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Russia's 'Invincible' Weapons: An Update

Julian Cooper¹
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On 1st March 2018, Vladimir Putin devoted much of his annual Presidential Address to the Federal Assembly to the presentation of a number of new 'invincible' weapons then under development. Soon after, these new systems were given names: 'Kinzhal' for a cruise missile launched from an aircraft flying at high altitude at a supersonic speed, 'Avangard' for a hypersonic boost-glide system, 'Sarmat' a heavy multi-warhead ICBM, 'Burevestnik' for a nuclear powered very long-range cruise missile, 'Poseidon' a nuclear powered autonomous under-water weapon able to carry nuclear munitions, and 'Peresvet' for a ground-based laser weapon system able to destroy or disable low flying drones, aircraft and, possibly, satellites. Nearly a year later, in 2019's Address to the Federal Assembly, Putin gave some additional information about the development of these systems and also spoke of two new ones to be developed in response to the decision of the United States to withdraw from the Intermediate Nuclear Forces (INF) Treaty.

The significance of Putin's 2018 presentation and details of these new systems were provided in an earlier publication and will not be repeated here.² The purpose of this paper is instead to outline what is now known about the current stage of development of the new weapons and future prospects for their deployment. It also considers a number of other significant new weapons currently under development and some general patterns that are beginning to emerge that could influence whether a new arms race is in prospect and, if so, what form it might take.

'Kinzhal' cruise missile

The 'Kinzhal' cruise missile is now in trial combat use in the Southern military district. Many media sources refer to the missile as the K-47M2, but there has been no official confirmation of this and there are grounds for doubt.³ It is believed to be a development of the missile of the 'Iskander' complex, developed by the Kolomno 'Nauchno-proizvodsvennaya korporatsia "KB mashinostroeniya"', but again there has been no official confirmation.⁴ According to an aviation industry source, the Fifth Generation

¹ Emeritus Professor, Centre for Russian, Eurasian and European Studies, University of Birmingham/Associate Senior Fellow, Stockholm International Peace Research Institute. © 2018 Changing Character of War Centre. All rights reserved. Material in this publication is copyrighted under UK law. Individual authors reserve all rights to their work and material should not be reproduced without their prior permission. The views and opinions expressed in these articles are those of the authors and do not necessarily represent the views of the Changing Character of War Centre, Pembroke College, or the University of Oxford.

² Julian Cooper, 'Russia's Invincible Weapons: Today, Tomorrow, Sometime, Never?', *CCW Research Paper*, May 2018, <http://www.ccw.ox.ac.uk/blog/2018/4/30/russias-invincible-weapons-today-tomorrow-sometime-never>

³ 'Nazvanie rakety "X-47M2" kak indikator kachestva SMI', 5 January 2019, <https://militaryrussia.livejournal.com/434366.html>

⁴ Sergei Moroz, 'VKS Rossii prinyimayut giperzvukovyye rakety "Kinzhal"', 13 March 2018, <https://naukatehnika.com/vks-rossii-prinyimayut-giperzvukovyye-raketyi-kinzhal.html>

Su-57 will receive a hypersonic missile similar to the 'Kinzhal' but of smaller dimensions and there is also a possibility that an equivalent system will be developed for the Tu-22M3 long-range bomber for attacking large naval targets such as aircraft carriers.⁵ Notwithstanding these ongoing uncertainties, the 'Kinzhal' is a real weapon system at an advanced stage of development. According to defence minister Sergei Shoigu, the crew of the MiG-31 equipped with the 'Kinzhal' have already undertaken more than 380 flights.⁶

'Avangard' hypersonic glide-boost vehicle

On 26th December last year, Putin announced the successful launch of a missile complex with the new 'Avangard' hypersonic glide-boost vehicle, providing confirmation that it is now at an advanced stage of development. According to Putin, the system will enter service in 2019; 'this is a great New Year's present for the country', he concluded.⁷ It is carried by an updated version of old UR-100N UTTKh (15A35) (SS-19 Mod.2 Stiletto) liquid-fuelled ICBMs, the production of which ended more than thirty years ago. Russia received approximately thirty of them from Ukraine in the early 2000s as part of settlement of a debt for gas. With some modernisation (to Mod 4), they provide a relatively cheap means of deploying the new hypersonic glider.⁸

In his 2019 Address to the Federal Assembly, Putin said that serial production of the 'Avangard' had started and plans were in place to equip the first regiment of the Strategic Missile Forces with the new system.⁹ He suggested that the appearance of the 'Avangard' was comparable to the launch of the first sputnik many years ago and later elaborated on this assessment when in discussion with media representatives.¹⁰ More detail was provided by Shoigu, who indicated that the first unit to be equipped with the 'Avangard' would be in Orenburg oblast' and that it would be on combat duty in December.¹¹

There has been open questioning in Russia of the need for the 'Avangard' given that Russia's existing ICBMs cannot be intercepted by US anti-missile systems, a condition unlikely to change in the years ahead. Some even suggest that Putin does not appreciate this reality, perhaps having been misinformed by military leaders. At the same time, others have questioned claims for its performance, in particular its ability to manoeuvre.¹² These arguments have been rebutted, with scathing reference to so-called 'divan experts'. Ivan Petrov, drawing on materials supplied by military specialists, argues that the 'Avangard' does indeed possess the military-technical capabilities claimed for it and that it is designed to overcome not just present-day US anti-missile systems, but new developments of the type outlined in the 2019 Missile Defense Review of the US Department of Defense.¹³

⁵ Anton Valagin, 'Ubiitsa avianostsev: Su-57 vooruzhat analogom "Kinzhal"', *Rossiiskaya Gazeta*, 6 December 2018, <https://rg.ru/2018/12/06/ubiitsa-avianostsev-su-57-vooruzhat-analogom-kinzhala.html>

⁶ 'Novoe rossiiskoe oruzhnie pozvolit garantirovat' bezopasnost' strany bez uvelicheniya raskhodov i vtyagivaniya v gonku vooruzhenii', *Ministry of Defence Website*, 20 February 2019, https://function.mil.ru/news_page/country/more.htm?id=12218197@egNews

⁷ 'Poseshchenie Natsional'nogo tsentra upravleniya oborony', *Presidential Administration Website*, 26 December 2018, <http://www.kremlin.ru/events/president/news/59519>

⁸ Vladimir Mukhin, 'Blok "Avangard" postavlyat na ukrainskie rakety', *Nezavisimaya Gazeta*, 4 February 2019.

⁹ 'Poslanie Prezidenta Federa'nomu Sobraniyu', *Presidential Administration Website*, 20 February 2019, <http://www.kremlin.ru/events/president/news/59863>

¹⁰ 'Vstrecha s predstavitel'yami rossiiskikh informagenv i pechatnykh SMI', *Presidential Administration Website*, 20 February 2019, <http://www.kremlin.ru/events/president/news/59865>

¹¹ 'Novoe rossiiskoe oruzhnie pozvolit garantirovat' bezopasnost' strany bez uvelicheniya raskhodov i vtyagivaniya v gonku vooruzhenii', *Ministry of Defence Website*, 20 February 2019, https://function.mil.ru/news_page/country/more.htm?id=12218197@egNews

¹² See Aleksandr Gol'ts, 'Pomozhet li strane superoruzhie, nazvannoe Putinyem novogodnim podarkom', 3 January 2019, <https://openmeida.io/exclusive/pomozhet-li-strane-superoruzhie-nazvannoe-putinyem-novogodnim-podarkom/>

¹³ Ivan Petrov, 'Kto dogonit "Avangard"', *Rossiiskaya Gazeta*, 31 January 2019, <https://rg.ru/2019/01/31/pochemu-giperzvukovoj-avangard-neuiazvim-dlia-liuboj-pro.html>; US DOD, *Missile Defense Review 2019*, https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf

'Sarmat' heavy multi-warhead ICBM

The heavy 'Sarmat' ICBM appears to be on schedule for deployment in 2020-21. In 2018, it underwent successful ejection tests and its first flight test is expected later in 2019. Past experience suggests that a series of test flights will be necessary before approval is given for the start of serial production at the 'Krasnash' works in Krasnoyarsk. This factory has been undergoing major re-equipment to prepare it for its new role, having previously focused on submarine-launched missiles. It will first be deployed at the Uzbur (Krasnoyarsk krai) and Dombarovskii (Orenburg oblast) bases of the Strategic Missile Forces, replacing the 46 'Voevod' (SS-18, Satan) heavy ICBMs now nearing the end of their service lives.¹⁴ Precise details of the new missile have not yet been revealed, but according to an MOD source it will carry a payload of three tonnes.¹⁵

'Peresvet' laser weapon

The 'Peresvet' laser weapon system has featured less in the media during the past year, but in December the Ministry of Defence claimed that it had been on trial combat duty since 2017.¹⁶ According to one report, it has to be deployed using two wheeled platforms as its nuclear power source is very heavy, making it impossible to employ a single transporter. Officials claim, however, that work is underway on the modernisation of the system. According to Yurii Borisov, the deputy prime minister overseeing the defence industry, this should result in a more compact system with significantly improved technical capabilities.¹⁷ It is planned to complete this work in two to three years.

