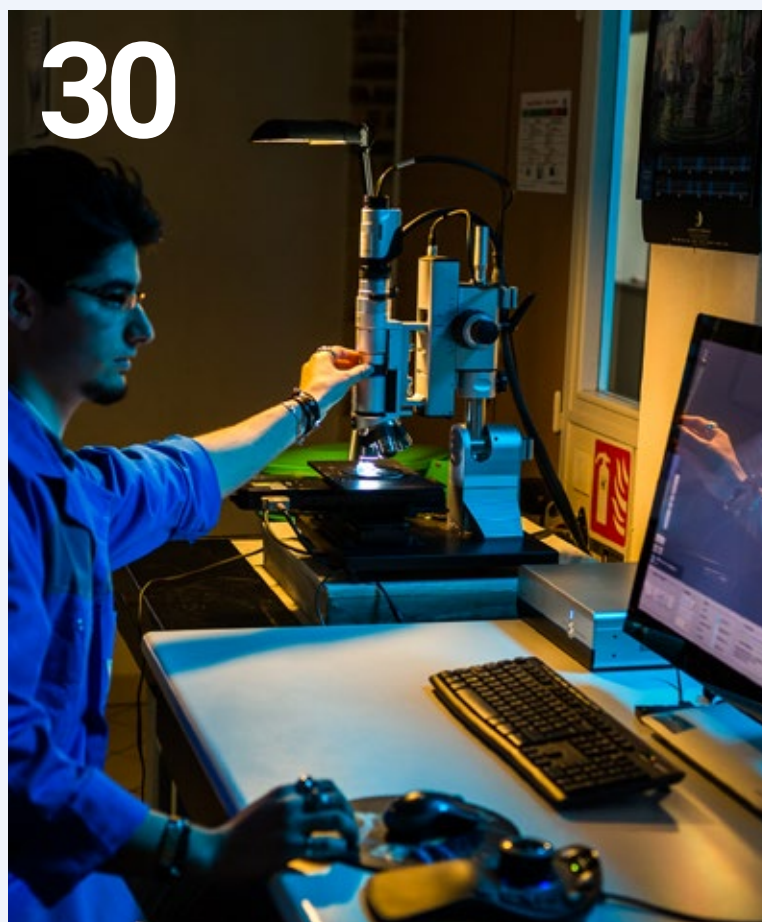
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## ● Contributors

From acquiring technological building blocks to defining new products alongside our customers, innovation at ACOME is centred on the implementation of multidisciplinary working groups which involve functions such as forecasting, marketing, business development, research and technology, the design office and development.



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## ● Editorial

# ACOME steps up innovation efforts

//////////////////// Our ambition is to make ACOME an innovative Group that focuses its performance on new inventions, offering sustainable network development solutions, all while creating value for our customers.

In a technology company, product commoditisation or trivialisation is a major risk. Through our ability to innovate, we can reassure our customers that when they come to ACOME they will find cables suited to their needs today and solutions for the future, a future which, during this period of multiple transitions, is open to a whole host of technological possibilities.

As a leading manufacturer in our markets, our aim is to anticipate developments. At ACOME, our customers will always find specialists who listen and support them in order to provide cutting-edge solutions, helping them to defend their positions in their respective markets.

### Scientific heritage

To ensure that innovation is the reactor core, up to one hundred technicians and engineers are involved in basic research, upstream research and development. They work on the technologies, materials, transmission characteristics and applications that these cables are designed for, with the aim of inventing, innovating and developing solutions that bring enhanced performance or new



**Jacques de HEERE**  
Chairman and Chief Executive Officer  
of the ACOME Group

features. ACOME takes steps to consolidate this scientific heritage by attracting new talent and encouraging the acquisition of new knowledge in highly-changing fields.

### Recent success and outlook

This investment brings success to ACOME in each of its markets: new insulating materials that are flexible and resistant to very high temperatures for electric or hybrid vehicles; miniaturization of cables inside congested ducts; development of fibre optic cables that can be installed both outside and inside buildings to improve operating costs; hybrid optical cables with built-in power conductors and optical fibre for mobile infrastructure networks; computer network cables that conform to the latest fire standards while maintaining very high speed transmission performance inside buildings, etc.

These are just a few examples to illustrate our past innovations. As you read through this magazine, you will see how our R&D teams anticipate future developments through research programmes, innovation projects, prototyping and innovative partnerships.



**Driving force**  
10% of ACOME employees work  
in Research, Innovation and  
Development

## ● Interview

# Combining innovation and co-development

### Aurélien BERGONZO

Director of Group Research, Innovation and Technology (DRIT).  
His role: to improve the technological maturity of the various components involved in the manufacture of cables and systems, and provide business units with the technological building bricks.



#### What is ACOME's vision in terms of innovation?

**AURÉLIEN BERGONZO:** We want to make innovation the key link between research and development.

To anticipate the solutions of tomorrow, our organisation distinguishes between the acquisition of technological building blocks, for which we are introducing innovation projects with our business lines and our customers, and the development of products driven by the business unit that holds the access channel to the market.

As part of our approach, there is always a very direct link to the market and the aim to achieve our ambition at ACOME, which lies at the heart of the challenges presented by connected mobility, in a responsible and sustainable manner.

#### How important is open innovation for you?

**A. B. :** In order to validate the tangible benefits that an innovation can provide, we bring our customers

into the conversation as we move forward with experimentation.

We organise Tech Days. These are day events focused on ACOME innovations during which we present to our customers and partners the ideas – sometimes patented but often confidential – that we are working on to meet their needs. These highly interactive exchanges can guide our lines of research. Through innovation, we can steer technological building blocks towards our customers. And if the proposal is approved by our customers, we can move to development and production. It is a virtuous cycle.

**ACOME R&D teams** are primarily based at the Mortain industrial site in France.





### Are IoT, Data, and Artificial Intelligence part of the language at ACOME?

A. B. : Traditionally, ACOME has expertise in two key processes in the cable industry: extrusion and cross-linking, driven by materials science. The forecasting work we have performed at DRIT has suggested stepping up our work in data science. Data science based on AI should become a new core technology at ACOME. We have improved our skills in this area by creating a process, product and system simulation unit. Data simulation and analysis allow us to understand physical characteristics more quickly, meaning we can develop the best possible solutions for our customers. For example, we are able to predict a cable's life-cycle under various environmental conditions.

Data science should become  
a new core ACOME technology

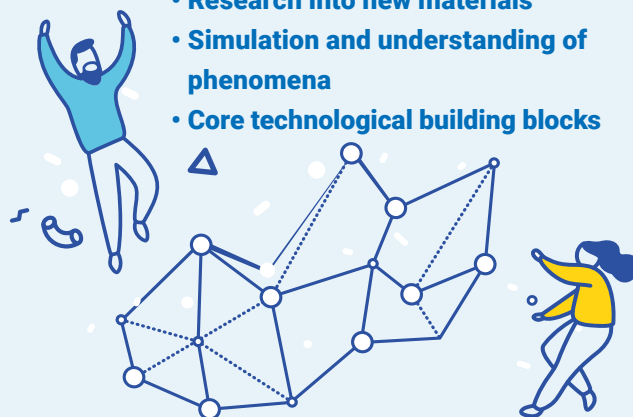
### How can this research be applied to manufacturing processes?

