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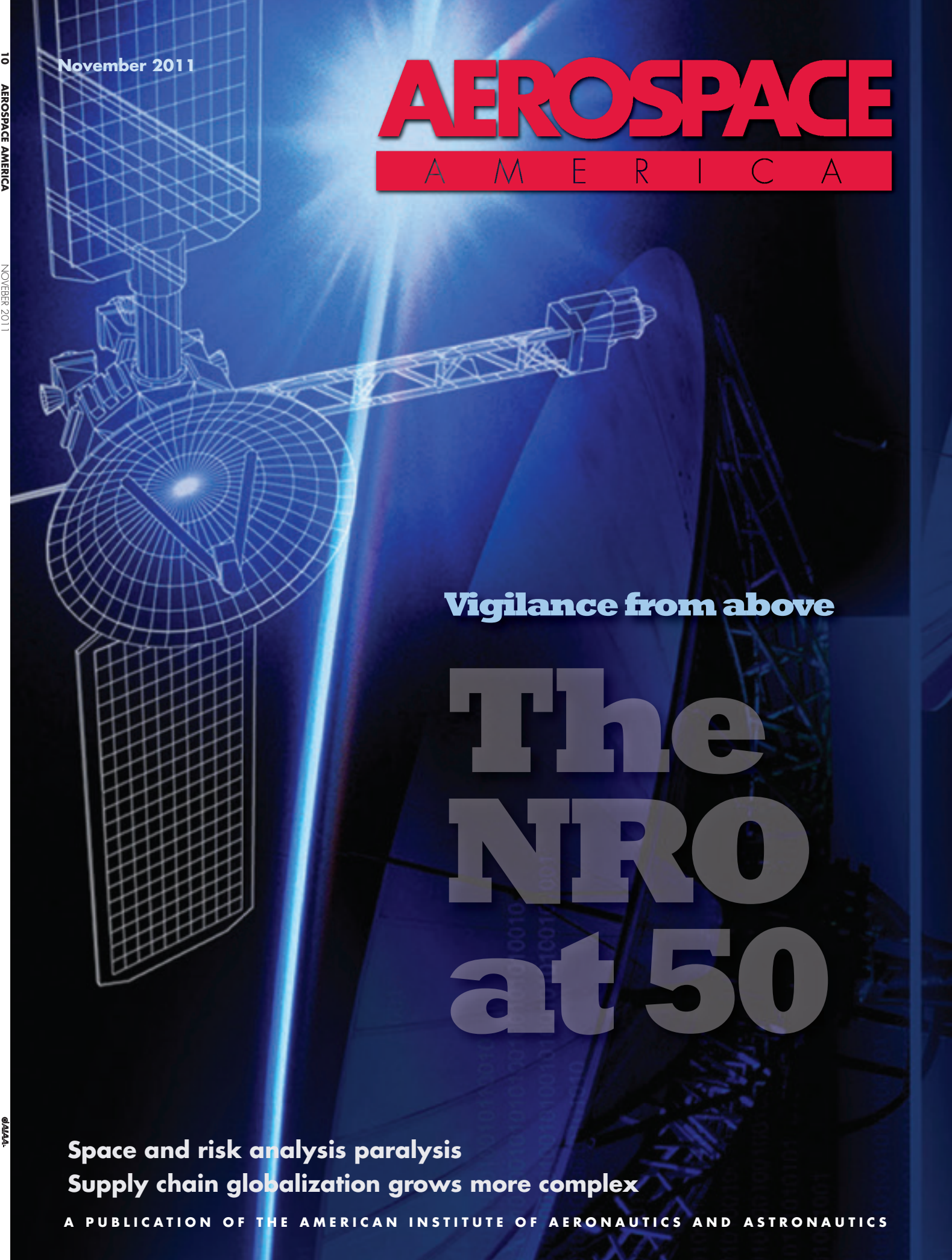

Vigilance from above

The NRO at 50

Space and risk analysis paralysis

Supply chain globalization grows more complex

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Vigilance from above

The NRO at 50

The National Reconnaissance Office came into being 50 years ago, on Sept. 6, 1961, as steward of the supersecret spy satellites that saw the U.S. safely through the Cold War. NRO's clandestine air and space systems still stand guard against a broad array of threats today.

