



ESPInsights

The Global Space Activity Monitor



Issue 5
January-March 2020

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FOCUS

The COVID-19 pandemic crisis: the point of view of space

2020 will forever be remembered as the year of the [COVID-19 pandemic crisis](#). At the date of publication, there are close to one million confirmed cases and more than 50.000 deaths worldwide. The crisis is just starting and a period of great uncertainty lies ahead of most countries and sectors.

Many governments across all continents have adopted measures to stop the spread of the infection, including the imposition of far-reaching restrictions on human interaction and movement both locally and internationally, as well as in some cases widespread temporary shutdown of businesses considered 'non-essential' to the basic infrastructure needed in the pandemic response. The crisis has started impacting national economies and the global economy in several sectors and causes widespread uncertainty and volatility on financial markets. While the space sector seems to be less impacted than others - as the aerospace sector is frequently considered "strategic" and the containment measures adopted by countries may not include space companies in the general shutdown of activities - it is not untouched by the crisis.

While the context does not allow a general assessment of the consequences on the space industry yet, it is clear that the sector is already impacted by direct or indirect effects of the pandemic, related to disruptions in operations and supply chains. In Europe, the measures related to the containment of the infection have resulted in restrictions affecting travel, meetings and work in general. [Launch activities at the Guyana Space Centre](#) have been suspended since 16 March - [to be resumed](#) "as soon as allowed by health conditions" - and the operations and data gathering of [four ESA science mission were temporarily stopped](#). Furthermore, and although the decision to [postpone the ExoMars 2020](#) mission stemmed primarily from the need for further testing and qualification, ESA DG Wörner acknowledged that the restrictions in response to the virus outbreak would have impacted the mission as well.

In this unprecedented context, the crisis is met with a mix of confidence and cautiousness from the space industry. [OHB](#) stated that the crisis will certainly cause delays in programmes development but not cause major losses in revenues, emphasising the robustness of the demand side in the space sector - as remarked by a [Quilty Analytics report](#) suggesting that the crisis could trigger new [demand](#) for space services. In Italy, [Avio](#) has been exempted by the shutdown, as part of a strategic sector, and looks confidently to resume launch operations soon. [Airbus](#) announced the stop until 9 April of all non-essential space activities in Spain, compliant with government measures. However, the most striking example of the pandemic's consequences is that of [OneWeb](#): the company filed for bankruptcy on 27 March after failing to secure additional funding, underlining in the press release the impact of the SARS-CoV-2 outbreak and turbulences on financial markets. The impact of the crisis on space companies still relying on massive private investments to close their business case will likely be disastrous.

In the United States, [NASA](#) announced measures to contain the outbreak, confirming interruptions that will affect the development of SLS and Orion. The agency remains confident that the crisis will not lead to major delays for scheduled missions such as Mars 2020. An initial [\\$60M](#) of funding part of a large package approved by the U.S. Senate to mitigate the economic effects of the crisis was secured for NASA. Apart from several major space events cancelled or postponed around the world, the pandemic also forced the postponement of the [National Space Council's](#) meeting, most likely due to the Chairman and Vice President Michael Pence's role as the head of the SARS-CoV-2 task force. On the industrial side, the responses are quite diverse: while Blue Origin continues all operations, [Bigelow Aerospace](#) announced the layoff of its entire staff.

The information that has been reported so far represents only the tip of the iceberg and thorough investigations of the impact of the pandemic on the sector will be needed at some point in time. For the moment agencies and companies seem to adapt, as they can, to an unprecedented situation whose future development and consequences are still unclear.

Amidst the pandemic, increasing attention is also drawn to the role of space applications in this crisis, as reported by [Eurisy](#), [SpaceWatch.Global](#), [PwC](#) and [Axios](#). Space infrastructures and space-based services and applications bring vital contributions to the management of the crisis and to the transparent and efficient coordination of countermeasures.

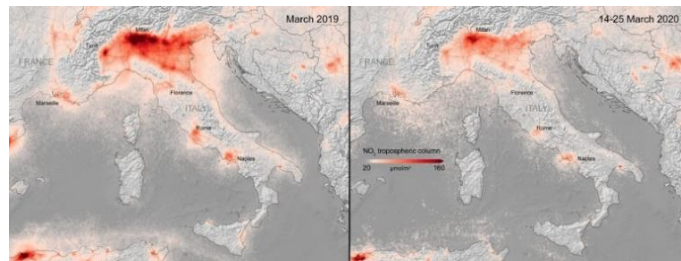


Figure 1 Credit: ESA

Apart from services enabled by [satellite communication](#) - with some [concerns](#) on network disruption - space can mainly contribute through:

- GNSS systems, as in the case of BeiDou-driven drones used by Chinese authorities for disinfection activities inside cities or, together with remote sensing, in case of satellite-powered Geographic Information Systems (GIS) that provide critical spatial information and datasets - developed also by [Maxar](#) - used by civil authorities;
- EO and remote sensing - and satellite imagery data combined with AI capabilities elaborated by [Descartes Labs](#) - are significantly contributing to raise awareness on the impacts of the pandemic at economic or environmental level, such as the massive reduction in air pollution, thus stressing the link between anthropogenic causes and pollution, one not negligible effect of the pandemic (Figure 1, NO₂ concentrations over the Po Valley, from Copernicus Sentinel-5P satellite, but also Figure 2 on the impact of lockdown measures in Venice).

[ESA](#) announced two initiatives: an open call focused on contributions from Earth Observation data and a “Custom Script Contest” together with the EU Commission to find innovative Artificial Intelligence and Machine Learning solutions to the crisis. Moreover, [ESA](#)



Figure 2 Venice in October 2019 and in March 2020.
Credit: Planet Labs Inc.

[Business Applications](#) in coordination with ASI and the [Italian Minister for Technological Innovation](#) and Digitisation announced a €2.5M programme to improve the contributions from space services and applications, especially for healthcare and education. [DLR](#) is converting 3D printers for the production of medical protective equipment and ventilators. The European GNSS Agency ([GSA](#)) opened a call to create a database of navigation applications that can facilitate governments' and citizens' response and recovery to the crisis. [NASA](#) as well launched a call for ideas for innovative use of satellite data to address the pandemic and lent its supercomputer capacities to foster medical research. Contributions came also from the industry itself, as [Virgin Orbit](#) and [SpaceX](#) started production of ventilators and hand sanitizers to be distributed in hospitals; Leonardo as well began development of valves for ventilators and Airbus distributed protective masks to hospitals and announced production of [3D-printed visors](#) for medical staff.

SPACE POLICY AND PROGRAMMES

EUROPE

Lift-off for ESA Sun-exploring spacecraft

On 10 February, the ESA [Solar Orbiter](#) mission to study the Sun was successfully launched and deployed in its orbital trajectory by the Atlas V 411, from Cape Canaveral. The ESA-led mission with NASA participation was developed by Airbus Defence and Space UK as the Prime Contractor. The spacecraft will reach a highly elliptical operational orbit around the Sun in approx. two years, benefitting from fly-bys around Earth and Venus; the Solar Orbiter will be the first mission to study and explore the polar regions of the Sun.



3 Credit: ESA - S. Corvaja

ESA and EDA start cooperation on two projects

Based on the ESA-EDA Administrative Arrangement from 2011, in January [the two Agencies officially approved two cooperative projects](#), one on the use of drone technology and one on Artificial Intelligence-based mechanical systems. The first project is called “Autonomous Drone Services” (AUDROS) and will investigate the use of autonomous vehicles and services for disaster prevention and immediate response; the second project is called ATENA and will explore the application of AI capabilities to the Guidance, Navigation and Control (GNC) systems in order to build future solutions for rendezvous and proximity operations.

ESA priorities for 2020

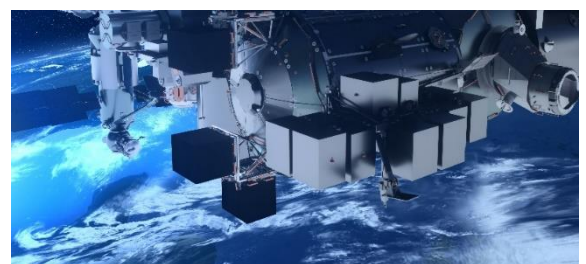
At the [Start of the Year Press Conference for 2020](#) held on 17 January, ESA DG Jan Wörner recalled the achievements secured at the Seville Ministerial Council and presented the overall budget for 2020, amounting to €6.68B with France being the largest contributor for the year with approx. €1.300M. Wörner highlighted climate change as a priority, emphasising the role of Copernicus in raising awareness and enabling informed decision-making, and remarked on the intention to negotiate a new Financial Framework Partnership Agreement with the EU, on the basis of the Multiannual Financial Framework 2021-2027.

ExoMars 2022

On 12 March, ESA and Roscosmos decided to postpone [the ExoMars mission to the launch window between August and October 2022](#), in order to complete the necessary tests and considering possible interruptions caused by the health situation in Europe. After launch, the landing on Mars will be now expected to occur between April and July 2023. The decision follows delays on the [parachute tests](#) and an announced review of the entire mission schedule. Already [in 2016](#), ESA and Roscosmos had to agree on postponing the launch date of 2018 to 2020. ESA DG Wörner stated that the decision on ExoMars should not affect the schedule of the Mars Sample Return mission, developed in cooperation with NASA.

Airbus’ Bartolomeo Platform headed toward the ISS

Launched on 7 March aboard the SpaceX CRS-20 mission to the ISS, Bartolomeo is the first European outdoor payload hosting platform that will be attached to the Columbus module on the ISS. Bartolomeo can host as many as 12 experiment slots and offers research opportunities aboard the ISS. This opportunity is also open to developing countries, thanks to an initiative promoted by Airbus [together with UNOOSA](#). In January, [ESA signed a contract with Airbus](#) to



4 Credit: Airbus

book a slot on the platform for an experiment prepared by the University of Oslo and the Norwegian Eidsvoll Electronic to study Earth's atmosphere.

A European Coordination Committee for the Lunar Gateway

In January, the 11 European Parties to the IGA reactivated the European International Space Station Intergovernmental Agreement Coordination Committee, with the goal of negotiating a common European position in view of [cooperating with international partners on the Lunar Gateway project](#). The Italian diplomat Stefano Queirolo Palmas has been appointed as Chair of the Committee.

ESA awards contract to drill and analyse lunar subsoil

On 30 January, [ESA awarded a contract to Leonardo](#) for €31.5M to build PROSPECT (Package for Resource Observation, in-Situ analysis and Prospecting for Exploration Commercial exploitation and Transportation), a system based on a robotic drill and a miniature laboratory. The instrument will be part of the ESA-Roscosmos Luna-27 mission. The advanced robotic system will explore the Moon's South Polar region, studying the chemical components of the soil and preparing future in-situ experiments.

EU Commission invests in space

In partnership with the European Investment Bank Group (EIB), the European Commission announced an investment of [€200M in the space sector](#). Of the total amount, an agreement signed at the European Space Policy Conference (the official proceedings of the Conference prepared by ESPI can be found [here](#)) between the EIB and ArianeGroup allocated €100M as a contingent loan to support the Ariane 6 programme, once operational; the remaining €100M are invested in the "InnovFin Space Equity Pilot" programme to support European SMEs in the space business. The Italian Primo Space early-stage fund was the first fund selected under this initiative to encourage the development of space companies.

Galileo's Return Link Service is operational

The Galileo satellite constellation is now able to provide a ["return-link" system](#) for the fast localisation of emergency and distress messages and the optimisation of Search and Rescue Services. Announced in January as operational, the system has been developed by ESA, based on an agreement between the EU Commission and the Cospas-Sarsat Programme that equipped 24 of the 26 Galileo satellites with the repeaters package.

Quality control contract on Earth Observation data

In March, [ESA awarded Telespazio Vega UK](#) a €25M service contract to lead the quality control operations, validation and final delivery of a broad range of EO data. The service is not limited to the ongoing ESA satellites missions - such as CryoSat-2 and Proba-V - but includes historic data sets from Envisat and 3rd party missions, such as Landsat 1-7, and will implement AI technologies procedures to streamline and further improve the quality of the validation process.

New contract for the Copernicus Emergency Management Service



5 Credit: European Union

The Joint Research Centre (JRC) of the EU Commission awarded a contract for the ["Copernicus Emergency Management Risk and Recovery"](#) to the Italian company e-Geos, leading a consortium of European subsidiaries and partners including the University of Strasbourg. The service focuses on a variety of customised geospatial information and data to support the management of natural as well as human-made emergency situations.

Arianespace launch estimate for 2020

Celebrating its 40th anniversary and officially announcing the [launch contract with ESA](#) for the upcoming Euclid mission,

Arianespace estimates up to 22 launch missions for 2020, including the maiden flights of Vega C and Ariane 6 and the return to flight in March of the Vega, aiming to more than double the nine launches of 2019 and break record of the 12 launches in one year established in 2015. In March, ESA officially confirmed on behalf of the European Commission the pre-order for four Ariane 62 launches, expected to be confirmed under the MFF 2021-2027 budget.

Consideration on European industrial strategies in space

On 5 March, during an audition at the Senate concerning the purchase operation on Chantiers de l'Atlantique by Fincantieri, the French Ministry of Economy and Finance Bruno Le Maire discussed at large the topic of European industrial strategies and ambitions in the naval, electronic, automotive, rail transport and space sectors. In particular, Le Maire emphasised the need to consider a merger between three European actors in the space domain - Avio, OHB and ArianeGroup - an operation that for Le Maire could unlock larger investment and financial capabilities and demonstrate a European industrial ambition.

Cautious approach on In-Orbit Servicing

Airbus Defence and Space conveyed a vigilant approach over the development of In-Orbit Servicing (IOS) capabilities, disclosing details on the interruption in 2018 of their projects on a servicing vehicle at the preliminary design review, based on overall reconsideration of the business case. Despite the success of the Northrop Grumman's Mission Extension Vehicle (MEV-1) in February, the expected launch on Ariane 5 of the MEV-2 in June and two contracts awarded by DARPA and NASA regarding IOS solutions, Airbus considers present commercial opportunities to be not enough to sustain a steady servicing missions market.

