Russia's ASAT development takes aim at LEO assets

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Russia has increasing anti-satellite (ASAT) capabilities that enable it to interfere with, or destroy, an adversary's satellites. *Sean O'Connor* reviews the history and capabilities of Russia's ASAT programmes

Key Points

- Russia is developing anti-satellite (ASAT) systems that are designed to interfere with, or destroy, satellites in Low Earth Orbit (LEO).
- This could reduce an adversary's ability to collect sensitive intelligence, possibly forcing a reliance on far less survivable collection systems such as airborne assets.
- Ground- and air-launched direct-ascent ASAT systems under development increase the risk of space debris and catastrophic consequences for all users within those orbital bands.

On 6 March 2018, Russia conducted a test of its direct-ascent anti-satellite (DA-ASAT) system, its experimental design programme (known in Russian as Opitno-Konstruktorskaya Rabota: OKR), codename Nudol, from the Plesetsk Cosmodrome. According to US defence sources quoted in *The Diplomat* , this was the system's sixth flight and the first from a mobile transporter erector-launcher (TEL).

The Nudol programme is one of several Russian ASAT systems that are being developed to engage targets in Low Earth Orbit (LEO) – an orbital band that encompasses altitudes up to 2,000 km.

Tactical military satellites often operate in LEO, and as a mobile weapon system, Nudol's TEL will be able to relocate within range of various target satellite orbital paths between orbits, enabling far more satellites to be threatened than a fixed-site system. However, this will be dependent on Russia fielding a targeting capability that is able to support widely dispersed TELs. Although it is still under development, deployment of Nudol will be the latest result of decades of research and development work into ASAT systems.

Growing advantages

Satellites enhance numerous military capabilities, contributing to intelligence, surveillance and reconnaissance (ISR) gathering, communications, navigation, and missile warning missions. The information supplied by space assets has been critical to US military dominance since the 1960s, and the force-multiplying potential of systems that counter these advantages is increasing as militaries become increasingly dependent upon the real-time information that satellites help to provide. Broadly, ASAT systems are intended to either impede the effectiveness of, or destroy, enemy satellites. Russia's development of a range of capabilities across the ASAT spectrum will ensure that several options will be available to Moscow.

Systems designed to impede the effectiveness of satellite functions can take many forms. Jamming systems interfere with the transmission of satellite signals; Global Positioning System (GPS) jammers, for example, interfere with the reception of GPS signals and impede navigation or targeting efforts. Lasers can also be used to interfere with a satellite's optical and imagery sensors by physically damaging them or by preventing them from acquiring data.

DigitalGlobe imagery showing the Beriev facility at Taganrog in southwestern Russia. A new hangar under construction may support installation of the 1LK222 laser into the A-60 airborne laser demonstrator.
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Beriev facility at Taganrog in southwestern Russia. A new hangar under construction may support installation of the 1LK222 laser into the A-60 airborne laser demonstrator. (2018 DigitalGlobe, Inc./2018 IHS Markit)

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Of the systems intended to destroy satellites, ASAT missiles or spacecraft are the most catastrophic. These systems are either direct-ascent or co-orbital (CO). Current Russian destructive ASAT development focuses on DA-ASAT systems. Ground-based space tracking sensors such as radars or optical telescopes can be used to identify satellites and generate their orbital parameters, translating this into initial target track data for an ASAT launch.

DA-ASAT systems are launched from a ground or airborne platform and take a direct path to an intercept point on the target satellite's orbit, although a degree of manoeuvring capability to counter a target's evasion attempts may be incorporated. Any manoeuvring capability would be a significant advance, as this is technologically difficult and costly in terms of fuel.

Examples of DA-ASAT missiles include China's SC-19 and the US ASM-135. SC-19 is not a Chinese designator, but rather a US intelligence designator indicating that the missile was the 19th observed system first detected at Shuangchengzi in Gansu province.

SC-19 is a development of the DF-21(CSS-5) ballistic missile equipped with a kinetic kill vehicle, which was used to destroy the FY-1C Chinese weather satellite orbiting in LEO at 865 km on 22 January 2007. The ASM-135 ASAT missile completed a successful intercept test on 13 September 1985. Launched from an F-15, the missile destroyed the Solwind P78-1 solar physics satellite orbiting in LEO at 525 km, before development stopped in 1988.

The 2018 report *Global Counterspace Capabilities: An Open Source Assessment* , produced by the Secure World Foundation, noted that the reaction time of a satellite in LEO under threat by a DA-ASAT is limited to 8–15 minutes. To counter such an attack during this timeframe, the DA-ASAT launch must be detected and identified, the targeted satellite identified, and the satellite manoeuvred onto a new, safer orbital path if it can. However, satellite manoeuvring fuel is finite, meaning that only a limited number of orbital changes can be accomplished. This potentially places a satellite in a situation where it must risk destruction or move to a new orbital path that limits, or eliminates, future mobility.

CO-ASAT systems are placed in orbit, and over the course of several orbits reorient themselves into the orbital path of the target satellite before closing for intercept. Examples of CO-ASAT systems include the former operational Soviet ballistic missile-based Istrebitel Sputnikov (‘Satellite Fighter’) system, and the developmental ballistic missile-based Nayad (14F10) and Naryad-V (14F11) systems; none are currently operational.

According to the January 2012 report ‘A History of Anti-Satellite Programs’ by the Union of Concerned Scientists, the average wait time for an opportunity to launch a CO-ASAT attack is six hours, given that LEO satellites pass over a given launch site only twice daily. However, CO-SATs can also lie dormant for years, and it is therefore unnecessary for launches to be timely.

Nudol system

The Nudol DA-ASAT system has been under development since at least 2011 and may form the mobile ASAT portion, or is possibly an offshoot, of the proposed A-235 anti-ballistic missile (ABM) system (RTTs-181M) – OTR (operational tactical rocket), codename Samolet-M – that has been under development since 1985. The A-235 is intended to replace the Moscow-area A-135 Amur (ABM-4A ‘Gazelle’/ABM-4B ‘Gorgon’, sometimes also designated ABM-3 ‘Gazelle’/ABM-4 ‘Gorgon’) ABM system, with various components including the 53T6M endoatmospheric interceptor, which is a modified 53T6 (ABM-4A ‘Gazelle’) from the A-135, currently undergoing testing.

The Nudol system is also referred to in the West as the PL-19. The PL- series designator indicates that the system was first identified by Western intelligence sources at Plesetsk Cosmodrome, and was the 19th such object identified at the site. At least five of the six known Nudol tests occurred at Plesetsk.

The first known open-source acknowledgement of the Nudol system in Russia came in 2010, when Russian electronics and engineering company JSC Avangard released its annual report. Among other areas, JSC Avangard is involved with composite and fibreglass component manufacturing, suggesting that the company may be responsible for producing launch canisters for the missile that arms the Nudol system.

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