Edwin Land pictured at the unveiling of the Polavision home movie system in 1971. A famed scientist and inventor, Land was also instrumental in the success of several Cold War intelligence reconnaissance programs. (Library of Congress/Bernard Gotfryd)

Edwin Land's Cold War Intelligence Legacy

Regis D. Heitchue

Regis D. Heitchue served as a senior executive in CIA's Directorate of Science and Technology. He specialized in advanced technical intelligence systems.

Intelligence Trailblazer

In his public life, Polaroid founder Edwin Land was a scientist and entrepreneur distinguished for his inventions in the fields of polarized light, photography, and color vision. He left a rich legacy of 533 patents, second only to Thomas Edison, by the time he retired in 1982. Books have been written about Land's extraordinary public achievements and the legacy he created. Yet there exists another legacy equally as rich, but less well known. This article sheds light on Land's many contributions to the US Intelligence Community.

A Triumph of Genius

Edwin Land's invention of the Polaroid camera changed picture-taking habits of millions of people around the world. In products, like the Polaroid instant camera, he sought to create an essentially aesthetic medium that inhabited the intersection of science and art. Shrouded from public view, however, Land was an adviser to presidents and a pioneer in the development of US means of gathering intelligence. It is a legacy that had not been made fully public owing to the extreme secrecy that surrounded his work at the time. Few, namely the senior officials he advised on such matters, knew of the immeasurable contributions he made.

In reading publicly available literature, one is left to admire his scientific and entrepreneurial achievements, but also unknowing of this other Edwin Land. In *A Triumph of Genius*, Ronald K. Fierstein provides only a brief account of Land's secret service

> *Perhaps most importantly, his contribution to America's defense and intelligence efforts over three decades, and in the service of seven presidents, performed mostly in secret with no public fanfare but to an inestimable amount of praise from our country's scientific elite, may be the true measure of Land's stature in the pantheon of great American minds and entrepreneurs.*[1]

That is indeed high praise, but it shows how little is publicly known of Land's role in national security. It can be said that his hidden legacy is as significant as his well-known public legacy.

The War Years

Founded by Land and George Wheelwright III in 1937, Polaroid Corporation in its early years was known for products like sunglasses and films that reduced glare by polarizing light. Land saw that Polaroid's products could be used not just in peacetime, but in war, and he sought passionately to be useful during the world war he saw looming. In December 1940, Land committed his company completely to military projects for the duration of the war. With characteristic prescience and impatience, Land launched Polaroid onto a new course, which he later called a "big change." He told the employees that one year from then, the United States would be in the war and starting at once, Polaroid's only purpose would be to win this war. Anyone who disagreed with this goal was free to leave. He told the employees that he didn't expect to make much profit. "We didn't exist for any profit, nor singly for the welfare of our employees, or to provide the consumer market with sunglasses that had been our start." "We have no purpose now except to win."

Polaroid's war work was based solidly on Land's and his company's preoccupation with polarizing apparatus and on the knowledge of plastics that Land's group had been forced to acquire to make the polarizers practical. The polarizers could be used in wartime by the military—antiaircraft gunners, machine gunners, and gunners aboard fighters and bombers—who had a frequent problem with glare. They needed goggles, polarizing and non-polarizing, and Polaroid gave them millions. Land called them "the best damn goggles in the world." Besides filters for goggles, the company made periscopes, lightweight stereoscopic rangefinders, aerial cameras, and the Norden bombsite.

The war demonstrated the strength of established scientific and technological institutions, but it also highlighted the usefulness of smaller enterprises like Polaroid in moving nimbly and rapidly to innovate. Polaroid grew explosively as a fast-turn-around innovator. Polaroid's and Land's total commitment to the war effort led to a whole range of technical advancements, and ultimately, to new innovative commercial products for the company.[2]

Polaroid's dedication to military problem solving had given the company a greatly expanded research and engineering division with very little, if any, civilian commercial business. To keep its employees and to continue

developing and growing, Polaroid needed some new product. The answer came to Land: He had taken a photograph of his young daughter Jennifer who asked why she couldn't see the picture right away. Land's answer was, why not? "Why not make a camera that gave a picture right away?" Based on the work he and Polaroid had done on the 3D vectograph technology that was primarily developed for miliary applications, he had conceptualized an instant photography system right away.[a]

