The Political Impact of Spy Satellites

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Abstract
During the Cold War, American and Soviet spy satellites were central in reducing tension between the super-powers, and in enabling the Strategic Arms Limitation Treaties to be negotiated. This paper outlines the political context of the Cold War spy satellites and the technical and operations solutions that the USA and the Soviet Union deployed to gather strategic intelligence. Turning to today's multi-polar world the paper comments on possible international initiatives. The potential for initiatives involving spy satellites to support United Nations sponsored actions world-wide are discussed.

1. Introduction

By the mid-1950s both the Soviet Union and the US had exploded nuclear weapons and fired long range missiles. Both countries therefore felt exposed to an attack by the other, fuelled by their recent history. The US recalled the surprise Japanese attack at Pearl Harbor in December 1941 that triggered full-scale war in the Pacific. The entry of China into the Korean War in 1950 and the first Soviet atomic and hydrogen bomb tests (1949 and 1953) had also come as major surprises. On the Soviet side, Germany's surprise attack in the summer of 1941 was still fresh in the memory.

The West had very little information about activities inside the Soviet Union – the closed nature of Soviet society prevented the movement of foreigners around the country, and newspapers and other publications were heavily censored. What little information the West had about the vast central regions of the Soviet Union came from defectors and the occasional over-flight by America's U-2 spy plane. The US initiated a program of high flying reconnaissance aircraft, commonly referred to as the U-2. Flights were made across the Soviet Union throughout the 1950s, safe in the knowledge that the Soviets did not possess an anti-aircraft weapon capable of reaching the 25+ km altitude of the U-2. However the US government realized that eventually the Soviets would develop such an anti-aircraft weapon, so in 1955 President Eisenhower initiated a reconnaissance satellite program aimed at replacing the U-2.

Soviet developments were focused on increasing the range of ballistic missiles, rather than on satellites. In 1955 the US had wrongly believed that the Soviets were rapidly deploying a large fleet of long range bombers. In retaliation the US boosted the number of B-52 bombers, which the Soviets decided not to try to match. The Soviet Union chose instead to achieve superiority in missile reach.

By 1957 the Soviet long range missile was being successfully tested, a fact that was known to the US, thanks to its network of radar tracking stations ringing the Soviet Union.

Somewhat reluctantly, the Soviet leadership gave the final go-ahead in the summer of 1957 for a payload to be carried on top of the long range missile to be placed in orbit. The US leadership had

predicted such a step, since it was understood that an inter-continental ballistic missile (ICBM) was easily modified to reach orbit.

Right from the outset, space played a role in reducing international tensions. Today, as the number and intensity of flash points increases, it is no surprise to find political leaders relying on space more and more.

The early use of space to reduce tensions was originally subject to military classification, but in recent years much of the story has been made public. As the EU and ESA start to exploit space in the security domain, it is instructive to look back at the relevant programmes in the early years of the space age.

2. The start of the space age

The first public acknowledgement of American military surveillance (i.e.: spy) satellites was on 1 October 1978 at the Kennedy Space Center when President Jimmy Carter stated: "Photographic reconnaissance satellites have become an important stabilizing factor in world affairs in the monitoring of arms control agreements. They make an immense contribution to the security of all nations." Further information on the relevant programmes and satellites had to await the mid-1990s, when the American CORONA programme was largely declassified. Information on the equivalent Soviet Zenit-1 programme also became available at about that time, but it is the CORONA programme that provides the most relevant political lessons.

The launch of Sputnik on 4th October 1957 on a converted intercontinental ballistic missile (ICBM) by the Soviet Union brought home to everyone in the West the ability of Soviet long range missiles to reach every corner of the globe. The USA however had no idea how many such missiles the Soviets had or could deploy. In mid-1960 the official estimate (highly classified at the time) of Soviet ICBMs likely to be deployed soon ranged from 700 according to the US Air Force to 150 by the US Army and US Navy, with the CIA estimate in between at 400. The high estimate by the Air Force illustrated the bias in such intelligence, since these estimates were used to justify investment in Air Force projects to counter the apparent Soviet threat.

The initial US concept was for a satellite that developed the film onboard and radioed the images to ground. By the time of Sputnik this project had encountered a variety of problems, delaying its completion and increasing its costs. Spurred on by the Soviet missile successes, an interim concept was initiated in which the film would be returned to earth in a recovery capsule and developed on the ground. This "interim" system, called CORONA, ended up as the mainstay of the US strategic surveillance program for more than 10 years.

