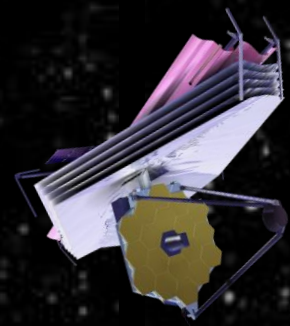
# Monthly Space News

Greg Stanley

Feb. 12, 2022



NSS North Houston Space Society

# James Webb Space Telescope (JWST) status

- All parts fully deployed
- Reached L2 Lagrange point
- Started 6 month halo orbit around L2
- Calibration of the 18 primary mirrors started
- Cooldown:  -347 °F, going to -390 °F
- Fuel may last 20 years

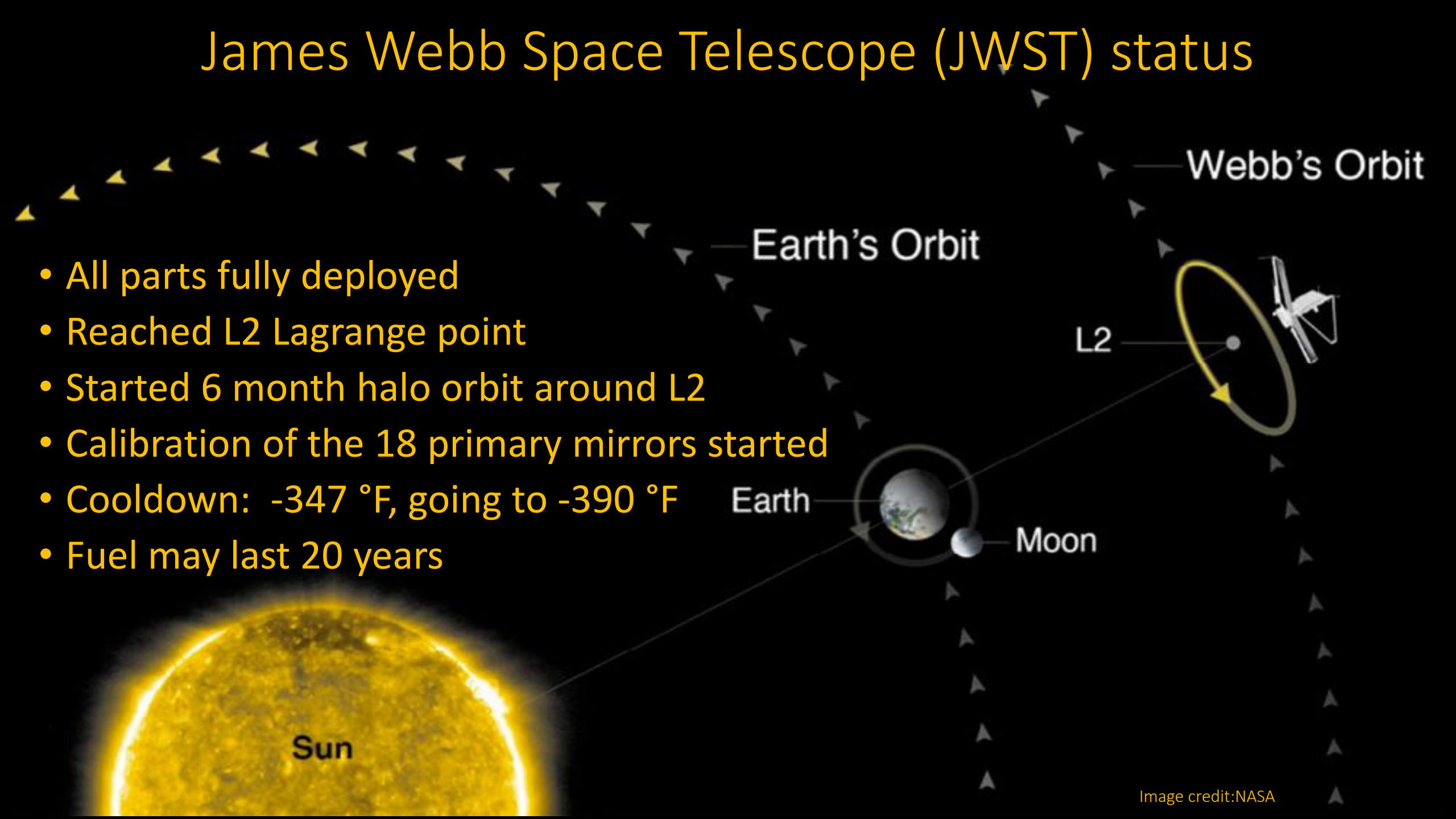
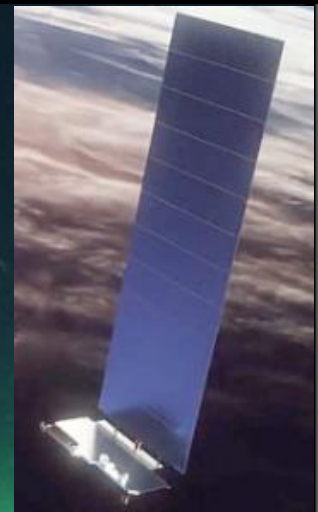



