Spies in the Sky

Surveillance Satellites in War and Peace

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Springer

Published in association with
Praxis Publishing
Chichester, UK

PRAXIS

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Byfleet
Surrey
UK

SPRINGER–PRAXIS BOOKS IN SPACE EXPLORATION
SUBJECT *ADVISORY EDITOR*: John Mason, M.Sc., B.Sc., Ph.D.

ISBN 978-0-387-71672-5 Springer Berlin Heidelberg New York

Springer is part of Springer-Science + Business Media (springer.com)

Library of Congress Control Number: 2007929435

Printed in Germany

Cover design: Jim Wilkie
Project management: Originator Publishing Services Ltd, Gt Yarmouth, Norfolk, UK

Printed on acid-free paper

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Preface

This is a story of intelligence estimates of weapons of mass destruction being wildly inflated, and of politicians using these inflated estimates to win elections. It's about the development of systems to detect weapons of mass destruction during which scientists have their careers destroyed by government cover-up. These could well be stories from the first 5 years of the 21st century, but in fact they come from the late 1950s. They are part of the story of the greatest contribution satellites have made to the world since the dawn of the space age.

The space age has now been with us for half a century, since Sputnik blasted into orbit on October 4th 1957 opening up an era of enormous excitement and anticipation—excitement at the discoveries and images returned by each new satellite; anticipation as mankind took the first tentative steps into the solar system.

In the short time since, satellites[1] have delivered many amazing achievements. The first ones were expensive and limited in performance. Now they are the cost-effective way to collect weather information or deliver TV to homes or tell you your position. Satellites are truly part of our everyday lives.

The greatest achievement of those first 50 years was clearly Neil Armstrong and his fellow Americans landing on the moon in 1969–1972—many people would say. Or was it the pictures from Jupiter, Saturn, and the surfaces of Mars, Venus, and Titan, changing forever our image of Venus from beauty to beast, and of Mars from bloody warrior to future tourism destination? Or surely the detection of global change including deforestation in the Amazon and shrinkage of the Antarctic ice cap must rank as the most important achievement of satellites?

Personally, I rank highly the role of telecommunication satellites in shrinking the globe. Thanks to these satellites the plight of famine victims in Africa, of earthquake and flood victims in Asia, and of war casualties in Iraq and Afghanistan is brought into our living rooms as it happens. The statements, actions, and follies of politicians

* Sometimes a "satellite" should be called a spacecraft, as explained in Chapter 2.

and celebrities on another continent can be watched as if next door. Sporting events that unite the world are witnessed by billions as they happen. Thanks to satellites, we now take for granted the ability to phone the other side of the world without having to pay half a week's salary for a crackly line. And while developed countries increasingly rely on undersea cables for inter-continental communications, Third World and isolated countries—in the Pacific Ocean, for example—are totally dependent on satellites for communication with the rest of the world. Not to mention seafarers and aviators for whom satellites are the only reliable form of communication when far from land.

So, we could certainly debate the most important contribution satellites have made to our life since 1957. In this book I hope to persuade you that the accolade as the most crucial role played by satellites since Sputnik was none of the achievements mentioned above, but was instead the relatively unsung role played by American and Soviet spy satellites in helping to prevent a nuclear holocaust during the Cold War.

The origins of this book lie in my own career. I have had the good fortune to work in two dynamic industries for the last 40 years—computers and satellites. Computers are at the heart of all major hi-tech endeavors these days, and through that fact I have had the opportunity to participate in several of the most exciting space programs of the first space half-century including the Hubble Space Telescope, the Apollo moon landings, Europe's first weather satellite, the landing of Huygens on Titan, the failed landing of Beagle 2 on Mars, the early telecommunications satellites, and the latest positioning satellites. Whether that experience makes me any more qualified to choose the most important space contribution of the half century I leave for you to decide.

