The First SIGINT Satellite June 21

After World War II, the United States only had a shallow knowledge of Soviet military capacity. Military attaches were severely restricted, and travel in the Eastern Bloc came to a halt. HUMINT was unsuccessful. There were, in short, no traditional intelligence sources on the adversary. All that remained was what came to be known as "technical intelligence."

The first form was aerial photography. The creator of post-war aerial reconnaissance, Richard Leghorn of the Army Air Corps, called in 1946 for specially designed aircraft that could fly high enough to avoid enemy air defenses. The first programs used existing airframes—chiefly the B-29, which could fly higher and farther than any other aircraft. But with the cameras available at the time, flight routes had to be within only a few miles of the Soviet coastlines. The Strategic Air Command (SAC) contended that peripheral reconnaissance was insufficient, that only overflights would suffice. Leghorn also was convinced that overflight of enemy territory would be required. The Eisenhower administration launched several unsuccessful balloon programs; they yielded next to nothing.

Meanwhile, a study group proposed earth-orbiting satellites, but many decision makers believed that the intelligence requirements would not justify the enormous expense of research and development of such an exotic solution.

Leghorn and Edwin Land (inventor of the Polaroid camera) pushed the development of high-altitude aircraft. Leghorn was convinced that it would be possible to build an aircraft that could fly between 60,000 and 70,000 feet. They pushed several projects, but Lockheed submitted an unsolicited proposal for a very high altitude reconnaissance aircraft; this became known as the U-2.

U-2s overflew the USSR from 1956 to 1960. But the program ended ingloriously on May 1, 1960, when the Soviets shot down a U-2 operated by CIA pilot Francis Gary Powers. The Soviets had developed an air defense capability that put the aircraft in jeopardy. Eisenhower cancelled the program.

In the mid-1950s, the Eisenhower administration took a second look at the early proposal to orbit a satellite. In May 1955, the president signed a proposal made

by the assistant secretary of defense for research and development, Donald Quarles, to launch an earth-orbiting satellite in conjunction with the International Geophysical Year (IGY). Its announced purpose was scientific experimentation. An unannounced rider on the scientific payload would be a military reconnaissance capability to augment, and later to replace, the U-2.

Eisenhower was fiscally conservative and did not believe in sacrificing the nation's prosperity to military ends. Thus, he reduced military spending during his last two years in office. There would be no crash program to get a satellite in orbit ahead of the Soviets, who had announced their decision to launch an artificial satellite. His secretary of defense, the recalcitrant Charles Wilson, once referred to a satellite as "a damn orange" up in the air.

When, in October 1957, the Soviet satellite Sputnik 1 was hoisted into the sky, there was little reaction at first from the White House. But a political storm was brewing that would turn the administration completely around on satellites. Sputnik 1 came to symbolize advancing Soviet technological and military prowess, and highlighted the slow reaction of the administration. Political opponents forced Eisenhower to take hasty measures: he created the Advanced Research Projects Agency (ARPA); he poured new money (and urgency) into satellite research efforts then going on; and, most importantly, Eisenhower established the National Aeronautics and Space Administration (NASA) in 1958. He intended NASA as an agency to draw all satellite design and construction into one place, and he put a civilian agency in charge of civilian and military space vehicles. However, all three uniformed Services continued to push their own programs.

Almost immediately, the Navy Bureau of Aeronautics contacted the Naval Research Laboratory (NRL) in Washington, D.C., and requested that NRL establish a new task to design an electronic countermeasures intercept system "for supersonic vehicles."

The Naval Research Laboratory was one of the federal government's premier research organizations. When it opened its doors in 1923 on the banks of the Potomac River in the Anacostia section of Washington, D.C., it boasted two divisions—Radio and Sound—and later expanded into research on heat and light, optics, metallurgy, chemistry, mechanics, and electricity. Scientists at NRL developed early sonar systems and helped develop the first operational American

radar, in time for use in World War II. After the war, the laboratory did important research on the emerging field of electronic countermeasures.

On March 28, 1958, Reid Mayo, an NRL engineer, was returning with his family from Grand Rapids, Michigan, when a late winter snowstorm stranded them at a Howard Johnson's restaurant on the Pennsylvania Turnpike. While his family dozed in the restaurant, Mayo gazed out at the snowstorm and thought about a new task. The problem was something like one he had been working on involving electronic countermeasures operations by a submarine using an antenna mounted on the periscope. What, he wondered, if the periscope were raised to the altitude of an orbiting satellite? He quickly did the math on a paper placemat, and realized that it should be possible for a satellite orbiting overhead to intercept electronic emissions that could not be heard from listening posts on the ground. When he got to work the following Monday, he took the idea to his superiors.

