



Job offer  
Royal Military Academy - Patrimony



**PhD. Researcher in Robotics / Drones / Computer Vision (M/F/X)**  
Departement Mechanics  
project “**DAP/24-09 GRAND**”  
Publication: 08/03/2024

## Job description and associated tasks

In the framework of the study DAP/24-09 GRAND, seeking the development of drones that can navigate without the use of **Global navigation satellite system (GNSS) signals**, we are looking for a full-time researcher in robotics / drones / computer vision with a master's degree in applied sciences / Engineering / Physics / Computer Science / Informatics and experience in the field of Robotics & Artificial Intelligence (AI).

### Context:

**The Royal Military Academy of Belgium (RMA)** is a military institution responsible for the basic academic, military and physical training of future officers, and for the continuing advanced training of officers during their active career in the Belgian Defence department ([Homepage | RMA](#)). It is fully recognized as a university, fulfilling the same criteria as civilian universities. The Royal Military Academy is also conducting scientific research at university level for projects funded by the Belgian Defence department or external sources. You will work within the research cell '**Robotics & Autonomous Systems**' (<https://mecatron.rma.ac.be/>) of the department of Mechanical Engineering of the Royal Military Academy and in close collaboration with the Department of Electronics and Informatics of the Vrije Universiteit Brussel. You will conduct scientific research at university level on a project entitled 'DAP/24-09 GRAND' (GNSS-free Autonomous Navigation of Drones) and it is explicitly the objective to perform a PhD. in collaboration with the VUB in the context of this study.

### Study:

Modern drones rely extensively on GNSS services for stabilization and for navigation. For military operations, this presents a serious problem, as GNSS signals can be fairly easily jammed or spoofed. Therefore, DAP/24-09 GRAND aims to develop autonomous navigation methodologies that do not rely on GNSS, but instead make use of visual odometry and terrain – based positioning for navigation purposes. The research will focus on the development of autonomous navigation capabilities using multimodal sensing. Specific objectives of the study are:

- Development of novel data fusion tools enabling GNSS-free Positioning, Navigation & Timing at varying altitude. Building on the expertise in the domain of the promotor and co-promotor at the VUB, DAP/24-09 GRAND will develop scientifically innovative methodologies that push the state of the art of drone navigation, by developing an integrated passive Positioning, Navigation and Timing (PNT) pipeline. Special focus will be on ensuring reliability of the results under less-than-ideal conditions (e.g. wind, seasonal variations on maps, etc).
- Development of a proof-of-concept drone system that can cross large distances. Building on the extensive expertise of the RAS-unit in the design of drone systems, a novel drone will be developed as a proof-of-concept demonstrator for the long-distance autonomous GNSS-free navigation capabilities. Very important to note is that the system design entails not only the drone system itself, but also the Human-Machine-Interface that will be designed in such a way that it becomes easy for the military operator to program long-term autonomous operations, without losing control or oversight of the system.

## Main Tasks

- Develop the operational and technical user requirements for the project, in close collaboration with the LAND component.
- Perform a literature and state-of-the-art study and develop use cases for the validation of the tools to be developed, based on the input of the Belgian Defence clients.
- Develop a set of algorithms that enable GNSS-free PNT at low altitude. At lower altitude, it is possible to determine the position and orientation of the drone by analysing the associated camera images using visual odometry (VO). DAP/24-09 GRAND will build up on the existing state of the art in VO by developing a novel approach towards passive PNT, based on multimodal sensor data fusion.
- Develop a set of algorithms that enable GNSS-free PNT at higher altitude. Due to constraints in world-to-image mapping process, a full 6-dimensional pose reconstruction will not be possible anymore using only VO. Therefore, DAP/24-09 GRAND will also develop a novel approach towards passive PNT using a combination of sensors in order to handle the limitations of classical VO and reduce the location inaccuracies.
- Optimization of algorithms, and deployment of the developed algorithms on an embedded platform that will run onboard of the drone.
- Develop a proof-of-concept drone system that is able to cross large distances (>10km) without depending on GNSS. The drone system will be equipped with a powerful embedded GPU processor, enabling it to run the algorithms developed during the PhD research and seamlessly transition between them at the right altitude for ensuring maximum reliability. This drone system will serve as a use case demonstrator for the Belgian LAND component.
- Validate the developed system in each of these use cases with the military end users in order to give all stakeholders a good view on the benefits and constraints of the system.
- Publish the results of the research in scientific articles at conference and journal level, and perform the necessary steps to complete a PhD in the course of the study.

## Required skills

### Technical skills

The applicant shall have a **master's degree** in applied sciences / Engineering / Physics / Computer Science / Informatics and experience in the field of Robotics & Artificial Intelligence (AI).

This is a multi-disciplinary study, requiring a mix of theoretical skills (conception of novel algorithmic approaches) and more practical skills (implementation and field validation of algorithms on drones).

