Job description: Research Engineer/Scientist (M/F) for the Royal Military Academy, Department of Mechanics, project "Automated take-off and landing of unmanned aerial vehicles from Belgian Navy Vessels" (MSP20-03)

1. Job description and associated tasks

In the framework of a triple helix research project between the Royal Military Academy, the company Flying Cam and the Belgian Navy, we are looking for a full-time research scientist/engineer with a master's degree in Applied Sciences / Engineering / Physics / Computer Science in the field of Robotics / Control Engineering / Aeronautics. Candidates looking for a doctoral position are encouraged to apply as well.

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 Defense department (www.rma.ac.be). 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 Defense department or external sources.

You work within the research cell 'Robotics & Autonomous Systems' (http://mecatron.rma.ac.be/) of the department of Mechanical Engineering. You conduct scientific research at university level on a project entitled 'Automated take-off and landing of unmanned aerial vehicles from Belgian Navy Vessels'. You work within a research team and in close collaboration with the company Flying Cam on one of their novel products and you will interact often with the Belgian Navy for defining requirements and setting up maritime test campaigns.

Study

Unmanned aerial systems are more and more being incorporated into maritime military operations, notably due to the advantages they pose for tactical planning. Technological advances have rendered these unmanned aerial vehicles fairly easy to operate for in-flight manoeuvres, as now advanced software tools are available to assist the human pilots in order to avoid crashes or to optimize the flight performance or in some cases to completely automate the flight operations. However, in comparison with land operations, one aspect remains a stringent bottleneck for the widespread deployment of unmanned aerial systems for maritime operations: the capability for these unmanned aerial systems to automatically take off and land on vessels in all kind of environmental conditions. Indeed, landing a relatively small aerial vehicle (that is therefore inherently very receptive to wind gusts) on the pitching and rolling deck of a moving ship is a very difficult control problem that requires the careful consideration of the kinematics and dynamics of both the unmanned aerial vehicle and the ship. In response to this requirement, this research study proposes to provide a proof of concept solution and practical implementation for a helicopter-type drone with the capability to land autonomously on the Belgian Navy vessels.

The research will be performed at the MECA (Mechanics) department of the Royal Military Academy (RMA). The candidate will be supervised by Dr. Ir Geert DE CUBBER and Dr. Ir Major Bart JANSSENS.

The contract will be for 4 years, with possibility of extension.

Main Tasks

- Perform research activities in the frame of the study project:
  - Perform a state of the art study on flight control of unmanned aircraft systems (UAS), autonomous flight, aerodynamics and dynamic modelling of ship movements
  - Compile operational and technical user requirements and trial scenarios in collaboration with the end user (Belgian Navy)
  - Develop automated take-off flight control algorithms
  - Determine the envelope of flight parameters that allow for a safe landing operation
  - Install sensing modalities on both the UAS and the vessel serving as landing platform in order to obtain in real time information about the essential parameters that determine the feasibility of the landing operation
  - Develop a model that encompasses the ship dynamics, the UAS dynamics and the environmental conditions in order to predict the optimal moment for starting the landing operation.
  - Integrate the prediction into a single autonomous landing system that is independent of vessel type and does not rely on ship-to-UAS communication.
  - Develop a system to estimate in real time the 3D structure of the environment and the relative pose and position of the UAS platform in this environment. Using this model and the sensor data, develop a methodology to determine the optimal flight trajectory
  - Perform four trial campaigns at sea, gradually increasing the level of difficulty, by first trying to land on larger platforms (e.g. frigates) to advance to very small platforms (coastal protection vessels) near the end of the study.
  - Develop an exploitation plan to optimally valorise the Intellectual Property developed within this study
- Report the progress results to the promotor and research team in English.
- Report the obtained results at international conferences and write scientific papers in English.

