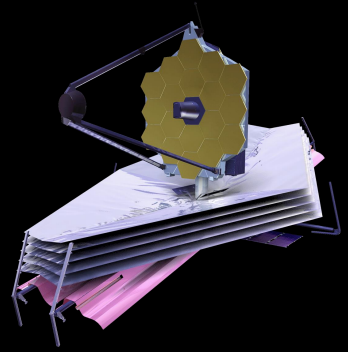
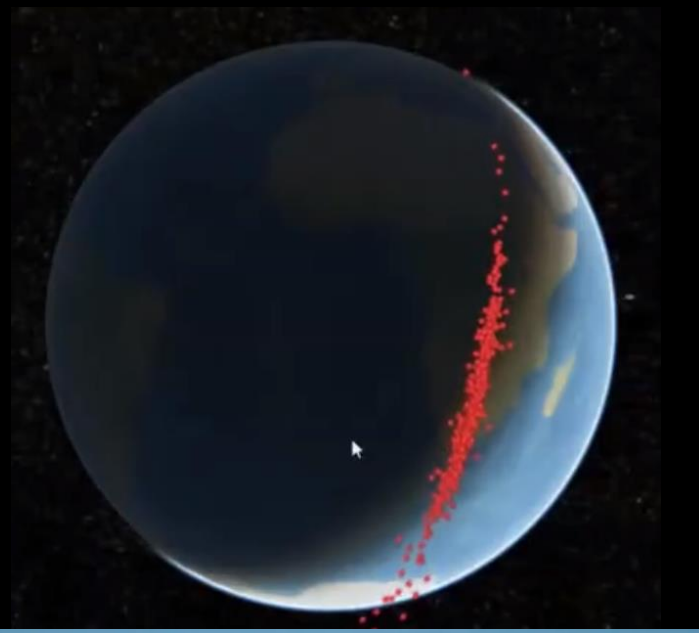
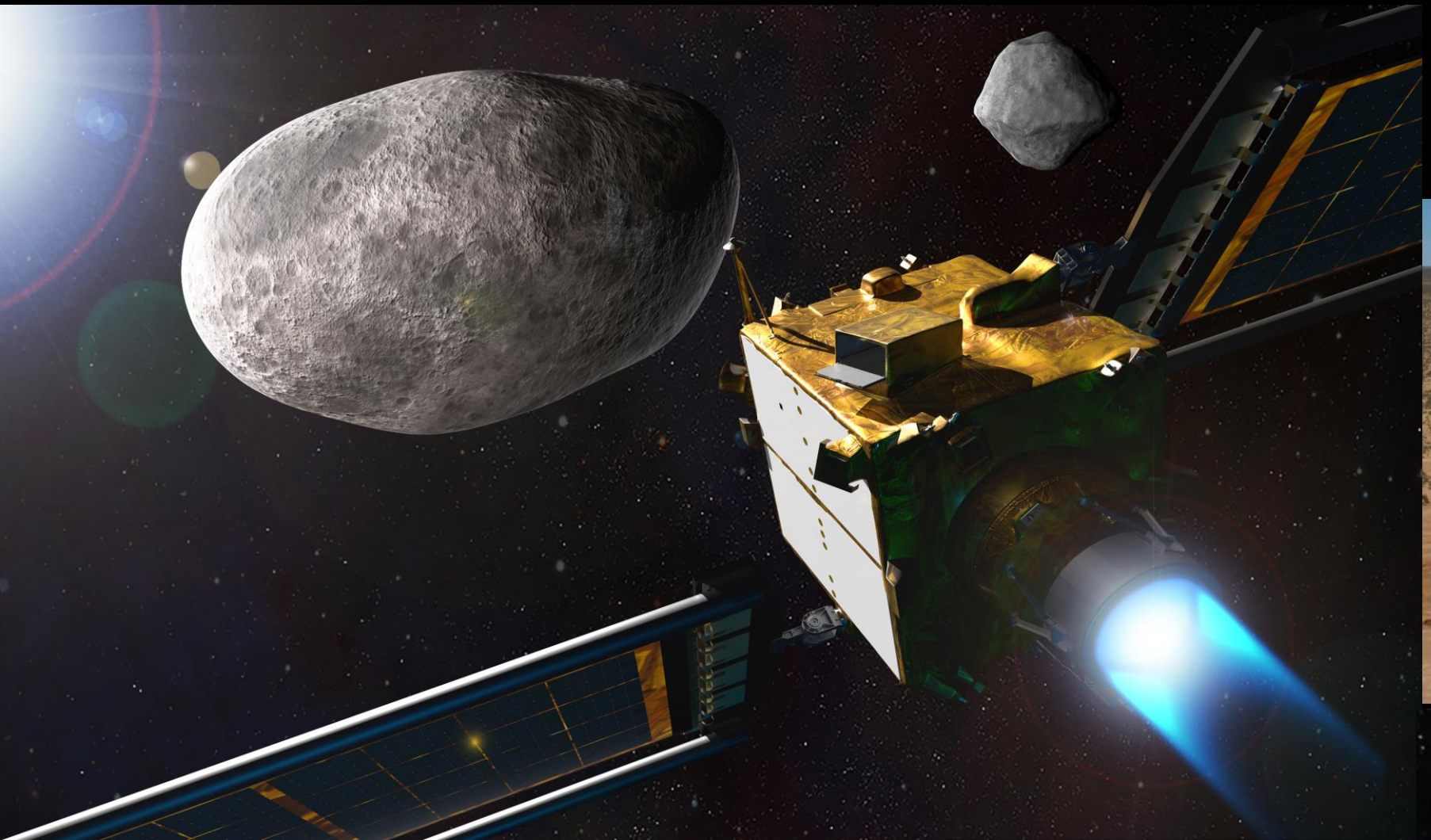
Monthly Space News

Greg Stanley

Dec. 11, 2021

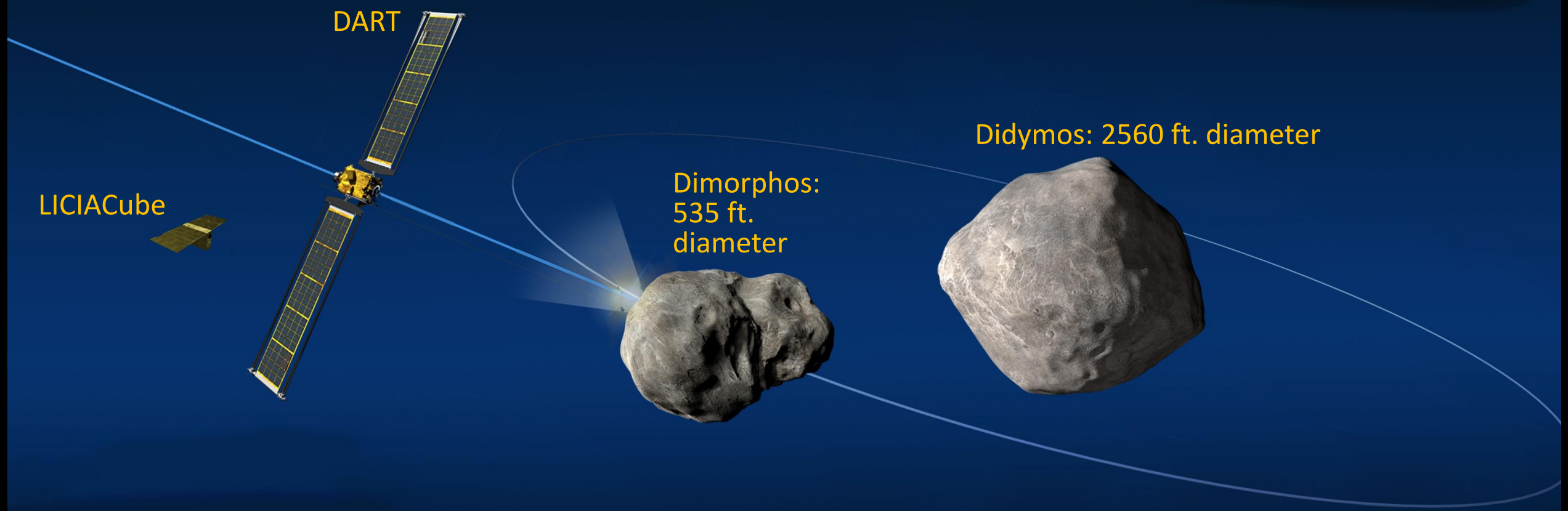






NSS North Houston Space Society

DART (Double Asteroid Redirection Test)

