THE BOOK OF Innovations

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

In order to meet the technological and societal challenges of each era, engineering has always been able to rely on its ability to innovate, particularly in the design, study or construction of structures, equipment or products.

Whatever the field in which SEGULA Technologies operates - Automotive, Aeronautics, Energy, Naval, Rail or Oil & Gas - the DNA of our group is to find the solutions to bring these projects to life and support their implementation in the most competitive way possible. It is therefore natural for us to place innovation at the heart of our development strategy and our growth dynamic.

In ultra-competitive markets, our customers need to innovate quickly. To support them, we are a permanent source of innovative solutions, based on:

→ **the efficiency of our organisation:** our Research and Innovation (R&I) located at the heart of our branches, close to customers and operational staff, is essential for understanding our customers' needs. This proximity also enables us to work closely with SMEs, start-ups, laboratories and competitive clusters, thus promoting cross-fertilisation and creativity.

→ **the talent of our engineers,** and the passion that drives them: more than 200 projects are developed each year by our R&I teams, projects that unite skills around major challenges in the design of new products and systems, new services or new methods.

→ **open innovation:** alliances and large-scale collaborative projects are formed with renowned customers and partners, enabling us to innovate quickly by capitalising on new synergies.

Aware of the fact that our engineers can contribute to the preparation of what tomorrow's world could be like, our group is particularly committed to **7 thematics**:

Industry 4.0

Connected and autonomous mobility

Advanced tools and methods

Environment

Weight reduction / New materials

Bio-engineering

Data engineering

Our Book of Innovations therefore aims to present you in a simple way some of the current innovations developed by our R&I teams.

We hope that this information will enable you to understand a new aspect of our group, that of our ability to constantly innovate in order to anticipate and accompany the changes in the world of industry.

SEGULA TECHNOLOGIES

SUMMARY

(click on projects titles to read more)

Thematics

(click to read more)

- Industry 4.0
- Advanced tools and methods
- Connected and autonomous mobility
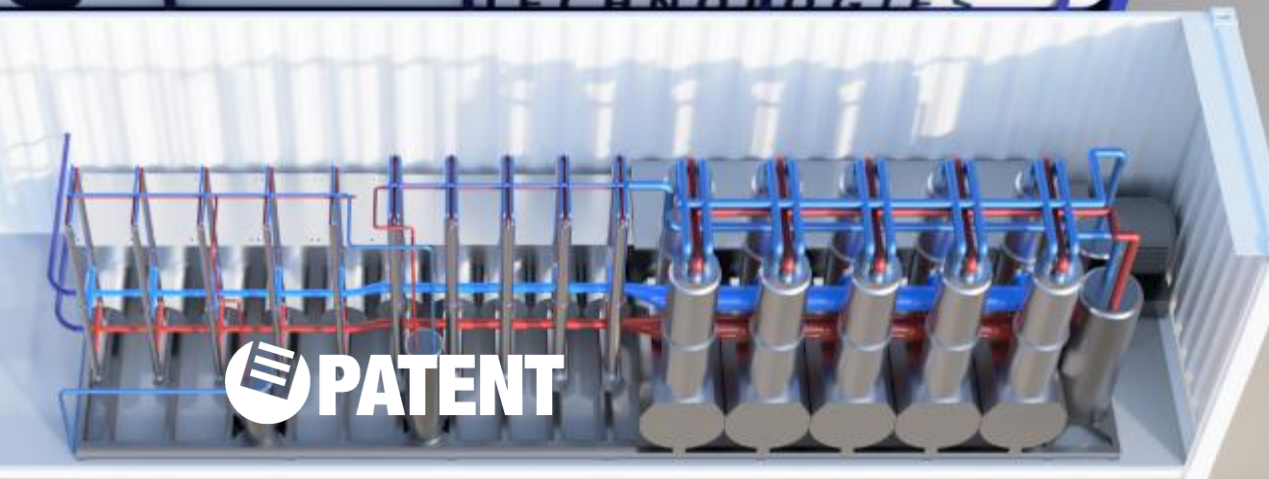- Weight reduction / New materials
- Environment
- Data engineering
- Bio-engineering

THE BOOK OF Innovations

Environment

REMORA

SEGULA TECHNOLOGIES

PATENT

Project leader:
SEGULA
Technologies

Partners:
IMTA, CETIM,
ADEME, CORIA,
GEM, LEMNA,
LTEN, IREENA

Planning:
Prototype since 2019
Demonstrator for
building in 2023 200kW
pilot in container in
2025

Competencies:
Thermics, Power Electronics,
Automation, Mechanics,
Hydraulics, Prototyping

HIGH-EFFICIENCY, LONG-TERM ELECTRICITY STORAGE

? The need for energy storage is growing as a result of the increasing share of intermittent renewable energies in the energy mix.

◎ The REMORA project aims to meet grid flexibility needs by storing electrical energy in the form of compressed air, with an overall efficiency target of 70% and a storage time of up to several tens of hours.

💡 REMORA is based on a process developed and patented by SEGULA Technologies, based on the principle of isothermal air compression. Following the successful testing of an initial terrestrial prototype, the design of a demonstrator designed to store the photovoltaic energy of a building has been launched. It will be installed in 2023.
The following years will be devoted to scaling up the product through industrial partnerships.

👍 High-efficiency storage, increased grid flexibility, synergy with renewable energies.
Use of standard, robust technologies, installation without geographical constraints, modular power and autonomy depending on requirements.
A non-polluting air- and water-based process with an estimated lifespan of at least 30 years.

