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Cold War in Space: Reconnaissance Satellites and US-Soviet Security Competition

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> We've spent $35 or $40 billion on the space program. And if nothing else had come out of it except the knowledge that we gained from space photography, it would be worth ten times what the whole program has cost. Because tonight we know how many missiles the enemy has.
> —Lyndon B. Johnson[1]

1. Introduction

1 Spaceflight is one of the most exciting aspects of the Cold War, with numerous books, films and scientific papers about the epic race to the Moon being published every year. But while the United States and the Union of Soviet Socialist Republics were competing for world recognition and prestige, investing enormous funds into attempts to put a human on the Moon, a quieter, but arguably more important, Space Race was taking place. Harvesting the developments in orbital technology, both the US and the USSR put hundreds of satellites in orbit of the Earth. While most of these satellites had scientific purposes, many were used to quietly gather intelligence on the opposing side. Even though they have received little scholarly attention, reconnaissance satellites played a crucial role in cooling down and stabilizing the security competition between the United States and the Soviet Union. Albert Wheelon, a key figure in the creation of the US satellite reconnaissance program, went as far as to state that reconnaissance satellites were an achievement "every bit as impressive as the Apollo Moon landings."[2]

2 The Space Race and its satellite component both had their roots in military competition between the superpowers. Both the US and the USSR, fearing aggression from the other side, worked on missiles that could deliver nuclear warheads onto their enemy's military assets and civilian populations. But it was also those missiles that enabled early civilian and scientific space exploration. The first satellite in space, *Sputnik-1,* was

launched on top of an R-7 Intercontinental Ballistic Missile (ICBM).[3] The same holds true for early US spaceflight. The first US satellite reached orbit on top of a modified *Redstone* ballistic missile, and it was until 1961 that the US delivered a payload into space on a non-military rocket, the *Saturn 1*.[4] In spite of these facts, the historiography of the Space Race tends to focus on the scientific and civilian competition in space. Even though scholars acknowledge the Space Race's roots in military competition, they generally study the efforts of both countries to place a human on the Moon, only occasionally devoting attention to the security aspects of the Space Race.[5]

3 Literature on the satellite race and its meaning for strategic competition is scarce. There are individual publications on specific satellite projects such as *Eyeing the Red Storm* by Robert Dienesch, or a collection of essays about the *Corona* satellites authored by members of the US intelligence community titled *Eye in the Sky: History of the Corona Satellites*.[6] But some satellite programs, such as the *Midas* program, have received practically no historiographical attention. In his famous book titled *The Long Peace*, John Lewis Gaddis discussed the importance of what he called the "reconnaissance satellite regime" to the stability of US-USSR relations.[7] But because the book was published during the Cold War, it lacks much of information available today that was subsequently declassified by the Clinton Administration in 1995.[8] The available publications discuss either a small snippet of the history of orbital intelligence systems, are not based on most up-to-date sources, or focus primarily on technical aspects of spaceflight. What is lacking is a thorough discussion of how and why these satellites came to be and in what way they changed policymakers' approach to the other superpower.

4 I thus aim to answer the question: what role did the Space Race play in the global security competition between the US and the USSR? I argue that the technologies and legal precedents that were born out of the early developments of the Space Race stabilized the Cold War security competition. The dawn of orbital technologies and the freedom of space precedent established by early space missions allowed for the development of reconnaissance satellites. These satellites provided information that played a critical role in changing Americans' perception of the USSR. The developments in spaceflight provided a solution to the issue of lacking intelligence and allowed for a less belligerent stance towards the communist empire. Spy satellites contributed to the stability of US-USSR relations by providing information on the opposing side's intentions and capabilities, creating early warning systems for nuclear attacks, and by providing a reliable method of verifying compliance with arms limitation treaties in a non-invasive manner. This article argues that the development of a system of mutual invigilation from orbit during the Space Race in the 1960s had a profound impact on US conduct of the Cold War. By providing unprecedented levels of transparency, this system supplied both sides of the conflict with invaluable information that eased the tensions and paved the way for *détente.*

5 This article draws its theoretical approach from the realist school of international relations. Its argument is based on the assumption that, in an international system in which there is no authority higher than a state, a state's key goal is to achieve security from external threats—in other words, simply to survive.[9] I follow the realist assumption that since it is impossible for a state to know the intentions of another state, the best thing it can do to ensure its survival is to judge the capabilities of the adversary and to undertake steps necessary to counter their potential, and, if need be,

eliminate the threat before it becomes too great.[10] This is why transparency is needed in the anarchical international system if it is to be stable.[11] It is in this context that intelligence gathering during the Cold War becomes an important topic. I intend to show that the early deficiencies in US intelligence led to a heightened sense of threat from the Soviet Union, which then led to a misguided and potentially destabilizing approach to the USSR. I argue that the Space Race provided both technical and legal remedies for this intelligence shortage, which allowed for a more peaceful coexistence of the US and USSR.

6 I present a narrative of how the developments in spaceflight were harnessed for national security purposes in the form of intelligence gathering, which then considerably limited the destabilizing factor of uncertainty in the relations between the US and the USSR. Using declassified documents produced by the US intelligence community in the late 1950s and 1960s and combining them with extant scholarship from the fields of history and international relations, I outline the creation of the first US intelligence satellites. I begin by tracing the history of intelligence gathering against the Soviet Union and describe its early deficiencies. I show how specific events and the inadequacies of early intelligence solutions fueled the need to turn to the different legal and technological developments made as part of the Space Race. I trace the development of the first two US satellite reconnaissance programs, *Corona* and *Midas*. I elucidate how and why they were created and discuss how their success in delivering intelligence allowed for a different approach to the Cold War by the United States. Lastly, I integrate this historical narrative with international relations theory. In order to show the impact of satellite intelligence on superpower security competition in the anarchical international system, I discuss the spy satellites in the context of transparency, deterrence and mutuality of surveillance.

