AIR & SPACE HISTORY

Early Cold War Strategic Reconnaissance

Four Articles by R. Cargill Hall

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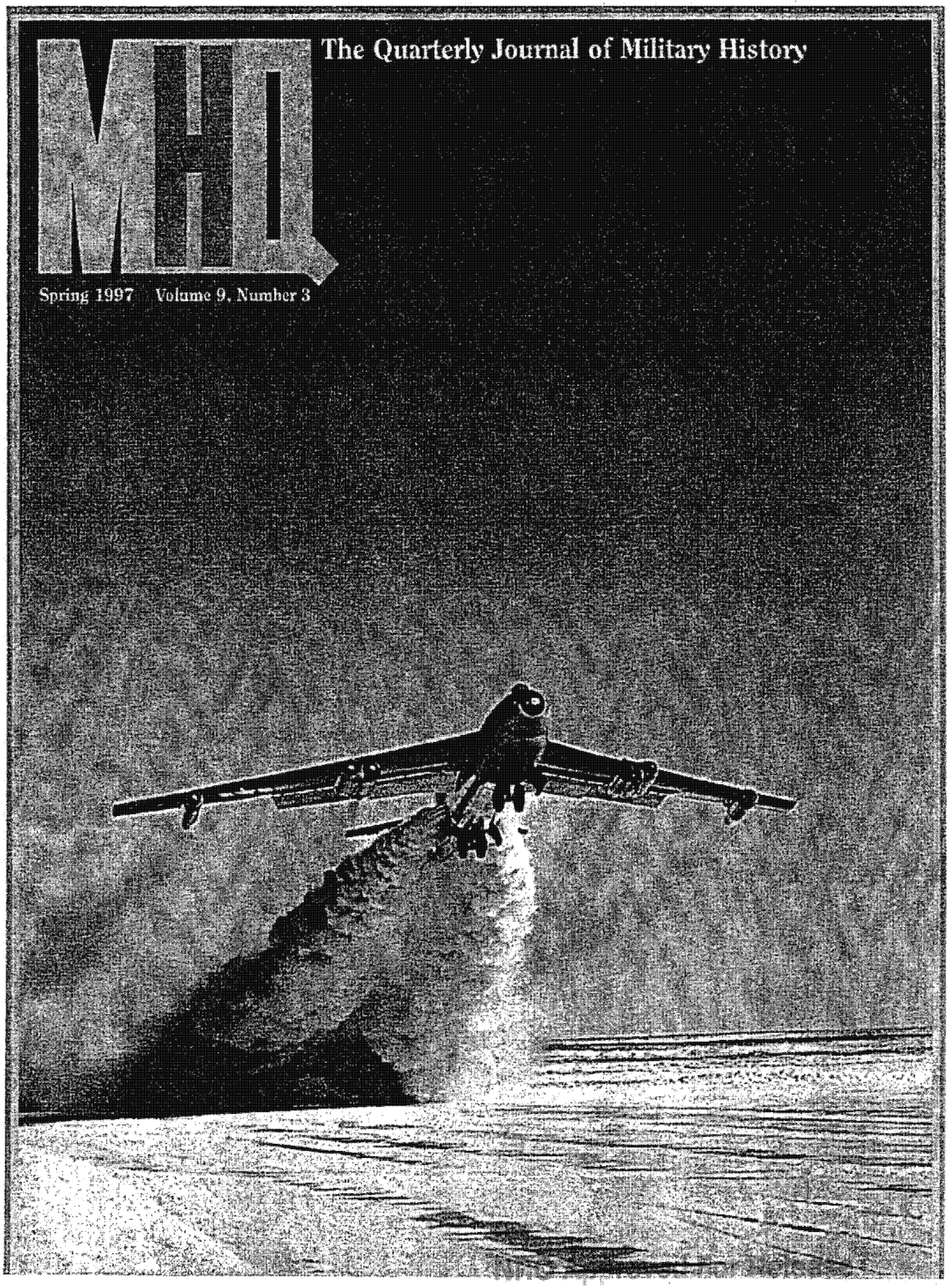
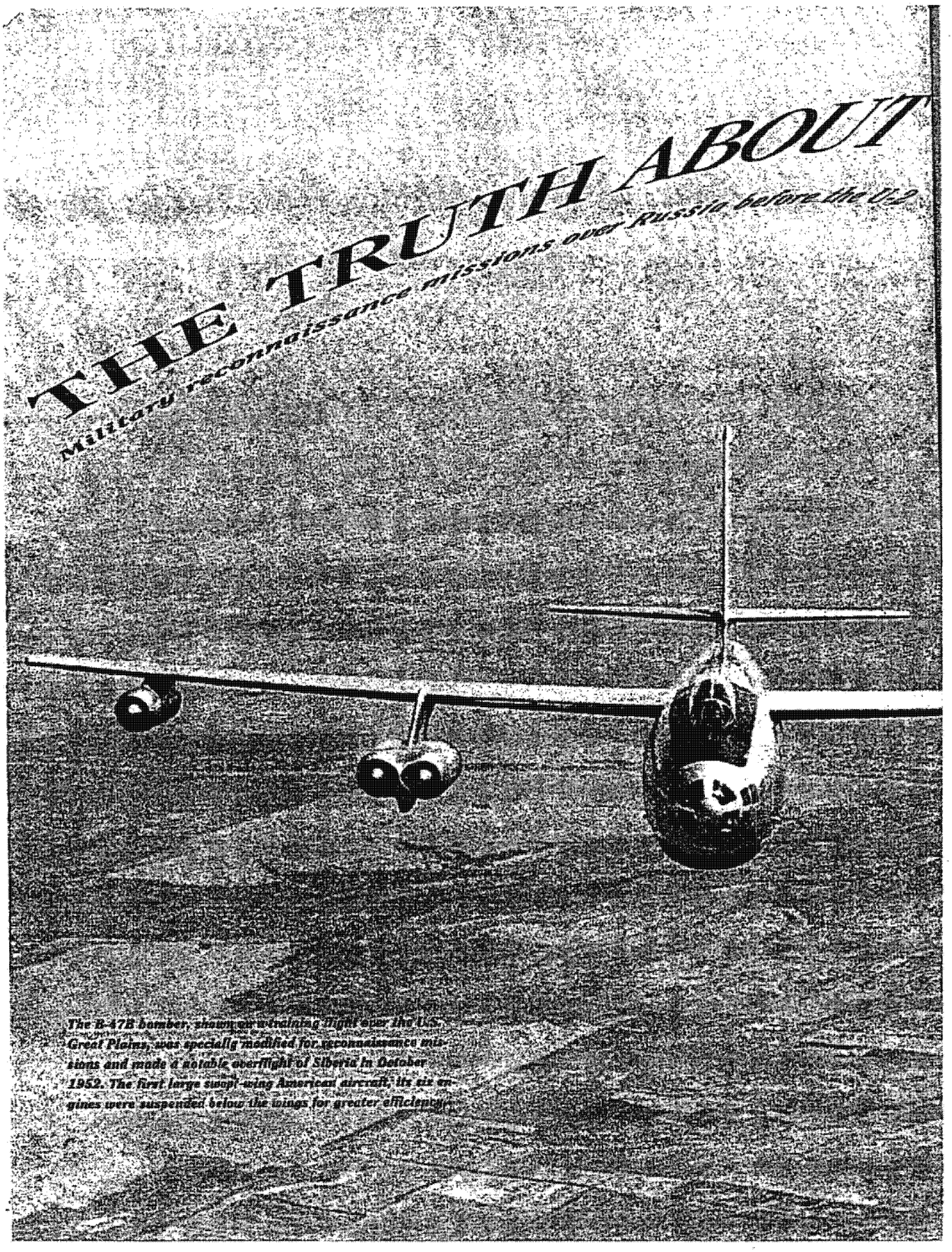
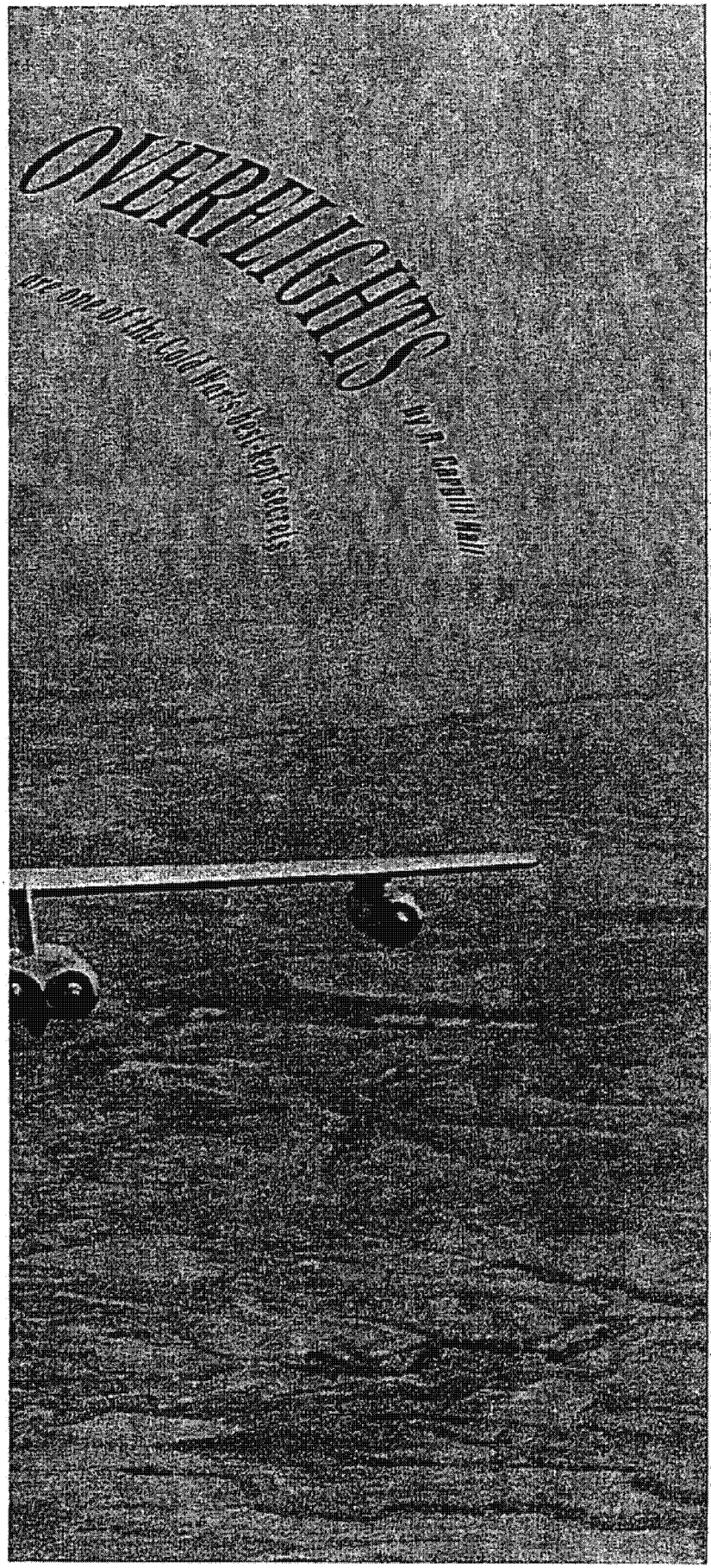


THE TRUTH ABOUT

Military reconnaissance missions over Russia before the U-2



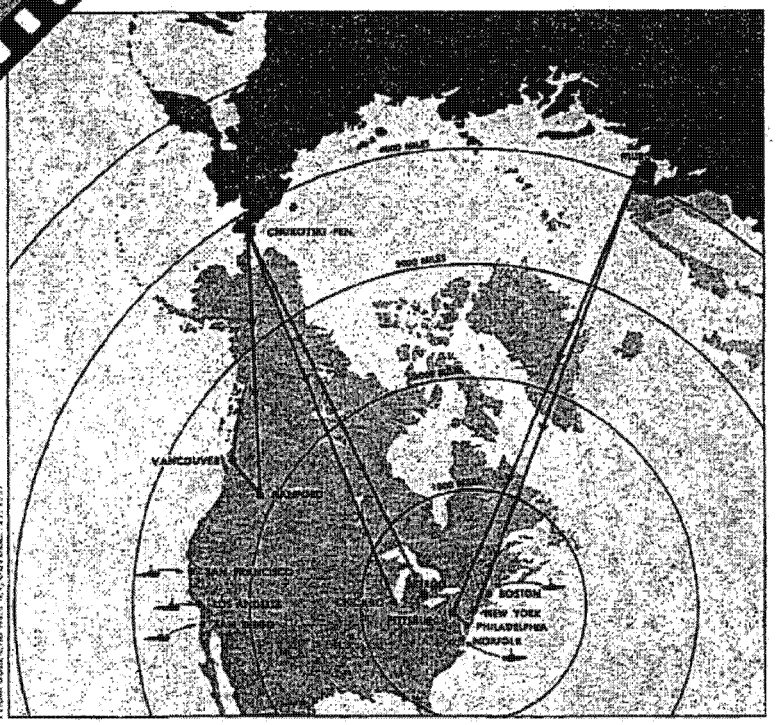
The B-47E bomber, shown on a training flight over the U.S. Great Plains, was specially modified for reconnaissance missions and made a notable overflight of Siberia in October 1952. The first large swept-wing American aircraft, its six engines were suspended below the wings for greater efficiency.



During the first half of the 1950s, before the introduction of the U-2, the United States and its allies sent military aircraft on secret reconnaissance flights over the Soviet Union. They flew over Siberia and behind the Ural Mountains, photographed cities such as Stalingrad, Murmansk, and Vladivostok, and on occasion were engaged by Soviet interceptors. Not a single plane was lost. These were never rogue operations. Between 1951 and 1956, Presidents Truman and Eisenhower and Prime Minister Churchill periodically and on a case-by-case basis authorized these military overflights of the U.S.S.R. and other "denied territory." The risks were great, but so were the intelligence payoffs.

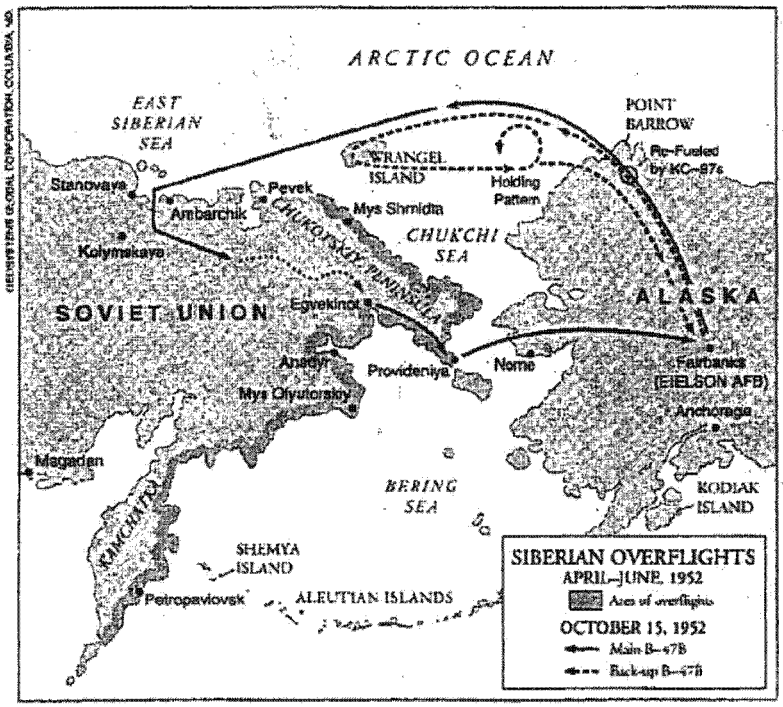
Even today, many of the men who took part in the missions (and who were sworn to secrecy) are reluctant to talk about them. Since the dissolution of the Soviet Union in 1991, it is true, fragmentary accounts have appeared. Too frequently, however, they have turned on misperceptions and questionable interpretations. Armed with a few interviews and still fewer archival records from the Cold War, authors have provided Oliver Stone-like conspiracies. Some have alleged that the missions were the sole responsibility of the commander in chief of the Strategic Air Command, Gen. Curtis LeMay—who, they charge, sought through overflights to blackmail the Soviet Union or provoke it into starting World War III. To quote one account, he "had apparently begun raising the ante with the Soviet Union on his own, covertly and extralegally."

Other writers have confused presidentially authorized overflight missions with a related aerial reconnaissance effort that operated near Soviet territory but without overflight authorization. The latter missions, which began before 1950 and continued throughout the Cold War, were known as the Peacetime Airborne Reconnaissance Program, or PARPRO. By combining the two different activities, Richard Rhodes could claim in *Dark Sun*, his history of the making of the hydrogen bomb, that "the Soviet Union shot down at least twenty



FROM COLLIER'S WEEKLY, OCTOBER 27, 1951

A 1951 map (above) shows why overflights of Soviet territory were considered so necessary. The fear was that Russian long-range bombers were massing for attacks—which would most likely come from airfields close to Alaska or from the Murmansk area. A Navy P2V-3W made nine shallow overflights of the Siberian coastline in the spring of 1952, below, and two B-47Bs entered Soviet airspace that October. One, piloted by Col. Donald E. Hillman, flew over Siberia but found no bomber threat. The dotted line indicates where his exact route is unknown.



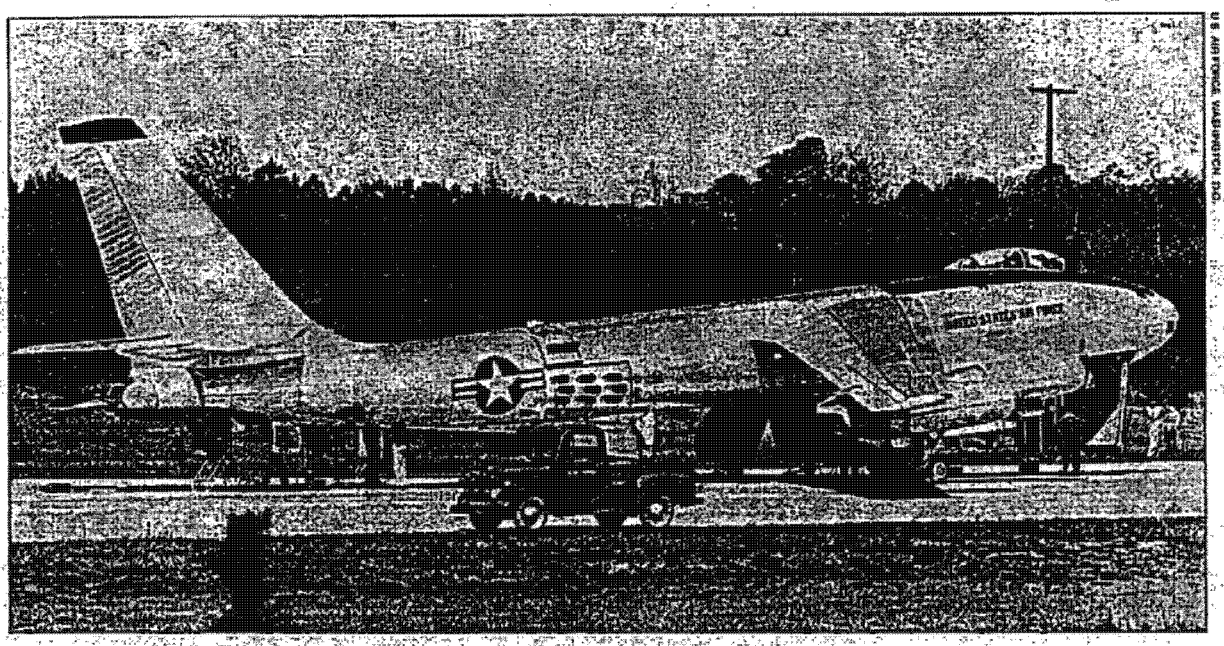
(DESIGNED BY GENERAL CARTOGRAPHIC CORPORATION, COLUMBIA, MD.)

planes during overflights with the loss of an estimated one to two hundred U.S. airmen."

A few words of definition are necessary here. In using the term "overflight," I mean a flight by a government aircraft that, expressly on the direction of the head of state, traverses the territory of another state in peacetime without that other state's permission. PARPRO aircraft did not possess overflight authorization, although a few of them did stray into Soviet territory or over the Soviet Union's territorial waters; some were shot down. Even today, almost all of the pertinent records about overflights remain unexhumed, but those already found, as well as the recollections of surviving participants, do provide a broad outline of this most clandestine Cold War enterprise. The true story, so far as it can now be determined, is more dramatic and its dimensions larger than anything recently alleged. The only conspiracy that exists is the conspiracy of silence.

The Cold War began in 1946–47 with the unraveling of the World War II alliance against the Axis powers. Anxious to preserve the independence of Western Europe in the face of a perceived military threat, Western leaders sought to determine the size, composition, and disposition of Soviet forces arrayed behind the "Iron Curtain." Late in 1946 Army Air Forces aircraft began flights along the borders of the Soviet Union and its satellite states. These PARPRO missions collected electronic and photographic intelligence, but their intelligence coverage was limited to peripheral regions. Before long, commanders of the new United States Air Force (USAF), formed by the National Security Act of 1947, sought permission to conduct direct overflights of Soviet territory, especially those regions in Siberia closest to Alaska.

The Joint Chiefs of Staff (JCS), however, after consulting with the director of Central Intelligence and the secretaries of defense and state, consistently denied these requests. Indeed, in 1948, after the Soviet foreign ministry vigorously protested the intrusion of American



U.S. AIR FORCE, WASHINGTON, D.C.

A B-47B, above, undergoes modification at MacDill AFB in Florida, c. 1952–53. Before the Air Force released this photo, it blotted out the identification number on the tail, an indication that the aircraft was being prepared for a "special mission." Below is the crew of the B-47B that flew over Wrangel Island. From left: Majors Lloyd P. Fields and William J. Reilly, and Col. Patrick D. Fleming. At right, Col. Donald E. Hillman was photographed shortly before his Siberian exploit.

"bombers" over Soviet territorial waters, the Department of State restricted PARPRO missions approaching Soviet borders to standoff distances of no closer than forty miles. Overflights remained out of the question. In receipt of one request for such a mission from Strategic Air Command (SAC) headquarters in Omaha, Nebraska, in October 1950, the USAF director of intelligence, Maj. Gen. Charles P. Cabell, replied that he would have to recommend against it. But, Cabell added, "[I am] looking forward to a day when it becomes either more essential or less objectionable."

That day, in fact, was close at hand. International tensions had increased significantly in late 1949 when the Soviet

COURTESY COLONEL LLOYD FIELDS, USAF (RET.)

COURTESY COLONEL DON MCLEAN, USAF (RET.)

Union exploded a nuclear device and Communist forces swept to victory in China. But perhaps the greatest shock for Western leaders occurred in June 1950, when North Korea launched a surprise attack on South Korea. In November 1950, a few weeks after Cabell wrote to SAC headquarters, Chinese military forces joined the Korean War. The sequence and pace of these events caused American political and military leaders to believe that their Soviet counterparts might launch an attack against Western Europe, possibly along with a surprise aerial attack on the United States.

With United Nations forces in North Korea in full retreat, President Truman issued a proclamation of national emergency on December 16, 1950, and called numerous National Guard units to active duty. A short time later, in an unannounced decision made after a review conducted by the JCS, the president approved selected overflights of the Soviet Union to determine the status of its air forces in those regions of Siberia closest to this country, as well as in the maritime provinces closest to Korea.

The Soviet region of greatest military concern was the Chukotskiy Peninsula, directly across the Bering Strait from Alaska. Russian Tu-4 bombers, essentially carbon copies of the B-29, equipped with nuclear weapons and massed on airfields on the peninsula, could make devastating one-way flights to attack American cities. In December 1950, Truman authorized two deep penetration overflights of this region; to accomplish them, the JCS and USAF headquarters selected for modification the fourth B-47B off the Boeing assembly line. This newest of SAC bombers, an air refuelable, swept-wing aircraft powered by six jet turbine engines, would be equipped with special compasses, autopilot equipment, a high-latitude directional gyro system for flight in the Arctic, and a special pod for installation in the bomb bay that contained a number of cameras. The B-47B "stratojet," which carried a crew of three (pilot, copilot, and bombardier-navigator), could reach a full speed of 448 knots (516 mph) and a ceiling of about 41,000 feet.

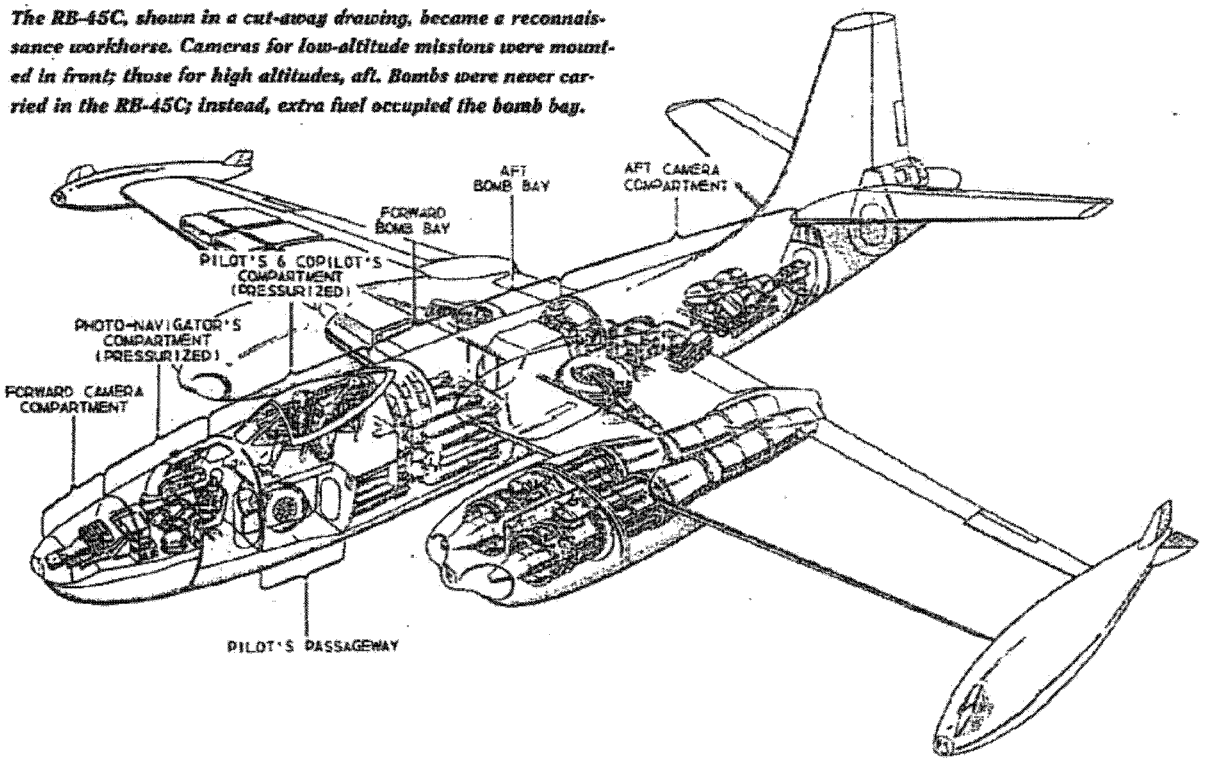
The command pilot that SAC selected for this mission was Col. Richard C. Neeley, a B-47 test pilot. Late in July 1951, Neeley and his crew flew the aircraft to Eielson AFB near Fairbanks, Alaska. On August 15, while awaiting clear weather in Siberia and authorization to proceed, Neeley was awakened from a nap in the barracks by a telephone call: His aircraft was burning on the ramp. He stepped outside to see a pillar of smoke and flame in the direction of the runway. Boeing technical representatives had been practicing a single-point fueling of the tanks over the bomb bay when a float valve stuck. Fuel rushed through an overflow vent onto a wing and swirled down onto a power cart below; an electric spark ignited the spill. While the wreckage still smoldered, orders to conduct the overflight mission arrived. Neeley notified SAC headquarters of the disaster; forty years later he still remembered the four-word return telex message: "Fix responsibility and court-martial!" (Since a mechanical malfunction was involved, there would be no court-martial.) It would be a year before a U.S. aircrew would make an attempt to overfly the eastern U.S.S.R.

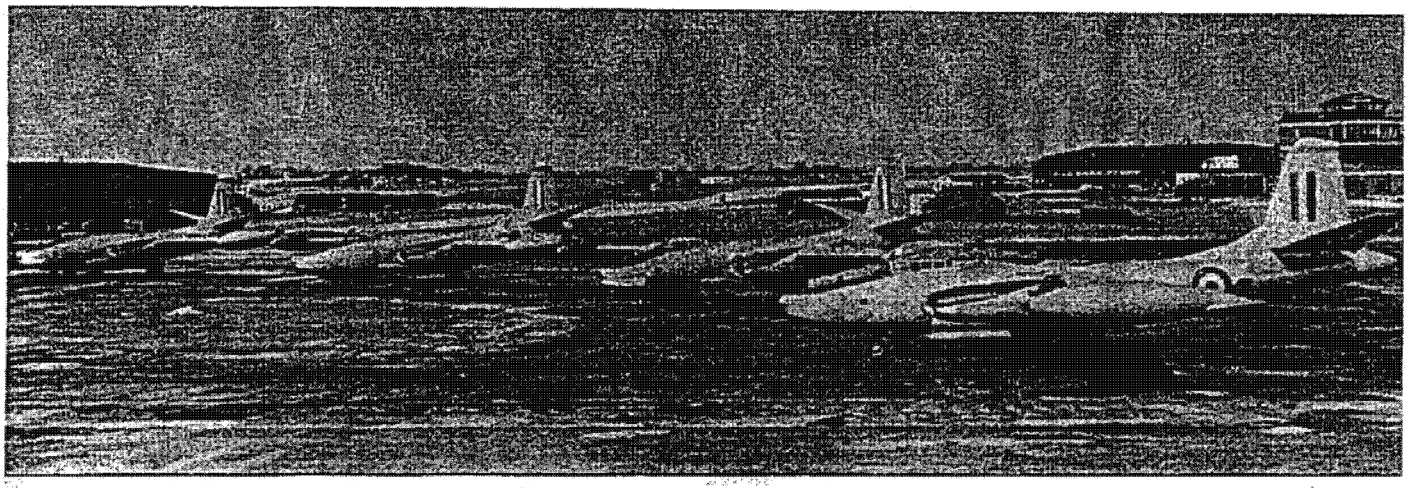
Meanwhile, Truman had initiated talks with British Labour prime minister Clement R. Atlee and his foreign minister, Ernest Bevin. Concerned that the United States might use atomic weapons in the Korean conflict, Atlee had visited Truman in Washington at the end of 1950. At that time or shortly thereafter, the two leaders had apparently agreed on

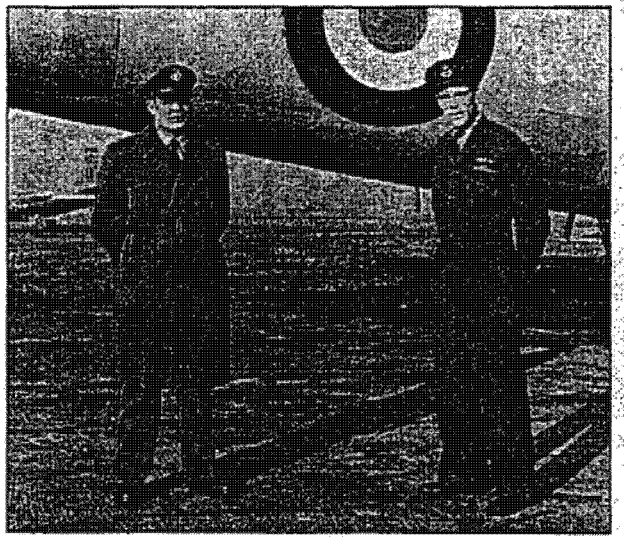
ALL BEREK PHOTOS (OPPOSITE PAGE) COURTESY COLONEL RAYMOND MUSTON, USAF (RET.)

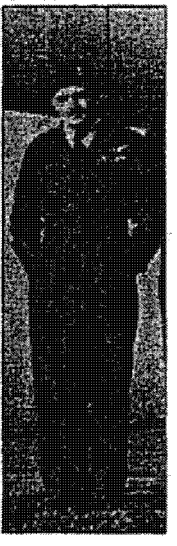
USAF PHOTO, WASHINGTON, D.C.

The RB-45C, shown in a cut-away drawing, became a reconnaissance workhorse. Cameras for low-altitude missions were mounted in front; those for high altitudes, aft. Bombs were never carried in the RB-45C; instead, extra fuel occupied the bomb bay.









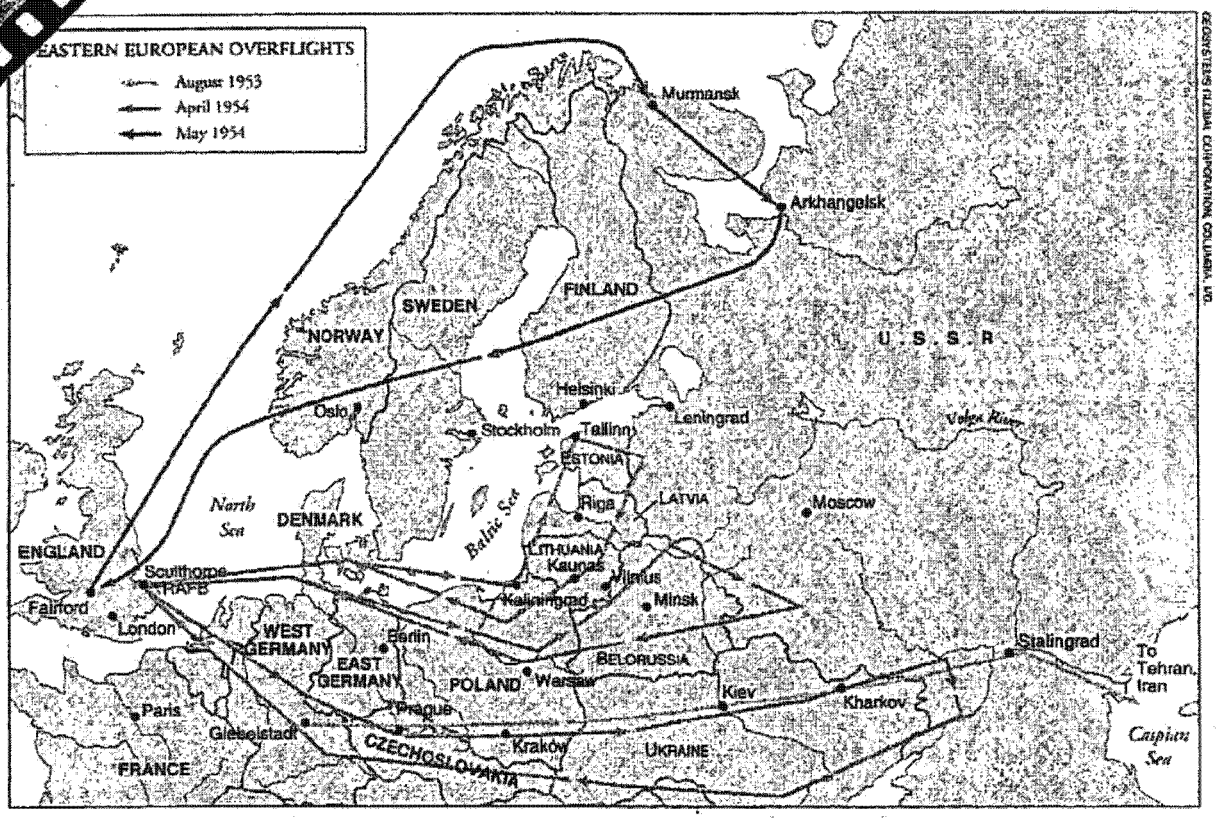
RB-45Cs, the planes that overflew Russia, line up at the Sculthorpe RAF base in 1952. Left: Lt. Col. "Hack" Mixson, the American overflight coordinator, poses with Squadron Leader John Crampton. Crampton's companion in the 1952 "Special Duty Flight" over the Ukraine was his navigator, Flight Lieutenant Rex Sanders, right.

a joint aerial reconnaissance program to overfly the European U.S.S.R.; it is not clear whether or not Truman made concessions on the use of atomic weapons, but it seems likely. Whether Atlee actually intended to approve any overflights is not known; in the event, he would not be around to make the decision. In October 1951, the British re-elected as prime minister their wartime leader, the Conservative Winston Churchill.

In the spring of 1951, the RAF formed a secret "Special Duty Flight" of three aircrews to fly North American Aviation RB-45C reconnaissance aircraft. Led by RAF squadron leader John Crampton and his navigator, Flight Lieutenant Rex Sanders, the British airmen flew from England to Barksdale AFB in Louisiana to begin formal flying training in the RB-45C, under the presumed disguise of British-American air refueling trials. Late in the fall of 1951, the RAF aircrews returned with four American aircraft (one acting as a spare) to Sculthorpe Royal Air Force Base in Norfolk, where a detachment of SAC RB-45Cs was already stationed. Lt. Col. Marion C. ("Hack") Mixson arrived in March 1952 to command the SAC detachment, to which Crampton's Special Duty Flight was attached. In the weeks that followed, Mixson, Crampton, and Sanders dealt with the British Air Ministry at the highest levels. In approving the mission, Churchill took a breathtaking political risk. In the 1950s the House of Commons was divided in its attitude toward the Soviet Union; many in the Labour Party were sympathetic in varying degrees to Britain's former ally. If any of the RB-45Cs had been brought down, the resulting outcry probably would have led to Churchill's unseating as prime minister. But balanced against this was the need of Western intelligence to acquire radar-scope photographs of specific military installations.

After a trial nighttime flight to the east of Berlin on March 21 to measure the state of Soviet air defense, the first overflight mission was approved and briefed. On the night of April 17–18, 1952, in absolute radio silence, three RB-45Cs repainted in RAF colors took off from Sculthorpe, were air-refueled, and entered the Soviet Union simultaneously at different locations. Flying at about 35,000 feet, the planes proceeded on separate tracks. As each RB-45C crossed the border—into the Baltic states in the north, Belorussia in the center, and the Ukraine in the south (the mission Crampton and Sanders flew)—the Soviet air defense system sprang into action, and Allied intelligence listened in. For all of the fighters that scrambled into the night sky, however, none found the British in the dark, and they returned safely to base. The information they brought back was crucial. In the event of war—which in the 1950s seemed likely—SAC had to destroy the U.S.S.R.'s Long Range Air Force at the outset to prevent it from striking targets in Western Europe and the United States. All three overflights photographed LRAF bases, as well as nearby air defense bases.

The Special Duty Flight disbanded shortly thereafter. But in October it was reformed at Sculthorpe. Training for a



This map plots the five overflights of European Russia in 1953 and 1954. In August 1953 (light green arrow), an RAF Canberra made the deepest penetration of all, when it attempted to photograph a new missile test site near Stalingrad. Soviet fighters damaged the aircraft—which managed to escape to Iran. RAF RB-45Cs made three simultaneous overflights the next April (duplicating routes taken in 1952); they checked on long-range air bases. A month later, USAF captain Harold Austin, in an RB-47E, made an epic overflight of the Soviet northern region (dark green line) and barely missed being shot down.

second mission began. But in early December the impending mission was cancelled. For Churchill, the risking of his political future in one covert overflight had perhaps proved enough. On December 18, John Crampton and Hack Mixon led the Special Duty Flight of four RB-45Cs back across the Atlantic Ocean, landing at Lockbourne AFB in Ohio as snow was falling. Through the gloom, base maintenance personnel who approached the aircraft stared in disbelief at the U.S. Air Force bombers still decked out in British livery.

Back in the United States, the Air Force, in collaboration with the U.S. Navy, already had begun to probe eastern Siberia's coastal radar sites and airfields through shallow penetration overflights. Directed by the JCS in 1952, these secret missions depended on the Navy Lockheed P2V-3W, a two-engine unpressurized aircraft that possessed a top speed of 300 knots (345 mph) and a service ceiling of 32,000 feet. The novel P2V-3W, equipped with a ventrally-mounted APS-20 radar beneath the aircraft, was employed primarily as a submarine hunter-killer. This aircraft was modified with an experimental electronics suite that filled the nose: It could identify, locate, and home on radars and communications equipment over a wide range of frequencies.

Piloted by Comdr. James H. Todd with Lt. (jg) Richard A. Koch copilot, the P2V-3W flew out of the Kodiak Island, Alaska, naval base and, in March 1952, conducted test missions against radars of the Alaskan Air Command. It then began overflights of the Siberian coast, leading an Air Force RB-50 (an improved version of the B-29) that photographed the Soviet radar sites and airfields.

Between April 2 and June 16, 1952, the two planes flew eight or nine missions. They maintained the strictest secrecy, without radio communications of any kind, even on takeoff and landing. They managed to locate and photograph Soviet installations from the Kamchatka Peninsula in the south all the way north through the Bering Straits to Wrangel Island. They were, according to Koch, daytime missions, which were normally launched from Kodiak or Shemya in the Aleutian Islands. The P2V-3W flew at 15,000 feet, with its crew on oxygen, and the RB-50 followed above and behind it. Flying inland about fifteen to twenty miles from the Soviet coastline, the Navy aircraft used special direction-finding equipment to locate installations for the camera-laden RB-50.

In Alaska, only the aircrews, the admiral commanding Fleet Air Alaska, the general commanding the Alaskan Air Command, and their deputies for intelligence, knew of these missions. Recovery

bases varied according to the mission. In one instance late in the evening, the Navy P2V-3W, intercepted by F-94s, landed in radio silence before nonplussed personnel in the control tower at Ladd AFB, Alaska (the RB-50 had presumably gone on to its home base). Immediately surrounded by gun-wagging security police, the Navy aircrew members were forced to throw their identity tags onto the tarmac. The exhausted aviators remained under guard and confined onboard their aircraft for several hours until a "higher authority" could be found to vouch for them.

On two of these overflight missions, Soviet MiG-15s intercepted the American aircraft: once over the Bering Strait near the St. Lawrence Islands, and once over Soviet territory, when the fighters scrambled from a snow-covered runway. In each instance, Koch recalled, the MiG-15s flew alongside, inspected and photographed the U.S. planes, but did not attack. (At this time, there was apparently a tacit gentleman's agreement between the air forces of the two nations not to initiate hostile action.) Shortly after these shallow overflight missions terminated in mid-June 1952, the Navy recalled the crew and their P2V-3W to the continental United States. The crew members neither asked nor were they told where the "take" from their missions went—or of any results produced.

Whatever the intelligence product of the Air Force/Navy peripheral overflights of Siberian shores in the spring, by the summer of 1952 American military and political leaders had new cause for concern. By listening in on Russian shortwave broadcasts, signals intelligence had learned that the Soviet air force had begun staging Tu-4 bombers in large numbers at airfields at Dikson on the Kara Sea, at Mys Schmidta on the Chukchi Sea, and at Provideniya on the Chukotskiy Peninsula at the Bering Strait. Moreover, U.S. intelligence suspected that World War II airfields deep inside Siberia, used for staging American lend-lease aircraft bound for Soviet forces on the Eastern Front, might also have been upgraded to accommodate these four-engine bombers. If loaded with the nuclear weapons then believed available to them, any unusual concentration of these bombers represented a real threat.