A. B. : We are working on the implementation of concept 4.0 lines which will be instrumented prototyping lines that will provide us with the opportunity to explore new processes, new materials and new technologies. Equipped with sensors, they will allow us to analyse data and bring knowledge and intelligence. We are also carrying out work on the possibility of using recycled materials in our processes. All this is part of a responsible and sustainable approach. This is a key focus for ACOME given our CSR commitments.

## The Group's research, innovation and development policy is a long-term endeavour

### Research and technology

- Research into new materials
- Simulation and understanding of phenomena
- Core technological building blocks



### Innovation and experimentation

- Assessment of innovative proposals based on validated concepts
- Experimentation (prototyping) and validation



### Development

- Design and development of new products and processes
- Solution approval



The test and qualification laboratory and the industrial property, monitoring and forecasting unit are two structuring activities that reinforce the Group's research, innovation and development policy.





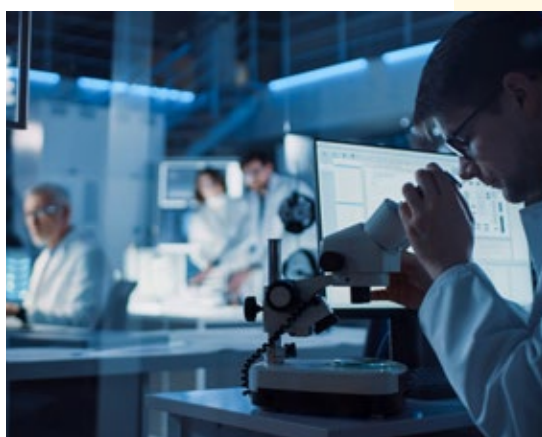
# Providing our customers with value through innovation

The Research, Innovation and Development policy is aimed at supporting the ACOME Group in meeting the challenges of connected mobility from a technological and sustainability perspective, in keeping with the Group's CSR policy and market conditions.



**S**pecialising in products with high technological added value, ACOME has made innovation one of the drivers in how it creates value and expands. To address the challenges faced every day in the fiercely contested sectors of telecoms infrastructure networks, communications networks in smart buildings, automotive and rail, the Group commits 10% of its French workforce to research and development.

The Group's teams and expertise in materials and compounds science, technologies, simulation, test and qualification laboratories, industrial property and forecasting are mainly concentrated in France at the inte-



grated research & technology centre (R&T) in Mortain, Normandy.

Some 100 technicians and engineers conduct basic research at the centre, while innovating, experimenting and developing new products that bring value to customers. In coordination with the French teams, technical teams are also dedicated to innovation and development efforts in China, in order to meet local market needs.

## INNOVATION, THE HEART OF R&D

Faced with the speed of technological changes that are sweeping across its markets, the Group has enhanced its research, innovation and development process in order to anticipate the needs of its key customers. This process was reviewed with the aim of ensuring control over the technological building blocks and reducing the time needed to develop new products up to market launch. Through its ability to turn inventiveness and creativity into genuine discovery or ingenuity, innovation becomes the key link between research and development.

## OPEN INNOVATION

ACOME is in a better position to support emerging needs as part of an open innovation approach through targeted partnerships with experts from related fields, schools and universities.

Multidisciplinary working groups involving functions such as forecasting, strategic and operational marketing, business development, research & technology, design and development, and intellectual property, have been set up. While innovation can be fueled

by research, it can also be fueled by various triggers, resulting from observing weak signals, understanding customer needs and interpreting emerging or unexpected factors.

“Ensuring control over new technological building blocks and reducing time to market.”

## DIGITAL SIMULATION: UNDERSTANDING AND INVENTION

In just a few years, digital simulation and modelling have become key technologies to help understand processes, materials and phenomena. As they can be used to create virtual prototyping of products, they allow us to find the optimum characteristics required by customers more quickly and at a lower cost. This scientific approach is used in par-





particular in the areas of rheology and the study of the behavioural laws of plastic materials, the extrusion process and the multiphysical simulation of cables in the environment in which they will be used. The aim of exploring new areas in the data economy and artificial intelligence, for example, is good reason to develop skills in data science. Goal: to meet market demands by providing better quality solutions and reducing time to market.

#### A TRADITION OF INNOVATION

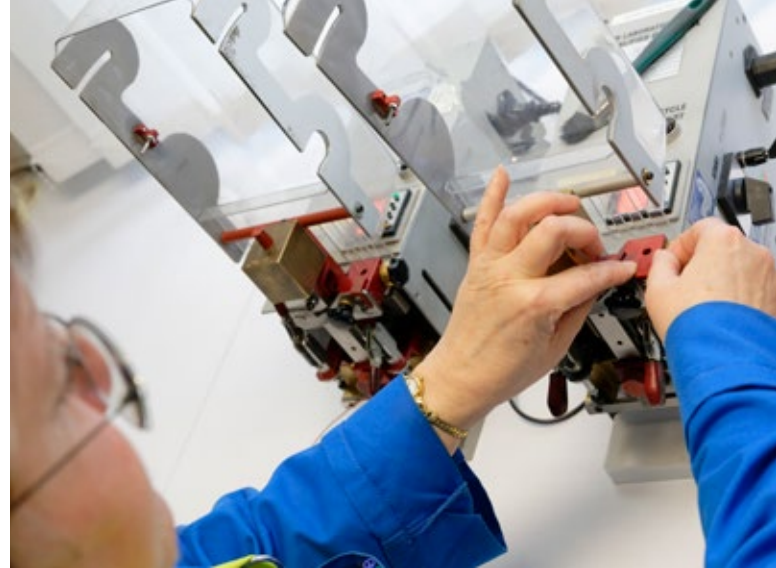
Innovation has been an integral part of ACOME's history since it began. The Group's major technological advances in wire drawing, control of polymer insulation through cross-linking and fibre optic connectivity have contributed to it being considered an industry-leading manufacturer. None of this would have been possible without the scientific knowledge and inventiveness of Acomians. Naturally, the Research, Innovation and Development policy puts human resources and capturing critical knowledge and expertise as key to success.

10%

of employees in France  
work in R&D

16%

of new products  
in 2019



#### Materials laboratory

### Controlling material

The ACOME materials laboratory draws on cutting-edge cross-functional technological expertise. The teams are specialists in metallurgy and metal physics, providing the Group with genuine scientific expertise in copper alloys and aluminium. Their work is aimed at identifying new alloys and new processes in order to optimise the mechanical and electrical performance of conductive materials and meet new market challenges.

Plastics processing is the Group's other major area of expertise. Our development policy is centred on the manufacturing of compounds that allows us to target precise specifications. Materials research is constantly broadening its knowledge of plastics with the aim of improving the property of insulating materials in demanding environments. This research may involve alternative formulations using recycled materials or bio-based products.

