Air Force Institute of Technology
Directed Energy Professional Society
Center for Directed Energy
2005 Summer Internship Program

Wright State University Physics Department
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2005 Research Experience for Undergraduates

HELEEOS Lite

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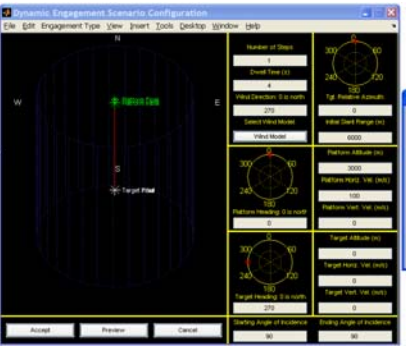
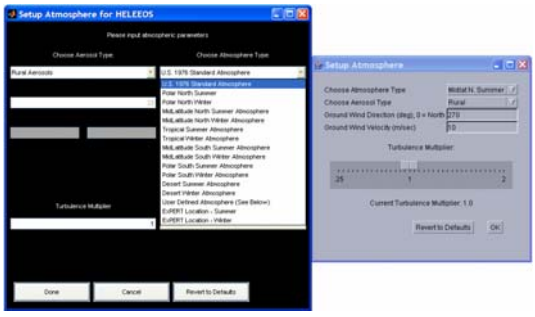
The Air Force Institute of Technology's (AFIT) Center for Directed Energy has developed the High Energy Laser End-to-End Operational Simulation (HELEEOS) parametric one-on-one engagement level scaling law model. The HELEEOS model has been designed to provide reasonable fidelity in predictions of energy delivered to a target over a broad range of engagement scenarios and to provide realistic probabilistic outcome analyses which permit an estimation of the level of uncertainty in the calculated probability of kill (Pk) for high energy laser (HEL) engagements. HELEEOS Lite is java program based on HELEEOS designed to provide probabilistic outcome analyses of Pk as well as other details in a smaller, faster, more simplified program.



HELEEOS Lite takes into account slant range, platform and target vertical and horizontal velocities, and relative altitudes. HELEEOS Lite offers a simplied definition of the engagement geometry, for example platform true course is restricted to 0 degrees, while still allowing the spatial relationship between target and platform to change over the engagement dwell time as is the case in HELEEOS.

HELEEOS Lite allows the user to choose from among five laser wavelengths. Beam power, beam quality, jitter, and exit aperture diameter are also user-defined inputs.

In HELEEOS Lite, the user defines only the fluence required to achieve the desired effect on the target. From this, the peak irradiance of the beam and the dwell time are used to determine the probability that this effect has been achieved, without requiring the user to input target size or any additional target details.



HELEEOS Lite allows the user to choose from eight types of atmosphere, ranging from polar winter to tropical summer, and five types of aerosol. These choices range over absorption and scattering levels that might reasonably be expected during propagation. HELEEOS Lite also takes into account wind and turbulence to calculate loss in peak irradiance due to all atmospheric causes, to include thermal blooming. A Hufnagel Valley 5/7 turbulence profile is assumed which the user can modify using a scalar multiplier.

HELEEOS Lite takes input data about engagement geometry, atmospheric conditions and laser properties, and uses its propagation model to estimate the probability that the target damage threshold is reached. HELEEOS Lite calculates Pk for a diffraction-only case, or 'best case' scenario and an all-effects considered, or 'worst case' scenario. HELEEOS Lite outputs these Pk values as well as intermediate calculations values, such as Strehl ratios, atmospheric parameters, and diffraction-limited details.