THE A-12 ARTICLES OF PROJECT OXCART AT GROOM LAKE
AND OPERATION BLACK SHIELD IN OKINAWA

The entire civilized world knew about the SR-71 Blackbird from 1968 until its retirement in the early 1990s. It wasn't, however, until the last few years that declassification of information about various cold war projects revealed the existence of the Roadrunners and their highly classified U-2, A-12, and YF-12 CIA projects IDEALIST and OXCART at Groom Lake and Operation BLACKSHIELD at Kadena, Okinawa that produced the SR-71, the most technologically advanced reconnaissance aircraft ever operated by the United States.

For 35 years, the U-2 and A-12 CIA pilots, code-named "Drivers," looked down on U.S. enemies from 15 miles above the earth, charting the movements of adversaries around the globe. These were planes built and tested by numerous CIA civilian contractors, it operations supported by Air Force personnel, and flown by Air Force pilots who switched to the Central Intelligence Agency, then back to the Air Force in careers spanning 30 years or more.

In 1958, well aware that the U-2 could not continue to overfly the Soviet Union with impunity, and in the absence of any guarantee that satellite reconnaissance programs would be successful, President Eisenhower approved CIA plans to build a successor to the U-2 - one that would fly higher and several times faster than the U-2. The OXCART program at Groom Lake would yield a exotic-looking aircraft capable of flying at 100,000 feet at a speed of about Mach 3.1 (2,170) mph. For a variety of reasons, the plane would not make its first operational flights until Operation BLACKSHIELD in 1967. After years of bureaucratic battles involving the CIA, Air Force, National Reconnaissance Office, and Bureau of the Budget, the program was terminated in 1968 in favor of an Air Force modification - the SR-71. It never flew over Soviet territory due to the success of satellite reconnaissance programs as well as the unwillingness of U.S. leaders to take the risks involved in any overflights.

Below you will find the official story of the OXCART and BLACKSHIELD Programs supplemented with several pages of photos of the A-12, YF-12 planes code-named "Articles" by the CIA. These photos were not a part of the official story. These photos will take you from the planning state, through the construction by Lockheed, Radar Cross Section tests at Groom Lake by CIA contractors, numerous images of the fleet of aircraft while operational, into their retirement, and finally, to their present locations at various museums and air parks.

(S)THE OXCART STORY

by

Thomas P. McIninch

(S) One spring day in 1962 a test pilot named Louis Schalk, employed by the Lockheed Aircraft Corporation, took off from the Nevada desert in an aircraft the like of which had never been seen before. A casual observer would have been startled by the appearance of this vehicle; he would perhaps have noticed especially its extremely long, slim, shape, its two enormous jet engines, its long sharp, projecting nose, and its sweptback wings which appeared far too short to support the fuselage in flight. He might well have realized that this was a revolutionary airplane; he could not have known that it would be able to fly at three times the speed of sound for more than 3,000 miles without refueling, or that toward the end of its flight, when fuel began to run low, it could cruise at over 90,000 feet. Still less would he have known of the equipment it was to carry, or of the formidable problems attending its design and construction.

(U) There was, of course, no casual observer present. The aircraft had been designed and built for reconnaissance; it was projected as a successor to the U-2. Its development had been carried out in profound secrecy. Despite the numerous designers, engineers, skilled and unskilled workers, administrators and others who had been involved in the affair, no authentic accounts, and indeed scarcely any accounts at all, had leaked. Many aspects have not been revealed to this day, and many are likely to remain classified for some time to come.

(S) The official designation of the aircraft was A-12. By a sort of inspired perversity, however, it came to be called OXCART, a code word also applied to the program under which it was developed. The secrecy in which it was so long shrouded has lifted a bit, and the purpose of this article is to give some account of the inception, development, operation, and untimely demise of this remarkable airplane. The OXCART no longer flies, but it left a legacy of technological achievement which points the way to new projects. And it became the progenitor of a similar but somewhat less sophisticated reconnaissance vehicle called the SR-71, whose existence is well known to press and public.

(S) Sequel to the U-2

(S) The U-2 dated from 1954, when its development began under the direction of a group headed by Richard M. Bissell of CIA. In June 1956, the aircraft became operational, but officials predicted that its useful lifetime over the USSR could hardly be much more than 18 months or two years. Its first flight over Soviet territory revealed that the defense warning system not only detected but tracked it quite accurately. Yet, it remained a unique and

(S)invaluable source of intelligence information for almost four years, until on 1 May 1960, Francis Gary Powers was shot down near Sverdlovsk.

(U) Meanwhile, even as the U-2 commenced its active career, efforts were under way to make it less vulnerable. The hope was to reduce the vehicle's radar cross-section, so that it would become less susceptible to detection. New developments in radar-absorbing materials were tried out and achieved considerable success, though not enough to solve the problem. Various far-out designs were explored, most of them seeking to create an aircraft capable of flying at extremely high altitudes, though still at relatively slow speed. None of them proved practicable.

(S) Eventually, in the fall of 1957, Bissell arranged with a contractor for a job of operations analysis to determine how far the probability of shooting down an airplane varied respectively with the plane's speed, altitude, and radar cross-section. This analysis demonstrated that supersonic speed greatly reduced the chances of detection by radar. The probability of being shot down was not of course reduced to zero, but it was evident that the supersonic line of approach was worth serious consideration. Therefore, from this time on, attention focused increasingly on the possibility of building a vehicle which could fly at extremely high speeds as well as great altitudes, and which would also incorporate the best that could be attained in radar-absorbing capabilities. Lockheed Aircraft Corporation and Convair Division of General Dynamics were informed of the general requirements, and their designers set to work on the problem without as yet receiving any contract or funds from the government. From the fall of 1957 to late 1958 these designers constantly refined and adapted their respective schemes.