7 Even though the Soviet Union developed space systems analogous to those of the US, the information about them available today is very scarce, as Russian archives still remain mostly classified. Therefore, this article focuses on studying the history of US space-based intelligence assets, with only brief mentions of their Soviet counterparts. The topic is relevant still today, as space-based intelligence systems that are based upon the developments of the early spaceflight era are still in use today, and they play an important role in stabilizing security competition between modern powers.

2. The Early Cold War and Information Scarcity

8 The Soviet-US Cold War was characterized by mutual distrust. The expansion of the Soviet sphere of influence after 1945 made the Soviet Union a dangerous opponent in the eyes of the Truman administration. In addition to the obvious ideological differences between the superpowers and Stalin's public declarations of the inevitability of a communist-capitalist confrontation, the United States' distrust and fear of the USSR were, in large part, fueled by the complete lack of hard intelligence about the Soviets.[12] Since the US had very little interest in the Soviet Union prior to the Second World War, not much was known about this closed society. The scope of the problem can perhaps be best illustrated by the fact that the most up-to-date maps of some regions of the USSR in US possession dated back to Tsarist times.[13]

9 The USSR proved extremely difficult to infiltrate with human agents. Beginning in the late 1940s, the US sent numerous agents equipped with falsified identity documents in

an attempt to spy on the Soviets from the inside. However, those efforts were suspended in 1954, as most of them were apprehended by the KGB.[14] In the early years after the Second World War, US intelligence was forced to rely on any source of information available, such as former Nazi intelligence officers and reconnaissance photographs taken by the German *Luftwaffe* over the USSR during the war.[15] One early intelligence report on Soviet military capabilities produced in 1946 stated that "any report of this nature is at best an educated guesswork."[16] That "guesswork" however, was constantly produced by US intelligence agencies and became the basis for formulation of US policy towards the Soviet Union in the earliest years of the Cold War.[17]

10 This near complete lack of information led to false estimates about the Soviet Union, which in turn heightened the feelings of danger among US policymakers, military personnel and legislators. US intelligence agencies in the late 50s, relying on scarce data, were convinced of Soviet strategic superiority. The Central Intelligence Agency and the Joint Chiefs of Staff under the Truman administration, having witnessed the Soviet eagerness to get engaged in the war in Korea, supplied Truman with continuous reports of growing Soviet capabilities and Moscow's clear aggressive intentions. In October of 1950, the CIA warned Truman of Soviet preparations for "major hostilities" in the near future, while the Joint Chiefs of Staff prepared a memorandum informing him that the Soviet armed forces are clearly "preparing for war."[18] The successful Soviet detonation of a nuclear device in 1949 and the perceived rapid growth of the Soviet fleet of long-range strategic bombers convinced many in the US government that the threat of Soviet bombers conducting a surprise nuclear attack was real. The threat posed by this so-called "bomber gap"—a belief that the US was falling behind in numbers of strategic bombers able to deliver nuclear bombs—came to be the defining aspect of the United States' early stance towards the USSR.[19]

11 Were the CIA's estimates of Soviet intentions and capabilities true, the United States would soon be facing an adversary too potent to be successfully deterred or defeated. This led many high-ranking officials in the US military to start advocating for preventive war—that is, to strike first, before the Soviets got a chance to surpass US capabilities. One of the most prominent advocates of preventive war, Curtis LeMay, commander of the Strategic Air Command, strongly encouraged the President to authorize pre-hostilities reconnaissance overflights over the USSR, and to consider a first strike.[20]

12 Robert Jervis lists two major incentives for a state to conduct a preventive strike: (1) fear that if it does not strike first, it will not be able to strike at all, and (2) wanting to prevent the other state from being able to retaliate.[21] "Fear" is the operative word here, for fear is caused by the actor's perception of the threat and not actual capabilities of the opponent. This fear was reflected in Truman's personal journals, which indicate that he did indeed seriously consider the possibility of a US first strike while the USSR was still relatively weak, especially at the time of the Korean War.[22] Fear of a surprise Soviet attack, fueled by faulty intelligence, was prevalent in the US at the time. Considerations about preventive war against the USSR were not limited to government circles and also spread outside of the government, with numerous journalists and political scientists arguing for preventive war as the only solution that could guarantee US national security in the face of growing Soviet strength.[23]

13 Change came about with President Dwight Eisenhower's assumption to office in 1952. Although he and his advisers did not eschew the idea of preventive war at first, it was his administration that pushed for the development of new intelligence gathering methods that would allow for a better assessment of the Soviet threat.[24] Eisenhower strongly believed that defense spending should be reduced, and he instead proposed an increased reliance on nuclear weapons as a deterrent against possible Soviet aggression. In order to convince the US public, and more importantly, Congress, that his so-called "New Look" strategy of reliance on nuclear deterrence was viable, Eisenhower first needed to obtain proof that the US was not vulnerable to a surprise Soviet nuclear attack, contrary to the popular belief at the time.[25] To gather this evidence, he authorized the development of numerous overhead intelligence gathering systems, which later culminated in the creation of the first operational reconnaissance satellite system in history that would virtually eliminate the dangerous problem of lacking intelligence.

