

ASTEROID MINING AND SPACE SIMULATIONS WITH CITIZEN SCIENCE AND GAMING. Michelle M. Cadieux, MBA independent on various space teams. Community Safety Programs (MN nonprofit corp) (940 44TH Ave NE #21561, Mpls MN 55421,) michellecadieuxmba@gmail.com

Introduction: Many space companies are trying to find out how the economics of space mining will work. Many of these projects are being completed in simulations like NASA spaceappschallenge.com, Astropreneur.com game, 3d printer simulations like D Space, NASA Dark Side of The Jam, and more.

Citizen Science exploration with groups like PongSat, are helping to gather intel on space that will affect exploration in new ways. PongSat has it's first micro-gravity lab now.

Crowdfunding has been successful for raising money for projects like NanoSat, LiftPort and others.

This paper will aim to explore some of what has been successful, and what hasn't when working on projects aimed at supporting space mining.

Gaming:

Astropreneurs is a game that hopes to help demonstrate the space business model. It was developed at a StartupWeekend with Paul Fuller, and worked on more at NASA's Dark Side of the Jam gaming hackathon with myself and a team, it has continued to grow with developer resources.

EVE online is one game that has asteroid hunting and has the composition of what is in different

Hackathons, business start up competitions are a good way to get teams together for a quick weekend to brainstorm ideas. Other competitions like Lunar X Prize and Mars Return Sampling and the NASA Systems Engineering Mars Sampling project for Saylor online university are also good places to find teams working on this. NASA had the <http://CreateTheFuture.com> contest on.

Crowdsourcing for volunteers should only be used for nonprofit teams. There have been changes in legislation that crack down on the use of unpaid interns and volunteers for profit making companies. There are also very tricky tax rules about assets acquired for a nonprofit should only be used for a nonprofit and not for profit entities.

NASASpinoff.com has always done a good job of showcasing how technologies that have been developed for space are used on earth. Memory foam and other products have been developed, even if velcro, tang, and teflon actually were not.¹ These technologies can help to establish the business case for funding projects, in a climate that is reluctant to fund space projects without a clear ROI.

Business Case: The business case has been estimated at a 400% ROI by a WA asteroid mining prof.

Value: Asteroid 1999 JV6, unfortunately just slipped past in January with an estimated worth of \$1.43 trillion, or an estimated mining profit of about \$190 billion based on what asteroid tracking database [Asterank](#) thinks can be retrieved. It will be back in 2015. PlanetaryResources estimates asteroids at \$100,000/ ton for \$9-18 billion industry with 10,000 near earth asteroids, average size greater than 75 microns, in less than 6 years, 2016-2020. 20 year cash cost \$122/ kg²

¹ <http://spinoff.nasa.gov/spinfaq.htm#spinfaq12>

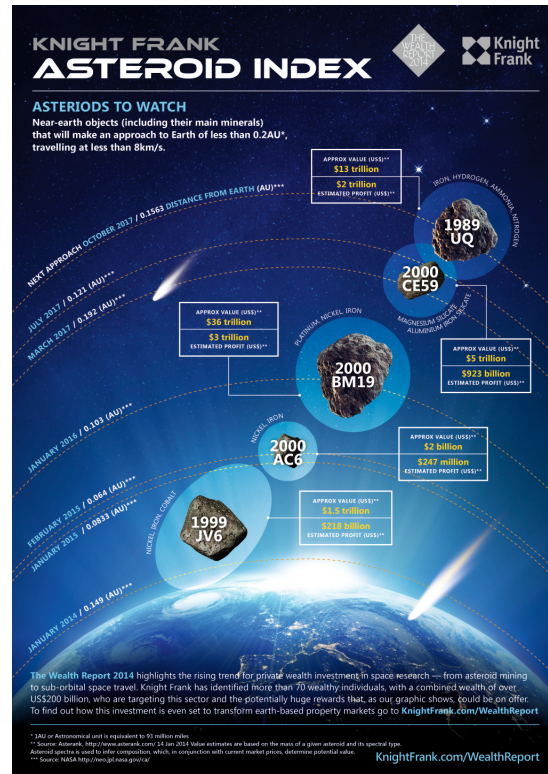
² Chris Lewicki, Planetary Resources, Space Resources Roundtable talk 6/2014

systems.

