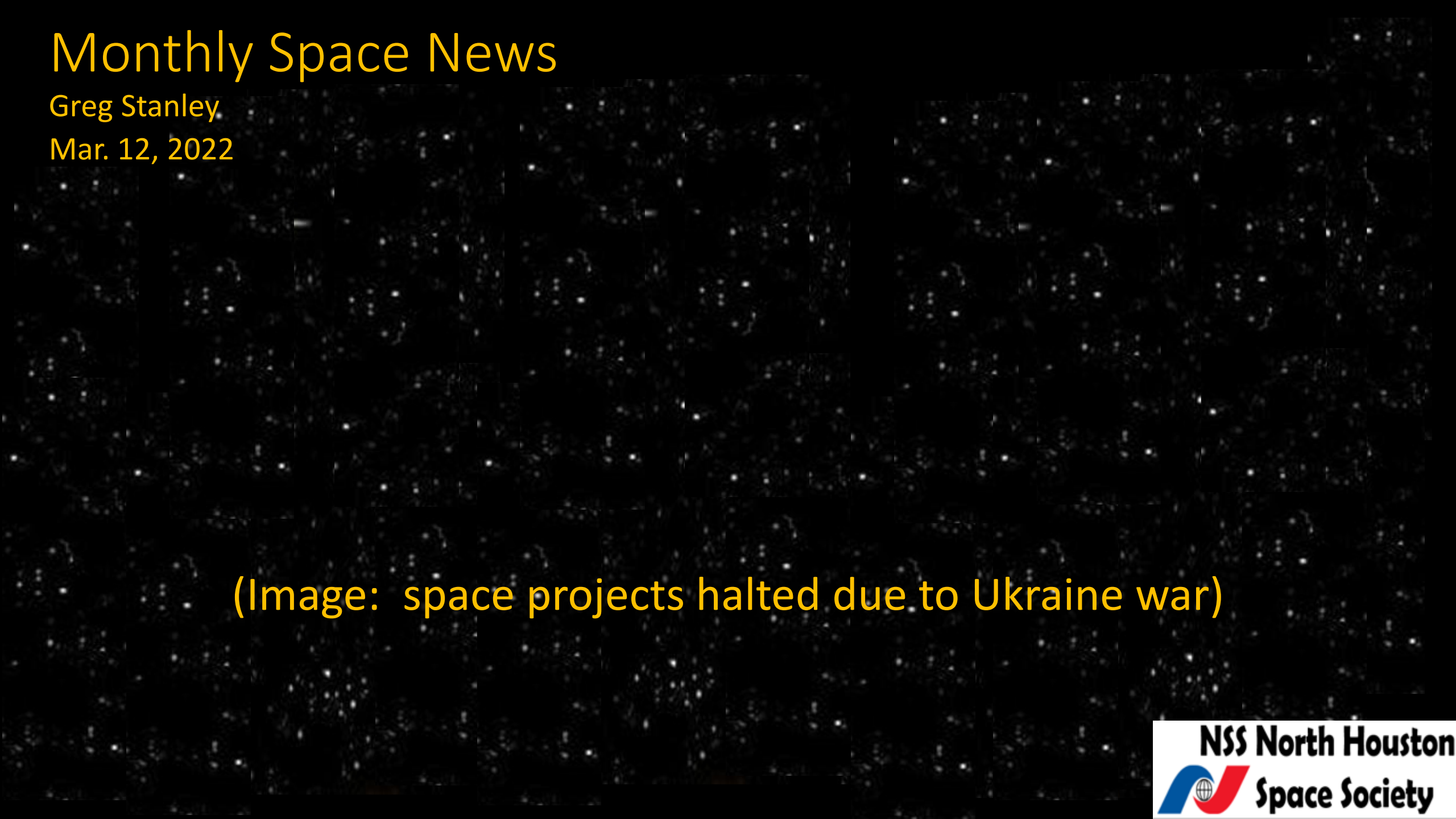
Monthly Space News

Greg Stanley

Mar. 12, 2022



(Image: space projects halted due to Ukraine war)