Image credit:NASA

# Space weather matters: Starlink lost 40 satellites

- 49 Starlink (internet) satellites launched Feb 3
  - Deployed initially to 210 km orbit (130 miles)
  - Normally climb on own ion engine power to final orbit: 550 km (340 mi.)
    - Failing satellites quickly de-orbit due to high drag
- Solar flare erupted Jan 30, predicted to arrive at earth Feb. 2
  - Earth's magnetic shield dumped the ions' energy into upper atmosphere
  - Resulting geomagnetic storm warmed atmosphere (visible: Aurora Borealis)
  - Increased atmospheric density: atmospheric drag increased by 50% at that altitude
- Satellites put into safe mode, flying edge-on to minimize drag
  - (Solar panel orientation probably also limits power, and engine not pointed optimally?)
- 40 satellites slowed too much, reentered full atmosphere and vaporized
- Storms will increase with 11 year solar cycle, with storms peaking in 2025
  - This minor G1 storm happens 1700 times/cycle
  - Worst case G5 storm: 4 times/cycle
  - Electrical damage possible from stronger flares



Credit: SpaceX

Aurora Borealis. Image credit: Schnuffel2002, Wikimedia Commons

# Ongoing testing: space debris cleanup/war preparation

- Chinese Shijian-21 satellite grabbed a defunct Chinese satellite in geo orbit
  - Moved that satellite to a higher than normal “graveyard” orbit, and returned
  - Shijian-21, launched last October, first tested circling around a satellite it released
  - Demonstrating capability similar to US satellites from Northrop Grumman (MEV-1,2)
  - Details not known.  Net?  Robotic arms? Spear?

Clues in mission patch?


Image credit: reddit user Temstar: https://www.reddit.com/r/Sino/comments/rgj9um/shijian21_mission_patch/

- Astroscale paused debris removal testing after an unspecified anomaly
  - Autonomous, longer distance approach than manual 2cm August test