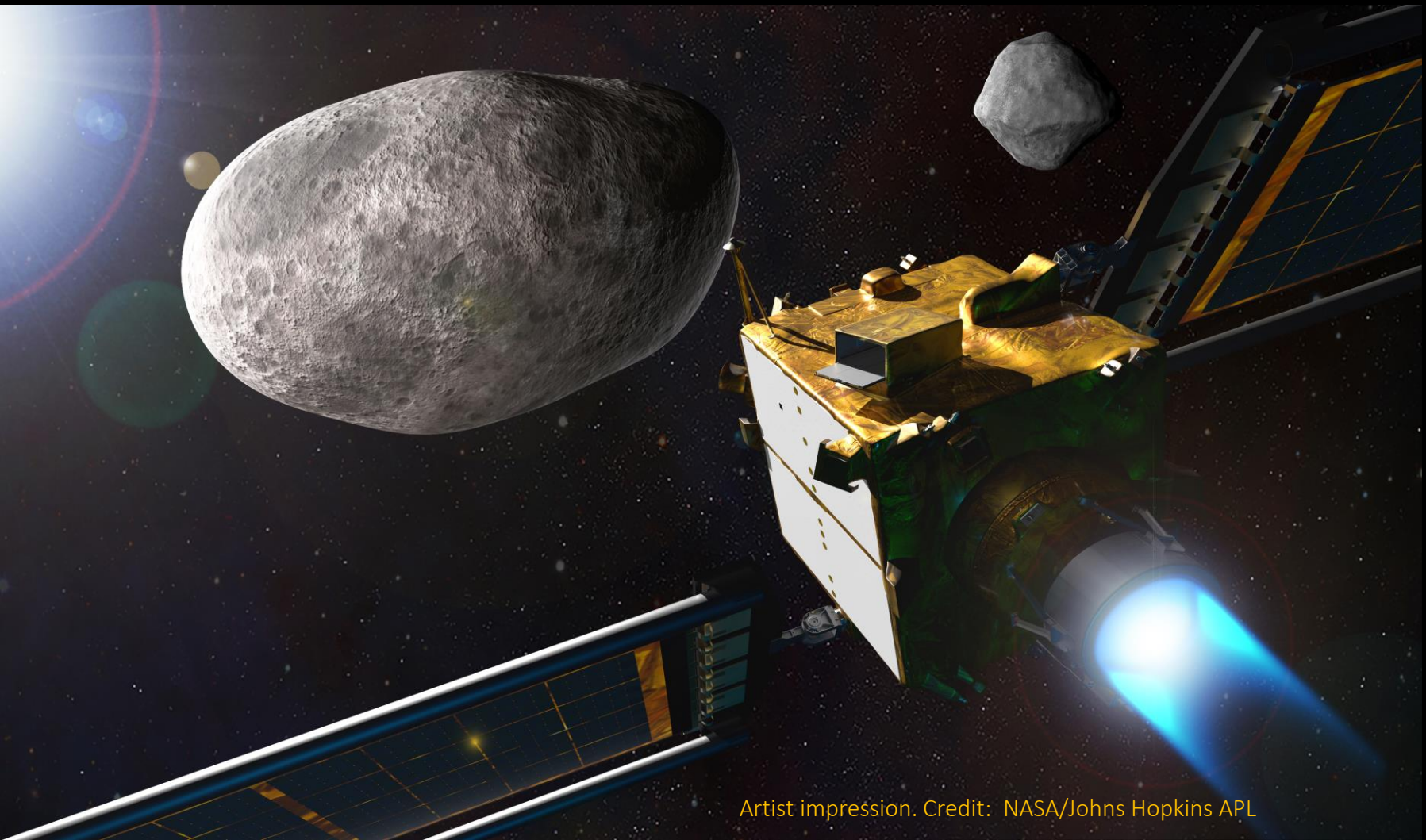


- DART launched Nov. 24 to test planetary defense by altering orbit of an asteroid
  - Test diverting an asteroid if on collision course with Earth, arriving Sept. 2022
  - 1100 lb craft will slam into Dimorphos, a moonlet orbiting Didymos, at 15,000 mph
- ESA (European Space Agency) 2024 Hera mission will study the effects

Artist impression. Credit: NASA/Johns Hopkins APL

DART (Double Asteroid Redirection Test)

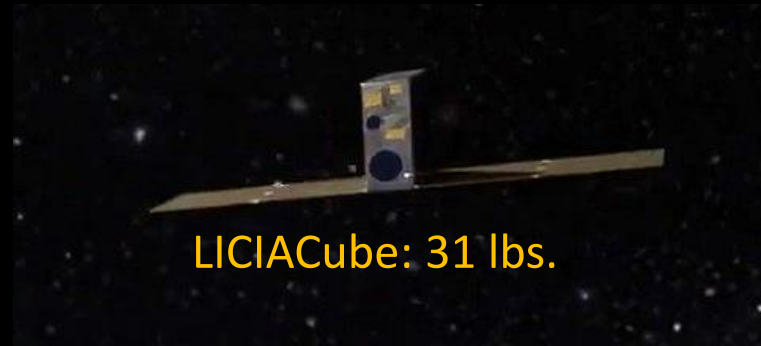
- First measurable human orbit alteration
  - May produce meteor shower, ejecting between 22,000 and 220,000 lbs of cm-size debris



Artist impression. Credit: NASA/Johns Hopkins APL

- Also testing
  - Roll-out solar cells like ISS
  - Reflective solar concentrators
    - 3x power
  - New ion engine