NSS North Houston Space Society

Ukraine war backlash: impact on Russian space programs

- Commercial relationships with West (incl. Japan, Korea, Taiwan) broken
  - Short term – Western contracts except International Space Station (ISS) are halted
  - Longer term – most relationships will get untangled
    - Commercial launch business was declining, now probably in severe decline at best
    - Commercial Russian rocket and engine business will severely decline at best
- Relationships with India and Middle East? Not as clear.
- Russia likely to become a client state of China, including joint space programs
- Russian space program will probably fall back to a mainly military focus
- Long term, sanctions will also degrade the Russian program
  - Semiconductor chips, other technologies
  - Results depend on Chinese help
  - 2014 sanctions after annexation of Crimea were ineffective (radiation-resistant chips)

Ukraine war: Ukrainian space industry is disrupted

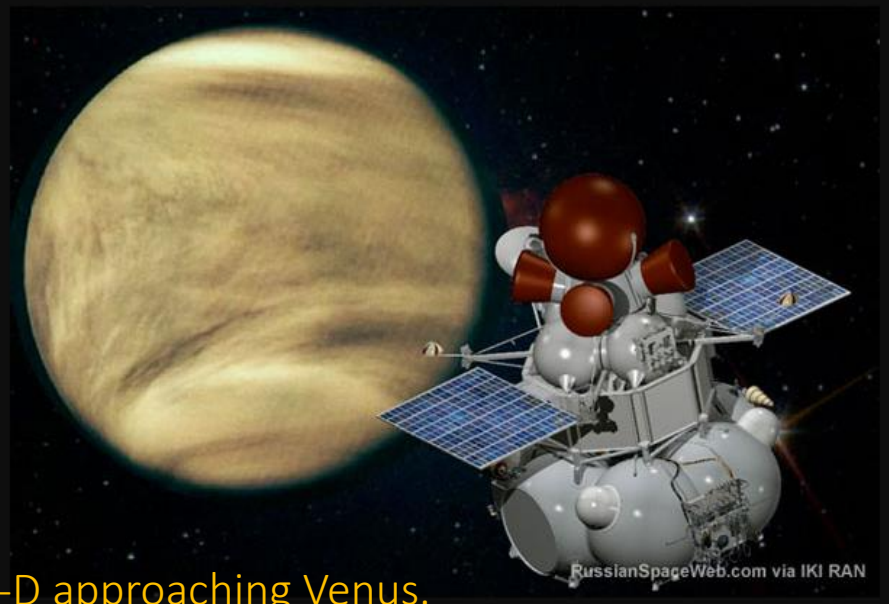
- It was bigger than you think – established during the Soviet era
  - Ukrainian Space agency had 16,000 employees, almost NASA sized
  - 20 state-run corporations mostly left over from Soviet era
  - Research, manufacturing, test facilities and hangars worth billions
- Manufacture engines for Europe's Vega rockets
- Northrop Grumman Antares rocket uses first stage designed and built in Ukraine with Russian RD-181 rocket engine
  - Antares rocket delivers the Cygnus cargo vehicle to ISS
- Unconfirmed reports that the Ukraine factory was damaged or destroyed

Ukraine war: impact on U.S. government space programs

- U.S. changed space policy since 2014, to reduce dependence on Russia
  - Starting Commercial crew program to launch astronauts
  - Congress ordered end of Atlas 5 rockets use of Russian RD-180 engines (2014)
    - 25 remaining Atlas missions planned before retirement, but we already have the engines
    - Now we won't get tech support, not a major concern
    - ULA's replacement rocket (Vulcan Centaur) plans to have Blue Origin BE-4 engines when available
- Russia now decided to stop selling RD-180 engine to U.S.
  - U.S. won't be buying them anyway (like "you can't fire me because I quit")
  - Dmitry Rogozin, head of Roscosmos (Russian space agency): *"Let them fly on broomsticks"*

Ukraine war: impact on U.S. government space programs

- Northrop Grumman Antares rocket with Ukrainian first stage, Russian engine
  - Northrop Grumman only has supplies to build next two launches (2022, 2023)
  - Looking at alternatives for first stage (Vulcan? SpaceX?)
- Venera-D robotic mission to Venus partnership halted (still in early phase)
- International Space Station (ISS) is the biggest question…