Meanwhile, according to Putin, in December 2019 all the 'Peresvet' supplied to the armed forces will be put on combat duty.¹⁸ It appears that the developer of the 'Peresvet' is the Sarov federal nuclear centre of Rosatom. Its trial deployment is said to be at Teikovo, Ivanovo oblast', located at a missile bases of the Strategic Missile Forces.¹⁹ According to expert opinion in Russia, it may have sufficient power to destroy optical and other systems of aircraft and possibly satellites in a low orbit, plus the destruction of small UAVs.²⁰

'Poseidon' underwater autonomous underwater system

Development of the 'Poseidon' (2M39) nuclear-powered autonomous strategic underwater weapon continues and the system does have reasonably frequent media coverage in Russia. It is known that the lead development organisation for the project as a whole is the St Petersburg 'Rubin' Centre Design Bureau, and specifically of the launch unit of the system, the Makeev Missile Centre in Miass in the Urals.²¹ Newly available evidence suggests that its development was originally launched in the late Soviet years but put on a new basis in 1992 as the 'Skif' R&D project, with the first test of a prototype

¹⁴ Hans M. Kristensen, Matt Korda, 'Russian nuclear forces, 2019', *Bulletin of the Atomic Scientists*, 2019, vol.75, no.2, p.76.

¹⁵ Aleksei Zakvasin, 'Strashnee "Satany"', *Voенно-Promyshlenniy Kurier (VPK)*, 8 February 2019, <https://vpk-news.ru/articles/48216>

¹⁶ Anton Nikitin, 'Boevye lazery "Peresvet" zastupili na opytно-boevoe dezhurstvo', *Vzglyad*, 5 December 2018, <https://vz.ru/news/2018/12/5/953800.html>

¹⁷ Iskander Batyrov, 'Dob"et li "Peresvet" do tseli', *Nezavisimaya Gazeta*, 5 December 2018, http://www.ng.ru/armies/2018-12-05/2_7456_target.html

¹⁸ 'Poslanie Prezidenta Federa'nomu Sobraniyu', *Presidential Administration Website*, 20 February 2019, <http://www.kremlin.ru/events/president/news/59863>

¹⁹ Ibid. and Aleksei Lasnov, 'V seti obnaruzhili mesto razvertyvaniya boevogo lazera "Peresvet"', *Vzglyad*, 17 August 2018, <https://vz.ru/news/2018/8/17/937603.html>; Leonid Nersisyan, 'Putin's New Strategic Systems: Plans, Realities, and Prospects', *New defence order. Strategy*, 2019, no.1, 28 January 2019, <http://en.dfnc.ru/2019-1-54/putin-s-new-strategic-systems-plans-realities-and-prospects/>

²⁰ 'Peresvet/NIR Ispravitel', <http://militaryrussia.ru/blog/topic-691.html>

²¹ 'Kompleks 2M39 Poseidon/OKR Skif - KANYON', <http://militaryrussia.ru/blog/topic-746.html>, 25 February 2019.

in October 2008, launched from the 'Sarov' submarine.²² There have been several tests since, the most recent being a claimed underwater test of the system in December last year.²³

Early in 2019, citing a defence industry source, it was claimed that once it had left its carrier submarine it would be able to move under water at a maximum speed of more than 200 km/h at a depth of more than one kilometre and would be able to manoeuvre as it moved towards its target.²⁴ Furthermore, it can be equipped with conventional or nuclear munitions.²⁵ Another industry source said that the navy was planning to deploy up to 32 'Poseidon' and that one of the two carriers, one in the Northern Fleet the other in the Pacific, would be the special-purpose submarine 'Khabarovsk' under construction at the 'Sevmash' yard, the other a converted project 949A submarine, the 'Belgorod'.²⁶ According to Aleksei Rakhmanov, president of the United Shipbuilding Corporation, the 'Belgorod' will be launched in spring this year and will be tested with the 'Poseidon', a process that will take about two years.²⁷

It was then revealed that 'Poseidon' would be deployed both for 'strategic tasks' and for destroying, for example, an aircraft carrier group. It is considered invulnerable to detection and attack.²⁸ It was reported in February 2019 that the nuclear reactor of the system had been tested at sea and this had confirmed its characteristics.²⁹ This followed confirmation by Putin that he had been informed that a key stage of the testing of 'Poseidon' had been completed.³⁰ It was then reported that the new system would undergo so-called factory tests at sea in the summer of 2019, when weather conditions would be favourable.³¹ As for the military purpose of the 'Poseidon', in the view of Vsevolod Khmyrov, a retired rear-admiral, it will devalue all efforts by the United States to create a global system of anti-missile defence and will be many times cheaper than any US systems developed to seek and destroy it.³² Konstantin Sivkov has published a detailed analysis of all possible means that could be used to detect and destroy the 'Poseidon', and concludes that it will be highly elusive, with no currently known counter measures, especially if it moves at its high potential speed.³³

But there may be other important uses for the 'Poseidon', both military and civilian. As the military journalist Sergei Ptichkin points out, the USSR had much experience in the use of unmanned underwater apparatus for research into the ocean depths and for reconnaissance, monitoring the movement of surface and ships and submarines of adversaries. He believes this could well be one of the purposes for which the 'Poseidon' has been developed and its potential role could include activities under Arctic ice.³⁴

²² Ibid.

²³ 'V Rossii pristupili k ispytaniyam bespilotnika "Poseidon"', *Vzglyad*, 25 December 2018,

<https://vz.ru/news/2018/12/25/957036.html>

²⁴ 'Istochnik: strategicheskii podvodnyi bespilotnik "Poseidon" poluchit skorost' bolee 200 km/ch', *Tass*, 4 January 2019,

<https://tass.ru/armiya-i-opk/5974747>

²⁵ 'Glavnaya tsel' - obespechenie voennoi bezopasnoti bez rosta raskhodov', *Krasnaya Zvezda*, 22 February 2019,

<http://redstar.ru/general-armii-sergej-shoigu-glavnaya-tsel-nashej-raboty-garantirovannoe-obespechenie-voennoj-bezopasnosti-rossii-bez-uvlicheniya-byudzhetnyh-rashodov-ili-vtyagivaniya-v-gonku-vooruzhenij/>

²⁶ 'Istochnik: VMF planiruet postavit' na boevoe dezhurstvo do 32 apparatov "Poseidon"', *Tass*, 12 January 2019

<https://tass.ru/armiya-i-opk/5991356>. The converted project 949A is the 'Belgorod', under construction at 'Sevmash',

'Sekretnoe APL dlya "Poseidon" spustyat na vodu vesnoi 2019 goda', 21 February 2019,

<http://sudostroenie.info/novosti/25932.html>

²⁷ 'Ispytaniya "Poseidon" zaimut okolo dvukh let, soobshchil istochnik', *RIA Novosti*, 20 March 2019,

<https://ria.ru/20190320/1551948863.html>

²⁸ Anton Antonov, 'V OPK "Poseidon" nazvali neuyazvimym', *Vzglyad*, 3 February 2019,

<https://vz.ru/news/2019/2/3/962349.html>

²⁹ Anton Nikitin, 'Reaktor bespilotnika "Poseidon" ispytali v more', *Vzglyad*, 6 February 2019,

<https://vz.ru.news/2019/2/6/962794.html>

³⁰ 'Vstrecha s Sergeim Lavrovym i Sergeem Shoigu', *Presidential Administration Website*, 2 February 2019,

<http://www.kremlin.ru/events/president/news/59763>

³¹ Ruslan Mel'nikov, 'Vystrelyat v more: yadernyi "Poseidon" ispytayut v 2019 godu', *Rossiiskaya Gazeta*, 10 February

2019, <https://rg.ru/2019/02/10/vystrliat-v-more-iadernyj-possejdon-ispytaiut-v-2019-godu.html>

³² 'Mnenie ekspertov', *Krasnaya Zvezda*, 22 February 2019, <http://redstar.ru/mnenie-ekspertov>

³³ Konstantin Sivkov, 'Neulovimyi "Poseidon"', *VPK*, 5 March 2019, <https://www.vpk-news.ru/articles/48763>

³⁴ Sergei Ptichkin, 'Chem udivit podvodnyi bespilotnik "Poseidon"', *Rossiiskaya Gazeta*, 26 February 2019,

<https://rg.ru/2019/02/26/chem-udivit-podvodnyj-bespilotnik-posejdon.html>.