France expands bilateral cooperation

In January, CNES signed cooperation agreements with China and Egypt. The first framework agreement with the Chinese Academy of Sciences (CAS) concerns research on microgravity and the Earth Observation domain, also linked to climate actions; the second one with the Egyptian Space Agency was signed alongside the first Egypt-France Space Seminar held in Cairo and aims to foster cooperation and commercial relations in space, regarding Research and Development and space applications, especially Earth Observation capabilities and the related Space Climate Observatory initiative.

Italy starts cooperation with Bahrain and consolidates ties with Australia

In February, ASI President Giorgio Saccoccia signed a Letter of Intent with the National Space Science Agency (NSSA) of the Kingdom of Bahrain to lay the foundations for further cooperation on space science and exploration as well as education opportunities in the sector. On the margin of the 9th Australian Space Forum, ASI signed a Declaration of Intent with the Australian Space Agency to implement a previous MoU of October 2019 and increase cooperation for joint experiments on the ISS, giving opportunity to Australia to access the Station for scientific activities.

In addition, in February ASI approved the Space Strategic Vision Document, to identify the decade 2020-2029 programmatic objectives on the basis of the adopted government guidelines, as well as the Triennial Activity Plan, focused on a short to medium-term programme and services planning.

Regional Aerospace Districts aim to Mars

In February, two Aerospace Districts of the Italian regions Campania and Sardinia (respectively, DAC and DASS) signed a Letter of Intent with the scope of developing a Small Mission to Mars (SMS) in cooperation with the Italian Aerospace Research Centre (CIRA). The SMS project - with costs estimated at €50M - aims to send a probe to Mars in 2027 to explore and analyse Mars' surface, fostering regional economic development and the opportunities of partnership with Universities and SMEs.

Luxembourg invests in a space venture capital fund and multiplies cooperation

In January, the Government of Luxembourg announced investments in the Orbital Ventures fund, particularly dedicated to space start-ups, with an initial closing of €70M. The Luxembourg-based

investment fund was established as a public-private initiative with participation from nine investors, including international companies such as OHB and SES. In addition, between January and February, Luxembourg also established cooperation with the U.S. Department of Defence and the State of New South Wales in Australia. In Washington, the Deputy Prime Minister and Minister of Defence Bausch signed the MoU for [Cooperation in Safety of Spaceflight and the Provision of SSA Services and Information](#). In Australia, the MoU focused on setting the conditions [for commercial opportunities and future cooperation on space](#), in particular on the topics of space resources. In March, Luxembourg had the first [bilateral meeting with Italy on space affairs](#) and delivered a joint declaration as groundwork for a subsequent agreement and to highlight existing and future cooperation opportunities.

Post-Brexit negotiations on space

On 31 January, the United Kingdom officially withdrew from the European Union, entering a transition period that ends on 31 December 2020 while negotiating a new partnership agreement. Despite withdrawing from the EU, the UK remains an ESA Member State. At the [Space19+ Ministerial Council](#), the UK consolidated its role as fourth contributor, subscribing with €1.65B - 11,5%; the increase was also backed by the UK space industries association, so as to secure the space role of UK in a post-Brexit context.

In the space domain, Brexit is certainly having the most [evident effects on navigation](#), with the UK holding an overall unclear [negotiation position](#) as far as in the “UK’s Approach to Negotiations” document released by the government it is only mentioned the European Geostationary Navigation Overlay Service (EGNOS) (Part 2, 20). While the UK has still access to the military GNSS signals from the GPS, the major issue concerns Galileo. In February, the EU Council approved the [negotiations directives for a new partnership proposed by the EU Commission](#). In Section 3(F) of Part III, the document determines as follows:



6 Credit: ESA

- the EU grants the UK the possibility to have access to the Galileo Public Regulated Service (PRS) “for sensitive applications in the context of Union or ad hoc operations”.
- The UK will not contribute anymore to the development of Galileo’s technologies - including future bids for EU GNSS contracts - despite a certain [expertise](#) matured in the sector over the years and financial contributions of [£1.2B](#).
- The access to PRS is conditional on the UK “participating in the non-security related activities of the Union’s Space Programme”, unless granting reciprocal access to the anticipated but currently [on hold UK GNSS system](#): the [Brexit Satellites](#) (BS) programme has an estimated costs of £5B (€5.7B) but its territorial coverage and purpose are not yet defined. Expected for March, the UK government has postponed the release of a feasibility study on a national satellite system. Eventually, the negotiations with the EU will have to take into considerations the defence and security-related aspects of the new UK-EU partnership.

Advancements on space centre and spaceport projects in UK

In January, the University of Leicester received the approval for the planning permission of the [Space Park Leicester](#), the project aimed at developing a research and innovation centre focused on space manufacturing and Earth Observation applications. During February the [Shetland Space Centre](#) received an investment of approx. €2.4M from the Leonne International fund, for the development of a launch site facility for small satellites and a separate ground station site; in addition, [Spaceport Cornwall](#) signed a MoU with the Canadian rocket company Space Engine Systems for future collaboration on broad range of operations.

USA

U.S. Space Force budget request

The National Defence budget proposal for FY2021 for the first time includes a [funding request for the Space Force](#). The USSF portion of the overall budget amounts to [\\$15.4B](#), of which:

- \$10.3B of which are allocated for the “research, development, testing and evaluation of space systems (RDT&E)” category, including \$2.3B for the Next-Generation Overhead Persistent InfraRed (Next-Gen OPIR) early warning satellites programme;
- \$2.6B for space operations and maintenance;
- \$2.4B for procurement of satellites and launch services.

The financial [estimates](#) highlight that the budget request for the Space Force is subject to a sharp increase over the next five years, mainly driven by classified programmes.

In February 2020, Congress also received the first [comprehensive plan for the organisational structure](#) of the Space Force, that recognises the necessity to build capabilities on space training and education and of merging existing bodies - such as the Space and Missile Systems Center and the Space Development Agency - under a single authority. Moreover, in January the Chief of Space Operations Gen. Raymond approved the [“Vision for Satellite Communications” strategy](#), envisioning an [integrated satellite communication architecture](#) with joint military and private communication services.

Presidential Budget Proposal for NASA

On 24 January, the House Science Committee introduced a [NASA authorization bill](#) that allegedly revises the target of landing astronauts on the Moon on 2024, emphasising instead the end-goal of sending humans to Mars. However, the House Committee later rejected the accusation of [“derailing Artemis”](#) and will examine again the bill, which will eventually have to be reconciled in Congress with the legislation approved by the Senate Space Subcommittee. On 10 February, the Trump Administration released the [NASA budget proposal for FY2021](#) requesting an overall amount of \$25.2B, an approx. [\\$2.5B/+12% increase](#) compared to the approved appropriation bill for 2020. Notably, the proposal clearly aims to [prioritise the development of the lunar Human Landing System](#) for Artemis requesting \$2.7B more than the fund approved in December 2019 - for a total amount of \$3.3B - at the same time requesting again the termination of the Office of STEM Engagement and of the astrophysics mission Wide Field Infrared Survey Telescope (WFIRST).

SpaceX selected for cargo services to the Lunar Gateway

On 27 March, NASA selected SpaceX to provide [deep space commercial cargo services to the future Lunar Gateway](#), as the first contract in the framework of the Gateway Logistics Services programme. SpaceX will deliver pressurized and unpressurized cargo as well as science experiments and other critical materials to the crew of the Lunar Gateway. The Hawthorne-based company is expected to use a [new spacecraft](#), the Dragon XL, launched onboard a Falcon Heavy rocket. According to NASA, each cargo mission will remain docked to the station for up to a year and could provide additional volume for crews on the Gateway. The contract is an indefinite delivery, indefinite quantity award but financial details were not yet disclosed, with the full programme Worthing overall \$7B.

Towards a reassessment of the SLS

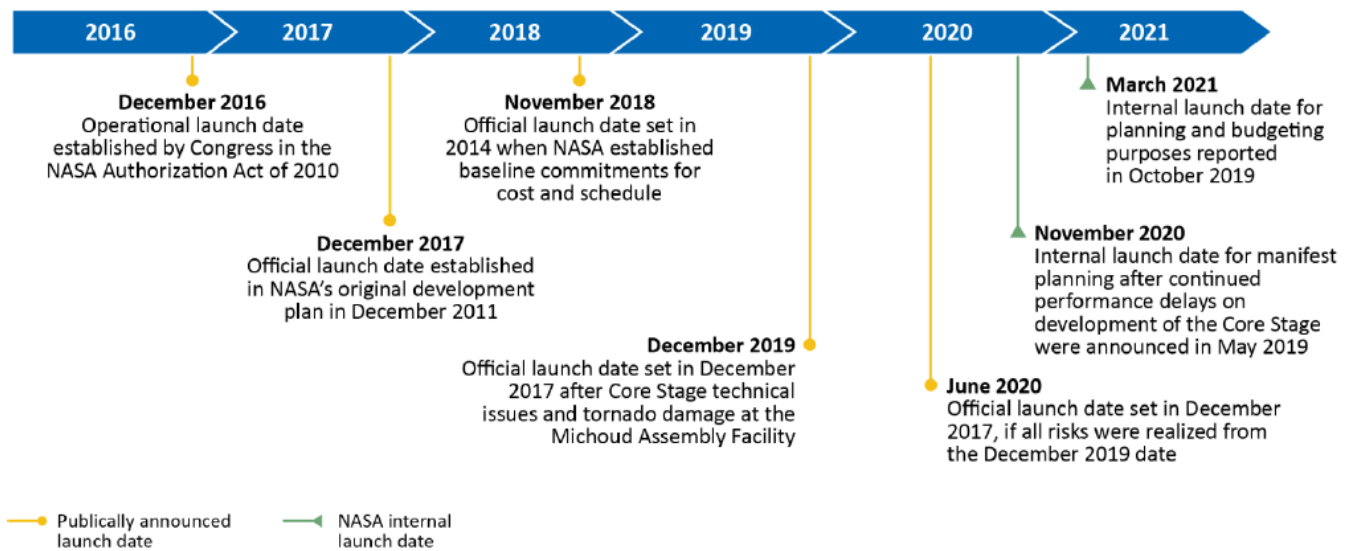
On 10 March, the NASA Office of Inspector General (OIG) released a report on [“NASA’s Management of Space Launch System Program Costs and Contracts”](#). According to the report, the SLS budget costs have



increased more than 33% over the initial Agency Baseline Commitment (ABC), exceeding a threshold that obliges notification to the Congress and a formal reassessment of the programme. The OIG informs that by the end of FY2020 “NASA will have spent more than \$17B on the SLS”, with approx.

\$2B of costs overruns and more than 2 years of delays. The report assesses that there have been poor performances by the industrial contractors, lack of monitoring and management and expresses concerns about possible shortcomings on quality control. The report further informs that with the notification to the Congress, NASA may not spend additional budget on SLS for 18 months, unless a re-baseline process is submitted and the programme is reauthorized by the Congress.

Figure 6: Shifting Artemis I Launch Dates



7 Credit: NASA OIG summary of Agency information

First instruments selected for Lunar Gateway

On 12 March, NASA announced the first two scientific instruments selected to fly on the Lunar Gateway: the radiation instrument package developed by ESA to monitor the astronauts’ exposure to radiation, and the space weather instrument suite developed by NASA to study the effects of solar particles and solar wind. Developed by NASA in on-going partnership negotiations with ESA, JAXA and the Canadian Space Agency (CSA), the Gateway is a lunar orbital outpost to support expeditions to the Moon and prepare further exploration to Mars.

Executive Order on Positioning, Navigation and Timing services

In February, President Trump issued an Executive Order aimed at protecting the national and economic security, hereby addressing the need to ensure a secure and responsible use of PNT services through standards, guidelines and specific requirements. Giving mandate to the Secretary of Commerce to identify the measures, the Executive Order emphasises the risks linked with the disruption and manipulation of PNT services and requests federal agencies and private operators to adopt a responsible use of the critical services.

U.S. Space Command expands cooperation

In February, France and Germany signed the MoU to officially adhere to the Combined Space Operations (CSpO) initiative, a strategic defence partnership operating under the U.S. Space Command that includes also Canada, the UK Australia and New Zealand. The extension of the membership aims to strengthen the multilateral forum and coordinate the efforts on SSA capacity-building and the best practices for space operations.

U.S. Federal Communications Commission approves C-band clearing

On 28 February, the U.S. FCC approved a plan to clear a portion of the C-band by [proposing \\$9.7B of incentives](#) to satellite operators in order to relocate by 2023 the spectrum allocation for 5G networks. The announcement came after a debate on the share of incentives requested by major satellite operators of the divided C-Band Alliance. According to the Commission Chair Ajit Pai, the new allocation of the C-band will compensate and exceed the incentives.

Progresses on In-Orbit Servicing capabilities

In March, more than one year after the withdrawal from the project of Maxar Technologies, DARPA announced the selection of [Northrop Grumman's SpaceLogistics](#) as commercial partner for the Robotic Servicing of Geosynchronous Satellites (RSGS) programme, building on the recent expertise gained by the company with the successful Mission Extension Vehicle (MEV-1). In parallel, [Maxar Technologies](#) was awarded a \$142M contract by NASA to cooperate on the [Restore-L mission](#) with the development of the robotic arm "Space Infrastructure Dexterous Robot" (SPIDER) to demonstrate in-orbit assembly technologies.

CANADA

The Canadian Space Agency awards contracts for Moon exploration

On 25 February, the Canadian Space Agency (CSA) presented the contracts awarded under the [Lunar Exploration Accelerator Program \(LEAP\)](#), established to create and coordinate business opportunities for the future of Moon exploration. According to the Canadian government, the seven contracts are "worth a total of \$4.36M" and were awarded to ABB, Bubble Technology Industries Inc., Canadensys Aerospace Corporation, Magellan Aerospace, Mission Control Space Services Inc. and Western University. The contracts fund various [lunar autonomous science payloads](#): spectrometers for mineralogical and hydrogen analysis, nano and a micro-rover, an impactor probe, an AI-based system for rover navigation and an integrated vision system for geological analysis.

Ensure continuity in Earth Observation programme

In February, the Government of Canada has issued a [Request for Proposal](#) for Concept Studies to identify [the successor of the Radarsat Constellation Mission \(RCM\)](#). Launched in June 2019 on a Falcon 9 rocket, the RCM is a three-satellite constellation developed by MDA, with a 7-year lifetime span, and designed to provide data for maritime surveillance, disaster management and ecosystem monitoring.

