

NISE Net Online Workshop

The Science Behind the 2020 Explore Science Earth and Space Toolkit – Asteroid Mining

Tuesday, March 24, 2020



Welcome!

Today's presenters are:

- **Jeannie Colton**, Arizona State University, AZ
- **Max Cawley**, Museum of Life and Science, NC
- **Jonathan Wiener**, Duke University, NC
- **Jim Bell**, Arizona State University, AZ

As we wait to get started with today's discussion, please:

Introduce yourself! Type your name, institution, and location into the Chat Box

Questions? Feel free to type your questions into the Chat Box at any time throughout the webinar or use the raise your hand function in the participants list and we'll unmute your microphone.

Today's discussion will be recorded and shared on nisenet.org at: nisenet.org/events/online-workshop



Today's Presenters



Jonathan Wiener, William R. and Thomas L. Perkins Professor of Law; Professor of Environmental Policy; and Professor of Public Policy – Duke University



Jim Bell, Professor, School of Earth and Space Exploration
Arizona State University



Max Cawley
Program Manager:
Learning Philosophy
& Evaluation –
Museum of Life and
Science



Jeannie Colton
Program Coordinator
School for the Future
of Innovation in
Society Arizona State
University

The Science Behind the 2020 Explore Science: Earth and Space Toolkit – Asteroid Mining



10 min

Jeannie Colton & Max Cawley Asteroid Mining hands-on activity overview

10 min

Jonathan Wiener, Duke University Space Law

10 min

Q & A from our audience

15 min

Jim Bell, Arizona State University Space mining: A current assessment

15 min

Q & A from our audience

Submit your questions...

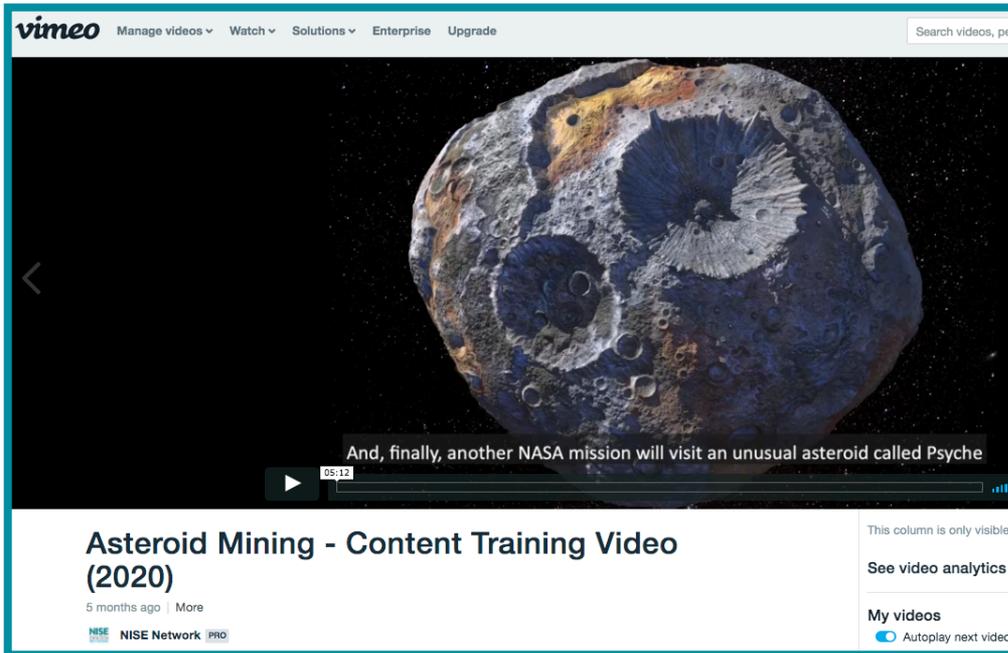
We will be collecting your Questions in the chat window to your right throughout the talk.

We will go through these questions in the Q&A section of the webinar. Those we don't get to today we will reply over email.



...in the chat box.