Doubts have been voiced, sometimes in very sharp terms, as to the wisdom of developing the 'Poseidon' and whether the spending on it can be justified. Most outspoken has been Maksim Klimov, for whom it is a 'dead end'. On the popular military website, *Voennoe obozrenie*, he subjects the whole Status-6/'Poseidon' project to withering criticism. He claims, with some evidence, that this is an initiative that dates back to the 1980s, when the nuclear powered 'torpedo' was conceived as being carried by submarine or surface ship. In his view, this very heavy underwater system will not be able remain undetected as it is likely to be noisy when travelling at speed. And its estimated weight is such that it will not be able to move slowly and quietly through ocean depths.

At the same time, he doubts whether a small nuclear reactor capable of generating the power needed for the claimed speed of up to 55 knots could possibly be accommodated within the scale of the 'torpedo' as shown in the images of it made available to date. He asks how it was possible that the military-political leadership came to be persuaded that this 'Cold War project' was worth reviving. In Klimov's view, it is 'much worse than "simply a deception of the leadership" and its military inexpediency. "Status-6" in essence is not a factor of strategic deterrence, but one of destabilisation'. At a time of budget stringency the funding of the project was not justified, the opportunity cost in terms of more valuable military innovations that were being deprived of support was far too large. Overall, he concludes, 'the military-political role of project 'Status-6' ('Poseidon') for us is not even zero, it is negative'. Klimov claims that the value of the 'Poseidon' was being questioned by many in the military and by scientists.³⁵ The fact that he has been able to publish such outspoken criticism of a project championed by the President on a popular website may well provide evidence that he is correct in making this claim.

'Burevestnik' nuclear-powered cruise missile

One of the most technologically challenging of the new weapons is the 'Burevestnik' nuclear powered long-range cruise missile. According to the military journalist Aleskei Ramm, from analysis of available pictures, it is a relatively large and heavy missile, not surprising if carrying a nuclear reactor, about 9 to 11 metres long. Given its size and weight, he considers it unlikely that it can be launched from an aircraft, e.g. a Tu-160 or Tu-95MS, making it highly probable that it is a ground-based system.³⁶ Tests of the 'Burevestnik' have continued, a fact known usually from US intelligence sources not Russian official statements. According to a US government source, a partially successful test was conducted at Kapustin Yar range the end of January this year, the thirteenth trial to date. This was the first known test since February 2018. The system now has an official designation of the US intelligence community, the KY30 missile or the SSC-X-9 SKYFALL.³⁷

On this occasion, the leak from the US was followed by acknowledgement of the test in the Russian media. A source in the missile building community informed TASS that at the end of January a successful test had been undertaken of the missile's small-dimension nuclear power unit, confirming the reactor's basic characteristics and the potential for an unlimited duration of flight.³⁸ In Ramm's view, the biggest technological challenge may be the development of a reliable navigation system, especially if it is envisaged that the missile will stay aloft over oceans for a long period.

Some questioning of the need for the 'Burevestnik' has continued. It will be subsonic and take a long time to reach its target, so can only be used as a counter-strike weapon. But if this is so, in what way does it add to the existing strike capability of strategic aviation? Can the expense of developing the new cruise missile be justified at a time when the MOD is planning to buy the very costly new version of the

³⁵ Maksim Klimov, "'Statusnyi" tupik', 11 March 2019 <https://topwar.ru/155207-statusnyi-tupik.html>

³⁶ Aleksei Ramm, "Krykatyi "Burevestnik": chto izvestno o tainstvennom russkom oruzhii", *Izvestia*, 5 March 2019, <https://iz.ru/852592/aleksei-ramm/krylatyi-burevestnik-chto-izvestno-o-tainstvennom-russkom-oruzhii>

³⁷ Ankit Panda, 'Russia Conducts Test of Nuclear-Powered Cruise Missile', *The Diplomat*, 6 February 2019, <https://thediplomat.com/2019/02/russia-conducts-test-of-nuclear-powered-cruise-missile>

³⁸ Ol'ga Nikitina, 'Neogranichennaya dal'nost' poleta rakety "Burevestnik" podtverzhena na ispytaniyakh', *Vzglyad*, 16 February 2019, <https://vz.ru/news/2019/2/16/964541.html>

Tu-160 bomber and the successor, the PAK DA, is still under development?³⁹ Concern has also been voiced about the radioactive contamination that may well occur when the missile is in flight, although Ramm doubts whether this can be a real issue as it would render the missile easily detectable in flight.⁴⁰ If development work on the "Burevestnik" is successful, therefore, it is still not clear that it will actually enter service.

New systems that Putin has not presented

One type of military system under development in Russia already for some time, continuing Soviet efforts, is an air defence missile complex with an anti-satellite (ASAT) potential. There is no mystery as to why Putin has made no reference to systems under development to destroy, 'blind', or diminish in some other way the military utility of satellite systems. Russia, like the United States, is a founding signatory of the 1967 Outer Space Treaty prohibiting the militarisation of space. It has been ratified by 107 countries, including the USA, Russia, China and North Korea.⁴¹ While this treaty does forbid the placement of weapons in space it does not explicitly ban research into system that can incapacitate satellites. Nevertheless, the leaders of signatory countries are not inclined to boast of any counter-space weapon system that they may possess or are in the process of developing.

The 'Nudol' (PL-19) project to develop an air-space defence missile system was started in about 2010, with 'Almaz-Antei' as the lead organisation.⁴² It is understood to be a mobile component of an upgraded version of the A-135 defence system which defends Moscow and the surrounding region. When the various components of this elaborate system have been modernised it will become the A-235. The development of the missiles was undertaken at the Ekaterinburg OKB 'Novator' design centre. According to US intelligence sources, it was first tested, unsuccessfully, in 2014, with a successful test in November 2015. Two more tests followed in 2016 and then two more in 2018, the last in December, both from a mobile launcher.⁴³ The available evidence suggests that the system is now at a quite advanced stage of development but it may still take a few years to put it into production and begin deployment.

The 'Peresvet' laser system, believed to have an ASAT capability has already been discussed. Additionally, there is a new electronic warfare system that can destroy communications satellites, the 'Tirada', with a claim that a contract for delivery of the 'Tirada-2.3' complex to the MOD was signed in 2018. According to a leading specialist on Russian defence systems, Dmitrii Kornev, this project dates back to 2001 and is a product of the Moscow Radio-technical Scientific Research Institute (MNIRTI) and the Moscow 'Scientific Research Institute of Microelectronic Apparatus "Progress"' (NIIMA), a leading centre for the development of advanced electronic components.⁴⁴

Another possible development is the 'Kornet', an anti-satellite missile carried by a MiG-31 fighter. This appears to be a recent Russian development based on a Soviet project dating back to the 1970s.⁴⁵ Some think that there is also a space system that is able to approach and inspect the functioning of satellites in orbit with the potential to put them out of action on a temporary or permanent basis. This mini-

³⁹ Vladimir, 'Dlya chego nuzhen "Burevestnik"', 20 November 2019, <https://topwar.ru/dlya-chego-nam-nuzhen-burevestnik.html>

⁴⁰ 'Letyashchii nad Rossiei "Burevestnik" okazhetsya radioaktivnym', *Lenta.ru*, 27 February 2019, <https://lenta.ru/news/2019/02/27/burevestnik/>

⁴¹ US Defense Intelligence Agency, *Challenges to Security and Space*, Washington D.C, January 2019. This report discusses ASAT developments in China and Russia, but not equivalent projects in the USA.

⁴² Nudol' is the name of a village in the Klin region, Moscow oblast, 'Raketa -"ubiitsa sputnikov" stanet otvetom na armerikanskuyu PRO', *Moskovsky Komsomolets*, 3 February 2018, <https://www.mk.ru/article/2158812/>

⁴³ 'Kompleks 14Ts033 Nudol', raketa 14A042', accessed 25 February 2018, <http://militaryrussia.ru/blog/topic-806.html>; on the December 2918 test, 'Nudol ASAT was tested from Plesetsk in December 2018', 6 February 2019, http://russianforces.org/blog/2019/02/nudol_asat-was_tested_from_pl.shtml

⁴⁴ 'Russkie "chistil'shchiki" blizhengo kosmosa: "Tirada", "Nudol" i "Kontakt"', *Zvezda*, 20 November 2018, <https://zvezdaweekly.ru/news/t/20181171054-woeqH.html>.

