

ID	Project title	Brief summary of your research topic	Skills required
1	Study the feasibility of using Drone for emergency response of cardiac arrest	<p>This project is linked to the CAELUS project (https://www.agsairports.co.uk/drones and https://www.strath.ac.uk/whyrathclyde/news/2022/10mfundingfrominnovateukformaldroneproject/). The project CAELUS is a consortium that will develop and trial what will be the UK's first national distribution network to use drones to transport essential medicines, blood, organs and other medical supplies throughout Scotland.</p> <p>CAELUS (Care & Equity – Healthcare Logistics UAS Scotland), secured £10.1 million funding from the Future Flight Challenge at UK Research and Innovation (UKRI) in 2022.</p>	<p>basic knowledge of a programming language (e.g. Python, Matlab, R, Julia). Basic statistical skills and interest in modelling and simulation. No knowledge on drones is required</p>
2	Use of seaweed derived biopolymer for geotechnical and structural applications	<p>To explore possible geotechnical and structural applications of alginate (soil stabilisation, bio-cementation, bricks, fire-resistant press boards made from wood dust/chips, waterproof mortars, plasters and paints). The research would involve the development of materials and small scale</p>	<p>Some background in chemistry, geotechnics, and mechanical testing of materials would be preferable.</p>
3	Towards a digital twin of the tokamak fusion reactor	<p>The study of confined nuclear fusion heavily relies on modelling, simulation and data for reactor design. In fusion energy, decisions about the state of the reactor must be made to a very high degree of confidence and with the highest reliability. It is of utmost importance that fusion simulations are carried out with rigorous numerical integration, i.e. bounding the uncertainty due to the input specifications and to the numerical computation. Differential equations can be solved rigorously using models of uncertainty that comprise arithmetic between</p>	<p>(*) Programming in high-level language, preferably Python. Matlab and Julia are also okay. (*) Excitement about quantitative science.</p>
4	Validation of computer models with conformal predictions.	<p>Conformal predictions are a popular statistical tool to construct confidence intervals to any existing machine learning algorithm, or pre-trained machine learning model. The confidence intervals produced by conformal prediction are valid, or well-calibrated, in the sense that the true model response is guaranteed to be within the interval with at least a pre-selected probability. Even though conformal predictions were born for the validation of data-only</p>	<p>Programming in high-level computer languages, preferably Python.</p>
5	Data v. Capta: automatic integration of scientific metadata for provenance.	<p>Scientific metadata (“data about the data”) captures some essential details about the measurement process that can affect the reliability and usability of the data. The structuring of the metadata, aka “ontology” is key to carry out data searches, particularly for data sets with multiple levels of metadata. The inability to search</p>	<p>Excitement about quantitative science. Computer programming.</p>

6	Propagating uncertainty through descriptive statistics.	Most widely used statistical methods are not designed to handle uncertainty, so it is commonly ignored in formal analyses. Uncertainty is the kind of uncertainty that is characterised by not having an underlying known probability distribution in any particular subset of the quantity of interest. Measurements acquired by digital instruments inherently carry uncertainty within their displayed digits. This kind of	Computer programming in Python. Excitement about quantitative science.
7	Rehabilitation of formerly contaminated soils	Soil contamination and aggressive remediation have lasting effects on soil physical and geochemical properties. Smouldering remediation is capable of removing 99.9+% of heavy hydrocarbon contamination using self-sustaining flameless combustion. Smouldering exposes soil to temperatures of 500 – 1100°C for short periods of time. During contamination and remediation, soil loses organic matter and some of its essential nutrients for supporting biological activity. Soil organic matter is destroyed by the combustion reactions. Nitrogen is typically lost by 500-750°C. Phosphorous availability changes and some is lost from 750°C. Availability	Numeracy and an interest in environmental engineering. Some laboratory experience is helpful but not essential.
8	Life cycle assessment of smouldering remediation	Smouldering remediation is capable of removing 99.9+% of heavy hydrocarbon contamination from soils using self-sustaining flameless combustion. It is particularly effective on the most recalcitrant organic contaminants. After a short-duration energy input to ignite the contaminant fuel locally, smouldering rapidly becomes self-sustaining and only requires externally supplied air to support the process. As a result, even though it is a combustion-based remediation process, its carbon footprint is significantly lower than other, more energy-intensive,	An interest in life cycle assessment. Some knowledge of environmental process engineering. Remediation-specific knowledge would be nice but is not essential.
9	Smouldering Biosolids to Improve Their Circular Economy Potential in Agriculture (Life Cycle Assessment)	Organic biosolids from municipal wastewater treatment and agricultural residues contain significant amounts of phosphorus and other nutrients. These materials are already reused extensively in agricultural applications; however, these applications do not make best use of biosolids' nutrient contents. In addition, their long-term use may cause environmental damage through nutrient loss, eutrophication of receiving waters, soil degradation, and contamination. Typical treatments do not address many persistent organic pollutants or heavy metals that may ultimately impact grazing animals and food crops. For example, use of sewage sludge as fertiliser is one of several working hypotheses to explain recent detection of low levels of polyfluoroalkyl substances (PFAS) in a fruit juice product in the USA. Improved wastewater treatment processes are urgently needed to address these issues. Smouldering treatment of biosolids offers a key opportunity	Familiarity with conventional wastewater treatment processes. Numeracy.

10	AWARE: Amoebae with antimicrobial resistant endosymbionts (AMR / antibiotic resistance)	Antimicrobial resistance (AMR) is a survival adaptation mechanism. AMR traits can emerge in microorganisms exposed to pollutants employed in interactions with other microbes from different biological kingdoms. In addition, the chemical and ecological community pressure increases the risk of the likelihood that AMR can transfer between microorganisms through mobile genetic elements. The biological mechanisms by which AMR develops under these circumstances are not yet fully understood. In this project, we aim to investigate the multi-trophic	bioinformatics, report writing, statistics
11	Micro-mechanical controls on embankment failure triggered by extreme weather events: a 4D imaging approach	Understanding how extreme weather events (drought and heavy rain) impact slope stability is critical if we are to protect civil infrastructure from the impact of climate change. Predicting failure and defining the optimal maintenance and mitigation programs for existing embankment infrastructure requires understanding a complex, spatially and temporally dynamic system. In this project	willingness to learn, new software and skills. some understanding of soil mechanics would be beneficial but is not essential
12	Rheology of complex suspensions: developing a 4D understanding of heterogeneity	Complex, particulate rich suspensions generally show non-newtonian rheological behaviour. This project will analyse how the local arrangement of the suspended particles affects the flow and deformation with the sample, to understand how the local structure controls strain localisation flow velocity. We have used high-speed 3D image (X-ray tomography) to collect 4D "movies" of flowing suspensions	willingness to learn and use high-end image analysis software. python or other scripting experience would be beneficial but is not essential.
13	The impact of root structure on water transport and uptake from drought impacted soils	The global population continues to increase while we face more extreme climatic conditions. Improving the resilience of key agricultural crops to drought is an important challenge if we are to reduce and prevent poverty and hunger. We have collected x-ray and neutron tomography data showing this process for young drought stressed plants before, during and after they have been watered. This	willingness to learn new software
14	Data fusion of undrained shear strength of clay from multiple site investigation data sources	The project aims to develop a data fusion framework to combine measures of 'undrained shear strength' of clay from different site investigation tools (e.g., CPT, Torvane, Triaxial tests). The number of measurements with different tools may differ enormously,	Python, Interest in machine learning, Pytorch skills would be advantageous