

A RAND NOTE

**Soviet Reactions to the National Aerospace Plane
(NASP)**

Rose Gottemoeller, Nathan Brooks

November 1990

RAND

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PREFACE

This RAND Note reviews and documents the Soviet public reaction to the proposed U.S. National Aerospace Plane as reflected in the open literature between the mid-1960s and mid-1989. The review was undertaken as a task in the project on "The National Aerospace Plane (NASP): Development Issues for Follow-on Systems," performed under the Aerospace and Strategic Technology Program of Project AIR FORCE.

Sponsored by the Air Force Directorate of Program Planning and Integration (SAF/AQX), the project has also required close cooperation with the NASP Joint Project Office (JPO). These research results should thus be of interest to a broad group in the Air Force planning, NASP JPO, and NASP contracting communities, as well as to those concerned with Soviet reactions to U.S. weapon programs in the high-technology sphere.

SUMMARY

This Note reviews the Soviet public reaction to the proposed development of the U.S. National Aerospace Plane (NASP), a manned hypersonic vehicle that the United States intends to build primarily to develop technologies for use on planes of the future, both military and civilian. For example, a NASP-derived, single-stage-to-orbit aerospace vehicle is being discussed as a possible follow-on to the space shuttle.

To learn how the Soviets are reacting to the NASP, we reviewed the open literature published between the mid-1960s and mid-1989, including military journals, general political commentary, popular science publications, and legal journals. We looked in particular for signs that the Soviets are developing defensive systems and other reactive measures to counter the NASP. We also sought evidence of possible international legal actions that they might take to limit NASP development.

The Soviets see the NASP as a component of strategic weapon modernization in space, and its development obviously concerns them. They link it to the U.S. strategic defense initiative (SDI) and the space shuttle. In contrast to their campaign against the SDI, however, they have mounted no sustained criticism of the NASP. One reason for this may be that they are conducting their own research on hypersonic flight, and although they describe such research as limited to commercial applications, it undoubtedly has military purposes as well.

The Soviets clearly recognize the bomber-modernization potential of the NASP and the fact that it may provide a wholly new capability to the air-breathing leg of the triad in the next century. They also link the NASP to a possible reconnaissance-strike capability at the strategic level. However, Soviet commentators provide no sense of how the Soviet Union would respond to such threats.

The continuation of the NASP program and the promise of eventual military applications will require the Soviets to respond to the threat. Their response, as in the SDI case, will most likely stress solutions that are the simplest and least expensive to develop and deploy. For example, rather than contending directly with the vehicle, they may target vulnerable ground support elements. They may also try to diffuse the NASP threat by encouraging the joint U.S.-USSR development of an aerospace vehicle, for example, for potential use in the Mars project. In such a case, they could argue that cooperative development of a space plane would enable each side to devote a smaller portion of its stringent budget to an aerospace plane.

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I. INTRODUCTION

This Note reviews the Soviet public reaction to the proposed development of the U.S. National Aerospace Plane (NASP), a manned hypersonic vehicle designed to take off horizontally from conventional runways, fly at up to 25 times the speed of sound, accelerate to low earth orbit, and land on the same runways while maintaining full maneuverability.¹ Such a plane would be able to fly from Washington, D.C., to Tokyo in two hours.

President Reagan announced plans to develop the NASP in his 1986 state-of-the-union address. The Department of Defense (DoD) and the National Aeronautics and Space Agency (NASA) have administered the NASP program jointly since its inception, indicating that the government envisions various applications of the concepts and systems demonstrated in the experimental test vehicle, to be known as the X-30.

One of the most promising applications for an aerospace craft derived from the NASP might be a single-stage-to-orbit (SSTO) vehicle designed to lift objects into space. As the space shuttle inevitably approaches the end of its operational life, many experts believe that a follow-on vehicle based on the NASP might be able to launch a payload into space at significantly lower cost than can current methods, while also providing assured launch capabilities. In addition to these space applications, several endoatmospheric military missions have been proposed for NASP-derived vehicles (NDVs).²

The NASP program obviously has the potential to create significant concerns in the Soviet leadership and in the military and research communities. Although initially discussed as a civilian airliner, the *Orient Express*, the NASP technology clearly would also have wide-ranging military applications. We attempt here to gain a sense of how the Soviets have reacted to the project, especially the potential military missions for a U.S. aerospace plane. We are especially interested in signs of the defensive systems and other reactive countermeasures that the Soviets might pursue to counter an NDV.

At the time the NASP program was announced, the Soviets had been reacting vehemently to the strategic defense initiative (SDI), publicly describing a range of possible Soviet responses that focused on ways to spoof, overwhelm, or directly attack a U.S.