One-step instant photography had been born. Land undertook nothing less than a revolutionary advance in photography, dispensing with the many steps required to develop a conventional film negative and print a positive. Slightly more than three years elapsed from "why not" to the first public demonstration early in 1947 of the Polaroid SX-70 instant camera.[3]

Penetrating the Iron Curtain

With the end of World War II Land would personally assume new responsibilies as senior advisor on intelligence matters to President Eisenhower and successive administrations. Due to his contributions during the war effort, Land was on the short list for inclusion in any intelligence activities that emerged as the postwar period evolved into the Cold War. In this new role, Land would no longer be inventing and producing products as he and his company had done during the war, but rather would advise senior American presidents and other officials on how best to understand and counter the threat posed by the Soviet Union. As long-time Land Panel member, Richard Garwin, said: "Land kept us on track and inspired us. Our job was not primarily to invent solutions, because there were usually plenty of those to exhaust the budget and the development resources. Rather, our job was, as quickly and surely as possible to separate the wheat from the chaff, and to encourage (even selectively breed) the wheat."[4]

Land's first Cold War involvement was Project Charles. It's 1951 report focused on air defense, a concept that was uncomfortable for the Air Force, which believed the best defense was an overwhelming offense. The need for further study led to an MIT effort initiated in late 1951 known as "Project Lincoln," codenamed Beacon Hill; the project concerned the Air Force's ability to conduct strategic reconnaissance on the closed societies of East Europe and the Soviet Union. James Killian, President of MIT, was closely involved with the Beacon Hill effort and, through it, he became acquainted with Land, who was one of the participating experts. Others were reconnaissance expert George Goddard, and astronomer and lens designer James G. Baker.

The classified *Beacon Hill Report: Problems of Air Force Intelligence and Reconnaissance* was published in June 1952. Its opening chapter, which summarized the entire report opened with a section on the importance of intelligence. It declared: "In the post-war world, intelligence and reconnaissance are more important to the United States, by several orders of magnitude, than in the pre-1945 world." Land contributed a chapter, "A new approach to photo reconnaissance." The report essentially concluded that then new age of scientific warfare was producing intelligence instruments that must be used to the maximum lest an enemy use them better.[5,6]

The important role that Killian and Land played in shaping US intelligence during the next 20 years turned on the unique secret relationship that Killian had with President Eisenhower who strongly expressed his need for frank advice on technical problems. The president referred to Killian, Land, and colleagues as "one of the few groups I encountered who seemed to be there to help the

a. A vectograph is a type of stereoscopic print or transparency viewed by using polarized 3D glasses to create three-dimensional representation from a single image. The vectograph was developed by Gustav Mahler of the Polaroid Corporation, where he worked with Land. This technological breakthrough was used in the wartime effort in late 1942 in stereoscopic reconnaissance of the Guadalcanal battlefields and later in mapping the Normandy beaches for the 1944 landings. (McElheny, 132)

country and not help themselves." Land recalled almost 30 years later that the president exclaimed, "Oh, I'm so grateful to you fellows who are out of town! You can't think in Washington. You go away and think and then you tell me what you've been thinking. There's no way to think if you live here."[7]

On March 15, 1953, the Science Advisory Committee in the Office of Defense Mobilization, which included Killian and Land in its membership, warned leaders about US vulnerability to a surprise attack. President Eisenhower was equally concerned, especially of the threat from Soviet Bison long-range bombers. Killian recommended the recruitment of a task force that became officially known as the Technological Capabilities Panel (TCP). In 1955 President Eisenhower commissioned the TCP to provide him with a comprehensive and extremely sensitive and highly classified study assessing the Soviet nuclear first-strike threat and the US ability to prevent or withstand it.[8]

Killian chose Land to head Project Three, the intelligence capabilities panel of TCP, to conduct a no-holds-barred review of US intelligence. At the time, Land was on leave of absence from Polaroid, living in Hollywood, California, and advising Alfred Hitchcock on the technology of making three-dimensional movies. He decided to return to the East Coast to lead Project Three.[9] The report issued by Project Three was perhaps the most important of such reports in the Cold War era, because it caused major changes in how the United States gathered intelligence on the Soviet Union. Eisenhower embraced those changes, providing presidential leadership of overhead reconnaissance programs—the U-2, OXCART, and CORONA—and protected those early efforts when their success was not assured.