⁴⁵ Ibid.

satellite space 'inspector' is believed to have been tested several times since 2013 as 'Kosomos-2519'.⁴⁶ The fact that Russia has been developing these ASAT systems does not mean that they will be deployed. It is probably the case that they are regarded as reserve systems that could be deployed quite rapidly in the event that another nation, or nations, begin to turn space into a potential arena of warfare.

Responding to the US withdrawal from the INF Treaty

This is not the place to discuss the vexed issue of responsibility for the breakdown on the INF Treaty and the decision of the United States to terminate its adherence to it. On 2nd February 2019, Russia's response was made clear at a meeting involving Putin, Shoigu, and foreign minister Sergei Lavrov. In the event that new intermediate-range missiles are deployed in Europe or elsewhere in a location within potential reach of Russia, Moscow will respond by bringing comparable systems into service. Two systems are to be developed though not necessarily deployed. First, work is to be started on 'grounding' the combat-proven 'Kalibr' naval cruise missile; second, the creation of a hypersonic land-based intermediate-range missile.⁴⁷ According to Putin, these two new systems were proposed by the Ministry of Defence.

Land-based 'Kalibr' cruise missile

The 'Kalibr' missile complex is now the basic armament of the Russian navy and saw combat use in the Syrian campaign.⁴⁸ It has two anti-ship cruise missiles with ranges of up to 200-250 km and the 3M14 cruise missile for use against targets on land with a range of up to 2,500 km.⁴⁹ It is a development of the Ekaterinburg 'Novator' design bureau and produced by its associated enterprise, Ekaterinburg 'Mashinostroitel'nyi zavod imeni M. I. Kalinina', from which it was formed as a subdivision in 1947, both now in the 'Almaz-Antei' concern.⁵⁰ A new variant is now being developed, apparently from last year, the 'Kalibr-M' cruise missile with a range of 4,500 km. It is intended for use with either conventional or nuclear warheads. The expected date of completion of the project remains classified.⁵¹

Now a new task has been set. In response to the decision of the United States to withdraw from the INF Treaty, a new version of the 'Kalibr' will be developed, a land-based cruise missile system which could in future be deployed in the event that new intermediate range missiles were to be deployed in Europe or elsewhere considered threatening by Russia. This will evidently be a variant of the 3M14 missile with an appropriate transport-launch vehicle, possibly a variant of an existing complex.⁵² As observers have pointed out, this new missile system could be quite rapidly developed. But it is not certain that it will enter service. This looks like a project designed to deter any attempt to introduce new missiles in Europe, maintaining the status quo that has existed since the INF Treaty, which came into force in 1968.

⁴⁶ Ibid; 'Raketa - "ubiitsa sputnikov" stanet otvetom na armerikanskuyu PRO', *Moskovsky Komsomolets*, 3 February 2019, <https://www.mk.ru/politics/2019/02/03/raketaubiyca-sputnikov-stanet-otvetom-na-amerikanskuyu-pro.html>

⁴⁷ 'Vstrecha s Sergeem Lavrovym i Sergem Shoigu', *Presidential Administration Website*, 2 February 2019, <http://www.kremlin.ru/events/president/news/59763>. Putin's edict halting Russia's compliance with the Treaty was adopted on 4th March, 'Podpisan ukaz o priostanovlenii Rossei vypolneniya Dogovora mezhdru SSSR i SShA o likvidatsii ikh raket srendeni dal'nosti i men'shei dal'nosti', *Presidential Administration Website*, 4 March 2019, <http://www.kremlin.ru/events/president/news/59939>

⁴⁸ Richard Connolly, 'The Kalibrisation of the Russian navy: Progress and Prospects', *CCW Research Note*, 12 February 2019, <http://www.ccw.ox.ac.uk/blog/2019/2/12/the-kalibrisation-of-the-russian-navy-progress-and-prospects-by-richard-connelly>

⁴⁹ Kompleks 3K-14/S-14 Kalibr, rakety 3M-54/3M-14 - SS-N-27/SS-N-30 SIZZLER, accessed 28 February 2019, <http://militaryrussia.ru/blog/topic-818.html>

⁵⁰ Note, since sanctions were imposed on OKB 'Novator' references to their current military-related activities have been removed from their websites - okb-novator.ru and www.zik.ru

⁵¹ Kalibr-M (proekt), accessed 28 February 2019, <http://militaryrussia.ru/blog/topic-906.html>

⁵² Anton Nikitin, 'Perspektivnyi "Kalibr-M" s dal'nost'yu poleta 4,5 tych. km reshili sdelat' nazemnym', *Vzglyad*, 23 February 2019, <https://vz.ru/news/2019/2/23/965644.html>

A land-based 'Tsirkon' hypersonic missile

The second new system to be developed is a land-based hypersonic intermediate-range missile complex. This is assumed by Russian specialists to be a variant of the 'Tsirkon' naval cruise missile under development in recent years but not yet in service.⁵³ The 'Tsirkon' was presented by Putin for the first time as one of Russia's new 'invincible' weapons in 2019's February Presidential Address. He claimed that it will have a speed of flight of approximately Mach 9, a range of more than 1,000 km, and that it will be capable of destroying targets both at sea and on land. Its use is foreseen on both surface ships and submarines, including those equipped for deployment of the 'Kalibr' missile.⁵⁴

The 'Tsirkon' is a development of the military-industrial corporation 'NPO mashinostroeniya', with its lead facility in Reutov, near Moscow, and a number of manufacturing enterprises, notably 'Strela' in Orenburg. This is one of the companies of the 'Tactical Missile Armament Corporation' ('KTRV'). Work appears to have started on the 'Tsirkon complex (3K-22) with its supersonic or hypersonic 3M-22 missile in 2011.⁵⁵ There has been little open reference to the project, although in 2016 and 2017 it was discussed in relation to the future Fifth Generation multi-role submarine, project 'Khaski', for which it would be the principal armament.⁵⁶ This project appears to be in the state armament programme to 2027, with the laying down of the first submarine possible in 2023. Some also suggest that the atomic cruiser (project 11442M) 'Admiral Nakhimov', now undergoing modernisation, will be armed with the 'Tsirkon'.⁵⁷

Various reports suggest that the 'Tsirkon' has been tested some ten times, not always successfully, the first time at sea from the submarine 'Severodvinsk' in April 2017 and the most recent, according to US intelligence reports, in December 2018, when it was claimed to have reached a speed of Mach 8.⁵⁸ Various estimates of its range have appeared, from 300-400 km to 800-1,000 km.⁵⁹ There was news in March 2019 that the 'Tsirkon' would be test launched from a warship for the first time before the end of the year, with the new project 22350 frigate 'Admiral Gorshkov' as the test ship, using its launchers for the 'Kalibr' and 'Oniks' missiles.⁶⁰ Next year, according to a defence industry source, it will be test launched from the 'Kazan' multi-role submarine.⁶¹ From the current rate of progress, it may be ready for service by the early 2020s and Orenburg 'Strela' would appear to be a likely manufacturer. The development of a land-based version will clearly take some time and a new transport-launch vehicle may be required, although this could be a unified with the one for the 'Kalibr', thereby reducing the

⁵³ According to defence industry sources, Ivan Safronov, 'Rossiya otvetit na vykhod SShA iz DRSM D rarabotkoi novoi raket', *Kommersant*, 2 February 2019.