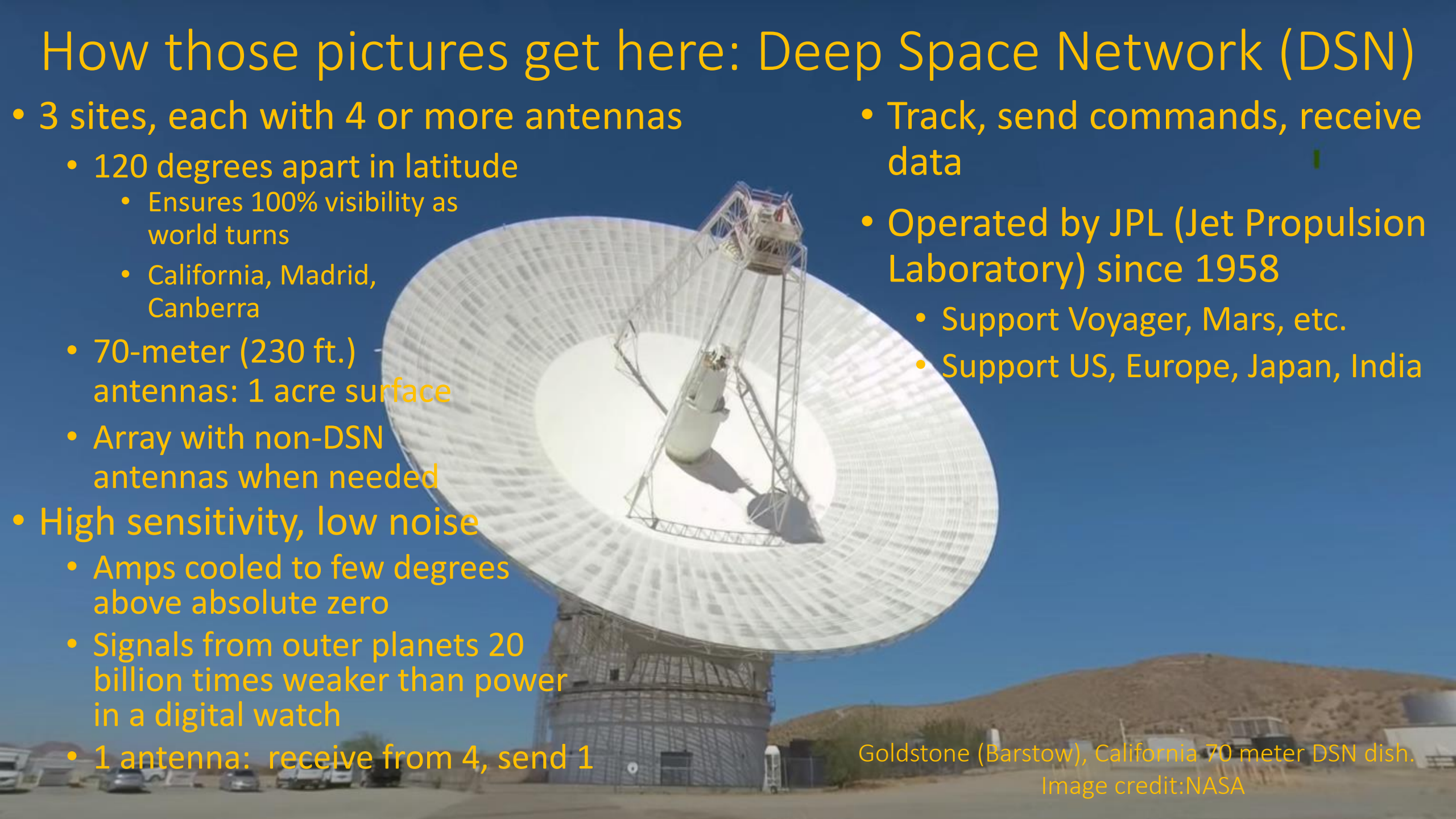
- LICIACube (10U Italian cubesat) will record collision and aftermath
  - Light Italian Cubesat Imaging for Asteroid



LICIACube: 31 lbs.

How those pictures get here: Deep Space Network (DSN)

- 3 sites, each with 4 or more antennas
  - 120 degrees apart in latitude
    - Ensures 100% visibility as world turns
    - California, Madrid, Canberra
  - 70-meter (230 ft.) antennas: 1 acre surface
  - Array with non-DSN antennas when needed
- High sensitivity, low noise
  - Amps cooled to few degrees above absolute zero
  - Signals from outer planets 20 billion times weaker than power in a digital watch
  - 1 antenna: receive from 4, send 1
- Track, send commands, receive data
- Operated by JPL (Jet Propulsion Laboratory) since 1958
  - Support Voyager, Mars, etc.
  - Support US, Europe, Japan, India



Goldstone (Barstow), California 70 meter DSN dish.
Image credit:NASA

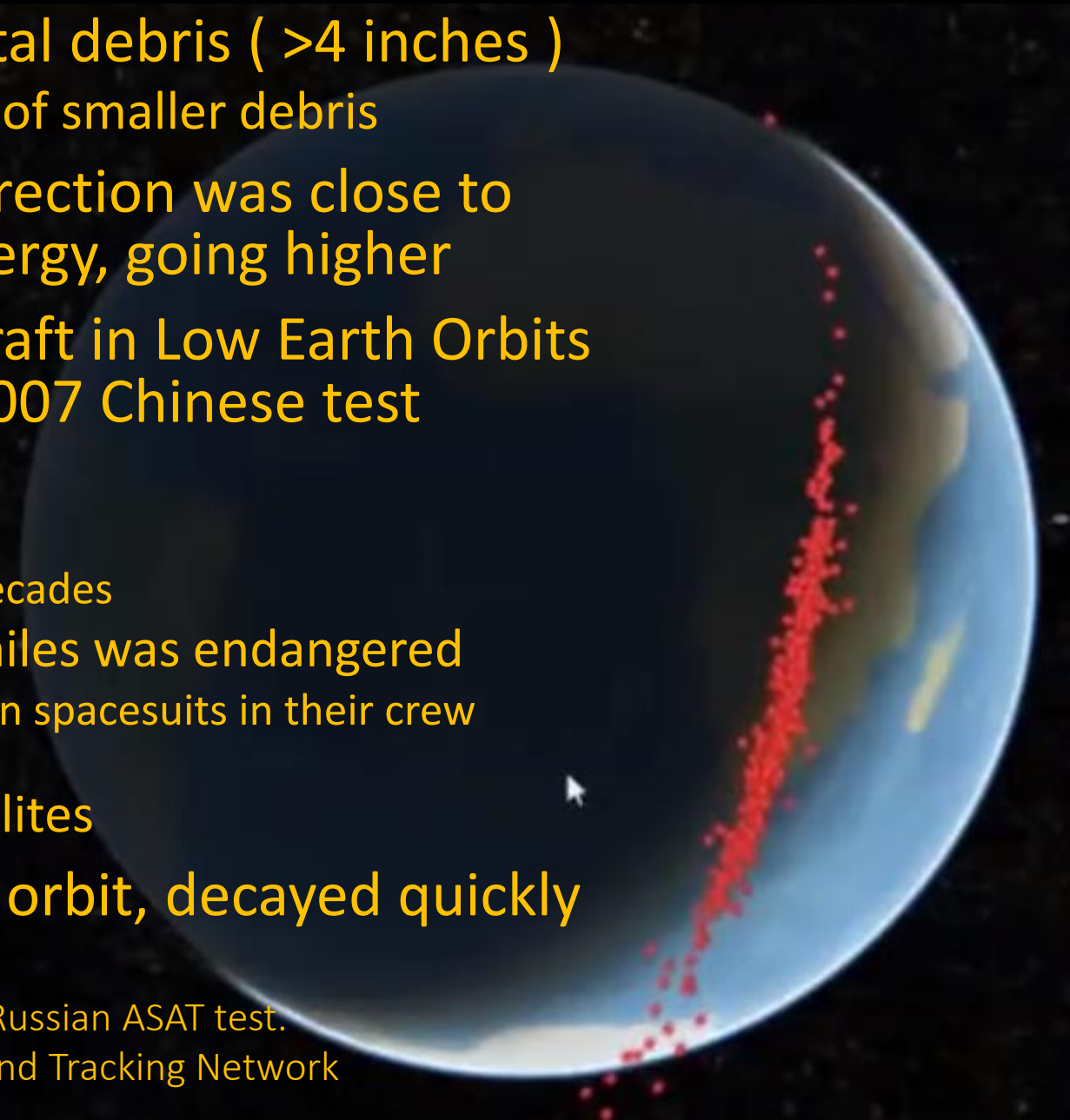
Russian anti-satellite (ASAT) missile test/demonstration

