

Perspective on Benefit in Lunar and Space Resources Development

MVA Webinar Series:
Governance of Global Moon Exploration and Settlement
Episode 3 – Sharing the Benefits of Lunar Activities
September 8, 2020

Ian Christensen
Director of Private Sector Programs
Secure World Foundation

A Busy Time for the Moon...

Projected Exploration Missions (2020-2030)

Data include announced missions, with dates as announced, and projected missions (likely missions such as typical supply missions to space stations), with estimated dates.

BRYCE
space and technology

Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
SpaceX Crew	1	1	1	1	1	1	1	1	1	1	1
Northrop Grumman Cargo	2	3	2								
Sierra Nevada Corp.		1	1								
Cargo Dragon		1	4	4	4	4	4	4	4	4	4
Dragon 2 Endeavour	1										
Boe-DFT 2	1										
Boe-CFT	1										
Crew 100	1	2	2	2	2	2	2	2	2	2	2
Soyuz Crew	4	2	2	2							
Orel Crew		2	2	2	2	2	2	2	2	2	2
Progress	2	2	2	2	2	2	2	2	2	2	2
HTV	1	1	1	1	1	1	1	1	1	1	1
Axiom 1		1	1	1	1	1	1	1	1	1	1

Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Shenzhou	1	1	1	1	1	1	1	1	1	1	1
NG Shenzhou	1										
Tianhe	1										
Wentian	2										
Mengtian	1										
Xuntian		1									
Tianzhou	1	1	1	1	1	1	1	1	1	1	1

Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Chang'e 5		1									
Chang'e 6				1							
Chang'e 7					1						
Chang'e 8						1					

Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Luna-15			1								
Luna-26				1							
Luna-27					1						
Luna-28 (sample return)						1					
Luna-29							1				
(Over)screwed circumnavigation)								1			
Orel (over)screwed circumnavigation)									1		
Orel (crewed landing)										1	

As of August 31, 2020

150 Crew and cargo missions to LEO

First crewed landing since 1972

95 Missions to the Moon

Missions to Mars

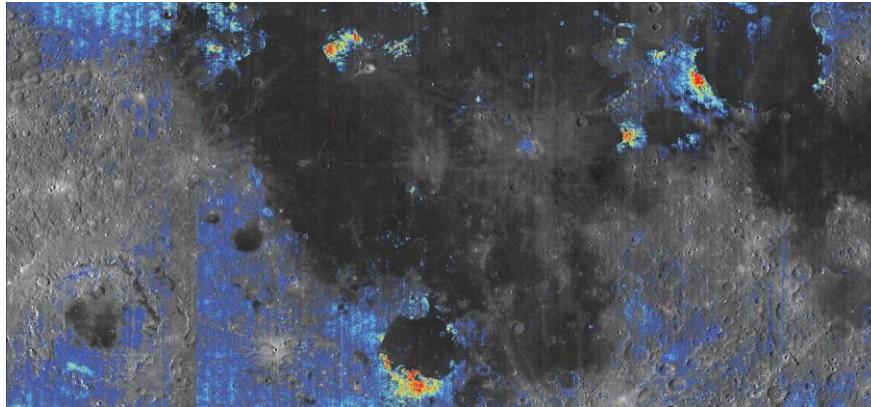
Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Mars 2020	1										
NASA MMG Sample Return Mission									1		
NASA MMG Mission TBD 1										1	
NASA MMG Mission TBD 2											1

Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Tianwen 1 Rover	1										

Mission	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ExoMars 2022		1									
Managaya-2			1								
JAXA M3				1							
JAXA TEREX 2					1						
JAXA MMX						1					
JAXA Hope							1				

Space Resources – Opportunity and Need

- Living in space for long periods of time will require making use of available resources
- Both the Moon and asteroids contain useable deposits of water and other natural resources which can support exploration activities
- Water can be processed into rocket fuel while other resources can be used to support other infrastructure development
- Fuel sourced from in-space resources offers the potential to lower the cost of in-space applications and enable broader and more sustained exploration activities



