Unmanned Aerial Vehicles (UAVs) are emerging as a key engineering tool for future environmental survey tasks.

UAV aerial imagery offers both timely (on-demand) and more detailed (higher resolution) information than comparable satellite imagery. This course will introduce the main principles behind UAV flight control, data capture, image processing and interpretation.

Course overview
This five day course will cover the principles of UAV flight control (theory, practice and practical demo), image processing (data capture and analysis) and data interpretation (using data from different case studies). The course will strengthen current knowledge of UAVs for environmental science whilst also addressing wider relevant key elements on data capture, analysis and interpretation.

Overall, this course introduces environmental professionals and researchers to state-of-the-art technology for environmental monitoring. It also introduces UAV users to the potential applications of UAVs within the environmental domain.

Who should attend?
Anyone interested in environmental monitoring, and those looking to expand UAV based applications into the “environmental domain”. Governmental organisations, researchers and environmental consultants, as well as insurance companies interested in mapping the effect of damage caused by environmental catastrophic events will also be interested.

Accreditation and partnerships
Delivered in collaboration with:
• University of Worcester.
• Civil Aviation Authority.
• Centro Regional de Estudios del Agua.

Supported by:
• River Restoration Centre.
• Remote Sensing and Photogrammetry.
• The Institute of Environmental Sciences.
• ClearSky Consulting Services.
• Photoscan.
Course content

Day one - Principles of UAV flight control
• UAV flight control - review of the main operational features of UAVs (e.g. quadrator dynamics, aerodynamic lifting surface and vehicle design parameters).

Day two - Image processing principles
• Data capture - this will focus on the design of monitoring programmes for UAV data collection (e.g. number and location of ground control points, flight height, image resolution and image footprint).
• Data analysis - image processing considerations will be discussed within this session.

Days three and four - Environmental applications
• Case study one: UAVs for freshwater ecosystem monitoring.
• Case study two: UAVs for and land (e.g. crop) monitoring.

Day five - Policy applications
• Civil Aviation Authority legislation.
• Practical session - hands on session on UAV flight operation. Expected drones to be showcased are Falcon 8, Draganflyer X6 and a fix-wing platform.
• UAVs for catastrophe monitoring.

Course delivery
Theoretical concepts will be covered in the first two days. Hands on practical case studies based on environmental applications will be used to illustrate theoretical concepts.
## Timetable

<table>
<thead>
<tr>
<th>Day one</th>
<th>Day two</th>
<th>Day three</th>
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<tbody>
<tr>
<td><strong>Principles of UAV flight control</strong></td>
<td><strong>Image processing principles</strong></td>
<td><strong>Case study one: UAVs for freshwater ecosystem monitoring</strong></td>
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<tr>
<td>9.00 – 10.30 Introduction</td>
<td>9.00 – 10.30 Mapping from imaging - data capture considerations</td>
<td>9.00 – 10.30 Sampling design and data collection</td>
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<td>Break</td>
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<tr>
<td>11.00 – 12.30 UAV conceptual design</td>
<td>11.00 – 12.30 Mapping from imaging - image processing considerations</td>
<td>11.00 – 12.30 Data analysis (image processing)</td>
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<tr>
<td>Lunch</td>
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<tr>
<td>14.00 – 15.30 UAV Flight control - operational considerations</td>
<td>14.00 – 15.30 Survey design considerations</td>
<td>14.00 – 15.30 Data analysis (image processing)</td>
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<td>Break</td>
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<tr>
<td>16.00 – 17.30 Practical session</td>
<td>16.00 – 17.30 Survey design considerations</td>
<td>16.00 – 17.30 Interpretation of results</td>
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<td>Day four</td>
<td>Day five</td>
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<td><strong>Case study two: UAVs for land management</strong></td>
<td><strong>UAVs for catastrophe monitoring</strong></td>
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<td>9.00 – 10.30 Sampling design and data collection</td>
<td>9.00 – 10.30 CAA Legislation</td>
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<td>Break</td>
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<tr>
<td>11.00 – 12.30 Data analysis (image processing)</td>
<td>11.00 – 12.30 Demo</td>
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<td>Lunch</td>
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<td>14.00 – 15.30 Data analysis (image processing)</td>
<td>14.00 – 15.30 UAVs for antipoaching activities</td>
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<td>Break</td>
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<tr>
<td>16.00 – 17.30 Interpretation of results</td>
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Speakers

This multidisciplinary short course draws on two world-leading Cranfield specialisms, aerospace and water engineering science:

Aerospace
- Dr Mudassir Lone - Lecturer.
- Dr James Whidborne - Reader.

Water engineering science
- Dr Monica Rivas Casado - Lecturer in Applied Environmental Statistics.

Dr Lone and Dr Whidborne have significant expertise in flight dynamics, simulation, control, guidance and vehicle autonomy. They have been working in the area of quadrotor UAV control for many years, including significant theoretical and experimental contributions. Dr Rivas Casado leads EPSRC research on hydrometry, hydrological modelling and robust design of monitoring programs, coupling numerical/statistical theory with environmental science. She has expertise in the organisation and delivery of short courses and holds a PgCert in Learning, Teaching and Assessment in Higher Education.

This course also draws on Cranfield’s expertise in land cover monitoring (Tim Brewer - Senior Lecturer) and image processing (Dr Daniel Simms - Research Fellow in Remote Sensing and GIS) and is further supported by UAV practice from the University of Worcester (Professor Ian Maddock and Dr Amy Woodget). Professor Maddock is a Professor of River Science and has teaching and research interests in river science, fluvial geomorphology, hydroecology, ecohydraulics and aquatic habitat modelling. Dr Woodget is a researcher at Worcester looking into the use of very high resolution UAS imagery and structure-from-motion photogrammetry for the quantification of physical habitat parameters within river systems.

Additionally, invited speakers from industry and Governmental organisations will provide expertise in policy implementation. ClearSky will be in charge of the UAV demo.
Key information

Fees
£1400 - 20% discount for Cranfield alumni and PhD students, 10% discount for colleagues of alumni.
£1340 - Professional/trade association discount.
£1280 - Institution of Environmental Sciences (IES) and Remote Sensing and Photogrammetry members.
£1280 - Multiple bookings*

Please note: Participants are also able to join the course for either the theory sessions (first two days - £560) or just the practical sessions (last three days - £840).

Accommodation
This course is non-residential. If accommodation is required, please make your own arrangements at a nearby hotel.

Location and travel details
Cranfield University is located about halfway between London and Birmingham, and on the outskirts of Milton Keynes. Junctions 13 and 14 of the M1 are five minutes away and Milton Keynes railway station is 20 minutes by taxi. London Luton, Stansted and Heathrow airports are 30, 90 and 90 minutes respectively by car, offering superb connections.

To book now, contact:
T: +44 (0)1234 754189       E: professionaldevelopment@cranfield.ac.uk
www.cranfield.ac.uk/enviro-uavs

* Minimum of five delegates