U-2

It was clear to Land and his intelligence panel that there were vast uncertainties in the United States about Soviet military and industrial capability, especially concerning intercontinental bombers and ballistic missiles that could attack the United States.[a] The idea of a very high-altitude aircraft that would overfly the Soviet Union to take photographs of suspect military installations had been proposed by Kelly Johnson in the famed Skunk Works at the Lockheed Corporation. The USAF had rejected the U-2 concept, but the idea was validated and given life by Land when he briefed President Eisenhower. Land convinced the president of the soundness of his plan and the wisdom that the CIA undertake overflights of the Soviet Union. Land argued, "No statesman could run the risk of provocation toward war and for the Air Force to engage in a program of that sort would seem rather dangerous."[10] CIA-led missions would lend an unaggressive and non-military nature to overflights of the Soviet Union.

In his report, *Project Three Findings to the Director of Central Intelligence, Allen Dulles, November 5, 1954,* Land advised, "Here is the brief report from our panel telling why we think overflight [of the Soviet Union] is urgent and presently feasible…we feel there are many reasons why this activity is appropriate for CIA, always with Air Force assistance…the kind of action that is right for the contemporary version of CIA; a modern and scientific way for an Agency that is always supposed to be looking to do its looking."[11]

Land had earlier told the president of his confidence that a U-2 overflying Russia could and would find and photograph the Soviet Union's Bison bomber fleet. And indeed, it did. Photography from 24 U-2 flights proved that earlier US intelligence estimates of Soviet bomber production were too high—the supposed "bomber gap" was a myth. Those same U-2 missions also provided limited, but insufficient intelligence on Soviet ballistic missile threats, paving the way for reconnaissance satellite missions that would prove that the

a. Panel members included Land, James G. Baker, Joseph W. Kennedy, Edward M. Purcell, and John W. Tukey.

highly controversial "missile gap" was also a myth.

The U-2 flew missions over the Soviet Union gathering photographic and other intelligence until May 1, 1960, when the Soviets succeeded in shooting down the U-2 piloted by Francis Gary Powers. After the shootdown, CIA and State Department officials attempted to conceal the U-2's true mission and the reasons for the loss of the aircraft. The cover stories that had been concocted well before the start of dangerous overflight operations were soon and easily proven by Soviet Premier Khrushchev to be lies, but not before he tricked the United States about what he actually knew about the downed aircraft and its pilot.

Land and Killian had participated in devising cover stories in the event of the loss of an aircraft over the Soviet Union. They believed that rather than elaborate cover stories intended to conceal the true purpose of U-2 missions, the United States should admit the truth—the purpose was to gather intelligence that the United States needed to guard against a surprise attack. "It is my judgement that the CIA long before [the U-2 loss] should have brought to bear hardnosed scientific and military judgement on the probabilities of the plane's being shot down and of the growing Soviet capability to attack the plane."[12]

Had their advice been accepted, the country and Eisenhower could have been spared the humiliation that followed Khrushchev's revelations. The most important consequence of the whole incident was Khrushchev's cancellation of a summit with Eisenhower following the president's refusal to apologize. Had the United States from the beginning of the loss of the aircraft simply told the truth, as Eisenhower would ultimately do and as Land and Killian had urged, possibly the summit with its peaceful aims might have been saved.

Edwin Land believed strongly in being truthful. He said in a commencement address after the U-2 incident:

> *It was not a question of the ineptitude that might be revealed by the truth, or the possible damage that the whole program of negotiation for peace may have suffered…and it was not a question of whether with foresight that particular crisis could have been avoided. The issue was this: Does an American, when he represents all Americans, have to tell the truth at any cost? The answer is yes, and the consequence of the answer is that our techniques for influencing the rest of the world cannot be rich and flexible like the techniques of our competitors. We can be dramatic, even theatrical: we can be persuasive; but the message we are telling must be true.*[13]

At the same time, Land was concealing his enormous involvement in the highly secretive U-2 project. Land chose to differentiate lies of commission from lies of omission. To him, lying outright was one thing. Hiding the truth was another, and his conscience had accepted the distinction.