Being an interim program, CORONA looked to existing solutions where possible. The platform was the upper stage of the Agena rocket, the camera was adapted from that flown in the U-2 aircraft, and the ejection capsule from high altitude balloon experiments – Figures 1 and 2. Despite avoiding unnecessary developments, CORONA was plagued by failures. All nine attempts to launch a CORONA in 1959 failed, involving most of the elements of the system - the first and second stages of the rocket, the camera, and the capsule ejection system.

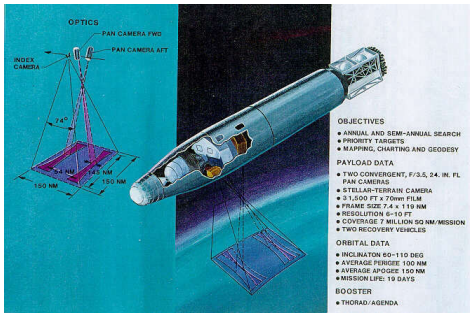

Figure 1. Typical CORONA stereo camera configuration built on the Agena upper stage

The shooting down of a U-2 over central Russia on 1st May 1960 closed off the only objective, albeit woefully incomplete, source of information about Soviet preparations. After a further 4 failures in 1960, the first CORONA images were returned to earth in August 1960. This first flight identified 64 previously unknown Soviet airfields, but the images were too blurred to provide detailed information on ICBMs. After several more failures, successful CORONA flights in mid-1961 proved that the Soviets had deployed only a handful of ICBMs, and these were of a type that was difficult to deploy rapidly or in large numbers.

The startling news that the Soviets lacked a significant ICBM fleet undercut the arguments of those in the USA who were calling for a pre-emptive nuclear attack on the Soviet Union.

Once a CORONA had exposed all of its film its mission was over – and this typically occurred within a few days for the early flights. A new satellite had to be launched to continue the surveillance, and the frequency with which this was done seems astonishing by today's standards. A new CORONA was launched on average every 6 weeks. Over the ten years of the program, a total of 145 were launched of which more than 120 were successful.

Figure 2. The parachute (yellow) carrying a CORONA capsule with its undeveloped film is snared by the catcher plane over the Pacific Ocean

The frequent launches of CORONA had the advantage that improvements could be introduced incrementally. The cameras were gradually improved - the swath width of the images increased from 190 km to 290 km, and the resolution to better than 2m. From 1962, stereo images were introduced – a major improvement for the analysts. Another major improvement from about 1963 was the addition of a second recovery capsule. The second capsule meant that images could be returned to earth before the film was finished. The

remainder of the film could be exposed over the course of several more days before being returned in the second capsule. Longer film reels were carried to take advantage of the longer mission duration.

3. The Soviet Zenit-2

The Soviets, too, had many failures before their surveillance satellite became operational in August 1962 - two years after CORONA. Like the US they initially intended to have a real-time read-out scheme. And like the US they found that too difficult to implement with the required image resolution, and reverted to a capsule recovery scheme.

The Soviet Zenit-2 satellite as it was called was based on the Vostok manned capsule, a design choice that was intended to reduce the need for new developments for example in the area of attitude stabilization. However the stability required by Zenit-2 proved much more demanding than for Vostok, and significant development was needed.

At 4.8 tons, Zenit-2 was more than double the mass of CORONA. The main design difference was that the Zenit-2 camera was housed in a pressurized capsule, thus avoiding the vacuum-induced film problems experienced by CORONA.

A further difference was that the whole camera was returned in the re-entry capsule not just a film reel as used by CORONA. The Soviets could re-use the Zenit-2 cameras, thus saving money, but the design meant that they couldn't add a second recovery capsule. It wasn't until the 1970s that they changed the design so that multiple recovery capsules could be accommodated. Like the manned Soyuz capsules, Zenit-2 descended on land.

4. SALT

Throughout the 1960s and thereafter the USA monitored the deployment of Soviet ICBMs and nuclear submarines in great detail (see Figures 3 and 4) – launching CORONA satellites regularly until the next generation of surveillance satellites became available in the 1970s. The Strategic Arms Limitation Treaties (SALT-I and SALT-II) that halted the nuclear arms race between the superpowers are phrased explicitly to allow their verification by surveillance satellites.

