APPENDIX A

Acronyms

AEC	Atomic Energy Commission
AFB	Air Force Base
AFDAP	Air Force office symbol for the Assistant for Development Planning under the Deputy Chief of Staff for Development
AMD	Air/Maritime Division
ARC	Ad Hoc Requirements Committee
ARDC	Air Research and Development Command (USAF)
ASPIC	Asian Photographic Interpretation Center
ATIC	Air Technical Intelligence Center (USAF)
BSAP	Boston Scientific Advisory Panel
BUORL	Boston University Optical Research Laboratory
COMINT	Communications Intelligence
COMIREX	Committee on Imagery Requirements and Exploitation
COMOR	Committee on Overhead Reconnaissance
DB	"Dirty Bird"
DCI	Director of Central Intelligence
DCID	Director of Central Intelligence Directive
DDCI	Deputy Director of Central Intelligence
DDI	Deputy Director for Intelligence
DDP	Deputy Director (or Directorate) for Plans
DDS&T	Deputy Director for Science and Technology
DPD	Development Projects Division
DPS	Development Projects Staff
ECM	Electronic Countermeasures
EG&G	Edgerton, Germeshausen & Grier, Incorporated
ELINT	Electronic Intelligence
FCRC	Federally Controlled Research Center
HASP	High-Altitude Air Sampling Program
IAC	Intelligence Advisory Committee
IAS	Indicated air speed
IC	Intelligence community
ICBM	Intercontinental ballistic missile
IR	Infrared
ISP	Intelligence Systems Panel (USAF)
JRC	Joint Reconnaissance Center
MATS	Military Air Transport Service (USAF)

MRBM	Medium-range ballistic missile
NACA	National Advisory Committee for Aeronautics
NAS	Naval air station
NASA	National Aeronautics and Space Administration
NIE	National Intelligence Estimate
NPIC	National Photographic Interpretation Center
NSA	National Security Agency
NSC	National Security Council
NSCID	National Security Council Intelligence Directive
ODM	Office of Defense Mobilization
ORR	Office of Research and Reports
OSA	Office of Special Activities
OSI	Office of Scientific Intelligence
PBCFIA	President's Board of Consultants on Foreign Intelligence Activities
P-E	Perkin-Elmer Company
PFIAB	President's Foreign Intelligence Advisory Board
PI	Photointerpreter
PIC	Photographic Intelligence Center
PID	Photo-Intelligence Division
PSAC	President's Science Advisory Committee
RAF	Royal Air Force
RFP	Request for proposal
SAB	Scientific Advisory Board (USAF)
SAC	Science Advisory Committee
SAC	Strategic Air Command
SA/PC/DCI	Special Assistant to the DCI for Planning and Coordination
SAM	Surface-to-air missile
SEI	Scientific Engineering Institute
SENSINT	Sensitive intelligence (USAF)
SLAR	Side-looking aerial radar
TAS	True air speed
TCP	Technological Capabilities Panel
USIB	United States Intelligence Board
WADC	Wright Air Development Command (USAF)
WRSP	Weather Reconnaissance Squadron, Provisional

APPENDIX B

Key Personnel

AYER, Frederick, Jr.
Special assistant to Trevor Gardner in the Office of the Secretary of the Air Force, Ayer was a strong advocate of overhead reconnaissance by balloons and an early supporter of Lockheed's CL-282 design.

BAKER, James G.
Harvard astronomer and lens designer, Baker was a leading designer of high-acuity aerial lenses during World War II and continued this work after the war. He also headed the Air Force Intelligence Systems Panel and served on the Technological Capabilities Panel's Project Three committee that urged the development of the U-2 aircraft. Baker designed the lenses for the U-2's cameras.

BISSELL, Richard M., Jr.
Head of all CIA overhead reconnaissance programs from 1954 until 1962, a former economics professor at MIT and high official of the Marshall Plan, Bissell became Allen W. Dulles's Special Assistant for Planning and Coordination in January 1954 and received responsibility for the new U-2 project at the end of that year. Later he also headed the first photosatellite project and oversaw the development of the OXCART. In 1959 Bissell became Deputy Director for Plans but kept the reconnaissance projects under his control. He resigned from the CIA in February 1962.

CABELL, George Pearre
Air Force general and DDCI from 1953 until 1962. Because of Cabell's many years of experience in aerial reconnaissance, DCI Dulles delegated most of the responsibility for the reconnaissance projects to him.

CARTER, Marshall S.
Army general who served as DDCI from 1962 until 1965. During the period leading up to the Cuban Missile Crisis, Carter served as Acting DCI on a number of occasions while DCI McCone was out of town. In October 1962 he fought unsuccessfully to keep the CIA involved in flying reconnaissance missions over Cuba. Carter became the Director of the National Security Agency in 1965.

CHARYK, Joseph R.
An aeronautical engineer who had followed careers first in academia and then the aerospace industry, Charyk became the Chief Scientist of

the Air Force in January 1959. Five months later he moved up to Assistant Secretary of the Air Force for Research and Development, and the following year he became Under Secretary of the Air Force. In these positions he was involved in coordination with the CIA on both the U-2 and OXCART projects. In 1963 Charyk left government to become the first chairman of the Communications Satellite Corporation.

CUNNINGHAM, James A., Jr.
An ex–Marine Corps pilot, he became the administrative officer for the U-2 project in April 1955. Cunningham handled the day-to-day management of the U-2 program and brought only the more complex problems to Richard Bissell's attention. Later he served as the Deputy Director of the Office of Special Activities and then Special Assistant to the Deputy Director for Science and Technology.

DONOVAN, Allen F.
An aeronautical engineer who had helped to design the P-40 fighter while working at the Curtiss-Wright Corporation, Donovan was one of the founders of the Cornell Aeronautical Laboratory after World War II. He served on several Air Force advisory panels and was a strong advocate of the proposed Lockheed CL-282 aircraft. Later he became vice president of the Aerospace Corporation.