2020 Explore Science: Earth & Space Toolkit + Videos



Watch all the facilitation and content training videos:
<https://vimeopro.com/nisenet/explore-science-earth-space>



Download the 2020 digital toolkit now:
<http://www.nisenet.org/earthspacekit-2020>

Asteroid Mining



EXPLORE SCIENCE

EXPLORING THE SOLAR SYSTEM

Asteroid Mining

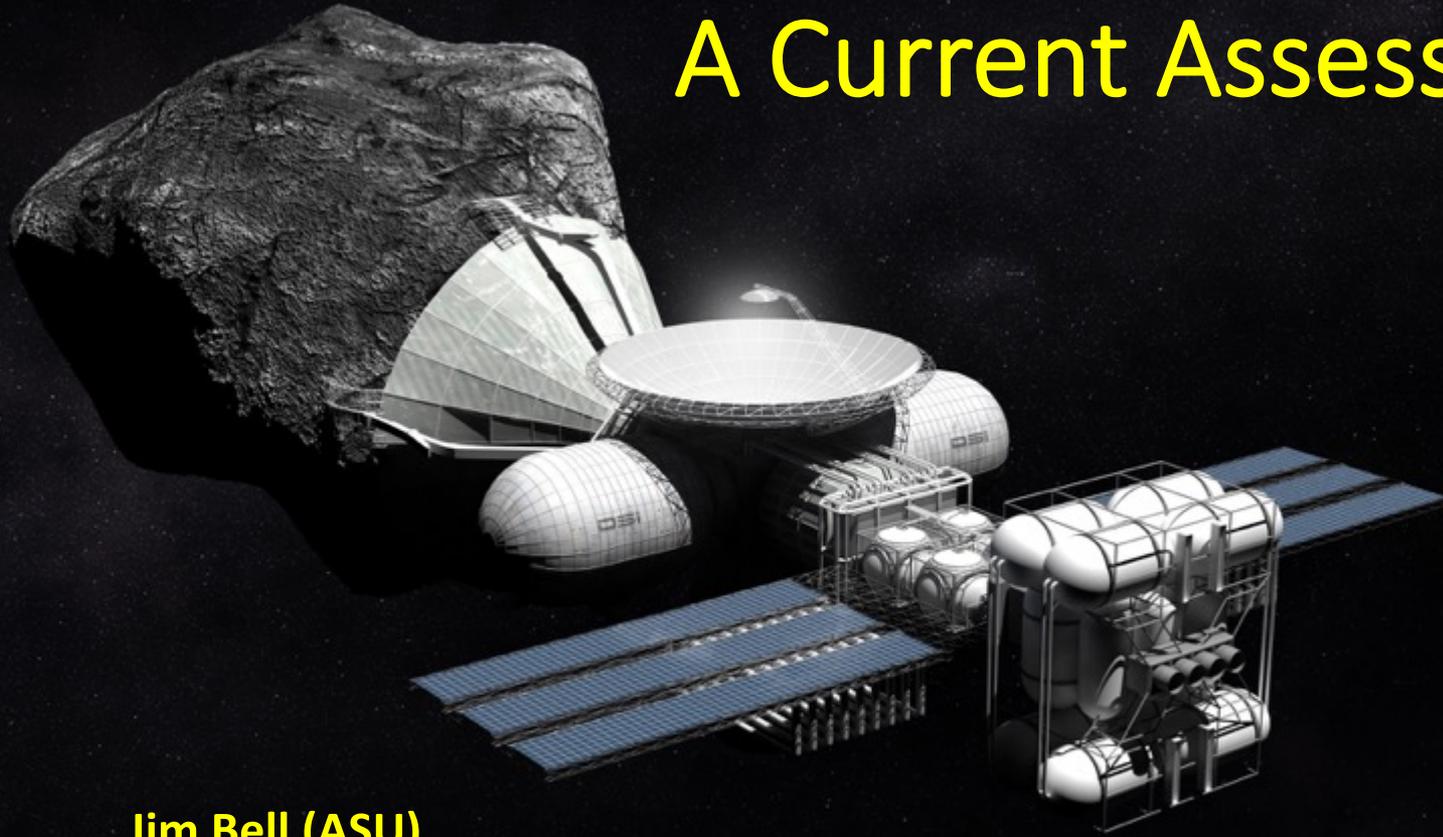
Imagine a future where we could mine asteroids.