Officials in the Department of Defense and the CIA again sought permission to photograph air bases in Siberia through deep-penetration aerial overflights. On July 5, 1952, headquarters advised SAC to modify two B-47B bombers for just such a special photo-reconnaissance mission over "unfriendly areas," in the event it was requested. On August 12, Secretary of Defense Robert A. Lovett delivered to President Truman memoranda from Gen. Omar N. Bradley, chairman of the Joint Chiefs of Staff, and Gen. Walter Bedell Smith, director of the CIA, requesting two reconnaissance overflights of Siberia. After discussion, the president approved "northern run" between Ambarchik and the Chukotskiy Peninsula, but disapproved as too dangerous a "southern run" over Provideniya southwestward past Anadyr to Magadan, returning eastward over the Kamchatka Peninsula. His approval of a single overflight, Truman told Lovett, was contingent on the concurrence of "appropriate officials of the State Department." Secretary of State Dean Acheson must have concurred, because on August 15, USAF headquarters issued instructions for the mission.

For this flight, SAC modified two B-47Bs from the 306th Bombardment Wing at MacDill AFB, Florida. Col. Donald E. Hillman, the deputy wing commander, was selected to plan the mission and pilot the primary aircraft. The mission was assigned the highest of security classifications; only the commander of SAC, Gen. Curtis E. LeMay, and his directors of operations and intelligence knew the details. In the field, initially only Maj. Gen. Frank Armstrong, commander of the 6th Air Division at MacDill (and responsible for executing the project) and Hillman knew of it. It should be emphasized that in this instance, as in all others involving overflights, LeMay took his orders from above.

On September 28, 1952, the two modified B-47Bs, accompanied by two KC-97 tankers, flew from MacDill to Eielson AFB. Hillman remained as command pilot of the primary aircraft, with Majors Lester E. Gunter, copilot, and Edward A. Timmins, navigator. Col. Patrick D. Fleming piloted the backup aircraft, with Majors Lloyd F. Fields, copilot, and William J. Reilly, navigator. With word of good weather over Siberia, General Armstrong authorized takeoff early on October 15, 1952. After meeting the KC-97 tankers in the area of Point Barrow, Alaska, the B-47s took on full loads of fuel and the mission proceeded.

Fleming and his crew photographed and mapped Wrangel Island, located about a hundred miles from the Siberian mainland, and then flew to the communications area over the Chukchi Sea and took up station, flying a racetrack pattern. Maintaining radio silence, Hillman continued on course past Wrangel Island, then turned southwest toward the Soviet coast. Making landfall close to noontime, Timmins switched on the cameras as the aircraft swung south for a short period, and then turned eastward and flew back toward Alaska, through the heart of Siberia. The weather, which had been bright and clear throughout the flight, changed after the B-47 crossed the coast. Scattered clouds appeared, and occasional haze at the ground obscured viewing of the surface for the remainder of the flight.

By now, after burning off fuel, Hillman's aircraft had become light enough to be able to fly above 40,000 feet and well over normal cruising speed, at approximately 480 knots (552 mph). After two of five target areas had been covered and photographs of the forbidden landscape below had been taken, warning receivers on board told the crew that the aircraft was being tracked by Soviet radar. Gunter swiveled his seat 180 degrees to the rear to control the plane's only defensive armament, the tailguns. A few minutes later he advised Hillman that he had Soviet fighters in sight, below and to the rear, climbing desperately to intercept them. But the fighters had scrambled too late to catch up to the B-47, and it flew eastward unopposed.

The aircraft completed photographing the remaining three areas in eastern Siberia without encountering any more

Soviet fighter aircraft caught up with the RAF Canberra near Stalingrad and managed to hit the British machine before they lost sight of it again. Though badly damaged, the Canberra escaped to Iran . . .

fighters. It passed over Egvekinot, then over Provideniya, and turned northeast, exiting Soviet territory at the coast of the Chukotskiy Peninsula. Hillman flew his B-47 straight back to Fairbanks, landing at Eielson well after dark. A few minutes later, Fleming's backup B-47 touched down. Altogether, the mission spanned seven and three-quarter hours in the air; the primary B-47 had made a 3,500-mile flight and overflown some 1,000 miles of Soviet territory.

Technicians immediately developed the film. The photographs would belie the presence of massed Tu-4 bombers in Siberia. Messages intercepted soon after revealed that the Soviet regional commander had been sacked and that a second MiG regiment was to be moved into the area. As for the Americans, members of both aircrews received the Distinguished Flying Cross.

By that same fall, Communist and U.N. forces had reached a virtual military stalemate at the 38th parallel in Korea. Indeed, the Korean conflict had provided President Harry Truman the legal rationale for overflights of the Soviet Union. The U.S.S.R., an unannounced co-belligerent, supported Chinese and North Korean forces with military aircraft operating from sanctuaries in the Soviet Far East. Under international law, when engaged in a United Nations peace enforcement operation, the U.S. could claim the right to overfly such sanctuaries under Chapter VII of the U.N. Charter. But as early as 1950, even before the outbreak of hostilities, a pair of special drop-tank and camera-equipped RF-80As began reconnaissance missions, in an effort to determine the composition of Soviet air forces in the Far East. Between March and August they periodically flew around—and later, directly over—Sakhalin and the Kurile Islands and the Soviet mainland near Vladivostok.

These Far East Air Forces tactical reconnaissance aircraft operated from Yokota Air Base near Tokyo. After the outbreak of the Korean conflict, a detachment of three SAC RB-45Cs performed occasional deep penetration overflights of North Korea, the Soviet maritime provinces, and of the People's Republic of China. One of these aircraft was apparently lost to MiG fighters over North Korea, near the Yalu River, in December, leaving only two aircraft to continue the missions. Although details are wanting, these RF-80As and RB-45Cs unquestionably penetrated Soviet territory before Col. Hillman's B-47B overflight almost two years later.

In October 1952, two RB-45C crews replaced their compatriots in the detachment at the Yokota air base. Led by Capt. Howard S. (Sam) Myers, Jr., they continued deep penetration overflights in the Far East. Besides missions over North Korea, other overflight missions, through few in number, focused on mainland China, Sakhalin Island, the Kamchatka Peninsula, and the Vladivostok area. For example, on the night of December 17–18, 1952, Myers and his two-man crew flew RB-45C number 8027, which was painted entirely black specifically to avoid detection by searchlights, from Yokota across the sea of Japan. They coasted inland a few miles south of Vladivostok; the Soviet city was well lit and clearly visible off the right wing tip at 35,000 feet. They continued on 300 miles to targets of interest in the neighborhood of Harbin, Manchuria. After collecting radar-scope photographs of airfields and other military and industrial installations in the area, they returned via South Korea. The two RB-45Cs continued to fly reconnaissance missions until April 1953.

The extreme secrecy that surrounded these flights increased, if that were possible, during 1953. It was a time of leadership change in both the Soviet Union and the United States. Stalin died, and Dwight D. Eisenhower succeeded Harry Truman as president. The former supreme commander of Allied Expeditionary Forces in Europe during World War II fully appreciated the value of strategic overflight reconnaissance that might alert American leaders to a potential nuclear surprise attack. (Both countries had now exploded hydrogen devices.) But if the Korean Armistice that he engineered in July ended hostilities, it also eliminated any legal justification for overflights of the Soviet Union and Communist China. Eisenhower weighed the importance of strategic reconnaissance to national security and the precedent set by President Truman against the political risks of continuing overflights in peacetime in violation of international treaties to which the United States was a signatory. His choice seemed clear. He determined to continue the overflights as part of the SENSINT (Sensitive Intelligence) Program.

In the Far East after July 1953, overflights of the Soviet maritime provinces launched from Japan employed new reconnaissance fighter aircraft—RF-86Fs and RF-100s—and B-57A Canberra bombers converted to photo reconnaissance aircraft. (Overflights of the People's Republic of China largely devolved on the air force of the Republic of China based on Taiwan.) Most, but not all, of the Far East Air Force (FEAF) reconnaissance fighter missions between 1953 and the end of 1956 were shallow penetration overflights. One deep penetration daytime overflight, however, is

known to have surveilled the city of Harbin in Manchuria, in the People's Republic of China.

Maj. Robert E. ("Red") Morrison piloted another unusually deep penetration overflight in a reconnaissance fighter in 1955. Morrison had assumed command of the 15th Tactical Reconnaissance Squadron, composed of RF-86Fs stationed at the Komaki air base, just west of Nagoya. These RF-86s had had their guns removed and their weight and balance adjusted. Each one was equipped with four drop tanks (two 200-gallon and two 120-gallon) that extended their range significantly, and each mounted two aerial cameras featuring a distortionless telephoto lens that adjusted automatically to the pressure and temperature variations inherent in high-altitude photography. Mounted on either side of the pilot's seat, the two cameras photographed the earth in a near-panoramic overlapping swath. Blisters outboard on the fuselage accommodated the film magazines. A wide-area mapping camera looked at the earth vertically from a position beneath and just forward of the pilot's seat.

Morrison's detachment of eight pilots received overflight orders exclusively from officers at FEAF headquarters. There, only four commanding officers and an intelligence officer knew of these missions. Morrison and his squadron conducted nine overflights between April 1954 and February 1955. Normally four aircraft would take part in daytime missions: they flew at altitudes of 45,000 to 48,000 feet, and always when atmospheric conditions precluded telltale contrails. (Though radar tracked the American fighters, Soviet interceptors could not "see" them to attack. By this time, the old gentleman's agreement had long since faded.) Airfields represented the principal reconnaissance targets, and Morrison and his compatriots overflew Vladivostok, Sakhalin Island, and Sovetskaya Gavan, Dairen, and Shanghai.

The last, and longest, of these missions, a two-ship flight with Morrison in command, occurred on February 19, 1955. Instead of a shallow horseshoe route over a coastal target, however, it was directed well into the Soviet mainland to photograph the airfield in Khabarovsk, a city located alongside the Amur River on the border of the U.S.S.R. and Manchuria. As the two aircraft climbed to altitude over the Sea of Japan, Morrison's wingman signaled mechanical problems and turned back. The flight leader pressed on, releasing the last two of his wing tanks as he approached altitude at the Soviet coast. But one of the two tanks did not separate, and the additional weight and drag prevented the aircraft from reaching its peak altitude. To complicate matters further, the preflight weather briefing had estimated winds aloft that did not match those encountered, and, at the appointed navigational moment, Morrison looked out to find no target in sight.

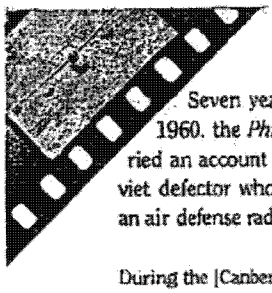
Fortunately, the Amur River could be seen, and as he flew along it Morrison homed on a broadcast from the Khabarovsk radio station. With the city in view, he performed a maneuver well known to World War II tactical reconnaissance pilots: Morrison first rolled ninety degrees to port, then reversed the process and rolled in similar fashion to starboard, thereby obtaining a clear view of the earth beneath and ahead of his aircraft, permitting adjustment in the line of flight that would bring the RF-86 directly over the airfield. As he completed these maneuvers and turned on the cameras, the airplane shuddered. The last drop tank, its markings of origin carefully filed off, separated from the wing and whistled downward over Khabarovsk. Though short on fuel, Morrison returned safely to the Chitose air base on Hokkaido, plunged through a break in the overcast, and landed. The airplane was so light, he recalled, he had difficulty forcing it down onto the runway. As his RF-86 turned off Chitose's concrete ribbon and onto the asphalt apron, its fuel expired and the engine flamed out.

Back on the other side of the world in the spring of 1953, Prime Minister Winston Churchill had reconsidered strategic overflight reconnaissance after word reached Western intelligence of a formidable Soviet missile program under way at a base called Kapustin Yar, near Stalingrad. Once again, Churchill approved an overflight. This time the RAF and the USAF collaborated to squeeze a large, oblique-looking camera into the aft fuselage of a standard RAF B-2 twin-engine Canberra bomber. This bomber could not be air-refueled; but, stripped of all excess weight and with its bomb bay filled with fuel tanks, the aircraft possessed a range sufficient for it to fly at high altitude from Germany across the southern U.S.S.R., and then swing south to Iran.

The British assigned the name "Project ROBIN" to this effort, which consisted of two or three shallow penetration missions over the Eastern Bloc satellite states preparatory to the main event. Approved by the prime minister, the primary mission was flown in late August 1953 from Giebelstadt in West Germany, close by the East German border. The Canberra was tracked by Soviet radar almost from the moment of takeoff. Happily for an RAF aircrew flying in broad daylight, accurate radar tracking did not prevent various elements of the Soviet air defense system from performing a Keystone Kops routine for Stalin's heirs in the Kremlin. In the face of an air defense system on full alert, the "unidentified" aircraft, operating at 46,000 to 48,000 feet altitude, remained untouched. With its 100-inch focal-length camera peering obliquely out the port side, it flew doggedly east past Kiev, Kharkov, and Stalingrad to its target, Kapustin Yar.

In spite of frantic commands and radar vectoring, Soviet fighter aircraft could not see the airplane above them and did not successfully intercept the plane until it approached Kapustin Yar. Though they managed to hit the British machine, it flew on, and the fighters lost sight of it again. Damage to the aircraft, however, introduced vibration, which adversely affected the optics performance of the camera. Pictures of Kapustin Yar subsequently furnished to the USAF and CIA were blurred and of poor quality; they apparently revealed little. The Canberra turned southeast to follow the Volga River. It escaped and managed to land safely in Iran. Its near-loss ended any further British thoughts of daytime strategic reconnaissance overflights of the western U.S.S.R.

But the flight had unexpected results.



Seven years later, on August 5, 1960, the *Philadelphia Inquirer* carried an account of the mission by a Soviet defector who had served in 1953 as an air defense radar officer:

> During the [Canberra] flight all sorts of unbelievable things happened. . . . In one region, the operator accidentally sent the Soviet flights west instead of east; in Kharkov, the pilots confused the planes [aloft] and found themselves firing at each other.

The result was a major purge. Many generals and officers were removed from their posts. One general was demoted to the rank of lieutenant colonel and committed suicide. Other personnel were sent to punishment battalions.

However discouraging the outcome of the Canberra's daytime flight to Kapustin Yar, the British and Americans soon agreed on another group of nighttime strategic reconnaissance overflights of the western U.S.S.R. (By this time the USAF had transferred its RB-45Cs from SAC to the Tactical Air Command [TAC], and General LeMay no longer played a direct role in the missions.) At Sculthorpe RAFB, the RAF's Special Duty Flight reformed with most of the same crews from the 1952 overflight missions; they were once again led by Squadron Leader John Crampton and Squadron Leader Rex Sanders. RAF Bomber Command's chief scientist, "Lew" Llewelyn, worked to improve the pictures produced by the cameras that filmed images on the radar scopes. In late April, the RAF aircrews learned that the mission plan was virtually identical to the one flown in 1952, except that the third aircraft would make a deeper penetration of southern Russia.

The Special Duty Flight executed the mission on the night of April 28–29, 1954. The primary targets again involved bases of the Soviet Long Range Air Force. The RB-45Cs again were repainted in RAF colors, and Crampton and Sanders again took the southern run, but it did not go so easily for them this time. As their airplane approached Kiev—and while Sanders tended the radar—Crampton was startled to see a highway of bursting flak about 200 yards before him at exactly his own altitude, 36,000 feet. Briefed to return if the security of the flight were compromised, he hauled the airplane around on its starboard wing tip, until its gyro compass pointed west, and descended to 34,000 feet to avoid the flak, which was set to explode at a fixed altitude. He cut short the mission. Nonetheless, the return track took the aircraft close to many of the remaining targets, which Sanders photographed as they passed. When the RB-45C met up with its tanker over West Germany, the refueling boom refused to stay in the aircraft receptacle. Fearing that it might have been damaged by the flak over Kiev, Crampton landed near Munich to refuel. Meanwhile the other two flights flew their routes without misadventure, though numerous fighters were sent up after them. A few weeks later, in early May, the RAF Special Duty Flight disbanded for the last time.

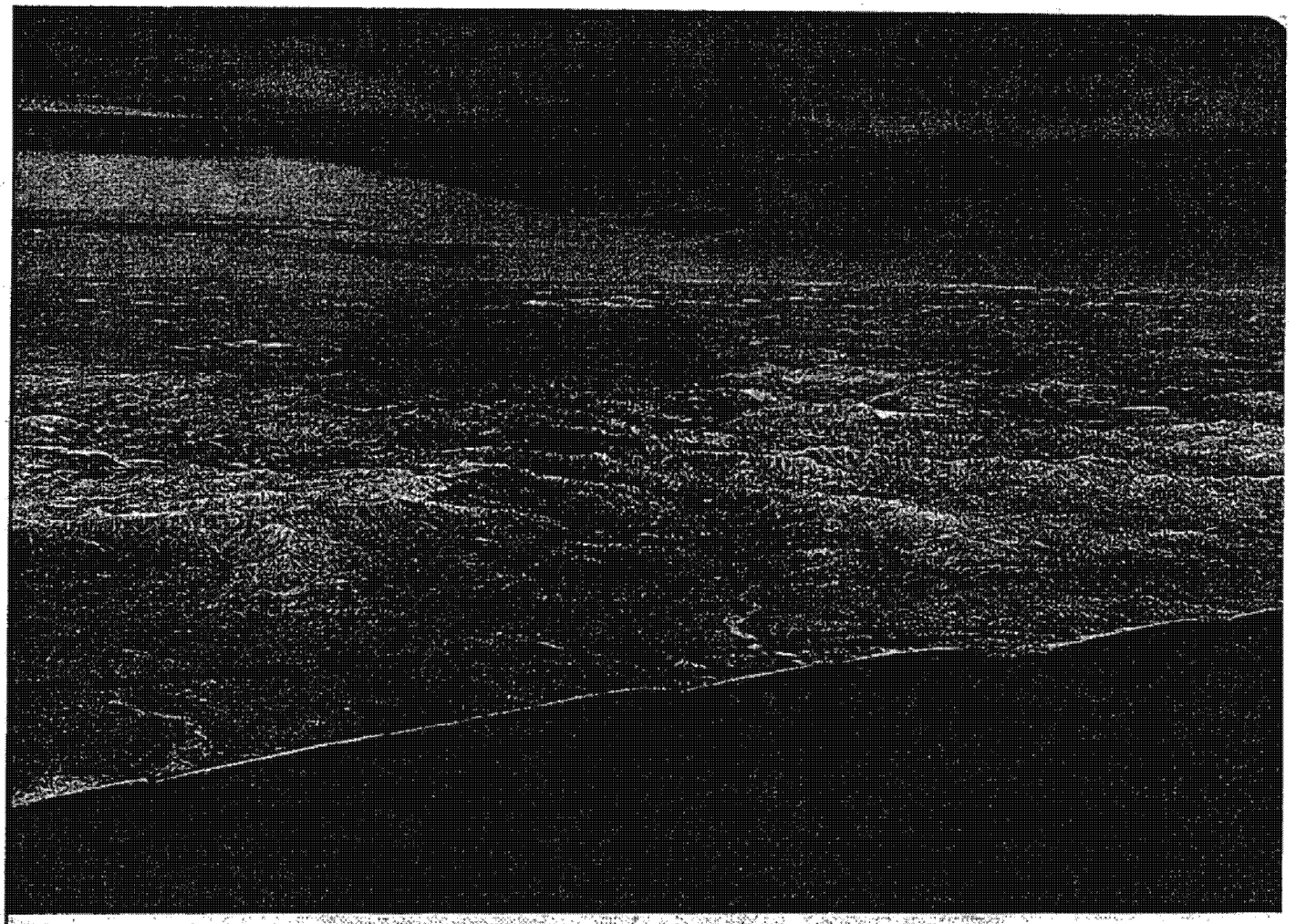
By now, Western leaders had been alerted to the existence of a new Soviet Myacheslav-4 jet-turbine-powered intercontinental bomber (NATO code-named "Bison"). With the number of Bison bombers and nuclear weapons believed to be growing, the region of greatest concern in the U.S.S.R., and about which the least was known, was the Kola Peninsula in extreme northwest Russia, above the Arctic Circle. Intercontinental bombers positioned here could fly foreshortened routes over the North Pole to attack targets in America—and could also easily strike targets in Great Britain. A daytime photographic mission was called for. Whether the British agreed or not, Eisenhower approved one of his own.

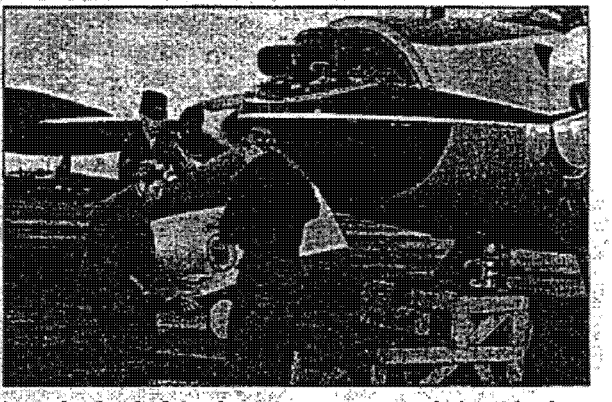
In mid-April 1954, SAC—on instructions from the JCS—dispatched a detachment of RB-47Es to the Fairford RAF base near Oxford. The RB-47E mounted in its nose and bomb bay the identical suite of cameras carried in the RB-45C. On May 8, three aircrews were briefed separately for a secret mission to be conducted in radio silence near the Kola Peninsula in the northern region of the U.S.S.R. Two crews were instructed to turn back at a certain coordinate; unbeknownst to them, the third crew was instructed to fly on into Soviet territory and photograph nine airfields over a 600-mile course from Murmansk south to Arkhangelsk, then southwest to Onega; at which point the aircraft would head due west to the safety of Scandinavia.

The aircrew named to fly this deep penetration overflight consisted of Capt. Harold Austin, pilot; Capt. Carl Holt, copilot; and Maj. Vance Heavilin, navigator. When these men took off from Fairford early on May 8, 1954, however, they were quite unaware that they followed by one week the nighttime flight of the three RB-45Cs over the western central Soviet Union. Soviet air defenses still reverberated from that futile exercise. After a refueling off southern Norway, and at the designated departure point about 100 miles north of Murmansk, two of the three aircraft turned back; Austin's pressed on. Two nonplussed aircrews watched over their shoulders as a comrade receded from view toward the Soviet mainland. It is a tribute to SAC's remarkable standards of professional training that the two aircrews did not break radio silence but, as briefed, returned to base.

Austin's aircraft coasted in over the Kola Peninsula at Murmansk, at noon, at 40,000 feet altitude, and at 440 knots (506 mph) airspeed. Heavilin turned on the radar cameras, along with the suite of cameras in the nose and bomb bay. The weather, Austin recalled, was crystal clear; it was one of those days when "you could see forever." Before they left the Murmansk area, a flight of three MiG fighters joined them, apparently confirming the identity of the intruder. As they approached airfield targets at Arkhangelsk, six more MiGs arrived, now intent on destroying the American aircraft. Cannon tracers flew above and below the RB-47E; the interceptors could not stay steady at that altitude, and their aim was poor. A running gun battle ensued as Austin finished covering his targets and turned toward Finland. As he banked the plane, a MiG stuck from above, and the aircraft took a cannon shell through the top of the port wing, knocking out the intercom. Holt had fired the tail gun, but it jammed after the first burst. Nevertheless, he kept the MiGs at a safe distance long enough to reach the Finnish border.

Austin's RB-47E, with its cameras and film, succeeded in reaching Fairford after

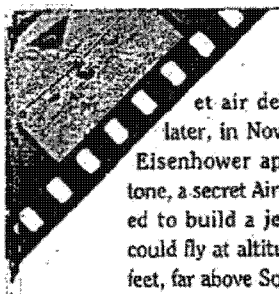




An RB-45C took this photo of the North Korean coast, top, and caught the shadow of another jet's contrails (visible along the coastline). It used a nose camera—one of which is being serviced, above right, at the Yakota air base in Japan. Capt. Howard S. Myers, Jr., and his co-pilot, Capt. Walter Yancey, left, made flights over the Soviet maritime provinces and Manchuria. Myers had one RB-45C painted black for night missions so that searchlights couldn't spot it.

another refueling over the North Sea. The photographs reassured Western leaders that long-range bombers were not deployed on the Kola Peninsula. For their extraordinary aerial feat, the aircrew members each received *two* Distinguished Flying Crosses, though the SAC commander, General LeMay, made it plain he would rather have decorated them only with a Silver Star. That award, however, required the approval of a board in Washington whose members were not cleared to know about SENSINT overflights.

If such reconnaissance overflights were to continue at a reasonable risk, another kind of airplane was required, one that operated above all known Sovi-



et air defenses. A few months later, in November 1954, President Eisenhower approved Project Aquatone, a secret Air Force-CIA effort directed to build a jet-powered glider that could fly at altitudes in excess of 70,000 feet, far above Soviet air defenses. So the U-2 was born.

There was at least one further overflight of the Soviet Union launched from Great Britain. In March 1955, a nighttime USAF mission led by Maj. John Anderson followed routes and overflew targets that were nearly identical to those of earlier RAF flights: Three RB-45Cs took off from the Sculthorpe RAF base, flew eastward at 35,000 feet, and simultaneously crossed the frontiers of Czechoslovakia, Poland, and the Baltic States—though this time the Ukraine track was farther to the south. The mission objective, as before, involved radar-scope photography of Soviet military installations and cities for Allied target folders. Soviet fighters again scrambled into the night sky but, even with ground radar vectoring, could not locate the reconnaissance aircraft in the darkness. All of the RB-45Cs returned safely, landing in West Germany. The crew members also received Distinguished Flying Crosses.

That reconnaissance overflight mission preceded by a few months the Four-Power Summit Conference held in Geneva, Switzerland, in July 1955. There President Eisenhower, in an unannounced disarmament proposal, would call for mutual Soviet and Western overflights, eventually called "Open Skies." At the time, the U-2 aircraft was about to begin flight trials in Nevada. Although Soviet officials rejected the Open Skies proposal, the president had determined to employ the U-2 in daytime missions over the western Soviet Union to assay the number of bombers in the Soviet Long Range Air Force—a number, USAF leaders insisted, that surpassed the number of such bombers in the Air Force inventory.

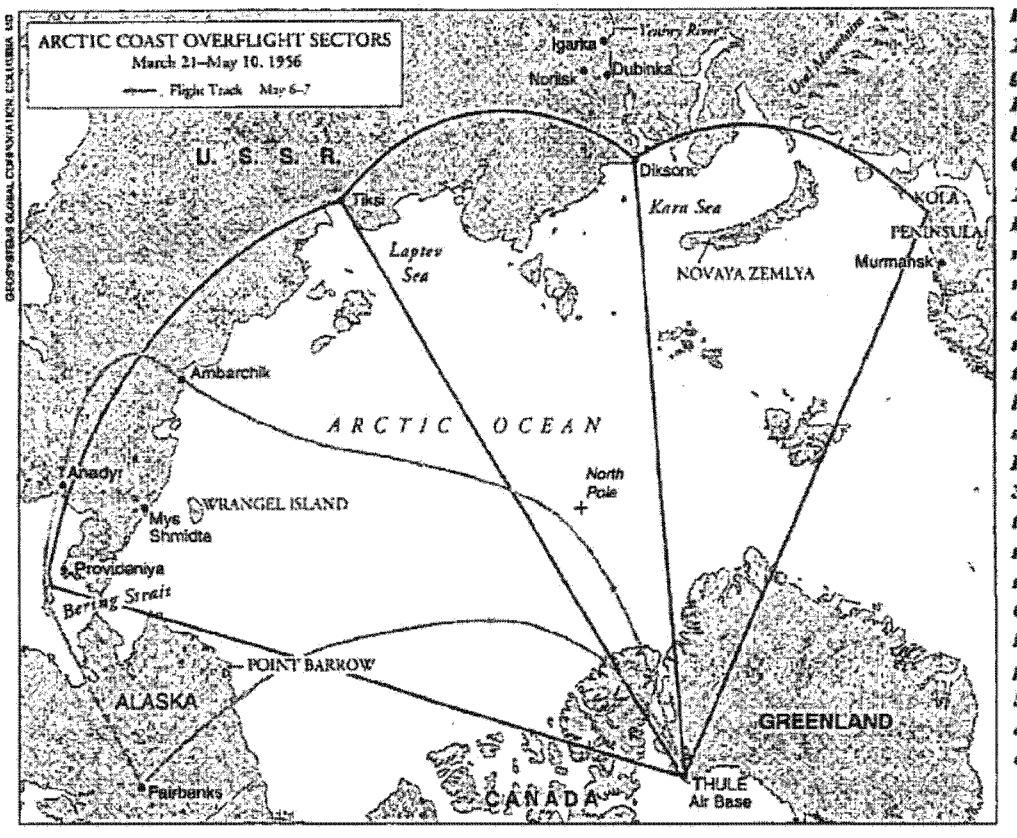
But the fragile U-2 was not air-refuelable. Even though its unrefueled radius of action was anticipated to be substantial, around 3,400 miles, when launched from England or West Germany it would be unable to fly much beyond the Ural Mountains and return in safety. And it was not designed to operate in the snow and ice of Arctic bases. For American intelligence, the U.S.S.R.'s vast Arctic territory, stretching 3,500 miles from the Kola Peninsula in the West to Wrangel Island in the East, remained largely terra incognita—and the U-2 appeared unable to explore it.

Between March 30 and May 7, 1955, shortly before the summit conference convened, the Strategic Air Command conducted Project Seashore, again on instructions from the JCS. Four RB-47Es, specially modified with the side-looking 100-inch focal-length cameras like those carried by the Canberra, teamed with four RB-47Hs to fly PARPRO missions from Elelson AFB, Alaska, along Siberia's northern and eastern shores. The resulting intelligence of increased aerial forces in the region caused the nation's leaders to consider overflights of Russia's entire northern slope to locate and identify air defenses as well as the disposition of aerial forces there. In early February 1956, President Eisenhower terminated Project Genetrix, the launching of high-altitude photo-reconnaissance balloons that would drift across the U.S.S.R. In the four preceding weeks, SAC had launched 516 of them from Western Europe and Turkey. Those that succeeded in crossing the U.S.S.R. released their gondolas by parachute, the gondolas being recovered in mid-air by C-119 cargo aircraft near Japan. But so many were shot down by Soviet air defenses, or were otherwise lost, that only forty-four were retrieved. At the same time, Eisenhower approved an Air Force project to fly SAC reconnaissance aircraft over and around the Soviet far north, mapping it completely—photographically and electronically.

The Strategic Air Command's Project Homerun overflights—unknown to all but a few until now—were launched from Thule, Greenland, between March 21 and May 10, 1956. During that seven-week period, RB-47E photo reconnaissance aircraft and RB-47H electronic reconnaissance aircraft flew almost daily over the North Pole to reconnoiter the entire northern slope and interior portions of the U.S.S.R., from the Kola Peninsula to the Bering Strait. It was a 3,400-mile round trip. The special SAC detachment formed for this operation included, with spares, sixteen RB-47Es of the 10th Strategic Reconnaissance Squadron, Lockbourne AFB, Ohio, five RB-47Hs from the 343rd Strategic Reconnaissance Squadron from Forbes AFB, Kansas, and two full squadrons of some twenty-eight KC-97 tankers. All of these aircraft shared Thule's single 10,000-foot, snow-and-ice-covered runway: all of them took off, refueled over the North Pole, and landed in complete radio silence.

The air base, located 690 miles north of the Arctic Circle on North Star Bay, is thirty-nine miles north of the nearest human habitation, the Eskimo village of Thule. The aircrews typically deplaned in temperatures of thirty-five degrees below zero (in a day when "wind chill factors" were unheard of), in a region devoid of vegetation and covered in snow, at a time of the year when darkness ruled nearly twenty-four hours a day. Maintenance crews and flight crews alike were quartered in what looked like railroad refrigerator cars, even down to the levered door handles. Toilets operated via the "armstrong" flush system—hand pumped. After receiving Arctic clothing, including fur-lined parkas and mukluks, the crews spent the first week in Arctic survival training and practicing Arctic flight operations—takeoffs and landings on ice-covered runways, navigating over the pole, and air refueling in radio silence.

Planners had divided the Soviet Arctic into three basic sectors, spanning a total of 3,500 miles. The first extended eastward from the Kola Peninsula to Dikson on the Kara Sea; the second extended from Dikson to Tiksi on the Laptev Sea, and the third from Tiksi to the Bering Strait. The RB-47s normally flew in pairs, often with an E (photo reconnaissance) and H (electronic reconnaissance) model teamed, in a normal wing formation. Because one tanker was required for each bomber, the KC-97s operated in a similar fashion. Each flight of one or more reconnaissance aircraft over the North Pole to the Soviet Union, whatever



In the spring of 1956, the Strategic Air Command's Project Homerun, based in Thule, Greenland, flew 156 overflights. Planners of these never-before-revealed mapping and intelligence missions divided the Soviet Arctic into three basic sectors, from the Bering Strait 3,500 miles east to the Kola Peninsula. In one single mission on May 6–7, six RB-47Es flew abreast, photographing Siberia in a so-called "massed overflight."

the number in it, was counted as a mission. About four or five missions were flown each day, rotating aircraft and crews, with the RB-47Es and Hs always arriving over Soviet territory during daylight. The aircrews for different missions were briefed separately, and no one knew where their compatriots were going or asked what became of the film and electronic recordings turned in at the end of the day.

The Thule missions photomapped the island of Novaya Zemlya (or "Banana Island" as the aircrews referred to it) and its atomic test site. They flew in behind the Ural Mountains and down rivers, reconnoitering the timber, mining, and nickel smelting industries in the region. Siberia, they discovered, remained mostly wilderness, with few roads or towns. Most of the Thule missions, however, operated but a few miles inside Soviet territory all across the Arctic, locating, identifying, and photographing the infrequent radar stations and air bases. They confirmed that the Soviet Union's northern regions were poorly defended against enemy aircraft. Only on three or four occasions did Russian aircraft attempt to intercept missions, never successfully. At Thule, Brig. Gen. Hewitt T. Wheless, commander of the 801st Air Division, directed the operation along with Col. William J. Meng, commander of the 26th Strategic Reconnaissance Wing at Lockbourne, which supplied the RB-47Es. Maj. George A. Brown served with them as the project operations officer and mission planner.

The Thule missions drew down in early May 1956, beginning with the RB-47Hs' departure for Lockbourne AFB. Before the RB-47Es followed them, they conducted the so-called "massed overflight." In a single mission flown on May 6 and 7, six RB-47Es took off from Thule, flew over the North Pole, and entered Siberia in daylight near Ambarchik. Flying abreast, they proceeded south at 40,000 feet, with engines operating at full power. The aircraft turned eastward and, as they photomapped the entire region, exited the U.S.S.R. over Anadyr on the Bering Strait. The RB-47Es recovered at Eielson AFB, Alaska, and the next day returned over the North Pole to Thule.

In retirement years later, Gen. Curtis LeMay more than once referred—erroneously—to a massed overflight of Vladivostok. In Tom Coffey's book, *Iron Eagle*, based on interviews with the general, LeMay declared: "I flew the entire SAC reconnaissance force over the Siberian city of Vladivostok." But later writers have conveniently forgotten—or ignored—his words at the end of this accounting: "It wasn't my idea," he said. "I was ordered to do it." Whether LeMay altered and exaggerated the account for effect, or for reasons of his own, we will probably never know.

Reflecting on the Thule missions collectively, Brig. Gen. William Meng recalled, "They were conducted in complete radio silence. One word on the radio, and all missions for the day had to abort. But that never happened; not one mission ever was recalled. Altogether," he concluded, "we flew 156 mis-

sions from Thule." Throughout the entire operation, Meng might have added, with maintenance crews working in subzero temperatures on exposed aircraft, and with aircrews operating from an ice-and- fog-covered runway, not a single person or airplane was lost in an accident or to Soviet action. To this day, the SAC Thule missions remain one of the most incredible demonstrations of professional aviation skill ever seen in any military organization at any time.

In Washington, D.C., on May 28, 1956, President Eisenhower met with top administration officials to discuss, among other things, a protest of the American overflights of Soviet Arctic territories. In attendance, beside Eisenhower's military assistant, Col. Andrew Goodpaster, were Allen Dulles, director of the CIA, Adm. Arthur M. Radford, chairman of the JCS, Gen. Nathan F. Twining, Air Force chief of staff, and Undersecretary of State Herbert Hoover, Jr. The Soviet note, dated May 14, had been delivered to the American embassy in Moscow (but, for whatever reason, did not mention specifically the massed overflight of Anadyr). Twining advised that the Thule Operation had been shut down a few days before the note was received. The president said he wanted to encourage the Soviet leadership to move in peaceful directions. The American response must be carefully drawn. Hoover read a proposed draft, to which, apparently, all agreed. Next day, on May 29, the Department of State presented to the Soviet embassy a note explaining that "navigational difficulties in the Arctic region may have caused unintentional violations of Soviet air space, which, if they in fact had occurred, the Department regretted."

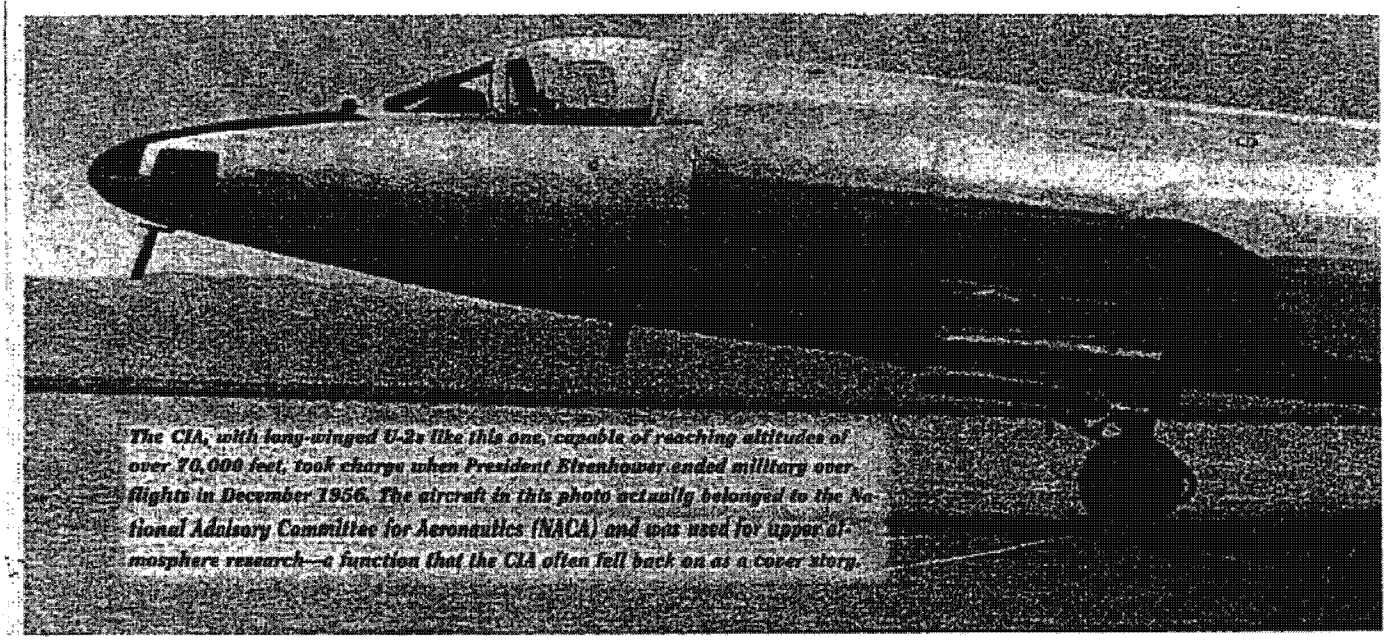
A few months later, on July 4, 1956, a U-2 took off from West Germany and flew a first mission over the western U.S.S.R. It, too, drew a sharp Soviet protest a few days later. Because the overflights threatened a rapprochement between the superpowers, the president had become increasingly uncomfortable approving American violations of Soviet airspace. But administration leaders, according to the president's science adviser, James Killian, viewed the single-engine, high-flying U-2 as far less menacing than a multi-engine reconnaissance bomber. Eisenhower determined to continue U-2 overflights, especially after a mission on July 5 provided intelligence about the number of Soviet long-range aircraft that all but ended the "bomber gap" controversy. A newly-appointed chairman of the JCS, former Air Force chief of staff Gen. Nathan Twining, nonetheless urged the president in the fall to approve another military overflight of Soviet territory with a new reconnaissance aircraft.

This aircraft was the air-refuelable Martin RB-57D-0, a single-seat photo-reconnaissance version of the RAF Canberra bomber, built under British license. The lightweight, long-winged aircraft, powered by two Pratt & Whitney J57 jet engines, possessed a combat speed of 430 knots (495 mph) and could reach an altitude of some 64,000 feet. Because it flew faster than the U-2 and almost as high, Eisenhower was persuaded that the machine would escape Soviet detection. He approved a mission to fly three RB-57Ds over separate targets in the maritime region near Vladivostok.

Three RB-57D-0s deployed to the Yokota air base in Japan in early November 1956. This detachment flew the mission on December 11, a bright, clear day. They entered the maritime region simultaneously from three different locations near Vladivostok and overflew three different targets. Contrary to Air Force hopes, the bombers were picked up on Soviet radar, and MiG-17s scrambled to intercept them; but the Americans were out of reach. In the exposed film returned to the intelligence community, the fighters were clearly visible, pirouetting in the thin air beneath the bombers. The resulting protest on December 14 left no doubt about the capabilities of Soviet air defenses to detect and identify aircraft:

On December 11, 1956, between 1307 and 1321 o'clock, Vladivostok time, three American jet planes, type B-57, coming from . . . the Sea of Japan, south of Vladivostok, violated the . . . air space of the Soviet Union. . . . Good weather prevailed in the area violated, with

AP/WIDE WORLD PHOTOS, NEW YORK CITY



The CIA, with long-winged U-2s like this one, capable of reaching altitudes of over 70,000 feet, took charge when President Eisenhower ended military overflights in December 1956. The aircraft in this photo actually belonged to the National Advisory Committee for Aeronautics (NACA) and was used for upper atmosphere research—a function that the CIA often fell back on as a cover story.

good visibility, which precluded any possibility of the loss of orientation by the fliers during their flight. . . . The Government of the Soviet Union . . . insists that the Government of the U.S.A. take measures to punish the guilty parties and to prevent any future violations of the national boundaries of the U.S.S.R. by American planes.

