

BUUAtions

INTRODUCTION

To address the technological and societal challenges of each era, engineering has always relied on its ability to innovate, particularly in the design, study, or construction of structures, equipment, or products.

Regardless of the field where SEGULA Technologies operates -Automotive, Aeronautics, Energy, Naval, Rail, or Oil and Gas - our group's DNA is to find solutions to bring these projects to life and support their implementation as competitively as possible. Therefore, we naturally place innovation at the core of our development strategy and growth dynamics.

In highly competitive markets, our clients must innovate rapidly. To assist them, we are constantly a source of permanent proposals for innovative solutions, relying on:

The efficiency of our organization: our Research and Innovation (R&I) is located at the heart of our agencies, close to clients and operational teams, and is essential for understanding our clients' needs. This proximity also allows collaboration with SMEs, start-ups, laboratories, and competitiveness clusters, promoting cross-fertilization and creativity.

The talent of our engineers and the passion that drives them: our R&I teams develop more than 200 projects each year. These projects bring together skills to address major challenges in designing new products and systems, new services, or new methods.

Open innovation: significant partnerships and collaborative projects are established with renowned clients and partners, allowing us to innovate rapidly by capitalizing on new synergies.

Our engineers contribute to shaping the world of tomorrow in 3 main areas :



Maturity Level of Innovations

Research

Testing

Roll Out

The objective of our book on innovations is to present in a simple manner some of the innovations that are currently developed by our teams.



SEGULA'S ACTIVITIES

GLOBAL ENGINEERING GROUP

SERVING THE COMPETITIVENESS OF ALL MAJOR INDUSTRIAL SECTORS



OUR VALUES

Responsiveness

Proximity

Ambition

Innovation

SUMMARY



Green Industry

Weight reduction Energy storage Sustainable mobility & logistics Water management / Clean water Reduction of energy consumption Material recycling



Smart Industry

Industry 4.0 Connected and autonomous mobility



Industry for Life

Bio-printing



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GREEN INDUSTRY

"Environmental problems pose a growing threat to our planet and the life on it. Collective action, focused on sustainability and environmental preservation, is essential to mitigate these threats and promote a more planet-friendly future.

We are working with ours customers and partners to find viable solutions, to address this critical issue, to help find solutions that work towards a greener future."

Anne-Christine Lombardi, Head of Open Collaboration Projects





Weight reduction

- 8 TOLDO Increased resistance of composite structures
- 9 COMPOSITE CAB Truck cabin mass reduction solution



Energy storage

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CUVE Increased resistance of composite structures





Sustainable mobility & logistics

- MULTI-STACK FUEL CELL Fuel cell increased sizing and perfomance
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ZERO Green liquid hydrogen-powered aviation







Water management / clean water

BIOFILTRATION Biological filtration system for industrial effluents



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ATARA Water resources management tool



Reduction of energy consumption

- 18 STABILOAD On-board load and stability Al model
 - BIOPTE Energetic uses of biomass processing
- 20 INNOVATIVE THERMAL MANAGEMENT Complete thermal management tool



Material recycling

CIMENT I3D 3D-Printed concrete using industrial waste



TOLDO INCREASED RESISTANCE OF COMPOSITE STRUCTURES

As impacts can compromise composite structures' integrity, TOLDO project **strengthens like-carbon structures** in the event of a collision.

Following the project validation, a technological solution has been developed to **enhance impact resistance** of composite structures even in a very hard ecosystem.

TOLDO advanced composite structure is a cross-sectorial solution that can **bolster durability** of automotive vehicles and aerospace systems.



PARTNERS ISAE, ICA, Airbus, CNRS, ArianeGroup



MATURITY

TESTING

TRL : 7

COMPETENCIES Aeronautics, Laminates, Numerical modelling









COMPOSITE CAB PATENT COMPOSITE CAB PATENT COMPOSITE CABIN MASS REDUCTION USING NEW MATERIAL

COMPOSITE CAB is a **lightweight truck cabin** designed to minimize fuel consumption while retaining an optimal load capacity.

The use of composite materials in the cabin **reduces its weight** (30% lighter cabin). This cabin also offers various internal features to enhance passenger comfort, including a sleeper configuration.

Our **patented sleeper concept** is currently used by Renault Trucks, but can also be proposed for application in other cross-sectoral domains.