With deep knowledge of the characteristics of its plastic components, the company builds its own extruders to be able to process these materials under the best possible conditions. As a result, ACOME is positioned across the entire value chain, from compounds to the physico-chemical crosslinking of polymers through extrusion. /

"Having scientific expertise in metals, alloys and plastics is a real asset for innovation"

## Test laboratories

# Thousands of tests performed each year

Whatever its intended purpose, each new wire or cable requires no less than thirty mechanical, electrical or optical tests before receiving approval from the customer, operator or manufacturer. Thousands of tests are carried out each year in the test and qualification laboratory. Around a dozen people work to guarantee the performance expected by our customers and consolidate the image of ACOME as a high-quality industry leader.

ACOME also has its own integrated fire test laboratory, accredited by Cofrac and regularly audited by our customers. This in-house laboratory enables the Group to develop products that meet the highest standards required by the Construction Products Regulation (CPR) and to continue to drive the fire resistance of its materials towards the highest Euroclasses.

To complement these test facilities, the Mortain site is currently being equipped with a concept 4.0 line. The line combines simulation tools, materials expertise and testing of new formulations or new processes. This tool will confirm the usefulness of planned technological developments before considering their large-scale production. /

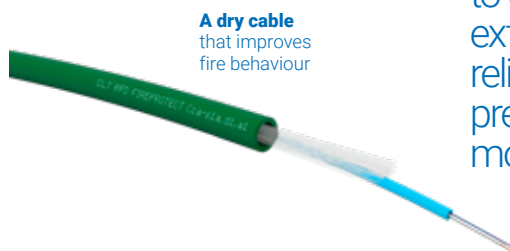


## Data Science

# Models to predict fire behaviour

By leveraging data science, ACOME has developed digital models that provide fire test results even before any laboratory tests are carried out, and as such, before even a single inch of cable is made! They compile the design data accumulated by the Group for decades and compare it with the results of fire tests carried out by the integrated Cofrac laboratory to predict the resistance of new cables. As this prediction model is more than 80% reliable, the time savings between design and approval are drastically reduced. The prototyping phases and iterations that could normally take weeks or months are limited, with compliance achieved much faster! /

“The experience we have acquired over the years has made it possible to define an extremely reliable prediction model.”



## Materials research

# Inventing new plastics

As key components of cable ducts, plastics are one of the areas of expertise of the ACOME materials division. As the holder of several patents, it transfers its knowledge to identify new ranges of more eco-friendly materials. With its high abrasion resistance, rPET\* could prove interesting for the protection of small wires that are used for installation in the automotive industry, made from alloy along with other plastics. Experiments were also carried out to specify composites based on reinforced polypropylene matrix with linen fibre. What is the characteristic we are aiming for? The mechanical tensile strength of this biomaterial where Normandy is the world's leading producer. /

\*Recycled PET intended for food production



# New mobility standards

The mobility of tomorrow will be electric and connected, and in the near future, autonomous. Vehicles will also be considered more and more as a shared and digital mobility service.

ACOME is getting ready to support this disruption in electromobility and connectivity.

## ● Challenges

The introduction of electric vehicles, *even more* so if they are autonomous, will bring about new requirements in terms of safety, performance and reliability for automotive wiring systems. New high-voltage (HV) beam architectures, new electrical/electronic architectures and new features in vehicles (entertainment, over-the-air management, a multitude of new sensors) are new challenges for the automotive industry. They will require strong expertise in areas ranging from electromagnetic compatibility to the robustness of signal transmission inside vehicles, between vehicles or with infrastructures to provide fail-safe, reliable and secure connectivity (data & power).

## How is ACOME preparing for this?

### Combining power and electromagnetic compatibility

With a view to addressing electric and hybrid markets, the ACOME innovation roadmap focuses on high value-added power cables, with a focus on systems and operational reliability. With our expertise in telecoms, ACOME provides innovative solutions for the treatment of electromagnetic compatibility (EMC).

### High-speed data transmission

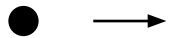
On the aspect of data transmission, ACOME is moving forward with the belief that innovation requires the provision of system solutions and is working to increase transmission speeds.

## Why is this already a reality?

### Getting ready for connected mobility

ACOME has undergone its transformation and is preparing for the rise of connected mobility. Innovation and development are clearly organised around the power cable market to meet the low and high voltage requirements of hybrid, electric or thermal vehicles, single-conductor wires for the engine system and the passenger compartment, multi-conductor cables for data transmission and coaxial cables for image transmission (cameras, radars, lidars, etc.).

Faced with increasing operational reliability requirements that require drastic decisions in the design of



### Moving towards connected mobility

The cars of tomorrow will be electric, connected and autonomous. ACOME is up to the challenge.





data network architectures and power in vehicles, ACOME is committed to open innovation and partnerships with manufacturers.

## Technology transfers from telecoms to automotive

ACOME's dual telecoms and automotive expertise is a key asset that few automotive cable specialists can boast today. The Group's telecoms expertise makes it possible to design reliable data cables (high speed data) perfectly suited to high-speed data transmission inside vehicles. Similarly, ACOME has taken advantage of its expertise in coaxial cable technology to combine it with its knowledge of the automotive market and that of its partners. The transfer of proven telecoms technology to automotive applications enhances ACOME's innovation performance.



## Automotive

# Mobility through ACOME innovation

The development of electromobility and the intensification of connectivity in vehicles are renewing automotive challenges. ACOME is charting its course in two key areas: power and on-board superfast broadband.

Inside a vehicle, power cables are between 50-80m in all-electric vehicles or BEVs (battery electric vehicles). With this in mind, ACOME is deploying an innovation strategy that consists of making cable networks a true concentrate of technology, by simultaneously processing crash resistance, abrasion and cooling properties.

## REDUCING VEHICLE CHARGING TIMES

To promote electromobility, reducing vehicle charging times is a key challenge. ACOME is innovating with high thermal dissipated cables that can be kept small in size while handling greater intensity and power. Two patents cover through the design, the control of extrusion technologies and material selection this ability to thermally dissipate calories in charging cables. From 150 amps today, cables could safely carry intensities of 500 or even 800 amps, which helps reach a significant reduction in charging times.





## COAXIAL CABLES EXTEND TO AUTOMOTIVE

In the area of data transmission, and particularly its ability to offer innovative technological solutions in the areas of Ethernet and High Speed Data, ACOME can also draw on its expertise in telecoms. As a result, to meet the needs of the connected vehicle, ACOME has been able to leverage and adapt the mastered technology that is coaxial cables. As part of a joint venture, the Group has combined its development and innovation capabilities with the production capacity of the Chinese manufacturer, Hansen. In a just a few

months, we have been able to bring concrete solutions to this very dynamic market to automotive players operating in China.

## ANTICIPATING AUTONOMOUS VEHICLES SPEEDS

ACOME is also anticipating the development of autonomous vehicles that require very high speeds. Circulating the data needed to manage autonomous driving equipment at faster speeds, particularly computers, is the challenge that the teams are preparing to meet.

