Space Spies in the Open: Military Space Stations and Heroic Cosmonauts after the Moon Race Was Lost, 1971–1977

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Abstract

During the 1970s the USSR launched a series of military space stations camouflaged in a civilian program. These stations represented an effort to reestablish the USSR as a space-faring nation in the aftermath of having lost the race to the moon and as a solution to the Defense Ministry's desire to recharge their challenge to the Americans in space. Initiated with the confidence that managing both civilian and military human spaceflight programs was a possibility, Soviet planners doubled down on this commitment by operating four human spaceflight programs at once – two secret and two relatively open. Separating the layers of the military component of the program from civilian is an extremely delicate procedure that reveals the precarious reality of building a human-tended military outpost in space that answered the military requirements of photo surveillance and physical defense against attacks in or .

In 1970s, the Soviet space program turned from its origins of the Cold War and developed its own, new and more internally defined course that maintained the many of the mythologies that had originated in the 1960s.[1] While the Apollo 11 moon landing marked a watershed in the Space Race, from the Soviet perspective all that changed was that there was no longer a head-to-head public competition between the two sides. From a Soviet perspective, competition had not ended. The US had truncated planned Apollo lunar missions and turned its focus solely on developing a reusable orbiter for the 1970s. The USSR found itself with human spaceflight hardware built and prototyped for a moon program and a program to place humans in low earth orbit for weeks at a time. They also had orbital hardware that had been overlooked due to internal infighting among design groups.[2] What resulted was a human spaceflight program devoted to a series of human tended military space stations that had been

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1 Slava Gerovitch, *Soviet Space Mythologies: Public Images, Private Memories and the Making of a Cultural* Identity, Pittsburgh, University of Pittsburgh Press, 2105, 1–26. See also the contributions to the second volume in this European astroculture trilogy, Alexander C.T. Geppert, *Limiting Outer Space: Astroculture After Apollo*, London 2017: Palgrave Macmillan.

2 A highly detailed of the rivalry between Sergei Korolev and Vladimir Chelomei is featured in: Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race, 1945–1974*, Washington, CD: NASA, 2000 234, 591–2, 843.

cobbled together from a previous era's hardware that folded a civilian program and a military-curated program together.

The result of the two space powers quickly changing directions of their human spaceflight programs after the Moon Race was that public perceptions turned on their heads. Without a clear, definable objective and a dwindling list of remaining firsts to be accomplished, the public could no longer measure the relative position of the competitors in this new era of the Space Race. The US closed out the Apollo program through a rump space station program by repurposing Apollo hardware and then took a long hiatus in human spaceflight, leaving an impression of the Americans turning away from human spaceflight. In contrast, the USSR progressed headlong into a venture into sustained human presence in space that sustained their public presence in space. They appended a new military program to the public space station. This program included a shielded project that seem to fulfill what had been an early 1960s American Air Force aspiration of establishing a military space station. The Americans had discarded the duplicative effort of running both a military and civilian human spaceflight programs once it became clear that robotic reconnaissance was the better alternative. The USSR took up the dual missions. The new space station program had a public face of continued flights of increasing duration under a public program, using two separate hardware systems that had been designed in the previous decade. And the USSR continued the much-denied program to send humans to the moon. They also took on a fourth mission or cooperating with the United States in human spaceflight rescue and safety at the same time. From the outside, the USSR seemed to be ascending in space as the US dismantled the Apollo program. Internally, the human spaceflight program was quadrupling its programs in spite of the fact that the space program had declined in the mid-1960s.[3]

Examining how the USSR managed these multiple purposed programs, especially the introduction of a shadow, military program touches on many issues of how the Soviet space programs transitioned from the heyday of human spaceflight in the 1960s that captivated the world's imagination to an age of stagnation in the 1980s. Spaceflight in the 1970s operated in a political environment that was increasingly disconnected from Soviet civil culture in the arts, literature and human rights that would ultimately undercut Soviet authority for in the next decade. In the 1960s, the space program had celebrated a hope for a bold new future for the country. By the 1970s, the human spaceflight program represented yet another bureaucratic tool of the Brezhnev

[3] Discussions of issues that emerged while balancing multiple programs can be found in the memoirs and diaries of the time and the outcome of these negotiations can be found in the collection of published documents that RKK Energiia published after the collapse of the USSR. See: Boris Chertok, *Rakety i liudi: lunnaia gonka*, Moscow: Mashinostroenie, 1999, here 208; Add here Kamanin, Chertok, Semenov

regime that fixated on the present and offered few if any promises for the future. Key to unraveling this mystery is an understanding of the climate and assumptions under which the Soviet space program and especially that of human spaceflight operated during the 1970s. Although linked by technology and scientific doctrine and both programs were distinct in their by politics during the first decade of the space age. The second, and more difficult comparison is to overall Soviet military doctrine of the time to assess if the military human space program did operate and change according to overall Soviet military doctrine or if it remained a battleground for bureaucratic infighting. This bureaucratic infighting suggests that in the case of human-tended military operations in space, the Soviet military lacked the influence to override other, civilian concerns outright.

The US and Soviet space programs diverged at this point, not only because the Americans had won the Moon Race, but because the era of thrilling firsts was now over..[4] The military origins of spaceflight are clear on both sides of the Cold War. Each side used the technology that emerged from the Second World War in remarkably similar ways for both military, strategic and propaganda purposes.[5] The rockets, navigation systems and even the first men to fly in space had their origins in the military. The military benefits of spaceflight were evident. Weather satellites and navigation systems, and as are those of communications and Earth observation were space based infrastructure that had become necessities first to national defense.[6] Where this argument falls apart is the fixation on human spaceflight. The origins of the hardware and technology of human spaceflight were military; there was little or no military justification for the first decade of human activities in space. The US had made this clear with the creation of NASA, a civilian agency, in 1958. On the other hand, the Soviet Union relied on a more precarious balance between military and civilian activities absent an administrative demarcation. The late 1960s and early 1970s were a period of rapid change in Soviet military policy. These changes addressed the changing political and technological nature of the Cold War, the transition from the immediate post-War era of Khrushchev to that of Brezhnev and the increasingly fragile and strained Soviet economic and foreign political conditions. [7] portion of the Soviet military budget.

American motivations for continuing spaceflight during the Post-Apollo period cannot be applied/transferred/transposed to Soviet planning. The USSR did not face the sharp edge of cost accounting that was routine in the US and became more

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4 Paul Stares, 'U.S. and Soviet Military Space Programs: A Comparative Assessment,' *Daedalus* 114.2 (Spring 1985), 127–49.

5 Ibid., 127.

6 Ibid.,129.

7 Siddiqi, *Challenge to Apollo*, 781.

commonplace in mid-1980s in Russia. As had been true since 1957, outer space had both a public and military face. Human spaceflight retained value in public relations that could offset monetary costs. Space stations maintained the illusion of an emerging Soviet utopia in space that rested on the heroic legends of the previous decade. The military aspect of the program satisfied lingering need to demonstrate the military competition against the Cold War foe. Where Soviet Premier Nikita Khrushchev (1894–1971) had relied frequently on rhetorical and symbolic competition, his successor Leonid Brezhnev (1906–1982) returned to direct military confrontation. The idea of the militarization of Russian and Soviet society was generally accepted among twentieth century historians of the region.[9] The tradition of maintaining a large standing army, external threats notwithstanding is well-documented under Tsarist and Soviet rule. The infusion of military culture into the population was a tried and true way to maintain legitimacy and served as a reinforcing strength to Party authority.[11] Khrushchev had recognized the need for substitute assurances for a society that was facing its first adult generation that had no personal memory of war or civil war. He had sought to placate the generation with promises of a future in space, easy harvests and full communism within their lifetimes. Brezhnev sought to placate that generation with time-honored references to military traditions without completely abandoning the communist hopes for the future.