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● Environment   ⌖ Connected and autonomous mobility

GREEN DELIRIVER
Inland waterway logistics

Project leader:
SEGULA Technologies

Partners:
GRDF, COALIS, NGV Powertrain, CCI78, SYCTOM, HAROPA Chantiers Haute Seine SIGEIF (the syndicate), VNF, GPS&O TOTALENERGIES

Competencies:
Naval architecture, Energy efficiency, Logistics, Design

A RIVER-BASED SOLUTION FOR CLEAN URBAN LOGISTICS

? The explosion in e-commerce has greatly increased the need for alternative logistics for the delivery of goods, as road transport is the world's 2nd largest emitter of CO_2.

⌖ The aim of GREEN DELIRIVER is to develop a silent, environmentally-friendly solution for transporting goods to the heart of urban centres, thereby decongesting city centres while reducing air and water pollution.

💡 GREEN DELIRIVER features a hybrid gas-electric engine, photovoltaic panels and batteries to reduce energy consumption.

👍 Reduced pollutant emissions, less noise pollution, less congestion in cities, a design that blends in perfectly with urban landscapes and integrated logistics that eliminate the need for specific unloading infrastructure.
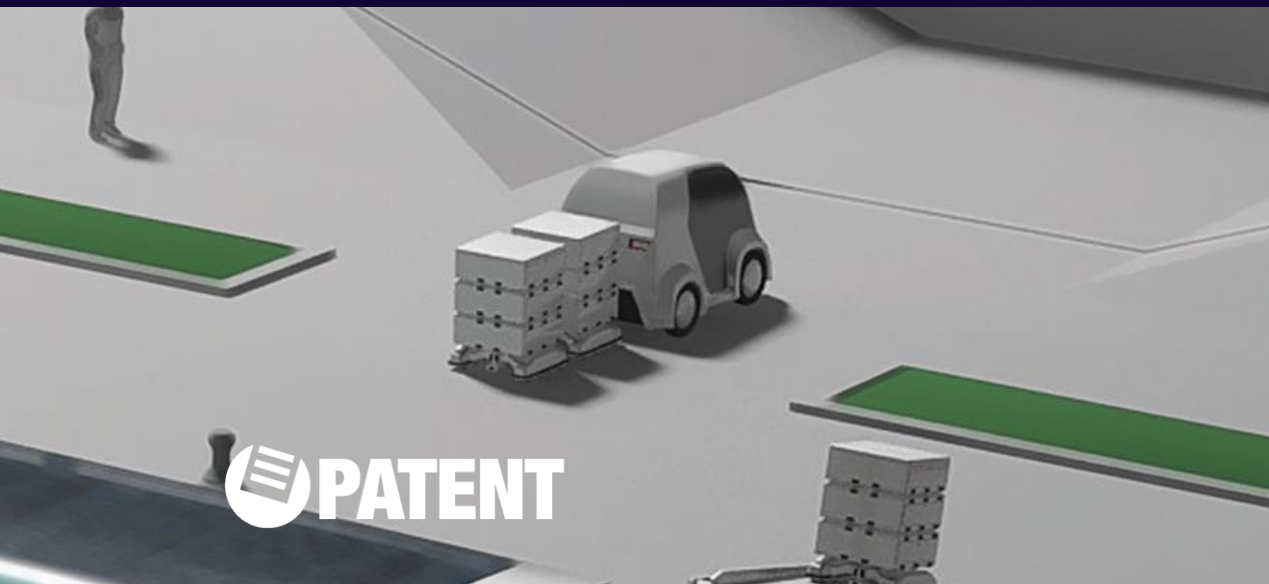
5

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THE BOOK OF Innovations

⬤ **Environment**   📶 **Connected and autonomous mobility**

GREEN DELIRIVER
Autonomous Conveyor

AUTONOMOUS CONVEYORS FOR THE LAST KILOMETER: INTELLIGENT GOODS MANAGEMENT

? The explosion of e-commerce has strongly developed the alternative logistics needs linked to the delivery of goods. Road transport is the world's 2nd largest CO_2 emitter.

◎ The GREEN DELIRIVER last-km electric conveyors are designed to ensure the loading and delivery of goods to the heart of urban centres, thus reducing pollution and traffic.

💡 The GREEN DELIRIVER last-mile conveyors are autonomous loading systems that are loaded directly onto a ship/train/truck. Once they arrive at the place of delivery, they reach the delivery points. The battery is recharged during the unloading and loading of the parcels.

👍 Reduction of pollutant emissions, reduction of noise pollution, decongestion of cities, integrated logistics eliminating the need for a specific infrastructure for unloading.

Project leader: SEGULA Technologies

Partners: GPSEO, NOVALOG, HAROPA

Planning: Prototype 2018

Competencies: Systems architecture, Energy efficiency, Mechanics, Logistics, Design

6

SEGULA TECHNOLOGIES
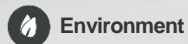
Environment

PAC

DIMENSIONING FUEL CELLS TO INCREASE RELIABILITY

The electrification of transport requires more efficient and environmentally friendly power sources. Fuel cells are therefore an ideal solution, increasing autonomy while reducing recharging time and the use of polluting batteries.

The aim of this project is to develop a new architecture of fuel cell systems in order to ensure independent control of the different cell packs, thus improving reliability and service life.

SEGULA is developing tools for the quick pre-dimensioning of hydrogen vehicles and more particularly of the PAC - battery technologies.

Improvement of vehicle performance (Vehicle Autonomy).
Reduction of maintenance costs.
Optimisation of energy chain reliability and lifetime.

Project leader:
SEGULA
Technologies

Partner:
FCLAB-UTBM

Competencies:
Electrochemistry, Power electronics,
Thermal, Fluidic, Mechanical

7

THE BOOK OF Innovations

● Environment ● Bio-engineering
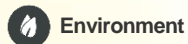
BIOFILTRATION

FILTRATION OF AQUEOUS EFFLUENTS BY MICROORGANISMS

? During the various industrial processes, the effluents are treated and then injected back into the process or directly into nature. As regulatory requirements are becoming stricter, it is therefore necessary to improve the filtration of these effluents.