## EUROPE 2025

**1.6 million vehicles  
from 2025**  
(vs 360,000 registrations  
in 2019)

Source: European Automobile  
Manufacturers' Association (ACEA)

## WORLD 2030

**Electric vehicles market share**  
will surpass thermal vehicles  
worldwide (51%)

Source: Boston Consulting Group – 2020

continued  
↓

## 2 questions

### MINIATURISATION OBJECTIVE OF THE CONDUCTOR

#### What does strand compression involve?

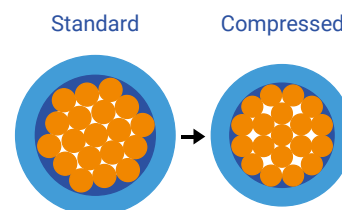
One strategy for lightening strands is to miniaturise the conductor through compression. The challenge was to find the best compromise between reducing the diameter and maintaining the mechanical and electrical performance of the strand. We had to understand the mechanisms that govern compression because it causes deformation of conductor geometry and a potential loss of properties.

#### How does it work in practice?

By closing any gaps between the strands, we can improve circularity and concentricity, and reduce the diameter of the conductor while maintaining flexibility and electrical properties. Compression technology even allows us to remove the residual stresses of stranding and limit the spring effect. Vehicle installation of 0.13 mm<sup>2</sup> hard strands with CuSn alloy is made easy.

This technology, which reduces the volume of insulating materials, is appropriate for high added-value products resistant to temperature classes T5 or T6. It is part of the Unilay strand for low voltage (LV) applications.

#### 19 strands



**Compressed strand** from the 0.13 mm<sup>2</sup> / 2 mm<sup>2</sup> range (Cu-ETP and CuSn)



In this race for speed, ACOME is working to develop increasingly robust cables for data transmission. These cables will be capable of routing speeds of more than 1 Gbit/s over a single pair. This is a challenge because it is not simply a case of transferring our know-how to the telecoms sector: cables must be suited to the requirements of the automotive environment and in particular its temperature, flexibility and lightness constraints while retaining all their transmission capacities throughout the years.



#### E-Layer technology

The new Ultraflex power cable range offers high performance and flexibility comparable to silicone power cables at a lower cost.



#### E-Layer

## First global alternative to silicone cables

ACOME has leveraged its unique expertise in insulation and compounds to develop and patent an innovative, alternative technology, fully silicone-free, for electric vehicles.

The cross-linked polyethylene (XLPE) insulating duct for LV and HV power cables is capable of withstanding temperatures of up to 200°C. The flexibility offered by this new material is comparable to that of silicone. The high performance it provides is proven in terms of electrical and mechanical resistance, with a significant price advantage over silicone and with comparable durability. Thanks to ideal technical specifications (structure, composition),

“E-Layer technology offers the same flexibility as silicone cables at a lower cost.”

E-Layer technology can bring performance and competitiveness together. This innovation is an example of the Group's commitment to meet the new challenges of new energy vehicles effectively. This technology has already been adopted by American manufacturers, which ACOME was able to support in the system integration of the cable/connector pair, which is key to reliability. /

## Premium co-development in high voltage

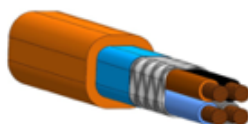
ACOME was selected as a high voltage expert supplier by a premium German manufacturer that very early on focused its strategy towards electromobility. On a visit to the R&D centre during the development of its upcoming battery cables, the manufacturer was able to assess our ability to produce compounds and implement them on a small scale on our laboratory extruder before moving on to production. Samples and prototypes are tested according to an experiment plan that allows us to distinguish between each variable and quickly obtain the expected results. As the fruit of co-development with the manufacturer, this power cable equipped with E-Layer technology meets flexibility requirements while building in the standards and constraints specific to automotive cables.

## Experiments

# Design by digital simulation

Digital simulation is one of ACOME's areas of expertise, helping to reduce the number of prototypes and tests and thereby speed up the development of new products at a lower cost. Here are two examples. ACOME was tasked with designing 50 mm samples, stripped at both ends with high pressure constraints to overcome. Our engineers from the simulation division developed an experimental plan supplemented by simulation and modelling. By studying material flows and exerted pressures, we were able to quickly validate the product with a Chinese manufacturer. Having to define 500mm power cable cross-sections with a requirement for shrinkage control, our engineers used the simulation tools to understand the phenomena of material flow within the extruder itself. They were able to determine the ideal shape of the tool to properly manage the pressure exerted on the cable while achieving the perfect roundness expected by the customer. /

## Before



## After



**Thanks to digital simulation**, engineers have managed to switch from a cable with light facets to a perfectly cylindrical product, where shrinkage and adhesion phenomena are controlled.

## 2 questions

# TAKING ELECTROMAGNETIC COMPATIBILITY TO THE NEXT LEVEL

**Why is electromagnetic compatibility still an innovation focus for ACOME?**

Electromagnetic compatibility (EMC) applies to both data cables and power cables, and presents new challenges for manufacturers. Power cable shielding is considered to be restrictive during beam production. The challenge is to offer good performance at a lower cost, with a high degree of processability for network engineers and parts manufacturers.

**How does digital simulation come into play?**

We support our customers in the design of their future products by carrying out a comprehensive electromagnetic study using multiphysical simulation. We carry out virtual prototyping of the cable in the environment in which it will be used. This allows us to simulate its operation under different conditions and to study the parameters that interest us (temperature variation behaviour, induced currents and voltages, etc.). Avoiding any disruption is a major safety issue.



**Research on electromagnetic compatibility** benefits from advances in digital simulation.



An aerial photograph of a city scene. In the center, there is a large train station with several tracks and a long, curved platform. To the left, a multi-lane highway curves through the city. To the right, there are several tall apartment buildings. The foreground is a blue-tinted area with a grid pattern, possibly representing a city plan or a digital overlay.

# From FttH to the Smart City

A long-standing player in telecoms networks, ACOME focuses its R&D efforts on supporting the introduction of 5G and the rolling out of FttH to new European markets.



## ● Challenges

While the interdependence of fixed and mobile networks can be confirmed, all eyes are on 5G, the fifth generation of wireless technology. Major improvements in speed and reduced latency are promising to transform the industry – and of course the automotive industry, or to lay the foundations for the Smart City. To meet its performance objectives, 5G will require the availability of fibre optic networks.

## How is ACOME preparing for this?

### Enabling convergence between fixed and mobile networks

To ensure that users can benefit from a service without transition between fixed and mobile (e.g. when a driver enters a tunnel), ACOME supports operators in their thinking on the choice of infrastructures capable of supporting all these data (network cores, cables and interconnection).

Our R&D team also strives to respond to operators' major challenges in terms of reducing energy consumption and miniaturisation, through ongoing work in compounds and cable properties.

ACOME also mobilises R&D resources with the aim of inventing the connectivity points that will be used to connect the Smart City applications of tomorrow.



### New optical cabling plant in France

The optical cable production capacity of the ACOME Normandy site will reach 10 million kilometres of fibre optic cabling by the end of 2020.