I. Routinization of Human Spaceflight

For both the US and the USSR human spaceflight captured the world's imagination during the 1960s in large part due to the rapid succession of first-time accomplishments. For a public that had long dreamed of spaceflight, each day seemed to break new barriers. The process of making human spaceflight routine also included the challenge of managing the high expectations of the 1960s. Routine should not become boring. The Soviets had an added challenge in managing expectations, because this transition coincided with the political task of rolling back expectations from the ambitious projections of Nikita Khrushchev. During his eight years in power, Khrushchev had made outrageous promised for the immediate Soviet future. He used spaceflight as a prophecy of things to come. Unpeeling the links between the accomplishments of the 1960s from the promises of accomplishing socialism within the next decade was a difficult task. Brezhnev's overarching policy of removing evidence of Khrushchev's management of the USSR notwithstanding, the Soviets had had no intention to abandon human spaceflight in the late 1960s and early

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9 Dimitri K. Simes, 'The Military and Militarism in Soviet Society,' *International Security*, Vol. 6.3 (Winter 1981–1982), 124–6.

11 Ibid., 131–5.

1970s. Cuts in the program had eliminated plans for an all-woman crew on a Voskhod spacecraft or any subsequent Voskhod flights after Leonov and Belayev's Voskhod 2 flight in 1965 during which Leonov became the first human to make a spacewalk. Male cosmonauts maintained their training for a series of planned, but unfunded missions that sustained administrative momentum. The design and testing for an operational Soyuz spacecraft had been the primary delay to launching humans into space from 1967 until 1969. Though, in contrast to the N-1 launch vehicle, the Soviet lunar rocket, the Soyuz problem was soluble despite the limited resources that the program had at its disposal. The flights of Soyuz 3 through 9 demonstrated that the spacecraft that had killed Cosmonaut Vladimir Komarov (1927–1967) had been made reliable for human flight. And yet a ferry craft without a mission to the Moon had to have another destination. The continued N-1 Moon rocket failures through 1974 placed the Moon beyond the Soviet's grasp. An orbiting space station in low Earth orbit could be an achievable accomplishment, one that could give the impression of a whole new direction with only a modest investment. At least two design bureaus recognized this next step. Each prepared their own design of a space station that would rely on the existing heavy-lift launch vehicle, the Proton. Originally proposed as a heavy-lift ICBM, the Proton had been the reliable vehicle to send probes to explore the solar system. .

Figure 1	The N-1 launch vehicle on launch pad in 1974.
Source:	Courtesy of US. Department of Defense.

A Proton launch vehicle sent the Salyut 1 space station into orbit on 19 April 1971. The official and secret Soviet designation of the station was DOS-1, for the acronym in Russian for 'Long-Term Orbital Station'. With only one docking port, the 15.8-meter long and 4.15-meter diameter station had a 90-cubic meter habitable volume, that is about the size of a large studio apartment. Four days after the station entered orbit and once preliminary systems turned on, Soyuz 10 launched to dock with the space station with a three-man crew that included Cosmonauts Vladimir Shatalov (commander, 1927-), Aleksei Yeliseyev (fight engineer, 1934-) and Nikolai Rukavishnikov (test engineer, 1932-2002). Shatalov had flown on board two previous Soyuz missions, Soyuz 4 and 8.[12] Yeliseyev had spacewalked from Soyuz 5 to 4 and was the flight engineer on board Soyuz 8. This was Rukavishnikov's first flight in space. The new docking adaptor that would allow internal access to the space station from the

[12] Precise numbering of Soyuz missions, or any series of Soviet space projects, is difficult, as the anonymous designation 'Kosmos' was used for test missions and failures for all launches without impact on sequence numbers.

Soyuz. Unfortunately, the Soyuz failed to achieve a hard dock and the mission was abandoned. The space station would not receive any occupants at the time.[13]

Six weeks later Soyuz 11 launched with a new three-man crew. Georgi Dobrovolskii (commander, 1928-1971), Vladislav Volkov (flight engineer, 1935-1971) and Viktor Patsayev (test engineer, 1933-1971) had originally been the back-up crew assigned to the mission, but the primary flight engineer Valeri Kubasov had received an anomalous reading on a chest x-ray that suggested that he had been exposed to Tuberculosis. This medical problem disqualified the entire crew that included Aleksei Leonov as commander and Pyotr Kolodin as test engineer (third seat). This was the first spaceflight for the commander Dobrovolskii. Volkov had a previous mission on Soyuz 7. Test engineer Patsayev was making his maiden voyage into space, too. Soyuz 11 successfully docked with Salyut 1, the cosmonauts entered the station and for 22 days, Soviet media updated the public with their activities on board Salyut 1.

Salyut 1 activities included live television broadcasts, Earth observations and photography. And even when a fire broke out on the eleventh day of their mission, mission control allowed them to continue with their flight plan. The Soyuz 11 crew broke the 18-day orbital mission record of Soyuz 9 and undocked from the space station and returned to Earth on 30 July 1971. When recovery crews arrived at the landing site and opened the landing capsule, they discovered that all three cosmonauts were dead, two firmly strapped into their seats. The third had made initial movements in attempt to close a valve in his last seconds of consciousness. A breathing ventilation valve had opened prematurely during descent instead of automatically adjusting cabin pressure at an altitude of 168 kilometers, and the gradual and complete loss of pressure was fatal. Previous Soyuz crews had worn spacesuits only as a necessity for spacewalks to gain external access to another spacecraft and provided a life support backup. In order to squeeze three people into a Soyuz spacecraft, cosmonauts had foregone spacesuits in their capsule. This plan was not beyond the Soviet's experience of risk. In 1964, in order to preempt the US Gemini program, they had launched a crew of three in a modified single passenger Vostok spacecraft without the backup support of spacesuits. The Voskhod crew had returned safely without pressurization incident. The risk of travelling into space without spacesuits had been normalized. Between 1967 and 1971, the only spacesuits that the Soviet cosmonauts used were for

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[13] Theodore Shabad, Special to the New York Times, "Soyuz Orbit Shifted; Link to Lab Awaited: Soyuz Orbit Shift Hints at Lab Link-up," *The New York Times*, (1923-Current file) [New York, N.Y] 24 April 1971: 1 and 58. Due to the fact that the mission intentions were not announced in advance, the objective of the Soyuz 10 mission was never published in the Soviet press. It was western analysts who mad the conjecture that the Soyuz 10 failed to dock. This conclusion was later confirmed in post-Soviet published sources and memoires.

extravehicular activities. The Salyut 1 space station mission had been a success. It was the landing that cost the Soyuz 11 crew their lives.[14]