RUSSIA

Advancements on Oryol spacecraft

In February, the Roscosmos Director General Rogozin reported the advancements related to the [Oryol \(Orel, "Eagle"\) spacecraft](#), in particular for what concerns the power and computer systems and the avionics. Developed by Energia Rocket and Space Corporation, Oryol is the Russian project for the next-generation of spacecrafts; it is designed as a multipurpose vehicle targeting flights to the ISS, for crews of up to six members, as well as future missions to the Moon. The first [flight test is expected for 2023](#) on an Angara-A5 rocket from the Vostochny Cosmodrome, while the first uncrewed launch to the ISS is planned for 2024.

Russia supports new cooperation agreements

In January, the Russian Space Agency signed an agreement with the [National Academy of Sciences of Belarus](#); the agreement provides the basis for expanding the Canopus remote sensing satellites constellation, improving its capabilities and intensifying the cooperation on the data and services provided. In addition, in January the Russian Federation Council approved an [interstate agreement signed with](#)

[Angola](#) in April 2019, focused on bilateral cooperation opportunities in various space services relevant for the Government of Angola.

INDIA

ISRO delineates programmatic priorities

In February, ISRO released the [Annual Report 2019-2020](#) on the planned priorities for the year. Overall, the proposed budget for 2020-2021 amounts to \$1.9B. The Report outlines several scientific projects, such as: the ADITYA-L1 solar mission, the NISAR joint mission with NASA focused on Earth's ecosystem, additional scheduled Earth Observation satellites launches to ensure continuity of existing programmes. Furthermore, the Report presents the Space Docking Experiment (SPADEX) project to demonstrate in-orbit docking capabilities between two spacecrafts.

Notable advancements concern also the Reusable Launch Vehicle (RLV) project and the human spaceflight programme Gaganyaan, with a first unmanned flight expected by the end of 2020 and the manned mission one year after in December 2021 despite recent discussion on [underfunding](#) to the programme. In addition, the Report addresses the progresses on SSA capabilities, such as the [Network for space object Tracking and Analysis \(NETRA\)](#) project, developed in cooperation with the Indian Institute of Astrophysics (IIA).

The report does not include details on the next [Chandrayaan-3](#) mission to the Moon; notwithstanding, in February ISRO Chair Sivan has confirmed the mission that will attempt to land on the Moon in 2021, with an approximate reported budget of \$91.2 million.

Indian astronaut candidates start training

In January, ISRO confirmed the selection of [four astronaut candidates](#) from the Indian Air Force who started the training process of approximately eleven months in Russia, on the basis of a previous agreement between the two States, to allow then to proceed with the module-specific training for the Gaganyaan programme.

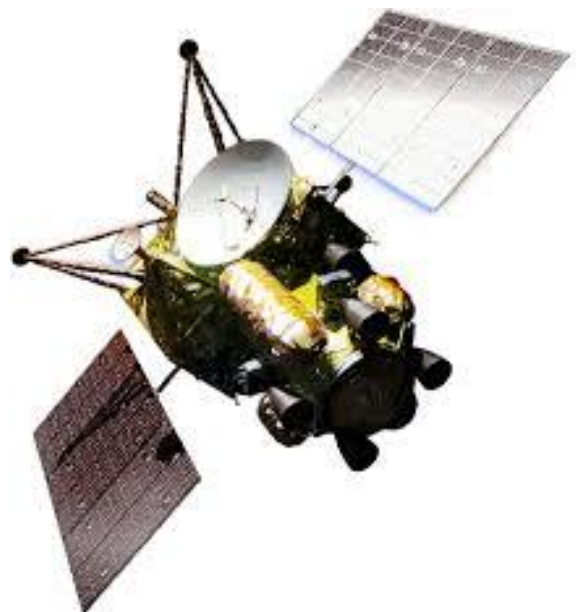
JAPAN

JAXA starts project for debris removal

In February, JAXA selected Astroscale Holdings Inc. as commercial partner for the first of the two phases of the [Commercial Removal of Debris Demonstration](#) project (CRD2). Expected by the end of FY2022, the first phase will focus on key technology demonstration for [acquiring data on debris](#) and approaching the target in order to allow correct and secure realisation of future rendezvous and proximity operations.

Development of the sample return mission on Phobos

On 19 February, JAXA officially approved the [Martian Moon Exploration Mission \(MMX\)](#), a robotic sample return mission expected for 2024. The MMX aims to visit Mars' moons Deimos and Phobos and to land on the latter, considered more interesting for the surface's composition, to collect approx. 10kg of samples. The Mission is developed with contributions of international partners as NASA and ESA, but also CNES and DLR that signed separate cooperation agreements in June 2019.



8 Credit: JAXA

FAO cooperates with Japan for monitoring forests

In January, JAXA and FAO signed a cooperation agreement on utilisation of [radar satellite data for monitoring forests and land use](#) by expanding the widely used FAO's platform - System for Earth Observation Data Access, Processing and Analysis for Land Monitoring (SEPAL). SEPAL provides information to adapt to the effects of climate change and, according to the parties, the agreement will foster the capabilities for forest management and support countries to implement the SDGs environmental commitments.

Forthcoming establishment of space defence unit

In January, Prime Minister Abe announced the establishment of the [Space Domain Mission Unit](#), as part of the Air Self-Defense Force (the national Air Force - JASDF), expected to officially occur in April 2020 ahead of a "full launch in 2022" with more solid operational capabilities. According to Abe, the Unit will cooperate with JAXA but will also foster the relations with the U.S. and especially with the newly established Space Force, expanding the Air Self-Defense Force capabilities.

CHINA

Launch plan for 2020

In January, the China Aerospace Science and Technology Corporation (CASC) announced the scheduled plan for 2020, [targeting at more than 40 overall launches](#). The announcement emphasises also the priorities among the launches. In particular: the launch of the first [Mars rover mission](#) expected in July, the Chang'e-5 probe to collect lunar samples, and the maiden flights of the Long March-5B and Long March-8. For what concerns the [Long March-7A](#), the maiden flight occurred as planned on 16 March, but the rocket experienced a failure for unclear reasons. In 2020, China aims to complete the BeiDou Navigation Satellite System (BDS) with one [launch](#) on 9 March and another expected in May, after integrating in the network [four satellites](#) and elaborating a [three-year plan to promote the industries and applications](#) related to BeiDou.

First 5G satellite of a planned constellation

On 16 January, China launched the [5G satellite Yinhe-1](#), on a Kuaizhou-1A rocket. Primarily developed and operated by the Galaxy Space manufacturer company founded in 2016, the Yinhe-1 is the first technology demonstration satellite for a planned constellation of up to 1000 LEO communication satellites, with 144 satellites planned for launch over a three-year period.

Quantum ground station technology

In January, China managed to establish transmission of encrypted data between the experimental [Quantum Experiments at Space Scale \(QUESS\) satellite](#), in orbit since 2016, and the first [mobile quantum ground station](#). The portable ground station enables quantum key distribution is reported to weigh approx. 80kg and was developed by the University of Science and Technology of China, QuantumCTek Co. Ltd. and the Jinan Institute of Quantum Technology.



9 Credit: Shandong Television, from South China Morning Post

EMERGING SPACE NATIONS

Kick-start of UAE innovation programme

Part of the National Space Investment Promotion Plan, in January the UAE Space Agency officially launched the [UAE NewSpace Innovation Programme](#) in partnership with Krypto Labs - an Abu-Dhabi-based incubation

hub. Based on previous agreement and a close collaboration between the two parties started in 2018, the Innovation Programme aims to create an accelerator centre for start-ups, Universities and technology companies engaged in [space industry-related projects](#). The first 3-months incubation programme will start in April with a market-oriented subsequent phase expected in August.

In addition, in February, the UAE Space Agency held a workshop together with Krypto Labs to present the [Global Space Industry Accelerator \(GSIA\)](#), created to foster the investments in the space sector.

UAE national space law

On 24 February, at the presence of UNOOSA Director Simonetta Di Pippo, the UAE Space Agency organised a workshop to present the [national space law, which came into effect](#) in December 2019. The Law is reported to regulate the space activities at large, including licences and permits, insurance and risk-associated requirements, debris mitigation measures and utilisation of space resources. According to the Director of Space Policy and Regulations at the UAE Space Agency, “the development of this law took into consideration 20 relevant treaties and agreements and compared its elements to more than 18 other national space laws”.

Australia launches consultations to support space mission

In February, the Australian Space Agency (ASA) launched a consultation initiative divided in sessions throughout the country, announced in September with the [approval of the Prime Minister](#). Addressed to industry, business and research actors, the initiative concerns [the Moon to Mars Programme](#) and aims to find a shared position on the initiative and several contributions to the Programme, that according to the Agency amounts to “a \$150M investment over five years” directed to the national space sector to support the NASA missions.

Opening of the ASA Headquarter

On 19 February, alongside the 9th edition of the Australian Space Forum, the Australian Prime Minister Scott Morrison officially inaugurated the headquarter of the Australian Space Agency in Adelaide. On the occasion of the Space Forum, ASA signed a [Declaration of Intent](#) with the Italian Space Agency to gain access to the ISS through cooperation on scientific activities.

MULTILATERAL ORGANISATIONS

Concerns on the spectrum allocations

After the World Radiocommunication Conference 2019 (WRC-19) in January, the UN specialised agency World Meteorological Organisation (WMO) addressed some conclusions of the Conference related to spectrum allocations for 5G networks. In particular, the [WMO raised concerns](#) about possible interferences between 5G applications and weather observation in the 24GHz band.

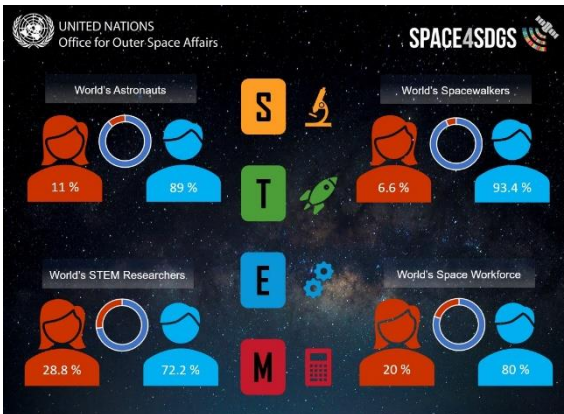
[ESPI Brief no. 37](#) looks into the main decisions approved at the WRC-19 and investigates the dynamic around the value of the spectrum itself.

MoU for critical satellite communications services

In February, during the NATO Defence Ministers Meeting the representatives from France, Italy, UK and U.S. signed a Memorandum of Understanding that will provide NATO with [military satellite communication capabilities to NATO](#) for 15 years. The service coordinated by the NATO Communications and Information Agency (NCI) comes after the previous NATO SATCOM Post-2000 project (in place from 2005 to 2019) and is based on a previous authorisation achieved in May 2019 for €1B, to ensure the acquisition of satellite communication services.

Space4Women

On the occasion of the International Day for Women and Girls in Science celebrated on 11 February, UNOOSA officially launched the [Space4Women project](#) through a new website portal. Addressing in particular the SDG 5 on gender equality, the initiative wants to raise awareness and facilitate the access to STEM and space careers and education opportunities for women.



10 Credit: UNOOSA

SPACE ECONOMY AND FINANCE

SPACE ECONOMY

Bryce Start-up Space Report on the Investment in Commercial Space Ventures

Released in March, Bryce's most recent [Start-up Space](#) report provides an overview of 2019 private investment in commercial space ventures, adopting a large perimeter of analysis. According to the report, 2019 proved to be a fruitful year for space ventures who attracted \$5.7B in financing over the course of the year, corresponding to a 62% increase compared to 2018. Investment was mainly directed towards a small number of industry leaders: SpaceX, Blue Origin, OneWeb and Virgin Galactic accounted for almost 70% of the total financing for the year. However, smaller companies and newcomers have also been able to attract significant capital, with Relativity Space (U.S. rocket manufacturer) and Qianxun Spatial Intelligence (Chinese GNSS company) attracting close to \$140M each.

Furthermore, an additional 129 space start-ups received financing bringing the total to 135 investment deals recorded in 2019. Another important point mentioned by the report is that 2019 saw the amount of non-US start-ups receiving financing grow by almost 70% (79 companies in 2019, compared to 47 in 2018): this is the first-time non-US companies receive more investments than US firms (79 vs 56 respectively).

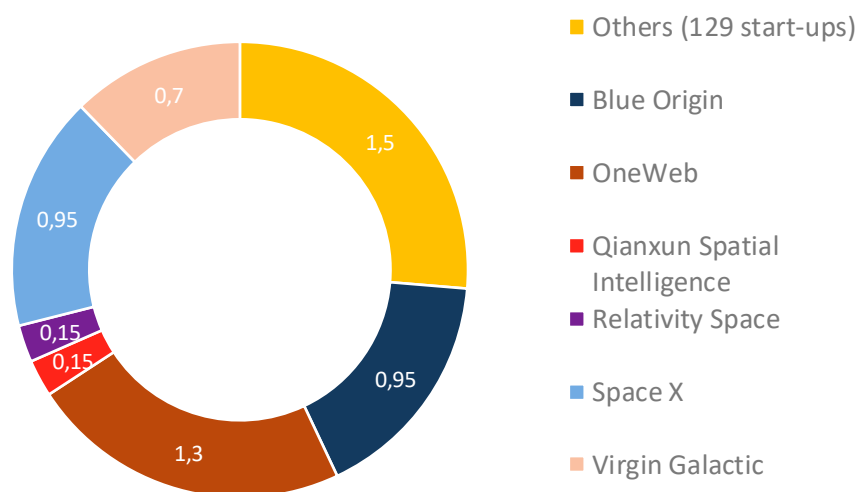


Figure 11: Percentage of investments to space companies. Data: Bryce Space and Technology. Visual elaboration: ESPI.

UK Space Agency Report on Space for Finance in Developing Countries.

