



# 10<sup>th</sup> JOINT MEETING



**SPACE RESOURCES  
ROUNDTABLE**



Colorado School of Mines  
June 11-14, 2019

# SRR-PTMSS Technical Committee



**Leslie Gertsch (MST)**



**Louise Procktor (LPI)**



**Dale Boucher (Deltion)**



**Angel Abbud-Madrid (CSM)**

## CSM Conference Organization & Logistics

Melody Francisco, Becca Guillen, and Jennifer Graser

## Session Chairs & students

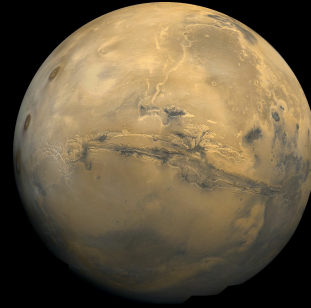
# SRR I ... 1999



**Needed to develop space  
resources industry:**

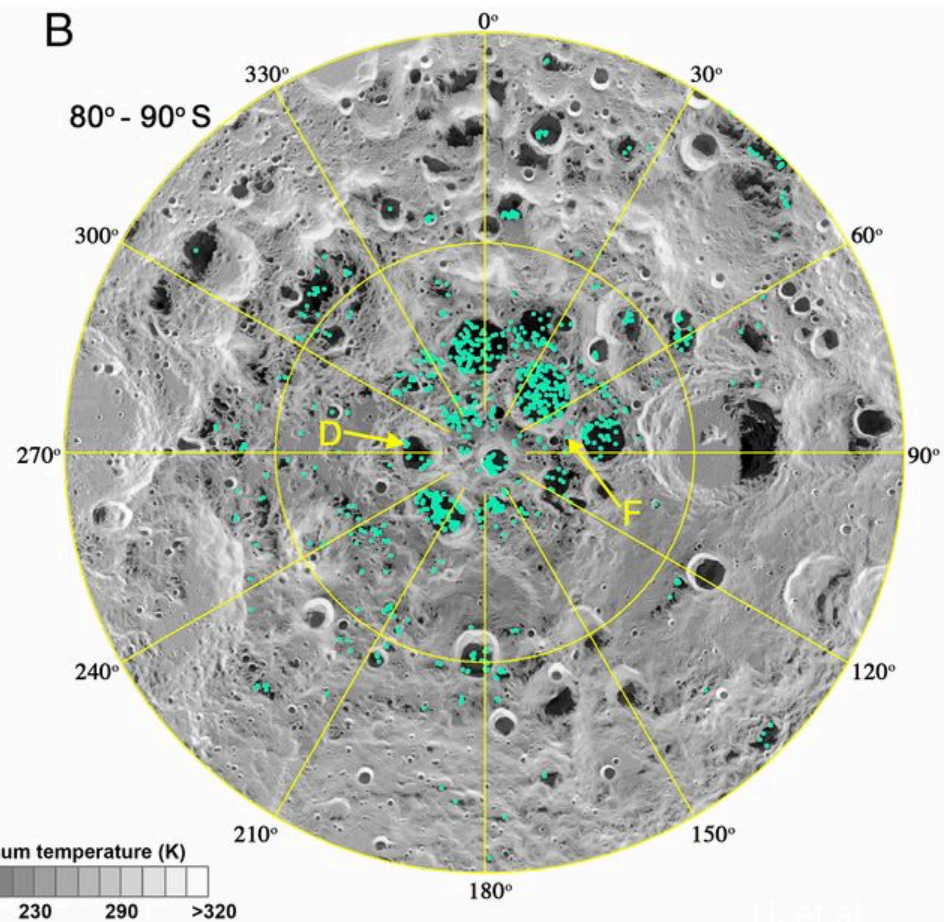
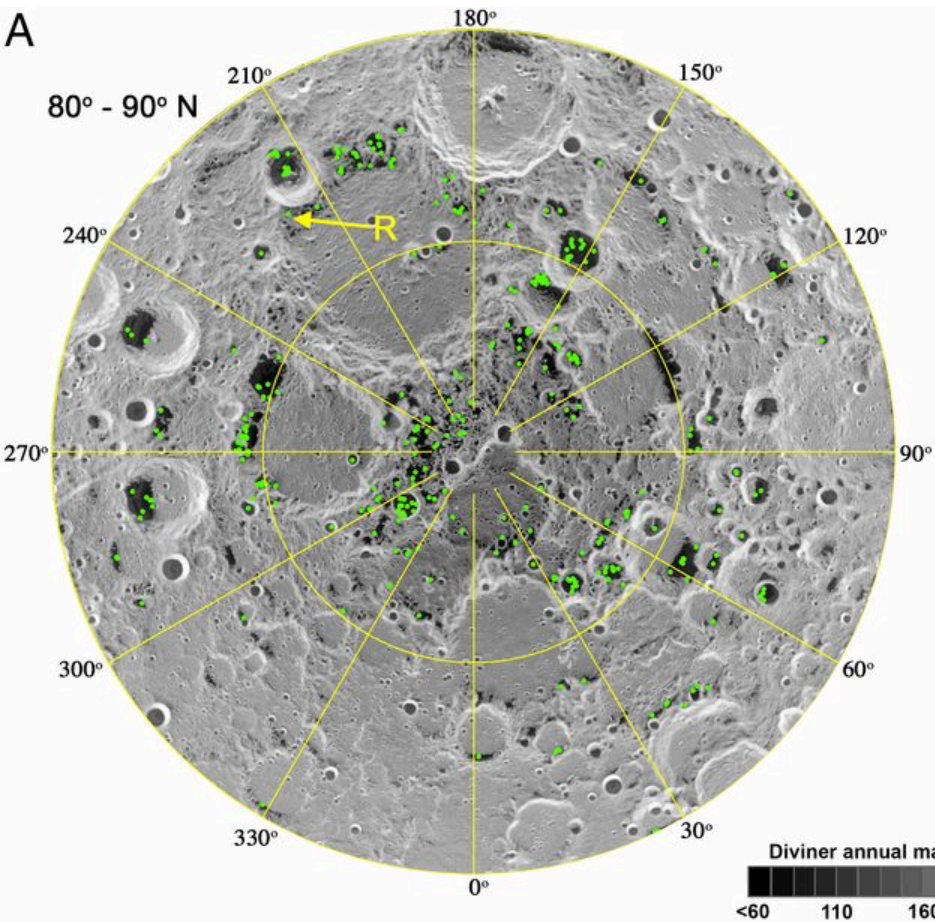
**A recoverable resource,  
technology to recover it,  
and a customer.**