II. Camouflaging the Military Salyuts with Civilian Programs

Plans for an Orbiting Piloted Station (OPS), code-named Almaz had been approved in 1968 about the same time that the DOS space stations were designed.[15] The DOS stations arose as a direct response to the Soyuz legacy that the Korolev design bureau faced in the late 1960s.[16] The original target launch date for the Almaz space stations had been the hundredth anniversary of Lenin's birth in April 1970. Vladimir Chelomei (1914-1984), Sergei Korolev's professional rival, had designed the station as a complete system with its own including a non-Soyuz cosmonaut transport system, the Transport Supply Spacecraft (TKS).[17] Chelomei's goal had never been to design an explicitly military station, but to design a successful human spaceflight alternative to Korolev's 1960s designs that had dominated the Soviet space program under Khrushchev. Chelomei's designs found institutional patronage in the Ministry of Defense under Ustinov.[18] The reality of building a completely new system and having it ready for launch caused delays in the schedule, causing Chelomei and the Ministry to defer their first launch to the Korolev Design Bureau's DOS station first. Another casualty of schedule was the TKS ferry vehicle that would deliver cosmonauts to Salyut. Both programs had to rely on the Soyuz ferry that the Korolev team had designed for DOS.[19] The Almaz system would have to adopt Soyuz navigation and dockingsystems.

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14 Bernard Gwerztman, Special to The New York Times, "Drop in Pressure Hinted in Deaths of 3 Astroanuts: Top Soviet Scientist, at Red Square Funeral, Reports an Unexpected Occurrence: Embolism Suggested Ashes of Men Are Placed in Urns at Kremlin Wall -- Thousands Mourn; Pressure Drop Hinted in Soyuz Deaths, "New *York Times* (1923-Current file) [New York, N.Y] 03 July 1971: 1.

15 The names of the Russian stations were very similar. The civilian stations build by Korolev's design bureau, OKB-1, were known as DOS stations, transliterated from the Russian for Long-Term Orbital Station (Dolgovechno Orbytal'naia Stantsiia). The Almaz stations received the code name of the Russian word for diamond. Boris Chertok, *Rakety i liudi: lunnaia gonka*, Moscow: Mashinostroenie, 1999, here 208; Kamanin, *Skrytyi kosmos, tom 2*, Moscow: Izdatel'stvo "RTSoft", 2013, 37; and Iurii P. Semenov, ed., *Raketno-kosmicheskaia korporatsiia 'energiia' imeni S. P. Koroleva, 1946-1996* (Korolev: RKK 'Energiia,' 1996, here: 267.

16 Ibid., 218.

17 Sergei Khrushchev, son of Nikita, and an engineer by training, has provided as close to a first-hand account of the feud between Sergei Korolev and Vladimir Chelomei and their competition for scarce resources and patronage within the Soviet rocket community. See Sergei N. Khrushchev, *Nikita Khrushchev and the Creation of a Superpower*, State College: Penn State University Press, 2001, 746–52.

18 Chertok, *Rakety i liudi*, 210.

19 The decision to abandon, or at least put on hold the TKS transport system placed an added burden on the cosmonauts and their infrastructure. This required training teams from DOS, Almaz, the lunar program and ultimately the Apollo-Soyuz Project to carry out

The Almaz system demonstrated how the layer of militarization was applied to the human spaceflight program. The US Air Force Manned Orbiting Laboratory (MOL) program had begun as a large-scale, human tended space station program that was fully independent of NASA's Gemini and Apollo programs. As progressed, ambitions contracted to a US Air Force pilot-astronaut crews to inhabit a "heavy" Gemini program. The Almaz program began with the concept of consolidated crew training, with sub-groups designated for specialized missions.[20] The crews were to be shared, as were the launch facilities and, ultimately, the transport vehicles. In this way, the Soviets could have avoided having to operate dual overt military and civilian programs at the same time. Once the reality of having to operate two separate programs set in, the economics of consolidation were lost. The diaries and memories of Nikolai Kamanin and Boris Chertok were full of notes on the logistics of sending crews to the appropriate locations for training. Published documents show the end resolutions of these discussion over priority and mission of the hardware that was currently in orbit.[21] That is how the USSR came to orbit the world's only series of military space stations. Chelomei's Almaz stations were military only because the USSR designated them as such.[22] Chelomei had designed a station as an alternative to his rival Korolev, it was only when he found patronage in the Ministry of Defense, that the Almaz became a military station. The cost of this patronage was the public fame of his project, the complete deployment of his system and the burden of a piecemeal military program.

The first Almaz (OPS-1) finally launched on 4 April 1973. TASS formally announced it as the second in the sequence of the Salyut program. Although it launched and initially orbited successfully, within two days the unmanned Salyut 2 began losing pressure and its flight control system failed. Analysts attributed the cause of the failure to shrapnel from the discarded and exploded Proton rocket upper stage that pierced the station. On 11 April 1973, seven days after launch, an unexplainable accident caused both solar panels to be torn loose from the space station, cutting off all power. Salyut 2/OPS-1 re-entered on 28 May 1973. Another Proton launch vehicle sent the Salyut 3/OPS into orbit on 25 June 1974. This second attempt at an Almaz launch maintained operations in orbit successfully. Despite of the Soviet best efforts to maintain that Salyuts 1, 2 and 3 were part of the same program, western space

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separate and independent training exercises at the same facility at the Cosmonaut Space Flight Training Center. See Rex Hall, David J. Shayler and Bert Vis, *Russia's Cosmonauts: Inside the Yuri Gagarin Training Center*, Chichester: Praxis Publishing, 2005, 37; and N.P. Kamanin, *Skrytyi kosmos, tom 2*, Moscow: Izdatel'stvo "RTSoft", 2013, 373.

20 Ibid., 157–8.

21 Iurii P. Semenov, ed., *Raketno-kosmicheskaia korporatsiia 'energiia' imeni S. P. Koroleva, 1946-1996* (Korolev: RKK 'Energiia,' 1996, here: 264-268.

22 Asif Siddiqi, 'The Almaz Space Station Complex: A History, 1964-1992, part 1,' *Journal of the British Interplanetary Society* 54.11/12, (November/December 2001), 390–2.

observers almost immediate detected a difference in the electronic signals between the DOS and Almaz stations. Astute and experienced listeners to Soviet space signals detected an additional, special, encrypted channel broadcasting from these stations that the DOS stations did not have. The precise purposes of that extra signal remained secret for decades, even though the significance was obvious to avid western space watchers, almost from the beginning.[23]

Salyut 3 was the first station to test a wide variety of installed reconnaissance sensors, including both radio and photographic equipment, and have a return canister for film for analysis. The photoreconnaissance capability of the station provided a marked improvement over previous generations of images from space. The observation deck on which the photographic camera was mounted had a limited ability to turn and track a visual target. The size and position inside a large pressurized module limited the platform's agility, though. That facility allowed the station crew to determine the bearing and direction of ships at sea that travelled under the flight paths of the station. Once the film had been exposed, cosmonauts returned film cassettes to Earth inside heavily insulted ablative canisters. It was known by its Russian acronym for Information Return Capsule, KSI.

Figure 2	Almaz Film Return Capsule (Information Return Capsule, KSI) on display at the Smithsonian National Air and Space Museum.
Source:	Courtesy of Smithsonian Institution.