(S) Bissell realized that development and production of such an aircraft would be exceedingly expensive, and that in the early stages at least it would be doubtful whether the project could succeed. To secure the necessary funds for such a program, high officials would have to receive the best and most authoritative presentation of whatever prospects might unfold. Accordingly, he got together a panel consisting of two distinguished authorities on aerodynamics and one physicist, with E. M. Land of the Polaroid Corporation as chairman. Between 1957 and 1959 this panel met about six times, usually in Land's office in Cambridge. Lockheed and Convair designers attended during parts of the sessions. So also did the Assistant Secretaries of the Air Force and Navy concerned with research and development, together with one or two of their technical advisors. One useful consequence of the participation of service representatives was that bureaucratic and jurisdictional feuds were reduced virtually to nil. Throughout the program both Air Force and Navy gave valuable assistance and

cooperation.

(S) As the months went by, the general outlines of what might be done took shape in the minds of those concerned. Late in November 1958, the members of the panel held a crucial meeting. They agreed that it now appeared feasible to build an aircraft of such speed and altitude as to be very difficult to track by radar. They recommended that the president be asked to approve in principle a further prosecution of the project, and to make funds available for further studies and tests. The president and his Scientific Advisor, Dr. James Killian were already aware of what was going on, and when CIA officials went to them with the recommendations of the panel they received a favorable hearing. The President gave his approval. Lockheed and Convair were then asked to submit definite proposals, funds were made available to them, and the project took on the code name GUSTO.

(C) Less than a year later the two proposals were essentially complete, and on 20 July 1959, the President was again briefed. This time he gave final approval, which signified that the program could get fully under way.

(C) The next major step was to choose between the Lockheed and Convair designs. On 20 August 1959 specifications of the two proposals were submitted to a joint DOD/USAF/CIA selection panel:

	Lockheed	Convair
Speed	Mach 3.2	Mach 3.2
Range (Total)	4,120 nm	4,000nm
Start Alt.	84,000 ft	85,000 ft
Mid-Range Alt.	91,000 ft	88,000 ft
End Alt.	97,600 ft	94,000 ft
Length	102 ft	79.5 ft
Span	57 ft	56.0 ft
Gross Weight	110,000 lbs	101,700 lbs
Fuel Weight		
Time to First Flight	22 months	22 months

(S) The Lockheed design was selected, Project GUSTO terminated, and the program to develop a new U-2 follow on aircraft was names OXCART. On 3 September 1959, CIA authorized Lockheed to proceed with antiradar studies, aerodynamic structural tests, and engineering designs, and on 30 January 1960 gave the green light to produce 12 aircraft.

(S) Pratt and Whitney Division of United Aircraft Corporation had been involved in discussions of the project, and undertook to develop the propulsion system. Their J-58 engine, which was to be used in the A-12, had been sponsored originally by the US Navy for its own purposes, and was to be capable of a speed of Mach 3.0. Navy interest in the development was diminishing, however, and the Secretary of Defense

had decided to withdraw from the program at the end of 1959. CIA's requirement was that the engine and aircraft be further developed and optimized for a speed of Mach 3.2. The new contract called for initial assembly of three advanced experimental engines for durability and reliability testing, and provision of three engines for experimental flight testing in early 1961.

(S) The primary camera manufacturer was Perkin-Elmer. Because of the extreme complexity of the design, however, a decision was soon made that a backup system might be necessary in the event the Perkin-Elmer design ran into production problems, and Eastman Kodak was also asked to build a camera. Minneapolis-Honeywell Corporation was selected to provide both the inertial navigation and automatic flight control system. The Firewell Corporation and the David Clark Corporation became the prime sources of pilot equipment and associated life support hardware.

(U) Lockheed's designer was Clarence L. (Kelly) Johnson, creator of the U-2, and he called his new vehicle not A-12 but A-11. Its design exhibited many innovations. Supersonic airplanes, however, involve a multitude of extremely difficult design problems. Their payload-range performance is highly sensitive to engine weight, structural weight, fuel consumption, and aerodynamic efficiency. Small mistakes in predicting these values can lead to large errors in performance. Models of the A-11 were tested and retested, adjusted and readjusted, during thousands of hours in the wind tunnel. Johnson was confident of his design, but no one could say positively whether the bird would fly, still less whether it would fulfill the extremely demanding requirements laid down for it.

(U) To make the drawings and test the model was one thing; to build the aircraft was another. The most numerous problems arose from the simple fact that in flying through the atmosphere at its designed speed the skin of the aircraft would be subjected to a temperature of more than 550 degrees Fahrenheit. For one thing, no metal hitherto commonly used in aircraft production would stand this temperature, and those which would do so were for the most part too heavy to be suitable for the purpose in hand.

(S) During the design phase Lockheed evaluated many materials and finally chose an alloy of titanium, characterized by great strength, relatively light weight, and good resistance to high temperatures. Titanium was also scarce and very costly. Methods for milling it and controlling the quality of the product were not fully developed. Of the early deliveries from Titanium Metals Corporation some 80 percent had to be rejected, and it was not until 1961, when a delegation from headquarters visited the officials of that company, informed them of the objectives and high priority of the OXCART program, and gained their full cooperation, that the supply became consistently satisfactory.

(S) But this only solved an initial problem. One of the virtues of titanium was its exceeding hardness, but this very virtue gave rise to immense difficulties in machining and shaping the material. Drills which worked well on aluminum soon broke to pieces; new ones had to be devised. Assembly line production was impossible; each of the small OXCART fleet was, so to speak, turned out by hand. The cost of the program

mounted well above original estimates, and it soon began to run behind schedule. One after another, however, the problems were solved, and their solution constituted the greatest single technological achievement of the entire enterprise. Henceforth it became practicable, if expensive, to build aircraft out of titanium.