Among its many achievements, a U-2 reconnaissance mission in October 1962 discovered that the Soviets had emplaced intermediate range ballistic missiles in Cuba, a discovery that would initiate the Cuban missile crisis.

OXCART

CIA's Richard Bissell had begun to explore alternatives to the U-2 for gathering strategic intelligence because he knew the aircraft would have a limited life expectancy as Soviet air defenses improved. The President's Scientific Advisory Committee headed by Killian recommended that feasibility studies be started for a follow-on manned reconnaissance aircraft. The president approved the idea of a feasibility study and Bissell was requested to undertake action. In early 1958, Bissell formed a panel chaired by Edwin Land, who would keep Eisenhower informed on its progress.

Land and his panel members met frequently, usually in Land's Cambridge office. They were intimately involved with CIA and USAF officials in evaluating contractor proposals for a U-2

replacement that would ultimately become the A-12 aircraft, later known as OXCART, and advising government officials on designs that offered the best combination of stealth, speed, and altitude.[a] In December 1958, CIA Director Dulles and Bissell, with Land and committee member Edward Purcell present, briefed the president. Eisenhower was concerned about the U-2's vulnerability and problems with satellite reconnaissance efforts. He told them to continue work and suggested that the US Air Force "could support the project by transferring some reconnaissance money."[14]

While President Eisenhower had initiated work on the OXCART program, Presidents Kennedy and Johnson were involved in key aspects of it concerning its secrecy and overflight missions. The USAF had found that variants of CIA's A-12 design would be highly suitable for its military missions and contracted with Lockheed for their production. Secretary McNamara desired to reveal publicly the existence of a USAF version of the aircraft, while CIA fought to keep the A-12 from the public eye. The President's Foreign Intelligence Advisory Board (PFIAB) members, particularly Killian, objected strenuously to disclosing any version of OXCART on the grounds that publicity would compromise its design innovations, enable the Soviets to develop countermeasures, and destroy its value for reconnaissance.[b] DOD and CIA ultimately resolved the controversy: the White House announced the development of the A-11, an advanced experimental military aircraft, while the CIA's A-12 spy plane remained secret.

In 1965 with the United States becoming increasingly involved in Vietnam, PFIAB recommended to the president that OXCART be immediately deployed to Okinawa for photographic reconnaissance missions. The deployment became a controversial issue with State and Defense, but by 1967, DCI Helms received President Johnson's approval for immediate OXCART deployment and use. CIA flew OXCART missions over Vietnam from Kadena Air Base under the code name BLACK SHIELD for a period until it was replaced by the Air Force SR-71 Blackbird, a derivative of the A-12 that Land and his colleagues, especially Edward Purcell, had a hand in creating. Those missions produced critical tactical intelligence for US military commanders to develop safer and more effective flight routes.[15]

CORONA

Well before Powers' U-2 was shot down in 1960, President Eisenhower had become decidedly uncomfortable approving U-2 missions over the Soviet Union despite extraordinary urgency for strategic intelligence. As a result, US leaders began to consider a reconnaissance satellite as a way to gather the needed information. The US Air Force had been investigating reconnaissance satellites, and in October 1957, the President's Board of Consultants on Foreign Intelligence Activities (PBCFIA) reviewed the USAF program, known as WS-117-L or SAMOS. In its report to the president, the PBCFIA expressed skepticism and frustration with the WS-117L program because it was intended to primarily support the Strategic Air Command's interest in warning of a Soviet attack.