DOOLITTLE, James H.
A vice president of Shell Oil Company and an Army Air Force reserve general, Doolittle headed General Eisenhower's Air Staff during World War II. After the war Doolittle served on many Air Force advisory panels, and in 1954 he chaired a special panel investigating the CIA's covert activities. Doolittle also served on the Technological Capabilities Panel and the President's Board of Consultants on Foreign Intelligence Activities.

DUCKETT, Carl E.
Headed the Directorate of Science and Technology from September 1966 until May 1976, first as Acting Deputy Director and then as Deputy Director beginning in April 1967. During his tenure, the emphasis in the CIA's overhead reconnaissance program shifted from aircraft to satellites.

DULLES, Allen W.
DCI from 1953 until 1961. Although initially reluctant to see the CIA involved in aerial reconnaissance, which he viewed as the military's area of responsibility, Dulles became a strong supporter of the U-2

program when he saw how much intelligence it could gather on the Soviet Union. Because his own interests lay more in the area of human intelligence, he left the management of the reconnaissance program in the hands of DDCI Cabell and project director Richard Bissell.

GARDNER, Trevor
During World War II, Gardner worked on the Manhattan Project, and later he headed the General Tire and Rubber Company before starting his own research and development firm, the Hycon Company, which built aerial cameras. Gardner served as the Secretary of the Air Force's Special Assistant for Research and Development and then as the Assistant Secretary for Research and Development during Eisenhower's first term of office. Gardner's concern about the danger of a surprise attack helped lead to the establishment of the Technological Capabilities Panel. Gardner also urged the building of Lockheed's CL-282 aircraft.

GEARY, Leo P.
Air Force colonel (later brigadier general) who was James Cunningham's Air Force counterpart in the U-2 program. He was instrumental in diverting engines from other Air Force projects for use in the U-2, and his 10 years with the U-2 project provided a high degree of continuity.

GOODPASTER, Andrew J.
An Army colonel who served as President Eisenhower's Staff Secretary from 1954 to 1961. During this period, he was the CIA's point of contact in the White House for arranging meetings with the President on the subject of overhead reconnaissance. Goodpaster's later career included service as the supreme commander of NATO and then commandant of the US Military Academy at West Point.

HELMS, Richard M.
DCI from 1966 to 1973. During his tenure as DCI, the CIA's manned reconnaissance program came under heavy pressure because of competition from the Air Force's reconnaissance program.

JOHNSON, Clarence L. (Kelly)
One of the nation's foremost aeronautical designers, Kelly Johnson graduated from the University of Michigan's School of Aeronautics in 1933 and began working for the Lockheed Aircraft Corporation. During World War II he designed the P-38 fighter, and after the war his design successes continued with the F-104 jet fighter, the Constellation airliner, and the CIA's two strategic reconnaissance aircraft, the U-2 and the OXCART A-12.

KIEFER, Eugene P.
An Air Force officer with a degree in aeronautical engineering who in 1953 informed a friend at Lockheed of the Air Force's search for a high-altitude reconnaissance aircraft, thus, leading to the initial design of the CL-282. After leaving the Air Force, Kiefer became Richard Bissell's technical adviser for the OXCART and photosatellite programs.

KILLIAN, James R., Jr.
President of the Massachusetts Institute of Technology, Killian headed a high-level and very secret study of the nation's ability to withstand a surprise attack. While this project was still under way, he and Edwin Land persuaded President Eisenhower to support the development of a high-altitude reconnaissance aircraft, the U-2. Later, Killian headed Eisenhower's Board of Consultants for Foreign Intelligence Activities, served as his Cabinet-level science adviser, and chaired the President's Science Advisory Board. Killian was also chairman of the President's Foreign Intelligence Advisory Board under John F. Kennedy.

LAND, Edwin H.
An extremely talented inventor famous for the development of polarizing filters and the instant-film camera. Land also devoted considerable time and energy to voluntary government service. During World War II, Land worked for the Radiation Laboratories, and after the war he served on numerous Air Force advisory panels. As the head of the Technological Capabilitites Panel's study group investigating US intelligence-gathering capabilities, Land became a strong advocate of the development of a high-altitude reconnaissance aircraft (the CL-282) under civilian rather than Air Force control. Land and James Killian persuaded President Eisenhower to approve the U-2 project and later the first photosatellite project. Land also served on the President's Board of Consultants for Foreign Intelligence Activities.

LEGHORN, Richard S.
An MIT graduate in physics, Leghorn joined the Army Air Force in 1942 and went to work for reconnaissance expert Col. George Goddard. By the time of the invasion of Europe, Leghorn was chief of reconnaissance for the 9th Tactical Air Force. After the war, Leghorn began preaching the need for "pre-D-day" reconnaissance in order to gather intelligence on the Soviet Bloc. He returned to the Air Force during the Korean war and later worked for Harold Stassen's Disarmament Office. In 1956 he became the head of the Scientific

Engineering Institute, an Agency proprietary working on ways to reduce the U-2's vulnerability to radar detection. In 1957 he founded Itek Corporation.

LUNDAHL, Arthur E.
A Navy photointerpreter during World War II and afterward. Lundahl became the chief of the Photo-Intelligence Division in 1953. To support the U-2 project, he established a separate photointerpretation center under Project HTAUTOMAT. Under his leadership the Photo-Intelligence Division grew rapidly and achieved office status as the Photographic Intelligence Center in 1958. In 1961 Lundahl became the first head of the National Photograhic Interpretation Center, which combined the photointerpretation efforts of the CIA and the military services.

McCONE, John A.
DCI from 1961 to 1965. A strong supporter of the CIA's manned reconnaissance program, McCone presided over the OXCART's main period of development and pushed for a greater role for the CIA in its joint reconnaissance programs with the Department of Defense.

MILLER, Herbert I.
Miller worked in the Office of Scientific Intelligence's nuclear branch and became Richard Bissell's first deputy for the U-2 project. He later left the Agency to work for the Scientific Engineering Institute.