⁵⁴ 'Poslanie Prezidenta Federa'nomu Sobraniyu', [Presidential Administration Website](http://www.kremlin.ru/events/president/news/59863), 20 February 2019, <http://www.kremlin.ru/events/president/news/59863>

⁵⁵ 'Kompleks 3K-22 Tsirkon/Tsirkon-S, raketa 3M-22 - SS-NX -33', accessed 1 March 2019, <http://militaryrussia.ru/blog/topic-718.html>

⁵⁶ 'Istochnik: podlodki "Khaski" vooruzhat giperzvukovymi raketami "Tsirkon"', *RIA Novosti*, 17 March 2016, <https://ria.ru/20160317/1391460490.html>; 'Oboikma s "Tsirkonami": zavhem Rossii atomnaya podlodka pyatogo pokoleniya', *VPK*, 21 December 2017 (original, *RIA Novosti*), https://vpk.name/news/201764_oboima_s_cirkonami_zachem_rossii_atomnaya_podlodka_pyatogo_pokoleniya.html

⁵⁷ 'Atomnyi kreiser "Admiral Nakhimov" poluchit giperzvukovye rakety', *VPK*, 27 October 2015 (original source, lenta.ru), https://vpk.name/news/143053_atomnyi_kreiser_admiral_nahimov_louchit_giperzvukovyye_rakety.html. The 'Admiral Nakhimov' is now expected to undergo tests in 2020 with return to service possible in 2021, 'Raketnyi kreiser "Admiral Nakhimov" vyidet na ispytaniya v 2020 godu', *RIA Novosti*, 17 January 2019, <https://ria.ru/20190117/1549508307.html>

⁵⁸ 'Kompleks 3K-22 Tsirkon/Tsirkon-S, raketa 3M-22 - SS-NX -33', accessed 1 March 2019 <http://militaryrussia.ru/blog/topic-718.html>; Amanda Macias, 'Russia again successfully tests ship-based hypersonic missile - which will likely be ready for combat by 2022', *CNBC*, 20 December 2018, <https://www.cnb.com/2018/12/20/russia-tests-hypersonic-missile-that-could-be-ready-for-war-by-2022.html>

⁵⁹ Ibid.

⁶⁰ 'Giperzvukovoi "Tsirkon" ispytayut s borta fregata "Admiral Gorshkov"', 12 March 2019, <https://topwar.ru/155314-giperzvukovoj-cirkon-ispytajut-s-borta-fregata-admiral-gorshkov.html>

⁶¹ 'Zaplanirovana pervaya strel'ba "Tsirkonom" s podlodki', *Vzglyad*, 19 March 2019, <https://vz.ru/2019/3/19/969012.html>

development time.⁶² The available evidence suggests that this could be a much longer term project than the 'grounding' of an already proven naval missile system.

A frequent claim is that the 'Tsirkon' is a development of the 'Brahmos-1' cruise missile being developed by the Russia-Indian joint venture of the same name, although as the authoritative 'military.russia.ru' website notes, there has been no official confirmation.⁶³ This is a hypersonic missile being jointly developed by NPO 'Mashinostroeniya' in Russia and India's Defence Research and Development Organisation, which in 1998 together formed Brahmos Aerospace Ltd. 'Brahmos-1' is a supersonic missile with a ramjet powering the cruise stage of its flight, with a speed of up to 2.8-2.0M, based on the Russian R-800 'Oniks' anti-ship missile manufactured at Orenburg 'Strela'. It has a solid powder starter motor and a ramjet for cruise flight and the anti-ship variant has a 200kg warhead. In 2008, it was announced that this cruise missile was to become the basis of a new hypersonic missile capable of reaching up to Mach 6.⁶⁴ According to some sources, the 'Brahmos-2' cruise missile, a model of which was displayed at the Aero India 2013 air show, may be a version of the eventual export version of the hypersonic 'Tsirkon'.⁶⁵

But is the 'Tsirkon' truly a hypersonic weapon? Or, like the 'Kinzhal', is it a missile that can approach and hit its target at hypersonic speed, but not cruise towards it over a distance at this speed? Perhaps it is not powered by a scramjet at all. These issues have been raised in the Russian media, notably by Oleg Kaptsov, who is convinced that it is 'hypersonic' only in a limited sense. In a detailed technical analysis, he argues that the 'Tsirkon' may be similar to the US ship-based RIM-161 'Standard Missile 3' of the Aegis anti-missile system. This is a compact four stage missile powered by solid-fuel motors able to attain hypersonic speed in its final stage of flight by flying to a very great height, destroying its target by kinetic impact, without use of a warhead.⁶⁶ This seems unlikely, however, since it would pose new technological tasks to the Russian defence industry, thus rendering an early test of the missile unlikely.

Yet there is another more plausible interpretation, again without the use of a scramjet, at least during the first stage of development. As Douglas Barrie of IISS has argued, 'while hypersonic air-breathing propulsion is normally associated with the scramjet (supersonic ramjet), efficient ramjets may be capable of sustaining speeds of up to around Mach 6'.⁶⁷ A new fuel, 'Detsilin-M', has been developed for use with very high speed missiles, including the 'Tsirkon'.⁶⁸

With the long experience gained with the supersonic 'Brahmos' cruise missile, it is possible that with improved technology and new fuel, it has been further developed to the point that Mach 6 is now attainable without the use of a scramjet. The 'Tsirkon' also appears to have a very powerful solid-fuel start motor.⁶⁹ If so, the claims of testing to Mach 8 could be explained by the fact that the missile is able to reach a high altitude and then reach its target at hypersonic speed, without the use of a scramjet.⁷⁰ Indeed, the 'Tsirkon' development programme as a whole may indeed have a second stage, the

⁶² 'Arsenal Putina: Giperzvukovoi "Tsirkon"', *Voennoe Obozreniye*, 20 February 2019, <http://militaryreview.ru/arsenal-putina-giperzvukovoj-cirkon.html>

⁶³ 'Kompleks 3K-22 Tsirkon/Tsirkon-S/raketa 3M22, SSNK-33, accessed 11 March 2019, <http://militaryrussia.ru/blog/topic-718.html>

⁶⁴ 'PKR "Bramos"', 29 June 2011, <https://topwar.ru/5350-pkr-bramos.html>

⁶⁵ 'Kompleks 3K-22 Tsirkon/Tsirkon-S/raketa 3M22, SSNK-33, accessed 11 March 2019, <http://militaryrussia.ru/blog/topic-718.html>

⁶⁶ Oleg Kaptsov, "Raketa "Tsirkon". Bit'va za giperzvuk', , 25 February 2019, <https://topwar.ru/91369-raketa-cirkon-bitva-za-giperzvuk.html>

⁶⁷ Douglas Barrie, 'Trends in Missile Technologies', 11 March 2019, <https://www.iiss.org/blogs/analysis/2019/03/trends-in-missile-technologies>.

⁶⁸ Andrei Petrov, '5 Nakhov - ne predel: do kakikh skoroestei "Detsilin-M" mozhet razgonat' "Tsirkon", 18 March 2016, https://rueconomics.ru/165352-5-mahov-ne-predel-do-kakih-skoroestei-decilin-m-mozhet-razognat-cirkon?utm_source=warfiles.ru

⁶⁹ Aleksei Ramm, Bogdan Stepovoi, 'VMF poluchit oblegchennye rakety "Tsirkon"', *Izvestiya*, 22 January 2019.

⁷⁰ This is hinted by Sivkov, writing in 2016, who notes that the 'Tsirkon' can reach a quite high altitude before descending to its target, Konstantin Sivkov, 'Strashnee "Kalibr". USA proigrali Rossii okeanskii TVD', *VPK*, 17 October 2016, <http://vpk-news.ru/articles/33019>.

development and eventual adoption of a genuinely hypersonic version with viable scramjet propulsion, though this may be a more distant goal.

If a scramjet is under development there are candidates for the organisations likely to be involved. Ramjets for supersonic missiles are produced by the Turaevo machine building design bureau 'Soyuz' (TMKB 'Soyuz') at Lytkarino, Moscow oblast', which has also been involved in research into hypersonic systems.⁷¹ The aviation industry's main centre for research into aero-engines, the Central Institute for Aviation Motor Building imeni P. I. Baranova (TsIAM), which, while based in Moscow, has a branch located at Lyykarino, has been engaged in research into ramjets and scramjets over many years and can be assumed to work closely with TMKB 'Soyuz'.⁷² In addition, there is R&D into ram/scram jets undertaken by 'NPO mashinostroeniya' itself, which has 'division 08' devoted to rocket engines, and which has worked on ramjets since the 1980s.⁷³ This suggests a major research effort has been underway for some time on the development of scramjets, so if the 'Tsirkon' even at this stage turns out to have one, it will not be entirely unexpected, even if it is in advance of the United States and other powers currently engaged in the development of hypersonic weapon systems.

