

Space Business Monthly News

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- Page 1–2: Editorials
- Page 3–4: Space Business-related Topics by Business Position/Market Field

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- Editorial 01: Direction of national space technology development (Kuzuoka)
- Editorial 02: STM and the threat of ASAT debris (Oishi)
- Editorial 03: The future of smallsat launch services companies in the U.S. (Murakami)

Editorial 01: Direction of national space technology development (Kuzuoka)

With Russia's invasion of Ukraine occurring at the end of this month, we decided to change and rewrite the theme of what we were intending to write here. As of Feb. 27 (when this article was being written), some space-related topics have not been officially announced yet, but that didn't stop experts in the U.S. from quickly making public comments. First, following Russia's invasion of Ukraine, on Feb. 23, National Reconnaissance Office (NRO) Secretary Honorable Dr. Christopher Scolese mentioned that "government and civilian observation satellites as well as satellite communications and GPS signals could become targets for Russia's attacks." Scolese didn't speak directly to specific attack methods, but he said that preparations have been necessary and that he would not be surprised if something happened, citing past occasions of GPS jamming.

Also, General James Dickinson, commander of the U.S. Space Command, also cautioned against not only missile attacks on U.S. satellites, but also attacks on U.S. satellites by Russian satellites that gradually approach and cause collisions. He emphasized, that when another satellite is near a U.S. satellite, it is necessary to consider not only the distance and orbit information but also the reason why it is there in the first place.

Russia's invasion of Ukraine may not have been foreseeable; but looking at the recent space programs of Western governments, there are many actions taken that are aimed at defense and homeland security, such as in the active use of space and ensuring the safety of space assets.

The United States has reviewed its total space defense assets including HGV (supersonic gliders) compliance as per the SDA and has announced a seven-layer space defense initiative that includes the custody layer, transport layer, battle management layer, and navigation layer. Development is in progress.

Meanwhile, in the European Union, Mr. Thierry Breton, director-general of the European Commission (EC) for the Internal Market, announced that plans for a satellite constellation for broadband communications, following Galileo for positioning and Copernicus for observation, will be proceeded with. This will provide secure connectivity for European governments and citizens. Breton was actually overwhelmed by the fact that there was strong opposition to this plan, as it had previously been questioned within the EC regarding

effectiveness. Thus, it would appear significant that this plan was announced by the director of the Regional Markets Bureau, not by the director of the Space Defense Bureau within the EC. It seems that they have adopted a smallsat constellation plan from the perspective of ensuring secure communications and resilience, rather than talking about building a satellite.

However, let's take a look at the situation in Japan. I would like to introduce you to the facts that the government budget for FY2022 was just established and that the space-related budget, including the initial budget and the supplementary budget for FY2021, was 521.9 billion yen—an increase of 72.3 billion yen (about a 16% increase) from the previous year. What should be noted in this budget is the "Strategic Program for Accelerating Research, Development and Utilization of Space Technology" (i.e., the "Stardust Program"), which started this year. This program aims to select 11 projects that the government should develop by investing 7.3 billion yen in space development and utilization promotion, along with intensive and agile development of technology.

The 11 projects include: the development of full digitization technology for satellite communications using ETS-9 (involving the Ministry of Education, Culture, Sports, Science and Technology); a demonstration project (by the Cabinet Office) for expanding government use (anchor tenancy) of private SAR satellite constellations; and the development of a highly resource-recycling food supply system that supports long-term stays on the moon (involving the Ministry of Agriculture, Forestry and Fisheries). Of course, it is understandable that these technological developments are considered to be important.

However, what we see as worrisome is that each government ministry/agency is trying to proceed with technological development on their own. The United States has the major goal of SDA's integrated space defense system, while Europe has the major goal of broadband communications with an emphasis on resiliency, and the direction is to consolidate the necessary technological development. On the other hand, Japan is moving in the direction of developing individual technologies. In developing these individual technologies at the same time, one would have to wonder: What are they trying to do with these technologies and what kind of stake are they trying to claim? In terms of how to use the technologies going forward, it will be necessary to reach a consensus on what kinds of space assets Japan will create.