¹U.S. Government Accounting Office (GAO), *National Aero-Space Plane. A Technology Development and Demonstration Program to Build the X-30*, April 1988.

²David C. Morrison, "Testing the Limits at Mach 25," *Science*, Vol. 240, May 20, 1988, pp. 973-975; see also GAO study.

strategic defense system. Although the Soviets also mentioned the possibility of emulating SDI, they frequently cited budget constraints as a reason for choosing allegedly cheaper options, such as spoofing the system.

In this atmosphere, we expected that the Soviets would likewise react publicly to the NASP with options for countering an NDV. An open discussion in the press and military literature, we assumed, would provide valuable insights into the aspects of the program that most worried the Soviets and to which they would most likely respond with serious countermeasures. We were interested, therefore, in what Soviet leaders, military spokesmen, scientists, and journalists would say in the print and broadcast media about the NASP and the potential of hypersonic aviation.

We reviewed military journals, general political commentary, popular science publications, and the legal literature published between the mid-1960s, when the Soviets were following the U.S. dynamic soaring (Dyna-Soar) research program, and mid-1989.³ During this period, Soviet popular science literature reflected the Soviets' enthusiasm for what they call *cosmic aviation*: reusable aerospace vehicles capable of hypersonic speeds, designed especially for lifting objects into space.

With the advent of the U.S. space shuttle program in the 1970s, the Soviets' public enthusiasm for reusable aerospace craft gave way to criticism of the shuttle, and public discussion of the potential for hypersonic aerospace flight essentially ceased for 15 years. This hiatus ended in the mid-1980s, when the Soviets began to comment on aerospace programs in the United States and Europe. They also began to praise the hypersonic airliner that came out of their own aerospace research program.

The volume of Soviet discussion, however, remained small. Unlike the SDI, which elicited a flood of comment and criticism, the NASP program has attracted relatively little attention. Much of the Soviet reaction, in fact, has linked the NASP to the SDI and the shuttle program. In contrast to the way they reacted to the SDI, however, the Soviets have proposed no specific measures to counter an NDV. We must, therefore, infer from the Soviet publicly suggested ways to counteract the SDI which measures might also apply to NDVs; such measures might include

³The Dyna-Soar program, which preceded the space shuttle, sought to incorporate hypersonic technology for reentry after attaining orbit with an expendable booster. See Roy F. Houchin II, "The Diplomatic Demise of Dyna-Soar: The Impact of International and Domestic Political Affairs on the Dyna-Soar X-20 Project, 1957-1963," *Aerospace Historian*, Vol. 35 (December 1988), pp. 274-280. See also Thomas W. Wolfe, *Soviet Strategy at the Crossroads*, Harvard University Press, Cambridge, Mass., 1985, p. 205.

- Fast-burning missiles for direct-ascent intercept
- Placement of space mines in NDV orbital paths
- High-powered ground-based lasers
- Obstacles and debris placed in NDV orbital paths
- Attack against NDV-related ground-support sites.

Although far from complete, this list illustrates the type of *active* measures that the Soviets proposed to attack space- and ground-based components of the SDI system. Other anti-SDI measures stress ways to ensure the capability of Soviet forces to penetrate a comprehensive ballistic-missile defense system. Such technologies, which include, for example, altered missile exhaust plumes to impede target acquisition, apply less directly to the NASP case.⁴

Several Soviet sources described military applications of the NASP technologies that were divorced from SDI, including bomber modernization, reconnaissance, and command and control—all in a strategic context. Thus, in at least these few sources, Soviet commentators seemed to recognize the missions for an aerospace plane that were being discussed in the United States.

To track the evolution of the Soviets' views on the NASP, we begin with a discussion of their interest in and plans for hypersonic aerospace vehicles, as revealed in the open literature. Section III reviews the recurring themes. To develop these themes, we turn in Sec. IV to the legal issues that the Soviets have used to highlight their concerns about the shuttle program and the NASP. Finally, we contrast the issues that the Soviets have stressed over time and suggest how Soviet attitudes toward the NASP program might evolve.