Credit: Almaz-Antey 2015 corporate calendar

- Russians destroyed one of their old 2-ton satellites with a Nudol DA-ASAT missile
  - DA = Ground-based ("Direct Ascent")
  - ASAT = Anti-SATellite missile
  - Satellite was in orbit at 300 miles (LEO)
  - Explosive warhead not needed, but possible
  - Tested 8-12 times previously, but not to an actual satellite
- A Nudol variant is also the ABM (Anti Ballistic Missile) protecting Moscow
  - Besides proving ASAT capability, simultaneously demonstrating ABM readiness
- 5-10 minutes from launch to intercept
  - Autonomous reaction will be needed to defend against these

Russian anti-satellite (ASAT) missile demo: Debris

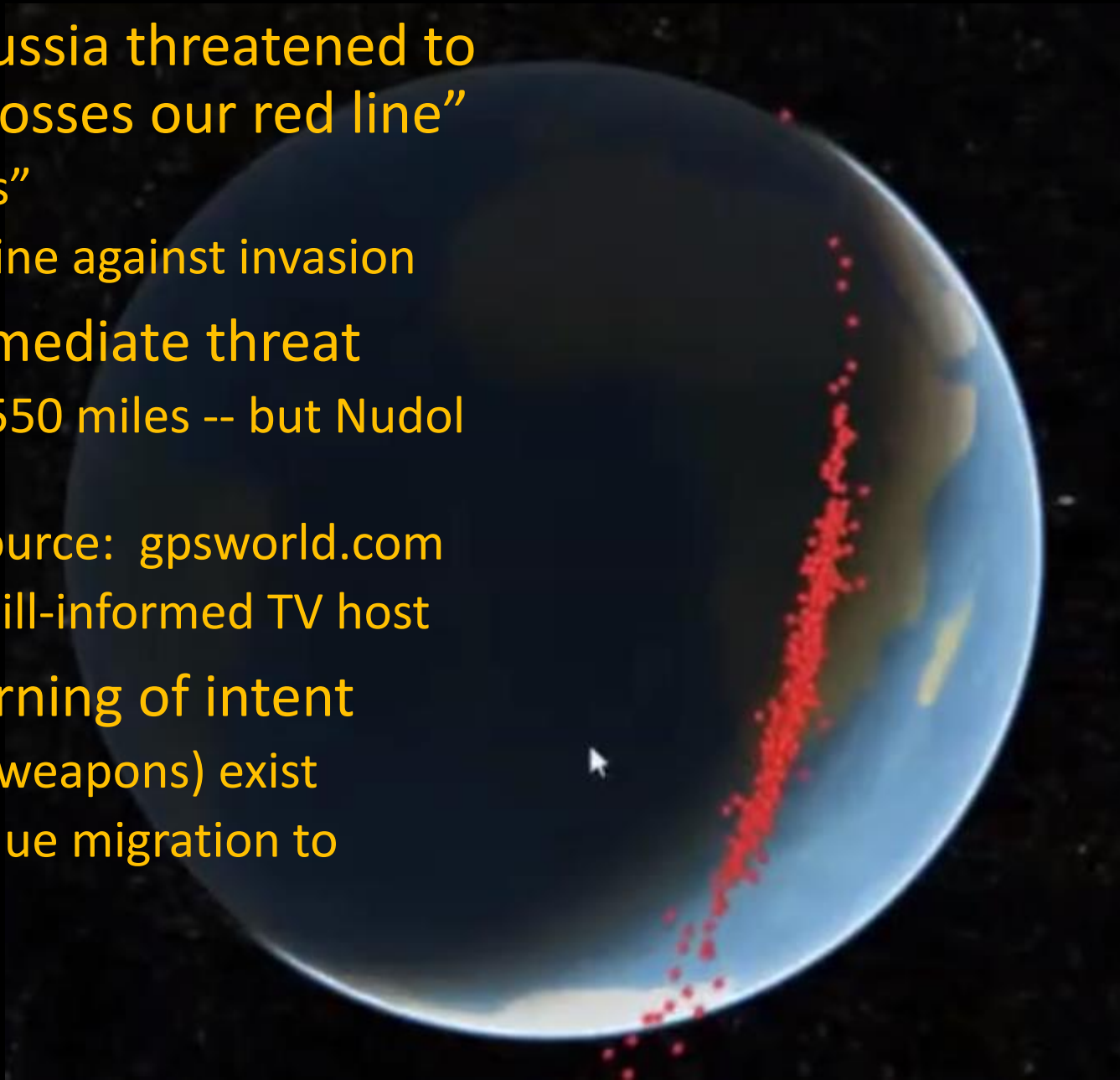
- Created 1,500 pieces of trackable orbital debris (>4 inches)
  - May be hundreds of thousands of pieces of smaller debris
- Instead of head-on collision, missile direction was close to target orbit, so more debris gained energy, going higher
- Debris threatens satellites and spacecraft in Low Earth Orbits (LEO) from all nations, for years, like 2007 Chinese test
  - Debris orbits between 190 – 680 miles
    - Lower orbits will decay in 5 years
    - Much went to higher orbits, could stay for decades
  - International Space Station (ISS) at 260 miles was endangered
    - Astronauts (including 2 Russians) sheltered in spacesuits in their crew capsules
  - SpaceX had to adjust orbits of some satellites
- Previous US & Indian tests were lower orbit, decayed quickly



Visualization of debris cloud shortly after 2021 Russian ASAT test.
Image credit: European Union Space Surveillance and Tracking Network

