

Monthly Space News

Greg Stanley
Sept. 10, 2022



This month's news highlights...

- Artemis 1 lunar launch delay
 - Hydrogen (Space Launch System propellant) pros and cons
 - Near Earth Asteroid Scout (secondary payload) with its solar sail
- September's DART planetary defense test: crashing into an asteroid
- Lunar space suits
- Space-based service coming to your cell phone (sort of)
- Recent launches

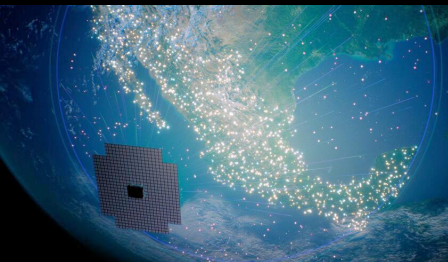
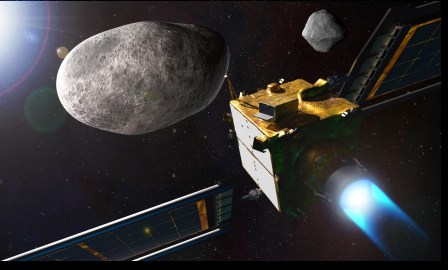
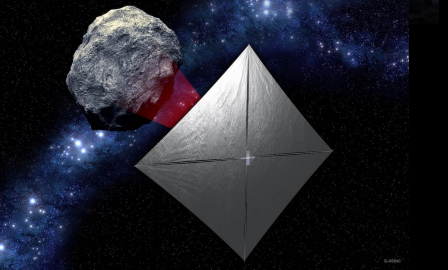


Image: NASA

Artemis I launch (SLS/Orion) scrubbed again

SLS + Orion
at launch

Launch Abort System

Orion, after disposal of
its propulsion stage

2 Solid Rocket
Boosters (SRBs)

4 RS-25D engines
(Space Shuttle)

- 42 day mission around moon (no crew)
- 1st scrub: one engine apparently didn't cool down enough (sensor problem), small H₂ leak
- 2nd scrub: large hydrogen leak in quick-disconnect fuel line fitting
 - Maybe human error: valve sequence/overpressure
- Delays led to battery life concerns
 - Flight Termination System (FTS)
 - 10 6U Cubesats sat in the rocket for a year
- Delayed until late September, or October
 - H₂ leaks: will fix, test cryogenically (only on launch pad)
 - Back to VAB? Vehicle Assembly Building for FTS certificate
- Still haven't ever fully fueled 1st & 2nd stages
 - "Tanking" test mid-September after H₂ fix.

Orion capsule

ESA Service Module

Credits: NASA

Benefits and problems with hydrogen rocket fuel

- Congress dictated SLS design choice: re-use Shuttle equipment & contractors

- Pros

- Efficient

- Light weight even as liquid at -423 °F
 - Power: highest specific impulse

- Used since 1950's

- Non-toxic (unlike, say, hydrazine)

- Only need water for future in-situ production on the Moon or elsewhere

- Cons

- Smallest molecule: leaks!

- Seals, pores in welds leak
 - History of leak problems
 - Shuttles grounded 6 months finding leaks

- Low temperature storage

- Expands rapidly with heat
 - Volatile (vaporizes easily)
 - Need insulation & venting on vehicle and land
 - SLS tank length shrinks 6" when fueled: complexity

