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100 Miles up

Gathering Intelligence from Space[1]

by Ricky Deutsch

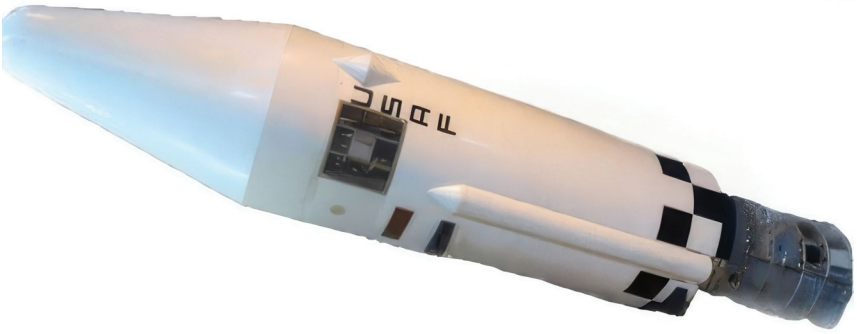
In the early years of the Cold War, President Eisenhower knew it was critical to understand the capabilities of our adversaries. As our intelligence of the Soviet Union was meager, he approved the creation of new surveillance technologies. The high-altitude GENETRIX balloon program provided initial photographic capability. The concept was to send high-altitude weather balloons with cameras dangling below them, riding the jet stream eastward over the Soviet Union. After their journey from Greece and Turkey, their sensors waited for daylight, then snapped random pictures over denied areas. They were then caught mid-air as they traveled around the earth over Alaska. Of the 2,500 planned, 516 were sent aloft, but only 34 got useful shots; many were of corn fields and cows. Some landed in the Soviet Union, revealing the mission. The program was canceled.

Also approved for development was the use of space-borne assets to provide the needed intelligence data. Sputnik tacitly allowed overflights by orbiting intelligence-gathering platforms. It was essential to US security to know about our opponents' weapons development, their industrial and agricultural capability and to create accurate maps for military planning. Film-based image intelligence (IMINT) enhanced our knowledge of Soviet actions.

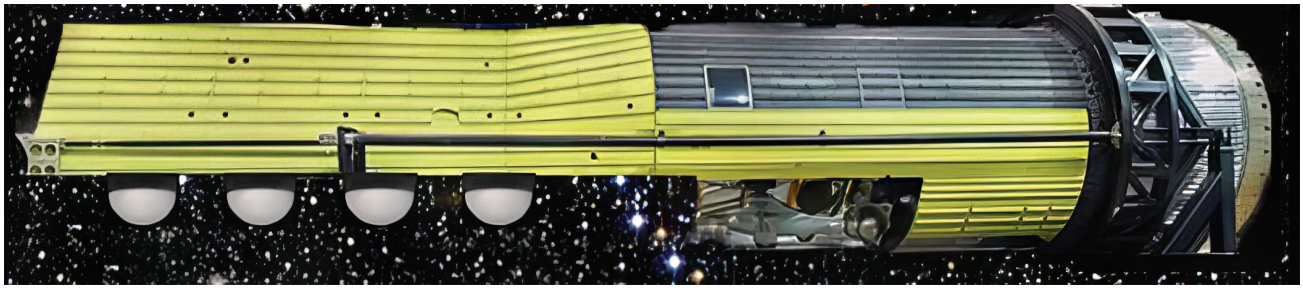
Evolving technology led to the development of the U-2 reconnaissance aircraft. The plane was a high-altitude craft holding a Perkin-Elmer designed high resolution film camera. 24 successful missions over the Russian landmass yielded a treasure trove of data not known before. In 1960, Mission 25 was shot down and pilot Francis Gary Powers put on trial. As a result, the President stopped overflights and later ordered A-12 and SR-71 missions to stay outside Soviet borders. It also featured a Perkin-Elmer designed film camera.

There was considerable debate to decide whether the space systems under development should be film or electro-optical. Film allowed higher resolution than pixels – the image could be enlarged, whereas digital images just provided larger dots. However, there would be a long wait to retrieve and analyze exposed film images. Nonetheless, the decision was to go with the film option. The top secret "CORONA" system was first launched in 1959 from Vandenberg Air Force Base (under the public cover of the Discoverer scientific life-sciences program). It flew in a three-axis stabilized polar orbit. This enabled the U.S. to view the entire planet. It was also sun-synchronized, allowing an object on the earth to be viewed often with the same shadow angles.