In January 2020, the UK Space Agency (UKSA), in collaboration with research company Caribou Space, published a [report](#) on the role of space technologies in addressing challenges within the finance sector in developing countries. The study is part of the International Partnership Programme (IPP), a five-year initiative promoted by the UKSA and funded for approx. €32M to promote sustainable development. The report addresses some of the main challenges faced by developing countries: virtually all of the 1.7 billion adults without a bank account or financial institution live in these countries; furthermore, on the African continent alone, only 5% of the population has insurance and only 9% has already borrowed from a bank. The report suggests that, historically, access to financial services has helped societies in driving development through consumption and access to welfare.

Therefore, the study aims to highlight six areas where the impact of space technologies could be particularly beneficial in the development of financial services in developing countries: 1) Increasing the customer base; 2) Reducing operational costs; 3) Improving risk management; 4) Reduction in index-based insurance basis risk; 5) Improved access to affordable finance products; 6) Increasing trust.

With the abundance of EO and satellite imaging data being accessible free of charge, the cost-effectiveness of financial services through space technologies is shown by the report to become competitive to existing alternatives; in addition, the report concludes that while the usage to space technology for finance is new its competitive advantages should not be overlooked.

SPACE FINANCE

ESPI Space Venture Europe Q1 2020

Methodology Note

The assessment of private investment provided in the report is based on the ESPI dataset that includes public data from a high number of sources. The perimeter of the analysis is based on the definition of start-up with following features:

- ✓ founded after 2000,
- ✓ with annual turnover <€50M,
- ✓ with number of employees <250,
- ✓ headquartered in Europe,
- ✓ whose main business is part of the space value chain.

More detailed information on definitions applied and investors and investment categories used for the purposes of this research, are available in the [Space Venture Europe 2018 Report](#) free for download.

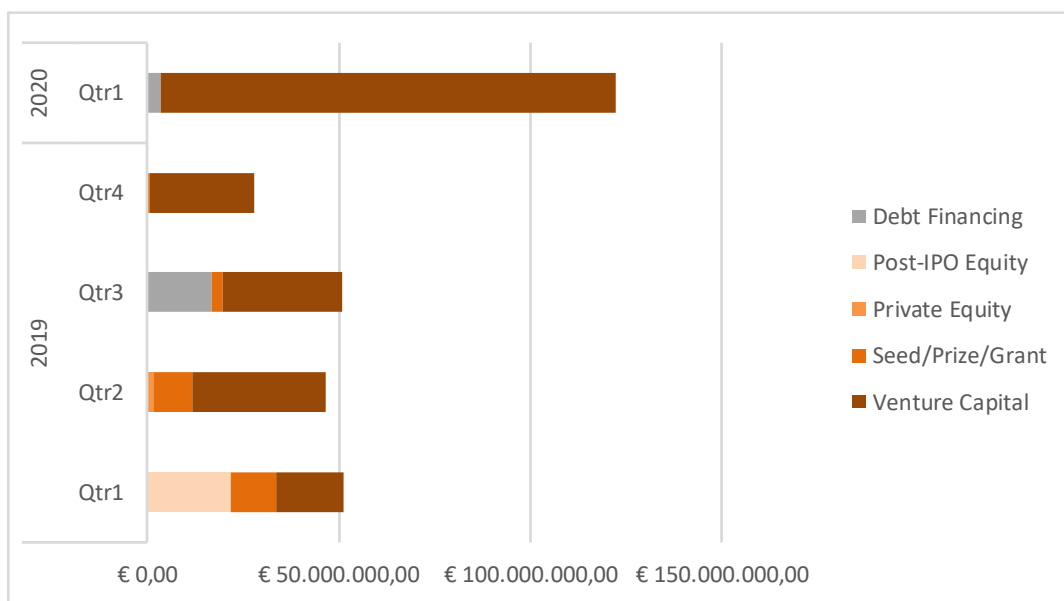


Figure 12: Private investments in European space start-ups by deal category

In Q1 2020, the total amount of private investments in European space and space-related start-ups amounts to €123.8M, a very high result compared to 2019 and primarily led by the investment secured by the French start-up Kinéis. Consistent with the previous year, the main source of private funding has been Venture Capital, corresponding to almost €120M and over the 97% of the total investment volume for Q1 2020 in Europe.

In Q1 2020, the distribution of private investments across the space value chain is sharply inclined toward the upstream sector, dominated by the investments in Kinéis and Kleos Space in the data related category, while the downstream segment accounts for approx. €6M.

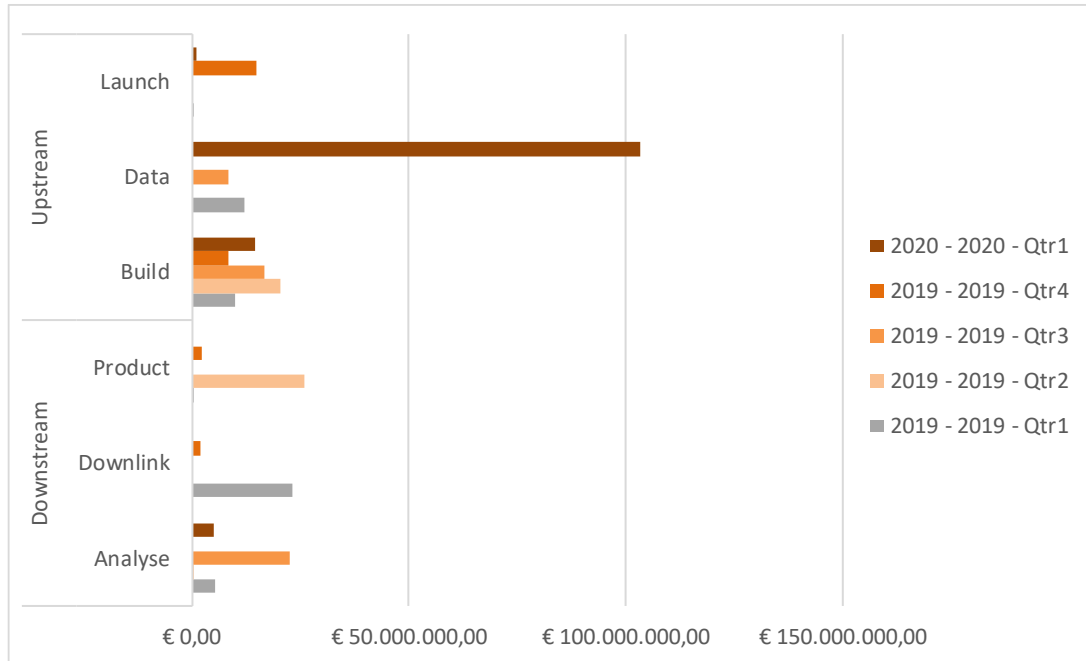


Figure 13: Private investment in European space start-ups across space value chain

Distribution of Top 4 Transaction in Europe



SPACE BUSINESS

OneWeb files for bankruptcy

On 27 March, OneWeb officially filed for [bankruptcy](#) under the Chapter 11 of the United States Bankruptcy Code. In the [official press release](#), the company and the CEO [Adrian Steckel stated](#) that the situation is a consequence of the “financial impact and market turbulence related to the spread of COVID-19”. Previously, on 19 March, [Bloomberg](#) reported rumours that OneWeb was considering bankruptcy and court-protection to reorganise the debts and the overall corporate financial situation. Eventually, the [decision](#) was taken after OneWeb [failed to secure additional funding](#) and SoftBank, OneWeb’s largest investor, agreed to the financial restructure. Founded in 2012 by Greg Wyler, the London-based company raised from 2015 approx. €3B in funding rounds: overall, the Japanese investment giant SoftBank invested €2.5B in the company. Other [investors](#) include Airbus, Qualcomm Technologies, Virgin Group.



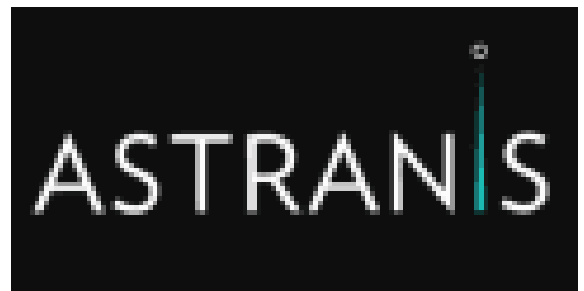
The news came just after the company launched its second batch of [34 satellites on 21 March](#). The constellation operated by OneWeb now counts with 74 satellites but is unable to offer communication services. OneWeb planned to launch additional satellites with a high frequency to reach 300 satellites and start a regional service by the end of 2020; subsequently, the company planned to start the global service in 2021 with 588 satellites in orbit. Over the years, OneWeb secured more than twenty launch services contracts with [Arianespace](#), 20 on Soyuz rockets plus the Ariane 6 maiden flight. Before officially communicating bankruptcy, OneWeb already announced [reductions in its 500-staff workforce and delays in the scheduled launches](#), citing as main reason the virus SARS-CoV-2 outbreak and the consequent pandemic crisis. About what could follow in the close future, [Wired](#) interviewed Bryce Space and Technology and Iridium’s CEO: according to Bryce, SoftBank decided to focus on its highest-priority investments - thus excluding OneWeb - while Matt Desch of Iridium commented about the impatience of investors for returns, that on large constellation are far from being immediate. Additionally, the BBC reminds that in case OneWeb might not find buyers, “the [UK government](#) is ultimately responsible for the 74 spacecraft in orbit”.

Announced Investment Deals

- ▶ [Kleos Space](#), a Luxembourg-based mapping company, secured a €3.1M debt financing loan agreement with the UAE Winance fund.
- ▶ [Kinéis](#), a French nanosatellite operator focused on IoT connectivity, raised €100M from several investors led by CLS Group.
- ▶ [Rezatec](#), a UK satellite imagery and analytics provider, raised €5.9M in a Series B funding led by Gresham House Ventures.
- ▶ The Spanish start-up [Pangea Aerospace](#) raised €1M in a venture round led by the Spain-based investment platform the Crowd Angel.
- ▶ The Zurich-based start-up [9T Labs](#), focused on 3D printing, raised \$4.3M in a seed round led by Wingman Ventures and Investiere.
- ▶ The French nanotechnologies and carbon battery start-up [NAWATechnologies](#) raised €13M in a venture round from a number of investors including Bpifrance.
- ▶ [Sateliot](#), a Barcelona-based IoT constellation developer, raised €1.4M in a venture round led by the Spanish Capitana Venture Partners.
- ▶ The Boston-based company developing in-space propulsion technology, [Accion Systems](#), raised \$11M in a Series B funding led by co-led by Boeing HorizonX Ventures and Shasta Ventures.

SPACE ECONOMY AND FINANCE

- ▶ The U.S. company developing solutions for on-demand launches, [SpinLaunch](#), raised \$35M in a funding round led by Airbus Ventures.
- ▶ The Chinese private launch provider [Galactic Energy](#) raised \$21.5M in a round led by Puhua Capital and Huaqiang Capital occurred in October but announced in late 2019.
- ▶ The U.S. provider of in-flight connectivity [SmartSky Networks](#) secured a funding of \$25M from the Global Credit Opportunities platform at BlackRock.
- ▶ [SkyWatch Space Applications](#), a Canadian start-up focused on EO satellite imagery software, raised \$7.5M in a Series A funding round led by Bullpen Capital.
- ▶ [Skylo](#), a U.S. start-up developing IoT technologies, secured \$103M in a Series B round led by the SoftBank group.
- ▶ The Australian [Gilmour Space Technologies](#) rocket company received a \$3M grant from the Australian Federal government.
- ▶ [Astranis](#), the U.S. telecommunication microsatellite start-up, raised overall \$90M from a Series B funding round led by Venrock and a debt financing operation led by TriplePoint Capital.
- ▶ The U.S. company [NextNav](#), focused on 3D geolocation and PNT services, raised \$120M in a funding round led by Fortress Investment Group.
- ▶ [Tarana Wireless Inc.](#), a U.S. based company developing wireless and radio technologies solutions, raised \$24M to advance on the broadband platform and connectivity network.
- ▶ [NewSpace Networks](#), a U.S. software developing company, secured \$200M to further develop Cloud integration, data analysis and IoT enablement for the aerospace industry.
- ▶ The Australian quantum cybersecurity company [QuintessenceLabs](#) secured an undisclosed funding from In-Q-Tel (IQT Inc.).
- ▶ The U.S. company [PredaSAR Corporation](#), developing a SAR satellite constellation, secured \$25M seed funding in round led by the venture capital firm Rokk3r Fuel.
- ▶ [MinoSpace](#), a Chinese satellite manufacturer company also known as Weina Star Technology, raised \$14.2M in a Series A funding.
- ▶ [AST & Science](#), a U.S. start-up focused on developing a satellite constellation for cellular network secured \$128M in a Series B round led by Rakuten and Vodafone, aimed at advancing the “SpaceMobile” constellation project.
- ▶ [SpaceIL](#), the Israeli organisation that attempted a lunar landing in 2019, received a \$1M grant from the Blavatnik Family Foundation to support the Beresheet 2 spacecraft programme.



Major contracts

- ▶ The U.S. Space Force awarded [Northrop Grumman](#), [Boeing](#) and [Lockheed Martin](#) a contract for the development of jam-resistant and cyber-secure communications payloads, under the Protected Tactical Satellite Communications (PTS) programme. Northrop Grumman received a \$253M contract, while Boeing and Lockheed Martin \$191M and \$240M contracts respectively.