◎ The objective of the BIOFILTRATION project is to develop a new method of effluent treatment. It consists in using the natural capacity of some microorganisms to fix a large variety of inorganic and organic molecules (metals, oxides, radioelements...).

💡 SEGULA Technologies studies the diversity of microorganisms that can purify effluents. The Group determines the microorganism and treatment process best suited to the industrial problem.
This new filtration process is adaptable to high temperatures, high pressures and a high radioactive environment.

👍 Development of filtration processes specific to each industrial problem.
Reduction of costs and treatment time.
Filtration of effluents that cannot be treated with current processes.
Possible recovery of inorganic and organic pollutants and revalorization.

Project leader:
SEGULA Technologies

Partner:
MAP Laboratory M2E Team (INSA LYON)

Planning:
Proof of concept obtained in 2019 for a specific industrial issue

Competencies:
Waste recovery, Depollution, Microbiology, Biotechnologies

8

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THE BOOK OF Innovations

🌿 Environment

SOxLOW

ON-BOARD DESULPHURISATION OF MARINE FUELS

? New rules stemming from the recommendations of the International Maritime Organisation (IMO) have recently been put in place to limit sulphur oxide emissions from ships in order to improve air quality and reduce ocean acidification.

◎ SOxLOW is a desulphurisation system for marine fuel oils (heavy refinery products) for continuous treatment on board ships.

💡 SEGULA Technologies has developed methodologies for the analysis of sulphur compounds, adapted to marine fuel oils and necessary for their treatment. The Group is currently conducting fuel oils depollution experiments.

👍 Possibility of adapting the system to existing vessels, functional on all types of heavy fuel oils, reduced environmental and health impacts in compliance with various regulations.

Project leader:
SEGULA
Technologies

Partners:
UCCS, IPREM,
IMT Atlantique

Competencies:
Chemistry, Processes, Ships

SEGULA TECHNOLOGIES

Environment   **Connected and autonomous mobility**

ODOT

© Brittany Ferries

BALLAST MANAGEMENT FOR FUEL SAVINGS

? Environmental and health concerns and the rising cost of fossil fuels make the reduction of energy consumption of ships a priority.

The ODOT (Operational Displacement Optimisation Tool) project aims to provide crews with a decision support tool to better manage cargo (cargo, consumables) and thus reduce energy consumption. It has been selected as part of the H2020 JOULE European collaborative project.

Using complex algorithms, the ODOT module optimises the distribution of masses in the ship, which reduces the resistance to forward motion and leads to energy savings of 5%.

Low financial investment, immediate return on investment, quick takeover, can be used on existing vessels.

Project leader:
SEGULA
Technologies

Partners:
STX France,
Brittany Ferries
EU H2020

Planning:
Product marketed

Competencies:
Naval architecture,
Hydrodynamics,
Software Engineering

10

THE BOOK OF Innovations

● Environment ⚙ Advanced tools and methods ⌾ Connected and autonomous mobility

E3S

ENERGY SMART SAILING SHIP

? A sailing ship is isolated from any energy supply during its navigation. Today's environmental concerns make intelligent management of energy flows essential, from environmentally friendly energy sources, while guaranteeing optimum safety and comfort for passengers.

◎ E3S is an onboard energy management tool that includes a computer with Artificial Intelligence and a Human Machine Interface interacting with the passengers.

💡 An optimisation algorithm defines and proposes the implementation of an energy management strategy, adapted to the global conditions of navigation in real time.

👍 E3S is a system that can be adapted to the configuration of the sailing ship, ensuring the availability of energy on board, optimal comfort and maximum passenger safety throughout the navigation.

Project leader:
SEGULA
Technologies

Competencies:
Control & Command, Operational Research,
Artificial Intelligence, Human Machine Interface

◆◆ SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Environment   **Advanced tools and methods**   **Data engineering**

ATARA

Project leader:
SEGULA
Technologies

Partners:
Lacs Sentinelles,
University of
Catalonia
French Biodiversity
Agency (OFB)

Competencies:
Simulation, Limnology,
Hydrodynamics, Water quality,
User interface, Energy

MANAGEMENT OF WATER RESOURCES

? Climate change and human activity are having an increasingly important impact on ecosystems and on services they provide (supply and control).
Modeling tools (1D to 3D) supported by optimization algorithms were developed for ecological management of aquatic systems and for preventing quantitative and qualitative water variations (flood prevention, turbidity monitoring, irrigation management, hydroelectric resources optimization, etc.).

The ATARA project (Assistance Tool for wAter Resources mAnagement) is based on the development of numerical modeling tools of hydro-bio-geochemical modeling of water bodies (lakes and reservoirs). All tools aim at estimating impact of human activities and climate change on water resources and at optimizing water use.

This project focuses on the development of hydrodynamic and water quality modeling tools. They exist at the macro-scale of a region (1D) and at the micro-level of a lake ecosystem (2D and 3D). These models are integrated into an interface enabling analysis of the results via statistical tools synthesizing the information, from in situ measurements and from national environmental scientific databases.
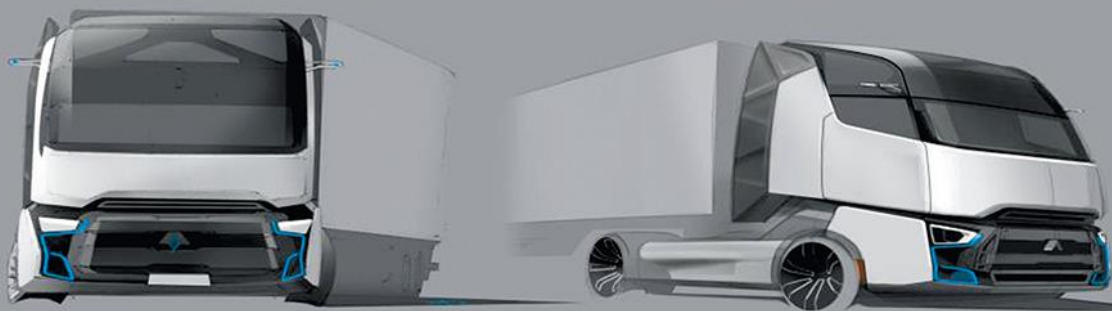
Provision of methods and tools, enabling impact modeling of human activity on water resources or other phenomena on water retention infrastructure, and optimizing expected services supplied by these ecosystems.

