The U-2's Intended Successor: Project OXCART, 1956-1968

Before the U-2 became operational in June 1956, CIA project officials had estimated that its life expectancy for flying safely over the Soviet Union would be between 18 months and two years. After overflights began and the Soviets demonstrated the capability of tracking and attempting to intercept the U-2, this estimate seemed too optimistic. By August 1956, Richard Bissell was so concerned about the U-2's vulnerability that he despaired of its ability to avoid destruction for six months, let alone two years.

To extend the U-2's useful operational life, project officials first attempted to reduce the aircraft's vulnerability to detection by Soviet radars. Project RAINBOW's efforts to mask the radar image of the U-2 not only proved ineffective, but actually made the aircraft more vulnerable by adding extra weight that reduced its maximum altitude. Because Soviet radar operators continued to find and track U-2s equipped with antiradar systems, the CIA canceled Project RAINBOW in May 1958.

Long before the failure of Project RAINBOW, Richard Bissell and his Air Force assistant, Col. Jack A. Gibbs, had begun to look for a more radical solution to the problem of Soviet radar detection—an entirely new aircraft. In the late summer of 1956, the two officials visited a number of airframe contractors in a search for new ideas. Among the more unusual was Northrop Aviation's proposal for a gigantic aircraft with a very-high-lift wing. Because it would not be made of metal, the wing would require a type of bridge truss on its upper side to give it rigidity. The proposed aircraft would achieve altitudes of 80,000 to 90,000 feet but only at subsonic speeds, just enough to keep it airborne.[1]

The slow-flying Northrop design did not solve the problem of radar detection, and in 1957 the emphasis switched to supersonic designs. In August 1957, the Scientific Engineering Institute (SEI), a CIA proprietary firm that had been working on ways to reduce the U-2's vulnerability to radar, began to investigate the possibility of designing an aircraft with a very small radar cross section. SEI soon discovered that supersonic speed greatly reduced the chances of detection by radar.[2] From this point on, the CIA's attention focused increasingly on the possibility of building an aircraft that could fly at both extremely high speeds and high altitudes while incorporating the best ideas in radar-absorbing or radar-deflecting techniques.

THE EVALUATION OF DESIGNS FOR A SUCCESSOR TO THE U-2

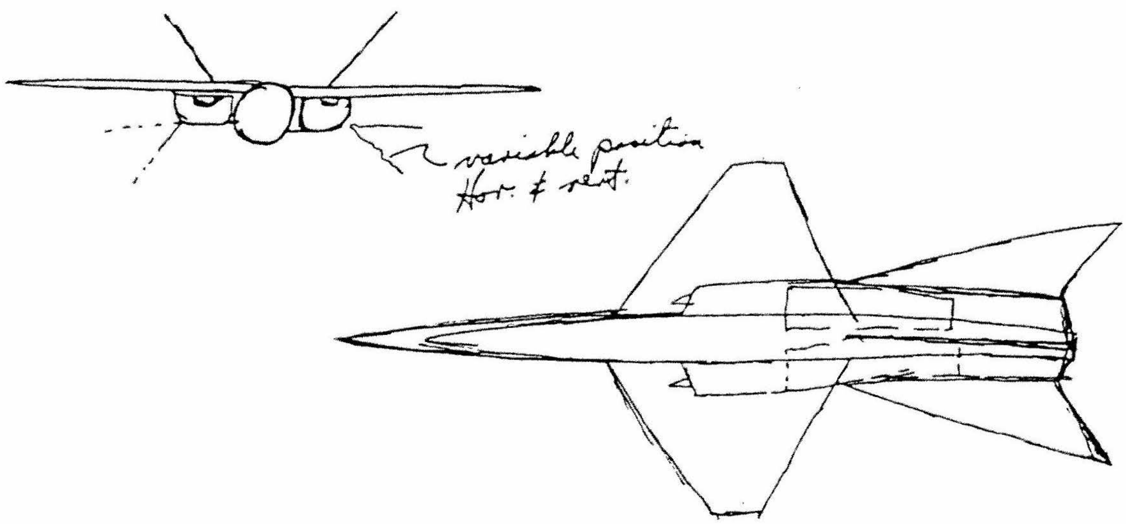
By the autumn of 1957, Bissell and Gibbs had collected so many ideas for a successor to the U-2 that Bissell asked DCI Dulles for permission to establish an advisory committee to assist in the selection process. Bissell also felt that the support of a committee of prominent scientists and engineers would prove useful when it came time to ask for funding for such an expensive project. Edwin Land became the chairman of the new committee, which included some of the scientists and engineers who had served on previous advisory bodies for overhead reconnaissance: Edward Purcell, Allen F. Donovan, H. Guyford Stever, and Eugene P. Kiefer. The Air Force's chief scientist, Courtland D. Perkins, was also a member. The committee first met in November 1957 and held six more meetings between July 1958 and the late summer of 1959. The meetings usually took place in Land's Boston office and almost always included the Air Force's Assistant Secretary for Research and Development, Dr. Joseph V. Charyk, and his Navy counterpart, Garrison Norton. Designers from several aircraft manufacturers also attended some of the meetings.[3]

[1] Donovan interview (S).

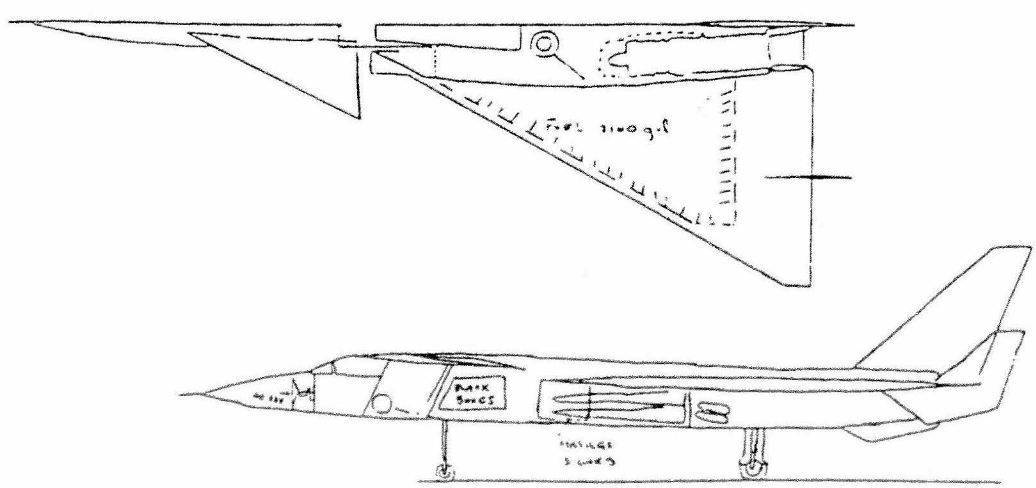
[2] [redacted] "The OXCART Story," *Studies in Intelligence* 15 (Winter 1971):2 (S).

[3] Clarence L. Johnson, Report No. SP-1362, "History of the OXCART Program," Lockheed Aircraft Corporation, Burbank, CA, 1 July 1968, p. 1 (TS Codeword).

A-1, 23 April 1958



A-1, 26 June 1958



Johnson's first drawing of the "U-3" (A-1); revised version of the A-1

The two most prominent firms involved in the search for a new aircraft were Lockheed, which had designed the successful U-2, and Convair, which was building the supersonic B-58 "Hustler" bomber for the Air Force and also working on an even faster model known as the B-58B "Super Hustler." Early in 1958, Richard Bissell asked officials from both firms to submit designs for a high-speed reconnaissance aircraft. During the spring and summer of 1958, both firms worked on design concepts without government contracts or funds.

Following extended discussions with Bissell on the subject of a supersonic successor to the U-2, Lockheed's Kelly Johnson began designing an aircraft that would cruise at Mach 3.0 at altitudes above 90,000 feet. On 23 July 1958, Johnson presented his new high-speed concept to Land's advisory committee, which expressed interest in the approach he was taking. At the same meeting, Navy representatives presented a concept for a high-altitude reconnaissance vehicle that examined the possibility of developing a ramjet-powered, inflatable, rubber vehicle that would be lifted to altitude by a balloon and then be propelled by a rocket to a speed where the ramjets could produce thrust. Richard Bissell asked Johnson to evaluate this concept, and three weeks later, after receiving more details from Navy representatives, Kelly Johnson made some quick calculations that showed that the design was impractical because the balloon would have to be a mile in diameter to lift the vehicle, which in turn would need a wing surface area greater than one-seventh of an acre to carry the payload.[4]

By September 1958, Lockheed had studied a number of possible configurations, some based on ramjet engines, others with both ramjets and turbojets. Personnel at Lockheed's Skunk Works referred to these aircraft concepts as "Archangel-1," "Archangel-2," and so forth, a carryover from the original nickname of "Angel" given to the U-2 during its development. These nicknames for the various designs soon became simply "A-1," "A-2," etc.

In September 1958, the Land committee met again to review all the concepts then under consideration and to winnow out the few that were most practicable. Among the concepts rejected were the Navy's proposal for an inflatable, ramjet-powered aircraft, a Boeing proposal for a 190-foot-long hydrogen-powered inflatable aircraft, and a

[4] Clarence L. Johnson, "Development of the Lockheed SR-71 Blackbird," *Studies in Intelligence* 26 (Summer 1982):4 (U); Johnson, "Archangel log," 23 July 1958, 14 August 1958.

Lockheed design for a hydrogen-powered aircraft (the CL-400). The committee examined two other Kelly Johnson designs at this meeting—a tailless subsonic aircraft with a very-low-radar cross section (the G2A) and a new supersonic design (the A-2)—and did not accept either one, the former because of its slow speed and the latter because of its dependence on exotic fuels for its ramjets and its overall high cost. The committee approved the continuation of Convair's work on a ramjet-powered Mach 4.0 "parasite" aircraft that would be launched from a specially configured version of the B-58B bomber. The design was termed a parasite because it could not take off on its own but needed a larger aircraft to carry it aloft and accelerate it to the speed required to start the ramjet engine. The Convair design was called the FISH.[5]

Two months later, after reviewing the Convair proposal and yet another Lockheed design for a high-speed reconnaissance aircraft (the A-3), the Land committee concluded in late November 1958 that it would indeed be feasible to build an aircraft whose speed and altitude would make radar tracking difficult or impossible. The committee, therefore, recommended that DCI Dulles ask President Eisenhower to approve further pursuit of the project and to provide funds for additional studies and tests.[6]

On 17 December 1958, Allen Dulles and Richard Bissell briefed the President on the progress toward a successor to the U-2. Also present were Land and Purcell from the advisory committee, Presidential Science Adviser James Killian, and Air Force Secretary Donald Quarles. DCI Dulles reviewed the results of the U-2 missions to date and stated his belief that a successor to the U-2 could be used all over the world and "would have a much greater invulnerability to detection."

Bissell then described the two competing projects by Lockheed and Convair, noting that the chief question at the moment was whether to use air launch or ground takeoff. The next phase, he added, would be detailed engineering, at the end of which it was proposed that 12 aircraft be ordered at a cost of about $100 million.

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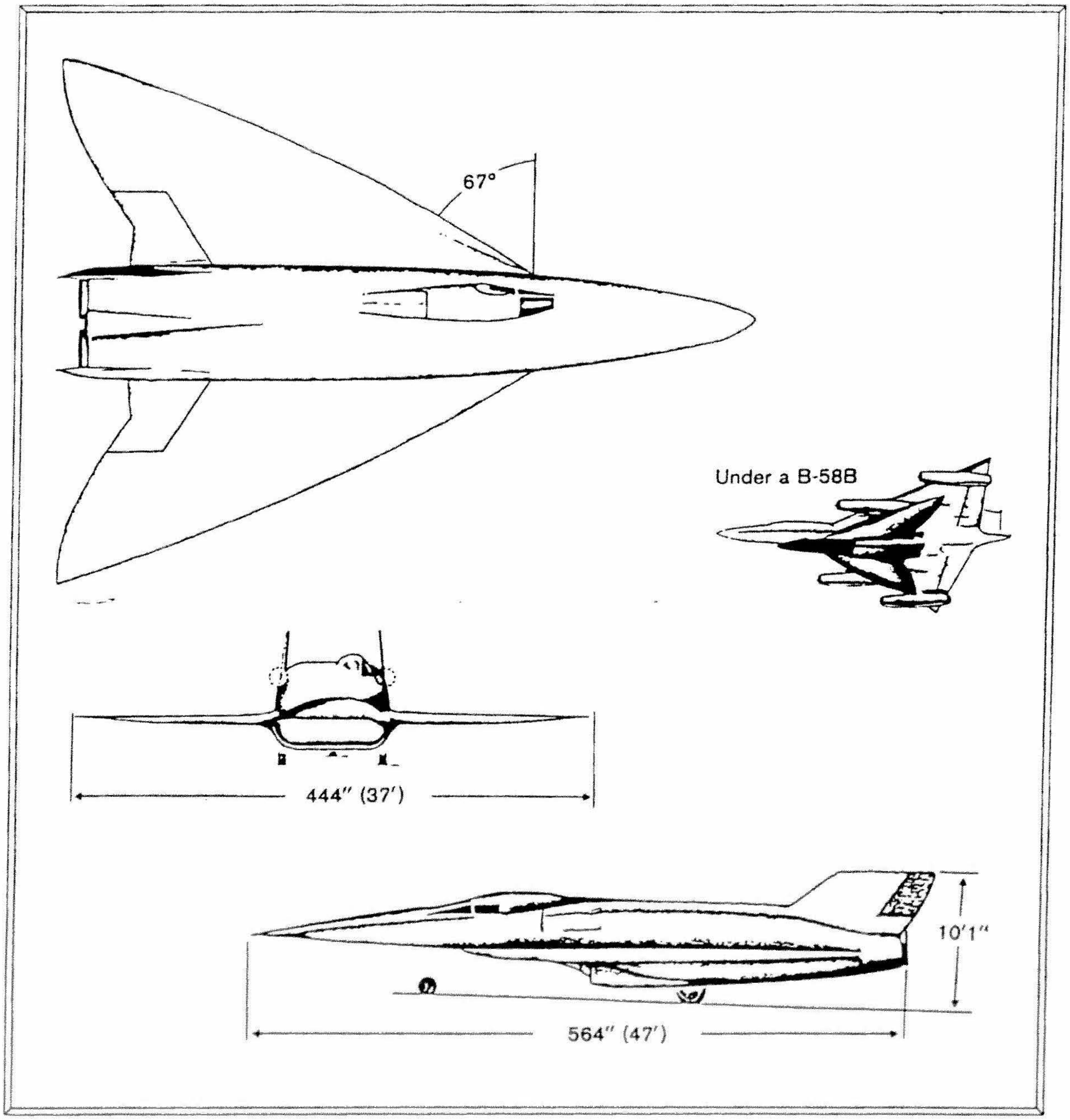
[5] *OSA History*, chap. 20, p. 8 (TS Codeword); Johnson, "Archangel log," 17-24 September 1958.

[6] *OSA Chronology*, p. 21 (TS Codeword); [redacted] "OXCART Story," p. 3 (S); *OSA History*, chap. 20, p. 8 (TS Codeword); Johnson, "Archangel log," 12 November 1958.