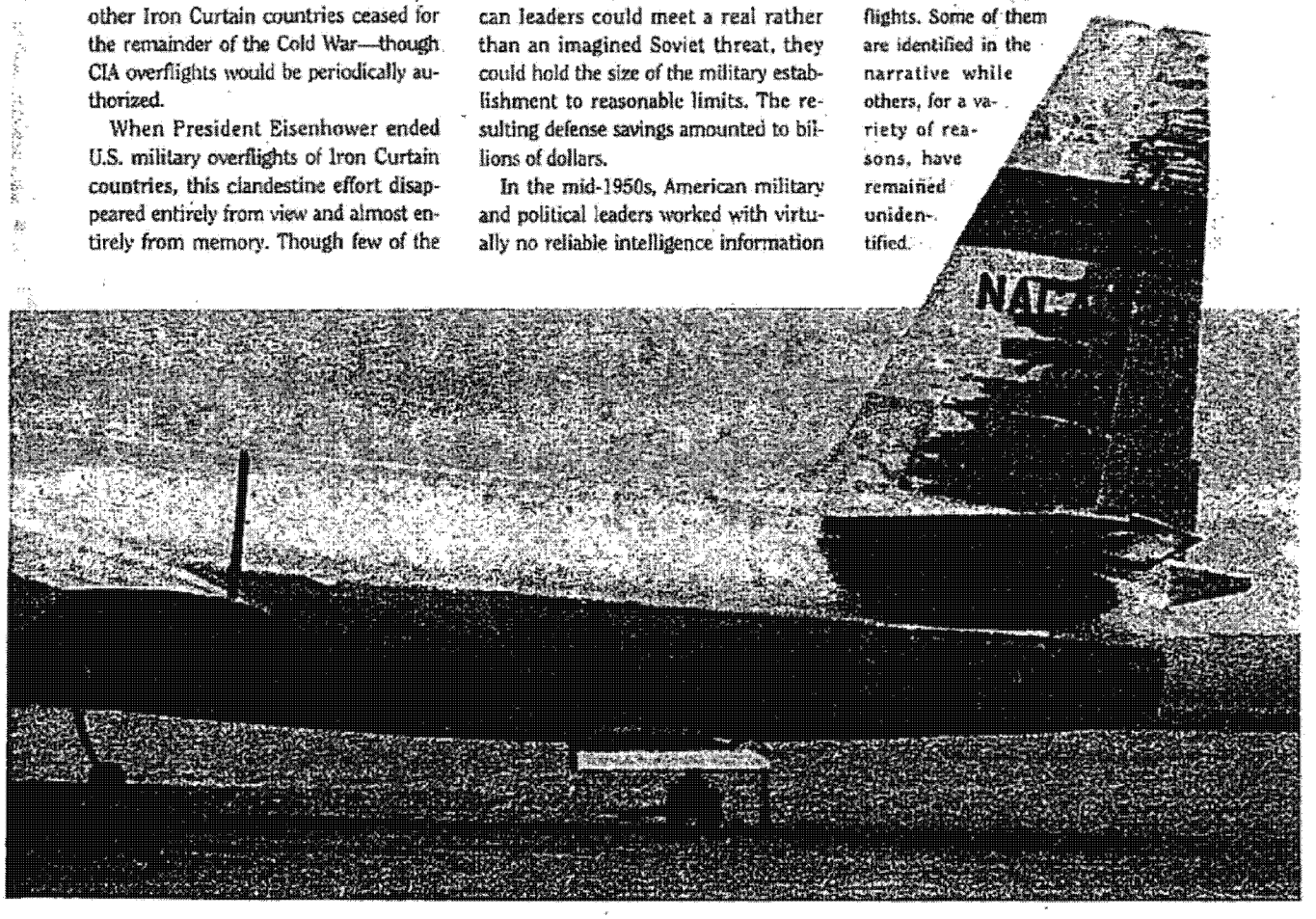
Four days after the Soviet note was delivered, an exasperated president met with Secretary of State John Foster Dulles to consider the embarrassing situation and decide on a course of action. Dulles had to say, under the circumstances, that it would be difficult for the country to deny the RB-57 overflights. But Eisenhower would not consent to such an admission. Instead, he instructed Colonel Goodpaster to relay an order to Secretary of Defense Charles Wilson, JCS chairman Gen. Nathan Twining, and CIA director Allen Dulles: "Effective immediately, there are to be no flights by U.S. [military] reconnaissance aircraft over Iron Curtain countries." With the sole exception of the Cuban Missile Crisis, U.S. military overflights of the U.S.S.R. and other Iron Curtain countries ceased for the remainder of the Cold War—though CIA overflights would be periodically authorized.

When President Eisenhower ended U.S. military overflights of Iron Curtain countries, this clandestine effort disappeared entirely from view and almost entirely from memory. Though few of the pertinent documents can now be located, and despite the passing of almost all those who shaped the policy, military overflights have an important place in the postwar evolution of strategic overhead reconnaissance.

By the time Eisenhower approved the building of the U-2 in late 1954, peacetime strategic overflight reconnaissance had become a firm national policy. The platforms from which to conduct it, meanwhile, moved to ever-higher altitudes: from military aircraft to high-altitude balloons, from the U-2 to the SR-71—a supersonic aircraft that could fly at altitudes above 80,000 feet—and, ultimately, from airspace into outer space with robotic reconnaissance satellites. After military fighters and bombers, every single one of these remarkable technical advances was evaluated, approved, and first funded for development by one American president: Dwight Eisenhower. By the time Eisenhower left office in 1961, the intelligence produced by overhead reconnaissance had eliminated the supposed "gaps" in weaponry between the superpowers. Once American leaders could meet a real rather than an imagined Soviet threat, they could hold the size of the military establishment to reasonable limits. The resulting defense savings amounted to billions of dollars.

In the mid-1950s, American military and political leaders worked with virtually no reliable intelligence information on Soviet military preparations and capabilities. Thanks to strategic overflight reconnaissance, their successors dealt with a surfeit of such information, almost all of it reliable. That transformation turned first on the sacrifices of American airmen who flew in the SENSINT program. They knew of the risks they took and, in the interests of national security, accepted them. Altogether, between 1946 and 1991, some 170 U.S. Air Force and Navy aircrew members were lost to Soviet attacks on PARPRO missions. Remarkably, however, among all of the American flights that intentionally overflew Soviet and Chinese territory on White House orders, none was lost until a Soviet antiaircraft rocket knocked Francis Gary Powers' U-2 out of the sky on May 1, 1960. But that is another story.

R. CARGILL HALL is an Air Force historian in Washington, D.C. He wishes to thank retired USAF and RAF members who generously contributed their recollections and papers to make possible this history of Cold War military overflights. Some of them are identified in the narrative while others, for a variety of reasons, have remained unidentified.



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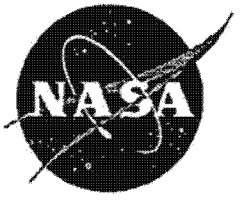

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Chapter Two

Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space

by R. Cargill Hall

During World War II, America's civilian and military leadership embraced scientific research for a multitude of advanced weapons.[1] Indeed, at war's end in 1945, General H.H. Arnold, commander of the Army Air Forces, could confidently assure Secretary of War Robert Patterson that the United States would shortly build long-range ballistic missiles to deliver atomic explosives and "space ships capable of operating outside the atmosphere."[2] Thirteen years later, both of the programs that Arnold forecast were underway. This period, the immediate prelude to the space age, spawned America's civil and military space programs—programs that were in the beginning opposite sides of the same coin. These programs were shaped and initiated at the direction of one U.S. president, Dwight D. Eisenhower. Elements of them would become instrumental in forewarning of surprise attack, monitoring compliance with international treaties, and maintaining a delicate peace between the Soviet Union and the United States. For contemporary reasons of national security, the actions that framed this enterprise and the space policy that President Eisenhower and his advisors created for it were made obscure even to many of those directly involved.

Beginnings of the American Space Program

When in late 1945 General Arnold counseled the secretary of war on prospective weapon developments, he also acted to ensure that the Army Air Forces would in the future be equipped with modern weapons superior to any held by a potential adversary. The Army Air Forces commander set up an independent consultant group, Project RAND, to perform operations research and provide advice. To guide a formative RAND and oversee aeronautical research, he created a new position at Army Air Forces headquarters, that of Deputy Chief of Air Staff for Research and Development. Arnold selected Major General Curtis E. LeMay for this position, a young man with a reputation for accomplishing formidable assignments.[3]

During 1946 and 1947, at a time of demobilization and declining budgets, LeMay directed improvements in research and development. In March 1946, among the first investigations at Project RAND, he asked for an engineering analysis of an Earth satellite

1. Daniel J. Kevles, *The Physicists* (New York: Vintage Books, 1979), Chapters 19 and 20.

2. U.S. Army Air Forces, *Third Report of the Commanding General of the Army Air Forces to the Secretary of War*, by General H.H. Arnold, November 12, 1945, p. 68.

3. Project RAND was contracted to the Douglas Aircraft Company in Santa Monica, California. The acronym is thought by some old-timers to represent Research and Development, and by others, Research for America's National Defense. See Bruce L.R. Smith, *The Rand Corporation: Case Study of a Non-profit Advisory Corporation* (Cambridge, MA: Harvard University Press, 1966), pp. 40-47.

vehicle[4] after learning of a similar investigation at the Navy Bureau of Aeronautics.[5] He wanted the RAND evaluation completed swiftly, in time to match the Navy presentation scheduled for the next meeting of the War Department's Aeronautical Board.[6] Representatives of the Army Air Forces and the Navy presented their preliminary findings at a May 15, 1946, meeting of the board's Research and Development Committee. Although RAND engineers ruled out the satellite as a weapons carrier, they claimed for it a number of important military support functions, including meteorological observation of cloud patterns and short-range weather forecasting, strategic reconnaissance, and the relaying of military communications.[7] [II-2] The Navy representatives likewise emphasized using Earth satellites in defense support applications: for fleet communications and as a navigation platform from which to guide missiles and pilotless aircraft.[8] The military members, however, could not agree on a joint satellite program or confirm that these uses of an Earth satellite would justify the anticipated costs of building, launching, and operating such a vehicle.

Studies of automatic Earth satellites continued at RAND and the Navy Bureau of Aeronautics while the post-war armed services jockeyed for position in a sweeping military reorganization. President Truman signed the National Security Act on July 26, 1947, that created the National Military Establishment and separate military departments of the Army, Navy, and Air Force. Beginning in September 1947, the three service secretaries reported to a new cabinet officer, the Secretary of Defense. But the reorganization did not immediately assign to any of the military services responsibility for new weapons. A newly formed Research and Development Board in the Department of Defense postponed any decisions of service jurisdiction over deployment or control of intermediate range and intercontinental ballistic missiles—rockets that would be required to propel human-made satellites into Earth orbit.[9]

The Research and Development Board inherited supervision of the satellite studies in the Defense Department, and assigned them in December 1947 to its Committee on Guided Missiles. This committee, in turn, formed a Technical Evaluation Group composed of civilian scientists to evaluate the Navy and Air Force programs and recommend a preferred course of action. Chaired by Walter MacNair of Bell Laboratories, on March 29, 1948, the group delivered its findings and recommendation. The members judged the technical feasibility of an Earth satellite to be clearly established; they concluded, however, that neither service had as yet established a military or scientific utility commensurate with the vehicle's anticipated costs. Consequently, the group recommended deferring construction of Earth satellites and consolidating all further studies of their use at RAND.[10] Adopted

4. Curtis E. LeMay with Mackinlay Kantor, *Mission with LeMay: My Story* (Garden City, NY: Doubleday & Co., 1965), pp. 399-400.

5. R. Cargill Hall, "Earth Satellites, A First Look by the United States Navy," in R. Cargill Hall, ed., *History of Rocketry and Astronautics: Proceedings of the Third through the Sixth History Symposia of the International Academy of Astronautics* (San Diego: Univelt, Inc., 1986), AAS History Series, Vol. 7, Part II, pp. 253-278.

6. The Aeronautical Board, formed during World War I and eventually made up of ranking military members of the Army and Navy air arms, reviewed aeronautical developments and attempted to reconcile "the viewpoints of the two services for the mutual benefit of aviation." The Earth satellite proposals passed from the Aeronautical Board to the War Department's Joint Research and Development Board (JRDB) in early 1947 and, in late 1947, to the JRDB's successor, the Research and Development Board (RDB). Civilian scientists directed and were well represented on the JRDB and RDB, which evaluated and approved all missile and aeronautical research and development within the military departments, and attempted, often without success, to prevent duplication of effort.

7. Douglas Aircraft Company, Inc., "Preliminary Design of an Experimental World-Circling Spaceship," Report No. SM-11827, May 2, 1946, copy in NASA Historical Reference Collection, NASA History Office, NASA Headquarters, Washington, DC.

8. Research and Development Committee, Aeronautical Board, Case No. 244, Report No. 1, May 15, 1946, pp. 1-2, Archives, Jet Propulsion Laboratory, Pasadena, CA.

9. Charles S. Maier, introduction to *A Scientist at the White House: The Private Diary of President Eisenhower's Special Assistant for Science and Technology*, by George B. Kistiakowsky (Cambridge, MA: Harvard University Press, 1976), pp. xxxiii-xxxiv, also pp. 95-96; Max Rosenberg, *The Air Force and the National Guided Missile Program, 1944-1950* (Washington, DC: Air Force Historical Division Liaison Office, 1964), pp. 22, 68, 84-85.

10. "Satellite Vehicle Program," Technical Evaluation Group, Committee on Guided Missiles, RDB, GM 13/7, MEG 24/1, March 29, 1948, NASA Historical Reference Collection.

by the Research and Development Board, these recommendations ended Navy satellite work for a number of years and focused the study of military satellites at RAND's headquarters on the West Coast, in Santa Monica, California.[11]

RAND's Earth satellite work in the late 1940s and early 1950s embraced system and subsystem engineering design, the preparation of equipment specifications, and studies of military uses. [II-5] It attracted a host of uncommonly able individuals, among them James Lipp, Robert Salter, Merton Davies, Amron Katz, Edward Stearns, William Kellogg, Louis Ridenour, Francis Clauser, and Eugene Root. Luminaries from academe, such as Bernard Brodie and Harold Lasswell of Yale University and Ansley Coale of Princeton, participated in special conferences, such as the one held at RAND in 1949 that surveyed the prospective political and psychological effects of Earth satellites.[12] All of these men had a hand in shaping the formative space program. And all of them could agree by the early 1950s that the most valuable, first-priority use of a satellite vehicle involved one strategic application: a platform from which to observe and record activity on the Earth.

Back in November 1945, with nuclear weapons and jet aircraft at hand, General Arnold concluded that the next war would provide the country little opportunity to mobilize, much less rearm or train reserves. [II-1] The United States could not again afford an intelligence failure like the one at Pearl Harbor; it could not again be caught unaware in another surprise attack. In the future, he had cautioned Secretary of War Patterson, "continuous knowledge of potential enemies," including all facets of their "political, social, industrial, scientific and military life" would be necessary "to provide warning of impending danger." Arnold also stated, "the targets of the future may be very large or extremely small—such as sites for launching guided missiles." Identifying them, like advance warning, also required "exact intelligence information."[13]

The extreme secrecy that cloaked events within the Soviet Union promoted the focus on intelligence gathering. When relations between the United States and the U.S.S.R. soured after World War II, little information about contemporary Soviet military capabilities existed in the West. In the absence of hard facts in the late 1940s, U.S. leaders acted on their perception of a "growing intent toward expansion and aggression on the part of the Soviet Union."[14] Shortly after the Soviets detonated an atomic bomb in 1949, the newly formed Board of National Intelligence Estimates in the Central Intelligence Agency (CIA)

11. In 1948 Project Rand reorganized as a non-profit advisory group, The Rand Corporation. In Washington, the Defense Department's Research and Development Board continued fitfully to operate until the fall of 1953 when its functions were subsumed in a new Office of Assistant Secretary of Defense for Research and Development; President Dwight D. Eisenhower appointed its first occupant: Donald A. Quarles.

12. Rand Research Memorandum, RM-120, "Conference on Methods for Studying the Psychological Effects of Unconventional Weapons," January 26-28, 1949; Paul Kecskemeti, RM-567, "The Satellite Rocket Vehicle: Political and Psychological Problems," October 4, 1950, both in Rand Library, Santa Monica, CA; see also R. Cargill Hall, "Early U.S. Satellite Proposals," *Technology and Culture* 4 (Fall 1963): 430-31.

Five months after an atomic bomb fell on Hiroshima, Japan, Louis Ridenour provided the American public a first, sobering assessment of future international atomic warfare conducted with Earth-mines and Earth-orbiting satellites. (In the 1950s, fears of a nuclear/thermonuclear surprise attack would move President Eisenhower to fold Earth satellites into an intelligence system designed to preclude such a catastrophe, and establish policy ensuring that spaceflight operations remained devoted to "peaceful purposes.") See L.N. Ridenour, "Pilot Lights of the Apocalypse," and the editor's introductory comment in *Fortune* 33 (January 1946): 116-17, 219.

Robert Salter contributed one of the first and most prescient surveys of the prospects for manned spaceflight in 1951, although the title he selected for it, doubtless to avoid peer ridicule, belied the subject. See Robert M. Salter, "Engineering Techniques in Relation to Human Travel at Upper Altitudes," *Physics and Medicine of the Upper Atmosphere: A Study of the Aeropause* (Albuquerque: University of New Mexico Press, 1952), pp. 480-487.

13. U.S. Army Air Forces, *Third Report of the Commanding General*, pp. 65-67.

14. Harry R. Borowski, *A Hollow Threat: Strategic Air Power and Containment Before Korea* (Westport, CT: Greenwood Press, 1982), p. 6; see also John Prados, *The Soviet Estimate: U.S. Intelligence Analysis and Russian Military Strength* (New York: The Dial Press, 1982), pp. 6-8, 19. See also the newly declassified CIA Office of Research Estimates and later National Intelligence Estimates at the National Archives, including: Central Intelligence Group, "Soviet Foreign and Military Policy," ORE-1, July 23, 1946; Historical Review Group, CIA, National Archives, Box 1, Folder 1; and Central Intelligence Agency, "The Possibility of Direct Soviet Military Action During 1949," ORE-46-49, May 3, 1949, Historical Review Group, CIA, National Archives, Box 3, Folder 102.

warned of the possibility of a Soviet nuclear surprise attack, albeit a limited one, against the United States. That prospect, underscored by the surprise Korean conflict in June 1950 and the development of thermonuclear devices between 1952 and 1954, haunted the nation's military and civilian leadership.[15]

Among America's leaders in the 1950s, the desire to preclude a nuclear or thermonuclear surprise attack was particularly acute. As Dwight D. Eisenhower's biographer aptly phrased it, they had "Pearl Harbor burned into their souls in a way that younger men, the leaders in the later decades of the Cold War, had not." Certainly this was true of Eisenhower in 1953 when he took the oath of office as president, for the subject completely dominated his thinking about disarmament and relations with the Soviets for the next eight years. Besides seeking ways to prevent a surprise attack, Eisenhower also sought "to lessen, if he could not eliminate, the financial cost and the fear that were the price of the Pearl Harbor mentality."[16] To that end, he could agree entirely with General Arnold's views that continuous knowledge of one's potential adversaries was essential "to provide warning of impending danger." The way to get it, Eisenhower also knew from wartime experience, was through aerial reconnaissance.

To secure hard intelligence about the Soviet Union, the CIA and the Air Force undertook a variety of projects at the beginning of the 1950s. Intelligence officers sifted captured German documents for aerial reconnaissance photographs of the U.S.S.R.; that these photographs dated from the early 1940s suggests the magnitude of the problem facing U.S. planners. The interrogation of German and Japanese prisoners of war returning from forced labor in the Soviet Union between 1949 and 1953 helped shed more light on the status of that country's military and industrial might. The Strategic Air Command began flying aircraft on the periphery of the U.S.S.R. on reconnaissance missions, and obtained considerable information about border installations and defenses. But these missions yielded nothing substantial about the Soviet heartland and the state of its economy, society, or military capabilities and preparations.[17]

Seeking this information, RAND proposed and the Air Force conducted the WS 119L program. Beginning in early January 1956, with the approval of President Eisenhower, Air Force personnel loaded automatic cameras in gondolas suspended beneath large Skyhook weather balloons, and during the next four weeks launched 516 of these vehicles in Western Europe. The balloons, equipped with radio beacons that allowed tracking, drifted on prevailing winds at high altitudes eastward across the Eurasian continent, through Soviet airspace. Under the terms of international law to which the United States was a party, the balloons clearly violated Soviet national sovereignty. Those that succeeded in crossing released their gondolas on parachutes, which were recovered in mid-air by C-119 cargo aircraft near Japan and Alaska.[18] Because the aerial path of the balloons could not be controlled, however, the pictures might as easily be of cloud cover or a Siberian forest as of a factory or an airfield. This program, which produced limited intelligence and strongly worded Soviet protests, was quietly canceled on February 6, 1956, at the president's direction. Although the Air Force would subsequently launch a few more of these balloons that operated at yet higher altitudes, Eisenhower quickly terminated that effort as well. Meanwhile, other, more promising avenues of gathering information had appeared.[19]

15. James R. Killian, Jr., *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (Cambridge, MA: The MIT Press, 1977), pp. 68, 94; Prados, *The Soviet Estimate*, p. 21. U.S. intelligence was caught almost completely unaware of the development of the Soviet hydrogen bomb. See, for example, "Estimate of the Effects of the Soviet Possession of the Atomic Bomb Upon the Security of the United States and Upon the Probabilities of Direct Soviet Military Action," ORE 91-49, April 6, 1950, Historical Review Group, CIA, National Archives, Box 4, Folder 131, p. 11.

16. Stephen E. Ambrose, *Eisenhower: Volume II, The President* (New York: Simon and Schuster, 1984), p. 257. The president's decision in favor of aerial reconnaissance is explained on pp. 258-59.

17. David A. Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960," *International Security* 7 (Spring 1983): 20-21; Prados, *The Soviet Estimate*, pp. 57-58.

18. In the event aerial retrieval failed, the gondolas were designed to float on the ocean's surface and radiate a signal for twenty-four hours. Although many of the gondolas came down in the Soviet Union, sixty-seven of them actually reached the recovery area; of these, the Air Force retrieved forty-four.

19. Tom D. Crouch, *The Eagle Aloft: Two Centuries of the Balloon in America* (Washington, DC: Smithsonian Institution Press, 1983), pp. 644-49; Ambrose, *Eisenhower, Vol. II*, pp. 309-11; Killian, *Sputnik, Scientists, and*

Research and Initial Development

While the CIA and the Air Force endeavored to gather information about the Soviet Union from any source, the Department of Defense acted on the issue of military roles and missions. On March 21, 1950, Secretary of Defense Louis Johnson assigned the Air Force responsibility for long-range strategic missiles, including ICBMs. A few weeks later, the Research and Development Board vested jurisdiction for military satellites in the same service. With these responsibilities, Air Force leaders directed RAND to complete studies of a military Earth satellite.[20]

The resultant RAND report, issued in April 1951, described a spacecraft fully stabilized on three axes and that employed a television camera to scan the Earth and transmit the images to receiving stations. [II-3] The television coverage thus acquired, RAND reminded the service had to occur when "weather permits ground observation."[21] The RAND report encouraged Air Force leaders to believe that directed, periodic observation of the Soviet Union might soon be conducted from extremely high altitudes. To confirm these findings, on December 19, 1951, Air Force headquarters authorized the firm to subcontract for detailed spacecraft subsystem studies. A few weeks later, in January 1952, the service convened a seminal "Beacon Hill" study group to assay strategic aerial reconnaissance under the auspices of Project Lincoln at the Massachusetts Institute of Technology.[22]

The Beacon Hill study group, which first met between January 7 and February 15, 1952, considered improvements in Air Force aerial intelligence processing, sensors, and vehicles. Chaired by Carl Overhage of Eastman Kodak, the fifteen-member group included Air Force optics specialist Lieutenant Colonel Richard Leghorn (later, the founder of Itek), James Baker of the Harvard Observatory, Edwin Land (the founder of Polaroid), Stuart Miller of Bell Labs, Richard Perkin (co-founder of Perkin-Elmer), scientific consultant Louis Ridenour, Allen Donovan of Cornell Aeronautical Labs, and Edward Purcell of Harvard University. These individuals concluded their deliberations in May and issued a final report in June 1952.

The Beacon Hill report recommended to the Air Force specific improvements in the orientation, emphasis, and priority assigned to strategic intelligence, and solutions to the problems involved in its collection, reduction, and use. The study group also suggested refinements in sensors. The improved sensors, the group advised, could be flown near Soviet territory in advanced high-altitude aircraft, high-altitude balloons (later, WS 119L), sounding rockets, and long-range drones such as the Snark or Navaho air-breathing missiles. Whatever the choice of vehicles, study group participants cautioned the service that actual "intrusion" over Soviet territory and violation of its national sovereignty required approval of political authorities "at the highest level." Space satellites, mentioned only in passing and then only as vehicles of the future in the grip of Newtonian mechanics, were, however, identified as certain intruders that would have to "overfly" the Soviet Union.[23]

Eisenhower, p. 12; Paul E. Worthman recollections, cited by W. W. Rostow in *Open Skies: Eisenhower's Proposal of July 21, 1955* (Austin: University of Texas Press, 1982), pp. 189-94. Project "Moby Dick," the test of WS 119L, was conducted in the United States during 1952-1955 and accounted for numerous UFO sightings—as did later tests of the U-2 and A-12.

20. Enclosure with recommendations for guided missiles to Memo 1620/17, for Secretary of Defense Louis Johnson, from the Joint Chiefs of Staff, March 15, 1950; Memo for the Joint Chiefs of Staff from Louis Johnson, "Department of Defense Guided Missiles Program," approving recommendations, March 21, 1950; Report, Air Research and Development Command, *Space System Development Plan*, WDPP-59-11, January 30, 1959, Tab I, "Background," p. I-1-1, all in NASA Historical Reference Collection.

21. J.E. Lipp, R.M. Salter, Jr., and R.S. Wehner, "The Utility of a Satellite Vehicle for Reconnaissance," The RAND Corporation, R-217, April 1951, p. 80, Rand Library.

22. RCA-Rand, "Progress Report (Project Feed Back)," Report RM-999, January 1, 1953, Rand Library. Background of the Beacon Hill study and related developments in 1951 is contained in Herbert F. York and G. Allen Greb, "Strategic Reconnaissance," *Bulletin of the Atomic Scientists*, April 1977, p. 34.

23. "Beacon Hill Report: Problems of Air Force Intelligence and Reconnaissance," Project Lincoln, Massachusetts Institute of Technology, Boston, MA, June 15, 1951, *passim*, JPL Archives.

Elsewhere around the country, various firms under contract to RAND were designing and evaluating specific satellite equipment, including a television payload (Radio Corporation of America), vehicle guidance and attitude-control devices (North American Aviation), and a nuclear auxiliary electrical power source (Westinghouse Electric Corporation, Bendix Aviation, Allis-Chalmers, and the Vitro Corporation). This effort, known collectively as Project Feed Back, confirmed that automated satellites could be built without exceptional delays and at an affordable cost. Whatever the legal ramifications of overflight in outer space might be, in September 1953, RAND officials recommended that a satellite be built.[24] [II-4] A few months later, they concluded their preliminary work and published a final report.

Issued on March 1, 1954, the Project Feed Back report described a military satellite for observation, mapping, and weather analysis, along with examples of the necessary space hardware and ground support systems. [II-6] The second stage booster-satellite would be placed in a low-altitude, "sun synchronous" polar orbit inclined 83 degrees to the equator. Launched at the proper time of day at this inclination, the satellite would precess in one year through 360 degrees, allowing a television camera to operate in maximum daylight brightness throughout all seasons.[25] RAND engineers estimated this satellite system would produce "30 million pictures in one year of operation," a sum equivalent to all the pictures held in the USAF Photo Records and Services Division acquired from all sources in peace and war over the previous twenty-five years![26] Where the Air Force might find the photo-interpreters needed to evaluate this mountain of information, RAND did not say.

In early 1954, however, the problem that faced U.S. policy-makers was not too much intelligence information about the Soviet Union, but far too little. Attempts to fly around the U.S.S.R. had thus far produced inadequate information; details of Soviet military preparations and capabilities remained as much an enigma as ever. Continued Soviet production of atomic weapons, and the means to deliver them, such as the Bison long-range bomber, combined in August 1953 with the Soviet detonation of a thermonuclear device, particularly disturbed President Eisenhower. Former Supreme Commander of the Allied Expeditionary Force in Western Europe, Eisenhower had helped engineer the destruction of the Axis powers in World War II and knew firsthand the enormous devastation that accompanied modern total war.

Any aerial surprise attack on the United States with nuclear weapons, even a limited one, could lay waste to most of the metropolitan areas on the East and West coasts. Moreover, with government agencies unable to gauge the exact nature and extent of a Soviet military threat, the president found himself at a distinct disadvantage in selecting the appropriate level of military preparedness to combat it. This situation, Eisenhower made clear at a meeting of his National Security Council on February 24, 1954, had to be resolved—and soon. As a first step to counter a possible surprise attack, he had already approved a prior council recommendation to design and construct, with Canadian approval, a Distant Early Warning (DEW) picket line of radars across the North American Arctic, to detect and track any Soviet bombers that might be directed against the two countries.[27]

Civilian scientists appointed to the Science Advisory Committee in the Office of Defense Mobilization, meanwhile, had been examining similar issues under the prodding of

24. Perry, *Origins of the USAF Space Program*, pp. 35, 39; and Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology* (Santa Monica, CA: The RAND Corporation, 1988), p. 47.

25. J.E. Lipp & R.M. Salter, "Project Feed Back Summary Report," The RAND Corporation, R-262, Volume II, March, 1954, pp. 109-10, Rand Library.

26. *Ibid.*, pp. 85-86.

27. Stephen E. Ambrose, *Ike's Spies: Eisenhower and the Espionage Establishment* (Garden City, NY: Doubleday & Co., 1981), pp. 253, 267; Rpt., Aerospace Defense Command, *A Chronology of Air Defense, 1914-1972*, ADC Historical Study No. 19, March 1973, p. 33; see also NSC 159/4 and attached statement of policy on "Continental Defense," September 25, 1953, and NSC 5408, "Report to the National Security Council by the National Security Planning Board," February 11, 1954, as reprinted in William Z. Slany, ed., *Foreign Relations of the United States, 1952-1954, Volume II: National Security Affairs, Part 1* (Washington, DC: U.S. Government Printing Office, 1984), pp. 475-89, 609-24.

Trevor Gardner, the "technologically evangelical assistant secretary of the Air Force for research and development." Learning of these studies, the president's special assistant for security affairs, General Robert Cutler, invited key committee members to the White House. Meeting with them on March 27, 1954, Eisenhower discussed his concerns about a surprise attack on the United States and the prospects for avoiding or containing it. "Modern weapons," he warned, "had made it easier for a hostile nation with a closed society to plan an attack in secrecy and thus gain an advantage denied to the nation with an open society." In spite of the Oppenheimer case, he apparently viewed the scientists as honest brokers in a partisan city, and he challenged them to tackle this problem.[28]

They did. Lee A. DuBridge, president of the California Institute of Technology and chair of the Science Advisory Committee, and James R. Killian, Jr., president of the Massachusetts Institute of Technology, formed a special task force to consider three areas of national security: continental defense, strike forces, and intelligence, with supporting studies in communications and technical manpower. Approved by President Eisenhower in the spring, the Surprise Attack Panel, or the Technological Capabilities Panel (TCP) as it was subsequently renamed, chaired by Killian, conducted its work between August 1954 and January 1955. Its membership included most of those who had produced the Beacon Hill Report and represented the best that American science and engineering offered. The panel's extraordinary two-volume report, *Meeting the Threat of Surprise Attack*, was issued on February 14, 1955. By all published accounts, the report affected the course of national security affairs enormously.[29]

The TCP report resulted in a number of significant alterations in U.S. defense preparedness. Among other things, it recommended accelerating procurement of intercontinental ballistic missiles (Atlas, and later Titan and Minuteman ICBMs), constructing land- and sea-based intermediate-range ballistic missiles (later Thor, Jupiter, and Polaris IRBMs), and speeding construction of the DEW line in the Arctic (declared operational in August 1957). The TCP also identified a timetable of changes in the relative military and technical positions of the two superpowers. Even more important, perhaps, were the recommendations to acquire and use strategic pre-hostilities intelligence. The intelligence panel, chaired by Edwin Land, urged construction and deployment of the U-2 aircraft[30] that could, if called upon, overfly the Soviet Union at very high altitudes.[31] Any mention of the U-2, however, was excluded from the report proper. In its section on intelligence applications

28. The description of Gardner, and Eisenhower as quoted, in Killian, *Sputnik, Scientists, and Eisenhower*, p. 68; see also, Prados, *The Soviet Estimate*, p. 60.

29. *Meeting the Threat of Surprise Attack*, Vol I and Vol II, February 14, 1955, JPL Archives; see also Killian, *Sputnik, Scientists, and Eisenhower*, pp. 11-12, 70-82; Herbert F. York and G. Allen Greb, "Military Research and Development: A Postwar History," *Bulletin of the Atomic Scientists*, January 1977, p. 22; also York and Greb, "Strategic Reconnaissance," p. 35. For the next two years, the deliberations of the National Security Council turned frequently to the findings and recommendations contained in this report. See John P. Glennon, ed., *Foreign Relations of the United States, 1955-1957: Volume XIX, National Security Policy* (Washington, DC: U.S. Government Printing Office, 1990), hereafter referred to as *Volume XIX*.

30. Eisenhower approved development of the U-2 during the TCP deliberations, on November 24, 1954, and assigned the project to the CIA instead of the Air Force. Under the guidance of Richard M. Bissell, Jr., CIA Special Assistant to the Director of Central Intelligence, Colonel O. J. Ritland, USAF, and Clarence L. "Kelly" Johnson of the Lockheed Aircraft Corporation, the first U-2 was airborne within eight months, on August 6, 1955. Ambrose, *Ike's Spies*, p. 268; Leonard Mosley, *Dulles: A Biography of Eleanor, Allen, and John Foster Dulles and Their Family Network* (New York: Dial Press, 1978), pp. 365-66.

31. Dwight D. Eisenhower, *Waging Peace, 1956-1961* (Garden City, NY: Doubleday & Co., Inc., 1965), p. 470; Killian, *Sputnik, Scientists, and Eisenhower*, pp. 71-84; Rpt., *A Chronology of Air Defense, 1914-1972*, p. 46. The cleared recommendations of the TCP are reprinted in *Volume XIX*, pp. 46-56.

Throughout the 1950s Eisenhower withheld knowledge of the U-2's existence from all but those few directly involved. The program never appeared as an item in National Security Council deliberations until "it tore its britches" in 1960. Karl G. Harr, Jr., "Eisenhower's Approach to National Security Decision Making," in Kenneth W. Thompson, ed., *The Eisenhower Presidency: Eleven Intimate Perspectives of Dwight D. Eisenhower*, Vol. 3 in *Portraits of American Presidents* (Lanham, MD: University Press of America, 1984), p. 97. The product of the U-2 flights was even more closely held, and Eisenhower refused to refute political charges that an American "bomber gap" and, later, a "missile gap" existed, even though he knew them to be false. The latter issue, artfully exploited by John Kennedy, may well have cost Richard Nixon the 1960 presidential election. Since that time, to avoid an unwanted repetition, candidates have been "briefed" on national security affairs before a presidential campaign begins. All of these events square with the perceptive thesis of Eisenhower governance elucidated by Fred I. Greenstein, *The Hidden-Hand Presidency: Eisenhower as Leader* (New York: Basic Books, Inc., 1982).

of science, the report recommended beginning immediately a program to develop a small scientific satellite that would operate at extreme altitudes above national airspace, intended to establish the principle of "freedom of space" in international law for subsequent military satellites.[32] Although committee members could hope that scientific satellites might set such a precedent, James Killian, who chaired the TCP, viewed RAND's proposed military observation satellite as a "peripheral project" and would refuse to support it until the Soviets launched Sputnik I nearly three years later.

Back in the summer of 1954, shortly after authorizing the surprise-attack study, President Eisenhower approved the formation of an organization devoted exclusively to that subject: the National Indications Center. This center, chaired by the Deputy Director of Central Intelligence and composed of specialists drawn from U.S. intelligence agencies, and the Departments of Defense and State, formed the interagency staff of the National Watch Committee, which consisted of presidential confidants such as the Secretaries of State and Defense, and the Director of Central Intelligence (DCI). Chartered on July 1, 1954, for the express purpose of "preventing strategic surprise," the center drew on information furnished by all national intelligence organizations. Eisenhower, one of the participants recalled vividly, was a man "boresighted on early warning of surprise attack."[33]

The National Indications Center assessed the military, economic, and social demands involved in mounting a surprise attack and issued a weekly "watch report" to the Watch Committee members. Staffers expanded a list of key indicators developed earlier under the direction of James J. Hitchcock in the CIA, and applied it to developments that would presage surprise attack in the nuclear age.[34] That is, presuming rational political leadership, one state intending to attack another would need to prepare carefully, say, by dispersing its industry and population many months in advance, and by deploying its military forces on land and sea just days or hours before "M-Day." Thus, the proper intelligence "indicators" applied against this matrix would yield readily identifiable signals, much like a traffic light: green—normal activity; amber—caution; and red—warning.[35] These strategic warning indicators, eventually linked to "defense conditions" (DEFCON 5 through 1), enabled U.S. leaders to mobilize resources and establish force readiness postures. The military, economic, and technical indicators listed in this matrix successfully predicted the Suez War in 1956, and have been monitored and reported in one form or another to the president and other command authorities ever since. The National Indications Center itself, however, was dissolved in March 1975.[36]

32. *Meeting the Threat of Surprise Attack*, Vol. II, pp. 146-48; Memo for the Record, L. B. Kirkpatrick, "Meeting with the President's Board of Consultants, Saturday, 28 Sep. 1957, 11 a.m to 2 p.m.," Eisenhower Library, Abilene, KS.

33. Interview with James J. Hitchcock, May 23, 1986; Cynthia M. Grabo, "The Watch Committee and the National Indications Center: The Evolution of U.S. Strategic Warning, 1950-1975," *International Journal of Intelligence and CounterIntelligence* 3 (Fall 1989): 369-70; see also Eisenhower letter to Winston Churchill, cited in Killian, *Sputnik, Scientists, and Eisenhower*, p. 88. One has only to peruse the documents in *Volume XIX* to gain an appreciation for Eisenhower's fixation on surprise attack and his dedication to forestalling such an event. See especially [8] at p. 40.

34. A RAND study doubtless figured in these deliberations and actions, though a direct linkage is not established at this time. One year earlier, three months after President Eisenhower's inauguration, Andrew W. Marshall and James F. Digby issued RAND Special Memorandum SM-14, *The Military Value of Advanced Warning of Hostilities and its Implications for Intelligence Indicators*, April 1953 (rev. July 1953). The authors compared intelligence warning of attack to the performance of military forces, and urged attention to short-term indications of Soviet preparations for surprise attack. Copies unquestionably circulated within intelligence circles, including the CIA.

35. The British first developed an indicators list in 1948 to identify actions the Soviets would have to take to occupy Berlin. Hitchcock subsequently altered and expanded the list at the CIA in the late 1940s and early 1950s to identify actions that would warn of a surprise attack against the United States. The best available source in the open literature that describes related RAND activities in the 1940s and 1950s is Davies and Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology*.

36. Grabo, "The Watch Committee and the National Indications Center," p. 384; *Volume XIX* [19]; another survey of this subject in the open literature is Duncan E. MacDonald, "The Requirements for Information and Systems," in F. J. Ossenbeck and P. C. Kroeck, eds., *Open Space and Peace: A Symposium on the Effects of Observation* (Stanford, CA: The Hoover Institution, 1964), pp. 64-83. The NSC Planning Board, also at the president's direction, in November 1954 had established a "net capabilities evaluation subcommittee" that performed a function similar to the National Indications Center for the council. See [1 and 19] in *Volume XIX*.

Establishing National Space Policy

President Eisenhower, to be sure, worried considerably about the danger of a Soviet surprise attack in the mid-1950s, and judged strategic warning absolutely vital to counter or preclude it. Shortly after the TCP submitted its report to the National Security Council, in the spring of 1955 the president's closest advisors determined, if at all possible, to keep outer space a region open to all, where the spacecraft of any state might overfly all states, a region free of military posturing. By adopting a policy that favored a legal regime for outer space analogous to that of the high seas, the United States might make possible the precedent of "freedom of space" with all that implied for overflight. This choice also favored non-aggressive, peaceful spaceflight operations, especially the launch of scientific Earth satellites to explore outer space that civilian scientists now urged as part of the U.S. contribution to the International Geophysical Year (IGY).[37] [II-8, II-11] This program, proposed by the U.S. National Committee for the IGY of the National Academy of Sciences in a March 14, 1955, report, had been approved by the academy and sent to National Science Foundation director Alan T. Waterman for government consideration.[38] [II-9]

By this time, a number of prominent scientists and military leaders actively sought approval for spaceflight missions. A few months after RAND's Feed Back report appeared, the Air Force had acted on its recommendations. On November 29, 1954, the Air Research and Development Command issued System Requirement No. 5, which called for competitive system-design studies of a military satellite. On March 16, 1955, while the National Academy of Sciences was completing its satellite deliberations, the USAF issued General Operational Requirement No. 80 (SA-2c), which approved construction of and provided technical requirements for military observation satellites. At the same time, the service named this observation satellite the WS 117L program. In April, the Naval Research Laboratory submitted to the Defense Department a "Scientific Satellite Program" for the IGY, eventually known as Vanguard, which proposed using as a first-stage booster the Viking sounding rocket. Meanwhile, the Army's Redstone rocket team led by Major General John B. Medaris and Wernher von Braun had for some months urged a small, inert Earth satellite launched with the Jupiter IRBM, called Project Orbiter (later named Explorer). [II-7] These and other events soon to follow made 1955 the most momentous of years for the fledgling U.S. space program.[39]

In May 1955, administration officials agreed that the country should launch scientific Earth satellites as a contribution to the IGY. In early May, Assistant Secretary of Defense for Research and Development Donald Quarles referred the Army and Navy IGY satellite proposals to his Committee on Special Capabilities, and requested a scientific

37. In 1952 the International Council of Scientific Unions (ICSU) established a committee to arrange another International Polar Year to study geophysical phenomena in remote areas of the Earth (two previous polar years had been conducted, one in 1882-1883 and another in 1932-1933). Late in 1952 the council expanded the scope of this effort, planned for 1957-1958, to include rocket research in the upper atmosphere and changed the name to the International Geophysical Year. In October 1954 the ICSU, meeting in Rome, Italy, adopted another resolution that called for launching scientific Earth satellites during the IGY. "Editorial Note," in John P. Glennon, ed., *Foreign Relations of the United States, 1955-1957: Volume XI, United Nations and General International Matters* (Washington DC: U.S. Government Printing Office, 1988), [361], pp. 784-85.

38. A few months earlier, in December 1954, the American Rocket Society's Committee on Space Flight completed a similar report on the utility of scientific Earth satellites, including a proposal by John Robinson Pierce of Bell Laboratories for a passive communication satellite that much resembled the later Project Echo, and submitted it to National Science Foundation Director Alan T. Waterman. By the spring of 1955 a number of Earth-satellite proposals had landed on the desks of officials at the National Science Foundation and the Department of Defense. See R. Cargill Hall, "Origins and Development of the Vanguard and Explorer Satellite Programs," *Airpower Historian* 9 (October 1964): 106-108.

39. *Ibid.*, pp. 102-104. Project Orbiter first appeared with the name "A Minimum Satellite Vehicle," the result of an August 3, 1954, meeting between Army officials at the Redstone Arsenal and Navy representatives from the Office of Naval Research. See Dr. Wernher von Braun, "A Minimum Satellite Vehicle: Based on components available from missile developments of the Army Ordnance Corps," September 15, 1954, NASA Historical Reference Collection.

satellite proposal from the Air Force.[40] He instructed committee members to evaluate these proposals and recommend a preferred program. Quarles, who warmly embraced the satellite recommendations of Killian's Technological Capabilities Panel and urged an IGY satellite program, subsequently drafted a policy for the launching of these and other spacecraft and submitted it on May 20 to the National Security Council (NSC). NSC members meeting on May 26 endorsed the Quarles' proposal and accompanying national policy guidance. A scientific satellite program for the IGY would not interfere with development of high-priority ICBM and IRBM weapons. Emphasis would be placed on the peaceful purposes of the endeavor. The scientific satellites would help establish the principle in international law of "freedom of space" and the right of unimpeded overflight that went with it, and these IGY satellites would serve as technical precursors for subsequent U.S. military satellites. "Considerable prestige and psychological benefits," the policy concluded, "will accrue to the nation which first is successful in launching a satellite."[41] The next day, "after sleeping on it," President Eisenhower approved this plan.[42] [II-10]

With the president's decision, the United States had tentatively set out to prosecute two closely associated space programs: instrumented military applications and civilian scientific satellites. Presidential advisors still perceived the more complex military spacecraft to be a long way off, but the IGY scientific satellite program was clearly identified as a stalking horse to establish the precedent of overflight in space for the eventual operation of military reconnaissance satellites. Charged with the WS 117L program, the Air Force earlier in 1955 had selected three firms to compete in a one-year design study of a preferred vehicle. Neither the military nor the scientific satellite program had selected a contractor to conduct the work, and neither shared a national priority.