Many people have helped me in the preparation of this book—one of the main challenges being to not impact my day job in the Space Division of LogicaCMG. My wife first encouraged me to write my opinions down. Others who have helped include (in alphabetical order) Richard Blott, Mike Cutter, Bob Kelley, Bill Levett, Martin Littlehales, John Mason, Ian Pryke, and Nick Veck. My publisher Clive Horwood has been a constant source of encouragement. Special thanks to David Harland and to Dwayne Day who provided many of the images. To these and others whose contribution has been important I offer my thanks, but I accept that the opinions and (hopefully rare) errors in the book are mine alone.

I have tried to attribute copyrights for the images used where they were evident. If anyone wishes to claim an image, I will happily amend the appropriate caption in the next edition of the book.

Pat Norris
July 2007

For Amy, Ciarán, and Valerie

Figures

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1 B-52 over Afghanistan. Credit: U.S. Air Force photo by Master Sgt. Lance Cheung
2 CORONA KH-4 schematic. Credit: Maxwell AFB

Rear cover

1 Artist's impression of CORONA KH-4B. Credit: National Reconnaissance Office

Abbreviations and acronyms

ABM	Anti-Ballistic Missile
AEHF	Advanced Extremely High Frequency
AIRSS	Alternative Infrared Satellite System
ASAT	Anti-SATellite [missile]
BBC	British Broadcasting Corporation
CCD	Charge-Coupled Device
CCTV	Closed Circuit TeleVision
CD	Computer Disk
CIA	Central Intelligence Agency
COMINT	COMmunications INTelligence
CSI	Crime Scene Investigation
DC	District of Columbia
Defcon	Defense Condition
DIA	Defense Intelligence Agency
DMS	Defense Meteorological Satellite
DoD	Department of Defense [US]
DSP	Defense Support Program
ELDO	European Launcher Development Organization
ELINT	ELectronic INTelligence
ESA	European Space Agency
EU	European Union
FIA	Future Imagery Architecture
GCHQ	Government Communications Head Quarters
GDP	Gross Domestic Product
GEOS	Geodetic Earth Orbiting Satellite
GPS	Global Positioning System
H-bomb	Hydrogen bomb
HDTV	High Definition TeleVision

Hex	Uranium hexafluoride
IAEA	International Atomic Energy Agency
ICBM	Inter-Continental Ballistic Missile
IGS	Information Gathering Satellite
INF	Intermediate-range Nuclear Forces [Treaty]
IRBM	Intermediate-Range Ballistic Missile
IRS	Indian Remote Sensing [satellites]
JPL	Jet Propulsion Laboratory
KH	KeyHole
LBJ	Lyndon B. Johnson
Li	Lithium
MAD	Mutually Assured Destruction
MFN	Most Favored Nation
MHz	MegaHertz
MIRV	Multiple Independently-targeted Reentry Vehicle
MIT	Massachusetts Institute of Technology
MoD	Ministry of Defence [UK]
MOL	Manned Orbiting Laboratory
MOX	Mixed-OXide
MRBM	Medium-Range Ballistic Missile
Musis	Multinational Space-based Imaging System
N-POESS	National Polar-orbiting Operational Environmental Satellite System
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NCIS	Navy Criminal Investigation Service
NGO	Non-Governmental Organization
NOAA	National Oceanographic & Atmospheric Administration
NORAD	NORth American Aerospace Defense Command
NPT	Nuclear non-Proliferation Treaty
NRO	National Reconnaissance Office
NSA	National Security Agency [US]
OTH	Over The Horizon [radar]
Pan-STARRS	Panoramic Survey Telescope and Rapid Response System
PC	Personal Computer
Pu	Plutonium
RORSAT	Radar Ocean Reconnaissance SATellite
RPM	Revolutions Per Minute
SALT	Strategic Arms Limitation Treaty
SAM	Surface-to-Air Missile
SAOCOM	SAtellites for Observation and COMmunication
SAR	Synthetic Aperture Radar; Search & Rescue
SBIRS	Space-Based Infra-Red System
SDI	Strategic Defense Initiative
SDS	Space Data System