Launched on 22 June 1976, the final military Salyut, Salyut 5 (OPS-3) was the third in the Almaz series. This was the most successful of the Almaz series by boarding crews in two out of three attempts. Salyut 5 reentered on 8 August 1977. After the final inhabitation of Salyut 5, the Soviet Union decided that with the advent of more sophisticated spy satellites, much as the United States had decided in 1969, to abandon human-tended reconnaissance. Even though Soviet automated spy satellites had a much-shorter lifetime than American ones, they cost less and were more versatile than Almaz stations.[24] The final two Salyuts were DOS/civilian space stations--Salyuts 6 and 7 in 1977 and 1982, respectively. The scientific focus for the last two Salyut stations shifted towards civilian research and international prestige for the Soviet Union. This marked a turning point for the Salyut program. The Soviets had

[23] Grahn, Sven. "Salyut-1, its origin, flights to it and radio tracking thereof," http://www.svengrahn.pp.se/trackind/salyut1/salyut1.html (accessed January 31, 2017).

[24] Stares, 'U.S. and Soviet Military Space Programs,' 136.

already established the Interkosmos program to encourage scientific collaboration among Warsaw Pact nations in 1967.[25]

All in all, the Almaz program was not entirely successful. The attempts to match the Korolev-designed Soyuz transport craft to the Chelomei Almaz program caused a series of docking malfunctions that the civilian program experienced infrequently. The significance of the reconnaissance bounty of the Almaz series remains a mystery. The film return capsules could not return the level of stereoscope images that the American Corona program had routinely returned since its inception in the 1960s.[26] But the crew did have the facilities from which to process and transmit radio signals containing image data directly from the station. As the US turned to automated spy satellites in the early 1960s and then to digital imaging through the Hexagon program in the late 1960s, the relative expense of human tended reconnaissance quickly outstripped its benefits. From the perspective of the Soviet population, the Almaz had an enormous drawback. As a secret program, the Almaz program provided little cause for national celebration. Successful launches and landings made the news announcements, but there was little or no press coverage of the day-to-day work of the cosmonauts. This was not the only time that a military space program in the Soviet Union had operated under the camouflage of a civilian program. That had been standard practice throughout the history of the Soviet program. This was the first time that military and civilian programs were interleaved under a single designation.

III. The Spy Cosmonauts

The American model of a military program had been to create two separate programs that operated under complete autonomy. The Soviet program relied on interdependencies between the two. The United States Air Force Manned Orbiting Laboratory (MOL) program established its own retinue of Air Force pilot-astronauts in the early 1960s. Selection, training and all forms of administration were entirely separate from that of NASA. Although they came from similar applicant pools as the later generations of Apollo astronauts, these were military astronauts, not Apollo explorers. And yet, their skills were transferable. Once the MOL program faced cancellation, those pilot-astronauts who had remained in the program at the time transferred to the civilian NASA program in 1969. All those making the age cutoff eventually flew either in the Apollo program or on board the US Space Shuttle. Thus, for a few years, the Americans maintained two administratively independent, yet

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25 Sheehan, Michael (2007). The international politics of space. London: Routledge. pp. 59–61.

26 Dwayne Day, *Eye in the Sky: Story of the Corona Spy Satellites*, Washington, D.C.: Smithsonian, 1999.

interchangeable astronaut corps. The composition of the Soviet spy satellite cosmonauts did not maintain an interchangeability and independence that the US had. The Soviets could not afford a separate and dedicated cosmonaut crew for the Almaz program, and drew from the selections of military pilots and engineer cosmonauts who had been training to fly in space since the late 1960s with a few additional Air Force Pilots added to the mix. And even though, unlike the US, the Soviets did launch missions dedicated to this program, it was not a particularly successful program. Only three of five attempts to man all three Almaz Salyuts were successful. Salyut 2 was a complete failure. Soyuz 14 was the only successful mission to Salyut 3. Soyuz 21 and 24 docked with Salyut 5. Overall, a smaller percentage of Soviet cosmonaut candidates flew in space than did Americans. An even smaller number of those trained exclusively for the Almaz military station program experienced successful space missions.

Cosmonauts Yuri Artyukhin (commander, 1930-1998) and Pavel Popovich (flight engineer, 1930-2009) were the crew of Soyuz 14, the only mission to Salyut 3, in 1975. Artyukhin who made this his only flight into space that time had graduated from the Soviet Air Force Institute with a doctorate in engineering. Pavel Popovich, of Vostok 4 fame, was making his second flight. Cosmonauts Gennadi Sarafanov and Lev Dyomin were both on their first spaceflight missions when their Soyuz 15 spacecraft failed to dock with Salyut 3/Almaz-2 a year after their predecessors.

Salyut 5 raised the success rate between the Soyuz ferry craft and the Almaz stations to a two out of three. The crew of Soyuz 21 included Boris Volynov and Vitaly Zholobov. Volynov was a Soyuz veteran, while his flight engineer flew his first mission to this station. And despite an emergency evacuation at end of mission, theirs was considered successful. Soyuz 23 did not make a complete dock with the station and Vyacheslav Zudov and Valery Rozhdestvensky returned to Earth without staying aboard their station. And finally, the crew of Soyuz 24, Soyuz veteran Viktor Gorbatko and first timer Yuri Glazkov accomplished the most compete and final military Salyut mission.

If hiding military operations among civilian programs in space was nothing new and the distinction between military and civilian cosmonauts was non-existent, then there must be another explanation of why the human spaceflight program in the 1970s never regained the acclaim of the 1960s. The absence of three individuals, Khrushchev, Korolev and Gagarin, no matter how key, does not explain the withering away of a civil infrastructure that had raised spontaneous crowds to celebrate the USSR's space accomplishments. There were, however, two changes in Soviet domestic and foreign policy, both seeming unrelated and inconsequential that might

contribute to an understanding of this sudden flipping of script from public to some more muted, routine and secret military cosmonauts. Both are legacies of the Brezhnev era. They included the spread of state-controlled television broadcasting throughout the 11 time zones of the USSR and development of the Brezhnev doctrine in Soviet foreign policy.

IV. Soviet Television Empire and Human Spaceflight

The role that the American free press played in shaping US culture and politics in the 1950s and 1960s is well known. Comedians, drama writers and journalists reporting on the Civil Rights movement in the American South and Vietnam were invited guests in US households every night. The USSR adapted to television at the end of the 1960s when sets penetrated into a majority of Soviet households. In order to convince the wide geographic distribution of the Soviet population to take part in this new media, the Brezhnev government could have either opted for a vast array of local programming or a highly centralized television enterprise. Decentralizing television program would have had obvious political repercussions. The final result was a highly centralized television office that demanded programming that would respect the 11 time zones and over 400 ethnicities through a single authoritative message.[27]

Up until 1970, the administration of Soviet television programming had been haphazard, reflecting official Soviet inattention to a media that lacked the political importance of film and the national appeal of radio. Individual local producers, largely in Moscow and Leningrad, presented shows that appealed to their own audiences while not offending political operatives. As the rate of household ownership of televisions passed the 60 percent mark in during the late 1960s. At that point, television audiences showed the potential to surpass movie audiences. In 1969, the Politburo issued a decree on the strengthening the ideological control of media broadcasts. The overhaul of Soviet media, created a State Committee for Television and Radio and placed Sergei Lapin at the head. This elevated programming to the Politburo level and set into place centralized broadcasting and policies. Lapin immediately fired large swaths of staff, centralized broadcasts across all times zones, and, perhaps, most famously, instituted a nation-wide news broadcast, *Vremia*, whose signal was sent to into homes throughout the USSR at 9 p.m. Moscow time.[28]

The impact of television reorganization on the public perceptions of spaceflight was two-fold. First the nightly, nation-wide broadcasts of the news provided a handy

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27 Kristin Roth-Ey, "Finding a Home for Television in the USSR, 1950-1970," *Slavic Review* 66.2 (Summer 2007) 278-306.