CCP Games has had a commitment to enacting real science and by recruiting scientific experts to make sure they are teaching it right. They also have a solid fan base that is bringing in millions per month in subscription fees.

GRAPHIC: Asteroids to watch.

<http://qz.com/184502/the-ultra-rich-are-starting-to-like-the-risks-involved-in-asteroid-mining/>



Law: There is also no formal law clearly defining taxation of profits from asteroid mining, though some legal experts contend there is **current US law** that could be adapted to cover it, albeit only for American citizens.

	<p>Michelle Cadieux, MBA. Webmaster TeamPrometheus.org, CEO Creative Communications marketing/ social media. Executive Director Community Safety Programs nonprofit</p> <p>Michelle has been involved with Leeward Space Foundation, LiftPort Space Elevator as the VP, Space.StartupWeekend.org, coach and more. She has worked in satellites with Lockheed, SolSpike.com rocket powered boot with SolarSystemExpress.com. Involvement includes Pong Sat conference with SVSC, LunarCubes.com, and many other events. She's a supporter of XPrize Team Jurban, Saylor MARS sample return and on the board of Team Prometheus.org.</p> <p>She has worked in investment firms, and helped raise \$100,000 for LiftPort Lunar Space Elevator on kickstarter. She been the Researcher Director for the Silicon Valley Business Journal, and worked in venture capital. She has done coaching/ business strategy with Silicon Valley Space Center svsc.org, aand judge and mentor with the conradawards.com and cleantechopen.com. She has won a business plan writing competition and entered about 40 hackathons/ contests in 2012. Michelle has been a computer based trainer and is named on a gaming patent.</p> <p>Her engineering background is in aerospace, satellites, chemical and structural engineering as a FEMA trained emergency/disaster manager/ trainer. Her education is an MBA from San Jose State, CNCP from CA Institute of Nanotechnology, All Hazards training from FEMA EMI, and NASA Systems Engineering Course from Saylor University.</p> <p>http://www.linkedin.com/in/creativecommunications</p>

RESOURCE LINKS: (most likely will be a published page on teamprometheus.org)

PAST CONFERENCE PROCEEDINGS:

http://www.isruinfo.com/index.php?page=srr_14_ptmss

<http://www.asterank.com> Asterank is a scientific and economic database of over 600,000 asteroids with collected, computed, or inferred important data such as asteroid mass and composition from multiple scientific sources. With this information, we estimate the costs and rewards of mining asteroids.

ECONOMIC IMPACT FORECASTS:

<http://www.newrepublic.com/article/117815/space-mining-will-not-solve-earths-conflict-over-natural-resources>

National Space Society statement
<http://www.nss.org/settlement/asteroids/key.html>

The Technical and Economic Feasibility of Mining the Near-Earth Asteroids
<http://www.nss.org/settlement/asteroids/sonter.html>

<https://www.newspaceglobal.com/> New Space Global research reports and monthly journal

LEADS LIST: <http://facebook.com/creativecommunications>
paper submissions, call for abstracts, announce

<http://twitter.com/creativecomm>

(old, but list of contests to check for new ones. <http://facebook.com/liftportal>)

TECHNOLOGY CHALLENGE IDEAS:

Space Mining and Resources Coalition: interested in the big problem statements. See Alexandra Hall

<http://www.gpo.gov/fdsys/pkg/CHRG-110hhrg41799/html/CHRG-110hhrg41799.htm>
NASA is seeking partnerships with other government agencies and the commercial sector to utilize the ISS as a National Laboratory, as designated by the NASA Authorization Act of 2005.

NASA Oxygen Extraction challenge never completed.

LiftPort com Alexandria Big Data Project, developing database to track some of the big questions of what we need to develop

<http://www.isec.org/index.php/activities/space-elevator-competitions> International Space Elevator Consortium Challenges (some of these have never been won)

Flow mechanics of regolith in low gravity, angle of repose, (Kennedy Apollo 16)

Microgravity

MARS 500 mission international

www.fox.com/utopia/ Reality show creating Utopia with small cast 1 year in remote location

Movie, ride to the moon, grow something... (IDreamOfSpace.com offering a ticket)

Government and popular support.

