Summary

Over the last several years, Russia has conducted ten suspected tests of direct ascent anti-satellite (DA-ASAT) systems. None 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 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, three DA-ASAT systems with their roots in Soviet-era programs appear to be under development in Russia.

The 14A042 Nudol (U.S. designation “PL-19”) likely evolved out of the Soviet A-135 missile defense system, which became operational in 1989. Originally, the A-135 system included two missile interceptors, the exoatmospheric 51T6 (NATO designation “SH11 Gorgon”) and the endoatmospheric 53T6 (NATO designation “Gazelle”). Both were silo-launched and used 10 kiloton nuclear warheads to destroy their targets. The system’s potential for use as an ASAT was limited to just the Gorgon, which was retired in 2007.

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 A-235 system, but there is no clear evidence that this is the case. While the Nudol may have evolved out of the A-135, it represents a major departure from older systems through the use of conventionally armed rather than nuclear-tipped interceptors. 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.
Initial non-flight testing of the Nudol system was successfully conducted in 2013, with the first successful flight test taking place in late 2015. Overall, there have been eight known flight tests, at least five of which were likely successful, and two additional unconfirmed tests. Sources suggest that early tests only involved the launcher and did not include a kill vehicle. Evidence is inconclusive as to whether any of the remaining tests included a kill vehicle. 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. Russia issued safety notices for airspace closures in June and November 2019 that are consistent with additional Nudol tests, but to date those have not been confirmed.

While Nudol is linked to Russia’s missile defense programs, evidence suggests it is being developed for the direct 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. Most significant, the system itself is described by Russian state-run press reports as a mobile, TEL-based “new Russian long-range missile defense and space defense intercept complex.” 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 but closer to the former is most likely, based on observations from flight tests as well as third-party analysis of suspected components.

The 78M6 Kontakt (also named “3OP6”) is an air-launched missile system 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. 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. The system was also intended to be capable of deploying with less warning than Soviet co-orbital interceptors and of attacking large numbers of satellites quickly: Soviet documents speak of an operational target of at least 24 satellites within 36 hours.

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. It is unclear whether such testing ever actually occurred, but such testing would demonstrate the ability to stably and accurately launch at-speed. Russia has retained at least two of the original MiG-31D ASAT variant and uses one of them to conduct near-space flights for hypersonic experimentation, most likely the recently announced Kinzhal air-launched cruise missile. If so, that may indicate they are no longer slated for use with ASAT weapons.

In 2009, the Russian Air Force announced the decision to resume the use of the MiG-31 as an ASAT launching platform. It is possible that indicated Russia is working to bring an updated version of the Kontakt capability online in the near future. Little public evidence exists to confirm a viable air-launched DA-ASAT program, but both the launch platform and ground-based support systems are undergoing intensive modernization efforts. In early 2017, a commander in the VKF informed the media that Russia plans to deploy an ASAT missile aboard the MiG-31BM, an additional high-altitude air-to-air interceptor variant of the Foxhound, claiming that “a new missile is being developed for this aircraft capable of destroying targets in near-space....Satellites, for sure....” This claim is unconfirmed and some experts have expressed doubt due to the lack confirmation of a model carrying an ASAT missile and because the MiG-31BM lacks special winglets for enhanced high-altitude launch stability. However, several Russian air-launched ASAT concepts and a two aircraft MiG-31 variant for in-air space-launch operations and hypersonic experimentation do not include such winglets either. In mid-2018, photographs showed a MiG-31 carrying what was reportedly a mock-up of a new ASAT missile to replace the Kontakt. According to three anonymous U.S. government sources, the system was being actively tested with the goal of reaching operational readiness in 2022.
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.\textsuperscript{30} 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.\textsuperscript{31} 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 as of 2017 it had not yet completed testing.\textsuperscript{32} 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.\textsuperscript{33} Russian defense minister Sergei Shoigu has announced that he expects deliveries to begin as soon as 2020, and funding has been guaranteed as part of the State Armament Program 2018-2027;\textsuperscript{33} Russia reportedly planned to field ten battalions of the new system at latest estimate.\textsuperscript{34}

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.

<table>
<thead>
<tr>
<th>Date</th>
<th>ASAT System</th>
<th>Launch Site</th>
<th>Payload</th>
<th>Altitude Reached</th>
<th>Result</th>
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<tr>
<td>8/12/2014</td>
<td>Nudol</td>
<td>Plesetsk</td>
<td>None known</td>
<td>1 km?\textsuperscript{7}</td>
<td>Failed shortly after launch</td>
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<td>4/22/2015</td>
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<td>0 km?\textsuperscript{7}</td>
<td>Failed at launch</td>
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<td>11/18/2015</td>
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<td>Plesetsk</td>
<td>Interceptor KV?\textsuperscript{8}</td>
<td>100 km?\textsuperscript{7}</td>
<td>Likely rocket test</td>
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<td>5/25/2016</td>
<td>Nudol</td>
<td>Plesetsk</td>
<td>None known</td>
<td>10 km?\textsuperscript{9}</td>
<td>Likely rocket test</td>
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<td>12/16/2016</td>
<td>Nudol</td>
<td>“Central Russia” (Plesetsk? Kapustin Yar?)</td>
<td>A-235 Test\textsuperscript{10}</td>
<td>100 km?\textsuperscript{10}</td>
<td>Likely rocket test</td>
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<td>Plesetsk</td>
<td>Dummy KV?\textsuperscript{21}</td>
<td>100 km?\textsuperscript{21}</td>
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<td>Plesetsk</td>
<td>Nudol’ KV\textsuperscript{12}</td>
<td>500 km?\textsuperscript{12}</td>
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<td>Plesetsk</td>
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<td>Plesetsk</td>
<td>14A042 interceptor\textsuperscript{13}</td>
<td>500?\textsuperscript{33}</td>
<td>Likely intercept test</td>
</tr>
</tbody>
</table>
Endnotes

5. GSKB Annual Report 2013
27. Twitter discussion between Pavel Podvig, “KURYER” (curator of militaryrussia.ru, @RSS_40), Thomas Newdick (@CombatAir), and Wolfgang Dressler (@dressler_w), February 23-24 2017, https://twitter.com/rss_40/status/835012292337098753?lang=en