⁴See Benjamin S. Lambeth and Kevin N. Lewis, *The Soviet Strategic Defense Initiative in Soviet Planning and Policy*, The RAND Corporation, R-3550-AF, January 1988, pp. 46-48. See also Bruce Parrott, *The Soviet Union and Ballistic Missile Defense*, SAIS Papers in International Affairs, No. 14, School of Advanced International Studies, Johns Hopkins University, Washington, D.C., 1987, esp. pp. 53-79. For Soviet discussions of SDI response options, see two publications of the Committee of Soviet Scientists for Peace, Against the Nuclear Threat, "Space-Strike Arms and International Security," Moscow, October 1985, a report prepared for the 47th Pugwash Symposium, London, December 5-6, 1985, pp. 36-46; and "Shirokomasshtabnaya protivoraketnaya sistema i mezhdunarodnaya bezopasnost'" (Large-Scale Ballistic Missile Defense System and International Security), Moscow, February 1986, pp. 57-88.

II. SOVIET PLANS FOR HYPERSONIC AIRCRAFT

Soviet authors discussing the Soviet Union's plans for hypersonic aircraft portray the planes as the future of flight, a specific direction that Soviet aviation design is taking. They emphasize only commercial aircraft and space-lift applications, however, and completely ignore the military rationale for such programs. This one-dimensional approach fits in with the overall Soviet view that the U.S. space program has military goals, while the Soviet program involves peaceful purposes.

Since the 1960s, the Soviets have stressed two main advantages in aerospace craft. First, the flexibility that aerodynamic lift and propulsion give such vehicles will make them an important component of future space-launch capabilities.¹ Specifically, they will be able to land and recover on conventional runways, instead of on the distant steppes of Kazakhstan, where Soviet spacecraft normally land. Second, the aerospace craft will be reusable, and they will be able to return payloads from space for repair and refurbishment, thus extending reusability beyond the launch vehicle itself. In this way, aerospace planes will have an economic advantage over normal space-launch vehicles.²

Soviet attention to flexibility and economic advantage has varied over time, with major emphasis coming in the 1960s and again in the late 1980s, as the Soviets grappled with the rationale for their own shuttle program.³ During the 1970s and most of the 1980s, however, the Soviets strongly criticized the U.S. shuttle program, generally dropping references to the economy and flexibility of reusable spacecraft.

During this hiatus in the literature, Soviet attitudes toward the technical challenges of aerospace craft evidently changed. A 1968 source, for example, portrayed the problems of single-stage-to-orbit vehicles as "insurmountable" and proposed that the Soviet Union build

¹A detailed discussion of these issues is found in a three-part article by G. Nesterenko, "Mezhdru stratosferoy i kosmosom" (Between the Stratosphere and Cosmos), *Kryl'ya rodiny*, September, October, and December 1968.

²Nesterenko, October 1968. Economic advantage was also cited as a rationale for the TU-144 supersonic airliner during this period. See P. Starostin, "Pervyy sverkhzvukovoy" (First Supersonic), *Kryl'ya rodiny*, March 1969.

³For recent Soviet commentaries on this issue, see Yu. Tomilin, "Space: Confrontation or Cooperation," *Mirovaya ekonomika i mezhdunarodnyye otnosheniya*, No. 9, September 1987, in Joint Publications Research Service (hereafter JPRS), JPRS-TAC-88-002, January 14, 1988; and S. D. Grishin, "Space," *Zemlya i vseleennaya*, No. 6, November-December 1987, pp. 18-26, in JPRS-USP-88-002, April 6, 1988.

a reusable launch vehicle with attached rockets to lift it to orbit.⁴ Twenty years later, by contrast, another source stated that, although it would not happen in the near term, the technical challenges inherent in developing such vehicles would be overcome.⁵ Thus, Soviet recognition of technical advances in the field seems clear.

In 1988, a Soviet aircraft powered by a liquid hydrogen engine drew a flurry of international attention.⁶ Although not strictly a hypersonic vehicle, this aircraft was presented to the media following a series of revelations at such venues as the Paris Air Show about planned Soviet hypersonic developments. The Soviets described the small-scale model hypersonic planes that they exhibited at the Paris show as commercial airliners having no military potential. They would, it was said, overcome the disadvantages that had been found in supersonic aircraft, such as the TU-144.⁷

In the context of Soviet interest in NASP-like vehicles, Soviet authors have also noted that a spacecraft of the shuttle type can serve as a precursor to aerospace plane development and that the flight testing of shuttle structures at hypersonic speeds provides valuable data for the creation of aerospace planes.⁸ A space shuttle, in this Soviet view, is an interim step on the road to single-stage-to-orbit vehicles such as the aerospace plane.

⁴Nesterenko, October 1968.

⁵Grishin, *Zemlya i vseennaya*.

