Crew safety assurance requires the understanding of space radiation risks and limiting risks to acceptable levels. Progress in radiation research in recent years allows us to identify areas where accurate risk estimates occur and open areas where future research should be the focus. The CRIS experiment along with measurements on Voyager I and II spacecraft has solidified earlier balloon experiments and theoretical models providing detailed estimates of the galactic cosmic rays (GCR) charge, mass and energy composition. The first Mars surface measurements by Mars Surface Lander (MSL) RAD experiment have provided data to validate models and has shown that neutron doses are manageable for a Mars surface stay. Accumulating data on solar particle events (SPEs) has led to statistical models of frequency, size and energy spectra enabling a reasonable worst-case to be defined to set shielding requirements. Organ doses from SPEs are readily reduced with passive shielding materials with no need for exotic approaches such as magnetic or plasma shielding. The bottom line is that SPE’s are readily shielded, while GCR are not. The large uncertainties in GCR exposures to risk estimates leaves GCR shielding evaluations incomplete at this time. Radiobiology research on heavy ion effects is therefore essential to develop accurate risk projections and to develop mitigations. Radiobiology research at this time suggests the following:

**Cancer Risks:** Radiobiology research has shown only a small risk for the more lethal and shorter latency risks of leukemia’s will occur due to long-term GCR exposures. We have proposed new models of leukemia risk that were supported by the U.S. National Research Council (NRC) as well as the National Council on Radiation Protection and Measurements (NCRP). The model reduces leukemia risk estimates several-fold compared to earlier estimates. However, solid cancer risk estimates remain large and highly uncertain due to the potential high efficiency of heavy ions in causing solid cancers shown in animal studies. Current estimates bust NASA radiation limits for most Mars mission scenarios. We discuss approaches to manage this risk through further research. Risk limits could be relaxed but by how much? Estimates as much as 8-times the current NASA limits have shown to be plausible. Therefor prioritization of improving the understanding of solid cancer risks and approaches to mitigate is warranted.

**Non-Cancer Risks:** Most risks such as acute radiation syndromes are easily avoided using shielding. The risks of circulatory diseases are shown to be small but perhaps non-zero. Of larger concern is a significant probability of vision impairing cataracts with short latency (<3 years) and cognitive and memory detriments during a mission. However here we have shown that application of results from accelerator based animal experiments with heavy ions on cognition to a Mars mission exposure would lead to only a small risk. Microgravity effects and other spaceflight factors could influence space radiation impacts on cognition. Because of the limitations in mice and rats in representing human brain function and inadequacy of ground-based models of combined stressors, we discuss approaches to use astronauts on near-term missions to gather the necessary information on impaired cognition for the first Mars crews.

**Approaches to Risk Limitation:** Approaches to risk limitation for exploration missions are under debate. We highlight a new effort by the International Commission on Radiological Protection (ICRP) to provide guidance to space agencies for risk limits for exploration missions.