

# NSS North Houston Space Society

## Space News

December 12, 2020

Greg Stanley



# Lunar news from China

“Chang’e flies to the Moon”



Credit: Nguyen Manh, via Pinterest

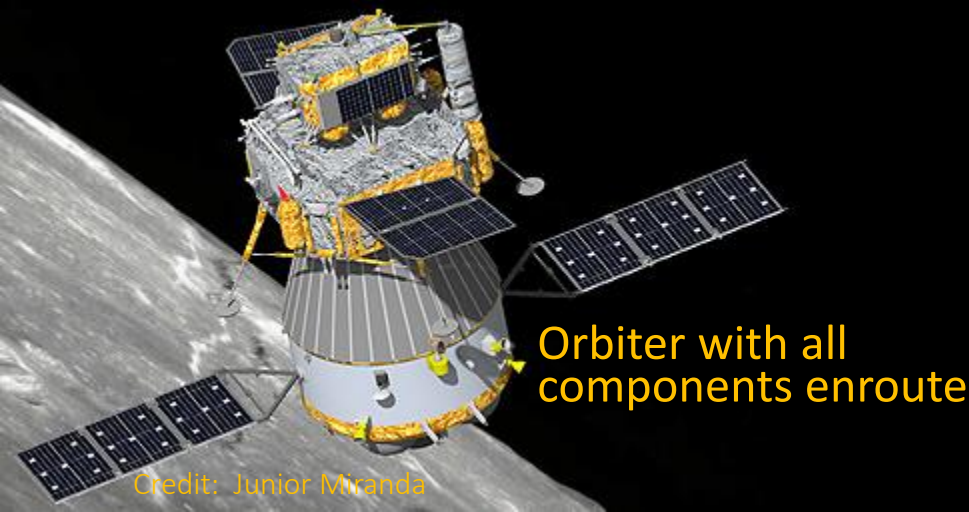
Chang'e (“Chang the beautiful”) Chinese Moon goddess, namesake of Chinese Lunar Exploration Program



Ming Dynasty, circa 1500

# Chinese lunar sample return (Chang'e 5) Overview

- Return 2 kg (4.4 lbs) of lunar rock & dirt to Earth
  - First return of lunar materials since 1976 (Russia's Luna 24)
- Structured like an Apollo mission, except completely robotic
- Target area: "Ocean of Storms"
  - Volcanic mound 1.21 billion years old, vs. Apollo samples 3.1 – 4.4 billion years old
- China's 3<sup>rd</sup> soft landing on the Moon
- First takeoff of a spacecraft from large planetary body since 1976 (Russia's Luna 24)
- First robotic docking between 2 craft orbiting the moon
- Launch mass: about 18,100 lbs



# Chinese lunar sample return mission (Chang'e 5)

## Milestones

- Launched Nov 23
- Entered Moon orbit Nov. 28
- Lander/ascender detached to begin descent to Moon's surface Nov 30
- Landed on Moon Dec 1
- Samples taken, sealed in a storage device in ascender
  - Drilled samples up to 2 meters (6.6 feet); also scooped samples from surface
  - Solar powered only – had to complete mission in 2 days before lunar night
- Ascender launched from Moon Dec 3; 6 minutes to orbit
- Ascender docked with Earth return craft Dec 5
- Samples transferred from ascender to orbiter
- Orbiter jettisoned the ascender Dec 6, deorbited ascender to crash
- Remaining plan:
  - Fire engines to leave Moon orbit Dec 13
  - Detach and land sample return capsule by parachute in Inner Mongolia Dec 16

# Chinese Lunar Exploration Program (CLEP)

- Phase 1: reach lunar orbit
  - Chang'e 1 (2007) and Chang'e 2 (2010)
- Phase 2: landing and roving on the moon
  - Chang'e 3 (2013)
  - Chang'e 4 (2019) on far side of the moon, also requiring a communications satellite in lunar orbit
- Phase 3: Collect lunar samples from near side of Moon and return to Earth
  - Chang'e 5 (2020) and Chang'e 6 (future, south pole)
- Phase 4: robotic station near lunar south pole (within a decade)
- Further in the future:
  - Crewed lunar landing in 2030's
  - Possible human outpost near lunar South Pole
  - "Earth-Moon economic zone" by 2050