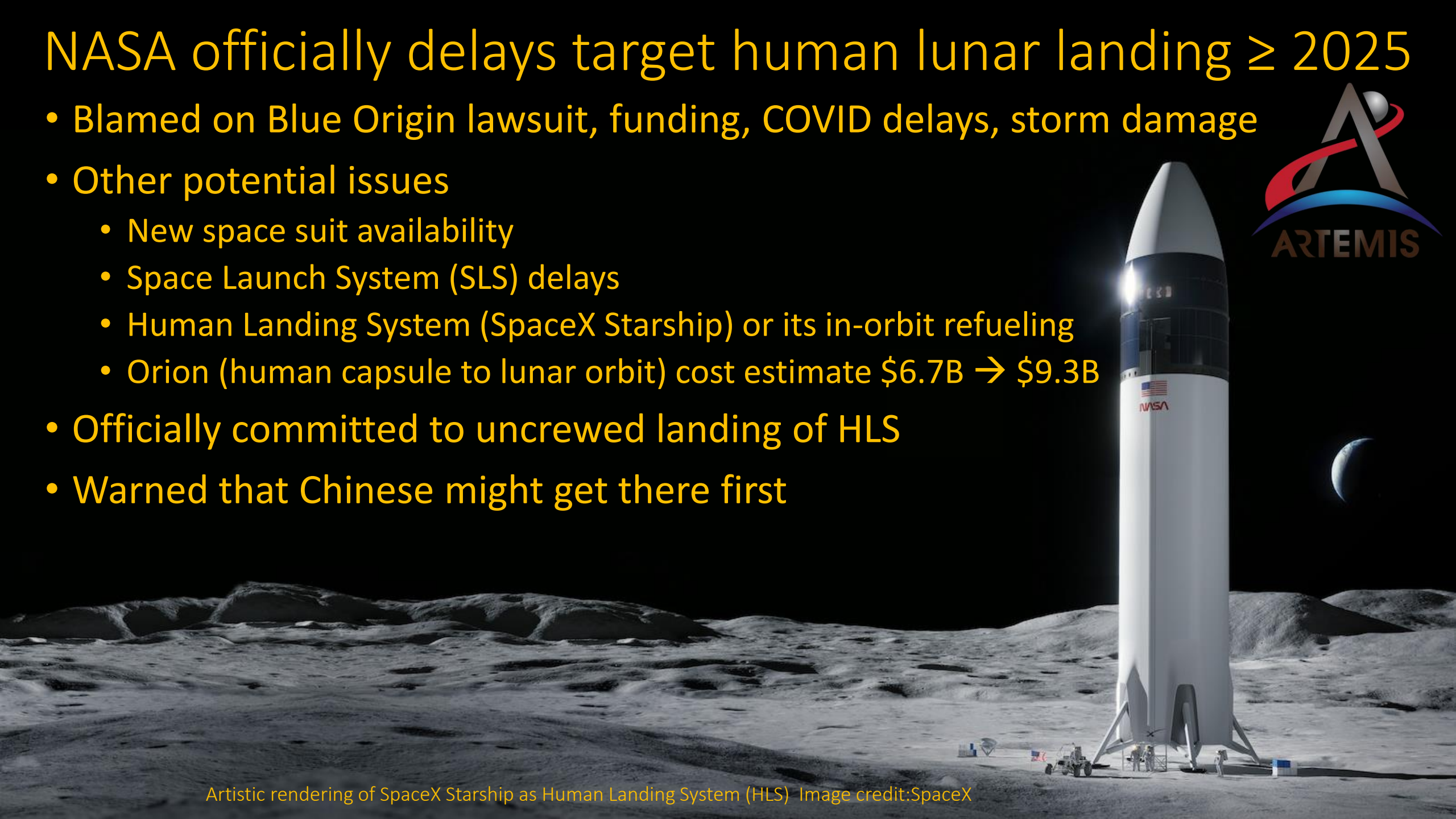
Follow-up threat after Russian ASAT test (maybe)

- Story: On Russian Channel One TV Russia threatened to blow up 32 GPS satellites “if NATO crosses our red line”
  - “Rendering GPS-guided missiles useless”
  - Presumably related to supporting Ukraine against invasion
- Reasons to doubt this is really an immediate threat
  - GPS satellites are in MEO – around 12,550 miles -- but Nudol reaches only 1,240 miles (LEO)
  - Story mostly starts with one obscure source: gpsworld.com
  - Could be outright fake news, or just an ill-informed TV host
- But the test is another long-term warning of intent
  - Other weapons (lasers, satellite-based weapons) exist
  - GPS-type navigation will need to continue migration to multiple systems for resilience



NASA officially delays target human lunar landing ≥ 2025

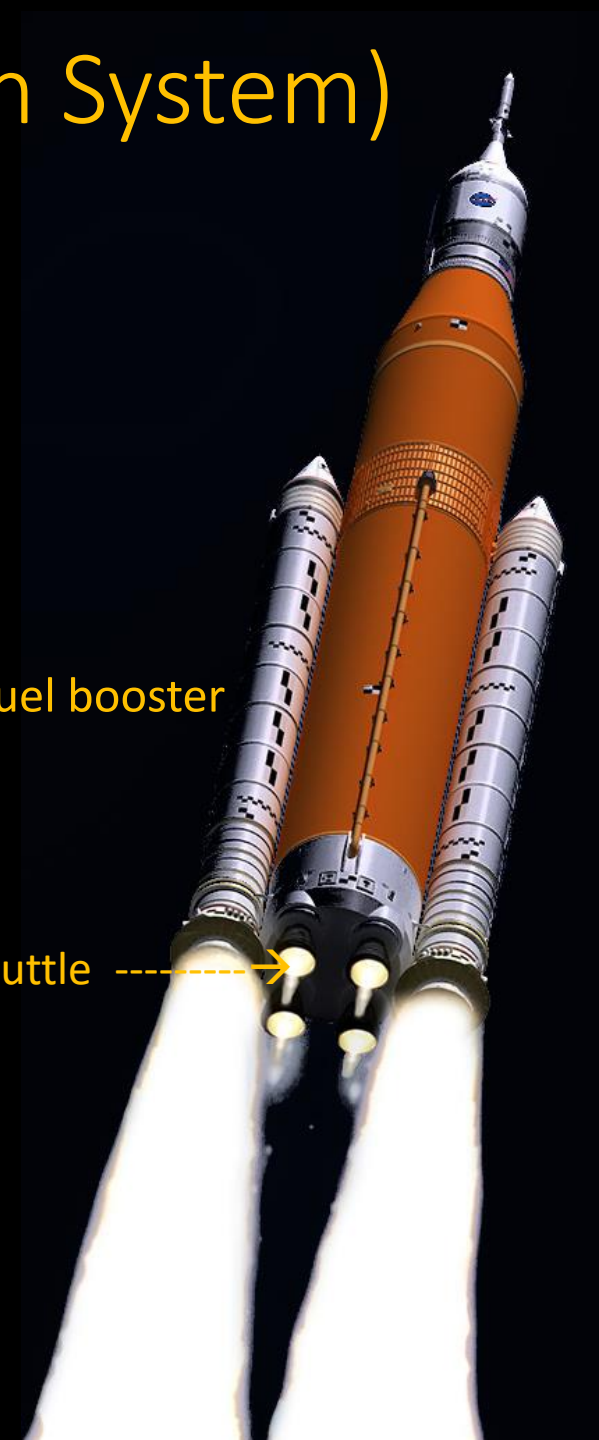
- Blamed on Blue Origin lawsuit, funding, COVID delays, storm damage
- Other potential issues
  - New space suit availability
  - Space Launch System (SLS) delays
  - Human Landing System (SpaceX Starship) or its in-orbit refueling
  - Orion (human capsule to lunar orbit) cost estimate $6.7B → $9.3B
- Officially committed to uncrewed landing of HLS
- Warned that Chinese might get there first



Artistic rendering of SpaceX Starship as Human Landing System (HLS) Image credit:SpaceX

NASA locks further into SLS (Space Launch System)

- NASA contracted $3.2 billion to Northrop Grumman to produce 6 more solid rocket booster pairs for SLS through 2031
  - Pairs to be available for possible future SLS Moon missions Artemis 4 through 8
  - Uses up steel cases housing booster segments originally stockpiled for Space Shuttle
  - Boosters will be disposable, unlike shuttle boosters which were recovered and re-used after refurbishing 5,000 parts
  - Also funds development and production of new booster version for Artemis 9
- Locks in technology and funding for vendors



SLS Image credit:NASA

NASA awards funding for three space station concepts

- $416M awarded to 3 groups to advance commercial space stations
- Commercial Low Earth Orbit Destinations (CLD) program, funding to 2025
  - $160M to Nanoracks with Voyager Space/Lockheed Martin for Starlab
  - $130M to Blue Origin with Boeing, Redwire, Sierra Space, others, for Orbital Reef
  - $125.6M to Northrup Grumman with Dynetics, others (based on Lunar Gateway/Cygnus)
- Adds to previous $140M funding to Axiom Space for a detachable ISS module
- Second phase funding in 2025, goal to replace ISS before 2030


Image credit: Nanoracks


Image credit:Blue Origin


Image credit:Northrop Grumman

Crazy idea that might work, or just crazy?