PBCFIA emphasized the need for peacetime strategic intelligence rather than reconnaissance in support of warfighting. Eisenhower, more concerned with preventing nuclear war than waging it, agreed. The board also doubted the feasibility of the Air Force plan to

a. Panel members included Land, Edward Purcell, Allen Donovan, H. Guyford Stever, Eugene Kiefer, and Courtland Perkins, as well as USAF, US Navy, and aerospace industry officials.
b. President Eisenhower established the President's Board of Consultants on Foreign Intelligence Activities in 1956; it was chaired by James Killian. In May 1961, President Kennedy reestablished the board as the President's Foreign Intelligence Advisory Board; Killian was again appointed as chair and Land was added as a member. Land served on the PFIAB from 1961 to 1977.

electronically transmit the reconnaissance data and instead believed that returning photographic film from orbit was the only workable approach.[16]

In November, 1957, Eisenhower named James Killian to serve as chairman of the new President's Science Advisory Committee. In his new capacity Killian conferred at the White House with Land, CIA's Richard Bissell, Eisenhower's staff assistant Army Colonel Andrew Goodpaster, and Air Force Systems Command (AFSC) commander General Bernard A. Schriever. They concluded that a film-recovery reconnaissance satellite managed through a covert program was the best near-term choice to augment U-2 missions.

Killian and Land wanted to streamline both the covert satellite program and its management, and they urged the president to assign responsibility for the new system to CIA, supported by the USAF, as had been done in the highly successful U-2 project. Their recommendation recognized CIA's ability to maintain tight security and move quickly.

In early 1958, Killian and Land met with Eisenhower, who agreed with the plan for a covert reconnaissance satellite that should be independent of the larger Air Force WS-117L program. Eisenhower emphasized that CIA should be in charge and that the newly established Advanced Research Projects Agency of the Department of Defense should execute CIA's orders.

Shortly after meeting with the president, Land visited CIA headquarters to inform a surprised Richard Bissell that he would now direct a covert reconnaissance satellite project. Dulles had known of Bissell's impending assignment, but it was Land who informed Bissell. To protect its intelligence mission, the covert satellite CORONA operated under cover of an overt scientific research satellite named DISCOVERER. CORONA was intended as an interim capability until the more complex WS-117-L satellite became available, but it would provide photographic intelligence for the next decade.

On August 25, 1960, Eisenhower greeted several of his top science advisers in the Oval Office with DCI Allen Dulles. Photography from the first successful CORONA mission, number 14, had just been recovered. Land unrolled a spool of film across the floor in front of the president and said, "Here are your pictures, Mr. President."[17] CORONA had captured images of airfields and other military installations in the Soviet Union; it would be the first of many reconnaissance satellites to return pictures of the earth from space.

CORONA missions produced intelligence of immeasurable value. The earlier uncertainty and lack of confidence in intelligence estimates as typified by the "missile gap" would be a thing of the past. A new era in intelligence collection had dawned. From that point forward, photographic intelligence from reconnaissance satellites would be critical for gathering information from closed societies. The entire concept of US intelligence gathering was revolutionized because satellite imagery was now foundational intelligence, the unifying structure of intelligence collection and analysis.

National Technical Means

During the early days of CORONA operations, USAF and CIA working relationships had been extraordinarily effective. By 1963 those relationships deteriorated as the participants—DCI McCone; National Reconnaissance Office Director Brockway McMillan, and his CIA opposite Bud Wheelon—engaged in skirmishes that adversely affected US satellite reconnaissance operations. McMillan began to fight for more control of CORONA and directed that all satellite programs, including CORONA, be consolidated at the NRO offices in El Segundo, California. In response, McCone accused McMillan of wanting to take the whole project over and enjoined McMillan to leave things as they were. In early 1964, however, McMillan directed that all changes in NRO programs be

referred to him. The test of wills over CORONA management persisted into early 1965, although McCone and Wheelon had won a victory by preventing McMillan from exercising control over any important aspect of CIA's CORONA activities.[18]

Land was well aware of the CORONA management controversies and in early 1965 had warned Wheelon and McMillan that unless they started cooperating with each other, "a strong wind would come along and blow them both out of the NRO tree."[19]

CORONA had never been intended as more than an interim search system, a temporary solution until the highly ambitious Air Force WS-117L satellite became operational, but by 1961, WS-117L was in technical and financial difficulties with at most an unpromising future, leading CIA to investigate the future role of the US space reconnaissance program.

McCone and Wheelon were determined to secure for CIA an unassailable place in post-CORONA space reconnaissance, and in May1963 McCone in May 1963 to convene a space reconnaissance advisory panel under the chairmanship of Edward Purcell. The panel's findings were not to McCone's liking; in late October 1963, together with Deputy Secretary Gilpatric, he formed a group of leading optical experts led by Sidney Drell to explore ways to improve satellite photography. The Drell panel supported CIA's conclusion that CORONA had been pushed to its technical limits and that a new search system was needed. In June 1964, McCone asked Land to convene yet another panel to consider the technical feasibility of a CORONA follow-on, known as FULCRUM, a search satellite with higher resolution.