(S) Since every additional pound of weight was critical, adequate insulation was out of the question. The inside of the aircraft would be like a moderately hot oven. The pilot would have to wear a kind of space suit, with its own cooling apparatus, pressure control, oxygen supply, and other necessities for survival. The fuel tanks, which constituted by far the greater part of the aircraft, would heat up to about 350 degrees, so that special fuel had to be supplied and the tanks themselves rendered inert with nitrogen. Lubricating oil was formulated for operation at 600 degrees F., and contained a diluent in order to remain fluid at operation below 40 degrees. Insulation on the plane's intricate wiring soon became brittle and useless. During the lifetime of the OXCART no better insulation was found; the wiring and related connectors had to be given special attention and handling at great cost in labor and time.

(S) Then there was the unique problem of the camera window. The OXCART was to carry a delicate and highly sophisticated camera, which would look out through a quartz glass window. The effectiveness of the whole system depended upon achieving complete freedom from optical distortion despite the great heat to which the window would be subjected. Thus the question was not simply one of providing equipment with resistance to high temperature, but of assuring that there should be no unevenness of temperature throughout the area of the window. It took three years of time and two million dollars of money to arrive at a satisfactory solution. The program scored one of its most remarkable successes when the quartz glass was successfully fused to its metal frame by an unprecedented process involving the use of high frequency sound waves.

(S) Another major problem of different nature was to achieve the low radar cross-section desired. The airframe areas giving the greatest radar return were the vertical stabilizers, the engine inlet, and the forward side of the engine nacelles. Research in ferrites, high temperature absorbing materials and high temperature plastic structures was undertaken to find methods to reduce the return. Eventually the vertical tail section fins were constructed from a kind of laminated "plastic" material the first time that such a material had been used for an important part of an aircraft's structure. With such changes in structural materials, the A-11 was redesignated A-12, and as such has never been publically disclosed.

(C) To test the effectiveness of antiradar devices a small-scale model is inadequate; only a full size mockup will do. Lockheed accordingly built one of these, and as early as November 1959, transported it in a specially designed trailer truck over hundreds of miles of highway from the Burbank plant to the test area. Here it was hoisted to the top of a pylon and looked at from various angles by radar. Tests and adjustments went on for a year and a half before the results were deemed satisfactory. In the course of the process it was found desirable to attach some sizable metallic constructions on each side of the fuselage, and Kelly Johnson worried a good deal about the effect of these protuberances on his design. In flight tests, however, it later developed that they

imparted a useful aerodynamic lift to the vehicle, and years afterward Lockheed's design for a supersonic transport embodied similar structures.

(S) Pilots for the OXCART would obviously have to be of quite extraordinary competence, not only because of the unprecedented performance of the aircraft itself, but also because of the particluar qualities needed in men who were to fly intelligence missions. Brigadier General Don Flickinger, of the Air Force, was designated to draw up the criteria for selection, with advice from Kelly Johnson and from CIA Headquarters. Pilots had to be qualified in the latest high performance fighters, emotionally stable, and well motivated. They were to be between 25 and 40 years of age, and the size of the A-12 cockpit prescribed that they be under six feet tall and under 175 pounds in weight.

(S) Air Force files were screened for possible candidates and a list of pilots obtained. Psychological assessments, physical examinations and refinement of criteria eliminated a good many. Pre-evaluation processing resulted in sixteen potential nominees. This group underwent a further intensive security and medical scrutiny by the Agency. Those who remained were then approached to take employment with the Agency on a highly classified project involving a very advanced aircraft. In November 1961, commitments were obtained from five of the group. The small number recruited at this stage required that a second search be undertaken.

(S) When the final screening was complete the pilots selected from the program were William L. Skliar, Kenneth S. Collins, Walter Ray, Lon Walter, Mele Vojvodich, Jr., Jack W. Weeks, Ronald "Jack" Layton, Dennis B. Sullivan, David P. Young, Francis J. Murray, and Russell Scott. After the selection, arrangements were made with the Air Force to effect appropriate transfers and assignments to cover their training and to lay the basis for their transition from military to civilian status. Compensation and insurance arrangements were similar to those for the U-2 pilots.

(U) One thing to be decided in the earliest stages of the program was where to base and test the aircraft. Lockheed clearly could not do the business at Burbank, where the aircraft were being built, if for no other reason that its runway was too short. The ideal location ought to be remote from metropolitan areas; well away from civil and military airways to preclude observation; easily accessible by air; blessed with good weather the year round; capable of accommodating large numbers of personnel; equipped with fuel storage facilities; fairly close to an Air Force installation; and possessing at least an 8,000 foot runway. There was no such place to be found.

(S) Ten Air Force bases programmed for closure were considered, but none provided the necessary security, and annual operating costs at most of them would be unacceptable. Edwards Air Force Base in California seemed a more likely candidate, but in the end it also was passed over. Instead a secluded site in Nevada was finally picked. It was deficient in personnel accommodations and POL storage, and its long unused runway was inadequate, but security was good, or could be made so, and a moderate construction program could provide sufficient facilities. Lockheed estimated what would be needed in such respects as monthly fuel consumption, hangars and shop space, housing for personnel, and runway specifications. Armed with the list of

major requirements, Headquarters came up with a construction and engineering plan. And in case anyone became curious about what was going on at this remote spot, a cover story stated that the facilities were being prepared for certain radar studies, to be conducted by an engineering firm with support from the Air Force. The remote location was explained as necessary to reduce the effect of electronic interference from outside sources.

(S) Excellent as it may have been from the point of view of security, the site at first afforded few of the necessities and none of the amenities of life. It was far from any metropolitan center. Lockheed provided a C-47 shuttle service to its plant at Burbank, and a chartered D-18 (Lodestar) furnished transportation to Las Vegas. Daily commuting was out of the question, however, and the construction workers arriving during 1960 were billeted in surplus trailers. A new water well was dug, and a few recreational facilities provided, but it was some time before accomodations became agreeable.

(S) Among the lesser snags, one existed because the laws of Nevada required the names of all contractor personnel staying in the state for more than 48 hours to be reported to state authorities. It was generally felt that to list all these names and identify the companies involved would be likely to give the whole show away. The Agency's General Counsel, however, discovered that Government employees were exempted from these requirements. Thenceforth all contractor personnel going to the site received appointments as Government consultants, and if questions were asked the reply could be that no one but government employees were at this site.