Following Putin's reference to the 'Tsirkon', a comment afterwards by retired rear-admiral Vsevolod Khmyrov created a stir. He said that the 'Tsirkon', if based on a ship or submarine able to reach a point 500 km from the shore of an adversary, could strike an inland target within 500 km of the coast within five minutes. From his comment, it was clear that the adversary he had in mind was the United States.⁷⁴ This was soon followed by a sensationalist 'Rossiya-1' TV presentation by the well-known journalist, Dmitrii Kiselev, who named five specific potential US targets for such a strike, including the Pentagon and Camp David. The Kremlin press spokesperson Dmitrii Peshkov felt the need to distance the presidential administration from Kiselev's tactless contribution. The well-known specialist Konstantin Sivkov sharply rebuffed Khmyrov, pointing out that it was highly unlikely that naval vessels would be able to reach such proximity to the US coast without detection and, anyway, the 'Tsirkon' was intended as an anti-ship weapon, not one for destroying command centres on land, especially protected ones underground.⁷⁵

Finally, it has been revealed that a smaller, lighter, variant of the 'Tsirkon' anti-ship missile will be developed to make it easier to carry on small artillery ships, in particular the project 'Karakurt' and the 'Buyan-M' vessels. No schedule for its development and eventual deployment has been indicated.⁷⁶
Some other significant new weapons under development or in prospect

Russia has some other weapon systems now under development or in prospect of development in the next few years. These have not been publicised in his characteristic style by Putin, but in the short to medium term they could have could play an important role in enhancing Russia's military capability.

Strike UAVs

A major gap in Russian weaponry is the lack of a strike UAV, particularly heavy systems able to strike at a long distance. One is now under development and is clearly being treated as a top priority. This is the 'Okhotnik' (S-70) developed by the Sukhoi design bureau. The project began in 2009 when it

⁷¹ <http://www.tmkv-soyuz-ru/About-the-Company-Rus>; <http://www.tmkb-soyuz.ru/41>, accessed 24 March 2019.

⁷² Evgenii Pozhidaev, 'Rossiiskie strasti po giperzvuku', 4 January 2013, <https://army-news.ru/2013/01/rossijskie-strasti-po-giperzvuku/>

⁷³ 'S oporu na silu i razum', accessed 27 March 2019, <http://www.npomash.ru/press/ru/tribua110310.htm?prn=y>

⁷⁴ 'Mnenie ekspertov', *Krasnaya Zvezda*, 22 February 2019, <http://redstar.ru/mnenie-ekspertov/>

⁷⁵ 'V Rossii priznali bespoleznost' "Tsirkon" protiv SShA', *Lenta.ru*, 22 February 2019,

<https://lenta.ru/news/2019/02/22/zircon>; 'Krem!' prokomentiroval dannye o tselyakh v SShA', *Lenta.ru*, 25 February 2019, <https://lenta.ru/news/2019/02/25/ydar/>; Nikita Kovalenko, 'Vozmozhnost' Rossii udarit po komandnym tsentram SShA "Tsirkonami" iz Atlantiki postavili pod somnenie', *Vzglyad*, 21 February 2019, <https://vz.ru/news/2019/2/21/405554.html>

⁷⁶ Aleksei Ramm, Bogdan Stepovoi, 'VMF poluchit oblegchennye rakety "Tsirkon"', *Izvestiya*, 22 January 2019.

emerged that both Sukhoi and MiG were working jointly on a heavy strike drone. Then, in 2011, a contract was signed for the 'Okhotnik' project between Sukhoi and the MOD.⁷⁷

Photographs of the 'Okhotnik' appeared in January 2019, taken during ground tests on the runway at the Novosibirsk aviation works where it is being built. These ground tests began in November 2018. It has a flying wing form and according to a leading expert on Russian aviation, Petr Butovski, this means that it is should capable of flying at supersonic speeds. Its weight is believed to be 22-25 tonnes, with a capacity to carry bombs and missiles of 2.8 tonnes. The power unit is thought to be the AL-41F1 aero-engine and it may have a range of up to 5,000 km. There appears to be some commonality with the SU-57 Fifth Generation fighter and some speculation suggests that the intention may be to use both systems together in some combat situations, with the drone tasked with destroying anti-aircraft systems.⁷⁸ According to industry minister Denis Manturov, the 'Okhotnik' will soon have its first flight test.⁷⁹

Meanwhile work continues on the creation of a medium strike UAV, the 'Al'tair' (the project as a whole is the 'Alt'ius' and this designation is sometime given to the UAV itself). This project ran into trouble in 2018 when the general director/chief designer of Kazan 'OKB imeni M. P. Simonova', the company responsible for its development, was arrested and charged with financial abuses.⁸⁰ After some time it emerged that work on the new system had been transferred to the Uralskii zavod grazhdanskoi aviatsii (UZGA), Ekaterinburg, already building the 'Forpost' reconnaissance drone under licence from the Israeli. Originally, this was to have been a five tonne UAV but its weight increased and it appears to have reached seven tonnes. There were test flights at the Kazan works and according to the deputy minister of defence for procurement, Aleksei Krivoruchko, the first flight of the 'Altair' in a renewed form will take place in May-June this year. He added that work on the project is now under very strict supervision by the MOD.⁸¹

New weapons developed but then not acquired in the volume envisaged

Advanced new weapons may be developed successfully but this does not necessarily mean that they will be deployed rapidly, or in large number. One factor is their very high cost, especially when built in very low volume. Two good examples are the Fifth Generation fighter, the 'Su-57' and the new main battle tank, the 'Armata'.

The Su-57 Fifth Generation fighter

The Su-57 first flew in 2010, and there are now nine test versions flying. According to an initial contract with the MOD, the first serial plane will be delivered this year, a second in 2020. Reports indicate that a second contract will be signed in 2020 to deliver thirteen more, some with the new second stage version of its aero-engine now under development, which will permit cruising at supersonic speed. This engine, known now simply as the 'Izdelie 30', was flight tested in December 2017 and it is expected that serial production of Su-57s with this power unit will begin in 2023.⁸² Only with this new power unit,

⁷⁷ 'Istochnik: tyazhelyi bespilotnik "Okhotnik" na ispytaniyakh razognalsya na polose do 200 km/ch', *Tass*, 23 November 2018, <https://tass.ru/armoya-i-opk/5824644>.

⁷⁸ Andrei Borisov, 'Okhota krepkaya', *Lenta.ru*, 13 February 2019, <https://lenta.ru/articles/2019/02/13/okhotnik>; Sergei Andreev, 'Koshmar PVO. Kakim budet novyi boevoi bespilotnik "Okhotnik"', 19 February 2019, https://life.ru/t/%D0%B0%D1%80%D0%BC%D0%B8%D1%8F/1193774/koshmar_pvo_kakim_budiet_novyi_boievoi_bi_espilotnik_okhotnik

⁷⁹ 'Manturov anonsiruet perviy polyot bespilotnik "Okhotnik"', *Interfax*, 15 February 2019, <http://www.militarynews.ru/story.asp?rid=0&nid=501911&lang=RU>

⁸⁰ Denis Komarovskii, 'Otreklis' ot drona: chto sluchilos' s proektom "Al'tair"', *Izvestia*, 15 October 2018, <https://iz.ru/799816/denis-komarovskii/otrekis-ot-drona-chto-sluchilos-s-proektom-altair>

⁸¹ 'Pervyi polet obnovlennogo bespilotnika "Al'tius" sostoitsya v mae-iyenu 2019 goda', 21 February 2019 <http://www.armstrade.org/includes/periodics/news/2018/1221/100550223>

⁸² 'Pervyi seriinyi Su-57 postupit v voiska v etom godu', *Interfax*, 26 February 2019, <http://www.militarynews.ru/story.asp?rid=0&nid=502720>; Svetlana Tsygankova, 'Kontrakt na postavku 13 istrebitelei Su-57 podpishut v 2020 godu', *Rossiiskaya Gazeta*, 16 January 2019, <https://rg.ru/2019/01/16/reg-cfo/kontrakt-na-postavku-13-istrebitelej-su-57-podpishut-v-2020-dodu.html>

which will permit the plane to cruise at supersonic speed, will it become a fully Fifth Generation fighter.⁸³ Originally, 60 Su-57s were to have been supplied by 2020.

The 'Armata' tank

The development of the T-14 'Armata' began in 2009-10 and a prototype appeared by the beginning of 2015.⁸⁴ It is now in limited trial use in the army. Originally, 2,300 units were to have been produced by 2020. Its high unit cost is evidently a major factor but there is also some evidence of doubts about its military value when compared to the latest, much cheaper, upgrades of the T-72, T-80 and T-90, now being procured in some volume. This year the army will receive its first serially built T-14 'Armata' tanks, twelve in all, apparently with quite a few modifications when compared to the prototype version, including an improved 1,500 h.p. diesel engine, transmission and fire control system. It is claimed that the serial version will be somewhat cheaper than the first twenty that went to the forces on a trial basis.