3. History of Overhead Reconnaissance: From Reconnaissance Balloons to Spy Satellites

14 Overhead reconnaissance seemed to the Eisenhower administration to be the most reasonable option for spying on the USSR. Reconnaissance overflights of modified aircraft, such as the RB-47 in the early 1950s, showed that the likelihood of bypassing Soviet air defense was higher than the prospect of penetrating the closed Soviet society and its security apparatus.[26] While the CIA was working on what would later become the famous U-2 reconnaissance plane, the Air Force devised its own overhead reconnaissance project: the *Genetrix* program. The program involved deploying balloons equipped with cameras over the USSR at altitudes unreachable by any plane or air defense system of the time and capturing photographs of the Soviet Union. But the *Genetrix* project failed to produce the desired results. Out of the 516 total balloons deployed over the Soviet Union, just 54 were recovered, and only 34 provided any useful photographs. The Soviets quickly learned that the balloons would lower their altitude at dusk enough for interception by modern jet fighters, which resulted in many being shot down. Many more were simply blown off-course by winds and never reached the areas they were supposed to photograph.[27] Even though the *Genetrix* program was a failure, overhead reconnaissance was still believed to be the best chance at gathering intelligence on the seemingly impenetrable Soviet society. The questions at hand were how to avoid intelligence gathering assets from getting shot down and how to make them more reliable.

15 Prior to the *Genetrix* program, in 1954, President Eisenhower created the Technical Capabilities Panel (TCP), headed by James Killian, the president of the Massachusetts Institute of Technology. The goal of this panel was to devise technological alternatives for secure intelligence collection on the USSR that would prevent a surprise nuclear attack against the mainland United States. In early 1955, the TCP finished a report that introduced the first concept of a reconnaissance satellite system, *WS-117L*. The so-called Killian Panel proposed a variety of detailed technical solutions that a reconnaissance satellite could employ. Even though the project was endorsed by Eisenhower, it ultimately failed. Robert Dienesch argues that the program was too ambitious and ahead of its time, with efforts too scattered and unconcentrated. This led to a lot of

resistance against the project, especially within the USAF, which preferred aerial overhead reconnaissance.[28] Although the studies conducted as part of the *WS-117L* later provided foundations for *Corona* and *Midas* satellites, the U-2 remained the primary overhead reconnaissance project for the time being.

16 At the same time that the CIA was finishing work on the U-2 spy plane program, the Eisenhower administration undertook a diplomatic offensive aimed at providing a legal basis for overhead intelligence gathering. At a summit in Geneva in 1955, Eisenhower proposed an Open Skies treaty to the Soviets.[29] He suggested that both states provide each other with complete blueprints of their military installations and sanction reconnaissance overflights by the other side, along with providing the necessary infrastructure for operating such overflights. Eisenhower hoped that this would provide an efficient and, more importantly, legal way of tracking military developments and movements and verifying compliance with potential disarmament treaties in the future. However, since the Soviet intelligence did not stand to benefit from the treaty as much as the US because the KGB did not have issues infiltrating the US state and security apparatus, Khrushchev definitively rejected Eisenhower's proposal.[30] Even though the attempt to legitimize the existence of the U-2 failed, the program proceeded, as the plane had been designed for illegal overflights from the start.

17 Luckily for Eisenhower, the Soviets' instigation of the Space Race offered him a solution to this legal issue. In 1957, an R-7 rocket launched from the Kazakh Soviet Socialist Republic carried the first artificial satellite into Earth's orbit. *Sputnik-1* orbited the Earth for a few days, passing over the United States several times.[31] Even though the incident caused mass panic in the United States, as it became clear that the US had fallen behind in satellite technology, the launch of *Sputnik* actually proved beneficial for the Eisenhower Administration, establishing an important legal precedent that would form the basis of future international space law. At the time, spaceflight was an entirely new domain. The legal status of space beyond Earth's atmosphere was not yet defined by any regulation or international treaty.[32] By having their satellite orbit over the United States without asking for prior US approval, the Soviets sent a clear message that they considered space to be an international domain and that they did not believe that existing conventions on airspace extended beyond the Earth's atmosphere. This was exactly what Eisenhower wanted to achieve through his Open Skies proposal—a legally sanctioned regime of overflights and monitoring from above. By setting a precedent and establishing the rule of freedom of space, the civilian Soviet space program laid the foundation for future space law and for what would soon become a silently agreed upon regime of mutual satellite invigilation.

18 In the meantime, the CIA's U-2 spy planes finally took off and proved successful in gathering intelligence. Even though Soviet radars were able to detect and track the plane, thanks to its unique design, the U-2 plane flew too high for interception by fighter planes and surface-to-air missiles. Despite knowing very well of the violations of its own airspace and fearing the humiliation of its air defense troops, the USSR never officially acknowledged or protested these intrusions. Soviet silence on the matter and no attacks on U-2 planes allowed the US to conduct safe overflights of various parts of the USSR and relatively safe acquisition of photographs of Soviet military installations.