## Why is this already a reality?

ACOME is one of the few European players to have a strong position on all fixed and mobile networks, a position that has been built over time and through recent support on the roll-out of superfast broadband. Our solutions cover mobile infrastructures, FttH and indoor 5G.

### Providing the fibre for the networks of tomorrow

Infrastructures are built to last. Products that are currently installed or will be installed for 5G networks must also be scalable. Given the purity and quality of the optical fibre produced by ACOME, it will be entirely possible to run through more wavelengths and therefore carry





higher flow capacity than we can nowadays. In France, ACOME is also a member of the expert committee created by ARCEP with the aim of ensuring the integrity and proper functioning of networks as part of the sharing of the terminal part of the local fibre optic loop. This committee is responsible for delivering opinions on the provisions to follow when deploying FttH networks.



**New drop optical cabling workshop**  
at the Normandy industrial site to connect subscribers to optical fibre.

## Telecoms

# ACOME innovation working for the territories

The convergence of fixed and mobile networks and the imminent arrival of 5G present the new challenges faced by telecoms infrastructures.

The challenge for ACOME is to provide value, even beyond its products.

In the next three years, global data traffic will triple, driven by mobile traffic that will also double. In France, this momentum is supported by the roll-out of the French Superfast Broadband Plan and its new four million eligible subscribers each year. The major technological shift involves the growing interdependence of fixed and mobile uses, and therefore, network convergence. For the same use (watching a TV series, for example), Internet users must be able – in the smoothest way possible – to download the film at home from their fixed network and watch it at any time on their smartphone or tablet, in other words, on the move. This is why operators invest in network cores, concentration points that allow them to group and prioritise traffic to carry it more quickly to its end destination.

## SHEDDING LIGHT ON THE THINKING BEHIND 5G DEPLOYMENT

5G questions how we design networks, for example, by taking the opportunity to deploy a single cable for the entire fixed and mobile infrastructure. Discussions have begun on antenna networks being fail-safe as outages



will need to be avoided once 5G is used to run industries, surgical equipment, autonomous vehicles or Smart City applications. As a result, the FttH network could be used for the backup network instead of powering the antenna network. These questions examine the dual-dimension of cables and interconnection units. ACOME contributes to these fundamental considerations that will influence the architecture of tomorrow's fixed and mobile networks.

### CABLE BLOWING: AN ECO-FRIENDLY SOLUTION

The roll-out of 5G requires operators to deploy new antennas and/or migrate existing sites to 5G. For operators, the challenges relate to the environmental footprint and the energy supply, in particular. ACOME

supports such challenges through an innovative product. Although still a prototype, this optical cable can be used to remotely supply power to an operator central office, already equipped with optical equipment, so as to manage several remote mobile sites without having to install an electrical meter. However, integrating such conductors tends to stiffen the cable. When blowing the cable through the ducts, this rigidity tends to restrict distances. ACOME has harnessed the synergies between its business units to leverage flexible automotive conductor technology. The R&D team then adapted it to the specific constraints of telecoms networks until it reached a perfectly fluid and sliding material. This innovation results in savings for the operator in terms of direct costs, operating costs and speed of deployment.

6<sup>th</sup>

Based on its carbon emissions, the telecoms and IT industry is ranked 6<sup>th</sup> in the world

4.8 zettabytes

Annual global IP traffic is expected to reach 4.8 zettabytes (4.8 billion terabytes) by 2022\*

\*source Cisco

continued



## 2 questions

### BECOMING THE INDUSTRY LEADER IN BLOWING

**What is involved in the blowing platform project?**

At Mortain, we have an optical cable blowing test bench that is based on the standardised pathway developed by the German manufacturer, Vetter. We are developing our test resources with an underground platform that will also include an IEC standardised pathway. It will allow us to measure our cable performance according to the different types of ducts that these cables will be blown through and to fuel our developments with experimental data.

**Can this be coupled with simulation?**

Indeed, the data collected will allow us to build a simulation model and, ultimately, make predictions. Such digital tests are an advantage in terms of cost and development time: no need to manufacture a prototype or carry out blowing tests for solutions that would not be perform well.





### PROVIDING VALUE TO INFRASTRUCTURE VIA MINIATURISATION AND IOT

Although the building of telecom infrastructures in France is mainly based on the use of cable pulling, in many European countries blowing is the most widespread process. To meet these specific implementation conditions, ACOME has developed a new range of products – Acoptic MCD 1521 HD – in which case the 1<sup>st</sup> product with 192 fibres is already available. While the traditional diameter of a fibre is 250 microns, this innovation is based on reducing the protective layer to 200 microns, while offering integrity in performance against environmental constraints. Equipped with a cable optimised for diameter, operators can deploy smaller micro ducts or increase the capacity of the network within existing micro ducts. The cable addresses the dual challenge faced by operators of miniaturising and controlling the environmental footprint.

IoT is also an area being explored by ACOME to bring value to the sector. The development of connected drums to optimise fibre optic stock management is part of this thinking, as is the use of sensors on optical cabinets, which are intended to remotely notify infrastructure operators of any work carried out by technicians.

## Connected drums

### For smart logistics

▶ ACOME has developed a connected drum that allows operators to locate fibre optic drums and determine the type and amount of cable remaining.

Although the installation and operation phase of optical fibre is still, to a large extent, yet to come, this smart object enables us to optimise the management of drums and improve the management of residual cable lengths, therefore avoiding waste. /



## Standardisation and regulations

### A renowned, recognised and engaged leader!

▶ Recognised as an innovative company in the fields of optical fibre and cables, ACOME is legitimately engaged in international (IEC), European (CENELEC) and French (AFNOR) standardisation bodies. Recognised as an innovative company in the fields of optical fibre and cables, ACOME is legitimately engaged in international (IEC), European (CENELEC) and French (AFNOR) standardisation bodies.

ACOME is also the technical advisor to the professional organizations Sycabel and Europacable, and is a member of working groups for the improvement of fibre optic deployments by bodies such as CREDO\* and Objectif Fibre. By contributing to such initiatives, the Group is able to provide its expertise on work in progress and to always be in step with the latest standard developments. Lastly, ACOME has a representative on the ARCEP fibre expert

committee, the regulatory authority whose aim is to establish best practices and recommended products for the roll-out of FttH in France by ensuring their interoperability. Through the recent work carried out by this body, the latest generation ACOME optical fibre can now be listed as product models to be deployed in France. /

\* A French think tank for the development of optical fibre

## Hybrid cables - at the heart of the energy transition

An optical cable capable of carrying the signal associated with a copper cable carrying energy: as a specialist in these two technologies, ACOME has combined its skills to design and manufacture such hybrid cables for infrastructure operators. To support the sector's transition, new R&D research has been launched for the energy supply of future 5G networks and the supply of renewable energies to central offices. ACOME experts have also identified potential breakthroughs that suggest use cases in smart building. Hybrid cables would allow us to use technologies such as PoE\* over longer lengths than the current 100m limit and with higher power, providing the building with greater intelligence.