In Burbank, California, in Kelly Johnson's Lockheed "skunk works," the U-2 project unquestionably claimed the highest of national priorities. With the first of these turbojet-powered gliders nearing completion, Eisenhower learned that the United States could soon overfly parts of Soviet airspace at will.[43] The U-2 had an anticipated operating ceiling in excess of 70,000 feet. No known jet fighter operated at altitudes above 50,000 feet. But however safe piloted aerial overflight, or however attractive this opportunity to acquire intelligence on Soviet military preparations, might be, any unauthorized penetration of another state's airspace represented a clear violation of international law—a violation, that is, unless the leaders concerned agreed to such flights beforehand.

While the U-2 neared its first test flight in Nevada, on July 21, 1955, at a summit conference in Geneva, Eisenhower advised Soviet leaders of just such a plan. The president, in an unannounced addition to a disarmament proposal, directly addressed the subject that most concerned him. The absence of trust and the presence of "terrible weapons" among states, he asserted, provoked in the world "fears and dangers of surprise attack." To eliminate these fears, he urged that the Soviet Union and the United States provide "facili-

40. The Air Force proposal, called "World Series," featured an Atlas first stage and Aerobee-Hi second stage; it was submitted to the Committee on Special Capabilities (Stewart Committee) during the first week of July 1955. Because World Series conflicted with the WS 117L program, Air Force leaders gave it scant support.

Throughout the Eisenhower presidency until his death in office, Donald A. Quarles would influence greatly the choice of policy and missions for the civilian and military satellite programs, first as Assistant Secretary of Defense for Research and Development (September 1953 to August 1955), then as Secretary of the Air Force (August 1955 to April 1957), and finally as Deputy Secretary of Defense (April 1957 to May 1959).

41. National Security Council, NSC 5520, "Draft Statement of Policy on U.S. Scientific Satellite Program," May 20, 1955, pp. 1-3. See also Annex B, accompanying Memorandum from Nelson A. Rockefeller to Mr. James S. Lay, Jr., Executive Secretary, "U.S. Scientific Satellite Program," May 17, 1955. These documents reprinted, along with the NSC endorsement, in John P. Glennon, ed., *Foreign Relations of the United States, 1955-1957: Volume XI, United Nations and General International Matters* (Washington DC: U.S. Government Printing Office, 1988), [340/341], pp. 723-33, hereafter referred to as *Volume XI*. Air Force leaders enthusiastically embraced the dictum that IGY satellites would not interfere with the ICBM, IRBM, and military satellite programs; Perry, *Origins of the USAF Space Program*, pp. 43-44.

42. Eisenhower quoted in Lee Bowen, *An Air Force History of Space Activities, 1945-1959* (USAF Historical Division Liaison Office, August 1964), p. 64. Eisenhower did approve the IGY satellite program in NSC 5520 the next day, on May 27, 1955; see *Volume XI* [341], p. 733.

43. Ambrose, *Ike's Spies*, p. 271; Clarence "Kelly" Johnson, interview with Morley Safer on CBS "60 Minutes," October 17, 1982; Eisenhower, *Waging Peace*, pp. 544-45.

ties for aerial photography to the other country" and conduct mutually supervised reconnaissance overflights.[44] Before the day ended, the Chair of the Soviet Council of Ministers, Nikolai Bulganin, and First Secretary of the Communist Party Nikita Khrushchev privately rejected the president's plan, known eventually as the "Open Skies" doctrine, as an obvious U.S. attempt to "accumulate target information." "We knew the Soviets wouldn't accept it," Eisenhower later confided in an interview, "but we took a look and thought it was a good move."[45] Though the Soviets might object, they were forewarned.[46] Eleven months later, some five months after he terminated the balloon reconnaissance program, Eisenhower approved the first U-2 overflight of the U.S.S.R.[47]

Back in the United States, late in the evening of July 25, 1955, Eisenhower informed the nation in a radio address of the results of the summit conference. On July 27, Eisenhower met with National Science Foundation Director Waterman, Assistant Secretary of Defense Quarles, and Undersecretary of State Herbert Hoover, Jr., to discuss how best to make known the existence of a U.S. IGY satellite program. A general statement, it was decided, would come from the White House after congressional leaders had been notified. These statements would emphasize the satellite project "as a contribution benefiting science throughout the world," and would not link it in any way "to military missile development." Two days later, on July 29, 1955, the president publicly announced plans for launching "small unmanned, Earth circling satellites as part of the U.S. participation in the International Geophysical Year" scheduled between July 1957 and December 1958. [I-17] His statement avoided any hint at the underlying purpose of the enterprise, and assigned to the National Science Foundation responsibility for directing the project, with "logistic and technical support" to be furnished by the Department of Defense. Donald Quarles' Committee on Special Capabilities in early August selected for the IGY satellite project the Naval Research Laboratory's Vanguard proposal, one that combined modified Viking and Aerobee-Hi sounding rockets for the scientific satellite booster, and placed the U.S. Navy in charge of logistics and technical support.[48]

In June 1956, the Air Force chose Lockheed's Missile Systems Division in Sunnyvale, California, to design and build the military satellites for the WS 117L program. Lockheed's winning proposal featured a large, second-stage booster satellite that could be stabilized in orbit on three axes with a high pointing accuracy. To become known as "Agena," this vehicle would be designed and tested to meet Air Force plans for an operational capability in the third quarter of 1963. While the diminutive Vanguard scientific satellite was projected to weigh tens of pounds and be launched by a modified sounding rocket, the

44. "Statement on Disarmament, July 21," *The Department of State Bulletin*, 33, No. 841, August 1, 1955, p. 174; Elie Abel, "Eisenhower Calls Upon Soviet Union to Exchange Arms Blueprints," *New York Times*, July 22, 1955, p. 1; also Prados, *The Soviet Estimate*, pp. 31-32. The term "Open Skies" was coined later by the popular press and applied to Eisenhower's statement on disarmament. The background of this proposal, as advanced by the president's special assistant, Harold Stassen, and debated in the National Security Council, is contained in John P. Glennon, ed., *Foreign Relations of the United States, 1955-1957: Volume XX, Regulation of Armaments; Atomic Energy* (Washington, DC: U.S. Government Printing Office, 1990), see especially [33 through 48]. By 1956-1957, Eisenhower and other key administration leaders would view aerial reconnaissance as an "inspection system" that could serve two critical functions: to forewarn of surprise attack *and* supervise and verify arms-reduction and nuclear-test-ban agreements.

45. Herbert S. Parmet, *Eisenhower and the American Crusades* (New York: The Macmillan Company, 1972), p. 406; see also W. W. Rostow, *Open Skies*, pp. 7-8.

46. Richard Leghorn, then working for Eisenhower's special assistant Harold Stassen, wrote the paper on which the "Open Skies" doctrine was predicated. He also produced the 32-page booklet explaining this disarmament proposal given to those attending the Big Four Geneva Conference. Richard S. Leghorn, "U.S. Can Photograph Russia from the Air Now," *U.S. News & World Report*, August 5, 1955, pp. 70-75; "Editor's Note" at p. 71. Cleared by the White House, this important article explained the administration's rationale for Open Skies and the implications of this plan for arms reduction.

47. Ambrose, *Ike's Spies*, pp. 31-34, 266.

48. Attendees at the July 27 meeting included Eisenhower's staff secretary and defense liaison, Colonel Andrew Goodpaster, U.S. Army. Goodpaster, "Memorandum of Conference with the President, July 27, 1955, 11:45AM." The news release is reprinted in *Volume XX* [342], p. 734; see also for related events and the Quarles' IGY selection process, Constance McL. Green and Milton Lomask, *Vanguard: A History* (Washington DC: NASA SP-4202, 1970), pp. 37-38, 55-56.

proposed Air Force satellite would weigh thousands of pounds and be launched atop an Atlas ICBM.[49]

Among other payloads, Lockheed recommended for development those projects already identified by the Navy and RAND, and added one of its own: an infrared radiometer and telescope to detect the hot exhaust gases emitted by long-range jet bombers and, more important, large rockets as they ascended under power through the atmosphere. This novel aircraft-tracker and missile-detection innovation advanced by Joseph J. Knopow, a young Lockheed engineer, fit nicely into the strategic warning efforts of the day and unquestionably helped tip the scales in Lockheed's favor.[50] The Air Force awarded the firm a contract for this program a few months later, in October 1956.[51]

Thus, a year before Sputnik, the two modest U.S. space programs moved ahead slowly, staying within strict funding limits and avoiding unwanted interference, with development of the nation's long-range ballistic missiles just underway. They shared a lower priority than other high-technology defense department programs. To avoid provoking an international debate over "freedom of space," Eisenhower administration leaders in 1956 restrained government officials from any public discussion of spaceflight.[52] At the Pentagon, after a WS 117L program briefing on November 17, Donald Quarles, now Secretary of the Air Force, instructed Lieutenant General Donald Putt, Deputy Chief of Staff for Research and Development, to cease all efforts toward vehicle construction. He expressly forbade fabrication of a mockup or of the first satellite without his personal permission. A military satellite, the Air Force learned, would under no circumstances precede a scientific satellite into orbit.[53]

In early 1957 President Eisenhower remained undecided whether the United States needed to launch more than six IGY satellites for science. Moreover, Secretary of Defense Charles Wilson remained unimpressed with expensive astronautical ventures of any kind.

49. In the mid 1950s, Convair's James W. Crooks, Jr., constantly reminded audiences at Wright-Patterson AFB and elsewhere that the Atlas could lift the weight of a new Chevrolet, 3,500 lbs., into low-Earth orbit. As events turned out, Atlas with a powered upper stage could lift a good deal more—about 10,000 lbs.—into low-Earth orbit.

50. In time, this payload proposal would be separated and identified as the Missile Detection and Alarm System (MIDAS), then evolve to become the contemporary Defense Support Program (DSP). Today, this remarkable set of military satellites can detect and provide advance warning of a missile attack within moments of a launch at sea or on land.

51. LMSD 1536, *Pied Piper Development Plan*, Vol II, March 1, 1956, Subsystem Plan, A. Airframe, A-Apdx., pp. 3-4; and Vol. I, System Plan, *passim*, Eisenhower Library.

52. Unwitting of the National Security Council deliberations and of the ground rules established for the nation's space program, contemporary American military leaders failed entirely to comprehend the rationale that prompted this restriction on public discussion. See, for example, Maj. Gen John B. Medaris, U.S. Army, with Arthur Gordon, *Countdown for Decision* (New York: Paperback Library, Inc., 1960), pp. 101, 124; and testimony of Lt. Gen James M. Gavin, Deputy Chief of Staff Research and Development, U.S. Army, in U.S. Senate, *Inquiry into Satellite and Missile Programs*, "Hearings before the Senate Preparedness Investigating Subcommittee of the Committee on Armed Services," Part II, 6 January 1958, p. 1474, and Part I, 13 December 1957, p. 509. Air Force General Bernard Schriever, charged with the missile and space efforts of that service in the mid-to-late 1950s, was still fuming in 1985. Recalling a February 1957 speech, he announced that the Air Force was ready to "move forward rapidly into space. I received instruction the next day from the Pentagon that I shouldn't use the word 'space' in any of my future speeches. Now that was February 1957! They [the administration] had the IGY going, you know, which was kind of a scientific boondoggle." Richard H. Kohn, June 1985 interview with Generals Doolittle, Schriever, Phillips, Marsh, and Dr. Getting, in Jacob Neufeld, ed., *USAF Research and Development* (Washington, DC: Office of Air Force History, 1990) p. 105. Regarding priority, GOR No. 80 of March 16, 1955, specified a date of "operational availability" for the military satellites in the mid 1960s, a date that bespoke a low priority and bracketed this system to follow the U-2. Certainly, the first military spaceflights would trail by many months those of the scientific satellites. IGY space program priorities considered in "Memorandum of Discussion at the 285d Meeting of the National Security Council, Washington, May 3, 1956," in *Volume XI* [343], pp. 740-41.

53. *USAF Space Programs, 1945-1962, Volume I* (USAF Historical Division Liaison Office, October 1962), p. 18. The historian added: "...it was apparent that the possible political repercussions arising from use of a military space vehicle were causing concern." On the West Coast, Schriever complained vigorously. The next year, in 1957, he declared, "I finally got $10 million [for WS 117L] from Don Quarles, who was Secretary of the Air Force, with instructions that we could not use that money in any way except component development. No systems work whatsoever. $10 million!" Schriever comments in *USAF Research and Development*, pp. 105-106. The Quarles' stricture remained in effect for nearly an entire year, and was not lifted until September 1957.

"A 'damn orange' up in the air," he snapped to confidants. In May 1957, as costs to build and launch the original six IGY vehicles soared from an estimated $20 million to $100 million, he told Eisenhower that Earth satellites, whatever their merit, "had too many promoters and no bankers."[54] [II-12] Donald Quarles, named Deputy Secretary of Defense one month earlier, nonetheless supported the U.S. IGY satellite effort while he kept an eye on related developments in the U.S.S.R. At his request near the end of June, CIA Director Allen Dulles assessed recent Soviet hints of an impending satellite launch. "The U.S. [intelligence] community," Dulles advised, "estimates that for prestige and psychological factors, the U.S.S.R. would endeavor to be the first in launching an earth satellite." Moreover, he said, it "probably is capable of launching a satellite in 1957."[55] [II-13] However accurate the CIA assessment might be, advocates of the WS 117L program found themselves unable to secure active support within the administration, and in July the Defense Department imposed sharp spending limits that effectively constrained their work to the "study level."[56]

This state of affairs changed dramatically a few months later, in October-November 1957, after the Soviet Union launched Sputniks I and II. Despite presidential assurances, the Soviet space accomplishments fueled a national debate over U.S. defense and science policies.[57] [II-14, II-15] Having downplayed the space program for purposes of their own, Eisenhower and his advisors underestimated the psychological shock value of the satellites that RAND had identified, the Technological Capabilities Panel had acknowledged, and the National Security Council had underscored just a few years before. What began as an evenly, if slowly paced, research and development effort was soon to receive high priority.[58]

Sputniks I and II, with their "Pearl Harbor" effect on public opinion, introduced into space affairs the issues of national pride and international prestige. The administration now moved quickly to restore confidence at home and prestige abroad. The Defense Department authorized the Army to launch a scientific satellite as a backup to the National Science Foundation-Navy Vanguard Project, and the president created the Advanced Research Projects Agency (ARPA), assigning it temporary responsibility for directing all U.S. space projects. James Killian, recently named Science Advisor to the President, also changed his mind. More funds were made available to the military space program, and in early 1958 the administration approved launching these satellites sooner with Thor IRBM boosters. Secretary of Defense Neil McElroy, who succeeded Charles Wilson in Sputnik's aftermath, ordered ARPA to launch space vehicles to "provide a closer look at the moon."[59]

54. Wilson as quoted by Harr, "Eisenhower's Approach to National Security Decision Making," p. 96, and as quoted in "Memorandum of Discussion at the 322d Meeting of the National Security Council, Washington, May 10, 1957," in *Volume XI* [345], p. 752.

55. Allen W. Dulles, Director of Central Intelligence, to The Honorable Donald Quarles, Deputy Secretary of Defense, July 5, 1957, Eisenhower Library.

56. Quarles subsequently drew congressional fire for also restricting the flow of funds to the high-priority missile program. See "Quarles on the Spot," in *Washington Roundup, Aviation Week*, October 28, 1957, p. 25.

57. In his first news conference after the launch of Sputnik I on October 9, 1957, President Eisenhower let slip his true interest in the event, though it went unnoticed in the excitement of the day. "From what they say they have put one small ball in the air," the President declared, adding, "at this moment you [don't] have to fear the intelligence aspects of this." *Public Papers of the Presidents of the United States: Dwight David Eisenhower, 1957* (Washington DC: U.S. Government Printing Office, 1958), p. 724.

58. Eisenhower's advisors had anticipated the launch of a Soviet satellite before the United States, and the Operations Coordinating Board, established within the structure of the National Security Council by Executive Order 10700, February 25, 1957, had prepared a contingency statement to be handled by the National Academy of Sciences. See Operations Coordinating Board, "Memorandum of Meeting: Working Group on Certain Aspects of NSC 5520 (Earth Satellite), Fourth Meeting held 3:30 P.M., June 17, 1957, Room 357 Executive Office Building," and attachment: "Contingency Statement; Proposed Statement by Dr. Detlev W. Bronk, President of the National Academy of Sciences, in the Event the U.S.S.R. Announces Plans for or the Actual Launching of an Earth Satellite," NASA Historical Reference Collection; Herbert F. York, *Race to Oblivion* (New York: Simon and Schuster, Clarion Book, 1970), pp. 106, 146.

59. Defense Secretary Wilson had announced plans to resign before the launch of Sputnik I. These actions and events are described in National Security Council (NSC) Action No. 1846, January 22, 1958, as cited in National Security Council, NSC 5814/1, "Preliminary U.S. Policy on Outer Space," August 18, 1958, p. 20; Mosely, *Dulles: A Biography of Eleanor, Allen, and John Foster Dulles*, p. 432; Prados, *The Soviet Estimate*, pp. 106-107; DOD News Release No. 288-58, March 27, 1958; see also ARPA Orders No. 1-58 and 2-58, March 27, 1958, all in NASA Historical Reference Collection. The new satellite project is described by Kistiakowsky in *A Scientist at the White House*, p. 378.

There was an undeniable public concern with Soviet leadership in outer space exploration. Eisenhower declared on April 2, 1958, that a unified national space agency had to be established.[60] Few disagreed, certainly not the U.S. scientists who had begun to seriously consider the future of research in space, the prospects for obtaining more federal funds for this activity, and the ways of organizing it within the government.[61] [II-16] During the subsequent dialogue and in legislative action, the nation's political leaders endorsed the president's choice of civilian control of expanded U.S. space activities. Except for national defense space operations, for which the Department of Defense remained responsible, the National Aeronautics and Space Act declared that all non-military aeronautical and space endeavors sponsored by the United States would be directed by a civilian agency guided by eight objectives. First among them was basic scientific research, defined as "the expansion of human knowledge of phenomena in the atmosphere and space...." Signed into law by President Eisenhower on July 29, the act wrote a broad and comprehensive mandate for the peaceful pursuit of new knowledge and accompanying technology in space.[62] [II-17]

The National Aeronautics and Space Administration (NASA), formed with the National Advisory Committee for Aeronautics (NACA) as its nucleus, began operating on October 1, 1958, with the ongoing scientific satellite and planetary exploration projects inherited from the National Science Foundation and ARPA. Air Force and other service leaders, limited exclusively to approved military space missions, still had to translate existing plans into functioning systems. Those military satellite projects already underway and projected at the end of 1958 formed the basic military space program.[63] It encompassed five functional areas and, with one exception, consisted of non-piloted military spaceflight projects (see Table 1).[64] In years to come, the Air Force would for the most part retain responsibility for technically managing and launching military spacecraft. Operational direction of the individual projects frequently was assigned elsewhere.[65]

60. Robert Vexler, ed., *Dwight D. Eisenhower, 1880-1969, Chronology, Documents, Bibliographical Aids* (Dobbs Ferry, NY: Oceana Publications, Inc., 1972), p. 42. NASA's enabling act was drafted by the NACA General Counsel Paul G. Dembling in January-February 1958. Endorsed by James Killian and other White House officials, and submitted to Congress by the President on April 2, the act passed essentially as first drawn—with the addition of a National Aeronautics and Space Council perhaps the most notable change. In recent years, however, some scholars have argued that congressional agitation forced the issue of a civil space agency on a reluctant president. See, for example, Derek W. Elliott, "Finding an Appropriate Commitment: Space Policy Development Under Eisenhower and Kennedy, 1954-1963," Ph.D. dissertation, The George Washington University, May 10, 1992.

61. See Chapter Four of this volume for a discussion of the debate over organizing the space agency.

62. National Aeronautics and Space Act of 1958, Sec. 102(a) and 102(c); Frank W. Anderson, Jr., *Orders of Magnitude: A History of NACA and NASA, 1915-1980* (Washington, DC: NASA SP-4401, 1981), p. 17; Maier, in Kistiakowsky, *A Scientist at the White House*, pp. xxxviii-xxxxix. An elucidation of the reasons for and objectives of using and exploring space are contained in a contemporary brochure issued by the President's Science Advisory Committee, "Introduction to Outer Space," March 26, 1958, NASA Historical Reference Collection.

63. Various Air Force officials, it is true, attempting to gain responsibility for directing the nation's space program in 1958, did graft to this basic plan and present to Congress all sorts of exotic space proposals, including manned and unmanned orbital bombardment systems and even lunar military bases from which to attack countries on Earth. Besides flying in the face of stated administration commitments to explore and use outer space for peaceful and defensive purposes only, these proposals gained few adherents other than those who already viewed the Soviet sputniks with unalloyed hysteria.

64. This program plan, it is also true, does not appear in this form in contemporary documents. The proposed manned rocket bomber (ROBO), later called Dyna-Soar (X-20), remained the sole exception to space robotics and in research and development until canceled in the early 1960s. Notwithstanding the variations that marked it afterward, the 1958 plan featured automated spacecraft and reflects the basic American military space program in effect today.

65. Neil McElroy, Secretary of Defense, Memorandum to Chairman of the Joint Chiefs of Staff, "Responsibility for Space Systems," September 18, 1959, in Alice C. Cole, *et. al.*, eds., *The Department of Defense: Documents on Establishment and Organization* (Washington DC: Office of the Secretary of Defense, 1978), p. 325; also DOD Directive No. 5160.32, "Development of Space Systems," March 6, 1961, as reprinted in *Ibid.*

Table 1

Military Space Program Plan
(November 1958)

Functions	*Projects*
Navigation	Transit navigation satellite system; assigned to the Navy on May 9, 1960
Meteorology	Tiros television (RCA) satellite system assigned to NASA; military system proposed, but held to studies while negotiations for a single civil-military system were underway with NASA and the Department of Commerce (Weather Bureau)
Communication	Courier active (repeater) strategic and tactical communication satellite system; assigned to the Army on September 15, 1960
Missile Detection and Space Defense	Infrared radiometers that detect focused [redacted] heat sources (Missile Detection and Alarm—MIDAS)
	Detection of nuclear detonations (Vela Hotel)
	Satellite inspector
	ROBO/Dyna-Soar (X-20)
	Radar tracking of Earth satellites (SPASUR/SPADATS)
	Optical tracking of satellites (from IGY Baker-Nunn system)
	Distant Early Warning (DEW) radar net and, by the early 1960s, the Ballistic Missile Early Warning System (BMEWS) radar net
Reconnaissance	Other automated satellites

Making Straight the Way

When NASA opened for business in October 1958, periodic U-2 flights over limited areas of the U.S.S.R. had been underway for two years. The Soviets protested vigorously, albeit privately, through diplomatic channels, and administration leaders knew that improved ground-to-air missiles would soon preclude all such missions.[66] Late in the year, President Eisenhower officially notified the Russians once again that the United States specifically sought to allay fears of surprise attack and create an inspection system to supervise arms-reduction agreements by means of aerial *and* space observation. He did so by

66. Eisenhower himself viewed these overflights in Soviet airspace as exceptionally provocative and a grave violation of national sovereignty; before personally approving each mission, he had to be convinced of the overriding need for it.

submitting a third, much more significant Open Skies proposal at an extraordinary "Surprise Attack Conference" sponsored by the United Nations in Geneva.[67]

Making his proposal the more remarkable, Eisenhower authorized his representatives, William C. Foster, later head of the Arms Control and Disarmament Agency, and Harvard chemist George Kistiakowsky, to include a "sanitized" version of the threat-and-warning portions of the surprise-attack indications matrix supplied by the National Indications Center. He thus furnished Soviet officials key indicators with which to assess the military status of states in the North Atlantic Treaty Organization—if they had not already devised similar warning indicators independently. The Soviets once again rejected Open Skies, though the U.S. position on the issue was made plain.[68] Even if the Soviets continued to reject the concept in international conference, might not the precepts of international law now be applied to achieve it?

One year earlier, Sputniks I and II had overflown international boundaries without provoking diplomatic protests. Four days after Sputnik I, in fact, Eisenhower and Deputy Secretary of Defense Donald Quarles discussed the issue. Quarles observed: "...the Russians have...done us a good turn, unintentionally, in establishing the concept of freedom of international space.... The President then looked ahead...and asked about a reconnaissance [satellite] vehicle."[69] The U.S. IGY Explorer and Vanguard satellites that followed the first sputniks into orbit in early 1958 likewise transited the world, and again not a single state objected to these overflights. The civil spacecraft would make straight the way for their military counterparts. Testifying before the U.S. House of Representatives in May 1958, Quarles underscored this point for a member of Congress skeptical that the United States should not object to Soviet reconnaissance satellites. "In a military sense," Quarles said, careful to speak only for the Department of Defense, "it seems to me that objects orbiting in outer space have an international character by the very nature of their position there, and it would be inappropriate for us to take the position that what you could see from there of our area would be improper for them to see.... I just think we cannot establish that kind of position that these [military satellites] are improper or objectionable or offensive. So I would have the view that we would not seek to object to such reconnaissance."[70] This tenuous "freedom of space" principle, the right of unrestricted overflight in outer space, the evidence indicates President Eisenhower purposely sought to exploit and codify when he signed the 1958 Space Act. That signature formally divided U.S. astronautics between civilian science and military applications directed to "peaceful"—that is, scientific—or defensive and nonaggressive purposes.

67. The second proposal Eisenhower submitted directly to Nikolai A. Bulganin, Chairman of the Soviet Council of Ministers, on March 2, 1956, eight months after the original proposal in Geneva. In it, Eisenhower agreed to accept on-site inspection teams if the Soviets would accept Open Skies. It, too, was rejected. See Ambrose, *Eisenhower: Volume II*, p. 311.

68. Annex 5 and Annex 6 of "Report of the Conference of Experts for the Study of Possible Measures Which Might be Helpful in Preventing Surprise Attack and for the Preparation of a Report Thereon to Government," United Nations General Assembly, A/4078, S/4145, January 5, 1959; William C. Foster, "Official Report of the United States Delegation to the Conference of Experts for the Study of Possible Measures Which Might be Helpful in Preventing Surprise Attack and for the Preparation of a Report Thereon to Governments," Geneva, Switzerland, November 10-December 18, 1958, p. 10, Eisenhower Library.

69. Quarles and Eisenhower remarks quoted in Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, Inc., 1985), p. 134; an abridged version, less the reference to military satellites, appears in "Memorandum of a Conference, President's Office, White House, Washington, October 8, 1957, 8:30 a.m.," *Volume XI* [347], pp. 755-56. Walter McDougall and Stephen Ambrose, without access to classified documents, correctly perceived the intent of Eisenhower's satellite decision and the rationale behind it. McDougall, *The Heavens and the Earth*, chapter 5; Ambrose, *Eisenhower: Volume II*, pp. 428, 513-14. Quarles, architect of the nation's space policy, reiterated for administration leaders the importance of the principle "freedom of space" and its implications for military observation satellites at a meeting of the National Security Council on October 10, 1957, in *Volume XI* [348], p. 759.

70. U.S. Congress, House, Select Committee on Astronautics and Space Exploration, *Astronautics and Space Exploration*, 85th Cong., 2d sess. (Washington, DC: U.S. Government Printing Office, 1958), p. 1109.

President Eisenhower amplified his space policy with National Security Council directives in June and August 1958 and January 1960. Anticipating the launch of military satellites, the first directive called for a "political framework which will place the uses of U.S. reconnaissance satellites in a political and psychological context most favorable to the United States." The second directive judged these spacecraft to be of "critical importance to U.S. national security," identified them with the peaceful uses of outer space, and set as an objective the "'opening up' of the Soviet Bloc through improved intelligence and programs of scientific cooperation." The third directive described the military support missions in space that fell within the rubric of peaceful uses, identified offensive space-weapon systems for study, and noted a positive political milestone in international law. The United Nations *Ad Hoc* Committee on the Peaceful Uses of Outer Space now accepted the "permissibility of the launching and flight of space vehicles...regardless of what territory they passed over during the course of their flight through outer space." But the UN Committee, the directive confided, at the same time stipulated that this principle pertained only to flights involved in the "peaceful uses of outer space."[71] [II-18, II-19, II-20, II-21]

Hewing to the policy of "freedom of space" and the peaceful space activities they defined for it, Eisenhower administration officials would in the months ahead permit only the study of offensive space weapons such as space-based antiballistic missile systems, satellite interceptors, and orbital bombers that could threaten the precedent of free passage.[72] This space policy, endorsed by President Eisenhower's successor, John F. Kennedy, secured two objectives simultaneously and permitted the launch and operation of military reconnaissance spacecraft. First, it reinforced the "sputnik precedent" as an accepted principle among states, officially recognizing free access to and unimpeded passage through outer space for peaceful purposes. [II-22] Second, by limiting military spacefaring to defense-support functions, it avoided a direct confrontation with the Soviet Union over observation of the Earth from space and ensured at least an opportunity to achieve Open Skies at altitudes above the territorial airspace of nation states. Thus, without formal convention, the United States could fashion unilaterally an "inspection system" to forewarn of surprise attack and supervise and verify future arms-reduction and nuclear-test-ban treaties.

But if the IGY scientific satellites had set an international precedent, and if publicly the United States was committed to a visible space program under civilian management, at the end of 1958 the actual launch and operation of military spacecraft had still to test President Eisenhower's policy—and Soviet reaction.

71. NSC 5814, "U.S. Policy on Outer Space," June 20, 1958, paragraph 54; NSC 5814/1, "Preliminary U.S. Policy on Outer Space," August 18, 1958, paragraphs 21, 30, and 47; NSC 5918, "U.S. Policy on Outer Space," December 17, 1959, paragraphs 18, 19, and 23.

72. The administration's rationale in opposing anything more than the study of space-based weapons is explained in Kistiakowsky, *A Scientist at the White House*, pp. 229-30, 239-40, and 245-46. A few days after the launch of Sputnik I, having just discussed this rationale with Eisenhower, Deputy Secretary of Defense Donald Quarles surprised and chagrined Air Force leaders who briefed him on the military satellite program and the potential of satellites for offensive applications: "Mr Quarles took very strong and specific exception to the inclusion in the presentation of any thoughts on the use of a satellite as a (nuclear) weapons carrier and stated that the Air Force was out of line in advancing this as a possible application of the satellite. He verbally directed that any such applications not be considered further in Air Force planning. Although both General [Curtis] LeMay and General [Donald] Putt voiced objection to this...on the grounds that we had no assurance that the U.S.S.R. would not explore this potential of satellites and could be expected to do so, Mr. Quarles remained adamant." Colonel F. C. E. Oder, USAF, Director, WS 117L, Memorandum for the Record, "Briefing of Deputy Secretary of Defense Mr. Quarles on WS 117L on 16 October 1957," October 25, 1957, Eisenhower Library.

Amplifying administration policy a year later, on October 20, 1958, ARPA Director Roy Johnson ordered the Air Force to cease using the Weapon System (WS) designation in the military satellite program "to minimize the aggressive international implications of overflight.... It is desired to emphasize the defensive, surprise-prevention aspects of the system. This change...should reduce the effectiveness of possible diplomatic protest against peacetime employment." Roy Johnson, Director, ARPA, to Maj. General Bernard Schriever, Cmdr., Air Force Ballistic Missile Division, Air Research and Development Command, n.s., October 20, 1958, Eisenhower Library. Despite these and subsequent messages that canceled offensive space-based, weapon-research programs, Air Force military leaders at that time seemed unable to grasp—or unwilling to accept—the meaning of President Eisenhower's "peaceful uses of outer space," or the rationale behind it.

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What is Past is Prologue
—*Shakespeare, The Tempest*

The Eisenhower Administration and the Cold War

Framing American Astronautics to Serve National Security

By R. Cargill Hall

In 1991 the Soviet Union, like the Berlin Wall before it, was suddenly and unexpectedly pulled down, replaced by a much weaker Commonwealth of Independent States. The cold war abruptly ended. After forty-five years of uneasy nuclear stalemate and the ever-present threat of an end to "modern civilization," the United States of America entered a new and uncertain era. If the United States and its Western allies emerged triumphant in this prolonged contest with communist ideology and its planned economy, they owed that triumph in large measure to a single American military and political leader: Dwight D. Eisenhower.

The cold war, which found the Western powers confronting the Soviet Union in occupied East Germany and the Eastern European states, began in 1946–1947 with the unraveling of the World War II alliance against the Axis powers. Western leaders could debate whether continued Soviet occupation of Eastern Europe represented an attempt to create a *cordon sanitaire* and thus secure its western periphery against attack or whether it signaled an attempt overtly to impose its totalitarian political system in every possible nation. The answer soon appeared certain: In Poland, a communist-controlled government assumed full power in 1947; a few months later, in February 1948, a communist coup in Prague ended the independence of Czechoslovakia. In June of that year, Soviet troops sealed the German capital city of Berlin to surface transport, prompting in response from the Western powers the successful "Berlin Airlift." Communist insurgency in nearby Greece and Turkey was met with the Truman Doctrine—direct American aid and support for the governments of these states.

Tensions increased further in 1949, when the Soviet Union tested a nuclear device, ending a United States monopoly of these terrible weapons. But perhaps the greatest shock occurred with the victory of Chinese communism in 1949 and the North Korean surprise attack

Soviet Premier Nikita Khrushchev presenting President Dwight D. Eisenhower with a replica of the Soviet sphere that landed on the moon, 1959.

against South Korea in 1950. American leaders now perceived the Soviet Union to be rapidly expanding its influence, intent on ensuring its ideology prevailed around the world. When in January 1953 Dwight David Eisenhower took the oath of office as the thirty-fourth President of the United States, he faced a sobering political and military situation worldwide. Surveying the challenges, he reflected:

> Two wars, with the United States deeply engaged in one, and vitally concerned in the other [in Indochina], were raging in Eastern Asia; Iran seemed to be almost ready to fall into Communist hands; the NATO Alliance had as yet found no positive way to mobilize into its defenses the latent strength of West Germany; Red China seemed increasingly bent on using force to advance its boundaries; Austria was still an occupied country, and Soviet intransigence was keeping it so. European economies were not yet recovered from the effects of World War II. Communism was striving to establish its first beachhead in the Americas by gaining control of Guatemala.[1]

To counter the extraordinary military and political threats posed by the USSR, between 1953 and 1961 Eisenhower and his lieutenants sought international agreements to ban, or at least limit with confidence, nuclear tests and nuclear weapons that might be monitored with onsite or overflight inspection. To help preclude a Soviet nuclear surprise attack on the Western powers, they selected and approved for development remarkable technical systems that could collect *reliable* intelligence about the military capabilities and the actual disposition of Soviet forces. At the same time, they approved development of new intercontinental weapon systems, reordered United States military strategy, revised the country's intelligence apparatus, and encouraged studies and established new organizations for purveying propaganda behind the Iron Curtain. Finally, and perhaps ultimately most crucial to this agenda, they fashioned the national policy and framed all of the organizations needed to guide and execute a new enterprise called astronautics. This last set of actions, as their authors intended and as the course of the cold war substantiated, contributed enormously to the nation's security and the maintenance of a delicate peace with the Soviet Union.

Eisenhower, Supreme Commander of Allied Expeditionary Forces, with Gen. Bernard Montgomery and Air Chief Marshal Arthur Tedder in Normandy, 1944.

The Cold War and American Astronautics

Because the "space age" began amid the superpower tensions of the 1950s, the tone, tempo, and direction of America's astronautical enterprise would be impressed with a near-indelible cold war seal. (Indeed, so indelible was it that when the cold war ended, NASA and other Eisenhower-fashioned space organizations in the 1990s would grapple internally to change that seal and revalidate their reason for existence!) On assuming the presidency in 1953, Eisenhower doubtless knew little about astronautics. His attention riveted on ending the Korean war, on ways to forestall or counter a Soviet surprise attack on the United States, and on international agreements to reduce the construction and testing of nuclear weapons. Besides these immediate concerns and an unusual commitment to duty and country, other basic perceptions and values also shaped this man and the outlook he brought with him to the Oval Office; they, too, affected profoundly the way American astronautics and space policy would unfold.

A fiscal conservative, Eisenhower believed the nation had to avoid mindless military expenditures to thwart every possible communist contingency. America, he was sure, could not survive both as a democracy and as "a garrison state." Furthermore, should fearmongers provoke a movement toward the latter outcome, he worried the country would spend enormous sums on credit, mortgage its existence to defeat communism, and by so doing, perhaps win the battle but ultimately lose the struggle. As a West Point graduate, career officer, and Supreme Commander of Allied Expeditionary Forces in Europe during World War II, Eisenhower well understood the military and its parochial interests. He also knew that the appropriate level of

military preparedness to combat a specific threat could only be determined with certainty through first-class intelligence.[2] The new President had been privy to just that kind of wartime intelligence made possible through aerial reconnaissance and ULTRA radio communication intercepts and decryption. The highly secret ULTRA program and its product, known only to a select few Allied commanders, in the 1950s still remained among the least known and darkest of wartime successes. (The ULTRA program would not even become public knowledge for another twenty years, until the 1970s.[3]) Of course, one could attempt to intercept radio messages in or take pictures of the Soviet Union from beyond its borders, but the aerial overflight of hostile foreign territory to collect this intelligence was denied by international treaty in peacetime. Moreover, intelligence agents inserted behind the Iron Curtain in the 1950s worked in a closed society where everyone's activity was scrutinized; they met with scant success, returning questionable data that most often could not be verified.

In executing key elements of the administration's defense agenda in the 1950s, Eisenhower and his advisers would adopt compartmented wartime security procedures: once again only a select few Americans, those who absolutely had to be informed, would be "witting" of the entire enterprise. More advanced technology clearly was needed for national defense and intelligence programs to counter the Soviet threat; in choosing that technology, President Eisenhower relied heavily on the counsel of a small group of important advisers. They were Donald A. Quarles, his assistant secretary of defense for research and development (later secretary of the air force and deputy secretary of defense); James R. Killian, Jr., president of MIT (later his science adviser); Edwin H. (Din) Land, inventor of the Polaroid instant camera; William O. Baker, Bell Laboratories research chemist; Edward M. Purcell, Harvard atomic physicist and Nobel laureate; James G. Baker, Harvard physicist and optics specialist; and George B. Kistiakowsky, Harvard chemist. These men, a few other scientists on presidential boards, and the Dulles brothers at the State Department and CIA among other cabinet officers, appear to have been the principals in whom the President confided and with whom he shared knowledge of the most tightly controlled programs. Among those programs were the activities of the Operations Control Board, the National Indications Center and National Watch Committee, and the Surprise Attack Panel, or Technological Capabilities Panel (TCP) as it was subsequently known and chaired by Killian. All of these organizations Eisenhower established in 1953 and 1954.

Within months of assuming office, the new President reordered and streamlined those agencies responsible for conveying word about America behind the Iron Curtain. He removed the International Information Administration from the Department of State and reorganized it as the U.S. Information Agency. He combined the functions of President Harry Truman's Psychological Strategy Board and Psychological Operations Coordinating Committee into a single new entity with the innocuous name of Operations Coordinating Board (OCB). Chaired by a ranking State Department official, the OCB reported to the National Security Council. Its September 2, 1953, charter charged the OCB with coordinating all "overseas information and psychological warfare activities" of the U.S. government.[4]

Within eighteen months, on July 1, 1954, Eisenhower established the National Indications Center for the express purpose of "preventing strategic surprise." This center, chaired by the deputy director of central intelligence and composed of specialists drawn from U.S. intelligence agencies, the Department of Defense, and the Department of State, formed the interagency staff of the National Watch Committee, which consisted of presidential confidants such as the secretaries of state and defense and the director of central intelligence (DCI).[5] The National Indications Center assayed the military, economic, and social demands involved in mounting a surprise attack and issued a weekly "watch report" to

On November 15, 1957, James R. Killian was sworn in as the President's science adviser by Sherman Adams.

the watch committee members.[6] Staffers expanded an indications list composed of key indicators developed earlier under the direction of James J. Hitchcock in the CIA and applied it to developments that would presage surprise attack in the nuclear age. That is, presuming rational political leadership, one state intending to attack another would need to prepare carefully, say, by dispersing its industry and population many months in advance and deploying its military forces on land and sea just days or hours before "M-Day." Therefore the proper intelligence "indicators" applied against this matrix would yield readily identifiable signals, much like a traffic light: green—normal activity; amber—caution; red—warning. These strategic warning indicators, eventually linked to "defense conditions" (DEFCON 5 through 1), enabled American leaders to mobilize resources and establish force readiness postures. The military, economic, and technical indicators in this matrix successfully predicted the Suez war in 1956 and have been monitored and reported in one form or another to National Command Authorities ever since.[7]

In March 1954 President Eisenhower attended a plenary session of the Office of Defense Mobilization's Science Advisory Committee, where he disclosed to attendees the existence of the Soviet Myacheslav-4 intercontinental BISON bombers and the threat they represented if directed against the United States in a nuclear surprise attack. He challenged the scientists to advise him of the new technologies that might be employed to prevent or forestall such an event. James Killian, with whom the President had become acquainted in the late 1940s when Eisenhower served as president of Columbia University, offered to form a panel for that purpose. On July 26 Eisenhower authorized the study. In doing so, he gave to Killian and "his panel of mostly civilian scientists 'carte blanche' to see ALL of the nation's military and intelligence secrets"—a mandate that provoked a collective shudder throughout the affected government organizations, organizations long accustomed to guarding and withholding information from outsiders.[8] Killian organized the TCP membership (forty-one scientists, engineers, and military communications experts) to examine three aspects of national security: Project One—Continental Defense, Project Two—Striking Power, and Project Three—Intelligence Capabilities, with supporting studies of technical manpower and communications.[9]

Din Land led the TCP's Project Three Intelligence Panel. It consisted of only six members, including Land, and focused on breaching the wall of secrecy that perhaps veiled Soviet preparations for a surprise atomic attack on the United States. In November 1954 Land and Killian conferred with President Eisenhower and secured his approval to build the jet-powered U-2 reconnaissance sailplane that could overfly restricted regions at extreme altitudes, even though, in international law, each state was accorded absolute national sovereignty in the airspace above it.[10] For a variety of reasons, not the least of which was secrecy, Eisenhower assigned the project to the CIA. Though national security might demand it, violating Soviet national sovereignty with unauthorized overflights threatened the gravest of consequences should a U-2 ever be detected and shot down. The two-volume TCP final report issued in February 1955 thus contained not a word about the U-2; discussion of it appeared only in a special annex prepared for the White House. At the White House, that most secret program was known but to four persons and, across the nation before May 1960, to fewer than 400 persons including the airplanes' mechanics and pilots. As Karl Harr later observed, the U-2 did not even appear as an agenda item in National Security Council deliberations until it "tore its britches."[11] The intelligence section of the TCP final report, however, did recommend beginning a scientific Earth satellite project that might establish the principle of "freedom of space" in international law and the right of overflight in that new domain "above" a nation's airspace.

Edwin H. "Din" Land led the TCP's Project Three Intelligence Panel. Sketch by Samuel Johnson Woolf.