NORTON, Garrison
An assistant to Trevor Gardner, Norton became an early supporter of the Lockheed CL-282 and started the CIA's interest in overhead reconnaissance by informing Philip Strong about the aircraft. Norton later became Navy Assistant Secretary for Research and Development and was involved with the OXCART program.

OVERHAGE, Carl F. J.
After working on the development of Technicolor, Overhage went to work for Kodak. He headed the Beacon Hill Panel in 1952 and later became director of Lincoln Laboratories.

PARANGOSKY, John N.
Parangosky worked for Richard Bissell's Development Projects Staff in the mid-1950s. He served as deputy chief of the Adana U-2 unit in 1959 and became project manager of the OXCART program from its inception through the test flight stage.

PERKIN, Richard S.
President of the Perkin-Elmer Corporation, Perkin was a close friend of James Baker and was also a member of several advisory panels, including the BEACON HILL project. He helped Baker decide what cameras to use in the first U-2 aircraft.

POWERS, Francis Gary
An Air Force Reserve Officer who became a CIA U-2 pilot in 1956, Powers flew 27 successful missions before being shot down over the Soviet Union on 1 May 1960. After his return to the United States in exchange for Soviet spymaster Rudolf Abel in 1962, Powers was cleared of all allegations of misconduct in his mission, capture, trial, and captivity. He became a test pilot for Lockheed and later piloted light aircraft and helicopters for radio and television stations. He died in a helicopter crash on 1 August 1977.

PURCELL, Edward M.
A physicist who won a Nobel prize in 1954 for his work in nuclear resonance, Purcell served on a number of advisory bodies, including the USAF Scientific Advisory Committee and Edwin Land's Technological Capabilities Panel study group. It was Purcell's ideas for reducing the radar cross section of the U-2 that led to the OXCART program. Purcell also contributed to the satellite programs.

RABORN, William F., Jr.
DCI from 1965 to 1966, Raborn pushed for the deployment of OXCART to the Far East but failed to sway the top officials of the Johnson administration.

REBER, James Q.
After serving as the Assistant Director for Intelligence Coordination in the early 1950s, Reber became the chairman of the Ad Hoc Requirements Committee in 1955 and continued to chair this committee after it was taken over by the US Intelligence Board in 1960 and renamed the Committee on Overhead Requirements. In 1969 he became the chairman of the USIB's SIGINT Committee.

RODGERS, Franklin A.
Formerly of MIT, Rodgers was the chief engineer at the Scientific Engineering Institute who converted the theories of Edward Purcell into practical systems to reduce the radar image of the U-2 and especially the OXCART.

SCHLESINGER, James R.
DCI from February to July 1973, Schlesinger supported the Nixon administration's proposal to terminate the Agency's U-2 program.

SCOTT, Roderic M.
An engineer with Perkin-Elmer who worked with James Baker in designing the first cameras for use in the U-2. Scott helped design the 30001 camera for the OXCART.

SCOVILLE, Herbert, Jr.
In February 1962 Scoville became the first Deputy Director for Research, which took over control of the Agency's reconnaissance programs from the Deputy Director for Plans. Frustrated by the lack of support from the DCI and the other directorates, he resigned in June 1963.

SEABERG, John
An aeronautical engineer who was recalled to active duty with the Air Force during the Korean war, Seaberg drafted the first specifications for a high-flying jet reconnaissance aircraft in 1953.

STEVER, H. Guyford
A professor of aeronautical engineering at MIT, Stever served on numerous Air Force advisory panels and later became the Air Force's chief scientist.

STRONG, Philip G.
Chief of collection in the Office of Scientific Intelligence, Strong kept himself well informed on developments in overhead reconnaissance and attended many Air Force advisory panel meetings as an observer. In 1954 he learned about the Lockheed CL-282 design and passed the information on to Edwin Land's study group investigating US intelligence-gathering capabilities.

WHEELON, Albert ("Bud") D.
Wheelon became the Deputy Director for Science and Technology in August 1963 following the reorganization and renaming of the Deputy Director for Research. He held this position until September 1966.

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APPENDIX C

Electronic Devices Carried by the U-2

From the beginning the U-2 was envisioned as more than a camera platform. In fact, the U-2 would ultimately carry only five types of photographic equipment but more than 20 different types of electronic devices, some for collecting electronic intelligence (ELINT), others ("ferret" equipment) for gathering intelligence on foreign radars, and a few for self-protection—electronic countermeasures to defeat enemy missile-control radars.

The various electronic, countermeasures and intelligence-gathering systems designed for the U-2 received designations using Roman numerals—Systems I through XXII. The first seven devices were built by the Ramo-Wooldridge firm, now part of the TRW Corporation. System-I used S- and X-band ELINT receivers to collect ground-controlled intercept and air defense signals. Weighing only 7.7 kilograms, this system was aboard all U-2s from 1955 through 1959. System-II, a communications and navigation system, never worked properly and was canceled. System-III, a 16-kilogram VHF recorder for communications intelligence (COMINT), was never used and was transferred to the Navy in 1958. System-IV, a ferret device that recorded electromagnetic energy in the 150- to 4,000-MHz range was used on 16 missions between 1957 and 1959, when it was given to the Air Force. System-V was similar to System-I but covered nine wave bands. The device was so heavy that U-2s using it could not carry a camera system. System-V was used on only three missions and was replaced by the lighter weight System-VI that covered the P-, L-, S-, and X-band frequencies and could be used with either the A or B camera. System-VI was used from 1959 through 1966.

The growing need for data on Soviet missile development led to a contract with the firm of Haller-Raymond-Brown (HRB) to build a missile-telemetry intercept system as quickly as possible. The resulting device (System-VII) could record up to 12 minutes of data from six simultaneous frequencies. This unit first saw service on 9 June 1959 and was used on another 22 missions during the next year. Following modifications to make System-VII suitable for use by the Navy, the designation was changed to System-VIII.

