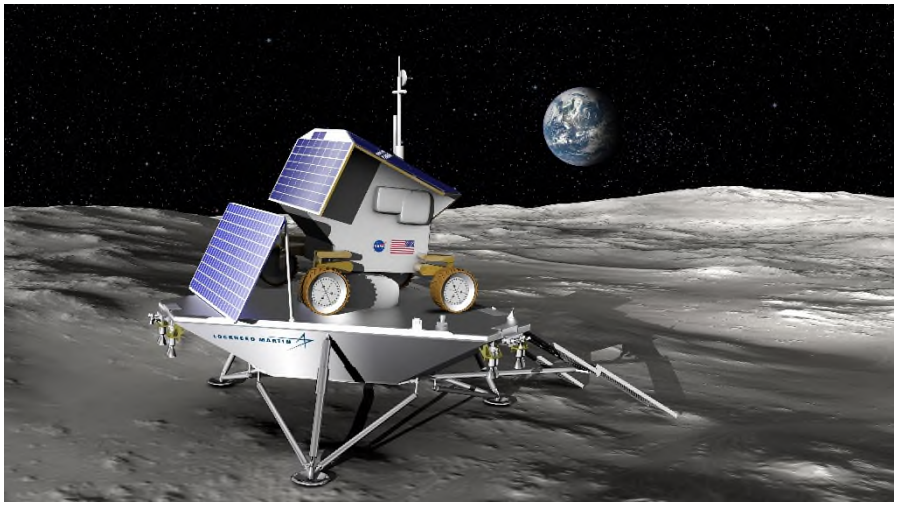
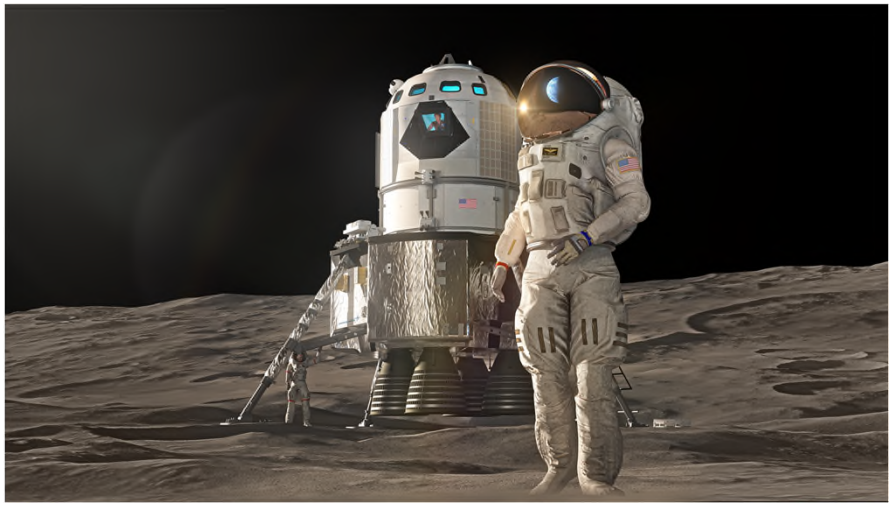
Integrated Lunar Lander Program