After 11 failures, CORONA's 13th mission was the first orbiting satellite to return an object from space. Corona #14 was the first to retrieve the exposed film

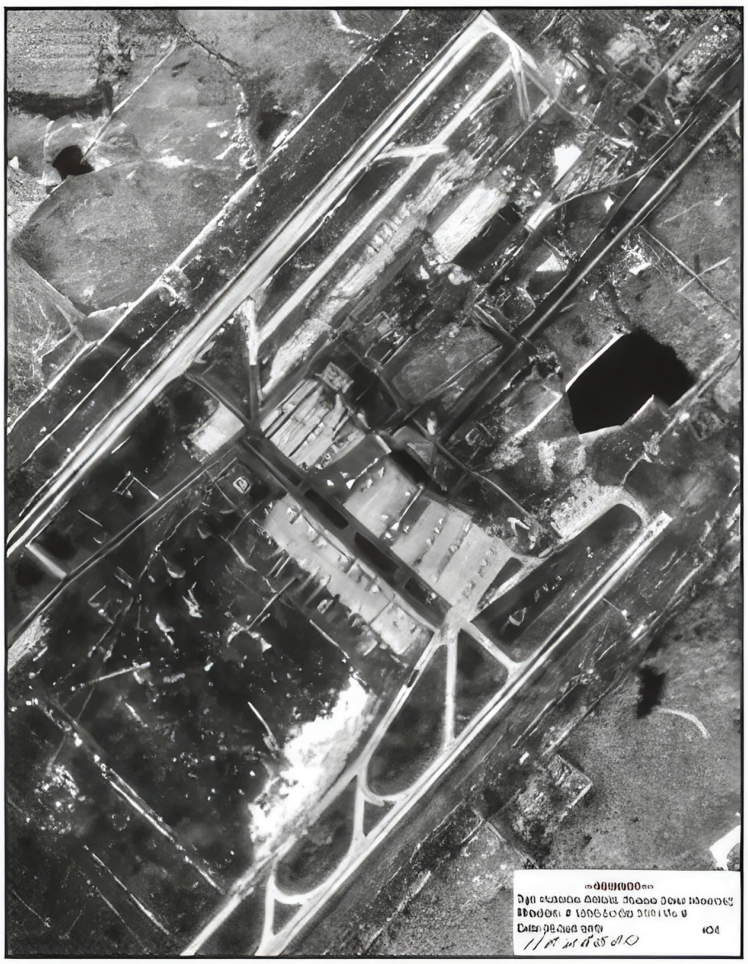


1. This article is condensed from the author's 2021 item, "Controlling Hexagon," in *Quest, The History of Spaceflight Quarterly*, Vol. 28, No. 1



via parachute by aircraft. Pictures of "denied areas" of the Sino-Soviet bloc could now be analyzed. The first image was of a military airfield, Cape Schmidt, Russia, close to Alaska. More intelligence was gathered on the first mission than by all the previous U-2 flights.

CORONA, in several versions, flew from 1959 to 1972. Its goal was wide-area capture with resolution improving from 40-feet to 5-feet. Photos were analyzed by the National Photographic Interpretation Center, to be used by the Intelligence Community, Strategic Air Command and other DOD agencies.



HEXAGON Mapping Camera Image of Russian airfield. Resolution is unreleased.

The CORONA program was joined by advanced close-up imaging satellites. Better camera development resulted in the next generation of vehicles, called GAMBIT. Its undertaking was to capture close-up images with even better resolution. While CORONA resolution was in the order of six feet, GAMBIT-1 produced high resolution images in the range of two to four feet.

The follow-on, GAMBIT-3, provided even higher resolution images; less than two feet. The exact number is still classified. While CORONA could detect a launch site; GAMBIT could tell what kind of missile was on the pad. GAMBIT satellites were called KH-7 and KH-8. KH stood for Keyhole – the code work for space-based intelligence. They joined CORONA and provided significantly better images of Soviet ICBM bases, airfields, harbors, nuclear test sites and other strategic and tactical land, air, and naval targets. Gambit-3's dual cameras had a focal length of 175 inches and also provided stereo pictures. This enabled analysts to gauge the height of objects. The two satellites worked in tandem for several years. Retired in 1972, CORONA flew 145 missions. Gambit flew 92 missions from 1963 to 1984.

In the mid-1960s, studies were completed leading to the development of the fourth-generation space reconnaissance system. Design goals were to have long duration missions and wide-area surveillance coverage similar to CORONA but with GAMBIT's high resolution.

