Institute of Aerospace Medicine
Institute Seminar, February 21, 2017, *Abstract*

Dr. Matthias M. Meier
Radiation Biology Department, Institute of Aerospace Medicine, German Aerospace Center, Cologne, Germany

The Radiation Field at Aviation Altitudes

The assessment of the exposure of aircrew to the complex radiation field at aviation altitudes has been a challenging task and a legal obligation in the European Union for many years. The corresponding EU directive stipulates basic standards for the radiation protection of aircrews that are regarded as radiation workers due to their exposure to cosmic rays.

The increased radiation exposure at aviation altitudes is primarily the result of cosmic rays generated by interactions of primary high-energy particles of cosmic origin with atoms in upper layers of the Earth's atmosphere. The intensity of the corresponding radiation field, which aircrew members and passengers are exposed to, depends on altitude, geomagnetic latitude, and solar activity (Matthiä *et al* 2014). The influence of solar activity varies within an 11-year cycle, the minimum of which corresponds to the highest radiation exposure at aviation altitudes due to the reduced shielding of the GCR (Galactic Cosmic Radiation) by the interplanetary magnetic field, which is modulated by the solar wind, i.e. the solar activity. Furthermore, SPEs (Solar Particle Events), which are often referred to as solar flares in aviator's jargon, can temporarily generate significant changes, i.e. increases or decreases, in the corresponding radiation exposure at aviation altitudes (Matthiä *et al* 2009). This will be illustrated with a case study of dealing with an SPE during the Halloween solar storms (Meier and Matthiä 2014).

The talk gives an overview of the state of the science in this field and an outlook on future research and developments (Meier *et al* 2016).

References:

Matthiä, D., B. Heber, G. Reitz, L. Sihver, T. Berger, and M. Meier 2009 The Ground Level Event 70 on December 13th, 2006 and Related Effective Doses at Aviation Altitudes *Radiation Protection Dosimetry* **136(4)** 304-310

Matthiä, D., M. M. Meier, and G. Reitz 2014 Numerical calculation of the radiation exposure from galactic cosmic rays at aviation altitudes with the PANDOCA core model *Space Weather* 12 161-171 doi:10.1002/2013SW001022

Meier M. M. and D. Matthiä 2014 A space weather index for the radiation field at aviation altitudes *J. Space Weather Space Clim.* **4** A13

Meier M. M., F. Trompier, I. Ambrozova, J. Kubancak, D. Matthiä, O. Ploc, N. Santen and M. Wirtz 2016 CONCORD: comparison of cosmic radiation detectors in the radiation field at aviation altitudes *J. Space Weather Space Clim.* **6** A24

Meier M. M., D. Matthiä, T. Forkert, M. Wirtz, M. Scheibinger, R. Hübel, and C. J. Mertens 2016 RaD-X: Complementary measurements of dose rates at aviation altitudes *Space Weather* **14** 1–6 doi: 10.1002/2016SW001418