# Chinese Lunar Exploration Program longer term

Strategic insight from Ye Peijian, head of CLEP \*:

*“The universe is an ocean, the Moon is the Diaoyu Islands\*\*, Mars is Huangyan Island\*\*\*. If we don’t go there now even though we’re capable of doing so, then we will be blamed by our descendants.*

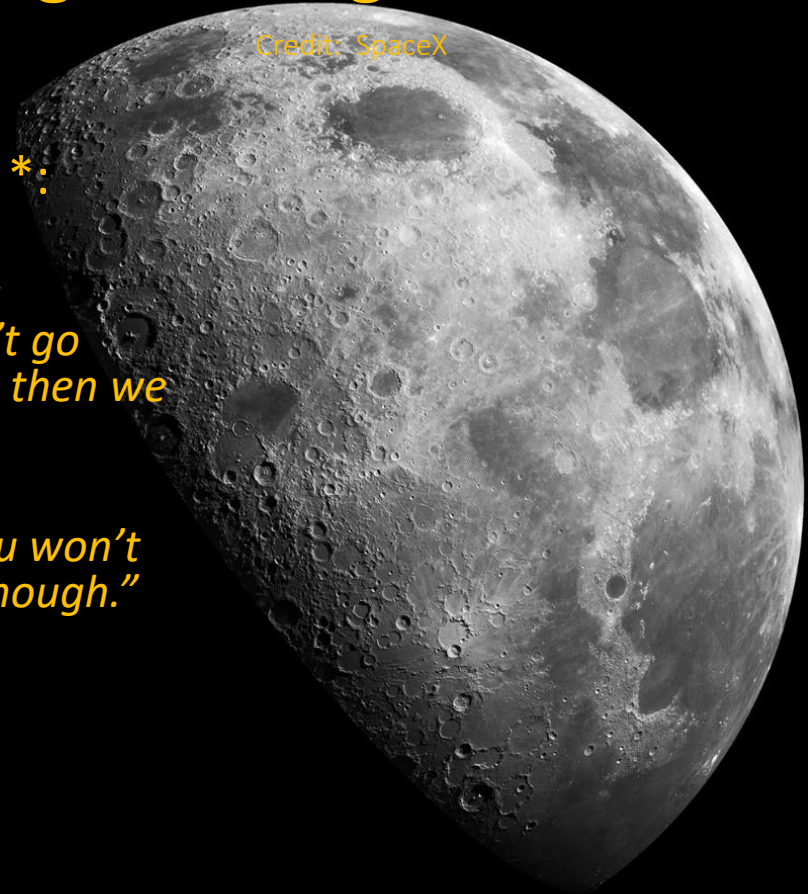
*If others go there, then they will take over, and you won’t be able to go even if you want to. This is reason enough.”*



**\*\*Diaoyu Island = Senkaku islands, disputed with Japan & Taiwan**

\* <https://asiatimes.com/2020/07/chinas-space-silk-road-reaches-mars-and-beyond/>

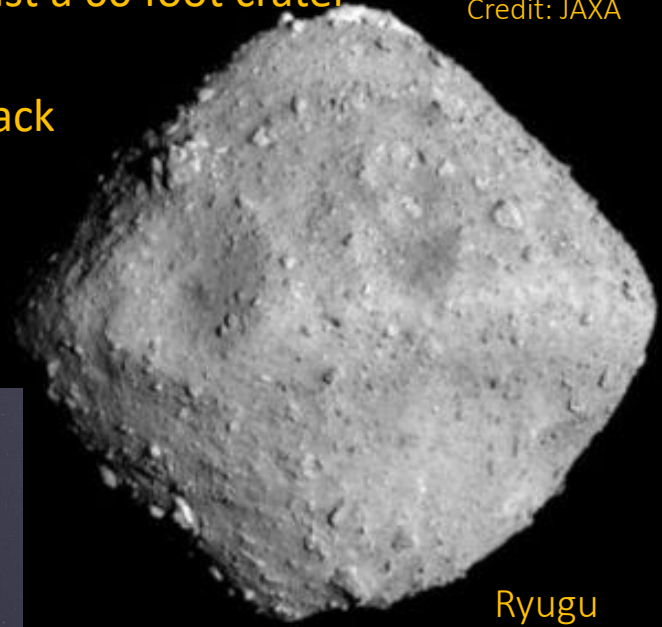
Credit: SpaceX



# Asteroids: update from Japan

- Japanese probe Hayabusa 2 returned 100 mg sample from half-mile wide 162173 Ryugu Dec 5 (launched Dec, 2014)
  - Had dropped robotic explorers, used explosives to blast a 60 foot crater
  - Departed Ryugu in Nov 2019
  - Sample return capsule parachuted to Australian outback
  - Parent craft will visit other asteroids in 2026, 2031