The NRO was established early in President John F. Kennedy's administration in response to the successful launch of Sputnik, which demonstrated that the Soviet Union had the rocket power to boost its nuclear-armed ICBMs into space and on course to North America. U.S. defense and intelligence leaders, who were left in the dark after aircraft reconnaissance of the Soviet Union was forced to a halt, had an urgent need to know what was going on inside that country.

Secretary of Defense Robert McNamara created the National Reconnaissance Program, which consisted of "all satellite and overflight reconnaissance projects whether overt or covert," and set up the NRO to manage it. The Central Intelligence Agency and the Defense Dept. were assigned joint operational responsibility for the NRO.

by James W. Canan
Contributing writer

Born out of urgent national need and once cloaked in secrecy, the National Reconnaissance Office is marking a half-century of vital contributions to the peace and security of the U.S. and its allies. Today its expanding roles range from tracking weapons of mass destruction to supporting humanitarian relief efforts to assessing damage from storms, tsunamis, and other disasters.

Details of the new arrangement were spelled out in a memo from Deputy Secretary of Defense Roswell Gilpatric to CIA Director Allen Dulles. It specified that the NRO would be overseen by the undersecretary of the Air Force and the CIA's deputy director of plans—at that time Joseph Charyk and Richard Bissell, respectively.

The Gilpatric memo also designated the undersecretary of the Air Force as the defense secretary's special assistant for reconnaissance, with full authority in all DOD reconnaissance matters. Eight months later, in May 1962, the CIA and DOD agreed to establish a single NRO director, and Charyk became the first.

The DOD and the CIA are said to have clashed in the early years over their respective areas of responsibility and influence within the NRO, but such matters have been settled for some time. The NRO director, a civilian Air Force official (usually the undersecretary), is ultimately responsible for executing NRO programs.

Secrecy was tight from the beginning in the covert world of the NRO. For more than three decades, the NRO's Satellite Operations Center occupied quarters in the Pentagon basement in partnership with the Air Force Office of Space Systems four floors above. No one entered those domains without top clearance and credentials. Hardly anyone knew, and no one openly talked about, what was going on there.

The NRO maintains ground stations in several areas in the U.S. and abroad.

Existence revealed

The NRO was declassified on September 18, 1992, and a few years later moved to Chantilly, Virginia, on the outskirts of the nation's capital. Its current surveillance and reconnaissance programs remain highly classified, but its intents and purposes are no longer secret. The NRO now proclaims that it "develops and operates unique and innovative overhead reconnaissance systems and conducts intelligence-related activities for U.S. national security," with the motto: "Vigilance from above."

Space historian Jeffrey T. Richelson wrote that the declassification of the NRO was advocated by several prominent government officials, including Martin C. Faga and Robert Gates, directors of the NRO and CIA, respectively. Other persuasive factors were "the much wider use in government of the products of NRO systems, pressure from the Senate Select Committee on Intelligence, [and] the suggestion of a review panel chaired by former Lockheed chief operating officer Robert Fuhrman and commissioned by [Gates] that the organization's

existence should be declassified," he wrote.

"The mission of the NRO," its 1992 declassification memorandum noted, "is to ensure that the U.S. has the technology and spaceborne and airborne assets needed to acquire intelligence worldwide, including to support such functions as monitoring of arms control agreements, indications and warning, and the planning and conduct of military operations. The NRO accomplishes this mission through research and development, acquisition, and operation of spaceborne and airborne data collection systems."

The agency also maintains ground stations at Buckley AFB, Colorado, Fort Belvoir, Virginia, and White Sands Missile Range, New Mexico. It maintains a presence at the Joint Defense Facility in Pine Gap, Australia, and the RAF base at Menwith Hill Station, U.K., and also has launch offices at Cape Canaveral and Vandenberg AFB.

"The National Reconnaissance Office's systems are critical to national security, U.S. policy makers, and war fighters," another NRO document asserts. "These systems provide the foundation for global situational awareness and address the nation's toughest intelligence challenges. Frequently, NRO systems are the only collectors able to access critical areas of interest, and data from overhead sensors provides unique information and perspective not available from other sources."

The organization says its top priorities now are "monitoring the proliferation of weapons of mass destruction, tracking international terrorists, drug traffickers, and criminal organizations, developing highly accurate military targeting data and bomb damage assessments, supporting international peacekeeping and humanitarian relief operations, [and] assessing the impact of natural disasters, such as earthquakes, tsunamis, floods, and fires."