⁶Malcolm W. Browne, "Clean Hydrogen Beckons Aviation Engineers," *New York Times*, May 24, 1988. A Soviet announcement of the vehicle was issued by TASS, in English, May 28, 1988, in Foreign Broadcast Information Service, *Soviet Union Daily Report* (hereafter FBIS), June 3, 1988, p. 84. An earlier discussion of the aircraft was broadcast over Moscow Radio in English for North America, August 21, 1986, in FBIS, August 29, 1986.

⁷Moscow Radio, August 21, 1986. Considering the earlier enthusiasm for the TU-144, it is interesting that a 1987 article on the triumphs of the Tupolev design bureau did not mention the supersonic airliner. See A. Ponomarev, "Podvig aviastroiteley" (Feat of the Aviation Builders), *Aviatsiya i kosmonavtika*, July 1987.

⁸Nesterenko, December 1968; V. Gorenko, "The Shuttle Space System in Pentagon Plans," *Zarubezhnoye voyennoye obozreniye*, No. 4, April 1986, pp. 45-54, in JPRS-TAC-85-019, July 19, 1986; Grishin, *Zemlya i vseennaya*.

III. SOVIET VIEW OF NASP UTILITY: THEMES IN THE LITERATURE

Since word of the NASP program first emerged in the U.S. media in the mid-1980s, Soviet commentators have taken a decidedly negative view of it, portraying it first and foremost as a military program linked to the SDI and the purported U.S. goal of militarizing space. The literature on the NASP, in fact, almost always links the program to the SDI. Two important exceptions—articles published in 1984 and 1985, before the NASP program was officially announced—focused on military missions for the U.S. aerospace vehicle outside the SDI context.¹ The missions discussed were reconnaissance, command and control, combat strike, and space control.²

The 1985 article also discussed the space-lift capability of the aerospace vehicle, but focused on its military aspect. Such a vehicle would be needed, the author asserted, to replace satellites that had been damaged in low earth orbit in the course of an antisatellite campaign.³ The national aerospace plane, in short, was portrayed as destined for military use, with absolutely no commercial applications, even for lifting payloads into orbit.

Soviet literature about the NASP, however, rarely discusses specific military missions. Most authors link the program to the SDI, which they portray as a ploy to extend U.S. strategic offensive weaponry into space. The shuttle and the NDV alike, in this view, play an important role in “Star Wars,” the aim of which is to create a space-based strategic force designed to strike targets on the ground, in the atmosphere, and in space.⁴ The NDV in particular is portrayed as a flexible and capable system for striking targets in the atmosphere.

¹See V. Kislov, V. Yeremeyev, “Gyperzvukovye samolety” (Hypersonic Aircraft), *Krasnaya zvezda*, January 25, 1984; M. Krymov, “Zvezdnyy militarizm” (Star Wars), *Aviatsiya i kosmonavtika*, No. 2, 1985, pp. 46-47. Marshal Yefimov, commander in chief of the Air Force, also mentioned surveillance and interceptor missions for hypersonic aircraft in a 1987 interview. See *Narodna Armiya* (Sofia, Bulgaria), January 7, 1987, in FBIS, January 11, 1988, p. 71.

²The Soviets seem to use “space control” similarly to the way they use “sea control,” i.e., to mean control of the sea sufficient to deny the enemy the advantages of superiority, at least in certain areas and for certain periods.

³Interestingly, although Krymov seems to imply damage from a *Soviet* antisatellite system, the Soviets officially deny any military activities in space.

⁴Moscow TASS in English, July 24, 1985, in JPRS-TAC-85-027, August 29, 1985; V. Chernyshev, “The Pentagon’s Dangerous Adventurism: What the Space Shuttle Program Conceals,” *Krasnaya zvezda*, January 19, 1985, 2nd edition, in FBIS Worldwide Report/Arms Control, July 19, 1985; Gorenko, *Zarubezhnoye voyennoye...;* E. Ermakov, “Ne v ugody li SDI?” (Won’t SDI Be Welcome?), *Aviatsiya i kosmonavtika*, February 28, 1987.

The point that the Soviets regard reusable aerospace vehicles as a component of the next generation of U.S. strategic offensive weapons was driven home in the aftermath of the *Challenger* explosion, when the Soviet media were attempting to make propaganda points from the accident. According to one source, a *Challenger*-like explosion of an NDV “crammed with armaments” might spur the Soviet side to immediate retaliation.⁵ This theme, clearly an attempt to raise Western public concerns about the *military* nature of the shuttle and NASP programs, highlights the Soviet insistence that the NDV will be part of the U.S. strategic offensive arsenal in the next century.⁶