\*Power over Ethernet

## Aerial FttH

# Designing aerial cables for the UK market

► In terms of cables, each country has its own standards and specifications, driven by different business models and technical constraints. In this vein, ACOME has built strong legitimacy in the aerial solutions space in Ireland, by providing Eircom with cables capable of withstanding average winds of 120 km/h and gusts of 180 km/h.

The requirements in the UK are very different: the standards stipulate that beyond a certain wind speed, the cable range between two poles must not attempt to resist stress, but must instead yield. The metal anchors used to connect the cable to the pole must be able to break without damaging the rest of the infrastructure. A number of prototypes have been tested at our laboratory in Normandy. Products meeting these specific requirements have already been developed, approved and delivered to British shipyards. /



IDEA OPTICAL

produces 2 out of every 3 street cabinets in France.

## Deployment of optical fibre

# Street cabinets turn smart

► As a key component of FttH infrastructure, street cabinets are often damaged. However, such mistreatment is generally due to work carried out to connect new subscribers.

Rather than strengthening door security, IDEA OPTICAL, an ACOME subsidiary specializing in fibre optic connection and patching solutions, has developed a new smart cabinet concept. It consists in particular of a LoRa antenna installed on the roof of the street cabinet which broadcasts a signal remotely as soon as the door of a cabinet is opened, and a magnetic switch placed on the compass of the door. This very discrete device makes it possible to know which cabinets are the most heavily used and to strengthen preventive maintenance operations. The connected street cabinet can also be linked to a self-identification system using a QR code, which the technician then scans at the end of the job. This system is currently undergoing life-size experiments with national network operators. /

"The connected systems used in street cabinets make it possible to optimise maintenance plans"

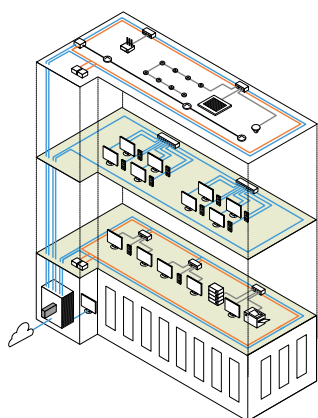


# A new generation of connected and scalable buildings

With its connected and interconnected buildings, the smart building marks the beginning of a new era. Their design must integrate the digital and energy transitions of the next 10 years and plan ahead for the workplace of the future. With its open and innovative systems, ACOME is getting ready for each of these developments.

## ● Challenges

Like society as a whole, buildings are increasingly connected, controllable and smart. They are also faced with a managerial change, the flex office; faced with a challenge, that of enabling quality mobile signal reception even though the buildings are more insulated and impervious to waves; and faced with the major energy transition challenge which directly impacts network energy consumption.



## How is ACOME preparing for this?

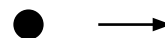
### DAS, PoE, IoT: now is the time for smart buildings

For the next ten years, the challenges of smart buildings will be to equip buildings with an infrastructure capable of supporting and managing all transitions. The convergence of all applications on IP, the roll-out of 5G inside buildings thanks to distributed antenna systems (DAS) and the development of Power over Ethernet (PoE), fuel ACOME lines of research and innovation projects. The challenge of cable fire resistance in enclosed spaces – buildings and tunnels – continues to be a focus of the roadmap used by the Group's researchers and engineers.

## Why is this already a reality?

### Optical fibre for smart buildings

A pioneer in the field of smart building, ACOME has been offering innovative architectures and products for over fifteen years, with a solution that continues to evolve and expand: Hemera Building. Both scalable and safe as it is built using optical fibre and open so that different architecture models can coexist. It is also fail-safe, which is an advantage from a 5G perspective.



### New workplaces

Designing today the infrastructures that will support tomorrow's applications.





## When the building sector adopts Power over Ethernet

Imagining what the future workstation will look like – both in terms of data and energy – is at the heart of the ACOME innovation program, which anticipates dramatic changes in the way office buildings are designed. Power over Ethernet (PoE) is gaining ground in the building sector. This technology, which transmits both data and direct current at very low voltage via a fibre-optic Ethernet cable, will likely be used in the coming years to power laptops and connect them to company networks. Given our heavy involvement in this technology, ACOME has helped build one of the largest buildings in Europe by supplying Ethernet cables that power both lighting and blinds, as well as technical building management.

## Ensuring reinforced fire resistance

Cables are used in all human activities and in often unimagined amounts: a high-rise building uses several kilometres of cables and it is estimated that the cable trays between Châtelet-Les Halles and Gare du Nord are 1,000 km long. Fire performance, and in particular the ability to reduce the speed of fire propagation and harmful emissions, is a central focus of ACOME materials research which continuously develops new cables meeting the strictest reaction to fire Euroclasses.

## Smart buildings

# ACOME innovation at the heart of buildings

At the heart of ecological and digital transitions, modern buildings should be smart, where they are energy-efficient thanks to increasingly fine-tuned control of build technical management, interconnected and connected, but also flexible to adapt to new working methods. With a specific challenge: to be capable of adapting to future technological developments.



What will the future workstation look like? How long will PCs still need a cable specific to their power supply? Do we already need to reduce electrical wiring and the number of strong current sockets in the walls, in favour of a greater number of network sockets?

Faced with new connectivity needs and the arrival of Power over Ethernet, a new paradigm is emerging. It is no longer enough to anticipate the increase in IT socket speeds; we must invent a transitional network architecture. Predicting three technologies that will profoundly revolutionise office buildings, ACOME is investigating their impact in its Workstation 2025 program.







### 3 TECHNOLOGIES THAT WILL REVOLUTIONISE OUR OFFICES

**1. Induction:** already used for smartphone charging. In the future, will this technology be suitable for laptop charging?

**2. Power over Ethernet (PoE):** it can be used to power IP phones, Wi-Fi terminals and remote surveillance cameras... and could quickly extend its coverage to all lighting (LED) and, at workstations, power PCs and screens, etc.

**3. The deployment of optical fibre** at the workstation, and consequently, the installation of optical connectors.

To successfully complete its innovation programme, a working group conducted numerous interviews with the IT divisions (ISDs) of large public and private companies, in order to understand their points of view and outlook.

### RELAYING 5G INSIDE BUILDINGS THANKS TO DAS

In the future, 70% of mobile communications will travel inside buildings and more and more connected objects will be connected to this network. While 5G promises high speeds and reduced latency, thermal regulations that strengthen the insulation of buildings hinders the passage of waves. The availability of 5G inside buildings is therefore the new challenge and DAS – distributed antenna network – seems to be the solution that can ensure uniform coverage and high-quality mobile speeds.

The ACOME R&D team was established to work on coaxial cable technology, which it has long mastered, with the aim of making it 5G compatible.