28 Ibid.

venue for frequent reports on cosmonaut activities. The fastidious collection of film footage of cosmonauts in training and in space had a ready market receptive to any new, non-overtly propagandistic footage. Second, the staid evening programming that tried to promote national contentment tended to dwell on period costume dramas, detective series and grim spy serials, avoiding provocative programming. Coverage of human spaceflight added drama and excitement to the mix without provoking ideas of discontent. There did remain a lingering fear of resurrecting memories of Khrushchev's "harebrained schemes" and extreme risk-taking of the 1960s.[29] Where space had been the center of public cultural events in the 1960s, Brezhnev television relegated it to the status of alternative to the nightly grain reports on the news or pre-recorded educational science specials. Space was no longer a public spectacle, but transformed into a reassuring coverage routine Soviet technological achievements.

Figure 3	The first space station Salyut 1 as seen by the Soyuz 11 crew in 1971.
Source:	Courtesy of Roscosmos.

Press coverage of human spaceflight in the Almaz program did not differ at all from that of DOS Salyut programs. Broadcasting images of men in spacecraft served to perpetuate the legend of the USSR continuing its leading role on the road to the cosmos and supported the ruse Salyut this was a single program. The programming softly echoed the Khrushchevian theme of cosmonauts leading armies of civilian workers into space. These men were portrayed as being at the forefront of establishing a permanent Soviet outpost in outer space. Clues to other activities were guarded and only revealed to the public a generation later, often without sufficient explanation even then. The important message at the time was that they were in orbit, not what they were doing there. Unlike the previous decade, there were no breathless announcements of record-breaking accomplishments generated from Salyut missions. In fact, the acknowledgement of the cosmonaut accomplishments on board the Almaz Salyuts was done secretly and years after the program terminated.

V. The Medal for the Distinction in Guarding the State Borders of the USSR

The Central Executive Committee of the Soviet Union established the "Hero of the USSR" award on 5 May 1934. The award was intended to honor feats in service to the Soviet state and society and to create a new legacy of legitimacy and duty within the

[29] One of the more recent scholarly biographies of Nikita Khrushchev details the motivations and execution the removal of Khrushchev from power: William Taubman, *Khrushchev: The Man and His Era*, New York: W. W. Norton & Company, 2004, here 578–619.

rapidly evolving Stalinist state. Modeled on the imperial awards and meddles of the previous century, sufficient time and cultural change had occurred to impress he public that this was by no means a tsarist medal.[30] The first recipients of the award were the seven pilots who participated in the successful aerial search and rescue of the crew and civilian passengers of the steamship *Cheliuskin*, which sank in Arctic waters, crushed by ice fields, on 13 February 1934 while attempting to navigate the Northern Maritime Route from Murmansk to Vladivostok.[31]

Recipients of the Hero of the Soviet Union award were not only men. Later in that decade, Valentina Grizodubova, a female pilot, was the first woman to become a Hero of the Soviet Union on November 2, 1938. She earned the award for her international women's record for a straight-line distance flight.[32] During World War II, Zoya Kosmodemyanskaya, a famous World War II Soviet partisan was the first woman to receive the award during wartime on 16 February 1942, albeit posthumously. By the time of the Space Race, the award was the obvious choice for honoring returning cosmonauts. Starting with Yuri Gagarin, and each cosmonaut of the 1960s and throughout the history of the USSR, received the honor, presented a maximum of twice in a lifetime for cosmonauts. Cosmonauts display two medals that commend their multiple spaceflights on their military uniforms and civilian suits.[33]

The Almaz program brought with it a new honor to Soviet cosmonauts although one that was shrouded in secrecy until after the program ended. In addition to receiving a "Hero of the USSR," and being dubbed "Pilot-cosmonaut of the USSR" some Almaz cosmonauts received another reward. The Medal "For Distinction in Guarding the State Border of the USSR" (DGSB) was established on 13 July 1950, by Decree of the Presidium of the Supreme Soviet of the USSR.[34] This was a lower rank than the

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30 Paul D. McDaniel, Paul J. Schmitt and Paul D. McDaniel, Jr., *The Comprehensive Guide to Soviet Orders and Medals*, Arlington: Historical Research, 1997.

31 The seven pilots were Anatoly Liapidevsky (certificate number one), Sigizmund Levanevsky, Vasily Molokov, Mavriky Slepanyov, Nikolai Kamanin, Ivan Doronin and Mikhail Vodopianov. R.E.G. (Ronald Edward George) Davies *The Chelyuskin Adventure* illustrated by Mike Machat (English and Russian text) (McLean, Virginia, Paladwr, 2005) tells the English and Russian bilingual adventure of the crew of the Chelyuskin. Although the recounting of the mission and plight are accurate, the book does not challenge the political context that led to the mission.

32 Two historians have devoted their time to uncovering the long forgotten history of women aviators in pre-war and wartime USSR: Reina Pennington, *Wings, Women, and War: Soviet Airwomen in World War II Combat*, University Press of Kansas, 1997; and Kazimiera Janina Cottam, *Women in War and Resistance Selected Biographies of Soviet Women Soldiers*, Newburyport: Focus Publishing/R. Pullins Co., 1998, here 5–7.

33 This numerical restriction for Hero of the USSR awarded to cosmonauts avoided confusion between their relative contributions to the Soviet state with the contributions made by wartime heroes. The three three-time awardees were all soldiers from the World War II. The only four time winners were Leonid Brezhnev and Marshall Georgy Zhukov.

34 The Decree creating the medal was originally enacted in 1950 and was revised twice, once in 1977 and again in 1980; see Union of Soviet Socialist Republics, 'Decree of the Presidium of the Supreme Soviet of the USSR of July 13, 1950' (in Russian), Legal

highest (Hero of the Soviet Union, Hero of Socialist Labor and Heroine Mother). This military award was written to honor extreme levels of service on the part of soldiers and border troops were the original intended recipients. The medal honored military exploits and special services displayed in the protection of the state borders of the USSR. The list of justifications for the award included range of seven skills and characteristics in border protection.

[35]This medal would probably have remained in a low level on anonymity for rank and file border soldiers if not for one recipient. East German Minister of State Security Erich Mielke (1907–2000) headed the Staatsicherheit (Stasi) from 1957 until the fall of the Berlin Wall in 1989.[36] The Soviet government awarded him the medal for Distinction in Guarding the State Border of the USSR in January 1970, seventeen years before awarding him the more distinguished "Hero of the Soviet Union."[37] This inaugural award made it clear that the border defenses were far more political than physical to merit receipt of the award.