The strategic weapon emphasis fits in with Soviet assertions that the NASP will play a role in bomber modernization. According to the military authors, strategic bombers will be modernized in a space context, with barriers between the atmosphere and space eliminated for operational purposes.⁷ As in the SDI campaign, the authors portrayed the U.S. aim as far from defensive. In their view, the United States is bent on creating a “completely new nuclear arsenal” based in space.⁸

According to another article, an NDV, together with a U.S. space station, could perform as a space-based reconnaissance-strike complex.⁹ The Soviet military have portrayed reconnaissance-strike systems as a major and fundamentally new threat to their military capabilities at the theater level. By linking an NDV to a space-based “strategic” reconnaissance-strike system, the author seemed to be signaling that the Soviets would consider the vehicle, in conjunction with other sensor systems, to be a major threat to Soviet strategic targets. Although the source did not specify these targets, another article noted that

⁵Moscow Television Service in Russian, February 6, 1986, in JPRS-TAC-86-019, February 28, 1986; see also *Krasnaya zvezda*, February 4, 1986, p. 3, in JPRS-TAC-86-019, February 28, 1986.

⁶One author intimated that the NASP program was begun in the wake of the *Challenger* disaster as an ambitious “new start” that would bolster public support for U.S. space activities. Yu. Okunev, “Amerikanskiy proyekt vozdušno-kosmicheskogo samoleta” (American Aerospace Plane Project), *Zarubezhnoye voyennoye obozreniye*, No. 3, 1987, pp. 45-46.

⁷Chernyshev, *Krasnaya zvezda*; Gorenko, *Zarubezhnoye voyennoye....* For a more general discussion, see A. Podberezkin, “Imperialism Unmasked: Washington’s Military Space Programs,” *Voyennyye znaniya*, No. 1, January 1986, pp. 46-47, in JPRS-TAC-86-043, May 30, 1986.

⁸V. Goryainov, “VVS SShA: Orudiye ‘neoglobalizma’” (U.S. Air Force: Weapon of “Neoglobalism”), *Aviatsiya i kosmonavtika*, July 1986.

⁹L. Tkachev, “Oruzhiye agressii” (Weapon of Aggression), *Aviatsiya i kosmonavtika*, June 1985.

they would include mobile weapon systems.¹⁰ The second article also noted, however, that an NDV could itself serve as a highly mobile reconnaissance system, with greater flexibility than an orbital platform, such as the space station.

Soviet sources have not commented extensively on other aerospace vehicle programs, such as the British HOTOL or the German Sanger projects. One short commentary on the HOTOL focused, as in the NASP case, on its potential role in strategic-weapon modernization, calling the HOTOL a “launch platform for a new generation of superweapons.”¹¹ It was also said to be capable of deploying strike weapons in space.¹²

As mentioned above, Soviet commentaries on NASP research have consistently criticized its military aspect and its possible application to a new round of the arms race involving the militarization of space. Soviet commentators have made the NASP synonymous with U.S. intent to deploy a new strategic offensive capability in space. In that sense, the themes attached to the NASP were identical to themes attached to SDI and the shuttle programs.

A new theme appeared in June 1988: For the first time, a Soviet official interviewed in the government newspaper *Izvestiya* portrayed the U.S. aerospace plane as both a welcome development in the technological sphere and a potential boon to U.S.-Soviet cooperation in space.¹³ According to G. Byushgens, the deputy director of the Central Aerohydrodynamic Institute (TsAGI), an NDV would be able to replace space launch vehicles that “have not lived up to hopes”—suggesting the shuttle program. In his view, an NDV would provide the United States with tremendous lift potential, serving as a valuable freight carrier and repair ship for space stations, industrial platforms, and satellites in low earth orbit. He also returned to the more general approval of reusable space launch vehicles that had characterized the Soviet literature of the 1960s, saying that they would be more economical and flexible than single-use rockets.

One of the most interesting aspects of his commentary was his assertion that, far from being regarded as a threat to the Soviet Union, the NASP should be viewed as an element of U.S.-Soviet cooperation in space, especially in a joint Mars project. He even suggested that

¹⁰Kislov and Yeremeyev, *Krasnaya zvezda*.

¹¹S. Mushkaterov, “British Contribution to SDI,” *Izvestiya*, December 26, 1986, p. 4, in JPRS TAC, March 6, 1987.

¹²For another Soviet commentary on the HOTOL program, see V. Gorenko, *Zarubezhnoye voyennoye obozreniye*, No. 11, November 1987, pp. 44-47, in JPRS-UFM-88-004, May 10, 1988.