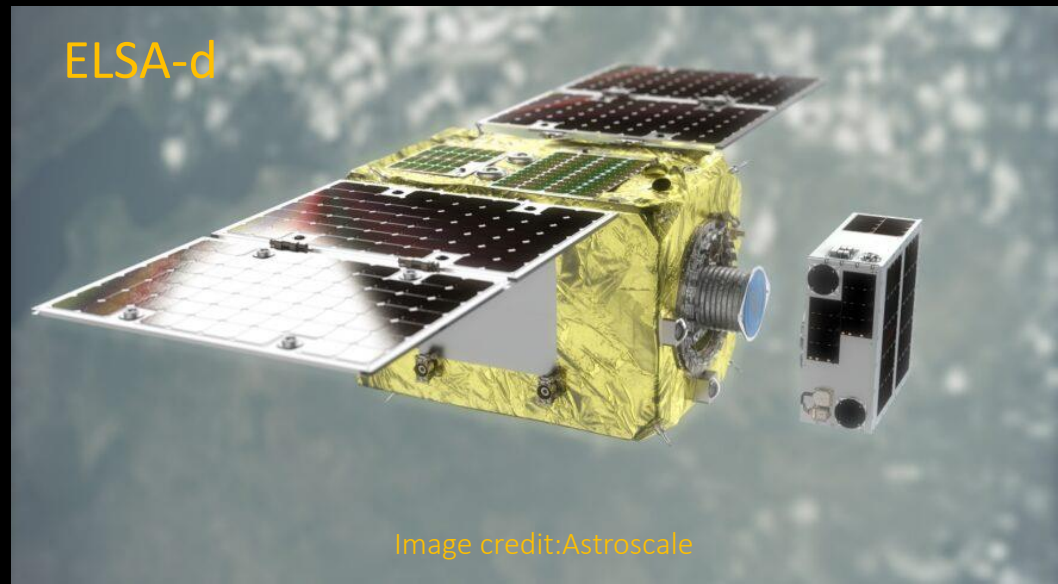



Image credit:Astroscale

# Astroscale ELSA-d test plan

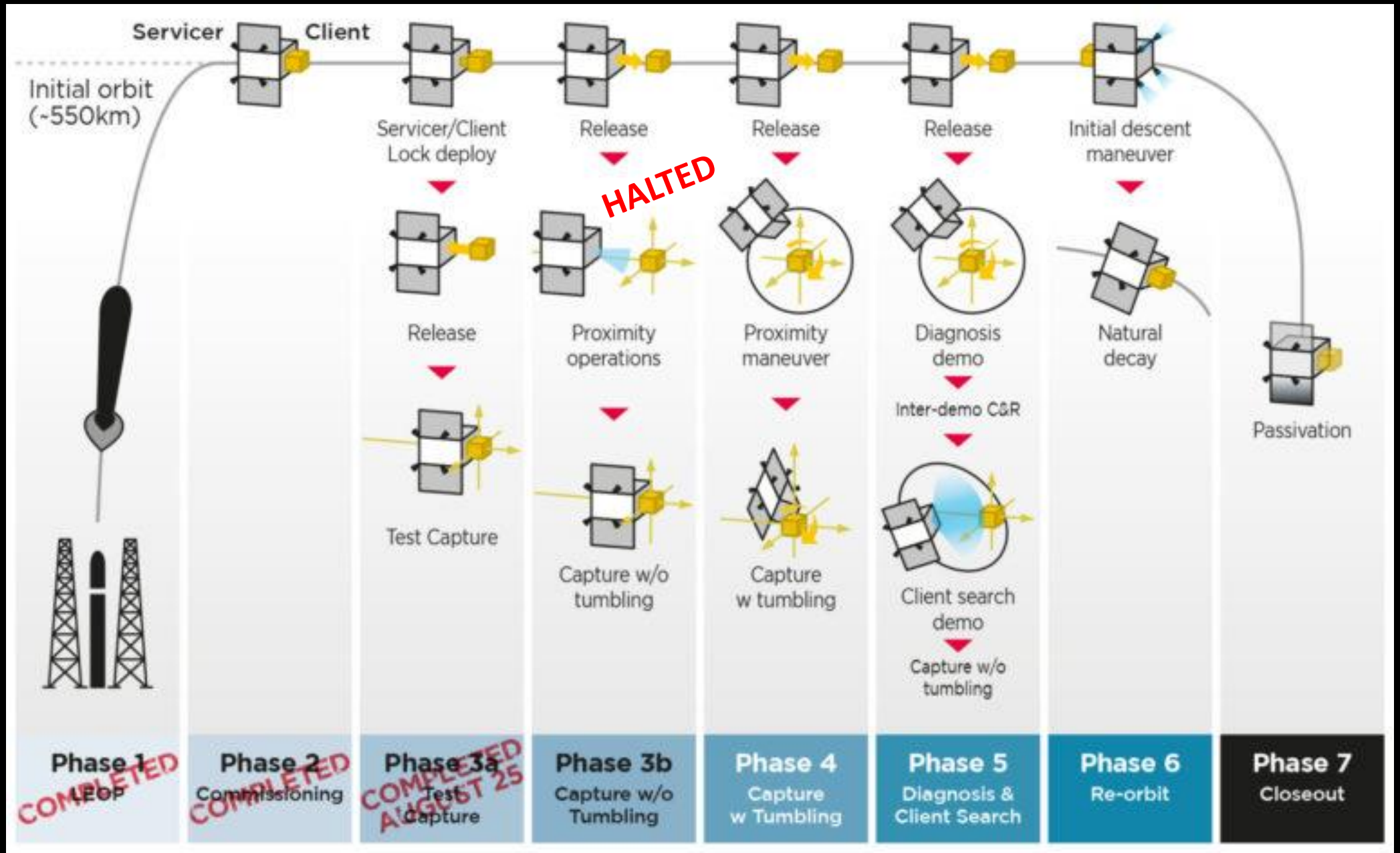



Image credit: Astroscale

# Ongoing space cold war

- U.S. satellite USA 270 (launched 2016) approached a pair of Chinese technology test satellites (Shiyan-12), which then moved away
  - Detecting and approaching other satellites, observing them, evading them
  - U.S., China, Russia, France, … all improving their “Space Situational Awareness”
- First publicly-announced space incident of this type was in early 2020
  - 2 Russian satellites tailgated a U.S. spy satellite (USA 245)
  - US satellites had “observer” ability in geosynchronous orbit at least since 2014 (now 6)
  - Russians also experimented with this capability long before 2020
  - China, Russia, U.S., also demonstrated the ability of a satellite to take hostile action
- Analogous to cold war close encounters between submarines, ships, planes

# Japanese space based solar power project updated

- Highlighted by NSS press release
- Revised Japanese technology roadmap
  - Testing power transmission from a satellite in Low Earth Orbit in 2025
  - 1 GW commercial power in 2030's
- Milestones about the same, but it's a firmer commitment

