



# SCIENCE & CREATIVITY: BUILDING A SUSTAINABLE WORLD



## Postdoctoral Researcher SAACD Project – Complex Autonomous and Self-Adaptive Defence Systems

Institution:	IMT Mines Alès (National School of Mines of Alès)
Main assignment:	Centre for Teaching and Research in Computer Science and Systems - SyCoIA
Administrative location:	Alès (Gard department – Occitanie region)
Contract type:	15-month fixed-term contract – Public sector contract – Full-time
Start date:	10/01/2026

### Introduction to our institution, the CERIS centre

#### The Institut Mines-Télécom

The Institut Mines-Télécom (IMT), a 'grand établissement' under the French Education Code, is a public scientific, cultural and professional institution (EPSCP) operating under the primary supervision of the ministers responsible for industry and digital affairs. As France's leading group of engineering schools, it brings together 11 public engineering schools across the country, training 13,500 engineers and PhD graduates. IMT employs 4,500 people and has an annual budget of €400 million, 40% of which comes from its own resources. IMT comprises 2 Carnot Institutes, 35 industrial chairs, produces 2,100 A-level publications and 60 patents annually, and generates €110 million in contract research.

#### IMT Mines Alès

The school's mission: "Drawing on its affiliation with IMT and its strong regional roots, IMT Mines Alès gives its students the best opportunities to fulfil their professional potential, enabling them to become responsible contributors to the nation's development whilst preserving the planet's resources." The values that drive us: boldness, commitment, sharing and excellence.

Founded over 180 years ago, IMT Mines Alès currently has 1,400 students (including 250 international students) and 380 staff members. It has two campuses in Alès and also has sites in Montpellier and Pau. Its students include general engineers, specialist engineers (through apprenticeships), PhD students and those on Master's or specialised Master's programmes. It welcomes over 500 trainees on professional continuing education courses.

The school has three research and teaching centres of high scientific and technological standing, working in the fields of materials and civil engineering (C2MA), the environment and risk (CREER), and artificial intelligence and industrial and digital engineering (CERIS). These units comprise around 85 permanent research-teaching staff (half of whom hold HDR status), 40 research support staff, and 100 PhD and post-doctoral students, who produce over 130 A-level publications and secure €3 million in research contracts annually, a third of which are direct contracts with industry.



These research staff contribute to six research units, including four UMRs. IMT Mines Alès is accredited to award doctoral degrees through four doctoral schools.

It has 12 technology platforms and 1,600 partner companies. Creativity is a key feature that underpins all its activities. The school was the first to set up an incubator in 1984 (200 companies established to date, 1,000 jobs created). The school offers rich and varied career paths: academic staff have opportunities for professional mobility across the various IMT schools and may also, if they wish, take on responsibilities within the school's functional departments (academic affairs, research, international relations, economic development, etc.) for part of their working hours.

IMT Mines Alès is an institution certified in Sustainable Development & Social Responsibility (DD&RS). Within the school, every individual plays a key role in our approach. We are committed to promoting environmentally friendly practices, fostering diversity and inclusion, and ensuring ethical conduct in our activities. We encourage all our staff to adopt a responsible approach in their daily work and to propose innovative ideas that strengthen our positive impact on society and the environment.

### Description of the Centre for Teaching and Research in Computer Science and Systems (CERIS)

CERIS is home to two research units: firstly, the SyCoIA unit (Complex Systems and Artificial Intelligence), which aims to master complex systems in the context of change linked to the digital revolution; and secondly, the joint EuroMov Digital Health in Motion unit, co-supervised by IMT Mines Alès - University of Montpellier, which focuses on human sensorimotor performance, with applications primarily in health and sport. Two academic departments are affiliated with CERIS: 2IA for Computer Science and Artificial Intelligence and PRISM for Industrial Performance and Mechatronic Systems, as well as two technology platforms: AIHM for Alès Imaging and Human Metrology and PFM for the Mechatronics Platform.

The 'Industry of the Future' area of excellence represents a new way of thinking about and organising business, drawing heavily on key principles, resources and technologies whose impact is organisational, methodological and technological in nature. The PRISM department offers students the opportunity to specialise in industrial and mechatronic systems engineering to meet the challenges of the digital transition in the pursuit of performance. It is structured, amongst other things, around strong skills in complex systems engineering.

Amidst rapid technological change, our organisations (industrial, educational, medical, governmental, administrative or financial) are increasingly connected and rely on IT tools and solutions that make ever greater use of artificial intelligence. The 2IA department offers students the opportunity to specialise in the development of software applications to address the challenges posed by this transformation. It comprises two options within the initial training stream and one apprenticeship stream.

The successful candidate will conduct their research within the SyCoIA Research Unit (UPR) in collaboration with members of the PFM.