More information :
Geert DE CUBBER & Bart JANSSENS: geert.de.cubber@rma.ac.be & bart.janssens@mil.be

2. Required skills	
Technical skills:	The applicant shall have a Master's Degree in Applied Sciences, Engineering Physics, Computer Science.
	This is a multi-disciplinary study, calling for skills in very different domains, ranging from UAS flight control to sensor integration to ship dynamics to control engineering to 3D reconstruction. A candidate with existing deep expertise in all these domains probably does not exist, so please do not let this keep you from applying.
	- Experience in programming is highly recommended. - Training or experience with MATLAB & Simulink is recommended; - Training or experience with the C programming language is recommended; - Training or experience in Robotics is recommended; - Training or experience in Unmanned Aerial Vehicles is recommended; - Training or experience in Aerodynamics is an added value; - Training or experience in Control Engineering is an added value; - Training or experience in Sensor integration is an added value; - Training or experience in Perception is an added value; - Training or experience in applied research and or design is an added value; - Affinity with aeronautics, drones or maritime operations is an added value

Specific requirement:	The researcher may be exposed to classified information and will therefore have to obtain the required security clearance. The candidate must consent with the background check required to obtain this clearance, which will be executed by Belgian Defense.
Personal skills :	• You conduct scientific research in an independent and upright way within a multidisciplinary environment that could lead you to a PhD.
	• You think in an innovative and creative way.
	• You communicate your results in a clear, concise and precise manner.
	• You take initiatives.
	• You are involved and results 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 will be working very closely together with the industrial partner Flying Cam and will get insight in their proprietary intellectual property. Confidentiality is therefore an absolute must.
	• This study calls for both theoretical and practical developments. You will need to integrate new sensors and perform yearly field validation campaigns on Belgian Navy vessels (count two weeks each summer). A practical attitude and willingness to bring novel scientific innovations into practice is therefore certainly required.
Other skills:	• The applicant shall have good knowledge of English (oral / written)
	• Minimum knowledge of French or Dutch is an added value for collaboration with peers

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3. Application	
	• Send a motivational letter, a CV and a scan of your ID card (both sides) to Geert DE CUBBER (geert.de.cubber@rma.ac.be), Bart JANSSENS (bart.janssens@mil.be) and to Thierry DEPREZ (thierry.deprez1@rma.ac.be) • 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 that is attached to the job description: http://www.rma.ac.be/nl/aanvraag-veiligheidsverificatie • Please mention clearly the reference of the project: **MSP20-03** • Application deadline: **July 15**, 2020 • The interviews will take place at the Royal Military Academy, Hobbemastraat 8, 1000 Brussels. The date and time of the interview will be communicated to the preselected candidates.
4. Miscellaneous	
Points of contact	• Concerning the research project: to Geert DE CUBBER (geert.de.cubber@rma.ac.be) and Bart JANSSENS (bart.janssens@mil.be) • Concerning the recruitment modalities: Lieutenant-Colonel of Aviation Thierry Deprez thierry.deprez1@rma.ac.be • For more information about the Royal Military Academy, see http://www.rma.ac.be • For more information about the 'Robotics & Autonomous Systems' research unit: http://mecatron.rma.ac.be

Others	• **Probable date of recruitment**: From September 1 2020, in consultation with the applicant. (Applicants graduating in June / July 2020 are accepted).
	
	• **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**: A11 (holders of a Master Degree) / A21 (Ir or holders of a Master Degree in Engineering Sciences (Applied Sciences))
	
	• **Extra-legal benefits:**
	  • Possibility to obtain a bonus for bilingualism (Dutch/French);
	  • Holiday pay;
	  • End-of-year bonus;
	  • Hospitalization insurance;
	  • Free public transport (home-work commute);
	  • Free access to the on-campus sport infrastructure;
	  • On-campus restaurant and cafeteria with discount on the daily menu.
	
	• **Workplace:**
	  • Royal Military Academy, Avenue de la Renaissance 30, 1000 Brussels;
	  • A reasonable amount of the work will need to be executed at the premises of the industrial partner (Liège area)
	  • A reasonable amount of the work will need to be executed at the premises of the end user partner (Zeebrugge area)
	  • Occasional travels abroad for scientific conferences, etc.
	  • Stimulating work environment.

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