SEGULA TECHNOLOGIES

COMPOSITE CAB

● Environment   ● Weight reduction / New materials

PATENT

Project leader:
Renault Trucks

Partners:
Solvay, PO, Altair, Mecaplast, Saertex, Addiplast, Insa, Isat

Competencies:
Composite Design, Eco-Design, Crash Calculation, LCA

LIGHTER TRUCK CAB USING COMPOSITES

? Road transport is facing major societal and technological challenges. It must solve the paradox of achieving an optimal load capacity while minimising vehicle weight.

COMPOSITE CAB aims to reduce fuel consumption while increasing a lorry's load capacity. The project focuses on reducing cab weight and incorporating various features using composites.

SEGULA Technologies has leveraged its expertise in computation and life cycle analysis (LCA) in order to re-design the rear section of the cab using composite sandwich materials. This solution has not only led to a significant reduction in weight but also the integration of new thermal and acoustic features and a non-mechanical sleeper system.

This project has resulted in a cab that is 30% lighter. The patented sleeper design is covered under an operating license negotiated with Renault Trucks and can be offered as a solution in other sectors.

THE BOOK OF Innovations

Environment   **Advanced tools and methods**

CUVE

LIQUID SLOSHING IN TANKS

? A liquid storage tank is subject to external forces, such as shock waves, violent accelerations, earthquakes or swell. This causes the liquid inside the tank to start moving, known as sloshing. This can have serious consequences for structures, the environment and the safety of people and goods.

The aim of the CUVE project is to develop a sloshing prediction tool for industries that store or transport liquids.

SEGULA has developed a tool that takes into account the full complexity of sloshing, with a model that incorporates the effects of fluid-structure interaction (tank deformability) and liquid overflow outside the tank.

Understanding of the conditions and consequences of sloshing.
Upstream optimisation of reservoir design to limit the negative consequences of sloshing.

Project leader:
SEGULA
Technologies

Partners:
LUSAC (University of Caen) and LRAHE (University of Béjaïa, Algeria)

Competencies:
Numerical modelling, Fluid mechanics, Structural mechanics, Fluid-structure interaction, Liquid sloshing

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

● Environment ⚙ Advanced tools and methods 🔍 Data engineering

HYDROVOL

IMPROVED NAUTICAL PERFORMANCE

? Improving means of transport in the maritime domain requires an understanding of the natural phenomena of the environment and the optimisation of their operation. The development of specific numerical models is therefore essential.

◎ The HYDROVOL project proposes a process and design tools based on a digital twin approach to optimise performance (energy, speed, stability) for systems with wind propulsion and hydrofoils.

💡 SEGULA Technologies focused on the simultaneous modelling of aerodynamic and hydrodynamic flows around watercraft in order to simulate different flight scenarios and define the optimal structure. Numerous tests were carried out to validate processes and tools.

👍 Significant improvement in the flight performance of foilers.
Optimisation of watercraft.
Guaranteed design efficiency from the very first prototype.

Project leader:
SEGULA
Technologies

Partners:
ZEPHIR Project
(Antoine Albeau and
Marc Amerigo) and BSG
Dev

Competencies:
Naval architecture, Stability,
Numerical modelling,
Hydrodynamics, Aerodynamics

SEGULA TECHNOLOGIES

BOOK
Innovations
THE
OF

Environment　　**Advanced tools and methods**　　**Connected and autonomous mobility**

GYRAUT

AUTONOMOUS MODULAR MONORAIL VEHICLE WITH GYROSCOPIC STABILISATION

? At the heart of the "Digitalisation and decarbonisation of mobility" strategy, new transport solutions need to be developed to offset the gradual abandonment of small railway lines.

◎ The GYRAUT project is based on the development of a shuttle service (some of which are monorails) capable of transporting passengers and/or freight without timetable constraints. This on-demand service complements public transport offer and should help to open up areas and reduce the carbon footprint associated with traffic.

💡 The uniqueness of this concept lies in the fact that two vehicles can pass each other on the same track.
This innovative monorail train takes the form of electric and autonomous modules for so-called "last-kilometer" lines.

👍 Reduced greenhouse gas emissions.
On-demand traffic.
Guaranteed comfort and stability thanks to gyroscopic technology.
Reduce operating costs by automating the service and reusing abandoned lines.

Project leader:
SEGULA
Technologies

Competencies:
Electronic systems, Control laws,
Servo control, Mathematical modelling

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Environment

SHyPs

NAVAL PROPULSION SIMULATOR

? Logistics needs and the desire to limit pollution require the development of new propulsion architectures and improved sizing. However, the possibility of hybridising energy sources (electric, diesel, etc.), the wide variety of engines and propulsion systems, the different hull shapes and the varied uses of boats make the optimisation of propulsion systems extremely complex.

◎ The SHyPs project enables to identify propulsion architectures adapted to the needs of shipowners and to optimise their sizing.
The associated environmental and economic impacts are thus assessed.

💡 SHyPs is based on a simulation tool validated by experimental tests. It takes into account the hydrodynamic phenomena involved and finely models energy exchanges for multiple architectures. SHYPS uses optimisation algorithms to propose the ideal architecture, sizing and energy management for each use.