(C) Construction began in earnest in September 1960, and continued on a double-shift schedule until mid-1964. One of the most urgent tasks was to build the runway, which according to initial estimates of A-12 requirements must be 8,500 feet long. The existing asphalt runway was 5,000 feet long and incapable of supporting the weight of the A-12. The new one was built between 7 September and 15 November and involved pouring over 25,000 yards of concrete. Another major problem was to provide some 500,000 gallons of PF-1 aircraft fuel per month. Neither storage facilities nor means of transporting fuel existed. After considering airlift, pipeline, and truck transport, it was decided that the last named was the most economical, and could be made feasible by resurfacing no more than eighteen miles of highway leading into the base.

(C) Three surplus Navy hangars were obtained, dismantled, and erected on the north side of the base. Over 100 surplus Navy housing buildings were transported to the base and made ready for occupancy. By early 1962 a fuel tank farm was ready, with a capacity of 1,320,000 gallons. Warehousing and shop space was begun and repairs made to older buildings. All this, together with the many other facilities that had to be provided, took a long time to complete. Meanwhile, however, the really essential facilities were ready in time for the forecast delivery date of Aircraft No. 1 in August 1961.

(S) The facilities were ready, but the aircraft were not. Originally promised for delivery at the end of May 1961, the date first slipped to August, largely because of Lockheed's difficulties in procuring and fabricating titanium. Moreover, Pratt & Whitney found

unexpectedly great trouble in bringing the J-58 engine up to OXCART requirements. In March 1961, Kelly Johnson notified Headquarters:

(U) "Schedules are in jeopardy on two fronts. One is the assembly of the wing and the other is in satisfactory development of the engine. Our evaluation shows that each of these programs is from three to four months behind the current schedule."

(S)To this Bissell replied: (U) "I have learned of your expected additional delay in first flight from 30 August to 1 December 1961. This news is extremely shocking on top of our previous slippage from May to August and my understanding as of our meeting 19 December that the titanium extrusion problems were essentially overcome. I trust this is the last of such disappointments short of a severe earthquake in Burbank."

(U) Realizing that delays were causing the cost of the program to soar, Headquarters decided to place a top-level aeronautical engineer in residence at Lockheed to monitor the program and submit progress reports.

(C) Delays nevertheless persisted. On 11 September, Pratt and Whitney informed Lockheed of their continuing difficulties with the J-58 engine in terms of weight, delivery, and performance. Completion date for Aircraft No. 1 by now had slipped to 22 December 1961, and the first flight to 27 February 1962. Even on this last date the J-58 would not be ready, and it was therefore decided that a Pratt and Whitney J-75 engine, designed for the F-105 and flown in the U-2, should be used for early flights. The engine, along with other components, could be fitted to the A-12 airframe, and it could power the aircraft safely to altitudes up to 50,000 feet and at speeds up to Mach 1.6.

(S) When this decision had been made, final preparations were begun for the testing phase. In late 1961 Colonel Robert J. Holbury, USAF, was named Commander of the base, with the Agency employee as his Deputy. Support aircraft began arriving in the spring of 1962. These included eight F-101's for training, two T-33's for proficiency flying, a C-130 for cargo transport, a U-3A for administration purposes, a helicopter for search and rescue, and a Cessna-180 for liaison use. In addition, Lockheed provided an F-104 to act as chase aircraft during the A-12 flight test period.

(S) Meanwhile in January 1962, an agreement was reached with the Federal Aviation Agency that expanded the restricted airspace in the vicinity of the test area. Certain FAA air traffic controllers were cleared for the OXCART Project; their function was to insure that aircraft did not violate the order. The North American Air Defense Command established procedures to prevent their radar stations from reporting the appearance of high performance aircraft on their radar scopes.

(S) Refueling concepts required prepositioning of vast quantities of fuel at certain points outside the United States. Special tank farms were programmed in California, Eielson AFB Alaska, Thule AB Greenland, Kadena AB Okinawa, and Adana, Turkey. Since the A-12 use specially refined fuel, these tank farms were reserved exclusively for use by the OXCART Program. Very small detachments of technicians at these locations maintained the fuel storage facility and arranged for periodic quality control

fuel tests.

(S) At the Lockheed Burbank plant, Aircraft No. 1 (serially numbered 121) received its final tests and checkout during January and February 1962, and was partially disassembled for shipment to the site. It became clear very early in OXCART planning that because of security problems and the inadequate runway, the A-12 could not fly from Burbank. Movement of the full-scale

(S)radar test model had been successfully accomplished in November 1959, as described above. A thorough survey of the route in June 1961, ascertained the hazards and problems of moving the actual aircraft, and showed that a package measuring 35 feet wide and 105 feet long could be transported without major difficulty. Obstructing road signs had to be removed, trees trimmed, and some roadsides leveled. Appropriate arrangements were made with police authorities and local officials to accomplish the safe transport of the aircraft. The entire fuselage, minus wings, was crated, covered, and loaded on the special-design trailer, which cost about $100,000. On 26 February 1962, it departed Burbank, and arrived at the base according to plan.

(S) First Flights

(U) Upon arrival reassembly of the aircraft and installation of the J-75 engines began. Soon it was found that aircraft tank sealing compounds had failed to adhere to the metals, and when fuel was put into the tanks numerous leaks occurred. It was necessary to strip the tanks of the faulty sealing compounds and reline them with new materials. Thus occurred one more unexpected and exasperating delay in the program.

(U) Finally, on 26 April 1962, Aircraft 121 was ready. On that day in accordance with Kelly Johnson's custom, Louis Schalk took it for an unofficial, unannounced, maiden flight lasting some 40 minutes. As in all maiden flights minor problems were detected, but it took only four more days to ready the aircraft for its first official flight.