- Training or experience in robotics is required;
- Training or experience in computer vision is required;
- Experience in programming is required;
- Training or experience in drones / unmanned aircraft systems is recommended;
- Training or experience in Perception is recommended;
- Knowledge of deep learning algorithms is recommended.
- Knowledge of ROS (<https://www.ros.org/>) is recommended;
- Training or experience in Control Engineering is an added value;
- Training or experience in Sensor integration is an added value;
- Training or experience in applied research and or design is an added value;

## Personal skills

- You conduct scientific research in an independent and upright way within a multidisciplinary environment
- You think in an innovative and creative way.
- You communicate your results in a clear, concise and precise manner.
- You take initiative.
- You are involved and result oriented.
- You are honest, loyal toward the institution and respect confidentiality.
- You plan and manage proactively your self-development, while being critical to your own functioning and striving to your self-improvement.
- You improve the team-spirit and solve interpersonal conflicts.
- You solve problems autonomously and find alternatives or solutions.
- You behave in a respectful way toward the others, their ideas and opinions as well as toward procedures and instructions.
- You are flexible for change and adapt yourself.
- You commit yourself in your job by giving the best of your aptitudes in striving toward the highest quality standards and persevere when needed.
- You are capable to write and present scientific papers about your work

## Other skills

- The applicant shall have excellent oral and written knowledge of English.
- Minimum knowledge of French or Dutch is an added value for collaboration with peers.

## Specific requirement

- Working for the Patrimony requires living in Belgium for the duration of the study.
- The function is only meant for a full-time employee, consultancy actions are not eligible

## Application

You will be working in a military environment. That is why everyone is expected to undergo a security verification. Please add to your application the filled out document. The form can be downloaded from: <http://www.rma.ac.be/nl/aanvraag-veiligheidsverificatie> (the document does not exist in English, sorry).

Send by email:

- a motivational letter;
- a CV
- a scan of your ID card (both sides);
- the filled-out security document

to Mr Geert DE CUBBER ([geert.de.cubber@mil.be](mailto:geert.de.cubber@mil.be)) and to Mrs Helena BRUYNINCKX ([erm-deao-rsw@mil.be](mailto:erm-deao-rsw@mil.be)).

Please mention clearly the reference of the project: "DAP/24-09 GRAND".

Application deadline: 15/04/2024.

The interviews will take place at the Royal Military Academy, Hobbemastraat 8, 1000 Brussels. In case of access restriction due to COVID-19 or non-Belgian application, on-line interviews will take place. The date and time of the interview will be communicated to the preselected candidates.

## Miscellaneous

### Contract

- Probable date of recruitment: From June 2024, in consultation with the applicant.
- Status: Full-time employment based on an open-ended contract with the Patrimony of the Royal Military Academy (you will not be a civil servant).
- Wage scale: class A1 (holder of a Master's degree in Science or equivalent). RMA-Patrimony applies a merit-based research career track, allowing researchers to advance in wage scale based upon annual evaluations.
- Holiday pay.

### Extra-legal benefits

- Possibility to benefit from a bilingualism allowance (Dutch/French) following a SELOR test;
- End-of-year bonus;
- Free DKV hospitalization insurance. Possibility of additional affiliation for one or more persons living under the same roof: spouse, child(ren) (50% of the price per additional member);
- Bike allowance / Free public transport (home-work commute);
- Meal vouchers (6€ / day);
- Free access to campus sports facilities outside working hours;
- On-campus restaurant and cafeteria with democratic prices (discount on the daily menu);
- Flexible working hours within the 38-hour week;
- Teleworking possible with allowance;
- Holidays:

- 29 days holiday / year from the 1st year of contract (then from 45 years: +1 day holiday every 5 years)
- + 1 week OFF every year between Christmas and New year's Eve (independent of the annual balance of holidays).
- Advantages and interesting offers thanks to the Benefits@work card (discounts, vouchers...);
- Entitlement to services offered by the 'Office Central d'Action Sociale et Culturelle de la Défense' (OCASC): among others holiday centres, discount on travel organised by the tour operator...;
- Possibility of benefiting from the nursery funded by Belgian Defence (subject to availability).

## Workplace

- Royal Military Academy, Avenue de la Renaissance 30, 1000 Brussels;
- Regular visits to VUB co-promotor at Pleinlaan 9, 1050 Brussels ;
- Occasional travels abroad for scientific conferences, etc.

## Points of contact

- Concerning the research project: to Mr Geert De Cubber ([geert.de.cubber@mil.be](mailto:geert.de.cubber@mil.be))
- Concerning the recruitment modalities: Mrs Helena Bruyninckx ([erm-deao-rsw@mil.be](mailto:erm-deao-rsw@mil.be))
- For more information about the Royal Military Academy, see [Homepage | RMA](#)
- For more information about the research cell 'Robotics & Autonomous Systems', see <https://mecatron.rma.ac.be/>