Fact Sheet

RUSSIAN DIRECT ASCENT ANTI-SATELLITE TESTING

June 2025

CONTACT: VICTORIA SAMSON
VSAMSON@SWFOUND.ORG

SECURE WORLD FOUNDATION

SUMMARY

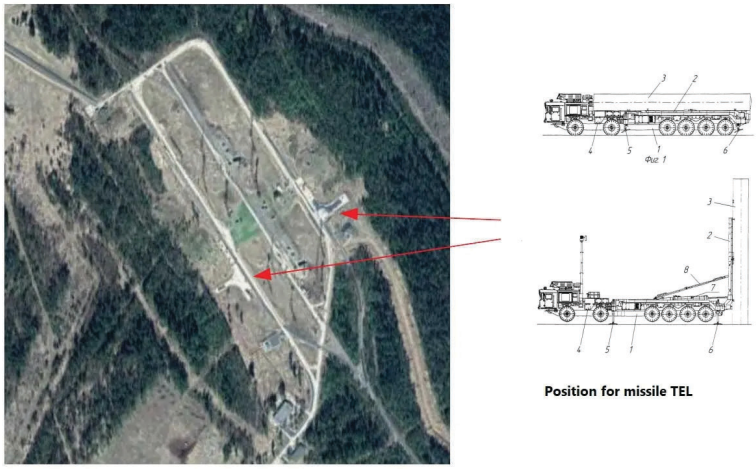
Over the last several years, Russia has conducted eleven known or suspected tests of direct-ascent anti-satellite (DA-ASAT) systems. One of these tests included the destruction of a target. The publicly available evidence suggests that Russian DA-ASAT capabilities currently consist of three primary programs—a mobile ground system, an aircraft-carried system, and a missile defense system that may have a DA-ASAT capability. The evidence also suggests that current Russian DA-ASAT systems are not yet operational and are not planned to have the capability to attack targets beyond low Earth orbit (LEO).

DIRECT-ASCENT ASAT PROGRAMS

DA-ASATs use a ground, air, or sea-launched rocket to place a kinetic kill vehicle (KKV) on a ballistic trajectory up into space. After separation from the rocket, the KKV uses onboard guidance, navigation, and control systems to identify and track a targeted space object and fine-tune its trajectory to create a hypervelocity collision. DA-ASATs are very similar to midcourse missile defense interceptors, with the difference being the missile defense targets are also on ballistic trajectories. Unlike a co-orbital ASAT, the DA-ASAT KKV itself does not have enough velocity to achieve orbit and any resulting fragments are likewise unlikely to remain in orbit unless they were part of an orbital object that was struck. Though Soviet and subsequently Russian ASAT programs have largely focused on co-orbital systems, with testing dating back to the 1960s, there is also a history of DA-ASAT technology development and fielding.

The 14A042 Nudol (U.S. designation "PL-19")

Designs for the A-135 replacement, the A-235 missile defense system, first surfaced in the mid-1980s. In August 2009, the PVO Almaz-Antey signed a contract with the Russian Ministry of Defense to work on a project called Nudol. Many sources define Nudol as part of the next generation system to replace the exoatmospheric interceptors of the Cold War era A-135 missile defense system, but there is no clear evidence that this is the case.[1] While the Nudol may share some heritage with the A-135, it represents a major departure from older systems through the use of conventionally armed rather than nuclear-tipped interceptors.[2] Additionally, imagery of the Nudol indicates a mobile launch capability but stationary radar. The system appears to be comprised of the 14A042 Nudol rocket, 14P078 command and control system, and 14TS031 radar.[3]



Commercial satellite imagery of Plesetsk, 2018.
Image credit: Defense Blog

Initial non-flight testing of the Nudol system was successfully conducted in 2014, with the first successful flight test taking place in late 2015. **Overall, there have been eleven known or suspected flight tests**, at least eight of which were likely successful, two unsuccessful, and one additional unconfirmed test. Sources suggest that early tests only involved the launcher and did not include a kill vehicle.[4] According to U.S. defense officials, the Nudol test in March 2018 was the first time it was fired from the transporter erector-launcher (TEL) it will be deployed with.[5]

On November 15, 2021, Russia conducted an intercept test of the Nudol system. A Nudol launched from Plesetsk placed a KKV on an intercept course with Cosmos 1408, a dead Russian military satellite, which was destroyed by the resulting collision. The test was preceded by a Notice to Air Missions (NOTAM) issued on November 13 for November 15-17 that corresponded to the usual re-entry zones for a Nudol launch.[6] As of February 2025, 12 pieces of orbital debris from the intercept remained on orbit, out of the over 1800 pieces cataloged in total.[7]