Convair FISH

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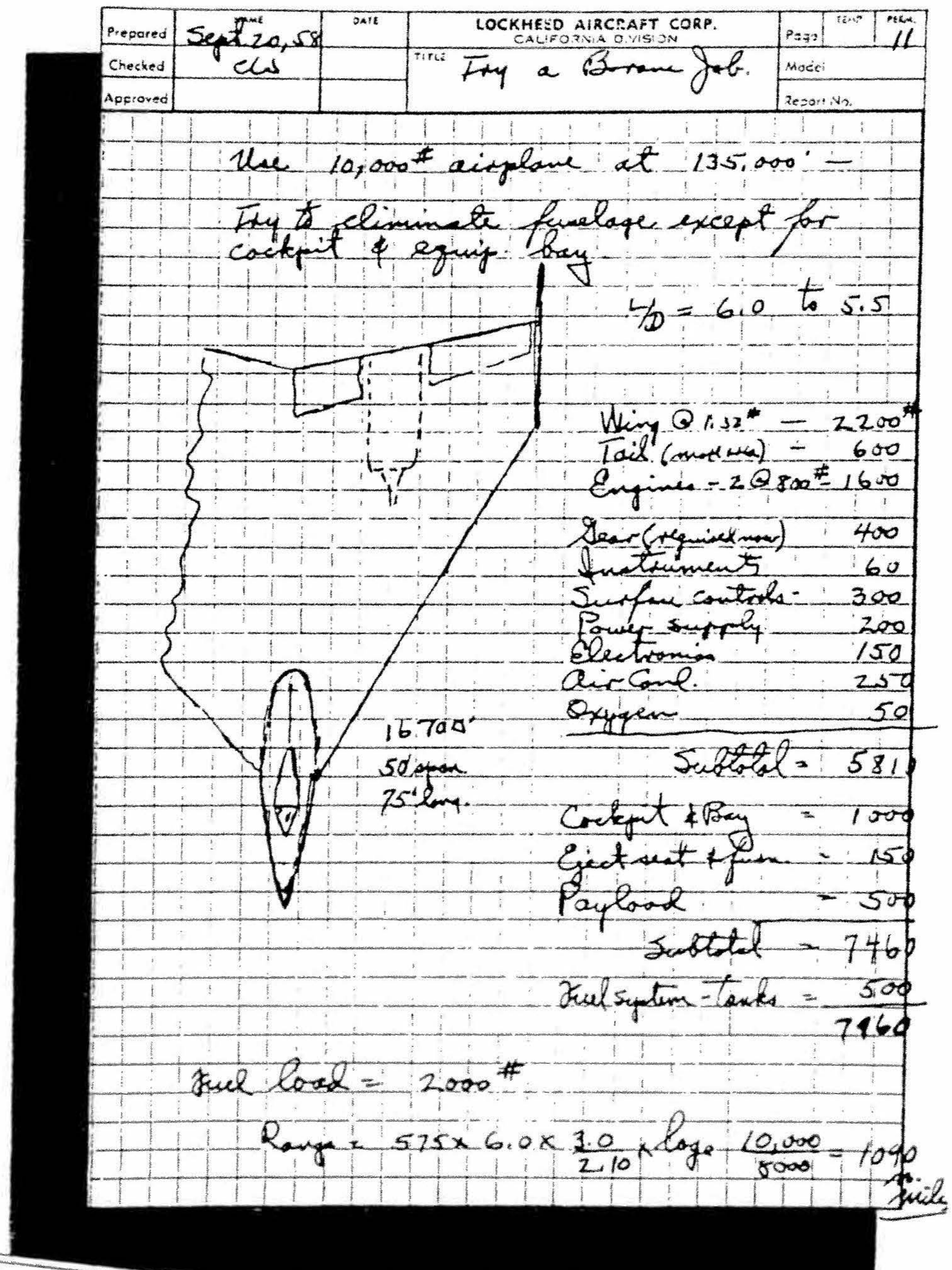
Kelly Johnson's A-2 Design



Prepared	Sept 20, 58	DATE	LOCKHEED AIRCRAFT CORP. CALIFORNIA DIVISION	Page	11
Checked	CLJ		TITLE Try a Borane Job.	Model	
Approved				Report No.	

Use 10,000# airplane at 135,000' –

Try to eliminate fuselage except for cockpit & equip. bay

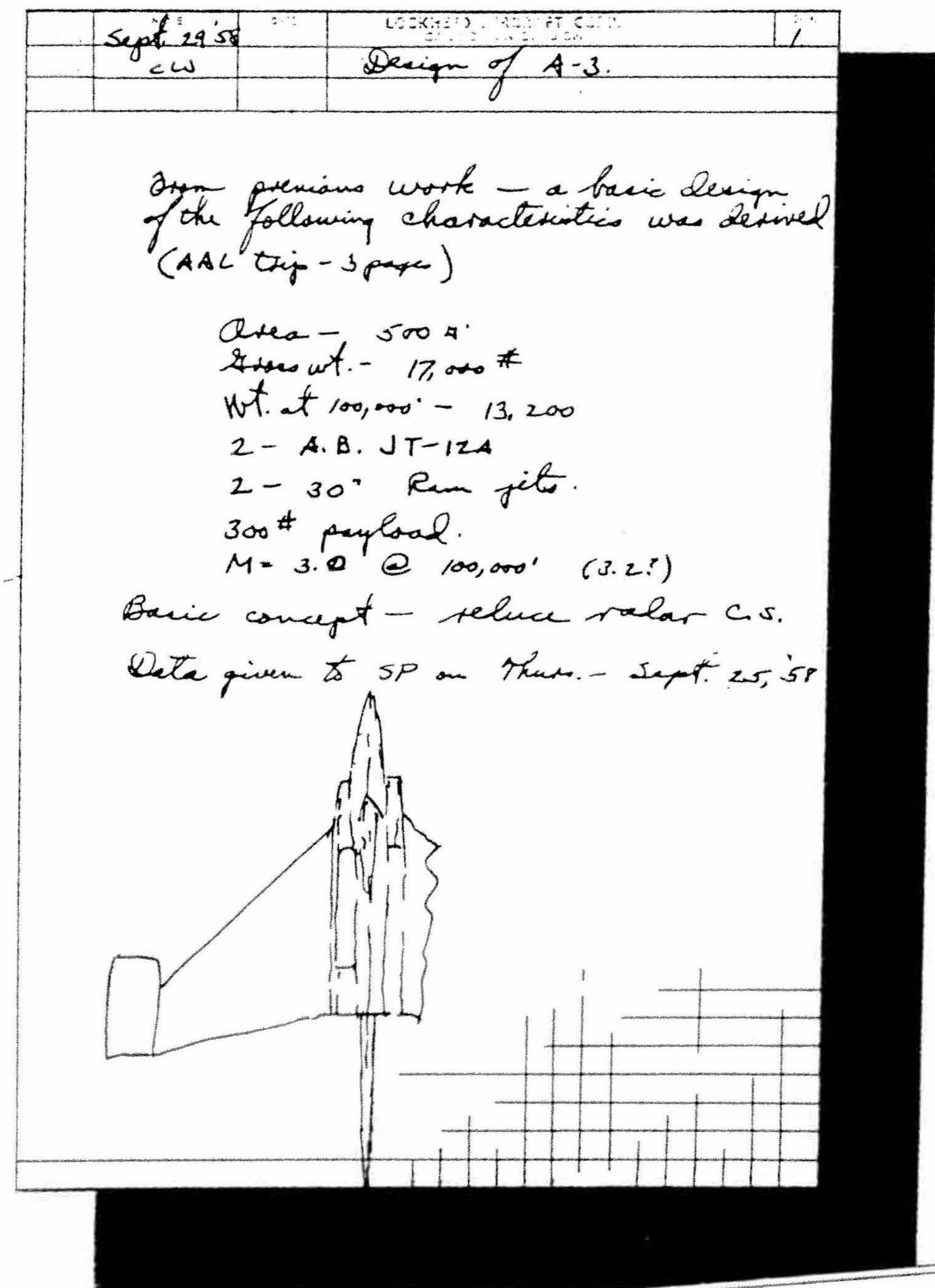
L/D = 6.0 to 5.5

Wing @ 1.32#	2200#
Tail (mod area)	600
Engines – 2 @ 800#	1600
Gear (required now)	400
Instruments	60
Surface controls	300
Power supply	200
Electronics	150
Air Cond.	250
Oxygen	50
Subtotal =	5810
Cockpit & Bay =	1000
Eject seat & furn. =	150
Payload =	500
Subtotal =	7460
Fuel system – tanks =	500
	7960

Fuel load = 2000#

Range = 575 x 6.0 x $\frac{3.0}{2.10}$ x $\log_e \frac{10,000}{8000}$ = 1090 n. mile

Kelly Johnson's A-3 Design


Sept. 29 '58
CW
Design of A-3.
1

From previous work — a basic design of the following characteristics was derived (AAL trip - 3 pages)

Area — 500 ft²
Gross wt. — 17,000 #
Wt. at 100,000' — 13,200
2 — A.B. JT-12A
2 — 30" Ram jets.
300# payload.
M = 3.0 @ 100,000' (3.2?)

Basic concept — reduce radar C.S.

Data given to SP on Thurs. — Sept. 25, '58

Although President Eisenhower supported the purchase of this type of aircraft, he questioned the plan to procure any before they had been tested. Promising that more thought would be given to the matter before such an order was placed, Secretary Quarles noted that CIA, the Defense Department, and the Bureau of the Budget were working on a funding plan for the project. The President suggested that the Air Force "could support the project by transferring some reconnaissance money." At the close of the meeting, Eisenhower asked the group to return after completing the next work phase to discuss further stages of the project with him.[7]

COMPETITION BETWEEN LOCKHEED AND CONVAIR

With funding for the proposed new type of aircraft now available, Richard Bissell asked Lockheed and Convair to submit detailed proposals. During the first half of 1959, both Lockheed and Convair worked to reduce the radar cross section of their designs, with assistance from Franklin Rodgers of the Scientific Engineering Institute. In pursuing his antiradar studies, Rodgers had discovered a phenomenon that he believed could be used to advantage by the new reconnaissance aircraft. Known as the Blip/Scan Ratio but also referred to as the Rodgers' Effect, this phenomenon involved three elements: the strength of a radar return, the altitude of the object being illuminated by the radar, and the persistence of the radar return on the radar screen (Pulse-Position Indicator display).

Most tracking radars in the late 1950s swept a band of sky 30° to 45° wide and 360° in circumference. Any object encountered in this area reflected the radar pulse in a manner directly proportional to its size—the larger the object, the stronger the returning radar signal. This return appeared on the cathode-ray tube of the radar screen as a spot or blip, and the persistence of this blip on the radar screen also depended on the strength of the radar return, with blips from larger objects remaining on the screen longer. During the late 1950s and early 1960s, a human radar operator watched the radar screen and kept track of the blips that indicated aircraft within the radar's field of view.

[7] Andrew J. Goodpaster, "Memorandum of Conference with the President, 17 December 1958, 10:26 a.m.," 22 December 1958, WHOSS, Alpha, DDEL (TS).

Rodgers determined that a high-altitude object moving two to three times as fast as a normal aircraft would produce such a small blip with so little persistence that the radar operator would have great difficulty tracking it, if indeed he could even see it. Rodgers estimated that for an aircraft to take advantage of this Blip/Scan Ratio phenomenon it must fly at altitudes approaching 90,000 feet and have a radar cross section of less than 10 square meters, preferably not much over 5 square meters. However, for a Mach 3.0 aircraft to achieve such a small radar cross section, its designers would have to make many concessions in its structural design and aerodynamics.[8]

By the summer of 1959, both firms had completed their proposals. In early June, Lockheed submitted a design for a ground-launched aircraft known as the A-11. It would have a speed of Mach 3.2, a range of 3,200 miles, an altitude of 90,000 feet, and a completion date of January 1961. Kelly Johnson had refused to reduce the aerodynamics of his design in order to achieve a greater antiradar capability, and the A-11's radar cross section, although not great, was substantially larger than that of the much smaller parasite aircraft being designed by Convair.[9]

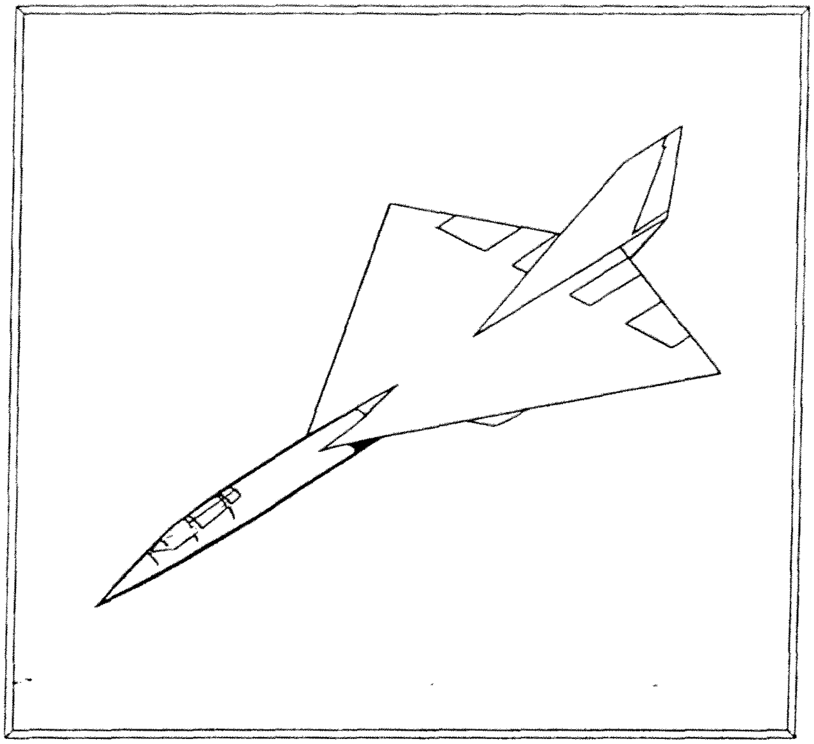
The Convair proposal called for a small, manned, ramjet-powered, reconnaissance vehicle to be air launched from one of two specially configured Convair B-58B Super Hustlers. The FISH vehicle, a radical lifting body with a very-small-radar cross section, would fly at Mach 4.2 at 90,000 feet and have a range of 3,900 miles. Two Marquardt ramjets would power its Mach 4.2 dash over the target area. Once the FISH decelerated, two Pratt & Whitney JT-12 turbojets would bring it back to base. The ramjet exit nozzles and wing edges would be constructed of Pyroceram, a ceramic material that could withstand the high temperatures of very high speeds and would absorb radiofrequency energy from radar pulses. Convair stated that the FISH could be ready by January 1961.[10]

Convair's proposal depended on two uncertain factors. First and foremost was the unproven technology of ramjet engines. At the time, no aircraft in existence could carry a large, ramjet-powered craft into the sky and then accelerate to sufficient speed for the ramjet engines

[8] Unnumbered Convair document on the Blip/Scan Ratio or Rodgers' Effect (TS).

[9] Johnson, "Archangel log," December 1958–July 1959.

[10] *OSA History*, chap. 20, p. 12 (TS Codeword); Convair Division, General Dynamics Corporation, "Project FISH Status Review," 9 June 1959 (S).



Lockheed A-11

to be ignited. Since ramjet engines had only been tested in wind tunnels, there was no available data to prove that these engines would work in the application proposed by Convair. The second uncertain factor was the B-58B bomber that was supposed to achieve Mach 2.2 before launching the FISH above 35,000 feet. This version of the B-58 was still in the design stage.

Convair's proposal suffered a major setback in June 1959, when the Air Force canceled the B-58B project. Conversion of the older, slower B-58A into a supersonic launching platform for the FISH was ruled out by the high cost and technical difficulties involved. Moreover, the Air Force was unwilling to part with two aircraft from the small inventory of its most advanced bomber. Even had the B-58B program not been canceled, however, the FISH proposal would probably not have been feasible. Convair engineers had calculated that the added weight of the FISH would prevent the B-58B from achieving the speed required to ignite the parasite aircraft's ramjet engines.