Space Resources Roundtable

June 12, 2019

Dave Murrow

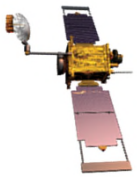
LOCKHEED MARTIN

LOCKHEED MARTIN PLANETARY EXPERIENCE

Viking 1 & 2
1976

Magellan
1989

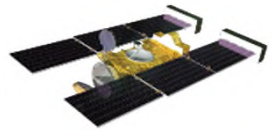
Hubble
1989



Mars Global Surveyor
1996

Cassini Propulsion
1997

Lunar Prospector
1998



Stardust
1999

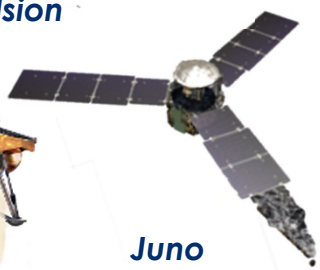
Mars Odyssey
2001

Genesis
2001

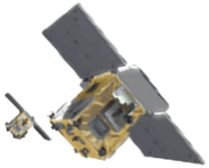
Spitzer
2007

Mars Reconnaissance Orbiter
2005

Phoenix
2007



Juno
2011



GRAIL A & B
2011

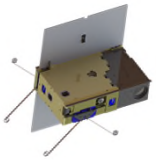
MSL Aeroshell
2011

MAVEN
2013

OSIRIS-REx
2016

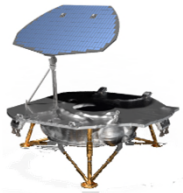
InSight
2018

Mars 2020 Aeroshell



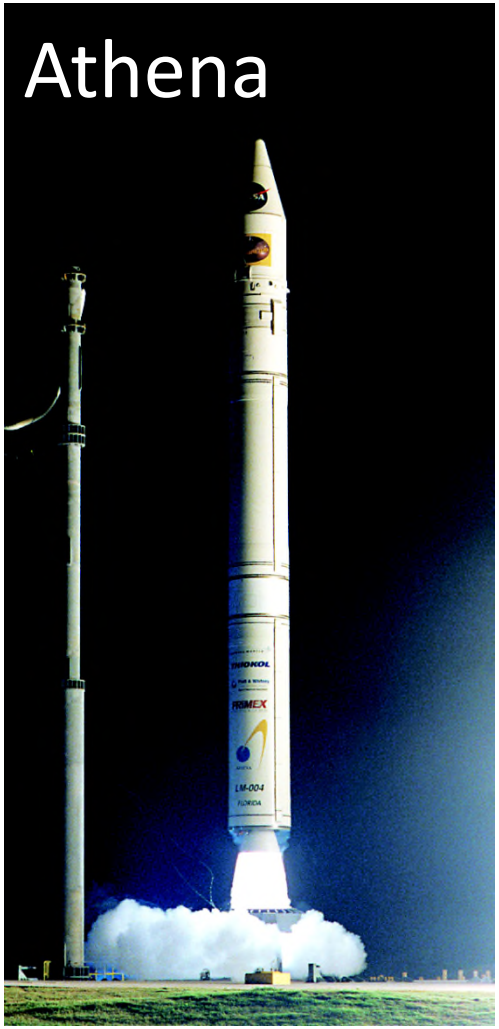
LunIR

Lucy



McCandless

OUR COMMERCIAL SPACE TRANSPORTATION HISTORY

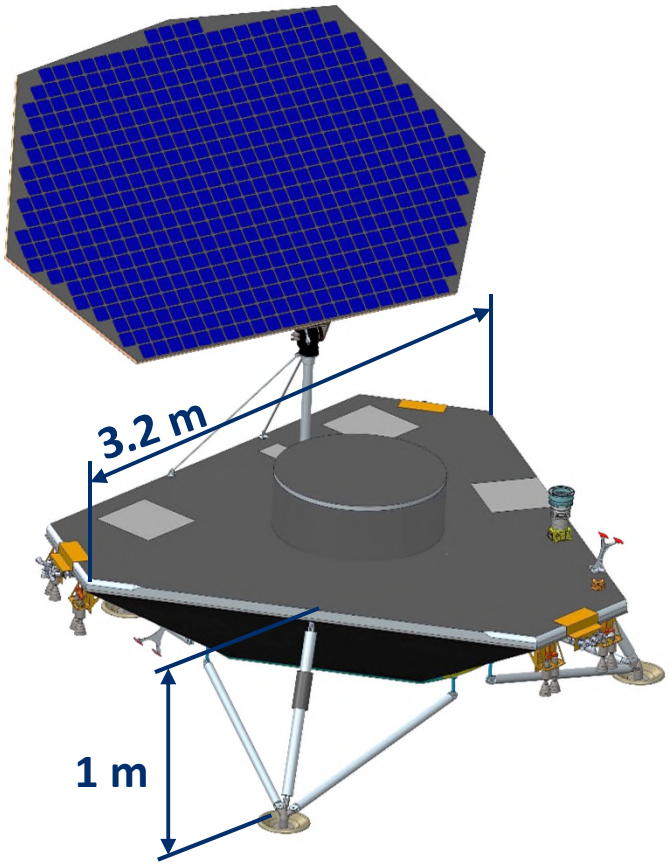


MCCANDLESS: NAMED FOR A TRAILBLAZER

Image credit: NASA

CAPABLE LANDER SIZED FOR ISRU CAPABILITY

MCCANDLESS CAPABILITIES



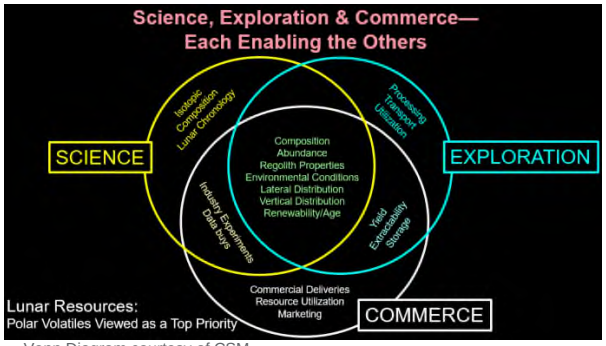
Capability	Standard	Enhanced
Cargo Mass	250 kg	325 kg
Payload Power	400 W, 28 Vdc	