Space Missions and Legal Principles

The genesis of America's military and civil space programs that surfaced during the Eisenhower administration is well explored in a variety of publications.[12] What is little known is the relationship of these programs to the administration's efforts at "opening up" the Soviet Union using technology that would keep this nation safe from a sneak atomic attack. Because of contemporary ULTRA-like security restrictions associated with some aspects of them, the relationship of these programs to each other still is not entirely understood, although the general outline is now declassified and has begun to appear in the open literature. Based primarily on studies contracted with The RAND Corporation, the United States Air Force in early 1955 solicited from industry proposals to design and build a collection of related military satellites, among them re-

connaissance vehicles. Other American scientists and engineers, meanwhile, proposed building and launching Earth satellites as part of the U.S. contribution to the International Geophysical Year (IGY), planned by the International Council of Scientific Unions to take place from July 1, 1957, through December 31, 1958.

In early 1955 all of the scientific satellite proposals landed by design on the desk of the assistant secretary of defense for R&D, Donald Quarles. Aware of the U-2 program and convinced that the TCP report's freedom of space thesis was crucial for the future of American intelligence, Quarles in late February privately urged the U.S. National Committee for the IGY in the National Academy of Sciences to request formally a scientific satellite project, which it did.[13] That request, made by a nongovernmental scientific group, passed through the director of the National Science Foundation, then, as intended, back to Quarles for review in the Defense Department. In April the assistant secretary referred all of the IGY scientific satellite proposals to his Advisory Group on Special Capabilities and asked that it recommend a preferred project. During Quarles's absence from Washington in early May, but apparently with his approval, the director of the National Science Foundation, Alan Waterman, met with the director of the Central Intelligence Agency (DCI), Allen Dulles, and director of the U-2 initiative (code-named Project AQUATONE), Richard M. Bissell, Jr., to discuss how best to proceed with "this item [previously] presented to the National Security Council in the Killian [TCP] Report, which has been transferred to the Department of Defense for comment."[14] On his return, Quarles acted on their advice. On May 20 he submitted directly to the National Security Council a proposal for launching an IGY satellite and the national policy to guide this activity. Meeting on May 26, 1955, the NSC endorsed Quarles's recommendation for an IGY scientific satellite project. This recommendation emphasized the peaceful purposes of the endeavor, but the project was intended to establish the principle in international law of freedom of space and the right of unimpeded overflight that went with it. The next day, "after sleeping on it," Eisenhower approved the project and the proposed space policy.[15]

> In accordance with our conversation before you left for Europe, I discussed the subject with Allen Dulles, with Richard Bissell present, the latter being the one in Central Intelligence who is following this closely. My question to them was how best to proceed in this matter. There appear to be two alternatives:
>
> (a) Take advantage of the fact that this item was presented to the National Security Council in the Killian Report, which has been referred to the Department of Defense for comment.
>
> (b) Present the plan to the National Security Council directly.
>
> It was agreed important to move promptly. In view of (a) above, in your absence Dulles volunteered to present the subject to the Operations Coordinating Board in order to get action started. From the position of the Department of State, which I knew at that time, it was evident that State did not wish to initiate further formal action and neither did Central Intelligence. The general conclusion was that you and I should work this out.

This part of Alan Waterman's May 13, 1955, memo to Donald Quarles summarized his discussion of IGY satellite proposals with Allen Dulles and Richard Bissell.

A few weeks later, on July 21, 1955, with the first test flight of a U-2 near at hand, President Eisenhower broached a new disarmament proposal at the four-power summit conference in Geneva, Switzerland. Prepared by Eisenhower's special assistant Harold Stassen, the proposal incorporated the arms control concepts of Richard S. Leghorn, World War II commander of the Army Air Forces 67th Reconnaissance Group. It called on each superpower to provide facilities to the other country for aerial photography and to conduct mutually supervised reconnaissance overflights in each nation's airspace.[16] Eventually known as the "Open Skies Doctrine" after Eisenhower proposed this novel approach for eliminating fear of surprise attacks,[17] it was summarily and immediately rejected by the Soviet leadership as an obvious ploy to acquire targeting data. Back in the United States a few days later, on July 29, the President publicly announced plans for launching "small unmanned, Earth circling satellites as part of the U.S. participation in the International Geophysical Year." In assigning to the National Science Foundation responsibility for directing the project, his statement avoided any mention of its underlying, covert purpose of setting in international law the precedent "freedom of space."[18]

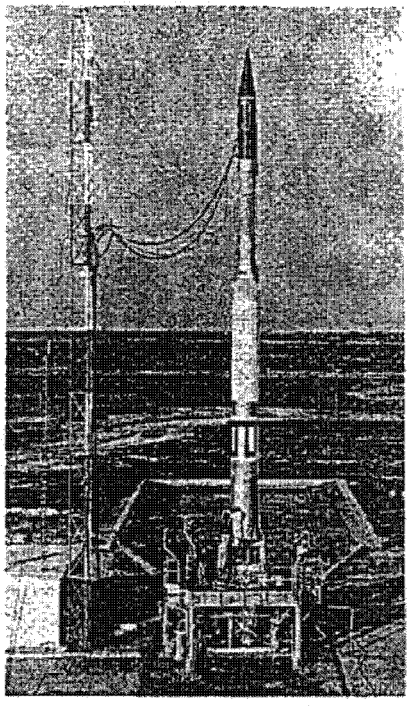
In the Department of Defense, Quarles's Advisory Group on Special Capabilities completed its evaluation of scientific Earth satellites and in early August 1955 recommended the navy's Vanguard proposal, which employed as a launcher the Naval Research Laboratory's Viking sounding rocket instead of the army's Orbiter proposal, which featured as its launcher a military ballistic rocket called Redstone. Approved by the Defense Department policy council, America's now-official IGY satellite project publicly claimed two primary objectives: to place at least one satellite in orbit around the Earth during the IGY and to accomplish one scientific experiment. Though aware of expressed Soviet intentions to also launch an Earth satellite during the IGY and of the potential ill effects of being the second power into space, administration leaders made no serious efforts in the months that followed to alter the priority assigned the Vanguard Project or accelerate it in a "race" for space with the Soviets. Indeed, no significant changes were made in Vanguard funding or schedules even in the summer of 1957, when DCI

Allen Dulles advised Quarles, now secretary of the air force, that the Soviets probably would launch a satellite before the end of the year.[19]

This apparent failure to change the course of America's IGY satellite project after receiving advance warning of Soviet astronautical efforts has prompted considerable speculation in recent years. At a meeting not long ago, John Logsdon reflected,."perhaps it was Eisenhower's intention all along that the Soviets be first into space!" One cannot rule this out, but all of the available evidence suggests administration leaders, though dismayed at the rising costs of Vanguard, for the most part remained unconcerned whether the Soviets did indeed launch the first satellite.[20] The Operations Coordinating Board had even prepared a congratulatory news release for Detlev Bronk, president of the National Academy of Sciences, to be read in that event, apparently misjudging grievously the blow to national pride that would result from it and the public outcry that would predictably follow.[21] We do know with certainty that Donald Quarles, as secretary of the air force in 1956, withheld spending on the air force military satellite program for anything except design work and that the Defense Department by 1957 expressly prohibited American military leaders from publicly discussing military space activity. This last restriction imposed on those "unwitting" of the true purpose of the IGY satellite program eventually would lead to some inflammatory congressional testimony and bitter comments about Eisenhower and American defense preparedness in published memoirs. Clearly, the administration intended that a scientific satellite, not a military satellite, be the first man-made object to orbit the Earth and that intemperate military members not provoke a worldwide debate on military space flight and thereby jeopardize prospects for international acceptance of the principle "freedom of space."[22]

With President Eisenhower's approval, the first U-2 flight over the Soviet Union occurred on July 4, 1956, exactly fifteen months before the launch of Sputnik I on October 4, 1957.[23] For the President, that first flight could not have come at a more auspicious moment. In America he faced U.S. Air Force leaders and their congressional allies who claimed a "bomber gap" existed between the two countries: the USSR possessed far more intercontinental BISON bombers than the United States had B-52 intercontinental bombers, which were then just beginning to reach service units. They demanded increased military expenditures for more bombers. Likewise, when the Soviets began to test long-range rockets in 1956–1957, a similar refrain about a "missile gap" appeared, accompanied by even greater hysteria in the media. By the time of the world's first satellite launch in late 1957, however, Eisenhower had obtained enough intelligence information from U-2 flights to know that a "bomber gap" did not exist and that the Soviet Union did not command numerous intercontinental ballistic missiles. At least he could so advise his generals and command silence, although he still could not persuade vocal politicians that America was secure and not prostrate before communist military might.[24]

Unquestionably, Eisenhower was nonplussed at the public reaction to Sputniks I and II and did his best to reassure Americans that the country was not at risk mil-



"Vanguard earth satellite launching rocket" readied for a static test, Cape Canaveral, Florida, 1957.

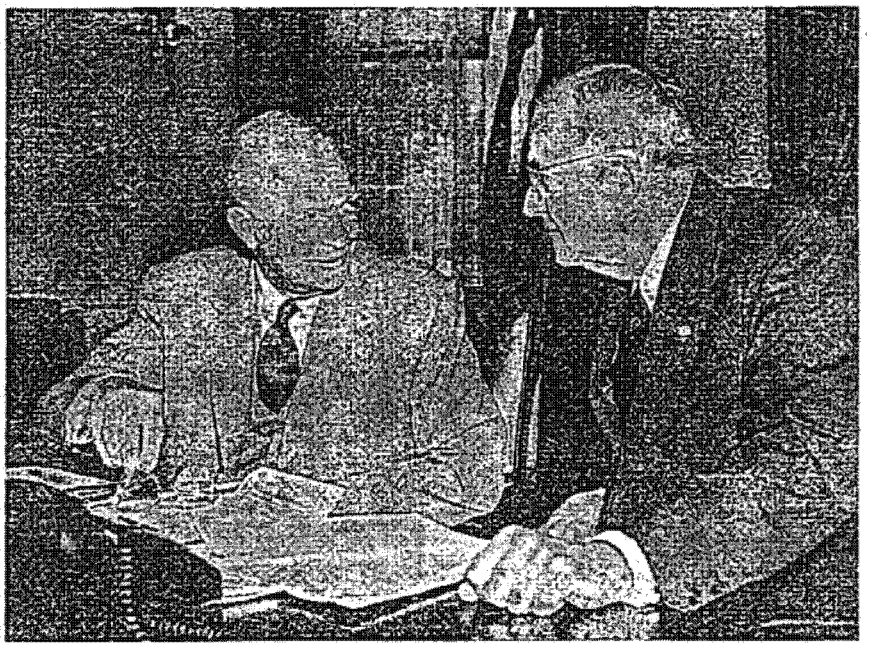
Donald A. Quarles (on right) is sworn in as secretary of the air force, August 15, 1955, one week after selection of Vanguard as the American IGY project.

itarily or in the fields of technology and education. Before delivering a nationwide address from the White House regarding these matters on November 7, 1957, Secretary of State John Foster Dulles pointedly asked the President if it would not now be wise to "disclose tonight that the United States has the capability of photographing the Soviet Union from very high altitudes without interference?"[25] Eisenhower refused. Having already denied these aerial overflights in response to Soviet protests,[26] and whatever the national outcry over Soviet space successes, he could not betray the source of his own confidence without inviting all of the international repercussions later visited on him when a U-2 was shot down. If "unaligned" government leaders around the world had yet to protest the overflight of Soviet airspace by U-2 aircraft in violation of international treaties and of United States' dissembling about it, in late 1957 not one of them protested the overflight of their territories in outer space by Sputnik I or its November successor, Sputnik II. And so enthusiastic were they with their incredible propaganda coup, Soviet leaders *at that moment* neither differentiated between scientific or military satellites nor qualified future flights of these vehicles; they unintentionally collaborated in establishing the precedent "freedom of space" that the President and his advisers quietly sought, a principle tentatively accepted by the United Nations in December 1958 and firmly rooted through custom in international law by the time Eisenhower left office in 1961.

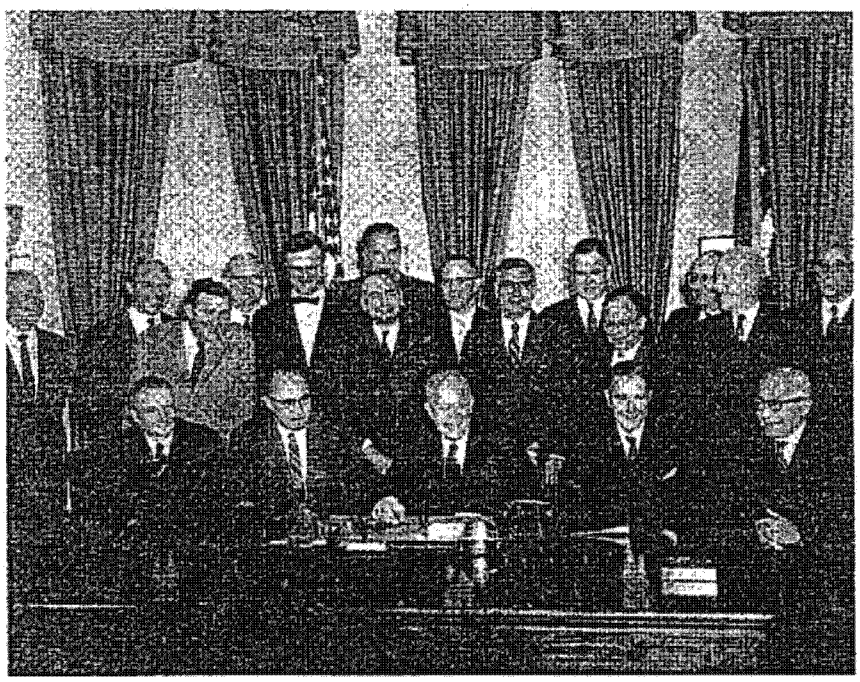
The Space Program Organized for the Cold War

The Pearl Harbor effect of the Soviet space feats on American public opinion prompted a variety of measures from the administration. In his message of November 7, 1957, the President announced the creation of a new post, special assistant for science and technology, and appointed to it longtime confidant James R. Killian. Now brought formally into government service, Killian chaired the newly formed President's Science Advisory Committee (PSAC); thereafter he exerted enormous influence on the manner in which the American space program was structured and conducted. The next day, Secretary of Defense Neil McElroy authorized the army to launch a scientific satellite using its Jupiter military missile, backing up the struggling National Science Foundation Vanguard Project. In January 1958 the President also approved the "highest priority above all others for research and development and for achieving operational capability" for these IGY satellite projects, along with the air force reconnaissance satellite effort then under way at Lockheed facilities in Sunnyvale, California.[27] And in February 1958 the administration established the Advanced Research Projects Agency (ARPA) in the Department of Defense, responsible for initial military research and development before passing a project to one of the services. Pending establishment of a national space agency, ARPA also gained temporary responsibility for managing all of the nation's civil scientific and military space projects.

At the White House, discussions of how best to fashion a national space agency began in earnest in February 1958. With his own interests focused on national security space applications, President Eisenhower was inclined at first to assign all American space endeavors to the Department of Defense. Because of the need to emphasize the peaceful uses of space, expectations that the scientific exploration of space would receive much less attention in the Defense Department, and the importance of conducting America's space program primarily in the open, Killian persuaded Eisenhower that a civilian agency was the better choice and that the National Advisory Committee for Aeronautics (NACA) should serve as the nucleus upon which to build. With the willing assistance of NACA director Hugh L. Dryden, they assigned the task of drafting legislation for the proposed space agency to NACA's general counsel, Paul G. Dembling. His measure, endorsed by Killian and Eisenhower and submitted to Congress on April 2, 1958, passed essentially as first drawn, with the



Eisenhower with Secretary of State J. F. Dulles, 1956. In November 1957 Dulles advised the President to reveal U.S. reconnaissance capability to the public.



President Eisenhower met with members of his Science Advisory Committee at the White House, December 19, 1960.

addition of a National Space Council containing a permanent staff perhaps the most notable change.[28] Except for military space flight, for which the Department of Defense remained responsible, the National Aeronautics and Space Act declared that all nonmilitary aeronautical and space endeavors sponsored by the United States would be directed by a civilian agency guided by eight objectives. First among them was basic scientific research. Signed into law by President Eisenhower on July 29, the act wrote a broad and comprehensive mandate for the peaceful pursuit of new knowledge and accompanying technology in space.

The National Aeronautics and Space Act divided American space activities between civilian space science and applications missions and military defense support missions for which the U.S. Air Force eventually became the lead service. Among the defense support satellite applications were navigation, communication, reconnaissance, detection of nuclear detonations, and missile early warning. To guide these astronautical activities after 1958, the administration amplified the tentative space policy fashioned in May 1955. Besides setting goals for civil and military astronautical activity, national space policy as proposed in June 1958 and as adopted and modified in August 1958 and January 1960 identified reconnaissance satellites "as a means of implementing the 'Open Skies' proposal or policing a system of international armaments control."[29] But reconnaissance satellites, for all practical purposes, still remained in the hands of the military service that first proposed them, with the Strategic Air Command scheduled to direct the operational system. On May 12, 1960, eleven days after the Soviet Union shot down an American U-2 reconnaissance aircraft deep inside its borders, President Eisenhower ordered a halt to all further aerial reconnaissance overflights of Soviet territory.[30] If the critical gap in overhead intelligence was to be spanned at all, reconnaissance satellites would need to serve as the bridge.

During the preceding seven years, Eisenhower and his lieutenants had formulated space policy to help straighten the way for reconnaissance missions to come. They also had significantly altered the organization, information requirements, and functional alignment of U.S. intelligence activities—all of these changes aimed at consolidating control of the apparatus and its output more firmly in the hands of civilian leaders in the executive branch in general and in those of the President in particular.[31] But none of these actions expressly addressed the management and operation of robotic satellites as technical collection instruments. When reconnaissance vehicles in outer space did furnish the kind of vital overhead intelligence formerly supplied by the U-2, how was the enterprise to be ordered and its product processed, analyzed, and distributed to best meet the needs of national defense? With only eight months remaining in his second term, Eisenhower sought immediate answers to these questions in two further reviews of U.S. intelligence operations,

DCI Allen Dulles was one of the President's key advisers on the use of astronautics for national security.

reviews expected to produce recommendations for the National Security Council.

One of the two evaluations addressed the air force reconnaissance satellite effort, then called the SAMOS Project, at that time widely reported in the news media. On June 10, 1960, Eisenhower instructed Secretary of Defense Thomas S. Gates, Jr., to form a small team to examine the SAMOS system, assess the likelihood of its meeting certain national intelligence requirements, and recommend any improvements in its organization or operations. He identified three scientists/engineers as team members: Joseph V. Charyk, under secretary of the air force (formerly air force assistant secretary for research and development), Herbert F. York, newly appointed defense department director of defense research and engineering (formerly director of the University of California's Lawrence Radiation Laboratory), and his own special assistant for science and technology, George B. Kistiakowsky (who had succeeded James Killian the year before).[32] Secretary Gates assigned the work to Kistiakowsky, who pursued the evaluation as time permitted among other duties that summer with the assistance of two PSAC staff members and of Edwin Land's intelligence panel, meanwhile keeping Gates, York, and Charyk informed of his progress and findings.

President Eisenhower's second science adviser, George Kistiakowsky (on far right) reviewed the SAMOS Project in 1960.

Back in February–March 1955, Richard Bissell, the Project AQUATONE director, had requested of Din Land that his TCP intelligence panel continue to serve him as a consultant group on new technical collection systems such as the U-2, which represented a major change in the CIA's way of doing business. CIA director Allen Dulles, a former member of the Office of Strategic Services (OSS) during World War II, much preferred conventional intelligence operations that employed human agents on the Earth equipped with cameras and shortwave radios; in fact, he had accepted the U-2 assignment only after the President insisted that his CIA take charge of it.[33] Bissell, not a technologist himself, needed the Land panel's technical advice, not to mention its support in dealing with his boss, Dulles. Land and his colleagues agreed and served for many years thereafter as unpaid consultants of what eventually became the CIA's Directorate of Science and Technology. To be sure, in 1957 the Land intelligence panel encouraged Bissell and the agency to start work on a U-2 successor, a remarkable airplane that would fly three times the speed of sound at altitudes in excess of 90,000 feet over great distances. On July 20, 1959, after contractor studies confirmed that such an airplane was technically feasible, Eisenhower authorized the CIA to proceed with its design and construction. Code-named OXCART, this project led to production of the A-12 (single-seat) and SR-71 (tandem two-seat) reconnaissance aircraft in the 1960s.[34]

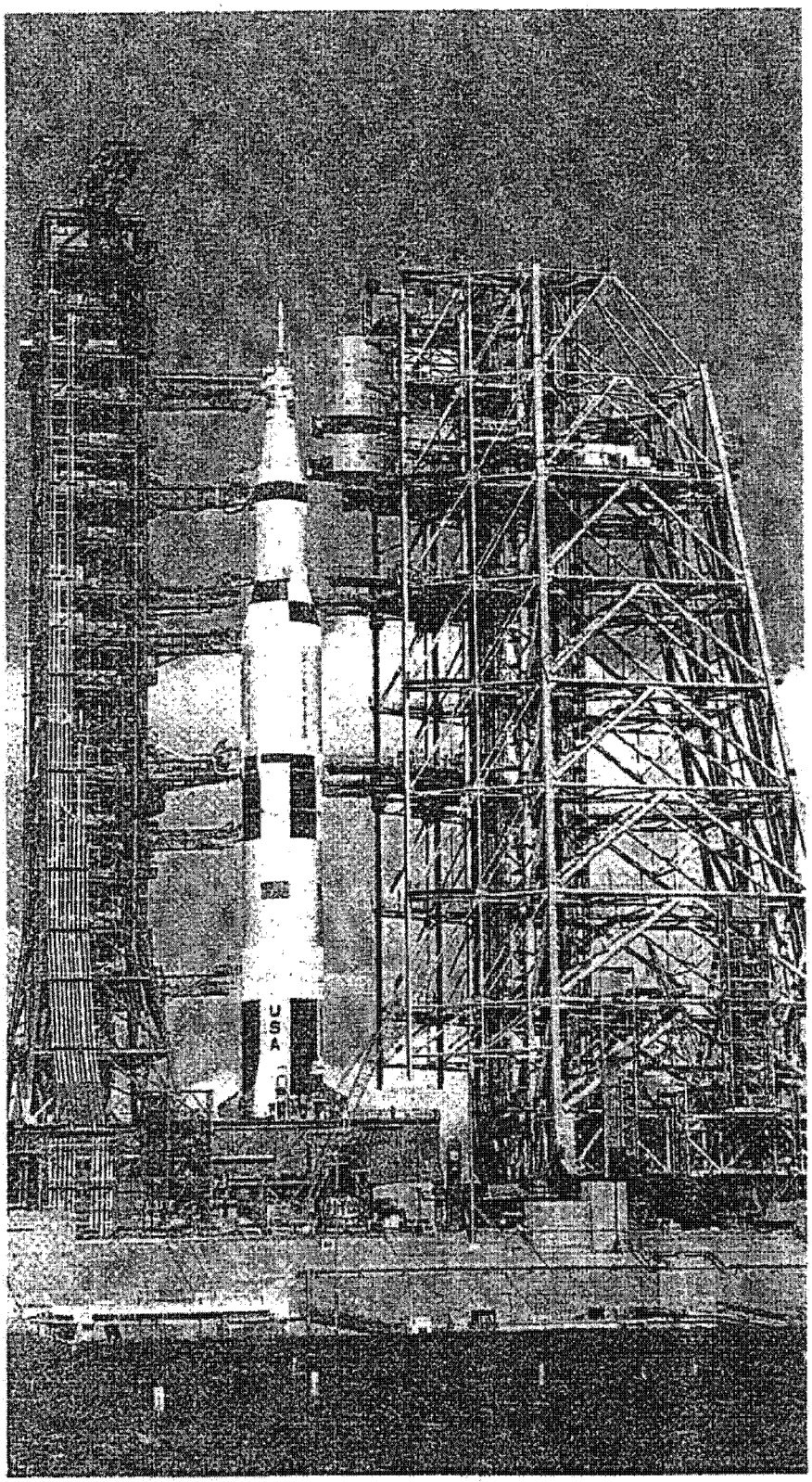
Kistiakowsky's review of the SAMOS Project concluded in August 1960. On August 18 in Cambridge, Massachusetts, the President's science adviser met with Joseph Charyk, Carl F. G. Overhage (director of MIT's Lincoln Laboratory), his two PSAC staff assistants, Harry G. Watters and George W. Rathjens, and Din Land to go over the findings and recommendations that would be presented to the National Security Council. Reconnaissance satellites, they agreed, would fill the intelligence gap created by the loss of the U-2. They judged them to be a vital national intelligence resource, not just a military resource, indispensable to the nation's security. Conduct of reconnaissance operations in space, therefore, like the U-2 overflights previously, had best be managed in secret, lest Soviet leaders

be provoked to interfere with or destroy these satellites. U.S. Air Force leaders clearly had paid far too much attention to publicizing this military mission in the press and far too little attention to rigorously and effectively prosecuting the effort. They found SAMOS to be technically and organizationally in some disarray. They decided that all executive responsibility for SAMOS management, policy, plans, priorities, and space operations be removed from the military and vested in a new Defense Department office under the secretary of the air force. That office would have a simple and direct chain of command from the air force general officer in charge of the project to the civilian air force secretary or under secretary, who would report to the secretary of defense. In this plan, except for the officer at the project level who would no longer report to or be directed by his uniformed superiors, the air force essentially disappeared from the management loop. The same group discussed these findings and recommendations with Richard Bissell on August 22, and, the day before the NSC meeting on August 24, Kistiakowsky briefed Secretary Gates—who endorsed them.[35]

The next morning at 8:15 A.M., before the NSC meeting began, James Killian, Din Land, Gordon Gray (the national security adviser), and George Kistiakowsky met with President Eisenhower to show him the first reconnaissance photographs returned from an Earth satellite a few days before. On entering the Oval Office, Din Land unrolled a reel of developed film across the carpet to the President standing beside his desk. After the viewing, and to avoid informing or provoking Soviet leaders, Eisenhower declared that no American reconnaissance photographs ever should be released publicly—a policy his successors adhered to for many years. Needless to say, most of those who attended the NSC meeting were primed to consider the organization and conduct of the nation's reconnaissance satellite program. Eisenhower approved the review group's recommendations, as did Secretary of Defense Gates. Air Force Secretary Dudley C. Sharp issued the requisite organizational directives on August 31, 1960. The new reconnaissance office, at first called the Office of Missile and Satellite Systems, would be directed by Air Force Under Secretary Joseph Charyk, who in this capacity reported to Gates.[36] A few weeks later, Eisenhower also responded to a recommendation of the second intelligence review. He separated and combined the photo interpreter assets from all three military services with the CIA's photographic intelligence division and established a single, civilian-controlled National Photographic Interpretation Center (NPIC) to receive, process, and distribute reconnaissance film. Arthur Lundahl, who moved with the CIA division, was named NPIC director.[37]

Before leaving office in January 1961, President Eisenhower had put the last organizational components in place. He thus completed the framing of American astronautics in a house of three wings: civil space science and applications (NASA), Department of Defense military support missions (such as communication, navigation, and missile early warning), and reconnaissance satellites. This division of effort also would be endorsed formally by his successors and remain in effect from that day to this. Placed among other items in the new administration's "in-basket," officials arriving in Washington with President John F. Kennedy became the first to approve Eisenhower's arrangement of space affairs. Charyk, a colleague of Robert S. McNamara when the two men worked for Ford Motor Company after World War II, would be asked by the secretary of defense to remain in public service as air force under secretary and first director of the renamed National Reconnaissance Office (NRO).[38] The space reconnaissance wing in the house of astronautics, it should be added, would make possible arms control and arms reduction treaties with verification. Where before, in the 1950s, Eisenhower administration officials worked with virtually no reliable intelligence information on Soviet military preparations and capabilities, their successors by the late 1960s dealt with a surfeit of such information, almost all of it totally reliable. Miles Copeland, an intelligence officer who served with Allen Dulles in the OSS during World War II and retired from the CIA, considered the marked change and reflected, "a satellite circling the world . . . will pick up more information in a day than the espionage service could pick up in a year."[39] Bespeaking the significance of this revolution, a few years after Eisenhower left office, President Lyndon Johnson publicly described robotic space reconnaissance as the most important and valuable of all American astronautical activities; indeed, it would effect profoundly the way in which the cold war played out.[40]

Astronautics represented but one element in a complex of national security issues decided in the Eisenhower administration. "My scientists," as Eisenhower liked to call them, had identified and secured his approval for all of the basic security systems that served the country so well thereafter—including the U.S. Air Force's satellite system that can detect and provide advance warning of a rocket attack within moments of its launch at sea or on land and the U.S. Navy's underwater hydrophone system that can detect and track the movement of submarines around the world.[41] Perhaps as a consequence, the efforts of PSAC in subsequent administrations were directed to other, mostly social and domestic issues, and its importance declined steadily until President Richard Nixon in 1973 dismissed his science adviser and disbanded PSAC.[42] Many years later, James Killian recalled how President Eisenhower had harnessed science and technology to help find solutions for national security issues. The President, he observed, brought together America's best and brightest from a variety of scientific fields, and an interdisciplinary synthesis "took place in the Eisenhower staff when those individuals who served on the Technological Capabilities Panel, on the President's Board of Consultants on Foreign Intelligence Activities, and on PSAC provided this cre-



Apollo 11 readied for launch, 1969. Although he did not favor manned flight to the moon, Eisenhower's early efforts helped make it possible.

ative integration of which I speak." For example, he continued, the fact that

> William Baker, Edwin Land, and I were engaged concurrently in several of these groups made it possible to achieve an extraordinary synthesis of minds and ideas to aid the President in achieving his goals in shaping our defense and intelligence programs and policy. The fact that a number of us, including Baker, Land, Zacharias, Wiesner, Beckler, Kistiakowsky, and many others worked together with interdisciplinary congeniality made possible the success of such achievements as the Polaris, the acceleration of our intercontinental ballistic missile program, the U-2, new techniques of undersea warfare, and spectacular advancement in our reconnaissance capabilities. Coupled with this concert of minds, . . . the results generated could be brought directly to the president for his consideration. My ready access to President Eisenhower made it possible for me promptly to bring to him, and to open opportunities for others to bring to him, new and important technologies, concepts, and analyses that added to the strength of our nation.[43]

These actions and events belie the popular image Eisenhower chose to project as a politician and statesman.[44] A well-known military leader who helped engineer the destruction of the Axis powers in Europe during World War II, he devised ways of assaying and constraining another foreign menace while serving his country again as perhaps its most "stealthy" President. Dwight Eisenhower and a few confidants in the 1950s planned and executed a critical American defense agenda. In that effort they organized and pursued the new technology of astronautics in a manner that most favorably influenced international events and met the most pressing security needs of the United States in a protracted cold war.[45] □

NOTES

[1]Dwight D. Eisenhower, *The White House Years: A Personal Account*, vol. 1, *Mandate for Change* (1963), p. 1. The very first words, obviously chosen to make a statement, are those of Thomas Jefferson: "When a man assumes a public trust, he should consider himself as public property."

[2]Eisenhower, *The White House Years: A Personal Account*, vol. 2, *Waging Peace* (1965), pp. 544–545. In a frequently quoted statement describing the value of aerial reconnaissance to an accurate national intelligence assessment, Eisenhower declared, "without it you would have only your fears on which to plan your own defense arrangements and your whole military establishment. Now if you're going to use nothing but fear and that's all you have, you are going to make us an armed camp. So this kind of knowledge is vital to us."

[3]Cf., especially, F. H. Hinsley, E. E. Thomas, C.F.G. Ransom, and R. C. Knight, *British Intelligence in the Second World War: Its Influence on Strategy and Operations*, vols. 2 and 3 (1981); Ralph F. Bennett, *Ultra in the West: The Normandy Campaign of 1944–1945* (1980); and Stephen E. Ambrose, *Ike's Spies: Eisenhower and the Espionage Establishment* (1981).

[4]See Rip Bulkeley, "Commentary on the Reluctant Racer: Dwight D. Eisenhower and United States Space Policy," in Roger Launius and Howard McCurdy, eds., *The Myth of Presidential Leadership: False Hopes and the Decline of the U.S. Space Program* (1995).

[5]The National Security Act of 1947 established the position director of central intelligence (DCI), together with a Central Intelligence Agency (CIA) under a National Security Council (NSC). This charter commanded the DCI, a presidential appointee, to wear two hats, serving as head of an operating organization, the CIA, and as the President's chief intelligence adviser and titular head and coordinator of all American intelligence activities. Through various measures, Eisenhower sought to increase presidential control over intelligence, and to that end he encouraged Allen Dulles to exert with his backing more authority as DCI in overseeing the nation's intelligence organizations. But Dulles declined to do so, and Eisenhower refused to fire him. John Ranelagh, *The Agency: The Rise and Decline of the CIA* (1986), pp. 347–348.

[6]Cynthia M. Grabo, "The Watch Committee and the National Indications Center: The Evolution of U.S. Strategic Warning, 1950–1975," *International Journal of Intelligence and Counter Intelligence* 3 (Fall 1989): 369–370.

[7]The British first developed an indicators list in 1948 to identify actions the Soviets would have to take to occupy Berlin. Hitchcock subsequently altered and expanded the list at the CIA in the late 1940s and early 1950s to identity actions that would warn of a nuclear surprise attack against the United States. Though all but forgotten, Eisenhower sought again to secure agreement with the Soviets on an even more significant Open Skies proposal presented at a special Surprise Attack conference in Geneva, Switzerland, in late 1958. For that proposal, he ordered a "sanitized" version of the threat-and-warning portion of the surprise attack indicators matrix furnished to all participants. Thus Soviet leaders received key indicators with which to assay the military status of states in the North Atlantic Treaty Organization—if they had not already devised similar warning indicators independently. The Soviets nonetheless again rejected Open Skies. James J. Hitchcock, interview by the author, May 23, 1986. The seminal indicators matrix appears in annex 5 and annex 6 of "Report of the Conference of Experts for the Study of Possible Measures Which Might be Helpful in Preventing Surprise Attack and for the Preparation of a Report Thereon to Governments," United Nations General Assembly, A/4078, S/4145, Jan. 5, 1959.

[8]Donald E. Welzenbach, "Din Land: Patriot from Polaroid," *Optics & Photonics News* 5 (October 1994): 22.

[9]James R. Killian, Jr., *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (1977), pp. 68–69.

[10]Land insisted that any committee he chaired would be no larger than the number of persons able to fit inside a taxicab. An incredible collection of intellects, Project Three members included Land, James Baker (designer of the B-2 aerial camera that, when captured with Francis Gary Powers, so dismayed Soviet leaders), John Tukey (co-author of the Cooley-Tukey Algorithm for executing fast Fourier Transforms, essential to virtually all subsequent advances in the world of electronics), Edward Purcell (nuclear physicist and Nobel laureate), Joseph W. Kennedy (the chemist who first isolated plutonium), and Allan Latham, Jr. (a founder of the Polaroid Corporation, now of the Arthur D. Little Company). Allen Donovan of Cornell Aeronautical Laboratory, who identified the three aircraft design axioms indispensable for flight at extremely high altitudes, also attended most of the Project Three meetings and became, in effect, a member *ex officio*. Of the three panels that made up the TCP, Land's was the smallest; soon known as the "Land Panel," it was, to be sure, also called the "Taxicab Committee." Reflections of Judge William H. Webster, DCI, in "Award Presentation" to Edwin H. Land, *Colloquy* 9 (July 1988): 7–8. See also Leonard Mosley, *Dulles: A Biography of Eleanor, Allen, and John Foster Dulles and Their Family Network* (1978), pp. 365–366.

[11]For the recollections Eisenhower was willing to share publicly in 1965, see *Waging Peace*, pp. 544–545; and Karl G. Harr, Jr., "Eisenhower's Approach to National Security Decision Making," in Kenneth W. Thompson, ed., *The Eisenhower Presidency: Eleven Intimate Perspectives of Dwight D. Eisenhower* (1984), p. 97.

[12]For civil space program antecedents, absent the intelligence motivator, see Milton Lomask and Constance McL. Green, *Vanguard. A History* (NASA SP-4202, 1970). Early efforts that led to a military space program are covered in Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology* (R-3692-RC, September 1988), and R. Cargill Hall, "Early U.S. Satellite Proposals," in E. M. Emme, ed., *A History of Rocket Technology* (1964). Papers and memoirs devoted to both programs can be found in the multivolume proceedings of the International Academy of Astronautics history symposia in *History of Rocketry and Astronautics* (1985–). Probably the best single survey of the formative military and civil space programs is contained in Walter A. McDougall, *The Heavens and Earth: A Political History of the Space Age* (1985).

[13]Memorandum, Alan T. Waterman, director, National Science Foundation, to Robert Murphy, deputy under secretary of state, Mar. 18, 1955 (declassified Nov. 15, 1989), NSC Staff Papers, OCB Central Files [11], OCB 000.91 #1 (2), Dwight D. Eisenhower Library, Abilene, KS (hereinafter cited as DDE Library).

[14]Alan T. Waterman, director, National Science Foundation, to Assistant Secretary of Defense Donald A. Quarles, May 13, 1955 (declassified Nov. 15, 1989), NSC Staff Papers, OCB Central Files [11], OCB 000.91 #1 (2), DDE Library.

[15]National Security Council 5520, "U.S. Scientific Satellite Program," May 20, 1955, in John P. Glennon, ed., *Foreign Relations of the United States, 1955–1957*, vol. 11, *United Nations and General International Matters* (1988), pp. 723–733. OCB members, including its chairman, Herbert Hoover, Jr., were heavily involved in these deliberations and in the July 1955 public announcement of an IGY satellite program. See Bulkeley, "Commentary on the Reluctant Racer."

[16]Cf. Richard S. Leghorn, "U.S. Can Photograph Russia from the Air Now," *U.S. News & World Report*, Aug. 5, 1955, pp. 70–75; and "Editor's Note" at p. 71. This important article explained the

rationale for an Open Skies and the implications of this plan for arms reduction. The significance of Richard Leghorn to USAF aerial reconnaissance is described in Donald Welzenbach, "The Anglo-American Origins of Overflying the Soviet Union: The Case of the 'Invisible Aircraft,'" in Roger Miller, ed., *Anglo-American Air Power Cooperation During the Cold War: Proceedings of the 1993 Air Power History Symposium* (1995).

[17]Text in "Statement on Disarmament, July 21," *Department of State Bulletin* 33 (August 1, 1955): 174.

[18]This news release reprinted in John P. Glennon, ed., *Foreign Relations of the United States, 1955–1957*, vol. 20, *Regulation of Armaments; Atomic Energy* (1990), p. 734.

[19]Declassified letter, Allen W. Dulles, director, Central Intelligence Agency, to Donald A. Quarles, deputy secretary of defense, July 5, 1957, reprinted in John Logsdon, ed., *Exploring the Unknown: Selected Documents in the History of the Civil Space Program*, vol. 1, *Organizational Developments* (NASA SP-4407, 1995). For a discussion of the decision in favor of Vanguard, see R. Cargill Hall, "Origins and Early Development of the Vanguard and Explorer Satellite Programs," *The Airpower Historian* (October 1964): 101–112.

[20]In June and July 1956, Donald Quarles's successor as assistant secretary of defense (R&D), Reuben Robertson, did solicit the opinion of members of his Advisory Group on Special Capabilities and of E. V. Murphree, special assistant to the secretary of defense for guided missiles, about the advisability of launching a scientific satellite on the army's Redstone-Jupiter rocket. The group's chairman, Homer Joe Stewart, advised that Vanguard appeared to be making reasonable progress toward a launch during the IGY, although the "Redstone re-entry test vehicle No. 29, now scheduled for firing in January 1957, apparently will be technically capable of placing a 17 pound payload consisting principally of radio beacons and doppler-equipment in a 200-mile orbit." Nonetheless, he continued, a flight at that time would occur before the start of the IGY and without adequate tracking and observation equipment in place. Pending evaluation of subsequent Vanguard progress, the group did not recommend starting a satellite project using the army missile. (Memorandum for the assistant secretary of defense [R&D], from H. J. Stewart, chair, Advisory Group on Special Capabilities, Subject: Vanguard and Redstone, June 22, 1956.)

In a July 5, 1956, memorandum, Murphree concurred with Stewart. "I don't know if I have a clear picture of the reasons for your interest in the possibility of using the JUPITER re-entry test vehicle for launching the [IGY] satellite," Murphree told Robertson, but it would amount to an "isolated action with no follow-up program." Moreover, it would divert army efforts away from important missile development and affect adversely the morale of the Vanguard group that held the satellite test assignment. (Memorandum for deputy secretary of defense, from E. V. Murphree, special assistant for guided missiles, Subject: Use of the JUPITER Re-entry Test Vehicle as a Satellite, July 5, 1956.)

Both declassified memorandums in White House Office, Office of Staff Secretary; Records, 1956–61, Department of Defense, box #6, Folder, Missiles and Satellites (1), DDE Library.

[21]Bulkeley, author of *The Sputnik Crisis and Early United States Space Policy* (1991), is fascinated by Eisenhower's apparent failure to foresee the psychological impact of the sputniks given the President's obvious interest in psychological warfare. Carried to the extreme, the logical conclusion is the one suggested by Logsdon, that Eisenhower intended that the Soviets be first into space, but to date no documentary evidence has surfaced that would support so radical a notion.

[22]For a most lucid description of the public's perception of Eisenhower in the wake of Sputnik, see Charles S. Maier, "Introduction" to George B. Kistiakowsky, *A Scientist at the White House: The Private Diary of President Eisenhower's Special Assistant for Science and Technology* (1976), pp. xxvii–xxx. "What principally distressed critics," Maier observed, "was the administration's failure to respond to Soviet gains with a sense of urgency. . . . Eisenhower refused to introduce crash programs. . . . his lack of perturbation when the United States seemed to be losing 'prestige,' his frequent recreation on the golf course, signaled to his opponents first a failure of comprehension, then a failure of energy."

[23]Michael R. Beschloss, *Mayday: The U-2 Affair* (1987), p. 121. Eisenhower himself viewed these overflights of Soviet airspace as exceptionally provocative and a grave violation of national sovereignty; before personally approving each mission, he had to be convinced of the overriding need for it.

[24]"During the four years of its operations," Eisenhower later affirmed, "the U-2 program produced intelligence of critical importance to the United States. Perhaps as important as the positive information—what the Soviets *did* have—was the negative information it produced—what the Soviets *did not* have. Intelligence gained from this source provided proof that the horrors of the alleged 'bomber gap' and the later 'missile gap' were nothing more than the imaginative creations of irresponsibility." Eisenhower, *Waging Peace*, p. 547, n. 1. Indeed, in his last book, James Killian, too, confirmed as much. "I will always remember . . . when George Kistiakowsky and I were presenting to the president U-2 photographs that gave him direct evidence of the status of the Soviet missile program and proved there was *no* missile gap." James R. Killian, *The Education of a College President: A Memoir* (1985), p. 456 (emphasis added).

[25]Eisenhower, *Waging Peace*, p. 225.

[26]See July 9, 1956, Soviet communication protesting unauthorized U.S. overflight, and July 10, 1956, U.S. response in *Department of State Bulletin*, July 30, 1956, p. 191. Because the best American radar systems could not detect the high-flying U-2 easily, Eisenhower and his scientific confidants believed, incorrectly as it turned out, that Soviet radar systems would be unable to detect these aircraft at all when operating at design altitude. They were proved wrong on the first mission. Eisenhower, *Waging Peace*, pp. 545–546.

