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Comparing space bombardment systems of China and the Soviet Union

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Abstract

In 2021, hypersonic weapon tests conducted by the People's Republic of China (PRC) elicited concerns in the U.S. due to the delivery system reminiscent of the Cold War: Fractional Orbital Bombardment System (FOBS). The attempts were followed by two competing assessments—alarmism and optimism—which hindered constructive understanding of the occurrence in public. To explore the alleged capability, this article juxtaposes Chinese FOBS with the antecedent. The comparison aims to highlight what differentiates, if any, the 2021 Chinese FOBS from its predecessor. The analysis selects three variables—capabilities, detection and interception mechanisms they face, and how they were acknowledged by Washington. Each factor, except the submunition capability of Chinese FOBS, seems to suggest that the Chinese FOBS tests are not Sputnik moment. Conversely, the HGV-submunition capability is worth garnering attention, given its ramifications to strategic stability.

Introduction

On October 16, 2021, the Financial Times reported that the People's Republic of China (PRC) had conducted a hypersonic weapon test, alleging that the Fractional Orbital Bombardment System (FOBS) was used to release the Hypersonic Glide Vehicle (HGV) into the atmosphere, though it missed a target by approximately 40km (Sevastopulo and Hille, 2021). Beijing, however, rejected the accusation. Zhao Lijian, the then spokesperson of the Ministry of Foreign Affairs of China, argued that it was a routine test of a reusable space vehicle, and the Global Times refuted the coverage by stating, "China will not compromise on such an unreasonable and unfair logic by some Westerners, and will keep making efforts to push its own development and research for the peaceful use of space" (Yang and Deng, 2021). The Financial Times later corrected its initial report; there were, in fact, two tests on July 27 and August 13 (Sevastopulo, 2021).

"A technological achievement with serious implications for strategic stability" (Senate Armed Services Committee, 2022, p.6). As the statement by the former commander of the United States Strategic Command at the committee indicates, some in the United States of America (U.S.) were profoundly alarmed by the new threat. Peter Pry even argued that the U.S. was far beyond the Sputnik moment,

urging a response against the imminent threat (2021, p.5). It is worth stating, however, that FOBS itself is the capability the former archrival of the U.S. once pursued and is rather an artefact from the Cold War era. Underscoring this fact, others refuted the 'alarmists'; Fareed Zakaria rebuffed the concerns as "dangerous paranoia" (2024). In short, there have been competing assessments regarding the Chinese FOBS tests, hindering a constructive understanding of the occurrence in public. Hence, this article intends to explore the peculiarity of the alleged capability to help understand the threat by asking: what differentiates, if any, the 2021 Chinese FOBS attempts from its predecessor? To address the question, this article juxtaposes Chinese FOBS with the antecedent and assesses those with the following variables: capabilities, detection and interception mechanisms they face, and how they were acknowledged by Washington.

First, I overview the development of Soviet FOBS in the 1960s in order to introduce the system itself, including the controversy over the so-called Outer Space Treaty. Second, I enumerate the facets of Soviet FOBS corresponding with the aforementioned variables. Third, I assess the 2021 Chinese FOBS tests in parallel based on the criteria. As a result of the analysis, three changes are observed: the possibility of Chinese HGV-submunition capability, the U.S. interception capability, and the hawkish reaction in 2021. On the other hand, the superiority of other delivery systems and competent U.S. detection mechanisms are continuities that are worth underscoring. In light of this, this article proposes a framework underscoring both sides—what has changed and what has not—and argues that the tests themselves are not Sputnik moment, though the possibility of submunition capability is worth garnering attention.

R-36-O

Outer space loomed as a frontier after the end of WWII. The Union of Soviet Socialist Republics (USSR) had become intrigued with an orbital weapon system soon after the success of Sputnik (Siddiqi, 2000, p.22), and the U.S. was aware of the Soviets' strategic intention to exploit outer space by 1963. For instance, John McCone, the former Director of Central Intelligence, reported the possibility of as many as 200 nuclear-armed satellites regularly orbiting the Earth in the forthcoming future, in which FOBS was mentioned as a standby force variant (1963, p.17). Moscow arguably considered FOBS as a breakthrough amidst the Intercontinental Ballistic Missiles (ICBM) standoff across the North Pole.

