KIDD

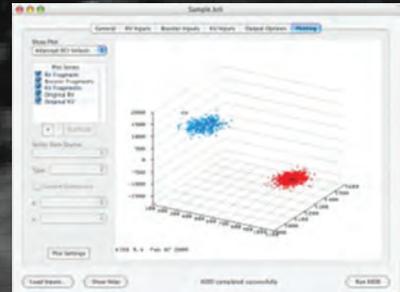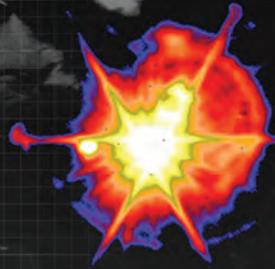## Kinetic Impact Debris Distribution Model

The Kinetic Impact Debris Distribution Model (KIDD) is a core lethality model (CLM) under the Missile Defense Agency's Modeling and Simulation Program (MDA/DES). It is a physics-based Monte Carlo simulation that predicts debris initial conditions from interceptors engaging ballistic targets. KIDD predicts debris from both the interceptors and the target.

- Inputs include interceptor model, target model, engagement parameters, radar parameters
- Outputs include mass, size, shape, area, velocity, tumble rate, material, thickness, RCS distribution, aerodynamic parameters, and temperature for each individual fragment; and size, mass, speed, and temperature statistics for groups of fragments.

Verified

KIDD has had IV&V since 2003. AMRDEC SSDD is currently the IV&V agent. KIDD utilizes a configuration management process that includes a Software Configuration Control Board (SCCB) chaired by MDA, with the IV&V agent and developer also participating, that meets regularly to review code status and make decisions regarding enhancements, problem resolution and schedule.

Validated

KIDD is validated against a database of over 288 sled, light gas gun, and flight tests. The database includes a wide range of closing speeds, hit points, strike angles, interceptors, and targets and contain data on 120,000 discrete fragments.

Integrated

KIDD is designed for integration into other M&S and is used in multiple element-level and BMDS-level digital and hardware-in-the-loop (HWIL) tools. KIDD has interfaces with the Parametric Endo/Exoatmospheric Lethality Simulation (PEELS) CLM and is integrated into the Post-Engagement Ground Effects Model (PEGEM) CLM. KIDD is also integrated into a number of flight test range safety tools including the MDA Range Safety Modeling Toolkit (RSMT).

KIDD is designed as a fast-running, multi-thread tool to predict debris for element and BMDS performance assessments, test and operational scenarios including range safety assessments, post-flight test assessments, exercises and war games, and development and testing of intercept assessment and debris mitigation algorithms. It is benchmarked against test and hydro-structural code data.

Product Summary

- Modular architecture for use with C, C++, and Fortran with a kernal and optional GUI and post-processors
- Windows, Linux, Solaris, and Mac OS X systems supported in both 32 and 64-bit architectures
- Interface
  - iKIDD GUI (Windows and Mac OS X only)
  - KIDD Subroutine API (C, C++, Fortran, and Fortran-90)
  - KIDD Structure API (C, C++, and Fortran-90)
- Targets Library
  - 48 target models (Conventional, Chem/Bio, Nuclear)
  - Common models with PEELS and PEGEM
- Fully documented and supported
  - Target manuals, user's manual, executive summary, basis of confidence, and V&V documentation
  - Help desk and training workshops
- Flexible, comprehensive input and output
  - User defined fragment output thesholds
  - Well-behaved operation with reporting of warnings and errors for post-run evaluations
- Users include
  - Elements: GMD, THAAD, PAC-3, Aegis BMD, C2BMC, Sensors (AN/TPY-2/ SBX), Arrow
  - Ranges: WSMR, PMRF, RTS
  - Commands, Agencies, Services: MDA, SMDC, STRATCOM, NORTHCOM, EUCOM, Army, Navy, Air Force
  - International: UK, PEGEM International Releases
  - OGA, FFRDC: DTRA, JHU/APL, SNL, LLNL, MIT/LL goverment analysts

KIDD is a critical component to understanding the capabilities and limitations of the systems that compride BMDS in the presence of post-intercept debris environments.