Space resource utilization is a gateway capability for human space exploration and a sustained human presence beyond low Earth orbit

Observations on Industry Positions

- Commercial or private lunar exploration & space resources industry segments are new and in-early stage
 - Most activity in the near-medium term will be closely associated with government programs & government customers
- Companies are under pressure to demonstrate technical viability and to fly successful technology demonstration missions
 - Companies also responding to investor pressure – need to demonstrate progress towards executing business plans
- Profit motivated – of course – but also a motivation of expanding humanity's access to space
 - Industry concerns about benefit being defined in purely monetary terms
- Industry actors looking for regulatory certainty – but concerned about too much regulation. Need for adaptive governance
- Industry actors interested in broad partnerships, but may be uncertain about the best ways to partner with emerging space countries





But What About:

MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV
TECH

Space mining could become a real thing — and it could be worth trillions

PUBLISHED TUE, MAY 15 2018 12:39 AM EDT | UPDATED TUE, MAY 15 2018 7:00 AM EDT

Andrew Wong

SHARE f t in e

KEY POINTS

- Minerals that lie in the belt of asteroids between Mars and Jupiter hold mineral wealth equivalent to about \$100 billion for every individual on Earth.
- Quickly evolving technology is making landing on asteroids an increasing likelihood.



FACEBOOK ADVERTISING
Political ads ban? 🚫

DATING-APP BOTS ❤️
How to spot a bot

WRONGFUL ARRES
Face recogn

News Sports Entertainment Life Money [Tech] Travel C

NATION NOW

NASA planning mission to an asteroid worth \$10,000 quadrillion

Sean Rossman USA TODAY

Published 7:18 a.m. ET Jan. 18, 2017 | Updated 1:48 p.m. ET Jan. 18, 2017

Goldman predicts the world's first trillionaire will mine asteroids

GLOBAL investment banking, securities and investment management firm Goldman Sachs believes it knows the key to becoming the richest person alive.



Matthew Dunn [@mattydunn11](#) 1 comment

news.com.au APRIL 25, 2018 12:51PM

Business and technical plans for returning resources to Earth are very speculative. And the economic assumptions require further analysis...

Benefit From Space Resources & Lunar Development

The Outer Space Treaty

- Preamble: “Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,...”
- ARTICLE I: “The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.”

- What is benefit? How do we define it? How do we communicate it?
 - *Need not be – should not be monetary – in nature*
- Participation of, and impact on, emerging or developing space states
- Identification of responsible and sustainable space resources utilization practices
 - Can we leverage experience/examples from other domains: e.g. Nagoya Protocol on Access and Benefit-sharing
- Hague International Space Resources Governance Working Group – Building Block on Benefit
- MVA Principles - #2 on Benefit Sharing

Benefit Sharing Topics - Broadly



Five Analysis Topics

1. Social License to Operate
2. International Cooperation Models
3. Principles for Responsible Investment
4. Capacity Building for Space Resources
5. Data Sharing and Lessons Learned

Capacity Building for Space Resources

- Increase participation and engagement by stakeholders whom are not directly involved in or space resources activities.
- Includes policy, technical, and business awareness
- Partnerships and data sharing
- Successful models in particular in Earth observation segment

Principles for Responsible Investment

- Recommend that separate set of principles be created specifically for Responsible Investment in Space Resources activities
- Informing factor for the future development of industry operator focused best practices and/or standards
- Helps to consider sustainability

Key Issues Moving Forward

- Identification and/of description of **global benefits** from space resources & lunar development
- **Resource access rights** – balancing “non-appropriation” vs. “freedom of exploration and use”
 - International claim and registration system?
 - Historic/heritage sites / sites of scientific interest?
 - Balancing commercial use vs. scientific use
- Establishing **safe operations** practices / principles for lunar activities
 - Lunar dust mitigation
 - Cis-lunar SSA
 - Safety zones?
- **Coordination** of various national laws/regulations/policies

General need for increased communication and dialogue between space resources development & the international policy/legal communities

Thank You

Ian Christensen

ichristensen@swfound.org

Direction of Private Sector Programs

Secure World Foundation