



Possible effects on avionics induced by Terrestrial Gamma-Ray Flashes

Marco Tavani (1,4), Andrea Argan (2), Alessandro Paccagnella (3), Alessandro Pesoli (4), Francesco Palma (4), Simone Gerardin (3), Marta Bagatin (3), Alessio Trois (5), Piergiorgio Picozza (4), Piero Benvenuti (6), Enrico Flamini (7), Martino Marisaldi (8), Carlotta Pittori (9), and Paolo Giommi (9)

(1) INAF-IAPS, Roma, Italy, (2) INAF, Roma, Italy, (3) Department of Information Engineering, University of Padova, Padova, Italy, (4) Department of Physics, University of Rome Tor Vergata, Roma, Italy, (5) INAF Osservatorio Astronomico di Cagliari, Cagliari, Italy, (6) Department of Physics and Astronomy "G. Galilei", University of Padova, Padova, Italy, (7) Agenzia Spaziale Italiana, Roma, Italy, (8) INAF-IASF, Bologna, Italy, (9) ASI Science Data Center, Roma, Italy

We address the issue of the possible susceptibility of typical aircraft electronics exposed to particle, gamma-ray and neutron irradiation coming from Terrestrial Gamma-ray Flashes (TGF). We consider possible scenarios regarding the intensity, the duration, and geometry of TGFs influencing a nearby aircraft, and study their effects on electronic equipment. We calculate, for different assumptions, the total dose and the dose-rate, and estimate single-event effects. We find that in addition to the electromagnetic component (electrons/positrons, gamma-rays) also secondary neutrons produced by gamma-ray photoproduction in the aircraft structure substantially contribute to single-event effects in critical semiconductors components. Depending on the physical characteristics and geometry, TGFs may deliver a large flux of neutrons within a few milliseconds on an aircraft. This flux is calculated to be orders of magnitude larger than the natural cosmic-ray background, and may constitute a serious hazard to aircraft electronic equipment. We present a series of numerical simulations supporting our conclusions. Our results suggest the necessity of dedicated measurement campaigns addressing the radiative and particle environment of aircraft near or within thunderstorms.