Almaz cosmonauts received the award in a reverse sequence than did those more famous and traditional awardees. Cosmonauts first received their expected decorations for participating in spaceflight immediately after flight, and then, in 1977, some but not all received the border service with distinction award. Both the selection and timing of this award is intriguing. In subsequent years of that decade, five of the ten cosmonauts who launched to the military Almaz stations received the same honor. They were (in order of their missions): Artyukhin, Sarafanov, Volynov, Zholobov, Glazkov and Gorbatko. They represented only crews to Salyuts 3 and 5, included the commander of one failed docking, and the flight engineer, but not the commander of what had been deemed a successful mission.[38]

The decision as to whom to make the award and not is almost as perplexing as unraveling the political or military contribution that a cosmonaut in low Earth orbit made to border defense. Interestingly, Pavel Popovich, the most senior cosmonaut among

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Library of the USSR, signed July 13, 1950, at http://www.libussr.ru/doc_ussr/ussr_4786.htm (accessed 7 April 2012).

35 The full criteria were: – bravery and selflessness displayed during combat operations aimed at the arrest of violators of the State Border of the USSR; leadership of border protection units while ensuring the inviolability of the borders of the USSR; vigilance and proactive actions which resulted in the arrest of violators of the State Border of the USSR; skillful organization of border service units and exemplary work to strengthen the borders of the USSR; excellent performance of military duties associated with the protection of the state borders of the USSR; assistance to border protection forces in their combat assignments aimed at the protection of the state borders of the USSR.

36 Photo of Erich Mielke courtesy Bundesarchiv, Bild 183-R0522-177 (accessed 4/12/2014).

37 David Binder, 'Erich Mielke, Powerful Head of Stasi, East Germany's Vast Spy Network, Dies at 92,' *New York Times* (26 May 2000), C19.

38 The mission assignments of each was: Artyukhin—Salyut 3, Soyuz 14; Sarafanov—Salyut 3, Soyuz 15 (failed to dock); Volynov—Salyut 5, Soyuz 21; Zholobov—Salyut 5, Soyuz 21; Glazkov—Salyut 5, Soyuz 24 and Gorbatko—Salyut 5, Soyuz 24.

the Almaz crews, was not awarded the DGSB, receiving the Hero of the Soviet Union for the second time after this mission and nothing more. An explanation for this oversight is elusive. It might be due to the fact that Popovich alone was one of the original twenty cosmonaut trainees accepted into the space program in 1959-1960 and he had already received the highest award as a recipient of the Hero of the Soviet Union medal. It is even more difficult to understand the reason that the commander of the failed to dock mission of Soyuz 15, Gennadi Sarafanov, was a recipient, but his crewmate Lev Dyomin was not. The Soyuz 23 mission to the third Almaz station also did not dock carrying Vyacheslav Zudov and Valery Rozhdestvensky and there was no mention of either of them. The Soyuz 24 crew of *Salyut 5*, Gorbatko and Glazkov, did receive the honor. The secretive selection process could either hint to a sophisticated measure of each cosmonauts' tactical contribution to border security.

The timing of the announcement of these awards is another difficult episode to decipher. All cosmonaut awards were made after Soviet abandonment of the Chemolei station in 1977. However, there were no formal citations published in the Soviet military press during 1977. It was only much later in the first published compendium of all Soviet and Russian cosmonauts in 2001 that the award is listed among “National Honors” among some cosmonaut entries. And even in this case the entries were made in idiosyncratic ways.[39] For some, the full title “For Distinction in the Defense of the Border” is spelled out completely.[40] For others, the listing merely states that they were awarded an “honor for the defense of the borders,” omitting whether or not this was for distinguished service, which might indicate a lower award.[41] There are no hints as to whether this was a publishing truncation of the name of the award, or if it was an indication that there were in fact two award levels. In trying to decipher this puzzle, it is clear that all the award winners were among the later selections of Soviet Air Force nominees to the cosmonaut corps and did not include the engineers and physicians from Korolev’s design bureau and the Institute for Biomedical Problems. As a result, crews were split, one receiving the award and another not. Popovich (commander) did not receive the award, but Yuri Aryukhin did for their Soyuz 14 mission to Salyut 3. And yet, Sarafanov received the award, but Dyomin (flight engineer) did not for their failed Soyuz 15 mission to the same station later in 1974. No member, failed or successful of the Soyuz missions to Salyut 4 received the awards at all. All four crew members of the successful Soyuz 21 and 24 missions to Salyut 5 were credited with the honor. Despite

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39 The first complete Russian guide to all cosmonauts nominated to the program that at least began training was published after the collapse of the USSR; see Iu. M. Baturin, ed. *Sovetskie i rossiiskie kosmonavty XX vek: spravochik*,Moscow: Informatsionno-izdatel’skii dom “Novosti kosmonavtiki,” 2001.

40 Ibid., 52, 62, 64 for Volynov, Glazkov and Gorbatko.

41 Ibid., 19, 161, and 80 for Artyurkhin, Sarafanov, and Zholobov.

the fact that there was no public announcement of the award, there seems to be no evidence of hiding the awards once they were made. One can only assume that cosmonauts proudly wore the red bordered green bar among their other military awards without fanfare.

The use of the DGSB must have been part of a distinct effort to appear to integrate the Almaz program into Soviet military foreign policy. This symbolic connection between the foreign policy missions and human spaceflight extended the military balance of power out into low Earth orbit, if only on a rhetorical level. While Mielke took documentable actions to protect the Soviet homeland no matter how repulsive his actions might have been, the steps that the cosmonauts took lacked any political or physical defense of the border. The ex-post facto acknowledgement of their work seemed closer aligned to 1970s Soviet mythmaking. This 1970s mythmaking, like that of Stalin a generation before, allowed for no ambiguity. As historian Elana Gomel has written, 'the Soviet New Man, on the other hand, marches along the one-way road of historical progress toward the revelation of his own glorious self.'[42] The "peaceful" Salyut cosmonauts were continuing the progress of the 1960s, without directly challenging their Cold War enemy, even though the underlying challenge of demonstrating continuous progress was steady. In contrast to their would-have-been adversaries, these cosmonauts were designated cold warriors after their program had finished, almost as an afterthought, drawing no celebrations.

While ambiguities about the crew training, missions on the stations and their military importance remain today, there are two known pieces of equipment that were on board that Almaz ships that defined the military missions. These pieces of equipment played no role in the continuing myth-making around Soviet cosmonauts, but they were instrumental in answering the Defense Ministry's demand for a space-based challenge to the United States. The first matched American aspirations to the use of space for reconnaissance. The second answered Soviet anxieties about the imagined coming battlefield in space.

VI. The Almaz Camera

As mentioned before, the external tell that gave away the Soviet secret of the dual identities of the Salyut stations was the radio channel link. The Kettering Group[43] had

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42 Elana Gomel, 'Gods like Men: Soviet Science Fiction and the Utopian Self,' *Science Fiction Studies* 31.3 (November 2004), 358–77, here 362.