Landing Precision	< 2 km	< 100 m
Payload Volume	>4 m^3 above deck, 2 x 0.4 m^3 internal	
Surface Mission Duration	300 hrs	Multi-day
Telecom to Earth	~100 kbps	>1 Mbps
Data Storage	48 gigabit	
Payload Data Interfaces	LVDS, RS-422, MILSTD-1553	Spacewire

Performance depends on mission-specific factors such as landing site, and is subject to change

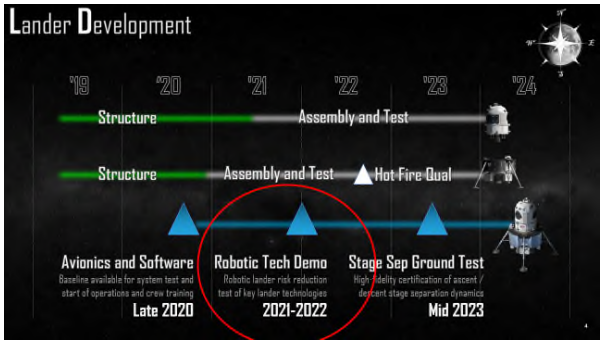
An Integrated Program Approach

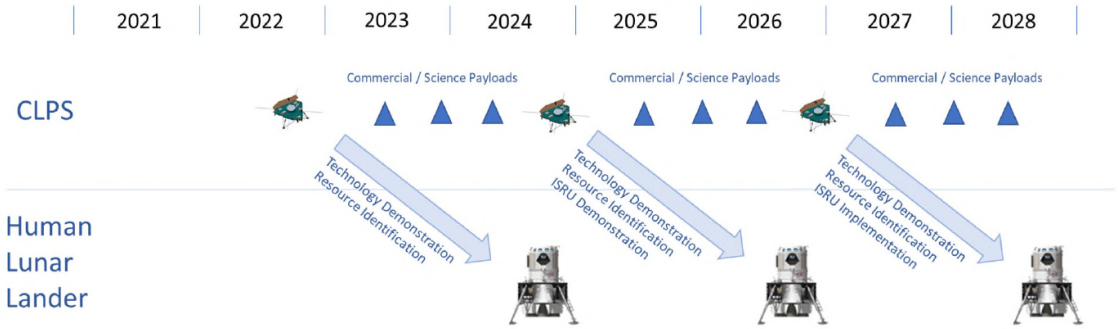
- Multiple Human and Robotic Missions
- Linked objectives

  Find Ice (Robotic), Bring Back Ice (Human)
- Pathways Defined based on discoveries



Venn Diagram courtesy of CSM





2024 Integrated Lander Development

'19 '20 '21 '22 '23 '24

Structure — Assembly and Test

Structure — Assembly and Test — Hot Fire Qual

Avionics and Software

Baseline available for system test and start of operations and crew training

Late 2020

Robotic Tech Demo

Robotic lander risk reduction test of key lander technologies

2021-2022

Stage Sep Ground Test

High-fidelity certification of ascent / descent stage separation dynamics

Mid 2023