SOUTH WEST NUCLEAR HUB

Project title: **Radiation mapping surveys using UAVs in the Chernobyl Exclusion Zone**

Research area: Nuclear Hazards and Risks

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Funders: EPSRC

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The Challenge

The accident at the Chernobyl nuclear power plant occurred during the early hours of Friday 26th April 1986 during a test on the Chernobyl 4 reactor prior to a routine shutdown. The resultant fallout led to radioactive isotopes being spread around the region (and beyond) leaving areas uninhabitable, whilst a much wider area was evacuated due to safety concerns.

Over 30 years has passed since the accident and whilst some radioactive isotopes have now decayed, others will remain for hundreds or thousands of years, creating hazards for humans and wildlife. Some of these areas are still inaccessible for humans and therefore creates a challenge to map and monitor the most dangerous areas.

The Solution

The team carried out a series of radiation mapping surveys using unmanned aerial vehicles (UAVs) equipped with gamma-ray spectrometers. The team conducted surveys of numerous interest areas in the Red Forest exclusion zone, using the DJI M600 UAV model.

Starting at the lowest risk site first, the village of Buriakivka, located 13 km from the accident epicentre, researchers moved on to the partially-demolished settlement of Kopachi before tackling the Red Forrest – one of the most highly-contaminated natural sites on Earth.

The gamma-ray spectrometry technology developed by the University of Bristol has previously been used in the first-ever UAV mapping of the Sellafield site in the UK and has also been deployed numerous times in the Fukushima Prefecture in Japan.

A scanning LiDAR (Light Detection and Ranging) pod was used to generate a terrain model, followed by a gamma spectrometer to measure the radiation intensity. This allowed the team to produce a highest resolution radiation map ever recorded of several areas.

Over nine field days, the total airborne time was 24 hours covering 730km to produce comprehensive 15 square kilometre radiation map.

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In a world first, fixed-wing drones were used to quickly map radiation over larger areas, flying at a height of 45 m - 60 m at a speed of c. 40 mph (65 km/h). Rotary drones were then used for more detailed investigation of key areas.

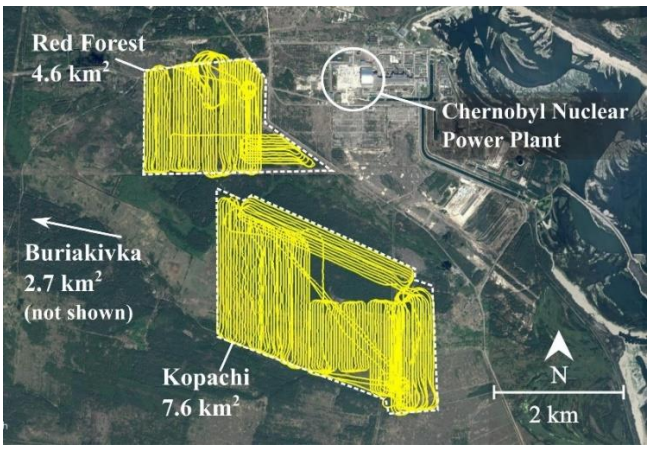

Fig 1: The areas mapped using UAVs in some of the worst-affected areas of the radioactive fallout plume

The Impact

This discovery of radioactive hotspots previously undetected will allow local authorities to recategorize zones, update safety protocols and allow the return of humans and wildlife. Large parts of the zone have already been declared safe to visit and 70,000 tourists visited the area in 2018. has increased ten-fold. This work will allow further safe areas to be identified and allow greater economic, social and environmental benefits to be realised e.g. the planned construction of new solar energy farms.

The team conducted this fieldwork research in April 2019 and were in the Chernobyl region on the 33rd anniversary of the accident. During their trip they were joined by ITV News crew and were featured on national UK television news bulletins on the 33rd anniversary.

This work demonstrated that the UK now has the capability to monitor radioactive sites and respond to nuclear incidents without exposing humans to risk. Detailed information can be gathered on a contaminated area from a safe zone, and be streamed live in real-time during the flight to researchers positioned in a safe zone.