

DUB-GEM - Development of an Unmanned Aerial Vehicle (UAV) – based Gamma spectrometry for the Exploration and Monitoring of Uranium Mining Legacies

Project goal:

Because of natural hazards such as flooding or landslides, former uranium mining legacy sites (ULS) in Kyrgyzstan, Tajikistan, Uzbekistan and Kazakhstan are at risk of uncontrolled radioactive contamination releases that may threaten transboundary rivers in the region. In the project DUB-GEM, an association of German and Central Asian partners develops an exploration technique installed on an Unmanned Aerial Vehicle (UAV) that allows the rapid mapping of radioactive pollution in the vicinity of these locations and enables the Central Asian states to survey ULS efficiently, on a regular basis, and with minimal financial effort.

Tasks and structure of the consortium:

In DUB-GEM, the two competing airborne UAV-based gammaspectrometric methods will be developed, as the expected measurement distance between survey area and drone lies exactly in the transition range of the respective measurement distances of established exploration methods previously used on the ground or in the air. Investigations are required to select the appropriate gamma detectors for each method and to specify and construct the UAV. With regard to the criteria to be applied in the construction of the UAV-system, rivaling aspects have to be considered (payload, legal aspects, flight time, flight strategy etc.). The goal is to find an optimal combination of properties for the UAV-system to be constructed. In addition, central flight parameters, optimized flight routes and operating parameters for drone deployment are to be derived and detector-specific evaluation routines developed once the UAV-system is operable.

The Federal Institute for Geosciences and Natural Resources (BGR) coordinates the project on the German side. The company Third Element Aviation (3EA) from Bielefeld will provide the required drone for the gamma spectrometer and thus expand their product portfolio with drones with a carrying capacity of up to 25kg. The IAF-Radioökologie GmbH (IAF) from Radeberg is responsible for the development of one of the planned two airborne gammaspectrometric methods. BGR is responsible for the second planned development line. The Central Asian partners benefit from German knowhow and can fulfill their obligations in remediation planning and/or supervision of remediated objects, for instance after extreme natural hazards.

Innovation in comparison with state of the art, distinctiveness:

The spatial exploration of former uranium mining sites with the help of so-called gamma spectrometers, is commonly carried out on the ground (e.g. on foot). Especially in difficult, mountainous terrain, exploration is often tedious and burdensome for the operator. Alternatively, helicopter-based systems may be used. The latter are efficient and largely independent of the terrain - but logistically and financially expensive, so their use is rather the exception. With the innovative development of a UAV-based reconnaissance method in the DUB-GEM project, the benefits of airborne systems remain largely intact, despite significantly lower operating costs. Factors such as dust development and the expected low flying height and speed as well as a large payload require innovative flight strategies that allow the UAV-system to cope with such difficulties.

Contribution to sustainability regarding land management, reduction of emissions. Strengthening Germany's competitiveness as a business location:

The method to be developed in DUB-GEM allows mapping and quantitative characterization of risk areas at ULS. DUB-GEM aims at laying the foundations for a future commercial use of an efficient exploration method as part of the planned remediation of ULS thereby contributing to sustainable land management and to the reduction of risks for radioactive emissions into the catchment area of the Ferghana valley.

With their commitment, the companies 3EA and IAF involved in the project secure medium and long-term business opportunities in the partnering countries and in further expanding their presence in

Central Asia. The gained knowledge can be applied in other regions affected with similar problems and in other fields of application.

Applications and, if applicable, relevance of the project result in everyday life:

Initiated by the European Union (EU) the so-called "Environmental Remediation Account for Central Asia (ERA)" was set up in 2016. Managed by the European Bank for Reconstruction and Development (EBRD) it will finance the remediation of ULS in the Central Asian states. In this context mapping of the sites is a necessary exercise where the method developed in DUB-GEM will be highly beneficial.

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Project [country]:	partners in	Kyrgyzstan: Ministry of Emergency Situations Uzbekistan: State Committee on Ecology and Environmental Protection of Uzbekistan (TBC) Tajikistan: Nuclear and Radiation Safety Agency Kazakhstan: Committee for Atomic and Energy Supervision and Control (TBC) Associated Partner: International Atomic Energy Agency (IAEA)
Project duration:		3 years
Project funding :		0.96 Mio. €



Image 1: Erosion gully on a uranium mine dump in southern Kazakhstan (BGR)



Image 2: Drone designed by the German project partner Third Element Aviation (3EA)