(U) On 30 April 1962, just under one year later than originally planned, the A-12 officially lifted her wheels from the runway. Piloted again by Louis Schalk, it took off at 170 knots, with a gross weight of 72,000 pounds, and climbed to 30,000 feet. Top speed was 340 knots and the flight lasted 59 minutes. The pilot reported that the aircraft responded well and was extremely stable. Kelly Johnson declared it to be the smoothest official first flight of any aircraft he had designed or tested. The aircraft broke the sound barrier on its second official flight, 4 May 1962, reaching Mach 1.1. Again only minor problems were reported.

(S) With these flights accomplished, jubilation was the order of the day. The new Director of Central Intelligence, Mr. John McCone, sent a telegram of congratulation to Kelly Johnson. A critical phase had been triumphantly passed, but there remained the

long, difficult, and sometimes discouraging process of working the aircraft up to full operational performance.

(C) Aircraft No. 122 arrived at base on 26 June, and spent three months in radar testing before engine installations and final assembly. Aircraft No. 123 arrived in August and flew in October. Aircraft No. 124, a two-seated version intended for use in training project pilots, was delivered in November. It was to be powered by the J-58 engines, but delivery delays and a desire to begin pilot training prompted a decision to install the smaller J-75's. The trainer flew initially in January 1963. The fifth aircraft, No. 125, arrived at the area on 17 December.

(S) Meanwhile the OXCART program received a shot in the arm from the Cuban missile crisis. U-2's had been maintaining a regular reconnaissance vigil over the island, and it was on one of these missions in October that the presence of offensive missiles was discovered. Overflights thereafter became more frequent, but on 27 October an Agency U-2, flown by a Strategic Air Force pilot on a SAC-directed mission, was shot down by a surface-to-air missile. This raised the dismaying possibility that continued manned, high- altitude surveillance of Cuba might become out of the question. The OXCART program suddenly assumed greater significance than ever, and its achievement of operational status became one of the highest national priorities.

(S) At the end of 1962 there were two A-12 aircraft engaged in flight tests. A speed of Mach 2.16 and altitude of 60,000 feet had been achieved. Progress was still slow, however, because of delays in the delivery of engines and shortcomings in the performance of those delivered. One of the two test aircraft was still flying with two J-75 engines, and the other with one J-75 and one J-58. It had long since become clear that Pratt & Whitney had been too optimistic in their forecast; the problem of developing the J-58 up to OXCART specifications had proved a good deal more recalcitrant than expected. Mr. McCone judged the situation to be truly serious, and on 3 December he wrote to the President of United Aircraft Corporation.

(U) "I have been advised that J-58 engine deliveries have been delayed again due to engine control production problems....By the end of the year it appears we will have barely enough J-58 engines to support the flight test program adequately....Furthernore, due to various engine difficulties we have not yet reached design speed and altitude. Engine thrust and fuel consumption deficiencies at present prevent sustained flight at design conditions which is so necessary to complete developments."

(U) By the end of January 1963, ten engines were available, and the first flight with two of them installed occurred on 15 January. Thenceforth all A-12 aircraft were fitted with their intended propulsion system. Flight testing accelerated and contractor personnel went to a three-shift work day.

(U) With each succeeding step into a high Mach regime new problems presented themselves. The worst of all these difficulties-indeed one of the most formidable in the entire history of the program-was revealed when flight testing moved into speeds between Mach 2.4 and 2.8, and the aircraft experienced such severe roughness as to

make its operation virtually out of the question. The trouble was diagnosed as being in the air inlet system, which with its controls admitted air to the engine. At the higher speeds the flow of air was uneven, and the engine therefore could not function properly. Only after a long period of experimentation, often highly frustrating and irritating, was a solution reached. This further postponed the day when the A-12 could be declared operationally ready.

(U) Among more mundane troubles was the discovery that various nuts, bolts, clamps, and other debris of the manufacturing process had not been cleared ** away, and upon engine runup or take-off were sucked into the engine. The engine parts were machined to such close tolerances that they could be ruined in this fashion. Obviously the fault was due to sheer carelessness. Inspection procedures were revised, and it was also found prudent at Burbank to hoist the engine nacelles into the air, rock them back and forth, listen for loose objects, and then remove them by hand.

(S) While on a routine flight, 24 May 1963, one of the detachment pilots recognized an erroneous and confusing air speed indication and decided to eject from the aircraft, which crashed 14 miles south of Wendover, Utah. The pilot Kenneth Collins, was unhurt. The wreckage was recovered in two days, and persons at the scene were identified and requested to sign secrecy agreements. A cover story for the press described the accident as occurring to a F-105, and is still listed in this way on official records.

(U) All A-12 aircraft were grounded for a week during investigation of the accident. A plugged pitot static tube in icing conditions turned out to be responsible for the faulty cockpit instrument indications it was not something which would hold things up for long.

(S) Loss of this aircraft nevertheless precipitated a policy problem which had been troubling the Agency for some time. With the growing number of A-12's, how much longer could the project remain secret? The program had gone through development, construction, and a year of flight testing without attracting public attention. But the Department of Defense was having difficulty in concealing its participation because of the increasing rate of expenditures, otherwise unexplained. There was also a realization that the technological data would be extremely valuable in connection with feasibility studies for the SST. Finally, there was a growing awareness in the higher reaches of the aircraft industry that something new and remarkable was going on. Rumors spread, and gossip flew about. Commercial airline crews sighted the OXCART in flight. The editor of Aviation Week (as might be expected) indicated his knowledge of developments at Burbank. The secrecy was thinning out.

(S) The President's Announcement

(U) In spite of all this, 1963 went by without any public revelation. President Johnson was brought up to date on the project a week after taking office, and directed that a paper be prepared for an announcement in the spring of 1964. Then at his press

conference on 24 February, he read a statement of which the first paragraph was as follows:

(U) "The United States has successfully developed 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. The performance of the A-11 far exceeds that of any other aircraft in the world today. The development of this aircraft has been made possible by major advances in aircraft technology of great significance for both military and commercial applications. Several A-11 aircraft are now being flight tested at Edwards Air Force Base in California. The existence of this program is being disclosed today to permit the orderly exploitation of this advanced technology in our military and commercial program."