SIGINT	SIGnal's INTelligence
SLBM	Submarine-Launched Ballistic Missile
SLR	Single Lens Reflex
SPOT	Satellite Pour Observation de la Terre
SR	Space-based Radar
START	STrategic Arms Reduction Treaty
TAT	Trans-Atlantic Telephone
TNT	TriNitroToluene
TRW	Thompson Ramo Wooldridge
TSF	Télécoms Sans Frontières
TV	TeleVision
U	Uranium
UAV	Unmanned Aerial Vehicle
UK	United Kingdom of Great Britain & Northern Ireland
UN	United Nations
US/USA	United States of America
WW-II	World War II

1

Sputnik

INTRODUCTION

It was a bolt from the blue. Since World War II, the USA had dominated the non-communist world—socially and politically as well as economically. In 1950 the USA produced 40% of gross world product, the global equivalent of gross domestic product. The only country to have ever come close to that dominance had been Britain with roughly 20% of gross world product after the Napoleonic wars in about 1820.[1]

Then on October 4th 1957 the Soviets launched Sputnik (Figure 1) into orbit, demonstrating leadership in a hi-tech domain that most of the rest of the world had assumed resided in the USA.

The effect was electric, especially in the USA. The communists had been successfully resisted in Berlin, Korea, and the Formosa Straits. It seemed that American military power could assert control anywhere in the world. Then overhead the heartland of America itself came a shining communist star. This Sputnik transmitted radio signals, but perhaps the next one would carry a nuclear bomb! And America had no answer to it!

The surprise was unwelcome not least because of the echoes it triggered of Pearl Harbor 16 years before, when Japan sank much of the American Pacific fleet with a surprise aerial attack on the naval base of that name in Hawaii (Figure 2). Pearl Harbor brought about America's entry into World War II, so any similar event would evoke strong memories—only the Al Qaeda suicide plane crashes on 9/11 compare in the effect Pearl Harbor had on the American communal psyche.

And there had been other recent surprises—the explosion of the first Soviet atomic bomb in 1949 and the Chinese entry into the Korean War in 1950 being the two most embarrassing. As we will see later the American government reacted to

[1] Kennedy (1989) pp. 190, 475.