19 The plane's biggest success was providing proof that there was indeed a bomber gap, but in favor of the US. In 1956, the Air Force had estimated that the USSR was already

in possession of approximately 100 new and modern M-4 long-range bombers.[33] The National Reconnaissance Office, on the other hand, estimated that by 1957, the USSR would possess around 1,300 heavy bombers.[34] By providing photographs of all major Soviet strategic airfields, the U-2 overflights proved both of these assessments to be wrong. Not a single M-4 bomber was to be seen in these photographs. Using data gathered with aerial intelligence, the CIA judged that the Soviet Union actually possessed a "minimum long-range bomber production program."[35] The new intelligence on the Soviet strategic bomber fleet and Intercontinental Ballistic Missile (ICBM) program gathered by the U-2 led the CIA to conclude that, contrary to prior beliefs, "the USSR [was] not engaged in a crash effort to develop an overwhelming nuclear delivery capability."[36] However, even though the U-2 plane provided Eisenhower with evidence to support his argument for decreased military spending, the nature of the U-2 program rendered this evidence unusable. Since the program involved illegal violations of Soviet airspace, it had to remain secret, even from members of Congress, as declassifying such intelligence would essentially mean admitting to violation of international law. Because of this secrecy, members of Congress often questioned the validity of data provided by the CIA when the source of the information remained classified.[37] This led the Congress to dismiss data gathered by U-2 and to maintain high defense budgets.[38]

20 But it was the U-2 incident of 1960 that was the final nail in the coffin for the aerial reconnaissance program over the Soviet Union. Eisenhower wanted to limit violations of Soviet airspace as much as possible, so the planes remained mostly grounded for nearly two years, with no overflights in 1958 and just a minimal number taking place in 1959. However, the President came under pressure from Congress, the Air Force, and various media outlets, all of whom claimed that the USSR had developed an advantage in ICBM numbers. The launch of *Sputnik* just a few years before instilled in the American public a widely accepted belief that the USSR had developed an advantage in rocket technology. In 1960, Eisenhower gave in and allowed the U-2 planes to resume flights with the goal of obtaining evidence that there was in fact no missile gap. But on May 1st, Eisenhower's worst fears came true. A U-2 plane was shot down by Soviet surface-to-air missiles as it was collecting intelligence on the Soviet ICBM program. Even though the pilot survived and was captured, the ensuing political crisis made it clear that the newest Soviet air defense technologies rendered reconnaissance planes obsolete.[39]

21 No other U-2 overflights of the USSR were ever approved by Eisenhower. By providing evidence that there was no bomber gap, the U-2 had proven that overhead reconnaissance can be effective, but a safer, and preferably legal way of conducting it was necessary. One month after the U-2 incident, the CIA deemed it necessary to accelerate the ongoing studies on the reconnaissance satellite program that had stalled in the previous few years, as they believed a spy satellite would be "less affected by … political considerations affecting other reconnaissance systems."[40]

22 The concept of using satellites for reconnaissance was not new; it had already been studied and described as promising by the Technical Capabilities Panel. Even though the concept was endorsed by Killian's Panel, the TCP also acknowledged that the technology needed had not yet been created. Additionally, the project encountered resistance in the US national security community, especially within the Air Force.[41] But in 1957, the USSR proved that putting a satellite in orbit was technically feasible, and

the initial resistance of the Air Force faded away amidst the *Sputnik* shock. In 1958, the US caught up and placed its first civilian satellite—*Explorer-1*—into Earth's orbit. The first successful US orbital flights convinced many that those technologies could indeed be harvested for matters of national security. The U-2 crisis in 1960 accelerated the studies on reconnaissance satellites even more. Building on the foundations laid by Killian's and Eisenhower's *WS-117L*, the *Corona* project was born.

4. *Corona* and *Midas*—An Intelligence Success

23 Work on a reconnaissance satellite was resurrected in 1958, following the first successful orbital flights of *Sputnik-1* and *Explorer-1*. President Eisenhower intervened and personally ensured that the studies on spy satellites were given more priority. The scattered and unfocused studies conducted as part of the canceled *WS-117L* were consolidated and received more funding. A new project called the *Corona* program was created. It was initially supposed to be an interim test program that would start in 1959 and last until late 1960, after which it would have been replaced by a dedicated and more advanced reconnaissance platform. In 1958, Lockheed received instructions from the CIA for the works to start, and the company started securing subcontractors for specific satellite subsystems, such as reentry vehicles and camera lenses. On May 14th 1958, the contractors submitted the first design for review. After suspension of the U-2 program, the program received higher priority and thus more funding, which further accelerated its progress.[42]

24 The final satellite design was very ambitious and complex for its time. The spacecraft was equipped with an f/5.0 aperture and 61 cm focal length panoramic camera, which allowed for sharp and close up photographs of the Earth's surface from space. Along with its impressive photographic system, *Corona* had a very unique system for returning the acquired imagery to Earth. Instead of transmitting the photographs to Earth, the *Corona* designers opted for a more complicated solution. The entire film roll would be sent back to Earth in a reentry vehicle, and it would then be caught mid-flight by a specially modified recovery plane. The film would be developed and studied on Earth, thus preventing any image quality loss during transmission from space. Furthermore, the satellites needed to be in polar orbits in order to maximize their coverage of the Earth's surface, which further complicated matters, as previous launch facilities and vehicles were designed for more equatorial orbits.[43]

25 This level of complexity necessitated coordination of many factors. The launch profile had to be met, film had to be fed into the capsule correctly, the capsule had to survive the heat of atmospheric reentry and then the recovery plane had to spot the parachute and recover the capsule in time. On top of that, the program's utmost secrecy was yet another complication. Here, the civilian space program again proved useful. In order to keep it a secret from the USSR, the entire program was disguised as part of a civilian scientific program run by NASA called *Discoverer*, and all *Corona* missions were to be launched under this designation.[44]