Editorial 02: STM and the threat of ASAT debris (Oishi)

This month, STM-related topics such as the "prediction of rocket debris hitting the moon" and "debris associated with a Russian ASAT approaching satellites in sun-synchronous orbit" really stood out to us.

As a starting topic, it was initially reported that the upper part of SpaceX's Falcon 9 rocket would collide with the

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Moon on March 4. After that, concerns shifted to the launch rocket of China's "CHANG'E-5T1" lunar exploration test aircraft, launched by China in 2014, but on Feb. 21, China's Ministry of Foreign Affairs complained that the upper stage of the rocket had all but entered the atmosphere and was completely burned up. Furthermore, the latest speculation is that this is actually due to the CHANG'E-5 mission in 2020. At present, the actual situation is unknown, but in the future, STM around the Moon will become important in the era of lunar construction, such as for Moon bases.

The second topic is considered to be a more-pressing issue. According to COMSPOC, a space monitoring company, the debris generated in the Russian ASAT experiment is in an orbit that interferes with the sun-synchronous orbit, and more recently, it is expected to come into close proximity to some of Planet's Dove satellites next month. However, Planet has commented such that because the Dove satellites are cubesats, the risk of collision is not high. (In terms of a daily average collision rate, the current background degree of about 0.0005 will increase to about 0.0008 at the time of proximity in early April.) There are also concerns about the impact on satellites other than those in sun-synchronous orbit. For example, for SpaceX's Starlink satellites, with automatic collision avoidance, it is expected that 80 maneuvers per day will be required to avoid collisions with Russian ASAT debris.

In the United States over the last few years and according to recent reports, issues regarding STM have been discussed by the U.S. Senate, and there have been White House press briefings on the subject, especially in the last few months. As a common problem for the entire government during this time, there has been a lack of action regarding STM. A similar point was made last month such that space debris experts have delayed in tackling the U.S. debris issue (however, it seems that a budget is being strived for). Meanwhile, in Europe on Feb. 20, the European Union announced plans to strengthen its STM functions.

In this month's SpaceNews.com article, titled "The challenges of space traffic management," an opinion was presented such that, in the United States, one of the fundamental problems causing STM to not be addressed is the inability to control what cannot be measured, and we really resonate with this. We believe that building a measurement system for the realization of STM would also act as a deterrent to ASAT experimentation.

In relation to the ongoing Russian invasion of Ukraine, the National Reconnaissance Office (NRO) has warned satellite operators of the possibility of a satellite attack by Russia. Until the arrival of peace in the Ukraine in the quickest time possible, we hope that a situation in which an "STM system detects the actual use of an ASAT and an accompanying increase in space debris" (i.e., the destruction of a satellite) does not happen in the future.

Editorial 03: The future of smallsat launch services companies in the U.S. (Murakami)

In this article, we take a look at the recent situation regarding the trends of smallsat launch services companies, which have been seeing a boom with the establishment of more than 100 such companies springing into existence.

SpaceX and Blue Origin are well known as emerging launch services companies. SpaceX has been carrying out NASA's manned missions and has become an indispensable presence in the United States. As a company also involved in commercial launches as well, alongside Arianespace, SpaceX has a large market share. Meanwhile, although Blue Origin is struggling to develop New Glenn, New Shepard is moving toward the commercialization of manned missions, albeit with a small number of launches.

Looking at smallsat launch services, Rocket Lab, Virgin Orbit, and Astra Space are listed as using SPACs. Relativity Space and FireFly have received a lot of funding from investors. Looking at the status of current business, Rocket Lab has a large order backlog and is developing a medium-sized rocket, known as "Neutron." On the other hand, its number of launches in 2021 was six, and the initial target of two launches per month has not been achieved. If one launch can bring in about 1 billion yen (approx. USD 8 million) of revenue, and if this is done only six times, sales only total the obvious 6 billion yen (or approx. USD 51 million). Business is being aimed to be expanded by acquiring satellite companies and software companies, and it is believed that the stable growth of business is obviously necessary. Investors also expect more-frequent launches and the early debut of the Neutron rocket. As for Virgin Orbit, it has also been listed as using a SPAC, and although it has secured satellites with the support of NASA and the U.S. military, the number of satellite launches was only twice in 2021 and once in 2022.