(U)The president went on to mention the "mastery of the metallurgy and fabrication of titanium metal" which has been achieved, gave credit to Lockheed and to Pratt & Whitney, remarked that appropriate members of the Senate and House had been kept fully informed, and prescribed that the detailed performance of the A-11 would be kept strictly classified.

(S) The President's reference to the "A-11" was of course deliberate. "A-11" had been the original design designation for the all-metal aircraft first proposed by Lockheed; subsequently it became the design designation for the Air Force YF-12A interceptor which differed from its parent mainly in that it carried a second man for launching air-to-air missiles. To preserve the distinction between the A-11 and the A-12 Security had briefed practically all witting personnel in government and industry on the impending announcement. OXCART secrecy continued in effect. There was considerable speculation about an Agency role in the A-11 development, but it was never acknowledged by the government. News headlines ranged from "US has dozen A-11 jets already flying" to "Secret of sizzling new plane probably history's best kept."

(U) The President also said that "the A-11 aircraft now at Edwards Air Force Base are undergoing extensive tests to determine their capabilities as long- range interceptors." It was true that the Air Force in October 1960, had contracted for three interceptor versions of the A-12, and they were by this time available. But at the moment when the President spoke, there were no A-11's at Edwards and there never had been. Project officials had known that the public announcement was about to be made, but they had not been told exactly when. Caught by surprise, they hastily flew two Air Force YF-12A's to Edwards to support the President's statement. So rushed was this operation, so speedily were the aircraft put into hangars upon arrival, that heat from them activated the hangar sprinkler system, dousing the reception team which awaited them.

(S) Thenceforth, while the OXCART continued its secret career at its own site, the A-11 performed at Edwards Air Force Base in a considerable glare of publicity. Pictures of the aircraft appeared in the press, correspondents could look at it and marvel, stories could be written. Virtually no details were made available, but the technical journals nevertheless had a field day. The unclassified Air Force and Space Digest, for example, published a long article in its issue of April 1964, commencing: "The official pictures

and statements tell very little about the A-11. But the technical literature from open sources, when carefully interpreted, tells a good deal about what it could and, more importantly, what it could not be. Here's the story ..."

(S) Going Operational

(U) Three years and seven months after first flight in April 1962 the OXCART was declared ready for operational use at design specifications. The period thus devoted to flight tests was remarkably short, considering the new fields of aircraft performance which were being explored. As each higher Mach number was reached exhaustive tests were carried out in accordance with standard procedures to ensure that the aircraft functioned properly and safely. Defects were corrected and improvements made. All concerned gained experience with the particular characteristics and idiosyncrasies of the vehicle.

(S) The air inlet and related control continued for a long time to present the most troublesome and refractory problem. Numerous attempts failed to find a remedy, even though a special task force concentrated on the task. For a time there was something approaching despair, and the solution when finally achieved was greeted with enormous relief. After all, not every experimental aircraft of advanced performance has survived its flight testing period. The possibility existed that OXCART also would fail, despite the great cost and effort expended upon it.

(S) A few dates and figures will serve to mark the progress of events. By the end of 1963 there had been 573 flights totalling 765 hours. Nine aircraft were in the inventory. On 20 July 1963 test aircraft flew for the first time at Mach 3; in November Mach 3.2 (the design speed) was reached at 78,000 feet altitude. The longest sustained flight at design conditions occurred on 3 February 1964; it lasted to ten minutes at Mach 3.2 and 83,000 feet. By the end of 1964 there had been 1,160 flights, totalling 1,616 hours. Eleven aircraft were then available, four of them reserved for testing and seven assigned to the detachment.

(C) The record may be put in another way. Mach 2 was reached after six months of flying; Mach 3 after 15 months. Two years after the first flight the aircraft had flown a total of 38 hours at Mach 2, three hours at Mach 2.6, and less than one hour at Mach 3. After three years, Mach 2 time had increased to 60 hours, Mach 2.6 time time to 33 hours, and Mach 3 time to nine hours; all Mach 3 time, however, was by test aircraft, and detachment aircraft were still restricted to mach 2.9.

(S) As may be seen from the figures, most flights were of short duration, averaging little more than an hour each. Primarily this was because longer flights were unnecessary at this stage of testing. It was also true, however, that the less seen of OXCART the better, and short flights helped to preserve the secrecy of the proceedings. Yet it was virtually impossible for an aircraft of such dimensions and capabilities to remain inconspicuous. At its full speed OXCART had a turning radius of no less than 86 miles. There was no question of staying close to the airfield; its

shortest possible flights took it over a very large expanse of territory.

(S) The first long-range, high-speed flight occurred on 27 January 1965, when one of the test aircraft flew for an hour and forty minutes, with an hour and fifteen minutes above Mach 3.1. Its total range was 2,580 nautical miles, with altitudes between 75,600 and 80,000 feet.

(U) Two more aircraft were lost during this phase of the program. On 9 July 1964 Aircraft No. 133 was making its final approach to the runway when at altitude of 500 feet and airspeed of 200 knots it began a smooth steady roll to the left. Lockheed test pilot Bill Park could not overcome the roll. At about a 45-degree bank angle and 200 foot altitude he ejected. As he swung down to the vertical in the parachute his feet touched the ground, for what must have been one of the narrower escapes in the perilous history of test piloting. The primary cause of the accident was that the servo for the right outboard roll and pitch control froze. No news of the accident filtered out.

(S) On 28 December 1965 Aircraft No. 126 crashed immediately after takeoff and was totally destroyed. Detachment pilot Mele Vojvodich ejected safely at an altitude of 150 feet. The accident investigation board determined that a flight line electrician had improperly connected the yaw and pitch gyros had in effect reversed the controls. This time Mr. McCone directed the Office of Security to conduct an investigation into the possibility of sabotage. While nothing of the sort was discovered, there were indications of negligence, as the manufacturer of the gyro had earlier warned of the possibility that the mechanism could be connected in reverse. No action had been taken, however, even by such an elementary precaution as painting the contacts different colors. Again there was no publicity connected with the accident.