26 The first few launches were complete failures. Missions *Discoverer-1* through *Discoverer-12* all faced some technical issues that led to mission failures. Some failed to enter orbit, other experienced issues with camera systems, and some burned in the atmosphere during reentry. However, on August 10th, 1960, the first *Corona* satellite, designated *Discoverer-13,* finally completed its first successful test mission.[45] Even

though the satellite did not take any photographs, it entered the desired orbit and the return capsule survived atmospheric reentry and was captured by a recovery plane, marking the first successful recovery of a man-made object from space, beating the Soviet Union in this achievement by just nine days.[46] August 19th marked the first fully successful reconnaissance mission—*Discoverer-14*—which entered the desired orbit and successfully returned photographs of the Soviet Union to the United States that proved invaluable to the US intelligence community. Throughout early 1960s, dozens of *Corona* satellites were launched every year, with mission success rates gradually improving. Ultimately, the program became highly reliable, with all missions between 1966 and 1972 being complete successes.[47]

27 The data that *Corona* satellites started delivering in 1960s finally provided the United States with much-needed, credible information on the Soviet military-industrial complex. The amount and quality of the intelligence data was like nothing the US intelligence community had seen before.[48] *Discoverer-14* alone provided information that would completely change the perceptions of the Soviet threat. A CIA memorandum in February 1960, produced six months before the launch of *Discoverer-14*, estimated that the USSR would be in possession of one hundred forty to two hundred ICBMs capable of attacking continental United States as early as 1961.[49] A month after the successful launch of *Discoverer-14*, this estimate was reduced to ten to twenty-five ICBMs by 1961. This was the result of just one successful flight, and each following mission further demonstrated that the Soviet threat was not salient.

28 After numerous launches, the US intelligence agencies were able to find a total of just six ICBMs in the entirety of the Soviet Union by 1962.[50] Two years later, basing their estimates on *Corona* imagery, the CIA judged with high certainty that the USSR was in possession of no more than 220 heavy bombers and 197 missiles capable of delivering nuclear weapons to the US.[51] In comparison, at the time the US possessed more than 1100 long-range bombers and more than 800 ICBMs.[52] The overwhelming US advantage finally became an undisputed fact. By 1972, reconnaissance satellites delivered over 860,000 photographs of the Soviet Union and other Eastern Bloc states, providing the US with accurate estimates of both conventional and nuclear Soviet forces.[53] Even though it was initially supposed to be an interim program, *Corona* was so successful that it assumed the role of the main reconnaissance program of the US, ousting other designs such as *Samos,* which was originally intended to replace *Corona*.[54]

29 However, *Corona* satellites had limitations. Even though they were able to track troop movements, photograph missile testing facilities and spot new plane types on runways, they were unable to do one crucial thing—detect ICBM launches. Early types of ICBMs took a long time to prepare for launch. For example, the first Soviet ICBM—the R-7—needed 24 hours to be rolled out onto the launching pad and to be fully fueled.[55] An R-7 being prepared for firing could have been spotted by *Corona* in time to open diplomatic channels or, if need be, strike preemptively. But rocket technology progressed, and newer generations of ICBMs required less time to prepare for launch, which meant that the time window to detect such preparations shrank. With no early warning of an attack, the US could have been struck with a surprise strike with no way to retaliate. These technological developments in rocket engineering again ignited the fear of a surprise attack that *Corona* had initially diminished. This is why a new approach was needed. Instead of detecting launch preparations, new satellites needed to detect launches themselves. The *Midas* satellites were born of this need.

30 The *Midas* satellites were direct derivatives of the *Corona* satellites, and many of their launches also took place under the cover of NASA's *Discoverer* program, even though the supervision of the program was assigned to the Air Force. Designed by Lockheed, the core of the spacecraft remained unchanged, but the satellites were equipped with different sensors. The photographic cameras and film return systems were removed, and infrared sensors that were originally designed as part of the *WS-117L* program were installed in their place. The infrared sensors were supposed to detect heat surges on the surface of the Earth that were indicative of an ICBM launch. The *Midas* network consisted of a total of twelve satellites orbiting at over 2,000 nautical miles above the Earth's surface, with every satellite in a different orbital plane to maximize the coverage of the ground. The detection of a missile's heat signature was instantaneous, providing sufficient early warning of an incoming attack.[56]

31 It is difficult, however, to accurately assess *Midas*' success. The sources available about the *Midas* program are, unfortunately, very scarce, which historians of spaceflight such as Dienesch have lamented.[57] There are very few openly accessible scientific publications about the program or official evaluations of its effectiveness. From the sources available, it is possible to say that the first few *Midas* satellites since the first launch in 1960 suffered from issues similar to early *Coronas.*[58] But on May 9, 1963, *Midas-7* became the first successful early-warning satellite in history. It reached the desired orbit and successfully detected scheduled launches of *Polaris* and *Minuteman* missiles. Unfortunately, due to the limited number of the satellites and their low Earth polar orbits, the entirety of the Earth's surface could not be constantly monitored. This was a serious limitation, as monitoring just the USSR was not enough. Coverage of the entire planet was needed if the satellites were to detect missiles launched from submarines that could be fired from anywhere in the world. Additionally, the infrared sensors often mistook sunlight reflected from clouds for missile launches. As such, the program was discontinued rather quickly, and the last *Midas* launch took place as early as in 1966. But US policymakers recognized the benefits of early warning satellites, and in 1970, a brand new early warning system—the Defense Support Program (DSP)—took *Midas*' place. The DSP provides the US with early warnings to this day.[59]

32 Overall, reconnaissance satellites solved the issue of lacking insight in a way that earlier intelligence platforms were unable to do. Thanks to the precedent set by *Sputnik* and technological advances of the space program, reconnaissance satellites became able to freely monitor the adversary without the risk of sparking an international crisis. Contrary to aerial assets, spy satellites could gather information unbothered by enemy defenses. By successfully capturing thousands of photographs, *Corona* satellites provided more intelligence than the entire U-2 program and finally allowed for accurate assessments of Soviet strength. President Lyndon B. Johnson valued *Corona* intelligence so much that he called it the most valuable outcome of the US space program.[60] *Midas* further contributed to this intelligence success. Even though it did not work perfectly, *Midas* (and its successor) extended the warning time enough for the entire US bomber fleet to take off in time and to escape destruction in case of an actual attack.[61] Thus, the developments of the Space Race provided both a technical and a legal solution to the potentially threatening lack of transparency.