Credit: JAXA



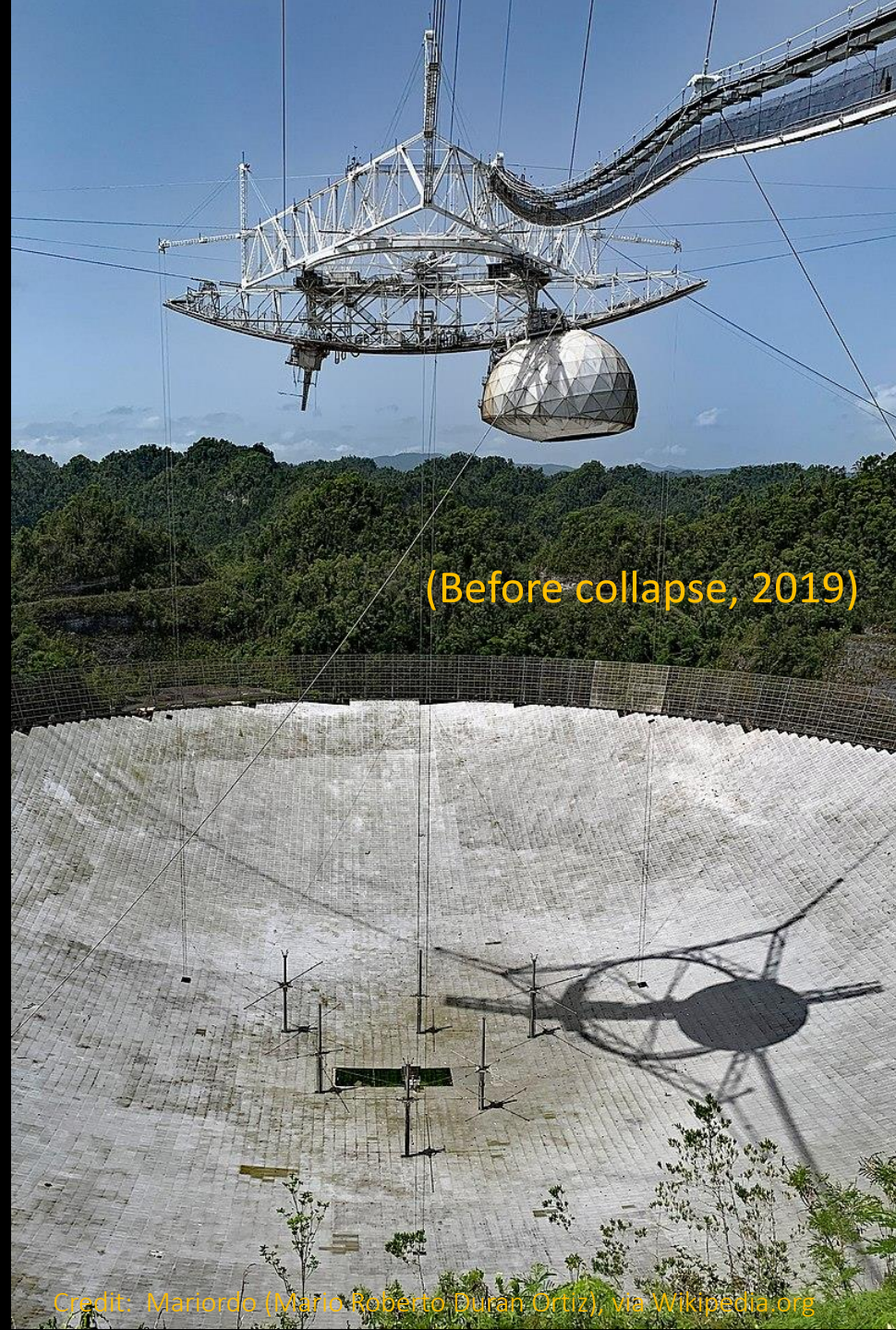
Ryugu

Hayabusa = “peregrine falcon”,  
symbolizing speed and strength



# Arecibo Observatory collapses

- 1000 foot reflecting dish in Puerto Rico was 2<sup>nd</sup> largest radio telescope
  - Second only to one in China
  - Most powerful radar observatory
- Built in 1963, featured in numerous movies like “Contact”, “GoldenEye”
- 900 ton suspended platform crashed into dish 450 feet below on Dec 1
  - First cable snapped August 10
  - Second cable broke November 6
  - NSF decided on demolition: facility was too unsafe
  - Final collapse occurred before demolition started
  - No injuries



