



# Nantes Université recrute

For its laboratory IREENA – Site of Saint-Nazaire (France)

## Post doctorate

LabCom ICARE – Implementation of Optimal Energy Management Methods for High Autonomy Hybrid UAVs

Nantes University is a public institution of higher education and research that proposes a **model of university that is unique** in France, uniting a university, a university hospital (CHU de Nantes), a technological research institute (IRT Jules Verne), a national research organization (Inserm), and the grandes écoles (Centrale Nantes, École des Beaux-Arts Nantes Saint-Nazaire, École d'Architecture de Nantes).

These players are pooling their strengths **to develop the excellence of Nantes' research** and **offer new training opportunities** in all areas of knowledge.

**Sustainable** and **open to the world**, Nantes University ensures the quality of the study and working conditions offered to its students and staff, in order to encourage their development on all its campuses in Nantes, Saint-Nazaire and La Roche-sur-Yon.

### **Working environment and context**

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Located in Saint-Nazaire, France, the Nantes Atlantic Electricity Research Institute (IREENA) is organized into three thematic research teams. The research carried out at IREENA focuses on energy management, sizing and integration of new energies in applications ranging from decentralized energy production (distributed generation and microgrids) to transport solutions (aeronautics, automotive, maritime). More specifically, IREENA's laboratory research focuses on the implementation and design of energy chains integrating new conversion, production and storage technologies. In addition to the technological aspect, IREENA research addresses methodological aspects related to the development of advanced control and energy management strategies for different energy paradigms.

As part of these activities, IREENA has recently set up a LabCom with the company XSun, called ICARE (Institut commun pour drones autonomes multi-énergies), which aims to address issues related to the optimized design of hybrid UAVs with high flight autonomy. A key step in this project will therefore be to identify solutions in terms of optimized sizing and energy management, based primarily on criteria of energy efficiency and drone endurance.

### **Missions**

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The challenge of this post-doc will be to implement the first modelling and energy management building blocks for a hybrid drone integrating photovoltaics, batteries and a fuel cell. The main objective will be to propose optimized energy management solutions, taking into account the multiple constraints of the UAV domain, in particular the constraints of mass, size, reliability and continuity of service. The management of degraded modes will have to be considered, as well as the validation on a HIL test platform that will be initiated as part of this work. In summary, the objectives of this project are to:

- propose a modeling basis for the future UAVs produced by XSun, and define the different mission profiles envisaged.
- develop optimized management rules to maximize UAV performance in different missions. Degraded and fault modes will also be considered.
- validate the work on a HIL test bench.

The postdoctoral fellow will be committed to the valorization of the work through communication at conferences and GdRs, as well as through publications in high-impact journals. S/he will also contribute to the development of the HIL test platform.

## Main activities

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The activities to be carried out by the post-doc can be divided into 4 main stages:

- Identify the technical and operational needs of UAVs based on a panel of potential missions. Develop a descriptive image of the energy identity of UAVs in terms of sources and storage. Then, define an application case that will serve as a base scenario for evaluating and testing the tools and methods developed in this post-doc.
- Define energy models for all components in the energy chain, including mission profiles and all auxiliary loads to be supplied.
- Propose optimized management strategies for UAVs, with the aim of maximizing performance and reliability (especially management of degraded modes).
- Set up the first building blocks of a HIL platform, to validate the management solutions developed, in a realistic environment.
- In parallel with these studies, the post-doc will be responsible for promoting the work carried out through publications in high-impact journals, as well as at national and international conferences.

## Profile required

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- Versant : State civil service
  - Type of recruitment : recruitment : Category A, permanent or contractual, 1 year fixed-term contract (article 4.2 Law 84-16)
  - Permanent need for a category A agent
  - Localisation : CRTT, 37 boulevard de l'université, 44600 Saint-Nazaire
  - Remuneration : 2900 € (around 2330 € net)
- Education and/or qualification : PhD in Electrical/Computer Engineering (obtained the doctorate less than three years ago at the date of recruitment)
- Position open to agents likely to take advantage of a legal priority in accordance with the provisions of article 60 of the law of January 11, 1984 on statutory provisions relating to the public service of the State (on presentation of proof).

## Skills and knowledge required

### General, theoretical or disciplinary knowledge:

Industrial computing, electrical engineering.

### Operational know-how:

- Methodology: Management and control strategies for hybrid/microgrid systems
- Programming: C language, RENESAS-type microcontroller target, energy management
- Experience in experimental implementation

### Soft skills:

- Teamworking
- Autonomy and sense of responsibility

- **Our strengths (a few examples. To be modified at your convenience)**

- Possibility of providing vacations (teachings)
- Laboratory on a human scale (20 teachers-researchers) with significant material resources and close to the sea

### Advice to applicants:

- Provide the contacts of your former thesis or MASTER supervisors.
- Do not hesitate to consult the Nantes University website

**Application deadline :** 15<sup>th</sup> July, 2024

**Date of hiring committee :** 18<sup>th</sup> July, 2024

**Desired start date :** 15<sup>th</sup> October, 2024

**Contact: please send your application (CV + cover letter) to**

[pole-st-recrutement@univ-nantes.fr](mailto:pole-st-recrutement@univ-nantes.fr) and [jean-christophe.olivier@univ-nantes.fr](mailto:jean-christophe.olivier@univ-nantes.fr)

**For more information, contact** [jean-christophe.olivier@univ-nantes.fr](mailto:jean-christophe.olivier@univ-nantes.fr) and [Nicolas.bernard@univ-nantes.fr](mailto:Nicolas.bernard@univ-nantes.fr)

[univ-nantes.fr](http://univ-nantes.fr)