In July 1965, Dr. Donald F. Hornig, special assistant for science and technology, had Land create a panel to review the National Reconnaissance Program and specifically a new search and search-surveillance system.[a] Land's panel evaluated both CIA's FULCRUM and the USAF contender for a new search system known as S-2. The panel judged that available data did not yet support the selection of either for full development. The FULCRUM and S-2 project staffs had little direct interaction, but they were bitter competitors in the fight for the development of the new search system that would become known as HEXAGON.

The HEXAGON (KH-9) satellite was ultimately developed as a joint covert effort by the USAF and CIA, but not before it was threatened with cancellation following Nixon's direction to reduce defense expenditures. On April 9, 1969, Nixon ordered the cancellation of HEXAGON and continuation of MOL-Dorian, albeit at a reduced expenditure.[b] DCI Helms immediately urged the president to delay action, and, on 21 April, Nixon reversed his earlier decision. Helms had argued that HEXAGON would provide a much better capability than MOL-Dorian for monitoring any arms-limitation agreement.

Arms control was a prominent component of US-Soviet relations after Nixon took office in 1969, and monitoring of such agreements, particularly those for strategic weapons, largely relied on satellite reconnaissance. HEXAGON was of paramount importance to US ability to confirm or deny Soviet strategic weapons developments and deployments. In both the US and the Soviet Union, space reconnaissance was considered highly sensitive, and so both sides adopted the phrase national technical means (NTM). NTM meant satellite reconnaissance—a capability so sensitive and highly classified at the time that

a. The Land Panel operated as the principal adviser for reconnaissance matters to the President's Advisory Group and the science adviser. The group first met on July 21, 1965, and met periodically until President Nixon abolished it in early 1973.
b. In the early 1960s, the US Air Force began efforts to put the Air Force into space by developing the Manned Orbiting Laboratory (MOL), whose overt objective was to determine the military utility of crewed space missions. Unknown to the public, MOL included a highly secret photographic-intelligence mission, codeword Dorian. See James D. Outzen, ed., *The Dorian Files Revealed: A Compendium of the NRO's Manned Orbiting Laboratory Documents* (Center for the Study of National Reconnaissance, August 2015).

neither party was willing to publicly acknowledge it.

Origin of the DS&T

Land, together with James Killian, was responsible for leading the Central intelligence Agency to embrace science and technology in the service of intelligence. A key recommendation from the TCP report urged "a vigorous program for the extensive use, in many intelligence procedures, of the most advanced knowledge in science and technology." In response, CIA created a permanent advisory board known officially as CIA's Scientific Advisory Board, though it came to be referred to as the Land Panel because Land chaired it for almost a decade.

Richard Bissell was a brilliant manager who had successfully led CIA's U-2, CORONA, and OXCART projects, but as the director of the Planning and Coordination Staff (later the Directorate for Plans), he was also responsible for CIA espionage operations and covert action. Land and Killian explained to new DCI John McCone their strongly held belief that Bissell's technical projects should not be managed under the Plans Directorate and that the scientific and technical part of the CIA should be a completely separate unit. Land and Killian saw science and technology almost as a religion, one that was incompatible with the agency's clandestine activities.

In February 1962, McCone responded by establishing the Directorate of Research (DR), the first directorate dedicated to technological advancement. The DR struggled to be an effective force internally and externally, and those struggles came to the attention of Killian and Land who decided they should provide McCone with more specific guidance for strengthening the CIA's technical capabilities. They did so in a March 1963 paper titled "Recommendations to Intelligence Community by PFIAB." In effect, they were telling DCI McCone just how they wanted him to revamp the agency's scientific and technical efforts. Before the year was out, those recommendations would be embraced in full by McCone.[20]

In August 1963, McCone replaced the Directorate of Research with the Directorate of Science and Technology (DS&T) and named Albert "Bud" Wheelon the director (DDS&T). Together with Wheelon, McCone permanently changed CIA, giving its science and technology mission equal standing with the two other major branches of the agency. The DS&T would become a powerful organization of incredible scientific and technical competency and was, in large part, a Land and Killian creation. After nearly nine years of urging the use of science as the handmaiden of intelligence, Killian and Land had succeeded in having a government unit created which embodied their ideas. A history of the DS&T said as much: "The existence of the Directorate of Science and Technology must ultimately be considered a monument to the wisdom of Edwin H. Land and James R. Killian, Jr."