**SRR XX ... 2019**



**Developments in space  
resources since last year ...**





Li, et al

● Ice exposures constrained by M<sup>3</sup>, LOLA, and Diviner

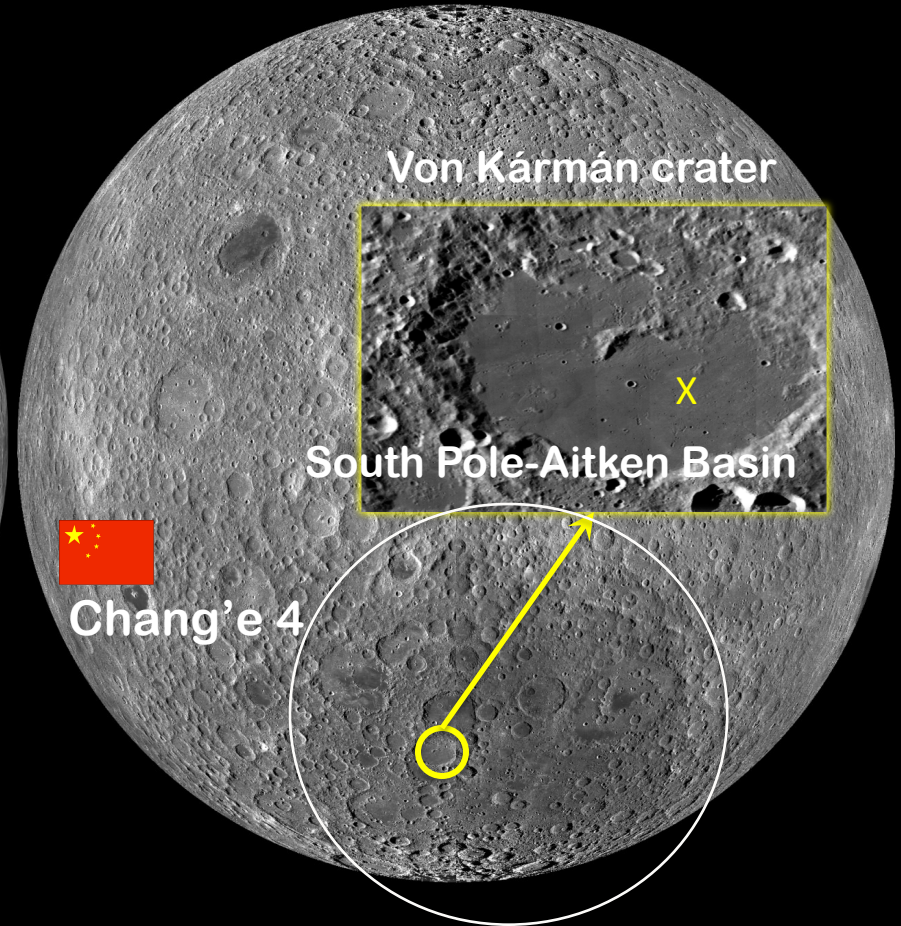
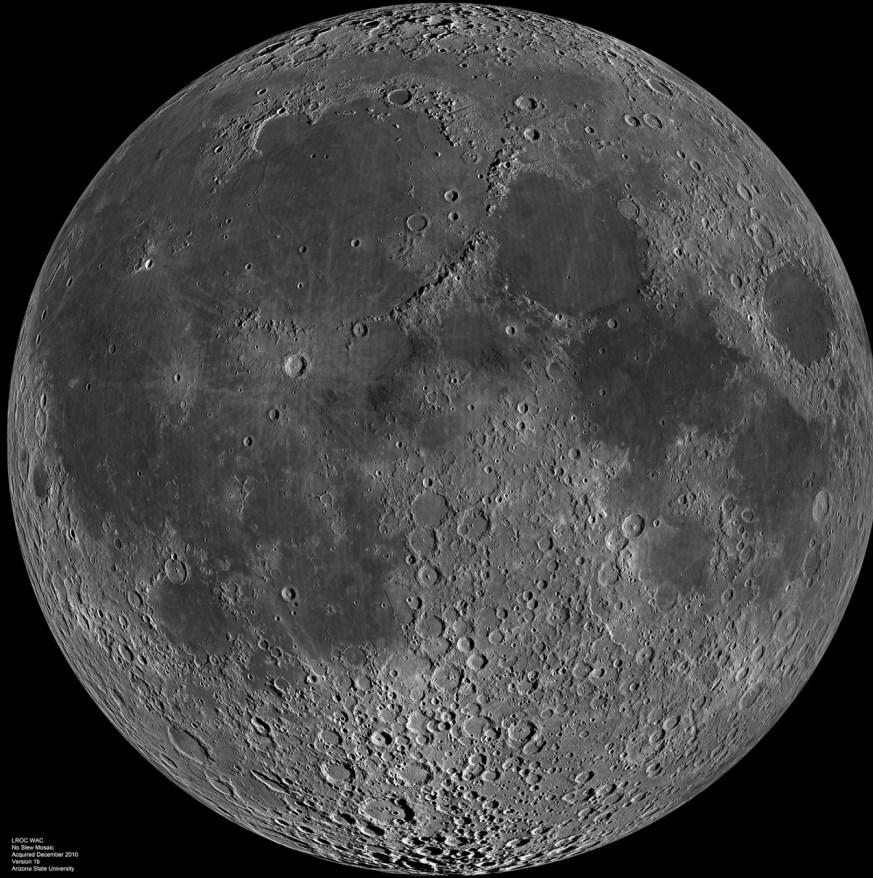
● Ice exposures constrained by M<sup>3</sup>, LOLA, Diviner, and LAMP

