

Architecting of a Secure Quantum Communications Satellite

Code: 19/38

Company: Craft Prospect Ltd

Location: Glasgow

Company Description:

Craft Prospect is a small company specialising in enabling technologies and services for emerging missions. We work with partners to deliver new CubeSat missions, and look for innovative downstream applications for space data. The company is a team of five engineers and has offices in Glasgow and Edinburgh, where we are part of the STFC incubation program.

www.craftprospect.com

Project Description:

Craft Prospect is developing a Secure Quantum Communications Nano-satellite to provide a Quantum Key Distribution (QKD) facility to security service providers. To ensure keys can be delivered via an optical channel, deep learning algorithms will be used for cloud detection. The combination of these advanced technologies presents a unique to industry architectural problem, namely, how to optimise the machine learning elements (requiring high data availability) while maintaining a system secure to external attack.

The exact tasks to be undertaken on this project are dependent on the project phase at which they join, and the skillset of the applicant. As such a general list of upcoming tasks is given below, from which a subset can be selected during initial conversations with the applicant:

- Stakeholder engagement with high profile customers to understand their needs to determine requirements.
- Running and effective management of stakeholder meetings and expanding the projects stakeholder group.
- Utilising the existing Model Based Systems Engineering approach (SysML in the Enterprise Architect tool).
- Detailed analysis of individual issues noted during the design definition as they arise, for example, utilising the Solidworks CAD package to perform payload fit checks.
- Refinement of the mission Concept of Operations through bespoke modelling and through the use of tools such as STK.
- Further refinement of the structural architecture including data block diagrams, timing architectures, Geospatial configuration and low-level subsystem design.
- Definition of functional architecture using the Enterprise Architect tool through items such as state machines, flow diagrams and sequence diagrams.

- Deploying functional architecture elements into extant simulation environments, for example to test payload modes and states in a representative environment.
- Deployment of functional architecture element onto extant hardware such as Xilinx SoCs in conjunction with the project Embedded Systems Engineer.
- Porting of existing mission analysis tools into Python or other high-level programming language.

Applicant Specification:

It is understood that the applicant will be developing skills during this placement. The skills that will be developed are given below, however these can be taught on the job and noncompliance should not deter application. The company will consider the best overall application rather than look for specific cross over in expertise. Some of the activities of the role are given below for interest:

- Communication skills, dealing with customers and other stakeholders to ensure their needs are met.
- Good project organisational practices and high-level project management skills.
- Experience of Nano-satellite mission design and the flow of activities required to take this from concept to end of life.
- Understanding of the New Space market, key companies, working practices and upcoming missions of interest.
- Experience of two highly applicable emerging fields namely deep learning and quantum technologies.
- Working in a highly experienced multi-disciplinary team to deliver complex work packages.
- General systems engineering skills such as customer engagement, requirement definition and functional and structural design.
- Knowledge of Model Based System Engineer (MBSE) methodologies and the use of Enterprise Architecture for mission design.
- Prototyping and analysis of developed solution to ensure they meet pre-defined requirements.
- Experience with mission simulation activities, investigating the many trade offs required when designing the ground network and orbital characteristics of a mission.
- Experience with the following tools depending on specific work packages undertaken:
 - Enterprise Architect
 - Solidworks
 - STK
 - Programming in Python

Minimum Requirements:

The specific tasks to be undertaken are wide ranging and as such can be tailored to meet the applicant's skill set. These range from soft skills driven engagement activities to lower level programming and embedded systems tasks. Systems Engineering is a more rarely taught skill at Universities and as such the general approach in industry is to take on engineers from a

range of backgrounds. As such applicants from the following (but not limited to) disciplines will be considered:

- Systems Engineering
- Electronics and Electrical
- Aerospace / Aeronautics
- Mechanical / Mechatronics
- Computing Science / Software Engineering
- Embedded systems / Digital Signal Processing

As a minimum requirement the applicant must be undertaking a relevant degree in a technical based programme. Preference will be given to applicants in later years at University and on Masters programmes, however this should not hinder application from early years students. Applicant should be willing to relocate to (or already be located in) the Glasgow area for the duration of the placement for work at the company office in Central Glasgow.

Preferred Additional Requirements:

Some knowledge of machine learning and / or quantum technologies may be useful.

Further details:

8 weeks minimum fixed term contract to be agreed with successful candidate but nominally with a start date around 17th June, 2019 to attend the SPIN Induction day at the Satellite Applications Catapult, and completion before 20th September for the Showcase the following week. Salary is £1,500 per calendar month gross.

Closing Date for Applications: 5pm on Tuesday 21 May

Applications should be made through the online form attaching a CV, before the closing date. Please note that elements of the form left incomplete will be deemed to render the application ineligible. They will be checked for eligibility and forwarded to the employer.