While Nudol is linked to Russia's missile defense programs, evidence suggests it is being developed for the main purpose of direct-ascent ASAT operations. What little is known publicly about the Nudol flight tests is more suggestive of an orbital ballistic trajectory intercept than a mid-course missile intercept. Not much is known for sure about Nudol's operational capabilities, and available estimates for maximum altitude vary widely from approximately 50 km to nearly 1,000 km. Something in the middle is most likely, based on observations from flight tests as well as third-party analysis of suspected components.[8]

The 78M6 Kontakt (also named "30P6") is an air-launched missile system initially explored by the Soviet Union and seemingly resurrected in recent years. The launch platform was originally intended to be a variant of the MiG-31 designated the MiG-31D.[9] At least six such aircraft were completed in the 1980s, with intent to be fitted with a Vympel-developed ASAT missile dubbed the 79M6 "Kontakt". Two variants of interceptors were planned for deployment: a three-stage interceptor capable of hitting targets at orbits of 120-600 km, followed by one capable against altitudes up to 1,500 km.[10] The system was also intended to be capable of deploying with less warning than Soviet co-orbital interceptors[11] and of attacking large numbers of satellites quickly: Soviet documents speak of an operational target rate of at least 24 satellites within 36 hours.[12] This overall mission profile was very similar to the U.S. ASM-135 ASAT program, which was carried on an F-15 fighter.[13]

The Kontakt program allegedly became ready for flight-testing around 1991 but was put on hold due to budget cuts in the 1990s. Recent reports from a former MiG test pilot describe several tests in which the missile was successfully launched from a MiG-31D in flight, homed in on a Soviet target, and then did a deliberate near-miss before self-detonating to prevent Americans from discovering it.[14] It is unclear whether such testing ever actually occurred.

There is evidence to suggest Russia is working to bring an updated version of the Kontakt capability online in the near future. In 2009, the Russian Air Force

MiG-31 carrying new ASAT mock-up, 2018.

Image credit: Shipsash

announced the decision to resume the use of the MiG-31 as an ASAT launching platform.[15] In early 2017, a commander in the VKF informed the media that Russia was developing an ASAT missile to be deployed aboard the MiG-31BM, an additional high-altitude air-to-air interceptor variant of the Foxhound, claiming that it would be "capable of destroying targets in near-space."[16] In mid-2018, photographs showed a MiG-31 carrying what was reportedly a mock-up of a new ASAT missile to replace the Kontakt.[17] More recent information suggests that the MiG-31B activity is linked to the Burevestnik co-orbital ASAT system, as opposed to a renewed version of the Kontakt DA-ASAT. According to three anonymous U.S. government sources, the system was being actively tested with the initial goal of reaching operational readiness in 2022; as of February 2025, it is most likely not.[18]

The S-500 anti-ballistic missile system is the most advanced of Russia's next-generation missile defense capabilities. Relatively little information about the S-500 exists in the public domain, but it appears to include an exoatmospheric interceptor, capable of destroying not only ballistic missiles prior to re-entry but also objects in orbit.[19] Russian officials, in the years following the Chinese and U.S. ASAT and missile defense tests of the late 2000s, began to explicitly discuss the S-500 as serving a dual missile defense-ASAT purpose.[20] The development of dedicated ASATs since then, however, makes this less likely. The system was originally intended to begin production and deployment in 2016 or 2017, but it was delayed.[21] Russian media report that the S-500 entered production in March 2018, with the system being manufactured at the Almaz-Antey plant in Nizhny Novgorod and missiles in Kirov.[22] Russian Defense Minister Sergei Shoigu had announced that he expected deliveries to begin as soon as 2020, and funding was guaranteed as part of the State Armament Program 2018-2027.[23] While it was reported that the first S-500 unit had been delivered to Russian forces in September 2021, Russian Deputy Prime Minister Yuri Borisov stated that it was not a mature system and still needed "configurations."[24] Even so, the S-500's manufacturer announced in April 2022 that mass production had begun and that serial delivery was intended to begin in 2025. In December 2021, TASS reported that the S-550 system had entered service and that it was capable of "hitting spacecraft, ballistic missile reentry vehicles and hypersonic targets at altitudes of tens of thousands of kilometers."[25] However, this report was immediately called into question as other reports indicated that development of the system had not yet started or that it had been confused with the S-500.[26]