The Convair proposal was therefore unusable, but the Lockheed design with its high radar cross section was also unacceptable to the Land committee. On 14 July 1959, the committee rejected both designs and continued the competition. Lockheed continued to work on developing a design that would be less vulnerable to detection, and Convair received a new CIA contract to design an air-breathing twin-engine aircraft that would meet the general specifications being followed by Lockheed.[11]

Following recommendations by the Land committee, both Lockheed and Convair incorporated the Pratt & Whitney J58 power plant into their designs. This engine had originally been developed for the Navy's large, jet-powered flying boat, the Glenn L. Martin Company's P6M Seamaster, and was the most powerful engine available. In 1958 the Navy had canceled the Seamaster program, which had left Pratt & Whitney without a buyer for the powerful J58 engine.[12]

Although the Land committee had not yet found an acceptable design, it informed President Eisenhower on 20 July 1959 that the search was making good progress. Concerned about the U-2's vulnerability to detection and possible interception and aware that the photosatellite project was encountering significant problems, the President gave his final approval to the high-speed reconnaissance aircraft project.[13]

THE SELECTION OF THE LOCKHEED DESIGN

By the late summer of 1959, both Convair and Lockheed had completed new designs for a follow-on to the U-2. Convair's entry, known as the KINGFISH, used much of the technology developed for the F-102, F-106, and B-58, including stainless steel honeycomb skin, planiform wing design, and a crew capsule escape system, which eliminated the need for the pilot to wear a pressurized suit. The KINGFISH had two side-by-side J58 engines inside the fuselage, which significantly reduced the radar cross section. Two additional

[11] *OSA History*, chap. 20, p. 15 (TS Codeword).

[12] Cunningham interview, 4 October 1983 (TS Codeword); Joseph V. Charyk, interview by Donald E. Welzenbach, tape recording, Washington, DC, 5 December 1984 (TS Codeword).

[13] Andrew J. Goodpaster, "Memorandum of Conference with the President," 20 July 1959, WHOSS, ALPHA, DDEL (TS).

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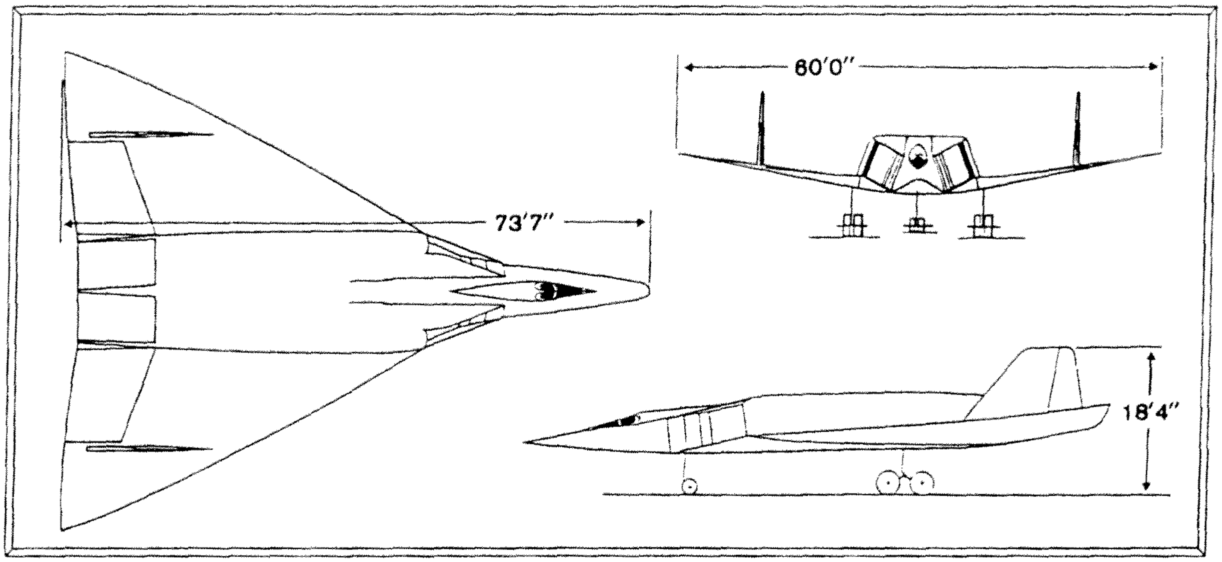


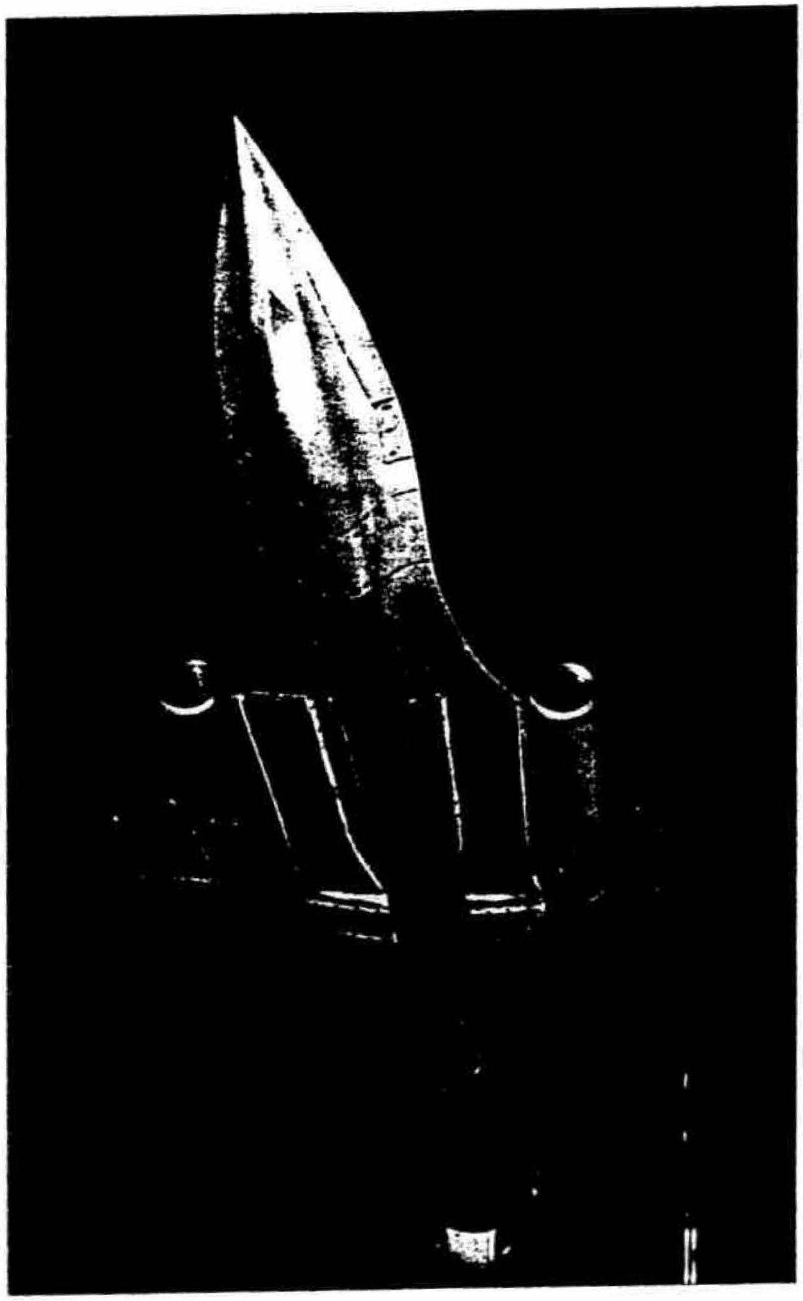
Convair KINGFISH

important design features that contributed to a small radar return were fiberglass engine inlets and wings whose leading edges were made of Pyroceram.[14]

Lockheed's new entry was much like its first, but with several modifications and a new designator, A-12. It, too, would employ two of the powerful J58 engines. Lockheed's major innovation in reducing radar return was a cesium additive in the fuel, which decreased the radar cross section of the afterburner plume. This improvement had been proposed by Edward Purcell of the Land committee. Desiring to save weight, Kelly Johnson had decided not to construct the A-12 out of steel. Traditional lightweight metals such as aluminum were out of the question because they could not stand the heat that would be generated as the A-12 flew at Mach 3.2, so Johnson chose a titanium alloy.

On 20 August 1959, Lockheed and Convair submitted their proposals to a joint Department of Defense, Air Force, and CIA selection panel. As the table shows, the two aircraft were similar in performance

[14] Convair Division, General Dynamics Corporation, "KINGFISH Summary Report," 1959 (S). Kelly Johnson was very skeptical of the Convair design, noting in the Archangel project log on 1-20 August 1959: "Convair have promised substantially reduced radar cross section on an airplane the size of our A-12. They are doing this, in my view, with total disregard for aerodynamics, inlet and afterburner performance."



Wind tunnel test of A-12 model

characteristics, although the Lockheed design's specifications were slightly better in each category. The Lockheed design was also preferable in terms of overall cost. In the vital area of vulnerability to radar detection, however, the Convair design was superior. Its smaller size and internally mounted engines gave it a smaller radar cross section than the Lockheed A-12.[15]

Comparison of Lockheed and Convair Designs

	Lockheed A-12	Convair KINGFISH
Speed	Mach 3.2	Mach 3.2
Range (total)	4,120 nm	3,400 nm
Range (at altitude)	3,800 nm	3,400 nm
Cruising Altitude		
Start	84,500 ft.	85,000 ft.
Midrange	91,000 ft.	88,000 ft.
End	97,600 ft.	94,000 ft.
Cost summary (for 12 aircraft without engines)	$96.6 million	$121.6 million

Some of the CIA representatives initially favored the Convair KINGFISH design because of its smaller radar cross section, but they were eventually convinced to support the Lockheed design by the Air Force members of the panel, who believed that Convair's cost overruns and production delays on the B-58 project might be repeated in this new project. In contrast, Lockheed had produced the U-2 under budget and on time. Another factor favoring the A-12 was security. Lockheed had experience in running a highly secure facility (the Skunk Works) in which all of the key employees were already cleared by the Agency.

Despite its vote in favor of the Lockheed proposal, the selection panel remained concerned about the A-12's vulnerability to radar detection and therefore required Lockheed to prove its concept for reducing the A-12's radar cross section by 1 January 1960. On 14 September 1959, the CIA awarded a four-month contract to Lockheed

[15] *OSA History*, chap. 20, pp 18-19 (TS Codeword).

to proceed with antiradar studies, aerodynamic structural tests, and engineering designs. This research and all later work on the A-12 took place under a new codename, Project OXCART, established at the end of August 1959 to replace its more widely known predecessor, Project GUSTO.[16] The CIA's project manager for OXCART was John Parangosky, who had long been associated with the U-2 program.

EFFORTS TO REDUCE THE A-12'S RADAR CROSS SECTION

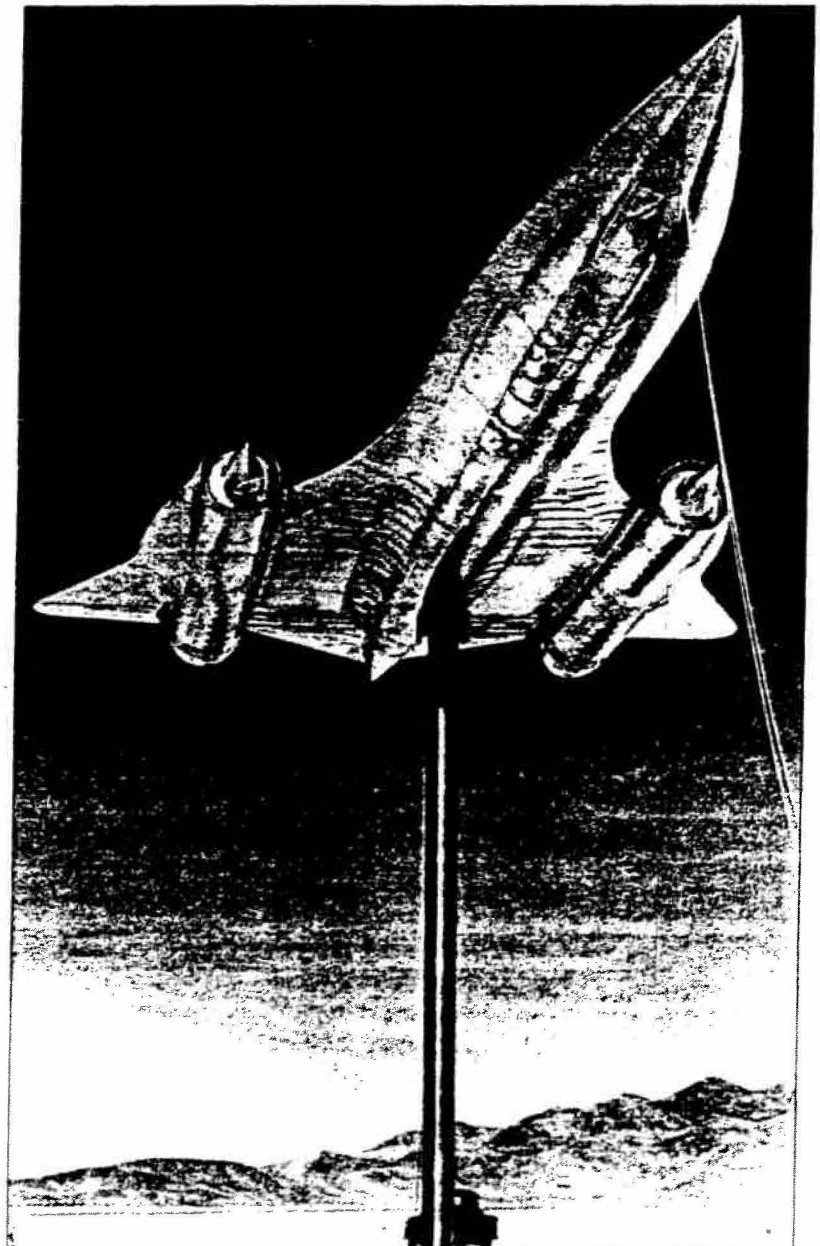
During the spring of 1959, Kelly Johnson's Skunk Works crew—which then numbered only 50—had begun building a full-scale mockup of the proposed aircraft. The mockup was to be tested for its radar cross section by Edgerton, Germeshausen & Grier (EG&G) in cooperation with the Scientific Engineering Institute at a small testing facility at Indian Springs, Nevada. Lockheed objected to this site because its pylon would not support the full-scale mockup and because the facilities were in full view of a nearby highway. On 10 September 1959, EG&G agreed to move its radar test facility to the former U-2 testing site at Area 51 of the Atomic Energy Commission's Nevada Proving Grounds.[17]

When the new radar test facility with its larger pylon was ready, Johnson put the A-12 mockup on a specially designed trailer truck that carried it from Burbank to Area 51. By 18 November 1959, the mockup was in place atop the pylon, and radar testing could begin. These tests soon proved that Lockheed's concept of shape, fuel additive, and nonmetallic parts was workable, but it would take more than 18 months of testing and adjustment before the OXCART achieved a satisfactory radar cross section.