# SpaceX Starship

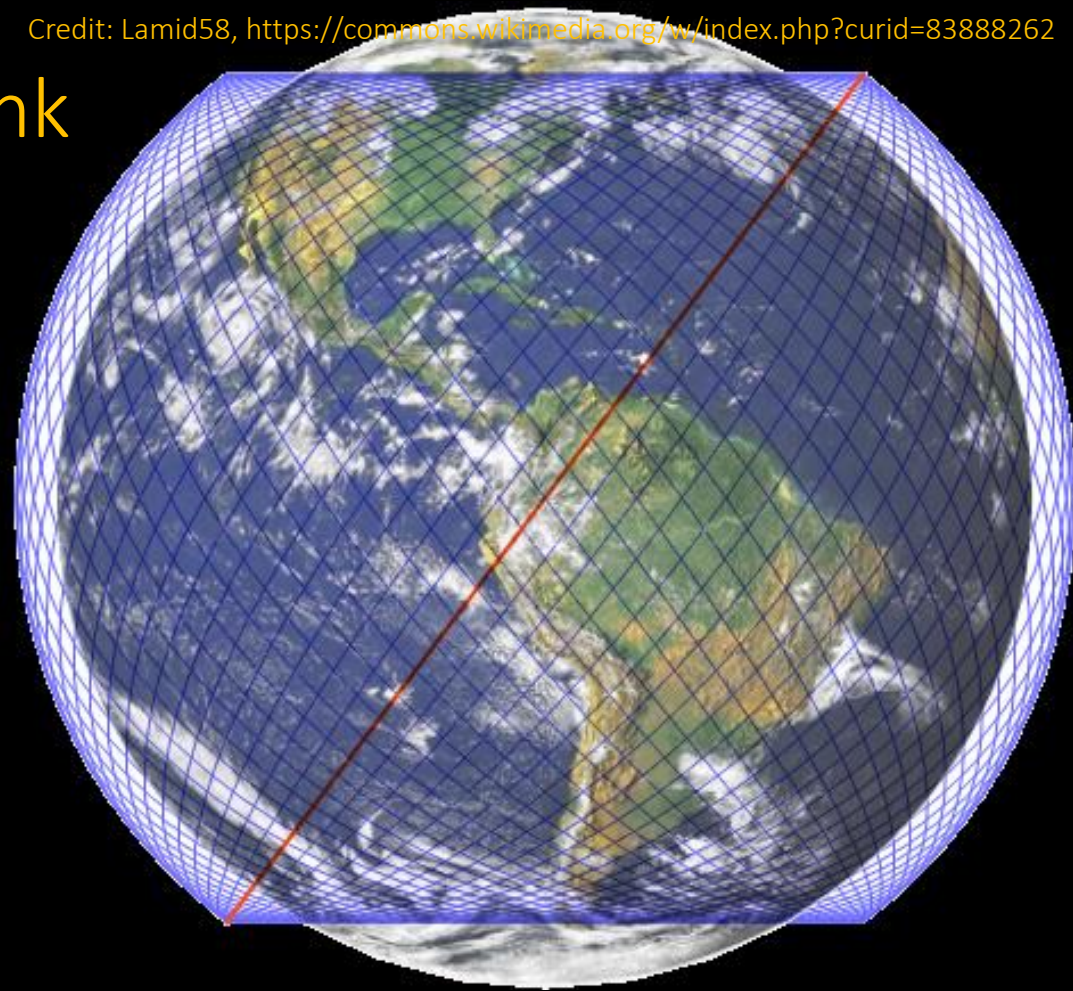
## Full size prototype test: SN8

- First flight with 3 Raptor engines, nose cone, flaps
  - Methane/LOX engines double the thrust of kerosene-fueled Falcon 9 Merlin engines
- 7 minute flight to/from 12.5 km altitude (41,000 ft)
  - Launch
  - “Belly flop” to glide down horizontally
  - Flip to vertical & fire engines for landing
- Accomplished most goals except for crash at end
  - Landed at too high a speed on the landing pad
  - Cause: low pressure in nose cone tanks feeding fuel
- SN9 is nearly built
- Elon Musk:
  - “... controlling all the way to putting the crater in the right spot was epic!”
  - “Mars, here we come!”



# SpaceX Starlink update

(Near-global satellite  
based internet service)



- SpaceX gets \$886 million over 10 years from FCC to subsidize Starlink for 642,925 rural homes & businesses in 35 states
- Total program: \$9.2 billion over 10 years , going to 180 ISPs

# Miscellaneous news

- Relativity Space closed a \$500 million round of capital
  - Valuation now \$2.3 billion
  - Now 2<sup>nd</sup> most valuable private space company backed by venture capital, after SpaceX (ignores Blue Origin, funded solely by Jeff Bezos)
  - Giant 3D printers for rocket engines and almost the entire rocket

# How many launches since the last meeting (Nov 7)?











*This includes failed launches only if they lift off the launch pad  
and only includes launches that attempt going into orbit*



The Starship SN8 test didn't count because it was sub-orbital  
(The crash at the end didn't disqualify it)



# Launches since last meeting (Nov 7, 2020) part 1

-  Nov 7 – Ceres 1 (new rocket – Galactic Energy) – data relay microsatellite
-  Nov 12– Long March 3B – communications satellite (GEO orbit)
-  Nov 13 – Atlas 5 – (classified) US National Reconnaissance Office
-  Nov 15 – Falcon 9 – 4 astronauts to ISS – NEW ERA BEGINS