OPERATIONAL STATUS

Given the known testing, it is likely that Russia could field an operational DA-ASAT capability against most LEO satellites within the next few years. This would include satellites performing military weather and ISR functions. Russia would have to wait for such satellites to overfly an area where one of the systems is deployed, but most LEO satellites would do so daily or every few days. Moreover, the potential for an air-launched DA-ASAT capability could dramatically expand the potential launch opportunities. To date, there is no public evidence suggesting Russia is experimenting with or developing DA-ASAT capabilities against satellites in higher orbits such as MEO or GEO, although it is possible given their advanced rocket and guidance technology.

Summary of Known or Suspected Russian DA-ASAT Tests in Space[27]

Date	ASAT System	Launch Site	Payload	Altitude Reached	Result
Aug. 2014	Nudol	Plesetsk	None known	1 km?	Failed shortly after launch
Apr. 22, 2015	Nudol	Plesetsk	None known	0 km?	Failed at launch
Nov. 18, 2015	Nudol	Plesetsk	Interceptor KV?	100 km?	Likely rocket test
May. 25, 2016	Nudol	Plesetsk	None known	10 km?	Likely rocket test
Dec. 16, 2016	Nudol	"Central Russia"	A-235 Test	100 km?	Likely rocket test
Mar. 26, 2018	Nudol	Plesetsk	Dummy KV?	100 km?	Likely intercept test?
Dec. 23, 2018	Nudol	Plesetsk	Nudol KV	500 km?	Likely intercept test?
Nov. 15, 2019	Nudol	Plesetsk	Likely KKV	?	?
Apr. 15, 2020	Nudol	Plesetsk	14A042 Interceptor	500 km?	Likely intercept test?
Dec. 16, 2020	Nudol	Plesetsk	Unknown	500 km?	Likely intercept test?
Nov. 15, 2021	Nudol	Plesetsk	KKV	470 km	Intercepted and destroyed Cosmos 1408, creating over 1,800 pieces of trackable debris

ENDNOTES

1. Bart Hendrickx, "Re: Russia Tests Nudol ASAT System," posting on the NASASpaceflight.com forum, January 18, 2020, https://forum.nasaspaceflight.com/index.php?topic=38943.msg2036403#msg2036403.
2. Vladimir Karnozov, "Russia to Modernize Moscow Missile Defense," AIN Online, June 26, 2019, https://www.ainonline.com/aviation-news/defense/2019-06-26/russia-modernize-moscow-missile-defense.
3. Pavel Podvig, "Russia Tests Nudol Anti- Satellite System," Russian Strategic Nuclear Forces, April 1, 2016, http://russianforces.org/ blog/2016/04/russia_tests_nudol_anti-satell. shtml; Pavel Podvig, "Construction at the Chekhov Radar Site," Russian Strategic Nuclear Forces, June 24, 2016, http://russianforces. org/blog/2016/06/ construction_at_the_chekhov_radar_site.shtml.
4. Pavel Podvig, "Russia Tests Nudol Anti-Satellite System," Russian Strategic Nuclear Force*s*, April 1, 2016, http://russianforces.org/blog/2016/04/russia_tests_nudol_anti-satell.shtml.
5. Ankit Panda, "Russia Conducts New Test of 'Nudol' Anti-Satellite System," The Diplomat, April 2, 2018, https://thediplomat.com/2018/04/russia-conducts-new-test-of-nudol-anti-satellite-system/.
6. Telegram posting from Warbolts, "Еще один пуск из этой серии. Что за изделие испытывается достоверно не известно до сих пор, но эксперты связывают его с "Нудоль". Закрытия в целом повторяют ранее объявляемые, период действия 15/11/2021 02:00 (UTC) - 17/11/2021 05:00 (UTC). Из интересного, в данных NOTAM на Плесецк и Чёшскую губу указан номер телефона некоего Чирикова." November 13, 2021, https://t.me/warbolts/707.
7. Data compiled from the public satellite catalog maintained by the U.S. military at https://spacetrack.org.
8. See Jonathan McDowell, "Launch Vehicles," accessed March 21, 2018, http://planet4589. org/space/lvdb/sdb/ LV. The suspected apogees were 350 km and 500–1,000 km. These estimates are notably highly consistent with estimates derived by Russian military open source blogger Dimmi from analysis of suspected components and launch observations, which are summarized in a table: "Complex 14TS033," MilitaryRussia.ru.
9. "MiG-31 Foxhound Interceptor Aircraft," AirForce-Technology.com, accessed March 15, 2018, https://www.airforce-technology.com/projects/mig-31.
10. Pavel Podvig, "Another Old Anti-satellite System Resurfaces," Russian Strategic Nuclear Forces, January 25, 2013, http://russianforces.org/ blog/2013/01/another_old_anti-satellite_sys. shtml.
11. John Pike, "USSR/CIS Miniature ASAT," GlobalSecurity.org, updated October 4, 2016, http://www.globalsecurity.org/space/world/russia/mini.htm.
12. Pavel Podvig, "Another Old Anti-satellite System Resurfaces," Russian Strategic Nuclear Forces, January 25, 2013, http://russianforces.org/ blog/2013/01/another_old_anti-satellite_sys. shtml.
13. Brian Weeden, "U.S. Direct Ascent Anti-Satellite Testing," Secure World Foundation, May 2022.
14. Audio of the interview with MiG test pilot Valery Menitsky is available here (accessed July 12, 2017): http://www.buran.ru/sound/ men_31d.mp3.
15. John Pike, "USSR/CIS Miniature ASAT," GlobalSecurity.org, updated October 4, 2016, http:// www.globalsecurity.org/space/world/russia/ mini.htm.
16. Bart Hendrickx, "Burevestnik: a Russian air-launched anti-satellite system," The Space Review, April 27, 2020, https://www.thespacereview.com/article/3931/1
17. Tyler Rogoway and Ivan Voukadinov, "Exclusive: Russian MiG-31 Foxhound carrying huge mystery missile emerges near Moscow," *The Drive*, September 29, 2018, http://thedrive.com/the-war-zone/23936/exclusive-russian-mig-31-foxhound-carrying-huge-mystery-missile-emerges-near-moscow.
18. Amanda Macias, "A never-before-seen Russian missile is identified as an anti-satellite weapon and will be ready for warfare by 2022," CNBC.com, October 25, 2018, https://www.cnbc. com/2018/10/25/russian-missile-identified-as-anti-satellite-weapon-ready-by-2022.html.