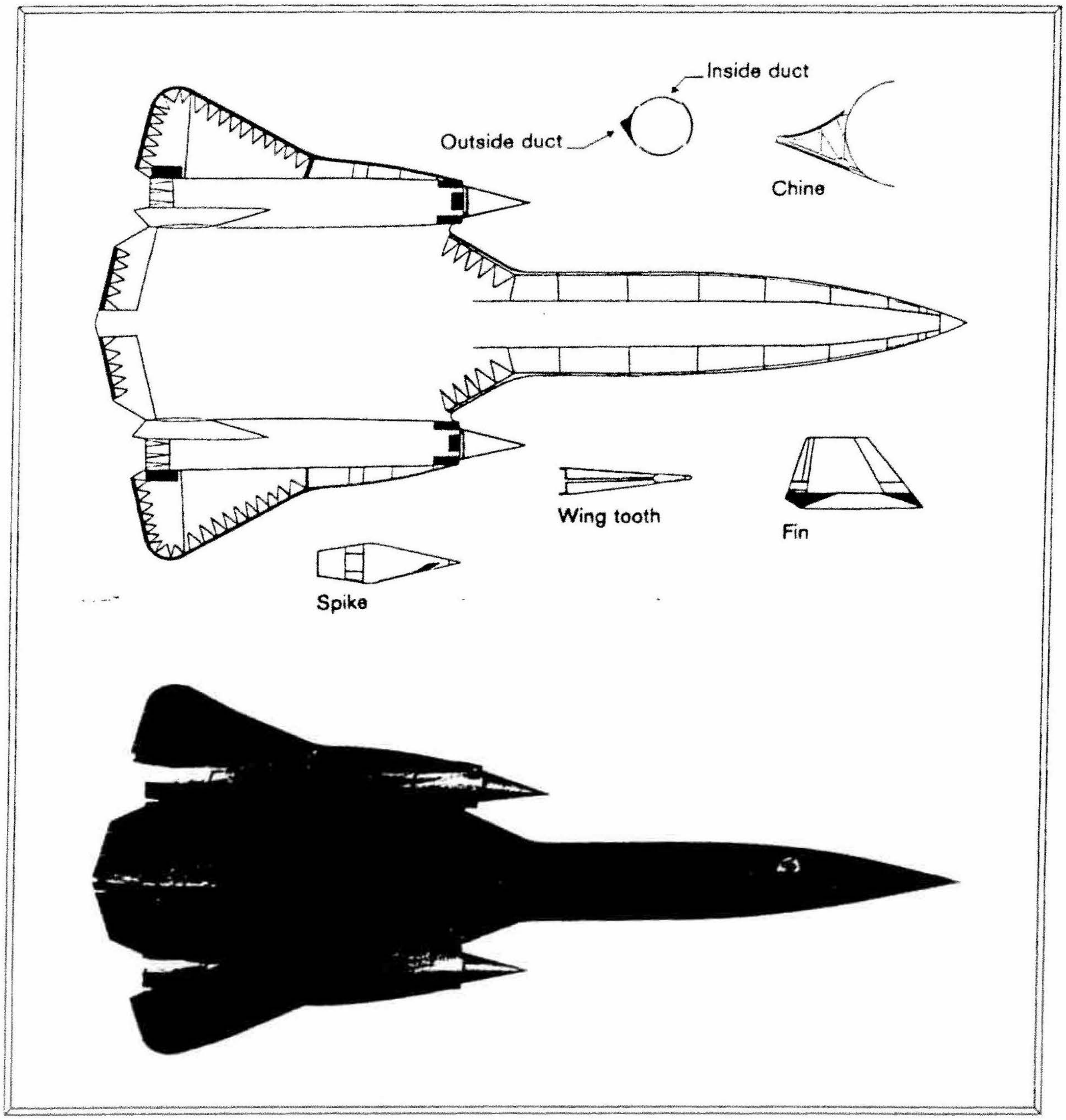
It was in the course of this radar testing that the OXCART received its characteristic cobra-like appearance. Edward Purcell and Franklin Rodgers had come up with a theory that a continuously curving airframe would be difficult to track with a radar pulse because it would present few corner reflectors or sharp angles from which pulses could bounce in the direction of the radar. To achieve the continuously curving airframe, Kelly Johnson added thin, curved extensions to the engine housings and leading edges of the wings and

[16] Parangosky interview (S); *OSA History*, chap. 20, pp. 19-21 (TS Codeword).

[17] *OSA History*, chap. 20, p. 22 (TS Codeword).



Radar testing of A-12 mockup



Antiradar features of the A-12

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eventually to the fuselage itself, creating what is known as a chine on each side. At first Johnson was concerned that these additions might impair the airworthiness of the plane, but wind tunnel testing determined that the chines actually imparted a useful aerodynamic lift to the vehicle. Because titanium was very brittle and therefore difficult to bend, Johnson achieved the necessary curvature by combining triangular-shaped pieces of titanium called fillets. These fillets were glued to the framework of the chines with a special adhesive, epoxy resin.

On later OXCART models the fillets were made from electrically resistive honeycomb plastic with a glass-fiber surface that would not melt at high speed. When struck by a radar pulse, the composite chines tended to absorb the pulse rather than reflect it. A similar approach was used for the leading edges of the wings. Again electrically resistive honeycomb material was fabricated into triangular shapes, known as wing teeth, and fitted into the titanium wings. Both the metal and composite fillets and teeth were held in place with the newly developed epoxy cements.

The greatest remaining area of concern in the A-12's radar cross section was the two vertical stabilizers. To reduce radar reflections, Kelly Johnson canted the stabilizers inward 15° and fabricated them out of resin-impregnated nonmetallic materials. Once these changes were completed, the only metal in each vertical stabilizer was a stainless steel pivot. The Air Force, which later ordered several versions of the OXCART aircraft for its own use, never adopted the laminated vertical stabilizers.[18]

THE OXCART CONTRACT

By mid-January 1960, Lockheed had demonstrated that its concept of shape, fuel additive, and nonmetallic parts would reduce the OXCART's radar cross section substantially. Richard Bissell, however, was very upset to learn that the changes had led to a reduction in the aircraft's performance, which meant it would not be able to attain the penetration altitude he had promised to President Eisenhower. Kelly Johnson then proposed to reduce the aircraft's weight by 1,000 pounds and increase the fuel load by 2,000 pounds, making it possible

[18] Johnson, "Development of Lockheed SR-71," pp. 6-7; *OSA History*, chap. 20, p. 35 (TS Codeword).

to achieve the desired target altitude of 91,000 feet. Afterward, he noted in the project log: "We have no performance margins left; so this project, instead of being 10 times as hard as anything we have done, is 12 times as hard. This matches the design number and is obviously right." [19]

These changes satisfied Bissell, who notified Johnson on 26 January that the CIA was authorizing the construction of 12 of the new aircraft. The actual contract was signed on 11 February 1960. Lockheed's original quotation for the project was $96.6 million for 12 aircraft, but technological difficulties eventually made this price impossible to meet. Recognizing that fabricating an aircraft from titanium might involve unforeseen difficulties, the CIA included a clause in the contract that allowed costs to be reevaluated. During the next five years, this clause had to be invoked on a number of occasions as the A-12's costs soared to more than double the original estimate.[20]

NEW TECHNOLOGIES NECESSITATED BY OXCART'S HIGH SPEED

According to the specifications, the OXCART aircraft was to achieve a speed of Mach 3.2 (2,064 knots or 0.57 miles per second, which would make it as fast as a rifle bullet), have a range of 4,120 nautical miles, and reach altitudes of 84,500 to 97,600 feet. The new aircraft would thus be more than five times as fast as the U-2 and would go almost 3 miles higher.

One major disadvantage of the OXCART's great speed was high temperatures. Flying through the earth's atmosphere at Mach 3.2 heated portions of the aircraft's skin to almost 900°F. An aircraft operating at these high speeds and high temperatures required fuels, lubricants, and hydraulic fluids that had not yet been invented. The OXCART's fuel requirement called for a low-vapor-pressure fuel with a low volume at operating temperatures; the fuel would also be used as a heat sink to cool various parts of the aircraft. The J58 engines required lubricants that did not break down at the very high operating temperatures of Mach 3.2 speeds. This requirement led to the

[19] Johnson, "Archangel log," 21 January 1960.

[20] *OSA History*, chap. 20, pp. 27-29, 33-34, 36 (TS Codeword).

OXCART production facilities

invention of synthetic lubricants. Lockheed also had to search long and hard for a hydraulic fluid that would not vaporize at high speed but would still be usable at low altitudes. Finding a suitable hydraulic pump was just as difficult. Kelly Johnson finally modified a pump that was being developed for North American's B-70 bomber project.[21]

Some of the greatest problems related to the high speeds and high temperatures at which the OXCART operated resulted from working with the material chosen for the airframe—titanium. After evaluating many materials, Johnson had chosen an alloy of titanium

[21] Johnson, "Development of Lockheed SR-71," pp. 11-12.

OXCART pilot suit

(B-120) characterized by great strength, relatively light weight, and good resistance to high temperatures, but high in cost. As strong as stainless steel, titanium weighed slightly more than half as much. Obtaining sufficient quantities of titanium of a quality suitable for fabricating aircraft components proved very difficult because methods for maintaining good quality control during the milling of titanium were not fully developed. Up to 80 percent of the early deliveries from Titanium Metals Corporation had to be rejected. It was not until 1961, when company officials were informed of the objectives and high priority of the OXCART program, that problems with the titanium supply ended. Even after sufficient high-quality titanium was received, Lockheed's difficulties with the metal were not over. Titanium was so hard that tools normally used in aircraft fabrication broke; new ones therefore had to be devised. Assembly line production was not possible, and the cost of the program mounted well above original estimates.[22]

The high temperatures that the OXCART would encounter also necessitated planning for the pilot's safety and comfort because the inside of the aircraft would be like a moderately hot oven. To save

[22] "OXCART Story," p. 5 (S); *OSA History*, chap. 20, p. 33 (TS Codeword).

weight, Kelly Johnson did not attempt to insulate the interior of the aircraft. The pilot would therefore have to wear a type of space suit with its own cooling, pressure control, oxygen supply, and other necessities for survival.

DESIGNING THE OXCART'S CAMERAS

Providing cameras for the A-12 posed a number of unique problems. In late 1959, OXCART managers asked Perkin-Elmer, Eastman Kodak, and Hycon to develop three different photographic systems for the new aircraft. These cameras would provide a range of photography from high-ground-resolution stereo to extremely-high-resolution spotting data.

The Perkin-Elmer (P-E) entry, known as the Type-I camera, was a high-ground-resolution general stereo camera using an f/4.0 18-inch lens and 6.6-inch film. It produced pairs of photographs covering a swath 71 miles wide with an approximately 30-percent stereo overlap. The system had a 5,000-foot film supply and was able to resolve 140 lines per millimeter and provide a ground resolution of 12 inches.

To meet severe design constraints in the areas of size, weight, thermal environment, desired photographic resolution, and coverage, Perkin Elmer's Dr. Roderick M. Scott employed concepts never before used in camera systems. These included the use of a reflecting cube rather than a prism for the scanner, a concentric film supply and takeup system to minimize weight shift, a constant-velocity film transport that provided for the contiguous placement of stereo images on one piece of film, and airbars for the film transport and takeup systems.[23]

Eastman Kodak's entry, called the Type-II camera, was a high-convergent stereo device using a 21-inch lens and 8-inch film. It produced pairs of photographs covering a swath 60 miles wide with an approximately 30-percent stereo overlap. It had an 8,400-foot film supply and was able to resolve 105 lines per millimeter and provide a ground resolution of 17 inches.

[23] *OSA History*, chap. 20, p. 26 (TS Codeword); "OXCART Story," p. 4 (S).

The Hycon entry, designed by James Baker and known as the Type-IV camera, was a spotting camera with extremely-high-ground resolution. In fact, it was an advanced version of the highly reliable B camera developed for the original U-2 program. It used a 48-inch Baker-designed f/5.6 lens to focus images onto 9.5-inch film. Like the B camera it could provide seven frames of photography covering a swath 41 miles wide with stereo overlap on 19 miles of the swath. The Hycon camera carried the largest film supply of the three cameras, 12,000 feet. It was able to resolve 100 lines per millimeter and provide a ground resolution of 8 inches. A version of this 48-inch Hycon camera, known as the H camera, later saw service in U-2R aircraft.

Each of the three camera systems had unique capabilities and advantages, so all three were purchased for the OXCART. Before they could be effectively employed in the aircraft, however, new types of camera windows were needed. The OXCART's camera windows had to be completely free from optical distortion. Achieving this goal was difficult in a window whose exterior would be subjected to temperatures of 550°F while the interior surface would be only 150°F. After three years and the expenditure of $2 million in research and development, the Corning Glass Works, which had joined this effort as a Perkin-Elmer subcontractor, solved the problem of producing a camera window that could withstand tremendous heat differentials. Its quartz glass window was fused to the metal frame by an unprecedented process involving high-frequency sound waves.[24]

Later in the program, the OXCART received yet another camera system. In 1964 the Texas Instruments Corporation developed an infrared camera for Project TACKLE U-2s that were being used to determine whether the People's Republic of China was producing weapons-grade nuclear material. This stereo device, known as the FFD-4, was adapted for use in OXCART. The camera had an effective focal length of 50 inches and a 150-foot supply of 3.5-inch film. The camera's resolution was 3°C thermally, 1 milliradian spatially, and 60 feet on the ground. It could be used for both day and night imagery collection.

[23] Baker interview (S); [24] "OXCART Story," pp. 5-6 (S)

CHOOSING PILOTS FOR OXCART

Just as in the U-2 program, the Air Force provided considerable support to Project OXCART, including training, fuel storage, and weather service. One of the most important areas of support was the provision of pilots; all of the OXCART pilots came from the Air Force. Prospective pilots had to be qualified in the most advanced fighters and be emotionally stable and well motivated. In contrast to 1955, when cover considerations had limited the U-2 pilot selection process to individuals with reserve commissions, the Air Force was able to devise personnel and cover procedures that enabled both regular and reserve officers to volunteer to become OXCART pilots. Because of the limited size of the A-12 cockpit, they had to be under six feet tall and weigh less than 175 pounds. Following extensive physical and psychological screening, 16 potential nominees were selected for intensive security and medical screening by the Agency. By the end of this screening in November 1961, only five individuals had been approved and had accepted the Agency's offer of employment on a highly classified project involving a very advanced aircraft. A second search and screening raised the number of pilots for the OXCART to eleven. The thorough screening process produced an elite group of pilots; all but one of these 11 officers eventually became generals. The new pilots transferred from military to civilian status and received compensation and insurance arrangements somewhat better than those of the U-2 pilots.[25]

SELECTION OF A TESTING SITE FOR THE OXCART

From the very beginning, it was clear that Lockheed could not test the OXCART aircraft at its Burbank facility, where the runway was too short and too exposed to the public. The ideal testing site would be far removed from metropolitan areas, away from civil and military airways, easily accessible by air, blessed with good weather, capable of accommodating large numbers of personnel, near an Air Force installation, and having a runway at least 8,000 feet long. But no such place was to be found.

After considering 10 Air Force bases programmed for closing, Richard Bissell decided to upgrade the Area 51 site in Nevada where the U-2 had been tested. Although its personnel accommodations, fuel

[25] "OXCART Story," pp. 6-7 (S); *OSA History*, chap. 20, pp. 48-50 (TS Codeword); Geary interview with Pedlow (S).

storage capacity, and runway length were insufficient for the OXCART program, the site's remote location would greatly ease the task of maintaining the program's security, and a moderate construction program could provide adequate facilities. Construction began in September 1960; a C-47 shuttle service ferried work crews from Burbank to Las Vegas and from Las Vegas to the site.

The new 8,500-foot runway was completed by 15 November 1960. Kelly Johnson had been reluctant to have a standard Air Force runway with expansion joints every 25 feet because he feared the joints would set up undesirable vibrations in the speedy aircraft. At his suggestion a 150-foot wide runway was therefore constructed of six 25-foot-wide longitudinal sections, each 150 feet long but staggered. This layout put most of the expansion joints parallel to the direction of aircraft roll and reduced the frequency of the joints.

Additional improvements included the resurfacing of 18 miles of highway leading to the base so that heavy fuel trucks could bring in the necessary fuel. The need for additional buildings on the base was met by the Navy. Three surplus Navy hangars were dismantled, moved, and reassembled on the north side of the base, and more than 100 surplus Navy housing buildings were also transported to Area 51. All essential facilities were ready in time for the forecast delivery date of the first A-12 on 1 August 1961.[26]

Unfortunately, this delivery date began to slip further and further into the future. Delays in obtaining the titanium, and later the J58 engines, caused the postponement of the final assembly of the first plane. Eventually, Kelly Johnson and Agency project officials decided to begin testing without waiting for the J58 engines by using Pratt & Whitney J75/19W engines, designed for the Convair F-106, to test the A-12 at altitudes up to 50,000 feet and at speeds up to Mach 1.6. Such a change, however, meant that the engine compartment of the first aircraft had to be reconfigured to accommodate the J75 engine. Lockheed hoped that this substitution would permit the delivery of the first A-12 by 22 December 1961 and its initial test flight by 27 February 1962.