FOBS, unlike conventional ICBM that follows the elliptical trajectory and reaches high apogee, is a delivery system that seeks to utilise the Low Earth Orbit (LEO) and is capable of inflicting damage upon

the U.S. from directions other than the North, where Ballistic Missile Early Warning System (BMEWS) was directed (Figure 1). Indeed, three FOBS proposals had been made in the USSR in an effort to circumvent the BMEWS: a renowned Korolev bureau (OKB-1)'s GR-1, Chelomey bureau (OKB-52)'s UR-200A, and the R-36-O from Mikhail Yangel bureau (OKB-586). Yangel eventually stood alone in the competition, with GR-1's use of unstable cryogenic fuels, Korolev's loss of influence due to the failures of his R-9A programme, and a purge of Chelomey's patron—none other than Nikita Khrushchev (Siddiqi, 2000, p.24). Interestingly, the PRC also sought FOBS as the DF-6 programme between 1965 and 1973 (Lewis and Hua, 1992, p.19).

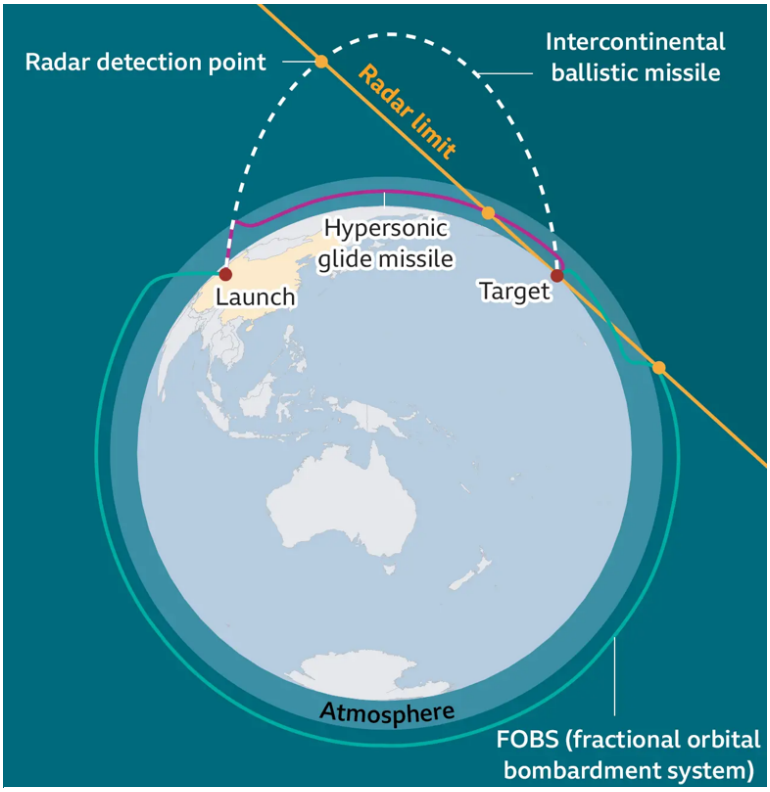

Figure 1: FOBS Trajectory

Source: Marcus, J. (2021). *China's hypersonic missile: Could it spark a new arms race?* Retrieved October 31, 2024, from https://www.bbc.com/news/world-asia-59001850

The R-36-O consisted of a two-stage rocket and the Orbital Payload (OGCh)—comprised of an instrumentation device, a retrorocket engine, and a warhead—and scores of trials had been conducted (Siddiqi, 2000, pp.24-25). Observing launch tests, as of 1968, the CIA was unsure as to which trajectory the R-36-O development was pursuing; "The Soviets may be trying to develop a weapon which could perform as a depressed trajectory ICBM, or a FOBS, or perhaps a dual system capable of performing either of these missions" (Helms, 1968, p.15). Upon completing the 20th launch tests, the R-36-O became operational in 1968 with three units and 18 missiles, which were not equipped with nuclear warheads until 1972 (Siddiqi, 2000, pp.26-27).

