National Aeronautics and Space Administration

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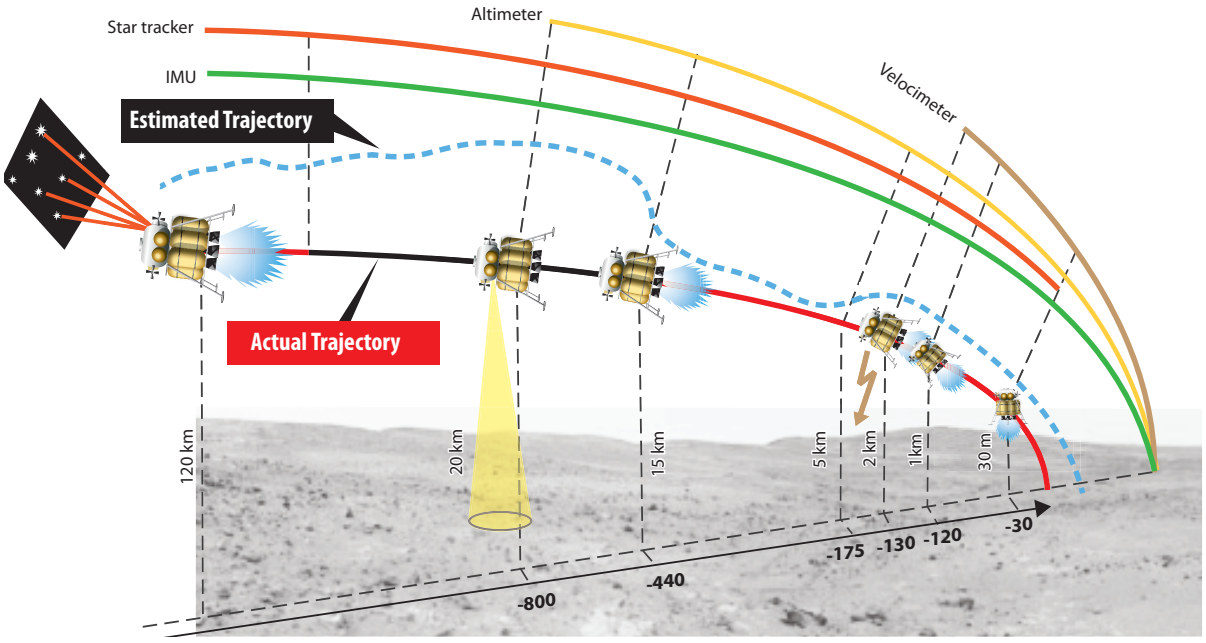
Simulation Framework for Rapid Entry, Descent, and Landing Analysis

The NASA Engineering and Safety Center has archived a number of key historic Entry, Descent, and Landing (EDL) simulation models and developed several new models to enhance the capability of the Agency to evaluate a wide range of EDL systems for system analysis studies, preliminary design, mission development and execution, and time-critical assessments. The simulation models developed in this activity can be used to help define the required architectures and investment strategies for future robotic and human exploration missions.



Applicability

All Entry, Descent, and Landing systems and missions.

Simulation Framework and Models

EDL flight simulations are typically developed for specific missions or analysis tasks. In many cases, once the effort is completed, the simulation models are not adequately documented or retained. Because many projects or studies requiring EDL would benefit from high-fidelity simulations with a library of validated and documented models, an NESC team converted and archived current and historic EDL models and scripts into a secure user library with appropriate user documentation and test cases. The team also developed several new models currently of interest in the EDL community. All of these models are implemented in a simulation framework utilizing the Program to Optimize Simulated Trajectories II (POST2). As a whole, the models include aerodynamic and mass models of entry vehicles, atmospheric and gravity models of planets and moons, guidance and control algorithms, a multimode Kalman Navigation Filter for onboard state estimation, aerodynamic uncertainties for dispersion analyses, guidance models for aerocapture and aerobraking, and several basic attitude-control models. A set of test cases is included to confirm the proper functioning of these models when incorporated into future simulations. The details and user guides for the models, scripts, and test cases have been published (see references below). Request for access to the simulation framework and models can be made at https://post2.larc.nasa.gov.

References

Murri, Daniel G.: Simulation Framework for Rapid Entry, Descent, and Landing (EDL) Analysis. NASA TM-2010-216867, Volumes I and II. November 2010

Murri, Daniel G.: Simulation Framework for Rapid Entry, Descent, and Landing (EDL) Analysis, Phase 2 Results. NASA TM-2011-217063. February 2011

For more information, contact the NESC at www.nesc.nasa.gov

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