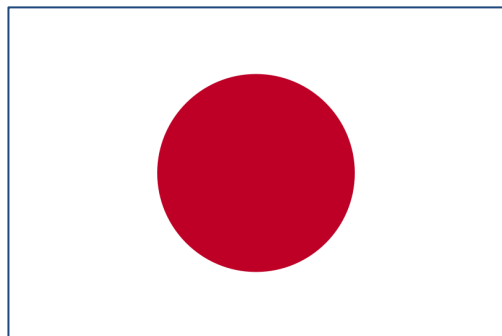
Li, et al (2018)

Near Side

# Moon activities:

Far Side







EXPLORE MOON *to* MARS

WHAT'S DIFFERENT?

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We're Going Forward to the Moon to Stay



**Commercial Lunar Payload Services (*CLPS*)**

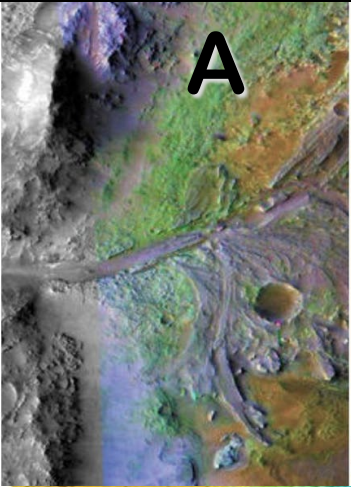
DRAPER



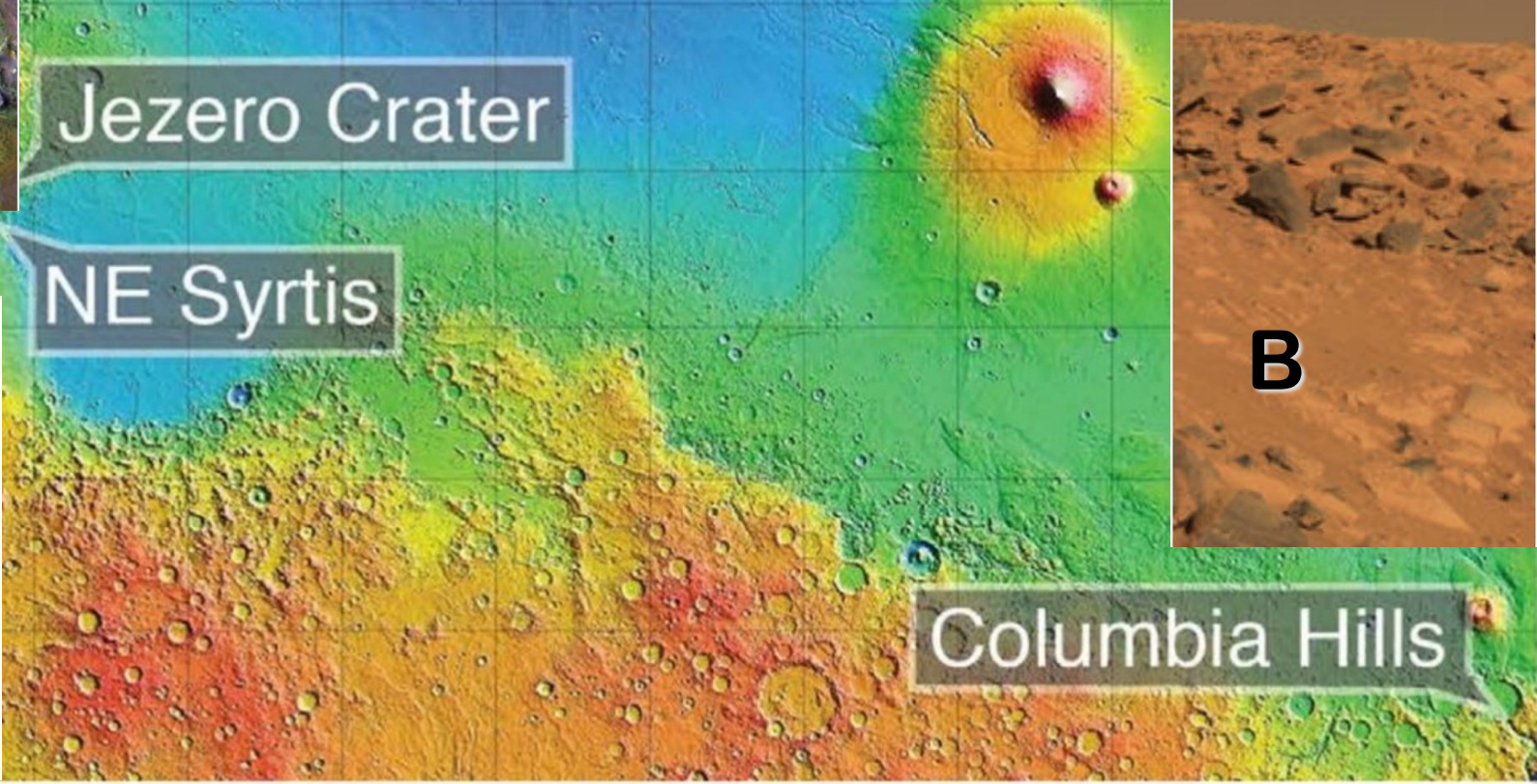
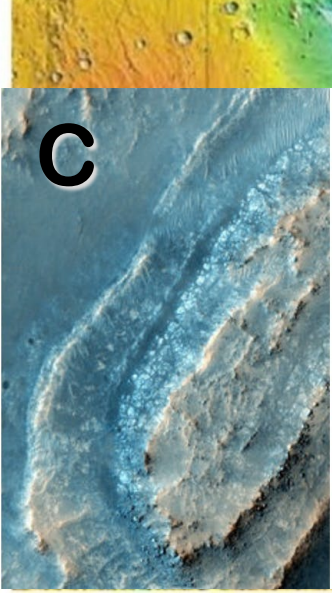
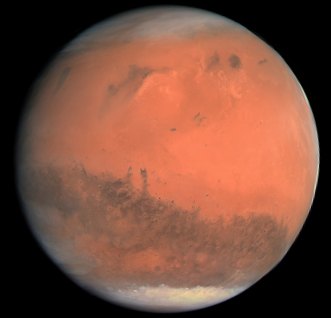
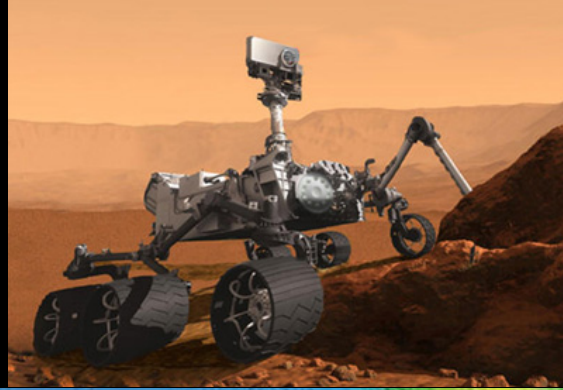
ORBITBeyond