- Flammable over wide range of air/H₂

- with nearly-invisible flame

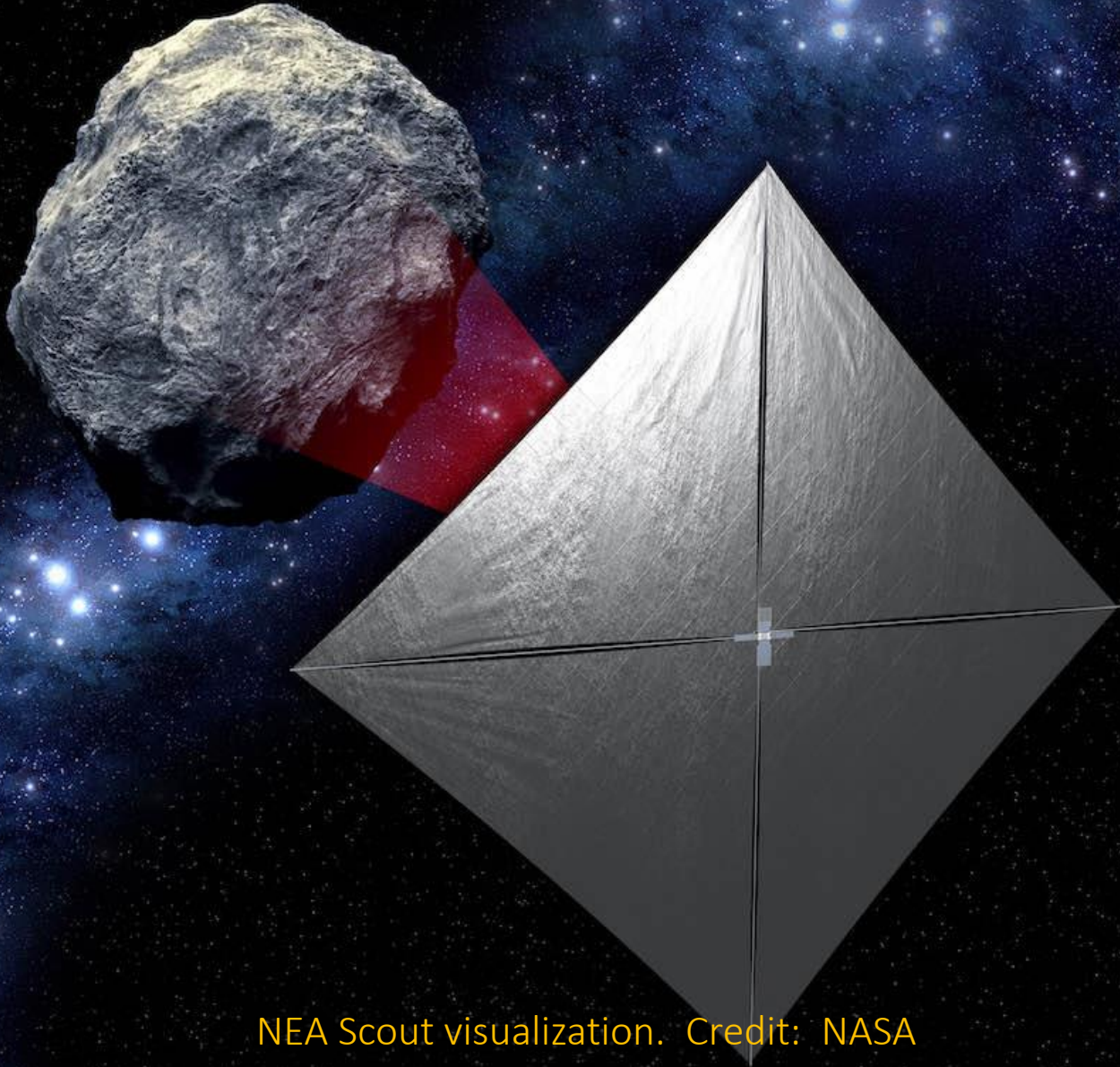
- Makes metals brittle



SLS at launch pad. Credit: NASA

One of ten Artemis I secondary payloads: NEA Scout

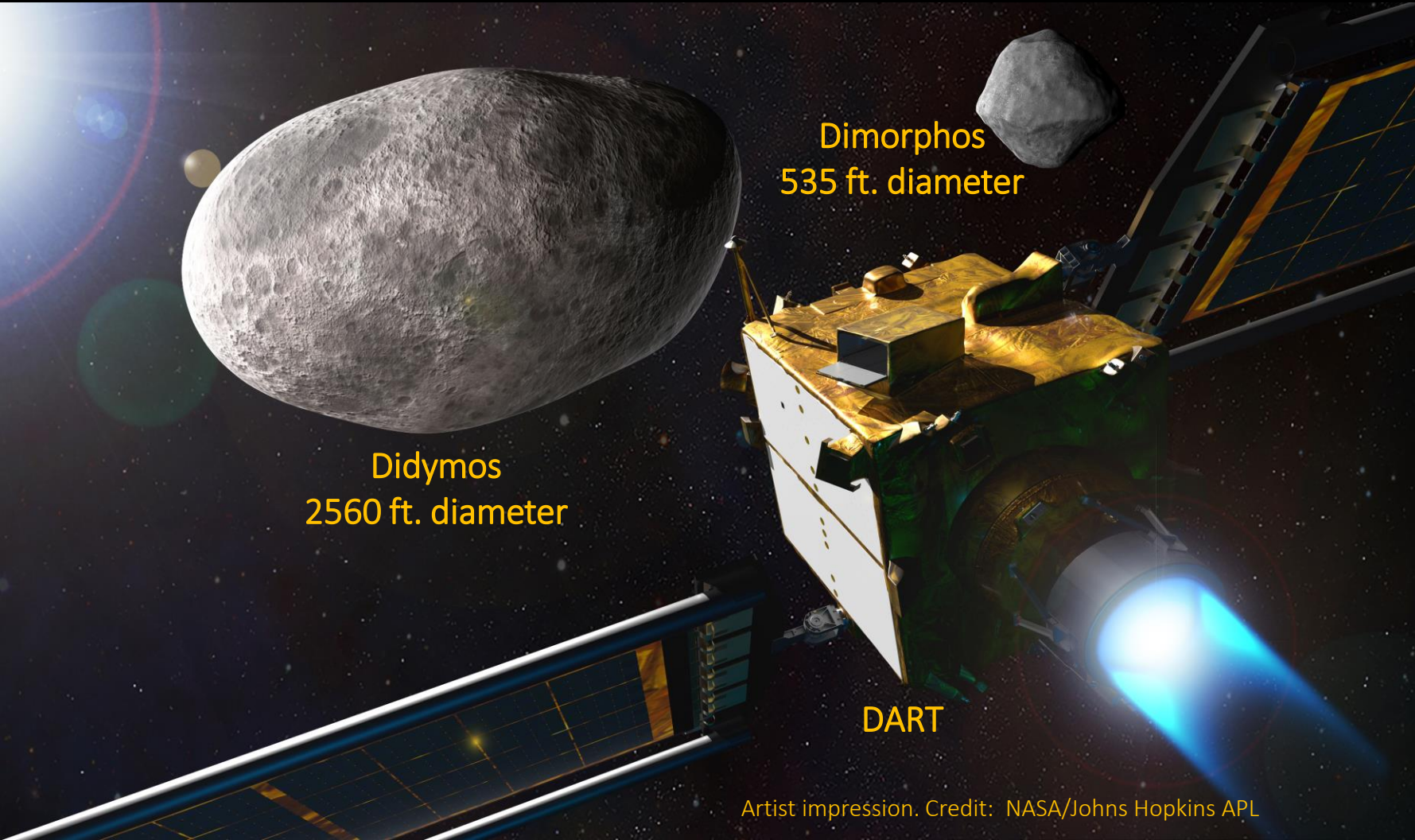
- Near-Earth Asteroid Scout will explore small asteroids near Earth
- A 6U CubeSat (shoebox) with a 925 sq. ft. solar sail (size of tennis court)
- Rideshare opportunities beyond Earth orbit are rare
- First visit is to a school bus sized asteroid in late 2023
 - Fly by within a mile at a slow 100 feet/second (68.2 mph)
 - 14 megapixel camera



NEA Scout visualization. Credit: NASA

DART (Double Asteroid Redirection Test) crashing Sept. 26

- DART: Test of planetary defense, crashing 1100 lb craft into an asteroid moonlet at 15,000 mph to measure orbit alteration