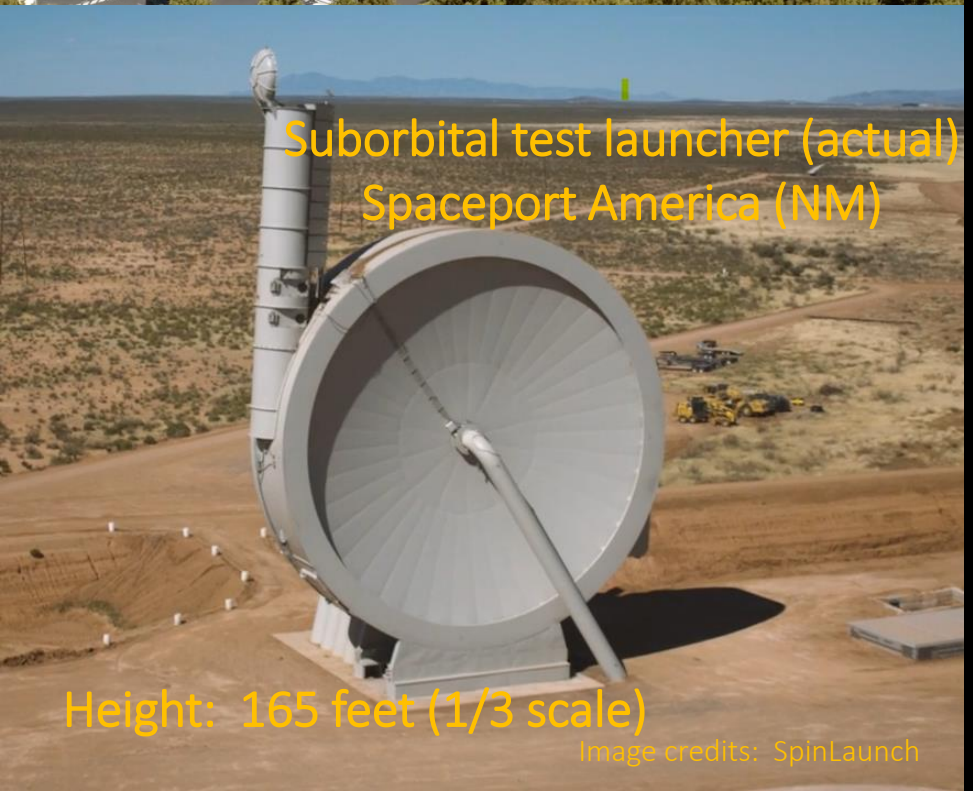


Image credits: SpinLaunch

- Vacuum-sealed centrifuge spins 10 foot rocket to supersonic speed before releasing
  - Replaces a first stage
  - After launch, conventional engines fire to reach orbit
    - Expect to cut fuel by 75%
    - Most fuel normally goes to accelerate remaining fuel
  - Cargo only – nothing living!
- First generation launching up to 200 kg (440 lbs)
- Eventual goal: handle 5 launches/day
- Raised $110 million so far

Crazy idea that might work, or just crazy?

- Projectile contains a 2-stage rocket
  - Simple design, e.g., pressure-fed fuel
- Vacuum broken after release

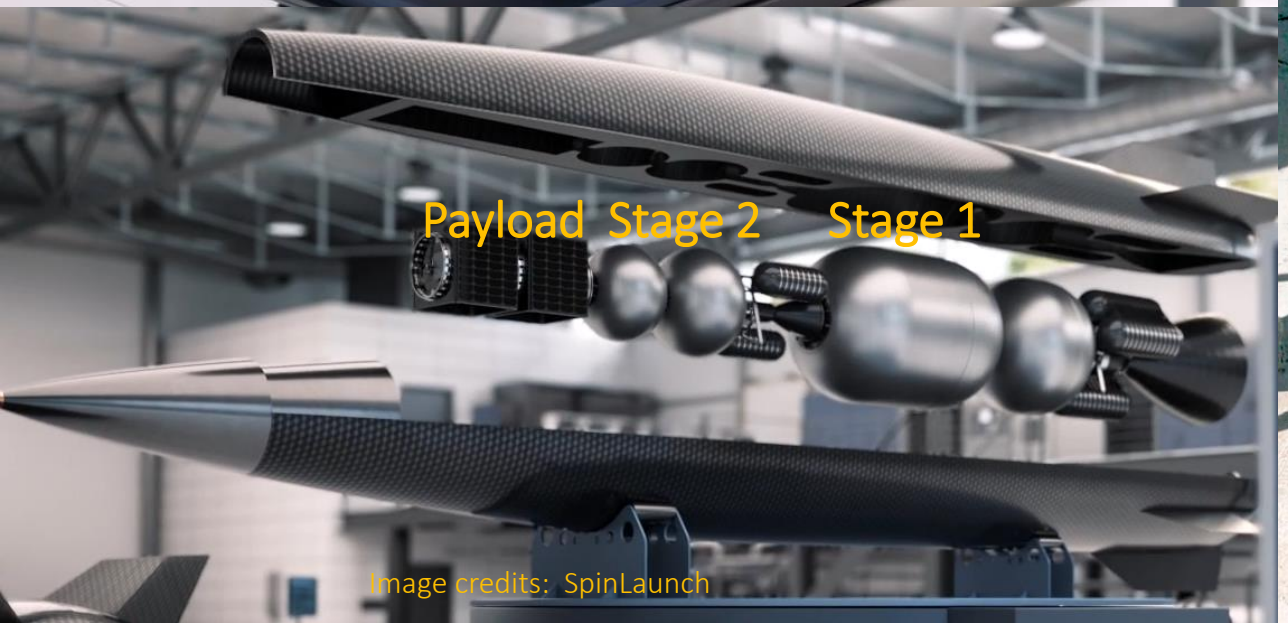
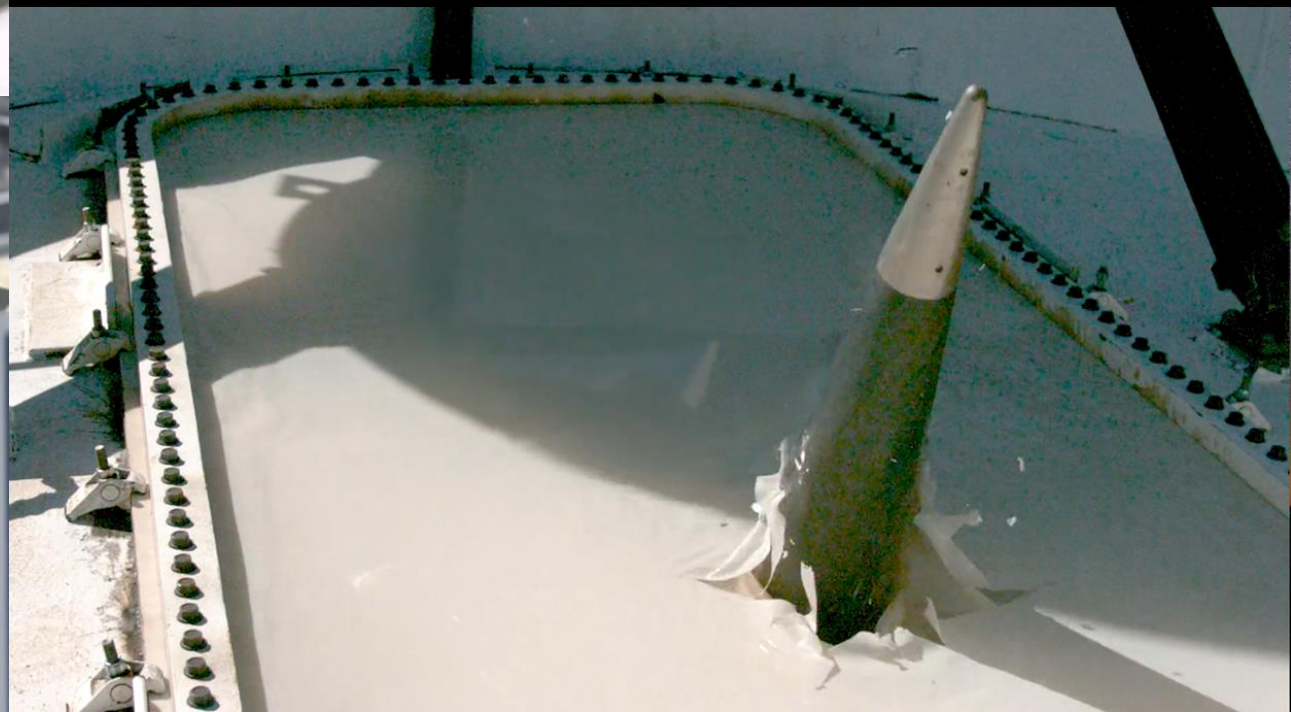