Venera-D approaching Venus.
Credit: russianspaceweb.com

Antares Rocket. Credit: Northrop Grumman

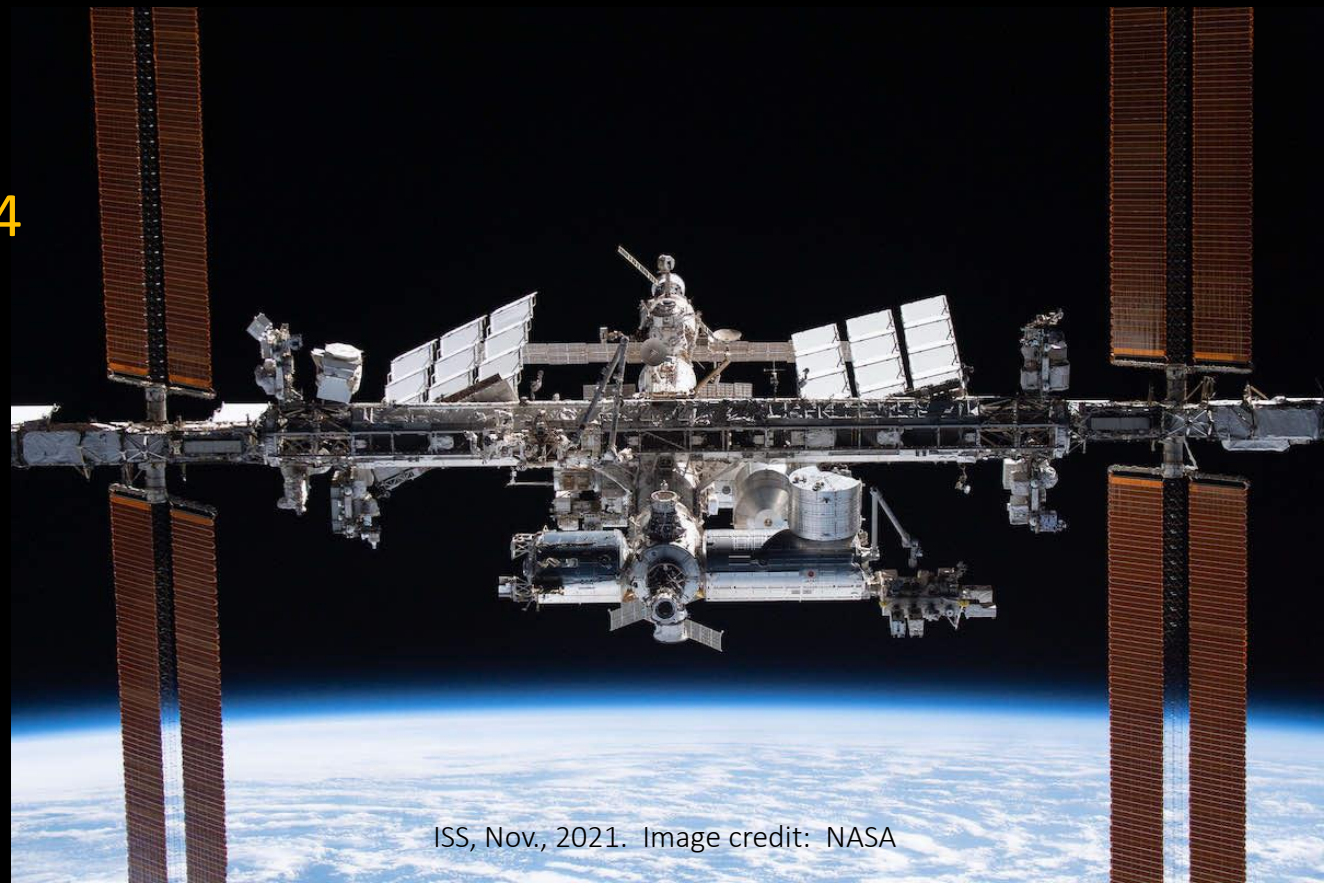
Ukraine war : impact on the International Space Station

