

## From Triad to Tetrad: Recent Developments in Russia's Strategic Nuclear Forces

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Traditionally, major nuclear powers have developed and deployed strategic nuclear forces across three legs. This configuration, known as a [nuclear triad](#), includes land-, sea-, and air-based strategic nuclear forces designed to ensure a survivable deterrent by complicating an adversary's ability to eliminate a country's nuclear retaliatory capability in a single attack.

First, the land-leg consists of silo-based and/or road-mobile intercontinental ballistic missiles (ICBMs). The benefit of this leg is responsiveness in a [launch-on-warning](#) scenario and survivability for dispersed [road-mobile ICBMs](#). Some posit that the silo-based systems also function as a “[warhead sink](#)”, targets meant to absorb an attacker's first strike. Second, the sea-leg entails long-range submarine-launched ballistic missiles (SLBMs). Due to the concealed nature of ballistic missile submarines (SSBNs), the advantage of this leg is [survivability](#). Third, the air leg comprises strategic bombers with air-launched cruise missiles (ALCMs) or bombs. The additional value of this leg is [flexibility and visibility](#). In other words, an air leg is useful for signaling resolve toward adversaries and reassuring allies. There are thus reinforcing military-strategic reasons to have these different capabilities.

In February 2024, the U.S. [claimed](#) that Russia is developing a nuclear anti-satellite capability. Such a capability could put current U.S. space-based nuclear command, control, and communications (NC3) at risk, and in the future, space-based components of the [Golden Dome](#) missile defense shield. Such a capability could enhance the effectiveness of the other legs of Russia's strategic deterrent, for example, by disabling or destroying space-based missile-defense and warning assets prior to a ballistic missile strike. In short, Russia is adding a space-based leg to its strategic forces, thereby moving towards a nuclear tetrad posture. Subsequently, this commentary will focus on the novel capabilities intended to bolster Russia's strategic forces.

### Recent Russian Tests

During the past few months, Russia has been testing multiple novel, destabilizing nuclear capabilities that are intended to overcome U.S. missile defense systems. First, on October 21, 2025, Russia seemed to have successfully tested the 9M730 [Burevestnik/Skyfall](#) ground-launched, nuclear-armed, and nuclear-powered cruise missile. Chief of the General Staff of the Russian Armed Forces, Valery Gerasimov, claimed that the missile flew 14,000 kilometers in 15 hours. While the system is slow, its extremely long range can result in an unpredictable flight path, evading missile defense, or even lingering over a specific area as a deterrence signal. Moreover, intercepting such a system can be challenging due to the nuclear-powered engine and subsequent radiation hazard.

A test of the [Poseidon/Kanyon](#) long-range, dual-capable, nuclear-powered uninhabited underwater vehicle (UUV) occurred at the end of October 2025. The Poseidon will be deployed on specific nuclear-powered submarines, such as the operation Belgorod and the future Khabarovsk, which is under construction. The obvious advantage of a nuclear-armed, nuclear-powered UUV is that it cannot be intercepted easily, but the potential targets are confined to naval assets, such as a carrier strike group, and coastal areas.

More recently, Russia successfully tested the new [RS-28 Sarmat](#) heavy ICBM on May 12, 2026. According to Russian media, this system can carry different payloads, such as “10 large nuclear warheads, 16 smaller ones, a combination of warheads and countermeasures, or hypersonic boost-glide vehicles.” Notably, President Putin mentioned that the missile could strike targets “over 35,000 kilometers” and maintain a “suborbital” trajectory.

A suborbital trajectory may reference either the [Avangard](#) nuclear-capable, hypersonic boost-glide vehicle. However, the open-source range is only over 6,000 kilometers. Or it could indicate that Russia is potentially redeploying a so-called Fractional Orbital Bombardment System (FOBS) capability. Such a system was deployed by the [Soviet Union](#) from 1968 to 1983, namely the R-36-O (RS-SS-9 Mod 3 Scarp). While it only covers a fraction of an orbital trajectory, a FOBS can be considered as a space-based weapon. [China](#) is similarly developing a FOBS. An additional theoretical space-based nuclear capability is a multiple-orbit bombardment system (MOBS). The [difference](#) between FOBS and MOBS is that the latter system would “complete one or more orbits before descending on its target.”

As stated in the introduction, Russia is developing a proper space-based option, specifically [a nuclear anti-satellite capability](#). Many details of the program remain classified. However, on April 25, 2025, U.S. officials [reported](#) that a Russian satellite involved in the development of a space-based nuclear weapon, named Cosmos 2553, was [malfunctioning](#). This is concerning because a nuclear detonation in space can result in a [variety](#) of effects depending on the altitude. For example, a detonation in medium Earth orbit (MEO), at altitudes between 2,000 and 36,000 kilometers, could disrupt navigation systems such as the U.S. Global Positioning System and the European Galileo Global Navigation Satellite System.

Beyond MEO are the geosynchronous and geostationary Earth orbits, used by the U.S. Space Force’s [Advanced Extremely High Frequency System](#), which is a joint service satellite communications system for tactical and strategic forces, and the [Space-Based Infrared System](#) that detects and tracks ballistic missile launches. With a MEO system Russia can hold an asymmetric advantage, as it can threaten the satellite capabilities on which the U.S. and NATO depend heavily. While this nuclear anti-satellite capability, once operational, probably will not stay permanently in orbit, the potential to launch such a system during conflict or war gives Russia an extra option to escalate. In other words, moving from a triad to a tetrad sends a clear strategic message to the adversary and add another way to “escalate to de-escalate.”

## The U.S. Response

Given the second Trump Administration’s decision to create the Golden Dome, [described](#) by Secretary of War Pete Hegseth as “a next-generation missile defense shield,” the U.S. may have calculated that the renewal of the strategic triad is insufficient to face the two-peer nuclear challenge. Nonetheless, with recent adversary developments of novel capabilities, such as the Burevestnik, Poseidon, and FOBS, and the move towards a nuclear tetrad which include a nuclear anti-satellite capability, Russia can undermine the credibility and effectiveness of such a deterrence-by-denial capability. Therefore, deterrence by punishment, or having credible retaliatory strategic forces, should remain the backbone of U.S. and allied security.

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