Lockheed ran into so many technological problems with the OXCART effort that by October 1961 its costs had swollen to $136 million and were still climbing. Something obviously had to be done

[26] *OSA History*, chap. 20, pp. 39-40, 43, 51 (TS Codeword); "OXCART Story," pp. 7-9 (S)

to reduce expenditures. After much refiguring, project officials decided to decrease the number of deliverable aircraft. Amendment No. 11 to the contract reduced from 12 to 10 the number of A-12s, for a total cost of $161.2 million.[27]

The cancellation of these two A-12s was offset by an Air Force order for the development of a supersonic interceptor variant of the A-12 to serve as a replacement for the North American F-108A Rapier interceptor project, which had been canceled in late 1960. With the assistance of the Agency's west coast contracting office, the Air Force entered into an agreement with Lockheed to produce three AF-12 aircraft, based on the A-12 design but modified to carry a second crewman and three air-to-air missiles. This effort was called Project KEDLOCK. The AF-12 (later redesignated the YF-12A) was designed to intercept enemy bombers long before they reached the United States, and initial Air Force plans envisioned a force of up to 100 of these supersonic interceptors. In fact, only three of these planes were built and delivered during the 1963-64 time frame because Secretary of Defense McNamara canceled the program as a cost-cutting measure. The Air Force bore all of the costs of the YF-12A project; CIA was only involved in helping to write "black" contracts.[28]

Lockheed was not the only OXCART contractor having trouble containing costs; Pratt & Whitney was fighting an even bigger battle. In mid-1961, Pratt & Whitney overruns threatened to halt the entire OXCART project. At the suggestion of Cdr. William Holcomb in the office of the Chief of Naval Materiel, Richard Bissell asked the Navy to assist in funding the J58's development. After hearing Bissell and Holcomb's suggestion that the J58 might be used in future Navy aircraft, VAdm. William A. Schoech, Chief of the Navy Materiel Command that had originally financed the J58 engine, authorized the transfer of $38 million in end-of-year funds to the project, thus keeping the OXCART's head above water.[29] As it turned out, the J58 was never used in a Navy aircraft.

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[27] *OSA History*, chap. 20, pp. 46-47, 51-55 (TS Codeword); "OXCART Story," p. 10 (S).

[28] *OSA History*, chap. 20, pp. 46-47 (TS Codeword).

[29] Parangosky interview (S); *OSA History*, chap. 20, p. 55 (TS Codeword). During this period, Kelly Johnson was very disappointed with Pratt & Whitney's work on the J58, particularly when they shocked him in September 1961 with the news that the engine would be overweight, underpowered, and late. Johnson, "Archangel log," 11 September 1961.

DELIVERY OF THE FIRST OXCART

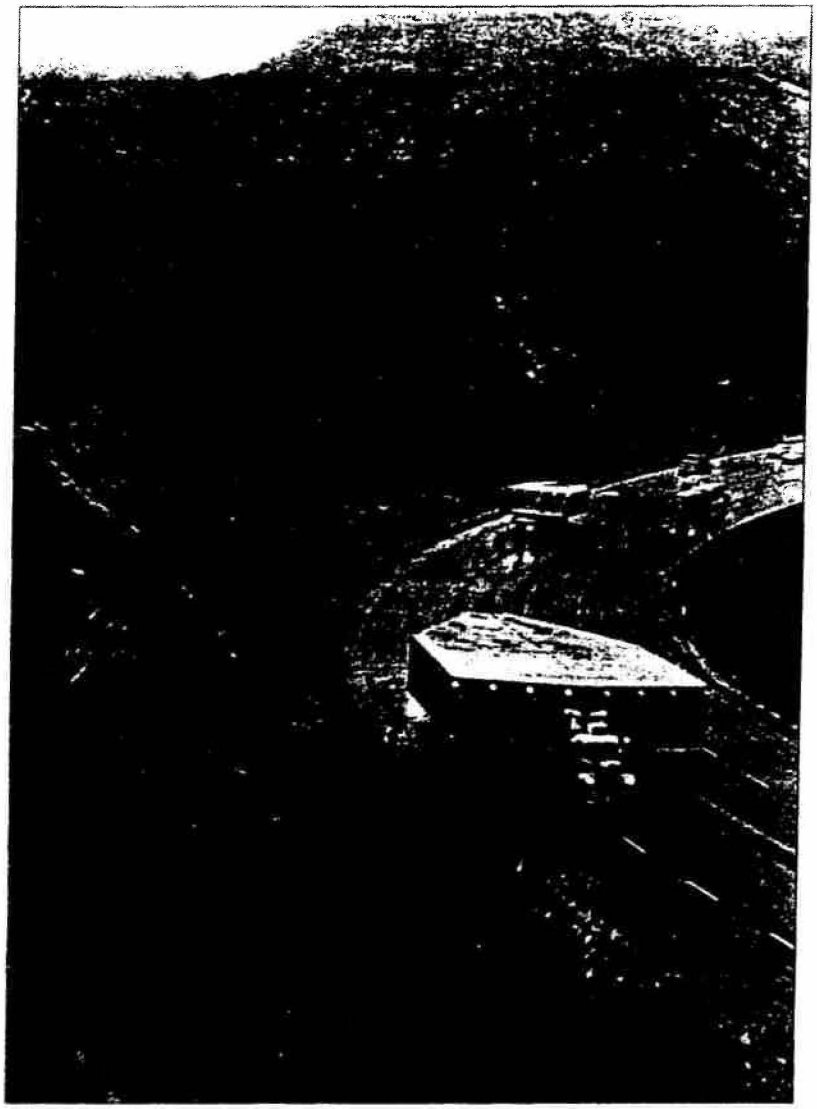
The first A-12, known as article 121, was assembled and tested at Burbank during January and February 1962. Since it could not be flown to the Nevada site, the aircraft had to be partially disassembled and put on a specially designed trailer that cost nearly $100,000. The entire fuselage, without the wings, was crated and covered, creating a load 35 feet wide and 105 feet long. To transport this huge load safely over the hundreds of miles to the site, obstructing road signs were removed, trees were trimmed, and some roadbanks had to be leveled. The plane left Burbank on 26 February 1962 and arrived at Area 51 two days later.

After the fuselage arrived in Nevada, its wings were attached and the J75 engines were installed, but the aircraft was still not ready to be tested. This new delay was caused by leaking fuel tanks, a problem that would never be solved completely. Because the A-12's high speeds heat the titanium airframe to more than 500°F, Lockheed designers had to make allowances for expansion. When the metal was cold, the expansion joints were at their widest. In the fuel tanks, these gaps were filled by pliable sealants, but the fuel for the A-12's engines acted as a strong reducing agent that softened the sealants, causing leaks. Thus, when fuel was first poured into the aircraft, 68 leaks developed. Lockheed technicians then stripped and replaced all the sealant, a tedious and time consuming procedure because the sealant required four curing cycles, each at a different temperature over a period of 30 to 54 hours. The engineers were never able to discover a sealant compound that was completely impervious to the jet fuel while remaining elastic enough to expand and contract sufficiently. The A-12's tanks continued to leak, so when it was fueled, it only received enough fuel to get airborne. The plane would then rendezvous with a tanker, top off its tanks, and immediately climb to operating altitude, causing the metal to expand and the leaks to stop.[40]

CHANGES IN THE PROJECT MANAGEMENT

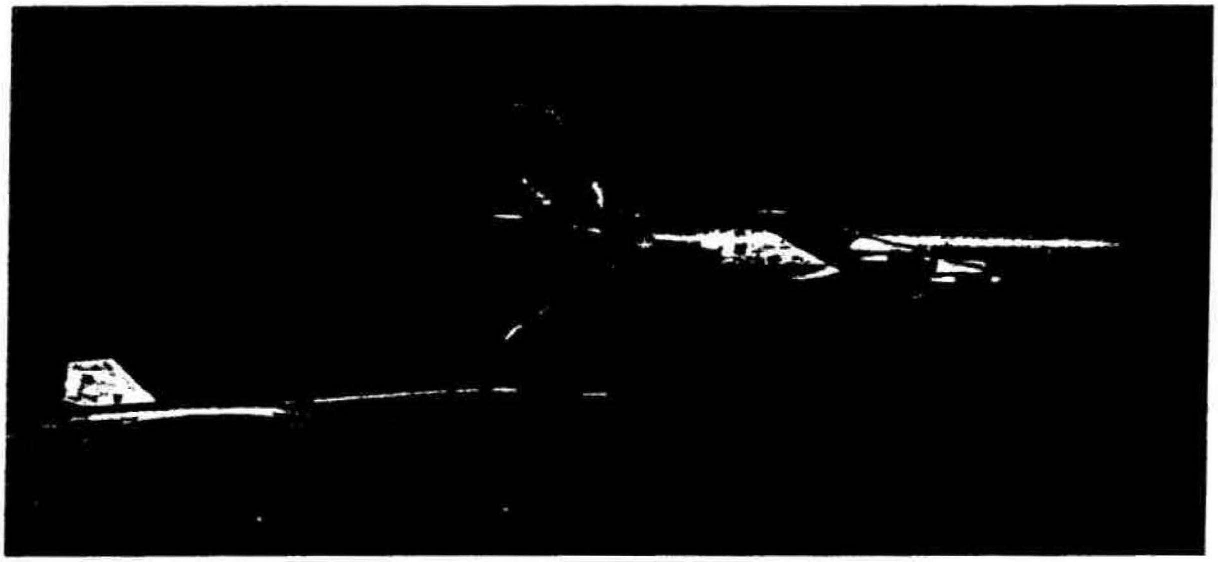
Richard Bissell, whose concern for the viability of the U-2 in 1956 had led to the establishment of Project OXCART and who had directed its growth all along, was no longer in charge when the first

[40] *OSA History*, chap. 20, p. 62 (TS Codeword); "OXCART Story," p. 11 (S).



Delivery of OXCART aircraft to Area 51

OXCART aircraft took to the air. He resigned from the Agency in February 1962, and his departure brought a major reorganization of the reconnaissance program. The Development Projects Division of the Directorate of Plans, with its two aircraft (OXCART and U-2) and its satellite project, were transferred to the new Directorate of Research headed by Herbert (Pete) Scoville. The following year Scoville resigned and this Directorate was reorganized and its name changed to the Directorate of Science and Technology, with Albert (Bud) Wheelon, Jr. as its first head. The overhead reconnaissance



In-flight refueling of the OXCART

projects belonged to the Office of Special Activities, headed by Col. Jack C. Ledford, who now had the title of Assistant Director for Special Activities. These project management changes in the CIA had no immediate impact on the OXCART project because the aircraft was still in the development stage, handled mainly by the contractors. Moreover, a good deal of continuity was provided by officers who had served for a number of years with the U-2 program and were now involved with OXCART: James Cunningham, the Deputy Assistant Director for Special Activities; Col. Leo Geary, the Air Force's project officer for the two aircraft; and John Parangosky, who oversaw the day-to-day affairs of the OXCART project.

OXCART'S FIRST FLIGHTS

With new sealant in its fuel tanks, the prototype OXCART was ready to take to the air. On 25 April 1962, test pilot Louis Schalk took "article 121" for an unofficial, unannounced flight, which was an old Lockheed tradition. He flew the craft less than two miles at an altitude of about 20 feet and encountered considerable problems because of the improper hookup of several controls. These were promptly repaired and on the next day, 26 April, Schalk made the official 40-minute maiden flight. After a beautiful takeoff, the aircraft began shedding the triangular fillets that covered the framework of the chines along the edge of the aircraft body. The lost fillets, which had been secured to the airframe with epoxy resin, had to be recovered and reaffixed to the aircraft, a process that took the next four days.

Once the fillets were in place, the OXCART's official first flight took place on 30 April 1962, witnessed by a number of Agency personnel including DDR Scoville. Richard Bissell was also present, and Kelly Johnson noted in the project log, "I was very happy to have Dick see this flight, with all that he has contributed to the program."[31] This official first flight was also the first flight with the wheels up. Piloted again by Schalk, the OXCART took off at 170 knots and climbed to 30,000 feet. During the 59-minute flight, the A-12 achieved a top speed of 340 knots. Kelly Johnson declared it to be the smoothest first test flight of any aircraft he had designed or tested. On 2 May 1962, during the second test flight, the OXCART broke the sound barrier, achieving a speed of Mach 1.1.[32]

John Parangosky

Four more aircraft, including a two-seat trainer, arrived at the testing site before the end of the year. During the second delivery on 26 June 1962, the extra-wide vehicle carrying the aircraft accidentally struck a Greyhound bus traveling in the opposite direction. Project managers quickly authorized payment of $4,890 for the damage done to the bus in order to avoid having to explain in court why the OXCART delivery vehicle was so wide.

One of the biggest problems connected with flight testing the A-12 was keeping its existence secret. Realizing that the nation's air traffic controllers would be among the first unwitting people to learn about the plane, the Deputy Assistant Director for Special Activities, James Cunningham, had called on Federal Aviation Administrator Najeeb E. Halaby in early 1962 to brief him about the craft's existence and ask his assistance in keeping it secret. Halaby cooperated fully with the Agency and personally briefed all FAA regional chiefs on how to handle reports of unusually fast, high-flying aircraft. Air controllers were warned not to mention the craft on the radio but to submit written reports of sightings or radar trackings. The Air Force gave similar briefings to NORAD, the North American Air Defense Command.[33]

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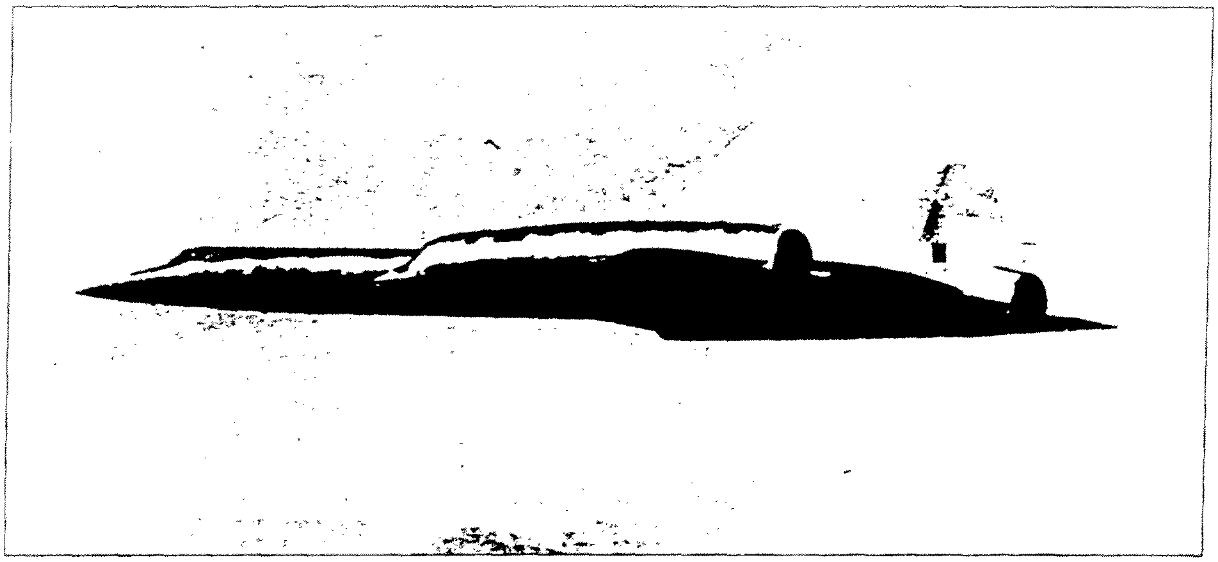
[31] Johnson, "Archangel log," 30 April 1962.