Everything that couldn't be verified was omitted from the Treaties; for example a limit to the number of missile silos is defined, not missiles themselves or their warheads.

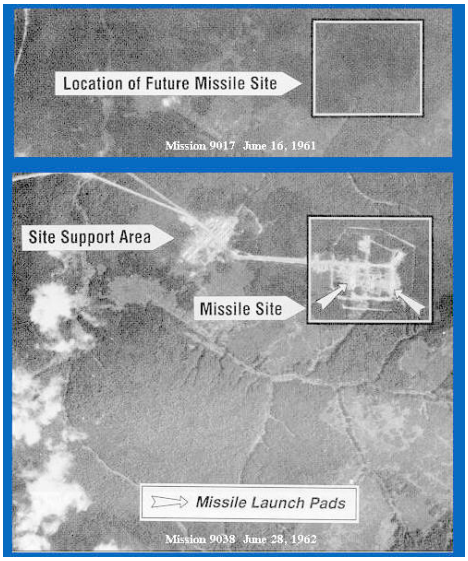

Figure 3. Images a year apart show new SS-7 ICBM sites at Yur'ya (near Kirov)
Credit: National Reconnaissance Office

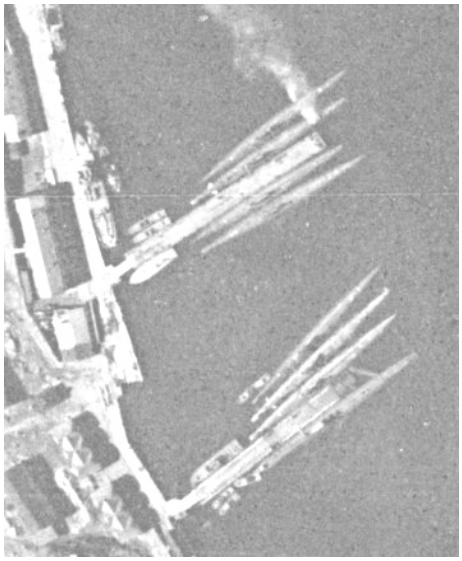

Figure 4. Soviet submarines at Polyarny (near Murmansk), 1966
Credit: U.S. Geological Survey

CORONA was ideal for identifying strategic threats, but failed on many occasions to provide tactical information. The 1968 Arab-Israeli 6-day war and the Soviet invasion of Czechoslovakia in 1967 were two examples where the CORONA imagery reached the intelligence analysts after the fighting was over. Nowadays, several organisations have deployed constellations of low orbit satellites in an attempt to provide both high quality imagery and fast response.

5. Europe

Western Europe played only a peripheral role in the strategic spy satellite programmes of the 1960s. However by the 1970s, programmes such as Meteosat and SPOT incorporated much of the same technology as the generation of American military surveillance satellites then emerging – digital detectors, for example. The scale of the USA programme has remained much larger than Europe's – today, all US defence space programmes total about $45 billion per annum, of which surveillance satellites make up a substantial part.

The EU Satellite Centre (EUSC) in Torrejon is the most public manifestation of Europe's current interest in the military uses of surveillance satellite data. The EUSC provides mapping and related information to EU member states and agencies for any of the world's trouble spots.

Although the risk of nuclear war between the superpowers has disappeared, regional tensions continue to pose a threat in many parts of the world. Satellite imagery can help the countries concerned avoid actions based on rumour, speculation or biased stories from defectors – as former UN Weapons Inspector chief Hans Blix put it: "defectors didn't want inspection, they wanted invasion".

The stakeholders in any zone of regional tension need reliable access to unbiased information – and surveillance satellites are one of the best sources for many purposes. As President Carter said in 1978, it is in the interests of all nations to reduce tensions that can lead to nuclear war. Most nuclear states have their own surveillance satellite programmes, but a few still rely on America or Russia, or lack any reliable source. Perhaps this is an area where ESA can recommend to Ministers in 2011 that steps be taken in the interests of world security – to create a reliable source of satellite imagery for any nation in the interests of reducing international tensions.

A more detailed discussion of the issues raised in this article, and of military surveillance satellites in general, is to be found in the author's book *Spies in the Sky* [Reference 1]

References (Examples)

1. Norris, P.: *Spies in the Sky – surveillance satellites in war and peace,* , Springer-Praxis, Chichester, UK, 2007 – see www.spiesinthesky.com