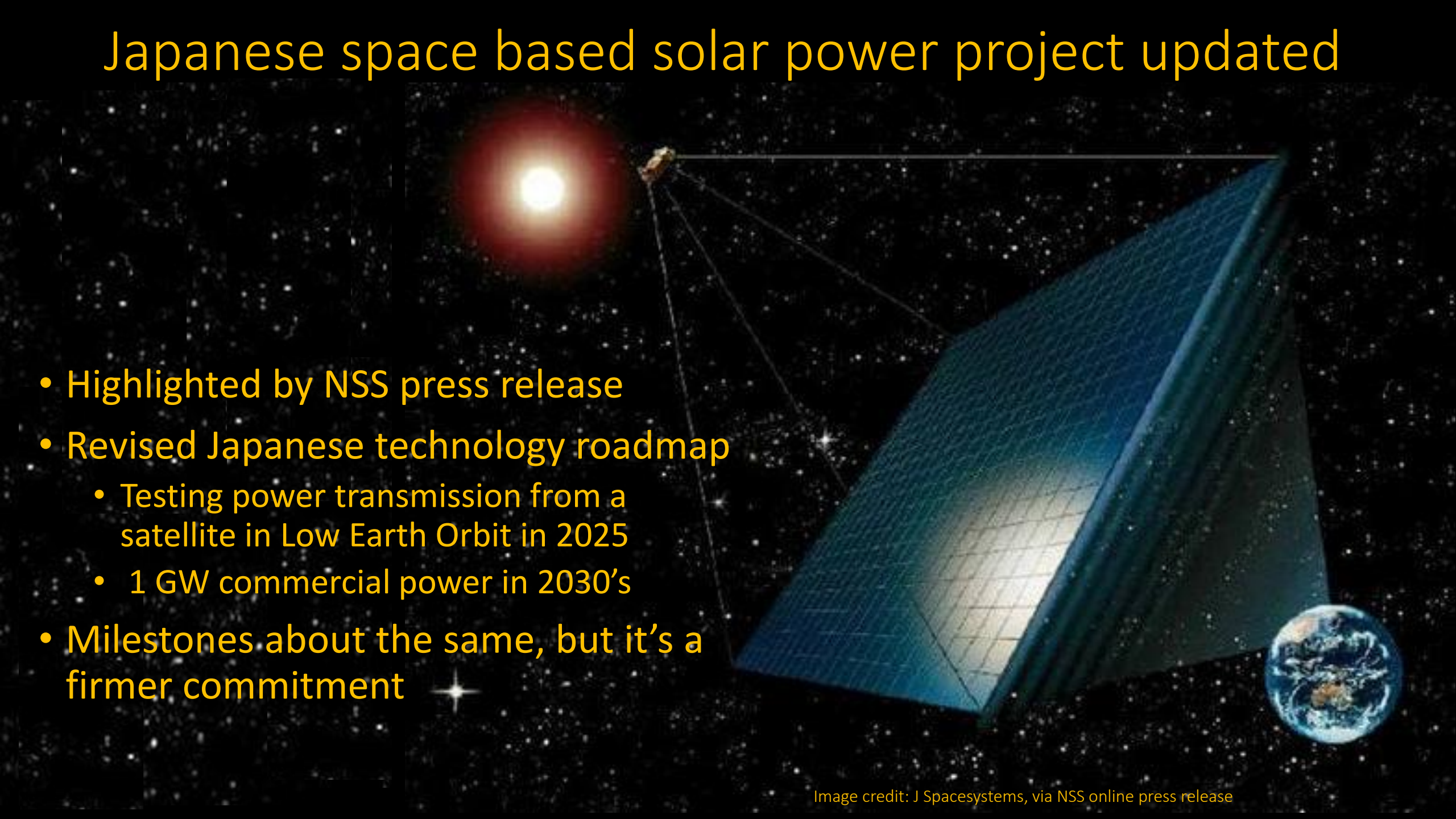


Image credit: J Spacesystems, via NSS online press release

# Space Based Solar Power (SBSP) overview

Idea from science fiction:  Isaac Asimov described power satellites with microwave power transmission in 1941

Image credit: Frazer-Nash Consultancy, via UK Space Agency ( www.gov.uk)

3 part architecture defined by Peter Glaser (1968):

- Collecting energy: solar cells or boilers, reflectors
- Transmission to Earth, typically microwave or laser
- Receiving power on Earth (or other location)

- Key innovation was using a large Rectenna
  - Invented in 1964
  - “antenna” plus “rectifier” converting AC to DC (diodes)
    - RFID tags, including Harris County EZ Tag, are powered this way (not E-ZPass, which needs a battery)
  - Covers large area  (square kilometers / square miles)