PARTNERS Solvay, PO, Altair, Mecaplast, Saertex, Addiplast, Insa, Isat



PLANNING PoC in 2016 Now Industrial part



MATURITY ROLLOUT TRL : 9





CUVE PREDICTION OF TANK EXPOSURE TO EXTERNAL FORCES

CUVE is a **predictive tool** designed to assess risk of damage to tanks due to liquid sloshing and optimize their structure accordingly to enhance their safety.

- This tool considers various scenarios, including fluid-liquid interaction and liquid overflow, to **prevent potential accidents** that could compromise the integrity of the tank.
- By optimizing the tank conception, this solution not only reduces the risk of harming people and goods but also allows better cost control by extending the tank's durability.





PARTNERS LUSAC (University of Caen Normandy), LRAHE (University of Bejaïa, Algeria)



PLANNING Seismic loads: 2023, Sloshing reduction solution: 2024, Tank design optimisation: 2025



MATURITY Roll Out TRL : 8



COMPETENCIES Fluid-Structure Interaction, Sloshing



REMORA



EFFECTIVE AND DURABLE ENERGY STORAGE SOLUTION

REMORA addresses the **storage** issue of electrical energy, especially from renewable sources.

Our **patented** solution offers a **compressed air system** that enables more durable and very effective energy storage (up to 70% yield) compared to other storage solutions.

The first demonstrator designed to harness solar energy is expected for beginning of 2024.

REMORA offers a **flexible**, **high-yield**, **durable** storage solution tailored to meet renewable energy needs, for mid and long-term daily storage (>10-hour), also using recycling materials.



PARTNERS IMTA, CETIM, Nantes Université, ADEME, CORIA, LEMNA, LTEN, IREENA



PLANNING Prototype: 2019, Demonstrator: 2023, 200 Kw container pilot: 2025



MATURITY

TESTING

TRL : 5



COMPETENCIES Energy efficiency, Multi-physics simulation, Experimental development







MULTI-STACK FUEL CELL FUEL CELL INCREASED SIZING AND PERFORMANCE

The project introduces an innovative fuel-cell system architecture that provides **enhanced autonomy** and **reduced recharging time**.

This program will allow us to develop tools to facilitate the sizing of optimized fuel cell systems integrated into a powertrain of any type of vehicle and adapted to their use cases.

As a result, this multi stack fuel cell solution **drives down the vehicle's maintenance costs** by extending of its internal components' **lifespan**.

As part of the project, a **test bench** is developed to validate small-scale fuel cell systems and also validate technical solutions for light mobility applications.



PARTNERS LUSAC (University of Caen Normandy), LRAHE (University of Bejaïa, Algeria)



PLANNING Seismic loads: 2023, Sloshing reduction solution: 2024, Tank design optimisation: 2025











ZERO GREEN LIQUID HYDROGEN-POWERED AVIATION

ZERO's project ambition is to bring to market the **world's first hydrogen-powered commercial aircraft** by 2035.

ZERO explores a variety of configurations and technologies options for liquid hydrogen (LH2) storage, distribution and integration in the aviation sector. The project includes mockup **1:1 scale tests** to validate hydrogen combustion in real conditions.

By overcoming operational hurdles and safety implications, ZERO paves the way to **reduce aviation's carbon footprint** with up to 900,000 tons of CO2 avoided every year by 2050.



PARTNERS IMTA, CETIM, Nantes Université, ADEME, CORIA, LEMNA, LTEN, IREENA



PLANNING Prototype: 2019, Demonstrator: 2023, 200 Kw container pilot: 2025











H2 BIMODO THE WORLD'S FIRST LIQUID HYDROGEN TRAIN

H2 BIMODO promotes use of new traction technologies for the railway lines in order to make Europe climate neutral by 2050.

H2 BIMODO project transforms an **electric railcar into a new bimodal traction** system by combining **liquid green hydrogen** and batteries.

The project offers a **100% sustainable and disruptive solution**, making it possible to reach two European goals: decarbonation and revitalization of capillary lines.



PARTNERS RENFE (operator), Enagás, H2Vector, TACTICA TIC



PLANNING Operational in 2025











GREEN DELIRIVER GREEN RIVER-BASED URBAN LOGISTICS SOLUTION

GREEN DELIRIVER is a boat designed to facilitate **clean logistics** from outer cities to urban areas, reducing road traffic CO2 emissions.

