

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Radiation Fields, Effects and Risks in Human Space Missions (5)

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A TLD-MICRODOSIMETER (LIBE-14) FOR AEROSPACE USAGE: RESULTS OF DOSIMETRY AND
RADIATION RISK ASSESSMENT OF AIRLINE PILOTS UNDERTOOK LONG-HAUL
INTERCONTINENTAL FLIGHTS DURING MARCH-MAY 2017**Abstract**

During habitat in Low Earth Orbiting (LEO) space stations astronauts are exposed to radiations, predominantly from high-energy protons and electrons and a small fraction of heavy charged particles including atomic nuclei as heavy as iron. On the other hand, during high altitude long haul flights pilots, cabin crew and passengers are also exposed to enhanced level of radiations originated from cosmic ray showers (CRS). The CRS is produced via the interaction of very high-energy (\sim GeV) primary particles (mainly protons) with the air molecules in upper atmosphere and composed of energetic particles of diverse species, i.e. neutrons, protons, electrons, muons, pions and photons. Furthermore, the magnitude of aircrew radiation exposure depends on flight altitude and duration, geographical location (latitude) and solar activity (modulation) status. In 1990, the International Commission on Radiological Protection (ICRP) classified airline crewmembers as “radiation workers”. A miniature passive micro-dosimeter (LiBe-14) based on LiF (TLD700) and Beryllium Oxide (BeO) thermoluminescence dosimeter chips emulating a large volume gas-filled Tissue Equivalent Proportional Counter (TEPC) was developed by one of the authors (BM). The LiBe-14 was deployed to assess the integrated ambient dose equivalent of two commercial pilots while undertaking long haul intercontinental flights during March-May 2017. The accumulated ambient dose equivalents of 1st (38 y, Female, 146 total block hours) and 2nd (29 y, Male, 149 total block hours) pilots were evaluated to be 511 and 694 μ Sv, respectively. The results agreed well within $\pm 20\%$ of simulated data evaluated using the well-known EPCARD (European Program Package for the Calculation of Aviation Route Doses) aviation dosimetry code. The results were used for inter-comparison studies of risk analysis of flight personnel under the guideline of Federal Radiation Protection Office BfS (Bundesamt für Strahlenschutz) of Germany. The successful implementation of LiBe-14 Microdosimeter in long haul, high-altitude aviation (aircrew) dosimetry justifies its feasibility in dosimetry and radiation risk assessment tasks relevant to astronauts working in the space habitat in the LEO environment.