5. Spy Satellites and Stability of the International System

33 As Michael Walzer has argued, in certain cases, espionage can promote rather than hinder communication and stability between nations.[62] Unfortunately, early forms of espionage in the form of human agents or aircraft proved to be ineffective and often heightened the risk of conflict. But satellites allowed for an entirely novel and non-invasive form of covert intelligence gathering. Space-based surveillance platforms provided the United States with unprecedented amounts of invaluable information that finally, after more than a decade of the Cold War had already passed, delivered sufficient data to correctly judge Soviet capabilities and intentions. In the anarchical international system, in which a state has to rely just on itself for its safety, information on the potential adversary is crucial.[63] Since a state that feels threatened might resort to preventive war in order to eliminate the threat before it becomes too great, reliable intelligence is necessary for all actors involved. When nuclear weapons enter the equation, the need for transparency and communication becomes even more urgent. The dawn of space surveillance mitigated this issue in a number of different ways.

34 First of all, the *Corona* program allowed for unprecedented levels of transparency and finally provided the US with reliable data on the USSR, which limited the risk of miscalculation—a factor that often destabilizes international systems.[64] The US government could now make informed decisions, knowing that the four-times-smaller ICBM arsenal and five-times-smaller bomber fleet of the USSR posed no strategic threat to the United States. These satellites were capable of monitoring armament programs, tracking military movements almost in real time, and of detecting any actual Soviet preparations for hostilities, whether nuclear or conventional. This, in turn, allowed for measured responses. This new information delivered by *Corona* finally silenced any serious considerations by members of the US government of a risky preventive strike against the USSR. Since the new intelligence ensured the United States' second strike capability, it became possible to turn instead to deterrence. Thus, transparency eliminated both incentives for a preventive strike listed by Robert Jervis: fear of vulnerability and fear of losing the ability to retaliate.[65]

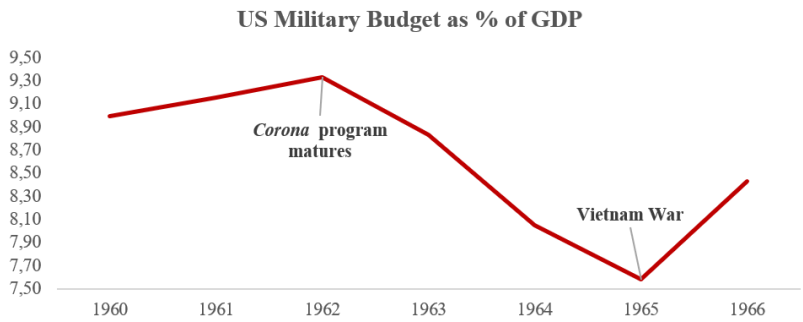
35 Furthermore, the program provided the US with means to constantly monitor Soviet political moves and proved especially useful during the numerous crises of the Cold War. Perhaps the best example of this was the employment of *Corona* satellites to track Soviet movements during the Cuban missile crisis.[66] Even though a satellite launched specifically with the task of surveilling Cuba on September 29th 1962 was unable to provide intelligence on the island itself because of dense cloud coverage, *Corona* satellites still had a major impact on the handling of the crisis. As Ernst May has pointed out, satellite imagery played a role in steeling the nerves of the Kennedy administration.

36 Kennedy's advisers judged from *Corona* imagery acquired over Eastern Europe that while some Warsaw Pact states were increasing the readiness of their armed forces, the preparations were not significant. This allowed Kennedy to correctly judge that the Soviets were not preparing for a major confrontation.[67] With the reliability of *Corona* increasing in the next years, they would continue providing critical information for crisis management throughout the Cold War. As Dino Brugioni, a senior manager at the

National Photographic Interpretation Center, recalled, *Corona* imagery was perceived as useful in making informed decisions during crises like the Six-Days War, the Soviet invasion of Czechoslovakia, the Sino-Soviet border conflict, the Vietnam War, the construction of the Berlin Wall, and the Kyshtym nuclear incident.[68]

37 Moreover, data from *Corona* satellites addressed the issue of the infamous security dilemma. The security dilemma is a concept which assumes that actions undertaken by one state to increase its own security can be viewed as hostile and offensive by the other side, thus leading to fear for one's security, tension, and arms races.[69] The constant growth of the United States' strategic arsenal in the early Cold War, when intelligence on Soviet capabilities was scarce, is a perfect example of this at play. While definitely threatening to the USSR, the US nuclear arsenal was developed with homeland security in mind. But the data delivered by *Corona* in 1960s showed that even as a defensive measure, such a potent nuclear force was not needed. Since the security dilemma becomes especially dangerous when offense is believed to have an advantage over defense, proof that the Soviet arsenal was not dangerous enough to warrant a first strike severely reduced the danger.[70] The conclusions that further growth of the strategic arsenal would not improve US security were reflected in the defense budget requests for the fiscal years following the introduction of this satellite system.[71]

38 The defense budget as a percentage of GDP declined steadily from the maturation of the *Corona* program around 1962 and it only started growing again with the increased US engagement in the Vietnam War in 1965.[72] *Corona* data achieved what prior intelligence assets were unable to do—to convince the Congress that reducing defense expenditures would not threaten US national security. As a result, the number of US strategic assets in active service at the time actually started decreasing. For example, the American arsenal went down from 860 ICBMs and 1100 bombers in 1964 to 935 and 800 respectively in 1965.[73] This cooling down of the destabilizing arms race resulting from the security dilemma was possible thanks to satellite intelligence.