- The International Space Station (ISS) is the only unaffected partnership (so far) except for some halted joint on-board experiments, and a tweet war…
  - Roscosmos head Dmitry Rogozin called former U.S. astronaut Scott Kelly a “moron” with dementia
  - Scott Kelly called Rogozin a “child” and a “clown” in subsequent interviews
- … and some Russian threats to withdraw, or not transport American astronauts

ISS, Nov., 2021. Image credit: NASA

Ukraine war : impact on International Space Station

- Dependence on Russian modules, cargo ships for propulsion to boost orbit
  - Implicit threat made that without Russian cooperation, ISS could crash uncontrolled
  - Will test new U.S. capability to boost ISS orbit with Cygnus cargo freighter
- Tensions make earlier ISS termination more likely, increase incentives to develop new private stations
- ISS operations and training continuing
  - Current crew has 2 Russians, 1 German, 4 U.S. astronauts
  - Crew changes still planned for March



ISS, Nov., 2021. Image credit: NASA

Ukraine war: impact on European Space Agency (ESA)

- Russian staff in French Guiana (ESA launch site) left
  - 87 Russian employees
  - Built in 2011 by ESA for $800M, launched 27 Soyuz rockets
- Stops missions booked on Soyuz rockets from French Guiana
  - 2 Pairs of ESA Galileo navigation satellites (GPS competition)
    - Future launches planned on European Ariane 6 when available (2023?)
  - French CSO-3 military spy satellite
  - ESA EarthCARE climate science mission
  - ESA Euclid telescope (2023) to study dark energy, dark matter
  - Sentinel 1C radar satellite
  - METOP-SG meteorological satellite

Dec. 29, 2020 Soyuz launch of French military spy satellite CSO-2, French Guiana. Credit: Arianespace

Ukraine war : ESA impact, continued

March 25, 2021 Soyuz launch of 36 OneWeb internet satellites, Vostochny Cosmodrome Credit: Arianespace

- Arianespace also managed commercial Soyuz launches from Russia
  - Commercial sale of Russian launches to the West is probably finished for this decade
  - Launches halted for OneWeb, South Korea, Sweden, Axelspace, Synspective, …

Ukraine war : ESA impact, continued

- ESA small rockets Vega, Vega C upper stages use Ukrainian RD-843 engine

- ExoMars joint ESA/Russia mission now unlikely in 2022
  - Next window would be 2024, if ever, for a troubled mission
  - ESA-built science orbiter already launched to Mars on Russian Proton rocket (2016)
  - ESA-built rover was planned for Mars using Russian Proton rocket, Russian lander (2022)

- Spektr-RG space X-ray observatory
  - Joint Russian/German project
  - At Sun-Earth L2 Lagrange point (like JW Space Telescope)
  - Germans announced all scientific cooperation will end
  - Russians shut if off in retaliation, and will take it over

ESA rover. Credit: ESA

Russian Spektr-RG stamp. Credit: A. Moskovets, RusMarka, Public domain, via Wikimedia Commons

Ukraine war: impact on space launch companies

- Few companies currently have any capacity to take up slack by loss of Russian launches, rockets, and engines
  - Rocket Lab will grow for small launches, despite cost disadvantage to SpaceX
  - Most other small launch specialists aren't ready (Virgin Orbit, Astra, Relativity, …)
  - Large (non-reusable craft) launches are limited (Atlas, Delta, Mitsubishi, Indian, …)
  - SLS isn't ready, is fully booked, and too expensive
  - Ariane 6, Blue Origin, Vulcan, new Mitsubishi rockets aren't ready
- Could China grab business?
  - Most launches are off limits due to U.S. export controls on U.S.-made spacecraft parts
  - OneWeb satellites are made in the U.S.
- That leaves SpaceX…

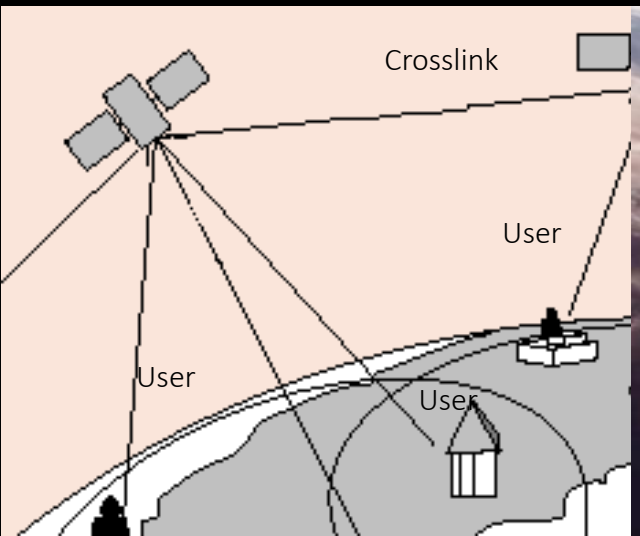
Ukraine war: impact on space launch companies