SPACE LAW

Jonathan Wiener

Space Mining: A Current Assessment



Jim Bell (ASU)
NISENET Presentation
24 March 2020

Artwork credit:

DSI
DEEP SPACE INDUSTRIES

FUEL PROCESSOR CONCEPT
BRYAN VERSTEEG
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Space Mining: A Current Assessment

- What resources exist/are needed from/in space?
 - "Economic" importance
 - "Exploration" importance
- Space Prospecting vs. Space Mining
- Challenges of Space Mining
- Predicting the Future...

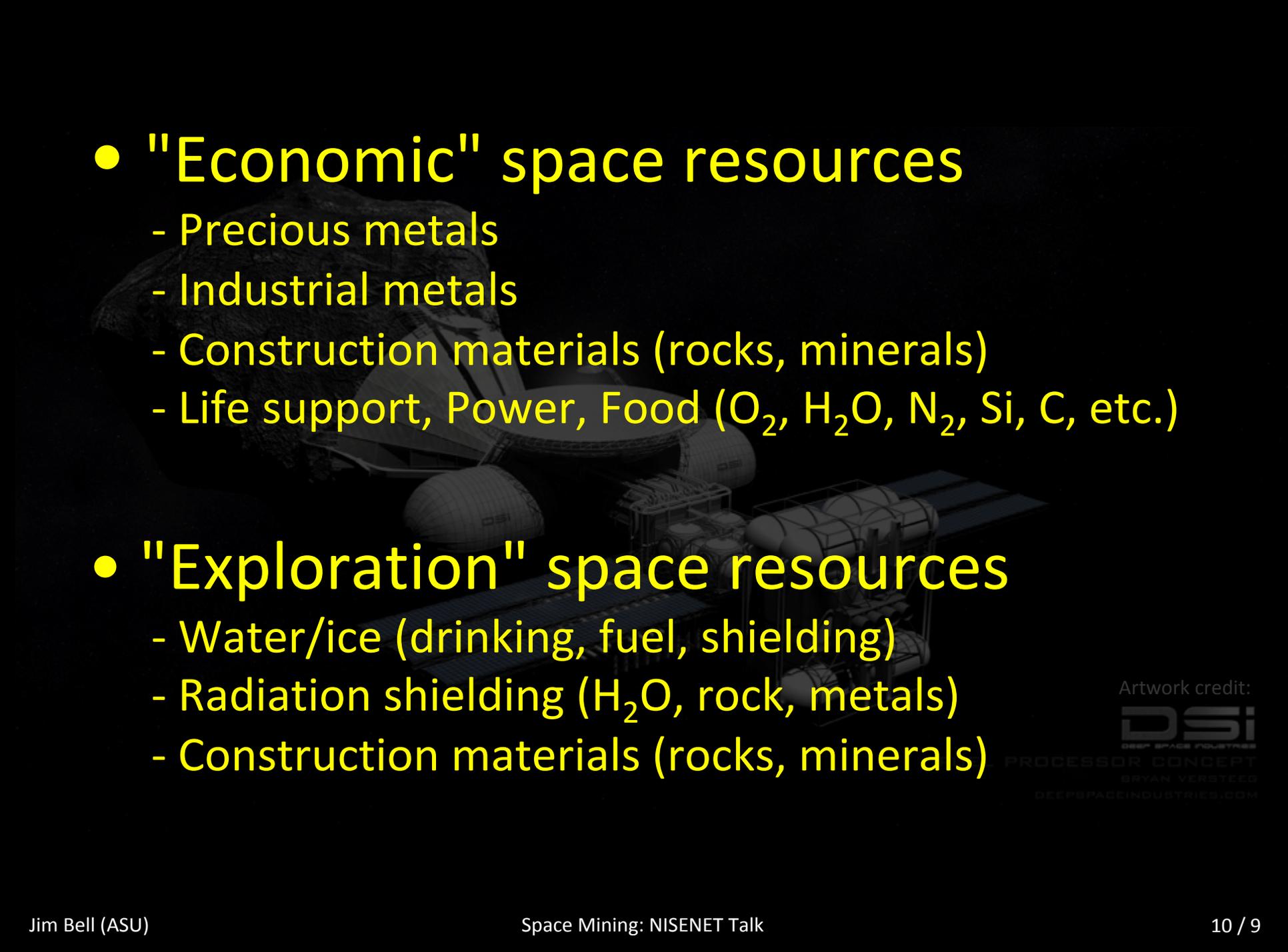
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- "Economic" space resources