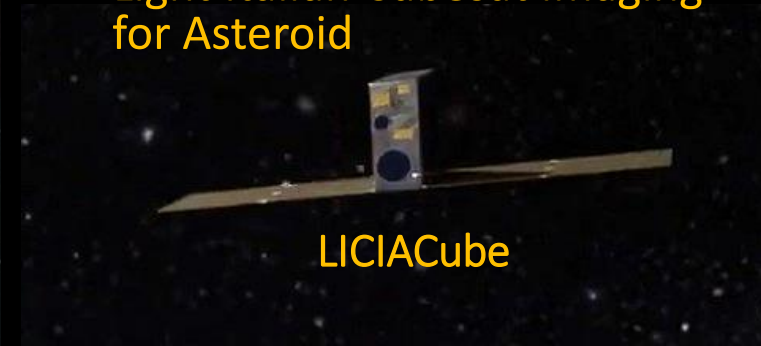


Didymos
2560 ft. diameter

Dimorphos
535 ft. diameter

DART

- Launched Nov. 24, 2021 on a Falcon 9
 - First measurable human orbit alteration
 - New ion engine mainly a test
- DART camera now sees the target moonlet Dimorphos
- LICIAcube (10U Italian cubesat) will record collision and aftermath
 - Light Italian Cubesat Imaging for Asteroid



LICIAcube

Lunar/International Space Station (ISS) space suit update

- Space suits were delaying Artemis lunar landing (2021 audit report), dangerous at ISS (water in helmets)
 - A failed ISS space suit was just brought back (Aug. 20) on a Cargo Dragon craft for analysis
- NASA started a new commercial spacesuit program
- NASA narrowed choices to Axiom & Collins Aerospace in June, 2022 (the only bidders on the project)
- Axiom Space contracted to build spacesuits for the Artemis 3 lunar landing (\$228.5M)
 - Collins and Axiom both eligible for future awards (ISS or Lunar), up to \$3.5B