## 2 questions

### FIRE PERFORMANCE: BETWEEN LIVE TESTS AND SIMULATION

#### What are the challenges of fire tests?

At the Cofrac-certified test laboratory, we carry out a number of projects to improve the fire performance of materials, as part of Construction Product Regulations (CPR). Each cable is subject to three families of tests that correspond to real safety issues for buildings and people: do not spread the flame, do not increase smoke and do not release toxic fumes. We therefore work on burnt heights, opacity and inflamed droplets. Rail operators, RATP and SNCF, are among the customers with the highest requirements. This led to the design of the FireProtect+ range (B2ca) intended for installation in tunnels.

#### Is this still an innovation focus?

Yes, because on the one hand we invent new materials to satisfy the highest Euroclasses, and on the other hand, we develop simplified test methods, supported by simulation, to optimise lead times and costs. By taking into account the complete design and testing experience of the past, this tool is able to predict results with a reliability rate close to 100%. Prototype manufacturing and standardised tests are, in fact, limited to cables with the required specifications.

50%

smart building use cases did not exist 5 years ago

\*source: Technical Construction Observatory

10%

only office buildings have a BMS (building management system)





With the aim of developing an even simpler, more passive and more energy-efficient system, a research group was set up. This group explores the possibility of integrating other networks, such as Tetra networks dedicated to emergency services. By being more eco-friendly and helping keep people safe, they represent a very promising line of research.

#### BRINGING INCREASED EFFICIENCY TO DOMESTIC WIRING

4K televisions, smart homes, online gaming, remote working, etc., data volumes and therefore bandwidth requirements are constantly increasing in domestic housing. Recognised for the performance of its Grade 2TV and Grade 3TV cables, ACOME has taken up the challenge of new standards to develop a new Grade 3TV cable (up to 10 Gbits/s) offering improved fire performance (Euroclass Cca-s1, d1, a1), better electromagnetic immunity and a reduced bend radius for ease of routing. These pair cables form a star network capable of supporting all high-speed Internet services, telephony, television and multimedia. In environmental terms, eco-design allows the new Grade 3TV to offer a 17% reduction in CO<sub>2</sub> footprint over the life cycle, compared to the previous version.



#### Smart renovation

Completely restructured, this office building makes use of the latest telecoms technologies.

#### Smart building

### Fibre optic loops at the headquarters of Parfums Christian Dior

Opposite the La Défense business district, this complex, called Kosmo, restructured by Ateliers 2/3/4, caters for more than 1,000 employees over 27,000 m<sup>2</sup>.

Given the need to optimise office space, our design team gave preference to the ACOME Hemera Building solution based on fibre optic architecture. While VDI copper pair wiring requires repeating the signal every 90 metres, optical loops have no distance constraints.

The network is built from PACE cables with permanent access, providing high installation flexibility. 1,100 optical microswitches were deployed on the building.

Thanks to this innovative solution, all rooms used for technical racks could be removed, thereby freeing up some 300 m<sup>2</sup>.

“Optical fibre architecture has freed up 300 m<sup>2</sup> of space”

## Cruise liners

# ACOME cables are heading for the open sea

► Aboard a cruise liner, data cabling is made up of 500 kilometres of copper pairs and around thirty kilometres of optical fibre: this is double what is deployed in a tower at La Défense. It must also meet specific constraints in terms of the restricted space available in ducts and the installation conditions. For Fincantieri, ACOME developed a unique cable structure for all data and safety signals: FTP Ethernet cables, 4 pairs or 2 times 4 pairs, LSOH, i.e. guaranteeing low smoke emissions and zero halogen in case of fire. ACOME is listed for two cruise liner models.

These copper cables are offered in a reinforced shielding version, crush-resistant while being highly flexible, lightweight - the weight along with space being a major issue on board - while ensuring the required data transmission speeds.

The R&D team is continuing research to further improve the abrasion resistance of these cables, which can also be used outdoors. /



## Grand Paris, equipping TBMs with optical fibre

ACOME equips TBMs on lines 16, 17 and 15 of Grand Paris with fibre optic cables and copper telephone cables.

The control cabin is connected with the outdoors using 2 to 5 cables for transmission of technical data related to machine adjustment and route tracking. ACOME supplied several dozens of kilometres of flame retardant ZH cables that limit the spread of flames and fumes for 2 hours.

## 2 questions

### POWER OVER ETHERNET (POE), A NEW ALLY FOR SMART BUILDING

**What is involved in the solution provided by ACOME in the Evidence building?**

The energy cabling solution developed with the start-up Energie IP is highly innovative due to its ability to control and supply direct current to the various key functions of the smart building.

Rather than adding a bus cable that carries the data to a strong current cable providing lighting, only one single F/UTP cable connects from the switch to the lighting equipment to be controlled.

**What are the advances in POE for smart buildings?**

The F/UTP cable from the Acolan range selected for this solution is POE certified. It has excellent electromagnetic protection and its diameter makes it one of the smallest category 6a cables on the market. In addition, due in particular to the limited use of aluminium in the shielding process, they generate up to 30% less greenhouse gas emissions than most equivalent cables on the market, according to environmental profiles certified by the PEP Eco-Passport platform 300km of these cables, factory pre-connectorised, supply the 2,300 m<sup>2</sup> property complex. Located in Saint-Ouen next to Paris, it is currently the largest building in the world with POE lighting and technical building management (BMS).



### A floating city

A reinforced cable structure was designed for all data and security signals.



PHOTOS





## A close up of our research centre

**R&D is part of the DNA at ACOME** which has continually innovated by harnessing its expertise in key technologies. Visit to the heart of the research centre based in Mortain, Normandy.

### HISTORY OF R&D

Capitalising on the agility inherent in its size and the stability inherent in its SCOP status, ACOME has made R&D and innovation the spearhead of its development. In 1949, the decision to insulate cables with plastic materials was a small revolution. The foundation of the research centre in 1976 is in line with the acquisition of the first electron accelerator that paves the way for cross-linking. A scientific and technical adventure that is far from over!



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## CUSTOMER REQUIREMENTS

Monitoring markets, listening to customer needs, identifying technological building blocks, co-developing: a cable is always a compromise between a very specific need and physico-chemical constraints as much as regulatory or implementation requirements. From specifications to product validation, the R&D organisation offers this ability to support each request as part of an approach based on local service and a strong partnership.



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## SIMULATION EXPERTISE

Digital simulation has become increasingly important in our R&D projects. Used to assess the characteristics and performance of a cable even before its prototyping, it speeds up innovation. It can be used on the extrusion part to understand flow phenomena, such as in the characterisation of cables prior to fire tests! Data science, artificial intelligence and forecasting models enhance understanding and problem solving.

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## MATERIALS EXPERTISE AND DEVELOPMENT

Producing your own compounds is an asset! The ingredients used in a new formulation – plastic pellets and other components – are mixed in the laboratory on a twin-screw extruder to refine the blends. The resulting semi-finished product is analysed, checked and reformulated if necessary until the compound meets the exact specified characteristics. This is also the guarantee of controlling the production line insulation process.







## WIRE DRAWING EXPERTISE

Wire drawing is an operation by which the copper wire is gradually refined in dies until the final diameter is obtained. It is then subjected to heat treatment (annealing) in order to increase its ability to deform without breaking (ductility) and its conductivity. Forming the conductive core of the cable, this know-how evolves to meet the challenges of miniaturisation and lightening.