# Mars activities:

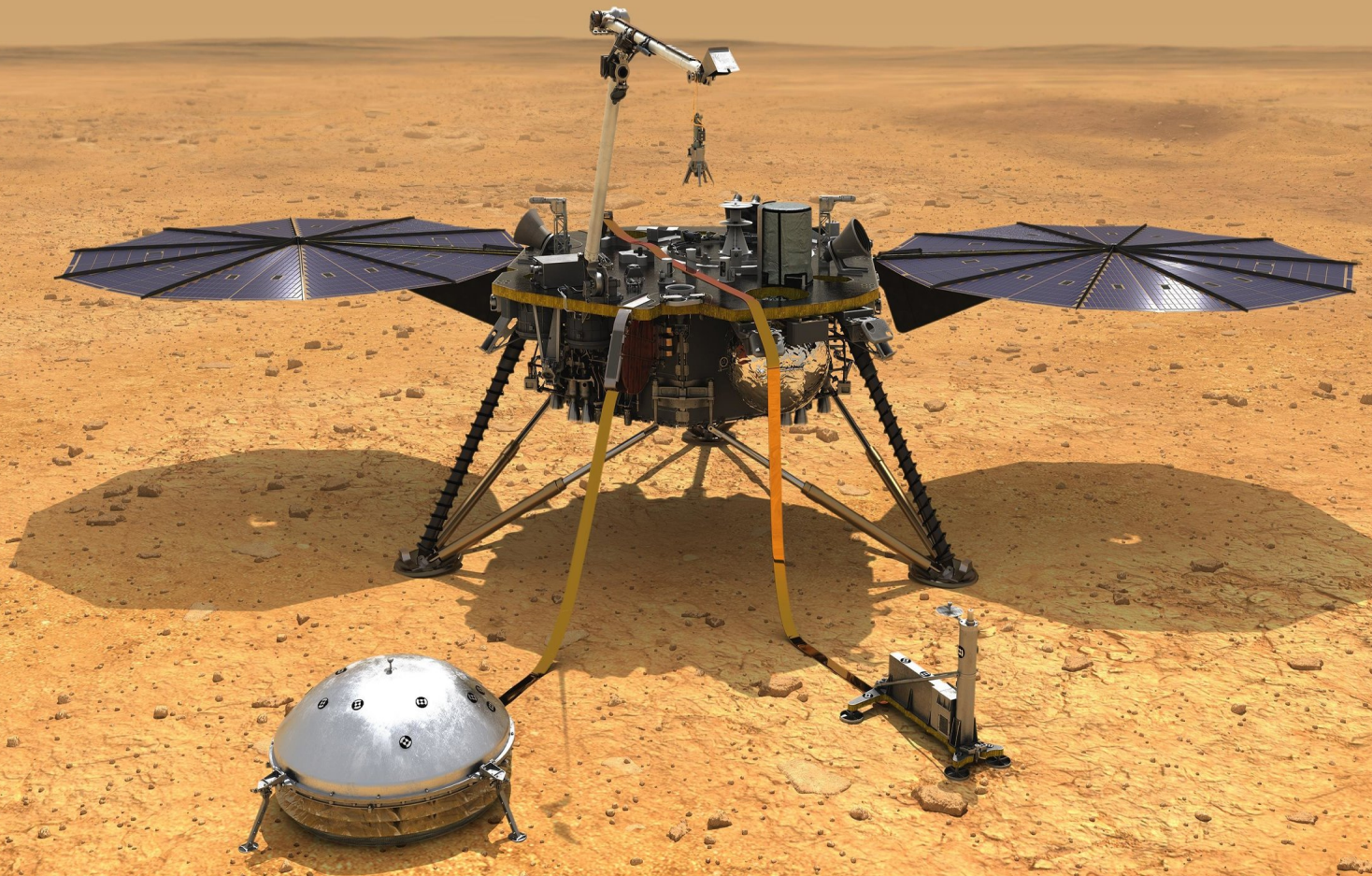


Mars 2020

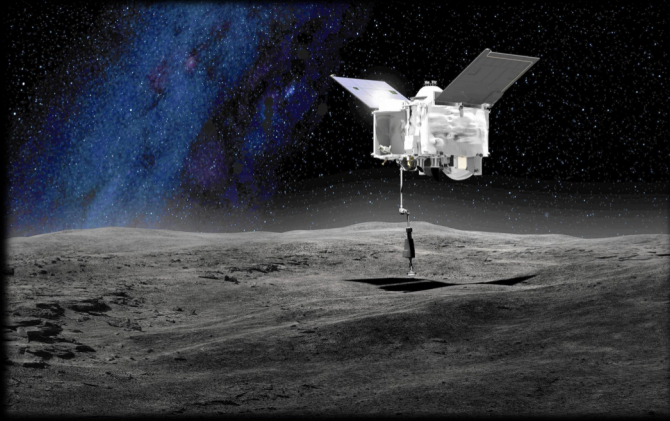




# MARS InSight Mission



# Asteroid activities:



Bennu

OSIRIS-REx

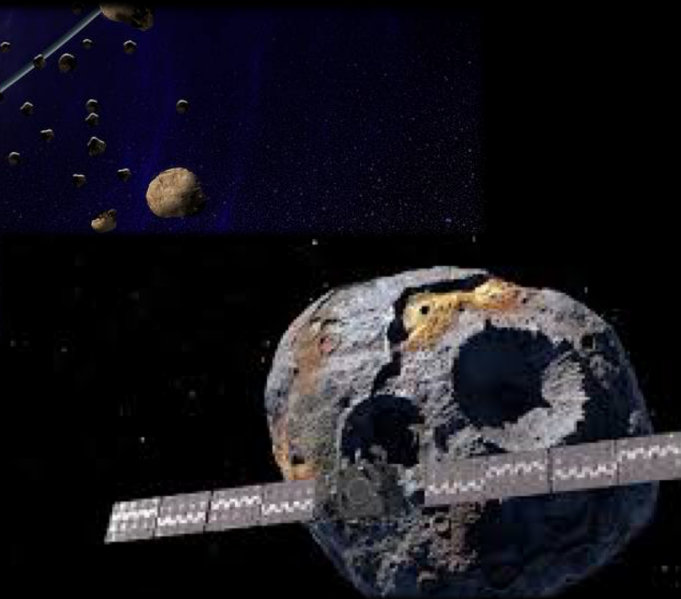


Hayabusa-2

Ryugu



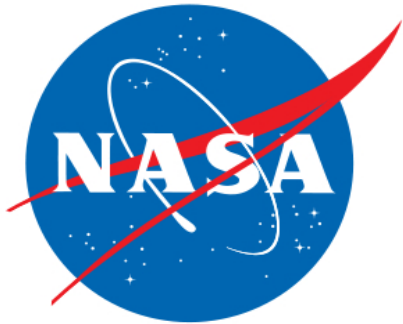
Lucy



Psyche



# USA activities:

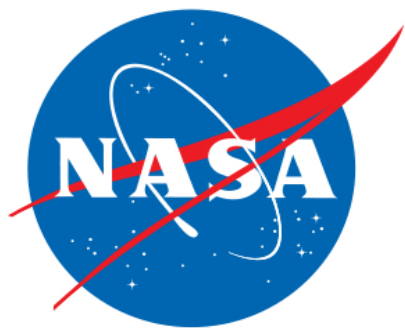




[Space.com](#) > [Tech](#)

# The US Geological Survey Is Getting Serious About Space Resources and Mining

By Leonard David, Space.com's Space Insider Columnist | September 4, 2018 07:00am ET