Soviet FOBS capability was revealed to the U.S. public in 1967. The New York Times, for instance, already reported in October the 'one-orbit shots' by the USSR (Clark, 1967). A proceeding press conference on November 3rd, by the then Secretary of Defence Robert McNamara, sparked public concerns against the system, where he officially presented the possibility of Soviet FOBS and argued that the system did not yet violate the Outer Space Treaty because it is "a fractional orbit, not a full orbit" (U.S. Department of Defense, p.12). The Outer Space Treaty—or officially the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies—went into force in October 1967. It stipulated the peaceful use of space and the

prohibition of installing nuclear weapons or any other kinds of weapons of mass destruction into orbit under Article IV (U.S. Department of State, 1967). The exposure of Soviet FOBS was soon after the commencement of the treaty.

Rep. James McClure condemned McNamara's statement by arguing, "What a strange sight it has been to see the administration in effect defending the Russians in this matter" (Congressional Record, 1967). Rep. William Dickinson and Sen. John Tower also denounced McNamara; Dickinson went as far as urging President Johnson to "replace Secretary McNamara" (CQ Almanac, 1967). Edward Welsh also disagreed with McNamara in a memorandum to the then National Security Advisor Walt Rostow. He stated that an object is "in orbit around the Earth", as Article 4 of the Outer Space Treaty set forth, whether or not it achieves a complete circuit (1967). Nonetheless, Spurgeon Keeny rejected the allegation and defended McNamara. He contended that the treaty did not prohibit States Parties from developing or testing systems capable of carrying nuclear weapons, and FOBS would only be used in times of war (Keeny, 1967, pp.2-3). Should ICBM be allowed on the treaty, he argued, so shall FOBS.

Soviet FOBS

Upon the Strategic Arms Limitation Talks II (SALT II) between the two superpowers, Moscow agreed to withdraw R-36-O; twelve of eighteen launchers would be dismantled, and another six would be converted for other purposes under Article VII (U.S. Department of State, 1979). Both governments also agreed to explicitly prohibit FOBS itself (Nuclear Threat Initiative, n.d.). This chapter explores the capability of R-36-O, detection and interception systems of the U.S., and how it was perceived by the U.S., which extraordinarily led to the abolition of one of the nuclear delivery systems due to the lack of salience.

Capability

A profound lack of yield and accuracy was a fatal defect of FOBS. For instance, only 30-35% of OGCh could be devoted to a warhead, whereas a warhead generally comprises 70 to 80% of ICBM's re-entry vehicle (Siddiqi, 2000, p.28). That is, the system could have inflicted much less damage upon the U.S. soil than ICBM. This is perhaps why McNamara asserted that the U.S. could "absorb" attacks by FOBS (U.S. Department of Defense, 1967, p.2). Regarding the accuracy, the circular error probability (CEP) of R-36-O was estimated to be approximately 2.4 to 4.8km, which was significantly wider than that of R-36

ICBM in which the CIA evaluated the CEP to be around 800m (Hughes, 1967, p.2; Helms, 1968, pp.9). Thus, using FOBS would have been limited to soft targets, such as Strategic Air Command (SAC) bombers, and even those tasks were unlikely to be accomplished. McNamara stated, “We have 40 SAC bombers bases. It would take a very substantial number of warheads targeted on those bases to destroy them and quite clearly they are not going to put that substantial number X into orbit” (U.S. Department of Defense, 1967, p.8).

A facet emanating from this issue is the superiority of other delivery systems. It had become consensual that ICBM is qualitatively and quantitatively better than FOBS. Keeny went as far as stating, “There is a real possibility, therefore, that rather than increase their military capabilities, the Soviets have actually reduced their net capabilities by deploying FOBS rather than ICBMs” (1967, p.1). Also, the primary characteristics of FOBS could be substituted by a submarine-launched ballistic missile (SLBM). Ballistic missile submarines were not constrained by launch points and were thus able to surprise adversaries by using SLBMs (Siddiqi, 2000, p.28). Accordingly, FOBS had become nothing more than a weapon of “political and psychological considerations” (McCone, 1963, p.9).