- ▶ NASA announced the selection of SpaceX for both the launch services for the [Psyche](#) Mission, for the amount of \$117M, and the Plankton, Aerosol, Cloud, Ocean Ecosystem ([PACE](#)) spacecraft, for approx. \$80M.
- ▶ The U.S. Space Force Space and Missile System Center awarded a contract to [L3Harris](#) for 10-year and worth \$1.2B to maintain and modernise the Maintenance of Space Situational Awareness Integrated Capabilities (MOSSAIC) programme.
- ▶ [Collins Aerospace](#) was awarded a contract from Lockheed Martin for \$320M to provide the critical subsystems under the Orion spacecraft development. The contract includes the development of the environmental control and life support systems, the active thermal control systems, the power management as well as the waste management systems.
- ▶ [Booz Allen Hamilton](#) won a contract of \$178M from the U.S. Naval Information Warfare Center and the U.S. Air Force Space and Missile Systems Centers to provide several technical services related to the improvement and management of the PNT systems.
- ▶ [Raytheon](#) was awarded a contract with the U.S. Air Force for a total of \$197M, to develop the Future Operationally Resilient Ground Evolution (FORGE) ground system facility specifically aimed to process missile warning satellites data.
- ▶ The Defense Information Systems Agency (DISA) part of the U.S. DoD awarded [Intelligent Waves](#) a contract worth \$48M to provide communication service under the Enhanced Mobile Satellite Services (EMSS) programme.
- ▶ Both [Space Adventures](#) and [Axiom Space](#) announced that they have signed contracts with SpaceX for short space tourism missions with private astronauts on two different commercial Crew Dragon launches to the ISS, expected for 2021.
- ▶ [Peraton](#) was awarded a \$218.6M contract by the United States Africa Command (AFRICOM) to provide satellite communications services from multiple satellite operators to meet emerging requirements.
- ▶ Firefly Aerospace signed two launch service agreements with [Satlantis](#) and [ISILaunch](#) respectively for the launch of a EO constellation beginning from 2022 and to offer several launch opportunities to ISILaunch customers.
- ▶ [Momentum](#) signed a contract with StreamJet Space Systems to deploy a CubeSat during the demonstration launch expected by the end of 2020.
- ▶ [Blue Canyon Technologies](#) was awarded a contract by MethaneSAT to develop the spacecraft for the first mission to collect data on methane emissions expected for 2022. Moreover, [Blue Canyon Technologies](#) announced a partnership with Made in Space for the development of a satellite bus for the on-orbit manufacturing demonstration mission Archinaut One.
- ▶ [Telespazio Argentina](#) secured a four-year contract from an international tender in Costa Rica to provide urban and rural cadastral survey of 50% of Costa Rican territory, for the overall value of \$20M.
- ▶ [Hisdesat](#) and exactEarth Ltd. have been selected by the European Maritime Safety Agency to provide for four years satellite-AIS data service for an overall amount of approx. €4.5M.
- ▶ The Spanish telecommunication company [Eurona](#) renegotiated a contract with Hispasat on commercialisation of satellite capacity that according to the firm will “save approx. €9M per year”.
- ▶ [Thales Alenia Space](#) was awarded a contract by Hispasat to develop the advanced Amazonas Nexus satellite, expected for 2022.





- ▶ [QinetiQ](#) was awarded a contract by ESA worth a total of €75M to develop the EO satellite Atmospheric Limb Tracker for Investigation of the Upcoming Stratosphere (ALTIUS) - as well as new cleanroom facility in Belgium - expected for launch in 2023.
- ▶ [In-Space Missions](#) signed a PPP programme with ESA for the overall value of €10M to develop the Faraday 2nd Generation, a satellite platform project co-funded under the ARTES programme.
- ▶ The Luxemburg-based start-up [IBISA](#) (Inclusive Blockchain Insurance using Space Assets) signed a contract with ESA, with the support of the Luxemburg Space Agency and the U.S. company ConsenSys, to develop its operations in India based on the insurance platform project.
- ▶ The Swiss start-up [Astrocast](#) signed a contract with Spaceflight Industries for the launch of 10 IoT nanosatellites, expected for 2021.
- ▶ [TriSept Corporation](#) announced the launch procurement contract with the UK Orbex Prime company for a mission expected by the end of 2022 from the Sutherland Spaceport.
- ▶ The video service UK start-up [Sen awarded NanoAvionics](#) a contract to manufacture five nanosatellites of a planned constellation for video streaming services, expected for launch in 2022.
- ▶ [Nilesat](#) signed a contract with SpaceX to launch by 2022 the Nilesat-301 GEO satellite, the manufacturing of which has been awarded to [Thales Alenia Space](#) as prime contractor.
- ▶ [GomSpace](#) signed a contract with Unseen Labs for the amount of approx. €1.7M for the development of nanosatellite platforms.
- ▶ [GMV](#) was awarded a contract from Northrop Grumman to develop the satellite operations centres for the two satellites part of the Arctic Satellite Broadband Mission (ASBM-1 and ASBM-2), operated by Space Norway HEOSAT.
- ▶ The [Swedish Space Corporation \(SSC\)](#) signed a contract with the German start-up Isar Aerospace for testing rocket engines at the Esrange Space Centre in northern Sweden.
- ▶ [AAC Clyde Space](#) was awarded a contract from the Israeli telecommunication company NSLComm for approx. €1.4M to develop, launch and operate a 6U satellite. Furthermore, [AAC Clyde Space](#) won a contract to supply the power systems and batteries for the [Nova-C lunar lander mission](#) project led by Intuitive Machines for an overall value of approx. \$1.3M.



Other Major announcements

- ▶ [Avio](#) signed a Letter of Intent with the Luxembourg-based subsidiary Made in Space Europe to develop In-Orbit Servicing solutions based on a multi-mission platform named VIRTUS (Vega In-orbit Robotic Technology Use & Services), a joint development based on Made in Space's robotic arm and Avio's propulsive module.
- ▶ The [Centre for Security, Reliability and Trust](#) (SnT) of the University of Luxembourg signed an agreement with the UK start-up Lift Me Off to cooperate on computer vision technologies for In-Orbit Servicing operations.
- ▶ [Skyrora](#) announced possible cooperation with Space Iceland, founded in 2019, to explore possible testing and launch services locations in Iceland.
- ▶ [Thales Alenia Space](#) appointed Massimo Comparini as Deputy CEO and Senior Executive Vice President Observation, Exploration and Navigation Business Line at Thales Alenia Space and as CEO of Thales Alenia Space Italia, succeeding to Donato Amoruso and after having served as CEO of the Telespazio and ASI joint venture e-Geos.

SPACE ECONOMY AND FINANCE

- ▶ The Italian space company [Sitael](#) announced the opening of a new office in Adelaide, Australia, in concomitance with the partnership with Inovor Technologies to cooperate on a defence satellite project.
- ▶ [Airbus Defence & Space](#) plans to cut 2300 jobs over the next two years due to a flat market and postponed contracts in defence. The distribution of job cuts is the following: 829 jobs in Germany, 630 in Spain, 404 in France, 357 in Britain and 142 in other countries.
- ▶ [Bigelow Aerospace](#) laid off its entire workforce of 88 employees, because of the coronavirus outbreak and financial difficulties. The company explained that it will hire them back after the crisis but some sources believe that it will be a permanent measure.
- ▶ [Lockheed Martin](#) announced the election of James D. Taiclet as new President and CEO of the company, effective from next 15 June 2020. Taiclet succeeds to Marillyn A. Hewson who served as President and CEO since 2013.
- ▶ [Rocket Lab](#) acquired Sinclair Interplanetary, a Canadian smallsat component company, which builds for instance reaction wheels and star trackers. Rocket Lab said that it will use Sinclair systems on its Photon line of smallsat buses, and that it will provide resources for Sinclair to scale up production of those components for sale to others.
- ▶ [HawkEye 360 Inc.](#) announced a strategic partnership with Airbus to deliver high-impact geospatial data analytics to build a comprehensive data sets and address specific requirements.
- ▶ [Maxar Technologies](#) announced a final agreement reached with a consortium led by Northern Private Capital (NPC) to sell MDA and all the related services and facilities for approx. \$765M.
- ▶ [Leonardo](#) announced the creation of a joint venture with the Brazilian Codemar named Leonardo&Codemar S.A. to work together on a variety of regional projects including space-related applications.
- ▶ The New Zealand-based company [Dawn Aerospace](#) announced an MoU with the regional Waitaki District Council for the approval of suborbital flights from the Oamaru Airport.
- ▶ The [Swedish Space Corporation \(SSC\)](#) signed an MoU with the Geo-Insights joint venture company to provide the Asia-Pacific market with ground station services.
- ▶ [Infostellar](#), a Japanese ground segment provider, signed an agreement with Azercosmos to provide their satellite customer with access to the Azercosmos Ground Station (AGS).
- ▶ The Luxembourg [Kleos Space](#) company announced a channel partner and data integrator agreement with the UK Geollect to enable vessel tracking capability and analytical intelligence solutions.
- ▶ [Made in Space](#) announced a new headquarter and manufacturing facility in Jacksonville, Florida, in order to further expand the facility's capability in terms of production as well as the presence and investments in Florida.
- ▶ [Audacy](#) announced default at the end of 2019, after a failure in a technology demonstration mission in December 2018, several office closures in 2019 and the inability to secure the necessary funding to build its satcom networks. In January, [EOS Defense Systems USA](#) announced the acquisition of Audacy business license for approx. \$6.7M.
- ▶ [Blue Origin](#) opened a new rocket engine production facility in Huntsville, Alabama, to primarily develop the BE-4 engine and transfer part of the production currently undergoing at the Kent facility.
- ▶ [Gilat Satellite Networks](#) has been acquired by Comtech Telecommunications Corp for the overall amount of \$532.5M.
- ▶ [Descartes Labs](#) disclosed its cloud-based platform that offers geospatial datasets for commercial geophysical applications.

SPACE ECONOMY AND FINANCE

- ▶ The U.S. satellite operator [Swarm Technologies](#) announced in February the successful installation of a satellite ground station at the McMurdo Station in Antarctica, a research centre operated by the National Science Foundation.
- ▶ [Singapore Space & Technology Association \(SSTA\)](#) signed an MoU with the Ministry of Foreign Affairs and Trade of Hungary for cooperation on space and satellite technologies.
- ▶ [Mitsubishi Electric Corporation](#) announced a new facility for satellite production in Kamakura, increasing the annual production capabilities as well as the overall efficiency and product quality.
- ▶ The French start-up [Cailabs](#) announced a partnership with the U.S. BridgeComm to improve the space, airborne and terrestrial optical wireless communication systems (OWC) with more robust laser technology.
- ▶ In January, [Iceye](#) announced the launch of its Dark Vessel Detection platform for enhanced maritime security through a combination of observations from its constellation of three synthetic aperture radar satellites with other data sources to provide customers with radar satellite images of vessels that are not broadcasting their identification, position and course with AIS transponders. In addition, in February Iceye announced Mark Matossian as the new CEO of the subsidiary [ICEYE US](#).
- ▶ [Kepler Communications](#) announced the opening of a new manufacturing facility in Toronto, Canada, in order to produce in-house the company's planned 140 satellites constellation.

The logo for ICEYE, featuring the word "ICEYE" in a bold, black, sans-serif font. The letter "I" is slightly larger and positioned to the left of the "C".

SPACE INDUSTRY AND INNOVATION

LAUNCHERS

EU books four Ariane 6 launches

On behalf of the EU Commission, ESA confirmed the pre-order of [four launches of Ariane 62](#) for the deployment of eight Galileo satellites part of the third batch expected in 2022. A first down payment has already been received by Arianespace, but the final confirmation will be reached with the approval of the MFF 2021-2027. At the moment, half of the rockets which will make the transition between Ariane 5 and Ariane 6 are for European institutional customers.

UK-based launch services company secures mission

The U.S. launch integrator TriSept Corp. [purchased an Orbex Prime launch vehicle](#) for a rideshare mission expected by 2022 from the Space Hub Sutherland spaceport located in Scotland. It is the first time that a mission integrator bought an Orbex Prime reusable rocket. The mission plans to launch between eight and twenty CubeSats and microsattellites.



14 Credit: Orbex Prime

Scottish company completes “greener” rocket engines tests

Skyrora has completed several static horizontal firings aiming at [testing its 3D-printed upper stage engine](#) and its eco-fuel created from waste plastics and called “Ecosene”, reportedly emitting 45% less greenhouse gasses. The engine is able to restart in orbit, which improves the orbital manoeuvrability of the rocket.

Future Vega thrust chamber passed tests

The thrust chamber assembly of the methane-fuelled [M10 rocket engine](#) has passed its first series of hot firing tests. This element is 3D-printed and was fired 19 times for a total of 450 seconds at the NASA Marshall Space Flight Center in the USA. The M10 engine will power the upper stage of future Vega launch vehicles from 2025. This engine is built to be more efficient in terms of propulsion and will be more environmentally-friendly, reducing emissions.

Spanish PLD Space makes progress

On 26 February, the Spanish launch provider PLD Space successfully achieved a [full mission duration hot test](#) of the TEPREL-B liquid rocket engine. The engine will be used on its first mission, MIURA 1 for suborbital launches. The company had suffered a catastrophic accident during a previous test in May 2019 and has taken time to verify the root causes of this problem. On 6 February, PLD Space announced a [customer](#) for the rocket: the Embry-Riddle Aeronautical University in Florida secured a flight for four student- and faculty-built experiments.

Furthermore, on 3 March the company signed an [agreement with Hispasat](#) to cooperate to define the technical features and analyse compatibility to launch services on board the MIURA 5 orbital launcher. The Spanish satellite operator will help PLD Space establish specifications like mass, volume, and mechanical features that satellites must meet to be integrated and launched on board MIURA 5.

RUAG Space signs agreement on Soyuz-2 launchers

On 11 March, RUAG Space and GK Launch Services signed a Long-term Purchase Agreement. Under this agreement, RUAG will supply [Payload Adapters and Separation Systems for the Soyuz-2 launchers](#), and for multiple launches, expanding the relations with GK Launch Services. The products are manufactured at the company’s facility located in Sweden.

NASA launch contract for navigation demonstration

NASA selected Rocket Lab to send the [CAPSTONE CubeSat around the Moon](#), which will allow the reduction of navigation uncertainties for the future Lunar Gateway. The launch will use the company's Proton platform to deliver a translunar injection. It will take place in 2021 from the new launch site of Rocket Lab, in Virginia. The firm-fixed-price launch contract is valued at \$9.95 million.



¹⁵ Credit: Northrop Grumman

Advancements of Omega

Northrop Grumman has completed a [static test fire of the second stage](#) of its Omega rocket. The test was performed in a cold-conditioned environment and lasted approx. 140 seconds. With the combination of the hot static fire test of May 2019, Omega's engines have been submitted to the most extreme propellant temperatures they will experience. Northrop Grumman announced that the rocket now proceeds to the first certification flight in 2021.