¹³V. Belikov interview with G. Byushgens, “Vozdushno-kosmicheskii samolet: sensatsiya aviasalona” (Aerospace Plane: Sensation of the Air Show), *Izvestiya*, June 1, 1988.

if the United States were to take the lead in developing an aerospace vehicle and share the results with the Soviet Union, the Soviet space program could take the lead in a different but equally expensive project. Neither country, he stated, can now afford duplicative efforts in space research.¹⁴

Thus, the Soviets have returned at least once to the public enthusiasm that they showed in the late 1960s for the development and application of hypersonic and aerospace vehicles. As those involved in Soviet space policy continue attempts to develop cooperation with the United States and other space programs, it will be interesting to watch this trend evolve. Soviet efforts to describe a public rationale for their own shuttle program will also provide perspectives on the value of reusable space launch vehicles. Given the aspects of Soviet hypersonic research that have already emerged into the open, one may assume that some kind of aerospace plane will play a part in these discussions.

¹⁴Others in the Soviet space policy community have raised this theme, notably Roald Sagdeyev, formerly the director of the Institute for Space Research (IKI); see Flora Lewis, "Is Soviet Science Ailing?" *New York Times*, July 10, 1988. See also Tomilin, *Mirovaya ekonomika*....

IV. NASP AND SOVIET LEGAL LITERATURE

To gain further insights into potential Soviet reactions to the NASP, we next turned to the legal literature. Because we could find only a small number of articles by military writers discussing the NASP, we decided to investigate other possible avenues that the Soviets could take to delay or otherwise react to the NASP program. They might, for example, propose international legal restrictions on the operation of vehicles like the NASP, as they did in 1963. On that occasion, Soviet diplomatic and legal action contributed to the U.S. decision to cancel the Dyna-Soar program.¹

We discovered that Soviet legal authors classify the aerospace plane and similar reusable manned vehicles in the same category as the space shuttle. Indeed, most Soviet legal articles that discuss the aerospace plane do so in the context of variants of the space shuttle. Thus, many issues raised in Soviet discussions of the space shuttle's legality apply to the NASP case, especially

- Environmental damage
- Violation of national territory by overflight
- Harm to a satellite from close approach by the vehicle
- Weapon-carrying potential of the vehicle.

This approach of studying Soviet legal writings allowed us to glean additional useful insights into Soviet reactions to the NASP. However, it also substantiated the conclusion that, as the Soviets elaborate a rationale for their own shuttle program, their public assessment of the U.S. shuttle and the NASP are likely to change. They will be unable to argue, for example, that sonic boom or ozone depletion problems of a Soviet shuttle will do less harm than those of an American shuttle. Although the Soviets will probably continue to classify the U.S. programs as having military goals and their own programs as having peaceful ones, the questions that they have raised in the legal literature—especially environmental and sovereignty considerations—will apply equally to each country's aerospace vehicles.

¹See Houchin, pp. 279-280.

The environmental consideration is likely to gain in importance as Soviet leaders devote ever greater attention to environmental problems and the Soviet public becomes more vocal in its opposition to environmental damage of all kinds. In addition, the Soviets are trying to cut costs in the military sector, and in the space program in particular. Thus, they are likely to reconsider both their aerospace plane and their shuttle in their budget process.² The Gorbachev regime, in short, is holding such programs to new standards, and their proponents are therefore hesitating to criticize the U.S. shuttle and the NASP for fear that such criticism might affect the Soviet programs.

The Soviets object to three types of purported environmental damage by the shuttle and other reusable manned spacecraft: sonic boom, ozone depletion, and pollution from rocket fuels.

The U.S. space shuttle produces sonic booms on launching and landing. Although NASA altered shuttle launch and return paths to decrease sonic booms over populated territory, the Soviets have continued to denounce the damage as excessive. They also claim, oddly, that the shuttle's booms harm ships on the open ocean.³

The Soviets also complain about ozone depletion: "Since the American space shuttle began operation, the combustion products of the solid-fuel engines of the first stage have had a harmful effect on the ozone layer of the atmosphere."⁴ As for the other rocket pollutants, the Soviets claim that even a few shuttle launches would introduce enough aluminum oxide particles into the earth's atmosphere to raise atmospheric reflectivity and change the radiation-heat balance, thus altering climatic conditions.⁵

Certain provisions of the 1967 Outer Space Treaty and the 1977 convention banning the military uses of space oblige nations to limit the environmental damage from their space activities. Several Soviet authors have proposed strengthening these provisions through additional treaties. The new measures, the Soviets assert, should "relate to specific

²Boris Yeltsin, the Soviet reformist politician, has been especially critical of the cost of the space program. For comments on the problems and expense of the Soviet shuttle, see Kathy Sawyer, "Soviet Shuttle's Mission Undefined," *Washington Post*, April 30, 1989.