EOI vs FROG

Space reconnaissance had provided highly significant intelligence over the years of CORONA, HEXAGON, and other systems, but being film-return systems, the intelligence was rarely timely, a major deficiency in times of crisis. That deficiency led both the Air Force and CIA to investigate timely space reconnaissance systems. CIA interest originated with Wheelon in his first six months as CIA's DDS&T.[21] The Air Force had done research on real time imagery in its WS-117L program and the concept that eventually emerged from their work was to modify their successful GAMBIT high-resolution reconnaissance satellite in what became known as FROG—Film Readout GAMBIT. CIA's concept, most often referred to as the EOI (Electro-Optical Imaging) satellite, employed a solid-state array of sensors to convert light to electrical signals for transmission to the ground. In the Air Force concept, photographic film would be developed on the satellite, then scanned for electronic transmission to earth. The Air Force lobbied FROG as simply an

Land Appeals to President Nixon

"Dr. Land [sic] asked the President if he might take a few minutes to discuss a matter which he believed to be of the utmost importance. Dr. Land said that there was surely agreement that the US overhead reconnaissance program plays a major role in the conduct of our foreign relations and in our knowledge of the enemy. He pointed out that each and every major step in the overhead reconnaissance program had been made possible by direct Presidential backing. No bureaucracy, he said, could go out on a limb to the extent necessary to achieve a quantum technical advance, and that such risks had to be borne by the President. Dr. Land said that the community is now at a stage where it again requires Presidential backing. This time it is with respect to a choice in the development of the near real-time readout capability. The cautious choice would be to utilize existing hardware and technology to develop a film imaging system which can be read out on call by US-based ground station. The adventurous choice, and one which would be a quantum technological advance, is to push the development of an electronic imaging system which can be read out through a relay satellite while the sensor is over the target. Dr. Land said that the electronic device offered significant advantages over a film system, and that the R&D time could be reduced from five to three years by the President saying that it should be done. Dr. Land asked the President to personally intervene."

(President's Foreign Intelligence Advisory Board, Memorandum for President's File, June 4, 1971)

adaptation to an existing satellite, while CIA experts believed FROG would be a risky and expensive new development.

Those differing views were at the heart of the competition for the real-time reconnaissance satellite. The battle lines had been drawn — Air Force's incremental and evolutionary, CIA's revolutionary and dramatic. Edwin Land campaigned vigorously for EOI because it was a revolutionary concept while FROG to him, was not a major advancement. Land very much favored the bold approach to problems "Do not undertake a program unless the goal is manifestly important and its achievement is nearly impossible."[22] —A quantum leap. A central and arguably the single most influential figure in the EOI-FROG drama was Edwin Land who took an active interest in CIA's concept as a means to, in his words, "see it now."[23]

The National Reconnaissance Program (NRP) Executive Committee (ExCom) was established in August 1965 by DOD and CIA agreement. The ExCom was powerful because it was made up of just the deputy director of defense, the DCI, and the president's science adviser. It controlled, subject only to the secretary of defense and the president, satellite project approvals and funding. ExCom first engaged in the EOI-FROG debate in November 1968, but by July 1971 it was evident that the principals were unable to agree on a position. Instead, DCI Helms and Defense Secretary Melvin Laird independently advised President Nixon. Helms told Nixon that EOI was the better choice and that FROG costs had been underestimated. Laird's memo supported EOI but expressed skepticism about its early availability, an important consideration for Nixon.