Shadowy past

Those missions are a far cry from the singular, extremely urgent one that preoccupied the NRO in its earliest days: keeping an eye on the growing number and variety of ICBMs on launch pads in the USSR, some in places where clouds shielded them from overhead cameras much of the time.

The secrecy surrounding reconnaissance from space had begun to loosen a bit at high levels of government not long before the NRO was formed. President Dwight D. Eisenhower had implied the existence of U.S. spy satellites in May 1960, noting that he had just ordered a halt to U-2 reconnaissance flights over the Soviet Union, not only because the Soviets had just shot down the U-2 spy plane flown by U.S. pilot Gary Powers, but also because "considerable progress was now being made in the photography of the earth from satellites."

In 1967, with the NRO barely past infancy, President Lyndon Johnson, in an off-the-record speech to a group of educators in Nashville, implicitly acknowledged the reality and the mission of U.S. spy satellites and their vital importance to national security. He also noted that the satellites had given the lie to the presumed "missile gap" with the Soviet Union.

"We've spent $35 [billion] or $40 billion on the space program," Johnson said, "and if nothing else had come of it except the knowledge we've gained from space photography, it would be 10 times what the whole program cost. Because tonight we know how many missiles the enemy has, and it turned out our guesses were way off. We were doing things we didn't need to do. We were building things we didn't need to build. We were harboring fears we didn't need to harbor."

Much later, in October 1978, President Jimmy Carter, in a speech at Cape Canaveral, became the first chief executive to acknowledge in public that the U.S. was indeed operating spy satellites. At the time, Carter was trying to persuade the U.S. Senate to ratify the proposed Strategic Arms Limitation Treaty (SALT) with the Soviet Union, and wanted to display satellite photos of the Soviet ICBM sites to show Senate skeptics that the U.S. would be capable of confirming Moscow's compliance with the terms of SALT.

Neither Johnson nor Carter went so far as to mention the NRO or its particular systems by name. Those satellites had their beginnings as far back as the mid-1950s, well in advance of NRO's creation, in an Air Force development program called WS (weapon system) 117L, a seminal effort that embodied fundamental space reconnaissance technologies in a planned family of electronic intelligence (Elint) and imagery intelligence (Imint) space systems.

By mid-1960, WS117L had evolved into two programs to build and deploy satellites capable of photographing the Soviet land mass—Samos (satellite and missile observation system), an Air Force program, and the CIA-led Corona. Samos, which evolved into

After pilot Francis Gary Powers was shot down over Soviet territory on May 1, 1960, U-2 flights came to a halt.

the Sentry program, reportedly developed Imint satellites designed to radio their imagery to ground stations or drop film capsules into the atmosphere for retrieval by aircraft, and Elint 'ferret' systems to collect radar emissions and identify their sources. Corona focused solely on photoreconnaissance. Its Discoverer satellites stored their film in capsules that were jettisoned and retrieved by Skyhook aircraft.

WS117L also gave rise to the Midas (missile defense alarm system) program to produce early warning, infrared-sensing satellites. Midas in turn spawned the defense support program, or DSP, satellites that served the U.S. through most of the Cold War, and then the SBIRS (space-based infrared system) satellites just now starting to form up in space.

Through the years, the NRO and its contractors developed and operated successively more capable overhead reconnaissance systems across the signals intelligence (Sigint) spectrum, which included Elint and communications intelligence capabilities. By all accounts, the NRO-operated Sigint spacecraft, including various radar detection and communications intercept satellites, have always been more closely guarded than its Imint systems. The NRO has always worked closely with the Sigint-specialized National Security Agency, headquartered at Fort Meade, Maryland.

At its creation, the NRO took control of all overhead reconnaissance assets and programs, including the Navy's Galactic Radiation and Background (Grab) program. Grab space systems were designed to collect Sigint of Soviet air defenses. A Grab satellite is said to be the first successful U.S. reconnaissance satellite. Grab evolved into an Elint program called Poppy.

The NRO and its programs were 'black' right off the bat. A DOD document of the time noted that "the title NRO is classified SECRET and the existence of the National Reconnaissance Program within the U.S. government is classified TOP SECRET."

Corona's photoreconnaissance

The CIA's pioneering Corona photoreconnaissance program got off to a rocky start in the 1950s, as it experienced a series of launch and operational failures. The discouraging pattern was finally broken in August 1960, when the Corona/Discoverer 14 launch vehicle, satellite, and Keyhole (KH) camera all performed flawlessly on launch and in orbit.