- Precious metals
- Industrial metals
- Construction materials (rocks, minerals)
- Life support, Power, Food (O_2 , H_2O , N_2 , Si, C, etc.)

- "Exploration" space resources

- Water/ice (drinking, fuel, shielding)
- Radiation shielding (H_2O , rock, metals)
- Construction materials (rocks, minerals)

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PROCESSOR CONCEPT
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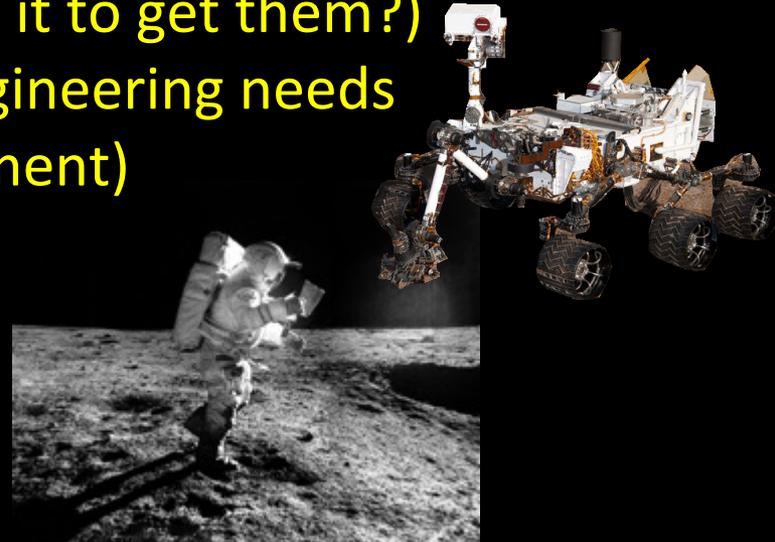
Space Prospecting vs. Space Mining



- Space Prospecting, like prospecting for resources on the Earth, involves:
 - Remote Sensing (where are the resources?)
 - Field/lab work (are they really there?)
 - Extraction experiments (how hard is it to get them?)
 - Accurate prediction of costs and engineering needs
 - Funding and ROI (investors, government)

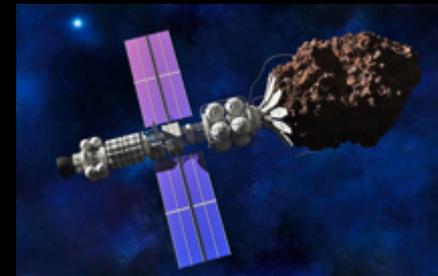
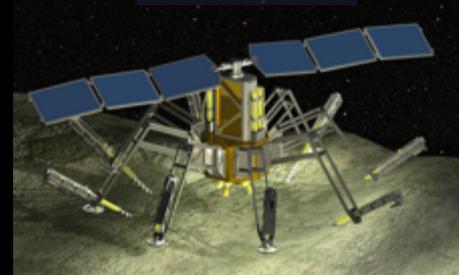


- What is happening today is Space Prospecting



Space Prospecting vs. Space Mining

- Space Mining, like mining for resources on Earth, will need to involve:
 - Engineering/tech dev of NEW equipment:
 - Low/no gravity; Ultra-low T, P; High rad, Low Power, ...
 - Field-deployed equipment and people (at scale)
 - Constant maintenance/safety vigilance
 - Much logistical support (transport, "life support", etc.)
 - Continuous "proving out" laboratory work
 - Funding and ROI (investors, government)