Detection & Interception

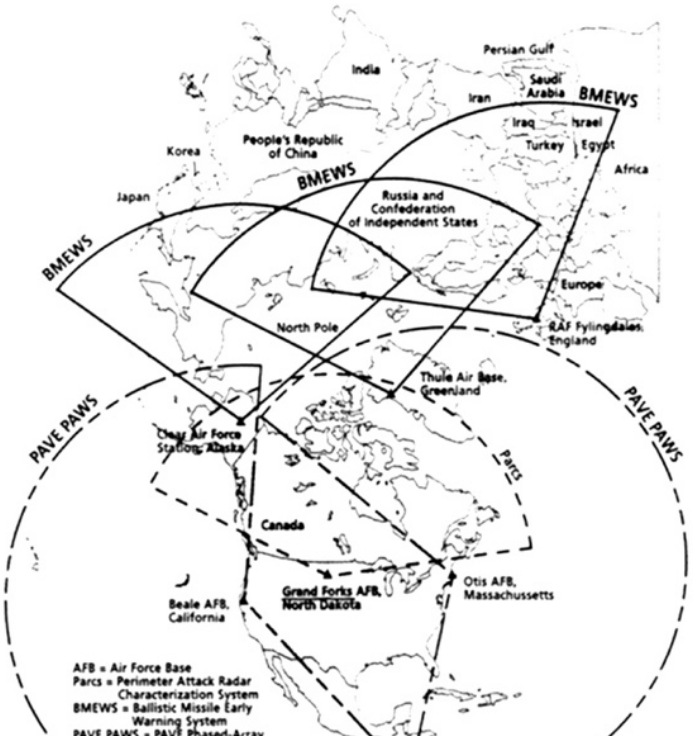

Figure 2: U.S. ground-based radar systems

Source: Gyűrösi, M. (2010). *The Soviet fractional orbital bombardment system program*. Retrieved December 5, 2024, from https://www.ausairpower.net/APA-Sov-FOBS-Program.html

Also, one of the preconditions for the deployment of FOBS had changed. The U.S. had already contemplated a similar orbital delivery system by 1963 and decided instead to develop the over-the-horizon radar (CQ Almanac, 1967). Perhaps having acknowledged the issue above, Washington concluded that developing FOBS would be futile. With the enhanced ground-based radar capability (Figure 2), further combined with a space-based early warning system under the Defence Support Programme (DSP), the U.S. could have easily detected FOBS from Tyura-Tam (Siddiqi, 2000, p.28). As the U.S. no longer relied solely on BMWES to detect incoming incursions, the significance of FOBS faded. With the improved detection capability, the implications of FOBS to the strategic

stability had become similar to that of other delivery platforms; none of those could possibly be intercepted after all.

Reaction

Political interests may have also affected Washington's inactive stance on FOBS. That is, the delivery system was simply not worth political turmoil. The officials allegedly hesitated to possibly dismantle the treaty just because of FOBS (Siddiqi, 2000, p.28). Also, the conclusion of the Nuclear Nonproliferation Treaty, which required cooperation with the Kremlin, was regarded as far more critical than the condemnation of FOBS (Paine, 2018). Keeny underscored this facet by stating, "Such hasty actions (criticism of Moscow) can lead to counter charges that we are interested in employing the Treaty for tactical, political advantage what it so serves our purposes" (1967, p.3).