³A. I. Rudev, "'Speys Shattl': politiko-pravovyye problemy" (Space Shuttle: Legal-Political Problems), *Sovetskoye gosudarstvo i pravo*, No. 4, 1981, p. 89; A. Rudev, "'Speys shattl' i kosmicheskoe pravo" (The Space Shuttle and Space Law), *Aviatsiya i kosmonavtika*, No. 3, 1983, p. 36; V. S. Vereshchetin (ed.), *Pravovyye problemy poletov cheloveka v kosmose*, Moscow, 1986, p. 66.

⁴Vereshchetin, pp. 67-68. Rudev cites provisions of the 1967 Outer Space Treaty that prohibit harmful environmental effects, but he also notes that there are deficiencies in the treaty, including lack of specificity. Rudev, 1981, p. 89.

⁵Vereshchetin, p. 68.

characteristics of the launch and operation of manned reusable spacecraft,” especially the prevention of sonic booms and excessive discharge of materials in near-earth space.⁶

Where violation of national territory is concerned, the Soviets regard their airspace—as distinct from outer space—as sovereign territory. Prior to 1979, neither the United States nor the Soviet Union paid much attention to the question of an exact boundary between airspace and outer space. But doubtless in reaction to the space shuttle, the Soviets began in 1979 to press for the establishment of such a boundary at 100-110 kilometers, the altitude needed to establish orbit.⁷ They later altered this position to allow for overflight at lower altitudes by space vehicles entering orbit or returning to earth. This concession did not, however, include the space shuttle: “We must emphasize that the privileged right...cannot be extended to cosmic vehicles of the space shuttle type.... Flights of the space shuttle in low orbit over the territory of other states can be seen as a violation of the latter’s sovereignty.”⁸

Probably the greatest concern of the Soviets stems from the space shuttle’s ability to maneuver close to satellites: “The U.S. does not hide its intentions of conducting, under various pretenses, operations such as approaching the space facilities of other nations and conducting various operations with them, including inspecting them, knocking them out of order, removing them from orbit, or destroying them.”⁹ In reaction to this alleged U.S. policy, Soviet legal writers emphasize that satellites are sovereign territory. Several have proposed establishing security zones around satellites wherein other spacecraft would be prohibited from approaching orbiting ships and stations and maneuvering near or inspecting them.¹⁰

In terms of the shuttle’s weapon-carrying ability, its potential as both a platform for space-based weapons and a means to ferry “all prospective payloads for military purposes” to space platforms for further assembly in particular seems to worry the Soviets.¹¹ This concern is linked to the Soviet campaign against the SDI, which would require the assembly of defensive weapons and sensor systems in orbit.

⁶Ibid., p. 67. See also Rudev, 1981, p. 89; and Rudev, 1983, pp. 36-37.

⁷E. G. Vasilevskaya, “O vysotnom razgranichenii vozdušnogo i kosmicheskogo prostranstva” (Concerning the Upper Delimitation of the Atmosphere and Outer Space), *Sovetskoye gosudarstvo i pravo*, No. 11, 1979, pp. 100-105.

⁸Rudev, 1981, p. 93.

⁹Vereshchetin, p. 69.

¹⁰A. Rudev and P. Lukin, *Kosmos i pravo*, Moscow, 1980, p. 104.

¹¹Rudev, 1981, p. 91.

Soviet space law experts have recognized that the space shuttle is a new type of vehicle and that the existing law and treaties about space do not adequately take account of its capabilities. They thus call for "a special international accord...forbidding the placement of weapons of mass destruction on space entities of the [shuttle] type."¹²

Although Soviet legal writings group the NASP with the space shuttle, objections to the two programs cannot be identical. For example, a NASP-derived vehicle will not use the same type of solid-fuel engines as does the shuttle; thus, it will not leave behind aluminum oxide particles. In addition, the NASP should create a far smaller sonic boom than does the shuttle or a supersonic aircraft.¹³

Other objections, however, will likely remain valid. Especially important will be the issue of a boundary between airspace and outer space. The aerospace plane will fly high, but not always at orbital altitudes. Thus, the acceptance of the Soviet proposal for a boundary at 100-110 kilometers would severely restrict the maneuverability of the NASP.

Soviet legal scholars will probably also continue to link the NASP to weapons in space and to the unresolved legal issues surrounding SDI. Recognizing that existing treaties deal vaguely with the military activities that are allowed in space, they have proposed specific measures calling for a total ban on any type of weapon in space. These included draft treaties presented to the United Nations in 1981 and 1983 and draft resolutions to the UN General Assembly in 1984 and 1985.¹⁴ The Soviets could use such proposals to stop or delay the development of the NASP.