[32] *OSA History*, chap. 20, p. 63 (TS Codeword); [redacted] "OXCART Story," pp. 11-12 (S).

[33] [redacted] OXCART Story," pp. 10-11 (S); *OSA History*, chap. 20, p. 60 (TS Codeword).



First flight of the A-12, 30 April 1962

Initial testing could not explore the A-12's maximum potential, since the J58 engine was still not ready. Developing this power plant to OXCART specifications was proving much more difficult than had been expected because the J58 had to reach performance levels never before achieved by a jet engine, while operating under extremely difficult environmental conditions. To simulate the stress that the J58 would undergo during maximum power output (Mach 3.2 at 97,000 feet), the power plant was tested in the exhaust stream of a J75 engine. In the course of this extremely severe testing, the J58's problems were gradually overcome. By January 1963, Pratt & Whitney had delivered 10 J58 engines to the Nevada testing site. The first flight of an A-12 with two J58 engines took place on 15 January 1963.[34]

SPEED-RELATED PROBLEMS

As J58-equipped A-12s reached higher and higher speeds, more difficulties arose. Major problems developed at speeds between Mach 2.4 and 2.8 because the aircraft's shock wave interfered with the flow of air into the engine, greatly reducing its performance. Solving this problem required long and often highly frustrating experimentation

[34] William H. Brown, "J58/SR-71 Propulsion Integration," *Studies in Intelligence* 26 (Summer 1982) pp. 17-18 (U); *OSA History*, chap. 20, pp. 58, 67 (TS Codeword).

that ultimately required a complete redesign of the air-inlet system that controlled the amount of air admitted to the engine. In the new, adjustable inlet the cone-shaped projection at the front—known as a spike—was designed to move in or out as much as three feet in order to capture and contain the shock wave produced by the aircraft at high speeds, thus preventing the shock wave from blowing out the fire inside the engine.[15]

Another J58 engine problem in early 1963 was foreign object damage. Small objects such as pens, pencils, screws, bolts, nuts, and metal shavings that fell into the engine nacelles during assembly at Burbank were sucked into the power plant during initial engine testing at Area 51 and damaged impeller and compressor vanes. To control the problem Lockheed instituted a program that included X-rays, shaking of the nacelles, installing screens over various air inlets to the engine, and even having workers wear coveralls without breast pockets. Another source of foreign object damage was trash on the runways. The giant J58 engines acted like immense vacuum cleaners, sucking in anything lying loose on the paving as they propelled the A-12 down the runway for takeoff. To prevent engine damage, Area 51 personnel had to sweep and vacuum the runway before aircraft takeoff.[16]

NEW VERSIONS OF THE OXCART

In 1962 the Agency and the Air Force ordered two more versions of the OXCART (in addition to the A-12 and the YF-12A). One was a modification of the A-12 to carry and launch ramjet-powered, 43-feet-long drones capable of reaching Mach 3.3 The two-seater mothership received the designation M-12; the drone was called the D-21. This project was known as TAGBOARD. The original development of the drones and mothership was sponsored by the CIA, but in June 1963 the project was turned over to the Air Force, which had overall responsibility for unmanned reconnaissance aircraft. Development of the M-12/D-21 combination continued until 1966, when an unsuccessful D-21 launch caused the loss of its mothership and the death of one of the crew members. Afterward the Air Force turned to B-52 bombers to carry the drones.[17]

[15] *OSA History*, chap. 20, p. 67 (TS Codeword).

[16] Johnson, "Development of Lockheed SR-71," p. 12.

[17] *OSA History*, chap. 20, p. 71; Jay Miller, *Lockheed SR-71 (A12/YF12/D-21)*, Aerofax Minigraph 1 (Arlington, Texas: Aerofax, Inc., 1985), p. 3.

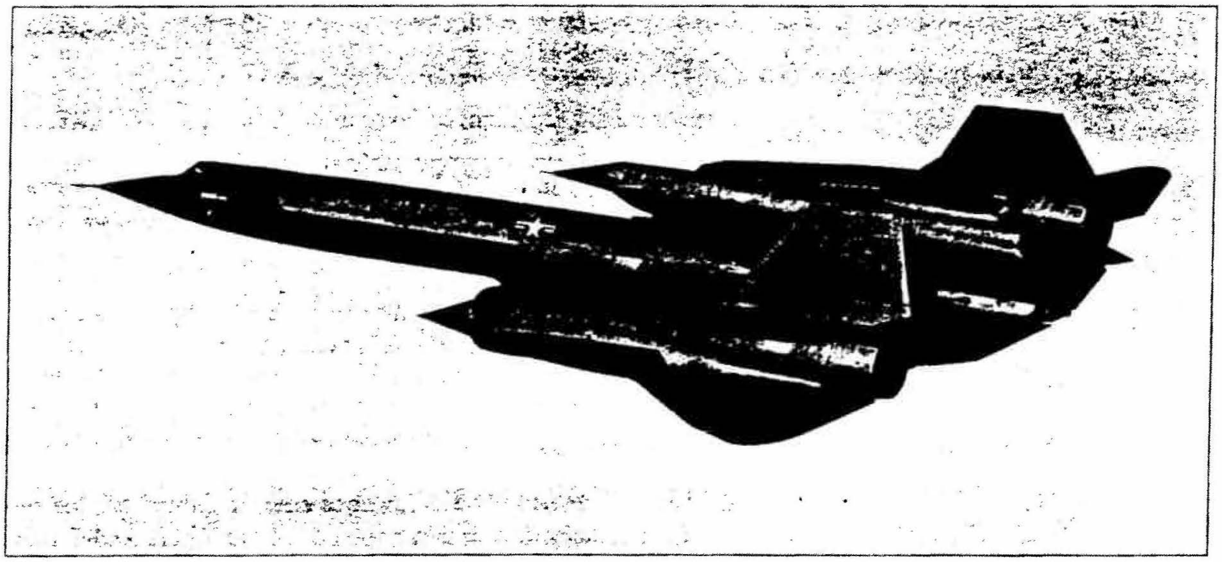
The second new version of the OXCART was another reconnaissance aircraft. In December 1962 the Air Force ordered six "reconnaissance/strike" aircraft, which were designed to conduct high-speed, high-altitude reconnaissance of enemy territory after a nuclear strike. This new aircraft differed from other A-12 versions in that it was longer, had a full-blown two-seat cockpit, and carried a large variety of photographic and electronic sensors. The additional weight of all this equipment gave the Air Force craft a slower maximum speed and a lower operating ceiling than the Agency's A-12. In August 1963, the Air Force added 25 more aircraft to this contract, for a total of 31.[38]

THE QUESTION OF SURFACING A VERSION OF THE OXCART

As the funds being spent on Air Force versions of the OXCART increased dramatically, the Defense Department became concerned that it could not offer any public explanation for these expenditures. At the same time, Agency and Defense Department officials recognized the growing danger that a crash or sightings of test flights could compromise the program. This led the Defense Department in late 1962 and early 1963 to consider surfacing the Air Force's interceptor version of the A-12 to provide a cover for OXCART sightings or crashes and an explanation for the rise in Air Force spending. Some journalists had also become aware of the aircraft's existence, raising concern that the secret would eventually come out in the press. Agency officials remained reluctant to reveal the existence of any version of the A-12, and the issue soon came to the attention of the PFIAB. James Killian and Edwin Land strongly opposed disclosing OXCART's existence, and in January 1963 they presented their views to President Kennedy at a meeting attended by DCI McCone and Defense Secretary Robert McNamara. Killian, Land, and McCone succeeded in persuading the President and Secretary of Defense to keep the OXCART's existence a secret for the time being.

Later that year supporters of the idea of surfacing the OXCART found a more powerful argument for their proposal—the need to disseminate the supersonic technology that had been developed for the

[38] *OSA History*, chap. 20, pp. 71-72 (TS Codeword).



M-12 carrying D-21 Drone

OXCART. This technology would be invaluable for Air Force projects such as the B-70 bomber and for the civilian supersonic transport (SST) then being discussed in Congress. In the fall of 1963, several Presidential advisers expressed their concern to DCI McCone that Lockheed had received a $700 million headstart in the development of supersonic technology, giving the firm a tremendous advantage over other aerospace companies working on a supersonic transport. McCone passed these concerns on to President Kennedy on 12 November 1963, just 10 days before the fateful trip to Dallas. The President instructed CIA and the Defense Department to develop a plan for surfacing the OXCART but to await further discussions with him before taking any action.[39]

President Lyndon B. Johnson received a detailed briefing on the OXCART program from McCone, McNamara, Bundy, and Rusk on 29 November, after just one week in office. McNamara strongly advocated surfacing a version of the OXCART. McCone was more cautious, calling for the preparation of a statement that could be used when surfacing became necessary but arguing that such a step was not

[39] John A. McCone, "Memorandum of Meeting in Cabinet Room for the Purpose of Discussing the Surfacing of the OX," 21 January 1963, DCI records (TS Codeword); idem, Memorandum for the Record, Discussion with the President—October 21st—6:00 p.m., 22 October 1963, DCI records (S); *OSA History*, chap. 20, pp. 73-74 (TS Codeword).

yet needed. Agreeing with McCone's position, President Johnson said the issue should be reviewed again in February.[40]

One additional argument in favor of surfacing the OXCART was the realization that the aircraft could not be used to fly undetected over the Soviet Union. By 1962 the United States had become aware of the effectiveness of a new Soviet radar system, codenamed TALL KING. The introduction of this computer-controlled radar undercut one of the basic premises of the OXCART program, the assumption that radar operators would not be able to track high-flying supersonic targets visually because of their small, nonpersistent radar returns. By coupling a computer to a radar, the Soviets could now weight the individual radar returns and identify those produced by high-flying, very fast objects.[41]

By February 1964 DCI McCone had become convinced that surfacing was necessary. Soviet development of the TALL KING radar system had eliminated his hope that OXCART would eventually be able to carry out its original intended purpose—overflights of the USSR. The final decision on the issue of surfacing the OXCART came at a National Security Council meeting on 29 February 1964, at which all of the participants supported the decision to surface. That same day President Johnson held a news conference at which he announced the successful development of an "advanced experimental jet aircraft, the A-11, which has been tested in sustained flight at more than 2,000 miles per hour and at altitudes in excess of 70,000 feet." [42]

President Johnson had spoken of the A-11 rather than the Agency's A-12, and the aircraft that was actually revealed to the public was the Air Force's YF-12A interceptor, a project that had already been canceled.[43] Following the President's announcement, two of

[40] John A. McCone, "Memorandum for the Record, Meeting with the President, Secretary McNamara, Mr. Bundy and DCI," 29 November 1963, DCI records (TS); *OSA History*, chap. 20, p. 73 (TS Codeword).

[41] *OSA History*, chap. 20, pp. 147-149 (TS Codeword).

[42] John A. McCone, Memorandum for the Record, "Discussion at the NSC Meeting, Attended by the President, all members and the four members of the President's personal staff, 29 February 1964," 2 March 1964, DCI records (S); Minnich, "OXCART Story," p. 14—erroneously identifies the date as 24 February—(S).

[43] President Johnson's use of the designator *A-11* at the press conference has sometimes been called an error, but Kelly Johnson wrote the President's press release and chose this designator for security reasons because it referred to the earlier version of the aircraft that lacked the radar-defeating modifications of the A-12. Johnson, "Archangel log," 25 February 1964.

these aircraft were hastily flown to Edwards Air Force Base. From this point on, the Air Force versions of the OXCART were based at Edwards and provided a diversion so that the faster and higher flying A-12s at the Nevada site could continue testing out of the public eye.

The President's announcement did not mention the CIA's involvement in the project, which remained classified, but keeping the Agency's extensive role in the OXCART a secret was not an easy task. The first step had been to separate the Air Force's versions of the A-12 from the Agency's by moving the Air Force aircraft to California. Next, those firms that were to be given the new technology had to be briefed on the program and agree to abide by the same secrecy agreements then in force with Lockheed. Moreover, everyone witting of OXCART (including those no longer associated with the program, such as Allen Dulles, Richard Bissell, and General Cabell) had been briefed about the impending Presidential announcement, so that they would not think that the need for secrecy about OXCART had ended.[44]

The process of surfacing versions of the OXCART continued on 25 July 1964, when President Johnson revealed the existence of a new Air Force reconnaissance aircraft, which he called the SR-71. Actually, the President was supposed to say RS-71 (for "reconnaissance-strike"). Deciding that renaming the aircraft was easier than correcting President Johnson, the Air Force invented a new category—"strategic reconnaissance"—to explain the SR-71's designation.

ADDITIONAL PROBLEMS DURING FINAL TESTING

The first A-12 crash occurred on 24 May 1963, when a detachment pilot, realizing the airspeed indication was confusing and erroneous, decided to eject. The pilot was unhurt, but the plane was destroyed when it crashed near Wendover, Utah. A cover story for the press described the plane as an F-105. All A-12s were grounded for a week while the accident was investigated. The malfunction was found to be caused by ice that had plugged up a pitot-static tube used to determine airspeed.[45]

[44] *OSA History*, chap. 20, p. 76 (TS Codeword).

[45] Ibid., pp. 69-70 (TS Codeword).

Two more A-12s were lost in later testing. On 9 July 1964, article 133 crashed while landing when a pitch-control servo device froze, rolling the plane into a wing-down position. Ejecting from an altitude of 120 feet, the pilot was blown sideways out of the craft. Although he was not very high off the ground, his parachute did open and he landed during the parachute's first swing. Fortunately he was unhurt, and no news of the accident filtered out of the base. Eighteen months later, on 28 December 1965, article 126 crashed immediately after takeoff because of an improperly wired stability augmentation system. As in the previous crash, the pilot ejected safely, and there was no publicity connected with the crash. An investigation ordered by DCI McCone determined that the wiring error had resulted from negligence, not sabotage.[46]

The A-12 made its first long-range, high-speed flight on 27 January 1965. The flight lasted 100 minutes, 75 minutes of which were flown at speeds greater than Mach 3.1, and the aircraft covered 2,580 miles at altitudes between 75,600 and 80,000 feet. By this time, the OXCART was performing well. The engine inlet, camera, hydraulic, navigation, and flight-control systems all demonstrated acceptable reliability.

Nevertheless, as the OXCART began flying longer, faster, and higher, new problems arose. The most serious of these problems involved the aircraft's wiring. Continuing malfunctions of the inlet controls, communications equipment, ECM systems, and cockpit instruments were often attributable to wiring failures. Wiring connectors and components had to withstand temperatures above 800°F, structural flexing, vibration, and shock. Such demands were more than the materials could stand. Not all of the OXCART's problems could be traced to materiel failures, however, and Agency officials believed that careless maintenance by Lockheed employees also contributed to malfunctions.[47]

Concerned that Lockheed would not be able to meet the OXCART's schedule for operational readiness, the Office of Special Activities' Director of Technology, John Parangosky, met with Kelly Johnson on 3 August 1965 to discuss the project's problems. Johnson not only assigned more top-level supervisors to the project but also

[46] Ibid., pp. 80-81 (TS Codeword); "OXCART Story," pp. 17-18 (S).

[47] *OSA History*, chap. 20, p. 94 (TS Codeword)

decided to go to Nevada and take charge of the OXCART's development himself. His presence made a big difference, as can be seen in his notes in the project log:

> *I uncovered many items of a managerial, materiel and design nature.... I had meetings with vendors to improve their operation.... Changed supervision and had daily talks with them, going over in detail all problems on the aircraft.... Increased the supervision in the electrical group by 500%.... We tightened up the inspection procedures a great deal and made inspection stick.*
>
> *It appears that the problems are one-third due to bum engineering.... The addition of so many systems to the A-12 has greatly complicated the problems, but we did solve the overall problem.*[48]

These improvements in on-site management got the project back on schedule.