Challenges of Space Mining

- Space Mining today is mostly science fiction...
 - But that's OK!
 - Earth mining takes DECADES to yield ROI
 - Earth mining requires significant prospecting work
 - Earth mining requires significant tech development

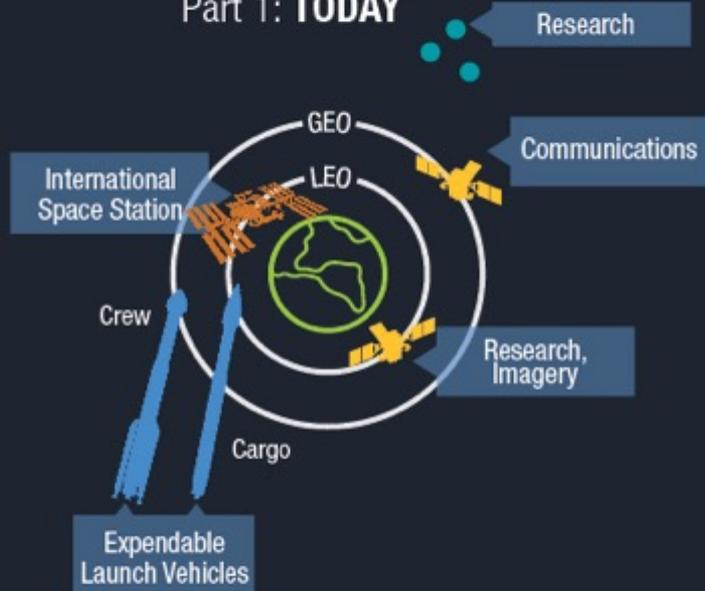
 - Space Prospecting is happening now!
 - That is defining the new needed engineering/tech work
 - Much needed tech development also helps exploration
 - Getting the future work force excited is key!

Predicting the Future...



Road Map to the CisLunar-1000 Economy

Part 1: TODAY



GROSS SPACE PRODUCT \$330B/YR

POPULATION x 5



Part 2: 5 YEARS



GROSS SPACE PRODUCT \$500B/YR

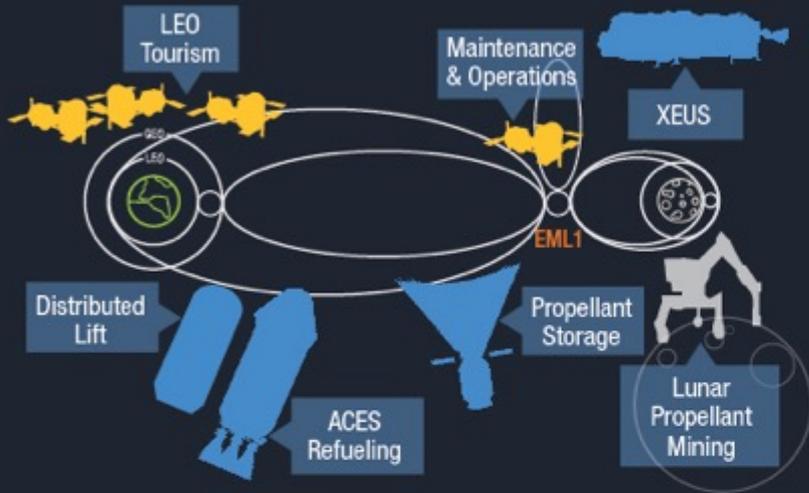
POPULATION x 20



see <https://www.youtube.com/watch?v=BXHQn82TLKQ>

Predicting the Future...