Incremental prizes, not just business plans and companies.

NASA

CONTESTS:

NASA's Fifth Annual NASA Robotic Mining Competition
<http://www.nasa.gov/offices/education/centers/kennedy/technology/nasarmc.html>

NASA ASTEROID GRAND CHALLENGE DATA AND STATION TRACKER OPEN Tracker:

<http://www.mining.com/nasa-is-offering-35000-in-awards-to-asteroid-hunters-93563/>

<http://www.topcoder.com/asteroids/tracker/>

<http://www.topcoder.com/asteroids/>

NASA Centennial Challenge:

http://www.nasa.gov/offices/oct/early_stage_innovation/centennial_challenges/index.html#.U5eA59SwUXs

<http://spaceappschallenge.com> April annual NASA app hackathon with open data.

<https://twitter.com/darksidejam> NASA Dark Side of the Jam Game Developers Conference/ Hackathon

PRIVATE CONTESTS:

<http://CreateTheFuture.com> Design contest.

<http://cleantechopen.com> clean tech

<http://lunarprize.com> Peter Diamandis

<http://synbiobeta.com/person/john-cumbers/> John Cumbers, past SRR speaker on synthetic bio

<http://newspacebpc.com> 2015 business competition, 2014 is lighting pitch (closed) presented at New Space Conference July 2014

<http://ChallengePost.com> govt or post your own

<http://ISEC.org> International Space Elevator Consortium challenges

<http://arielwaldman.com/projects/spacehack/>

GRANTS:

Find a billionaire (good luck!) 1600 on Forbes list. www.forbes.com/billionaires/list/

NASA Innovative Advanced Concepts (NIAC) | NASA

www.nasa.gov/directorates/spacetech/niac/

<http://sbir.gsfc.nasa.gov> SBIR Small Business Innovation Research grants

Space Grant:

<http://www.nasa.gov/offices/education/programs/national/spacegrant/home/#.U5MRF96wUXs>

CROWDFUNDING:

<http://spacefinancegroup.com> consulting.

<http://kickstarter.com> requires video intro and prototype for items you create.

<http://indiegogo.com>

<http://rockethub.com>

<https://experiment.com/> science

<http://petridish.org>

VIDEO:

Create a youtube channel for nonprofits

<https://www.youtube.com/nonprofits>

Create a VIMEO channel:

example: <http://vimeo.com/liftportal>

INCUBATORS:

<http://hackerdojo.com> hacker space near NASA Ames.

<http://roboticsalley.org> Minneapolis

FOUNDATIONS:

<http://www.aiaa.org/secondary.aspx?id=258> AIAA foundation

<http://leewardspacefoundation.org>

<http://spacegambit.org> DARPA funded grants for hackerspaces working on space tech.

<http://thielfoundation.org> Peter Thiel from Paypal and 20 under 20 foundation <http://www.thielfellowship.org/under-20-summit/>

GOOGLE:

It's official, you can now sell your **#space #startup** to Google! **@skyboximaging** agrees to acquisition [.bit.ly/1n3TWjK](http://bit.ly/1n3TWjK)

ASSOCIATIONS:

Space Mining and Resources Coalition

<http://svsc.org> Silicon Valley Space Center

<http://ISDhub.com> International Space Development hub, (virtual)

<https://twitter.com/armenpapaz>

Armen Papazian, Money Mechanics for Space

<http://www.keipr.com/id20.html>

<http://spaceangelsnetwork.com>

submit your company

<https://gust.com/organizations/space-angels-network>

National Space Society

<http://www.nss.org/awards/>

<http://arielwaldman.com/projects/sciencehackday/> Science Hack Day Ambassador Program,
ariel@sciencehackday.org.