👍 Reduced pollutant emissions and energy consumption.
Can be used for new builds or repowering.
Proposed controlling laws and energy management strategies that are increasingly adapted to usage.

Project leader: SEGULA Technologies

Partners: IRENAV, L2EP

Planning : Prototype 2023 Design office use from 2024

Competencies: Hydrodynamics, Thermodynamics, Power Electronics, Naval Architecture

17

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Environment · Bio-engineering

BiOpTE

BIOMASS ENERGY RECOVERY

? The depletion of fossil resources and climate change are forcing us to look for new sources of energy, such as plant biomass. The conversion of biomass into energy is complex because of the wide variety of its characteristics (moisture, ash, nitrogen, sulphur). To overcome these drawbacks, pre-treatment processes need to be implemented.

◎ The aim of the BiOpTE project is to define the optimum process for pre-treating and converting biomass into energy so that it can be used directly in industry and for mobility.

💡 SEGULA Technologies has developed a numerical optimisation tool capable of determining the best solution for exploiting biomass for energy while controlling environmental impacts. This tool identifies the processes required (drying, torrefaction, pyrolysis, gasification, methanation, etc.) and their scheduling for each type of material.

👍 Optimisation of industrial processes and energy efficiency.
Reduced greenhouse gas emissions.
Production of synthesis gas, methane, dihydrogen (H_2) and other energy carriers.

Project leader:
SEGULA Technologies

Partner:
LATEP (UPPA)

Competencies:
Microbiology, Biotechnologies,
Process engineering

18

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Connected and autonomous mobility   Advanced tools and methods

STABILOAD

Stabiload

ON-BOARD LOAD AND STABILITY CALCULATOR

? The loading of ships must comply with the stability criteria defined by the International Maritime Organisation, but also the proper distribution of stresses on the ship's structure.

STABILOAD is a modular and connected on-board load and stability calculator. It allows the simulation of the ship's equilibrium and the resistance of the structure, as well as the verification of stability criteria.

It performs stability calculations in an intact state, but also after damage (IACS type 2, 3 and 4), with calculations of the liquid hulls and the resistance of the structure. STABILOAD simulates flooding suits while being connected to the ship's sensors. It has a return to port after damage module (SRTP).

Improved safety, quick completion of the loading plan (remote gauging, connection to ferry booking services), decision support in the event of damage, customisable software and load optimisation modules.

Project leader:
SEGULA
Technologies

Clients:
Brittany Ferries,
PIRIOU, MCM, French
Naval Forces...

Planning:
Product marketed

Competencies:
Naval Architecture, Stability,
Software Engineering

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Connected and autonomous mobility

LI-FI CAR

CAR-TO-CAR LI-FI COMMUNICATION

? The development of driver assistance systems is a major challenge for car manufacturers who must meet increasing safety objectives (accident reduction).

◎ The objective of this project is to design a system for real-time transmission of vehicle to vehicle data in order to avoid possible collisions.

💡 SEGULA has designed a system that uses Li-Fi technology to transmit data between vehicles via the front and rear lights that are already on the vehicle. This system can be used to maintain suitable distances between two vehicles, and in the future, it can be used to create convoys of partially autonomous vehicles by transferring datas between the lead vehicle and those following behind.

👍 Cost-effective technology, safety.

Project leader:
SEGULA
Technologies

Competencies:
Embedded systems,
Operational safety

20

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Connected and autonomous mobility

Advanced tools and methods

DESIS

NON-CONTACT AND REMOTE DETECTION OF VITAL SIGNS

? Contactless monitoring of vital signs of people is an essential tool for the safety of vehicle drivers (trains, cars, trams, planes, etc.) thanks to the collection of real-time information on physiological characteristics.

The DESIS project aims to develop techniques based on the notion of cyclostationarity of vital signals to obtain information on the heartbeat or breathing of drivers without being dependent on the noise of the targeted application.

The project **DESIS** is based on the development of a functional system coupled with a data acquisition and processing methodology, enabling real-time analysis and capable of detecting alarming variations in vital signs (abnormal heartbeat or breathing, characteristic peaks in signals...).

Non-invasive (no contact), effective and reliable (low false detection rate), low cost.

Project leader:
SEGULA
Technologies

Partners:
IFSTTAR /IEMN

Planning:
2018-2021

Competencies:
Electronic systems,
Data processing

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

📶 **Connected and autonomous mobility**

IMADRONE

SEMI-AUTOMATIC PILOTING OF A DRONE IN EXTREME CONDITIONS

? Drones are used to capture images of the surfaces of engineering structures (which are then processed to analyse their condition) in inaccessible and difficult terrains.

◎ The objective of this project is to develop a reliable means of inspecting engineering structures, using an algorithm which factors in the parameters that can influence a drone's flight path (wind gusts, etc.) in order to produce a 3D reconstruction in post-processing.

💡 SEGULA has installed a semi-automatic piloting system which lets the drone scan the surface to be inspected without the risk of missing shots as it reacts to weather conditions. SEGULA has incorporated image processing to calculate ego-motion and control trajectory.

👍 Obstacle detection in all directions without previous familiarity with the inspection area.

Project leader:
SEGULA
Technologies

Partners:
Technidrone

Competencies:
Embedded systems,
Image processing

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Industry 4.0 🔍 **Data engineering** ⚙ **Advanced tools and methods** 📡 **Connected and autonomous mobility**

PREMCO

PREDICTION OF DANGEROUS MOVEMENTS OF PEOPLE NEAR THE RAILS

? With a view to making vehicles increasingly autonomous, it is essential to strengthen on-board safety systems and, in particular, solutions for predicting potential hazards.

◉ PREMCO proposes to equip vehicles with a system for monitoring and anticipating the movements of objects surrounding them (pedestrians, cars, bicycles).