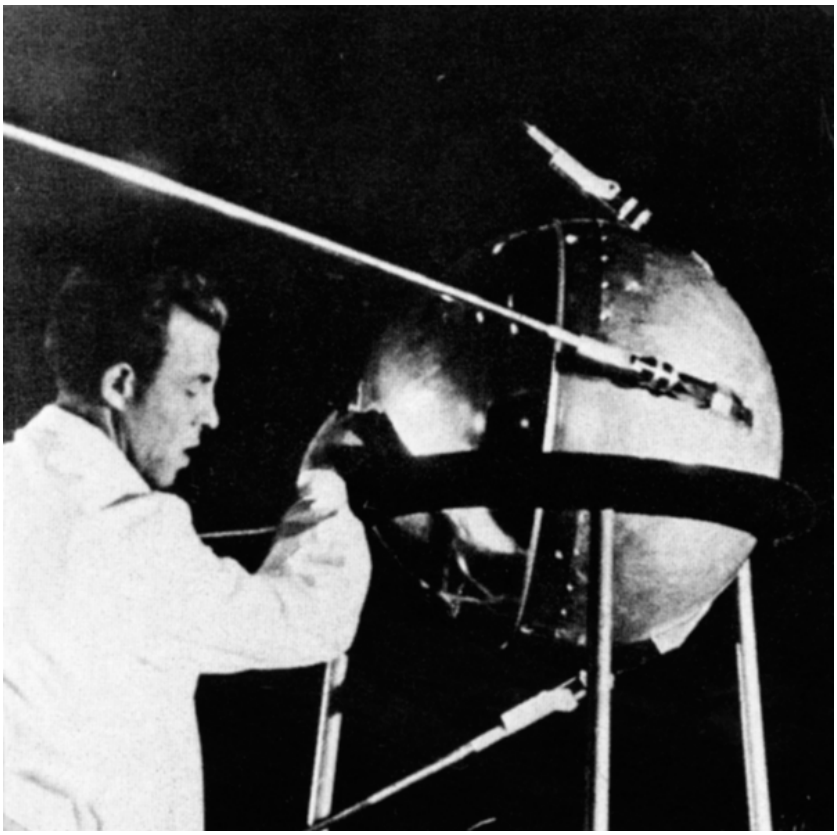

Figure 1. Sputnik: the world's first artificial satellite was placed in orbit on October 4th 1957.

these earlier surprises by investing heavily in spy planes such as the U-2, and had authorized development of a spy satellite two years before Sputnik. In fact, a successful Soviet long-range missile launch in August 1957 had alerted the American intelligence agencies to the ability of the Soviets to orbit a satellite, but they (and President Eisenhower) underestimated the impact the event would have on public opinion.

There was a torrent of heart-searching analysis from every corner, not least from Werner Von Braun, the German inventor of the V2 that had pummelled England in 1944–1945, now domiciled in the USA. He had been advocating a US space program in a series of TV shows and magazine articles throughout the early 1950s.

As the former commander of Allied forces in Europe during World War II, President Eisenhower, or "Ike" as he was affectionately known everywhere except Germany, was a big fan of satellites provided they did something useful. He had approved the development of a spy satellite two years earlier because he recognized that they provided a way to determine the progress in missile and bomber developments in the Soviet Union. At the same time he had rejected a number of projects

Figure 2. Ships of the American Pacific fleet ablaze after the Japanese surprise attack on Pearl Harbor, Honolulu, December 7th 1941.

from Von Braun and those of like mind, because he (Ike) was adamantly against expensive Federal programs that had no practical objective.

He urged his countrymen to see Sputnik for the publicity stunt it was, and he assured them that the US led in missile technology. The US could have launched a satellite a year earlier. In September 1956 Von Braun's Jupiter rocket reached a height of 1,100 km and a speed of 21,000 km/h. The fourth stage, instead of containing a rocket to give it the extra push to 29,000 km/h and into orbit, was filled with sand on orders from the top to prevent Von Braun "accidentally" placing it in orbit. Eisenhower's goal was to ensure that his spy satellite would be allowed to over-fly the Soviet Union. He was worried that if an overtly military rocket took the first US satellite into orbit the Soviets would cry foul and perhaps seek to have such satellites barred through the United Nations. Ike therefore wanted the first US satellite to have an American technical heritage rather than the German and military tinge that Von Braun's group automatically implied.

Eisenhower actually *welcomed* the launch of Sputnik as ensuring that the Soviets could not object when the US started flying its satellites over the Soviet Union before too long.[2] He had been pushing for a policy of "open skies" since 1955 in which both superpowers would allow the other's aircraft to make reconnaissance flights over

[2] DeGroot (2007) p. 57.

their territory to verify military preparedness. Of course, the Soviets, rightly, saw this as a cynical ploy whereby the US would allow the Soviets to observe the lead that the US had in bombers and missiles, and the US would watch to see if the Soviets were catching up.

Despite Ike's calming words, Sputnik unlocked a deep emotional response across America. The parallels with Pearl Harbor were explicitly voiced by many commentators. Edward Teller, for example—one of the creators of America's hydrogen bomb—declared on TV that the event was an even greater disaster than the Japanese surprise attack 16 years before. Some Congressional leaders called for a special session of Congress to debate the perceived massive Soviet lead in missile technology. Everyone understood that the carnage of the atomic bomb blasts that wiped out Hiroshima and Nagasaki to end World War II was now just a short missile trip away—should the Soviets so decide. Because of its great distance from its World War II enemies, Japan and Germany, America had been spared any significant attacks on its heartland during the War, but that accident of geography seemed now to have been consigned to history—and the public and politicians alike reacted emotionally.