- SpaceX should be the big winner for 2022-2023, probably beyond
  - Reusability means faster launch cadence (more flights), lower costs
  - Designed for mass production
- Europeans will delay as much as possible until their new rockets are ready

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

Ukraine war: impact on space-based internet service

- OneWeb (UK-Indian satellite internet company) is hardest hit:
  - Previous launches all on Russian Soyuz, both in French Guiana and Russian sites
  - Will switch next 220 satellites (6 launches) to other launchers after Russia demanded the UK govt. withdraw, as a condition to launch. Avoiding competitor SpaceX!
- SpaceX started internet service to Ukraine, at request of Ukraine leaders
  - Now prioritizing cyber defense and overcoming signal jamming seen in Ukraine
- Cyberattack stopped Viasat satellite internet for Ukraine & other Europeans



Ukraine war: impact on users of space

- Earth observation satellite business will continue to grow
  - Secrecy is harder in peace or war, improving even public access
    - Everyone saw satellite images of all those Russian army deployments
    - Ukraine asked for (now received) real-time images, especially radar-based that cut through weather
  - Not just optical: also radar for piercing clouds, signals intelligence tracking aircraft, …

Maxar satellite Image, Ukraine, 2/27.
Credit: Maxar Technologies, via SpaceNews.com

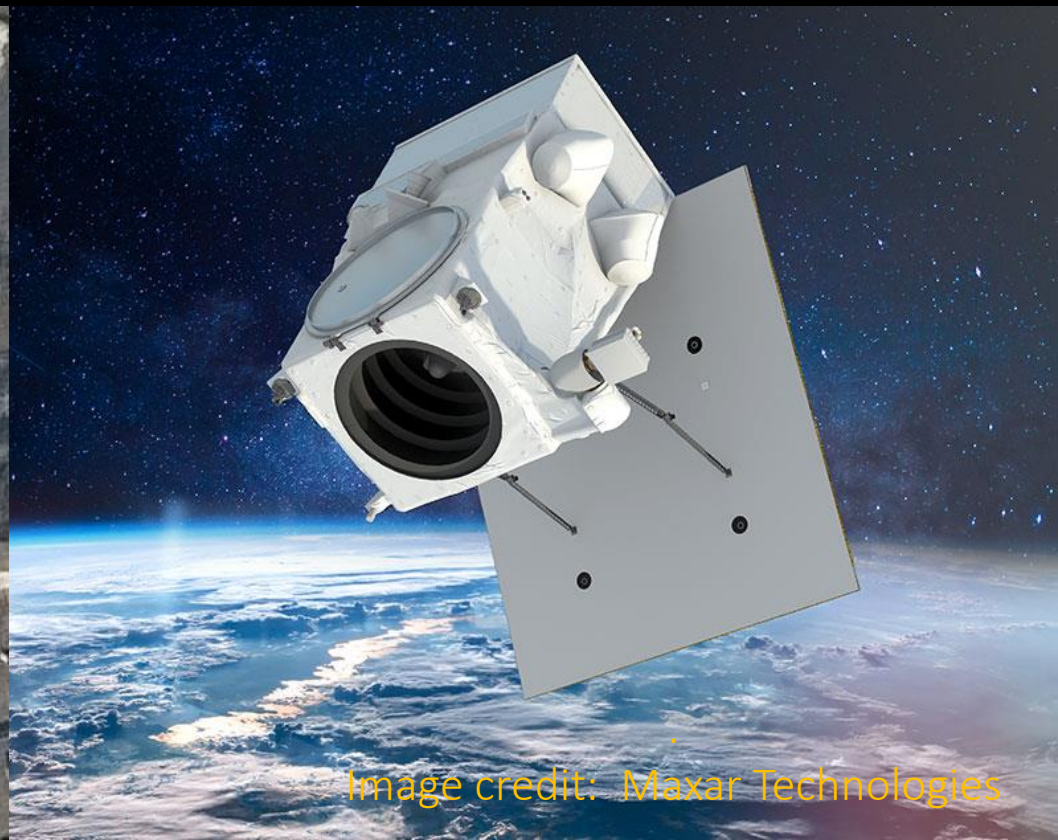


Image credit: Maxar Technologies

Ukraine war : Space is not immune to indirect effects

- Increased spending on arms and energy infrastructure will divert funds that might have gone towards space
  - Germans and other NATO countries may finally achieve 2% GDP on defense
- General supply chain interruption issues
  - Neon gas needed for semiconductor manufacturing mostly comes from Russia & Ukraine
  - General manufacturing and mining interruptions, especially in Europe
- Accelerated investing to de-globalize manufacturing will divert funds that might otherwise have gone to space (and increase inflation through higher costs)
- A preview for larger effects when China blockades and invades Taiwan
  - >4x bigger economy
  - At the center of the advanced semiconductor industry

Artemis (Moon program) launch costs revealed

- Testimony from NASA Inspector General Paul Martin to a House Science Committee hearing about the first 4 launches
- Single Artemis launch operational cost: $4.1 billion (“unsustainable”)
  - $2.2B for the SLS rocket + $568M for ground systems = $2.768B for SLS