Relativity Space has raised about 160 billion yen (approx. USD 1.38 billion) by manufacturing and launching a rocket made 100% using a 3D printer in 60 days. And in early 2022, the company is expecting to launch the Terran 1, with the Terran R (fully reusable) in development, with launch expected for 2024. Against this backdrop, even if corporate value is raised by going public, nothing can be realized without the success of a rocket, so we have been watching this situation carefully.

Also, FireFly launched its first craft in 2021, but failed. Investment from Ukraine has further compounded the problem, but with the guidance of the U.S. government, the Ukrainian involvement was able to be proceeded with, and funding was maintained.

Although Astra Space was listed using a SPAC, investors have accused the company of making misleading statements, with losses being incurred. These statements include being able to launch anywhere/anytime and that the company had a vast market considering its future constellation plans. Despite the explanations, this might get a bit hotter, so it is necessary to watch the developments. However, SpaceX has cleared similar several hurdles in getting to its current state, so we don't think the company could get to where it is now without the understanding of investors.

In any case, I think it is natural to try to lead a business to success, but I think it is also essential to succeed in one's main business as a foundation. Launches can occur back-to-back with every risk of failure, and we believe that only those that can achieve the basics of providing a reliable system at a reasonable price and in a timely manner will survive.

February 2022 Space Business-related Topics by Business Position/Market Field

OldSpace, etc.

Mixed space, etc.

NewSpace, etc.

Satellites

Launches

Others

Japan

- Thales supplies digital processor for South Korea's KOMPSAT-3 (Fig.1)
- China successfully launches the Land Exploration No. 1 01 group B satellite, the country's largest SAR satellite (Fig.2)
- Lack of critical skilled workers delays first ViaSat-3 launch to late summer
- Tesat-Spacecom to establish US manufacturing facility (Fig.3)
- Intelsat partners with JSAT to collaborate on IFC solution for Asia
- Magellan to provide satellite avionics to CHORUS
- Intelsat selects SkyEdge IV as a ground platform
- SES establishes joint venture in India to increase satellite capacity
- European Union advances broadband constellation (Fig.4)
- New O3b gateway station in Senegal
- Yahsat wins contract from UAE government
- Eutelsat postpones growth forecast due to delay in satellite delivery
- TAS, etc. acquires ESA's HYDRON-related laser communications contract
- Globalstar selects MDA and Rocket Lab for new satellite procurement

- Boeing all-composite cryogenic fuel tank proves technology readiness
- Lockheed Martin wins contract to build rocket for Mars sample return (Fig.5)
- China's space business: High-density launch schedule, at more than 50 launches this year
- India puts three satellites into orbit at the first launch in 2022
- Lockheed Martin terminates agreement to acquire Aerojet Rocketdyne
- Northrop Grumman launches Cygnus cargo ship to space station
- China denies rocket set for moon crash was from 2014 Chinese mission
- U.S. and international partners to share launch cost of new WGS-11+
- Successful launch of PSLV rocket, first since the launch failure in 2021
- China's new generation of manned launch vehicles may use new vertical take-off & landing recovery scheme
- Russia halts Soyuz rocket launches from French Guiana