## That Moon Colony Will Be a Reality Sooner Than You Think

By Wilbur Ross

Mr. Ross is the secretary of commerce.



# International activities:

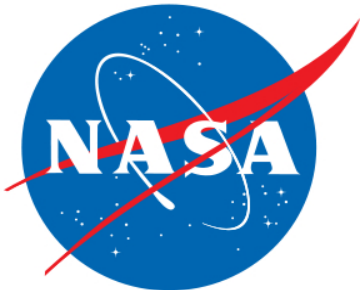


United Arab Emirates

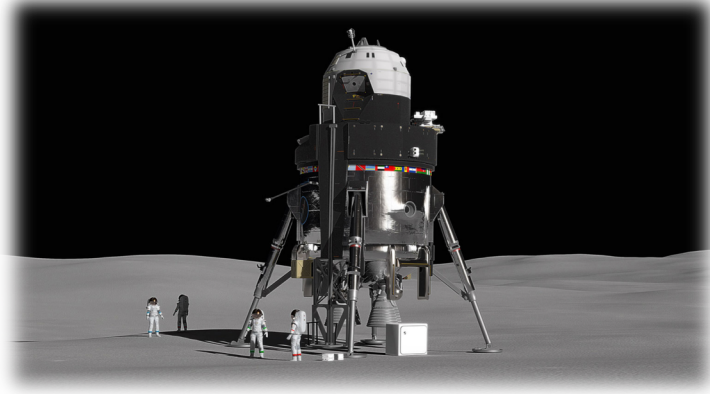
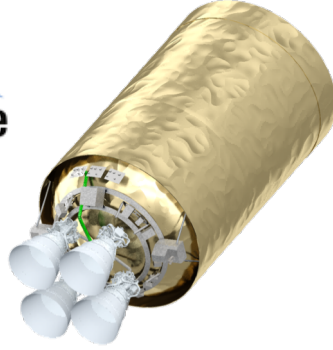
وكالة الإمارات للفضاء  
UAE SPACE AGENCY



Australian  
Space Agency



# Private sector activities:





## Elon Musk: In Seven Years, SpaceX Could Land Humans on Mars

The entrepreneur's updated plan calls for a giant rocket that could send humans to Mars—and possibly the moon—by 2024.