43 The Kettering Group is a group of informal space watchers that grew out of the leadership of Science Master Geoff Perry at the Kettering Grammar school for Boys. Perry had sought to make science exciting for his charges by having them track the new phenomenon of artificial satellites and map their orbits. The group began its work during the orbit of Sputnik 2 and Laika and ended with the death of Perry in 2000.

learned to distinguish between Almaz and DOS stations from their radio signals, the Almaz having a dedicated link for reconnaissance information.[44] Almaz had a short-wave telemetry transmitter, called 'support' telemetry by the Russians. Just like DOS, Almaz had a VHF transmitter for the main telemetry system. However, the command uplink and command verification downlink systems were completely different. DOS used the command system on Soyuz, similar to the one used on the International Space Station (Zvezda), while Almaz probably used a system common to military spacecraft and also the FGB (Zarya) on the ISS.[45]

This dedicated link was for the Agat-1 reconnaissance camera and its radio download link. The redundant system provided two paths for reconnaissance data to reach Earth. A payload from Almaz could be returned via the Information Return Capsule (KSI); a modified ablated warhead that would return film to Earth. Cosmonauts had another option of returning photographed information through a radio link to the ground. A limited amount of film from the reconnaissance cameras would be developed on board, scanned and transmitted to the ground - all within 30 minutes. This versatility of the Agat camera system had been a selling point to the Ministry of Defense. The Almaz promised to be a substantial improvement over the performance of the Zenit automated spy satellite system.[46] The Zenit program had begun almost as early as the Space Race itself with a first launch in 1961. Zenit used a Vostok capsule bus with the camera and film mounted inside. The entire landing sphere had to be recovered including film and camera in order to retrieve the images. While the Agat system was more versatile in theory, the program was not as robust either in deployment or longevity. The USSR continued to launch Zenit-style spy satellites until 1994, numbering over 500 in a 33-year period. [47] The Agat system was deployed only twice, in Salyut 3 and Salyut 5. The technical success of the Agat system notwithstanding, the system could not live up to the potential of providing timely reconnaissance and surveillance photos to meet national security requirements. There had been a two-year gap between camera deployments and only three out of five planned crews successfully inhabited the stations. Throughout this time, the USSR had been steadily refining its use of the Zenit spy satellite program, deploying both high and low altitude satellites that relayed a variety of signal to Earth.[48] The Agat system was a static

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44 Peter A. Gorin, 'Zenit: The First Soviet Photo-Reconnaissance Satellite,' *Journal of the British Interplanetary Society* 50. issue (date 1997), 440-442, here 441.

45 Sven Grahn, 'The Almaz Space Station Program' http://www.svengrahn.pp.se/histind/Almprog/almprog.htm (accessed 5 November 2013).

46 Chertok, *Rakety i liudi*, 210.

47 Gorin, 'Zenit,' 440–6.

48 Peter Gorin, "Zenit:Corona's Soviet Counterpart," In Robert A McDonald. *Corona Between the Sun and the Earth: the first NRO reconnaissance eye in space*. Bethesda, MD: The American Society for Photogrammetry and Remote Sensing, 1997: 84-107.

electronic and film system that, despite its limited targeting capability, could not rival Zenit's versatility in orbital choices.

VII. The Weapon

Rumors of the role of the Almaz stations as a weapon preceded public disclosure for decades. Author Nichals Johnson mentioned stories of a Gatling gunon board one of the stations in 1987.[49] The key to interpreting the weapon is to withdraw from the general discussion of militarization of space in order to understand its specific role as a space weapon. The distinction between the concepts of militarization and weaponization of spaceflight is an historical one. Space exploration is de facto based on the development of military technology, Weaponization has been discouraged through international treaties even while specific concepts have been tested in space. Atmospheric weapons in space are subject to Newton's third law of Physics. As though to fully demonstrate a turn towards the weaponization of space, the Almaz station was equipped with a machine gun. Suitable for defending against or attacking another aircraft in flight, this machine gun had no clear contemporary target. This rather unusual feature was never tested until all operations were complete and the station was about to be de-orbited. As far as personal accounts tell, the machine gun was only deployed on Salyut 3. On 24 January 1975 ground crews ordered the tests of what was then reported to be an on-board 23 mm Nudelman aircraft cannon. During the 1970s and through the end of the twentieth century, analysts assumed that the weapon that was deployed onto the military Salyut had been adapted directly from an aircraft cannon. Soviet lore proclaimed that this gun had been mounted on the exterior of the station as a defensive measure. Having inflated and vague target ranges from 500-3000 meters, the gun was clearly not an effective antisatellite weapon, but one that would ward off a direct physical boarding or capturing attack against the station.

Although the machine gun existed as no more than rumors and conjecture for decades, its detailed history and description have become public in the past ten years. A photo of the purported gun was only published in 2015.[50] It was a 23-millimeter cannon, as reported at the time, but one designed by Aron Rikhter as a powerful aircraft weapon for the Tupolev Tu-22 Blinder supersonic bomber. The adaptation of an aircraft gun to space revealed two major design challenges that could not be overcome. First, in order for the cosmonauts to fire using an optical sight in their

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49 Nicholas L. Johnson, *Soviet Military Strategy in Space*, London: Jane's Publishing company, 1987, here 76-79.

50 Anatoli Zak, 'Here Is the Soviet Union's Secret Space Cannon,' *Popular Mechanics* on line article. (16 November 2015), http://www.popularmechanics.com/military/weapons/a18187/here-is-the-soviet-unions-secret-space-cannon/.

cockpit, they would have had to turn the entire 20-ton station to point the cannon toward its target. This was not a practicable operation. The second design obstacle was that the R23M could not overcome was basic Newtonian physics. The recoil of the cannon even against a 20-ton station was sufficient that during its only post-inhabitation, pre-de-orbit firing, on 24 January 1975, that the Salyut-3 ground controllers initiated station jet thrusters simultaneously with the firing to counteract the recoil.[51] The Salyut cannon was a weapon that could not be targeted in real time and could not be used while there was a crew inside the station to defend. It could provide no practical, tactical support in space and its shrouded identity prevented it from being of any use for deterrence. And given ist location on board a low Earth orbiting station, put other strategic satellites in far higher orbits beyond its range. Nonetheless, the rumor of its existence prevailed for decades before the Ministry of Defense unveiled it, thus fueling the internal mythology of the defensive military space station deterring capture and boarding. In all likelihood, this canon was no more than a one-off test of a concept.

Figure 4	Almaz Salyut Nudelman canon.
Source:	Courtesy of Anatoly Zak.

VIII. Conclusions

As others have argued, the de-Khrushchevization of the Soviet state in the 1960s was marked by deliberate efforts to remove all traces that had been embarrassing and challenging from Khrushchev's de-Stalinization.[52] Nikita Khrushchev's confrontational stances, 'harebrained schemes"' and negligence of rational planning were easy targets for ridicule. Yet the 1970s in no way were a complete reversal of Khrushchev's contradictions. The decade did not usher in a new age of rationalism, nor was there complete de-Khruschevisation of Soviet idealism. Under Brezhnev, the Soviet state took a small step back from the awkward and obviously hypocritical stances that Khrushchev had taken in effort to absolve himself from Stalin's legacy. But they remained facing a troubled country still recovering from the Second World War with an increasingly disaffected youth who had no memory of the War, with no personal memories the Stalin terror. Brezhnev faced the very real challenges of ruling in a world

51 Zak, 'Here is the Soviet Union's Secret Space Cannon.'
52 Taubman, *Khrushchev*, 578–19.

in the midst of cold war and domestic and nearby challenges to Soviet rule. Human spaceflight was one of the tools that Khrushchev had left to combat these challenges.