Sputnik pushed Eisenhower's coldly logical arguments aside. The media engaged in a frenzy of alarm—the normally considered tones of the *New York Times* changed to ones of panic, advising its readers of a radical change in the military balance of power. The *Washington Post*, not noted for shrill headlines, wrote of a state of unpreparedness similar to 1941.

Politicians soon spotted an opportunity to hurt their opponents. Democratic leaders in both Houses of Congress took the opportunity to criticize the President and his party for allowing the Soviets to take the lead in space. "Our survival is at stake," said Senator Mansfield. Senate Majority Leader Lyndon B. Johnson (LBJ) warned that the Soviets would "soon be dropping bombs on us from space like kids dropping rocks onto cars from freeway overpasses"—demonstrating some gaps in his grasp of the physics involved. Upping the ante, he proclaimed that "control of space means control of the world ... for the purposes of tyranny or for the service of freedom." LBJ was angling to be the Democratic Presidential candidate in 1960, and he kept the pressure up, calling Senate hearings on the space and missile gaps that started just six weeks after Sputnik. He demanded a national response similar to that of "the day after Pearl Harbor". Not to be outdone, House Speaker John McCormack worried that the US was headed for "national extinction" unless a response to Sputnik emerged. Another Presidential hopeful, Senator John F. Kennedy, jumped on the band wagon, proclaiming Sputnik "the most serious defeat the United States has suffered in many, many years." In the face of this cacophony of alarm, Ike's calmness looked like complacency.[3]

The Administration made a few attempts to attribute the Soviet success to the technology and people they had captured in Germany at the end of World War II—that is, "their Germans are better than our Germans." Not only did this line not go

[3] DeGroot (2007) pp. 50–72.

down too well with "our Germans"—Von Braun and his German colleagues in Huntsville—it did nothing to dampen public concern.

A political momentum emerged over-night for the USA to emulate the Soviet feat. Before long, the US Navy missile teams had as much funding as they could absorb to get a satellite in orbit. But Von Braun's Army team was still held back because of its militaristic connotations.

SPUTNIK-2 AND 3

In the Soviet Union and the rest of the communist block Sputnik was also a surprise, but one that was greatly welcomed. Like Eisenhower, Soviet Premier Nikita Khrushchev was unimpressed by Sputnik at first, seeing it as just a powerful rocket. The official communist newspaper, *Pravda*, carried the story of the launch as a small item on the front page without mentioning the name of the satellite.

That soon changed! Seeing the hysteria created around the world, *Pravda* two days later devoted almost the whole of the front page to Sputnik. The political impact of this space age coup was not lost on the leadership. World leaders who were normally antagonistic towards, or disinterested in, the Soviet Union congratulated Khrushchev on its success. Every opportunity was used to trumpet the technology leadership, and by implication the moral leadership, of the Soviets. The Soviets condescendingly assured the world that "there is no danger to any of the peoples of this world from this man-made moon".[4]

The surprises kept coming.

Sputnik 1 weighed about 83 kg or nearly 200 lb, and only one month later the Soviets launched Sputnik-2 weighing over half a ton. Sputnik-2 also contained a dog, Laika, which lived four days in space until a spacecraft failure caused her death. The ability of the Soviets to put a second satellite into orbit so soon after the first was impressive—and scary. The ability to carry a living creature suggested that "where dog goes, man will follow", and the thought of a Soviet person flying over the US unimpeded made Americans queasy.

Then just 6 months after that, in May 1958, the massive 1.5-ton Sputnik-3 was orbited, demonstrating—if that were still needed—that the Soviets had massive rocket capability. Because Soviet events took place in total secrecy they were able to suppress news of their failed launches and only report the successes. In contrast, America's launches took place in the full glare of publicity with the world's press and broadcasters present. The perception that the US failed a lot and that the Soviets were always successful fueled the public paranoia.