## STRANDING EXPERTISE

Using a copper wire stretched to the right diameter, R&D still has some areas to optimise. Reducing the conductor diameter can save on insulating material. Strand compression is however governed by the need to find the best compromise between reducing the diameter and maintaining the mechanical and electrical performance of the cable!

continued

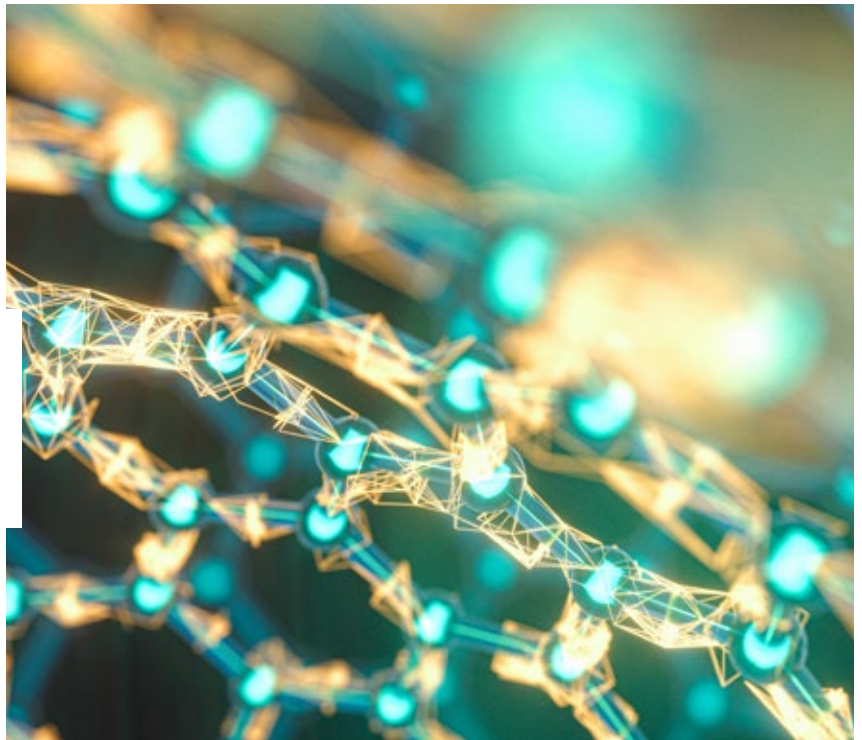


## INSULATION - EXTRUSION EXPERTISE

The simulation on the extrusion part shows how the material behaves and the best way to apply it to components that need to be insulated. A better understanding of the material flow phenomena in the extruder enabled us to determine the ideal shape of the tool, so as to apply ideal pressure to restore the cylindrical shape of the cable, while controlling sealing and shrinkage.

## RADIATION EXPERTISE

Cross-linked polymer (XLPE) used as insulation material usually has a monostructural structure. For E-Layer Ultra Flex, we designed a triple-layer XLPE duct with a flexibility comparable to that of silicone. ACOME, which was one of the first cable manufacturers in Europe to adopt this technology, has made controlling e-beam radiation its trademark.





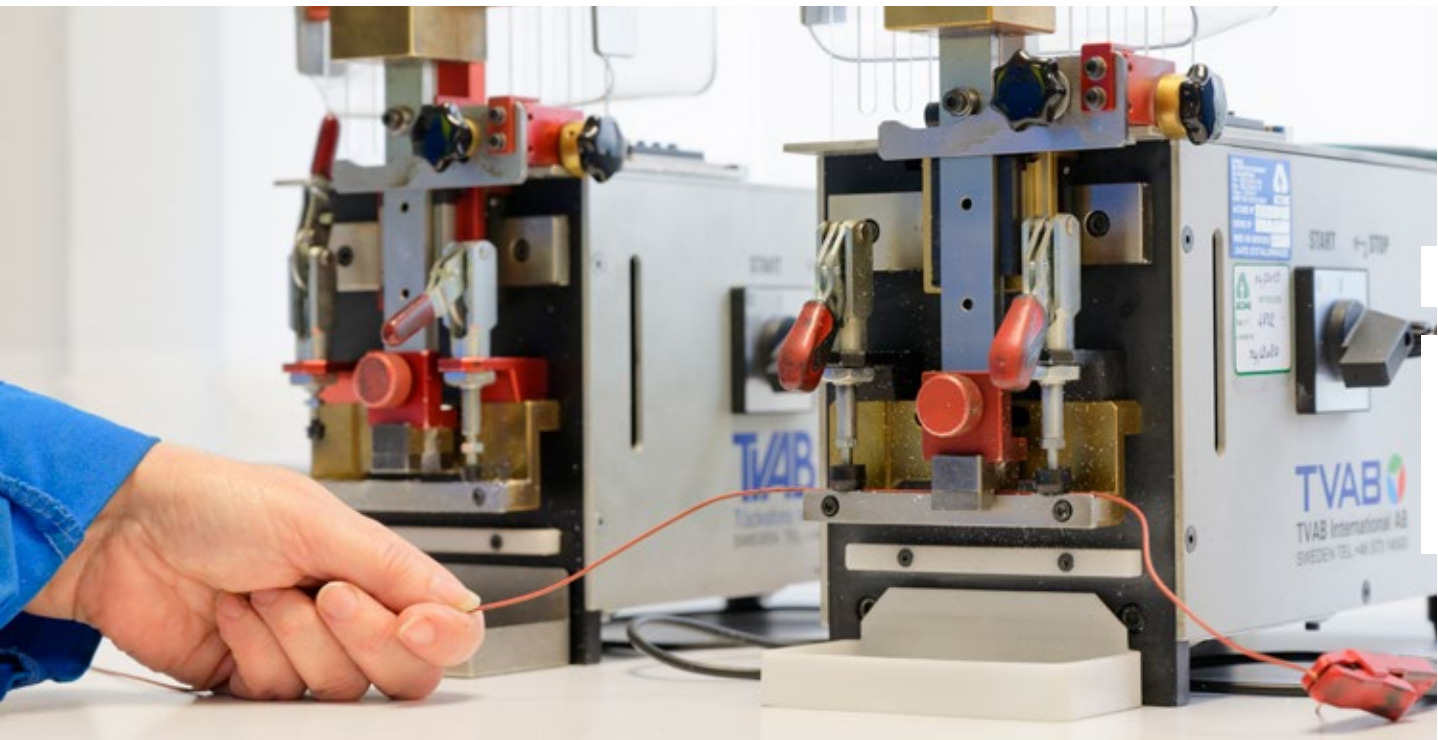
## SHIELDING EXPERTISE

Shielding forms an essential barrier against electromagnetic interference. The design of the metal braid that surrounds the cable is a challenge for the safe operation of equipment.



## TEST LABORATORY

The development of a new technology requires thousands of hours of laboratory testing. Conducted with great scientific rigour, following an experiment plan, they make it possible to ensure that products will withstand the new constraints imposed on cables.







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