Image credit:NASA

# Rectenna

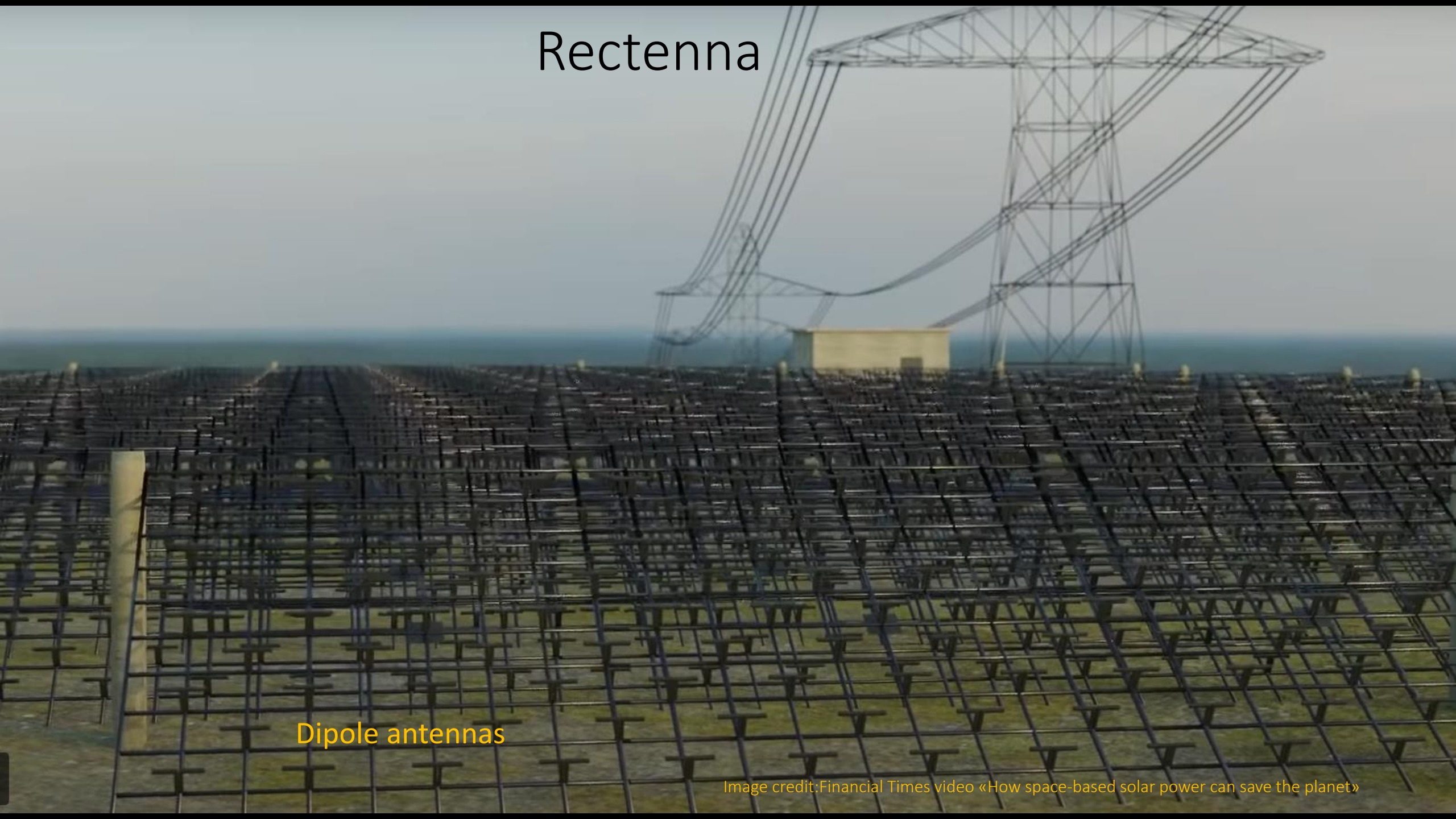



Image credit:Financial Times video «How space-based solar power can save the planet»

# Space Based Solar Power reconsidered – why now?

- Launch cost coming down dramatically, launch capacity going up
- Solar panels and other technology cost & weight coming down
- Robotics improving – large scale automated assembly avoids need for astronaut support
- Newer modular designs with plate-sized size panels with better controls
  - Self contained, mass-produced “sandwich” tiles
    - Solar cells on one side
    - Microwave transmitters on other side
    - Electronics in between
  - Tiles independently aim microwave beams, eliminating weight of large amounts of wire to connect them
  - May also eliminate most supporting structures – self-assembling “school of fish” approach eliminates most assembly work

# Some advantages of space based solar power

- Sun never sets in space (in high orbit) – available 24 hrs. vs. 7-8 hrs.
- No atmospheric interference, weather (30% more Sun)
- Clean, no-carbon power (once in place, and ignoring maintenance)
- Can be redirected, e.g., for disaster relief, military use

- Long term: raw materials & processing on the moon or asteroids
  - Low gravity and no atmospheric drag reduces launch costs
  - No earth pollution for mining, processing, launches


Conceptual drawing. Image credit:NASA

# Barriers to space based solar power

- Cost has always been the biggest barrier (10x – 100x)
  - Launch and maintenance cost, greater than land-based solar cell installation
  - Space conditions are more severe – high-orbit panels degrade 8x faster than on earth
    - People and the electronics in robots do poorly in radiation at high orbits
  - Scale:  large transmitting & receiving antennas, for safety and microwave beam spreading
- Risks
  - Interference with existing satellites (collisions, radiation damage, communications, etc.)
  - Space debris
  - Damage to people, animals & facilities on the ground or air if transmission aiming strays
  - Vulnerability to war, terrorism, …
- Technology issues
  - Atmospheric losses, depending on radio frequency used
  - Energy losses due to transmission and conversion electronics
    - Light to DC electricity to microwave to high frequency AC electricity to DC to 60 Hz AC
  - Solar cells need to optimize watts/mass rather than watts/area
  - Heat dissipation
- Elon Musk (2012): *“the stupidest thing ever”  “Stab that bloody thing in the heart”*