Tests on Starship prototypes

A [pressurization test](#) performed on a prototype of Starship (SN1) led to the destruction of the spacecraft. The vehicle did not have its nose cone nor Raptor engines installed and was in the process of being supplied with liquid nitrogen. However, a second prototype (SN2) successfully passed a [cryogenic pressure test](#) on 8 March.

Advancements for Russian rockets in view of the Moon

The CEO of Energia Rocket and Space Corporation announced that, apart from super-heavy rockets such as Proton-M and Angara-A5, heavy and medium-class rockets could also be [used to deliver cargo to the Moon](#). This is for instance the case for scientific experiments and fuel cargo. The Soyuz-5 rocket, currently developed by RSC, could thus be used for these missions. Moreover, in March the Roscosmos Director General announced that new components of the Soyuz-5 rocket have been manufactured at the Progress rocket and space centre, essential modules for the [super-heavy Yenisei rocket](#) that is expected to fly in 2028.

China resumes activities for new rockets' launch missions

Since January, the outbreak of the Covid-19 crisis has caused widespread uncertainty in China and some delays concerning the space sector as well. Despite this and regardless of the failure of the [Long March 7A](#) which occurred on 16 March, China is preparing for the launch of the [heavy-rocket Long March 5B](#), expected by the end of April, to test the rocket and a new generation spacecraft for deep space missions. Moreover, activities resume also for the Kuaizhou-11 rocket, developed by the launch service provider Expace headquartered in the Wuhan area.

Stratolaunch focuses on flexible hypersonic vehicles

After [announcements](#) made at the beginning of the year, on 30 March Stratolaunch disclosed the development of a reusable [hypersonic vehicle](#), called [Talon-A](#), which is designed to be launched from the company's giant [carrier aircraft](#), tested only once in 2019. The vehicle is also expected to be able to take off on its own from a runway and is planned to reach speeds of Mach 5 to Mach 7. The vehicle will be 8.5 meters long with a wingspan of 3.4 meters and a total mass of about 2,720 kilograms at launch. The Talon-A is scheduled for initial operations in 2020 and will serve as a testbed for hypersonic technologies. By 2023, Stratolaunch plans to support multiple Talon-A missions on a single flight of its aircraft, with as many as three Talon-A vehicles carried by the plane at once. Stratolaunch is also developing Talon-Z, a second hypersonic vehicle, and a reusable spaceplane, Black Ice.

EARTH OBSERVATION

Finnish Iceye expands in the U.S. and expands capabilities

Iceye opened an [office in the United States](#) led by a former official of Google who managed the Terra Bella Earth-imaging initiative. Iceye considers the United States as a big market and a top priority, and already has customers there. Iceye is also considering building a full manufacturing chain in the United States.

On the industrial innovation side, in January Iceye launched [the Dark Vessel Detection platform](#), while in March the company released a collection of [SAR video acquisitions](#) to demonstrate the technological capabilities of its in-orbit constellation. It also unveiled a new product: [SAR imagery with a resolution of 25 cm](#). This last capability is produced through data acquired by a single satellite for a 10 seconds observation. This precision is obtained for objects that are parallel to the path of the spacecraft, while for perpendicular objects the precision is of 50 cm.

Multi-year contract for European navigation safety system

The [European Maritime Safety Agency \(EMSA\)](#) selected Hisdesat, as prime contractor, and exactEarth Ltd. to provide satellite Automatic Identification System (AIS) data service for four years for an overall amount of approx. €4.5M, to “support EMSA’s vision and maritime strategy”.

First demonstration of GNSS Reflectometry data

Spire Global presented data from its first two [GNSS Reflectometry CubeSats](#), which use GNSS signals to provide information on Earth’s weather. ESA’s Pioneer programme helped fund Spire’s GNSS Reflectometry program. The spacecraft currently used are only demonstration spacecraft but a second pair is planned for launch in 2020, in order to continuously monitor soil moisture and ocean winds.

Capella Space discloses new satellite design

In January, the U.S.-based on-demand SAR provider Capella Space released an [upgraded satellite design](#) for its sub-0.5m SAR imagery services. According to the company, the advancement was made possible by on-orbit testing on the testbed satellite “Denali” launched in 2018 and ground-based tests to assure improvements in performances also in view of the “Whitney” constellation of six satellites expected soon in 2020.

TELECOMMUNICATIONS

French IoT constellation start-up secures full investment

On 3 February, the French start-up Kinéis has reached its capital-raising target of [€100M](#). The investment shall secure the manufacturing of a satellite [constellation](#) as well as launch, ground infrastructure and insurance services. The company’s end-goal is the launch of 25 CubeSats in LEO at 650km, designed with an eight-year lifetime, targeting Internet of Things devices and Automatic Identification System (AIS) payload for tracking ships. The constellation will rely on an own ground station network, developed by Thales Alenia Space.

Creation of the HAPS Alliance

On 21 February, [several companies](#) created the [HAPS Alliance](#) to promote the use of high-altitude vehicles in the stratosphere to bridge the digital divide. Some of the companies involved are Airbus Defence & Space, Intelsat, China Telecom, Softbank. As part of the Alliance, member companies plan to collectively advocate for High Altitude Platform Station (HAPS) business development, build a cooperative HAPS ecosystem, develop common product specifications, and promote the standardization of HAPS network interoperability. They will also work on spectrum and commercial standards.



16 Credit: Eutelsat

Propulsion systems for Eutelsat spacecrafts

The nanosatellite manufacturer AAC Clyde Space granted a contract to Exotrail, a company providing in-orbit transportation solutions for small satellites, to equip the [ELO 3 and ELO 4 spacecrafts](#) with propulsion systems of Eutelsat's IoT constellation [ELO](#) (Eutelsat LEO for Objects). The systems are expected to be delivered by the end of the year, and the two satellites are scheduled to be launched in 2021.

Concerns by satellite operators over competition by launch providers

At the Satellite 2020 Conference in March, SES and Eutelsat expressed concerns over the looming [competition on the market with launch providers](#), such as SpaceX and Blue Origin. The two operators launched several times with SpaceX and Eutelsat has a forthcoming launch contract with Blue Origin. Yet the possible competition posed by Starlink and Amazon's Kuiper constellation could have effects on these operators' decisions over future launch contracts.

SES announces initiative to refine business scope

In March, SES announced [the initiative "Simplify and Amplify"](#), which will be implemented throughout 2020 to ensure growth. The objective is to position SES as a leader in global content connectivity solutions, focusing on the potential separation of the Networks business from its Video business; under the initiative, SES aims to simplify operations, re-organising some functions and reviewing the company's global footprint.

User terminals for LEO constellations

With plans to start the first services by the end of 2020, SpaceX and OneWeb commented on the production status and corporate strategies for the development of [cheap user terminals](#) for community Wi-Fi services: while OneWeb has "a broad network of suppliers", SpaceX is developing the components in-house. In the meantime, in March the FCC granted SpaceX with a license for up to one [million ground terminals](#) for its Starlink constellation, for a duration of 15 years. Each ground antenna is 0.48 m in diameter.

Satellite "cell-towers" first demonstration

Lynk Global announced that it has managed the first milestone of [connecting a satellite in LEO to a cell phone](#), by sending a message from space to the mobile phone. The test was carried out several times. The company uses LEO nanosatellites that act like cell towers to connect to unmodified cell phones.



17 Credit: NASA/Lynk

Car manufacturer announces space business

The Chinese car manufacturer Geely announced that [it will build its own satellite network](#), which is expected to launch by the end of 2020. The objective of the company is to enable a "smart three-dimensional mobility ecosystem". A production facility and testing centre will be built in the city of Taizhou and will manufacture satellites for Geely but also for other firms. The company is investing \$326M in the project and aims to eventually be able to build 500 satellites a year. These low-orbit satellites will support high-speed data transmission, precise navigation, and cloud computing, and thus enable fast over-the-air updates to Geely's vehicles and "content delivery" to the company's owners. Moreover, demand for in-car connectivity for autonomous vehicles is expected to grow significantly in the future and having its own network will hence be an advantage.

Malfunction in GEO satellite manufactured by Boeing

DirecTV was forced to move and deactivate its [Spaceway-1 satellite out of the geostationary orbit](#) because of a battery malfunction which created a risk of explosion. It was put in a graveyard orbit 500km above the GEO to avoid any risk to other spacecraft. The problem occurred in December and Boeing, the manufacturer of the satellite, stated that the spacecraft should be deorbited before it is forced to use its batteries. It will not affect customers, as the satellite was used as a backup. Because of the urgency, DirectTV said that it could not remove the remaining propellant from the satellite. According to Boeing, a similar problem is not to be expected on other satellites of this family and an update in operating procedures has been provided in order to reduce even more the likelihood of such an event.

Israel Satcom

The Israel Aerospace Industries (IAI) will design and manufacture a national communication satellite for Israel called [Dror-1](#). It will primarily rely on domestic technologies and have a designed lifetime of 15 years. The commitment of the Israeli government is in line with its wish to ensure communication independence.

In-Flight Connectivity demonstration

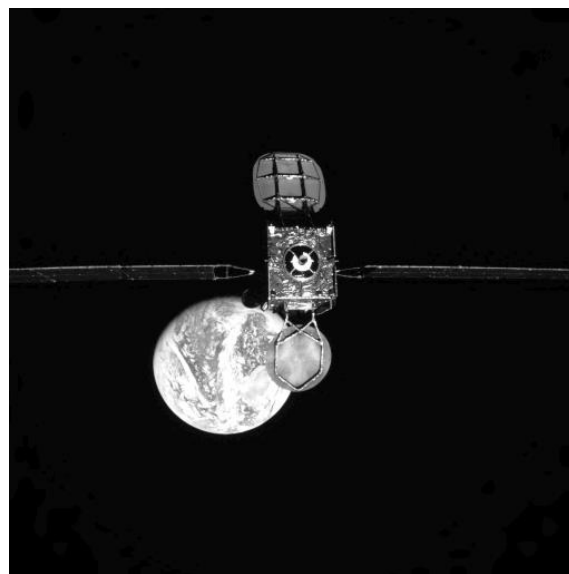
The Israel-based Gilat Satellite Networks, acquired by [Comtech](#) Telecommunications Corp., announced its first-to-flight [Electronically Steered Antenna \(ESA\) terminal](#) has achieved what it calls an industry-first with In-Flight Connectivity (IFC) over Non-Geostationary (NGSO) satellites. It enabled to instantaneously switch between GEO and LEO when necessary. According to the company, this antenna opens the market to low latency, real-time applications.

SSA

UK leads SSA experiment on Rendezvous and Proximity Operation

The UK Defence Science and Technology Laboratory (Dstl), sponsored by the Ministry of Defence, conducted [the “Phantom Echoes” experiment on SSA sensors and capabilities](#) in February. In partnership with U.S., Canada, Australia and New Zealand (representatives of which including UK are part of the “Five-Eyes” cooperation initiative), the experiment focused on the RPO phase of the Mission Extension Vehicle (MEV-1). The MEV-1 is the first commercial In-Orbit Servicing mission developed by Northrop Grumman that on 25 February successfully docked with Intelsat 901 above the GEO orbit.

Details of the mission, as well as the implications and challenges of In-Orbit Servicing emerging capabilities are the focus of the [Espionage Brief no. 38](#).



18 Credit: Northrop Grumman

ArianeGroup expands Space Surveillance Network

ArianeGroup will add an eighth station to its [GEOTracker network](#), a global system of optical sensors that provides positioning and orbit information of objects in GEO and MEO. The station will be installed in Australia’s Northern Territory, at the Centre for Appropriate Technology Ltd. (CfAT). The seventh station was already set up at Ottobrunn, near Munich in Germany, in 2019.

HUMAN AND ROBOTIC EXPLORATION

Towards the Demo-2 mission

In January, SpaceX successfully performed a [launch abort test of the Crew Dragon capsule](#), thus completing the final major flight milestone for the programme. The test was primarily intended to verify the safety of the capsule for astronauts, but was also used to try the "dry dress" rehearsal of the launch countdown. Other tests on the parachutes are still taking place, as minor issues not related to the [parachute](#) system occurred during a test on 24 March. The [Demo-2 mission](#) is expected for May as recently announced by NASA.

Crew Dragon sets for two space tourism flights

[Space Adventures](#) made an agreement with SpaceX to fly a Crew Dragon mission with four tourists. The mission is scheduled for late 2021-mid 2022 with the objective to reach an altitude of more than 1000 km. Space Adventures also has an agreement with Boeing to sell seats on Starliner.

[Axiom Space](#) signed a contract with SpaceX for a Crew Dragon mission to the ISS. The mission will not take place before the second half of 2021 and will transport one professional Axiom astronaut and three private individuals. The mission will last ten days (eight on the station and two for transfer).

Commercial module on ISS

NASA will provide a docking station on the ISS to Axiom Space where the company will be able to install a [commercial module for research and other applications](#). Negotiations on a formal contract will begin. Several modules will constitute Axiom Space's contribution to the ISS, with the first one expected to be launched in 2024.

Xplore aiming at deep space missions

Xplore Inc. has signed a partnership agreement with Nanoracks, which will provide [commercial deep space flight opportunities](#) for its customers and serve as a customer interface for payload design, preparation and integration on Xplore missions to the Moon, Mars, Venus, Lagrange Points and near-Earth asteroids. The goal is to offer high cadence and low-cost flight opportunities. The spacecraft used will be Xplore's Xcraft, designed to carry 30 to 70 kg. Moreover, the Seattle-based company selected two [new technologies for propelling and refuelling the Xcraft](#) in March: Orbion Space Technology will deliver its Aurora propulsion system, while Orbit Fab will partner to enable in-space refuelling through the Rapidly Attachable Fluid Transfer Interface (RAFTI).

Firefly Aerospace moves to spacecraft manufacturing for the Moon

Firefly Aerospace, a company developing a small launcher, announced that it is [developing the orbital transfer vehicle \(OTV\) and the Genesis lander](#) to bring payloads to the surface of the Moon. The company indeed confirmed that it has submitted bids to participate in the NASA Commercial Lunar Payload Services Programme (CLPS). The OTV is expected to have a dry mass of 130 kg and will be powered by Aerojet Rocketdyne's XR-5 Hall thrusters. Genesis will be able to transport 85 kg of cargo to the lunar surface and will use some technology licensed for the Beresheet mission.