Ending the Debate

A memorandum from Henry Kissinger brought finality to an issue that had consumed, but eluded, ExCom officials. Kissinger advised all concerned in unambiguous terms that the president had concluded that the development of the EOI system, later known as KENNEN (KH-11), should be undertaken toward a 1976 operational date and "under a realistic funding program." Further, the president had decided

that there should be no further development of the Film Read-Out GAMBIT system. FROG was dead. [24]

Retired Lt Gen Lew Allen, who led the USAF competition for a real-time satellite, had one perspective on the end to the KENNEN story:

> *Although I supported FROG and [redacted] institutionally, my heart wasn't in it—they should not have gone forward. I had a conservative view of "K" [KENNEN], and still do, a remarkable technical vision, but one it is possible the country could do without…. A remarkable aspect of "K" history is the awesome effectiveness with which CIA and the Land Panel dedicated themselves to supporting "K" once Land made his basic commitment. The only parallel in history is the unified dedication of the Romans to the destruction of all Carthage."*

Richard Helms, however, saw KENNEN's great intelligence value:

> *[The] development of the KH-11 was an absolute masterpiece…I knew if it was ever going to be made to work it was going to be an absolute breakthrough. It was going to change the timeliness and the ability to collect intelligence in a way that nothing else had done except maybe the advent of the U-2 or the first photographic satellite. That was the kind of thing I wanted to see the Agency move forward on… we were more innovative than anybody else in government, including the Department of Defense.*[25]

Land's Legacy

Today, many years after the end of the Cold War, it is hard to appreciate just how little intelligence about the Soviet Union was available at the time. The Soviet Union controlled virtually all significant information and was highly secretive about its military, especially nuclear weapons. To make matters worse, the Soviet Union was an especially difficult environment for human intelligence operations. Fortunately, President Eisenhower—through the influence of Land, and often James Killian—saw that overhead reconnaissance provided the means for penetrating the Iron Curtain.

Land, who never held an official position in government, exerted great influence on intelligence matters through his engagements with Presidents Eisenhower, Kennedy, Johnson, and Nixon. He convinced Eisenhower to develop the U-2 at a time when the US was largely ignorant about the Soviet Union. U-2 intelligence greatly reduced US fears about what lay behind the Iron Curtain.

The Soviet Union's launch of the world's first intercontinental ballistic missile in August 1957 created a sense of urgency for intelligence on the new Soviet threat, and Land believed such intelligence could only be achieved through satellite reconnaissance. CORONA proved that the "missile gap," one of the hottest issues in US politics at the time, was a myth, a gap in reverse.

CIA's OXCART program never achieved its intended purpose of strategic reconnaissance over Russia (much to DCI McCone's disappointment), but it was the progenitor for the highly successful and more famous Blackbird tactical reconnaissance aircraft. Blackbird missions over North Vietnam and North Korea were flown with no losses, a tribute to the work of Land's team who helped design the features of the aircraft that made it virtually invulnerable to enemy attack.

CIA experts Bud Wheelon, Les Dirks, and others had the brilliance and vision behind the EOI/KENNEN satellite, but it was Land who made it happen. While he was an inventor in his Polaroid work, in national security his role was not to invent but to advance those ideas he thought most important. EOI was certainly one of those ideas and today, KENNEN-like satellites circle the globe giving US leaders near-instant intelligence on worldwide crises, as do commercial EOI satellites whose images in the media we see every day.

The DS&T that Land and Killian helped create became a

powerful technical intelligence collection organization, a peer with CIA's clandestine and analysis directorates. One of the DS&T offices —Development and Engineering, once the largest office in the CIA—was nationally recognized as a dominant player in satellite reconnaissance.

From available records, it appears that Land mostly retired from his national security intelligence work in the mid-1970s.[a] It is unclear why he chose to retire then, although it might have been occasioned by the epic legal battle Polaroid waged between 1976 and 1985 with one-time mentor Eastman Kodak. In the long run, neither company survived. Polaroid won the battle with Kodak in 1985 but filed for bankruptcy protection in 2001. Kodak, which contributed hugely to US national reconnaissance through its work on large optics, exotic films, and film processing, missed the boat on digital photography. It filed for bankruptcy protection in 2012. Land died on March 1, 1991, in Cambridge, Massachusetts, age 81.■

a. In 1980, Land founded the Rowland Institute at Harvard University. The Rowland Institute is a privately endowed, non-profit, basic research organization, conceived to advance science in a wide variety of fields.

Endnotes

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