System-IX was an electronic-countermeasures (ECM) device for generating false-angle information in response to X-band radar pulses from surface-to-air missile radars. Also known as the Mark-30, the

unit was manufactured by the Granger Company. One of these devices was aboard Gary Powers' U-2 when he was shot down.

System-X was a modification of the HRB's System-VII that was specially built in 1962 for a mission over the Soviet Union that never took place. Systems-XI through XV were ECM devices used by U-2s overflying China and North Vietnam during the Vietnam war. System-XVI was a passive ELINT collector.

System-XVII was built by HRB-Singer as a result of an October 1963 USIB requirement for the collection of antiballistic-missile (ABM) data from Saryshagan. The system was to be deployed in a U-2 that would fly over western China, along the Sino-Soviet border, collecting data on the ABMs being tested at Saryshagan. By the time the unit was completed in 1965, however, the tipoff time before test launches had been reduced from almost 24 hours to less than an hour, making it impossible to stage U-2 missions in time to collect the data.

In the late 1960s, additional ECM systems were needed to counter the increasing threats posed by more accurate SAMs and higher flying aircraft. System-XX was specifically designed to counter the acquisition and guidance radars used by MIG aircraft, and System-XXII was an infrared jammer to counter air-to-air missiles. System-XXI, a COMINT package that replaced the much older System-III, was originally developed for the OXCART program and was later adapted for use aboard the follow-on U-2, the U-2R.

APPENDIX D

U-2 Overflights of the Soviet Union, 4 July 1954–1 May 1960

Date	Mission	Pilot	Airfield	Unit	Payload	Route
4 July 1956	2013	Stockman	Wiesbaden	A	A-2	East Germany, Poland, Minsk, Leningrad, Estonia, Latvia, Poland
5 July 1956	2014	Vito	Wiesbaden	A	A-2	East Germany, Warsaw, Minsk, Moscow, Estonia, Latvia, Lithuania, Poland
9 July 1956	2020	Knutson	Wiesbaden	A	A-2	East Germany, Poland, Minsk, Poland
9 July 1956	2021	Overstreet	Wiesbaden	A	A-2	Czechoslovakia, Vienna, Hungary, L'vov, Kiev, Minsk, Poland
10 July 1956	2024	Dunaway	Wiesbaden	A	A-2	Poland, Kishinev, Kerch', Sevastopol', Simferopol', Odessa, Romania, Hungary
20 November 1956	4016	Powers	Adana	B	A-2	Iran, Yerevan, Baku, Astara, Caucasus
18 March 1957	4020	Cherbonneaux	Adana	B	Sys-V	Soviet border to Afghanistan, Azerbaijan, Armenia, Georgia
20 June 1957	6005	Rand	Eielson	C	B	Khaylyulya, Ust'-Kamchatsk, Kozyrevsk, Karaganskiy-Ostrov
5 August 1957	4035	Edens	Lahore	B	B	Afghanistan, Tashkent, Tyuratam, Kazalinsk, Aral Sea
11 August 1957	4039	McMurray	Lahore	B	B	Alma-Ata, Ust'-Kamenogorsk, Sinkiang
21 August 1957	4045	Snider	Lahore	B	A-2	Novokuznetsk, Tomsk
21 August 1957	4048	Jones	Lahore	B	A-2	Lake Balkhash, Karaganda, Omsk, Alma-Ata

APPENDIX D

U-2 Overflights of the Soviet Union, 4 July 1954–1 May 1960 (continued)

Date	Mission	Pilot	Airfield	Unit	Payload	Route
22 August 1957	4049	Birkhead	Lahore	B	A-2	Merket Bazar, Kuldja, Abakan, Krasnoyarsk, Kansk, Sinkiang
22 August 1957	4050	Cherbonneaux	Lahore	B	A-2	Lake Balkhash, Semipalatinsk, Barnaul, Prokop'yevsk, Novokuznetsk, Leninogorsk
28 August 1957	4058	Jones	Lahore	B	A-2	Dushanbe, Tashkent, Tyuratam, Kazalinsk, Aral Sea
10 September 1957	4059	Hall	Adana	B	A-2	Krasnovodsk, Gur'yev, Astrakhan', Tbilisi
16 September 1957	6008	Baker	Eielson	C	A-2	Kamchatka Peninsula, Milkovo
13 October 1957	2040	Stockman	Giebelstadt	A	A-2	Norway, Finland, Murmansk, Kandalaksha
1 March 1958	6011	Crull	Atsugi	C	A-2	Dal'nerechensk, Khabarovsk, Blagoveshchensk, Belagorsk, Komsomolsk, Sovetskaya Gavan'
9 July 1959	4125	Knutson	Peshawar	B	B	Tyuratam for suspected Sputnik launch
6 December 1959	8005	Robinson [a]	Peshawar	B	B	Kuybyshev, Kapustin Yar, Caucasus
5 February 1960	8009	MacArthur [a]	Peshawar	B	B	Tyuratam, Kazan
9 April 1960	4155	Erickson	Peshawar	B	B	Lake Balkhash, Semipalatinsk, Kyzylespe, Dzhezhkazgan, Tyuratam
1 May 1960	4154	Powers	Peshawar	B	B	Tyuratam, Kyshtym, Sverdlovsk; downed by SAM