Nevertheless, its price is considered unacceptably high. According to Yurii Borisov, the armed forces will not aim for its mass procurement as it is considered too expensive, instead they prefer to acquire modernised versions of existing models. An initial contract for 100 'Armata' has been signed, plus 32 armoured systems on the same chassis, all to be delivered by the end of 2021. Reports suggest that 'Uralvaganzavod' has undertaken to reduce the unit cost to 250 million roubles, compared to almost 500 million for the earlier prototype version, but approximately 180,000 for a modernised T-72.⁸⁵ There is keen awareness that the unit cost of the 'Armata' could be reduced if export orders were accepted, increasing the volume of output. But the Russian MOD is usually reluctant to approve a new weapon system for export until it is in wide use in the domestic armed forces. It remains to be seen whether the 'Armata', notwithstanding its novelty, will ever become a standard main battle tank of a new generation, or a stepping stone to a future advanced tank of an acceptable cost enabling it to play that role.

The S-500 'Prometei' air-space defence system

This long-range system air-space defence system should enter service soon but there has been no official indication of exactly when. In his review of procurement targets for 2019 in December, Shoigu made no reference to the S-500. But in February last year there was a report that serial production of the system had started, and in May US intelligence sources claimed that it had been successfully tested, hitting a target more than 480 km away. The 'Almaz-Antei' concern started work on the S-500 in 2010 but there has been considerable secrecy, with very few reports on progress. Ten division sets were to have been deployed by the end of SAP-2020. In 2014, the MOD revealed that a prototype had been tested and there was a possibility that it could be adopted for service in 2017.⁸⁶ A report in September last year indicated that its development had been completed and that it was ready for serial production but it appears that an obstacle to this still remains.⁸⁷

The problem almost certainly relates to the development of the system's truly long-range missile, the 40N6M, a more advanced version of the S-400's 40N6 missile but with a range of up to 600 km instead of 400 km. This is one of three new missiles that were to be created for the 'Prometei' by the Moscow

⁸³ Kirill Ryabov, 'Zakrytaya tema. Chto izvestno ob "Izdelii 30"', 18 March 2019, <https://topwar.ru/155513-chto-izvestno-ob-izdelii-30.html>

⁸⁴ 'T-14 Armata', accessed 2 March 2019, <http://militaryrussia.ru/blog/index-655.html>

⁸⁵ Aleksei Ramm, Aleksei Kozachenko, Bogdan Stepovoi, 'Tankovyi tolk: Minoborony v etom godu poluchit pervye seriinye "Armaty"', *Izvestia*, 12 February 2019, <https://iz.ru/844419/aleksei-ramm-aleksei-kozachenko-bogdan-stepovoi/tankovyi-tolk-minoborony-v-etom-godu-poluchit-pervye-seriinye-armaty>; "'Armata' nikak ne razgonitsya', *Ekspert*, No.8, February 18, p.6; Evgenii Kameneskii, 'Tank T-14 "Armata" mogut "spasti" eksportnyi zakaz i 120-mm pushka', 27 February 2019, <https://topwar.ru/154608-tank-armata-spaset-jeksportnyj-zakaz-i-120-mm-pushki.html>

⁸⁶ On the history of the S-500, see Il'ya Kramnik, 'Protivoraketnyi "Prometei"', *Izvestia*, 9 March 2018, <https://iz.ru/717770/ilija-kramnik/protivoraketnyi-prometei>

⁸⁷ Anton Valagin, 'Rossiya zavershila sozdanie sistemy PVO S-500 "Prometei"', *Rossiiskaya Gazeta*, 28 September 2018, <https://rg.ru/2018/09/28/rossiia-zavershila-sozdanie-sistemy-pvo-s-500-prometej.html>

'Fakel' design bureau. But there have been many problems and delays with the development of the 40N6, which was only adopted for armament in September 2018, after which procurement started. More than one thousand are to be produced during SAP-2027.⁸⁸ As the military journalist Pavel Fel'gengauer pointed out in February, the S-400s now widely deployed in Russia and being exported to China have been equipped with shorter range missiles while awaiting delivery of the ones genuinely giving them a range of 400 km.⁸⁹

In these circumstances, it is highly probable that the development of the even longer range version, the 40N6M, is well behind schedule. There would be little point in deploying the very costly new system if its performance was only equivalent to that of the now widely deployed S-400 air defence system. But the S-400 is now a profitable export item in high demand, and it could be that there are also capacity constraints limiting possibilities for the S-500. In addition, as one specialist has hinted, there may be concern that deployment of the new system could undermine the strong demand for the existing one.⁹⁰ It could be some time before the S-500 enters into service and a limited initial deployment may well be of a version lacking the full range of intended capabilities. The training of personnel to use the new system has already begun at the Gatchina air defence centre, Leningrad oblast' although there has been no indication of when an actual S-500 will be made available to it.⁹¹

The S-350 'Vityaz' air defence system

The project to develop and build the S-350 ('Vityaz', 50R6A) medium-range air defence system was started in 2007, with the initial aim of getting it accepted into service by 2012. This proved to be extremely optimistic. 'Almaz-Antei', the concern responsible for the work, has had to change the schedule many times. A prototype was shown publically in June 2013 and SAP-2020 set the goal of acquiring 38 of them by the end of the period. Last December Shoigu said that one unit of the system would be acquired before the end of 2019, and in February this year it was announced that a S-350 'Vityaz' would be delivered later in 2019 to the Gatchina centre for training troops in its use.⁹² The system has a range of 60 km and each transporter-launcher carries twelve missiles.

Major projects postponed

A number of future projects have been rescheduled so that they will now start later than seemed likely earlier. There are several examples that could be outlined, but two will suffice.

The PAK DA strategic bomber

This project to develop a new long-range strategic bomber, the PAK DA, began at the Tupoljev design bureau in 2009. The available information indicates that it will be a subsonic aircraft of delta-wing form. According to the military specialist Sergei Ptichkin, it will be armed with hypersonic missiles and may be equipped to destroy military satellites. Its basic weapon is thought to be the X-102 missile with a range of up to 5,500 km, and which can carry a nuclear warhead. It was reported in November 2018 that on the website for state procurement a tender had appeared for development work on the engine of the new strategic bomber.⁹³

⁸⁸ 'Istochnik: dal'noboinaya raketa 40N6 sistemy S-400 prinyata na vooruzhenie', *Tass*, 18 October 2018, <https://tass.ru/armiya-i-opk/5688864>

⁸⁹ Pavel Fel'gengauer, 'Gruz-400', *Novaya Gazeta*, 21 February 2019, <https://www.novayagazeta.ru/articles/2019/02/21/79636-gruz-400>

⁹⁰ Aleksandr Stepanov, 'Oboronka zaderzhivaet sroki sozdaniya noveishei ZRS S-500', *Nasha versiya*, No.20, 20 May 2018.

⁹¹ Leonid Khairamdinov, 'Obresti navyk atak v stratosfere', *Krasnaya Zvezda*, 1 March 2019, <http://redstar.ru/obresti-navyk-atak-v-stratosfere/>

⁹² 'Kompleks S-350 v pervyye postupit v uchebnyi tsentr zenitnykh raketnykh voisk v 2019 godu', *VPK*, 6 February 2019, https://vpk.name/news/244220_kompleks_s350_vpervyye_postupit_v_uchebnyy_centr_zenitnykh_raketnykh_voisk_v_2019_godu.html

⁹³ Sergei Ptichkin, 'Strateg na odnomkryle', *Rossiiskaya Gazeta*, 22 November 2018, <https://rg.ru/2018/11/22/bombardirovshchik-novogo-pokoleniia-poluchit-novyj-dvigatel.html>

According to the general director of the 'Tupolev' company of the United Aviation Corporation, Aleksandr Konyukhov, it will take five to seven years to develop the new aircraft.⁹⁴ It was revealed in February 2019 that all the contractual documentation for the PK DA had been signed and its basic characteristics approved, opening the way to the commencement of development. The schedule appears to be ambitious, though it is possible that a prototype could appear before the end of 2027, the final year of the current state armament programme.⁹⁵ This is later than earlier reports. For example, in May 2017 Yuriy Borisov, then deputy defence minister, said that the PAK DA could make first flight in 2025-26 and serial production was planned for 2028-29, suggesting three years for flight tests.⁹⁶ Now it seems unlikely that it will enter service even in the 2030s. Meanwhile, work continues at the Kazan aircraft factory on putting a new modernised version of the Tu-160 strategic bomber into production.