Since 1987, however, the Soviets have published no articles critical of the U.S. space shuttle in their main legal journals. The cessation of such articles closely coincided with their announcement that they were preparing to launch their first space shuttle. As noted above, this development suggests a new sensitivity in the Soviet space and defense communities to criticisms of the U.S. shuttle or NASP that might be turned against their own programs. In an era of budget stringency and concern about environmental damage, advocates of Soviet programs cannot afford to allow public criticism of a U.S. concept or technology also under development in the USSR.

¹²Ibid., p. 92.

¹³The sonic boom created by the NASP at takeoff will be several times higher than that from a supersonic aircraft but it will decrease rapidly as the NASP flies an orbital injection trajectory to higher altitudes.

¹⁴For details about the 1981 and 1983 draft treaties, as well as the 1984 and 1985 draft resolutions, see David S. Myers, "Soviet Proposals on the Militarization of Space," *Space Policy*, Vol. 2, 1986, pp. 240-252. See also Malcolm Russell, "Military Activities in Outer Space: Soviet Legal Views," *Harvard International Law Journal*, Vol. 25, No. 1, 1984, p. 188.

Thus, although the legal literature on the shuttle has enabled us to discover issues that are of importance to the Soviets in the NASP case, the literature is likely to change in emphasis as they attempt to grapple with the implications of their own shuttle program. They may, for example, begin to take a more accommodating approach to the issue of airspace sovereignty during various stages of shuttle flight. Much will depend, of course, on their own concept of shuttle operations.

V. CONCLUDING OBSERVATIONS

In conclusion, we should like to emphasize several points. First, the Soviets are conducting significant research into hypersonic flight, and although they describe it as being limited to commercial applications, it probably underpins an important military program. Thus, the United States should not discount the Soviet potential to build their own aerospace plane with military applications.

At the same time, the Soviets clearly have displayed only modest concern over the NASP program. Unlike their campaign against the strategic defense initiative, they have mounted no sustained criticism against the NASP. In discussing the latter, most often they have presented it as just another aspect of the overall SDI program. In this context, SDI, the shuttle, and the NASP all become linked to strategic offensive weapon modernization in space—the so-called militarization of space. The Soviets have not specifically discussed the military potential of the NASP in significant detail.

The Soviets have, however, clearly recognized the bomber modernization potential of the NDV, the fact that it may provide a wholly new capability to the air-breathing leg of the triad in the next century. They have also linked the NDV to a possible reconnaissance-strike capability at the strategic level. Since real-time reconnaissance-strike has been of major concern to them in the European theater, this “strategic” potential—payload delivery to any point on earth in ninety minutes—must seem like the serious worsening of an already bad threat.

Soviet commentators have provided no sense of how the Soviet Union would respond to such a threat, however. The modest nature of their public comments on the NASP program suggests, in fact, that Soviet policymakers are continuing to concentrate on a response to SDI. To the extent that the SDI and the NASP have been linked in the literature, Soviet responses to the SDI can also be viewed for their relevance to the NASP case. The Soviets have stressed, for example, the possibility of striking ground-based facilities associated with a strategic defense system, and one may infer that such facilities supporting the NASP could also become targets. They have not, however, mentioned the possibility of developing surface-to-air missiles (SAMs) or other specific countermeasures to NDVs.

The current Kremlin leadership may feel that the Soviet Union can diffuse the threat by encouraging a view of the NASP as a mode of U.S.-Soviet cooperation in space. Realizing the effect that budget stringency is also having in the United States, Soviet

policymakers might argue that cooperative development of a space plane would allow both sides to claim cost savings under a joint program. A cooperative effort would also allow the Soviets to bring their own research into the open. To the extent that the Soviets can encourage the United States to think in those terms, the NASP program might decrease as a military threat while increasing in its potential to contribute to long-standing Soviet goals in space—for example, the Mars project.

At present, most indicators show Soviet concern at the military potential of the NASP program. The continuation of the NASP program in some form and the promise of eventual military applications will require the Soviets to respond to the threat. Their response, as in the SDI case, will most likely stress solutions that are the simplest and least expensive to develop and deploy. Rather than grappling with the vehicle directly, for example, the Soviets may choose to attack its ground support elements, should they be vulnerable. Their response to the NASP, in short, would probably show the same attention to controlling costs and complexity that their responses to the strategic defense initiative showed.

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