- UK announces new funding for military space programs
- NASA and ISS operations to stop in 2030; will be crashed to Earth in 2031
- India targets August launch for its Chandrayaan-3 moon lander
- US Space Force seeks ideas from industry for stopping cyber-attacks
- ESA Mars travel strategy models the hibernation patterns of bears
- Viasat adds polar coverage for ground station service business
- US Space Force willing to invest in debris removal projects
- First JWST images show mirror alignment going as planned
- China proposes formal lines of communication with US
- Bipartisan legislation seeks to reform FCC satellite licensing rules
- Russian ASAT debris creating "squalls" of close approaches (Fig.6)
- EU lays out plan to bolster space traffic management capabilities
- Space Logistics announces mission extension pod contract with Optus
- NRO warns satellite operators of possible Russian attacks

- KDDI launches satellite communications service for ships
- NEC's new technology, ground landscape and satellite image matching
- Kyushu Bureau of Economy, Trade and Industry to hold space business seminar on Mar. 10
- Tottori Prefecture allocates 164 million yen, sand dunes selected as testing ground for lunar rover

- Mynaric receives optical comms contract from ESA
- Orbital Insight wins DoD contract to develop technology to identify intentional GNSS disruptions
- NASA outlines concerns about Starlink next-generation constellation in FCC letter
- China berates United States after satellite near-miss
- SpaceLink names Axiom Space as implementation partner for demo of its end-to-end relay service on the ISS

- Regulatory approval uncertain for first launch schedule in UK (Fig.7)
- COSMO-SkyMed Second generation FM2 mission successfully launched by SpaceX
- SpaceX launches NRO's classified satellite
- Astra fails to launch NASA-sponsored CubeSat
- Arianespace launches 34 OneWeb satellites in first mission in 2022

- Europe launches fund to invest in space startups (Fig.8)
- NASA and SpaceX investigating delayed Dragon parachute opening (Fig.9)
- Shanghai signs agreement with China's megaconstellation group, aims to foster commercial space hub

- KDDI operates multiple drones via mobile communication, collaborates with JAL on remote management

- Ursa Space Systems selected to join AWS ISV accelerate program
- Solar panel startup mPower Technology secures funds for mass production
- OneWeb and Marlink to cooperate on connectivity solutions
- Lynk satellite connects with thousands of devices (Fig.10)
- Wyler raises \$50M for "sustainable" megaconstellations
- SpaceX loses 40 launched Starlink satellites in magnetic storm
- Wyvern acquires funding for the expansion of hyperspectral imaging market
- Terran Orbital announces new contracts and significant expansion of manufacturing capacity
- SpaceX successfully launches 46 Starlink satellites
- Musk launches satellite network service in Ukraine

- SpaceX considers shifting Starship testing to Florida
- AE Industrial Partners acquires Firefly shares from Noosphere

- Relativity and SpaceX bid on commercial space station competition
- Quantum Space debuts aiming to build evolvable/scalable space platform (Fig.11)
- Partnership between C-CORE and GHGSat to continue for constellation ground services
- Chinese space launch startups attract frenzy of investment (Fig.12)

- EV demonstrations: Satellite utilization, fully automatic driving, Fukushima National College of Technology
- AxelGlobe Earth observation platform chosen as a winner in the 2021 Nikkei Superior Products and Services Awards
- Obayashi Corp.: Soil technology for lunar agriculture, successful cultivation with simulated sand
- Minamisoma City, Fukushima Pref. makes rocket development support agreement with IST
- Rikei and OEC conclude strategic business alliance agreement
- Synspective signs agreement to launch second SAR satellite, "StriX-β," with Rocket Lab (Fig.13)
- Fukui Prefecture conducts rice experimentation using satellites (Fig.14)
- Softbank: Joint demos with HW Electro for disaster countermeasures using stratospheric communications and EVs
- Gifu Prefecture: Supporting business development in the space field with local companies
- Steadily realizing a return-type satellite: Tohoku University venture startup and an MOU for a technology demonstration craft (Fig.15)
- Asteria invests 230 million yen in SpaceX
- Tokio Marine & Nichido: Now professionally supporting the space industry
- Oita Pref., US groups hook up in bid to use Oita Airport for space plane landings

OldSpace, etc.