In an unclassified speech last August, NRO director Bruce Carlson noted that Discoverer 14's "KH-1 camera provided more photographic coverage of the Soviet Union than [had] all of the previous U-2 missions combined.

"More importantly," Carlson declared, "Corona's 40-ft resolution provided hard evidence of the pace and scope of Soviet ballistic missile deployments, and allowed analysts to count Soviet heavy bombers. The data from this first [successful Corona] mission also disproved the existence of a 'missile gap' in favor of the Soviet Union, and contributed to the overall stability of the nuclear balance" between the U.S. and the USSR, Carlson declared.

Carlson hailed Corona, which ended in 1972, as the first program to recover objects from orbit, deliver intelligence infor-

Grab has been described as the first successful U.S. reconnaissance satellite.

A Samos satellite is launched by an Atlas booster. The program never proved successful.

This image of the Severodvinsk shipyard was captured on February 10, 1969.

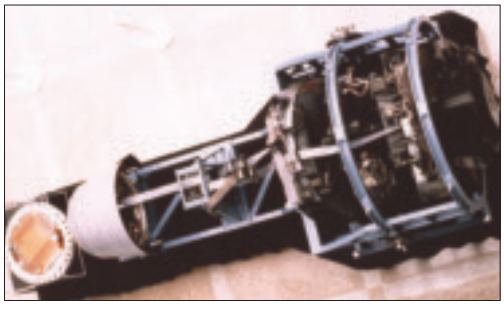
After a rocky start, the Corona program proved to be extremely valuable.

mation from a satellite, produce stereoscopic satellite photography, and employ multiple reentry vehicles. It also was "the first satellite reconnaissance program to pass the 100-mission mark," having launched 145 satellites, the NRO director declared.

Corona's results were mixed for many years. In a recently declassified document NRO notes that the cameras of Corona space systems "swept the Soviet land mass for signs of missile development and nuclear testing activity" and made "virtually immeasurable" contributions to U.S. intelligence. The KH-1, KH-2, and KH-3 cameras aboard the first generation of Discoverer satellites did a sequentially better job, but still left a lot to be desired.

"Corona imagery…had limitations," the declassified NRO document says. "In 1961, for example, it could resolve no object smaller than 10-15 ft. U.S. photointerpreters and U.S. planners needed, and demanded, higher resolution imagery for their intelligence estimates relating to Soviet weapons systems and target identification."

Corona's satellites grew larger and its camera systems got better over the years. Images became progressively sharper, and ground resolution of objects was reduced to less than 5 ft. Late-model Corona/Discoverer satellites reportedly carried two film recovery systems instead of just one.



Corona cameras improved over the years, providing progressively sharper imagery, with ground resolution of objects reduced to less than 5 ft.

Keyhole into a new dimension

"Analysis would improve if photo interpreters could perceive a third dimension," space reconnaissance chronicler Jeffery A. Charlston writes. "This could be accomplished with stereo imagery, and stereo capability soon emerged as a desired goal for the Corona program." To meet the goal, engineers combined two KH-3 cameras in a single payload, he explains.

"Pointed forward and aft of the spacecraft to provide overlapping coverage from different angles, the two cameras could create stereo images. The system would be known as Mural–KH-4," Charlston writes. "Mural became the workhorse of the Corona family after its first mission on August 30, 1961."

After Mural came Lanyard—the KH-6

camera system that could be aimed independently without aiming the spacecraft itself, thus enhancing its photographic flexibility and spatial coverage. That system gave way to a high-resolution spotting satellite system called Gambit, also known as the KH-7, which brought satellite photoreconnaissance into the computer age.

Gambit was just declassified in September of this year. An NRO paper calls it "a surveillance system" that "covered far less area than Corona" but "produced photography with a much better resolution. Objects as small as 6 ft could now be located and observed."

"By early 1962," Charlston writes, "it became clear that KH-7 would be different from all its predecessors in one important way. Its required precision, for both targeting and basic procedures, meant that its operations would need to be designed on computer."

The Gambit 3 satellite, also known as the KH-8, was launched in 1967. It was "capable of stereo photography" and was highly successful, an NRO document says.

"The Gambit program eventually flew 54 missions over 20 years, concluding in 1984. It provided U.S. officials with unique, highly detailed imagery of sensitive targets, and became a major tool for photo analysts during the Cold War," the document adds.