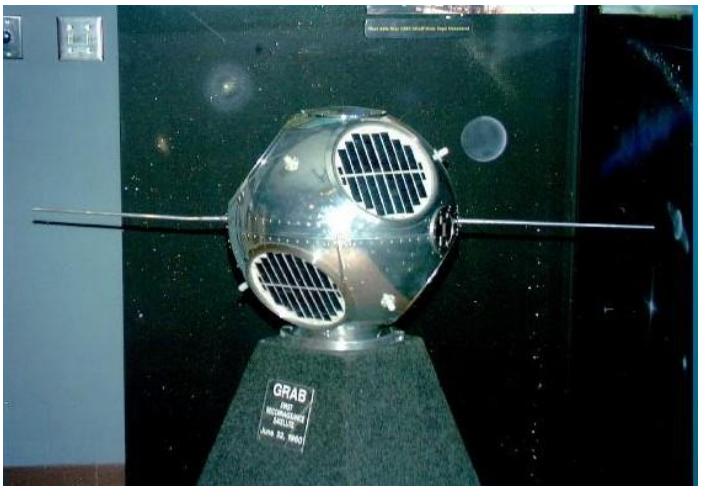
Electronic intelligence (ELINT) was the target of Mayo's proposed satellite. ELINT is the information that can be gained from intercepting and analyzing electronic emissions, chiefly radar. A second aspect known as "operational" ELINT was concerned with the "where and when" of radar operations. Once a radar system's capabilities were known, its operational activities were of interest to both tactical intelligence users and weapon system analysts. The United States had begun peripheral ELINT reconnaissance flights along the borders of the USSR in the late 1940s. This put a radio receiver high enough above the earth's horizon that it could collect beyond the normal 30 mile limit.

NRL engineers worked on Mayo's proposal through the spring of 1958, and in June, the team chief submitted a seven-page proposal for an ELINT collection satellite in earth's orbit to the Office of Naval Intelligence (ONI). During the fall and winter, NRL briefed the Navy, ARPA, CIA, NSA, and various offices in the Air Force that would participate. Among many competing proposals, Mayo's idea got the nod because of its low cost and relatively quick pay-off. The secretary of defense forwarded it to President Eisenhower on August 18, 1959. Eisenhower approved it on August 24.

There were legal questions about satellite reconnaissance. International law clearly forbade unauthorized aerial overflights of a country, a position that had

gone unchallenged since before World War I. But what about satellites? If the collector were 500 miles up, was that high enough to satisfy legal concerns? Eisenhower was more concerned about this aspect than about any other. He approved Mayo's plan only after having been assured by the State Department that Soviet discovery of the satellite would pose minimal embarrassment.

The Soviet Union had issued countless threats and warnings to other countries to stay away from its borders, and had shot down several reconnaissance planes that simply flew too close to the 12-mile limit. These concerns drove the decision to keep this project tightly controlled; the new system was placed under a security control called "Canes" (pronounced "Cannis"). Initially, only about 200 people in the entire U.S. government were cleared for the program.



GRAB, on display at the National Cryptologic Museum

To provide security for the new system, NRL devised a cover program. Called GRAB (Gallactic RAdiation Background), its purpose was "to determine the average galactic radiation background at 1200 angstroms. By extrapolating the results, a prediction for noise levels at any frequency can be determined." There actually was a project that took such measurements, but that was the "white" side. The ELINT collection package was the "black" side of the program.

While NRL designed the collection package to be placed on the satellite, the Naval Security Group (NSG), part of America's cryptologic system, was brought into the project to provide ground receiving stations, signal analysis, and reporting of intercepted data. As the satellites passed overhead, they would transmit intercepted radar pulses to NSG ground sites along the periphery of the Soviet Bloc. The equipment initially would be located in vans containing antennas and receivers. The use of separate vans would provide security and would permit rapid deployment to ground sites. Also, the vans could be moved to new locations

if circumstances changed. Because of geographical concerns, some receiving sites were ultimately located at non-Navy sites.

Satellites would be controlled by ground command. The GRAB calibration hut, a dual interrogation/receiving site, was deployed to a naval communications station on Oahu, Hawaii, for on-orbit checkout. (This site was used with the initial satellite but was later moved to Hybla Valley, Virginia.) There would be an interrogation hut, for mission operations control, in Europe.

The modern era of satellite reconnaissance began on Wednesday, June 22, 1960. A Thor Able Star launch vehicle lifted off from Cape Canaveral at 1:54 AM and headed south by southeast. The GRAB satellite was ejected from the Transit A vehicle during its first orbit, its antenna was deployed, and its telemetry signal was acquired by NASA's Minitrack stations in the Americas. The DoD news release referred to solar radiation measurements but did not, of course, cover the covert Canes mission.

Meanwhile, an NRL team headed for Oahu. They spent several days unpacking and tuning the equipment, and on July 5 they were ready. After a few tense moments their equipment acquired the tracking signal, as it sped by on orbit 199. Then they tried to activate the mission downlink. It took two tries, but they got it working, and the engineers who packed the van were the first to hear radar signals intercepted from space.

The follow-on Poppy system was witness to technical events that characterized the Cold War period. The system had three primary targets: the integration and modernization of the huge Soviet air defense network; the early developmental stages of the Soviet ballistic missile warning and defense systems; and the increasing worldwide deployment of Soviet naval power.

(U) 502 caption: a model of the GRAB satellite on a museum pedestal.