By 20 November 1965, the final validation flights for OXCART deployment were finished. During these tests, the OXCART achieved a maximum speed of Mach 3.29, an altitude of 90,000 feet, and sustained flight time above Mach 3.2 of 74 minutes. The maximum endurance test lasted six hours and 20 minutes. On 22 November, Kelly Johnson wrote to Brig. Gen. Jack C. Ledford, head of the Office of Special Activities, stating, "The time has come when the bird should leave its nest."[49]

Three years and seven months after its first flight in April 1962, the OXCART was ready for operational use. It was now time to find work for the most advanced aircraft ever conceived and built.

DISCUSSIONS ON THE OXCART'S FUTURE EMPLOYMENT

Although the OXCART had been designed to replace the U-2 as a strategic reconnaissance aircraft to fly over the Soviet Union, this use had become doubtful long before the OXCART was ready for operational use. The U-2 Affair of 1960 made Presidents very reluctant to consider overflights of the Soviet Union. Indeed, Presidents Eisenhower and Kennedy had both stated publicly that the United States would not conduct such overflights. In July 1962, Secretary of

[48] Johnson, "Archangel log," 5 August–30 April 1965.

[49] "OXCART Story," p. 23 (S).

A-12s at Area 51

Defense McNamara told DCI McCone that he doubted that the OXCART would ever be used and suggested that improvements in satellite reconnaissance would very likely eliminate the need for the expensive OXCART program. Strongly disagreeing, McCone told McNamara that he had every intention of using OXCART aircraft to fly over the Soviet Union.

McCone raised this issue with President Kennedy in April 1963, at a time when the nation's photosatellites were experiencing a great number of failures and the intelligence community was clamoring for better photography to confirm or disprove allegations of the existence of an antiballistic missile system at Leningrad. Unconvinced by McCone's arguments for OXCART overflights, President Kennedy expressed the hope that some means might be devised for improving satellite imagery instead.[50]

[50] John A. McCone, Memorandum for the Record, "Summary of meeting with Secretary McNamara and Secretary Gilpatric, General Carter and Mr. McCone on 5 July 1962," 6 July 1962, DCI records (S); McCone, Memorandum for the File, "Meeting with the President—5:30—15 Apr 1963 in Palm Beach, Florida," DCI records (S).

Although overflights of the Soviet Union appeared to be out of the question, the OXCART's eventual employment elsewhere in the world remained a strong possibility, particularly after the Cuban Missile Crisis of October 1962 demonstrated the continuing need for manned strategic reconnaissance aircraft. Since satellites had not been able to supply the kinds of coverage needed, U-2s had carried out numerous overflights of Cuba. Nevertheless, the U-2 remained vulnerable to surface-to-air missiles (as had once again been demonstrated by the downing of a SAC U-2 during the Missile Crisis), and project headquarters had even briefly considered sending the A-12 over Cuba in October 1962, even though the aircraft still lacked the required J58 engines and would have had to use much less powerful ones.[51] After the Missile Crisis ended, Air Force U-2s continued to photograph Cuba under a tacit superpower understanding that such monitoring of the withdrawal of the missiles would proceed without interference. But the possibility of future Soviet or Cuban action against the U-2s remained, raising the dismaying prospect that the United States would not be able to tell if the Soviet Union was reintroducing ballistic missiles into Cuba.

Such fears became acute in the summer of 1964 after Soviet Premier Nikita Khrushchev told foreign visitors such as columnist Drew Pearson, former Senator William Benton, and Danish Prime Minister Jens Otto Krag that, once the US elections had been held in November, U-2s flying over Cuba would be shot down. Project headquarters therefore began preparing contingency plans (Project SKYLARK) for the possible employment of OXCART over Cuba, even though the new aircraft was not yet ready for operations. On 5 August 1964, the Acting DCI, Gen. Marshall S. Carter, ordered the project staff to achieve emergency operational readiness of the OXCART by 5 November 1964, in case Premier Khrushchev actually carried out his threat to shoot down U-2s.[52]

To meet this deadline, the Office of Special Activities organized a detachment of five pilots and ground crews to conduct flights to validate camera performance and qualify pilots for Mach 2.8 operations. Simulating Cuban missions during training flights, the detachment

[51] On 23 October 1962 Johnson noted in his "Archangel log": that the performance of an A-12 with J75 engines (as suggested by project headquarters for possible use over Cuba) would be "hardly spectacular."

[52] Johnson, "Archangel log," 17 August 1964; "OXCART Story," p. 19 (S); *OSA History*, chap. 20, p. 81 (TS Codeword).

Approved for Release: 2013/06/25

demonstrated its ability to conduct overflights of Cuba by the 5 November deadline, which passed without any hostile action by the Soviets or Cubans. The detachment then worked to develop the capability for sustained operations with its five aircraft. All these preparations were valuable training for the OXCART program, even though the SKYLARK contingency plan was never put into effect. Since U-2s continued to satisfy collection requirements for Cuba, the A-12s were reserved for more critical situations.

When the Agency declared that OXCART had achieved emergency operational status on 5 November 1964, the aircraft was still not prepared for electronic warfare, as only one of the several planned electronic countermeasure devices had been installed. Nevertheless, a senior government panel decided that the OXCART could conduct initial overflights of Cuba without a full complement of warning and jamming devices, should the need for such missions arise.

One reason for the delay in completing OXCART's electronic warfare preparations was the Air Force's concern that OXCART use of existing ECM devices could, in the event of the loss of an OXCART over hostile territory, compromise the ECM equipment used by Air Force bombers and fighters. Even if OXCART's ECM devices were merely similar to military ECM systems, the Air Force still worried that their use would give the Soviets an opportunity to work out countermeasures.

Such concerns led the Agency to an entirely different approach to antiradar efforts in Project KEMPSTER. This project attempted to develop electron guns that could be mounted on the OXCART to generate an ion cloud in front of the plane that would reduce its radar cross section. Although this project proved unsuccessful, the CIA also developed a number of more conventional ECM devices for use in the OXCART.[53]

As the OXCART's performance and equipment continued to improve, there was renewed consideration of deploying the aircraft overseas, particularly in Asia, where US military activity was increasing. On 18 March 1965, DCI McCone, Secretary of Defense McNamara, and Deputy Secretary of Defense Vance discussed the

[53] *OSA History*, chap. 20, pp. 149-151 (TS Codeword); Notes on the OXCART project by John Parangosky, OSA records (TS Codeword).

growing hazards confronting aerial reconnaissance of the People's Republic of China. In three years the Agency had lost four U-2s over China, and the Air Force had lost numerous reconnaissance drones. The three men agreed to go ahead with all the preparatory steps needed for the OXCART to operate over China so that it would be ready in case the President decided to authorize such missions.

Project BLACK SHIELD, the plan for Far East operations, called for OXCART aircraft to be based at Kadena airbase on Okinawa. In the first phase, three planes would be flown to Okinawa for 60-day periods, twice a year, an operation which would involve about 225 personnel. Later there would be a permanent detachment at Kadena. In preparation for the possibility of such operations, the Defense Department spent $3.7 million to provide support facilities and real-time secure communications on the island by early autumn 1965.[54]

In the summer of 1965, after the United States had begun introducing large numbers of troops into South Vietnam, Southeast Asia became another possible target for the OXCART. Because the continued use of U-2s for reconnaissance missions over North Vietnam was threatened by the deployment of Soviet-made surface-to-air missiles, McNamara asked the CIA on 3 June 1965 whether it would be possible to substitute OXCART aircraft for U-2s. The new DCI, Adm. William F. Raborn, replied that the OXCART could operate over Vietnam as soon as it had passed its final operational readiness tests.[55]

Formal consideration of proposed OXCART missions involved the same approval process that was used for U-2 overflights. In late November 1965, after the OXCART had passed its final validation tests, the 303 Committee met to consider a proposal to deploy the OXCART to Okinawa to overfly Southeast Asia and China. Although the committee did not approve deployment, it ordered the development and maintenance of a quick-reaction capability, ready to deploy to Okinawa within 21 days after notification.

There the matter remained for more than a year. During the first half of 1966, DCI Raborn raised the issue of deploying the OXCART to Okinawa at five separate 303 Committee meetings but failed to win

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[54] *OSA History*, chap. 20, pp. 90-91 (TS Codeword).

[55] "OXCART Story," p. 21 (S).

sufficient support. The JCS and the PFIAB supported the CIA's advocacy of OXCART deployment. Top State and Defense Department officials, however, thought that the political risks of basing the aircraft in Okinawa—which would almost certainly disclose it to the Japanese—outweighed any gains from the intelligence the OXCART might gather. On 12 August 1966, the divergent views were presented to President Johnson, who upheld the 303 Committee's majority opinion against deployment for the time being.[56]

The CIA then proposed an OXCART overflight of Cuba in order to test the aircraft's ECM systems in a hostile environment. On 15 September the 303 Committee considered and rejected this idea on the grounds that sending OXCART over Cuba "would disturb the existing calm prevailing in that area of our foreign affairs."[57]

With operational missions still ruled out, proficiency training remained the main order of business. This led to improvements in mission plans and flight tactics that enabled the detachment to reduce the time required to deploy to Okinawa from 21 days to 15. Records continued to fall to the OXCART. On 21 December 1966, a Lockheed test pilot flew an A-12 for 16,408 kilometers over the continental United States in slightly more than six hours, for an average speed of 2,670 kilometers per hour (which included in-flight refueling at speeds as low as 970 kilometers per hour). This flight set a record for speed and distance unapproachable by any other aircraft.[58]

Two weeks later, on 5 January 1967, an A-12 crashed after a fuel gauge malfunctioned and the aircraft ran out of fuel short of the runway. Pilot Walter Ray ejected but was killed when he could not become separated from the ejection seat. To preserve the secrecy of the OXCART program, the Air Force informed the press that an SR-71 was missing and presumed down in Nevada. This loss, like the three preceding crashes, did not result from difficulties caused by high-speed, high-temperature flight but from traditional problems inherent in any new aircraft.

Proposals for OXCART operations continued to surface, and in May 1967 the CIA forwarded a detailed request to the 303 Committee to use the OXCART to collect strategic intelligence about a new

[56] [redacted] "OXCART Story," p. 23 (S); *OSA History*, chap. 20, pp. 110-111 (TS Codeword).

[57] *OSA History*, chap. 20, p. 112 (TS Codeword).

[58] [redacted] "OXCART Story," p. 24 (S).

Soviet missile system. As early as 1962, the intelligence community began to be concerned about the actual purpose of new missile installations that first appeared near Tallinn, Estonia, and soon spread along the northwestern quadrant of the Soviet Union. Attempts to photograph the sites using reconnaissance satellites had been frustrated by the prevailing cloud cover in the region. Because of the lack of accurate information about the missile sites, there was a wide divergence of views within the intelligence community about their purpose. These views ranged from the CIA's belief that the installations contained long-range, surface-to-air missiles designed to counter strategic bombers, to the Air Force's contention that Tallinn sites represented a deployed antiballistic missile system.

Photointerpreters insisted that imagery with a resolution of 12 to 18 inches was necessary to determine missile size, antenna pattern, and configuration of the engagement radars associated with the system. Electronic intelligence (ELINT) analysts also needed data about the Tallinn radars, but there were no collection sites that could monitor the Tallinn emanations when the radars were being tested. Moreover, the Soviets never operated the radars in the tracking and lockon modes, a fact that prevented analysts from knowing the frequencies or any other performance characteristics of the radar.

To settle the question of the purpose of the Tallinn installations, Office of Special Activities planners proposed a mission that would use the high resolution of the OXCART's camera along with the U-2's sophisticated ELINT-collection equipment. This project's unclassified name was Project SCOPE LOGIC; its classified title was Operation UPWIND.

The proposed project involved launching an A-12 OXCART aircraft from Area 51 in Nevada and flying it to a Baltic Sea rendezvous with a Project IDEALIST U-2 flying from an RAF facility in Great Britain. The OXCART would fly north of Norway and then turn south along the Soviet-Finnish border. Shortly before Leningrad, the A-12 would head west-southwest down the Baltic Sea, skirting the coasts of Estonia, Latvia, Lithuania, Poland, and East Germany before heading west to return to Area 51. The entire flight would cover 11,000 nautical miles, take eight hours and 38 minutes, and require four aerial refuelings.

Although the A-12 would not violate Soviet airspace during this dash, it would appear to Soviet radar network operators to be headed for an overflight penetration in the vicinity of Leningrad. It was hoped that the A-12's passage would provoke Soviet air defense personnel to activate the Tallinn system radars in order to track the swift OXCART aircraft. As the A-12 made its dash down the Baltic, its Type-I camera would be filming the entire south coast. If Agency analysts were correct in their assumption that the Tallinn system was designed to counter high-altitude aircraft at long ranges, then the OXCART would be in jeopardy during this dash down the Baltic. Nevertheless, Agency weapons experts believed that the A-12 aircraft's speed and suite of electronic countermeasures would keep it safe from the standard Soviet surface-to-air missile installations.

While the A-12 was conducting its high-speed dash along the Baltic coast of Eastern Europe, the U-2 would be flying farther out to sea, safely beyond the range of all Soviet SAMs. The U-2 would be able to collect the Tallinn radar installation's ELINT emanations.

Agency and Defense Department officials supported the proposed mission, but Secretary of State Dean Rusk strongly opposed it and the 303 Committee never forwarded the proposal to President Johnson.[59] The Tallinn radar installation remained of great interest to the intelligence community, and in the late 1960s the CIA attempted to develop a small, unmanned reconnaissance aircraft that could photograph Tallinn and other coastal areas. The project (AQUILINE) was abandoned in 1971 (see appendix E).

FIRST A-12 DEPLOYMENT: OPERATION BLACK SHIELD

Although the Tallinn mission was still being considered in May 1967, another possible employment for the OXCART came under discussion. This time the proposal was for OXCART to collect tactical rather than strategic intelligence. The cause was apprehension in Washington about the possible undetected introduction of surface-to-surface missiles into North Vietnam. When President Johnson asked for a proposal on the matter, the CIA suggested that the OXCART be used. While the State and Defense Departments were still examining the proposal's political risks, DCI Richard Helms

[59] Memorandum for DDCI R. L. Taylor from C. E. Duckett, DDS&T, "Collection of Photo and ELINT Data on Tallinn Sites Utilizing the OXCART and the U-2," 4 May 1967, DS&T records (TS Codeword).

raised the issue at President Johnson's "Tuesday lunch" on 16 May. Helms got the President's approval, and the CIA put the BLACK SHIELD plan to deploy the OXCART to the Far East into effect later that same day.[60]

The airlift of personnel and equipment to Kadena began on 17 May 1967, and on 22 May the first A-12 flew nonstop from Area 51 to Kadena in six hours and six minutes. A second aircraft arrived on 24 May. The third A-12 left on 26 May, but the pilot had trouble with the inertial navigation system and communications near Wake Island. He made a precautionary landing at Wake, where a pre-positioned emergency recovery team was located. The problem was corrected and the aircraft continued its flight to Kadena on the following day.

Before the start of the operation, the CIA briefed a number of key US and Allied officials on the operation. Included were the US Ambassadors [redacted]

By 29 May 1967, 13 days after President Johnson's approval, BLACK SHIELD was ready to fly an operational mission. On 30 May, the detachment was alerted for a mission on the following day. As the takeoff time approached, Kadena was being deluged by rain, but, since weather over the target area was clear, flight preparations continued. The OXCART, which had never operated in heavy rain, taxied to the runway and took off.

This first BLACK SHIELD mission flew one flight path over North Vietnam and another over the demilitarized zone (DMZ). The mission was flown at Mach 3.1 and 80,000 feet and lasted three hours and 39 minutes. While over North Vietnam, the A-12 photographed 70 of the 190 known surface-to-air missile sites and nine other priority targets. The A-12's ECM equipment did not detect any radar signals during the mission, which indicated that the flight had gone completely unnoticed by both the Chinese and North Vietnamese.