(S) The year 1965 saw the test site reach the high point of activity. Completion of construction brought it to full physical size. All detachment pilots were Mach 3.0 qualified. Site population reached 1,835. Contractors were working three shifts a day. Lockheed Constellations made daily flights between the factory at Burbank and the site. Two C-47 flights a day were made between the site and Las Vegas. And officials were considering how and when and where to use OXCART in its appointed role.

(S) Targeting the OX

(S) After the unhappy end of U-2 flights over the Soviet Union, US political authorities were understandably cautious about committing themselves to further manned reconnaissance over unfriendly territory. There was no serious intention to use the OXCART over Russia; save in some unforeseeable emergency it was indeed no longer necessary to do so. What then, should be done with this vehicle?

(S) The first interest was in Cuba. By early 1964 Project Headquarters began planning for the contingency of flights over that island under a program designated SKYLARK. Bill Park's accident in early July held this program up for a time, but on 5 August

Acting DCI Marshall S. Carter directed that SKYLARK achieve emergency operational readiness by 5 November. This involved preparing a small detachment which should be able to do the job over Cuba, though at something less than the full design capability of the OXCART. The goal was to operate at Mach 2.8 and 80,000 feet altitude.

(C) In order to meet the deadline set by General Carter, camera performance would have to be validated, pilots qualified for Mach 2.8 flight, and coordination with supporting elements arranged. Only one of several equipments for electronic countermeasures (ECM) would be ready by November, and a senior intragovernmental group, including representation from the President's Scientific Advisory Committee, examined the problem of operating over Cuba without the full complement of defensive systems. This panel decided that the first few overflights could safely be conducted without them, but the ECM would be necessary thereafter. The delivery schedule of ECM equipment was compatible with this course of action.

(S) After considerable modifications to aircraft, the detachment simulated Cuban missions on training flights, and a limited emergency SKYLARK capability was announced on the date General Carter had set. With two weeks notice the OXCART detachment could accomplish a Cuban overflight, though with fewer ready aircraft and pilots than had been planned.

(S) During the following weeks the detachment concentrated on developing SKYLARK into a sustained capability, with five ready pilots and five operational aircraft. The main tasks were to determine aircraft range and fuel consumption, attain repeatable reliable operation, finish pilot training, prepare a family of SKYLARK missions, and coordinate routes with North American Air Defense, Continental Air Defense, and the Federal Aviation Authority. All this was accomplished without substantially hindering the main task of working up OXCART to full design capability. We may anticipate the story, however, by remarking that despite all this preparation the OXCART was never used over Cuba. U-2's proved adequate, and the A-12 was reserved for more critical situations.

(S) In 1965 a more critical situation did indeed emerge in Asia, and interest in using the aircraft there began to be manifest. On 18 March 1965 Mr. McCone discussed with Secretaries McNamara and Vance the increasing hazards to U-2 and drone reconnaissance of Communist China. A memorandum of this conversation stated:

(S) "It was further agreed that we should proceed immediately with all preparatory steps necessary to operate the OXCART over Communist China, flying out of Okinawa. It was agreed that we should proceed with all construction and related arrangements. However, this decision did not authorize the deployment of the OXCART to Okinawa nor the decision to fly the OXCART over Communist China. The decision would authorize all preparatory steps and the expenditure of such funds as might be involved. No decision has been taken to fly the OXCART operationally over Communist China. This decision can only be made by the President."

(S) Four days later Brigadier General Jack C. Ledford, Director of the Office of Special Activities, DD/S&T, briefed Mr. Vance on the scheme which had been drawn up for

operations in the Far East. The project was called BLACK SHIELD, and it called for the OXCART to operate out of the Kadena Air Force Base in Okinawa. In the first phase, three aircraft would stage to Okinawa for 60-day periods, twice a year, with about 225 personnel involved.

(S)After this was in good order, BLACK SHIELD would advance to the point of maintaining a permanent detachment at Kadena. Secretary Vance made $3.7 million available to be spent in providing support facilities on the island, which were to be available by early fall of 1965.

(S) Meanwhile the Communists began to deploy surface-to-air missiles around Hanoi, thereby threatening our current military reconnaissance capabilities. Secretary McNamara called this to the attention of the Under Secretary of the Air Force on 3 June 1965, and inquired about the practicability of substituting OXCART aircraft for U-2's. He was told that BLACK SHIELD could operate over Vietnam as soon as adequate aircraft performance was achieved.

(S) With deployment overseas thus apparently impending in the fall, the detachment went into the final stages of its program for validating the reliability of aircraft and aircraft systems. It set out to demonstrate complete systems reliability at Mach 3.05 and at 2,300 nautical miles range, with penetration altitude of 76,000 feet. A demonstrated capability for three aerial refuelings was also part of the validation process.

(S) By this time the OXCART was well along in performance. The inlet, camera, hydraulic, navigation, and flight control systems all demonstrated acceptable reliability. Nevertheless, as longer flights were conducted at high speeds and high temperatures, new problems came to the surface, the most serious being with the electrical wiring system. Wiring connectors and components had to withstand temperatures of more than 800 degrees Fahrenheit, together with structural flexing, vibration, and shock. Continuing malfunctions in the inlet controls, communications equipment, ECM systems, and cockpit instruments were in many cases attributable to wiring failures. There was also disturbing evidence that careless handling was contributing to electrical connector failures. Difficulties persisted in the sealing of fuel tanks. What with one thing and another, officials soon began to fear that the scheduled date for BLACK SHIELD readiness would not be met. Prompt corrective action on the part of Lockheed was in order. The quality of maintenance needed drastic improvement. The responsibility for delivering an aircraft system with acceptable reliability to meet an operational commitment lay in Lockheed's hands.