Big Bird follows Gambit

Film-recovery payloads culminated with the Hexagon satellites. Declassified in September simultaneously with Gambit, Hexagon was designed in the 1960s and launched in 1971 to provide both high-resolution and wide-area coverage from on high.

"It was one of the largest and most complex reconnaissance satellites ever built," the NRO paper says. "Known to the American public as 'Big Bird,' it was 10 ft in diameter and 55 ft long. It rivaled NASA's Space Lab in size."

According to the NRO, Hexagon featured two panoramic, counterrotating, optical-bar cameras and four recovery capsules. The later model Hexagon satellites also contained a fifth capsule to return film from a camera devoted to mapping.

"Stellar and terrain cameras in Hexagon made it possible to extract mapping, charting, and geodetic data for the Defense Mapping Agency and other organizations in the intelligence community," the NRO

Gambit-1 KH-7 was the first successful surveillance system that carried a pointing or 'spotting' camera with high-resolution capability. It conducted close-in surveillance of denied territories in the USSR with a primary intelligence focus on ICBM silos.

A leader looks back

Martin C. Faga provides his intimate perspective on the 50-year history of the National Reconnaissance Office, which he directed from 1989 to 1994, as follows:

"The history of the NRO breaks into three major phases, each of about 15 years. The beginning years were roughly 1961-1975. These years were technically difficult because everything was new: the launch systems, the collection systems, the analysis and production systems. Capabilities were modest, and most collection and its initial analysis took place over a period of months.

"Volumes of information were small compared to today. Nonetheless, they offered tremendous, continuous reconnaissance of the Soviet Union and other areas of interest, and provided great strategic intelligence sufficient to assure our leadership that we knew, top level, what weapons the Soviets had, how they were deploying, and how they were evolving over time.

"The 'missile gap' concern came to an end early in this period. While the NRO's information was enormously valuable, it was relatively limited in scope and its consumers probably numbered in the few thousands.

"The second period was the mid-'70s through the first gulf war in early 1991. Almost all NRO systems became real-time systems during this period, and they enabled a robust 'indications and warning' effort. This meant that the intelligence community could daily sample activity in the Soviet Union and in other countries of long-term or short-term concern, and could assure the president daily that activity that could lead to large-scale war with the United States was not occurring.

"This 'nothing significant happening' reporting [by the intelligence community] was immensely valuable to the leadership of the government, and allowed it to constantly assess the response of the Soviets and others to diplomatic, military, or other initiatives of the United States. Consumers [of intelligence] during this period rose into the tens of thousands, at least.

"The third period began during the first gulf war and continues to today. NRO systems were not only near real time, but their collection capacity had grown enormously, and processing equipment became fast enough and portable enough to be placed in the field. This was the basis for significant use of satellite reconnaissance by deployed military forces in the field. It caused the gulf war to be called the first space war.

"Interestingly, when the Russians assessed the basis for the overwhelming U.S. success in that war, they attributed it to precision-guided munitions and real-time intelligence, which, in fairness, was more than satellite reconnaissance.

"French Defense Minister Pierre Joxie, having heard of U.S. imaging capabilities from his forces, asked after the war for the opportunity to see such imagery. Upon seeing it, he exclaimed, and later publicly stated: 'No nation can be a strategic power unless it possesses modern satellite reconnaissance.'

"Despite myriad problems with data volumes and distribution of satellite reconnaissance during the gulf war, the military didn't miss the message. During the period that followed, they became huge—and probably the primary—consumers of satellite reconnaissance, and they invested heavily in infrastructure to acquire output from the NRO and its mission partners NGA (National Geospatial-Intelligence Agency) and NSA (National Security Agency) to deliver raw and finished intelligence to field units at every level.

"In 1989, then [U.S. Army] Lt. Gen. Carl Stiner was largely alone in declaring that his special forces 'couldn't go to war without space systems.' Today, every commander would say that. And all of them would be talking about more than satellite reconnaissance—also about the incredible success of the GPS, missile warning, and weather and communications satellites on which all modern military actions heavily depend."

Hexagon KH-9, the last of the U.S. national reconnaissance film-return systems, was developed as a replacement for the Corona. It conducted 19 successful missions.

Corona cameras have improved over the years, providing progressively sharper imagery, with ground resolution of objects reduced to less than 5 ft.

document says. It notes that the NRO launched 20 Hexagon Big Birds from June 1971 to April 1986, and that the program's only failure happened on its 20th and final flight, April 18, 1986, when the launch booster exploded above Vandenberg AFB.