19. Christopher F. Foss, “S-500,” Jane’s Land Warfare Platforms: Artillery and Air Defense (London: IHS Global, 2016), 580-1; Bill Gertz, “Pentagon: China, Russia Soon Capable of Destroying U.S. Satellites,” Washington Free Beacon, January 30, 2018, http://freebeacon.com/national-security/ pentagon-china-russia-soon-capable-destroying-u-s-satellites/.
20. Anatoly Zak, “Russian Anti-Satellite Systems,” Russian Space Web, updated November 30, 2017, http://www.russianspaceweb.com/naryad.html.
21. Missile Defense Project, “S-500 Prometheus,” Missile Threat, Center for Strategic and International Studies, May 4, 2017, last modified July 1, 2021, https://missilethreat.csis.org/defsys/s-500-prometheus/.
22. Vladimir Karnozov, “Russia’s Next-generation S-500 SAM Enters Production,” *AINonline*, March 14, 2018, https://www.ainonline.com/aviation-news/defense/2018-03-14/russias-next-generation-s-500-sam-enters-production.
23. Karnozov, ibid.
24. Inder Singh Bisht, “Russia Begins Mass Production of S-500 Air Defense System,” *The Defence Post*, April 28, 2022, https:// www.thedefensepost.com/2022/04/28/russia-mass-producing-s-500/.
25. “First S-550 air defence systems enter service in Russia – source,” *TASS*, December 28, 2021, https://tass.com/defense/1382133.
26. Joseph Trevithick, “No, Russia’s S-550 Missile Defense System Hasn’t Been Fielded,” The Drive, December 29, 2021, https://www.thedrive.com/ the-war-zone/43675/no-russias-s-550-missiledefense-system-hasnt-been-fielded.
27. Data compiled from multiple sources. For full details, please see the SWF Global Counterspace Capabilities: An Open Source Assessment, “Section 2.2 — RUSSIAN DIRECT-ASCENT ASAT,” April 2025, https://swfound.org/counterspace/.

525 Zang Street, STE. D
Broomfield, CO 80021 USA
v : + 1 303 554 1560

1779 Massachusetts Ave. NW
Washington, DC 20036 USA
v : + 1 202 568 6212

e : info@swfound.org

SWF Publication: FS25/5

Published: 25.06