OLTARIS: On-Line Tool for the Assessment of Radiation in Space

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Abstract

The effects of ionizing radiation on humans in space is a major technical challenge for exploration to the moon and beyond. The radiation shielding team at NASA Langley Research Center has been working for over 30 years to develop techniques that can efficiently assist the engineer throughout the entire design process. OLTARIS: On-Line Tool for the Assessment of Radiation in Space is a new NASA website (http://oltaris.larc.nasa.gov) that allows engineers and physicists to access a variety of tools and models to study the effects of ionizing space radiation on humans and shielding materials. The site is intended to be an analysis and design tool for those working radiation issues for current and future manned missions, as well as a research tool for developing advanced material and shielding concepts. The site, along with the analysis tools and models within, have been developed using strict software practices to ensure reliable and reproducible results in a production environment. They have also been developed as a modular system so that models and algorithms can be easily added or updated.

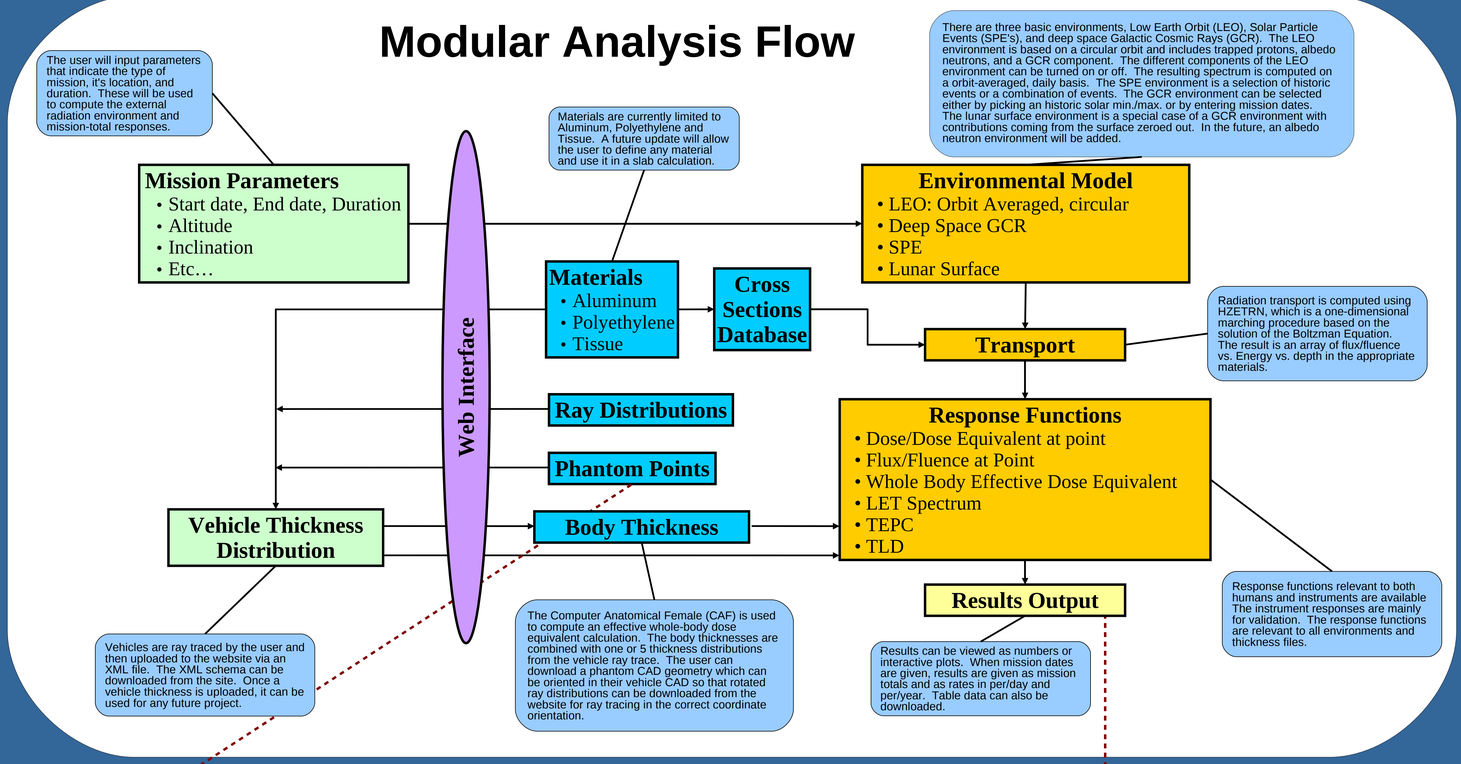
Capabilities

- User Selected Environment(s)
  - Free-Space Galactic Cosmic Ray (GCR)
  - Free-Space Solar Particle Event (SPE)
  - Earth Orbit (Circular)
- User-Defined Thickness Distributions
  - Upload Ray Traced Geometry
  - Aluminum, polyethylene, tissue
- User-Selected Response Functions
  - Differential Flux/Fluence
  - Dose and Dose Equivalent
  - Whole-Body Effective Dose Equivalent
  - TLD-100 (Thermo-Luminescent Dosimeter)
  - Differential/Integral LET (Linear Energy Transfer)
- Future Capabilities
  - Slab with user-defined materials
  - Lunar Albedo Environment
  - Design feedback and enhanced visualization

