### Hashtags: #asteroid, #asteroidmission

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### Tags: Model

**Challenge Description**

How would you send humans to explore an asteroid? How would you send a spacecraft to survey the asteroid belt? And how would you deflect an asteroid that was on a threatening course with Earth?

Space flight simulators provide the capability to create asteroid mission simulations. See simulators like NASA’s General Mission Analysis Tool and others that can provide 3D visualization of spacecraft, orbital trajectories, and ephemera. Other simulators provide additional simulation capabilities, including Multi-Function Displays, out-of-cockpit views, pod-bay doors, docking, lift-off, and landing or a capability to design launch vehicles and spacecraft by selecting and connecting subsystems. This challenge involves planning, designing, and creating an asteroid mission simulation using one or more of these simulators. Simulations of asteroid surface mission operations can be developed with free open source game engines or the free versions of commercial game engines, provided that the simulations include realistic physics.

Select a space flight simulator or physics based game engine and study the documentation, Application Programming Interface, video tutorials, and model repository. Develop an asteroid mission and design the spacecraft. Implement the spacecraft and mission with the space flight simulator. Simulate the mission and identify future improvements for the simulation.

**Background**

Publicly available space mission simulators have large international communities that provide examples, tutorials, videos, discussion forums, and reusable models and simulations. A mission simulation developed for this challenge can build upon existing models provided that the copyright license allows it and the technologies represented in the model are technically feasible before the simulated start of mission date. A benefit of using publically available simulators is it provides equal opportunities for everyone and it minimizes the possibility of someone modifying the external environment simulation to suit the spacecraft simulation.

**Solution Ideas**

Here are some ways for you to frame this solution:

Create documented asteroid mission simulations with source files for the simulation, including geometric models, images, textures, scripts, and source code; source files must include comments and associated documentation; and source file documentation must include procedures for executing the simulation, input data ranges, and descriptions of what-if scenarios. Mission simulation documentation can include descriptions and diagrams of the spacecraft and instruments; descriptions and diagrams of the orbital trajectories and results of the simulation including durations, propellant usage, extracted payload; documentation must provide screen-shots of the simulation and explain how it supported the analysis of the mission concept; and documentation must include recommendations for improving the simulation.

**Sample Resources**

Space mission simulators and physics based game engines

* <http://gmat.gsfc.nasa.gov/>

NASA Technical Reports or Research

* <http://ntrs.nasa.gov/search.jsp?print=yes&R=20080045879>
* <http://ntrs.nasa.gov/search.jsp?print=yes&R=20130013170>
* <http://ntrs.nasa.gov/search.jsp?print=yes&R=20120013195>
* <http://ntrs.nasa.gov/search.jsp?print=yes&R=20120003776>
* <http://ntrs.nasa.gov/search.jsp?print=yes&R=20120001818>
* <http://ntrs.nasa.gov/search.jsp?print=yes&R=20120008777>