[27]NSC Actions Nos. 1844–1849, *Record of Actions by the National Security Council at its Three Hundred and Fifty-Second Meeting held on January 22, 1958 (Approved by the President on January 24, 1958)*, NSC Action No. 1846, "Priorities for Ballistic Missiles and Satellite Programs," p. 3 (declassified Mar. 14, 1984), box 20, folder NSO-Record of Actions, 1958 (1), White House Office, Office of the Staff Secretary, Records, 1952–1961, Subject Series, Alphabetical Subseries, DDE Library.

[28]Robert L. Rosholt, *An Administrative History of NASA, 1958–1963* (NASA SP-4101, 1966), p. 8. Also, Robert A. Divine, *The Sputnik Challenge* (1993), pp. 101–105. For another accounting, one in which Eisenhower does not act but instead is acted upon by Congress, see Glen P. Wilson, "Lyndon Johnson and the Legislative Origins of NASA," *Prologue: Quarterly of the National Archives* 25 (Winter 1993): 363–373.

[29]National Security Council, NSC 5814, "Preliminary U.S. Policy on Outer Space," June 20, 1958, para. 21; National Security Council, NSC 5814/1, "Preliminary U.S. Policy on Outer Space," Aug. 18, 1958, para. 21; and National Security Council, "U.S. Policy on Outer Space," Jan. 26, 1960, apparently moved to para. 18. See also R. Cargill Hall, "The Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," *Colloquy* 14 (December 1993): 5–6, 19–24.

[30]Kistiakowsky, *A Scientist at the White House*, p. 334.

[31]One of these changes is in the public domain and worth underscoring. Concerned over the objectivity of his military and civil intelligence organizations in the face of vigorous turf battles,

on February 6, 1956, President Eisenhower issued Executive Order 10656, which established the President's Board of Consultants on Foreign Intelligence Activities. Composed of eight private citizens, this review board, like the TCP, received carte blanche to review "the foreign intelligence activities of the Government and to periodically report its findings to the President. Such reports pertain to the quality of the foreign intelligence provided to the executive branch of the Government, the performance by the Central Intelligence Agency of its functions, the performance of their respective foreign intelligence functions by the principal intelligence elements of the executive departments and other agencies, and other related foreign intelligence matters which the Board deems appropriate." *United States Government Organization Manual, 1958–1959*, p. 538. And like the TCP, its first chairman was Eisenhower's most trusted confidant outside federal service, MIT's ubiquitous James Killian. Created by executive fiat, the board's existence ended with that of the Eisenhower administration in January 1961. After the debacle of the Bay of Pigs invasion in April 1961, however, President John F. Kennedy recognized the wisdom of it and reestablished this independent review board, renamed the President's Foreign Intelligence Advisory Board (PFIAB). G.J.A. O'Toole, *The Encyclopedia of American Intelligence and Espionage* (1988), p. 378.

[32]Carl Berger, historical report, "The Air Force in Space, Fiscal Year 1961," Office of Air Force History (1966), p. 34. Berger identifies York's deputy, John H. Rubel, as the team member, but York clearly filled this role before suffering a heart attack in August 1960, at which time Rubel did assume his duties.

[33]Eisenhower was adamant that military officers not serve as pilots of the U-2; moreover, he did not trust the air force to keep anything secret for any length of time.

[34]"The OXCART Story," *Studies in Intelligence* 26 (Summer 1982). This abbreviated history appeared in the CIA's classified in-house journal. It was declassified and publicly released in 1992 without journal page numbers. William McInnich, the author of record, represented a nom de plume for John P. Parangoski, who was the OXCART project officer.

[35]Berger, "Air Force in Space," pp. 38–40; Kistiakowsky, *Scientist at the White House*, pp. 384–387.

[36]Berger, "Air Force in Space," pp. 40–43; also, Kistiakowsky, *Scientist at the White House*, pp. 387–388.

[37]Because he did not participate directly, Kistiakowsky mentions the second intelligence review, which sought to prevent unwanted duplication of effort and "project proliferation," only obliquely in his published diary at p. 340.

[38]Bill Gertz, "The Secret Mission of NRO," *Air Force Magazine* (June 1993): 62. Viewed by its architects as a temporary expedient, able to function at least until a permanent organization could be fashioned elsewhere in the Defense Department, the NRO evolved to serve America's civil and military leaders well indeed throughout the cold war—proving itself institutionally to be just as vital a national resource as Kistiakowsky, Land, Charyk, and Killian supposed it would.

[39]Miles Copeland, "The Functioning of Strategic Intelligence," *Defense and Foreign Affairs Digest* (February 1977): 30.

[40]*U.S. News & World Report*, Sept. 9, 1968, p. 2.

[41]The remarkable set of air force early warning satellites employ infrared equipment to detect the hot exhaust gases emitted by long-range jet bombers and large liquid- and solid-propellant rockets as they ascend under power through the atmosphere. The idea for this system was advanced in 1955–1956 by a Lockheed engineer, Joseph Knopow, and was developed as the Missile Detection and Alarm System (MIDAS), then evolved to become the contemporary Defense Support Program (DSP). This concept meshed nicely with Eisenhower's concerns for advance warning of surprise attack, although until the mid-1960s, when on-orbit tests proved it conclusively, some American scientists remained skeptical that a working system could be achieved. The idea behind the navy's undersea effort, known as the Sound Surveillance System (SOSUS), was advanced by Willem Hackmann, who discovered the deep sea sound channel layer during World War II and proposed using it as a means to locate flyers downed over water (who would release depth bombs to detonate under the sea). Navy leaders became serious about such a system after W. Maurice Ewing of the Lamont Geological Observatory described its "trip-wire" applications for detecting and tracking Soviet submarines at the 1956 Woods Hole Nobska Summer Study on undersea warfare. Eisenhower and his PSAC, especially its subcommittee on antisubmarine warfare chaired by Harvey Brooks, actively supported development and deployment of this system, and the SOSUS cable-laying was accomplished in the late 1950s using converted Liberty ships. With the end of the Soviet Union and the cold war, SOSUS also has begun to be employed in the interests of ecology—tracking the movements of whales. See Naval Research Laboratory (NRL) News Release No. 60-93R, "Navy Program Provides Major Breakthrough for Marine Mammal Research," Aug. 18, 1993, and Clyde E. Nishimura, "Monitoring Whales and Earthquakes by Using SOSUS," *1994 NRL Review*, pp. 91–101.

[42]Eisenhower credited his science advisers for the advances made during his administration and for keeping the American space program on a course of his choosing. "The appointment of Dr. Killian, and later Dr. George B. Kistiakowsky of Harvard, worked out wonderfully. In character and accomplishment they could have had no superiors. . . . My 'wizard' helped me to keep the subject of space away from becoming a 'race' and from deteriorating into a series of stunts. He helped to make certain that the government was supporting both basic and applied research. Without such distinguished help, any President in our time would be, to a certain extent, disabled." *Waging Peace*, p. 224, n. 12.

[43]Killian, *Education of a College President*, pp. 455–456. For some of the unclassified contributions of PSAC, see pp. 335–337.

[44]As the records are declassified, a reassessment of President Eisenhower's actual (versus publicly perceived) role in American history appears well under way. Divine's *Sputnik Challenge* (1993) is a case in point. In an October 1993 episode of the PBS television documentary *American Experience*, "Eisenhower," hosted by David McCullough, historians considered the marked difference between Eisenhower's awkward syntax frequently evident in his public appearances as President and his well-crafted written work to be found throughout his career (he wrote his own memoirs). Fred Greenstein recounted a discussion in the Oval Office between Press Secretary James Hagerty and the President during the international crisis over the islands of Quemoy and Matsu. Concerned about a forthcoming news conference, Hagerty warned his boss of potentially embarrassing questions likely from reporters regarding America's use of tactical nuclear weapons against communist Chinese forces. Eisenhower is said to have replied, "Don't worry, Jim, if that comes up I'll just confuse them."

[45]One prominent alteration in the size and shape of American astronautics, it must be said, did occur later. Although Eisenhower heartily disapproved, he could not control decisions in favor of an extensive manned space flight program, especially manned flight to the moon. Selected by his successor John F. Kennedy and approved by Congress, Project Apollo would be prosecuted to best the Soviets in a major astronautical endeavor expressly for purposes of international prestige. Because manned flight to the moon had no direct national security value, Eisenhower judged the effort unwise and its immense cost unjustified. (An afterthought: In his memoirs, except for the U-2, which had become public knowledge, Eisenhower mentioned none of the technical advances or changes in intelligence operations described in this account for which he was responsible. One would be hard-pressed to think of a contemporary politician able to resist claiming credit for such an intelligence revolution, or willing to carry the secrets with him to the grave.)

EYE IN THE SKY

THE STORY OF THE CORONA SPY SATELLITES

EDITED BY DWAYNE A. DAY,
JOHN M. LOGSDON,
AND BRIAN LATELL

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4
POSTWAR STRATEGIC RECONNAISSANCE AND THE GENESIS OF CORONA

The concept of strategic reconnaissance that emerged in the first few years after World War II differed sharply from accepted wartime convention. The Army Air Forces' (AAF) doctrine associated strategic reconnaissance with the well-established intelligence functions of identifying and pinpointing vital targets for aerial bombardment, with identifying any antiair threats that might impede the striking force, and with bomb damage assessment. With the advent of atomic weapons, however, a few young officers and civilian scientists and engineers, especially those associated with the AAF's Aeronautical Photographic Laboratory at Wright Field, Dayton, Ohio, began to think of strategic reconnaissance in quite different terms, as an intelligence tool that could be used to provide advance warning of a surprise attack. At first termed "pre-D-day photography," then "pre-hostilities reconnaissance," a redefined strategic reconnaissance mission called for acquiring reliable intelligence about the economic and military activities and resources of a potential foreign adversary through periodic, high-altitude overflight in peacetime.[1]

In the remarkably short span of 15 years (1945–60), as the Cold War increasingly shaped national perceptions and actions, this concept was embraced by American political leaders and made into national policy. Secretly, at the direction of two presidents, resources would be allocated and technology developed to put this policy into practice. First, military aircraft would be used for peacetime overflight of potential foreign adversaries. Next, specially designed, unarmored, high-flying reconnaissance balloons and aircraft would be so employed. Finally, by 1960, automated satellites would gather intelligence concerning activities on Earth while operating silently in outer space. The clandestine reconnaissance plans, national policy, and machines created in this period would provide far more diverse and reliable kinds of intelligence than that providing

advance indications and warning of surprise attack. Collectively, they also made possible the sizing of the U.S. military establishment to meet actual threats rather than imagined ones, enabled arms control treaties with verification, and helped maintain a delicate peace between the Cold War's international protagonists.

A CONCEPT FORMED

The first person to articulate the concept of overhead strategic reconnaissance was Lieutenant Colonel Richard S. Leghorn, wartime commander of the 30th Photographic Reconnaissance Squadron in the European Theater. He had graduated from the Massachusetts Institute of Technology (MIT) in 1939 with a bachelor's degree in physics and a reserve commission in the Army Ordnance Corps. While still a college student, Leghorn served as an officer in the Sigma Chi fraternity, where he became well acquainted with its faculty "den mother" and MIT graduate, the 32-year-old editor of MIT's *Technology Review*, James R. Killian Jr. With a degree in English and without scientific credentials, Killian nonetheless possessed an extraordinary knack for facilitating collaborative efforts among scientists and nonscientists, and among students and faculty alike. Killian and Leghorn's paths would cross again many times in the years to come.

Richard S. Leghorn, whom many call the father of American strategic reconnaissance, 1955. (Photo courtesy R. Cargill Hall)

Working at Eastman Kodak in December 1939, Leghorn met Major George W. Goddard, commander of the Army Air Corps' small Aeronautical Photographic Laboratory at Wright Field, near Dayton, Ohio. Determined that his active military service would be in aerial photography, Leghorn offered to work for Goddard at Wright Field if the major could arrange to transfer his commission to the Air Corps. In early 1940, Goddard did just that. Shortly after Germany invaded Denmark, Norway, the Low Countries, and France in the spring of 1940, Leghorn learned he now held a commission in the Army Air Corps. At year's end he obtained an active duty assignment at the Aeronautical Photographic Laboratory.[2]

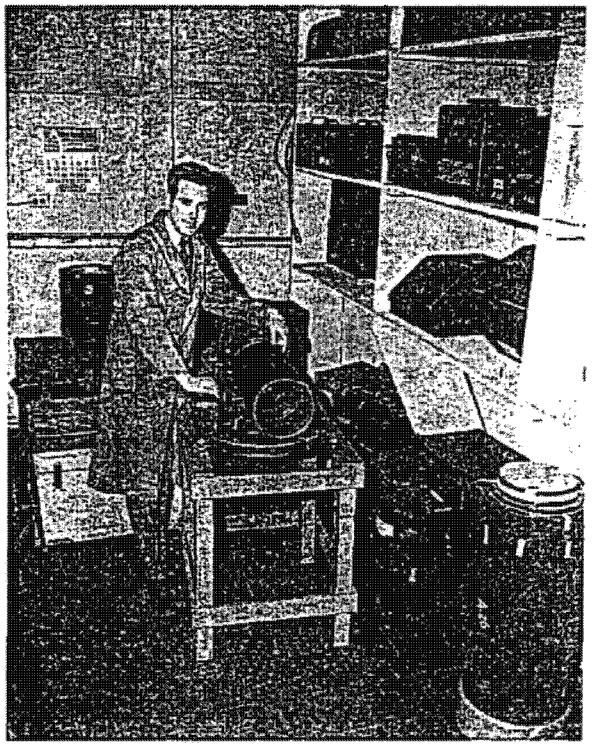
Second Lieutenant Richard Leghorn arrived at Wright Field in March 1941; there he worked on improving methods of assessing and exploiting data from aerial photographs. At Goddard's laboratory, Leghorn became acquainted with two individuals whose interests and careers also would become intertwined with his in the years afterward: Amrom H. Katz, a recently hired civilian physicist from Milwaukee, Wisconsin, who tested and compared the performance of camera shutter systems; and Lieutenant Walter J. Levison, a physicist from City College of New York, who tested and characterized light-sensitive materials and development processes in the laboratory's sensitometry unit.

Major Goddard also recruited for wartime services astronomer James G. Baker at Harvard University. German-made lenses were no longer available; Baker visited Goddard in December 1940 to discuss the situation. With the permission of his superiors at Harvard College Observatory, after January 1941 Baker designed and perfected lenses for a number of Air Corps reconnaissance cameras. During World War II, the Harvard Optical Laboratory, which Baker formed for this purpose, became a major component of the National Defense Research Committee's (NDRC) Division 16, which operated under the wartime Office of Scientific Research and Development.[3] The K-22 aerial camera was one of the most significant of Baker's contributions to aerial photography. This camera featured a 40-inch focal length f/5.0 distortionless telephoto lens that adjusted automatically to the pressure and temperature variations inherent in high-altitude aerial photography. By war's end, James Baker was widely recognized as America's preeminent lens designer for aerial reconnaissance cameras, a reputation he maintained with even more remarkable contributions for much of the rest of the century.[4]

Many of the men from Goddard's Aeronautical Photographic Laboratory, together with Duncan E. Macdonald, a physicist from Boston University, worked together in 1946 for the AAF, filming the two atomic tests of Project CROSSROADS at Bikini Atoll in the Pacific. Traveling between Roswell, New Mexico, where the photographic unit was formed, and Kwajalein Atoll, where it was stationed for the tests, Leghorn read a summary report of the *United States Strategic*

Bombing Survey (Europe), issued on September 30, 1945. This document assessed the effectiveness of and lessons learned from the strategic bombing campaign against Nazi Germany and the reconnaissance that supported it. A few key points impressed Leghorn. "In the field of strategic [target] intelligence," the report stated, the United States needed "more accurate information, *especially before* and during the early phases of the war." The report urged improving coordination among intelligence services in the collection and evaluation of information, and suggested involving civilian scientists in peacetime as well as in wartime. Underscoring these and other points, the report concluded: "The combination of the atomic bomb with remote-control projectiles of ocean-spanning range stands as a possibility which is awesome and frightful to contemplate."[5]

In addition to the frightening possibility of a future sneak atomic attack on the United States, what struck Leghorn most forcibly was the identified need for pre-hostilities targeting reconnaissance, separate and distinct from tactical reconnaissance during wartime. That distinction matched his own experiences in pre-D-day photographic missions flown from Great Britain and in subsequent combat reconnaissance conducted on the Continent. But in a world where more than one state possessed atomic weapons, securing strategic targeting data was insufficient to ensure survival. Leghorn also realized that the United States had



James G. Baker, director of the Harvard Observatory Army Air Forces Optical Project, adjusting a 40-inch focal length aerial camera developed for the service, ca. 1944. Baker was one of the pioneers of American reconnaissance cameras. (Photo courtesy of James G. Baker)

to have reliable indications and warning of force levels and enemy capabilities for a surprise attack *in advance,* if it was to avoid an atomic disaster. This information, Leghorn was sure, could only be acquired through periodic, extremely high altitude aerial reconnaissance overflight of potential adversaries using new aircraft especially designed for this task.

During the long hours between sorties on Kwajalein, he explained and elaborated upon this proposition to anyone who would listen, and especially to Duncan Macdonald, who was among the first converts to his cause. The CROSSROADS atomic tests that the AAF photographic unit filmed in July 1946, in particular the underwater test on July 25 that tossed the Japanese heavy cruiser *Nagato* 400 yards like a bathtub toy, also seared themselves in his memory and committed him to selling "pre-D-day photography," as he then termed it, to the AAF, to America's political leaders, and to the public.[6]

Leghorn's first opportunity to do so came a few months later in December 1946 when Macdonald invited him to speak at the dedication of Boston University's Optical Research Laboratory. Back in 1943, Colonel George Goddard had secured funding to build a proper optical workshop for James Baker and relocate his AAF lens design efforts from the basement confines of the Harvard College Observatory. The new brick structure, built on the grounds of Harvard University with reinforced footings that eliminated any vibrations from traffic on nearby roads, was completed in late 1944 and, as an element of the wartime NDRC, was dedicated as the Harvard Optical Laboratory. In this

The American "Baker" atomic bomb test at Bikini Atoll on July 25, 1946. This test was a seminal event for American strategic reconnaissance. Not only did it bring together many of the top photographic and reconnaissance experts at the time, but it also impressed upon them the incredible destructiveness of nuclear weapons.

well-equipped facility, Baker and his assistant Duncan Macdonald had finished designing the 60-inch f/5.0 lens and began work on an ultra-high-precision (K-30) 100-inch f/10 system using a 9 × 18-inch film format. The Perkin-Elmer Company in Glenbrook, Connecticut, fabricated all of Baker's lenses for the AAF. By war's end, the laboratory employed thirty-six optics scientists and fifty technicians. In September 1945, however, when Colonel Goddard visited Cambridge, Harlow Shapley, chief of astronomy at Harvard, advised him that the university would return to peacetime operations immediately. That meant severing all ties with military research. James Baker would return to the university full-time and the Harvard Optical Laboratory staff would be disbanded.[7]

Desperate to save his team of optical designers and technicians for national security research, a shaken Goddard appealed to Daniel L. Marsh, president of nearby Boston University (BU), to house the optical laboratory staff in three temporary wartime structures built by the federal government on the BU campus. The AAF would continue to fund the laboratory's operation. If Marsh and Chester M. Alter, dean of the BU graduate school, agreed, Duncan Macdonald, BU physics professor and Baker's wartime assistant, would serve as director of the new Boston University Optical Research Laboratory (BUORL).[8] In February 1946, Marsh and Alter did agree. After moving out those in residence in the buildings, re-equipping them, and transferring the Harvard staff, BUORL was formally dedicated on December 13, 1946, with Duncan Macdonald as director. The luminaries that attended the dedication signified the importance accorded the optics laboratory both locally and nationally. They represented the colleges and universities along the Charles River, virtually every major photographic and optical firm in the country,[9] and the military services. AAF leaders in attendance included Major General Curtis E. LeMay, Deputy Chief of Air Staff for Research and Development; Brigadier General Alden R. Crawford, Assistant Chief of Air Staff for Materiel; and Major General Laurence C. Craigie, Chief, Engineering Division, Air Technical Services Command.[10]

At the BUORL dedication Leghorn outlined the requirements for and impediments to achieving strategic overflight reconnaissance. A world in which more than one country possessed atomic weapons, Leghorn asserted, was a world that would "demand . . . aerial reconnaissance prior to the outbreak of hostilities." In that world, he continued,

> military intelligence becomes the most important guardian of our national security. The nature of atomic warfare is such that once attacks are launched against us, it will be extremely difficult, if not impossible, to recover from them and counterattack successfully. Therefore, it obviously becomes essential that we have prior knowledge of the possibility of an attack, for defensive action against it must be taken before it is launched. Military intelligence is the agency for providing this information, and our

national security rests upon its effectiveness, next to a sound international political structure.

Overhead reconnaissance conducted with cameras in daylight and, if they could be developed, radars at night and in overcast conditions would produce the core of this intelligence, particularly "in the case of potential enemies of a totalitarian, police-state nature where the acquisition of information by the older methods of military intelligence is more successfully blocked." Nonetheless, Leghorn had to concede, unauthorized overflight of a foreign state in peacetime was denied by treaty law and

would be considered an act of military aggression. It is unfortunate that . . . peacetime spying is considered a normal function [while] . . . aerial reconnaissance—which is simply another method of spying—is given more weight as an act of military aggression. Unless thinking on this subject is changed, reconnaissance flights will not be . . . performed in peacetime without permission of the nation state over which the flight is to be made.

Leghorn thought it highly unlikely that such overflight permission would ever be granted. Consequently, he concluded, to ensure national security the United States would have to devise means for overflight reconnaissance that could not be detected:

The accomplishment of this objective is not as technically difficult as it might at first appear. Extremely long-range aircraft capable of flying at very high altitudes are currently on the drawing boards, and in some cases prototypes have been constructed. Effective means of camouflaging them at high altitudes against visual observations are well known. It is not inconceivable to think that means of preventing telltale reflections of other electromagnetic wave lengths, particularly of radar frequency, can be developed. With such a tool at hand, information can be secured of a potential enemy's mining of radioactive materials and his plants—necessarily large—for the production of fissionable products, as well as a variety of other essential data.[11]

The kind of world that Leghorn described for members of the audience, however, did not yet exist in 1946. The United States alone possessed atomic weapons. The Army Air Forces preferred to modify multiengined combat aircraft for reconnaissance and to avoid spending scarce funds on single-purpose aircraft tailored to that mission alone. Finally and most discouraging, even "with such a tool at hand," international law proscribed unauthorized flight in the airspace of another state. Unless political and legal strictures against reconnaissance overflights were changed, any American leader ordering them could trigger a serious international incident, and might provoke another war.

A LEGAL OBSTACLE AND A POLITICAL WATERSHED

International air navigation treaties negotiated in the wake of World War I featured one cardinal principle: each state claimed for itself exclusive sovereignty over the airspace above its territory and territorial waters. Just as no land vehicle might enter another state without clearance at the border, no foreign aircraft might enter the airspace of another state in peacetime without prior permission. States' representatives agreed that the welfare and safety of each nation was no greater than its command of the air overhead. Article 1 in the first convention of 1919 made the point explicitly:

> The High Contracting Powers recognize that every Power has complete and exclusive sovereignty over the air space above its territory.
>
> For the purpose of the present convention the territory of a State shall be understood as including the national territory, both that of the mother country and of the colonies, and the territorial waters adjacent therein.[12]

Subsequent treaties on air commerce that U.S. presidents signed and the Senate ratified contained similar introductory articles. In terms of application, moreover, all international treaties to which the United States was a contracting party, under the Supremacy Clause of the Constitution (Article VI, Section 2), became the law of the land. Whether or not he had read these international instruments, it was this elemental aspect of air law to which Richard Leghorn referred in his 1946 BUORL address. Among the military members who heard him, no general officer could deny the primacy of civilian leadership or the rule of law. Only a president of the United States, as a head of state, might counter the strictures of international law—either by withdrawing his country from a treaty under the terms provided for it, or, for some overriding reasons of state, by expressly violating its canon and the law of nations.

In the months after the December 1946 dedication, the Cold War began in earnest. In an attempt to detect Soviet military preparations, the AAF in late 1946 began flying RB-29 reconnaissance aircraft along the USSR's northern borders nearest the United States. Equipped with cameras of limited focal length (36-inch or less), these aircraft flew within a few miles of the Soviet coastline to obtain oblique photography of Soviet territory. The two regions of greatest concern were the Chukotskiy Peninsula directly across the Bering Strait from Alaska and the Kola Peninsula north of Leningrad on the Barents Sea, which contained the port of Murmansk.[13] The Soviet Union, however, claimed sovereignty over territorial waters and the airspace above it within twelve miles of its coast, not the three miles recognized by the United States. To avoid any incidents, the Department of State instructed the AAF to observe the twelve-mile limit.[14]

Even so, the Soviets protested American "bombers" violating the airspace above their territorial waters. The State Department responded with aerial approach restrictions that eventually reached a distance of 40 miles.[15] A 40-mile limit, of course, precluded any useful aerial photographic reconnaissance missions. But after the Soviet Union detonated an atomic device in August 1949[16] and communist forces swept to victory in China in October, the stand-off restriction was reduced to 20 miles and, in the face of other provocations, the entire issue was reopened.

Soviet detonation of an atomic weapon well in advance of U.S. expectations greatly concerned American leaders. Curtis E. LeMay, by then commander of the Strategic Air Command (SAC), recommended that the United States employ pre-hostilities strategic overflight reconnaissance to detect Soviet preparation for a surprise attack and, more important, should adopt a preemptive war policy.[17] At the prodding of MIT's George Valley, the Air Force Scientific Advisory Board undertook an assessment of nearly nonexistent U.S. air defenses with the intention of identifying ways for improving them.[18] Soviet action in Europe had already prompted the Truman Doctrine (economic and military assistance that helped Greece and Turkey repel communist insurgents), the Marshall Plan (economic assistance that helped rebuild the war-ravaged Western European infrastructure), and the North Atlantic Treaty Organization (NATO). Now, at the president's direction, the National Security Council (NSC) began a sweeping evaluation of U.S. military preparedness and of the nation's objectives, strategy, policies, and programs for national security with respect to the USSR.[19]

A few months later, on June 25, 1950, North Korean forces launched a surprise attack on the Republic of South Korea, and in November Chinese forces entered that conflict in force. The sequence and pace of these events, coupled with available intelligence of Soviet forces in Eastern Europe, prompted American political and military leaders to believe that their Soviet counterparts might launch an attack against Western Europe, possibly accompanied by a surprise aerial attack on the United States. On December 16 President Truman issued a Proclamation of National Emergency, called numerous National Guard units to active duty, and signed an executive order creating an Office of Defense Mobilization to control all executive branch mobilization activities including production, procurement, manpower, and transportation. On December 19 the president advised the nation that General of the Army Dwight D. Eisenhower would return to active duty as Supreme Commander, Allied Powers in Europe (SACEUR), in charge of NATO forces. While the JCS assessed existing war plans and alerted American commanders to the possibility of a global war,[20] they also considered how aerial overflight reconnaissance might determine with greater certainty Soviet preparations for an atomic surprise attack.

The JCS chairman, General of the Army Omar N. Bradley, ordered a reassessment of aerial reconnaissance policy and then placed the issue before the president.[21] Reliable information on the status of Soviet aerial forces in those regions of Eastern Siberia closest to the United States could be acquired only through reconnaissance overflight. In the Korean conflict, the USSR supported North Korea with its military aircraft operating from sanctuaries in the Soviet Far East. Under Chapter VII of the United Nations Charter, the United States, when engaged in a UN peace enforcement operation, could claim the right to overfly sanctuaries used by an unannounced co-belligerent state. Whether recognized as lawful or not, however, if the aircraft was shot down, it promised an international incident of the first magnitude. (An earlier incident happened in April 1950, when Soviet fighters downed an unarmed U.S. Navy reconnaissance aircraft in international waters off the coast of Latvia, in the Baltic Sea.)[22]

The threat of a surprise nuclear strike was taken seriously. National security considerations demanded that the political risks of overflights be accepted. In late December 1950, Air Force Vice Chief of Staff General Nathan Twining briefed President Truman to that effect. After examining the overflight plans and routes, the president approved two flights, one over Russia's Arctic northern shore in eastern Siberia, and another over Russia's southern shore nearer Japan.[23] Shortly thereafter, on January 4, 1951, Headquarters USAF assigned this mission to one of SAC's newest swept-wing jet-propelled bombers, an air-refuelable B-47B then scheduled for delivery in April 1951.[24] Though initial plans called for two aircraft, only the fourth production aircraft was specially modified for reconnaissance overflights. In July it flew to Eielson AFB at Fairbanks, Alaska. While awaiting clear weather in early August 1951, this B-47B was destroyed by fire during refueling operations.[25] Later attempts to overfly the eastern USSR depended on both the production of more B-47Bs and presidential approval.

Meanwhile, Truman initiated talks on intelligence gathering with British Labor Prime Minister Clement R. Atlee and his foreign minister, Ernest Bevan (succeeded in April 1951 by Herbert S. Morrison). The American and British leaders agreed to a joint aerial reconnaissance program to overfly the western USSR during the Korean hostilities. Under terms of the agreement, apparently secured in the spring of 1951, the Royal Air Force (RAF) would reconnoiter targets in the western USSR whenever intelligence demands dictated such action. These missions would be approved by the prime minister, who turned out to be the redoubtable wartime leader Winston Churchill, reelected in October 1951. To conduct these overflights, the RAF formed a secret three-aircraft "Special Duty Flight" in July 1951. Equipped with USAF RB-45Cs, these aircraft, on two separate nighttime missions, overflew the Baltic states, Belorussia, and Ukraine: once in April 1952, and again in April 1954.[26]

With communist and UN forces on the Korean peninsula locked in a military stalemate in early 1952, U.S. leaders received intelligence that the Soviet Air Force had begun moving bombers into Siberia. These Tupolev Tu-4 aircraft, essentially carbon copies of the Boeing B-29, were flying together in large numbers into and out of airfields at Dickson on the Kara Sea, at Mys Schmidta on the Chukchi Sea, and at Provideniya on the Chukotskiy Peninsula, just across the Bering Strait from Alaska. If loaded with the nuclear weapons then believed available to the Soviet Air Force, these Tu-4s could make one-way flights to strike the United States.[27] The Office of the Secretary of Defense and the CIA again determined a need for Siberian overflights. On July 5 Headquarters USAF, which was party to these deliberations, directed SAC to modify two B-47B bombers for a special photoreconnaissance mission over "unfriendly areas."[28]

On August 12, 1952, Secretary of Defense Robert A. Lovett delivered to President Truman memoranda from General Bradley and General Walter Bedell Smith, Director of Central Intelligence (DCI), requesting two reconnaissance overflights of Soviet Siberia from Eielson AFB. After discussion, the president approved the "Northern run" between Ambarchik on the East Siberian Sea and Provideniya on the Chukotskiy Peninsula, but disapproved as too dangerous a "Southern run" over Provideniya southwestward past Anadyr to Magadan, returning eastward over the Kamchatka Peninsula. His approval of a single reconnaissance overflight, Truman told Lovett, was contingent on the concurrence of "appropriate officials of the State Department."[29] Secretary of State Dean Acheson must have concurred, because on August 15 Headquarters USAF issued instructions for the mission. It was flown successfully in October.[30] The overflight photography established that the Soviet Union was not massing Tu-4 bombers near Alaska.[31] The world that Richard Leghorn had forecast was at hand. Overflight of the USSR or other unannounced co-belligerents opposing UN peace enforcement would be approved on a case-by-case basis when the security interests of the United States demanded it.

A few weeks after the Siberian overflight, in the national elections of November 1952, Americans selected Dwight D. Eisenhower as president. In January 1953 Eisenhower took the oath of office as the thirty-fourth president of the United States. The former Supreme Commander of Allied Expeditionary Forces in Europe, who had directed the Normandy invasion during World War II and had served as the postwar SACEUR, appreciated the value of "pre-D-day photography." As a commander-in-chief intent on thwarting, if not eliminating, the threat of an atomic surprise attack, he embraced the concept and conduct of pre-hostilities strategic overflight reconnaissance. But the Korean Armistice, signed in July 1953, ended the Korean conflict and with it any legal justification for the overflights begun by his predecessor.

Eisenhower recognized the importance of strategic reconnaissance to national security, the political risks of continuing overflights for that purpose in peacetime, and the precedent set by President Truman. He decided to continue periodic reconnaissance overflights of the Sino-Soviet bloc. The revised effort, including RAF participation with the consent of his British wartime comrade Winston Churchill, comprised a major part of what was termed the SENSINT (Sensitive Intelligence) Program. (Another significant portion consisted of the reconnaissance flights around the periphery of the Sino-Soviet bloc states.) Between July 1953 and December 1956, when Eisenhower discontinued all military overflights of the USSR, the overflight component involved four USAF commands, elements of the RAF, and Republic of China (ROC) Air Force based on the island of Taiwan. In the case of the American air commands, once the president approved an overflight, authority to proceed passed from the Joint Chiefs of Staff to Headquarters USAF, then through channels to the operational unit.[32]

Meanwhile, alerted to the existence of the new Soviet Myacheslav-4 intercontinental bomber (NATO code-named BISON),[33] in March 1954 Eisenhower challenged James Killian, by now president of MIT, and other members of the Office of Defense Mobilization's Science Advisory Committee to advise him of new ways to protect America from a sneak attack. Killian formed for this task a Technological Capabilities Panel (TCP). In August, panel members began a survey of U.S. defense preparedness and of new technology that might be applied to offensive, defensive, and intelligence operations.[34] With the number of Soviet BISON bombers and nuclear weapons believed to be growing, the region of greatest concern in the USSR—from which such an aerial attack could be mounted and about which the least was known—was the Kola Peninsula in extreme northwest Russia above the Arctic Circle. Again, American and British leaders sought reliable intelligence about the type, number, and disposition of Soviet aerial forces.

On May 8, 1954, a few days after the RAF Special Duty Flight conducted its second nighttime mission, a SAC RB-47E embarked from Fairford RAFB on a daytime photographic overflight of the Kola Peninsula and various airfields east of Leningrad. Soviet MiG-17s attacked and damaged the reconnaissance aircraft during the mission.[35] Before the month's end the American-equipped RAF Special Duty Flight disbanded permanently.[36] If such strategic reconnaissance overflights were to continue with acceptable risk, another kind of airplane clearly was required, one designed expressly to fly at extremely high altitudes, far above Soviet air defenses.

TECHNICAL AND INSTITUTIONAL IMPEDIMENTS

If, in the interests of national security and after weighing attendant risks, a U.S. president authorized reconnaissance overflights of Sino-Soviet territory, what

kind of aircraft was best suited to the assignment? The Strategic Air Command controlled the lion's share of Air Force reconnaissance assets because it possessed the only long-range jet-powered aircraft that could be refueled in flight and configured for deep-penetration electronic and photographic reconnaissance missions. None of these aircraft, however, was designed to operate above 45,000 feet altitude; all of them were thus susceptible to attack by air defenses. To assess the state of the art and to recommend new or improved reconnaissance technical collection systems, the Air Force turned to scientific consultants organized earlier to assist Air Force Development Planning. Among them were Carl F. J. Overhage, chief of Eastman Kodak's Color Laboratory; James Baker and Edward Purcell from Harvard University; Edwin Land, president of Polaroid; Louis Ridenour of International Telemeter; and Allen F. Donovan of Cornell Aeronautical Laboratory. At the early 1952 request of the Air Force, these men, along with Richard Leghorn, who had been recalled to active duty in the Air Force during the Korean conflict, participated in what became known as the "Beacon Hill Study," named for the Boston locale where they convened. In the years afterward, these same scientist-consultants would reappear on the Air Force Scientific Advisory Board and on other government panels.[37]

The seminal *Beacon Hill Report* appeared in June 1952. Having evaluated pre-hostilities reconnaissance requirements, the Beacon Hill group recommended improvements in sensors and identified vehicles that could fly them near or over Soviet territory. These included high-altitude balloons (then Project GOPHER),[38] high-altitude aircraft, sounding rockets, and long-range Snark or Navaho air-breathing missiles employed as drones. Although aware of the contemporary reconnaissance satellite studies at the RAND Corporation in Santa

Dr. Edwin "Din" Land, president of Polaroid. Land served as a key advisor to presidents and U.S. intelligence agencies during the height of the Cold War. (Photo courtesy of the National Reconnaissance Office)

Monica, California, members of the Beacon Hill group perceived that this technology would require an enormous investment, including the development of launching rockets. Such machines could not be developed in time to meet current national intelligence demands. Both Leghorn and Land favored immediate development of balloons and aircraft that would operate at extreme altitudes of 70,000 feet or higher.[39] (The subsequent development of intercontinental ballistic missiles and the launch of an artificial earth satellite prompted both Land and Leghorn to actively support *immediate* development of reconnaissance satellites.)[40]

At the Pentagon in early January 1953, Leghorn completed his work on an Intelligence and Reconnaissance Development Planning Objective (DPO) for Colonel Bernard A. Schriever, Assistant for Air Force Development Planning. At month's end he left active duty to return to Eastman Kodak, removing himself temporarily from planning based on the pre-hostilities reconnaissance concepts he had helped formulate. The DPO called for high-altitude balloons and eventually earth satellites to provide wide-area searches of the Soviet Union, with close-area surveillance provided by high-altitude airplanes and second-generation satellites. To achieve close-area surveillance, the study identified a requirement for a special purpose, single-engine, lightweight (unarmored) reconnaissance airplane to be employed expressly for peacetime strategic reconnaissance at altitudes of 70,000 feet or higher.[41]

A few months later, on July 1, 1953, the Wright Air Development Center (WADC) issued six-month study contracts for such a special-purpose Air Force reconnaissance airplane to three East Coast firms: Bell Aircraft Company, Fairchild Engine and Airplane Corporation, and the Glenn L. Martin Company. The design requirements were the brainchild of Major John D. Seaberg. The closed procurement competition called for acquiring an airplane similar to the one Leghorn had urged the Air Force to embrace—a jet-turbine-powered aircraft that would perform "pre- and post-strike reconnaissance," possess a flight radius of 1,500 miles unrefueled, and fly at an altitude of 70,000 feet or higher. In March 1954 WADC chose for development the twin-engine Bell entry, the X-16, over the single-engine Fairchild entry. To meet near-term reconnaissance needs, the service also selected for procurement a modified version of the twin-engine British Electric Canberra bomber (later known as the RB-57) offered under license by the Martin Company. The winning X-16 design featured two wing-mounted jet engines (the second engine perceived as a safety feature), an armor-plated pressurized cabin, an ejection seat, and a single carry-through wing spar that met military specifications (MilSpecs) and required high g-loading (the ability of an aircraft to make hard, high-speed turns).[42]

Officials at Lockheed Aircraft Corporation in Burbank, California, became aware of this competition and in late November 1953 closeted themselves with

their premier designer, Clarence L. (Kelly) Johnson. In March 1954, about the time ARDC selected the X-16, Lockheed sent to the recently promoted Brigadier General Bernard Schriever an unsolicited proposal for a different kind of reconnaissance airplane. Called the CL-282, it did not contain an ejection seat and featured a single jet engine, an unpressurized cabin, bolted-on, high-aspect "wet" wings, and a payload bay between them that could carry some 500 pounds in 15 cubic feet. It was designed to attain an altitude of 70,000 feet and fly for 2,000 miles at a restricted airspeed—not to exceed 390 knots (any greater speed would tear the wings off). This fragile, single-purpose, high-altitude vehicle would tolerate only very low maneuver loads—about 2.25 gs—far below the requirements of military specifications.[43]

Schriever was interested. Although the X-16 promised to meet MilSpecs, the CL-282 appeared to meet all requirements of the intelligence and reconnaissance DPO. He invited Kelly Johnson to Washington, D.C. In late March or early April 1954, Johnson and his Lockheed associates briefed Assistant Secretary of the Air Force for Research and Development Trevor Gardner, Deputy Chief of Staff for Research and Development General Donald Putt, and others. Leaders of the Air Research and Development Command (ARDC), responsible for acquisition of the counterpart X-16, successfully opposed the unsolicited Lockheed proposal, but not before it came to the attention of former members of the Air Force's Beacon Hill group now serving on James Killian's TCP. Through Philip Strong and Schriever, it also came to the attention of the CIA.[44]

Schriever knew a bright Yale-trained economist named Richard M. Bissell Jr., who recently had joined the CIA as one of Allen Dulles's principal managers. Late in May or in early June 1954, Schriever telephoned Bissell and invited him to the Pentagon. There, two members of Schriever's staff, RAND economist Burton Klein and Captain Eugene Kiefer, both of whom had continued to work on refining the intelligence and reconnaissance DPO, briefed Bissell on the CL-282 and its technical prospects and potential. Klein, working on loan to Schriever, recalled, "Bissell was immediately impressed and showed great interest in this airplane."[45]

A few weeks later the TCP began its secret assessment of the nation's offensive forces, air defenses, and intelligence capabilities. Word of Lockheed's proposed CL-282 already had reached members of the TCP's intelligence committee, including Alan Donovan and James Baker, just returned from his Air Force consultant's visit to the RAF. Chaired by Polaroid's Edwin Land and composed mostly of individuals who had served previously in the Beacon Hill Group, Land's TCP intelligence committee soon became convinced that this high-altitude airplane, believed to be nearly invisible to radar, was the nation's best answer to acquiring pre-hostilities strategic overflight reconnaissance at minimum risk.[46]

Eisenhower at that moment was ready to consider a proposal for a novel reconnaissance airplane that operated at extreme altitudes. Soviet fighters had attacked and nearly shot down the Air Force RB-47E that had flown over the Soviet Kola Peninsula a few months before. Military aircraft might again perform such provocative and illegal missions, but they increased the risk of triggering the conflict he sought to avoid. In late 1954, to provide the nation warning of surprise attack, the president decided to build and send these unarmed, single-engine Lockheed airplanes over the "denied areas" of greatest concern. At the operating level, except for Richard Bissell, Trevor Gardner, and Generals Bernard Schriever and Donald Putt, the leadership of the CIA and of the Air Force mostly opposed purchase of the CL-282. Eisenhower nonetheless determined that the CIA would direct this crucial project, with the airplane procured in the greatest secrecy outside of established channels. The Air Force would provide the needed technical support. (The project was started with Schriever's knowledge, although he learned of it later.)

On November 24, 1954, the president met at the White House to discuss the proposition with the secretaries of state and defense, the secretary of the Air Force, the DCI, and senior Air Force officers. Secretary of State John Foster Dulles "indicated that difficulties might arise out of these operations, but that 'we could live through them.'" All agreed to proceed with the project in secrecy along the lines of shared management.[47] For this joint civil-military project, the CIA would provide the funding, overall direction, and security procedures. The Air Force would provide the facilities infrastructure, trained technical personnel, and, eventually, pilots. If these decisions marked the impending demise of military aircraft overflights of the USSR, they unquestionably established strategic overflight reconnaissance as a national policy.