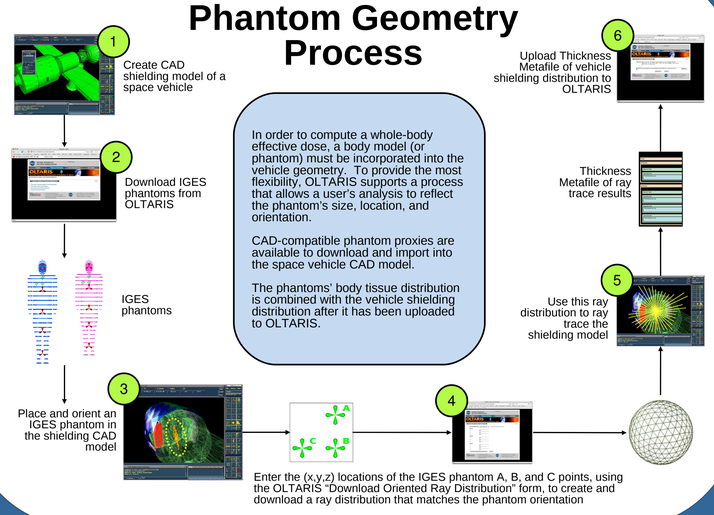
Software

- Requirements derived from use cases – give the user what they want.
- Website built primarily with open source software.
  - Ruby on Rails, MySQL, Sun Grid Engine, Flash
- Analysis engine is mostly FORTRAN.
- All software is version controlled and regression tested to ensure reliability.
- Modular architecture allows for easy maintenance and rapid insertion of new models, methods, and algorithms.
- Validation benchmarks used to test and evaluate the accuracy of the physics and transport models.

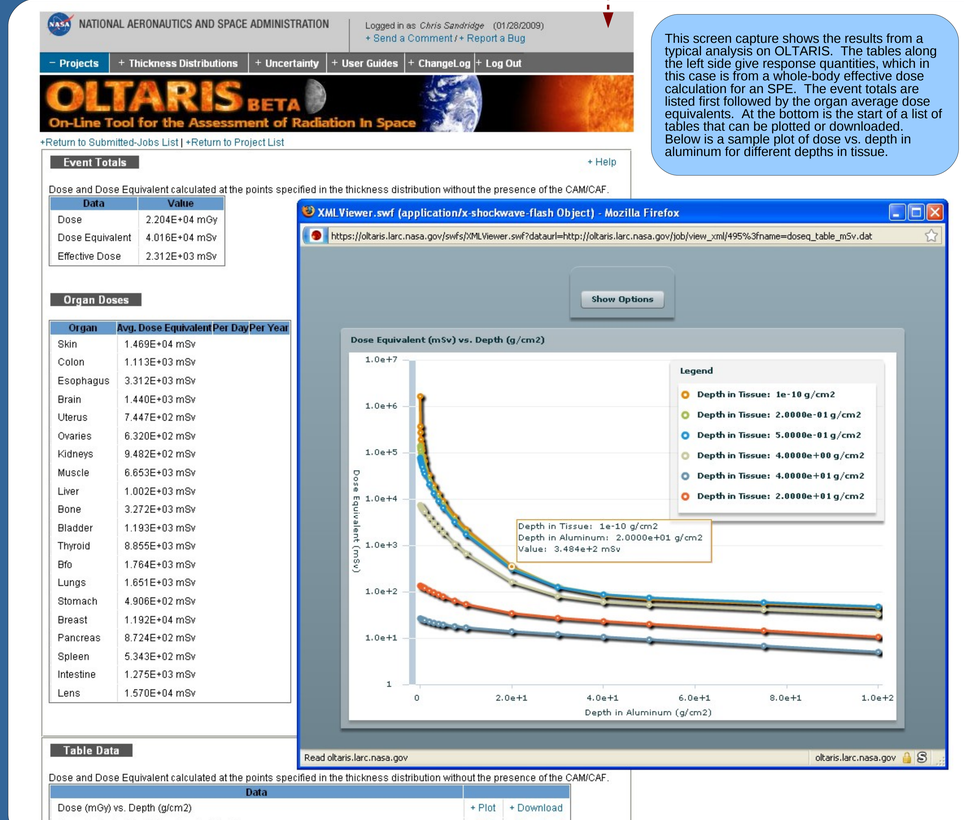
Modular Analysis Flow



Phantom Geometry Process



https://oltaris.larc.nasa.gov



This screen capture shows the results from a typical analysis on OLTARIS. The tables along the left side give response quantities, which in this case is from a whole-body effective dose calculation for an SPE. The event totals are listed first followed by the organ average dose equivalents. At the bottom is the start of a list of tables that can be plotted or downloaded. Below is a sample plot of dose vs. depth in aluminum for different depths in tissue.