The Soviet space successes were spectacular but little else. But they were spectacular. And this only heralded the real eye opener, the launch of the first man into space in 1961. Cosmonaut Yuri Gagarin became a household name across the globe when he orbited the earth on April 12th that year (Figure 3). His charm and good looks enhanced his ability to play the role of communism's ambassador to the world.

[4] DeGroot (2007) pp. 66–68.

Figure 3. Space as politics: Yuri Gagarin, the first man to orbit the earth, and Soviet Premier Nikita Khruschev on the dais in Moscow's Red Square, April 1961. Picture courtesy: British Interplanetary Society archives.

He was feted wherever he went, hosted by Royalty and Presidents in Western countries as well as in communist and neutral ones.

THE US FIGHTS BACK

Meanwhile, the USA was playing catch-up in this new "space race". The US Navy team had been building the Vanguard rocket since being selected to launch the first US satellite two years earlier in August 1955—much to the disgust of Von Braun and his Army colleagues. Vanguard had no other purpose than to launch a scientific satellite and—unlike Von Braun's Jupiter rocket—was not a modified missile, thus achieving the appearance of non-military motivation that Eisenhower wanted. Sputnik-2 with its canine passenger had such a powerful impact that Eisenhower gave in to the calls from all sides for the US to respond.

The first attempt by the Navy Vanguard team to emulate Sputnik in December 1957 failed with an explosion seconds after launch. There was an orgy of soul searching about how far behind America had fallen. The Soviet delegation to the United Nations offered financial aid to the US as part of a program of technical assistance to backward countries.

It wasn't until February 1st 1958, that one of Von Braun's US Army Jupiter rockets carried Explorer 1 into orbit. Unlike the massive Soviet Sputniks, Explorer 1 weighed in at just 14 kg.

These early flights illustrated some of the features inherent to each of the societies that created them. The Soviet launches took place in secrecy and were only announced to the public once they were successfully in orbit. The American launches, failures as well as successes, appeared live on television for all to see. The American openness had many advantages when the launches worked, but they were embarrassing for all concerned when they failed—as they did all too frequently in those first years. It was difficult for the engineers to work efficiently in the full glare of publicity, not least because of the immediate and copious criticism from the politicians that provided the funding.

The Soviets too were subject to criticism, albeit in private. Although taking place out of the limelight, the penalty for failure in the Soviet Union was inherently more severe than in the West. Chief Designer Sergei Korolev had spent several years in a concentration camp during the Stalin era. The Khrushchev regime of the late 1950s was more tolerant than under Stalin, but memories of the treatment meted out to dissenters and undesirables were still high in people's minds. Thus, Korolev didn't hesitate when Khrushchev demanded that Sputnik-2 be built and launched within a month of Sputnik 1 so that Khrushchev could trumpet its success to the Communist Party Congress. Khrushchev had been lukewarm about Korolev's Sputnik project until he saw the massive propaganda coup it provided after Sputnik 1 was launched.

The difference in openness was also apparent in other ways. Journalists received detailed briefings on every aspect of the American attempts, but the Soviets were parsimonious in providing information. And it wasn't always accurate—the most famous example was when Gagarin followed instructions and actually lied at his press conference by stating that he had landed in his capsule. In fact, the design had called for him to bail out of the capsule and descend on his parachute, which he had duly done. The lie was fabricated to ensure that the Soviets could claim the first launch and return of a man into space—ejecting in the atmosphere arguably disqualified the Soviets from claiming a successful return.

THE CHIEF DESIGNER

Perhaps the most bizarre aspect of Soviet secrecy was the anonymity of Korolev (Figure 4). The few references to him spoke only of "the Chief Designer", without naming him. The Soviet leaders were paranoid about American abilities to entice scientists to defect to the West, and refusing to name the head of their space program was part of their reaction. Other reasons had to do with Korolev's shady past (in communist eyes) including a spell in the gulag (concentration camp system) in 1938–1944. By hiding Korolev from the limelight, the Soviets missed a great opportunity to dethrone Von Braun as the world's leading publicly recognised rocket scientist. Korolev's achievements arguably exceeded Von Braun's in that he created not only the rockets (and missiles) but also the satellites that they carried into space, while Von Braun was largely excluded from the satellite business.