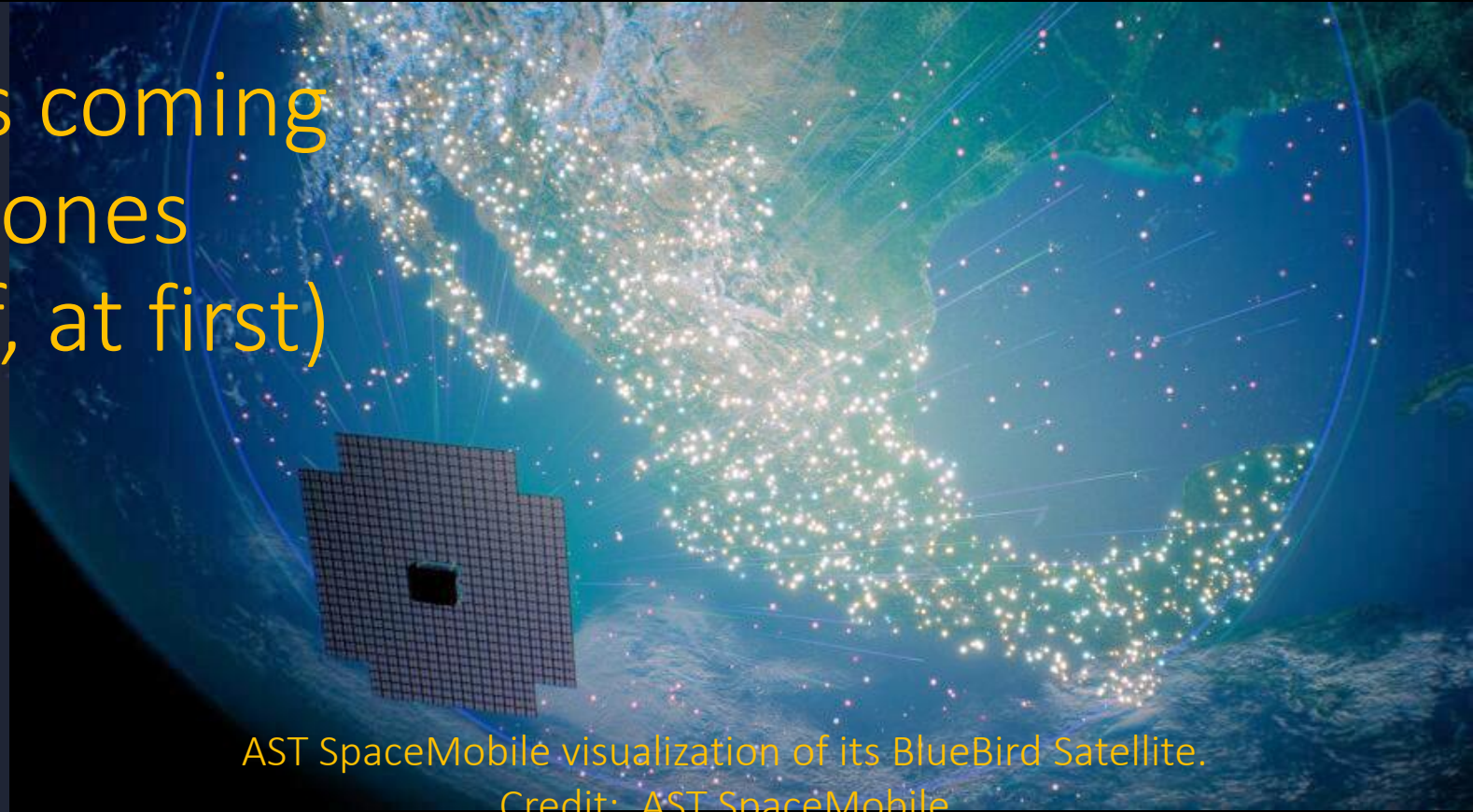


Credit:
NASA

Space based service is coming to ordinary cell phones (sort of, at first)



Credit: Lynk Global



Credit: AST SpaceMobile

- Iridium proved LEO satellite constellations can provide service to specialized mobile phones in 1998 (special frequency, clunky antenna, heavy battery, line of sight)
- New entrants essentially put cell phone towers in the sky, with much bigger antennas, filling in gaps in existing cell service (not competitive in well-served areas)
- SpaceX (Starlink), Apple just announced, but Lynk Global and AST SpaceMobile are further along

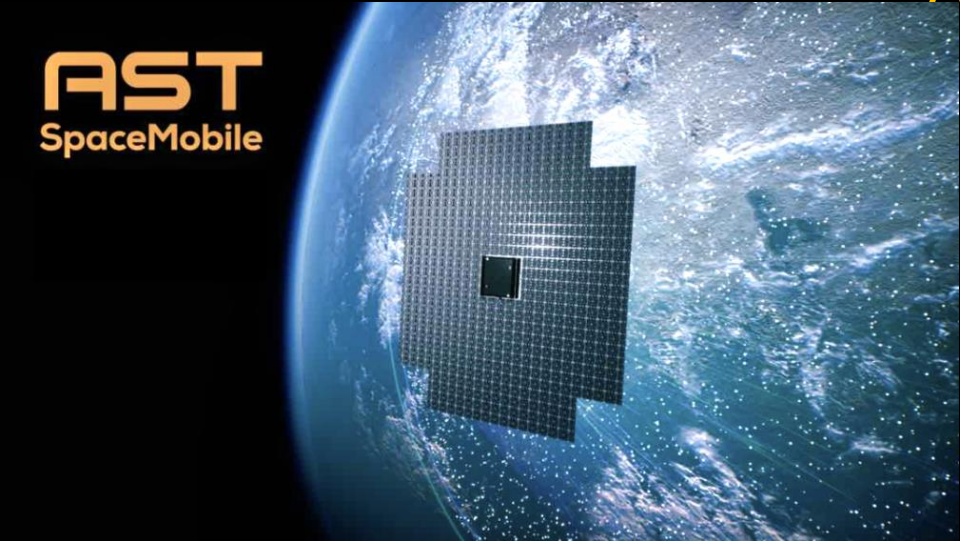
Space based cell phone service – initial players