Silicon Valley Robotics

www.svrobo.org/

Block party <http://www.svrobo.org/calendar/robot-block-party/>

<http://www.lpi.usra.edu/> Lunar and Planetary Institute

JOBS: \$120-170k due 6/25

<http://www.usajobs.gov/GetJob/ViewDetails/372414100>

Lunar and Planetary Institute

SCHOLARSHIPS:

Space Resources Roundtable awards two scholarships. <http://csmospace.com/events/srr/scholarships.html>

<http://leewardspacefoundation.org>
high school scholarship

GRAD STUDENTS:

SSSERVI July 2014 conference Silicon Valley, @ames. Graduate conference on Small Bodies peer review conference. Travel grant for grad and early post doc.

<http://impact.colorado.edu/lungradcon/2014/registration.html>

STUDENT

GROUPS:

NASA Student
<http://www.nasa.gov/offices/education/programs/descriptions/Students-rd.html#.U5MQsN6wUXs>

Programs:

NASA College Programs:

<http://education.ssc.nasa.gov/highered.asp>

<http://teamprometheus.org> model rocket group and high altitude balloon experiments.

<http://FREDnet.com>

High School:

BEST Robotics

Competition:

<http://www.robotevents.com/robot-competitions/best/>

<http://conradawards.org> HS Innovation Awards

<http://sciencefair.google.com>

<http://pisces.uhh.hawaii.edu> PISCES Hawaii

UNIVERSITY:

International Space University

www.isunet.edu

MARS SAMPLE RETURN PROJECTS FROM SAYLOR:

<http://www.saylor.org/essay-gallery/>

TEENS:

<http://LeewardSpaceFoundation.org> does a high school space scholarship.

<http://www.jpl.nasa.gov/events/inventionchallenge/>

KIDS:

@GeekPartnershipSociety Minneapolis does a space camp grant for elementary school kids.

<http://geekpartnershipsociety.org>

MASCOTS:

<https://www.facebook.com/CamillaSpaceChicken>

Stanford

Solar

Center

chicken

<http://facebook.com/elsieliftport>

LiftPort

Lunar

Space

Elevator

Giraffe

<https://twitter.com/AstronautAbby>

NASA CITIZEN SCIENCE:

science.nasa.gov/citizen-scientists

DiskDetective.org, you'll look at animated images from NASA's WISE space telescope and other telescopes, and help astronomers hunt for good disk candidates among galaxies, asteroids and interstellar dust

PlanetaryResources.com <http://www.planetaryresources.com/2013/06/planetary-resources-calls-on-citizens-of-earth-to-aid-in-planetary-defense/>

<http://bit.ly/KnowAsteroids>

<http://bit.ly/FuelSpace>

www.astrobotic.com

<http://madeinspace.com>

<https://www.idreamofspace.com> raffle for a suborbital ticket

CASSIS will deliver payloads

<http://exploration.esa.int/mars/48523-trace-gas-orbiter-instruments/?fbodylongid=2210>

SSEP | Student Spaceflight Experiments Program

ssep.ncesse.org/

spacefrontier.org/projects/teachers-in-space

CUBE/ PONG SAT:

<http://SVSC.org> Silicon Valley Space Center, and PongSat conference.

<http://jpaerospace.com/pongsat/>

<http://LunarCubes.com> conference

CubeSat

input

to

NASA:

<https://www.newspacewatch.com/articles/73717-nasa-asks-for-input-on-two-cubesat-deep-space-competition-concepts.html>

GAMES:

Astroprenuer:

<http://astropreneur.com>

<https://kerbalspaceprogram.com/> Kerbal / NASA spaceflight simulator

EVE ONLINE GAMING DATA:

<http://www.thonky.com/eve-online-guide/find-ore/>

Angry Birds:

<http://www.nasa.gov/content/nasa-helps-angry-birds-space-find-asteroids-deeper-in-space/index.html#.U5dUhNSwUXt>

(Minecraft: Asteroid 5251 but is more about exploring).

Asteroid Mining Empire

www.freeonlinegames.com/game/asteroid-mining-empire

www.coolgames.com/asteroid-mining-empire.html

The Space Game

www.candystand.com/play/the-space-game

Ascent

www.thespacegame.com

Star Miner:

www.moddb.com/games/asteroid-miner

EMAIL ME WITH ADDITIONAL RESOURCES:

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