The new HEXAGON (KH-9) became the last film-based image intelligence satellite. It was a massive 30,000 pound, 60-foot long by 10-foot diameter satellite, with a payload weight of over 7,000 pounds. It was dubbed "Big Bird." It featured advanced Perkin-Elmer cameras.

The "Blue Cube," Sunnyvale AFS, CA

JC-130 "Catch a Falling Star"

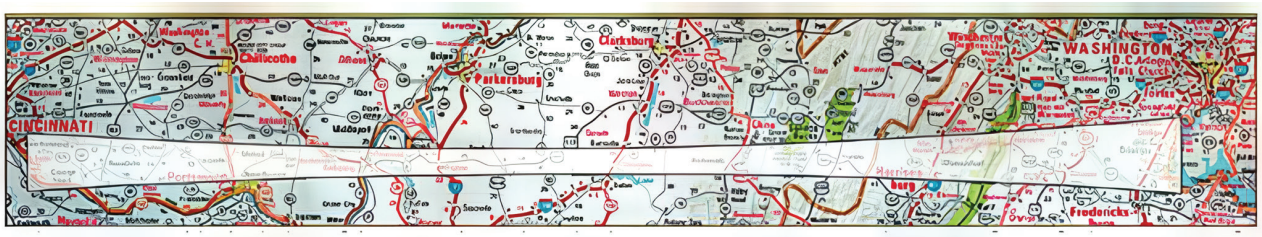
The Danbury, CT company had 1,000 employees with security clearances working on this program.

As with its predecessors, HEXAGON was capable of stereo photography. This was accomplished using 6.6-inch-wide film that spooled from two containers, each holding 30-miles of ultra-thin, color and black & white KODAK film. It carried four film reentry vehicles. Constant improvements allowed flights as long as 275 days. Mission support from the Satellite Control Facility in Sunnyvale, CA worked 24/7, coordinating Command Generation, Tracking Station scheduling, bucket ejection and recovery in mid-air by the 6594th Test Group. The Secretary of the Air Force Special Projects (SAFSP) team managed all aspects of these programs – from design to construction, launch, on-orbit operations, recovery and CIA interface.

HEXAGON's photographic system could capture 370-mile by 10-mile-wide swaths of the earth while traveling as low as 90 miles at perigee. HEXAGON imaged 877 million square miles of terrain over its 19 missions. Twelve flights carried a Mapping Camera that collected geodetic data to provide tens of thousands of accurate points needed for operation of strategic and tactical weapon systems.

All of these satellites ejected recovery vehicles (called "buckets"), containing the exposed film. Based at Hickam AFB, Hawaii, C-119 and later JC-130 aircraft snagged the bucket as it descended from space via parachute at 15,000 feet. Multiple aircraft, helicopters, ships and divers were prepared, should the reentry vehicle (RV) land in the ocean. Once snagged by hooks a mere 20-feet below the aircraft, the RV would be reeled in. From the early 1960s to 1985, they caught nearly 300 from various programs. In 1986, the HEXAGON program ended after 19 highly successful missions. Flight 20 blew up on the launch pad.

The National Reconnaissance Office provided intelligence data to the United States senior policy makers, the Intelligence Community and the DOD. These film-based image intelligence (IMINT) satellites helped win the Cold War. Our knowledge of Soviet strength provided an upper hand during the various arms control negotiations. They were the national



Representation of 370-mile ground scan in a single HEXAGON frame – polar orbit.

means of verification, critical to the signing of agreements limiting Intermediate-Range Nuclear Forces, Antiballistic Missile Systems, and intercontinental and submarine-launched ballistic missiles.

These three satellites are all now declassified by the NRO and with some restrictions, can be discussed publicly. They can be viewed at the Smithsonian and The National Museum of the United States Air Force, Dayton, OH. Electro-optical technology became the standard with the 1976 launch of the Kennen (KH-11) vehicle.

CORONA, GAMBIT, HEXAGON – **"Trust – but Verify."**

Ricky Deutsch is a former Air Force Captain based at the Satellite Control Facility (the "Blue Cube)" in Sunnyvale, CA. This TEMPEST-certified 100-ft tall windowless building held the Mission Control Complexes of Top-Secret National Reconnaissance Office satellite programs. Here, commands would be transmitted to the series of the film-based reconnaissance satellites. After his military service, he was a marketing manager at Ford Aerospace, Intel Corp and Sun Microsystems. He is a member of the San Francisco Bay Area chapter of the Association of Former Intelligence Officers.