  - $1B for Orion spacecraft, $300M to ESA for Orion’s Service Module
  - Not including earlier development – costs are double if included
- Entire program 2012-2025 will cost $93B
- Cost-plus contracts cited as disincentive for cost & time
- NASA cut costs in other areas by contracting for commercial services (like commercial crew to ISS)…
- … but many in Congress still want to pull development back “in-house” like SLS, and keep jobs in their districts

Space Launch System (SLS) Image credit: NASA

How many launches since the last meeting (Feb 12)?

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

Rocket Lab's Electron launch from new pad 1B in New Zealand, Feb. 28. Credit: Rocket Lab

Launches since last meeting (Feb. 12)


Feb 13 – PSLV (India's Polar Satellite Launch Vehicle) –Earth observation satellite, 2 small


Feb 14 – Soyuz – 80th Progress cargo delivery to International Space Station (ISS)


Feb 19 – Antares – 18th Cygnus cargo delivery to ISS


Feb 21 – Falcon 9 – 46 Starlink (internet) satellites (higher orbit now since geo storm)


Feb 25 – Falcon 9 – 50 Starlink (internet) satellites


Feb 26 – Long March 4C – Earth observation (radar) satellite


Feb 27 – Long March 8 – 22 satellites for various Chinese space companies


Feb 28 – Electron – Japanese radar imaging satellite (on new 2nd launch pad at NZ site)


Mar 1 – Atlas 5 – NOAA weather satellite


Mar 3 – Falcon 9 – 47 Starlink (internet) satellites


Mar 5 – Long March 2C – 6 demonstration satellites for future internet constellation


Mar 8 – Qased (Iran) – reconnaissance satellite


Mar 9 – Falcon 9 – 48 Starlink (internet) satellites -- *"an American broomstick"*

Discussion & questions?

Image: NASA

Featured speaker: Robert Dyck

- Senior IT professional with 30 years of experience
- Owns Ardeco Computers (Winnipeg, Manitoba, Canada)
  - Computer repairs, networking, custom software development
- Chair, Winnipeg chapter of the Mars Society
- Education: Computer Science at the University of Manitoba

- TOPIC: The “Big Ship”

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Featured speaker next month: Dr. Gary Johnson

- Retired aerospace engineer with wide experience
  - Aerospace, automotive, alternate fuels, certified auto mechanic, …
  - Cactus-killing farm implements. HowToKillCactus.com
- Has patents on ramjet rocket motors, tool for controlling prickly pear cactus
- BS., M.S. Aerospace engineering, U. of Texas at Austin
- Ph.D., General Engineering, Kennedy-Western University

- TOPIC: Large Ship Propulsion

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