💡 Based on the principle of stereo-correlation processing (simultaneous video processing of the scene by 2 cameras), SEGULA Technologies has developed an algorithm for predicting the trajectories of moving objects.

👍 Real-time solution, increased security.

Project leader:
SEGULA
Technologies

Competencies:
Video processing,
Detection of moving objects

23

SEGULA TECHNOLOGIES

Industry 4.0

IMACAR

USING IMAGE PROCESSING TO IMPROVE PERCEIVED QUALITY

? The perceived quality of a product is currently a major issue for consumers, who are increasingly more demanding when it comes to their vehicles.

◉ The objective of this project is to improve the vehicle's perceived quality by developing a more reliable means of assembling the body parts while reducing the time taken to position them.

💡 SEGULA has come up with a solution for estimating and adjusting play between parts, based on image processing with a camera installed at the assembly station.

👍 A non-invasive solution, suitable for all types of components, reliable under industrial use (assembly plant), fast calculation and more precise positioning.

Project leader:
SEGULA
Technologies

Partner:
IVECO Bus

Competencies:
Image processing

THE BOOK OF Innovations

Industry 4.0　　Advanced tools and methods　　Data engineering

SMARI

DIGITALISATION OF INDUSTRIAL PLANTS AND OBJECT RECOGNITION

? The construction of reliable and complete 3D digital models of industrial plants is indispensable for reverse engineering and the evolution of existing plants towards Industry 4.0.

◎ SMARI's objective is to create a Mobile Information Acquisition and Recognition System for the modelling of complex industrial installations for monitoring and inspection purposes, and to meet any redesign or optimisation needs that may arise.

💡 SEGULA Technologies develops methodologies for processing point clouds and images obtained from lasergrammetry or photogrammetry. Acquisition and modelling will be carried out in a semi-automatic manner. For this purpose, complex object recognition techniques are being developed.

👍 Digitisation of industrial installations in complete safety (minimisation of risks linked to human intervention on the installations). Speed of reconstruction of a 3D model that can be used with current engineering tools, competitive for making digital twins.

Project leader:
SEGULA
Technologies

Partner:
Lab-STICC

Competencies:
Scanning, 3D Scan, AI,
Object Recognition

25

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Advanced tools and methods

ANAXAGORE

ANAXAGORE →

REDUCTION OF DESIGN TIMES FOR COMPLEX SYSTEMS

? Control-command systems are becoming increasingly complex and require trades which all have specific tools, creating risks of errors and vulnerabilities that are often not identified until the end of development.

◎ ANAXAGORE's goal is to provide automated gateways between design models to quickly achieve reliable solutions.

💡 SEGULA Technologies has developed software that uses the Physical System Model (P&ID) to generate a complex control-command system ranging from commands sent to actuators to the supervision HMI. During the design process, ANAXAGORE enables the integration of ergonomic criteria of HMIs, formal verification and simulation techniques to check the safety of the designed system, and Data Mining technologies to detect cybersecurity issues.

👍 Reliable exchanges between experts through a standardised language between the different tools, shortens design times and facilitates the supervision of complex systems.

Project leader:
SEGULA
Technologies

Partners:
Lab-STICC, CRPCC,
LIAS, CRIStAL, IRISA,
Polytech St-Nazaire,
ENSM

Competencies:
IT, Automation, Ergonomics,
Data Mining, Cyber-security

26

SEGULA TECHNOLOGIES

THE BOOK of Innovations

Advanced tools and methods

SADENav

DECISION SUPPORT SYSTEM FOR SHIP FITTING OUT

?   Ship fitting out is complex and relies on the know-how of trade experts. The constraints to be taken into account are numerous and varied.

◎   The SADENav project is based on the development of a decision support tool which offers experts a specific fitting out solution for each ship study. This tool also has a learning capacity, in order to propose ever more relevant solutions.

💡   SADENav is based on the Virtual Reality technique, through the digitisation and 3D visualisation of premises and objects. The constitution of digital twins allows a collaborative and simultaneous work to the numerous trades. Its learning ability enriches the system as it is used.

👍   SADENav allows the expert to be immersed in a 3D digital environment, and real time collaborative working between the involved trades.

Project leader:
SEGULA
Technologies

Partners:
AAU Research
Laboratory, Ecole
Centrale de Nantes

Competencies:
Ship fitting, Virtual Reality, Human-Machine Interaction,
3D Modeling and Digitisation, Interactive Object Placement,
3D Visualisation

27

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Advanced tools and methods   Environment

ECOBATI

REDUCING THE ENERGY CONSUMPTION OF A BUILDING THANKS TO DIGITAL SIMULATION

? Between heating and ventilation systems, buildings account for more than 40% of energy consumption in France.

◎ The aim is to optimise the energy consumption of buildings by adapting heating and ventilation according to external conditions and the occupancy of the premises.

💡 The solution consists in monitoring the evolution of the energy supply in a building according to weather conditions and occupancy over the course of a day, thanks to CFD simulation. Complex physical phenomena with different time scales are taken into account.

👍 Reduction of energy consumption and therefore lower associated costs. Possibility of deploying the approach to all buildings.

Project leader:
SEGULA
Technologies

Competencies:
Design,
Numerical computation in fluid mechanics

28

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Advanced tools and methods

TOLDO

TOLERANCE TO IMPACT DAMAGE OF A COMPOSITE LAMINATE

? Laminated composite materials are sometimes exposed to external mechanical impacts, which can significantly change their structure and reduce their resistance.

The TOLDO project (TOLDO - TOLDO Impact Density Tolerance of a Composite Laminate) aims to simulate the behaviour of hybrid carbon/glass composite structures after an impact such as a falling tool or a bird strike.

SEGULA Technologies has developed a digital model to simulate the damage caused by an impact. This model has been validated through experimentation. Technological solutions have thus been developed to improve damage tolerance.