Figure 4. Sergei Korolev, the Chief Designer, May 1961, with some of the first group of cosmonauts; front row (L to R): Yuri Gagarin (first man in space), Korolev, Yevgeni Karpov (head of the cosmonaut corps); back row (L to R): Pavel Popovich (made two trips to space, 1962 and 1974), Grigori Nelyubov (expelled from cosmonaut corps in 1963 after drunken brawl, died 1966), Gherman Titov (second man to orbit the earth in August 1961, died 2000), Valeri Bykovsky (three space trips in 1963, 1976, and 1978). Picture courtesy: British Interplanetary Society archives.

"He had unlimited energy and determination, and he was a brilliant organiser," Khrushchev said in his 1974 memoirs, adding that "his reports were always models of clarity."[5]

Korolev's interest in rocketry began in the 1920s. According to the now almost legendary version of his life story, in 1929 he visited the generally accepted "father of rocketry", Konstantin Tsiolkovsky, who enthused him with the mission of building rockets to reach earth orbit. Tsiolkovsky died in 1953, four years short of his centenary and the fulfilment by Korolev of his dream. Before being sent to the gulag Korolev had led the development of rockets for the Soviet military. In the bizarre Soviet system, during World War II and still in prison, he was ordered to continue his rocket work—he even received the Medal for Valiant Labor while still a prisoner.

[5] DeGroot (2007) p. 55.

Korolev's death in 1966 was a great loss to the Soviet space efforts. Thereafter, they failed to achieve many of their goals, most notably the race to the moon. It wasn't until the softening of Soviet secrecy in the 1980s that his name became known in the West.

In death as in life, Korolev was surrounded by secrecy. He went to hospital for an exploratory abdominal operation, but because of his importance to the Soviet state the Health Minister himself felt compelled to undertake the operation. The Minister had not prepared as thoroughly as he should have and botched the operation, causing Korolev's death.[6] This story is attested to by several Soviet commentators but is not yet the official version—maintaining Korolev's veil of secrecy even now.

SUBSTANCE VERSUS HYPE

The much greater weight of the Soviet satellites was to some extent compensated for by the greater sophistication of the American ones. The Soviets missed the first major scientific discovery of the space age by virtue of not carrying instruments on Sputniks 1 and 2, and by a faulty tape recorder on Sputnik-3. The tiny American Explorer 1 carried a radiation detecting instrument (Geiger counter) that enabled its designer James Van Allen to discover the radiation belts that encircle the earth, and which are now known as the Van Allen belts. As Explorer 1 passed the high point in its elliptical orbit, 1,500 km above the earth, the instrument fell silent as if there was absolutely no radiation. Van Allen correctly interpreted this to mean that the instruments had become saturated because the radiation was too intense, thereby discovering the radiation environment that now bears his name, and becoming the first science superstar of the space age.

The technical heritage of the two nations was also subtly different. President Eisenhower was at pains to distinguish between the military missile and scientific satellite communities. On the assumption that the USA would be the first to launch a satellite, he wanted to avoid the Soviets perceiving it as a threat to their sovereignty. So he assigned responsibility for missiles to a different group than the one tasked with launching a satellite. A year after the Sputnik shock Eisenhower created NASA as a civilian agency responsible for non-military space activities, thus formalizing the split. Eisenhower was opposed to civilian space programs, seeing them as nothing but prestige exercises. He worried that they would drain away resources and talent from the military space program which he considered strategically important. He acceded to the formation of NASA under pressure from both parties in Congress, large parts of the media, and the scientific community.[7] In response to the same pressures, he also created the post of scientific adviser, and appointed the President of MIT, James Killian, to it.

The difference between public perception and actual achievement was already apparent a year after Sputnik—it would become even more so later. In 1958, 23

[6] Siddiqi (2003) p. 514.
[7] Ambrose (1984) p. 458.