[a] RAF pilot

APPENDIX E

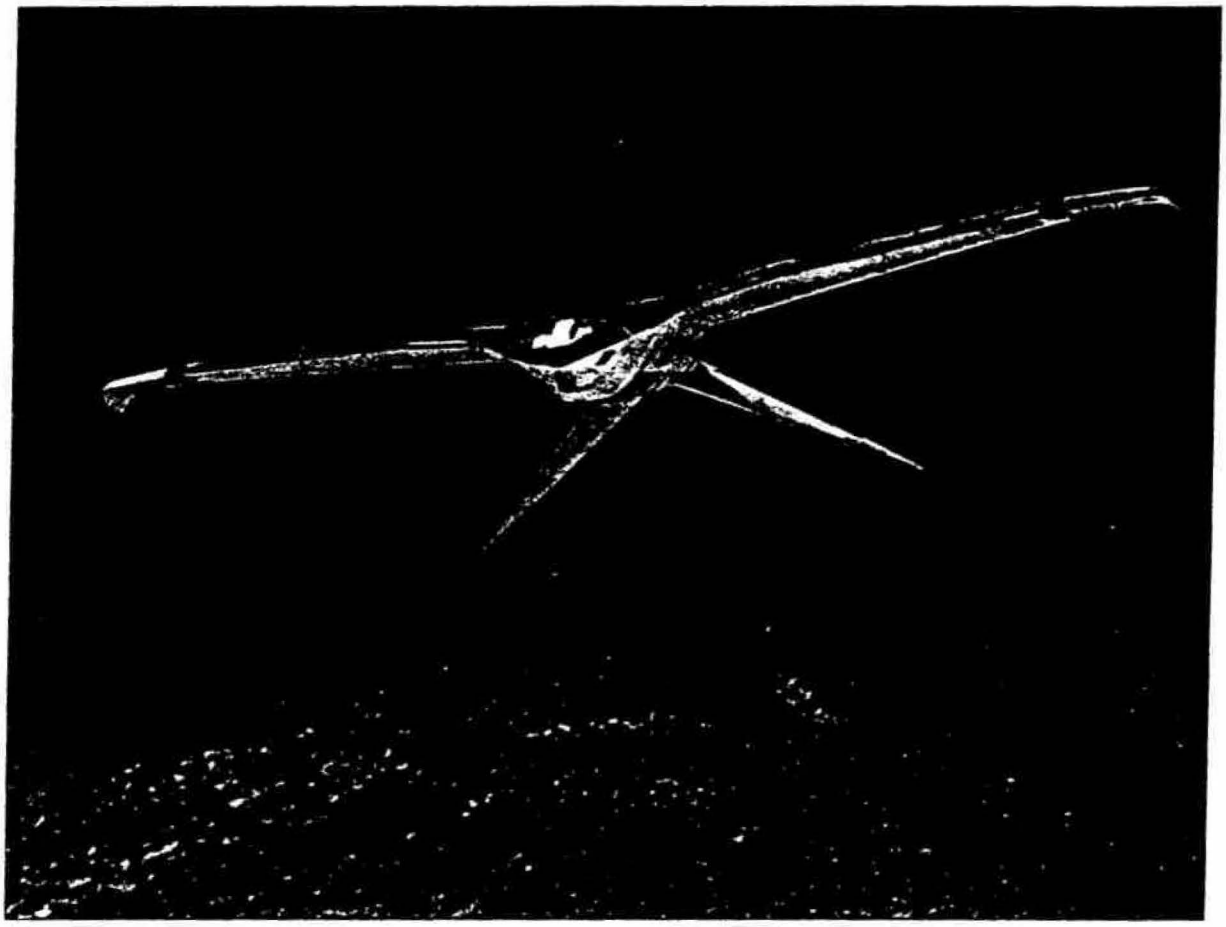
Unmanned Reconnaissance Projects

AQUILINE

In the early 1960s, there were many problems in obtaining coverage of hostile territory. The U-2 was too vulnerable to Soviet surface-to-air missiles, as had been demonstrated by losses over the Soviet Union, Cuba, and the People's Republic of China. The OXCART was still under development and even when completed might prove vulnerable to Soviet radars and missiles. Although safe from interception, the newly developed photosatellites could not provide coverage of a desired target on short notice. Because several of the intelligence community's primary targets such as Cuba and the new Soviet radar installation at Tallinn (Estonia) were not located deep in hostile territory, CIA scientists and engineers began to consider the possibility of using small, unmanned aircraft for aerial reconnaissance. They believed that recent advances in the miniaturization of electronic technology would make possible the development of a reconnaissance vehicle with a very-low-radar cross section and small visual and acoustical signatures. Such a vehicle could reconnoiter an area of interest without the hostile country realizing that it had been overflown.

In mid-1965, David L. Christ, chief of the Office of Research and Development's Applied Physics Division, and Frank Briglia of the same office began working on the concept of a small, inexpensive aircraft that would be about the size of a large bird and could carry various payloads for photography, nuclear sensing, and ELINT collection. ORD soon formed a Special Projects Group to develop the aircraft with Briglia as the project manager. Only one firm—the Douglas Aircraft Company—responded favorably to a request for proposal to study the feasibility of a low-altitude reconnaissance system. On 15 November 1965, Douglas received a study contract. This was followed by two Agency contracts on 21 November 1966 for the development of an operational low-altitude intelligence-gathering system. Further contracts followed in 1968 and 1969.

The AQUILINE prototype developed by Douglas Aircraft (which became part of McDonnell-Douglas in 1969 as the result of a merger) was essentially a powered glider with an 8.5-foot wingspan. The aircraft weighed only 105 pounds. AQUILINE's tail-mounted engine drove a two-bladed propeller. Powered by a small 3.5-horsepower two-cycle engine originally developed by the McCullough