👍 Provision of a predictive numerical model, increase in the life span of materials, increased security.

Project leader:
SEGULA
Technologies

Partners:
ISAE, ICA,AIRBUS,
CNRS, ARIANE Group

Competencies:
Aeronautics, Laminates,
Numerical modelling, Impacts

29

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

🔍 **Data engineering**   🔄 **Advanced tools and methods**

COMMANDO

SYNTHESIS OF ADVANCED CONTROL LAWS FOR THE CONTROL OF SWARMING UAVS

? Site inspection, maintenance or surveillance operations can be simplified and optimised through the use of UAVs (pollution detection, intrusion detection, mapping, etc.).
The use of UAVs in swarms increases the performance of operations but comes up against the complexity of implementation and real-time management.

◎ In order to optimise the flight performance of UAVs in formation or swarm, it is necessary to develop, for each UAV, control laws that enable them to perform their tasks (trajectory tracking, target tracking, positioning, etc.) efficiently in terms of speed and precision. The main obstacle to the development of these control laws is the complex (multi-variable) and non-linear dynamics of UAVs.

💡 The COMMANDO project proposes to use observers to follow the swarm.
The locations provided by these observers are integrated into control laws to optimise the navigation of the swarm.

👍 Optimised management of a swarm of UAVs (precision and speed).
Improvement of the control integration when faced with black box models.
Reduction in the number of sensors required for the precise location of each UAV.

Project leader:
SEGULA Technologies

Partners:
IRSEEM / ESIGELEC

Planning:
2019-2020

Competencies:
Electronic systems,
Data processing,
Ordering laws

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Advanced tools and methods

MTCSIM

A SIMULATION TOOL FOR ENERGY CHAIN SIZING

? Engine development, energy management and component sizing all require a multitude of calculations and simulation during their design phases.

⊚ The MTCSim (Mathematical Temporal Calculation Simulation) project aims to develop an economic tool allowing in particular the simulation of electric and hybrid powertrains vehicles. It was produced independently of market tools. In addition, MTCSim offers the possibility of finely configuring the mathematical models specific to each organ.

💡 SEGULA Technologies has developed an integrated and modular digital simulation platform based on physical models of systems, subsystems and components.

👍 The implementation of the software platform and the mastery of knowledge related to the field of digital simulation allows good reliability and the possibility of upgrading the tool at a lower cost compared to market tools.

Project leader:
SEGULA
Technologies

Competencies:
Energy modelling,
Electrotechnics

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Bio-engineering

WalkCare

AUTONOMOUS PERSONAL ASSISTANCE ROBOT

? The Silver Economy must respond to the challenges generated by the increase in dependency linked to the ageing of our populations.

◎ The objective of this project is to help the elderly to move safely while giving them more independence in their movement. This within the establishment where they reside.

💡 In collaboration with Novéup start-up, SEGULA has developed an intelligent autonomous robot called WalkCare. Its robotic performances allow the location of users, the monitoring of their health data and the prevention of falls.

👍 Independence of users.
Enhanced security when moving around.
Better patient follow-up.

Project leader:
SEGULA
Technologies

Partner:
Novéup

Competencies:
Robotics, embedded systems,
system architecture, design, HMI,
electronics

32

SEGULA
TECHNOLOGIES

THE BOOK OF Innovations

🔬 **Bio-engineering**   🔬 **Weight reduction / New materials**

I3D-ARTERE

PATENT

POLYMER 3D PRINTING OF ARTERIAL SUBSTITUTES

? Cardiovascular disease is the leading cause of death worldwide and the he need for vascular substitutes is constantly increasing due to the low number of healthy donors. To date, there is no solution for treating these pathologies without the use of synthetic or exogenous materials.
Thus, SEGULA Technologies has put developing innovative polymeric arterial substitutes.

◎ The aim of the I3D-ARTERE is to produce polymer vascular substitute implantable in the human body using additive manufacturing technology, capable of withstanding variations in blood flow pressure, while adapting to the morphology and both mechanical and biological properties of the patient.

💡 SEGULA Technologies, with the help of its partner 3d.FAB, has designed a novel method and custom-made biomaterials. This solution provides the possibility to meet the needs of each patient efficiently and quickly thanks to the controlled degradation of polymers and the simultaneous tissue regeneration.

👍 Replacement of injured artery with a biodegradable prosthesis to the specific morphology of the patient, without the possibility of rejection of the patient.
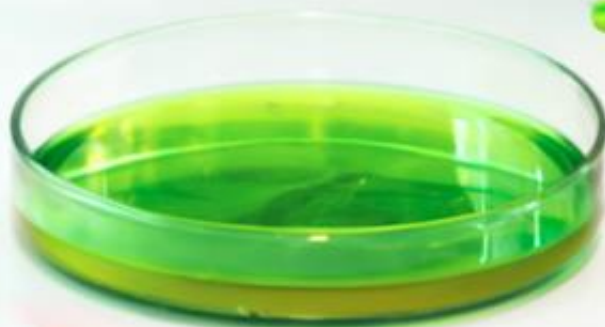
Project leader:
SEGULA Technologies

Partners:
3d.FAB platform,
Lyon1 University

Planning:
2018-2021

Competencies:
Polymer Additive Manufacturing,
Controlled Polymer Degradation,
Bioengineering, Cellular
Regeneration

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

⚗️ **Bio-engineering**   🔬 **Weight reduction / New materials**

BIOPREENT

3D PRINTING OF PLANT CELLS

? 3D printing of plant cells is still a relatively undeveloped field compared with the printing of animal and human cells. However, the potential of plant 3D bioprinting is huge, making it possible, for example, to produce timber structures for construction.

◎ BIOPREENT aims to develop a bio-ink containing plant cells to enable 3D printing of complex plant structures.
This will avoid deforestation, transport and waste of unused raw materials.
BIOPREENT will also deepen our understanding of the plant model.