Successful test for lunar lander engine

On 28 February, under a contract with Boeing for the NASA Human Landing System, Intuitive Machines successfully tested at the Marshall Space Flight Center the VR3500 [moon lander engine](#) for over 600 seconds; the performance sets a record for duration test and also confirms compliance with the requirements and objectives for future lunar missions.

SCIENCE AND INNOVATION

Stratobus for ISR applications

Thales Alenia Space and Thales signed a contract with the French defence procurement agency (DGA) to assess whether the [Stratobus platform](#) (an autonomous stratospheric airship) can perform intelligence, surveillance and reconnaissance (ISR) missions responding to the operational needs of the French army. The two companies will have to design an operational concept study and to build a full-scale demonstrator; the Director of the Stratobus product line Jean-Philippe Chessel stated that the objective is “to carry out a flight demonstration by the end of 2023”.



19 Credit: Thales Alenia Space

Success for commercial IOS

Northrop Grumman's Mission Extension Vehicle ([MEV-1](#)) docked to the Intelsat satellite for which it will perform life extension services. This is the first commercial In-Orbit Servicing (IOS) mission and the first time in history a docking has ever been performed with a satellite that was not pre-designed for the operation. Service from Intelsat-901 is expected to resume in March or April. Northrop Grumman is already building a second MEV for Intelsat, which will be launched in 2020. Northrop Grumman is expected to launch the MEV-2 in June and has been selected by DARPA for its Robotic Servicing of Geosynchronous Satellites ([RSGS](#)) programme.

Development of a Nuclear-powered space tug in Russia

A [space tug](#), equipped with a megawatt class nuclear engine is scheduled to be launched in 2030, according to a presentation by Roscosmos First Deputy Director General Yuri Urlichich, displayed at the 44th Korolev Academic Space Conference. After 2030, the spacecraft will be serially produced and will enter commercial use.

Methane rocket engine

The Air Force Research Laboratory (AFRL), the NASA Space Technology Mission Directorate and Masten Space Systems Inc. completed the tests of a [liquid methane rocket engine](#), the first of its kind tested at AFRL. The hot fire testing campaign started in July 2019. Masten's objective is to provide space transportation and reliable planetary landers.



20 Credit: Masten Space Systems/Matthew Kuhns

Data compression standard

In March, ESA reported an innovative data compression method to enhance the compression of the stream of housekeeping data in real time. The software was, elaborated by operations engineers and tested aboard the minisatellite Proba-2. The methodology behind the [ESA-developed Pocket software](#) has also been patented in the U.S. and will be adopted as standard by the Consultative Committee for Space Data Systems (CCSDS).

Finnish start-up to demonstrate de-orbiting module

The Finnish start-up Aurora Propulsion Technologies signed a contract to fly the demonstration of a [deorbiting technology on Momentus' Vigoride](#) spacecraft. The CubeSat will test water thrusters as well as the Plasma Break Module, which includes a tether thinner than a human hair and measuring 500 meters long to increase atmospheric drag. This technology is relevant for Momentus as it could help them become not only an in-space transportation but also a deorbiting company. In March, Momentus announced the purchase of six [rideshare missions with SpaceX](#) on a Falcon 9 rocket, expected in 2020 and 2021, for the Vigoride flights.

Tethers Unlimited tests improved technologies

Tethers Unlimited announced that a first demonstration satellite, which uses the company's conductive tape to [increase its atmospheric drag and accelerate its deorbiting](#), has started its descent last fall according to plans. The Prox-1 satellite deorbited more than 24 times faster than before deploying the tape. The company is also developing its Terminator Tapes for several types of satellites. In addition, the company has delivered its SWIFT-LINQ first mesh network [inter-satellite crosslink solution](#) for small satellites, enabling to transfer resources and data between satellites without resorting to larger and more expensive spacecrafts.

Simultaneous commands from ESA deep space antenna

For the first time, an [ESA antenna succeeded in sending commands to two different spacecraft](#) at the same time. The spacecraft were Mars Express and ExoMars Trace Gas Orbiter; using its two transmitters, the antenna sent the messages at different frequencies to avoid interferences. This test will allow to improve the flexibility of ESA's Estrack network of antennas across the globe, to find, control, or receive data from missions across space. Moreover, by working out new ways of sharing ground stations, ESA allows more users to access current resources while new antennas are being built.

Development of the Chinese Large Solar Telescope

In March, scientists from the Chinese Academy of Sciences announced the development of country's first [solar telescope](#), which is also one of the world's largest, is complete. The Chinese Large Solar Telescope has an aperture of 1.8 meter and took high-resolution images of the Sun's atmosphere in December 2019. The telescope will be used to observe solar activity, help on solar research and forecast space weather events.

SPACE ACTIVITY OVERVIEW

KEY INDICATORS AND GRAPHS

Methodology note

ESPI is tracking all launch events and related data since 2000. The ESPI Space Launch Activity Database encloses those worldwide data allowing for detailed quantitative analysis rendered into graphs and charts. The database is a repository of publicly available information on global space activity such as:

- Launch events: date, launch site, outcome, launcher, spacecraft and service provider;
- Spacecraft: customer, orbit, mass, manufacturer, payloads, mission and market.

The database architecture allows the user to create dedicated field and categories to tailor specific analysis. In order to provide the reader with a spacecraft's categorization taking into account both the capacity of the launchers and the different sizes of satellites, ESPI team defined and applied to the dataset the following categories:

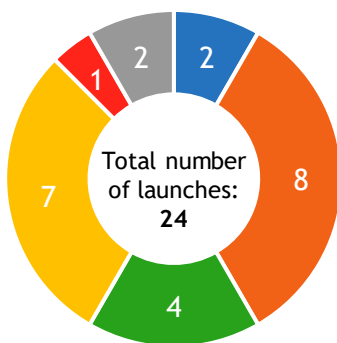
| | | |
|----------------------------|-------------------|---------------|
| Large spacecraft >500kg | Extra heavy-class | >8,000kg |
| | Heavy-class | 2,000-8,000kg |
| | Medium-class | 500-2,000kg |
| Small spacecraft <500kg | Mini-class | 100-500kg |
| | Micro-class | 10-100kg |
| | Nano-class | <10kg |

Detailed information about all the satellites deployed are available in the Launch Log section.

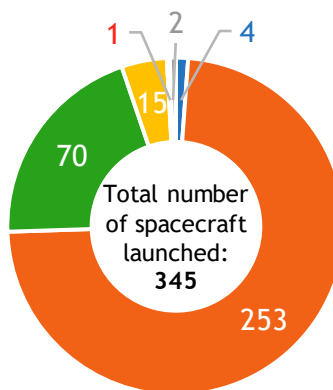
Launch activity by country

The United States and China are the two main countries in terms of number of launches in Q1 2020. However, regarding the number of spacecraft launched, the United States is far ahead all others, as it launched roughly 75% of all spacecraft sent into orbit. This is especially due to the launch of four batches of Starlink satellites, which account for 240 satellites. Similarly, almost all of the 70 spacecraft launched by Russia are satellites for the OneWeb constellation, hence the small share represented by Russia in the total mass. Finally, while Europe sent into orbit only four satellites, it contributed to 12% of the mass launched this quarter.

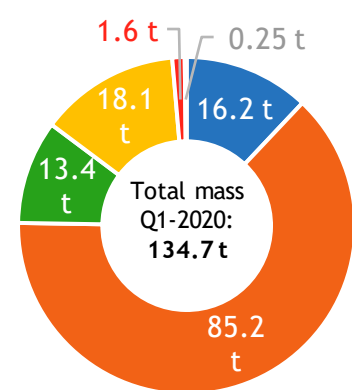
Total mass launched per launch country



Total number of spacecraft launched per launch country



Total mass launched per launch country

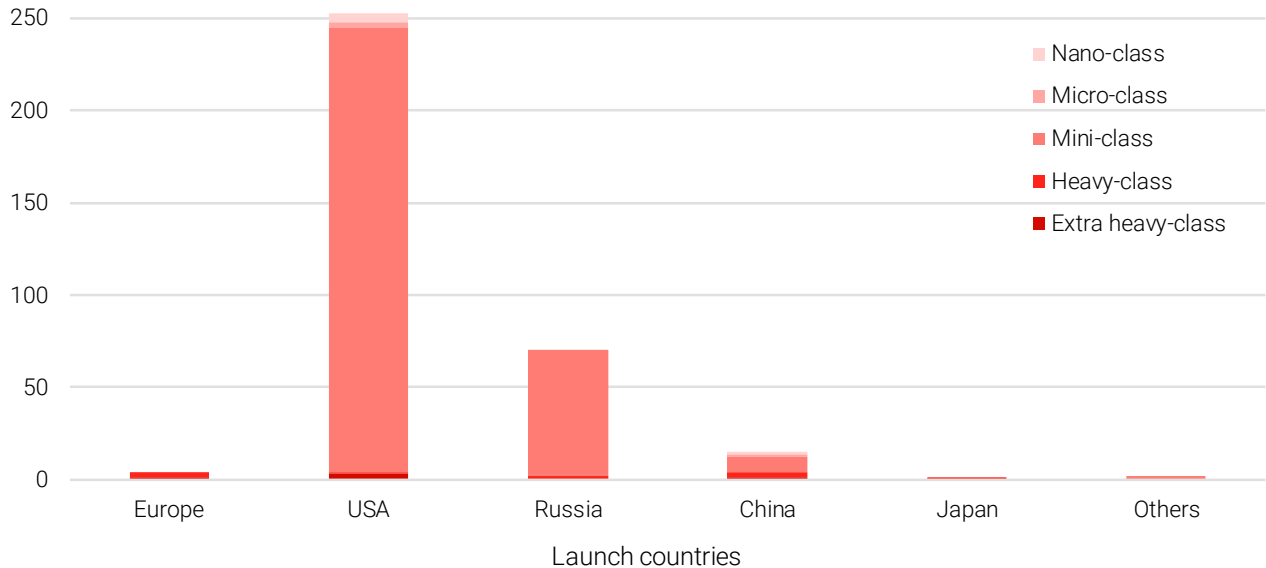


■ Europe ■ USA ■ Russia ■ China ■ Japan ■ Others

Spacecraft classes

In the three major launch countries in terms of number of spacecraft (the United States, Russia and China), most of the spacecraft launched were mini-class. Overall, this category represents 92.5% of all space systems launched this quarter, as mega-constellation satellites belong to this category. Contrarily, Europe and Japan only launched large (i.e. heavy or extra-heavy) spacecraft this quarter.

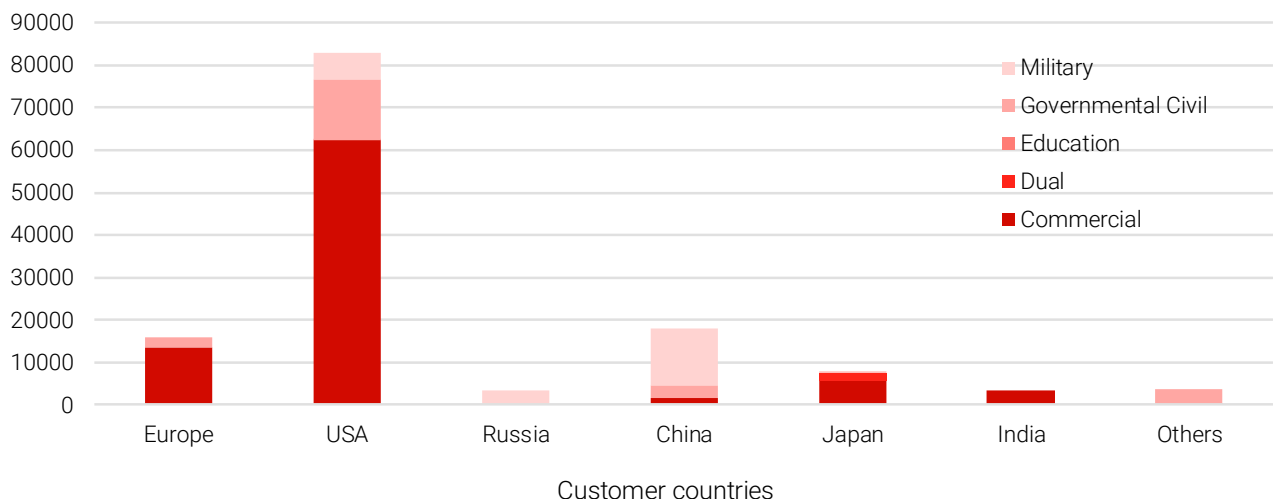
Number of spacecraft launched by class and country



Spacecraft markets

The commercial market is the dominating one in Q1 2020. 75% of the spacecraft launched for the United States are aimed at this market. The proportion is similar for spacecraft launched for Japan (78%) and even higher for Europe (85%) and India (100%). On the contrary, the main market for satellites launched for China and Russia is the military market, making up the majority of the spacecraft launched. The governmental civil market remains significant for the total mass launched for the United States, especially due to the weight of cargo transfer missions to the ISS.