OVERFLIGHT AT EXTREME ALTITUDES: THE GENESIS OF CORONA

At the CIA, Allen Dulles named Richard Bissell director of Project AQUATONE, as the CL-282 effort was called. Bissell had the work under contract with Lockheed by the end of 1954.[48] The first of the famous aircraft, renamed the "U-2," was test-flown in Nevada eight months later. AQUATONE's Air Force Deputy Director, Colonel Osmond J. Ritland, supported Bissell from his office in the Pentagon, while Colonel Marion C. Mixson worked directly with Bissell at the CIA.[49] Elsewhere in Washington, in preparation for a Four-Power Summit Conference scheduled in Geneva, Switzerland, in July 1955, President Eisenhower assigned responsibility for arms control and disarmament proposals, including prospective methods for policing future agreements, to his special assistants Harold Stassen and Nelson Rockefeller.[50]

Any aerial reconnaissance overflight of another state without authorization of course remained an illegal and hostile act unless national leaders agreed to it beforehand. On July 21, 1955, at the Geneva summit conference, President Eisenhower advised Soviet leaders of just such a plan. Devised primarily by Nelson Rockefeller, assisted by Max Milliken and Walt Rostow of MIT, it became an unannounced addition to a disarmament proposal.[51] The absence of trust and the presence of "terrible weapons" among states, he asserted, provoked in the world "fears and dangers of surprise attack." To eliminate those fears, he urged that the Soviet Union and the United States provide "facilities for aerial photography to the other country" and conduct mutually supervised reconnaissance overflights.[52] Before the day ended, First Secretary of the Communist Party Nikita Khrushchev privately rejected the president's plan, known eventually as the "Open Skies" doctrine, as an obvious attempt to accumulate target information. Immediately following the Geneva conference, Harold Stassen assembled another group of experts to consider the subject further and to evaluate other arms limitation proposals.[53]

Shortly after returning to the United States, on July 29, 1955, the president publicly announced plans for launching "small unmanned, Earth circling satellites as part of the U.S. participation in the International Geophysical Year" (IGY), scheduled between July 1957 and December 1958. His statement avoided any hint at the principal underlying purpose of this enterprise, which was to establish the principle in international law of "freedom of space," with all that that implied for strategic reconnaissance conducted at altitudes above the "airspace" to which the states beneath claimed exclusive sovereignty. Crafted early in 1955 in response to TCP recommendations by Donald H. Quarles, Eisenhower's assistant secretary of defense for research and development, this initial U.S. space policy established a precedent during the IGY and would become a cardinal principle of public space law—incorporated in international treaties a decade later. It paved the way for the launch and operation of the first American reconnaissance satellites in 1959–60.[54] (See chapter 5 on the subject of freedom of space.)

In August 1955, at the invitation of World War II hero and presidential confidant James Doolittle, Richard Leghorn became a member of the Stassen/Rockefeller arms control and disarmament group, serving on the "aerial inspection" subcommittee. Now aware of the U-2 project, Leghorn viewed strategic reconnaissance as a potential "inspection system" that would serve two critical functions: to forewarn of surprise attack and to supervise and verify arms-reduction and nuclear test-ban agreements.[55] President Eisenhower and other key administration officials also embraced this view before the first U-2 mission ventured into Soviet airspace.

In the meantime, after a prolonged gestation period, the Air Force completed testing of its balloon reconnaissance system. This effort mounted aerial cameras

in gondolas suspended beneath large polyethylene balloons for flight at very high altitudes (greater than 70,000 feet). The balloons, launched from Western Europe, were intended to drift over the USSR on prevailing winds and to be recovered in Japan or Alaska. This effort perfected methods of flying balloons at constant-pressure altitudes, parachutes capable of supporting a 600-pound load descending from high altitudes, and an aerial recovery system that employed C-119 cargo airplanes equipped with grappling lines and winches able to snatch the gondola packages in mid-air.[56] The camera employed in this project was designed and engineered for the Air Force by Walter Levison and Francis Madden at Boston University's Optical Research Laboratory. Weight constraints precluded a standard trimetrogon installation, and the two men fashioned a novel lightweight camera that used a 9 × 9-inch film format, equipped with two separate 6-inch Metrogon lenses that viewed the earth obliquely. The lenses provided a 10-degree overlap at the center and the camera covered the ground from horizon to horizon. Various firms manufactured some 2,500 of these BU "duplex cameras" for the project.[57]

This initial balloon reconnaissance project, known as GENETRIX (WS-119L), was executed in early 1956. Teams from the Strategic Air Command launched the balloons from bases in West Germany, Scotland, Norway, and Turkey beginning on January 10. Between that date and February 6, when President Eisenhower terminated the effort in the face of strong Soviet protests, 516 balloons were released to sail over Russia on the prevailing winds. The U-2 aircraft was about to begin flight operations, however, and, not wanting to alert Soviet leaders to its high-altitude capabilities, administration officials directed the Air Force to ballast the GENETRIX balloons to prevent them from ascending to altitudes greater than 50,000 feet. As a

Walter Levison, who developed the WS-461L balloon camera and proposed that the camera be modified for use in a reconnaissance satellite. Levison's camera design was used on the CORONA satellite. (Photo courtesy Walter Levison)

result, numerous balloons with their camera packages were shot down; only sixty-seven reached the recovery area, and of these only forty-four were retrieved.[58]

A few months after Eisenhower terminated that phase of GENETRIX, he approved the first flight of Project AQUATONE. On July 4, 1956, a camera-equipped U-2 took off from Wiesbaden, West Germany, to survey the USSR's naval shipyards and especially its submarine construction program. It overflew Poland, Belorussia, Moscow, Leningrad, and the Soviet Baltic states. Contrary to American expectations, Soviet radar detected and tracked this first U-2 at its 70,000 feet altitude.[59] This overflight caused considerable consternation among the post-Stalin Kremlin leaders. Strategic reconnaissance, to be sure, furnished not only indications and warning but also targeting data for a nuclear attack. According to his son, Sergei, Soviet Communist Party Chairman Nikita Khrushchev rejected the 1955 Open Skies proposal because he believed Americans were

> really looking for targets for a war against the USSR. When they understand that we are defenseless against an aerial attack, it will push the Americans to begin the war earlier . . . [and] if in this fear of each other the Americans realized that the Soviet Union would become stronger and stronger, but was weak now, this [intelligence] might push them into a preventive war.

The event triggered Kremlin orders for new surface-to-air missiles and high-performance fighters, and accelerated work to perfect an intercontinental ballistic missile.[60]

U.S. leaders in 1956 might have been seeking the U-2 to collect intelligence of Soviet military capabilities that would warn them of an impending nuclear Pearl Harbor. But the flights forcefully reminded Khrushchev and other Kremlin officials of the Luftwaffe reconnaissance overflights that preceded Germany's surprise attack on the USSR in 1941. Fears of a surprise attack among Soviet authorities were essentially mirror images of those shared by their American counterparts.

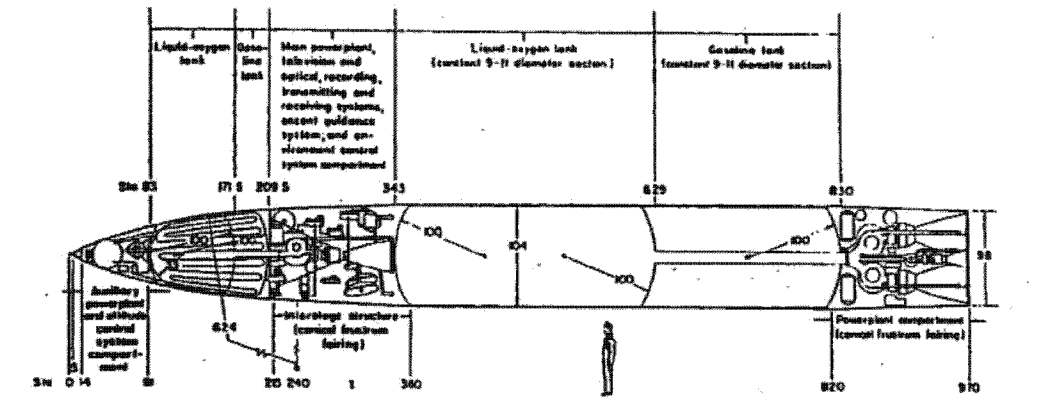
In the months that followed, President Eisenhower approved only a small number of U-2 overflights. These assayed Soviet nuclear production and test facilities and the number, kind, and disposition of its military forces. The intelligence thus acquired might also dispel or confirm American intelligence concerns that "bomber" and "missile" gaps existed between the two superpowers. Soviet scientists and engineers, in the meantime, successfully tested an ICBM in August 1957 and, two months later, launched the world's first artificial earth satellite, Sputnik I. In addition to its profound psychological impact among the publics of Western nations, Sputnik's orbiting of the earth did indeed establish

the international precedent of "freedom of space" and of the eventual right of overflight in outer space that the president and his advisors had desired. But the media clamored for space projects with which to surpass the Russians. Without divulging the intent of his IGY-generated space project and its clandestine policy, the president had to decide who would control and direct U.S. astronautical activities, now certain to be much larger and more diverse than anyone had imagined.

Working with his advisors and the Congress, Eisenhower answered these questions between late 1957 and 1961. The answers turned primarily on issues of national security.[61] The issue of first concern arose a few weeks after the October 4 launch of Sputnik I. On October 24 the President's Board of Consultants on Foreign Intelligence Activities (PBCFIA) submitted one of its periodic reports to Eisenhower. Formed by executive order the year before to review and report to the president on activities of the government's intelligence organizations,[62] this eight-member board was chaired by the ubiquitous James Killian and included among its members Edwin Land. The PBCFIA report recommended an evaluation of overhead reconnaissance systems, including satellites.[63]

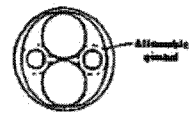
The U.S. Navy and Army Air Force had begun studies of earth satellites in 1945–46. The RAND Corporation had continued them for the U.S. Air Force after 1947. On March 1, 1954, RAND issued a concluding Project Feed Back report which recommended that the Air Force begin a reconnaissance satellite project. Simultaneously, the Defense Department Study Group on Guided Missiles advised the Air Force that the design and construction of an ICBM was technically feasible, and that if such a program was pressed vigorously, ICBMs would become available by 1960. The group recommended that the program begin immediately. On February 16, 1954, the Air Force transmitted these findings and recommendations to Assistant Secretary of Defense for Research and Development Donald Quarles. Endorsed by the Eisenhower administration, by year's end Bernard Schriever found himself in charge of the Western Development Division (WDD), the ARDC organization created specifically to build the nation's ICBM.[64] Starting on parallel tracks, the military satellite and its potential booster would soon converge on the West Coast—all under Schriever's direction.

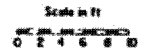
At the ARDC's Detachment 1 at Wright-Patterson Air Force Base (WPAFB), the RAND Feed Back report particularly impressed Major Quenten A. Riepe who, along with Captain James S. Coolbaugh, promoted the project at ARDC and at Headquarters USAF. The Air Force's Geophysics Laboratory and the Rome Air Development Center in New York supported this effort. In November 1954, ARDC issued System Requirement Number 5, which called for competitive system design studies of a reconnaissance satellite. On March 16,



Vehicle characteristics	Booster plus satellite stage		Satellite stage	
	Full	Empty	Full	Empty
Weight (lb)	177,900	35,400	22,520	4,480
Primary structure weight (lb)	2,485		620	
Covering and secondary structure weight (lb)	1,750		335	
C G location, station number	524	381	168	207
Mass moment of inertia, pitch and yaw (slug ft²)	1,447,102	675,558	12,320	6,184
Mass moment of inertia, roll (slug ft²)	49,405	7,805	3,393	495
Thrust developed (lb)	284,860*		36,030	
Propellant flow rate (lb/sec)	1,140		122	
Major exit area to throat area ratio	10		20	
Combustion chamber pressure (psia)	600		600	
Propellant system	O_2 + CH_4,		O_2 + CH_4,	
Specific impulse (sec)	271.4†		299	

* Sea level static. † Integrated time average value

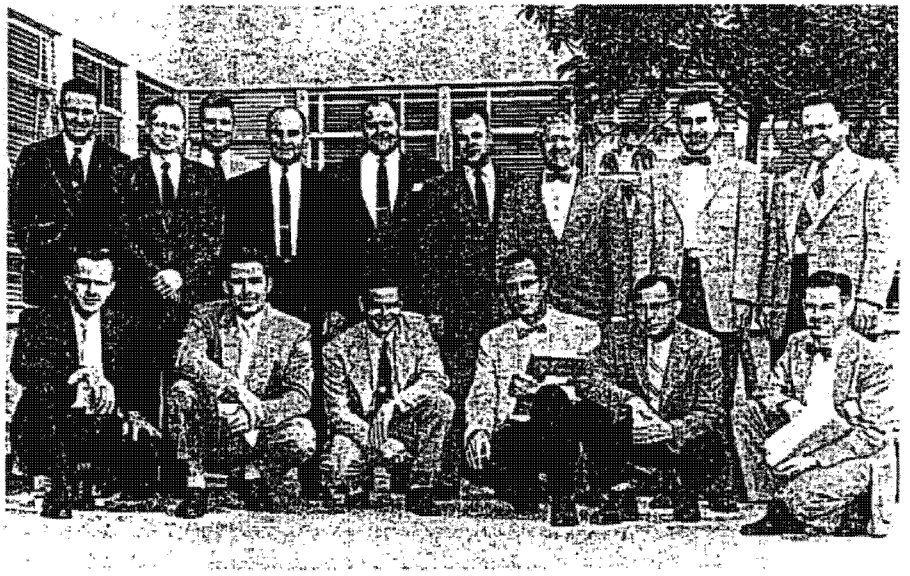




A satellite vehicle schematic diagram from the RAND "Project Feed Back" report, March 1954. RAND engineers envisioned a nuclear-powered satellite with a television camera. (Courtesy of RAND)

1955, Headquarters USAF issued General Operational Requirement (GOR) Number 80 (SA-2c). GOR 80 approved construction of, and provided technical requirements for, a reconnaissance satellite.[65]

At ARDC's Detachment 1 in the spring of 1955, Riepe directed a four-member team that worked on the reconnaissance satellite project. In addition to Riepe and Coolbaugh (now technical director, but specializing in auxiliary power and propulsion), it consisted of First Lieutenant John C. Herther (guidance and stabilization) and Captain William O. Troetschel (communications, command and control). Lieutenant Colonel William G. King replaced Riepe as the satellite project director in mid-August and, shortly thereafter, the Detachment 1 satellite team awarded small contracts to various firms for improvements in guidance systems and auxiliary power. Funding was obtained with which to pay four firms for a one-year competitive design study of a reconnaissance satellite, and three responded positively: Radio Corporation of America, Glenn L. Martin Company, and the Lockheed Aircraft Company. On the West Coast, made aware that the reconnaissance satellite project would affect directly the procurement of ICBMs, Schriever arranged in October to transfer the Air Force reconnaissance satellite office from WPAFB to his own WDD in Los Angeles.[66]



The original WS-117L team on March 4, 1956, shortly after their arrival at the Western Development Division, Los Angeles. Standing (left to right): Capt. William O. Troetschel; Edwin Kolb; 1st Lt. John C. Herther; Lt. Col. William G. King; Russell Johnson; James Suttie; Joseph Fallik; Capt. James S. Coolbaugh; and Capt. Frank S. Jasen. Kneeling: Fritz Runge; Capt. Richard P. Berry; Navy Capt. Robert C. Truax; Robert Copeland; Lt. Col. George P. Jones; Lt. Col. George Harlan.

Except for Lieutenant Colonel King, who was placed in charge of the Snark Project and remained at WPAFB, the satellite team moved to Los Angeles in February 1956. King, however, ensured that his team would remain together, be assigned to WDD, and not report to Ramo-Wooldridge, the firm that oversaw ballistic missile developments for Schriever. At the urging of Trevor Gardner, Undersecretary of the Air Force for Research and Development, Schriever named Commander Robert C. Truax, USN, as director of the Air Force Reconnaissance Satellite Office. Air Force Colonel Frederic C. E. (Fritz) Oder succeeded Truax in August, but Truax stayed on as his deputy. The Lockheed Aircraft Corporation won the satellite design competition in June and received a letter contract in October 1956. It would develop space reconnaissance and missile early warning satellites for the Air Force in what was now called the Weapons System (WS) 117L Program. By 1957, work on WS-117L was underway at Lockheed's newly formed Missiles and Space Division, then located in Palo Alto, California.[67]

The Air Force WS-117L program represented the nation's only reconnaissance satellite effort in 1957; it continued to labor under strict funding restrictions imposed by Secretary of the Air Force Donald Quarles.[68] Planning for space reconnaissance featured a second stage booster-satellite to be launched

into a near polar orbit by an Atlas ICBM adapted for that purpose. At first designed for a long-life mission of one year at an atmospheric drag-free altitude of 300 miles, the WS-117L Lockheed "Agena" satellite, as it later became known, was based on the 1954 RAND Feed Back study and was originally conceived to be gravity gradient–stabilized. That is, the vertically oriented Agena moved on orbit with its fixed, nose-mounted Eastman Kodak strip camera pointed toward the earth, thus aligning the long axis of the satellite's mass distribution perpendicular to the earth. (The WS-117L "pioneer" version of the Eastman camera was designed to deliver a resolution of 100 feet at the earth's surface; a more advanced version promised a resolution of 20 feet.) The gravity gradient stabilization scheme eliminated the need for fuel and associated weight required for gas jets, and made possible long-lived, very high-altitude orbital operations. It required only electricity for momentum-wheel damping with rate-sensing gyroscopes. Power was to be supplied by batteries recharged through solar cells. Film would move across the camera slit in the opposite direction of vehicle motion. The exposed film was to be processed on board, scanned electronically with a CBS "flying-spot scanner," and the video signal transmitted to Earth when the satellite passed within sight of a ground station in the United States. There, the signal could be reformed into a photographic image of the original scene.

This approach to space reconnaissance, in the view of some at the Air Force–funded RAND Corporation in Santa Monica, had significant drawbacks. First, the satellite had to carry enough film to be used over a one-year lifetime. Second, without a recorder for storing the images, the film had to be read out on each pass and then discarded on orbit. Third, the limited radio bandwidth and data transmission rate, coupled with the brief time available for communication while the satellite remained in line of sight of a ground station as it passed overhead, seriously restricted the number of images that could be relayed to Earth. In fact, RAND calculations yielded a daily figure equivalent to five or six 9 × 9-inch photographs whose quality was 100 lines per millimeter transmitted to Earth.[69]

Back in 1956, Richard C. Raymond in RAND's electronics division had compared the long-lived film readout system with a recoverable payload in which exposed film would be returned to Earth in a reentry capsule after a short mission. "Film recovery," Raymond calculated, "would yield at least two orders of magnitude more data" in a given period of time. RAND sent these findings to Headquarters USAF in March 1956. The RAND proposal, however, also had a drawback of its own. When seeking indications and warning of a potential surprise attack against the United States, one wanted information in near real time, not days later in the form of exposed reels of film that required developing. Rejecting the RAND proposal, the Air Force contracted with Lockheed

for the WS-117L visual readout, infrared, and ferret (signals intelligence) system a few months later, in October.[70]

Amrom H. Katz, the Air Force physicist who had participated in the 1946 CROSSROADS atomic bomb tests and had joined RAND several years later, was a recognized camera expert and a champion of pursuing simple technical solutions rather than complex ones. Katz and a RAND associate who shared his views, Merton E. Davies, embraced Raymond's answer to a fast-paced space reconnaissance project. While attending the annual meeting of the American Society of Photogrammetry in Washington on March 4–6, 1957, Davies encountered Frederic Wilcox of Fairchild Camera and Instrument Corporation. Wilcox described for him a new Fairchild panoramic camera developed for an aerial drone. It fit inside a pod and the entire camera rotated in a drum. Davies thought about the complexity inherent in this design. By the time he and Katz boarded a plane for the flight back to the West Coast, he had a "hot idea" for space flight: fix the camera to the satellite and spin the entire ensemble.[71] By late spring 1957, Davies and Katz were advocating the spinning camera and film-recovery scheme in briefings for scientific and military officials who visited RAND. These included Colonel Fritz Oder, Air Force director of WS-117L, his deputy, Navy Commander Bob Truax, and eventually members of the Reconnaissance Panel of the Air Force Scientific Advisory Board (SAB), the SAB's ad hoc Panel on Advanced Weapons Technology and Environment, the Defense Department's Advisory Group on Special Capabilities (Stewart Committee), and those of the Science Advisory Committee of the Office of Defense Mobilization. James Killian and Edwin Land were among the members of the last group. The two RAND champions of a recoverable space reconnaissance capsule system completed their formal study, with the assistance of other RAND coauthors, and issued it on November 12, 1957.[72]

Though aware of both the planned film readout and recovery space reconnaissance systems by mid-1957, Killian and Land still favored ongoing aerial overflight reconnaissance to meet the nation's immediate intelligence requirements. Both had recognized reconnaissance satellites as a system of future consequence in the 1955 TCP report. They had recommended that the nation prepare for this activity by establishing in public international law the principle of "freedom of space." To that end, the president had approved the IGY satellite project and its related space policy.[73] The launch of Sputnik I on October 4, 1957, which helped establish the legal precedent they sought, also caused them both to reconsider the timing and technical prospects of space reconnaissance. On October 24, reporting as members of the President's Board of Consultants on Foreign Intelligence Activities, but after hearing the satellite briefings by RAND and WS-117L officials, they advised Eisenhower that neither a new reconnaissance aircraft under study at the CIA (Project OXCART,

which would become the supersonic A-12/SR-71) nor the Air Force WS-117L readout reconnaissance satellite would achieve operational status before 1960. They recommended evaluating the interim solution proposed for an advanced reconnaissance system: the film-recovery satellite advocated at RAND and adopted by the WS-117L office.[74]

By the fall of 1957, both Killian and Land had Eisenhower's complete confidence. Project AQUATONE's U-2 had proved a stunning technical success and an intelligence bonanza. If a satellite that ejected a film capsule for recovery on Earth appeared promising to them, it would be investigated. On October 28 "the Executive Secretary of the National Security Council notified the Secretary of Defense and Director of Central Intelligence that the president had asked for a joint report from them on the status of the advanced [reconnaissance] systems." On December 5 Undersecretary of Defense Donald Quarles, another trusted presidential confidant, replied on behalf of the Defense Department and of DCI Allen Dulles. Because of the sensitivity of the subject, he said, his review would be conducted through oral briefings. Held later in the month, the technical evaluation apparently confirmed the views of Killian and Land. The WS-117L satellite that took pictures, developed them on board, then scanned the film electronically and radioed the images to stations on Earth faced daunting, long-term technical challenges. *If* atmospheric reentry techniques based on ICBM warhead technology could be perfected, film exposed on one- or two-day missions might be returned to Earth for developing and analysis. The parachutes and air-sea recovery system already perfected to retrieve GENETRIX cameras and film added confidence in this approach.[75]

The interim reconnaissance satellite system that Quarles compared with the WS-117L readout system was the same plan that had been described in November by Davies and Katz, and had already been endorsed by Fritz Oder and Bernard Schriever. It consisted of a Thor IRBM liquid-propellant launch vehicle with an Aerobee 75 solid-propellant second stage developed for the Vanguard IGY satellite launcher. Mounted atop the Aerobee was a football-shaped third-stage satellite that contained the camera, film, and a small solid-propellant recovery rocket. The spin-stabilized satellite contained a Fairchild-manufactured transverse panoramic slit camera that featured a 12-inch focal-length f/3.5 lens, and could cover a narrow angle of approximately 21 degrees. Wide-angle scanning, accomplished by spinning the satellite, moved the lens across the field during the exposure time. Pictures were to be taken only when the lens, mounted perpendicular to the roll axis, swung past the earth below. At 135–140 miles altitude, the camera would produce a resolution on the surface of 60 feet at 40 lines per millimeter.[76]

On the West Coast, Oder had counted himself among the first Air Force converts to the Davies and Katz recoverable reconnaissance satellite concept back

in the summer of 1957. Indeed, by August he had sold the concept to his superiors, new Major General Bernard Schriever, commander of the Air Force Ballistic Missile Division, and Schriever's deputy, Brigadier General Osmond Ritland. The three men also conferred with Richard Leghorn, by now a member of the Aerial Inspection Subcommittee of the President's Arms Control and Disarmament Group. All agreed. If this effort was to succeed quickly, it would require presidential approval and the highest of national priorities, and needed to be prosecuted covertly like Project AQUATONE. Schriever would soon approach select members of the Air Staff and others in Washington about this project and about a "second story" that might be devised to provide a cover. Oder's WS-117L program office in Inglewood, California, meanwhile, included the Thor-boosted reconnaissance satellite, identified as Program IIA, in its 1957 WS-117L Development Plan. Lockheed also was instructed to plan for this addition to the WS-117L program.[77]

In Washington, D.C., on November 12, 1957, Assistant Secretary of the Air Force for Research and Development Richard E. Horner carried out his own technical assessment for Secretary of Defense Neil McElroy. He affirmed that a film-recovery satellite could reach operational status at least a year before the WS-117L readout satellite.[78] A few days later, on November 15, in the aftermath of the second, more spectacular Soviet Sputnik launching, Eisenhower named James Killian to be his special assistant for science and technology and to serve as chairman of the new President's Science Advisory Committee (PSAC). In his new capacity as presidential science advisor, and still serving as chairman of the PBCFIA, in early December Killian conferred at the White House with Polaroid's Land, the CIA's Bissell, President Eisenhower's staff assistant Army Colonel Andrew Goodpaster, and Schriever. The men reviewed aircraft strategic reconnaissance capabilities and the potential options for satellite reconnaissance. A film-recovery satellite acquired and managed through a covert program, they concluded, represented the nation's best near-term choice to augment the U-2. A Thor IRBM and the Lockheed liquid-propellant Agena booster-satellite developed for the WS-117L, they agreed, enabled a heavier payload. The larger and more powerful Lockheed upper stage, which could be stabilized on all three axes in space, would be substituted in place of the smaller solid-propellant Aerobee 75.[79]

On February 6, 1958, a few weeks after Quarles's December review of strategic reconnaissance systems, Killian and Land met with DCI Allen Dulles, Secretary of Defense McElroy, and Undersecretary of Defense Quarles. They agreed to separate the Air Force film-recovery satellite Program IIA from the WS-117L program and assign it to a CIA–Air Force team, again led by Bissell. The next day, on February 7, Killian and Land met with Eisenhower to discuss the plan. Land explained for the president that they could expect a lower reso-

lution of objects at the earth's surface in photographs taken from space, compared with the resolution obtained in photographs taken by high-altitude balloons and aircraft. But the proposed film-recovery satellite, he said, did not radiate any electronic signals and would be almost undetectable. The Air Force WS-117L readout reconnaissance satellite program, which already had received a good deal of publicity, would continue, thus providing the Air Force and its WS-117L contractors an opportunity to surmount the technical challenges and deliver near real-time images.

After listening to the recommendation, the president agreed that an interim film-recovery satellite project should begin, but independently and covertly, separated from the larger reconnaissance satellite program and managed in a manner like the U-2. The CIA, Eisenhower emphasized, should be in charge and the new Advanced Research Projects Agency (ARPA) should execute its orders.[80] In February 1958, with scant experience in or technical skills associated with launch vehicles and automated satellites, the CIA was thus charged with managing a crucial space project. The president's decision represented his preference for civilian control of national intelligence and his confidence in the men who had quickly and successfully discharged Project AQUATONE. That preference and confidence notwithstanding, to execute the space reconnaissance project the agency unquestionably would have to depend on General Schriever and the team he had assembled at the Air Force Ballistic Missile Division and its aerospace contractors.

FIRST YOU SEE IT AND THEN YOU DON'T: CORONA UNDERWAY

A new entrant in the civil-military space arena, the Advanced Research Projects Agency (ARPA) was established in the Defense Department on February 7, 1958. The president assigned to ARPA, along with military space activity, temporary responsibility for all U.S. civil satellite projects. With the authority and responsibility for directing astronautical ventures thus consolidated, Eisenhower hoped this new agency might eliminate the interservice feuding over seemingly glamorous space missions. In military space matters, the Air Force now had to respond to ARPA orders in developing and conducting space flight operations. Temporarily, ARPA also would be involved in the covert satellite reconnaissance effort. It would openly fund Air Force procurement of the Thor boosters and Agena upper-stage satellites. The CIA would provide the security system and covertly procure reconnaissance components, such as the cameras and film-reentry capsules. The Air Force would furnish the overall management and technical infrastructure.[81]

Bespeaking the enormous influence that Eisenhower's scientist-consultants now exerted in the administration, a day or two after meeting with the president, Polaroid's peripatetic Edwin Land visited CIA headquarters and informed a startled Richard Bissell that he would now direct a covert reconnaissance satellite project. DCI Allen Dulles, to be sure, knew of his subordinate's impending assignment, but it was Land who told Bissell of his new responsibility. At the CIA, in addition to the covert Project AQUATONE for which he also served as director, Bissell held the official title of Special Assistant to the DCI for Planning and Development. Bissell drew the CIA cadre for the satellite project from his Development Projects Staff. Before month's end he confirmed as his deputy director Air Force Brigadier General Osmond J. Ritland, Schriever's vice commander at the Air Force Ballistic Missile Division, who had served so ably as his first deputy on Project AQUATONE. Under Ritland, the Air Force once again would furnish the project infrastructure, in this case developing, launching, commanding, and controlling all of the satellites on orbit in addition to providing recovery of the film capsule above and, in conjunction with the U.S. Navy, on the surface of the Pacific Ocean.[82]

Before work on the project could proceed, Eisenhower officials first had to eliminate the publicly known WS-117L Thor-based reconnaissance satellite film-recovery Program IIA. Next, they had to resurrect it as a covert satellite project with a plausible "cover" (or "second story") to account for its existence. Finally, Richard Bissell had to assemble and organize the contractor team that would execute the covert satellite project. In the first instance, Herbert York, ARPA's chief scientist, followed the instructions of Undersecretary of Defense Donald Quarles. Quarles prepared a directive that was signed by ARPA's newly named director, Roy W. Johnson, and sent to Air Force Secretary James H. Douglas Jr. on February 28, 1958. It canceled the Air Force Thor-boosted reconnaissance satellite recovery component of the WS-117L program and authorized in its place the Air Force Discoverer Project, which would develop a "biomedical capsule" for the recovery of biological specimens lofted into space atop Thor-Agena launch vehicles. This new scientific biomedical space project, the directive asserted, was expected to contribute to America's early achievement of manned space flight.[83] It was Quarles who "set this all up," York recalled, and who pulled the strings of this public sleight-of-hand.[84]

Simultaneously, at the monthly review meeting of Air Force and contractor participants, John H. (Jack) Carter, Lockheed's manager of WS-117L, announced without explanation that Program IIA had been canceled. As one attendee recalled, RAND's Amrom Katz and Merton Davies, the two men who had fashioned that program, were in the audience and they jumped out of their chairs:

They went ballistic, Amrom particularly. Amrom took it upon himself to try to get the effort reinstated and he began going around the country briefing anyone who would listen about the unwise decision to cancel the recoverable camera system. I mean he had a cause! He became so well known as an agitator on this that he disqualified himself for being cleared for what was now a black program—even though he had conceived it! The folks in charge knew that if they cleared Amrom, he would immediately cease agitating and that would tip everyone else that the program was underway.[85]

During the next six weeks Bissell identified the contractor team and its leadership and selected a name for the effort: Project CORONA. The name came first, confirmed at a meeting of project officials on March 10, 1958.[86] On March 15 Bissell met with General Ritland and confirmed the choice of the Douglas Aircraft Thor booster and Lockheed Agena second stage for CORONA. Moreover, they determined to make Lockheed the system engineer, responsible for the technical direction and integration of the entire effort. Lockheed's Project CORONA manager therefore would have to be one of its best engineers. Finally, they discussed funding an alternate camera to backstop the primary Fairchild–General Electric system.

The decision to consider a backup camera arose at least in part in response to an unsolicited proposal that Bissell had received a month before from a new firm: Itek (Information Technology). The firm's founders, Richard Leghorn as president and Duncan Macdonald and Arthur Tyler as vice presidents, had incorporated on September 27, 1957. Tyler and Leghorn were Eastman Kodak executives, and Macdonald now was Boston University's Dean of the Graduate School (Tyler had invented the Eastman Kodak "Minicard" system, an IBM punched card that contained a high-resolution microfilm negative, which might be a photographic image or an engineering drawing, but could be sorted and retrieved by a computer.) On October 4 Sputnik I shocked the world. For the nascent "document retrieval" company, that shock provided the impetus for a rapid takeoff. At the financial closing on October 10, Itek's founders put up only a modest amount of money while Laurance S. Rockefeller and other Rockefeller family members furnished most of the funds required for the first few months of operation. Within weeks, Leghorn negotiated a subcontract with Ramo-Wooldridge to develop and manufacture equipment that would process and catalogue the images produced by the WS-117L readout reconnaissance satellites. The firm now began to hire personnel for this effort.[87]

In the meantime, the Air Force had advised Boston University that it would cease funding operation of the BU Physical Research Laboratories (BUPRL—formerly the BU Optical Research Laboratory) that since 1946 had operated under contract to Brigadier General George Goddard's Aeronautical Photographic Laboratory at WPAFB. Directed by F. Dow Smith, chairman of

the BU physics department, with Walter Levison serving as his deputy, the nonprofit BUPRL over the years had designed and developed numerous aerial cameras for the Air Force.

Indeed, in early 1957, Levison had begun the design of a panoramic camera for a follow-on Air Force balloon reconnaissance project called WS-461L. Using the higher resolution of the center lens field to sweep a wide angle, the panoramic camera provided high resolution over a wide swath. Such cameras, to be sure, had been used since the nineteenth century, but except for James Baker's work on the spherical shell lens, little effort had been invested in developing aerial panoramic cameras. In 1949, Lieutenant Colonel Richard W. Philbrick, the Air Force Liaison officer at BUORL, for the first time modified an S-7 Sonne strip camera and mounted it so that the film traveled perpendicular to the direction of flight. He rotated the entire camera around the longitudinal axis of the aircraft and pulled the film past a slit synchronously with the rotation of the camera body and lens. A dramatic panoramic photograph of Manhattan Island taken with this camera appeared in an issue of *Life* magazine that year. Philbrick's pioneering work had prompted the Fairchild design of a rotating aerial camera that caught the attention of Davies and Katz; however, Levison avoided rotating the camera by selecting a 12-inch focal length f/5 triplet, three-element lens and rotating it 120 degrees about its rear node, back and forth, perpendicular to the line of flight. Again working with Francis Madden and using this mechanization and the fast (for aerial photography) f/5 lens, this camera, when combined with high-resolution 70mm (2-inch) document copy-type film, would immediately produce images with 100 line pairs per millimeter. In March 1957 Katz christened the proposed camera design HYAC (for high acuity), and, on viewing the test results, in January 1958 he declared: "Seeing this photo . . . gave me a real and honest thrill. I think this is one of the top achievements in the history of aerial photography, certainly that portion of the history to which I've been exposed and in which I've been involved."[88]

The HYAC camera underwent flight tests in late 1957. At the same time, Itek's president Richard Leghorn met with BU's president Harold C. Case. Although the USAF might still fund specific projects like the HYAC camera, Case feared that the overall expense of operating the BUPRL would quickly drain the university's financial reserves. He wanted to divest the university of the enterprise immediately. Moving more rapidly than other bidders, again with the financial backing of Laurance S. Rockefeller, Leghorn made an offer that acquired for Itek the entire 106-member staff of the BUPRL and all of its on-going contracts, physical equipment, camera designs, and research reports, effective January 1, 1958.[89] At its core, Itek now was BUPRL resurrected to operate for profit.

Leghorn and Macdonald were aware of the impending Air Force–CIA satellite reconnaissance project and its planned use of the Fairchild panoramic cam-

era. With the flight-tested HYAC camera behind them, they possessed an impressive alternate. If scaled-up from a 12-inch to a 24-inch focal-length lens, and using high-resolution 70mm film, calculations showed that this nodal point-scanning, 70-degree panoramic camera would provide a resolution on the earth's surface of 20 feet. That was a significant improvement over the 60-foot resolution of the Fairchild spin-stabilized camera. Moreover, with sufficiently low blur rates, faster optics, and projected Eastman Kodak film improvements, a scaled-up HYAC-type camera might achieve a resolution at the earth's surface approaching that of balloon-borne cameras. The Itek camera proposal, which arrived at CIA headquarters in mid-February 1958, prompted Bissell and Ritland to consider funding a backup to the Fairchild camera. But were other American aerial camera systems available that might be preferred in the space reconnaissance role?

To answer that question, on March 18, 1958, CORONA leaders conducted an evaluation of alternate cameras at the Old Executive Office Building in Washington, D.C.[90] In addition to Bissell and Ritland, the assessment panel consisted of the president's science advisor, James Killian, and two of his key PSAC advisors, Edwin Land and Harvard chemist George Kistiakowsky. The remaining panel members included Herbert York, ARPA's chief scientist, and the Air Force WS-117L managers, Fritz Oder and his deputy, Bob Truax, who had just moved to Washington for an ARPA assignment that would in fact cover his new role as a technical advisor to Richard Bissell on Project CORONA.

Four companies offered an alternate camera at this review: General Electric, Fairchild, Eastman Kodak, and Itek. The presenters for each of the firms arrived separately and waited in different anterooms, and each of the teams briefed the assembled CORONA evaluators alone. General Electric had hired Richard Raymond from RAND, and that firm offered a variation of the Fairchild spinner. Fairchild, in turn, offered a refined version of its original camera that could, it was hoped, secure a resolution at the earth's surface somewhat better than the 60 feet claimed for the original. Eastman Kodak, which held the contract for the pioneer and advanced strip cameras of the WS-117L readout system, likewise recommended a version modified for panoramic coverage with spin stabilization. Finally, physicist and Itek cofounder Duncan Macdonald and John C. (Jack) Herther offered a reciprocating 70-degree field panoramic camera with an f/5 Tessar-type 24-inch focal length lens, otherwise similar to the high-performance HYAC balloon camera.[91]

Itek's proposed vertical-looking camera scanned at right angles to the line of flight, which demanded a satellite horizontally stabilized on all three axes. That introduced technical complexity and accounted for the presence of Jack Herther. Richard Leghorn had hired him as one of Itek's first technical employees just before the BUPRL acquisition. A 1955 MIT graduate, he wrote his

thesis on a gyrostabilized ascent guidance system for the WS-117L orbiting stage, after which he had been posted as a reserve officer to the nascent program office in the ARDC's Detachment 1 at WPAFB.[92] Now Herther explained for the Project CORONA evaluation team how the Lockheed ascent guidance system could be modified to stabilize the Agena horizontally on all three axes in space for a short duration, low-altitude reconnaissance mission. This orbital attitude-control system, Herther affirmed, would produce the pointing accuracy and low roll and pitch blur rates needed for the Itek camera to deliver a resolution at the earth's surface of at least 20 feet.[93]

Duncan Macdonald had worked previously with Arthur Lundahl, chief of the CIA's photo-interpretation unit, on matters of high-altitude Air Force balloon and U-2 aerial photography. He knew that a camera's effective resolution at the earth's surface allowed photo-interpreters to positively identify objects 3 to 5 times larger than the resolution achieved.[94] Based on photo-interpretation needs, the performance experience with the HYAC flight test program, and a stable (low blur rate) platform in space, Macdonald predicted that eventually it should be possible to achieve balloon quality photographs from satellite altitudes. After all of the presentations, the CORONA evaluation team conferred and selected Itek. The long-shot newcomer would supply the backup camera.[95]

On March 24–26, 1958, Bissell and Ritland closeted themselves with all of the primary CORONA contractor representatives at the Flamingo Motel in San Mateo, California. Bissell informed attendees that a backup camera would be procured from Itek. Lockheed announced that James W. Plummer, formerly in charge of the WS-117L Eastman Kodak payloads, would serve as the CORONA manager responsible for the technical integration of the project. Project participants agreed that General Electric would provide the recovery system and that the effort would consist of ten CORONA vehicles, with three more if needed, launched from Vandenberg AFB on the California coast. Component fabrication, assembly, testing, and a first launch, participants agreed in a burst of optimism, could be accomplished before the end of 1958.

Back in Washington, D.C., on April 9, 1958, Bissell finished for the president's approval the CORONA Project Proposal. It called for the concurrent procurement of both the Fairchild and Itek cameras, though at this point the Itek system appeared a clear favorite because of its better initial resolution and promise of even greater resolution for photo-interpretation growth potential. Two days later, perhaps at the urging of Edwin Land, General Ritland and Bissell decided against procuring the Fairchild camera with its spin-stabilization, and in favor of the Itek HYAC-type camera that required a stable platform in space. The revised proposal outlined a project that would consist of twelve launchings, become operational in June 1959, and conclude a year later in June 1960 when the WS-117L readout system was scheduled to become operational.

Fairchild would remain in the project, at least temporarily, by fabricating the Itek-designed cameras.[96]

The revised CORONA Project Proposal also identified ARPA as exercising overall technical supervision, with the Air Force, through Air Force Ballistic Missile Division, acting as its agent. The CIA would remain responsible for CORONA's security system and for procuring the reconnaissance equipment. With the concurrence of ARPA director Roy Johnson and other project participants, Bissell and the Deputy Director of Central Intelligence, General Charles P. Cabell, presented this proposal to President Eisenhower on April 16, 1958.[97] After asking some questions, the president verbally approved it.[98] On April 25 Bissell issued a two-page Statement of Work to guide the prime contractor, Lockheed's Missile and Space Division. Among other objectives, it called for photographs with a resolution at the earth's surface of 25 feet or better with a location accuracy objective of plus or minus one mile; maximum possible ground coverage; and recovery of latent image film "by means of ballistic reentry and land or sea recovery." After identifying the primary subcontractors and items that the government would furnish, the statement turned to the question of managing the organizational amalgam. Overall technical direction, it advised the firm, "is the joint responsibility of several agencies of the Government. In the interest of effective management, however, such direction will be provided primarily by and through the Air Force Ballistic Missile Division acting as the agent for all interested components."[99]

At the end of April 1958, CORONA participants thought that they had embarked on a short-term, high-risk strategic reconnaissance venture that would augment the U-2 as an overhead technical collection system until WS-117L satellites became operational in 1961. That CORONA would succeed beyond anyone's expectations, that it would eclipse the WS-117L program entirely, that it would continue in operation over 12 years and set the pattern for American reconnaissance satellite projects to follow, and that managing it would prompt creation of a National Reconnaissance Office, they could not know and would not have believed. On the recommendation of science advisors, on the approval of the president, on the word of businessmen and government officials pledged in the clasping of hands, and on a broadly drawn two-page Statement of Work, Project CORONA was underway. The space-based "intelligence revolution" had begun.

needed, Eastman Kodak came up with an infrared inspection method that could be used to determine optimum exposure levels so that additional development could be applied before the image was fixed.

121. McDonald, "CORONA," 707–8, and Report No. 9, KH-4B System Capability, "Appraisal of Geologic Value for Mineral Resources Exploration," March 1971, contained in *CORONA*, ed. Ruffner, 321.
122. Greer, "CORONA," 36–37.
123. "Appraisal of Geologic Value for Mineral Resources Exploration," 321.
124. *CORONA*, ed. Ruffner, 356.
125. Linda Neuman Ezell, *NASA Historical Data Book*, vol. 3: *Programs and Projects 1969–1978* (Washington, D.C.: NASA, 1988), 335–41.
126. Walter Levison, interview by Dwayne A. Day, November 16, 1995.
127. Albert Wheelon, comments at "Piercing the Curtain," May 23, 1995.
128. Murphy interviews, March 7 and December 5, 1996.
129. Greer, "CORONA," 39.
130. According to Frank Madden, the qualification models for the KH-3, KH-4, and KH-4A were all refurbished and flown. For the KH-4B qualification model, the government funded only one camera of the stereo pair and the central supporting structure. This is the model on display in the National Air and Space Museum, Washington, D.C. A plywood model of the missing camera was added to complete the stereo configuration.
131. This number includes the 3 LANYARD, 12 ARGON, and 4 engineering (two radiometric, STARAD and one R&D) missions.