Project AQUILINE

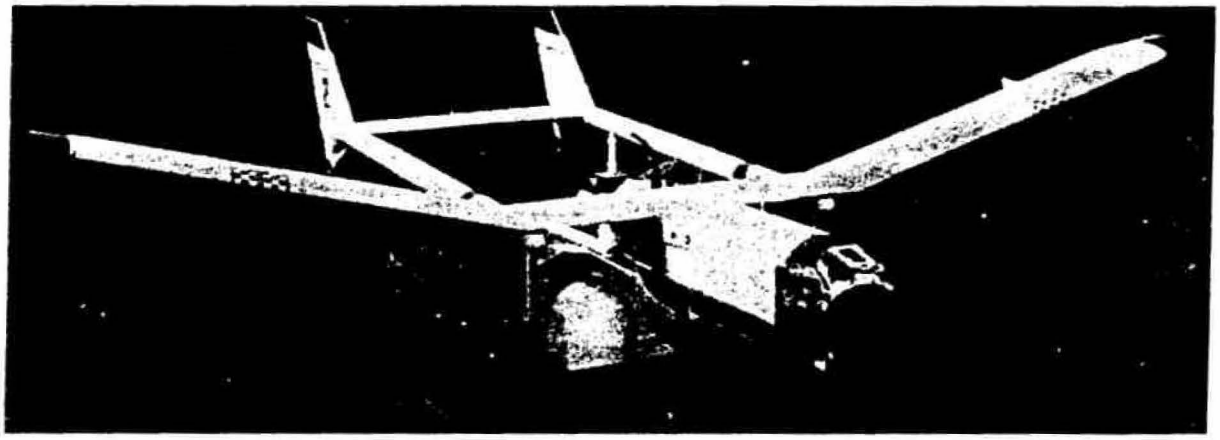
Corporation for chainsaws

In 1968 tests on an AQUILINE prototype at Randsburg Wash on the US Navy's Naval Ordnance Test Station at China Lake, California, showed that the aircraft was extremely difficult to see. To assist pilots of chase aircraft in keeping AQUILINE in sight, its entire upper surface was painted bright orange; even so, sighting remained difficult.

The testing process was very hard on AQUILINE because it was recovered by flying it into a net close to the ground, which almost always caused some damage to the wings or propeller. As a result, one

or more of the aircraft was always being repaired, and eventually three of the five AQUILINE prototypes were destroyed in testing.

At this point the project was turned over to the Office of Special Activities for operational testing Flight tests showed the aircraft to be successful by the standards originally set for the project in 1967, as it flew 130 miles and obtained very high resolution photography of a target before returning successfully to the original launchsite. However, improving AQUILINE sufficiently to make it a practical long-range reconnaissance system was estimated to cost another $35 million and take two to three years. On the recommendation of DDS&T Carl Duckett on 1 November 1971, Project AQUILINE was canceled.



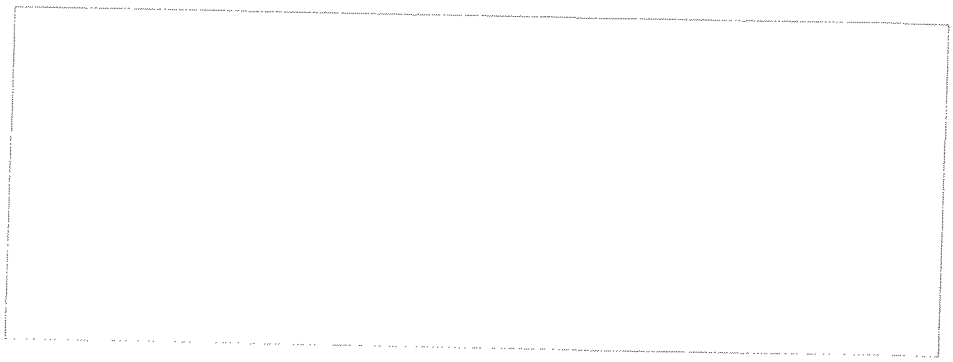
Project AXILLARY

AXILLARY

While Project AQUILINE was still under development, its chief aerodynamicist, Charles N. Adkins, left the program because he believed that its escalating costs would prevent it from ever producing a deployable aircraft. He wanted to build a small, inexpensive remote-controlled aircraft to test a low-cost lightweight autopilot currently being developed by ORD. Under a $5,000 time-and-materials contract with Melpar, Incorporated, Adkins hired a local model aircraft builder to assemble and modify a standard Hawk-750 glider kit and power it with a rear-mounted engine and pusher propeller. Following a series of successful test flights, Adkins installed a small camera and took a number of aerial photographs.

By this time the effort to build a "Miniature Multi-Purpose Airborne Vehicle" had become known as Project AXILLARY. Melpar, Inc., received a second contract for $50,000 to install ORD's autopilot in the aircraft, and the project managers now began searching for a use for their vehicle. The two main possibilites were (1) as a short-range reconnaissance vehicle for use in a peace-monitoring or intelligence-gathering system and (2) as a short-range warhead delivery system. In 1971 the Office of Special Activities evaluated AXILLARY flight-testing and determined that the small model aircraft was not suitable for use as a covert reconnaissance vehicle because of its large radar cross section and significant accoustical signature. The aircraft's radar signature made it potentially useful as a weapons systems, however. ORD suggested that AXILLARY be equipped with a radar-homing unit which would make it an inexpensive means for surface-to-air missile systems in North Vietnam. The Director of

Defense Research and Engineering, John Foster, liked the concept and provided DOD funding for ORD to develop two versions of AXILLARY, one with a radar-homer and one with a television reconnaissance package. The radar homing system proved successful as AXILLARY sought out and destroyed a radar during testing at China Lake Naval Air Station. However, the end of US involvement in Vietnam in early 1973 led to the cancellation of further DOD funding, and AXILLARY was placed on the shelf.



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BIBLIOGRAPHY

Published Works Cited

Aart, Dick van der. *Aerial Espionage, Secret Intelligence Flights by East and West.* Shrewsbury, England: Airlife Publishing, 1985.

"AF Cites Red Bomber Progress." *Aviation Week*, 24 May 1954, p. 14.

"Alleged Overflight of Soviet Area by American Planes." *US Department of State Bulletin*, vol. 36, 28 January 1957, p. 135.

"Alleged Violations of Soviet Territory: Soviet Note of July 10, 1956 with U.S. Reply." *US Department of State Bulletin*, 30 July 1956, pp. 191-192.

Alsop, Stewart. *The Center.* New York: Popular Library, 1968.

Ambrose, Stephen E. *Eisenhower.* Vol. 2, *The President*, New York: Simon and Schuster, 1984.