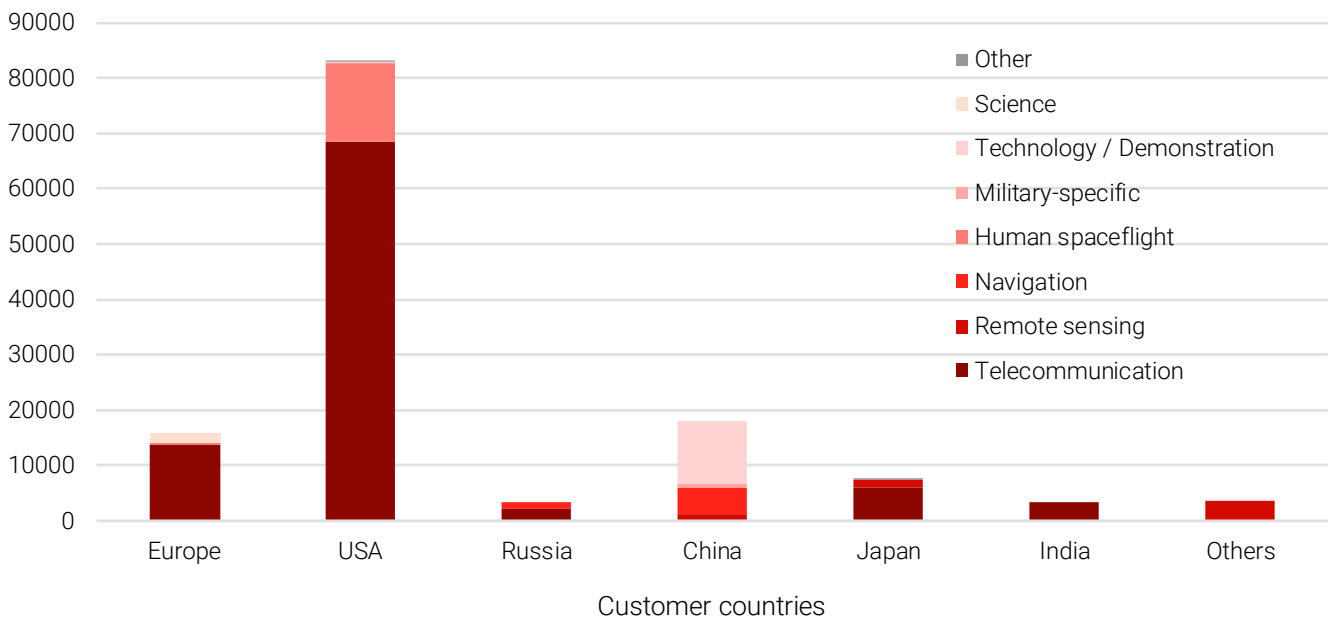
Total mass of spacecraft (kg) launched by market and by customer country



Spacecraft missions

Telecommunication systems represent most of the mass launch for the United States and Europe. This situation is largely explained by the launch of satellites to the mega-constellations of SpaceX (USA) and OneWeb (Europe), which represent 91% and 73% respectively of the mass launched for telecommunications systems in their registration country. Communication satellites also have a big share in the total mass launched for Japan and India, and correlate with the mass launched for the commercial market of these two states. China is the country with the most varied portfolio of missions but two main missions dominate: technology/demonstration, which represent more than half of the total mass launched for the country this quarter; and navigation.

Total mass of spacecraft (kg) launched by mission and customer country



ESPI LAUNCH LOG

| Launch date | Launch country | Launcher | Spacecraft name | Main customer | Customer country | Prime manufacturer | Manufacturer country | Mass (kg) | Mission | Market |
|-------------|----------------|-------------------------|----------------------------|---------------------------------------|------------------|---|----------------------|------------|----------------------------|--------------------|
| 07/01/2020 | USA | Falcon-9 v1.2 (Block 5) | Starlink 2 (60 satellites) | SpaceX | USA | SpaceX | USA | 260 (each) | Telecommunication | Commercial |
| 07/01/2020 | China | CZ-3B/G3 | Tongxin Jishu Shiyan 5 | People's Liberation Army | China | SAST | China | 3000 | Technology / Demonstration | Governmental Civil |
| 15/01/2020 | China | CZ-2D(2) | Jilin 1-Kuanfu 01 | Chang Guang Satellite Technology Co. | China | Chang Guang Satellite Technology Co. | China | 1250 | Earth Observation | Commercial |
| | | | ÑuSat 7 | Satellogic SA | Argentina | Satellogic SA | Argentina | 37 | Earth Observation | Commercial |
| | | | ÑuSat 8 | Satellogic SA | Argentina | Satellogic SA | Argentina | 37 | Earth Observation | Commercial |
| | | | Tianqi 5 | Guodian Gaoke | China | Guodian Gaoke | China | 8 | Technology / Demonstration | Commercial |
| 16/01/2020 | France | Ariane-5ECA+ | Eutelsat Konnect | Eutelsat | France | Thales Alenia Space | France | 3619 | Telecommunication | Commercial |
| | | | Gsat 30 | Insat | India | ISRO | India | 3357 | Telecommunication | Commercial |
| 16/01/2020 | China | Kuaizhou-1A | Yinhe 1 | Galaxy Space | China | Galaxy Space | China | 227 | Technology / Demonstration | Commercial |
| 29/01/2020 | USA | Falcon-9 v1.2 (Block 5) | Starlink 3 (60 satellites) | SpaceX | USA | SpaceX | USA | 260 (each) | Telecommunication | Commercial |
| 31/01/2020 | New Zealand | Electron KS | NROL 151 / USA 294 | NRO | USA | Unknown (USA) | USA | 140 | Technology / Demonstration | Military |
| 06/02/2020 | Russia | Soyuz-2-1b Fregat-M | OneWeb L2 (34 satellites) | OneWeb Ltd. | United Kingdom | OneWeb Satellites | France | 147 (each) | Telecommunication | Commercial |
| 09/02/2020 | Iran | Simorgh | Zafar 1 | ISRC | Iran | Iran University of Science and Technology | Iran | 113 | Earth Observation | Governmental Civil |
| 09/02/2020 | Japan | H-2A-202 | IGS-Optical 7 | Cabinet Satellite Intelligence Center | Japan | Mitsubishi Electric | Japan | 1600 | Earth Observation | Dual |
| 10/02/2020 | USA | Atlas-5(411) | Solar Orbiter | ESA | Europe | Airbus | France | 1800 | Space Science | Governmental Civil |
| 14/02/2020 | USA | Antares-230+ | Cygnus CRS-13 | NASA | USA | Northrop Grumman Innovation Systems | USA | 7492 | Cargo Transfer | Governmental Civil |
| | | | DeMI | MIT | USA | Blue Canyon Technology | USA | 10 | Technology / Demonstration | Governmental Civil |
| | | | Red-Eye 2 | DARPA | USA | DARPA | USA | 100 | Technology / Demonstration | Governmental Civil |
| | | | TechEdSat 10 | San Jose State University | USA | San Jose State University | USA | 8 | Technology / Demonstration | Education |
| 17/02/2020 | USA | Falcon-9 v1.2 (Block 5) | Starlink 4 (60 satellites) | SpaceX | USA | SpaceX | USA | 260 (each) | Telecommunication | Commercial |
| 18/02/2020 | France | Ariane-5ECA+ | GEO-KOMPSAT 2B | Korea Aerospace Research Institute | South Korea | Korea Aerospace Research Institute | South Korea | 3379 | Meteorology | Governmental Civil |

SPACE ACTIVITY OVERVIEW

| | | | | | | | | | | |
|------------|--------|-------------------------|----------------------------|------------------------------------|----------------|------------------------------------|-----------|------------|------------------------------|--------------------|
| | | | JCSat 17 | SKY Perfect JSAT Corporation | Japan | Lockheed Martin | USA | 5857 | Telecommunication | Commercial |
| 19/02/2020 | China | CZ-2D(2) | XJS C | CAST | China | SAST | China | 500 | Technology / Demonstration | Military |
| | | | XJS D | CAST | China | SAST | China | 500 | Technology / Demonstration | Military |
| | | | XJS E | CAST | China | Harbin Institute of Technology | China | 500 | Technology / Demonstration | Military |
| | | | XJS F | CAST | China | DFH Satellite Co. | China | 500 | Technology / Demonstration | Military |
| 20/02/2020 | Russia | Soyuz-2-1a Fregat-M | Meridian-M 9 | Russian Aerospace Forces | Russia | ISS Reshetnev | Russia | 2000 | Telecommunication | Military |
| 07/03/2020 | USA | Falcon-9 v1.2 (Block 5) | Bartolomeo | ESA | Europe | Airbus | France | 484 | Space Station Infrastructure | Governmental Civil |
| | | | Dragon CRS-20 | NASA | USA | SpaceX | USA | 6650 | Cargo Transfer | Governmental Civil |
| | | | G-Satellite | One Team | Japan | University of Tokyo | Japan | 4 | Other | Governmental Civil |
| | | | iSIM | Satlantis | Spain | Satlantis | Spain | 15 | Technology / Demonstration | Commercial |
| | | | Lynk 4 | Lynk | USA | Lynk | USA | 10 | Technology / Demonstration | Commercial |
| | | | Quetzal 1 | Universidad del Valle de Guatemala | Guatemala | Universidad del Valle de Guatemala | Guatemala | 1 | Technology / Demonstration | Education |
| 09/03/2020 | China | CZ-3B/G3 | BD-3 G2Q | People's Liberation Army | China | CAST | China | 4600 | Navigation | Military |
| 16/03/2020 | Russia | Soyuz-2-1b Fregat-M | Glonass-M 51 | Roscosmos | Russia | ISS Reshetnev | Russia | 1415 | Navigation | Military |
| 16/03/2020 | China | CZ-7A | Xinjishu Yanzheng-6 | Unknown (China) | China | Unknown (China) | China | 6000 | Technology / Demonstration | Military |
| 18/03/2020 | USA | Falcon-9 v1.2 (Block 5) | Starlink 5 (60 satellites) | SpaceX | USA | SpaceX | USA | 260 (each) | Telecommunication | Commercial |
| 21/03/2020 | Russia | Soyuz-2-1b Fregat-M | OneWeb L3 (34 satellites) | OneWeb Ltd. | United Kingdom | OneWeb Satellites | France | 147 (each) | Telecommunication | Commercial |
| 24/03/2020 | China | CZ-2C(3) | Yaogan 30-06-01 | People's Liberation Army | China | CAS | China | 300 | Signal Intelligence | Military |
| | | | Yaogan 30-06-02 | People's Liberation Army | China | CAS | China | 300 | Signal Intelligence | Military |
| | | | Yaogan 30-06-03 | People's Liberation Army | China | CAS | China | 300 | Signal Intelligence | Military |
| 26/03/2020 | USA | Atlas-5(551) | AEHF 6 | US Space Force | USA | Lockheed Martin | USA | 6168 | Telecommunication | Military |
| | | | TDO 2 | US Space Force | USA | Georgia Institute of Technology | USA | 24 | Space Situational Awareness | Military |

LAUNCH HIGHLIGHTS

Launch of Eutelsat Konnect, the first Spacebus Neo satellite



Picture 1: Credit: Arianespace

In January 2020, the Eutelsat Konnect satellite was [launched](#) onboard an Ariane 5. The satellite, which was built by Thales Alenia Space, is the first satellite based on the all-electric [Spacebus Neo platform](#) that was developed in cooperation with ESA and CNES in the frame of the ARTES programme, which aims at building more competitive communication satellites. The spacecraft will provide high-throughput broadband services in Ka-band for up to 40 countries across Africa and 15 over Europe.

Solar Orbiter aims at studying the Sun

The Solar Orbiter mission was [launched](#) by an Atlas V in February. ESA was the leader of the mission, which carries 10 instruments to study the Sun, but NASA was also part of the project by providing one instrument, components for other instruments as well as the launch of the spacecraft. The satellite will go as close as 42 million kilometers of the Sun to better understand its magnetic field, the formation of solar wind and the impact of solar activity on Earth. For the first time, the spacecraft will also be able to provide images of the poles of our star. The satellite will coordinate with Parker Solar Probe and they will both complement each other. Given the time needed to approach the Sun, the full mission will formally start in November 2021.



Picture 2: Credit: ESA

Launch of Bartolomeo to the ISS and last launch for Dragon's current version



Picture 3: Credit: Airbus Defence and Space

During the CRS-20 mission early March, SpaceX [flew](#) the last capsule of its first-generation Dragon spacecraft in the last flight under its original resupply contract with NASA, awarded in 2008. Its successor, Dragon 2, which is based on the design of Crew Dragon, is expected to launch end of October. The launch of March also marked the 50th recovery of an intact booster for SpaceX. It was also transporting [Bartolomeo](#) to the ISS, a module developed, built and operated by Airbus Defence and Space to be installed outside of the European module Columbus, where it will be hosted by ESA. The new facility will extend the capacity of the space station for research, and will host commercial experiments.

Launch of four batches of Starlink and the first two full batches of OneWeb

Over the quarter, SpaceX launched four groups of satellites for its Starlink constellation, thus delivering 240 spacecraft to orbit, demonstrating a steady and intense launch rate. During the launch of the latest batch, [two issues happened](#): an engine of the Falcon 9 rocket prematurely shut down while not preventing the correct insertion in orbit of the satellites; and SpaceX did not manage to recover the booster, for the second time in a Starlink mission. Regarding OneWeb, the company launched its first two full batches of 34 satellites each. The launch was performed by Arianespace from Baikonur. However, after having first announced [breaks](#) between its launches, contrary to the monthly schedules originally planned, OneWeb eventually filed for bankruptcy shortly after the second launch, thus raising questions about the future missions that were arranged. Therefore, while 2020 should have been the first year of mega-constellations, this event showcased the potential fragility even of promising projects such as these.



Picture 4: Credit: SpaceX



Failure of Long March-7A

The first launch of the Long March-7A rocket failed, which prevented its classified payload to be put in geosynchronous transfer orbit. The source of the failure is still unknown but could have consequences on other launches as this new launcher shares elements with other rockets of the Long March family. For instance, the second stage engines are the same as on Long March-6 and -7 while some side boosters and the core stage have commonalities with Long March-5. Depending on the cause of the anomaly, upcoming Chinese missions could therefore be impacted, including for China's flagship programmes (e.g. mission to Mars).

Picture 5: Credit:
NasaSpaceflight.com

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The European Space Policy Institute (ESPI) is an independent public think-tank based in Vienna and specialized in international and European space affairs.

ESPI provides decision-makers with an informed view on mid- to long-term issues relevant to Europe's space activities. In this context, ESPI acts as an independent platform for developing positions and strategies. The Institute fulfils its objectives through various multidisciplinary research activities leading to the publication of books, reports, papers, articles, executive briefs, proceedings and position papers, and to the organisation of conferences and events including the annual ESPI Autumn Conference.

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The publication is organised around four thematic sections:

- ▶ **Space Policy and Programmes** outlines important space policy developments in the World by country and region. This includes political decisions, institutional affairs, public budgets and programmatic plans.
- ▶ **Space Economy and Finance** provides statistics and information on space markets and industry results as well as on major investment and contractual deals in the European and global space sector.
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Short title: ESPIinsights Issue 5
Published in: March 2020

Editor and publisher:

European Space Policy Institute, ESPI
Schwarzenbergplatz 6 • A-1030 Vienna • Austria
Tel: +43 1 718 11 18 -0 / Fax: -99
Email: office@espi.or.at

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