(S) In this uncomfortable situation, John Paragosky, Deputy for Technology, OSA, went to the Lockheed plant to see Kelly Johnson on 3 August 1965. A frank discussion ensued on the measures necessary to insure that BLACK SHIELD commitments would be met, and Johnson concluded that he should himself spend full time at the site in order to get the job done expeditiously. Lockheed President Daniel Haughton offered the full support of the corporation, and Johnson began duty at the site next day. His firm and effective management got Project BLACK SHIELD back on schedule.

(S) Four primary BLACK SHIELD aircraft were selected and final validation flights conducted. During these tests the OXCART achieved a maximum speed of Mach 3.29, altitude of 90,000 feet, and sustained flight time above Mach 3.2 of one hour and fourteen minutes. The maximum endurance flight lasted six hours and twenty minutes. The last stage was reached on 20 November 1965, and two days later Kelly Johnson wrote General Ledford:

(S) " ... Overall, my considered opinion is that the aircraft can be successfully deployed for the BLACK SHIELD mission with what I would consider to be at least as low a degree of risk as in the early U-2 deployment days. Actually, considering our performance level of more than four times the U-2 speed and three miles more operating altitude, it is probably much less risky than our first U-2 deployment. I think the time has come when the bird should leave its nest."

(S) Ten days later the 303 Committee received a formal proposal that OXCART be deployed to the Far East. The Committee, after examining the matter, did not approve. It did agree, however, that short of actually moving aircraft to Kadena all steps should be taken to develop and maintain a quick reaction capability, ready to deploy within a 21-day period at any time after 1 January 1966.

(S) There the matter remained, for more than a year. During 1966 there were frequent renewals of the request to the 303 Committee for authorization to deploy OXCART to Okinawa and conduct reconnaissance missions over North Vietnam, Communist China, or both. All were turned down. Among high officials there was difference of opinion; CIA, the Joint Chiefs of Staff, and the Presidents Foreign Intelligence Advisory Board favored the move, while Alexis Johnson representing State, and Defense in the persons of Messrs. McNamara and Vance, opposed it. The proponents urged the necessity of better intelligence, especially on a possible Chinese Communist buildup preparatory to intervention in Vietnam. The opponents felt that better intelligence was not so urgently needed as to justify the political risks of basing the aircraft in Okinawa and thus almost certainly disclosing to Japanese and other propagandists. They also believed it undesirable to use OXCART and reveal something of its capability until a more pressing requirement appeared. At least once, on 12 August 1966, the divergent views were brought up to the President, who confirmed the 303 Committee's majority opinion against deployment.

(S) Meanwhile, of course, flight testing and crew proficiency training continued. There was plenty of time to improve mission plans and flight tactics, as well as to prepare the forward area at Kadena. New plans shortened deployment time from the 21 days first specified. Personnel and cargo were to be airlifted to Kadena the day deployment was approved. On the fifth day the first OXCART would depart and travel the 6,673 miles in five hours and 34 minutes. The second would go on the seventh and the third on the ninth day. The first two would be ready for an emergency mission on the eleventh day, and for a normal mission on the fifteenth day.

(S) An impressive demonstration of the OXCART's capability occurred on 21 December 1966 when Lockheed test pilot Bill Park flew 10,198 statute miles in six hours. The aircraft left the test area in Nevada and flew northward over Yellowstone National Park,

thence eastward to Bismark, North Dakota, and on to Duluth, Minnesota. It then turned south and passed Atlanta en route to Tampa, Florida, then northwest to Portland, Oregon, then southwest to Nevada. Again the flight turned eastward, passing Denver and St. Louis. Turning around at Knoxville, Tennessee, it passed Memphis in the home stretch back to Nevada. This flight established a record unapproachable by any other aircraft; it began at about the same time a typical government employee starts his work day and ended two hours before his quitting time.

(S) Shortly after this exploit, tragedy befell the program. During a routine training flight on 5 January 1967, the fourth aircraft was lost, together with its pilot. The accident occurred during descent about 70 miles from the base. A fuel guage failed to function properly, and the aircraft ran out of fuel only minutes before landing. The pilot, Walter Ray, ejected but was killed when he failed to separate from the ejection seat before impact. The aircraft was totally destroyed. Its wreckage was found on 6 January and Ray's body recovered a day later. Through Air Force channels a story was released to the effect that an Air Force SR-71, on a routine test flight out of Edwards Air Force Base, was missing and presumed down in Nevada. The pilot was identified as a civilian test pilot, and the newspapers connected him with Lockheed. Flight activity at the base was again suspended during investigation of the causes both for the crash and for the failure of the seat separation device.

(S) It is worth observing that none of the four accidents occurred in the high Mach number, high temperature regime of flight. All involved traditional problems inherent in any aircraft. In fact, the OXCART was by this time performing at high speeds, with excellent reliability.

(S) BLACK SHIELD

(S) About May of 1967 prospects for deployment took a new turn. A good deal of apprehension was evident in Washington about the possibility that the Communists might introduce surface-to-surface missiles into North Vietnam, and concern was aggravated by doubts as to whether we could detect such a development if it occurred. The President asked for a proposal on the matter; CIA briefed the 303 Committee and once again suggested that the OXCART be used. Its camera was far superior to those on drones or on the U-2, its vulnerability was far less. The State and Defense members of the Committee decided to reexamine the requirements and the political risks involved. While they were engaged in their deliberations, Director of Central Intelligence, Richard Helms, submitted to the 303 Committee another formal proposal to deploy the OXCART. In addition, he raised the matter at President Johnson's "Tuesday lunch" on 16 May, and received the Presidents approval to "go." Walt Rostow later in the day formally conveyed the President's decision, and the BLACK SHIELD deployment plan was forthwith put into effect.

(S) On 17 May airlift to Kadena began. On 22 May the first A-12 (Serial No. 131) flew nonstop to Kadena in six hours and six minutes. Aircraft No. 127