The 'Lider' destroyer

There has been prolonged discussion of the intention to build a larger surface ship for the Russian navy than the corvettes and frigates that are now being procured. Attention has focused on the 'Lider' (project 23560) destroyer, first raised as a possibility in 2009. It was initially envisaged that this would be laid down in 2012 and possibly enter service by 2018. Around 2014 it was even claimed that at least twelve destroyers would be built.⁹⁷ But the project then suffered numerous delays, again probably relating at least in part to its high cost.

After 2014 a new problem appeared, supplying it with a suitable power unit, given the impossibility acquiring a gas turbine from Ukraine. Russia is still grappling with the problem of developing and manufacturing ship power units and chains for lighter surface vessels and it will be some time before a power unit for a destroyer becomes a practical proposition. In these circumstances, it is not surprising that a nuclear power unit began to be seen as the solution, although this will add weight to the ship. In June 2015, the then commander-in-chief of the Russian navy, Viktor Chirkov, told the press that construction of the 'Lider' could begin in 2019.⁹⁸ At that time, it was envisaged that it would be a relatively light vessel with a displacement of 14,000 tonnes, and this was still being maintained late last year, when, according to one source, up to six would be built.⁹⁹

It now appears to have been decided to build two project 23560 'Lider' type destroyers with nuclear power units at a cost of approximately 100 billion roubles each (c.\$1.5 billion at the current exchange rate). Their displacement will be up to 20,000 tonnes, much heavier than originally envisaged. Indeed, as has been noted by one author in a scathing critique of 'this floating coffin with hundreds of missiles', its displacement approaches that of an aircraft-carrying cruiser such as the 'Petr Veliki', at just under 24,000 tonnes.¹⁰⁰ An outline project has been agreed and it has been reported that under the current state armament programme, 2018-27, R&D is set to begin in 2021 leading directly to the start of construction, with each ship needing seven years for completion. The aim is apparently to launch both vessels by the end of the 2020s. This means that it is very unlikely that the Russian navy will be able to commission a destroyer until about 2032 at the earliest, assuming the project is implemented. It is

⁹⁴ Viktor Baranets, 'Poyavlenie PAK DA mozhet pereroit' voennye doktriny mira', 6 February 2019, <http://www.arm-expo.ru/analytics/novye-razrabotki/-vikto-baranets-poyavlenie-pak-da-mozhet-perekroit-voennye-doktriny-mira/>

⁹⁵ Aleksandr Peshkov, 'Utverzhdzen okonchatel'yi oblik PAK DA', *Zvezda*, 14 February 2019, <https://tvzvezda.ru/news/opk/content/2012214119-X1Umz.html>

⁹⁶ 'Gnezdo "Belogo lebedya"', *VPK*, 4 May 2017, https://vpk.name/news/180819_gnezdo_belogo_lebedya.html

⁹⁷ 'Perspektivnyi esminets/NIR Lider/pr.23560', accessed 27 February 2019, <http://militaryrussia.ru/blog/topic-636.html>

⁹⁸ *Ibid.*

⁹⁹ Aleksandr Shishkin, 'Kak dolzhen vyglyadet' VMF Rossii v blizhaishem budushchem', *Vzglyad*, 27 December 2018, <https://vz.ru/society/2018/12/27/956861.html>

¹⁰⁰ Roman Skomorokhov, 'Rossiiskii linkor vpered eskardy!', 1 March 2019, <https://topwar.ru/154804-rossijskij-linkor-vpered-i-jeskadry.html>. Skomorokhov does not think the destroyer will be built.

expected that the 'Lider' will be armed with more than a hundred 'Tsirkon', 'Kalibr' and 'Oniks' missiles.¹⁰¹

Conclusion

Progress has clearly been made in the development of all the new systems presented by Putin in his Address of 1 March 2018. The 'Kinzhal' will probably be the first to make the transition from trial use to formal adoption, to be followed by the 'Avangard' and later by the 'Sarmat' and 'Peresvet'. The future of the 'Poseidon' is less certain and the 'Burevestnik' appears to be the least developed and is unlikely to become a viable, deployable, weapon until well into the next decade, if at all. But even when development work on these systems has been completed it is by no means certain that the new systems will be procured in anything more than very modest quantities. An exception may be the 'Sarmat' ICBM, which will be acquired in sufficient number to replace the 'Voevod' missiles nearing the end of their service lives, although this could change if the New Start Treaty is not extended.

In the case of the new land-based intermediate range land-based missiles to be developed in response to the likely end of the INF Treaty, they may not be deployed at all. The systems will be developed to the point that they could be deployed, but much will then depend on the steps taken by the United States and NATO.¹⁰² If no new intermediate range missiles are based on territories within range of Russia then the newly developed systems are unlikely to be deployed but held in reserve to inhibit new initiatives that threaten to upset the equilibrium. The same could also apply to the new anti-satellite system under development: their deployment being dependent on the actions of other major powers.

As the cases of the Su-57 and 'Armata' illustrate, costly new systems which when initiated were expected to be acquired in quantity may reach the point when they are ready for deployment but then are procured in only modest volume. Unless significant export orders can be achieved, this will make it difficult to reduce their unit cost and the system could end up being technology demonstrators, potentially of value for future new developments. It remains to be seen whether the same will apply in the cases of the new air defence systems, the S-350 and S-500.

As for the PAK DA strategic bomber and the 'Lider' destroyer projects, they may never be implemented or, if they are, only after long delays. Of the weapons discussed, perhaps only the strike drones, the 'Okhotnik' and 'Alt'air', if they successfully pass through flight tests and final state acceptance tests, will be acquired in quantity and make a significant contribution to Russia's military capability.

Why does Russia pay so much attention to the development of new weapons when they may end up with very limited, or zero, practical application, effectively being little more than technology demonstrators? The Russian leadership, civil and military, evidently considers the funding of them worthwhile. Undoubtedly, the new systems have considerable symbolic value, at times demonstrated with enthusiasm by President Putin. They serve to show that Russia now has strong military technological capabilities, notwithstanding sanctions and a less than vibrant economy.

For the Russian defence industry, which was starved of funding for many years, the development of technologically sophisticated new weapons is probably playing a significant role in restoring eroded capabilities. It focuses attention on the development of advanced materials, new electronic components, innovative design and manufacturing technologies, in particular digitalised systems, and with quite tight budget constraints may be promoting greater cost effectiveness and higher productivity. Indeed, Yurii Borisov may well be right when he claims that 'the defence-industrial complex is now in a very good state, even in relation to other branches of industry. The growth of labour productivity, and sales,

¹⁰¹ 'Istochnik: Rossiya k kontsu 2020-x godov planiruet postroit' dva esmintsa tipa "Lider'", *Tass*, 28 February 2019, <https://tass.ru/armiya-i-opk/6167819>

¹⁰² The Russian Foreign Ministry is firm that new missiles will be deployed only if the US locates intermediate range missiles in Europe, 'MID nazval uslovie dlya razmeshcheniya noykh raket v evropeiskoi chasti Rossii', *RBK*, 16 March 2019, <https://www.rbc.ru/politics/16/03/2019/5c8cbeed9a79472c8743f81a>

is higher than the average for the country.¹⁰³ In time, these developments may bring economic benefit to Russia going beyond the defence sector. Priority is now being given to the diversification of the defence industry to develop and manufacture high technology civil goods, but this may prove difficult. For its military products, the defence industry has a demanding customer in the MOD, with considerable political backing, but in the civilian sector customer power is relatively weak, especially in a sector which experiences very limited competition.

By showing advanced capabilities in the development of new weapons there appears to be an intention to deter the United States from undertaking military technological innovations that Russia would find threateningly destabilising, particularly new developments that could make space an arena for potential military action. To some extent, an arms race is underway, but this requires an appreciation of the rules of this new game by other militarily powerful powers, not only the United States, but also China. Perhaps, in time, the *Bulletin of the Atomic Scientists* can gradually turn back the minute finger on its famous Doomsday Clock, now at two minutes to midnight, as recognition mounts that behind all the current sound and fury about threatening new nuclear and conventional systems the reality may not be becoming as threatening as sometimes appears at first sight.

Contact Details

Changing Character of War Centre, Pembroke College, Oxford, OX1 1DW
Tel: +44 (0)1865 276458 Email: info@ccw.ox.ac.uk Twitter: @Oxford

¹⁰³ 'Borisov: tempy rosta proizvoditel'nosti truda i vyruchki v OPK vyshe srednikh po strane', *Tass*, 4 March 2019, <https://tass.ru/armiya-i-opk/6182770>