



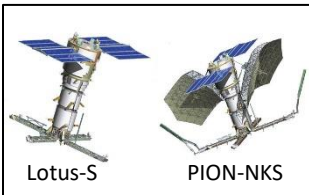
The Final Frontier Flash



11 Jan 21: China Aerospace Science and Technology Corporation ([CASC](#)) [announced successful tests of a range of liquid and solid rocket engines](#)

- CASC stated it had made progress on key technologies for a 220-ton thrust, liquid hydrogen-liquid oxygen staged engine.
- The new staged combustion cycle engine is an upgrade to [CASC's YF-77 \(VIDEO\)](#) and is designed to power the 2nd stage of the [Long March 9 rocket](#).
- Progress included successful hotfire tests of the preburner and propellant turbopumps and combined testing.

The Long March 9 rocket is a super heavy-lift launch vehicle being developed to launch major missions, including supporting future crewed missions to the moon. The rocket is designed to lift 140 tons to LEO or 50 tons to trans lunar injection. A first flight is expected around 2030. ([VIDEO of Future Chinese SLVs](#))

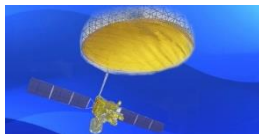


Overview: The [Russian Liana constellation](#)

- The Liana constellation began development in 1993 and is composed of the Lotus electronic intelligence (ELINT) satellites & the PION-NKS, and ELINT and Synthetic Aperture Radar (SAR) imager.
- Conflicting requirements of the land-based and naval systems prompted developers to propose two variants—Lotos and Pion.
- After years of delays the [first Lotus-S launched on 20 Nov 2009](#). However, it turned out that about [half of the on-board systems did not function](#), which required the postponement of the launch of new satellites to a later date for the finalization of the equipment.
- The [second Lotus-S launched on 25 Dec 2014](#). ([VIDEO](#)) There is reporting of an [additional 2 Lotus-S launches](#): 12 Feb 2017 & 25 Oct 2018. Combined this would bring the total on-orbit inventory to 4 Lotus satellites.
- The [Pion-NKS system](#) was expected to provide all-weather target guidance and electronic intelligence for the Russian Navy.
- [Pion-NKS ended up a decade behind](#) its land-focused sibling Lotos-S. There are reports that Pion-NKS stalled around 2014, as a result of Western sanctions and the loss of Ukrainian suppliers.
- [Sep 2018, Minister of Defense Sergei Shoigu said](#) that the PION-NKS production and testing schedule...would finally be approved in October 2018.
- [Mar 2020, Shoigu announced](#) the Pion-NKS satellite...is at its final stage.
- PION-NKS may finally launch in 2021. It is [manifested to fly on a Soyuz 2-1B rocket \(Serial# 77069-203\)](#) sometime in 2021 ([Not earlier than March](#)). An [additional Lotus-S is also scheduled to launch](#) in Feb 21.

While the Russian Ministry of Defense was still lacking an all-weather, day-and-night radar imaging capability from space (as of 2018), it continues to invest in developing space systems and the terrestrial infrastructure to use them. For instance, [special terminals installed on Russian battleships](#) were reported to be capable of downlinking real-time data directly from the Liana network for the purpose of weapon guidance.

***Fun Fact:** Over the course of the late 1980s and 1990s, China's commercial launch industry was seeing initial signs of success, but this all changed with [multiple failures in the mid-1990s](#), namely Apstar-2 and Intelsat-708 (more [VIDEO](#)). The two failures—both involving American-made satellites—led to the United States barring the launch of sensitive American technology on Chinese rockets...meaning no American-made satellites, and indeed few European-made ones, could launch on Chinese rockets. As a result, China focused on developing turnkey space solutions for export...building the satellite, launch vehicle, and all assorted hardware and technical services.*



19 Jan 21: [China's first launch of 2021](#).

- A Chinese Long March 3B rocket launched from Xichang & deployed the Tiantong 1-03 satellite to GEO. ([Launch VIDEO](#))
- Tiantong 1-03 is the third satellite of the communications constellation. The previous 2 satellites were launched in 2016 & 2020.

- The Tiantong constellation provides S-band mobile communications services with coverage across the Asia-Pacific region, the Middle East, and parts of Africa.

The Tiantong constellation is similar to INMARSAT and is operated by China Telecom. The launch was the first of more than 40 space missions scheduled for liftoff from China this year.



29 Jan 21: [China launched three Yaogan military satellites](#) on a Long March 4C rocket, adding to a fleet of spacecraft independent analysts believe are designed to spy on naval forces. ([VIDEO of LM-4C preparation & Launch](#))

- The trio of Yaogan 31 (translated: Remote Sensing) satellites are orbiting at ~680 miles (1,100 km), with 63.4° inclination. ([See Orbit](#))
- Yaogan 31 satellites are believed to be [maritime reconnaissance satellites for tracking foreign naval movements](#).
- Using 3 satellites in formation allows them to intercept radio signals from the ground and calculate/track the position of warships while also studying their activity based on their radio emissions.
- Six previous Long March 4C missions in 2010, 2012, 2013, 2014, and 2018 carried similar naval surveillance satellites into space. All launched from Jiuquan to place satellite triplets into the same 680-mile-high orbit inclined 63.4° to the equator.

With this launch, [there are 69 Yaogan satellites](#) in a variety of orbits, ranging from 35° to 100° and from 480 km circular orbits to 1,200 km eccentric orbits. China launched its first Yaogan satellite in 2006 (Yaogan 1 broke up from an internal explosion in Feb 2010) and the constellation is made up of a variety of sensor types: Electro-Optical, Synthetic Aperture Radar and SIGINT.



Jan 21: [Opinion piece](#) from [Doug Laverro](#): future conflicts will inevitably include targets in the space domain and we must rethink how we will deal with international discussions on attacks against space systems and anti-satellite (ASAT) weapons.

- By the early 2000's it became abundantly clear that space systems were the key link in U.S. power projection...and a critical vulnerability.
- Chinese strategic writings from that period stated "for countries that can never win a war with the United States by using the method of tanks and planes, attacking U.S. space systems may be an irresistible and most tempting choice."
- Since the Outer Space Treaty of 1967, multi-lateral space treaties, principles, and resolutions have been added to the body of space law. But no new space arms control instrument has been agreed to since that time. In some future war, anti-Satellite activities will occur – the question we need to deal with is how that war will be fought. The aversion to the creation of large-scale, long-lived debris is simply the tacit extension of already existing prohibitions on weapons that cause indiscriminate harm, a principle that underpins many other weapons-type prohibitions. When viewed from this perspective, it seems quite likely that nations could agree on such a ban, even as they continued to permit forms of attack that did not create large-scale, long-lived debris.