Hybrid electric/biogas (Compressed Natural Gas, CNG) propulsion allows for very low polluting emissions.

Notably, GREEN DELIVER has been selected to participate in the **opening ceremony of the 2024 Olympic Games** on the Seine River.



PARTNERS GRDF, COALIS, NGV Powertrain, CCI78, SYCTOM, HAROPA, SIGEIF (syndicate), VNF, GPS&0, Total Energies



PLANNING Demonstrator: 2024







Water Clean

Water management / Clean water

BIOFILTRATION BIOLOGICAL FILTRATION SYSTEM FOR INDUSTRIAL EFFLUENTS

BIOFILTRATION offers an **alternative biological filtration** method for more efficient purification of effluents.

This method utilizes the natural capacity of some **microorganisms** and their **resistance to high temperatures**, pressures, radioactivity and hazardous environments.

BIOFILTRATION is an **eco-friendly solution** that helps industries grow more environmentally compliant with **cleaner effluents** at a lesser cost.



PARTNERS MAP laboratory M2E team (INSA LYON)



PLANNING Started in 2019 PoC in 2019



MATURITY Testing Trl: 2-3



COMPETENCIES Waste recovery, Depollution, Biotechnologies







ATARA WATER RESOURCES MANAGEMENT TOOL

The Assistance Tool for Water Resources Management (ATARA) is a set of **multifaceted modelling tools** that simulate and enhance water management, storage and related services.

ATARA uses field monitoring methods, including satellites and in-situ monitoring units. Once collected, the data is analyzed and leveraged through 1D, 2D, or 3D modelling, which assists in the creation of **forecast scenarios**.

ATARA supports hydroelectric energy producers and other stakeholders in **improving water access and usage** in a context of scarcity that directly impacts the quality and quantity of water resources.



PARTNERS Lacs Sentinelles, EDF, Polytechnic University of Catalonia, University of Córdoba, French Biodiversity Agency (OFB)

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PLANNING Started in 2016



MATURITY Roll Out Trl: 9



COMPETENCIES Simulation, Limnology, Water quality



STABILOAD ON-BOARD LOAD AND STABILITY AI MODEL

Our Loading calculator provides more efficient management of the freight mass distribution on board to comply with stability criteria and distribution of stresses on the structure.

STABILOAD is customizable and connected on-board, it can simulate unusual and specific configuration to make a quick and safe loading of the boat.

It has a Safe Return To Port module which simulates flooding due to damage, calculating liquid hulls and the resistance of the structure connected to the ship's sensors increasing safety.

Utilizing advanced algorithms, this tool can achieve up to a 5% reduction in energy consumption during shipment, adjusting the boat's trim.



PARTNERS STX France, Britanny Ferries, EU H2020

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COMPETENCIES Naval architecture, Stability, Algorithmic



BIOPTE ENERGETIC USES OF BIOMASS PROCESSING

Harnessing new energy sources like biomass, is a growing priority. Yet, its conversion into usable energy requires specific processing steps.

The BiOpTE tool **identifies the most efficient processing methods for transforming specific biomasses** into actionable energy sources such as roasting, pyrolysis, or gasification.

BiOpTE helps reduce industrial gas emissions (GHGs) and offers access to more sustainable energy sources, such as dihydrogen (H2).



PARTNERS LATEP (UPPA)



MATURITY RESEARCH TRL: 6

COMPETENCIES Energy, Industrial processing, Algorithmic



Reduction of energy consumption

INNOVATIVE THERMAL MANAGEMENT COMPLETE THERMAL MANAGEMENT TOOL

Innovative Thermal Management develops a complete tool to **simulate and optimize the thermal management** of all types of vehicles and architectures.

By taking into consideration the vehicle architecture, the materials used, the climatic conditions and the phases of use, SEGULA has developed a comprehensive tool that makes it possible to perfect the thermal management of vehicles without any architectural limitations. All this while ensuring the best possible passenger **thermal comfort**.

This **adaptable and predictive tool** allows to increase autonomy, to **reduce energy consumption**, and increase thermal comfort.