💡 The technology developed by SEGULA Technologies is based on the use of hydrogels, a process previously developed for bioprinting in the medical field (SEGULA Technologies patent).

👍 Production of oxygen by bioprinted algae for bioreactors.
Production of wood structures with a very low carbon cost.
Understanding the fundamental mechanisms of proliferation in the plant model.
Eventual application to the animal model (tissue engineering).

Project leader:
SEGULA
Technologies

Partners:
3d.FAB platform,
Lyon1 University

Competencies:
Additive manufacturing, Biochemistry,
Plant biology and physiology

SEGULA TECHNOLOGIES

THE BOOK OF Innovations

Weight reduction / New materials

BETON I3D

PATENT

3D PRINTING OF CONCRETE INCORPORATING BOTTOM ASH

? At present, bottom ash (ash from household waste incinerators) is an industrial waste that is rarely recycled. Its composition depends on local lifestyles (local sorting instructions, recycling rates) and time of the year, which complicates its treatment.

◎ The aim of the Béton I3D project is to formulate a new, more environmentally-friendly concrete for 3D printing, based on the recycling of household waste.
The aim is to define tools adapted to the composition of bottom ash, as its incorporation into concrete mixtures leads to side reactions that modify the final properties of the material.

💡 SEGULA Technologies studies concrete formulations incorporating bottom ash and, with its partners, carries out numerous tests to characterise viscosity, drying times and mechanical properties. The tests also enable to understand the mechanisms of chemical reactions in order to eliminate or totally control the side reactions that occur during concrete formation.

👍 Recovery of waste not used by industry.
Drastic reduction in the carbon footprint of concrete production thanks to the partial substitution of cement.
Reduced energy consumption.
Creation of complex shapes using 3D printing.

Project leader:
SEGULA Technologies

Partners:
SUEZ Recyclage et Valorisation
IMT Mines Alès

Competencies:
Additive manufacturing, Materials, Materials chemistry

35

SEGULA TECHNOLOGIES

THEMATIC SUMMARY

(click on projects titles to read more)

Industry 4.0

23 **PREMCO**
PREDICTION OF DANGEROUS
MOVEMENTS OF PEOPLE NEAR
THE RAILS

25 **SMARI**
DIGITALISATION OF INDUSTRIAL
PLANTS AND OBJECT
RECOGNITION

24 **IMACAR**
USING IMAGE PROCESSING TO
IMPROVE PERCEIVED QUALITY

THEMATIC SUMMARY

(click on projects titles to read more)

Connected and autonomous mobility

THE BOOK OF Innovations

THEMATIC SUMMARY *(click on projects titles to read more)*

◉ Environment

THEMATIC SUMMARY

(click on projects titles to read more)

Bio-engineering

8   **BIOFILTRATION**
FILTRATION OF AQUEOUS
EFFLUENTS BY MICROORGANISMS

33   **I3D-ARTERE**
POLYMER 3D PRINTING OF
ARTERIAL SUBSTITUTES

18   **BIOPTE**
BIOMASS ENERGY RECOVERY

34   **BIOPREENT**
3D PRINTING OF PLANT CELLS

32   **WALKCARE**
AUTONOMOUS PERSONAL
ASSISTANCE ROBOT

THE BOOK OF Innovations

THEMATIC SUMMARY
(click on projects titles to read more)

Advanced tools and methods

11 E3S
ENERGY SMART SAILING SHIP

12 ATARA
MANAGEMENT OF NATURAL
WATER RESOURCES

14 CUVE
LIQUID SLOSHING IN TANKS

15 HYDROVOL
IMPROVED NAUTICAL
PERFORMANCE

16 GYRAUT
AUTONOMOUS MODULAR
MONORAIL VEHICLE WITH
GYROSCOPIC STABILISATION

19 STABILOAD
ON-BOARD LOAD AND STABILITY
CALCULATOR

21 DESIS
NON-CONTACT AND REMOTE
DETECTION OF VITAL SIGNS

23 PREMCO
PREDICTION OF DANGEROUS
MOVEMENTS OF PEOPLE NEAR
THE RAILS

25 SMARI
DIGITALISATION OF INDUSTRIAL
PLANTS AND OBJECT
RECOGNITION

26 ANAXAGORE
REDUCTION OF DESIGN TIMES FOR
COMPLEX SYSTEMS

27 SADENAV
DECISION SUPPORT SYSTEM FOR
SHIP FITTING OUT

28 ECOBATI
OPTIMIZATION OF THE ENERGY
CONSUMPTION OF A BUILDING

29 TOLDO
TOLERANCE TO IMPACT DAMAGE
OF A COMPOSITE LAMINATE

30 COMMANDO
SYNTHESIS OF ADVANCED
CONTROL LAWS FOR THE
CONTROL OF SWARMING UAVS

31 MTCSIM
A SIMULATION TOOL FOR ENERGY
CHAIN SIZING

THEMATIC SUMMARY

(click on projects titles to read more)

Weight reduction / New materials

13 COMPOSITE CAB
LIGHTER TRUCK CAB USING COMPOSITES

34 BIOPREENT
3D PRINTING OF PLANT CELLS

33 I3D-ARTERE
POLYMER 3D PRINTING OF ARTERIAL SUBSTITUTES

35 BETON I3D
3D PRINTING OF CONCRETE INCORPORATING BOTTOM ASH

THEMATIC SUMMARY
(click on projects titles to read more)

🔍 Data engineering

12 **ATARA**
MANAGEMENT OF NATURAL
WATER RESOURCES

25 **SMARI**
DIGITALISATION OF INDUSTRIAL
PLANTS AND OBJECT
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15 **HYDROVOL**
IMPROVED NAUTICAL
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