Furthermore, having acknowledged the legality of FOBS, the U.S. may have been able to proceed with the deployment of the Anti-Ballistic Missile (ABM) capability—the Safeguard programme—which would have been treated similarly to FOBS under the treaty due to its interception mechanism. Permitting the Soviet FOBS under the treaty would have also validated having ABM countermeasures, as the Spartan ABM was developed to intercept incoming objects by detonating its nuclear warhead in outer space only in times of war (Listner, 2022). Whilst the administration opposed the installation of ABM due to the concerns that Mutual Assured Destruction (MAD) would deteriorate, public opinion had favoured the defence capability, resulting in the announcement to deploy the limited, Chinese-oriented Sentinel programme in September 1967 (CQ Almanac, 1967). Hence, some in the congress advocating the further deployment of Soviet-oriented ABM may have been silent amidst the threat of FOBS.

Chinese FOBS

The Russian FOBS was arguably unthreatening, and the U.S. preferred to disregard Soviet FOBS for political considerations. If so, how different can the Chinese FOBS be? Of course, as the PRC asserts, they could have simply been tests of a reusable space vehicle. Given the lack of Chinese transparency in its nuclear posture, it is unclear if and why Beijing is pursuing FOBS. Assuming the tests were FOBS, however, we can obtain implications from the fuss. This chapter, following the aforementioned analysis, examines the capability, detection and interception systems of the U.S., and how it was perceived by

Washington.

Capability

Most importantly, the Chinese FOBS capability per se would not significantly alter the power balance between Beijing and Washington. This is because the U.S. has primarily deterred attacks from adversaries not by intercepting incoming missiles but by mounting impermissible consequences followed by aggression on U.S. soil (Acton, 2021). In short, the threat has been omnipresent. The current Chinese nuclear arsenal can already take millions of Americans hostage, and thus, “What amounts to lobbing a bomb at a target in a slightly unusual way is not a game-changer when both sides can already vaporise each other” (Bowen and Hunter, 2021, p.6). Additionally, the PRC is rather keen to improve its ICBM capability. It is reported, for instance, that the PRC will acquire more than 1000 operational nuclear warheads by 2030, many of which would be mounted on ICBMs (U.S. Department of Defense, 2023, p.104). Also, the People's Liberation Army Rocket Force (PLARF) confidently launched DF-31AG this year toward the Pacific Ocean for the first time since 1980 (Hui, 2024). Furthermore, a working group at ROLES have revealed by exploiting the synthetic aperture radar that scores of ICBM silos constructed in Hami, the Xinjiang Uyghur Autonomous Region in the PRC, are not decoy and are capable of storing ICBMs (Akiyama et al., 2024, p.12). This corroborates—similar to the lack of comparative strategic importance of Soviet FOBS—that Beijing still considers ICBM as one of the pivotal pillars of its nuclear deterrence, and FOBS would constitute, if at all, a marginal role in Chinese deterrence capability.

Whilst FOBS itself—as the sections above illustrate—is not necessarily threatening, it is worth stating here that the cynosure in the occurrence of 2021 may have significantly been mislaid. That is, the facet we need to focus on is not the delivery system itself, but the submunition in which the HGV launched. Amidst the atmosphere, HGVs experience extreme temperatures up to 2200°C and plasma, causing boundary layer transition, “the sudden formation of hot, turbulent airflow around a vehicle” (Karako and Dahlgren, 2022, pp.11-12). The PRC, however, seems to have overcome such a harsh environment. The U.S. officials were reportedly bewildered as the HGV appeared to “defy the law of physics” by launching a projectile whilst approaching its target (Sevastopulo, 2021a; 2021b). This method, resembling Russian Matryoshka Dolls, is technically challenging. For instance, the U.S. had attempted to release the D-21 drone from a supersonic jet in 1966, resulting in the death of one personnel due to shock waves created by two vehicles which downed the aeroplane (Hitchens, 2021). The abovementioned environment in the atmosphere was thought to hinder the vehicle from exploiting a guidance system, and using HGV would be limited to static targets (Bolder, 2022, p.428). Nonetheless, by launching a submunition, the Chinese HGV might soon be capable of striking mobile targets, such as

an aircraft carrier (Chen, 2024, p.5). This possibility is corroborated by the Guangdong Aerodynamic Research Academy's exhibition of the GDF-600 at the recent Zhuhai Airshow, in which the HGV with six sub-payload options was presented (Trevithick, 2024). Thus, this tactical implication of the tests, which had not existed in the 1960s, is far more disruptive than the use of FOBS itself.