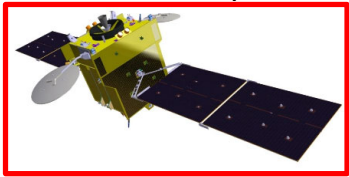


Fig.1: South Korea's GEO-KOMPSAT-3, supplied by Thales and fitted with the latest digital processors; scheduled to be launched in 2027 (Credit: ETRI)



Fig.4: European Commission for the Internal Market Thierry Breton said on February 15 that the planned constellation is a "Galileo moment" for Europe. (Credit: European Commission)

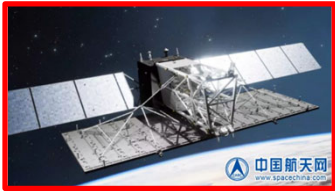


Fig.2: China's L-SAR 01A Earth observation satellite, which was launched from the Jiuquan Satellite Launch Center onboard the Long March-4C rocket (Credit: CASC)



Fig.5: The Mars ascender (formerly NASA designed) launches from the surface of Mars and transports into orbit the samples collected by the Perseverance lander. (Credit: NASA)



Fig.3: Tesat-Spacecom (TESAT), a global leader in space optical communications technology, has established a manufacturing base in the United States to support the US government and commercial customers.

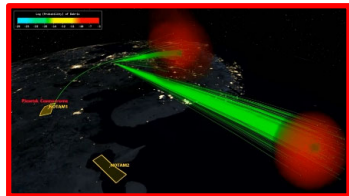


Fig.6: Simulation of the Russian ASAT; much of the debris from the event is in orbit that is regularly aligned with satellites in sun-synchronous orbit. (Credit: COMSPOC)

Mixed space, etc.



Fig.7: UK's Spaceport Cornwall aims to host Virgin Orbit's LauncherOne, due out in mid-2022, as soon as the spaceport and launch system licenses are obtained from the UK government. (Credit: Spaceport Cornwall)



Fig.9: Infrared image of the Crew Dragon's descent for the Crew-2 mission. One of four parachutes is not fully deployed. (Credit: NASA TV)



Fig.8: The EU Commissioner, European Investment Bank, and European Investment Fund signed an agreement on January 25 with the CASSINI fund initiative for investing in European space startups. (Credit: European Commission Systems)



Fig.13: Synsperspective satellite assembly

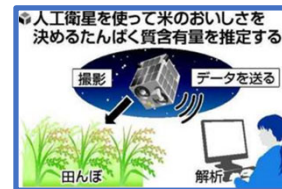


Fig.14: Fukui Prefecture will start a demonstration experiment in 2022 to estimate the content of the protein that determines the deliciousness of rice by photographing rice via the "Suisen" microsatellite launched last year.

NewSpace, etc.

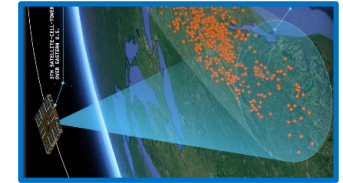


Fig.10: Lynk Global satellites generate a communications beam that sweeps the area, providing coverage for mobile devices. The red dots in the image above represent mobile phones on the east coast of the United States connected to Lynk's fifth satellite. (Credit: Lynk Global)

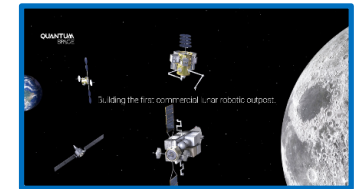


Fig.11: With a focus on rapid technological advancement and lowering the cost to access cis-lunar space, a quartet of space veterans are launching Quantum Space, a commercial space infrastructure and services company.



Fig.12: Rendering of the Tianlong commercial reusable launch vehicle being developed by China's Space Pioneer

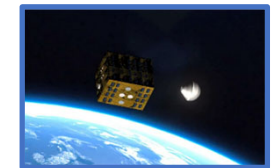


Fig.15: Rendering of the "ELS-R100" technology demonstration craft (at left) and the sample recovery capsule, aiming for launch at the end of 2011