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# The Use of Measurements and PCAIRE for Monitoring the Cosmic Radiation Exposure of Aircrew

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Aircrew are constantly exposed to galactic cosmic radiation, which varies in a predictable manner with altitude, geomagnetic latitude and date (i.e., period within the solar cycle). In light of this fact and in response to recommendations made by the International Commission on Radiological Protection (ICRP) in 1990, aircrew in many countries have been classified as occupationally exposed to cosmic radiation. Consequently, over the past decade there has been a significant effort to measure and model this aircrew radiation exposure. The authors have accumulated extensive dose measurements at jet altitudes with various passive and active (battery-operated) radiation monitors, such as bubble detectors, thermoluminsecent detectors (TLDs), a tissue equivalent proportional counter (TEPC), a smart wide energy neutron detection instrument (SWENDI), an ionization chamber, a silicon-based LIULIN-4N LET (linear energy transfer) spectrometer and an Eberline FH41B. The response of these detectors, which varies with the type of radiation, has been compared at various altitudes and latitudes and at different periods in the solar cycle.

The data from these numerous worldwide flights have been encapsulated into a program that calculates the radiation dose for any flight in the world at any period in the solar cycle. This experimentally-based program, Predictive Code for Aircrew Radiation Exposure (PCAIRE) has been designed to be used by air carriers to meet national dosimetry requirements. In both the European Union and Canada, following guidance from the European Commission and the ICRP, the preferred method for the routine assessment of aircrew radiation exposure is by computations (based on a knowledge of the flight route and altitude), supported by periodic measurements. With these requirements in mind, the PCAIRE code has been validated against the integral route dose measurements made during recent experimental flights. In addition, the various radiation monitors have been assessed in terms of their suitability as code verification tools.

Keywords: aircrew radiation exposure; galactic cosmic radiation; radiation detectors; PCAIRE code.