

CRM Group will lead the ACES project funded by the [Win4Collective program of the Service Public de Wallonie \(SPW Recherche\)](#). This new project aims to develop additively manufactured components with embedded sensors.

ACES aims to show a possible extension of the use of parts made by additive manufacturing by integrating measurement capacities in the form of sensors and electrical power elements (connectors, conductive tracks). More specifically, we will seek to demonstrate the possibility of integrating sensors at the surface of 3D metal parts manufactured by printing on a SLM (Selective Laser Melting) powder bed. Beyond its standard use and thanks to highly innovative structural electronic technology, the 3D object then becomes intelligent and allows it to interact with the outside world by measuring data related to its environment (temperature, pressure, constraints, etc.). Two modes of sensor integration will be considered:

- a hybrid integration in which an existing sensor is connected to tracks printed on the 3D part, which offers the possibility of incorporating a wide variety of sensors, even complex ones,
- full integration in the form of printed elements within the structural object, in which the sensor itself is printed on the part, and which will be considered for simpler devices (temperature measurement, stress measurement)

To achieve this result, a set of technical issues must be studied:

- the optimization of the design of the SLM printed part to facilitate the integration of sensors and connectors,
- the optimization of the surface condition of the printed metal part, more specifically the reduction of roughness, in order to make it possible to print active elements on the surface,
- the production of electrical insulation layers between the metal part and the conductive printed elements,
- the development of new methods for printing electrical devices on 3D shapes,
- the production of protective coatings to allow the use of parts in various environments (corrosion, wear, temperature, etc.)
- management of the power supply to the sensors and their interfacing with the outside world in order to use the measurement signals
- the impact of the integration of sensors and tracks on the structural properties of the object.

The treatment of these different aspects will increase the expertise of the research partners to meet the general objective of the IOT / Additive Manufacturing combination. This will also provide benefits for the CRAs which can meet more specific industrial needs

and requiring only a part of the skills worked (for example integration of sensors on conventional parts, optimization of the surface conditions of SLM printed parts, finishing treatments of the parts. additives, ...)

Through these different tasks, an objective is also to offer a set of manufacturing methodologies that can be fully or partially integrated by companies participating to the Industrial Comity (7 SMEs and 3 large companies), as well as to identify new application opportunities both for additive manufacturing parts and for them. sensors.

Complementary Partnership

The consortium is composed of CRM Group, Sirris and Multitel.

- **CRM Group** will coordinate ACES, will develop new methods for printed and structural electronics and manufactures printed sensors (Thermal spray, Liquid spray...).
- **SIRRIS** will made the parts by SLM and develop sensors with the micro-printing by AJP and Valve jetting.
- **MULTITEL** will treat the interconnectivity of the objects and will prepare sensors by LIFT technology.