-  Nov 16 – Vega (ESA) – 2 satellites (\$400M comm. & research) – FAIL
  - Misconnected cables caused engine nozzles to turn the wrong direction!
-  Nov 19 – Electron (NZ/USA) – 30 small satellites to LEO
  - First stage recovered by parachute to ocean for the first time
  - 24 “SpaceBEE” communications satellites, each the size of a slice of bread
  - Millennium (Boeing) “DragRacer” test: 2 lb./2” x 230 ft. tape tether for drag for LEO de-orbiting, should de-orbit in 45 days vs control satellite lasting 7 years
-  Nov 21 – Falcon 9 – oceanography satellite (measures sea levels)
-  Nov 23 – Long March 5 – mission to return samples from Moon
-  Nov 24 – Falcon 9 – 16<sup>th</sup> Starlink launch - 60 satellites - internet service
-  Nov 29 – H-2A (Japan) – Optical Data Relay satellite (GEO orbit)

# Launches since last meeting (Nov 7, 2020) part 2



Dec 1 – Soyuz– surveillance satellite for UAE



Dec 2 – Soyuz– 3 communications satellites, other rideshares



Dec 5 – Long March 3B – Earth observation satellite



Dec 6 – Falcon 9 – 6553 lbs cargo resupply to ISS

- first of bigger 2<sup>nd</sup> generation “Cargo Dragon” capsules
- 2400 lb. Bishop Airlock (the one we saw/touched on our Nanoracks tour)
- Numerous science experiment materials, including:
  - BioAsteroid experiment: using microorganisms for biomining metals, similar to earlier “BioRock experiment to extract metals from basalt on Moon or Mars



Dec 9 – Long March 11 – 2 small science satellites



Dec 10 – Delta 4-Heavy – (classified )US National Reconnaissance Office

# Featured Speaker: Eagle Sarmont



- Retired aerospace engineer and ship's officer
  - Designed, built, and test flown homebuilt aircraft
  - Helped design & build high-performance aircraft (F-5, F-18, F-20, F-22, F-35, U-2, SR-71, F117), satellites
- Original research, including non-rotating Skyhook (to be discussed)
- Author of the book *Opening the High Frontier*
- Wants to make space flight affordable for everyone