*Jeff Bezos Unveils Blue Origin's Vision for Space, and a Moon Lander*





# Policy, outreach, and legal activities:

## The Hague International Space Resources Governance Working Group



**AIRBUS**

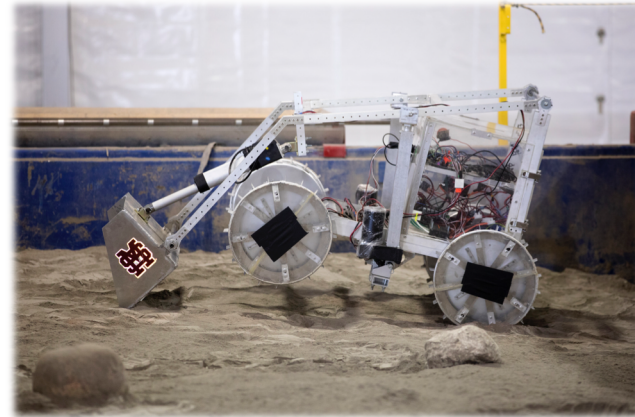
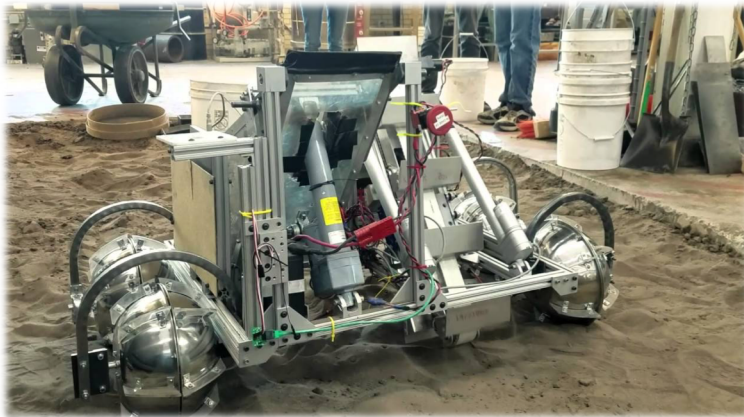
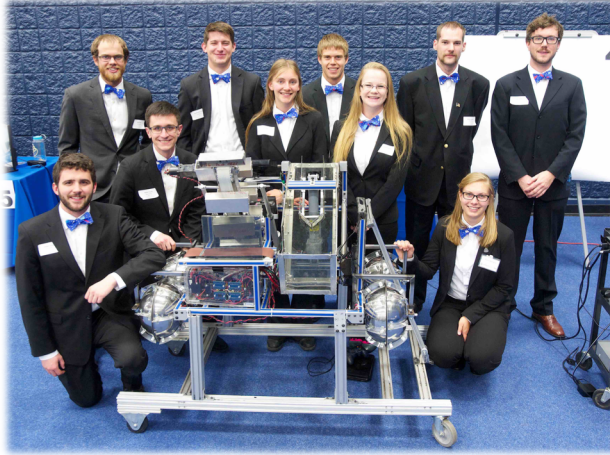