PARTNERS St Jean Industries, CETHIL(INSA LYON)



MATURITY

ROLL OUT

TRL: 9

COMPETENCIES Thermodynamic









CIMENT I3D PATENT

CIMENT I3D focuses on designing tools and techniques for **producing concrete from waste materials** while maintaining the same final properties as cement.

Ongoing studies aim to master the processing phase and prevent reactions that could alter the composition of the waste-based concrete.

This **eco-friendly** solution helps diminish energy consumption in the construction industry but can also provide **significant cost reduction** from unused and accessible industrial waste.



PARTNERS SUEZ Recycling and valorization, IMT Mines Ales

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PLANNING Started in 2020



MATURITY TEStING TRL: 5



COMPETENCIES Additive manufacturing, Innovative processes, Materials chemistry

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SMART INDUSTRY

"In order to make your operations safer, more convenient, more efficient and productive, system automation (or autonomous system) have become a requirement.

These systems are found in robotics, security, predictive maintenance, autonomous vehicles, energy management... SEGULA contributes to smart industries' progress and adoption, particularly in the fields of artificial intelligence, robotics and sensors."

Soeren Muller, Head of Software and Digitalization, Segula Germany





Industry 4.0



ANAXAGORE Design & development process 4.0



SMARI Plant digitalization and object recognition



TOPONE

Safe autonomous underground gallery inspections



Connected and autonomous mobility



PREMCO On-board load and stability Al model



DESIS

Contactless and remote vital signs detection





ANAXAGORE DESIGN & DEVELOPMENT PROCESS 4.0

Industry 4.0 demands that industrial system design and **development processes** become more flexible, adaptable, and resource-efficient to respond quickly to the market in a personalized and cost-effective manner.

ANAXAGORE is a software that offers a standardized framework and tools to streamline the development of these systems. It integrates digital technologies into various design operations to **automatically generate executable codes** and deliverables.

This solution increases the **productivity of industrial designers & developers** and enhances the flexibility and reliability of design and development processes by shortening design times and efforts.



PARTNERS LabSTICC, IRISA LIAS, CRIStAL



PLANNING
2024: Demonstrator



MATURITY TESTING TRL: 6



COMPETENCIES Thermodynamic







SMARI Plant digitization and object recognition

Industrial plants need to evolve towards Industry 4.0, using reliable and up-to-date plans.

SMARI provides **AI tools to speed up 3D-modelling of complex industrial installations**, from on-site acquisition to CAD modelling, in a semi-autonomous manner, using a 3D-scan and object recognition model.

This project enables **time reduction** to redesign plans of existing installations, **minimization of risks** linked to human intervention for maintenance on installations and offer **high fidelity data** which can be used to construct digital twins.



PARTNERS Lab STICC



PLANNING Prototype in 2024 User test in 2025



MATURITY RESEARCH TRL: 4/5



COMPETENCIES 3D Scan, Al, Object Recognition



TOPONE **SAFE UNDERGROUND GALLERY INSPECTIONS**

TOPONE is a prototype **drone** that can autonomously inspects any underground power line.

TOPONE solution combines thermographic camera to detect hot spots on the damaged cables, and an RGB camera that checks for breaks or cracks. Information on the environmental conditions (O2 and harmful gas concentration, temperature) are also collected via onboard sensors.

TOPONE solution allows for avoiding -sometimes deadly-accidents of inspection missions and securing eventual technical intervention.



PARTNERS CATEC



PLANNING Prototype in 2024



MATURITY TESTING TRL: 5



COMPETENCIES Data processing









Connected and autonomous mobility

PREMCO PREDICTING DANGEROUS MOVEMENT FOR TRAINS

PREMCO provides a **monitoring system** designed to **anticipate hazardous situations**, particularly when objects or humans approach the train.

This system utilizes image processing and AI, that **can accurately predict the trajectory of objects in motion**.

The solution not only **diminishes** the **cost** associated with **equipment downtime** periods but also ensures **better traffic management** by avoiding day-to-day incidents.



PARTNERS IRSEEM



PLANNING 2022-2026: Prototyping 2026-2027: Rolling Out



MATURITY Testing Trl: 5



COMPETENCIES Modeling, Robotics, Al







DESIS CONTACTLESS AND REMOTE VITAL SIGNS DETECTION

DESIS **collects vital data signs** to detect any problematic health conditions that could affect train conductors and their passengers.