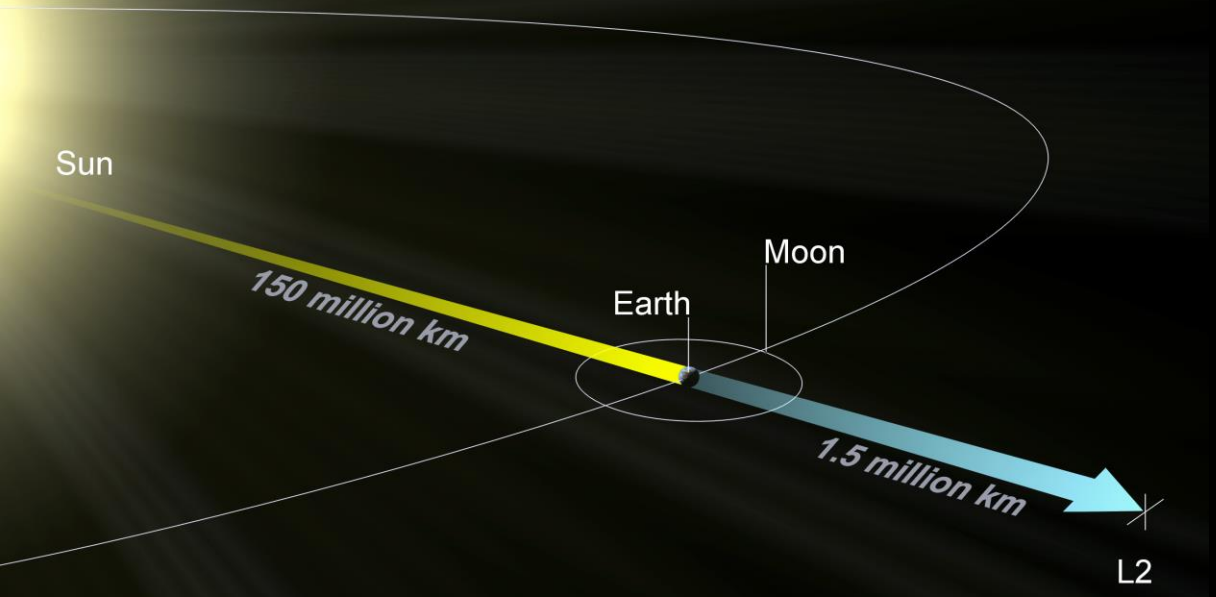
Image credits: SpinLaunch



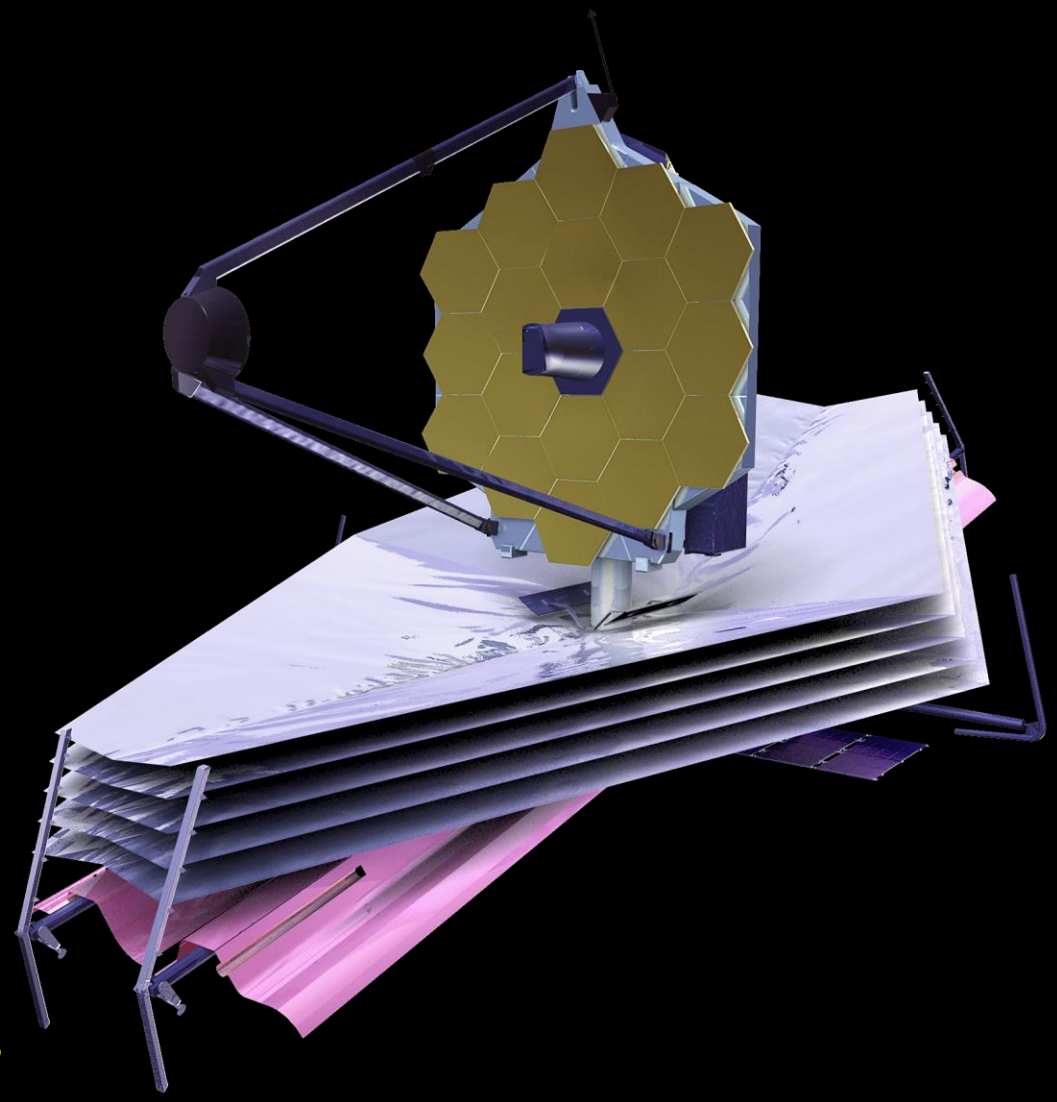
Crazy idea that might work, or just crazy?

