

Background

In case of a nuclear emergency, accidental releases of radioactive material might cause large scale environmental contamination. After the emergency has been brought under control, and the radioactive releases have settled on the ground, it is essential to map as quickly as possible the extent of the contaminated area and to evaluate the severity of the contamination. Airborne gamma measurements are known to be an effective means for quickly and safely mapping and evaluating large scale contaminations of gamma-emitting radio nuclides.

Objectives

We wanted to integrate gamma measuring equipment, based on a NaI detector, into an Agusta A109BA helicopter of the Belgian armed forces. This was done within the framework of "Aid to the Nation", a special program developed by the Belgian Armed Forces for facilitating cooperation between the armed forces and civilian organisations, for projects that are to the benefit of the Belgian Nation. Working in this framework, we also want to develop the necessary procedures that will allow quick and efficient deployment of the measuring capability in case of an emergency.

Principal results

The gamma measuring equipment basically consists of:

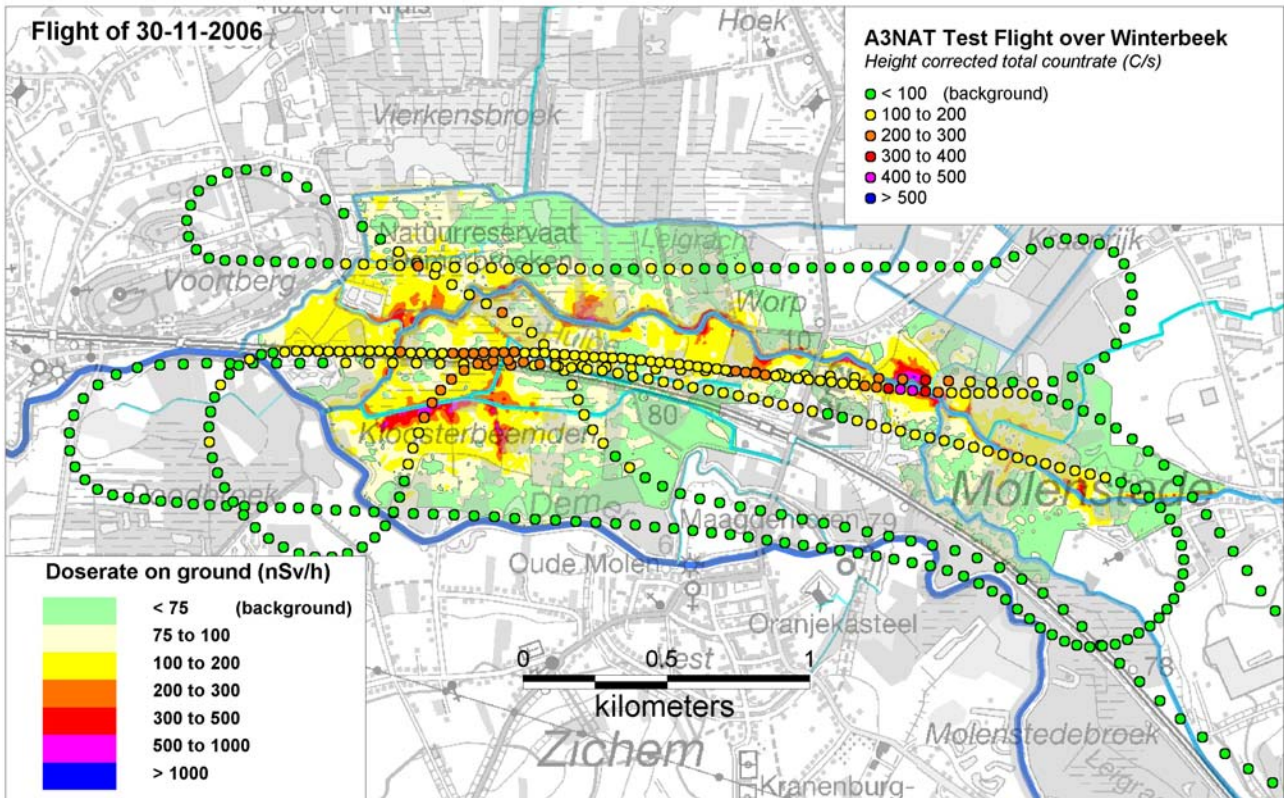
- one four inch NaI detector, in a cylindrical casing (scintillator volume approx 0.82 liter)
- one single channel analyzer:
 - one energy window: lower and upper level settable between 0 and 1.0 MeV
 - one "overflow" window: all counts above upper level energy window
- one Garmin Emap GPS for coupling geographic positions to the radiation data
- one analog input for receiving data from the altitude-RADAR on board of the helicopter
- one laptop computer for data logging during the flight : geographic position, height above ground, count rate in energy window; count rate above energy window are logged and the data are displayed graphically in real-time on a moving map image.

The equipment is shown below and was installed and tested and approved for use in the A109BA helicopter.



Radiation detector (cylindrical casing), analyzing electronics unit (rectangular casing) and laptop computer, mounted in the Agusta A109 helicopter, ready for use

A brief test flight was performed over a contaminated area along the Winterbeek near the community of Zichem (Diest). This small river was contaminated with radium in the past, as a consequence of non nuclear industrial activities involving NORM (naturally occurring radioactive materials). Through frequent flooding of the Winterbeek in this area, the radium was dispersed in the environment. As a consequence, a few hundred hectares of terrain here show enhanced gamma radiation levels. These had previously been measured through a foot campaign with a portable gamma dosimeter. They are shown in the figure underneath as dose rates on the ground : green areas indicate normal background levels, yellow, orange, red, purple and blue areas indicate increasing levels of gamma radiation. The coloured dots indicate the gamma radiation levels measured from the air, with green again indicating background count rates, and other colours indicating increased gamma count rates. It can easily be seen that good agreement between the airborne and the ground measurements exists.



Height corrected total count rate (everything above 0.2 MeV) measured from the helicopter shown as colored dots, plotted on a map of the contamination on the ground, as it is known from prior ground measurements. Good agreement between airborne and ground measurements can be observed.

Future developments

More detailed flights over areas with well know contamination will be made to calibrate the existing system. A new and more performant gamma detection system will be taken into use, allowing full spectrometry of the gathered radiation data, hence making it possible to distinguish between different radionuclides. Further efforts will be made to develop and improve the procedures and protocols necessary for quickly deploying the available airborne gamma measuring systems.

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Agusta A109BA helicopter on the army base of the "Heli Wing" at Bierset (Liège)