### Hashtags: #asteroid, #asteroidprospector

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### Tags: Model

**Challenge Description**

Develop a game to travel across the solar system going from asteroid to asteroid. The strategy is to decide which asteroid to visit and mine next, given a field of asteroids that vary in location, composition, size, and more. A major part of this challenge is learning over the course of the International Space Apps Weekend what the purpose and value of an asteroid resource utilization/industry could be and incorporating it into the game.

**Background**

Asteroids in our solar system contain valuable resources. They also contain resources that offer potential value to humanity. They may be valuable to the global economy as Earth’s finite resources begin to dwindle. Future space exploration might use these in-space resources for radiation shielding, life support, growing food, 3D printing spare parts, etc. By using resources found at or on the way to a destination, the vehicle doesn’t bring everything that will be used during the entire mission from Earth. This reduces the amount of mass, space, and cost in launching and transporting those resources from Earth.

Asteroids may be useful for the operation of commercial ventures in space (metals, minerals, and volatiles), such as tourism (hotels or tours), energy production (like beaming solar energy to Earth), manufacturing of consumer goods, building communication relay platforms, supporting mining operations, etc. The resources from asteroids may be used in place, transported through space to support activities elsewhere, or returned to Earth. Asteroids in near cycler obits could potentially provide a “space taxi” approach to moving between two planets (i.e. Earth and Mars).

**Solution Ideas**

Here are some ways for you to frame this solution:

The game could be as simple or as complex as the developers wish and have time to develop. More complex is not always better. The following are ideas that could be incorporated into the game at the developer’s choice:

Start location options: the Earth, the Moon, Mars, inside the Asteroid Belt, etc.

Objective Options: 1) to travel furthest from the starting point, 2) to travel around the Sun within the Asteroid Belt, 3) to get back to Earth from another planet/place, 4) to reach a habitat on Mars or Titan, 5) to gather the most valuable collection of resources, 6) to save the Earth from an impending giant impact, 7) to supply an industry that terraforms Mars, 8) to explore the solar system and beyond.

Asteroid field options: constant each time the game is played; varied each time the game is played; changes as game passes and bodies move around the sun, etc.

Mission type options: human; robotic; both.

Starting capital and material options: user is given a standard or randomly selected set of equipment (like mining equipment) and other resources are made available; the user buys a selection of these with a limited amount of startup cash

Vehicle design options: user is given a set vehicles or can choose between vehicles that vary in propulsion system, resource storage capability, mass, etc.; users can buy or manufacture mining equipment, factory equipment, etc.

Mining: user can mine metals for manufacturing new equipment, volatiles like ice for life support or to make rocket propellants, soil to extract oxygen from the minerals for life support, etc.

Manufacturing: user can make propellants from water or other volatiles, refine metals from minerals to manufacture equipment, print solar cells from regolith (soil) for energy, 3D print metals and plastics and electronics, etc.

Expending resources: propulsion, transportation of resources the to Earth or elsewhere for sale, used in extra-terrestrial industry, life support, maintaining ship, etc.

None of the options above are required; they are listed as a start for considering approaches to development. It is not an all-inclusive list; there are many ways to set up an asteroid prospecting game.

Additional variations could include:

Survival option: use the resources to survive and make it to the destination.

Planetary Defense option: if an asteroid is potentially hazardous, receive extra points or payment from the people of Earth for pushing the asteroid into a safe orbit. Possibilities include: 1) if a big asteroid hits Earth, the game is over, 2) if a small asteroid hits Earth, the user is penalized, 3) the user must decide how to push each asteroid (kinetic impact, gravity tractor, nuclear explosion, etc), 4) if choose a nuclear explosion on the asteroid, it is then unavailable for mining due to radiation, 5) if choose to mine the asteroid, there is a risk of it hitting Earth

Space Tourism option: build outposts and hotels on the asteroids or planets; set up a transportation system with refueling stations to take people there

Exploration option: visit destinations of interest and make discoveries along the way.

Be creative and have fun with the game!

**Sample resources**

* [“A Review of Extra-Terrestrial Mining Robot Concepts”](http://ntrs.nasa.gov/search.jsp?R=20120008777&hterms=mueller+asteroid+asteroid&qs=Ntx%3Dmode%2Bmatchall%7Cmode%2520matchall%26Ntk%3DAll%7CAuthor-Name%26N%3D0%26No%3D10%26Ntt%3Dasteroid%7Cmueller)
* [“Nature's Way of Making Audacious Space Projects Viable”](http://ntrs.nasa.gov/search.jsp?R=20110016183&hterms=asteroid+industry&qs=Ntx%3Dmode%2Bmatchallany%26Ntk%3DAll%26N%3D4294128800%26Ntt%3Dasteroid%2Bindustry)
* [NASA Technical Reports: Search Asteroid + Utilization](http://ntrs.nasa.gov/search.jsp?Ntx=mode+matchallany&Ntk=All&N=0&Ntt=asteroid+utilization)
* [NASA Technical Reports: Search Asteroid + Industry](http://ntrs.nasa.gov/search.jsp?Ntx=mode+matchallany&Ntk=All&N=0&Ntt=asteroid+industry)
* [NASA Technical Reports: Search Asteroid + Mining](http://ntrs.nasa.gov/search.jsp?N=0&Ntk=All&Ntt=asteroid%20mining&Ntx=mode%20matchallpartial)
* [“Defending Planet Earth: Near Earth Object Surveys and Hazard Mitigation Strategies”](http://www.nap.edu/catalog.php?record_id=12842)
* [“Establishment of a Spaceport Network Architecture”](http://ntrs.nasa.gov/search.jsp?R=20120015766&hterms=20120015766&qs=N%3D0%26Ntk%3DAll%26Ntt%3D20120015766%26Ntx%3Dmode%2520matchallpartial)
* [NASA Robotic Mining Competition](http://www.nasa.gov/offices/education/centers/kennedy/technology/nasarmc.html)
* [Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-Rex) – Asteroid Sample Return Mission](http://osiris-rex.lpl.arizona.edu/)
* [“Prospecting the Asteroids”](http://gslibir.gsfc.nasa.gov/colloquia/4552) Goddard Engineering Colloquium
* [Aldrin cycler concept](http://en.wikipedia.org/wiki/Mars_cycler)

*Asteroid databases, infographics, and data visualization libraries*

* <http://www.jpl.nasa.gov/infographics/>
* <http://neo.jpl.nasa.gov/orbits/>
* <https://developers.google.com/chart/interactive/docs/index>
* <http://tamc.github.io/Sankey/>
* <http://d3js.org/>
* <http://philogb.github.io/jit/>
* <http://ejohn.org/blog/processingjs/>
* <http://minorplanetcenter.net/physical_db>