Part 3: 15 YEARS

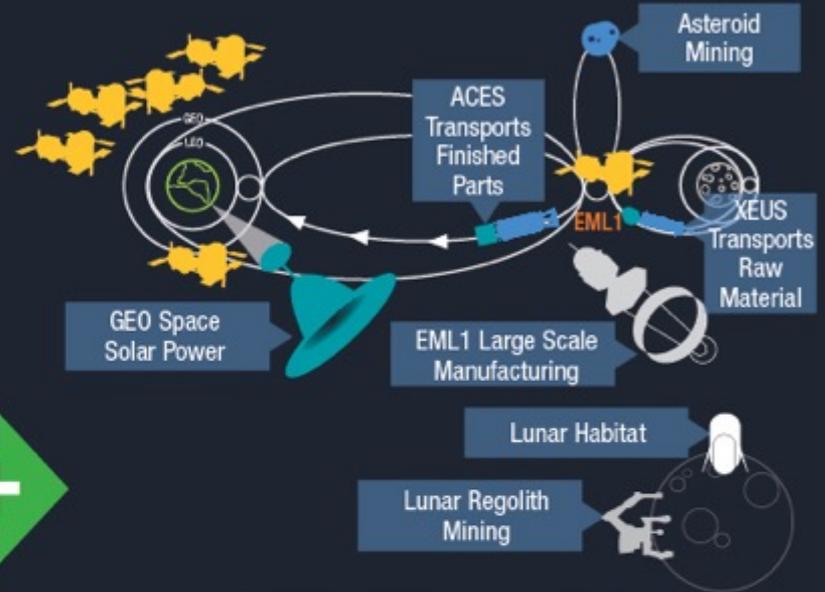


GROSS SPACE PRODUCT \$900B/YR

POPULATION x 300



Part 4: 30 YEARS



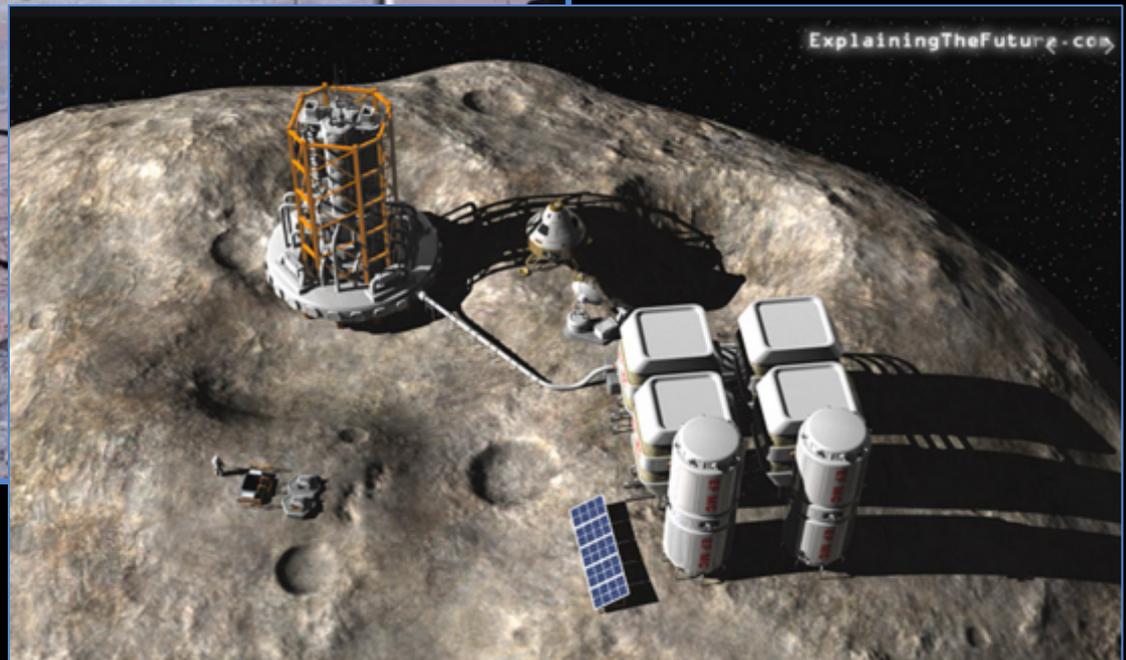
GROSS SPACE PRODUCT \$2.7T/YR

POPULATION x 1,000



see <https://www.youtube.com/watch?v=BXHQn82TLKQ>

Making the Future...



Questions?

Upcoming Online Workshops



NISE Network Online Informal Get-Together

Tuesday, March 31, 2020

2pm-3pm Eastern / 11am-12pm Pacific

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Thank You