By analyzing parameters such as heart rate DESIS plays a crucial role in ensuring the safety of train conductors and customers on board.

This **cost-effective solution** helps railway companies avoid tragic accidents and potential lawsuits which can tarnish the company's reputation.

The project can also be used for **other usages**, such as : remote medical surveillance, or monitoring of incidents for other drivers (truck drivers, airplane pilots).



PARTNERS



PLANNING 2022-2025: Prototype 2025-2026: Roll Out



MATURITY Testing Trl: 4



COMPETENCIES Modeling, Electronic, Signal processing





INDUSTRY FOR LIFE

" Progress in life science is important and necessary, as it helps improve human health(e.g. population aging), with new and safer technology. It can also solve the issue of human organs and cells' donations scarcity and in saving natural resources also preserve biodiversity, and avoid harming the environment.

Our collaborations with renowned laboratories allow us to have life sciences and new technologies meet, for promising projects for the future" **Damien Convert**, *Chief Commercial Officer*







Bio-printing



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NEW ART

3D-Printed polymer for artery substitution

BIOPREENT

3D-Printed vegetal cells bio-ink





Bio printing

NEW ART 3D-PRINTED POLYMER FOR ARTERY SUBSTITUTION

The growing demand for arteries prosthesis, coupled with the limited availability of donor organs, requires the exploration of alternative materials.

NEW ART introduces a **method for crafting customized biomaterials** (arteries substitutes) through additive manufacturing with no risk of patient rejection.

This artery prosthesis solution enables more **vital organ availability** and faster delivery for hospitals that usually wait long times for an available donor.



PARTNERS 3d FAB Platform, Lyon 1 University



PLANNING Started in 2018



MATURITY TESTING TRL: 4/6



COMPETENCIES Polymer additive manufacturing, Controlled polymer degradation, Cell regeneration







BIOPREENT 3D-PRINTED VEGETAL CELLS BIO-INK

As 3D printed vegetals hold significant promise for creating sustainable structures, BIOPREENT develops a **bio-ink based** on vegetal cells serving as a primary material for designing 3D printed structures like wood.

The technology lies in the utilization of **biosourced hydrogel**, a material also used in the production of bio-medical tissue.

This approach enables the fabrication of structures with low carbon cost. If successful, this solution could enable **significant cost savings**, notably in the construction industry.



PARTNERS 3d FAB Platform, Lyon 1 University

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PLANNING Started in 2020



MATURITY TESTING TRL: 5



COMPETENCIES Additive Manufacturing, Plant Biochemistry



THEMATIC SUMMARY PER INDUSTRY



AUTOMOTIVE

- 9 TOI DO INCREASED RESISTANCE OF COMPOSITE STRUCTURES
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INNOVATIVE THERMAL MANAGEMENT COMPLETE THERMAL MANAGEMENT TOOL

FUEL CELL INCREASED SIZING AND PERFORMANCE

ANAXAGORE **DESIGN & DEVELOPMENT PROCESS 4.0**

RAIL

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- H2 BIMODO THE WORLD'S FIRST LIOUID HYDROGEN TRAIN
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- PREMCO 28 HAZARD ANTICIPATION SOLUTION FOR TRAINS
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BUS & TRUCKS

9 TOLDO INCREASED RESISTANCE OF COMPOSITE STRUCTURES



COMPOSITE CAB TRUCK CABIN MASS REDUCTION SOLUTION



MULTI-STACK FUEL CELL FUEL CELL INCREASED SIZING AND PERFORMANCE



DESIS VITAL SIGN REMOTE DETECTION SOLUTION



AEROSPACE

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ANAXAGORE DESIGN & DEVELOPMENT PROCESS 4.0



DESIS VITAL SIGN REMOTE DETECTION SOLUTION





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SMARI PLANT DIGITIZATION AND OBJECT RECOGNITION



TOPONE SAFE UNDERGROUND GALLERY INSPECTIONS



NAVAL





GREENDELIRIVER SUSTAINABLE LOGISTICS SOLUTION



STABILOAD FREIGHT MANAGEMENT SOLUTION



LIFE SCIENCE

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NEW ART 3D PRINTED BIOMEDICAL SOLUTION

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BIOPREENT 3D PRINTED VEGETAL CELLS



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ENERGIES & UTILITIES

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