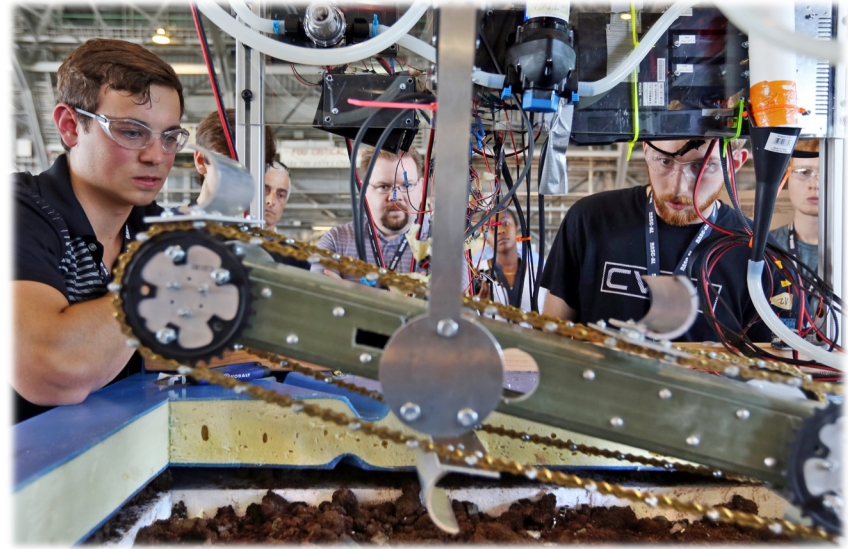
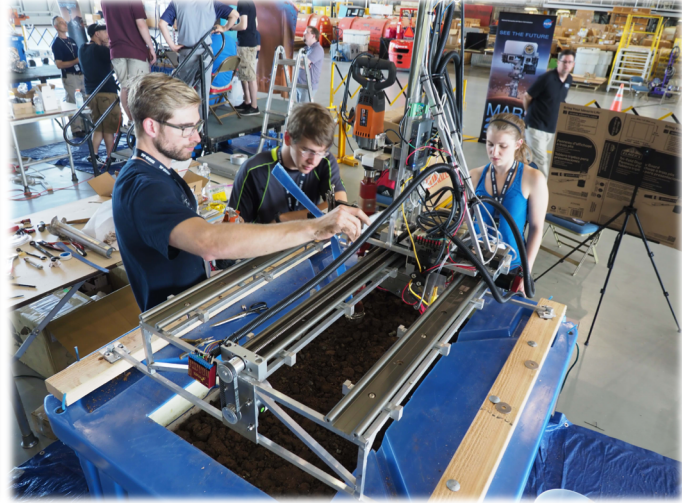
**DRAFT BUILDING BLOCKS  
FOR THE DEVELOPMENT  
OF AN INTERNATIONAL FRAMEWORK  
ON SPACE RESOURCE ACTIVITIES**

September 2017



# University activities:





Design, build + create  
in this \$2.25M challenge.  
Open now for registration.

*Click here  
for rules,  
info and  
registration.*

# 3D Printed Habitat CHALLENGE





# SPACE RESOURCES PROGRAM

COLORADO SCHOOL OF MINES



First program in the world educating scientists, engineers, economists, entrepreneurs, and policy makers in the field of space resources

## **DEGREE OFFERINGS (Launched Fall 2018)**

- Post-baccalaureate Certificates
- Master of Science Non-Thesis
- Ph.D.

SPRS501

## SPACE RESOURCES FUNDAMENTALS

[START HERE](#)[GETTING HELP](#)

SPRS502

## SPACE SYSTEMS ENGINEERING

COLORADO SCHOOL OF MINES

[START HERE](#)

## WEEK ONE

We will cover everything you need to know about space resources. We will also identify its uses and explore resources utilization plans.



## WEEK ONE

Review general course information, get to know your classmates and be introduced to systems engineering and space systems.



## WEEK TWO

Explore the Needs Analysis phase of the system development lifecycle.

## WEEK THREE

Explore the system development lifecycle.



## WEEK ONE

SPRS503

## SPACE RESOURCES SEMINAR

COLORADO SCHOOL OF MINES



COLORADO SCHOOL OF MINES

SPRS598

## ECONOMICS OF SPACE RESOURCES

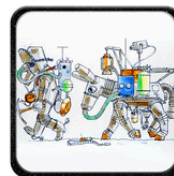
[→ START HERE](#)[▶ ZOOM LINK](#)[📁 STUDENT RESOURCES](#)

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COLORADO SCHOOL OF MINES

SPRS591

## SPACE RESOURCES DESIGN PROJECT I

[START HERE](#)[GETTING HELP](#)

## MODULE ONE

In this module we will review concepts in space resources and systems engineering and introduce the design problem.

## MODULE TWO

In this module groups will begin the design process by developing mission/system concepts.

## MODULE THREE

In this module groups will develop requirements for their mission/system design.

## MODULE FOUR

In this module groups will complete a preliminary design review of their mission/system design.

\* Fully online program

\* Worldwide reach

\* Asynchronous/Synchronous



# SPACE RESOURCES PROGRAM

COLORADO SCHOOL OF MINES



- Professions:
  - Scientists & engineers
  - Economists
  - Policy analysts
  - Entrepreneurs
  - Investors
  - Lawyers
- \* 45 students (30 more in Fall)
- \* From 4 continents
- \* From 12 countries
- \* From 3 Space agencies
- \* Industries:
  - Aerospace
  - Mining, metals, oil & gas
  - Chemical, mechanical
  - Computer science

# Sponsors

**HONEYBEE** ROBOTICS  
Spacecraft Mechanisms Corporation



**LOCKHEED MARTIN**



**Deltion**  
Innovations Ltd



**Advanced**  
SPACE



**TELEDYNE**  
BROWN ENGINEERING  
Everywhere **you** look™

Lunar and Planetary Institute



**COLORADO SCHOOL OF MINES**  
EARTH • ENERGY • ENVIRONMENT



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ROUNDTABLE**



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