39 Figure 1: US military spending as percentage of GDP in the 60s. Source: Military expenditure (% of GDP) - United States, World Bank.

40 Another factor that contributed to the satellites' stabilizing role was the mutuality of surveillance. Despite initial secrecy, the USSR seems to have acquired information about *Corona*'s existence and it hinted to this fact in its diplomatic actions.[74] Initially, the Soviet Union tried to contest the legality of reconnaissance satellite overflights over sovereign territory in accordance with international law.[75] But it proved difficult to justify such a stance considering that its own satellites had previously orbited over the United States. Ultimately, Soviet protests went silent in 1963, when the USSR

launched its first reconnaissance satellite—the *Zenit 2*— into orbit. *Zenit* satellites mirrored the tasks of *Corona*, providing photographs of strategic and military installations all over the United States.[76]

41 By mid-1960s, both the *Corona* and *Zenit* programs were fully operational, providing both sides with intelligence on their opponents. Soviet's silent acceptance of the existence of spy satellites was tremendously important. Both sides now had reliable sources of information on the capabilities of the opponent. The positive impact on the stability of relations between the superpowers seems to have been recognized as early as the 1960s. For example, a CIA estimate of Soviet strategic forces in 1964 noted that not only was the Soviet ICBM program not a threat to the US, but the USSR was not even trying to match the US nuclear arsenal. As the report stated, "recognition that the US would detect and match or overmatch such an effort ... appeared to have ruled out this option."[77]

42 What further reinforced the mutuality was the introduction of a satellite registry by the United Nations in 1962 (with voluntary participation from both the US and USSR), through which all satellite launches became public information. However, the nature of the satellites launched was able to be concealed from the general public.[78] This was an important detail, as both governments would be notified of a new satellite launch, but the secrecy allowed avoiding any loss in prestige connected to publicly acknowledging that the enemy had insight into one's territory. Thus, a new system of covert, legal, and mutual invigilation from space was born, allowing for levels of transparency that had not been experienced before. Knowledge of the existence of the opponent's satellites was important, as each side knew that their adversary would be alerted to any potentially threatening move and would be able to react in time. This rendered surprise strikes obsolete.

43 Early warning satellites further contributed to international security, as they enabled effective nuclear deterrence. *Midas* and, later, DSP provided the US with the ability to immediately detect and counter potential Soviet ICBM attacks. This again eliminated important incentives for a preventive strike by either side. Since a warning in advance allowed beginning the potential retaliatory strike in time, Americans' fear of an inability to retaliate was directly addressed. As for the USSR, knowing of the existence of the United States' early warning systems eliminated a potential incentive for the Soviets: taking the risk of a first strike in the hopes of preventing retaliation. Later on, the Soviet Union also recognized the benefits of space-based early warning systems and created its own counterparts, launching its first early warning system—the *Oko*—in 1972.[79]

44 Just as in the case of photographic reconnaissance satellites, the USSR and the US created networks of early warning satellites that allowed them to monitor each other and warn of any nuclear attack in advance. Even though detailed information about both Soviet and American early warning systems remain classified to this day, it is hard to dispute their stabilizing role. They became one of the key pillars of the Mutually Assured Destruction doctrine that characterized international security in the second half of the Cold War.[80] Early warning systems ensured both states that they would not lose their ability to retaliate in case they became the target of an attack, and they limited the incentives for a preventive strike, which Kenneth Waltz identifies as some of the most important factors for successful nuclear deterrence.[81]

45 In the later phase of the Cold War, the nature of spy satellites allowed them to play a crucial role in enforcing and verifying compliance with the various disarmament and arms limitation treaties between the US and the USSR. They were the sole assets capable of non-invasive verifying of compliance, and both sides wanted to prevent foreign inspectors from physically entering their military installations.[82] Satellites' usage for this purpose is the only function that US and USSR governments have publicly endorsed, although not explicitly. Both the Strategic Arms Limitations Talks (SALT) I and II treaties, signed in 1972 and 1979, respectively, included implicit provisions allowing compliance verification using satellites. As such, SALT I permitted the signing parties to "use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law."[83] SALT I also forbade any "concealment measures which impede verification," including changes in current "construction, assembly, conversion, or overhaul practices." SALT II went even further, requiring the parties to incorporate "functionally related observable differences" and "externally visible design features" into aircraft and missiles.[84]