Detection & Interception

Another implication is the next generation of space-based missile detection systems against hypersonic weapons, including the FOBS-delivered HGV. Michael D. Griffin, the former Under Secretary of Defense for Research and Engineering, stated, "I think we'll have a workable defensive capability (against hypersonic weapons) by the middle of the decade (U.S. Department of Defense, 2018). As the U.S. could detect FOBS by exploiting the over-the-horizon radar and DSP satellites in the Cold War, the Chinese FOBS would also likely be found. By deploying scores of satellites at the LEO as a 'constellation'—with the wide-field of view satellites detecting the earliest phase and the Hypersonic and Ballistic Tracking Space Sensor (HBTSS) responsible for the dimmer gliding phase (Figure 3)—a birth-to-death tracking would be possible (Karako and Dahlgren, 2022, pp.19-20). Additionally, the U.S. will soon be capable of intercepting the FOBS-delivered HGV by the Glide Phase Interceptor (GPI), co-developed by the U.S. and Japan. In short, the detection capability against FOBS remains and will soon be further supplemented by the interception capability, which did not exist against Soviet FOBS.

Reaction

The reaction against the Chinese FOBS could have been manipulated by political interests, similar to the 1960s but in the opposite direction. "I fear this is much more like 9/11", Jeffrey Lewis at the Middlebury Institute of International Studies stated, "where in the aftermath of the surprise and reeling from a mix of fear and vulnerability, we embarked on a series of disastrous foreign policy decisions that made us far less safe" (Marcus, 2021). An unknown weapon falling from an unprecedented direction is admittedly appalling, but it may have obscured the magnitude of the threat. Fareed Zakaria also argued, "For the Pentagon, it's an opportunity: Raising fears about a huge and tech-savvy enemy is a surefire way to guarantee vast new budgets that can be spent countering the enemy's every move, real or imagined" (2021). Dominika Kunertova, on the hype of hypersonic weapons, similarly stated, "The attention does not represent a technical assessment. Instead, it often reflects the interests of political actors and profit-oriented industries" (2022, p.59). This sentiment indicates a stark difference from 1967, when political interests led to a repressive posture on FOBS.

Conclusion

Three differences are salient in the comparison: the possibility of submunition launched from the HGV, interception capability, and a hawkish reaction against Chinese FOBS. On the other hand, two continuities are observed in the circumstances surrounding Soviet and Chinese FOBS: the effectiveness of other delivery systems and firm detection mechanisms against them. Each factor, except the submunition capability, seems to suggest that the Chinese FOBS tests are not Sputnik moment. The FOBS, by nature, is not a technological breakthrough, as its characteristics do not deviate far from that of the contemporary nuclear triad. Also, the detection mechanism that once existed against Soviet FOBS has been ameliorated, soon to be even supplemented by GPI's interception capability. The political interests shall also be underlined, as it, rather than the threat itself, may have fueled the scepticism. Nonetheless, the HGV-submunition capability, though its actuality has yet to be confirmed, can disrupt the strategic stability between two great powers, possibly offsetting the advantage brought by GPI. Thus, the submunition capability, not the delivery system itself, must be underlined.

	Soviet FOBS	Chinese FOBS	Changes
FOBS Capability	Insignificant	Insignificant	No
Submunition	–	Possible	Yes
Detection	Possible	Possible	No
Interception	–	Possible	Yes
Reaction	Inactive	Active	Yes

Here, scrutiny of this article has made it possible to underscore the changes and continuities of two FOBS and propose a framework for evaluating the threat. Rather than depicting the 2021 Chinese FOBS attempts as a threatening new space weapon or a mere replication of the Soviet weapon, two sides—what has changed and what has not—must be examined. Neither treating the Chinese FOBS as the new Sputnik nor underestimating the weapon can lead us to a conducive understanding of what the 2021 FOBS tests could have been.

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