This official evisceration of the legacy of Khrushchev left the country with three characteristics of a Brezhnev-era Soviet culture. The first was the doctrine of the continuing Cold War with the United States that could never be lost. The second was the militarization of the civilian culture including human spaceflight without any appreciable change in the programs and outcome. The third change that manifested itself in the new, Brezhnev culture was the shift to inward to a more defensively stanched public culture. The result of these changes in Soviet human spaceflight culture from the Khrushchev to Brezhnev regimes was an invitation to a broad collection of ideas about the purposes of human spaceflight. The early 1970s were the first time that no single vision of human spaceflight dominated completely. The Moon Race continued through the testing of the N-1 launch vehicle. A civilian program cobbled together leftover hardware to maintain the profile that had been established during the 1960s. International cooperation became a spaceflight objective, be it with the United States or with Warsaw Pact allies. And the Ministry of Defense adopted a hardware program within which to test and demonstrate a program originally conceived to challenge U.S. military space stations. While Khrushchev had been accused of providing trite and often facile answers to the public demand for a more relaxed and robust post-war culture, the Brezhnev response relied on nostalgia for the period that they sought to erase from memory. The public wanted a time and place that was safe and hopeful.[53] Khrushchev had built that illusion with spaceflight.

The major mission distinction between the Almaz an DOS program came from the hardware added to the former orbiting station. The missions of photo reconnaissance inspecting potential hot spots during a cold war and avoiding orbital capture did not promise a comfortable and safe future for the civilian population. The stations never had a sustainable mission for the military. They served to reassure the internal members of the defense industry of three things: First, even though the United States had gone to the Moon, Soviet national prestige in space remained intact. The Cold War remained a continuous battle between the two nations that continued beyond the Moon Race. Second, space policy was no longer directed towards a goal of stunt missions and one-upping the US but it did have a well-defined national security role that was too secret to be public. In effect, Brezhnev had coopted Khrushchev's promotion of the domestication of the science and technology revolution back to the

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[53] Svetlana Boym vividly describes this desire for returning to the safe place from childhood in her essay: Svetlana Boym, 'Kosmos: Remembrances of the Future,' in *Kosmos: A Portrait of the Russian Space Age*, New York, NY: Princeton Architectural Press, 2001, 82–99.

military.[54] And the third, underlying and possibly unintended message of the combined Salyut program to the Soviet public was one of confident reliability of Soviet hardware. By conflating the military and civilian programs through dual use of the Soyuz hardware and by calling them both Salyut, Soviet planners offered the public an illusion of a hardware continuity. This was a similar continuity and comfort that resulted from the anonymous "Kosmos" designation that disguised failures, covert and test missions. The irony was that this fake continuity of the Salyuts initially undermined public perceptions of reliability. Nervous western reporters who were anticipating the 1975 Apollo-Soyuz Test project and the average Soviet citizen could assess the high failure rate among early Soviet space station docking attempts.[55] The combined Almaz/DOS programs made both audiences nervous.

After a total three failed attempts to inhabit and carry out missions the Almaz military stations, the Soviet program reverted to the civilian DOS program during the late 1970s with Salyuts 6 and 7. This act did not only relinquish human spaceflight to the civilian realm, but it had other, far reaching consequences. Surrender opened Soviet space stations for use as diplomatic stages, welcoming foreign Warsaw-Pact and subsequently, other allied pilots, including westerners on board as guest cosmonauts. The removal of the military label also opened the door for returning Soviet women to space in 1982 after almost two decades of unexplained absence.[56] In the mid-1980s the launch of the modular Mir space station indicated that the USSR continued to explore the possibility of utilizing more robust and varied hardware in its space station program. Soviet and Russian demonstration of their capabilities to maintain a human presence in space over the 15-year life-space of Mir laid the groundwork for Russia to join the United States, European Space Agency, Canada and Japan to build the International Space Station (ISS).

Figure 5	Zvezda Module.
Source:	Courtesy of NASA.

54 Susan E. Reid, 'The Khrushchev Kitchen: Domesticating the Scientific-Technological Revolution,' *Journal of Contemporary History* 40.2 (April 2005), 289-316, here 290.

55 Christopher S. Wren, 'Two Soviet Astronauts in Good Health; First Night Landing Hailed in Moscow: Salyut Still Operating No Explanations,' *New York Times* (30 August 1974), 8.

56 Svetlana Savitskaya, the daughter of former Soviet Marshall of the Air Forces, Yevgeniy Savitskiy, was an international recognized aerobatic pilot when she launched on board the Soyuz T-7 spacecraft to the DOS space station Salyut 7 on August 19, 1982, for a two-week stay. She returned to space just under two years later on board Soyuz T-12 to become the first woman to perform a spacewalk. Although never formally documented, it is widely assumed that the timing of her two missions were to preempt the United States and Sally Ride and Kathryn Sullivan's respective missions.

Figure 6	TKS on display at the Smithsonian Institution National Air and Space Museum.
Source:	Courtesy of Smithsonian Institution.

The results of the 1970s brief change in cosmonaut culture were not without positive legacies. The changing political and military climate in the twenty-first century has laid clear three opportunities that could not have been imagined in the 1970s. The salvaged hardware pieces that remained after the Almaz program had been preserved recycled and reconfigured and became components of the International Space Station. The base block of the International Space Station, the Zvezda module is of OPS-5/Almaz heritage having drawn on the more vigorous space station design from the 1960s (see Figure 2).[57] The Zarya or Functional Cargo Block (FGB) module (the second Russian module) of ISS is based on the TKS spacecraft originally designed as the transport ship for the Almaz. The TKS design itself was launched and landed but never piloted. During the 1980s, it docked with the Mir space station modules once as the anonymous Kosmos 1443 (see Figure 3). The TKS transport ship is now is the basis of the proposed next generation human transport spacecraft from Russia. And finally, and most unlikely, as parts of the US Manned Orbiting Laboratory (MOL) program have been declassified allowing for the first time a direct comparison between the Cold War powers' military space station hardware, the Almaz program has gained favorable comparison for the technical capability of the program.[58] As it turned out, if all things had been equal, stretched finances and resources had not being curtailing factors and both sides had been free to complete programs that fulfilled their respective military's ideals of human tended military stations, the USSR might not have abandoned that secret war of the heroic military space pilots standing guard several hundred miles above all borders. The irony is that the hardware of the 1970s endured, but not the attempt to remake Soviet space culture to reflect Soviet military politics or to stretch Soviet fiscal capabilities beyond their very limited resources.

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57 Anatoli Zak, "Almaz," EO Port. Sharing Earth Observation Resources, entry posted 15 July 15, https://directory.eoportal.org/web/eoportal/satellite-missions/a/almaz (accessed 20 July 2015): and Cathleen Lewis, "Zvezda Service Module Celebrates 15 Years in Orbit," Air and Space Blog, 19 August 2015 (http://blog.nasm.si.edu/space/zvezda-celebrates-15-years (accessed 29 December 2015).

58 The United States Department of Defense has only recently declassified documents on the Manned Orbiting Program, but the crossover between the Air Force and civilian programs of personnel, hardware and contractors has provided sufficient information to describe the program in broad strokes. The most famous, pre-declassification recounting of the program was assembled in: *Frontline*, "Astrospies: An Elite Corps of Secret U.S. Astronauts is Trained to Gather Intelligence on the Soviets During the Cold War," 12 February 2008 on PBS URL: http://www.pbs.org/wgbh/nova/military/astrospies.html (accessed 29 December 2015).