# Space based solar power:  other projects

- Extensive early NASA research since 1975 was shelved due to cost
- US Naval research lab:  first orbital test on the X-37B in 2020
  - Tested conversion of sunlight to microwave power, but not transmitted to Earth
- Air Force Research Laboratory looking for power for forward bases
  - $100M contract awarded to Northrop Grumman, with satellite test in 2024
- Caltech ongoing program, backed by a $100M private donation
  - Test array launch by 2023
- UK is discussing an operational system by 2050
- China will launch small-scale tests by 2025, hope for larger (MW size) station by 2030

# How many launches since the last meeting (Jan 8)?

*Includes failed launches if they lift off the launch pad*
*Only includes launches attempting orbit or beyond*

December 31, 2022 SpaceX Falcon 9 booster landing at Cape Canaveral. Credit: SpaceX

# Launches since last meeting (Jan 8)

 Jan 13 – Falcon 9 – “Transporter 3”:  105 small satellites

 Jan 13 – LauncherOne/Boeing 747 (Virgin Orbit) – 7 small satellites

 Jan 17 – Long March 2D – Classified satellite

 Jan 18 – Falcon 9 – 49 Starlink (internet) satellites. Launched 2,042/planned 4,400 ++

 Jan 21 – Atlas 5 – 2 military satellites for approaching, inspecting objects in geo orbits

 Jan 31 – Falcon 9 – Italian Space Agency radar surveillance satellite

 Feb 2 – Falcon 9 – Spy satellite for US NRO (National Reconnaissance Office)

 Feb 3 – Falcon 9 – 49 Starlink (internet) satellites (40 lost later from geomagnetic storm)

 Feb 5 – Soyuz – classified, probably a military spy satellite

 Feb 10  – Soyuz – 34 OneWeb (internet) satellites, now at 428 / planned 648

 Feb 10 – Astra Rocket 3.3 – 4 NASA-sponsored cubesats (FAIL in upper stage)

- (total 11)

# Discussion & questions?

Image: NASA

# Featured speaker: Andrea Leinfelder

- Space reporter for the Houston Chronicle
  - Covers technology, including human spaceflight, robotic exploration, LEO operations
  - Also covers commercial space companies, ports, hurricanes, local business news
- Previously at other papers in Florida and Arizona
- BS Journalism from University of Florida

Images credits: Houston Chronicle

HOUSTON CHRONICLE

## NASA and SpaceX eye or sluggish parachute

By Andrea Leinfelder STAFF WRITER

NASA and SpaceX are examining parachutes used for landing capsule after back-to-back splashdowns saw one parachute lag

A SpaceX capsule carrying crew had one parachute inflate 75 s expected when landing in the Gulf of Mexico on Nov. 8, and a carrying cargo had a parachute lag by 63 seconds when landin Ocean on Jan

## Watery grave planned for space station

By Andrea Leinfelder
STAFF WRITER

At the end of its life, the International Space Station will plummet into the Pacific Ocean.

NASA and its international partners are working to extend space station operations through 2030. If they're successful – and its life isn't ended prematurely or extended again – that means the space station could have a controlled water landing as soon as January 2031.

Nearly the size of a football field including the end zones, the station would break into smaller pieces upon reentry and then splash down near Point Nemo, a spot in the Pacific Ocean that is farthest from land.

This deorbit plan isn't new, but it was highlighted this week in the congressionally mandated International Space Station Transition Report. This report outlined goals for

*Space station continues on A11*

## NASA's launch of moon rocket delayed

By Andrea Leinfelder STAFF WRITER

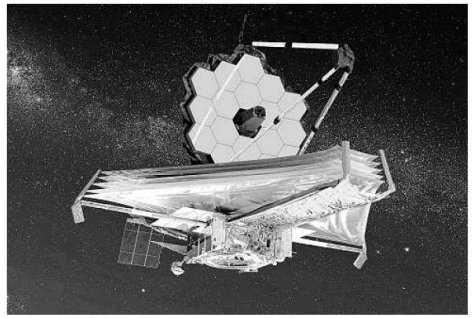
Kim Shiflett / NASA

The mobile launcher for the Artemis I moon mission, atop a transporter, sits at NASA's Kennedy Space Center in Florida. The initial launch of the mission won't be until April or May.

The first launch of NASA's moon rocket has been pushed to April or May, the

## Webb telescope reaches new home in space

By Andrea Leinfelder STAFF WRITER



Adriana Manrique Gutierrez / NASA via New York Times

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