Andrew, Christopher. *Her Majesty's Secret Service: The Making of the British Intelligence Community.* New York: Viking, 1986.

"Aviation Week Story Spurs Debate on US, Red Airpower Positions." *Aviation Week*, 30 May 1955, pp. 13-14.

Beschloss, Michael R. *Mayday: Eisenhower, Khrushchev and the U-2 Affair.* New York: Harper & Row, 1986.

Brown, William H. "J58/SR-71 Propulsion Integration." *Studies in Intelligence* 26 (Summer 1982): pp. 17-18 (Unclassified).

Brugioni, Dino. *The Cuban Missile Crisis-Phase I, 29 August-16 October 1962.* DDS&T Historical Series, NPIC-1 (CIA: NPIC, 1971) (Secret).

Burrows, William E. *Deep Black: Space Espionage and National Security.* New York: Random House, 1987.

"Can Soviets Take the Air Lead? What LeMay, Wilson, Ike Say." *US News and World Report*, 11 May 1956, pp. 108-114.

Chronology of the Office of Special Activities, 1954-1968. (CIA: DS&T, 1969) (Top Secret Codeword).

Coughlin, William. "Gardner Defends Greater R&D Spending." *Aviation Week*, 26 September 1955, p. 14.

Eastman, Ford. "Defense Officials Concede Missile Lag." *Aviation Week*, 9 February 1959, pp. 26-27.

Edwards, Philip K. "The President's Board: 1956-60." *Studies in Intelligence* 13 (Summer 1969): p. 118 (Secret).

Eisenhower, Dwight D. *Waging Peace, 1956-1961*. Garden City, NY: Doubleday, 1965.

Freedman, Lawrence. *US Intelligence and the Soviet Strategic Threat*. 2nd ed. Princeton: Princeton University Press, 1986.

George, A. L. *Case Studies of Actual and Alleged Overflights, 1930-1953*. Rand Study RM-1349. Santa Monica: Rand, 1955 (Secret).

[redacted] *The Defector Reception Center Germany, 1951 to 1967*. Clandestine Service Historical Series CSHP-41. CIA: History Staff, 1972 (Secret).

Hotz, Robert. "Firing of 900-Mile Russian Missile Spurs US Changes." *Aviation Week*, 20 February 1956, pp. 26-28.

———. "Russian Air Force Now Gaining in Quality." *Aviation Week*, 12 March 1956, pp. 286-291.

———. "Russian Jet Airpower Gains Fast on US." *Aviation Week*, 23 May 1955, pp. 12-15.

"Is Russia Ahead in Missile Race?" *US News and World Report*, 6 September 1957, pp. 30-33.

"Is Russia Really Ahead in Missile Race?" *US News and World Report*, 4 May 1956, pp. 34-35.

"Is Russia Winning the Arms Race?" *US News and World Report*, 18 June 1954, pp. 28-29.

"Is US Really Losing in the Air?" *US News and World Report*, 18 May 1956, pp. 25-27.

Johnson, Clarence L. "Development of the Lockheed SR-71 Blackbird." *Studies in Intelligence* 26 (Summer 1982): p. 4 (Unclassified).

Johnson, Clarence L. with Maggie Smith. *Kelly: More Than My Share of It All*. Washington, DC: Smithsonian Institute Press, 1985.

Khrushchev, Nikita S. *Khrushchev Remembers: The Last Testament*. Boston: Little, Brown, & Co., 1974.

Killian, James R., Jr. *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology*. Cambridge: MIT Press, 1977.

Kistiakowsky, George B. *A Scientist at the White House*. Cambridge: Harvard University Press, 1976.

Kleyla, Helen H., and Robert D. O'Hern. *History of the Office of Special Activities, DS&T*. 16 vols. Directorate of Science and Technology Historical Series OSA-1. CIA: DS&T, 1969 (Top Secret Codeword).

Lay, James S. "The United States Intelligence Board, 1958-1965." CIA History Staff MS-2 (draft), 1974 (Top Secret Codeword).

Licklider, Roy E. "The Missile Gap Controversy." *Political Science Quarterly* 85 (1970): pp. 600-615.

[redacted] *The National Photographic Interpretation Center*. Vol. 1, *Antecedents and Early Years*. Directorate of Science and Technology Historical Series NPIC-2. CIA: NPIC, 1972 (Secret).

———. *National Photographic Interpretation Center: The Years of Project HTAUTOMAT, 1956-1958*. 6 vols. Directorate of Science and Technology Historical Series NPIC-3. CIA: NPIC, 1974 (Secret).

Miller, Jay. *Lockheed U-2*. Aerograph 3. Austin, Texas: Aerofax, 1983.

[redacted] "The OXCART Story." *Studies in Intelligence* 15 (Winter 1971): pp. 1-34 (Secret).

"Missiles Away." *Time*, 30 January 1956, pp. 52-55.

"Mystery of the RB-47." *Newsweek*, 25 July 1960, pp. 36-37.

"Nikita and the RB-47." *Time*, 25 July 1960, pp. 30-31.

"Office of Special Activities History, April 1969 to Phase-Out." (draft) (CIA: DS&T, 1974), chap. 3, pp. 36-42 (Top Secret Codeword).

Pero, Richard K. "Message Received—Unfortunately." *Studies in Intelligence* 27 (Winter 1983): p. 29 (Secret).

Pocock, Chris. *Dragon Lady: The History of the U-2 Spyplane*. Shrewsbury, England: Airlife, 1989.

Powers, Francis Gary, with Curt Gentry. *Operation Overflight*. New York: Holt, Rinehart and Wilson, 1970.

Powers, Thomas. *The Man Who Kept the Secrets: Richard Helms and the CIA*. New York: Alfred A. Knopf, 1979.

Prados, John. *Presidents' Secret Wars: CIA and Pentagon Covert Operations Since World War II*. New York: William Morrow, 1986.