- First suborbital test said to be successful
  - 20% of full centrifuge power (no rocket engine yet)
  - Projectile reached “in the tens of thousands of feet”
- Expecting another 30 suborbital test flights in next 6-8 months
- Technical challenges
  - High vibration
  - High G force (10,000 G)
  - Hitting wall of dense air at 5,000 mph: aerodynamics issue and high temperatures
  - Inrush of air as vacuum breaks at launch
  - Launcher vibration & shaking due to imbalance once projectile is released
- May be practical on the Moon to launch materials: vacuum, low gravity

James Webb Space Telescope (JWST) launching soon



- Successor to the Hubble Space Telescope
  - Project started 1996
  - Initially scheduled to launch in 2007
- Launch scheduled Dec. 22 from French Guiana on an Ariane 5 rocket
- Halo orbit around Sun-Earth Lagrange point L2
  - Earth blocks sunlight at L2 point
  - Halo orbit around L2 so the Moon doesn't block signals
- Doug Hall will talk about JWST in more depth



Images credit:NASA

How many launches since the last meeting (Nov 6)?

This includes failed launches if they lift off the launch pad

Only includes launches attempting going into orbit or beyond

Russian ASAT test does not count: it reached orbital altitude, but could not achieve speed to remain in orbit

Includes delayed report of a Chinese launch on Nov. 4

Nov. 13, 2021 SpaceX Falcon 9 launch of 53 Starlink satellites. Credit: SpaceX

Launches since last meeting, part 1


Nov 4 (delayed report) – Long March 6 – Earth observation satellite


Nov 10 – Falcon 9 – 3rd SpaceX crew launch to ISS (docked Nov 11)


Nov 13 – Falcon 9 – 53 Starlink internet satellites (new shell at 335 miles)


Nov 16 – Arianespace Vega – 3 signal intelligence satellites for French military


Nov 17 – Electron – 2 BlackSky earth observation satellites


Nov 19 – Rocket 3 (Astra) – first successful Astra test flight to orbit


Nov 19 – Long March 4B – Earth observation satellite


Nov 22 – Long March 4C – Earth observation satellite


Nov 23 – Falcon 9 – DART planetary defense test to smash into an asteroid


Nov 24 – Soyuz – New docking module launched to International Space Station (last!)


Nov 24 – Soyuz – Russian military early warning satellite


Nov 25 – Kuaizhou 1A – earth observation satellite or maybe military


Nov 26 – Long March 3B – communications satellite

Launches since last meeting, part 2

 Dec 2 – Falcon 9 – 48 Starlink satellites, 2 BlackSky earth observation satellites

 Dec 4 – Soyuz – 2 Galileo (European Navigation system) satellites (total now 28)

 Dec 6 – Ceres-1 (Galactic Energy, private Chinese company) – 5 small satellites

 Dec 7 – Atlas 5 – U.S. Space Force technology demonstration satellites

 Dec 8 – Electron – 2 more BlackSky earth observation satellites (total now 12)

 Dec 8 – Soyuz – 12 day mission to International Space Station (2 Japanese tourists)

 Dec 9 – Falcon 9 – NASA X-ray astronomy satellite

 Dec 9 – Long March 4B – 2 classified intelligence-gathering satellites

Discussion & questions?

Image: NASA

Featured speaker: Doug Hall

- Long been involved in NSS and interested in space-related technology
- Expert in oilfield wellhead equipment, both surface and subsea
- Worked for OneSubsea, Cameron, Schlumberger, GE Oil & Gas, Vetco Gray
- BS in Mechanical Engineering from Rensselaer
- Licensed Professional Engineer
- TOPIC: James Webb Telescope

Image credit: ESA – D. Ducros

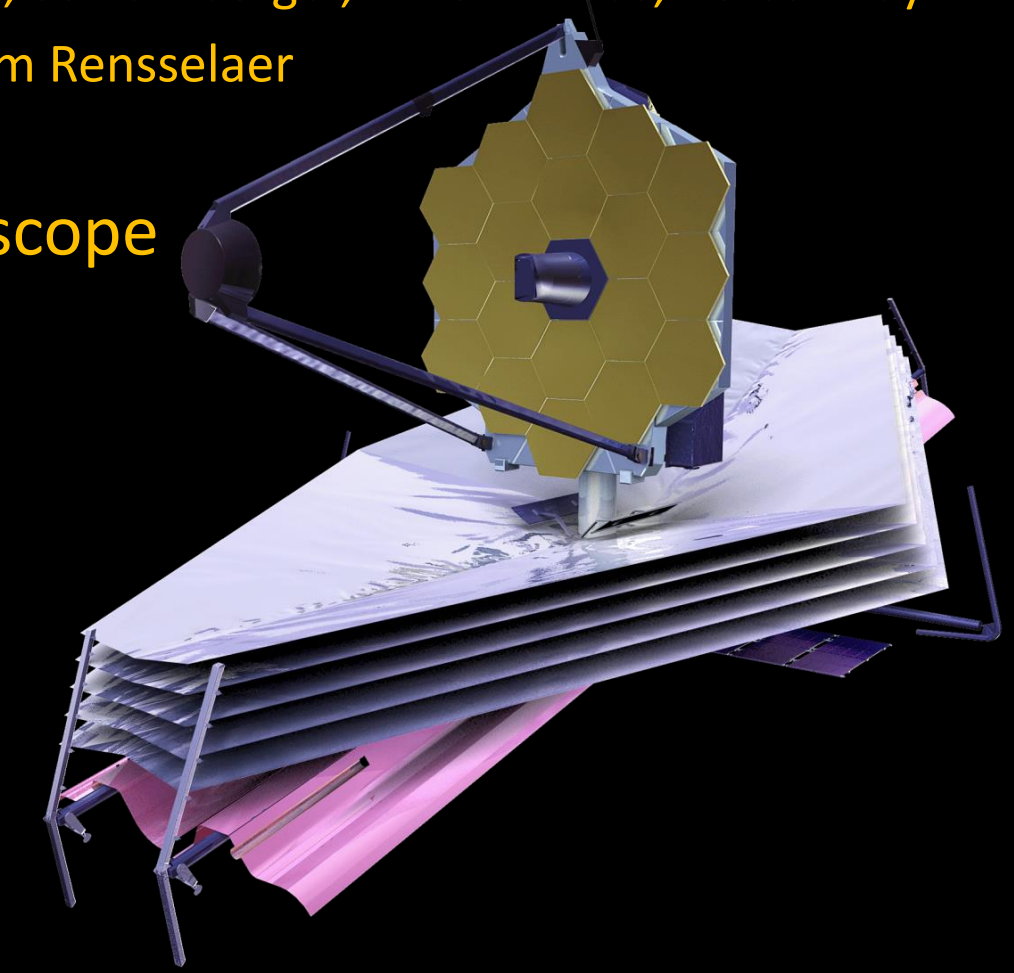


Image credit: NASA