



A New Radiation Belt Model: AE-9/AP-9

Overview. The radiation belts and plasma in the Earth's magnetosphere pose hazards to satellite systems which restrict design and orbit options with a resultant impact on mission performance and cost. For decades the standard space environment specification used by the engineering community has been provided by the NASA AE-8 and AP-8 trapped radiation belt models. There are well-known limitations on their validity, however, and a consensus has been growing that a new standard trapped radiation and plasma model is needed for spacecraft design and mission planning purposes.

The National Reconnaissance Office (NRO), NASA, the Air Force Research Laboratory (AFRL), the Aerospace Corporation, Los Alamos National Laboratory (LANL) and the Naval Research Laboratory (NRL) have recently embarked on a project to produce the next generation radiation belt model, AP(E)-9. This model upgrade will offer significant improvements in terms of the radiation hazards specified, accuracy and uncertainty quantification, spectral and spatial coverage, and time-correlated probability of occurrence statistics. Preliminary requirements have been gleaned from participation in the DoD-sponsored Space Environment Effects Working Group (SEEWG), the NASA Living With a Star Workshop, and the NOAA Space Weather Workshop.

The new model will improve upon the existing AE-8/AP-8 model by including new capabilities and extended energy and species coverage to include:

- Protons 100 eV – 1 GeV
- Electrons 100 eV – 10 MeV
- Ions 1 keV – 200 keV

A statistical description of natural variability of the radiation belts will be included, as will indications of uncertainty due to inaccuracy and scarcity of measurements. An empirical component will provide simple percentage confidence levels for flux levels as functions of energy and location, while the "Standard Solar Cycle" component will provide a more detailed description of the temporal correlations via a fly-through capability. Preliminary versions are scheduled to be available by March 2010.

Background. For decades NASA has supported scientific investigations that have lead to a significant improvement in our understanding of the trapped radiation environment. The Radiation Belt Storm Probes (RBSP) mission, part of NASA's Living With a Star program, is designed to dramatically augment that knowledge base. As a complement to the RBSP payload, NRO is providing a Relativistic Proton Spectrometer (RPS) which will measure 50 MeV to 2 GeV protons, thus extending the RBSP capability from a few eV to the most energetic trapped particles. Both the RPS and the AE-9/AP-9 model development effort are part of the Proton Spectrometer Belt Research (PSBR) program managed by the NRO.

Industry feedback: To ensure that the new AE-9/AP-9 model meets the broadest set of needs for satellite and spacecraft design, *the PSBR team is actively seeking inputs from industry.* Feedback on model requirements and functionality can be sent to any of the points of contact below, or you can visit the Radiation Model User Forum at the LWS SET Website::

lws-set.gsfc.nasa.gov/RadSpecsForum.htm

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