### SyCoIA

Against a backdrop of accelerating digital transformation, the emergence of complex cyber-physical systems and the widespread use of artificial intelligence in decision-making processes, engineers and researchers face new scientific challenges: designing resilient, adaptive, explainable and interoperable systems capable of operating in uncertain environments whilst respecting human, ethical and regulatory constraints. This complexity calls for an integrated approach, combining modelling, simulation, systems and software engineering, trustworthy AI, process optimisation and human decision-making.

It is within this framework that the SyCoIA unit operates. Drawing on its multidisciplinary expertise, the SyCoIA research unit has defined a manifesto in the form of a research project: to design and pilot intelligent systems using approaches that integrate artificial intelligence, software engineering, systems engineering, modelling and simulation, for a trustworthy digital transformation that is human-centred and adapted to dynamic and uncertain environments. It will focus in particular on complex systems capable of learning, adapting and making decisions in a reliable, explainable and interoperable manner within dynamic and constrained environments, by proposing theoretical and methodological frameworks to ensure the performance, robustness, traceability and trustworthiness of these intelligent systems.

More specifically, the successful candidate will work at the interface between the COPS and CORTEX themes:



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- COPS is an interdisciplinary theme aimed at designing, optimising and controlling complex systems through systems engineering, simulation, artificial intelligence and digital twins. It applies to a variety of fields such as industry, healthcare and regional development, with a strong focus on Industry 5.0.
- CORTEX (COntext-aware, RobusT and EXplainable AI – trustworthy, adaptive and human-centred AI) offers a technical and original perspective on the study of trustworthy AI systems that are both robust and human-centred. The growing improvements and adoption of AI necessitate in-depth reflection and research into the level of trust that can be placed in AI systems. How can we ensure that the AI models we develop are both robust – i.e. capable of performing well despite significant variations in usage conditions or environmental disturbances – and human-centred – i.e. serving humanity in accordance with an established set of values?

## PFM

The Mechatronics Platform brings together, on a single floor (460 m<sup>2</sup>), a multidisciplinary team and the equipment required for the development of complex mechatronic systems, covering all phases of engineering from requirements specification through to physical prototyping. Its workshops are equipped with CNC machine tools, electronic circuit board manufacturing processes, additive manufacturing, cobots...

## Job description

**The successful candidate will be involved in the Trusted Autonomous and Self-Adaptive Systems for Defence (SAACD) project.** This project aims to overhaul the engineering and development of this type of complex system.

An SAACD can be defined at two levels:

- ▶ **Component SAACD:** this is a drone comprising hardware and software subsystems, capable of observing, predicting, deciding and reconfiguring itself to fulfil its mission (e.g. surveillance, detection, pursuit, control, etc.). The integration of embedded AI requires a rethink of engineering methods.
- ▶ **SAACD System of Systems (SoS):** this corresponds to the assembly of several Component SAACDs, in homogeneous swarms or heterogeneous packs, to fulfil a common mission, e.g. monitoring critical infrastructure.

Both must be designed to enhance their capacity for autonomy and self-adaptation. Four major challenges have been identified:

- ▶ (P1) modelling uncertain environments where robust, weakly supervised machine learning algorithms can be deployed to inform engineering processes and validate this design at the earliest possible stage;
- ▶ (P2) integrating reliable, and therefore explainable, and frugal on-board AI (limited to inference and/or also capable of learning, e.g. reinforcement learning) as one of the on-board components of an SAACD initially. This AI aims to support the observation and interpretation of the environment, autonomous control, prediction, and decisions regarding adaptation or partial reconfiguration;
- ▶ (P3) to consider the contribution of a Digital Twin System of the component SAACD or SAACD SdS to facilitate its adoption and support the training of human operators required to interact with this SAACD;
- ▶ (P4) ultimately aim for the certification of SAACDs through evidence of validity and reproducibility.

The R&D questions focus on:

- ▶ (For P1 and P4) *“AI as a service”* to enhance engineering: modelling of the dynamic, complex and uncertain environment (primarily for the purposes of understanding, verification and validation) in which the Component SAACD or SAACD SdS operates;
- ▶ (For P2 and P4) *“AI as a component”* as an integral part of the SAACD, but one that must balance frugality and reliability of the actions envisaged according to the situation encountered in this changing and unpredictable environment;
- ▶ (For P3) Exploit Digital Twin Systems, incorporating the AI contributions developed in P1 and P2, to optimise the simulation, certification, maintenance, training and operation of both types of SAACD.