- Lynk Global (Falls Church, VA)



- Tested space-based text messaging in 2020
- Launched 4 test satellites by May, 2021
- Launched first mass-producible satellite in June, 2021
- Launching 2 more satellites in November, 2022, with 11 sq. ft. antenna
- Starting text services before the end of the year (intermittent only – hourly)
- Goal: global talk, text, data coverage by 2025 with thousands of satellites, 14 mobile network operators. Need thousands of satellites for continuous talk.

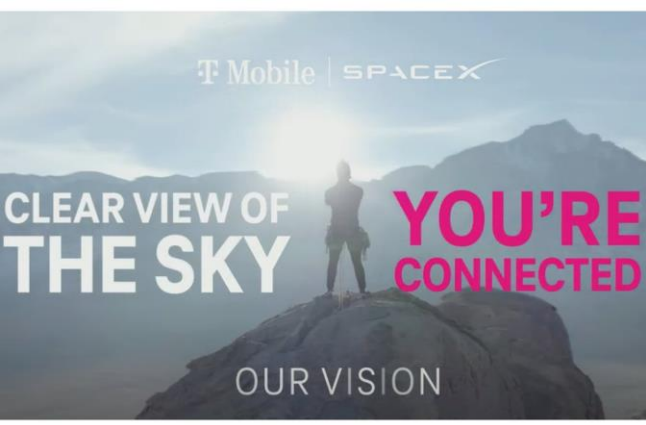
- AST SpaceMobile (Midland, TX)



- Prototype “BlueWalker 3” satellite to launch in September has 693 sq. ft. antenna (roughly 26 x 26 ft.)
- First 5 commercial satellites delayed until late 2023; 110 in original plan
- Has agreements, backing from Vodafone, Rakuten, Orange, Nokia, American Tower

Space based cell phone service – new announcements

- SpaceX Starlink announced link with T-Mobile



- Beta testing at end of 2023
- V2 Starlink satellites will add a 270 sq. ft. antenna for cell service
 - Roughly 16.4 x 16.4 ft
- Limited bandwidth
 - 2-4 mbps shared among all users in a zone (2000 calls/ 100,000 texts)
 - Initially limited to text messages and pictures, with voice & data later on

- Apple/Globalstar partnership for emergency text messages

- “Emergency SOS” on iPhone 14 when out of terrestrial network coverage
- Start in November in U.S., Canada
- Must point phone directly at a satellite (aided by an app)
- Globalstar has 24 second-generation satellites (40 total) in Low Earth Orbit (LEO)



Credits: Apple, SpaceX

How many launches since the last meeting (Aug 13)?

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

Ariane 5 rocket launching a
Eutelsat communications satellite
9/7/22 Credit: ESA



Launches since last meeting (Aug 13)



Aug 19 – Falcon 9 – 53 Starlink (internet service) satellites



Aug 19 – Long March 2D – 3 spy satellites



Aug 22 – Kuaizhou 1A – unknown



Aug 23 – Long March 2D – (optical) earth observation



Aug 27 – Falcon 9 – 54 Starlink satellites – heaviest Falcon 9 payload at 36,800 lbs



Aug 31 – Falcon 9 – 46 Starlink satellites



Sept 2 – Long March 4C – spy satellite



Sept 4 – Falcon 9 – 51 Starlink satellites + Boeing rideshare testing broadband comms



Sept 5 – Kuaizhou 1A – 2 communications satellites



Sept 5 – Long March 2D – 3 spy satellites



Sept 7 – Ariane 5 (only 3 left now) – commercial communications satellite

- _____
- 11 total

Discussion & questions?



Image: NASA



Featured speaker: Chris May

- Flight controller, instructor at Johnson Space Center
- Musician
- B.S., M.S. degrees in Mechanical Engineering

TOPIC: My Journey Through Flight Operations