CHAPTER 4. POSTWAR STRATEGIC RECONNAISSANCE AND THE GENESIS OF CORONA

Note: I am indebted to numerous overhead reconnaissance pioneers who read and commented on the preliminary draft of this chapter and enriched it with their own recollections and documentary contributions. They are James Baker, James Coolbaugh, Merton Davies, Richard Garwin, William Hawkins, Jack Herther, William King, Richard Leghorn, Walter Levison, Frederic Oder, Bernard Schriever, Dow Smith, Robert Truax, William Troetschel, Paul Worthman, and Herbert York.

1. Strategic reconnaissance, to be sure, is a practice as old as warfare. What made it truly different after World War II was the acceptance of peacetime overflight and the appearance of the technical innovations (cameras, lenses, films, aircraft, and spacecraft) that made overflight reconnaissance possible. This form of reconnaissance, of course, embraced all sources, that is, signals intelligence (electronic, telemetry, and communications traffic) as well as imaging intelligence (radar and photography). This study focuses on the latter category because it directly answered the most pressing Cold War questions: Were the Soviets massing bombers along its northern shores, and was the U.S. the victim of a bomber and missile gap?
2. Donald E. Welzenbach, "Strategic Overhead Reconnaissance," unpublished draft manuscript, 1995, chapter 1.

3. George W. Goddard, "Photography Remains King in the Aerospace Age," *Photogrammetric Engineering* (March 1962): 88–89.
4. In addition to the K-22, during the war Baker designed a 60-inch f/6 telephoto lens—a folded optical system using mirrors; a 36-inch f/8 telephoto lens; a 4-inch f/2.8, spherical rotating lens that exposed spherical "shell" plates; and a 36-inch f/8 fluorite lens utilizing one element of synthetic optical fluorite that yielded "a perfection of color correction not hitherto achieved." At war's end, he was completing work on the 60-inch f/5 sealed telephoto lens that covered a 9- by 18-inch negative area. Considering these wartime contributions, Col. George Goddard judged Baker to be "the most versatile optical designer known to this command." Quotes from Col. George W. Goddard, Chief, Photographic Laboratory, Air Technical Service Command, letter to Gen. H. H. Arnold, Commanding General, Army Air Forces, July 17, 1945, as cited in Col. M. M. Irvine, War Dept Liaison Officer to National Defense Research Committee, letter to Office of Scientific Research and Development, Subject: "Transfer of Harvard University Records to Army Air Forces; Projects AC-29 and AC-88," April 17, 1946. See also Summary Technical Report of Division 16, NDRC, *Optical Instruments,* vol. 1 (Washington, D.C.: Government Printing Office, 1946), which contains details of the Harvard program. Baker wrote or coauthored a number of the chapters in this work.

   After World War II, James Baker worked as a consultant to Boston University's Optical Research Laboratory, Perkin-Elmer, and Eastman Kodak, while volunteering his services to committees of the USAF, the CIA, and PSAC. All of his postwar efforts had enormous ramifications for national security. Among other contributions, he designed and calibrated the high-resolution lenses for the 240-inch focal length "Boston Camera" as well as the lenses for the U-2, SR-71, and Eastman Kodak satellite cameras. Because almost all of Baker's government-related service involved classified projects, this modest man remained then, as he remains today, virtually unknown outside of the photogrammetry and intelligence communities.
5. "The U.S. Strategic Bombing Survey, Summary Report (European War)," September 30, 1945, as reprinted in *U.S. Strategic Bombing Surveys (European War and Pacific War)* (Washington, D.C.: Government Printing Office, October 1987), 39 (emphasis added), 41–42.
6. Welzenbach, "Strategic Overhead Reconnaissance," chap. 3.
7. George W. Goddard with DeWitt S. Copp, *Overview: A Lifelong Adventure in Aerial Photography* (Garden City, N.Y.: Doubleday, 1969), 349–50.
8. Back at the Harvard Yard, an unsatisfied Harvard University President James B. Conant insisted that the school not profit in any way from wartime military research. Despite a government offer of the Harvard Optical Laboratory to the school for the price of $1.00, Conant ordered the brand-new structure razed to the ground. The demolition, completed in June 1946, obliterated all signs of military optical research from campus, if not from memory.
9. Including representatives of Eastman Kodak, Polaroid, Bill Jack Optical, Fairchild Camera, Bausch & Lomb, Hycon, Perkin-Elmer, and Chicago Aerial.

10. Welzenbach, "Strategic Overhead Reconnaissance," chap. 3; Goddard, *Overview*, 351.
11. Richard S. Leghorn, "Objectives for Research and Development in Military Aerial Reconnaissance" (December 1946 [unpublished]), 26–27 (emphasis added). Beside Macdonald and Leghorn, the speakers included Maj. Gen. Curtis E. LeMay and Col. George W. Goddard, among others.
12. International Convention for Aerial Navigation, 1919, Article 1, as reprinted in De Forest Billyou, *Air Law*, 2d ed. (New York: Ad Press, 1964), 17.
13. Soviet aircraft from the Kola Peninsula could fly routes over the North Pole to attack the United States. By 1947, most American political and military leaders had come to view the atomic bomb as not just a larger, more destructive aerial bomb, but, if delivered in numbers, as a potentially decisive weapon. Gen. George C. Kenney, the first Commander-in-Chief, Strategic Air Command (CINCSAC), believed this and he directed the attention of the Strategic Air Command to the Arctic regions both "as a route of SAC bombers [and] as an avenue for a Soviet atomic strike upon the United States." John T. Farquhar, "A Need to Know: The Role of Air Force Reconnaissance in War Planning, 1945–1953," Ph.D. diss., Ohio State University, 1991, 75, 101–2. For the next few years, the CIA's strategic reconnaissance chief recalled, American leaders remained preoccupied with "the Soviet bomber force and the threat it posed to North America, as well as to Europe." Richard M. Bissell Jr., with Jonathan E. Lewis and Francis T. Pudlo, *Reflections of a Cold Warrior: From Yalta to the Bay of Pigs* (New Haven: Yale University Press, 1996), 92.
14. The National Security Act, signed by President Harry S. Truman on July 26, 1947, created the National Military Establishment and separate military departments of the Army, Navy, and Air Force.
15. Letter to Acting Chief of Eastern European Affairs, Department of State (Stevens), February 16, 1948, and AFOIR-CM to AAC/CC, Subject: "Violation of Soviet Frontier," n.d. (ca. Jan.–Feb. 1948), entry 214, TS Control and Cables Section General Files (July 45–Dec. 54), folder 2-900/2-999 (Feb. 1948); memorandum, Executive to the USAF DCS/O (Donnelly) and Multiple Addressees. Subject: "DCS/O Meeting, 14 May 1948," May 14, 1948, entry 214, TS Control and Cables Section General Files (July 45–Dec. 54), folder 2-1600/2-1699 (May 1948); memo for the Record, "To Brief Background Facts on Establishment of 40-Mile Limit on Reconnaissance Flights in the Pacific Area," n.d., entry 214, folder 2-3300/2-3399; and SECAF (Symington), letter (unsigned carbon copy) to Secretary of State (Marshall), n.d., entry 214, folder 2-1500/2-1599 (May 1948), all in RG 341, NARA, St. Louis (hereafter referred to as NARA-SL).
16. For the story of the detection, see Charles A. Ziegler and David Jacobson, *Spying without Spies: Origins of America's Secret Nuclear Surveillance System* (Westport, Conn.: Praeger, 1995).
17. In his letter to the Air Force Chief of Staff, LeMay observed: "Assuming that as a democracy we are not prepared to wage preventive war, this course of action poses two most different requirements: (1) An intelligence system which can locate the vulnerable elements of the Soviet striking force and forewarn us when attack by that force is imminent, and (2) Agreement at top governmental level that when

such information is received the Strategic Air Command will be directed to attack." Lt. Gen. Curtis E. LeMay, letter to Gen. Hoyt S. Vandenberg, December 12, 1949, as reprinted in Peter J. Roman, "Curtis LeMay and the Origins of NATO Atomic Targeting," *Journal of Strategic Studies* 16 (March 1993): 49. Although the first requirement would be adopted as national policy, the second was not. LeMay nonetheless remained a proponent of preemption, and in the years that followed seemingly took a perverse delight in explaining the concept and how he would execute it to civilian "policy experts" who visited his office at SAC Headquarters.

18. This effort eventually included Project Lincoln at MIT and the creation of the Distant Early Warning system, a radar picket line across Northern Alaska, Canada, Greenland, and Iceland. Eva C. Freeman, ed., *MIT Lincoln Laboratory: Technology in the National Interest* (Lexington, Mass.: MIT, 1995), 2–9; and George E. Valley Jr., "How the SAGE Development Began," *Annals of the History of Computing* 7 (July 1985): 196–226.
19. This review by State and Defense resulted in NSC-68, "United States Objectives and Programs for National Security," approved on September 30, 1950. See *Foreign Relations of the United States, 1950* (Washington, D.C.: Government Printing Office, 1977), 1:236–92, 400–401. The first paragraph of the conclusion declared: "Within the next four or five years the Soviet Union will possess the military capability of delivering a surprise atomic attack of such weight that the United States must have substantially increased general air, ground, and sea strength, atomic capabilities, and air and civilian defenses to deter war and to provide reasonable assurance, in the event of war, that it could survive the initial blow and go on to the eventual attainment of its objectives" (287–88).
20. In a cable to JCS Commands (today called Specified Commands), General of the Army and JCS Chairman Omar Bradley warned them that "the current situation in Korea has greatly increased the possibility of a general war," and directed that each "take such action as is feasible to increase readiness without creating atmosphere of alarm." JCS, cable to Lt. Gen. Curtis E. LeMay and other JCS Commanders, December 6, 1950, Box B-196, Papers of Curtis E. LeMay, LC. Truman had phoned Eisenhower on December 18, 1950, and asked him to return to active duty as SACEUR. Eisenhower, who believed in collective security and the NATO concept, accepted, and at month's end traveled to Washington to confer with government leaders. Afterward his son, John Eisenhower, recalled, "He expressed to me his disgust with the terrified atmosphere pervading all of Washington, from the President on down." John Eisenhower, *Strictly Personal* (Garden City, N.Y.: Doubleday, 1974), 156–57.
21. As late as October 5, 1950, the USAF Director of Intelligence, Maj. Gen. Charles P. Cabell, saw no hope of securing permission for overflights of the Soviet Union from the Departments of State, Defense, and the JCS. Responding to a SAC Headquarters request that the Air Force seek authorization to overfly the Kola Peninsula and the Chukotskiy Peninsula to determine "Soviet capabilities for delivering atomic bombs to targets within the United States," Cabell declined, adding, "If SAC wants formally to request it anyhow, I would recommend against

it, and unless SAC specifically requests otherwise, I would not forward it." He concluded, however, "[I am] looking forward to a day when it becomes either more essential or less objectionable." Communist Chinese intervention in Korea and positioning of Soviet forces in Eastern Europe a few weeks later clearly made these missions "more essential and less objectionable." Maj. Gen. Charles P. Cabell to Col. William A. Adams, SAC Director of Intelligence, October 5, 1950, TS Control and Cables Section General Files (July 45–Dec. 54), DCS/Operations, Director of Intelligence, entry 15621, RG 341, NARA-SL.

22. Farquhar, "A Need to Know," 142. For a listing of American aircraft lost to Soviet attacks, see Charles Maechling Jr., "Intrusions, Overflights, and Shootdowns," *Air Power History* 36 (Summer 1989): 6–15.
23. Gen. Nathan F. Twining, interview by John T. Mason Jr., August 17, 1967, in Arlington, Va. (third of four interviews), "Eisenhower Administration Project," 130–32, Oral History Research Collection, Butler Library, Columbia University; and Brig. Gen. Richard C. Neeley, USAF (Ret.), telephone interview by R. Cargill Hall, August 1, 1995. (Neeley was the pilot that SAC selected to fly this reconnaissance mission.) In his interview, Twining asserted that the Joint Chiefs wanted to use a new B-47 for this purpose and that President Truman signed papers approving the first overflights. Such papers, among the most closely held of the Cold War, have not yet been located. President Eisenhower later approved overflights verbally, but initialed the flight plans "DDE."
24. Maj. Gen. Carl A. Brandt, USAF Director of Requirements, DCS/Development, memorandum to Directorate of Intelligence, DCS/Operations, Subject: "Intelligence Requirement for B-47s for Special Reconnaissance Missions," January 4, 1951, with enclosure, "Memorandum for Record," DCS/O– Directorate Intelligence, TS Control and Cables Section General Files (July 45–Dec. 54), Box 2-17300 (1950) to 2-18299 (1951), folder 1-17300/2-17399, RG 341, NARA-SL. The memorandum identifies B-47B 49-2645 by tail number as the vehicle to be delivered on April 25, 1951, modified with special compass and autopilot equipment, and a high-latitude directional gyro system. For this first mission, identified in a classified addendum as "Project WIRAC," a special bomb-bay capsule had to be designed and fabricated to contain the cameras and associated equipment.
25. Neeley interview.
26. Records containing the terms and conditions of the British-American agreement have not been located and doubtless remain classified. Descriptions of the training and the missions flown have appeared in the memoirs and published recollections of RAF crew members. See, for instance, Squadron Leader John Crampton, RAF (Ret.) "The Royal Air Force RB-45C Special Duty Flight, 1951–1954," an address to the RAF Historical Society at the RAF Staff College, Bracknell, March 22, 1996, and Rex Saunders, letter to R. Cargill Hall, July 9, 1996.
27. Dino A. Brugioni, telephone interview by R. Cargill Hall, November 1, 1995. The tension and profound concern is evident in contemporary National Security Council deliberations publicly released. A 1952 national military evaluation determined that the United States would face "unavoidable defeat" if "a certain

number of targets in the U.S. were destroyed." Moreover, "the Soviet Union is capable of producing the requisite number of atomic, or thermonuclear, bombs to destroy those targets and is capable of producing the means of delivering the bombs." In August 1952 the CIA estimated that the USSR possessed a stockpile of thirty to fifty atomic weapons with an energy yield between thirty and seventy kilotons. The intelligence agency projected that the number of weapons would increase to 100 in mid-1953, 190 in mid-1954, and to 300 in mid-1955. *Foreign Relations of the United States, 1952–1954,* vol. 2: *National Security Affairs,* pt. 1 (Washington, D.C.: Government Printing Office, 1984), 14, 105, and 232, respectively.

28. Maj. Gen. Robert W. Burns, USAF Acting Deputy Chief of Staff, Operations, to Gen. Curtis E. LeMay, CINCSAC, Subject: "Special Aerial Photographic Operations," July 5, 1952, Accession 810-60, Package 129, Records of U.S. Air Force Commands, Activities, and Organizations, RG 342, NARA. For Tupolev's reverse engineering of the B-29, see Steven J. Zaloga, *Target America: The Soviet Union and the Strategic Arms Race, 1945–1964* (Novato, Calif.: Presidio, 1993), 63–79.
29. Robert A. Lovett, Secretary of Defense, memorandum to General of the Army Omar N. Bradley, Chairman, Joint Chiefs of Staff, Subject: "Reconnaissance Requirements," August 12, 1952, TS Accession 810-60, package 129, RG 342, NARA.
30. Maj. Gen. R. M. Ramey, USAF Director of Operations, to Gen. Curtis E. LeMay, CINCSAC, Subject: "Special Aerial Photographic Operations," August 15, 1952, with attachment: Lt. Col. P. O. Robertson, Acting Chief, Reconnaissance Division, memorandum to General Montgomery, Subject: "Project 52 AFR-18 [Instructions]," August 13, 1952, Accession 810-60, package 129, RG 342, NARA; and Col. Donald E. Hillman, USAF (Ret.), with R. Cargill Hall, "Overflight: Strategic Reconnaissance of the USSR," *Air Power History* 43 (Spring 1996): 28–39.
31. Headquarters USAF, Directorate of Intelligence, "Briefing for the Secretary of the Air Force, 23 June 1953" (script), and "Index to Charts," June 22, 1953 (script), p. 6, Accession 81-0325, Box 1, Case 14, RG 342, NARA. General LeMay awarded each member of the aircrews a Distinguished Flying Cross for this hazardous reconnaissance mission in lieu of a Silver Star, which he would have preferred to give. But the latter award required justification at USAF Headquarters, an action that would acquaint too many people with the reason for the award. In May 1953, LeMay struck an agreement with Air Force Vice Chief of Staff Gen. Nathan F. Twining to award DFCs or Air Medals to SAC reconnaissance aircrews operating overseas, who "performed special missions from bases in the United Kingdom." Gen. Curtis E. LeMay, CINCSAC, letter to Gen. N. F. Twining, Chief of Staff, USAF, November 17, 1955, Box 60, Twining File, LeMay Papers, LC.

    The secrecy surrounding these JCS-directed "special missions" was so tight that many senior Air Force leaders without a "need to know" in their entire career knew nothing more than rumor. One of them, Gen. Horace M. Wade, SAC Commander of the Eighth Air Force, later Commander-in-Chief of U.S. Air Forces in Europe, who retired as Vice Chief of Staff of the USAF, reflected on

these years: "We were desperate. We were desperate for intelligence from the inside of Russia. I have a feeling, if the truth were really known, that there was a B-47 that was flown from Alaska across Russia and landed in Turkey. . . . I can't prove it, but I have a feeling that this was done." Gen. Horace M. Wade, USAF (Ret.), interview by Hugh N. Ahmann, Portland, Oregon, October 10–12, 1978, USAF Oral History Collection, p. 316, Air Force Historical Research Agency, Maxwell AFB, Alabama.

32. Gen. Jacob E. Smart, USAF (Ret.), letter to R. Cargill Hall, April 8, 1996. Smart, who in the mid-1950s served Far East Air Forces (FEAF) as director of operations, continued: At Headquarters FEAF, "we selected the optimum date and time of each mission based on a wide range of factors including sun-angle, weather, status of crew, aircraft and equipment, perceived activity in the target area, preparedness of supporting units—notably real-time intelligence gathering, air-sea rescue, etc.—all with care to avoid alerting friend, foe, or the media that something unusual was under way or planned."
33. Unknown to American intelligence until some years later, the BISON did not perform well and the Soviets built about 100 of these jet bombers, only enough to equip three wings. See Bill Gunston and Yefim Gordon, "The Extinct Bison," *Air International* 49 (October 1995): 222–29; 49 (November 1995): 275–79; and 49 (December 1995): 342–47.
34. For Eisenhower's views of the importance of this intelligence, see Christopher M. Andrew, *For the President's Eyes Only: Secret Intelligence and the American Presidency from Washington to Bush* (New York: HarperCollins, 1995), 199–201, 220–21; for the role of Killian and Land in 1954, see R. Cargill Hall, "The Eisenhower Administration and the Cold War," *Prologue: Quarterly of the National Archives* 27 (Spring 1995): 62–63.
35. Documents pertaining to the president's approval of this Soviet overflight have not been located but most likely reside in CIA, OSD, or JCS files instead of the Eisenhower Library. (It was the president's custom to listen to an overflight proposal and, if he approved it, initial the flight plan. In the case of the U-2, that document was returned to the CIA by Allen Dulles.) Learning of this and preceding overflights, Director of Naval Intelligence Rear Adm. Carl F. Espe requested photographs of the Soviet Union from the Air Force Director of Intelligence, Maj. Gen. J. A. Samford. Espe cited a total of six such flights, including the most recent one on May 8. Director of Naval Intelligence, Rear Admiral Carl F. Espe, memorandum to Director of Intelligence, USAF, Maj. Gen. J. A. Samford, Subject: "Photography, Request For," May 25, 1954, in entry 214, Box 77, Folder 4-1114/1129, RG 341, NARA. Samford's reply has not been found in Air Force or Navy archives or records.

    Beginning with the Korean War, some historical evidence suggests that the JCS did delegate to JCS commanders, under certain circumstances, authority to conduct reconnaissance missions close to, or limited overflights of, the littoral regions of Communist China and the Soviet Union. See Gen. Bryce Poe II, "The Korean War: An Airman's Perception," draft paper cleared for public release on July 19, 1995, pp. 2, 23–25. Regrettably, when word of SAC-generated overflights

of the Soviet Union became public knowledge before any pertinent Cold War records had been declassified, some authors in search of a conspiracy concluded that one JCS commander, CINCSAC General Curtis LeMay, authorized all of them without permission in a vain attempt to provoke the Soviet Union into starting World War III. Purposefully culling and arranging quotes from interviews, and ignoring all the conventions of scholarship, they affirmed for readers that Presidents Eisenhower and Kennedy had to contend with a real "General Ripper" loose in the national military establishment. See, for instance, Richard Rhodes, "The General and World War III," *New Yorker,* June 19, 1995, 47–59, and Paul Lashmar, "Killer on the Edge: The Warmongering Career of Curtis LeMay," *New Statesman and Society,* September 15, 1995, 20–22.

36. Crampton, "Royal Air Force RB-45C Special Duty Flight"; and James G. Baker, interview by R. Cargill Hall, May 9, 1996.
37. Eugene P. Kiefer, letter to Donald Welzenbach, March 16, 1988; Harold F. ("Bud") Wienberg, interview by R. Cargill Hall, March 16, 1995 (hereafter Wienberg interview); and Merton E. Davies and William R. Harris, *RAND's Role in the Evolution of Balloon and Satellite Observation Systems and Related U.S. Space Technology,* R-3692-RC (Santa Monica, Calif.: RAND Corporation, 1988), 33; see also Thomas A. Sturm, *The USAF Scientific Advisory Board: Its First Twenty Years, 1944–1964* (reprint: Washington, D.C.: Air Force History Office, Government Printing Office, 1986), 44–45, 48, and appendix C, "SAB Membership Roster." The Davies and Harris volume is the most comprehensive and thorough survey available on these subjects.
38. For an unclassified account of this project, later known as MOBY DICK and GENETRIX, see Curtis Peebles, *The Moby Dick Project: Reconnaissance Balloons Over Russia* (Washington D.C.: Smithsonian Institution Press, 1991).
39. Camera shutter and lens technology, they knew, would require major improvement to move up from the altitude of 13 miles, employed for balloon and aerial platforms, to an altitude of 300 miles then planned at RAND for a reconnaissance satellite and still provide useful images of objects on the earth's surface.
40. Davies and Harris, *RAND's Role,* 35–38.
41. The contents of the AFDAP intelligence and reconnaissance DPO was described by Richard S. Leghorn in comments on an early draft of this study, July 5, 1995. A copy of the I&R DPO has not been found.
42. Jay Miller, *Lockheed U-2* (Arlington, Tex.: Aerofax, 1983), 10–12, 17–18. Miller's account is based on documents provided by and an interview by a principal at WADC, Maj. John Seaberg. The X-16 effort was canceled shortly after the U-2 began test flights in August 1955.
43. Welzenbach, "Strategic Overhead Reconnaissance," chap. 8. For other authoritative accounts, see Miller, *Lockheed U-2;* also Clarence L. "Kelly" Johnson with Maggie Smith, *Kelly: More than My Share of It All* (Washington, D.C.: Smithsonian Institution Press, 1985), chap. 13; and Ben R. Rich with Leo Janos, *Skunk Works: A Personal Memoir of My Years at Lockheed* (New York: Little, Brown, 1994), chaps. 6 and 7.
44. Burton Klein, telephone interview by R. Cargill Hall, October 4, 1995.

45. Ibid.
46. Not only would this unarmed single-engine aircraft fly higher, but, as Killian later told Herbert York, it would be "manifestly less hostile" than Air Force reconnaissance bombers used on overflight missions. Herbert F. York and G. Allen Greb, "Strategic Reconnaissance," *Bulletin of the Atomic Scientists* 33, no. 4 (April 1977): 35. Also, regarding U-2 origins, James G. Baker, letter to R. Cargill Hall, December 21, 1993. Baker was a member of Din Land's TCP intelligence committee and designed the remarkable B-2 camera later employed in the U-2. He also served as chairman of the Air Force Scientific Advisory Board's intelligence systems panel in 1954. As he recollected events, Allen Donovan brought word of Kelly Johnson's CL-282 to members of the Air Force panel at a meeting after Baker had returned from a trip to Europe in early March (the meeting would have had to follow in late March–July). "We kept these discussions very close indeed and carried them over into the TCP not long afterward. As a result, Din met at Lockheed with Kelly Johnson and called me from California. Din said words I cannot forget: "'Jim, I think we have your airplane.'"
47. A. J. Goodpaster, "Memorandum of Conference with the President, 0810, Nov. 24, 1954," "ACW Diary, Nov 1954," A7, Bay 3, Anne C. Whitman Series, Anne Whitman File, Dwight D. Eisenhower Library, Abilene, Kansas (hereafter DDE). The best accounting of events leading to the November 24 meeting appear in Dino A. Brugioni, *Eyeball to Eyeball: The Inside Story of the Cuban Missile Crisis* (New York: Random House, 1990), 16–19; James R. Killian Jr., *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (Cambridge, Mass.: MIT Press, 1977), 82; and Michael R. Beschloss, *Mayday: The U-2 Affair* (New York: Harper and Row, 1991), 82; also Donald Welzenbach, "Din Land: Patriot from Polaroid," *Optics and Photonics News* 5 (October 1994): 23–24.
48. A biographical sketch of the versatile and complex Richard Bissell appears in Evan Thomas, *The Very Best Men* (New York: Simon and Schuster, 1995). For his own posthumous accounting, see Bissell, *Reflections of a Cold Warrior*.

    For an account of the significant intelligence results of the U-2 missions, see the statement of Allen W. Dulles, DCI, before the U.S. Senate Committee on Foreign Relations on May 31, 1960, regarding "Events Incident to the Summit Conference," in U.S. Senate, *Executive Sessions of the Senate Foreign Relations Committee*, Historical Series, vol. 12, 86th Congr., 2d sess., 1960 (declassified and made public November 1982), 280–87.
49. Ritland and Mixson chose U-2 pilots from an Air Force pool. Once chosen, they were seconded to the CIA from the Air Force. They were restored to military status after a period of service with the CIA. Wienberg interview. Although CL-282 and the U-2 shared a basic design concept, the latter aircraft differed substantially in configuration and equipment from the original Lockheed proposal. For example, a Pratt & Whitney J57 axial flow turbojet engine recommended by John Seaberg powered the U-2 instead of the GE J73 engine that Kelly Johnson first specified.

50. In 1955 Nelson Rockefeller served as special assistant to the president for psychological warfare, while Harold Stassen served as special assistant to the president for disarmament.
51. Gen. Andrew J. Goodpaster, USA (Ret.) letter to R. Cargill Hall, January 11, 1996; and John Eisenhower, letter to R. Cargill Hall, January 9, 1996. According to Leghorn, Stephen Posony, another member of Schriever's AFDAP team from Air Force intelligence, helped draft the Open Skies proposal for Nelson Rockefeller. Solid accounts appear in Brugioni, *Eyeball to Eyeball*, 25–26; Eisenhower, *Strictly Personal*, 177–78; and Dwight D. Eisenhower, *The White House Years: Mandate for Change* (Garden City, N.Y.: Doubleday, 1963), 519.
52. "Statement on Disarmament, July 21," *Department of State Bulletin* 33, no. 841 (August 1, 1955): 174. The term "Open Skies" was coined later by the popular press and applied to this disarmament plan. The background of this proposal, as debated in the National Security Council, is contained in *Foreign Relations of the United States, 1955–1957*, vol. 20, *Regulation of Armaments; Atomic Energy* (Washington, D.C.: Government Printing Office, 1990), see esp. docs. 33 through 48.
53. The most authoritative account of these events appears in W. W. Rostow, *Open Skies: Eisenhower's Proposal of July 21, 1955* (Austin: University of Texas Press, 1982).
54. NSC 5522, "[Executive Department] Comments on the Report to the President by the Technological Capabilities Panel of the Science Advisory Committee," June 8, 1955. For instance, see comments by Donald Quarles for the Department of Defense and Allen Dulles for the CIA at pp. A15-A44, and A45-A56. White House Office, Office of the Special Assistant for National Security Affairs: Records, 1952–61, NSC Policy Papers, Box 16, Folder NSC 5522 Technological Capabilities Panel, DDE. Also, R. Cargill Hall, "The Eisenhower Administration and the Cold War: Framing American Astronautics to Serve National Security," *Prologue* 27 (Spring 1995): 59–72; and Hall, "The Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 1, ed. John Logsdon et al., NASA SP-4407 (Washington, D.C.: Government Printing Office, 1995), 225–33.
55. Richard S. Leghorn, interview by R. Cargill Hall and Donald Welzenbach, December 13, 1995. Leghorn's views of strategic reconnaissance employed as an arms control and disarmament inspection system at this time appeared in a seminal article: "U.S. Can Photograph Russia from the Air Now: Planes Available, Equipment on Hand, Techniques Set," *U.S. News and World Report*, August 5, 1955, 70–75.
56. Paul E. Worthman recollections cited by Rostow in *Open Skies*, 189–94; Tom D. Crouch, *The Eagle Aloft: Two Centuries of the Balloon in America* (Washington, D.C.: Smithsonian Institution Press, 1983), 644–49; and Peebles, *The Moby Dick Project*.
57. Levison, interview by R. Cargill Hall, May 9, 1996 (hereafter Levison interview); Levison, letter to Hall, September 2, 1996.

58. Crouch, *Eagle Aloft*, 644–49; and Levison interview. In the event aerial retrieval failed, the camera-carrying gondolas were designed to float on the ocean's surface and radiate a signal for 24 hours before a plug dissolved and the gondola sank.
59. Bissell, *Reflections of a Cold Warrior*, 112.
60. Sergei Khrushchev, interview by R. Cargill Hall and Richard S. Leghorn, Providence, R.I., July 5, 1995.
61. See Hall, "Eisenhower Administration and the Cold War."
62. Executive Order 10656, February 6, 1956, as cited in *U.S. Government Organization Manual, 1958–1959* (Washington, D.C.: Government Printing Office, 1958), 538.
63. Kenneth E. Greer, "CORONA," *Studies in Intelligence*, Supplement 17 (Spring 1973), as reprinted in *CORONA: America's First Satellite Program*, ed. Kevin C. Ruffner, Center for the Study of Intelligence (Washington, D.C.: Government Printing Office, 1995), 4–5.
64. Jacob Neufeld, *Ballistic Missiles in the United States Air Force, 1945–1960* (Washington D.C.: Office of Air Force History, 1990). The Teapot Committee report and recommendation, as it was popularly known, is reprinted at appendix 1 of the Neufeld book.
65. William G. King, USAF (Ret.), telephone interview by R. Cargill Hall, September 9, 1996; James S. Coolbaugh, "The Beginnings of the Air Force Satellite Program: A Memoir," contained in Space Policy Institute Collection, George Washington University; and Hall, "Origins of U.S. Space Policy," 218–21.
66. Troetschel, "An Early History of the Air Force Space Program," n.d., contained in SPI; Coolbaugh, "Beginnings of the Air Force Satellite Program"; and King interview, September 9, 1996.
67. Back in the spring of 1956, Truax and Coolbaugh "flew a B-25 up and down the West Coast looking for the best spot to locate a satellite launch facility. RAND's recommendation of Alaska as the place to locate such a facility was long forgotten. We finally settled on two sites. The ideal place for polar launches was the south side of the Army's Camp Cooke, which was located on Point Arguello, about 55 miles WNW of Santa Barbara. The other site which could have been used was near Santa Cruz. (This latter location became Lockheed's Santa Cruz Test Facility, where the Agena stage was 'hot'-fired as part of its pre-launch validation.) We were lucky in our selection of the Camp Cooke site because the Navy had a radar tracking site there and Bob knew the Navy officer in charge of the operation, Commander Bob Frietag. When 'the dust settled,' the Air Force was authorized to build a launch base for satellites there. This action predated the Air Force's acquisition of Camp Cooke for a missile launch base by about nine months." Coolbaugh, "Beginning of the Air Force Satellite Program," 44.
68. Hall, "Origins of U.S. Space Policy," 224.
69. Amrom H. Katz and Merton E. Davies, "On the Utility of Very Large Satellite Payloads for Reconnaissance," RAND D-5817, November 14, 1958, 6.
70. Davies and Harris, *RAND's Role*, 69–70. A number of conditions prefigured the choice of a long-lived readout reconnaissance satellite. Beside the demand for indications and warning of surprise attack that arose in the 1950s, when RAND

conducted its early satellite studies, returning anything from earth orbit was judged technically unfeasible. Moreover, without an ICBM available, a satellite program also would have to develop and pay for its own booster. Finally, without the re-entry option, whatever was placed in orbit would have to function for a long time, at least one year, to justify the expense of getting it up there. For a discussion of these conditions, see Amrom H. Katz, "Some Notes on the Evolution of RAND's Thinking on Reconnaissance Satellites," RAND D-4753, November 27, 1957.

Studies of a recoverable film payload and ways to protect it from the searing heat of atmospheric reentry that began in 1956 continued at RAND throughout the year. See J. H. Huntzicker and H. A. Lieske, "Physical Recovery of Satellite Payloads—A Preliminary Investigation," RAND RM-1811, June 26, 1956. The authors estimated that a payload of 50 pounds of film could be recovered from a satellite weighing about 225 pounds.

71. Merton E. Davies, telephone interview by R. Cargill Hall, July 2, 1996. Davies eventually received a U.S. patent for his "spin-pan camera."
72. Ibid., 86–87; and M. E. Davies and A. H. Katz et al., "A Family of Recoverable Reconnaissance Satellites," RAND RM-2012, November 12, 1957.
73. With the declassification of many Eisenhower administration records, the covert IGY satellite policy, first surmised by Walter MacDougall and Stephen Ambrose, is absolutely confirmed. (See chapter 5.) The recommendations for it outlined in James Killian's TCP report of February 1955 are contained in NSC 5522, "Comments on the Report to the President." See, for instance, those sections submitted by the CIA and Departments of State and Defense. The NSC 5522 report is in White House Office, Office of the Special Assistant for National Security Affairs: Records, 1952–1961, NSC Policy Papers, Box 16, Folder NSC 5522 Technological Capabilities Panel, DDE. See also Hall, "Eisenhower Administration and the Cold War," 59–72; and Dwayne A. Day, "A Strategy for Space: Donald Quarles, the CIA and the US Scientific Satellite Programme," *Spaceflight* 38 (September 1996): 308–12.
74. Greer, "CORONA," 4–5.
75. Ibid., 5. According to Greer, no records of this briefing were kept and the outcome is surmised from subsequent decisions.
76. Davies and Katz, "Family of Recoverable Reconnaissance Satellites."
77. Col. F. C. E. Oder, WS-117L Director, memorandum to Maj. Gen. B. A. Schriever, Commander, AFBMD, no subject, August 27, 1957; and Lockheed Missiles and Space Division, WS-117L Development Plan for Program Acceleration, LMSD-2832, January 6, 1958.
78. Richard E. Horner, Assistant Secretary of the Air Force (R&D), memorandum to Neil McElroy, Secretary of Defense, Subject: "Outer Space Vehicles," November 12, 1957.
79. Col. F. C. E. Oder, WS-117L director, memorandum to Maj. Gen. B. A. Schriever, no subject, December 7, 1957. After the meeting in Washington, Schriever returned to the West Coast and met with Air Force program participants on December 5. They included Robert Gross and Willis Hawkins of Lockheed, as well as Colonel Oder and General Schriever from AFBMD. They agreed on a

configuration of the film-recovery satellite that used a Thor booster and Lockheed Agena upper stage equipped with horizon sensors and stabilized in space in a position horizontal to the earth. The Fairchild camera was to be mounted in a reentry capsule fixed to the Agena's forward end. Mounted on a drive shaft, the capsule was to be spun up and released from the Agena after the ensemble had stabilized on orbit. This approach appears in Lockheed's development plan released a few weeks later. WS-117L Development Plan for Program Acceleration, LMSD-2832, January 6, 1958. Both Oder and Hawkins have affirmed that by January 1958 the AFBMD and Lockheed participants intended to abandon this separable spinning payload and fix a variant of the Fairchild camera directly to the attitude-stabilized Agena. Though doubtless true, this latter plan does not appear in any contemporary documents thus far located. It was unquestionably adopted in February and March 1958, using another, different kind of camera. However, James Plummer has stated that the initial CORONA design he was told to pursue was Davies and Katz's spinner with the Aerobee upper stage, not a vehicle using the Agena.

80. Brig. Gen. A. J. Goodpaster, "Memorandum of Conference with the President," (meeting in Oval Office on February 7 with Land, Killian, and Goodpaster), February 10, 1958, White House Office of Staff Secretary, Alpha Series, Box 14, Intelligence Matters, DDE.
81. Greer, "CORONA," 6.
82. Ibid., 5.
83. Roy W. Johnson, Director, ARPA, memorandum to James H. Douglas Jr., Secretary of the Air Force, Subject: "Reconnaissance Satellites and Manned Space Exploration," February 28, 1958.
84. Herbert F. York, letter to R. Cargill Hall, August 24, 1996. York said, "Thereafter, I frequently testified before the Congress and gave press statements about how Discoverer was a great engineering program for the development of space maneuver, recovery, life support, etc. . . . I had to face the wrath of RAND . . . (Katz, Buchheim, etc.) and explain how we and others had reviewed their recoverable satellite ideas and decided to place our bets on the [Air Force] 'readout' system instead." Also York, letter to Hall, September 13, 1996. Quarles, York added, "was very influential, but he was also very low key and soft-spoken, so history largely ignores him. He was widely thought to be conservative and unimaginative. He was conservative in approach, but he was smart and much more knowledgeable about technical issues than anyone else in the Pentagon before the changes wrought by Sputnik. In brief, he quickly understood whatever was brought to his attention and he was decisive."

To be sure, not everyone perceived space reconnaissance favorably. Late in February or early March 1958, Robert Truax recalled, ARPA director Roy Johnson briefed the Joint Chiefs of Staff and mentioned the Air Force WS-117L, which he described as " 'the most important weapon system under development in the country.' I got a hurry-up call to go brief '21 knot' [Admiral Arleigh] Burke, the Chief of Naval Operations, who didn't know what WS-117L was. After my briefing he snorted: 'Why, it is nothing but a reconnaissance system! If it doesn't

hit the other guy with something hard, it can't be important.'" Robert C. Truax, letter to R. Cargill Hall, September 12, 1996.

85. Wienberg interview. For Bissell and Ritland, Katz's public reaction made credible for the knowledgeable world at large that the film-recovery project had indeed ended, when in fact it had not. A year or so later, however, as long-time comrades ceased speaking with them about space reconnaissance, Davies and Katz realized that the project had continued and that they would not be asked to contribute. The bitter aftertaste of that knowledge would remain with them for many years.
86. No minutes were taken and years later attendees produced two accounts of the naming. In the first version, when Bissell looked around the room and asked, "What shall we call this project?" a participant reportedly removed the paper ring from his cigar and said, "Why not CORONA?" In the second version, a participant pointed to a typewriter on a desk nearby and said, "Why not CORONA?" Whichever version is correct, the name stuck.
87. Leghorn, interview by Welzenbach and Hall, December 13, 1995.
88. Levison interview, and Richard W. Philbrick, interview by R. Cargill Hall, May 10, 1996; Amrom Katz, letters to Walter Levison, March 14, 1957, and January 3, 1958. A description and diagram of the HYAC camera appears in Davies and Harris, *RAND's Role*, 78–85.
89. Davies and Harris, *RAND's Role*, 29–30; When Duncan Macdonald became graduate dean, F. Dow Smith succeeded him as chairman of the BU Physics Department, as well as director of the BU Physical Research Laboratories. Smith encouraged Case to dispose of the BUPRL as a unit, and not to break the organization into pieces, as some alternate scenarios had proposed. F. Dow Smith, interview by R. Cargill Hall, April 22, 1996.
90. No records of this meeting have been located and accounts of surviving participants differ on the location. One source recalled the CORONA evaluators met in Cambridge, Mass., for the briefings. Jack Herther, who presented the Itek briefing with Duncan Macdonald, is certain it was held in the Old Executive Office Building because he remembers purchasing the airline tickets for the flight from Boston to Washington, the names of many of those present at the briefing, and that there was no contact with competitors (other contractors) because of the physical separation of the briefing teams. The results of this meeting set the stage for the subsequent decision to make Itek's HYAC the primary instead of the backup camera.
91. For an authoritative description of Itek's HYAC camera scaled for space flight, see F. Dow Smith, "The Eyes of CORONA: The World's First Satellite Reconnaissance Program," *Optics and Photonics News* 6, no. 10 (October 1995): 34–39. To improve resolution at the earth's surface, Itek eventually combined a faster high-resolution Petzval lens and fine-grain film in place of focal length. That design tradeoff belied George Goddard's maxim for close-up photography: "There is no substitute for focal length." Or, as rephrased by Amrom Katz: "If you want close-up pictures, get close up!"

    Goddard, who urged greater focal length in terms of feet, not inches, likely would have disapproved of the Itek design compromise. Perhaps the greatest

expression of his approach was the immense "Boston Camera" constructed at BU's Optical Research Laboratory. It featured a James Baker-designed 240-inch focal length f/8 lens (with the forward lens, made of a single blank of Schott glass, 32 inches in diameter), and it produced pictures on an 18- by 36-inch film format, with a CR-39 plastic filter chemically designed to achieve a coating that duplicated Eastman Kodak's Wratten 21. Completed and delivered to the Air Force in 1951, this camera was mounted in the largest available transport, the double-decker Boeing C-97, and used in the LOROP (long-range oblique photography) program that employed aircraft cameras to look across denied borders. Retired in the 1960s, the camera is now on display at the USAF Museum at Wright-Patterson AFB in Ohio. F. Dow Smith, letter to R. Cargill Hall, September 3, 1996, and Baker, interview by Hall, May 9, 1996.

92. John C. Herther and Malcolm R. Malcomson, "A Transition Control System," submitted in partial fulfillment of the requirement for the master of science degree at MIT, May 23, 1955; and John C. Herther, interview by R. Cargill Hall, July 27, 1996 (hereafter Herther interview).
93. Herther interview. To be sure, the Lockheed Missile and Space Division team directed by Jack Carter and James Plummer ultimately designed and fabricated Agena's ascent guidance and on-orbit stabilization system. At Itek, Herther served as the system integration engineer and also directed the flight environmental qualification testing of the CORONA camera, including vibration, shock, and the extended simulated orbital vacuum operation for diagnosing film breakage that occurred in space operations. Ultimately, the only fix for the breakage problem was to have Eastman Kodak replace 6-mil acetate-based film with the 2-mil polyester-based film. That exchange yielded the extra benefit of three times more pictures per pound! Herther subsequently became the Itek project manager for LANYARD, a CIA/Air Force CORONA follow-on involving a 66-inch focal length f/5 panoramic camera that achieved 2-foot resolution at the earth's surface on its single successful development flight in August 1963.
94. The unsolicited Itek camera proposal in February 1958 had referenced "unpublished correspondence" between Duncan Macdonald and Arthur Lundahl that correlated photo-interpretation experiments performed at BU and the CIA. These experiments confirmed that positive recognition of objects in photographs required a ground resolution size significantly smaller (by a factor of 3-to-5 depending on conditions) than the object size.
95. John C. Herther, letter to R. Cargill Hall, May 13, 1996.
96. Greer, "CORONA," 7–9; Herther interview.
97. "Project CORONA Outline," COR-0013, with cover letter from Richard M. Bissell Jr., to Col. Andrew Goodpaster, USA, COR-0014, both dated April 15, 1958.
98. No formal record of the April 16 meeting was kept. Beside a verbal approval, legend has it that Eisenhower scribbled "Okay, DDE," on the proposal, or, variously, Cabell noted his approval on the back of an envelope. Whatever the case, this putative "written" authorization has not yet been located.
99. CORONA Statement of Work, April 25, 1958.

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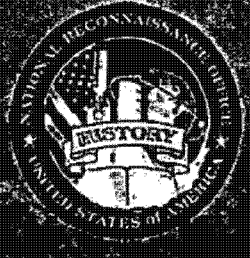

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