This project will consist of formalising and integrating the contributions and inputs from: (i) model-based systems engineering (MBSE), pattern-based systems engineering (PBSE) and data-driven systems engineering, (ii) frugal, embedded, trustworthy (explainable and robust) AI, and finally (iii) advanced technical s for modelling, simulation and optimisation in a complex, uncertain environment for the design of an SAACD.

The working approach is structured around four successive and iterative phases involving the successful candidate and combining methodological, technological and experimental components, drawing on the expertise of SyCoIA's



lecturers and researchers in MBSE/MBSSE/PBSE, predictive analytics, autonomous decision-making, robust and explainable AI, and interoperable Digital Twin Systems. These phases are summarised as follows:

- ▶ Phase 1 – Definition and modelling of use cases: M1–M3
- ▶ Phase 2 – AI services for engineering (AI-as-a-Service): M4–M8
- ▶ Phase 3 – Trusted, resource-efficient embedded AI (AI-as-a-Component): M6–M11
- ▶ Phase 4 – Integration, demonstration and validation using digital twins: M10–M16

## Desired profile and general assessment criteria

The SAACD project manager and the existing team will support the successful candidate in developing their skills, whilst making the most of their experience and talents in at least one, and preferably several, of the following R&D areas:

- ▶ Modelling and simulation of the uncertain environment in which a component SAACD or SdS operates
- ▶ Explainable AI (knowledge of the latest advances in explainability methods: intrinsic, simplification, counterfactual, etc.)
- ▶ Robust AI (knowledge of methods for quantifying uncertainty in deep learning or formal verification methods applied to deep learning)
- ▶ Embedded and therefore resource-efficient AI
- ▶ Reinforcement learning, supervised and unsupervised learning
- ▶ Distributed/decentralised control: synchronisation, coordination, adaptation, for example using multi-agent systems
- ▶ Decision support under uncertainty

The successful candidate will be required to acquire the necessary and sufficient skills for the SAACD project's requirements in the fields of Model-Based, Pattern-Based and Data-Based Systems Engineering (MBSE/MBSSE/PBSE) and Digital Twin Systems Engineering during the course of the project. They will be required to organise, plan and map out the organisation of tasks, meetings and actions, and will be responsible for managing and contributing to the drafting of project deliverables.

## Minimum required level of education and/or experience

Beyond your qualifications, your personality will make the difference. 

- ▶ Postgraduate PhD in CNU sections 61 or 27
- ▶ Ability to contribute to at least one of the research themes mentioned above and relevant to the project
- ▶ Experience in research and development (industrial and/or academic, other than that related to the thesis itself)

## Required technical and soft skills

- ▶ Dynamism
- ▶ Independence
- ▶ Intellectual curiosity
- ▶ Ability to act as a liaison between the Systems Engineering, AI and Simulation communities.
- ▶ Ability to integrate into the team, centre and school's projects
- ▶ Scientific output: quality and number of publications in recognised international journals
- ▶ Proficiency in scientific English is essential



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## Application



### Administrative application requirements

The position offered by IMT Mines Alès is a 15-month fixed-term, full-time contract under public law, governed by the management framework of Institut Mines-Télécom, role P (Postdoctoral Researcher), category II.

**Salary:** €35,400 gross per annum.



### How to apply

Applications (CV and cover letter) should be sent **exclusively to:**



<https://institutminestelem.com/o/post-doctorante-projet-saacd-systemes-autonomes-et-auto-adaptatifs-complexes-de-defense-cdd-15-mois-imt-mines-ales>

The recruitment team will carefully review your application.



### Recruitment schedule

A panel of several people will interview you and ensure you are in the best possible position to succeed in this meeting.

**Application deadline: July 5, 2026**

**Provisional date for the panel meeting: July 23, 2026**

**Desired start date: October 1, 2026**



### Contact details

If you require further clarification on any aspect of the application, please do not hesitate to contact the people listed below:

#### Regarding the role:

**Jacky MONTMAIN**, Director of CERIS

✉ : [jacky.montmain@mines-ales.fr](mailto:jacky.montmain@mines-ales.fr)

Tel: +33 (0)4 34 24 62 94

**Vincent CHAPURLAT**, SAACD Project Manager

✉ : [vincent.chapurlat@mines-ales.fr](mailto:vincent.chapurlat@mines-ales.fr)

Tel: +33 (0)4 34 24 62 87

#### For administrative matters:

**Géraldine BRUNEL**, Head of Human Resources

✉ : [geraldine.brunel@mines-ales.fr](mailto:geraldine.brunel@mines-ales.fr)

Tel: +33 (0)4 66 78 50 66



### Induction

#### A smooth induction for a successful start

From the moment you arrive, you will benefit from an induction period to help you familiarise yourself with your role and your working environment. You will be welcomed by your HR contact, who will guide you through all the necessary steps to ensure a smooth start in your new role.