[60] "OXCART Story," p. 25 (S).

During the next six weeks, there were alerts for 15 BLACK SHIELD missions, seven of which were actually flown. Only four detected hostile radar signals. By mid-July 1967, the BLACK SHIELD missions had provided sufficient evidence for analysts to conclude that no surface-to-surface missiles had been deployed in North Vietnam.[61]

Project Headquarters in Langley planned and directed all operational BLACK SHIELD missions. To ensure secure communications between Headquarters and Kadena, [redacted]

A typical mission over North Vietnam required refueling south of Okinawa, shortly after takeoff. After the planned photographic passes, the aircraft withdrew for a second aerial refueling in the Thailand area before returning to Kadena. So great was the plane's speed that it spent only 12.5 minutes over Vietnam during a "single-pass" mission, and 21.5 minutes during a "two-pass" mission. Because of its wide 86-mile turning radius, the plane occasionally crossed into Chinese airspace when getting into position for a second pass.

After the aircraft landed, the camera film was removed and sent by special plane to processing facilities in the United States. By late summer, however, an Air Force photo laboratory in Japan began doing the processing in order to place the photointelligence in the hands of US commanders in Vietnam within 24 hours of a mission's completion.

BLACK SHIELD activity continued unabated during the second half of 1967. From 16 August to 31 December 1967, 26 missions were alerted and 15 were flown. On 17 September one SAM site tracked the vehicle with its acquisition radar but was unsuccessful with its FAN SONG guidance radar. It was not until 28 October that a North Vietnamese SAM site launched a missile at the OXCART. Mission photography documented the event with photographs of missile smoke above the SAM firing site and pictures of the missile and its contrail. Electronic countermeasures equipment aboard the OXCART performed well, and the missile did not endanger the aircraft.

[61] [redacted] "OXCART Story," pp. 25-28 (S); *OSA History*, chap. 20, pp. 119-124, annex 152 (TS Codeword).

The only time the enemy came close to downing an OXCART was on 30 October 1967. During his first pass over North Vietnam, pilot Dennis Sullivan detected radar tracking. Two SAM sites prepared to launch missiles but neither did. During Sullivan's second pass the North Vietnamese fired at least six missiles at the OXCART, each confirmed by vapor trails on mission photography. The pilot saw these vapor trails and witnessed three missile detonations near but behind the A-12, which was traveling at Mach 3.1 at about 84,000 feet. Postflight inspection of the aircraft revealed that a piece of metal had penetrated the underside of the right wing, passed through three layers of titanium, and lodged against a support structure of the wing tank. The fragment was not a warhead pellet but probably debris from one of the missile detonations that the pilot observed.[62]

BLACK SHIELD missions continued during the first three months of 1968, with four missions flown over North Vietnam out of 14 alerts. The last OXCART overflight of Vietnam took place on 8 March 1968. During this same three-month period, the OXCART made its first overflight of North Korea after the USS Pueblo was seized on 23 January 1968. The goal of this mission was to discover whether the North Koreans were preparing any large-scale hostile move in the wake of this incident. When NPIC photointerpreters examined OXCART photography taken on 26 January, they found the missing USS Pueblo in Wonsan harbor.

Secretary of State Dean Rusk was reluctant to endorse a second mission over North Korea for fear of diplomatic repercussions should the aircraft come down in hostile territory. The Secretary was assured that the plane could transit North Korea in seven minutes and was unlikely to land in either North Korea or China. The 303 Committee then endorsed a second mission over North Korea, which was flown on 19 February. A third and final overflight of North Korea on 8 May 1968 proved to be the last operational deployment of the OXCART aircraft.[63]

THE END OF THE OXCART PROGRAM

Almost a decade had elapsed between the time when the concept for the OXCART aircraft was first examined and the first A-12 was operationally deployed. Now after only 29 operational missions, the most

[62] "OXCART Story," p. 28 (S).

[63] Ibid., pp. 28-29 (S).

USS Pueblo in Wonsan Harbor

advanced aircraft ever built was to be put out to pasture. The abandonment of the OXCART did not result from any shortcomings of the aircraft; the causes lay in fiscal pressures and competition between the reconnaissance programs of the CIA and the Air Force.

Throughout the OXCART program, the Air Force had been exceedingly helpful; it gave financial support, conducted the refueling program, provided operational facilities at Kadena, and airlifted OXCART personnel and supplies to Okinawa for the Vietnam and Korean operations. Air Force orders for variants of the CIA's A-12—the YF-12A interceptor and the SR-71 reconnaissance aircraft—had helped lower development and procurement costs for the OXCART. Nevertheless, once the Air Force had built up its own fleet of reconnaissance aircraft, budgetary experts began to criticize the existence of two expensive fleets of similar aircraft.

In November 1965, the very month that the A-12 had been declared operational, the Bureau of the Budget circulated a memorandum that expressed concern about the costs of the A-12 and SR-71 programs. It questioned both the total number of planes required for the combined fleets, and the necessity for a separate CIA fleet. The memorandum recommended phasing out the A-12 program by September 1966 and stopping any further procurement of the SR-71 models. The Secretary of Defense rejected this recommendation, presumably because the SR-71 would not be operational by September 1966.[64]

In July 1966, at the Bureau of the Budget's suggestion, a study group was established to look for ways to reduce the cost of the OXCART and SR-71 programs. The study group consisted of C. W. Fischer from the Bureau of the Budget, Herbert Bennington from the Department of Defense, and John Parangosky from CIA. The study group listed three possible courses of action: maintain both fleets, mothball the A-12s but share the SR-71s between CIA and the Air Force, or mothball the A-12s and assign all missions to Air Force SR-71s. On 12 December 1966, four high-level officials met to consider these alternatives. Over the objections of DCI Helms, the other three officials—Deputy Secretary of Defense Cyrus Vance, Bureau of the Budget Director Charles L. Schultze, and Presidential Scientific Adviser Donald F. Hornig—decided to terminate the OXCART fleet. Concerned that this recommendation would strip the CIA of its supersonic reconnaissance capability, Helms then asked that the SR-71 fleet be shared between CIA and the Air Force.[65]

Four days later, Schultze handed Helms a draft memorandum for the President requesting a decision either to share the SR-71 fleet between CIA and the Air Force or to terminate the CIA capability entirely. Having just received new information indicating that the SR-71's performance was inferior to that of the A-12, Helms asked for another meeting to review this data. His concern was that the SR-71 could not match the photographic coverage that the A-12 could provide. Only one of the SR-71's three camera systems was working anywhere near the original specifications, and that was its Operational Objective system which could only photograph a swath 28 miles wide with a resolution of 28 to 30 inches. The A-12's Type-I P-E camera could photograph a swath 72 miles wide with a nadir resolution of 12 to 18 inches and oblique resolution of 54 inches. Thus, the A-12's camera covered three times as much territory as the SR-71's camera and did so with better resolution. In addition, the A-12 could fly 2,000 to 5,000 feet higher than the SR-71 and was also faster, with a maximum speed of Mach 3.1 compared with the SR-71's Mach 3.0.[66]

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[64] *OSA History*, chap. 20, p. 130 (TS Codeword); "OXCART Story," p. 30 (S).

[65] *OSA History*, chap. 20, pp. 130-133 (TS Codeword); "OXCART Story," pp. 30-31 (S)

[66] "OXCART Story," p. 31 (S); *OSA History*, pp. 133-134 (TS Codeword).

In spite of Helms's request and the strength of his arguments, the Bureau of the Budget memorandum was submitted to President Johnson. On 28 December 1966, the President approved the termination of the OXCART program by 1 January 1968.

This decision meant that CIA had to develop a schedule for an orderly phaseout of the A-12. This activity was known as Project SCOPE COTTON. Project headquarters informed Deputy Defense Secretary Vance on 10 January 1967 that the A-12s would gradually be placed in storage, with the process to be completed by the end of January 1968. In May 1967, Vance directed that SR-71s would assume responsibility for Cuban overflights by 1 July 1967 and would add responsibility for overflights of Southeast Asia by 1 December 1967. Until these capabilities were developed, OXCART was to remain able to conduct assignments on a 15-day notice for Southeast Asia and a seven-day notice for Cuba.[67]

All these arrangements were made before the OXCART had conducted a single operational mission, which did not occur until 31 May 1967. In the months that followed the initiation of operations in Asia, the OXCART demonstrated its exceptional technical capabilities. Soon some high-level Presidential advisers and Congressional leaders began to question the decision to phase out OXCART, and the issue was reopened.

The CIA contended that the A-12 was the better craft because it flew higher, faster, and had superior cameras. The Air Force maintained that its two-seat SR-71 had a better suite of sensors, with three different cameras (area search, spotting, and mapping), infrared detectors, side-looking aerial radar, and ELINT-collection gear. In an effort to resolve this argument, the two aircraft were pitted against each other in a flyoff codenamed NICE GIRL. On 3 November 1967, an A-12 and an SR-71 flew identical flight paths, separated in time by one hour, from north to south roughly above the Mississippi River. The data collected during these missions were evaluated by representatives of the CIA, DIA, and other Defense Department intelligence organizations.

The results proved inconclusive. Both photographic systems provided imagery of sufficient quality for analysis. The A-12 Type-I camera's 72-mile swath width and 5,000-foot film supply were superior to the SR-71 Operational Objective camera's 28-mile swath and

[67] "OXCART Story," p. 31 (S); *OSA History*, p. 138 (TS Codeword).

3,300-foot film supply. On the other hand, the SR-71's infrared, side-looking aerial radar, and ELINT/COMINT equipment provided some unique intelligence not available from the A-12. Air Force planners admitted, however, that some of this equipment would have to be sacrificed in order to provide the SR-71 with ECM gear.[68]

Although the flyoff had not settled the question of which aircraft was superior, the OXCART did win a temporary reprieve in late November 1967. The Johnson administration decided to keep both fleets for the time being, particularly because the OXCART was actually flying missions over North Vietnam. With expenditures for the Vietnam war rising steadily, the question of reducing the costs of competing reconnaissance programs was bound to surface again. In the spring of 1968, there was yet another study of the OXCART and SR-71 programs. On 16 May 1968, the new Secretary of Defense, Clark Clifford, reaffirmed the original decision to terminate the OXCART program and store the aircraft. President Johnson confirmed this decision on 21 May.[69]

Project headquarters selected 8 June 1968 as the earliest possible date for phasing out all OXCART aircraft. Those A-12s already at the Nevada site were placed in storage, and the aircraft on Okinawa were scheduled to return by 8 June. Unfortunately, tragedy struck before this redeployment took place. On 4 June 1968 during a test flight from Kadena to check out a new engine, an A-12 disappeared 520 miles east of Manila. Search and rescue missions found no trace of the plane or its pilot, Jack W. Weeks. Several days later the remaining two A-12s left Okinawa to join the other eight OXCART aircraft in storage at Palmdale, California. Because the A-12s were smaller than either of the Air Force's versions, the only parts that could be salvaged for Air Force use were the J58 engines. The OXCART's outstanding Perkin-Elmer camera cannot be used in the SR-71 because the two-seater Air Force aircraft has a smaller camera compartment than that of the A-12. Constructed from one of the most durable metals known to man but unable to fly for want of engines, the OXCART aircraft are fated to remain inactive at Palmdale for many, many years.

[68] Information supplied by James Cunningham to Donald E. Welzenbach.

[69] "OXCART Story," pp. 32-33 (S); *OSA History*, chap. 20, pp. 143-146 (TS Codeword).

Initial storage arrangements for A-12s at Palmdale

POSSIBLE SUCCESSORS TO THE OXCART

The OXCART was the last high-altitude reconnaissance aircraft produced for the CIA, although the Office of Special Activities did briefly consider several possible successors to the OXCART during the mid-1960s. The first of these, known as Project ISINGLASS, was prepared by General Dynamics to utilize technology developed for its Convair Division's earlier FISH proposal and its new F-111 fighter in order to create an aircraft capable of Mach 4-5 at 100,000 feet. General Dynamics completed its feasibility study in the fall of 1964, and OSA took no further action because the proposed aircraft would still be vulnerable to existing Soviet countermeasures. In 1965 a more ambitious design from McDonnell Aircraft came under consideration as Project RHEINBERRY (although some of the work seems to have come under the ISINGLASS designation as well). This proposal featured a rocket-powered aircraft that would be launched from a B-52 mother ship and ultimately reach speeds as high as Mach 20 and altitudes of up to 200,000 feet. Because building this aircraft would have involved tremendous technical challenges and correspondingly high costs, the Agency was not willing to embark on such a program at a time when the main emphasis in overhead reconnaissance had shifted from aircraft to satellites. As a result, when the OXCART program ended in the summer of 1968, no more advanced successor was waiting in the wings—only the veteran U-2.

SUMMARY OF THE OXCART PROGRAM

Intended to replace the U-2 as a collector of strategic intelligence, the OXCART was never used for this purpose. Its brief deployment was strictly for obtaining tactical intelligence and its photographic product contributed very little to the Agency's strategic intelligence mission. By the time OXCART became operational, photosatellite systems had filled the role originally conceived for it. The most advanced aircraft of the 20th century had become an anachronism before it was ever used operationally.[70]

The OXCART did not even outlast the U-2, the aircraft it was supposed to replace. The OXCART lacked the quick-response capability of the smaller craft: a U-2 unit could be activated overnight, and within a week it could deploy abroad, fly sorties, and return to home base. The OXCART planes required precise logistic planning for fuel and emergency landing fields, and their inertial guidance systems needed several days for programming and stabilization. Aerial tankers had to be deployed in advance along an OXCART's flight route and be provisioned with the highly specialized fuel used by the J58 engines. All of this required a great deal of time and the effort of several hundred people. A U-2 mission could be planned and flown with a third fewer personnel.

Although the OXCART program created a strategic reconnaissance aircraft with unprecedented speed, range, and altitude, the program's most important contributions lay in other areas: aerodynamic design, high-impact plastics, engine performance, cameras, electronic countermeasures, pilot life-support systems, antiradar devices, use of nonmetallic materials for major aircraft assemblies, and improvements in milling, machining, and shaping titanium. In all of these areas, the OXCART pushed back the frontiers of aerospace technology and helped lay the foundation for future "stealth" research.

[70] On 26 January 1967 Kelly Johnson noted in his "Archangel log":
I think back to 1959, before we started this airplane, to discussions with Dick Bissell where we seriously considered the problem of whether there would be one more round of aircraft before the satellites took over. We jointly agreed there would be just one round, and not two. That seems to have been a very accurate evaluation, as it seems that 30 SR-71's give us enough overflight reconnaissance capability and we don't need the additional 10 Oxcart aircraft.

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Conclusion

U-2 OVERFLIGHTS OF THE SOVIET UNION

Before the first U-2 overflights in the summer of 1956, project managers believed that their aircraft could fly virtually undetected over the Soviet Union. They did not expect this advantage to last very long, however, because they also expected the Soviets to develop effective countermeasures against the U-2 within 12 to 18 months. Recognizing that time was against them, the U-2 project managers planned a large number of missions to obtain complete coverage of the Soviet Union as quickly as possible. At this time, the U-2 program focused solely on the collection of strategic intelligence.

Once operations began, however, project managers found themselves operating under severe constraints. Contrary to the CIA's expectations, the U-2 could not fly undetected. Its overflights led to Soviet diplomatic protests and numerous attempts at interception. Not wishing to aggravate the Soviet Union during periods of tension or to harm relations during more favorable intervals, President Eisenhower placed strict limits on overflights, personally authorizing each one and greatly limiting their number. Yet, the President never went so far as to eliminate the overflight program. As Commander in Chief, he valued the intelligence that the U-2 overflights collected, especially at times when the press and Congress alleged that the United States was falling behind the Soviet Union militarily, first in bombers and then in missiles. As a result of the President's ambivalence toward overflights, the years 1956-60 were marked by long periods during which no overflights occurred, followed by brief bursts of activity.