———. *The Soviet Estimate: U.S. Intelligence Analysis and Russian Military Strength*. New York: Dial Press, 1982.

[redacted] *Covert Support to Indonesian Revolutionary Government, 1957-1958*. 2 vols. Clandestine Service Historical Series, CSHP-53. CIA: History Staff, 1970 (Secret).

"Red Air Force: The World's Biggest." *Newsweek*, 23 August 1954, pp. 28-33.

Richelson, Jeffrey. *American Espionage and the Soviet Target*. New York: William Morrow, 1987.

"Russia Parades Airpower as 'Big Stick'." *Aviation Week*, 28 June 1954, p. 15.

[redacted] *Low-Level Technical Reconnaissance over Mainland China (1955-66)*. Clandestine Services Historical Program, CSHP-2.348. CIA: History Staff, 1972 (Secret).

Stanley, Roy M., II. *World War II Photo Intelligence*. New York: Scribners, 1981.

Sturm, Thomas A. *The USAF Scientific Advisory Board: Its First Twenty Years, 1944-1964*. Washington, DC: USAF Historical Office, 1967.

Twining, Nathan F. *Neither Liberty nor Safety*. New York: Holt, Rinehart & Winston, 1966.

United States Air Force. Project LINCOLN. *BEACON HILL Report: Problems of Air Force Intelligence and Reconnaissance*. Massachusetts Institute of Technology, 15 June 1952 (Secret, downgraded to Confidential).

United States Congress. Senate. Foreign Relations Committee. *Executive Sessions of the Senate Foreign Relations Committee (Historical Series)*, vol. 12, 86th Congress, 2nd Session, "Report on the U-2 Incident," 6 March 1962 (declassified 1982).

United States Congress. Senate. Select Committee to Study Governmental Operations with Respect to Intelligence Activities. *Foreign and Military Intelligence*. Book 1. Washington, DC: US Government Printing Office, 1976.

United States Office of Defense Mobilization. Science Advisory Committee. Technological Capabilities Panel. *Meeting the Threat of Surprise Attack*, 14 February 1955. (Top Secret/Restricted Data, downgraded to Secret).

"US Representations to the Soviet Government on C-130 Transport Shot Down by Soviet Fighter Aircraft." *US Department of State Bulletin*, 23 February 1959, pp. 262-271.

Weber, Karl H. *The Office of Scientific Intelligence, 1949-68*. Directorate of Science and Technology Historical Series OSI-1. CIA: DS&T, 1972 (Top Secret Codeword).

Welzenbach, Donald E. "Observation Balloons and Weather Satellites." *Studies in Intelligence* 30 (Spring 1986): pp. 21-28 (Secret).

White, James J. "Francis Gary Powers—The Unmaking of a Hero, 1960-1965." (draft) CIA: History Staff, 1974 (Secret).

Wise, David and Thomas B. Ross. *The U-2 Affair*. New York: Random House, 1962.

Witze, Claude. "Russians Outpacing US in Air Quality, Twining Warns Congress," *Aviation Week*, 27 February 1956, pp. 26-28.

"Yakovlev Yak-25RM Mandrake," *Jane's Defence Weekly*, vol. 3, no. 7, 16 February 85.

Interviews and Speeches

Interview with Robert Amory, Jr., by Donald E. Welzenbach and Gregory W. Pedlow, Washington, DC, 22 April 1987 (Secret).

Interview with James G. Baker by Donald E. Welzenbach, Washington, DC, 24 April 1985 (Secret).

Speech given by Richard Bissell at CIA Headquarters, 12 October 1965 (Top Secret Codeword).

Interview with Joseph V. Charyk by Donald E. Welzenbach, Washington, DC, 5 December 1984 (Top Secret Codeword).

Interview with former U-2 pilots James Cherbonneaux, Carmine Vito, and Hervey Stockman, by Donald E. Welzenbach, Washington, DC, May 1986 (Secret).

Interview with James A. Cunningham, Jr., by Donald E. Welzenbach, Washington, DC, 4 October 1983 (Top Secret Codeword).

Interview with Allen F. Donovan by Donald E. Welzenbach, Corona del Mar, California, 20 May 1985 (Secret).

Interview with Brig. Gen. Leo A. Geary, USAF (Ret.), by Donald E. Welzenbach, 3 April 1986 (Secret).

Interview with Gen. Andrew J. Goodpaster by Donald E. Welzenbach and Gregory W. Pedlow, Washington, DC, 8 July 1987 (Secret).

Speech by Maj. Gen. Patrick J. Halloran (former Air Force U-2 pilot) at the National Air & Space Museum, 24 April 1986 (Unclassified).

Interview with James R. Killian, Jr. by Donald E. Welzenbach, Cambridge, Massachusetts, 2 November 1984 (Secret).

Interview with Edwin H. Land by Donald E. Welzenbach, Cambridge, Massachusetts, 17 and 20 September 1984 (Top Secret Codeword).

Interview with Brig. Gen. Jack C. Ledford, USAF (Ret.), by Gregory W. Pedlow, Washington, DC, 20 February 1987 (Secret).

Interview with Richard S. Leghorn by Donald E. Welzenbach, Washington, DC, 19 August 1985 (Secret).

Interview with Arthur S. Lundahl and Dino Brugioni by Donald E. Welzenbach, Washington, DC, 14 December 1983 (Top Secret Codeword) .

Interview with Garrison Norton by Donald E. Welzenbach, Washington, DC, 23 May 1983 (Secret).

Interview with John Parangosky by Donald E. Welzenbach, 6 March 1986 (Secret).

Interview with James Q. Reber by Donald E. Welzenbach and Gregory W. Pedlow, Washington, DC, 21 May 1987 (Secret).

Interview with Carmine Vito by Donald E. Welzenbach, Washington, DC, 7 May 1986 (Secret).

Interview with John S. Warner, Office of the General Counsel, by Donald E. Welzenbach, Washington, DC, 5 August 1983 (Top Secret Codeword).

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