46 These provisions were included so that visual identification could be performed by photographic reconnaissance satellites, based on already acquired knowledge of the other side's designs and practices, despite the fact that satellites were not explicitly mentioned in the treaties. This is confirmed by since declassified intelligence documents. Richard Helms, the Director of Central Intelligence from 1966 to 1973, correctly observed in an address about SALT at the National War College that a method of compliance verification from outside of the USSR was needed. "I am talking, of course, about satellite reconnaissance," he said.[85] Indeed, he directly stated that the provision on technical means of verification refers to satellites. Such phrasing was supposed to legalize satellite compliance verification without publicly admitting satellites' existence. As Helms put it: "There will be no misunderstanding between Washington and Moscow what is meant. But we'll avoid a lot of problems by saying it that way."[86] But satellite compliance verification was not limited just to the SALT treaties. Identical mentions of "technical means of verification" can be found in other arms control agreements, such as the Anti-Ballistic Missile (ABM) Treaty or Strategic Arms Reduction Treaty (START I).[87] Helms was right in claiming that the development of mutual space espionage was "crucial in bringing about the possibility of a major arms control treaty."[88]

47 Just as the ABM Treaty aimed to restrict the use of missile defenses to ensure the mutuality of nuclear deterrence, policymakers also attempted to safeguard the beneficial mutuality of space surveillance. President Jimmy Carter, one of the authors of the SALT II treaty, deemed mutual space espionage so important for arms control that he and his Administration became vocal opponents of anti-satellite (ASAT) weaponry.[89] Indeed, the development of ASAT weapons became the subject of talks between the US and the USSR during Carter's presidency. Even though no agreement specifically dedicated to restricting usage of ASAT weapons was ever signed, the aforementioned arms limitation treaties did restrict ASAT usage with the inclusion of bans on "interference with national technical means of verification," which, according to Weber and Drell, referred to anti-satellite weapons.[90] Recognizing the wisdom of the famous Russian proverb "trust, but verify," policymakers on both sides correctly

judged that ASAT weaponry could potentially destabilize the established, system of mutual espionage from space.[91]

6. Conclusion

48 The Space Race played an important role in influencing the dynamics of the Cold War. This article has shown how spaceflight was employed for national security purposes, which in turn mitigated the lack of trust resulting from insufficient intelligence. The volatile history of overhead intelligence gathering culminated in the creation of reconnaissance satellites. These satellites resolved some of the most pressing issues of the early Cold War resulting from the anarchical nature of the international system. The lack of solid intelligence on the Soviet Union led to the proliferation of false data and exaggerated numbers on the armed forces of the communist empire along with fear of Soviet aggression. Since uncertainty about the opponent's capabilities and intentions is considered one of the most destabilizing factors in the international system, the Cold War was characterized by tension, uncertainty, and considerable threat of a global war prior to the creation of the system of mutual monitoring from space,.

49 Early attempts at aerial reconnaissance did not offer a solution to the problem. The *Genetrix* balloons were an outright failure, and technical limitations of the U-2 airplanes, together with the illegal nature of their missions, proved the program to be inadequate. But the successful launches of *Sputnik-1* in 1957 and *Explorer-1* in 1958 opened the door to space surveillance. Thanks to the precedent set by *Sputnik,* space became an international domain. This allowed for intelligence gathering without the threat of loss of life and practically eliminated the risk of sparking a conflict while gathering intelligence. The subsequent creation of the *Corona* satellites finally delivered the much-needed information about the Soviet adversary. The satellites not only quickly provided more useful data than the U-2 program, but also reassured the American decision-makers that there was, in fact, no Soviet strategic advantage. This, in turn, allowed for a decrease in military spending and a cooling down of the arms race. The unprecedented levels of transparency allowed for informed decision-making and directly addressed the security dilemma. The *Midas* early warning satellite program and its successor, DSP, further allowed the easing of tensions. The possibility of immediate detection of ICBM launches allowed policymakers to once and for all eschew their ideas of preventive war and to instead focus on deterrence and, in the worst case scenario, preemption. Moreover, spy satellites paved the way for arms limitation treaties, as they provided both sides with non-invasive and legal methods of verifying compliance. The mutuality of space surveillance further contributed to the stability of the international system. None of those successes could have taken place without the technological and legal developments of the early spaceflight era.

50 This article has demonstrated how and why the silent consensus between the US and the USSR on mutual surveillance from orbit came to be and how its transparency then influenced the anarchical international system. Since this article has focused on the US perspective, as more Soviet sources become available in time, further research could probe Soviet perceptions of the US threat and whether their own reconnaissance satellites had an impact on the formulation of Soviet foreign policy towards the United States. The Soviet Union developed very innovative space-based reconnaissance

systems, such as the discussed *Zenit*, its direct successor, the *Yantar*, and the space station *Almaz*—the first-ever crewed, space-based spy system.[92] Further research could investigate whether those systems changed the Soviet approach to the United States and its allies. Unfortunately, with the secrecy surrounding modern Russian archives, historians might have to wait for a while before this knowledge is finally uncovered.

NOTES

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ABSTRACTS

This article traces the history of US and Soviet reconnaissance satellites during the Cold War. It fills the gap in historiography of the Space Race that has inadequately studied military space programs and focused largely on civilian spaceflight, with the Apollo Moon landings being a prime example. It argues that the military satellites employed by both the US and Soviets offered unprecedented amounts of information on the other side and eliminated the issue of lacking intelligence that characterized the early Cold War. This in turn allowed for a more peaceful coexistence between these two ideologically opposed superpowers. Spy satellites allowed for a better assessment of the other side's military strength, created a system of early warning for nuclear attacks, and offered a non-invasive way of verifying arms control treaties. These reconnaissance satellites and their successors play this important role up to this day.

INDEX

Keywords: Space Race, Cold War, espionage, reconnaissance satellites, overhead reconnaissance, Corona, Midas, CIA

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