"Gambit and Hexagon proved invaluable to U.S. policymakers," the NRO declares. "For much of the Cold War, these systems kept watch over the Soviet Union and other communist block areas. They proved critical to U.S. security by providing detailed intelligence on U.S. adversaries. Their search and surveillance capabilities also made possible arms limitation negotiations and the verification of nuclear reduction treaties."

KH-11: Instant gratification

By the mid to late 1970s, the NRO had come within reach of a long-sought goal: getting satellite imagery from space to ground stations and into the hands of national security decision-makers in near real time. This finally happened—made possible by the advent of digital electronics and programmable computers—when Gambit and Hexagon systems were replaced by the next generation of photoreconnaissance satellites that radioed their imagery to Earth and eliminated the need for film return.

"On December 19, 1976, the first U.S. near-real-time imagery intelligence satellite launched into space," Charlston writes. "The camera it carried abandoned the [previous] film-readout concept, using an electrooptical technology developed by the NRO's Program B."

That satellite reportedly was the first of the vaunted KH-11 series that made the Soviet Union and other denied areas of the globe far more—and more sharply—discernible than ever before. By all accounts, exceptionally large volumes of KH-11 imagery were transmitted to ground stations and national security decision-makers with unprecedented speed and clarity.

Keeping the war cold

Fifteen years ago, former NRO Director Martin C. Faga met Lt. Gen. Georgiy Polischuk, deputy director of the Russian GRU (Foreign Intelligence Directorate) and former director of the Soviet equivalent of the NRO. Polischuk was in the U.S. as part of a Russian delegation to discuss the potential environmental applications of classified satellites.

As recalled by Faga, here is what his former Soviet counterpart said to him on that occasion:
"I am proud of my service and of yours. We both labored during the Cold War to keep our leaders informed. Every time our leaders feared the worst, our hard evidence showed that the intentions of the other side were not so dire. I know that we both helped prevent the Cold War from becoming a hot one."

Faga adds that Polischuk "was, of course, speaking of the thousands of people who were involved on both sides."

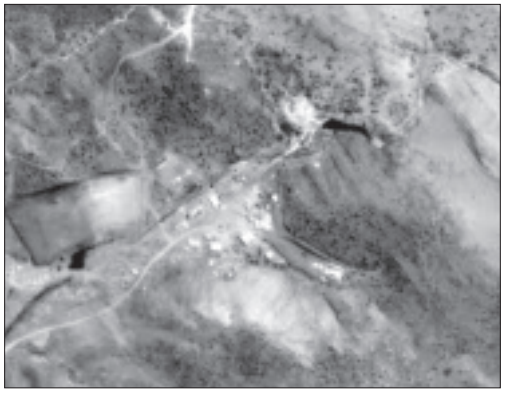
Big or small, a huge legacy

Through most of the NRO's first 50 years, its spaceborne reconnaissance systems grew progressively larger and more complex. Today, the NRO strives for smaller, less complex, less expensive satellites capable of working in concert to do the same missions while cutting launch costs and response times.

In his speech last August, NRO director Carlson noted that "small satellites have already proved invaluable since the earliest days of space reconnaissance and the NRO. The Navy's Grab and Poppy satellites of the 1950s fit the description, he said, with the largest Poppy measuring only 27 in. x 34 in. and weighing just 282 lb.

Carlson said the NRO will continue to use small satellites to develop and demonstrate innovative technologies, help maintain the space industrial base, and sustain and develop the space industry workforce.

"Perhaps we will fly many small satellites in formation in order to produce large synthetic apertures for higher resolution [of images]," the director said. "Or maybe we'll be able to rapidly change on-orbit configurations and formation geometry in response to evolving mission/sensing requirements."



This photograph of the Zhawar Kili Al-Badr Camp (West), Afghanistan, was used by Secretary of Defense William S. Cohen and Gen. Henry H. Shelton, U.S. Army, chairman, Joint Chiefs of Staff, to brief reporters in the Pentagon on the U.S. military strike on a chemical weapons plant in Sudan and terrorist training camps in Afghanistan on Aug. 20, 1998.

Today's small reconnaissance satellites are designed to work together on orbit by virtue of highly advanced communications systems in and from space, officials note. Skeptics contend, however, that no matter how capable small satellites may be in isolation or as a team in space, they will be hard-pressed to match the prowess of the larger systems that evolved as steadfast Cold War sentinels through the first half-century of the NRO.